FLORISTIC STUDIES ON MONOCOTYLEDONS OF IDUKKI DISTRICT, KERALA

Thesis submitted to
the University of Calicut in partial fulfilment of
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DOCTOR OF PHILOSOPHY

in

BOTANY

by

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CERTIFICATE

This is to certify that the thesis entitled '**Floristic studies on monocotyledons of Idukki district, Kerala'** submitted to the University of Calicut by **Dani Francis** in partial fulfilment for the award of the degree of Doctor of Philosophy in Botany is a bonafide record of research work done under my guidance and supervision in the Department of Botany, University of Calicut. No part of this work has been presented elsewhere for any Degree or Diploma previously.

C.U. Campus
23.12.2023

SANTHOSH NAMPY
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DECLARATION

I hereby declare that the thesis entitled '**Floristic studies on monocotyledons of Idukki district, Kerala'** submitted by me in partial fulfilment for the award of Doctor of Philosophy of the University of Calicut, incorporates the results of original work done by me in the Department of Botany, University of Calicut under the supervision of Prof. Santhosh Nampy. No part of the work has formed the basis for the award of any other Degree or Diploma previously.

C.U. Campus
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Dani Francis

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"For I know the plans I have for you," declares the lord, "plans to prosper you and not to harm you, plans to give you hope and a future" (Jeremiah 29: 11)

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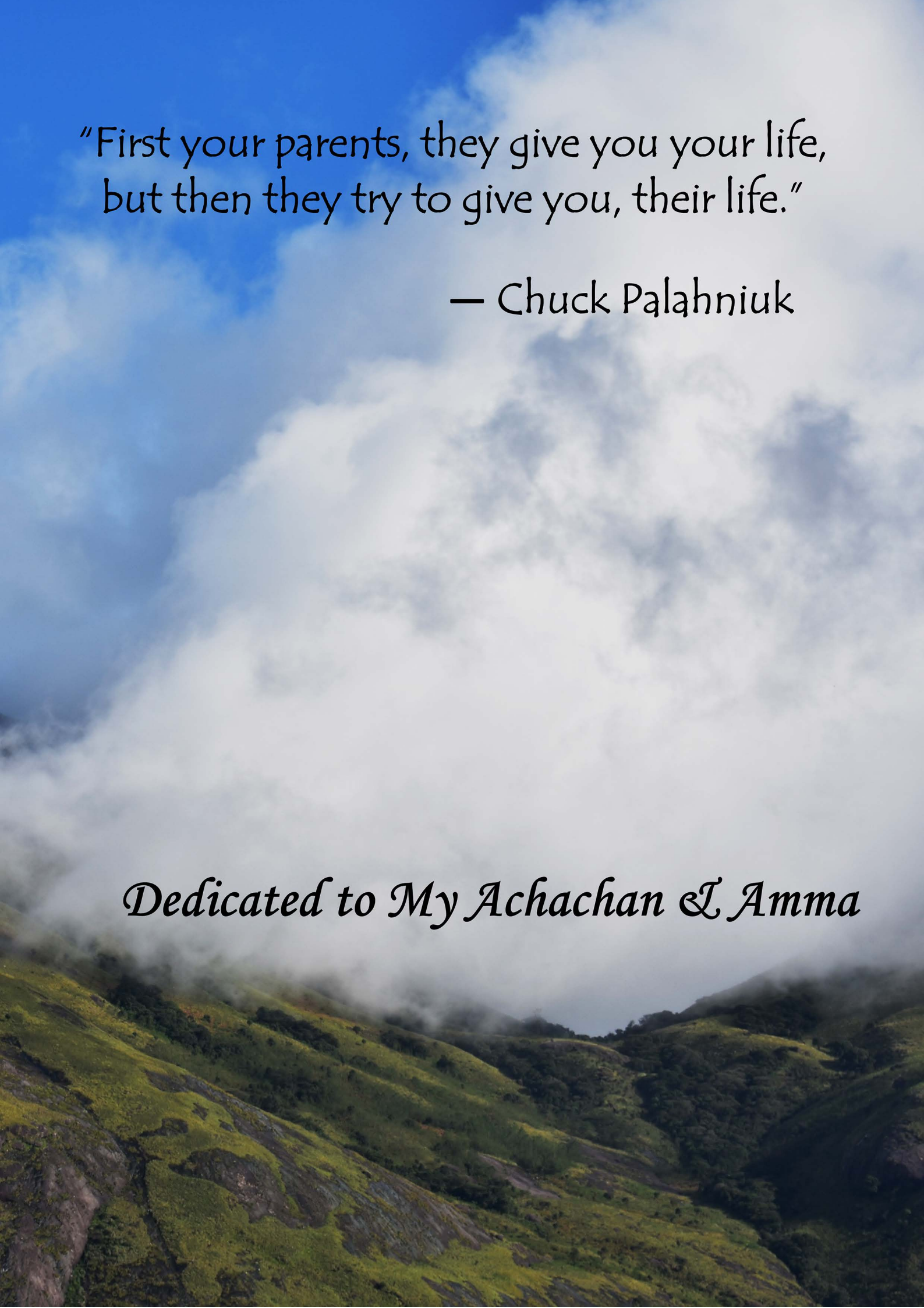

"First your parents, they give you your life,
but then they try to give you, their life."
— Chuck Palahniuk
Dedicated to My Achachan & Amma

ABSTRACT

Survey and documentation of the floristic wealth of a region is a prerequisite for planning the proper utilization of its potential plant resources on one hand and to conserving the depleting genetic resources on the other. Idukki, the 'Cradle of plantation crops' and 'Home to nature' is the largest district of Kerala covering an area of 4,612 km^2 and is one of the richest parts of southern Western Ghats with 5 national Parks and 3 wildlife sanctuaries. The vegetation comprises evergreen forests, semi-evergreen forests, moist deciduous forests, dry deciduous forests, shola forests, grasslands, and forest plantations. Anamudi 'the Everest of South India' is located in this district. Monocots are much diverse and one of the major groups of flowering plants in the Idukki district. This thesis discusses the taxonomy, diversity, endemism, and recommendations for the conservation of monocotyledons in the Idukki district.

During the present study, a total of 652 species in 248 genera under 28 families were collected. Out of the total plants, 592 species occur in the wild and 58 were cultivated. It is the largest number of taxa of monocotyledons compared with the rest of the districts. 45% of the state's monocotyledon diversity occurs in this district, which indicates the species richness of the district. Among the 592 wild taxa, 213 are included in IUCN Red List for threatened plants. The study area harbours 138 (23%) endemic species. 26 species are introduced, majority of them are introduced for ornamental and fodder purposes, but most of them become aggressive colonizers and threaten the habitat of the native species. During the investigation, three new species: *Eriocaulon vamanae* Dani & Nampy and *Burmannia munnarensis* Dani & Nampy were described, while *Ariopsis idukkiana sp. nov.* is communicated. *Burmannia indica* was rediscovered after 110 years. Seven species are new records to Kerala and two are new reports to the study area. *P. neilgheriensis* and *P. courtallensis* were reinstated.

Since Idukki is one of the major tourist destinations, the majority of the hill stations are accessible to tourists. The development of tourism actively and passively affects the floral and faunal diversity through construction activities, road widening, pollution, etc. Moreover, the extreme climate fluctuations and their resulting flood, fire regimes, snowfall, landslides, etc. lead to habitat fragmentation and destruction. The study provided a comprehensive account of the monocotyledon diversity of Idukki, which provides insights into the importance of conservation, identification, impact assessment, research, management decisions, and policy formulation.

സംഗ്രഹം

കേരളത്തിലെ ഏറ്റവും വലിയ ജില്ലയായ ഇടുക്കി, വ്യത്യസ്തമായ ഭൂപ്രകൃതിയാലും ജൈവ വൈവിധ്യത്താലും സമ്പുഷ്ടമായ പ്രദേശമാണ്. അഞ്ചു ദേശീയോദ്യാനങ്ങളും, മൂന്ന് വന്യജീവിസങ്കേതങ്ങളും ഉൾപ്പെടുന്ന ജില്ലയുടെ സസ്യസമ്പത്തിനെ കുറിച്ചുള്ള സമഗ്രമായ പഠനത്തിന്റെ ഭാഗമായി, ആറ് വർഷം നീണ്ടുനിന്ന ഏകബീജ പത്ര സസ്യങ്ങളെക്കുറിച്ചുള്ള ഗവേഷണഫലമാണ് ഈ പ്രബന്ധത്തിൽ ഉൾപ്പെടുത്തിയിരിക്കുന്നത്.

ജില്ലയിലുടനീളം നടത്തിയ പഠനയാത്രകളിലൂടെ 28 സസ്യകുടുംബങ്ങളിലായി വിന്യസിച്ചു കിടക്കുന്ന 652 ഏകബീജ പത്ര സസ്യങ്ങളെ തിരിച്ചറിയുവാൻ സാധിച്ചു. ഇതിലൂടെ കേരളത്തിൽ കണ്ടുവരുന്ന ഈ വിഭാഗം ചെടികളിൽ ഏകദേശം 45 ശതമാനവും ജില്ലയിൽ കാണപ്പെടുന്നുവെന്നും മറ്റു ജില്ലകളെ അപേക്ഷിച്ച് സസ്യസമ്പത്ത്ഇടുക്കിയിൽ കൂടുതലാണെന്നും മനസ്സിലാക്കുവാൻ സാധിച്ചു. പഠന വിധേയമായ സസ്യങ്ങളിൽ 25 കുടുംബങ്ങളിലുൾപ്പെടുന്ന 592 ഇനങ്ങൾ വന്യവും 58 ഇനങ്ങൾ കാർഷിക വിളകളായി ഉപയോഗിക്കുന്നതുമാണ്. ഇതിൽ തന്നെ വംശനാശഭീഷണി നേരിടുന്ന 50 സസ്യങ്ങളും ഉൾപ്പെടുന്നു. കൂടാതെ പുറം രാജ്യങ്ങളിൽ നിന്ന് അലങ്കാര സസ്യമായോ തീറ്റപ്പുല്ലായോ ഇറക്കുമതി ചെയ്ത ഇരുപത്തിയാറോളം സസ്യങ്ങൾ പ്രാദേശിക സസ്യങ്ങൾക്ക് വെല്ലുവിളിയായി മാറിയിരിക്കുന്നു.

2018-19 വർഷങ്ങളിലെ വെള്ളപ്പൊക്കവും, മണ്ണിടിച്ചിലും, തുടർന്നുണ്ടായ വരൾച്ചയും, മഞ്ഞു വീഴ്ചയുമെല്ലാം ഇവിടുത്തെ സസ്യ-ജന്തുജാലങ്ങളുടെ ആവാസ വ്യവസ്ഥയെ സാരമായി ബാധിച്ചിട്ടുണ്ട്. ഇതു കൂടാതെ മാനുഷിക ഇടപെടലുകൾ മൂലമുള്ള മലിനീകരണവും, കൃഷി വ്യാപനവും, ക്വാറി പ്രവർത്തനങ്ങളും, റോഡ് വികസനങ്ങളും അനധികൃത വിനോദ സഞ്ചാര പ്രവർത്തനങ്ങളുമെല്ലാം അതിന്റെ ആക്കം കൂട്ടുന്നു.

ഗവേഷണത്തിലൂടെ ഇടുക്കി ജില്ലയിലുള്ള മുഴുവൻ ഏകബീജ പത്ര സസ്യങ്ങളുടെയും സമഗ്രമായ അപഗ്രഥനത്തോടൊപ്പം മൂന്ന് പുതിയ ചെടികളെ (*Eriocaulon vamanae* Dani & Nampy, *Burmannia munnarensis* Dani & Nampy, *Ariopsis idukkiana* sp. nov.) സസ്യലോകത്തിനു പരിചയപ്പെടുത്തുവാൻ സാധിച്ചത് ഗവേഷണ നേട്ടമെന്നതിലുപരി ഈ മേഖലയിലെ സസ്യ സമ്പത്തിന്റെ സംരക്ഷണ പ്രാധാന്യം കൂടി വിളിച്ചോതുന്നു.

CONTENTS

	Page No.
Abstract	
Introduction	1
Review of Literature	21
Materials and methods	29
Result: Systematic treatment	37
Discussion	699
Summary and Conclusion	729
Recommendations and future perspectives	735
References	739
Appendices	**763**
Index	

INTRODUCTION

"I know of no pleasure deeper than that which comes from contemplating the natural world and trying to understand it." — David Attenborough

Introduction

Man has relied on the biological products of the earth since the dawn of time. Plants, like humans, are an essential component of the living world. Their contributions to our lives economically, nutritionally, and aesthetically are immeasurable. Their photosynthetic activities provide the oxygen that supports all aerobic life and the chemical energy that runs the entire atmosphere (Gottlieb, 1971). Man has lived in harmony with nature since ancient times and began searching for plants. They lived a nomadic life, looking for food in the forest itself. His relentless quest contributed to the initiation of agriculture. They started to domesticate wild plants. His quest for plants continues in this century also.

We live in an age of environmental crisis caused by no one other than men himself, because of his scant respect for the fellow beings that inhabit the earth. It should be clear even to the most ignorant of our fellow men that man's welfare is intimately connected with plants. Despite this, and armed with the most modern technology, man who came to this world about two billion years behind the other groups of organisms continues to conquer nature in pursuit of his immediate but short-term material prosperity. In this process, he maltreats vegetation, irreparably damages the macrocosm in which his children and grandchildren should live, and brings doom to all life on this planet (Sears, 1961; Sharp, 1964). Plant diversity is critical in regulating the diversity of other organisms and, as a result, the global ecosystem's stability. On these grounds alone, the continued existence of the plant world is inevitably a matter of human survival.

"*The earth, the air, the land, and the water are not an inheritance from our forefathers but on loan from our children. So, we have to hand over them at least as it was handed over to us*" (Gandhiji). This underlines the need to conserve biodiversity. In recent years, there developed a global realization of the need for the conservation of biodiversity for the sustenance of human life. Both government and NGOs are trying to find a way to conserve nature.

Tropical rainforests, considered the 'cradle of evolution,' are home to more than 60% of the world's biodiversity and remain largely unexplored. Tropical forests are exquisite expressions of nature, with their huge trees, small orchids, large apes, and tiny insects. It may contain half of all species on the planet, but many of them will vanish due to continuous deforestation. Conserving tropical forests is an urgent concern for ecologists as over half of the original forests have already been lost. India is a tropical country with 7-8% of the world's reported species, denoting the rich diversity of the country. Among the 34 biodiversity hotspots around the world, the Himalayas, Indo-Burma, Western Ghats, and Sundaland are located within the nation. So far, the country has identified nearly 45,500 plant taxa and 91,200 animal species, with significant endemism predominantly in the four biodiversity hotspots. There are many wild relatives and ancestors of cultivated plants that grow innately in India, which is known for its diverse crop plant diversity around the world. With constant research, plants and animal diversity inventories have gradually been updated, with many new species being discovered. The nation's hasty economic growth, industrialization, and population explosion have put huge pressure on biodiversity, leading to the destruction and fragmentation of natural habitats (National Biodiversity Authority, annual report, 2017-18).

"*If conservation of natural resources goes wrong, nothing else will go right*" (M.S. Swaminathan)

There is no doubt that a basic understanding of plant distribution is essential to planning for the conservation of plant biodiversity. Inventories of plants are the cornerstones of plant conservation, so floristic studies can provide efficient and convenient information about individual plants. Plant diversity depicts the flora of a specific area and their diversity across different geographical environments. The importance of floristic studies and investigation has grown throughout the world in the modern era. In India, the search for plants began Before Christ (BC), in Vedas such as the Rigveda, Atharvaveda, etc., and in other literary works like Arthashasthra, Charakasamhitha, Susruthasamhita, etc., which give information about trees, medicinal plants, vegetables, etc. Worshipping trees and plants was an integral part of ancient Indian culture, which aided in preserving the

biodiversity of the country. The English who reached India during the colonial period studied the floristic diversity and published various floristic works including the *Flora of British India* (Hooker, 1885), *Flora of the Presidency of Madras* (Gamble, 1915-1936), *Icones Plantarum Indiae Orientalis* (Wight, 1838-1853), etc. After that several authors have published various Floras of different states and districts. A complete inventory of the national flora is continued by the Botanical Survey of India.

Idukki, the 'Cradle of plantation crops' and 'Home to nature' is the biggest district of Kerala with 4,612 km^2 and is one of the richest parts of southern Western Ghats. Its diversity is tremendous compared to the other districts in the state. The area is unique in having an abundance of habitats that attribute rich vegetation and diverse biota with a enormous plant diversity. The vegetation comprises evergreen, moist deciduous, dry deciduous, temperate forests, scrub jungles, and grasslands. In Kerala, floristic studies of twelve of the fourteen districts have already been compiled by various workers. Floristic studies of selected regions of the Idukki district have already been carried out (Sebastine & Vivekananthan, 1967; Shetty & Vivekananthan, 1971; Vivekananthan, 1978; Sasidharan, 1998, 1999), but a complete Flora of Idukki is still untouched.

Monocots are a significant group of flowering plants, with a cosmopolitan distribution and contribute a greater part of agricultural crops in terms of biomass production. The members of this group are substantial ecologically, commercially, aesthetically, and as staple food. Monocotyledons are a significant group of angiosperms that have been recognized since the seventeenth century, when Ray (1682, 1696, 1703) studied seed structure. The term "monocotyledons" (or "monocots") refers anatomically to those flowering plants (angiosperms) having a shoot apex that is lateral to a single embryonic seed leaf, which otherwise is known as the cotyledon (Fahn, 1982). The primary root is short-lived in most of the species, resulting in a proliferation of adventitious roots, which often take on a highly fibrous appearance. All of the species lack secondary growth from a vascular cambium, but some (e.g., *Smilax* sp.) possess shoots that appear to be woody due to a cork cambium and its associated secondary tissues. The shoot vasculature of monocots varies but is organized commonly as a series of scattered

bundles, which also occur in some early diverging dicotyledon groups. A trimerous floral perianth was once thought to reliably distinguish between monocots and dicots; however, many dicot families (e.g., Annonaceae, Haloragaceae, Lauraceae, Lythraceae, Magnoliaceae, Myristicaceae, Papaveraceae, Polygonaceae, etc.) also possess trimerous flowers. Monocots uniformly possess monosulcate pollen, which occurs also in some dicotyledons. Monocotyledon leaf venation usually is described as parallel because of its superficial appearance as prominent, parallel vascular strands. Technically the veins all connect ultimately through smaller lateral veins, rather than ending blindly within the mesophyll as in dicot leaves (Fahn, 1982). Sheathed leaves are common in this group. Although toothed leaf margins are generally uncommon in monocots, several aquatic species (e.g., Hydrocharitaceae) do possess serrate foliage.

Classification is essential for the identification and segregation of plants. Though, there are several classifications proposed by earlier authors (Linnaeus, 1753; Engler & Prantl, 1897; Hutchinson, 1959), Bentham and Hooker's (1862-1883) classification are the most convenient and widely accepted system of classification. Since, it is purely based on morphological characters, it will be more suitable for plant documentation. Recently, Angiosperm Phylogeny Group (1998-2016) proposed new classification mostly based on molecular data. Even if, the classification is widely followed in almost taxonomic studies, there have some inconsistencies in the placement of families and genera. As a floristic study, identification of plants is primarily based on morphological characters, the Bentham and Hooker system of classification is used here, provided with notes on the current status of families and taxa according to APG (2016). Species diversity of monocots is high in this district as it is predominantly covered with forests and grasslands. Since Idukki lies in the richest part of the hottest hotspot 'Western Ghats', it is suggested that the majority of the state's monocotyledon diversity would be reflected here. The proposed study is therefore aimed to prepare an inventory of the diversity of monocotyledons of the species rich Idukki district.

Area of study

Idukki, the gorgeous high range district of Kerala, is geographically recognized for its unrivalled scenic beauty holding lush-green tropical forests, fascinating mountainous hills, and dazzling valleys, harmonising with natural and manmade water bodies, rivers, streams, and various scenic plantations and agricultural fields. It is known as the 'cradle of plantation crops' or 'home to nature'. This district is the largest in Kerala with a vast area of 4612 km^2 and having the lowest population density, which established in 1972 carving out Devikulam, Udumbanchola, and Peerumade Taluks from former Kottayam District and Thodupuzha Taluk of erstwhile Ernakulam district. North Pamba Valley area and the area around Sabarimala Sannidhanam in Mlappara Village of Peerumade Taluk were transferred to Pathanamthitta District. At present, the district consists of five Taluks viz., Devikulam, Udumbanchola, Thodupuzha, Peerumade, and Idukki. The word Idukki is derived from the Malayalam word 'idukku' which means gorge.

1. Location and boundaries

Idukki is located in the middle part of Kerala. It is bounded by Madurai district of Tamil Nadu on the East, Ernakulam and Kottayam districts on the West, Pathanamthitta on the South, and Trichur and Coimbatore districts on the North. It lies between 10°00'0.00" N 77°00'0.00" E.

2. Topography and Geography

The topography and geography of Idukki are unique. The district is dominated by mountain ranges and forests, with no lowland, and forest covering more than 50% of the total area. The pattern of the land based on the elevation comprises Midland (above 20–100 MSL), The Mid-upland (100–300 m ASL), Upland (above 300–600 m ASL), Western Ghats High Range (600–1200 m ASL) and Top Western Ghats High Range (above 2000 m ASL). There are nine peaks in the district, which exceed a height of 2000 meters above Mean Sea Level which include, Anamudi, Eravimala, Tathumala, Chenthavara, Kumarickal, Karimkulam, Devimala, Anchanad. Anamudi peak, the 'Everest of South India' with an altitude of 2695 m.

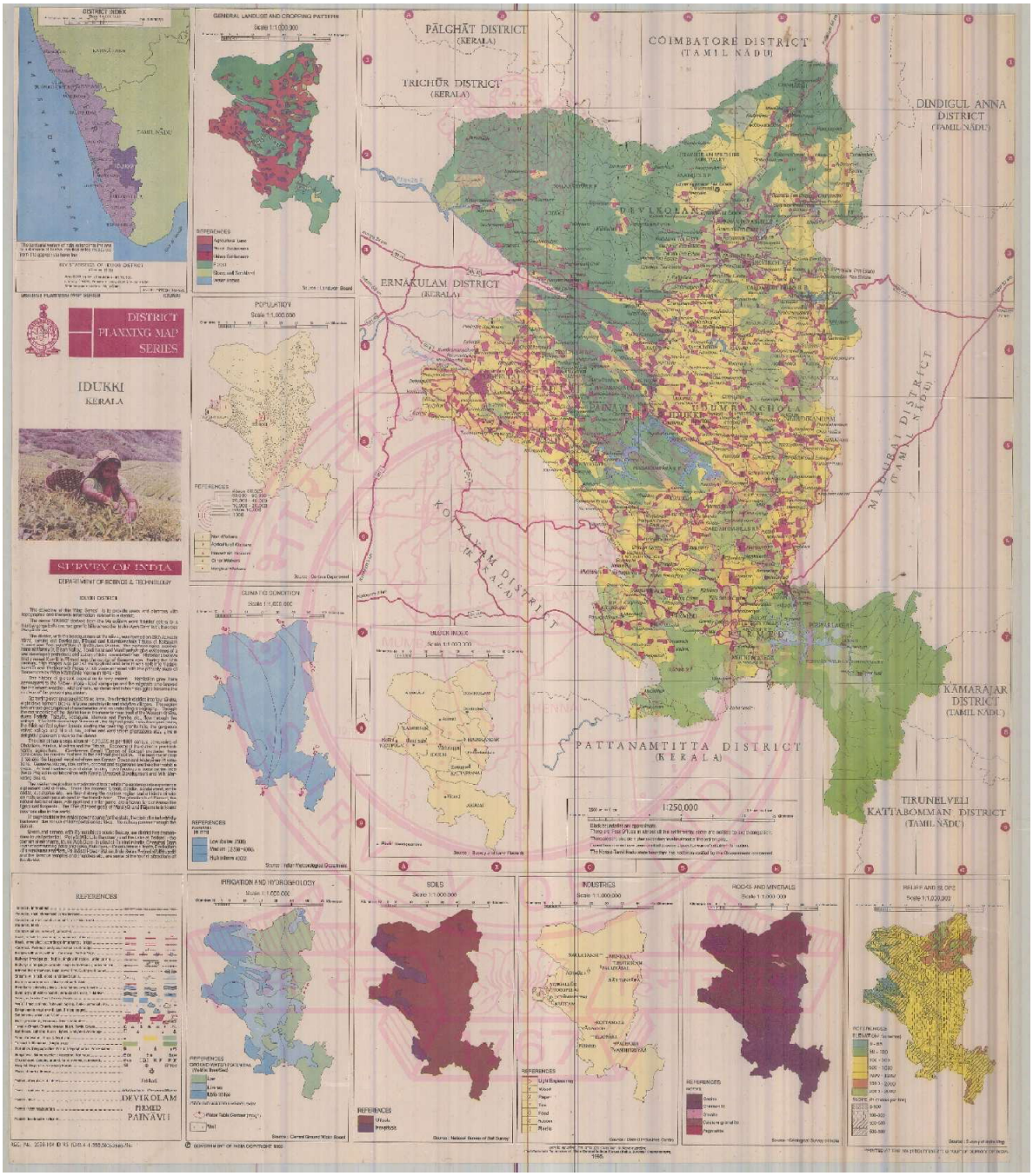


Fig. 1. Map of the district

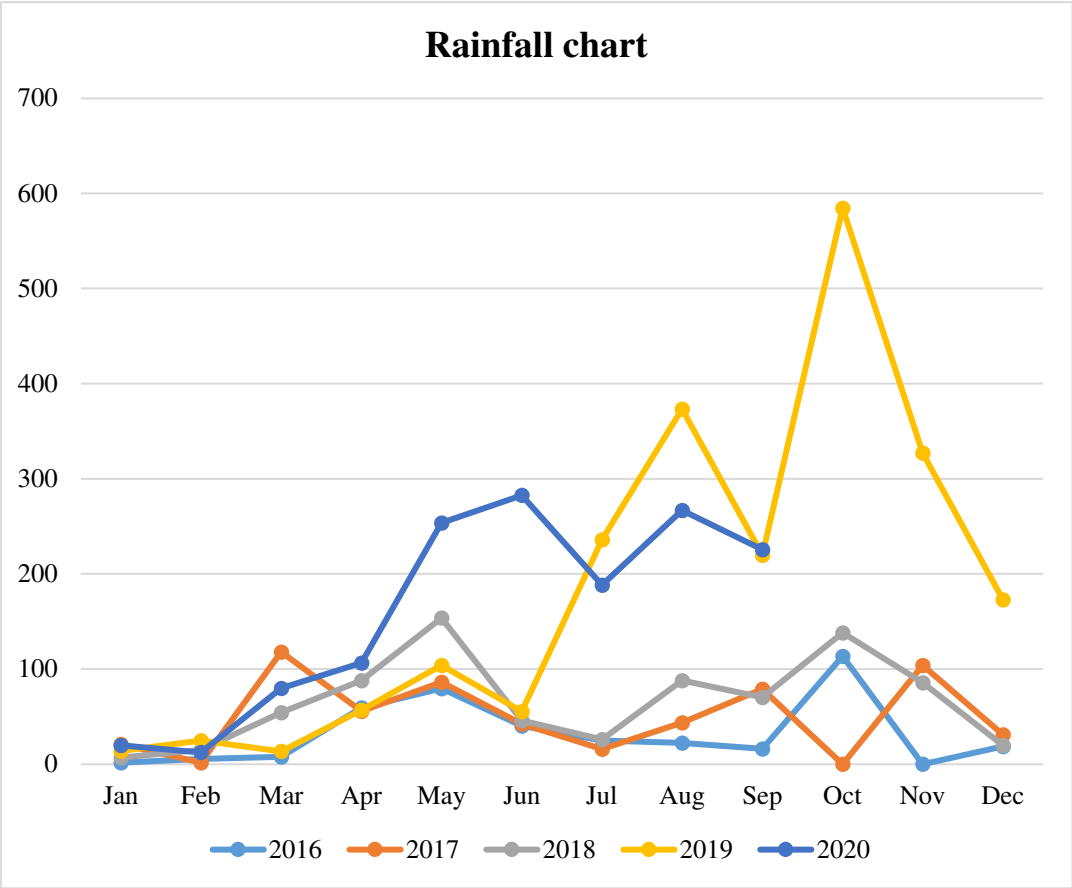
3. Climate

The climate varies considerably from the other areas of the state due to peculiar topography. The upland region is having a moderately cold climate. In the places above an elevation of 2400 m, the temperature at times falls to the freezing point in the winter. The occurrence of mist is usual in the upland regions lying over an altitude of 1300 m, above mean sea level. The western region of the district

comprising midland area having a medium climate, between 21–27 ^{0}c temperature with minimum variation (District Census Handbook, 2011, part XII A).

3.1. Rainfall

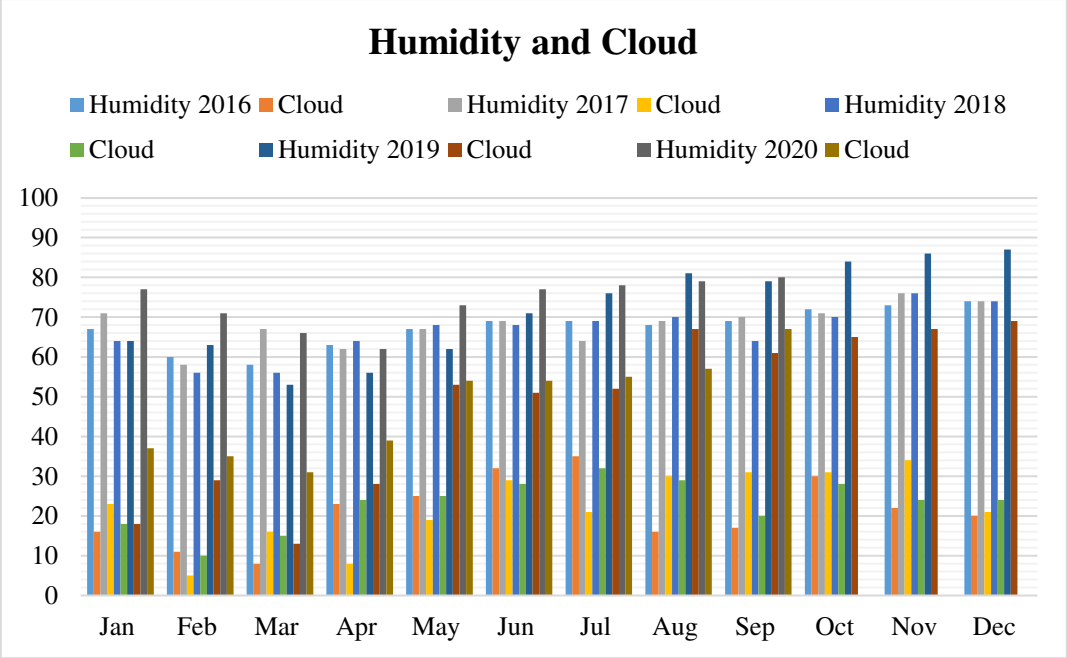
Rainfall rates in the district vary from less than 1000 mm (Marayoor, Kanthallur, Chinnar) to around 5000 mm (Peerumedu, Neriyamangalam, etc.). The eastern part of the district is situated in the rain shadow region of the Western Ghats. As a result, the rainfall increases from east to west (District Survey Report of Minor Minerals, 2016). The district received the highest rain during the years 2018, 2019 and 2020 **(Graph 1).**



Graph 1: Monthly Rain fall in mm from 2016–2020

3.2. Relative Humidity

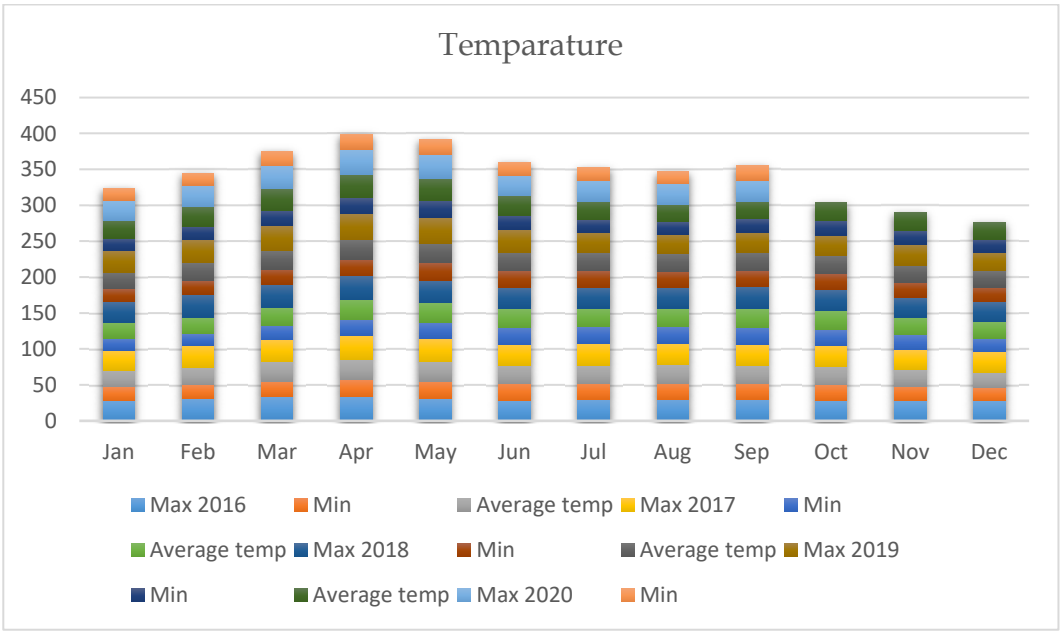
The relative humidity is higher in the morning and lower in the evening. It varies between 85 to 98.45% during the morning hours and 40.8 to 87.3% during the evening hours (District Survey Report of Minor Minerals, 2016) **(Graph 2)**.



Graph 2: Monthly average humidity and cloud in % from 2016–2020

3.3. Temperature

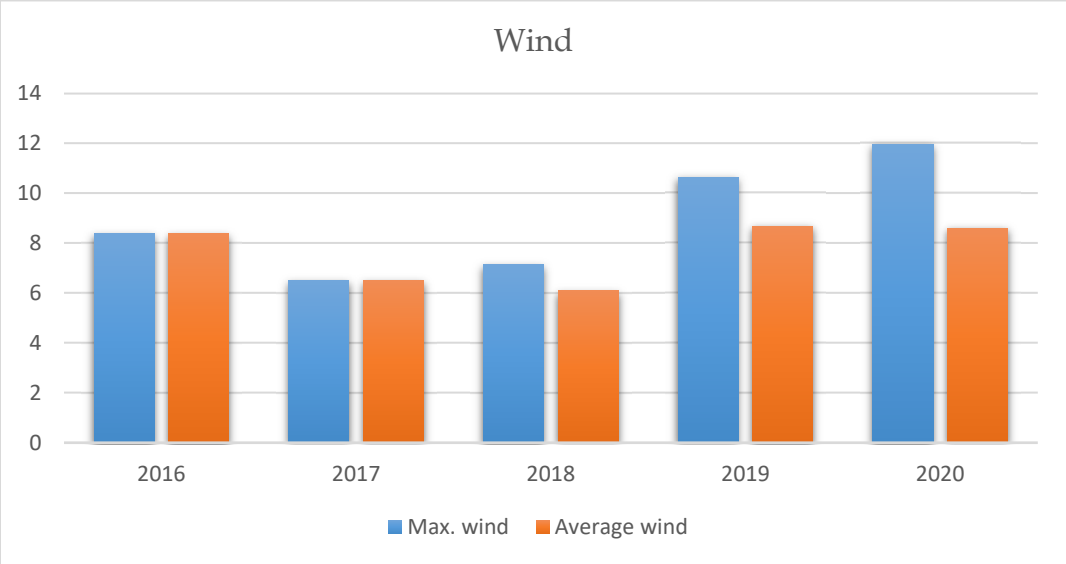
March to May perceives an increase in temperature, while January and February observe lower temperatures. The average maximum temperature varies from 25 to 32°C and the minimum temperature from 18.6 to 14°C (District Survey Report of Minor Minerals, 2016). Following the flood in 2018 and 2019, the temperature rose significantly **(Graph 3).**



Graph 3: Average monthly temperature in ^{0} c from 2016–2020

3.4. Wind

The wind speed varies between 3.9 and 7.95 km/h. Wind speed is high from March to July and from November to January (District Survey Report of Minor minerals, 2016) **(Graph 4)**.



Graph 4: Monthly average wind speed in km/h from 2016–2020

4. Habitat types and vegetations

4.1. Aquatic habitat

Aquatic habitats of the district include rivers, waterfalls, dams, lakes and associated marshy areas. The reservoirs represent less floristic diversity because of the fluctuating water level. This type of habitat found in in Munnar, Periyar, Devikulam, Chinnar, Marayur, Kanthallur, Kattappana, Cheruthoni etc.

4.2. Terrestrial habitat

Forests and plantations make up the vast majority of terrestrial habitats. Evergreen, semi-evergreen, moist deciduous, dry deciduous, shola forests, and grasslands are examples of forest types.

4.2.1. Evergreen forests

This type of forest is mostly found in Mankulam, Periyar, Neriyamangalam, and Idukki. Large trees form the closed canopy of forest formation.

4.2.2. Semi-evergreen forests

This type of forest serves as an ecosystem for several species, making it very important in terms of biodiversity. It is also found in Thekkady, Neriyamamngalam, Mankulam, Devikulam, etc.

4.2.3. Moist deciduous forests

This type of forest is limited to narrow fragmented patches in the district, which are frequently separated by habitations. It is mostly found in Adimali, Neriamangalam, Kulamavu, Painavu, Thekkady, Kuttikkanam and so on. Despite its proximity to human habitation, it is under severe threat pressure.

4.2.4. Dry deciduous forests

This type of forest is restricted to the Chinnar and Marayur belts in this district, which are rain shadow regions of the Western Ghats. Lemon grass cultivation is very common in this region. It is a type of open forest with stunted trees mixed with xerophytic plants. Rain is occassional in this region.

4.2.5. Shola forests

These are the tropical montane forests that can be found in valleys separated by rolling grasslands at higher elevations. Shola forests are abundant in the district, particularly in Munnar, Eravikulam, and Devikulam. Three Shola National Parks are Mathikettan Shola, Pambadum Shola, and Anamudi Shola. It is a biodiversity hotspot. The ecotone region of Shola and grasslands, in particular, has a diverse range of animals and plants. Because of the high winds, the trees are small and densely branched, covered by lichens, mosses, ferns, and orchids.

4.2.6. Grasslands

The majority of the grasslands in the district are located alongside the shola forests.

4.2.7. Plantations

Forest plantations include Eucalyptus, Teak, and other trees that support the growth of a variety of orchids, grasses, sedges, and other plants. The districts also have tea and cardamom plantations.

Fig. 2. A. Anakkulam; **B.-D.** Mankulam; **E.** Anamudi National Park.

Fig. 3. Sholas and Grasslands: **A. & B.** Anamudi; **C. & D.** Eravikulam; **E. & F.** Meesapulimala; **G. & H.** Pettimudi.

Fig. 4. A. Anayirangal dam; **B.** Chinnar; **C.** Nallathannikallar; **D.** Neriamangalam; **E.** Pambla dam; **F.** Periyar Tiger Reserve; **G.** Devikulam; **H.** Meenuliyanpara.

5. Protected areas

The study area comprises of five national parks and three wildlife sanctuaries.

5.1. Eravikulam National Park

Eravikulam National Park is a conservation area for endangered mountain goats in South India, as well as a wonderful spot to see the diversity of the high-altitude shola-grassland ecosystem with rare flora. Anamudi Peak is situated in the core of the national park.

5.2. Mathikettan Shola National Park

The park covers an area of 12.82 km^2. Because of the unique characteristics of the shola forests, it has been declared as National Park.

5.3. Pambadum Shola National Park

It is the smallest National Park in Kerala, covering an area of 1.31 km2 and is affirmed as National Park in 2004. The Nilgiri Marten, a small carnivore is found in this park. This park also contains a wide variety of flora.

5.4. Anamudi Shola National Park

Anamudi Shola National Park is composed of Mannavan Shola, Idivara Shola and Pullardi Shola, with a total area of about 7.5 km^2.

5.5. Periyar National Park and Wildlife Sanctuary

This area spread over the Idukki and Pathanamthitta districts. It is known as an Elephant reserve and a Tiger reserve, with a total of 925 km^2. The core zone of 350 km^2 was declared as the Periyar National Park in 1982.

5.6. Idukki Wildlife Sanctuary

The sanctuary has a total span of 77 km2. The Idukki dam reservoir is located in this sanctuary. It is surrounded by lush tropical evergreen forests, deciduous forests, tropical semi-evergreen forests and grasslands.

5.7. Chinnar wildlife Sanctuary

This sanctuary is located in a rain shadow area, and is a thorny scrub forest, comprising of several xerophytic species. This sanctuary receives only light rain in comparison to other areas of the district.

5.8. Kurinjimala Sanctuary

The Sanctuary is well-known for Neelakurinji.

6. Faunal diversity

With the exception of lions, the forests of Idukki are teeming with wild animals. Common inhabitants of the jungle include the Tiger, Leopard, Elephants, Bison, Wild bear, Monkeys, Nilgiri Tahr, Nilgiri Marten, various birds, reptiles, amphibians, and so on.

7. Soil types

Four kind of soil types found in the district, such as forest loams, lateritic soils, brown hydromorphic soils and alluvial soils (District Survey Report of Minor minerals, 2016).

7.1. Forest loams

Forest loams make up roughly 60% of the district and are formed by weathering of the rock under forest cover. The top layer is humus-rich. Because of the heavy percolation, they are typically acidic, with high nitrogen and few bases. They have a loamy to silty loam texture with dark reddish brown to black.

7.2. Lateritic soils

It is well-drained and minimal in plant nutrients and organic matter. Soil fertility is usually poor with fewer amount of nitrogen and phosphorus.

7.3. Brown hydromorphic soils

This type of soil is restricted to valley areas in undulating terrain. These brownish black soils are formed as a result of the transportation and deposition of materials from adjacent hill slopes. The surface texture differs from sandy loam to clay.

7.4. Alluvial soils

This type of soil can be found as narrow strips along the riverbanks. It is fertile, with surface texture varies from sandy loam to clay.

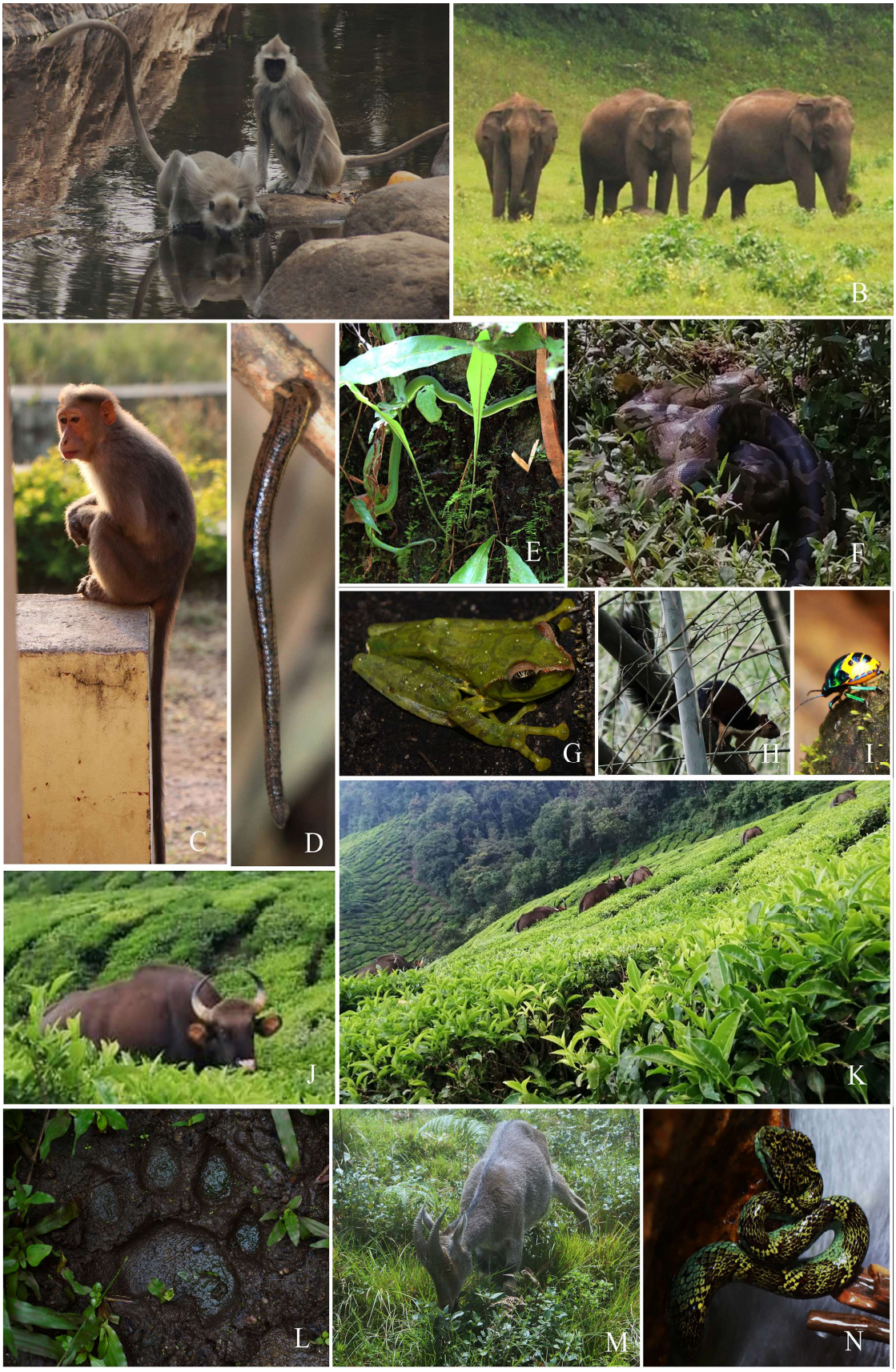


Fig. 5. Faunal diversity of Idukki district

8. Hydrology

8.1. Dams/reservoirs

There are fourteen dams are present in the district. They are, Idukki Dam, Anayirangal Dam, Cheruthoni Dam, Kallarkutty Dam, Kulamavu Dam, Kundala Dam, Lower Periyar Dam, Mattupetty Dam, Malankara Dam, Mullaperiyar Dam, Munnar Headworkers Dam, Ponmudi Dam, Erattayar Dam, and Chenkulam Dam

8.2. Rivers

The **Periyar River**, which originates in the Periyar Tiger Reserve, is Kerala's longest river, with an overall length of approximately 244 kilometers. Its major tributaries are, Muthirapuzha River, Mullayar River, Cheruthoni River, Perinjankutti River, Edamala River, and Chinnar River.

The **Azhuthayar**, a tributary of the Pamba River, is the third longest river in Kerala. It begins from Peerumedu, runs through dense forests and ends up in Koruthodu and outlines the border between Kottayam and Idukki districts.

The **Pambar River** initiates from the Anaimudi Hills and flows mostly through the Pathanamthitta district.

The **Thodupuzha River** is a tributary of the Muvattupuzha River, having its source in the Thodupuzha Taluk.

8.3. Waterfalls

There are five waterfalls are found in this district, which includes Cheeyappara Waterfalls, Lakkom Water Falls, Thommankuthu waterfalls, Thuvanam Waterfalls, and Valara waterfalls.

8.4. Backwaters and Canals

Devikulam, Eravikulam and Elaveezha Poonchira are the three-freshwater lakes in the district, with no backwaters. The canals are mainly used for irrigational purposes.

9. Land and Land Use Patterns

Land use patterns in the district are typical of high-altitude regions because it is situated in the Western Ghats. This region has the highest concentration of plantations and forests in the entire state. The district has over half covered in forest. In the plantation crops more than 80% occupies perennial crops, in which 50% confines cardamom, tea, rubber and coffee and 25% of area with pepper. Paddy farming is not very common. Agricultural land includes both irrigated and unirrigated areas with mixed crops. The district is known for its lemon grass

vegetation, which is distinctive for Western Ghats. A few barren rock outcrops are scattered in the wasteland (District Survey Report of Minor minerals, 2016).

10. Tribal Population

Nine major tribal groups such as Muthuvan, Mannan, Mala Arayan, Urali, Ulladan, Mala Pulayan, Paniyan, Mala Vedan, and Mala Pandaram live in the district. The Muthuvan constitute the majority of tribes. Mala Vedan and Mala Pandaram have significantly smaller populations than the other groups. Ethnically, the Muthuvan, Mannan, Paniyan, and Mala Pulayan are related to groups in Tamil Nadu. It appears that the Ulladan, Mala Arayan, and Urali came to Idukki from other regions of Kerala (Varghese & Mathew, 2015).

Significance of study

Idukki is the biodiversity rich districts in Kerala with three wildlife sanctuaries and five national parks accommodating a considerable number of endemic taxa. About 97% of the district is covered by rugged mountainous terrain and more than 50% is covered by various forest types. There have been previous floristic investigations, but this is the first comprehensive documentation of monocotyledons in the Idukki district. Since Idukki is a popular tourist destination, the most of the hill stations are accessible to tourists. The tourism development actively and passively affects floral and faunal diversity through construction activities, road widening, pollution, mining etc. Moreover, the extreme climate fluctuations and their resulting flood, fire regimes, snowfall, landslides, etc. lead to habitat fragmentation and destruction. The study provided a comprehensive account of the monocotyledon diversity of Idukki, which provides insights into the necessity of conservation, identification, impact assessment, research, management decisions, and policy formulation.

Objectives

1. Survey, collection, and documentation of the monocots of Idukki district.
2. Identification of each taxon in consultation with types or other authentic collections and relevant literature.
3. Preparation of herbarium specimens for future reference.
4. Assessment of the rare, endemic, and threatened monocot species in the area.
5. Compilation of Monocot Flora of Idukki district.

REVIEWOFLITERATURE

Review of Literature

The antiquity of floristic investigations in India begins around 3000 BC in the primeval Sanskrit literature such as Rig Veda, Yajurveda, Sama Veda, and Atharva Veda. In the great epic Ramayana, Valmiki recorded the use of medicinal plants. There are also reports of the medicinal properties of plants in the literature, such as Charakasmhitha and Susruthasamhitha (both of 2nd AD). Vrikshayurveda is emphasized in ancient and medieval Indian Sanskrit literature as a branch of knowledge that literally means "knowledge of tree life" and deals with plant pathology and various methods of treatment in general. During Marco Polo's travels in Malabar (1298 AD), he mentioned the cultivation of ginger (Quilon Ginger) (Malhotra, 2000). There has been considerable interest shown by several European countries in the plant wealth of India, especially those from the southern region of the Western Ghats.

Europeans pioneered systematic and scientific research in this region. During India's colonial period, Europeans began to study Indian plants, primarily in search of medicinal plants that could be used in modern medicine. A checklist of medicinal plants, the *Coloquis dos Simples* was written by Garcia De Orta (1565) and is regarded as the first botanical work in the Western Ghats, in which the author provided first-hand knowledge of some prominent Indian medicinal plants. *Hortus Malabaricus,* a twelve-volume work written by Van Rheede (1678–1693), includes the collection and documentation of the plant wealth of Malabar with detailed descriptions and illustrations of 781 plant species. Later Manilal (2003, 2008) reinterpreted and translated this work in Latin into English and Malayalam.

A major contribution to Indian floristics was made by British botanists. Among them, who worked in peninsular India, Robert Wight's contribution stands out. *Prodromus Florae Peninsulae Indiae Orientalis* by Wight and Arnott (1834) is a significant work on the plants of peninsular India. The *Illustrations of Indian Botany* (Wight, 1840) and *Icons Plantarum Indiae Orientalis* Wight (1838–1853) are the major publications, in which several taxa were described, many of which

are seen in Kerala. Beddome (1868–1874, 1869–1874, 1876, 1880) published a series of valuable works which includes *The flora Sylvatica for Southern India*, *Foresters Manual of Botany for Southern India* and *Icones Plantarum Indiae Orientalis* comprised figures of many species. *Flora Indica* by Roxburgh (1820, 1824), was a milestone towards the compilation of the flora of India. The monumental work of Hooker (1872-1897), the *Flora of British India* with seven volumes still serves as a cornerstone for floristic studies in India, which enclosed phanerogams of erstwhile British India, including Kerala. Subsequently, Cooke (1901-1908) and Gamble (1915–1936) published *The Flora of the Presidency of Bombay* and *The Flora of the Presidency of Madras* respectively. Gamble's (1915-1936) work is regarded as paramount among regional floras. South Indian plants have undergone a variety of works, including *The Forest Trees of Travancore* (Bourdillon, 1908) which was the first comprehensive work on 582 indigenous trees of Travancore, followed by *Flowering Plants of Travancore* (Rama Rao, 1914), *Vernacular List of Trees, Shrubs, and Climbers of Madras Presidency* (Lushington, 1915), *A Survey of the Flora of Anamalai Hills in the Coimbatore District, Madras Presidency* (Fischer, 1921), and *Flora of South Indian Hill Stations* (Fyson, 1932). All of these contributions to Indian botany were portrayed in *The Chapters on the History of Botany in India*, Burkill (1965). The Botanical Survey of India studied regional and local floras in order to prepare an exhaustive flora of India. As part of the aforementioned project, the publications *Flora of Karnataka* (Sharma *et al.*, 1984) and *Flora of Tamil Nadu, India* (Nair & Henry, 1983; Henry *et al.*, 1987, 1989) were published. There is much value and relevance in *Flora of Hassan district, Karnataka, India* (Saldanha *et al.*, 1976) and *The Flora of Tamil Nadu-Carnatic* (Matthew, 1982, 1983, 1988) regarding the south Indian flora.

The botanical investigations of 12 out of 14 districts in Kerala have already compiled by a various authors such as Manilal and Sivarajan (1982), Mohanan (1984); Ansari (1985); Ramachandran and Nair (1988); Antony (1989); Vajravelu (1990); Babu (1990); Mohanan and Henry (1994); Sasidharan and Sivarajan (1996); Anilkumar *et al.* (2005); Sunil and Sivadasan (2009); Narayanan (2009).

Important botanical studies on protective areas have been completed in Kerala which include *Flora of Silent Valley Tropical Rain forests of India* (Manilal, 1988), *Flora of Thenmala Division* (Subramaniyan, 1995), *Flora of Nilambur* (Sivarajan & Mathew, 1996), *Studies on the Flora of Shenduruny Wildlife Sanctuary* (Sasidharan, 1997), *Studies on the Flora of Periyar Tiger Reserve* (Sasidharan, 1998), *Studies on the Flora of Chinnar Wildlife Sanctuary* (Sasidharan, 1999), *Floristic studies in Parambikulam Wildlife Sanctuary* (Sasidharan, 2002) and *Flora of Agasthyamala* (Mohanan & Sivadasan, 2002).

Botanical explorations in Idukki

The flora of the Idukki district has not yet been thoroughly explored, and the scattered and fragmentary floristic studies available are insufficient to provide a clear picture of its floristic structure in comparison to remainig districts of Kerala. The first botanical collection was created by Beddome in 1882 from Peermade and adjacent Anamudi, which were formerly a part of the princely state of Travancore (Iyppu, 1955). Later on, Barnes (1939), Bourdillon (1908), Beddome, Meebold and Venkoba Rao collected specimens in the late 19th century and early 20th centuries. Hooker (1872–1897), Gamble and Fischer (1915–1936) cited these collections. Ram Rao (1914) in his *Flowering Plants of Travancore* mentioned various localities in the Idukki district. Chandrasekharan (1962) scrutinized the forest types of Idukki. A brief account of the flora of Anamudi and Devikulam was published by Sebastian and Vivekananthan (1967). Shetty and Vivekananthan (1971) compiled the vascular flora of Anamudi and surrounding hills in the current Idukki district, which includes several shola patches from that area as well as several noval and lesser-known taxa. Vivekananthan (1978) identified 12 rare and threatened plants while studying the flora of the Periyar Tiger Reserve. Mohanan *et al.* (1984) conducted a plant survey in the Idukki Hydroelectric Project area and gave details of some rare and interesting species. Balasubramanyam *et al*. (1989) documented certain plant taxa from the Pooyamkutty Hydroelectric Project Area. A total of roughly 400 species were identified by Shetty and Vivekananthan (1991) from the Anamudi and surrounding areas, 143 of which were found in grasslands.

Chandrasekharan (1962) noted the floristic features of the shola forests in the districts of Idukki and Wayanad while classifying the forest types of Kerala. Swarupanandan *et al.* (1998) conducted a comprehensive study of the flora of Shola forests in Mannavan shola and other sholas in Eravikulam National Park, reported 543 plant taxa from both cryptogams and phanerogams. According to this study, 109 species were endemic and 128 species were rare. Nair and Menon (2001), reported 36 arborescent species in the Eravikulam sholas, in which 30 species are endemic to peninsular India. Augustine (2000) investigated the angiosperm diversity and the ethnobotany of Periyar Tiger Reserve. Swarupanandan *et al.* (2001) performed research on the sholas of the Idukki district.

Menon (1997) gathered voluminous data on the floristic and community ecology of the shola forests of Eravikulam and Kanthallur in Idukki district, and attempted to map the shola vegetation of Eravikulam National Park using remote sensing techniques. Babu (1997) also used remote sensing data to investigate the shola-grassland ecosystem at Eravikulam. Karunakaran (1997) studied the grassland ecology of Eravikulam National Park, and gave information on the grass diversity of the region. Jose *et al.* (1994) conducted research on the grassland-shola forests of Eravikulam and discovered that the sholas with their distinctive deep fertile soil and high moisture holding capacity, can persist in the same steady climax state as long as anthropogenic and other disastrous instabilities do not abolish them.

Monocotyledons

Hooker (1872-1897.) and Gamble (1915–1936) based on Bentham and Hooker's (1862-1883) classification reported monocotyledon species of British India and Madras Presidency respectively in their works. Chase (2004) mentioned about the phylogenetic relationships of monocots. Several revisionary works on selected plant families/ genera of monocotyledons were available: Burmanniaceae (Jonker, 1938); *The grasses of Burma, Ceylon, India and Pakistan* (Bor, 1960); *A revision of Peliosanthes* (Liliaceae) (Jessop, 1976); *Introduction to orchids* (Abraham & Valsala, 1981); *A revision of the genus Hydrilla* (Hydrocharitaceae) (Cook & Luond,

1982); A *revision of the genus Blyxa* (Hydrocharitaceae) (Cook & Luond, 1983); *A revision of the genus Najas* L. (Najadaceae) *in the Old World* (Triest, 1988); *A revision of the Indian species of Oberonia* (Orchidaceae) (Ansari & Balakrishnan, 1990); *Flora of Kerala- grasses* (Sreekumar & Nair, 1991); *The Typhaceae in the southeastern United States* (Thieret & Luken, 1996); *Notes on the distribution and endemism of Indian Fimbristylis* (Prasad & Singh, 1997); *A revision of family Potamogetonaceae of India* (Kothari, 2001); *Zingiberaceae and Costaceae of south India* (Sabu, 2006); *The Cannaceae of the world* (De Kamer & Maas, 2008); *Flora of Tamil Nadu-Grasses* (Kabeer & Nair, 2009); *The family of Eriocaulaceae in India* (Ansari & Balakrishnan, 2009); *Rattans of India, Taxonomy, Biology and Utilization* (Renuka *et al.*, 2010); *Taxonomic revision of the genus Amomum Roxb. (Zingiberaceae) in India* (Thomas & Sabu, 2011); *Taxonomic revision of the genus Hedychium J.Koenig (Zingiberaceae) in India* (Sanoj & Sabu, 2011); *The family Juncaceae in India* (Chhetri *et al.,* 2011); *Taxonomic revision of the genus Commelina L. (Commelinaceae) in India* (Sheba & Nampy, 2012); *Taxonomic revision of the genus Murdannia Royle (Commelinaceae) in India* (Ancy & Nampy, 2015); *Morphological & Taxonomical studies on the genus Cyanotis D.Don (Commelinaceae) in India* (Resmi & Nampy, 2015); *Cyperaceae of Western Ghats, West coast and Maharashtra* (Wadoodkhan, 2015); *Endemic Vascular plants of India* (Singh *et al.,* 2015); *A taxonomic study on Arisaema Mart. (Araceae) in India* (Manudev & Nampy, 2017); *Systematic studies of selected genera of Zingiberaceae and molecular phylogeny of the family in India* (Aiswarya & Sabu, 2017); *A cytotaxonomic revision of Drimia Jacq. (Hyacinthaceae: Urgineoideae) in India* (Yadav *et al.*, 2019); *Revision of Indian Musaceae* (Joe & Sabu, 2019); *A revision of Tripogon (Poaceae: Chloridoideae) in India* (Thoiba & Pradeep, 2020) and *Systematic analysis of the genus Eriocaulon L. in India based on molecular and morphological evidence* (Darshetkar *et al.*, 2021).

Several new taxa have been discovered in various regions of the study area including *Dimeria sreenarayanae* Ravi & Anil Kumar (1992); *Habenaria periyarensis* Sasidh., K.P.Rajesh & Augustine (1998); *Dimeria idukkiensis* Ravi &

Anil Kumar (1992); *Murdannia satheeshiana* Joby, Nisha & Unni (2011); *Commelina clavatoides* Nampy & S.M.Joseph (2012); *Chlorophytum sharmae* Adsul, Lekhak & S.R. Yadav (Adsul *et al.*, 2014); *Dimeria raviana* Kiran Raj & Sivadasan (Kiran Raj *et al.,* 2015); *Eriocaulon biappendiculatum* Manudev, Robi & Nampy (Manudev *et al.*, 2015); *Hedychium matthewii* Sinj. Thomas, B.Mani & Britto (Thomas *et al*., 2015); *Tripogon idukkianus* Sunil & Pradeep (Sunil *et al*., 2015); *Tripogon munnarensis* Thoiba & Pradeep (Thoiba *et al.*, 2016); *Eriocaulon idukkianum* Manudev, Robi & Nampy (Manudev *et al.*, 2017); *Eriocaulon vamanae* Dani & Nampy (Francis *et al.*, 2020); *Pothos boyceanus* G.Rajkumar, Shaju, Nazarudeen & Prakashk (Rajkumar *et al.*, 2020); *Burmannia munnarensis* Dani & Nampy (Francis *et al.*, 2021); *Eriocaulon pandeyana* Nampy, Harishma & M.Vishnu (Harishma *et al.*, 2022).

MATERIALS AND METHODS

Materials and Methods

Field exploration

Extensive and systematic exploration of in different areas of the Idukki district were conducted during 2016–2022 for collecting plant specimens. A total of 40 field trips were conducted and 200 days were spent in the field. For each plant, 2 or 3 samples were collected. Samples were collected scientifically without harming other species. For herbaceous species, the entire plant, including the root was procured, and for larger species, fruiting and flowering twigs were collected. Several populations of most of the species were observed in the field, and the characters that will be devastated after preservation were recorded directly from the field. About 652 species were collected under 28 families. Collected samples were preserved in 4% formalin and 70% ethanol and labelled for further scrutiny in the laboratory. Photographs of all the plants were taken using α 55 (Sony, Japan) and 77 D (Canon, Japan) cameras. GPS data for the collection area was recorded using a GPS 72H (Garmin, Switzerland).

Fig. 6. Plant collection from different places of Idukki district

Herbarium preparation

The specimens for the herbarium were prepared by following the method of Bridson and Formann (1991). Collected samples were pretreated with formalin to kill the specimen and for preventing rapid degradation of the material, and pressed in the newspaper. The specimens were dried in an oven, the newspapers were changed daily and finally pasted on herbarium sheets using glue (fevicol SH). Thick stems, fruits, bulbs, *etc.* were often tied to the sheet using white thread. The dried specimens were poisoned in a saturated solution of mercuric chloride and alcohol into 1:9 ratio. The poisoned specimens were again kept for drying. A herbarium label with a standard size of 14.5 × 11 cm is pasted on the lower right corner of the sheet, incorporated information recorded in the field book, such as collection number, collection date, altitude, locality probably with longitude and latitude, name of the plant, family, notes, name of the collector, determinavit, name of herbaria, *etc*. The accession number from the field book was attached to the herbarium sheet using a tag. Small plants, flower buds, anthers, seeds, *etc*. were kept in translucent packets, attached to the sheet. This will help others to examine the specimen for further study. Finally, the mounted specimens belonging to a species were placed in a white species cover, and species covers belonging to a genus were arranged alphabetically and placed in a genus cover. All the specimens, thus prepared, were deposited in the Calicut University Herbarium (CALI).

Fig. 7. Herbarium processing and preparation

Plant description

Detailed morphological descriptions were prepared after proper determination and examination of a wide range of specimens. A data sheet was prepared for each group, and the observed data were recorded. The data sheet includes all the information about roots, stems, leaves, bracts, flowers, fruits, seeds, *etc*. The specimens were worked out using the Luxeo 4Z stereo microscope (Labomed, USA) and photographs were taken by Stemi 508 stereo microscope (Zeiss, Germany) affixed with an Axiocam 105 colour camera. The morphological terms used to describe the taxa followed Simpson (2006) and Beentje (2010). The metric system has been used for all kinds of measurements. Data on phenology is reported mostly from field studies and rarely from the literature and herbarium sheets.

Plant identification

Identification of taxa was done in consultation with pertinent literature such as Flora of British India, Flora of Presidency of Madras, Biodiversity documentation of Kerala (Sasidharan, 2004), District Floras of Kerala, Flora of Tamil Nadu-Carnatic, Flora of Ceylon, e-flora of China, etc. The monographs, revisions and latest publication on individual genera were also consulted. Literature and relevant information related to the taxa under investigation were gathered from various sources, such as institutional libraries and online information retrieval systems. The literature retrieval systems of the Biodiversity Heritage Library (http://www.biodiversitylibrary.org) of the New York Botanical Garden, Botanical Literature (http://www.botanicus.org), and Tropicos (https://www.tropicos.org) from the Missouri Botanical Garden Library, GBIF (https://www.gbif.org) were also used. Plants of the World Online (POWO, https://powo.science.kew.org) were used to determine global distribution. Identification was also done by comparing specimens available at the Calicut University Herbarium (CALI), Madras Herbarium (MH), Kerala Forest Research Institute Herbarium (KFRI), and images from the Kew Herbarium (K), Royal Botanic Garden Edinburgh (E), Muséum National d'Histoire Naturelle (P), ZE Botanischer Garten und Botanisches Museum, Freie Universität Berlin (B), *etc*. Online herbariums were accessed through the databases Index Herbariorum

(http://sweetgum.nybg.org/science/ih/) and Global Plants JSTOR (https://plants.jstor.org). Some of the specimens were referred to concerned experts in India and abroad for confirmation of identification. The species were categorized on the basis of the Bentham and Hooker's system of classification. The nomenclature of each species was updated as per the Shenzhen Code (Turland *et al.*, 2018). Author citation is followed by Plants Of the World Online (POWO, 2023) and the database IPNI (https://www.ipni.org).

Key preparation

Parallel dichotomous keys were prepared separately for family, genus, and species for rapid identification.

Conservation Status assessment

The conservation status of newly described species was assessed using IUCN Red List categories and criteria (2019, 2022) and also reported the species in IUCN Red List of Threatened Species. The endemism of plants was procured from recent literature.

Drawing illustrations/Photo plates

Illustrations of selected species were done using the camera lucida attached to a M 80 stereo microscope (Leica, Wetzlar) and drawn using rotring isograph pen 0.1- and 0.2 mm nibs in gateway paper. Photo plates were prepared from the photographs of habitat and habit taken from the field and the floral parts taken from the microscope using the software Adobe Photoshop 2020.

Plan of the thesis

Bentham and Hooker's system of classification is followed in the thesis with slight modification in the light of modern taxonomic thinking. In the case of the family Poaceae, classification is based on Clayton and Renvoize (1986). Workable dichotomous parallel keys are used for families, genera, and species. The treatment of each species includes the original citation of the correct name followed by basionym and other relevant synonyms if any, thereby facilitating a reference to various Indian Floras and publications which are arranged chronologically.

A short description and critical note on families were provided. Detailed botanical description of each species based on the authors collection and materials from various herbaria (CALI, MH, KFRI) is given, most of the garden and cultivated plants are listed in the table. The description is followed by worldwide distribution, habitat, flowering and fruiting, specimens examined and critical notes. Rare, endangered species are listed. Illustrations of new species are included. Photo plates depicting the vegetation types of the Idukki district, plates for each family and general plates for species are also included in the thesis, along with a bibliography on the floristic studies of the district, an index to families and copies of research papers published during the course of the investigation. Climatic data are provided in the appendix.

SYSTEMATIC
TREATMENT

Systematic treatment

MONOCOTYLEDONAE

Key to the families

1. Ovary superior …… 2

1. Ovary inferior …… 16

2. Fruits a caryopsis …… Poaceae

2. Fruits other than caryopsis …… 3

3. Perianth lobes calycine or absent …… 4

3. Perianth lobes corolline ……12

4. Flowers arranged in spikelets; perianth lobes absent …… Cyperaceae

4. Flowers not in spikelets; perianth lobes present or absent …… 5

5. Inflorescence terminal heads …… Eriocaulaceae

5. Inflorescence not terminal heads …… 6

6. Aquatic submerged herbs …… 7

6. Terrestrial or marshy herbs …… 8

7. Flowers in terminal racemes or spikes; fruits drupelets …… Potamogetonaceae

7. Flowers axillary, solitary or clustered; fruits an achene …… Najadaceae

8. Leaves grass like; flowers bisexual, arranged in cymes or dense spikes …… 9

8. Leaves not grass like; flowers unisexual, arranged in simple or branched spadix ……10

9. Flowers arranged in terminal or lateral cymes …… Juncaceae

9. Flowers arranged in dense terminal cylindric spikes …… Typhaceae

10. Spadix unbranched …… Araceae

10. Spadix branched …… 11

11. Leaves in terminal crown, palmate or pinnately divided; fruits not a syncarp …… Arecaceae

11. Leaves not in terminal crown, simple; fruits a syncarp …… Pandanaceae

12. Perianth lobes dissimilar, differentiated in to petals and sepals …… 13

12. Perianth lobes similar, not differentiated in to petals and sepals …… .15

13. Inflorescence bracteate heads …… Xyridaceae

13. Inflorescence not bracteate heads …… 14

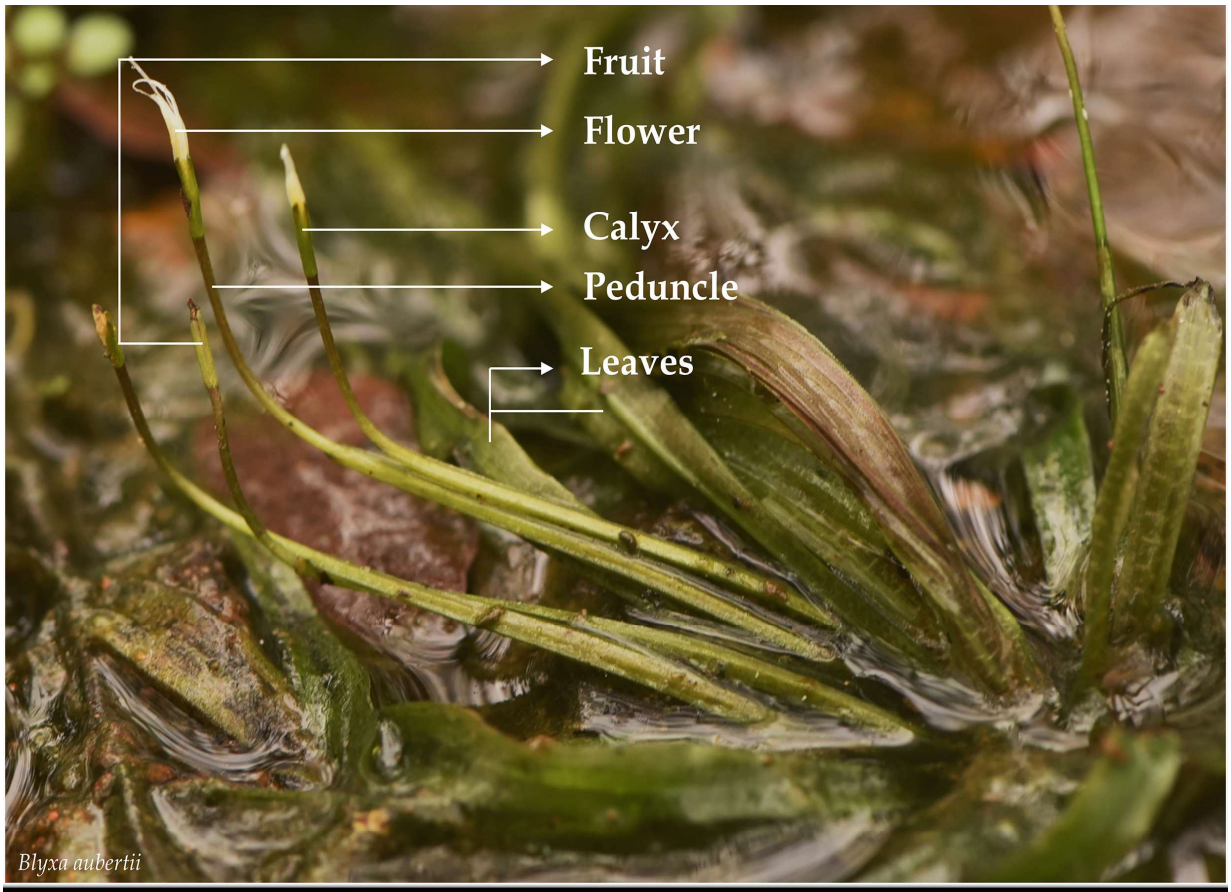
14. Plants terrestrial; fruits a loculicidal or indehiscent capsules…… Commelinaceae

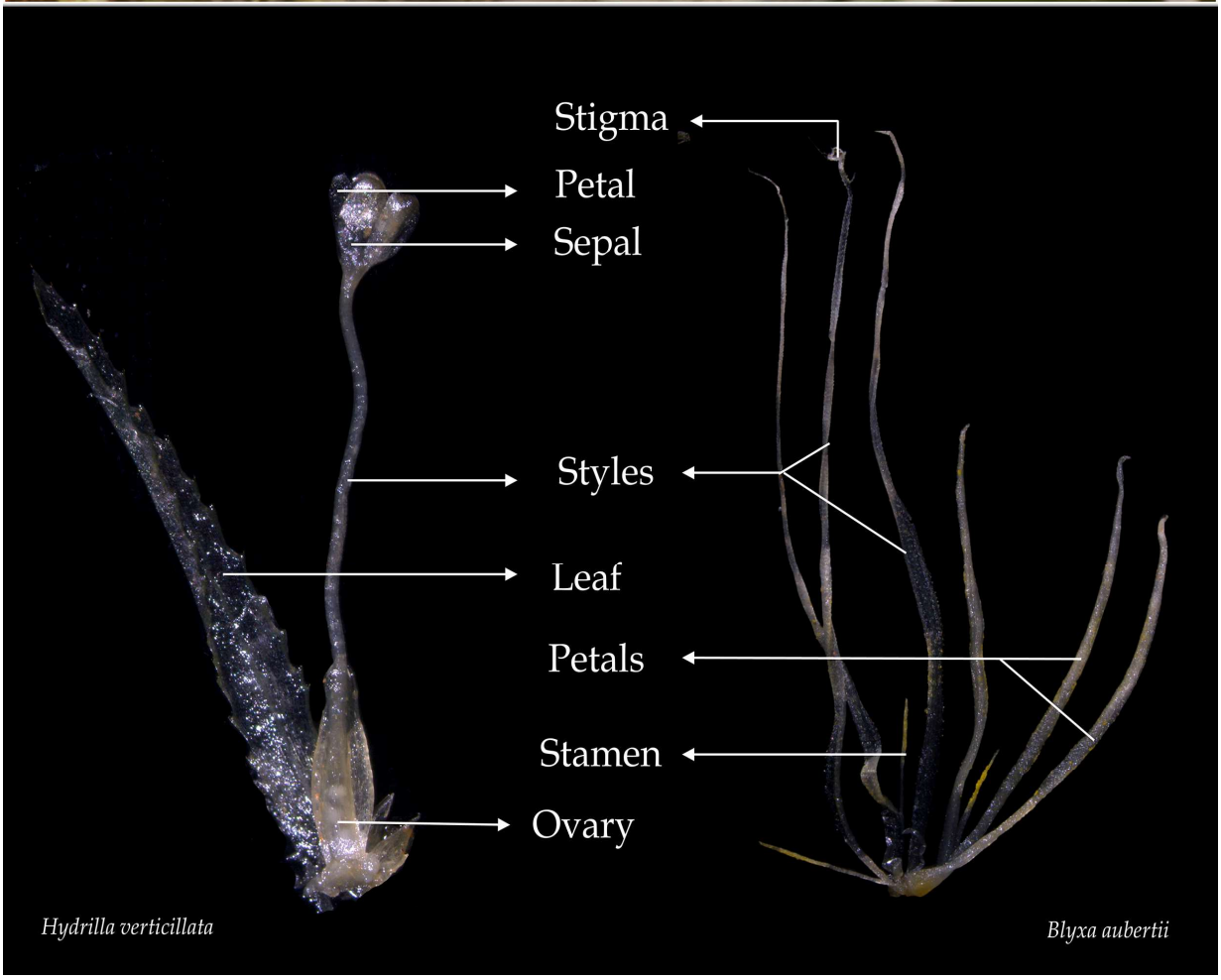
14. Plants aquatic; fruits an achene or follicle …….…….…….…….. Alismataceae
15. Marshy or aquatic herbs; stamens unequal one larger than others ……..…….
…….Pontederiaceae
15. Terrestrial herbs; stamens equal ……..... Liliaceae
16. Pollen grains collected in pollinia; seeds very minute ……..….. Orchidaceae
16. Pollen grains not collected in pollinia; seeds not minute ……..…….. 17
17. Flowers regular ……..…….…….…….…….…….…….…….…….…….…….…….. 18
17. Flowers irregular ……..…….…….…….…….…….…….…….…….…….…….…….. 23
18. Leaves differentiated into radical and cauline; anthers sessile on the corolla….
……..…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….. Burmanniaceae
18. Leaves not differentiated into radical and cauline; anthers not sessile ……... 19
19. Flowers unisexual ……..…….…….…….…….…….…….…….…….…….…….…….. 20
19. Flowers bisexual ……..…….…….…….…….…….…….…….…….…….…….…….. 21
20. Aquatic herbs ……..…….…….…….…….…….…….…….…….…….…….…….. Hydrocharitaceae
20. Terrestrial or climbing shrubs ……..…….…….…….…….…….…….…….…….. Dioscoriaceae
21. Inflorescence umbels ……..…….…….…….…….…….…….…….…….…….…….. Amaryllidaceae
21. Inflorescence racemes or panicles ……..…….…….…….…….…….…….…….. Haemodoraceae
22. Stamens 5, 2-lobed ……..…….…….…….…….…….…….…….…….…….…….. Musaceae
22. Stamens 1, one-lobed ……..…….…….…….…….…….…….…….…….…….…….. 23
23. Anther lobes 2; epigynous glands present ……..…….…….…….…….…….…….. Zingiberaceae
23. Anther lobes 1; epigynous glands absent ……..…….…….…….…….…….…….. 24
24. Inflorescence spikes or panicles; ovules 1……..…….…….…….…….…….…….. Marantaceae
24. Inflorescence racemes; ovules many ……..…….…….…….…….…….…….…….. Cannaceae

HYDROCHARITACEAE Juss.,

Gen. Pl. 67. 1789, *nom. cons.*

Aquatic, tufted rigid herbs. Leaves radical, linear or subulate; sheaths short. Scapes simple, glabrous. Inflorescence a terminal spike or head. Flowers sessile, bisexual; bracts orbicular or obovate, imbricate, coriaceous, persistent. Perianth inferior, 2-seriate. Sepals 3, deciduous; laterals 2, small, scarious, narrow, arched, keeled or winged; dorsal sepaloid, broader, arching over the corolla, sometimes absent. Petals 2 or 3, yellow, clawed; claws connate in to tube below. Stamens 3, inserted filiform, sometimes 0. Ovary inferior, free, 1 or imperfectly 3-celled; placentas 3,


Fruit
Flower
Calyx
Peduncle
Leaves
Blyxa aubertii


Stigma
Petal
Sepal
Styles
Leaf
Petals
Stamen
Ovary
Hydrilla verticillata
Blyxa aubertii

basal or parietal; ovules many; style 3-fid; stigma capitate or dilated. Capsules loculicidal, 3-valved or splitting lid like round at the top. Seeds numerous, minute, linear or ellipsoid, ribbed.

at the base of petal; anthers sagittate. Staminodes 3, alternating with the petals,

It is a cosmopolitan plant family with 13 genera and 97 species worldwide (POWO, 2023), 10 genera and 19 species in India. Diverse morphology and wide range of reproductive systems make this family particularly fascinating botanically. Although the family is primitively unisexual, there are derived bisexual species as well as dioecious and monoecious sexual conditions (Les *et al.,* 2008). Three species are found in the study area.

Key to the genera

1. Stems branched; leaves cauline, whorled …… *Hydrilla*
1. Stems unbranched; leaves radical, not whorled …… 2
2. Peduncles of female spathe spirally coiled; petals of female flowers obscure ….
…… *Vallisneria*
2. Peduncles of female spathe not coiled; petals of female flowers well developed
…….. *Blyxa*

Blyxa Thouars

Gen. Nov. Madagasc. 4. 1806.

Key to the species

1. Seeds ellipsoidal, smooth or with longitudinal ribs, without any projections …..
…… *B. aubertii*
1. Seeds fusiform, with prominent acute spines, and filiform projections or ridges
…… *B. echinosperma*

Blyxa aubertii Rich., Mem. Cl. Sci. Math. Inst. Natl. France 1811(2): 19. 1814. *Blyxa ceylanica* Hook.f., Fl. Brit. India 5(15): 661. 1888; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1397. 1928.

Annual, aquatic herbs, 13–29 cm long. Root stocks 2–4 cm long with numerous thin roots. Leaves radical, lanceolate-linear, 13–24 × 2–9 cm, acute at apex, attenuate at base, spiny at margins, glabrous, green; mid vein prominent, distinct,

cross veins obscure. Inflorescence solitary or rarely 2-flowered, tubular, sessile or pedunculate; peduncles terete, 30–50 cm long. Flowers bisexual, solitary or 2-flowered, emergent. Hypanthium terete, 5–7 cm long, 2-clefted at apex, completely cover the ovary. Sepals 3, linear, 6–8 × 0.8–1 mm, obtuse at apex, cuneate at base, scaberulous at margins, glabrous, green. Petals 3, linear, band like, twisted, 8–17 × 0.3–0.5 mm, twisted at apex, attenuate at base, spinulate at margins, glabrous, white, remain twisted within the calyx. Stamens 3, antisepalous; filaments 2–4 mm long; anthers linear, 1–1.5 mm, dehiscing before the stigma, emerge from the calyx tube, yellow. Ovary linear-cylindrical, 4–5 cm long, 3-loculed, many ovuled; style divided, 4–8 cm long; stigma 3, linear, 8–12 mm long, papillose distally, white. Capsules terete, cylindrical, narrowed distally into hypanthium. Seeds ellipsoidal, smooth or with longitudinal ribs.

Distribution: Tanzania to Mosambique, Madagascar, Tropical and Subtropical Asia to NW. Pacific (POWO, 2023); *Habitat*: Ponds, paddy fields; *Fl. & Ft.*: September-December.

Specimens examined: Kumarikulam, Periyar Tiger Reserve, 12.03.1995, *K.P. Rajesh & Jomy Augustine* 14859 (KFRI); Malankara dam, Thodupuzha, 10.12.2022, *Dani Francis & Santhosh Nampy* 176128; Muttam, 10.12.2022, *Dani Francis & Santhosh Nampy* 176130 (CALI); near subsidiary turners valley, Eravikulam, 03.12.1987, *P. Bhargavan* 82306; Valara river side, 21.08.1965, *K.M. Sebastine* 25330 (MH).

Notes: This species is characterized by its attenuated, radical leaves, bisexual flowers, linear, band like petals which often remain folded and twisted within the calyx, and ellipsoidal smooth or with longitudinal ribs on seeds without long spines and apical and basal tails. The rhizomes are easily detached from the substrate before the fruits ripen, hence it is not considered to be a serious weed. It is also used as an aquarium plant (Cook & Luond, 1983).

Blyxa echinosperma (C.B.Clarke) Hook.f., Fl. Brit. India 5: 661. 1888; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1397. 1928. *Hydrotrophus echinospermus* C.B.Clarke, J. Linn. Soc., Bot. 14: 8. 1873.

Annual, aquatic herbs, 13–20 cm long. Root stocks 2–3 cm long with numerous thin roots. Stems shortened. Leaves radical, strap-shaped, 10–20 × 0.4–0.7 cm, acuminate at apex, attenuate at base, spiny at margins, glabrous, green, 7–9-

nerved. Inflorescence solitary or rarely 2-flowered, tubular, pedunculate; peduncles terete, slender, 2–12 cm long. Flowers bisexual, solitary or 2-flowered, emergent. Hypanthium terete, 2–5 cm long, 2-clefted at apex, completely cover the ovary. Sepals 3, linear, 6–8 × 0.8–1 mm, obtuse at apex, cuneate at base, scaberulous at margins, glabrous, green. Petals 3, linear, band like, twisted, 10–14 × 0.5–0.8 mm, twisted at apex, attenuate at base, spinulate at margins, glabrous, white, remain twisted within the calyx. Stamens 3, antisepalous; filaments 2–4 mm long; anthers linear, 1–2 mm, dehiscing before the stigma, emerge from the calyx tube, yellow. Ovary narrowly cylindric, 3–7 cm long, 3-loculed, many ovuled; style divided, 0.6–1.5 cm long; stigma 3, linear, 8–12 mm long, papillose distally, white. Capsules terete, cylindrical, narrowed distally into hypanthium. Seeds fusiform, with filiform projections or ridges 2–12 mm from each end, and with prominently acute spines on surface.

Distribution: Tropical and Subtropical Asia to N. Australia (POWO, 2023); *Habitat*: Ponds, paddy fields; *Fl. & Ft.*: May-October.
Specimen examined: Meenmutty, 30.05.1982, *C.N. Mohanan* 74096 (MH).
Notes: This species is characterized by fusiform seeds with filiform projections or ridges 2–12 mm from each end, and with prominently acute spines on surface.

Hydrilla Rich.,

Mem. Cl. Sci. Math. Inst. Natl. France 12(2): 9, 61. 1811.

Hydrilla verticillata (L.f.) Royle, Ill. Bot. Himal. Mts. 1: 376. 1839; Hook.f., Fl. Brit. India 5: 659. 1888; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1396. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 517. 2004. *Serpicula verticillata* L.f., Suppl. Pl. 416. 1782.

Submerged, monoecious herbs, 15–40 cm tall. Roots long, thin. Stems branched, creeping or erect, slender, terete, glabrous; internodes 0.7–1 cm long. Leaves whorled, linear-lanceolate, 0.5–1.6 × *c.* 0.1 cm, acute at apex, cuneate at base, sessile, serrate or denticulate at margins, spines unicellular, glabrous, green. Squamulae intravaginales usually two in each leaf, narrowly triangular, *c.* 0.5 mm long, hyaline, irregularly fringed with finger-like projections. Flowers unisexual, formed within spathes. Male spathes solitary in leaf axils, globose, *c.* 1.5 mm diam., 8–16 appendages towards apex, at dehiscence a small knob at the center of the

top, splitting distally and liberating the flower. Male flowers solitary, released underwater as globose buds which float and open in air on the surface of the water; pedicels *c.* 0.5 mm long; sepals 3, free, at anthesis strongly convex, imbricate, *c.* 3 × 2 mm, white; petals 3, free, linear or spathulate, 1.5–2 mm long, reflexed, white; stamens 3; filaments 0.5–0.7 mm long; anthers erect, latrorsely and explosively dehiscent. Female spathes solitary or rarely two in leaf axils, sessile, cylindrical, tapering distally, hyaline; hypanthium filiform, 1–5 cm long; sepals 3, free, oblong-ovate, 5–7 × 3–4 mm, obtuse at apex, sub-truncate at base, glabrous, hyaline; petals 3, free, 5–7 × 1.5–2 mm, obtuse at apex, glabrous, transparent. Staminodes 3, minute or absent. Ovary unilocular, cylindrical; style single; stigma 3, triangular, rarely lobed, papillose adaxially. Fruits indehiscent, cylindrical. Seeds fusiform, 2–3, minute, smooth.

Distribution: Poland to Asia, Australia, Uganda to N. Zambia (POWO, 2023); *Habitat*: Stagnant water; *Fl. & Ft.*: Throughout the year.

Specimens examined: Lower periyar, 27.01.1983, *A.G. Pandurangan* 76655 (MH); Malankara dam, 10.12.2022, *Dani Francis & Santhosh Nampy* 176129; Thodupuzha river, 10.12.2022, *Dani Francis & Santhosh Nampy* 176127 (CALI); Thondiyar, Periyar Tiger Reserve, 24.12.1994, *Jomy Augustine* 14290 (KFRI); Uppthara, 29.04.1984, *C.N. Mohanan* 81662 (MH).

Notes: *Hydrilla* is a monotypic genus. The vegetative parts of this species are highly plastic and readily modified by changes in the environment. It thrives under various types of pollution and nutrient enrichment, and it can withstand a great deal of habitat disturbance. Its gregarious growth makes it a serious weed in many countries, where it fills pools, ponds, and shallow reservoirs and may block irrigation ditches and canals. It is particularly troublesome in ponds for rearing fish (Cook & Luond, 1982).

Vallisneria L.,

Sp. Pl. 2: 1015. 1753.

Vallisneria spiralis L., Sp. Pl. 2: 1015. 1753; Hook.f., Fl. Brit. India 5: 660. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1396. 1928.

Submerged tufted, stemless, stoloniferous herbs, 25–50 cm long. Leaves long, linear, flat, ribbon like, 20–50 × 0.4–0.6 cm, acute at apex, sub-truncate at base,

serrulate at margins, glabrous, green. Flowers dioecious. Male spathes tubular, 2-toothed at apex; pedicels slender, 3–6 cm long. Male flowers numerous, at maturity the flowers completely detach from the spathe and rise to the surface, where they are dispersed by wind and currents. Sepals 3, linear. Petals 3, linear, white. Stamens 3; anthers narrow, erect. Female spathes oblong, 1.5–2 cm long, 3-toothed at apex, carried to the surface in flower by the uncoiling of the scape which after fertilization again coils close and brings the ovary down to ripen under water, white; peduncles spirally coiled, 40–60 cm long. Female flowers solitary, sessile. Sepals ovate, *c.* 2 × 1 mm, obtuse at apex, cuneate at base, glabrous. Petals obscure. Ovary narrow not produced upwards; ovules numerous; stigma 3, broad. Fruits linear, many seeded.

Distribution: Europe to Indo-China and S. Africa (POWO, 2023); *Habitat*: Rivers and ponds; *Fl. & Ft.*: October-February.

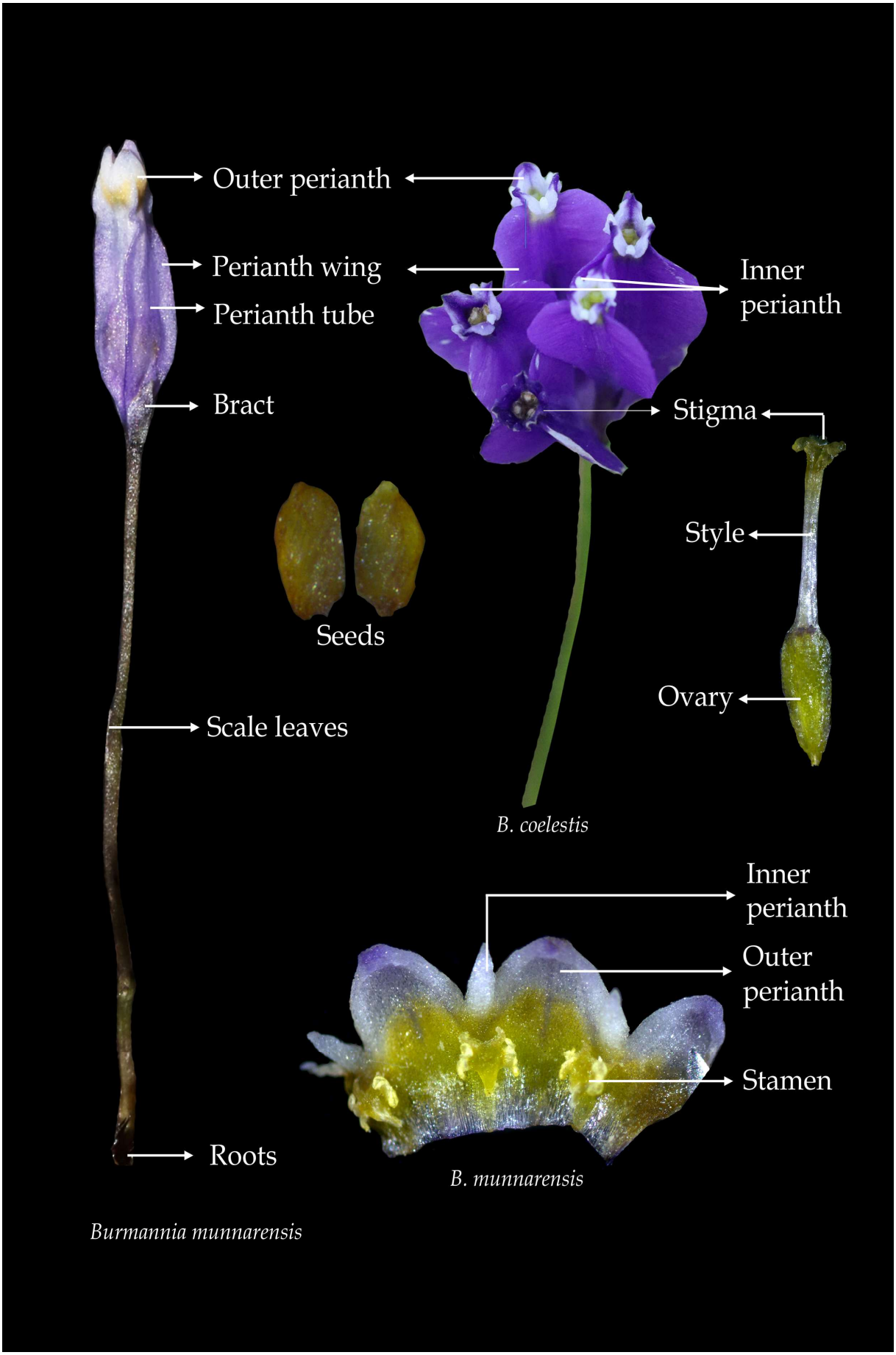
Specimen examined: Thodupuzha river, 10.12.2022, *Dani Francis & Santhosh Nampy* 176125 (CALI).

Notes: *Vallisneria spiralis*, commonly known as 'eelweed', 'eelgrasses, or 'tape grass', is a dioecious perennial freshwater plant. This species shows high ecological plasticity, promoting sediment stability and affecting water column and sediment biogeochemistry, and its dense stands provide habitat for aquatic fauna (Rimac *et al.*, 2020). This species is considered effective invader because of their its efficient dispersal, vegetative reproduction, high biomass production, and popularity in the aquarium trade (Wasowicz *et al.,* 2014).

BURMANNIACEAE Blume,

Enum. Pl. Javae 27. 1827.

Herbs. Leaves linear, radical and cauline, entire or reduced to scales. Inflorescence terminal, many flowered cymes or racemes or solitary flower. Flowers bisexual, each opposite a bract. Perianth superior, persistent, 6-lobed or cleft, rarely 3-lobed; lobes valvate. Anthers 3 or 6, 2-celled, sessile on the perianth throat. Ovary inferior, 3-celled or 1-celled with 3 parietal placentas; style single, stigma various; ovules numerous. Capsules loculicidal, or transversely dehiscing. Seeds minute; testa reticulate.


Outer perianth
Perianth wing
Perianth tube
Bract
Scale leaves
Roots
Seeds
Inner perianth
Stigma
Style
Ovary
B. coelestis
Inner perianth
Outer perianth
Stamen
B. munnarensis
Burmannia munnarensis

The family includes myco-heterotrophic and autotrophic species. Jonker (1938) reported 16 genera and 58 species in his monograph, while 14 genera and 219 species are recognized in POWO (2023). Three genera and 12 species are reported from India (Hazra, 1988; Hareesh *et al.,* 2018). Francis *et al.* (2021) described *Burmannia munnarensis* from Kerala and rediscovered *B*. *indica* after 110 years from the type locality. Four species occur in the study area.

Burmannia L.,

Sp. Pl. 1: 287. 1753.

Key to the species

1. Radical rosette of leaves present or sometimes absent (in *B. pusilla*); perianth wings triangular, cordate or half orbiculate ……..…….. 2

1. Radical rosette of leaves absent; perianth wings half elliptical ……..…….. 3

2. Margin of perianth lobes double; perianth wings triangular or cordate ..... ……..…….. *B. coelestis*

2. Margin of perianth lobes single; perianth wings half orbiculate ..... *B. pusilla*

3. Flower wings 1.5–6 mm broad; margin of perianth lobes swollen, not involute or revolute ……..…….. *B. indica*

3. Flower wings 0.3–0.5 mm broad; margin of perianth lobes rather thin, involute ……..…….. *B. munnarensis*

Burmannia coelestis D.Don, Prodr. Fl. Nepal. 44. 1825; Hook.f., Fl. Brit. India 5: 665. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1399. 1928; Jonker, Monogr. Burmann. 120. 1938; Hazra in M.P.Nayar *et al.*, Fasc. Fl. Ind. 19: 9. 1988; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 492. 2004.

Annual, erect, chlorophyllous herbs, 7–12 cm tall. Roots fibrous, short. Stems slender, glabrous, green. Radical leaves lanceolate, *c.* 2.3 × 0.2–1 mm, obtuse at apex, 3-nerved, parallel, glabrous, greenish; cauline leaves appressed, scale like, linear-lanceolate, 2–3.5 mm long, acute-acuminate at apex, glabrous, single nerved, greenish. Inflorescence solitary, *c.* 9 × 4 mm. Flowers bisexual, 9 × 4.1 mm, 3-winged, sessile or shortly stalked; stalks 1–3 mm long. Perianth purple; wings triangular or cordate, *c.* 2 × 1.1 mm, running from the base of the limb to the base

of the ovary and decurrent along the pedicel, obtuse at apex, glabrous; tubes cylindrical, *c.* 9 × 4.1 mm; outer perianth triangular, 1–1.5 × *c.* 0.6 mm, acute at apex; margins double, thick, glabrous; inner perianth narrow, triangular, 0.5–1 mm long, acute at apex, margins double, thick, glabrous. Stamens 3, sessile in the perianth throat, 2 mm long, yellow; anthers 2, thecae lateral, connectives with two curved, divergent, obtuse, apical crests, and an obtuse, basal spur. Ovary *c.* 2 × 1.5 mm, oblong, 3-celled, ovules many; style trifid, *c.* 4 mm long, glabrous; stigma trifid, capitate. Capsules obovoid, truncate, 2–4 mm long, dehiscing in transverse slits. Seeds numerous, obovate, 0.1–0.3 mm long, slightly curved; testa spirally twisted.

Distribution: Nepal to Caroline Islands (POWO, 2023); *Habitat*: Open wet grasslands and on dripping rocks; *Fl. & Ft.*: October-December.

Specimens examined: Kattappana, 13.11.1981, *C.N. Mohanan* 72484 (MH); Koyimanchola way side, 10.02.2021, *Dani Francis & Santhosh Nampy* 188703; Kudimala-Lakkamkudi, 09.12.2019, *Dani Francis & Santhosh Nampy* 170012 (CALI); Kulamavu, 12.10.1982, *C.N. Mohanan* 74584 (MH); Meenuliyanpara, 29.12.2019, *Dani Francis & Santhosh Nampy* 164620; *Ibid.*, 25.10.2020, *Dani Francis & Santhosh Nampy* 170086; Mesthirikettu, near Eravikulam, 30.12.2017, *Dani Francis & Santhosh Nampy* 158075 (CALI); Mlappara, Periyar Tiger Reserve, 20.09.1995, *N. Sasidharan & Jomy Augustine* 16836 (KFRI); painavu-Kulamavu Road, 11.11.1981, *V.S. Raju* 71231; Pullupara, Peruvanthanam, 24.11.1967, *K. Vivekananthan* 29342; Umayamala, Eravikulam, 03.08.1970, *B.V. Shetty* 31799 (MH).

Burmannia indica Jonker, Monogr. Burmann. 161. 1938; Hazra in M.P.Nayar *et al.*, Fasc. Fl. Ind. 19: 12. 1988; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 492. 2004; Dani *et al.*, Phytotaxa 507(1): 108. 2021. **Fig. 8**

Annual, erect, chlorophyllous herbs, 15–35 cm tall. Roots fibrous, short. Stems slender, profusely branched, glabrous, pale green-straw coloured. Radical leaves absent; cauline leaves appressed, scale like, linear lanceolate, 1–3.5 mm long, acute-acuminate at apex, glabrous, 3–5-nerved, greenish. Bracts lanceolate, 2–4.2 × *c.* 1.3 mm, acute at apex, glabrous, green. Inflorescence branched distally, 1–8

flowers on each branch. Flowers bisexual, 10–20 × *c.* 5 mm, sessile or shortly stalked; stalks 1–7 mm long. Perianth pale purple; wings half elliptical, 10–16 × 1.5–6 mm, running from the base of the limb to the base of the ovary and decurrent along the pedicel, rounded or cordate at apex, glabrous; tube cylindrical, 10–13 × 1–1.5 mm; outer perianth erect, triangular, 1–2 × 1.5–2 mm, acute at apex, margin single, thick, swollen, glabrous; inner perianth erect, thick, linear, 0.5–1 mm long, acute at apex, margin single, swollen, glabrous, white. Stamens 3, sessile in the perianth throat, *c.* 1 mm long, yellow; anthers 2, thecae lateral, connectives with two curved, divergent, obtuse apical crests, and an obtuse basal spur. Ovary ellipsoid or obovoid, 1–6 mm long, 3-celled; ovules many, green; style filiform, *c.* 8 mm long, glabrous; stigma trifid, funnel-shaped, sub-bilabiate. Capsules obovoid, truncate, 1–6 mm long, dehiscing in transverse slits. Seeds numerous, obovate, 0.1–0.3 mm long, slightly curved; testa spirally twisted.

Distribution: Endemic to Kerala; *Habitat*: Open wet grasslands and on dripping rocks; *Fl. & Ft.*: October-December.

Specimens examined: Meenuliyanpara, 29.12.2019, *Dani Francis & Santhosh Nampy* 164619; *Ibid.*, 25.10.2020, *Dani Francis & Santhosh Nampy* 170085 (CALI); Peermade, December.1909, *A. Meebold* 12915 (B10 0296386).

Notes: *Burmannia indica* was first described by F.P. Jonker in 1938 based on a homogenous collection of A. Meebold in 1909 from Peermade (now in Idukki district of Kerala). Hazra (1988) in *Fascicles of Flora of India* and Sasidharan (2004) in *Flowering plants of Kerala* mentioned its occurrence based on Meebold's collection. There was no subsequent collection of this species anywhere after Meebold (Hooker, 1888; Gamble, 1928; Matthew, 1983), and thus, the present report forms a rediscovery after a lapse of 110 years and proves its existence in the area. The new locality Meenuliyanpara also belongs to the same district separated by approximately 270 km from the type locality. Jonker (1938) mentioned *B. indica* as a saprophytic species, indicating the myco-hetrotrophic nature of the species, but the present collection is chlorophyllous and not myco-hetrotrophic. It is likely that Jonker didn't see any living material and his description was based solely on Meebold's specimens. Moreover, the open and often wet habitats of *B. indica* also indicate an autotrophic nature.

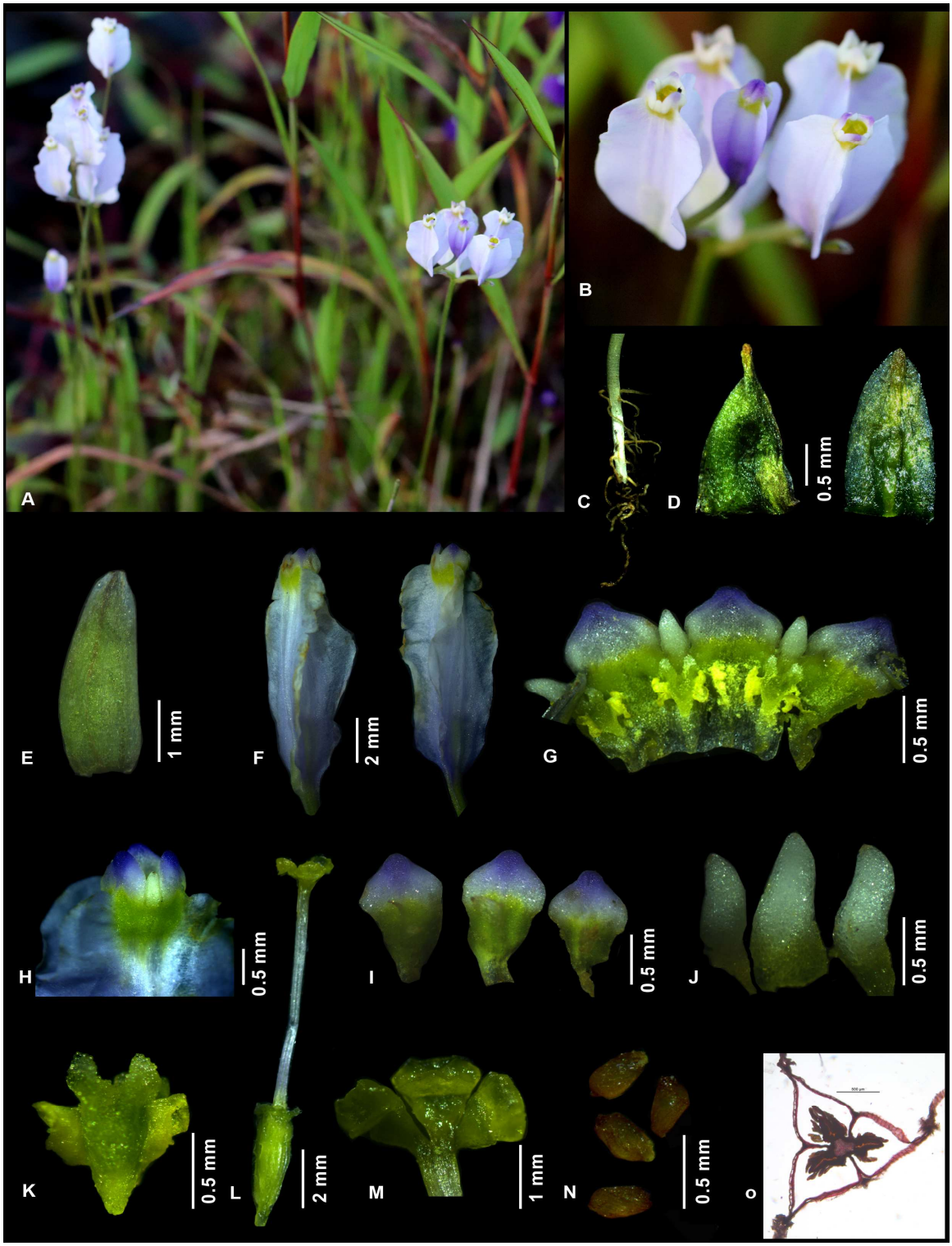


Fig. 8. *Burmannia indica* Jonker: **A.** Habitat; **B.** Inflorescence; **C.** Basal part of the plant, see the absence of radical leaves; **D.** Scale like leaves; **E.** Bract; **F.** Flowers; **G.** Upper part of flower split open showing perianth lobes and stamens; **H.** Upper part of flower showing closeup of perianth; **I.** Outer perianth lobes; **J.** Inner perianth lobes; **K.** Stamen, see the two lateral thecae, apical crests and basal spur; **L.** Gynoecium; **M.** Enlarged view of stigma; **N.** Seeds; **O.** Cross section of ovary.

Burmannia munnarensis Dani & Nampy, Phytotaxa 507(1): 106. 2021.

Figs. 9, 10

Annual, erect, chlorophyllous herbs, 8–18 cm tall. Roots fibrous, short. Stems slender, seldom branched, glabrous, green. Radical leaves absent; cauline leaves appressed, scale like, linear-lanceolate, 2–3.5 mm long, acute-acuminate at apex, glabrous, single nerved, greenish. Bracts lanceolate, *c.* 2.5 × 0.8–1 mm, obtuse at apex, glabrous, green. Inflorescence rarely branched, 1–4-flowered. Flowers bisexual, 10–15 × 2–5 mm, narrowly 3-winged, sessile or shortly stalked; stalks 1–5 mm long. Perianth pale purple; wings half elliptical, 8–11 × 0.3–0.5 mm, running from the base of the limb to the base of the ovary and decurrent along the pedicel, rounded at apex, glabrous; tube cylindrical, 5–8 × 1–1.5 mm; outer perianth triangular, 1–1.5 × *c.* 0.6 mm, acute at apex; margin single, involute, slightly thick, glabrous; inner perianth erect, narrow, linear, 0.5–1 mm long, acute at apex, margin single, slightly involute, glabrous. Stamens 3, sessile in the perianth throat, *c.* 1 mm long, yellow; anthers 2, thecae lateral, connectives with two curved, divergent, obtuse, apical crests, and an obtuse, basal spur. Ovary 3–7 mm long, obovoid, 3-celled; ovules many, green; style filiform, *c.* 6 mm long, glabrous; stigma trifid, funnel-shaped, sub-bilabiate. Capsules obovoid, truncate, 3–7 mm long, dehiscing in transverse slits. Seeds numerous, obovate, 0.1–0.3 mm long, slightly curved; testa spirally twisted.

Distribution: Endemic to Kerala; *Habitat*: Open wet grasslands and on dripping rocks; *Fl. & Ft.*: October-December.

Specimens examined: Koymanchola way side, 10.02.2021, *Dani Francis & Santhosh Nampy* 188704; Munnar, way to Rajamala, 08.11.2020, *Dani Francis & Santhosh Nampy* 173331(CALI); Old Devikulam, 25.01.1964, *K.M. Sebastine* 18467; Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 170099 (CALI).

Notes: The new taxon is morphologically close to *Burmannia indica* Jonker but differs by the narrow flower wings (0.3–0.5 *vs* 1.5–6 mm), nature of the perianth lobes (involute *vs* not involute), length of the perianth tube (5–8 *vs* 10–13 mm) and inflorescence (rarely branched, 1–4-flowered *vs* branched at the top, 1–8-flowered).

Fig. 9. *Burmannia munnarensis* Dani & Nampy: **A.** Habit; **B.** Basal part of plant without leaves; **C.** Scale leaves; **D.** Bracts; **E.** Single flower; **F.** Upper part of flower split open showing perianth lobes and stamens; **G.** Gynoecium; **H.** Stigma; **I.** Inner perianth lobes; **J.** Outer perianth lobes; **K.** Stamen, see the two lateral thecae, apical crests and basal spur.

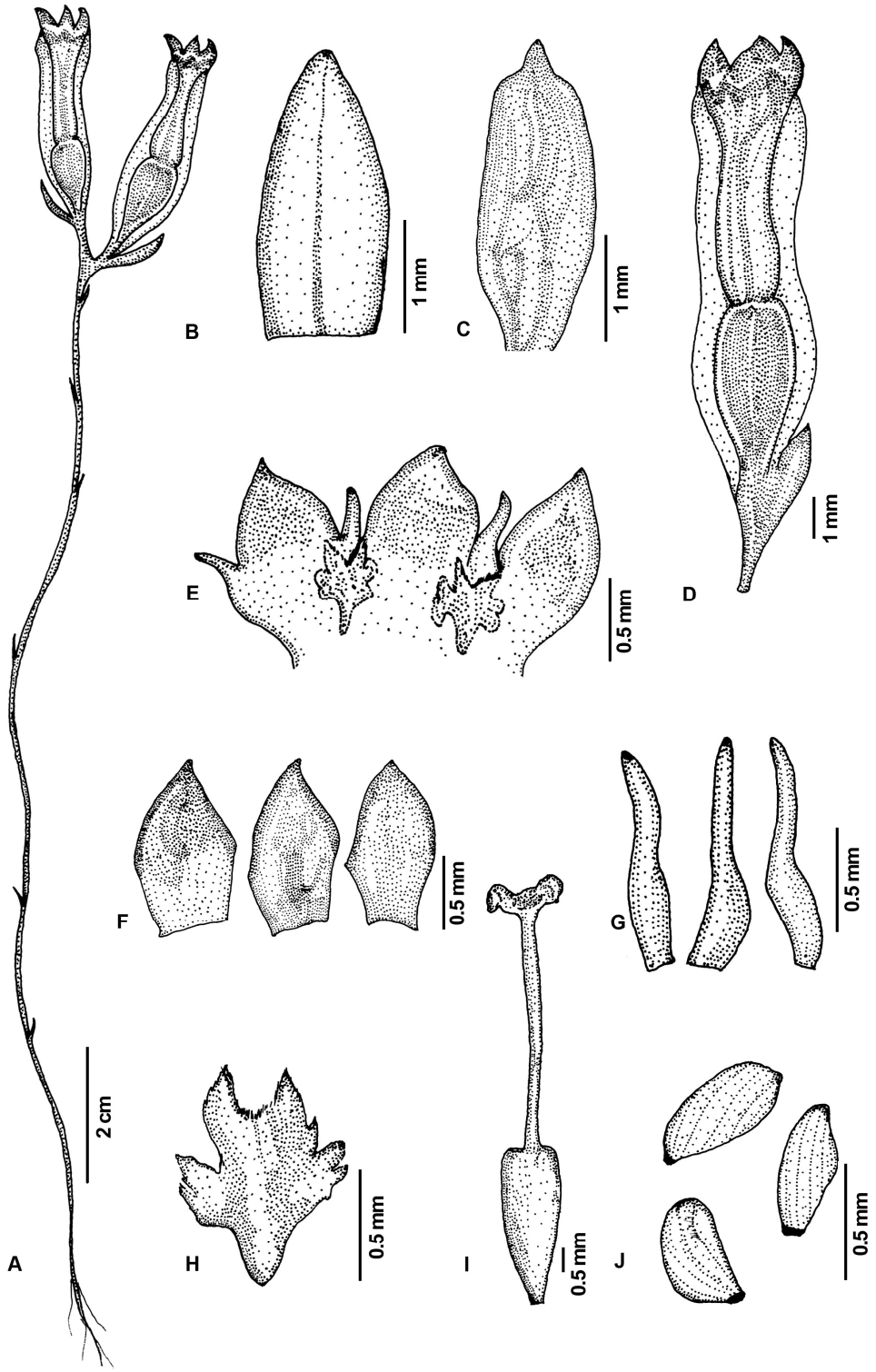


Fig. 10. *Burmannia munnarensis* Dani & Nampy: **A.** Habit; **B.** Scale leaf; **C.** Bract; **D.** Single flower; **E.** Upper part of flower split open showing perianth lobes and stamens; **F.** Outer perianth lobes; **G.** Inner perianth lobes; **H.** Stamen, see the two lateral thecae, apical crests and basal spur; **I.** Gynoecium; **J.** Seeds.

Burmannia pusilla (Miers) Thwaites, Enum. Pl. Zeyl. 325. 1864; Hook.f., Fl. Brit. India 5: 665. 1890; Jonker, Monogr. Burmann. 130. 1938; Hazra in M.P.Nayar *et al.*, Fasc. Fl. Ind. 19: 13. 1988. *Gonianthes pusilla* Miers, Trans. Linn. Soc. London 18: 537. 1841.

Annual, erect, chlorophyllous herbs, 4–12 cm tall. Roots fibrous, short. Stems slender, glabrous, green. Radical leaves up to 5 mm long, sometimes lacking; cauline leaves appressed, scale like, lanceolate, 1–2.5 mm long, acute-acuminate at apex, glabrous, single nerved, greenish. Bracts lanceolate or elliptic, 1–2 mm long, acute at apex, glabrous, green. Inflorescence usually 1-flowered, rarely branched. Flowers bisexual, 4.5–6 mm long, 3-winged. Perianth bluish; wings half orbiculate, 3.5–6 mm long, running from the base of the limb to the base of the ovary and decurrent along the pedicel, rounded at apex, glabrous; tube cylindrical, 1.5–3 mm long; outer perianth broad, triangular, 1–1.5 × *c.* 0.6 mm, obtuse at apex, margin single, thick, glabrous; inner perianth fleshy, linear, *c.* 0.5 mm long, acute at apex, margin single, glabrous. Stamens 3, sessile in the perianth throat, *c.* 1 mm long, yellow; anthers 2, thecae lateral, connectives with two curved, divergent, obtuse, apical crests, and an obtuse, basal spur. Ovary *c.* 3 mm long, obovoid, 3-celled; ovules many, green; style filiform, *c.* 5 mm long, glabrous; stigma trifid, funnel-shaped, sub-bilabiate. Capsules obovoid, truncate, *c.* 3 mm long, dehiscing in transverse slits. Seeds numerous, obovate, 0.1–0.3 mm long, slightly curved; testa spirally twisted.

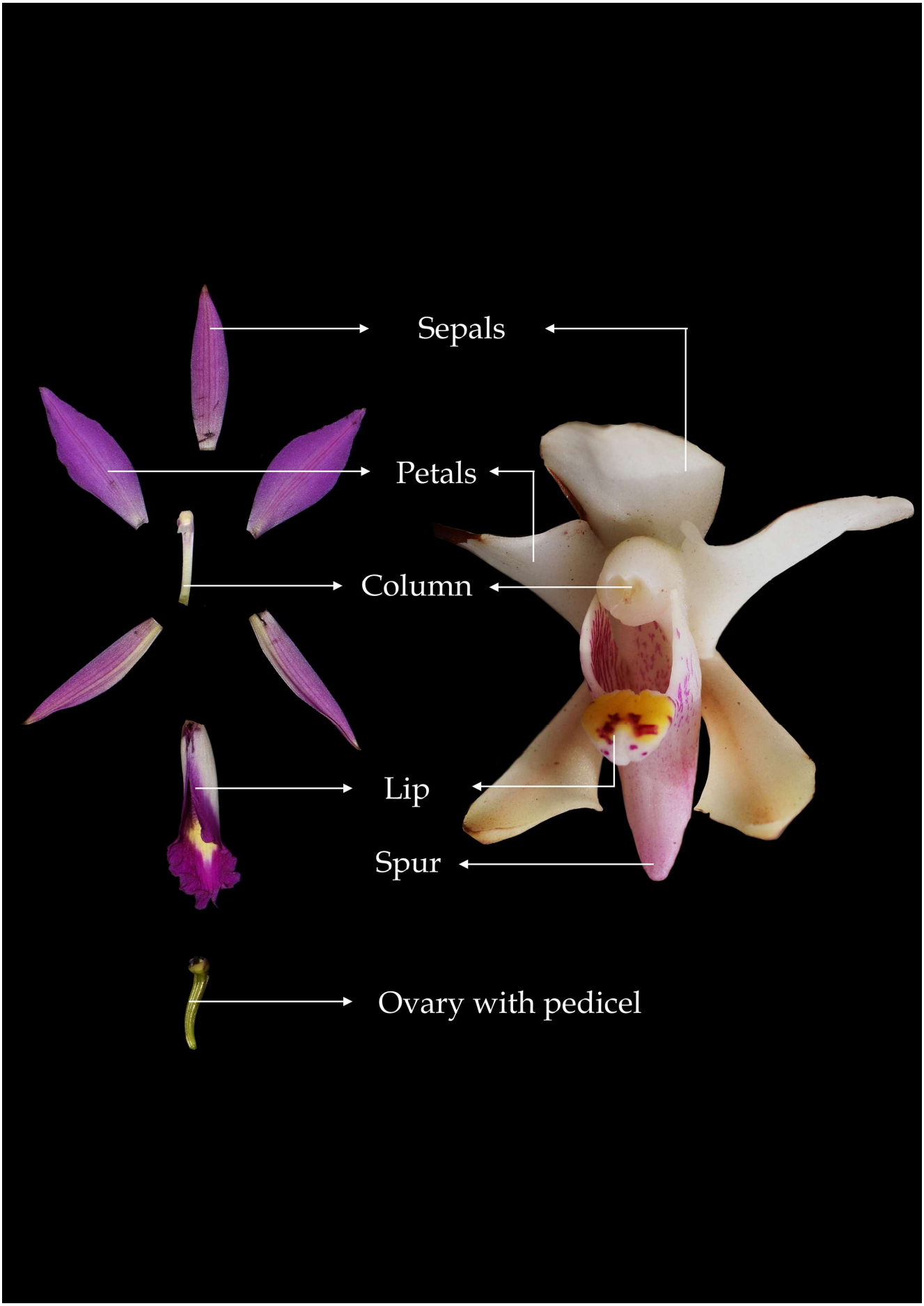
Distribution: India, Sri Lanka, Indo-China (POWO, 2023); *Habitat*: Open wet grasslands and on dripping rocks; *Fl. & Ft.*: October-December.

Specimen examined: Meenuliyanpara, 29.11.2019, *Dani Francis & Santhosh Nampy* 164644 (CALI).

ORCHIDACEAE Juss.,

Gen. Pl. 64. 1789, *nom. cons.*

Epiphytic or terrestrial herbs, often tuberous rooted, leafy or leafless. Inflorescence lateral or terminal, solitary or spicate or racemose, sometimes panicled. Flowers bisexual, minute to large or showy. Calyx 3; sepals similar or dissimilar; lateral sepals often united and form spur. Lateral petals 2, alike; lip dissimilar. Stamens and style united into a long or short column. Anther usually


Sepals
Petals
Column
Lip
Spur
Ovary with pedicel

single on the front, top or back of the column, 2 or 4-celled; pollinia globose or pyriform, waxy or powdery masses, with or without stalk. Ovary inferior, twisted; ovules minute. Capsules usually open by 3 or 6 longitudinal fissures, rarely fleshy and indehiscent. Seeds numerous, minute.

Orchidaceae with a cosmopolitan distribution is one of the two largest families of flowering plants, perhaps second after Asteraceae (Chase *et al.*, 2015). The family comprises 705 genera and 25,000–35,000 species worldwide (POWO, 2023). According to Pal and Nagrare (2006), there are 184 genera and 1300 species in India. They grow in a wide range of habitats in almost every part of the earth except the Arctic, open waters, and hot deserts. Their remarkable range of life history strategies, floral and vegetative morphology and pollination syndromes have long fascinated biologists (Fay & Chase, 2009). As one of the most seriously threatened plants on the planet, orchids are highly vulnerable to habitat destruction and serve as excellent indicators of environmental degradation. Fifty genera and 127 species are reported from the study area.

Key to the genera

1. Plants terrestrial 2
1. Plants epiphytic 23
2. Plants saprophytic 3
2. Plants autotrophic 4
3. Rhizomes erect; lips clawed ..... *Aphyllorchis*
3. Rhizomes horizontal, tuberous; lips sessile ..... *Epipogium*
4. Plants with pseudobulbs 5
4. Plants without pseudobulbs 13
5. Pseudobulbs emerging above ground 6
5. Pseudobulbs underground as corms or tubers 12
6. Pseudobulbs uninodal; leaves solitary ..... *Tainia*
6. Pseudobulbs pleurinodal; leaves many 7
7. Lateral sepals fused to form a fleshy jug shaped tube ..... *Acanthophippium*
7. Lateral sepals not forming a tube 8
8. Pseudobulbs ovate, compressed; inflorescence lateral 9

8. Pseudobulbs cylindrical, stems like, sheathed by leaf bases; inflorescence terminal 10

9. Pseudobulbs angular; column lacking a foot ..... *Eulophia*

9. Pseudobulbs ovate; column with a foot ..... *Calanthe*

10. Flowers resupinate; column winged above ..... *Liparis* (in part)

10. Flowers not resupinate; column not winged 11

11. Column erect, with 2-apical finger like projections ..... *Crepidium*

11. Column spreading, without finger like projections ..... *Malaxis*

12. Tubers globose; leaves cordate or orbicular; inflorescence terminal; flowers glabrous ..... *Nervilia*

12. Tubers irregularly slender; leaves grass like; inflorescence lateral; flowers pubescent ..... *Pachystoma*

13. Anthers confluent with column apex by its base 14

13. Anthers movably attached to column by its apex 18

14. Lips superior, hooded with 2 short spurs; anthers bent markedly backwards... ..... *Satyrium*

14. Lips inferior, with or without spur; anthers erect 15

15. Leaves 1 or a few; floral bracts smaller than flowers; dorsal sepal fused to lateral petals; lateral sepals fused; lip 3-lobed, 'Y' or 'T' shaped..... ..... *Disperis*

15. Leaves many; floral bracts larger than flowers, leafy; sepals free; lateral petals adnate to column; lip entire or bilobed with a sinus in between, broadly obcordate or flabelliform ..... *Brachycorythis*

16. Flowers large, white-pale yellow, showy; lateral lobes of lip fringed-lacerate ..... *Pecteilis*

16. Flowers small, white, green or yellow; lateral lobes of lip not fringed-lacerate 17

17. Sepals sub-equal, more or less connivent ..... *Peristylus*

17. Sepals unequal, lateral sepals spreading or reflexed ..... *Habenaria*

18. Plants tufted; stems tall, reed like; leaves grass like ..... *Arundina*

18. Plants not tufted; stems short, not reed like; leaves various 19

19. Leaves plicate; inflorescence a clustered spike, glabrous ..... *Tropidia*

19. Leaves not plicate; inflorescence spirally arranged spikes, glandular pubescent ……. *Spiranthes*

20. Leaves greenish maroon with golden netted veins, clustered at base ……. *Anoectochilus*

20. Leaves green, all along stem ……. 21

21. Lips entire ……. *Goodyera*

21. Lips lobed ……. 22

22. Sepals connate to middle in a tube ……. *Cheirostylis*

22. Sepals free ……. *Zeuxine*

23. Stems sympodial ……. 24

23. Stems monopodial ……. 37

24. Plants pseudo bulbous ……. 27

24. Plants without pseudo bulbs ……. 25

25. Leaves dorsiventrally flattened; inflorescence lateral ……. *Sirhookera*

25. Leaves laterally compressed, closely imbricate, fleshy ……. 26

26. Stems slender, diffuse; inflorescence terminal or leaf opposed, slender ……. *Podochilus*

26. Stems reduced; inflorescence always terminal, usually stout ……. *Oberonia*

27. Inflorescence terminal ……. 28

27. Inflorescence lateral ……. 30

28. Inflorescence simple; flowers resupinate; lateral sepals deflexed under lip; column without foot ……. *Liparis* (in part)

28. Inflorescence often branched; flowers non-resupinate; lateral sepals forming a mentum; column with foot ……. *Polystachya*

29. Pseudobulbs sub-discoid, button like; leaves membranous, caducous; flowers solitary or sometimes 2 ……. *Porpax*

29. Pseudobulbs ovoid; leaves thick, slightly plicate, persistent; flowers more than 2 ……. *Coelogyne*

30. Pseudobulbs pleurinodal ……. 31

30. Pseudobulbs uninodal ……. 34

31. Pseudobulbs compressed, covered by leaf sheaths; leaves radical, long strap-shaped, coriaceous; inflorescence on a separate shoot …….*Cymbidium*

31. Pseudobulbs various; leaves cauline, not strap-shaped; inflorescence borne on leafy shoot from upper nodes …… 32

32. Inflorescence lateral, distal or pseudo terminal; flowers extremely variable in colour …… *Dendrobium*

32. Inflorescence axillary; flowers usually cream-yellow or with purple tinch …… …… 33

33. Inflorescence many flowered, lax or dense …… *Pinalia*

33. Inflorescence 1 or a few, often spreading …… *Cylindrolobus*

34. Lips sessile on base of column, usually broadest and concave at base, column without a foot …… *Thelasis*

34. Lips hinged, not gibbous at base, column with a long upcurved foot …… *Bulbophyllum*

35. Leaves always terete …… 36

35. Leaves dorsiventrally flattened (terete in a few species) …… 37

36. Stems scandent; flowers large and showy, white; lips distinctly spurred …… …… *Papilionanthe*

36. Stems erect; flowers a few, purplish; lips not spurred …… *Luisia*

37. Stems pendent …… *Robiquetia*

37. Stems not pendent …… 38

38. Plants dwarf, 1–20 cm long …… 39

38. Plants medium-large sized, 30–50 cm long…… 41

39. Lips distinctly spurred …… 40

39. Lips not spurred …… *Gastrochilus*

40. Leaves sub-terete; spurs 2 …… *Diplocentrum*

40. Leaves dorsiventrally flattened; spurs 1 …… *Smithsonia*

41. Stems slender, climbing; leaves 2–10 cm long …… 42

41. Stems stout, erect; leaves 12–15 cm long …… 46

42. Inflorescence axillary, shorter or as long as leaves; flowers brownish yellow… …… *Trichoglotis*

42. Inflorescence terminal, longer than leaves; flowers yellow …… *Taprobanea*

43. Inflorescence racemose …… 44

43. Inflorescence racemose or paniculate …… 45

44. Racemes densely many flowered, drooping; lateral lobes of lips obscure or absent; mid-lobe of lips flattened, not keeled ……..... *Rhynchostylis*

44. Racemes few-many flowered, not drooping; lateral lobes of lips distinct; mid-lobe of lips fleshy with broad longitudinal keels ……..…… *Vanda*

45. Peduncles 20–40 cm long, flowers in terminal racemes; lips sub-panduriform with villous margins ……..…….. *Cottonia*

45. Peduncles 3–10 cm long; flowers in cymes or axillary racemes; lips ovate, oblong, obovate or orbicular, margins not hairy ……..…….. 46

46. Stems not woody; leaves flattened or terete ……..…… 47

46. Stems woody; leaves always flattened dorsiventrally ……..... *Aerides*

47. Sepals keeled at back; spur in an angle to distal part of lip …….. *Schoenorchis*

47. Sepals not keeled at back; lip joined to column by back edges of lateral lobes ……..…….. *Cleisostoma*

Acanthophippium Blume,

Bijdr. Fl. Ned. Ind. 353. 1825.

Acanthophippium bicolor Lindl., Edwards's Bot. Reg. 20: t. 1730. 1835; Hook.f., Fl. Brit. India 5: 815. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1426. 1928; Abraham & Vatsala, Intr. Orchids 272. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 703. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 444. 2004.

Terrestrial herbs. Pseudobulbs ovoid, 2.5–8 × 2–5 cm, corrugated, clothed with old remains of leaves. Stems 8–20 cm long. Leaves 2 or 3, oblong-lanceolate, 15–45 × 0.3–10 cm, acuminate at apex, sheathing at base, glabrous, green. Racemes 3–5-flowered, arising from top of a new pseudobulb; scapes sheathed. Flowers *c.* 4 × 3.5 cm, yellow speckled with red at tip and inside; pedicels 5–7 mm long; bracts ovate-lanceolate, 3–3.5 × 2.5–3 mm, acuminate at apex, truncate at base, entire, glabrous, brown. Sepals 3, fused to form gibbous tube with reflexed tip; dorsal sepal oblong, 3–3.2 × 0.8–1 mm, obtuse at apex, truncate at base, glabrous, yellow speckled with red; lateral sepals oblong, 3–3.2 × 1–1.2 mm, obtuse and recurved at apex, fused to form a fleshy jug shaped tube at base, glabrous, yellow speckled with red. Lateral petals 2, spathulate, 2.8–3 × 1.2–1.5 mm, obtuse at apex, cuneate at base, glabrous, yellow. Lips 3-lobed, *c.* 1.5 × 2 cm; 2 lateral flaps, oblong, 0.8–1

× 0.5–0.7 mm, rounded at apex, glabrous, yellow; mid-lobe larger than lateral lobes, oblong, 2.5–3 × 1.8–2 mm, obtuse at apex, recurved, glabrous, deep yellow with 3-undulate ridges on disc. Spur 0. Column sub-cylindric, *c.* 1.5 cm long, narrowly winged at apex. Pollinia 8. Ovary twisted, 6 mm long; ovules in 3 vertical rows, glabrous, reddish.

Distribution: S. and E. India, Sri Lanka (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: March-April.
Specimen examined: Meenmuty, 26.04.1984, *C.N. Mohanan* 81618 (MH).

Aerides Lour.,

Fl. Cochinch. 2: 525. 1790.

Key to the species

1. Leaves oblong; sepals obovate to orbicular; mid-lobe of lips emarginate at apex; spur incurved ..... *A. maculosa*

1. Leaves strap shaped; sepals widely ovate; mid-lobe of lips obtuse at apex; spur straight ..... *A. ringens*

Aerides maculosa Lindl., Edwards's Bot. Reg. 31: 58. 1845; Hook.f., Fl. Brit. India 6: 45. 1890; C.E.C.Fisch., in Gamble, Fl. Madras 3: 1442. 1928; Abraham & Vatsala, Intr. Orchids 444. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 444. 2004.

Epiphytic herbs, 5–6 cm tall. Stems woody, stout. Leaves distichous, oblong, 12–15 × 1–5 cm, emarginate at apex, sheathing at base, glabrous, green spotted with purple. Racemes simple or branched, 15–25 cm long; peduncle *c.* 10 cm long. Flowers many, *c.* 2 cm in diam., pink; pedicels 6–8 mm long; bracts ovate, *c.* 2 × 1 mm, acute at apex, truncate at base, sparsely crenulate, glabrous, brown. Sepals 3, obovate-orbicular, 8–10 × 8–10 mm, obtuse at apex, truncate at base, glabrous, pink with purple dots. Lateral petals 2, obovate, 8–10 × 4–5 mm, obtuse at apex, cuneate at base, glabrous, pink with purple dots. Lips 3-lobed, obovate, 12–15 × 12–15 mm, crenulate, glabrous, deep pinkish violet with a callus on disc; lateral flaps small; mid-lobe ovate, emarginate at apex. Spur incurved, *c.* 5 mm long.

Column *c.* 5 mm long, pink. Pollinia 2, yellow. Ovary twisted, 6–8 mm long; ovules in 3 vertical rows, glabrous, pinkish white. Capsules obovate, *c.* 1 cm long, green.

Distribution: India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: May-June.

Specimens examined: Idukki reservoir, 14.06.1983, *A.G. Pandurangan* 79228 (MH); Silent valley, Munnar, 27.05.1994, *Stephen Sequeira & Joy C.C.* 7563 (KFRI).

Aerides ringens (Lindl.) C.E.C.Fisch. in Gamble, Fl. Madras 3: 1442. 1928; Abraham & Vatsala, Intr. Orchids 446. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 725. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 444. 2004. *Saccolabium ringens* Lindl., Gen. Sp. Orchid. Pl. 220. 1833. *Aerides linearis* Hook.f., Fl. Brit. India 6(17): 47. 1890. **Fig. 12A**

Epiphytic herbs, 10–35 cm tall. Stems fully covered by leaf sheaths. Leaves distichous, strap shaped, 4–20 × 1–2.5 cm, emarginate at apex, sheathing at base, glabrous, green. Cymes, 6–15 cm long; peduncle 7.5 cm long. Flowers many, *c.* 1.3 cm in diam.; pedicels *c.* 6 mm long; bracts lanceolate, 2–2.5 × 0.8–1 mm, obtuse at apex, truncate at base, sparsely crenulate, ciliate-glabrous, brownish. Sepals 3, widely ovate, 4.2–4.7 × 4–4.2 mm, sub-rounded to obtuse at apex, truncate at base, glabrous, pink. Lateral petals 2, obovate, 4–4.8 × 3–3.3 mm, obtuse at apex, cuneate at base, glabrous, pink. Lips 3-lobed; lateral flaps 2, oblong to orbicular, 0.8–1 × 0.5–0.7 mm, obtuse at apex, glabrous, pink; mid-lobe larger than lateral lobes, elliptic-ovate, 5–5.4 × 3–3.2 mm, obtuse at apex, glabrous, pink. Spur conical, 4–4.2 × *c*. 2 mm. Column 6–6.8 × 2.5–2.8 mm. Pollinia 2, orbicular, *c.* 2 × 2 mm, glabrous, light yellow. Ovary twisted, 6 mm long; ovules in 3 vertical rows, glabrous, light green with purple. Capsules oblong, 1–1.3 cm long.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: April-December.

Specimens examined: Way to Anamudi peak, 26.04.2019, *Dani Francis & Santhosh Nampy* 159119; Kattadikadavu, near Venmani, 07.12.2018, *Dani Francis & Santhosh Nampy* 167805 (CALI); Kuttikkanam, Peermade, 25.09.1964, *K. Vivekananthan* 21404 (MH); Meesapulimala, 06.05.2019, *Dani Francis & Santhosh Nampy* 159160; Painav, 04.04.2018, *Dani Francis & Santhosh Nampy* 158484 (CALI); Umayamala, 17.04.1966, *B.V. Shetty* 27301 (MH).

Anoectochilus Blume,

Bijdr. Fl. Ned. Ind. 8: 411. t. 15. 1825, *nom. et orth. cons.*

Anoectochilus elatus Lindl., J. Proc. Linn. Soc. Bot. 1: 178. 1857; K.M.Matthew, Illustr. Fl. Palni Hills 684. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 444. 2004. *Anoectochilus elatior* Lindl. in Hook.f., Fl. Brit. India 6: 95. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1453. 1928; Abraham & Vatsala, Intr. Orchids 196. 1981.

Fig. 12B

Terrestrial annual herbs with underground creeping rhizomes, 20–25 cm tall. Stems slender, fleshy. Leaves ovate or elliptic, 2–8 × 2–4 cm, obtuse at apex, cuneate at base, greenish maroon with golden netted veins. Racemes *c.* 25 cm long. Flowers 2.8–3.1 cm long; pedicels *c.* 2 mm long; bracts ovate, 9–16 × 5–8 mm, cuspidate at apex, cuneate at base, entire, tomentose, pink-beetroot in colour. Sepals 3; dorsal sepal ovate, 9–11 × 5–6 mm, cuspidate at apex, truncate at base, glandular hairs arranged as beads, pinkish white with central pink line; lateral sepals narrowly oblong, 10–12 × 3–5 mm, mucronate at apex, cuneate at base, glandular hairy, hairs arranged as beads, pinkish-white with central pink line. Lateral petals 2, falcate, 8–11 × 3–4.5 mm, cuspidate at apex, truncate at base, glabrous, white. Lips *c.* 2 × 0.5 cm, 3-lobed, basal region a central midline with 2 lobes at apex, oblong, mid-region dissected with 6 pairs of fimbriae, upper region divided in to 2 flaps, like wings of butterfly, sub-oblong, glabrous, white. Spur oblong, *c.* 8 × 4 mm, apex divided into two, sagittate, 2-calli within. Column *c.* 3 × 3 mm. Pollinia 2, *c.* 5 mm long, pyriform, yellow. Ovary twisted, *c.* 1.5 × 0.3 cm; ovules in 3 vertical rows, hispid-glandular hairy, brown-violet. Capsules elliptic, hirsute.

Distribution: South India (POWO, 2023); *Habitat*: Forest ground; *Fl. & Ft.*: September-January.

Specimens examined: Ezhuthupara, Mankulam, 05.12.2018, *Dani Francis & Santhosh Nampy* 168871; Kannadippara, Mankulam, 17.09.2018, *Dani Francis & Santhosh Nampy* 161949; way to Kanketty, Mankulam, 20.12.2019, *Dani Francis & Santhosh Nampy* 164808 (CALI); Kanthallur, Munnar, 27.09.1983, *Mukthesh Kumar* 2962 (KFRI); Meenmutty, 11.11.1981, *B. Ramanujan* 72464 (MH); Mathikettan Shola National Park, Karipara, *Syam Radh S. & Santhosh Nampy*

137903; Perattakalam, Mathikettan shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 151441 (CALI); Umayamala, 22.11.1965, *B.V. Shetty* 26624 (MH).

Notes: *Anoectochilus elatus* is commonly known as the South Indian jewel orchid due to its beautifully coloured, velvety leaves nerved in gold or silver and is grown as popular ornamental plant (Patil, 2020).

Aphyllorchis Blume,

Tab. Pl. Jav. Orchid. f. 77. 1825.

Aphyllorchis montana Rchb.f., Linnaea 41(1): 57. 1876; Hook.f., Fl. Brit. India 6: 116. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1428. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 444. 2004.

Fig. 12H

Terrestrial, leafless herbs, 20–65 cm tall. Stems terete, glabrous, sheaths near the base of stem tubular, loose and close together, becoming smaller, lanceolate, more compact and distant upwards. Racemes lax, 15–40 cm long. Flowers resupinate, *c.* 2.5 mm long, straw-colored with purple tips; pedicels *c.* 0.6 mm long; bracts lanceolate, 0.5–1.3 × 0.1–0.3 cm, obtuse at apex, cuneate at base, glabrous, straw coloured, smaller than Ovary. Sepals 3; dorsal sepal lanceolate to ovate to boat-shaped, 7–12 × 2–3 mm, obtuse at apex, truncate at base, puberulous, deep yellow with purple patches; lateral sepals lanceolate to ovate, 10–11 × 1.5–2 mm, obtuse at apex, truncate at base, glabrous, dark yellow with purple striations. Lateral petals 2, lanceolate, 9–11 × 2–3 mm, obtuse at apex, attenuate at base, glabrous, yellowish with purple striations. Lips 3-lobed, narrowly obovate-oblong, *c.* 9 × 5 mm, sub-acute at apex, truncate at base; lateral lobes rounded to lanceolate, *c.* 2 × 0.3 mm, acute at apex, claw sub-saccate, broad with 2 linear calli, deep yellow with purple striations. Spur 0. Column *c.* 1.5 × 2 mm, glabrous. Pollinia 2, yellow. Ovary twisted, *c.* 1.8 × 1.5 mm, ovules in 3 vertical rows, puberulous, purple. Capsules elliptic, glabrous.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Forest ground; *Fl. & Ft.*: August-September.

Specimen examined: Kozhiyalakkudi, Anakkulam, 18.09.2018, *Dani Francis & Santhosh Nampy* 161967 (CALI).

Notes: *Aphyllorchis montana* is commonly called 'mountain pauper orchids'. This species has fleshy upright stems and small to medium sized resupinate flowers with narrow sepals and petals. It is included in the CITES Appendix-II (De, 2022).

Arundina Blume,

Bijdr. Fl. Ned. Ind. 8: 401. 1825.

Arundina graminifolia (D.Don) Hochr., Bull. New York Bot. Gard. 6: 270. 1910; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1432. 1928; Abraham & Vatsala, Intr. Orchids 497. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 700. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 445. 2004. *Bletia graminifolia* D.Don, Prodr. Fl. Nepal 29. 1825. *Arundina bambusifolia* Lindl., Gen. Sp. Orchid. Pl. 125. 1831, *nom. illeg.*; Hook.f., Fl. Brit. India 5: 857. 1890.

Terrestrial herbs. Stems up to 2 m tall, terete. Leaves distichous, linear-lanceolate, 5–20 × 1–1.1 cm, acute at apex, glabrous, green. Racemes terminal, 20–40 cm long. Flowers *c.* 4 × 3 cm; pedicels 1.5 cm long, pink-purple; bracts clasped to the peduncle, ovate, 5–7 × 2–4 mm, acute to sub-acuminate at apex, truncate at base, entire, glabrous, purplish green, smaller than ovary. Sepals 3, equal, lanceolate-ovate to elliptic, 3–3.5 × 0.5–0.8 cm, acute at apex, truncate at base, glabrous, pink. Lateral petals 2, rhomboid-elliptic, 3–3.5 × 1–1.3 cm, acuminate at apex, obtuse at base, glabrous, pink. Lips trumpet-shaped, 3.5–3.8 × 2–3 cm, bilobed at apex, crenulate; mid-lobe with lamellae, purple with white shades at base. Spur 0. Column *c.* 5 × 4 mm, glabrous; pollinia 8, lenticular, *c.* 4 mm long, glabrous, yellow. Ovary *c.* 1 cm long; ovules in 3 vertical rows. Capsules elliptic, 3–5 cm long.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: March-January.

Specimens examined: Kalvary mount, 14.10.1982, *C.N. Mohanan* 74685; near Kamashi, way to Kattappana, 23.08.1977, *K. Vivekananthan* 50507; way to Kattappana, 05.10.1983, *A.G. Pandurangan* 79263; *Ibid*., 25.09.1984, *C.N. Mohanan* 80196; Kulamavu, 15.12.1982, *C.N. Mohanan* 76098; Lockhert gap, 23.01.1964, *K.M. Sebastine* 18421 (MH); Meenuliyanpara, 29.11.2019, *Dani Francis & Santhosh Nampy* 164609 (CALI); Munnar, Body Road, 25.03.1980, *R. Ramamurthy* 66377 (MH).

Notes: *Arundina graminifolia* is commonly called 'bamboo orchids'. It is found in grasslands in full sun and is often grown as ornamentals.

Brachycorythis Lindl.,

Gen. Sp. Orchid. Pl. 363. 1838.

Key to the species

1. Leaves apex acute; lips obcordate; spur *c.* 3 mm long ……..…….. *B. iantha*

1. Leaves apex mucronate; lips flabelliform; spur *c.* 5 mm long ……. *B. splendida*

Brachycorythis iantha (Wight) Summerh., Kew Bull. 10: 238. 1955; Abraham & Vatsala, Intr. Orchids 254. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 445. 2004. *Platanthera iantha* Wight, Icon. Pl. Ind. Orient. 5: t. 1692. 1851. *Habenaria iantha* Hook.f., Fl. Brit. India 6(17): 164. 1890. *Phyllomphax obcordata* var. *iantha* C.E.C.Fisch., in Gamble, Fl. Madras 3: 1476. 1928.

Fig. 12C

Annual, terrestrial herbs with underground tuberous rhizomes, 20–30 cm tall. Stems ridged, puberulous. Leaves elliptic-oblong, 2.5–3 × 1–2.5 cm, acute at apex, clasped at base, glabrous, entire, sessile, green. Racemes terminal, 20–30 cm long. Flowers 1.5 × 1 cm, pink; pedicels *c.* 1 mm long; bracts leafy, ovate, 2–2.3 × 0.8–1 cm, acute at apex, cuneate at base, entire, glabrous, green. Sepals 3; dorsal sepal lanceolate-ovate, 4–4.5 × 1.5–2 mm, acute at apex, cuneate at base, 3-nerved, glabrous; lateral sepals ovate-oblong, 5–7 × 2–2.5 mm, acute at apex, cuneate at base, 3-nerved, glabrous, pinkish white. Lateral petals 2, free, lanceolate, 4.5–5 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, pink. Lips not lobed, obcordate, 10–14 × 10–12 mm, broad sinus at apex, slightly undulate, glabrous, entire, pinkish purple. Spur *c.* 3 mm long, smaller than ovary. Column *c.* 3 × 2 mm. Pollinia 2, pyriform, *c.* 2 × 1 mm, brown. Ovary twisted, *c.* 1 cm long; ovules in 3 vertical rows, pale green.

Distribution: S. India (POWO, 2023); *Habitat*: Grass lands; *Fl. & Ft.*: May-October.

Specimens examined: Bison valley, Devikulam, 25.06.1981, *Nambiar & Mukthesh Kumar* 1572 (KFRI); Dhanas valley, Upper Vaguvarai, 17.10.1989, *P. Bhargavan* 90993; Eravikulam, 10.06.1980, *S. Coll.* 133 (KFRI); way to Eravikulam hut, 14.10.1989, *P. Bhargavan* 90935 (MH); Lockhert gap, 27.07.1982, *Nambiar & N.*

Sasidharan 1836; Ollavayal, Chinnar Wildlife Sanctuary, 02.10.1996, *N. Sasidharan & K.K. Sajeev* 17433; Silent valley, Munnar, 27.05.1994, *Stephen Sequiera & Joy C.C.* 7561 (KFRI); Umayamala, 06.08.1967, *B.V. Shetty* 28317 (MH).

Brachycorythis splendida Summerh., Kew Bull. 10(2): 240. 1955; Abraham & Vatsala, Intr. Orchids 256. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 445. 2004. *Habenaria iantha* Hook.f., Fl. Brit. India 6(17): 164. 1890. *Phyllomphax obcordata* var. *iantha* C.E.C.Fisch., in Gamble, Fl. Madras 3: 1476. 1928.

Fig. 12D

Annual, terrestrial herbs with underground tuberous rhizomes, 25–40 cm tall. Stems ridged, puberulous. Leaves lanceolate-elliptic, 2.5–6 × 1.3–2.5 cm, mucronate at apex, clasped at base, glabrous, entire, sessile. Racemes 25–30 cm long. Flowers 1.9–2 cm diam., pink, alternately arranged on inflorescence; pedicels *c.* 1 mm long; bracts leafy, ovate, 2–2.1 × 0.8–1 cm, mucronulate at apex, cuneate at base, entire, 5-nerved, glabrous, rugose on the surface, green. Sepals 3; dorsal sepal lanceolate-ovate, 5–7.5 × 1.5–2 mm, mucronate at apex, 3-nerved, rugose on surface, glabrous; lateral sepals lanceolate, 7.5–8 × 1.8–2 mm, curved, mucronate at apex, cuneate at base, 3-nerved, glabrous, purple. Lateral petals 2, free, lanceolate or falcate, 6–7 × 1–1.3 mm, obtuse at apex, cuneate at base, 2-nerved, glabrous, not rugose, purple. Lips not lobed, adnate to the column, flabelliform, *c.* 7 × 8 mm, broad sinus at apex, apicule not prominent or absent, slightly undulate, glabrous, entire, purple. Spur *c.* 5 mm long, half of the pedicel, smaller than ovary. Column *c.* 3 × 2 mm. Pollinia 2, pyriform, *c.* 2.2 × 1 mm, brown. Ovary twisted, *c.* 1.3 cm long; ovules in 3 vertical rows, rugose, pale green.

Distribution: SW. India (POWO, 2023); *Habitat*: Grass lands; *Fl. & Ft.*: June-September.

Specimens examined: Bison valley, Devikulam, 25.06.1981, *Nambiar & Mukthesh Kumar* 1571 (KFRI); Choondal, Mathikettan Shola National Park, 16.07.2015, *Syam Radh S. & Santhosh Nampy* 145045; way to Cholamala, Nallathanni Kallar, 16.09.2018, *Dani Francis & Santhosh Nampy* 161929 (CALI); Eravikulam National Park, 11.07.1995, *Stephen Sequiera* 7849 (KFRI); Kulamavu, 24.09.1981, *C.N. Mohanan & B. Ramanujan* 71949 (MH); Narakakanam, 06.09.2017, *Dani Francis & Santhosh Nampy* 154376 (CALI); Painavu, 20.08.1981, *K. Vivekananthan & V.S.*

Raju 71111 (MH); Pandippara, 16.07.2021, *Dani Francis & Santhosh Nampy* 176037; Umayamala, 30.08.2019, *Dani Francis & Santhosh Nampy* 170265 (CALI); *Ibid*., 06.08.1967, *B.V. Shetty* 28318 (MH); Vellimala, Periyar Tiger Reserve, 28.08.1994, *N. Sasidharan & Jomy Augustine* 14061 (KFRI).

Notes: *Brachycorythis slendida* is popularly called the 'splendid short helmet orchid'. This species is closely related to *B. iantha*, but differs by its flabelliform lip with broad sinus at the apex with or without an apicule (*vs.* obcordate lip with triangular apicule) (Summerhayes, 1955). It is listed in the CITE Appendix II (De, 2022).

Bulbophyllum Thouars,

Hist. Orchid. t. 3 1822, *nom. cons.*

Key to the species

1. Inflorescence densely many flowered; flowers not open widely…… *B. sterile*
1. Inflorescence 1–12 flowered; flowers open widely…… 2
2. Pseudobulbs indistinct or minute, button like; flowers red …… *B. xylophyllum*
2. Pseudobulbs distinct, globose, sub-globose or ovoid; flowers not red …… 3
3. Pseudobulbs ovoid …… 4
3. Pseudobulbs globose or sub-globose …… 7
4. Inflorescence 15–20 cm long; bracts ovate …… *B. fuscopurpureum*
4. Inflorescence 3–8 cm long; bracts lanceolate …… 5
5. Leaves obovate; lateral sepals spathulate …… *B. kaitiense*
5. Leaves linear-oblong; lateral sepals oblong-lanceolate …… 6
6. Flowers yellow with maroon purple striations; pedicels 2.5–4 mm long; dorsal sepals elliptic; lips strongly recurved …… *B. elegantulum*
6. Flowers white with pink spots or striations, deep purple on lips; pedicels 8–10 mm long; dorsal sepal lanceolate; lips not strongly recurved …… *B. mysorense*
7. Flowers solitary; pedicels 5–6 mm long; lips obscurely 3-lobed, lateral lobes represented by 2-auricles …… *B. bonaccordense*
7. Flowers 2–12; pedicels 1.5–3 mm long; lips not lobed …… 8
8. Leaves oblong or lanceolate …… 9
8. Leaves elliptic or ovate …… 10
9. Flowers lemon yellow with maroon tinch; sepals fimbriate along margin; dorsal sepal ovate; lips grooved, glabrous …… *B. fimbriatum*

9. Flowers purple; sepals entire; dorsal sepal subulate; lips not grooved, acicular hairy along margin …….. *B. tremulum*

10. Leaves green; inflorescence 5–6-flowered; lateral sepals spathulate; lateral petals elliptic ……..……. *B. fischeri*

10. Leaves purplish; inflorescence 2–3-flowered; lateral sepals obliquely ovate; lateral petals linear ……. *B. stocksii*

Bulbophyllum bonaccordense (C.S.Kumar) J.J.Verm., Schuit. & de Vogel, Phytotaxa 166: 110. 2014. *Trias bonaccordensis* C.S.Kumar, Blumea 34: 105. 1989; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 475. 2004.

Epiphytic herbs with creeping rhizomes. Pseudobulbs globose, 0.8–1.2 cm long, dark greenish yellow. Leaves ovate, 2.5–3.5 × 1.2–1.5 cm, acute at apex, narrowed at base, glabrous, green. Flowers solitary, lateral from pseudo bulb, *c.* 2 cm across, creamy yellow with crimson red spots; pedicels 5–6 mm long. Sepals 3; dorsal sepal triangular-ovate, 10–12 × 9–11 mm, obtuse at apex, truncate at base, glabrous, gland dotted; lateral sepals 2, triangular-ovate, 12–14 × 10–12 mm, obtuse at apex, slightly fused at base, glabrous. Lateral petals 2, lanceolate, 2.8–3 × 1–1.2 mm, acute at apex, sub-truncate at base, entire, glabrous, white. Lips mobile, oblong, 10–12 × 3–3.2 mm, rounded at apex, glabrous, creamy yellow with a few crimson spots; lateral lobes represented by 2-yellow auricles. Spur 0. Column 5–6 mm long, yellow with crimson red patches. Pollinia 2, yellow. Ovary obovate, *c.* 6 mm long; ovules in 3 vertical rows, glabrous, green. Capsules obovate, *c.* 2 × 1 mm, glabrous.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen and semi-evergreen forests; *Fl. & Ft.*: December-March.

Specimen examined: Melmala, Periyar Tiger Reserve, 25.12.1994, *Jomy Augustine & K.P. Rajesh* 14457 (KFRI).

Bulbophyllum elegantulum (Rolfe) J.J.Sm., Bull. Jard. Bot. Buitenzorg, ser. 2. 8: 23. 1912. *Cirrhopetalum elegantulum* Rolfe, Gard. Chron. Ser. 3. 9: 552. 1891; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1421. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 446. 2004.

Epiphytic herbs, *c.* 6.3 cm long. Pseudobulbs ovoid, *c.* 2 × 1 cm, ridged, distantly placed. Leaves solitary, linear-oblong, 2–2.5 × 0.4–0.7 cm, obtuse, emarginate at

apex, attenuate at base, glabrous, coriaceous, green. Inflorescence 5–8 cm long, 4–6-flowered. Flowers 3–5 × 0.2–0.4 cm, yellow with maroon-purple striations; pedicels 2.5–4 mm long; bracts lanceolate, 3.5–5 × 1–1.2 mm, acute at apex, cuneate at base, 3-nerved, glabrous, greenish yellow with purple striations. Sepals 3; dorsal sepal elliptic, 3–6 × 2–3 mm, obtuse at apex, truncate at base, puberulous, yellow with purple striations; lateral sepals 2, oblong-lanceolate, 9–13 × 2–4 mm, acute at apex, truncate at base, glabrous, connate along dorsal margin, papillate towards base, yellow with purple striations. Lateral petals 2, elliptic, 2–3.5 × 1–2.5 mm, obtuse at apex, obtuse at base, glabrous, yellow. Lips narrowly oblong, strongly recurved, 2–3.5 × 0.8–1 mm, obtuse at apex, glabrous, dull brown. Spur 0. Column 2–2.5 mm long, with a pair of minute triangular sub-obtuse teeth. Pollinia 2, orbicular, yellow. Ovary obovate, *c.* 3 × 1 mm; ovules in 3 vertical rows, glabrous, yellow.

Distribution: S. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: September-May.

Specimens examined: Kottamala, Periyar Tiger Reserve, 17.05.1994, *Jomy Augustine* 13745; Uppermelmanalar, Periyar Tiger Reserve, 13.05.1994, *Jomy Augustine* 13713 (KFRI).

Bulbophyllum fimbriatum (Lindl.) Rchb.f. in Walpers, Ann. Bot. Syst. 6: 260. 1861; Abraham & Vatsala, Intr. Orchids 336. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 446. 2004. *Cirrhopetalum fimbriatum* Lindl., Edwards's Bot. Reg. 25: 72. 1839; Hook.f., Fl. Brit. India 5: 774. 1890; C.E.C.Fisch in Gamble, Fl. Madras 3: 1420. 1928. Epiphytic herbs. Pseudobulbs sub-globose, *c.* 2 × 1.5 cm long, distant on rhizomes, yellowish green. Leaves solitary, oblong-lanceolate, 3–4 × 0.4–0.7 cm, emarginate at apex, attenuate at base, glabrous, membranous, leaves shed before the emergence of flowers. Inflorescence solitary, lateral to pseudobulb, 10–12 cm long, 8–12 flowered. Flowers *c.* 2 cm long, lemon yellow with a maroon tinch; pedicels 1.8–2 mm long; bracts lanceolate, 4–4.2 × 1–1.3 mm, acuminate at apex, cuneate at base, glabrous, lemon yellow with a maroon tinch. Sepals 3; dorsal sepal ovate, 7–7.5 × 2–2.5 mm, caudate at apex, truncate at base, fimbriate along margin, hooded, glabrous, lemon yellow with deep purple; lateral sepals 2, oblong-lanceolate, 25–30 × 2.5–3 mm, sub-acute at apex, truncate at base, glabrous,

connate along ventral margin, lemon yellow. Lateral petals 2, ovate, 3.5–4 × 0.8–1 mm, acuminate at apex, obtuse at base, fimbriate along margin, glabrous, lemon yellow with deep purple. Lips tongue-like, oblong, 2.8–3 × 0.8–1 mm, sub-acute at apex, curved, glabrous, grooved, thick and fleshy, purple with yellow at centre. Spur 0. Column 2.8–3, purple. Pollinia 2, orbicular, yellow. Ovary obovate, *c.* 3 × 1 mm; ovules in 3 vertical rows, glabrous, lemon yellow.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen and semi-evergreen forests; *Fl. & Ft.*: February-March.

Specimens examined: Vallakkadavu, Periyar Tiger Reserve, 21.03.1994, *N. Sasidharan & Jomy Augustine* 13465 (KFRI).

Bulbophyllum fischeri Seidenf., Dansk Bot. Ark. 29(1): 202. 1974; Abraham & Vatsala, Intr. Orchids 341. 1981. *Cirrhopetalum gamblei* Hook.f., Fl. Brit. India 5(16): 778. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1420. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 448. 2004. **Fig. 11C**

Epiphytic herbs, *c.* 6.3 cm long. Pseudobulbs globose, *c.* 1 cm long, brown. Leaves elliptic-ovate, 2–2.5 × 0.4–0.7 cm, emarginate at apex, attenuate at base, glabrous, coriaceous. Inflorescence 5–7 cm long, 5–6 flowered. Flowers 1.5–2.1 × 0.1–0.4 cm; pedicels 2.5–3 mm long; bracts lanceolate, 4–5 × 1–1.3 mm, obtuse at apex, cuneate at base, 3(4)-nerved, glabrous, cream with pinkish tinch, slightly thick. Sepals 3; dorsal sepal lanceolate-ovate, 5–7 × 1.5–2 mm, acute at apex, truncate at base, glabrous, yellow with purple striations; lateral sepals 2, spathulate, 15–17 × 1–3 mm, slightly curved at apex, truncate at base, glandular pubescent towards basal half, with some projections or growth on upper surface, yellow. Lateral petals 2, elliptic, 3.5–4 × 2–2.1 mm, obtuse at apex, obtuse at base, entire, 3-nerved, glabrous, yellow. Lips tongue-like, *c.* 2.5 × 1.3 mm, flattened and curved at apex, glabrous, yellow, thick and fleshy, rugose. Spur 0. Column 2.8–3 × 1–2 mm, light yellow. Pollinia 2, orbicular, *c.* 0.2 × 0.2 mm, glabrous, yellow. Ovary obovate, *c.* 3 × 1 mm, ovules in 3 vertical rows, glabrous, light yellow with pink.

Distribution: S. India, Sri Lanka and S. Indo-China (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: June-April.

Specimens examined: Way to Anamudi base camp, 10.12.2019, *Dani Francis & Santhosh Nampy* 170028 (CALI); Bison valley, Devikulam, 27.07.1982, *Nambiar &*

N. Sasidharan 1838 (KFRI); Devikulam-Munnar Road, 06.04.1963, *N.C. Rathakrishnan* 16242 (MH); Eravikulam National Park, 29.09.2017, *Dani Francis & Santhosh Nampy* 156303 (CALI); Lockhert gap, 15.06.1963, *K.M. Sebastine* 16508 (MH); Pettimudi, Edamalakkudi, 19.03.2019, *Dani Francis & Santhosh Nampy* 159110 (CALI); Rajamala, Munnar, 25.06.1981, *Nambiar & Mukthesh Kumar* 1574; Sundermala, Periyar Tiger Reserve, 16.04.1994, *N. Sasidharan & Jomy Augustine* 13595 (KFRI); Umayamala, 18.04.1966, *B.V. Shetty* 27324 (MH); Uppermelmanalar, Periyar Tiger Reserve, 11.04.1995, *Jomy Augustine & K.P. Rajesh* 15018 (KFRI); Vandanmedu, 28.08.1977, *K. Vivekananthan* 50570 (MH); Viripara, Mankulam, 29.09.1983, *Mukthesh Kumar* 2975 (KFRI).

Bulbophyllum fuscopurpureum Wight, Icon. Pl. Ind. Orient. 5: t. 1651. 1851; Hook.f., Fl. Brit. India 5: 760. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1418. 1928; Abraham & Vatsala, Intr. Orchids 334. 1981; Biodiv. Doc. Kerala-Fl. Pl. 446. 2004.

Epiphytic herbs. Pseudobulbs ovoid, 4–4.5 × 1.8–2 cm long, tapering towards apex, ridged, distantly placed, greenish yellow. Leaves solitary, oblong, 15–20 × 3–4 cm, emarginate at apex, narrowly acute at base, glabrous, coriaceous, green. Racemes 15–20 cm long, 5–6-flowered, drooping. Flowers *c.* 2.5 cm across, yellow with deep purple; pedicels *c.* 3 cm long; bracts ovate, 10–12 × 6–8 mm, acute at apex, sub-truncate at base, glabrous, deep purple. Sepals 3; dorsal sepal ovate, 1.5–2 × 0.8–1 mm, acuminate at apex, truncate at base, glabrous, deep purple with yellow tinch; lateral sepals 2, ovate-lanceolate, 30–32 × 11–12.5 mm, acute at apex, truncate at base, keeled, fleshy, glabrous, deep purple with yellow tinch. Lateral petals 2, small, ovate, 0.8–1 × 0.8–1 mm, long caudate tail at apex, obtuse at base, glabrous, deep purple. Lips tongue-like, oblong, 12–16 × 7–9 mm, sub-acute at apex, glabrous, disc channeled, thick, fleshy, glabrous out, pubescent in, deep purple. Spur 0. Column *c.* 2 × 1.2 mm, deep purple. Pollinia 2, yellow. Ovary obovate, *c.* 2.4 mm long; ovules in 3 vertical rows, purple yellow.

Distribution: India (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: January-May.
Specimens examined: Kuttikkanam-Peermade, 21.01.1965, *K. Vivekananthan* 22935 (MH); Odamala, Periyar Tiger Reserve, 17.04.1994, *Jomy Augustine* 13605

(KFRI); Painavu, 19.02.1984, *A.G. Pandurangan* 78058 (MH); Uppermelmanalar, Periyar Tiger Reserve, 11.04.1995, *Jomy Augustine & K.P. Rajesh* 15036 (KFRI

Bulbophyllum kaitiense Rchb.f. in Walpers, Ann. Bot. Syst. 6(2): 262. 1861; Abraham & Vatsala, Intr. Orchids 338. 1981. *Cirrhopetalum nilgherrense* Wight, Icon. Pl. Ind. Orient. 6. t. 1654. 1853; Hook.f., Fl. Brit. India 5: 778. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1420. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 448. 2004.

Fig. 11B

Epiphytic herbs. Pseudobulbs ovoid, *c.* 2 cm long, brownish. Leaves obovate, 5–6 × 1–1.25 cm, emarginate at apex, narrowly acute at base, glabrous, coriaceous; petiole *c.* 3 mm long. Inflorescence 3–5 cm long, 2–5 flowered, glabrous. Flowers 2.8–3.2 × 0.1–0.9 cm, yellow; pedicels 2.5–3 mm long; bracts lanceolate, 5–5.2 × 1–1.2 mm, acute at apex, attenuate at base, 5-viened, glabrous, pale yellow. Sepals 3; dorsal sepal lanceolate-ovate, 5–7 × 1.5–2 mm, acute at apex, truncate at base, glabrous, greenish yellow; lateral sepals 2, spathulate, 14–17 × 1–3 mm, slightly curved at apex, truncate at base, glandular pubescent towards basal half, with some projections or growth on upper surface, yellow. Lateral petals 2, elliptic, 3–4 × 2–2.1 mm, obtuse at apex, obtuse at base, 3-nerved, glabrous, greenish yellow, entire; Lips tongue-like, 2–2.5 × 1–1.3 mm, flattened and curved at apex, glabrous, greenish yellow with a pinkish tinch, thick and fleshy, rugose. Spur 0. Column *c.* 2 × 1.2 mm, cream with pinkish tinch and white dots. Pollinia 2, bean-shaped, *c.* 0.5 × 0.3 mm, glabrous, yellow, rugose. Ovary obovate, *c.* 2.4 mm long; ovules in 3 vertical rows, glabrous, greenish yellow.

Distribution: India (Anamalai hills and Nilgiri hills) (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: August-May.

Specimens examined: Lockhert gap, Devikulam, 17.05.1994, *Joy C.C. & Stephen Sequiera* 7542 (KFRI); Mathikettan shola National Park, 11.12.2016, *Dani Francis & Santhosh Nampy* 151397 (CALI); Melmanalar, Periyar Tiger Reserve, 11.04.1995, *N. Sasidharan & Jomy Augustine* 15017 (KFRI); Mathikettan Shola National Park, Sivanpara checkpost, 08.05.2015, *Syam Radh S. & Santhosh Nampy* 137951 (CALI).

Bulbophyllum mysorense (Rolfe) J.J.Sm., Bull. Jard. Bot. Buitenzorg, ser. 2. 8: 26. 1912; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1418. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 446. 2004. *Cirrhopetalum mysorense* Rolfe, Bull. Misc. Inform. Kew 1895: 34. 1895.

Epiphytic herbs. Pseudobulbs ovoid, *c.* 2 × 1.5 cm long, greenish yellow. Leaves solitary, linear-oblong, 6–7.5 × 1–1.5 cm, obtuse and emarginate at apex, sub-acute at base, glabrous, coriaceous, green. Umbel 4–5 cm long, 3 or 4 flowered, arising from base of pseudobulb. Flowers white with pink spots or striations; pedicels 8–10 mm long, greenish purple; bracts lanceolate, 3–4 × 0.8–1 mm, acuminate at apex, cuneate at base, 1-viened, glabrous, pale green. Sepals 3; dorsal sepal lanceolate, 12–14 × 3–3.5 mm, acuminate at apex, truncate at base, glabrous, white with pinkish striations; lateral sepals 2, lanceolate, 15–16 × 2.5–3 mm, acuminate at apex, truncate at base, glabrous, white with pink striations. Lateral petals 2, ovate-elliptic, 4–5 × 3.2–3.5 mm, acute at apex, obtuse at base, 3-nerved, glabrous, white with pink striations. Lips oblong, *c.* 3 × 1 mm, acute at apex, curved, glabrous, deep purple. Spur 0. Column *c.* 2 × 1 mm, yellow. Pollinia 2, yellow. Ovary obovate; ovules in 3 vertical rows, glabrous, green with pink striations.

Distribution: India (POWO, 2023); *Habitat*: Semi-evergreen forests; *Fl. & Ft.*: June-September.

Specimen examined: Thekkady, Periyar Tiger Reserve, 31.07.1993, *Jomy Augustine* 12201 (KFRI).

Bulbophyllum sterile (Lam.) Suresh, Interpr. Van Rheede's Hort. Malab. 298. 1988; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 447. 2004. *Epidendrum sterile* Lam., Encycl. 1: 189. 1783. *Bulbophyllum nilgherrense* Wight, Icon. Pl. Ind. Orient. 5. t. 1650. 1852; Hook.f., Fl. Brit. India 5: 761. 1890; C.E.C.Fisch., in Gamble, Fl. Madras 3: 1418. 1928; Abraham & Vatsala, Intr. Orchids 334. 1981. **Fig. 11A**

Epiphytic herbs. Pseudobulbs ovoid, 3–3.5 × *c.* 2 cm, 3–5 cm apart on creeping rhizomes, smooth, green, 4-angled. Leaves solitary, elliptic, 10–15 × 2–3 cm, emarginate at apex, thick, fleshy, coriaceous. Racemes *c.* 6 cm long. Flowers not opening widely, *c.* 1 cm long; pedicels 1.5–2 mm long; bracts ovate, 3.5–4 × 2–2.1

mm, acute at apex, truncate at base, entire or slightly wavy, puberulous, cream speckled with purple. Sepals 3, ovate, acute at apex, cuneate or truncate at base, glabrous, wavy, purple; dorsal sepal 5–5.5 × 2–3 mm; lateral sepals 8.1–8.3 × 4–5 mm. Lateral petals 2, ovate, 2.7–3 × 1.1–1.3 mm, acute at apex, truncate at base, entire, 1-nerved, glabrous, purple. Lips elliptic, *c.* 5.5 × 3 mm, ear shaped, obtuse at apex, entire, glandular or papillate, deep purple or brown, thick and fleshy; lateral lobes lanceolate, *c.* 2.1 × 1 mm, white dotted on thesurface, fused with lip. Spur 0. Column *c.* 3 × 1 mm, pinkish cream with white dots. Pollinia 2, orbicular, 0.4 mm long, glabrous, yellow. Ovary twisted, *c.* 1 cm long; ovules in 3 vertical rows.

Distribution: Nepal to India and Myanmar (POWO, 2023); *Habitat*: Forest and river banks; *Fl. & Ft.*: December-March.

Specimens examined: Anamudi peak, 11.12.2019, *Dani Francis & Santhosh Nampy* 164552; above Valara waterfalls, River bank, 27.12.2017, *Dani Francis & Santhosh Nampy* 156518 (CALI); Vallakkadavu R.F., 11.03.1973, *B.D. Sharma* 43802 (MH).

Notes: According to Abraham and Vatsala (1981), this species has a wider range of variations in the size and colour of flowers. Flowers may arrange in dense or lax racemes. Pale purple flowers with deep purple lip or pale purple flowers speckled with deep purple and deep purple lip are common at low elevations. At high altitudes, either has cream yellow flowers with purple lip or yellow flowers speckled with purple and orange lip or orange flowers speckled with purple lip.

Bulbophyllum stocksii (Benth. ex Hook.f.) J.J.Verm., Schuit. & de Vogel, Phytotaxa 166(2): 111. 2014. *Trias stocksii* Benth. ex Hook.f., Fl. Brit. India 5(16): 781. 1890; Abraham & Vatsala, Intr. Orchids 346. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 476. 2004.

Perennial epiphytic herbs, 3–3.5 cm long. Pseudobulbs globose, 0.8–1 × 0.8–1 cm, 1-leaved, brownish green. Leaves solitary, elliptic, 2–3 × 1–1.5 cm, obtuse and mucronate at apex, attenuate at base, glabrous, brownish green. Flowers 2 or 3 from lateral side of pseudobulb, *c.* 5 × 6 mm, brownish yellow. Sepals 3, unequal; dorsal sepal ovate, 5–6 × 3–4 mm, obtuse at apex, truncate at base, 7-nerved,

glabrous; lateral sepals obliquely ovate, 4–5 × 3–4 mm, obtuse at apex, truncate at base, 7-nerved, glabrous. Lateral petals 2, linear, 2–3 × *c.* 2 mm, obtuse at apex, cuneate at base, glabrous. Lips oblong, *c.* 8 × 4 mm, acute at apex, deep purple. Spur 0. Column oblong, *c.* 3 × 1 mm, glabrous. Pollinia 2, glabrous, yellow. Ovary cylindrical, *c.* 2 mm long.

Distribution: S. India (POWO, 2023); *Habitat*: Growing epiphytically on shola margin; *Fl. & Ft.*: December-January.

Specimens examined: Arjunankotta, Periyar Tiger Reserve, 26.01.1994, *Jomy Augustine* 13145; Kuttikkanam-Peermade, 21.01.1965, *K. Vivekananthan* 22934; *Ibid.*, 08.01.1968, *K. Vivekananthan* 29392 (MH); Mathikettan Shola National Park, near Sivanpara checkpost, 07.12.2017, *Syam Radh S. & Santhosh Nampy* 151791 (CALI).

Notes: This species was previously treated under the genus *Trias* Lindl., but Vermeulen *et al.* (2014) placed it under *Bulbophyllum*.

Bulbophyllum tremulum Wight, Icon. Pl. Ind. Orient. 5: t. 1749. 1851; Hook.f., Fl. Brit. India 5: 763. 1890; C.E.C.Fisch., in Gamble, Fl. Madras 3: 1418. 1928; Abraham & Vatsala, Intr. Orchids 331. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 447. 2004.

Epiphytic or lithophytic herbs. Pseudobulbs depressed, globose, *c.* 1 × 1 cm, green. Leaves solitary, oblong, 3–5 × 0.8–1 cm, obtuse at apex, acute at base, glabrous, coriaceous, green. Racemes 12–15 cm long, 5–10 flowers in two rows on either side of axis. Flowers 1.5 cm across, purple; pedicels 2.5–3 mm long; bracts ovate, 1.8–2 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, green. Sepals 3, inside and margin hairy; dorsal sepal subulate, 9–9.5 × 1–1.5 mm, sub-acuminate at apex, truncate at base, purple; lateral sepals 2, ovate, 9–9.5 × 1–1.5 mm, slightly curved at apex, truncate at base, purple. Lateral petals 2, falcately lanceolate, 1.8–2 × 0.9–1 mm, acute at apex, obtuse at base, glabrous, purple. Lips oblong, 6–6.5 × 1–1.5 mm, acicular hairy along margins, deep purple. Spur 0. Column *c.* 2 × 1.2 mm, purple. Pollinia 2, yellow. Ovary obovate; ovules in 3 vertical rows, glabrous, greenish yellow.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen and semi-evergreen forests; *Fl. & Ft.*: December-February.

Specimens examined: Kuttikkanam-Peermade, 21.01.1965, *K. Vivekananthan* 22935; Painavu, 19.02.1984, *A.G. Pandurangan* 78058 (MH).

Bulbophyllum xylophyllum C.S.Parish & Rchb.f., Trans. Linn. Soc. London 30: 151. 1874; Hook.f., Fl. Brit. India 5: 766. 1890; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 447. 2004.

Epiphytic herbs. Pseudobulbs minute, or indistinct, button like, *c.* 1.2 × 1 mm, green. Leaves solitary, elliptic, 2.8–3 × 1–1.2 cm, sub-acute at apex, cuneate at base, glabrous, coriaceous, green. Inflorescence slender, 3–3.5 cm long, 10–12-flowered. Flowers red; pedicels 2.5–3 mm long; bracts ovate, 1.8–2 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, red. Sepals 3; dorsal sepal lanceolate-ovate, 3.8–4 × 1.8–2 mm, acute at apex, truncate at base, glabrous, red; lateral sepals 2, ovate, 2.8–3 × 1.8–2 mm, apiculate at apex, truncate at base, glabrous, red. Lateral petals 2, linear, *c.* 2 × 1 mm, acute at apex, obtuse at base, glabrous, red. Lips oblong, 1–1.2 × 0.8–1 mm, obtuse at apex, puberulous, grooved distally, fleshy, curved, red. Spur 0. Column *c.* 1 × 0.7 mm, red. Pollinia 2, yellow. Ovary obovate; ovules in 3 vertical rows, glabrous, greenish red.

Distribution: S. India, E. Nepal to China and Indo-China (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: December-April.
Specimen examined: Melmala, Periyar Tiger Reserve, 26.12.1994, *Jomy Augustine & K.P. Rajesh* 14474 (KFRI).

Calanthe R.Br.,

Bot. Reg. 7: t. 573.1821, *nom. cons.*

Key to the species

1. Racemes lax flowered; lips hardly exceeding sepals, mid-lobe turbinate …….. …….. *C. masuca*

1. Racemes dense flowered; lips longer than sepals, mid-lobe widely ovate …….. …….. *C. triplicate*

Calanthe masuca (D.Don) Lindl., Gen. Sp. Orchid. Pl. 249. 1833; Hook.f., Fl. Brit. India 5: 850. 1890; Gamble, Fl. Madras 3: 1432. 1928; Abraham & Vatsala, Intr. Orchids 265. 1981. *Bletia masuca* D.Don, Prodr. Nepal. 30. 1825. **Fig. 11D**

Terrestrial herbs, up to 40 cm tall. Pseudobulbs green, covered by leaf sheaths. Leaves widely elliptic, 20–30 × 8–10 cm, obtuse at apex, narrowed to a grooved petiole. Racemes arising from base, erect, 25–35 cm long, many-flowered. Flowers 2.5–4.5 cm across, pale pink-purple; pedicels *c.* 2 cm long, sparsely hairy; bracts leafy, lanceolate-ovate, 2–2.6 × 0.3–0.7 cm, acute at apex, truncate at base, entire, tomentose, green. Sepals 3, ovate, 3–3.2 × 0.8–1 cm, fleshy, acuminate at apex, oblique-sub-truncate at base, 7-nerved, light pink. Lateral petals 2, rhombic, 2–2.5 × 0.8–1 cm, acute at apex, obtuse at base, wavy, 5-nerved, glabrous-puberulous, pink. Lips 3-lobed, hardly exceeding sepals; mid-lobe turbinate, *c.* 2.3 × 1.6 cm, emarginate at apex with a notch, with 2 calli at base, slightly crenulate, violet; lateral lobes ovate, *c.* 3 × 2 mm, obtuse at apex, glabrous. Spur linear, *c.* 3.5 cm long, blunt at apex, scaberulous, pink. Column oblong, *c.* 5 × 5 mm, glabrous or scaberulous. Pollinia 4 in 2 loci, *c.* 3 mm long, yellow. Ovary obovate, *c.* 1.8 × 0.5 mm; ovules in 3 vertical rows, scaberulous, pinkish white. Capsules obovate, 2–3 mm long.

Distribution: Madagascar, tropical and Subtropical Asia (POWO, 2023); *Habitat*: Forest ground; *Fl. & Ft.*: September-January.

Specimens examined: Mannavan shola, 27.11.1979, *Nambiar* 1029 (KFRI); Nyamakkad, 8th mile, 24.01.2018, *Dani Francis & Santhosh Nampy* 158161; Puthukkad, Nallathanni Kallar, 15.09.2018, *Dani Francis & Santhosh Nampy* 161919 (CALI).

Calanthe triplicata Ames, Philipp. J. Sci. C 2: 326. 1907; Abraham & Vatsala, Intr. Orchids 262. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 702. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 447. 2004. *Calanthe veratrifolia* Ker. Gawl., Bot. Reg. 9: t. 720. 1823; Hook.f., Fl. Brit. India 5: 851. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1432. 1928.

Terrestrial herbs with underground creeping rhizomes, 50–130 cm tall. Rhizomes ellipsoid or ovoid. Stems stout with 3 or 4 sheaths below and leafy up to inflorescence. Leaves elliptic, 26–29 × 8–10 cm, acute-acuminate at apex, attenuate at base, glabrous. Racemes arising from base, erect, 25–35 cm long, many-flowered. Flowers 4–4.5 × 2.8–3 mm, light pink; pedicels 3.5–4 cm long, sparsely hairy; bracts leafy, 4.3–5 × 1–3 cm, cuspidate at apex, cuneate at base,

entire, 10-nerved, glabrous. Sepals 3, fused to pedicel tube; dorsal sepal lanceolate-ovate, 4.5–5 × 2.5–3 mm, obtuse at apex, truncate at base, puberulous, fleshy, light pink; lateral sepals fused with spur at base, ovate, 7.1–8 × 2.5–3 mm, fleshy, mucronate at apex, truncate at base, 5-nerved, puberulous, light pink. Lateral petals 2, obovate, 6–8 × 2.5–3 mm, cuspidate at apex, attenuate at base, nerves indistinct, glabrous, purple. Lips 3-lobed, longer than sepals; mid-lobe widely ovate, *c.* 8 × 4 mm, dentate, apex cuspidate, divided, entire, light pink with dark pink tinched, two callus at base, orange; lateral lobes falcate, *c.* 6 × 1.5 mm, acute at apex, glabrous. Spur linear, *c.* 1.2 cm long, emarginate at apex, puberulous. Column 2–3 × 0.5–1 mm. Pollinia 4 in 2 loci, 0.5 mm long, yellow. Ovary *c.* 1.3 cm long, puberulous.

Distribution: Tropical and Subtropical Asia to Pacific (POWO, 2023); *Habitat*: Forest ground; *Fl. & Ft.*: November-June.

Specimens examined: Anamudishola, 03.04.2017, *Dani Francis & Santhosh Nampy* 152068; *Ibid*., 25.01.2018, *Dani Francis & Santhosh Nampy* 158292; *Ibid*., 22.06.2018, *Dani Francis & Santhosh Nampy* 159361 (CALI); Umayamala, 22.11.1965, *B.V. Shetty* 26614 (MH).

Notes: *Calanthe triplicata* is commonly called 'Christmas orchid'. It is characterized by its white or light pink flowers which have a lip with four spreading lobes (lateral lobes and the deeply bipartite mid-lobe) and mostly yellow or orange callus at the base. It is usually grown as ornamentals (Kurzweil, 2010).

Cheirostylis Blume,

Bijdr. Fl. Ned. Ind. 8: 413, t. 16. 1825.

Cheirostylis flabellata Wight, Icon. Pl. Ind. Orient. 5. 16. 1851; Hook.f., Fl. Brit. India 6: 105. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1454. 1928; Abraham & Vatsala, Intr. Orchids 194. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 680. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 447. 2004. **Fig. 11E**

Annual terrestrial herbs, 7–15 cm tall. Stems slender, fleshy, glandular hairy. Leaves ovate, 1.5–2 × 1.1 cm, obtuse at apex, cordate at base, membranous; petioles 0.5–1 mm long. Racemes 16 cm long, 7-flowered, white; peduncles 7–10 cm long, glandular hairy, fleshy. Flowers 4–5 mm long, white; pedicels 2–3 mm long, glandular hairy; bracts subulate, 7–7.2 × 1.5–1.8 mm, acuminate at apex,

cuneate at base, entire, with a prominent central vein, glandular hairy on margin and very less in adaxial surface, reddish with dark red spots. Sepals 3, connate to the middle to form a tube, ovate, 1.8–2 × 1.2 mm, obtuse at apex, cuneate at base, veins obscure, glandular hairy, reddish green. Lateral petals 2, free, lanceolate, 3–4.2 × 0.8–1 mm, obtuse at apex, veins obscure, glabrous, white. Lips lobed, adnate to column, *c*. 7 × 2–6 mm, crumbled, 4–5 pair of lobes, glabrous, bearing 2 small-clawed appendages at base, entire, white. Spur 0. Column *c.* 3 × 2 mm, 2 appendages completely cover the column. Pollinia 4 in 2 loci, *c.* 3.2 mm long, pyriform, yellow. Ovary twisted, *c.* 4 × 2 mm; ovules in 3 vertical rows, glandular hairy, light green.

Distribution: Indian Subcontinent to Andaman Islands (POWO, 2023); *Habitat*: Forest ground and margins; *Fl. & Ft.*: December-March.

Specimens examined: Choondal, 04.01.2017, *Dani Francis & Santhosh Nampy* 151440; Devikulam, 07.02.2017, *Dani Francis & Santhosh Nampy* 151645; way to Kanketty, Mankulam, 20.12.2019, *Dani Francis & Santhosh Nampy* 164825 (CALI); Kanthallur, 30.03.1978, *Nambiar* 00278 (KFRI); Nyamakad, 8th mile, 24.01.2018, *Dani Francis & Santhosh Nampy* 158240 (CALI); Old Devikulam, 25.01.1964, *K.M. Sebastine* 18466; Rajamala, 02.02.1970, *B.V. Shetty* 31785 (MH); Sigarette point, way to Vettikkudy, Munnar, 18.03.1995, *Stephen Sequiera* 7596 (KFRI).

Notes: *Cheirostylis flabellata* shows similarity with *Zeuxine longilabris* in habit and habitat, but is distinguished by its sepals connate to the middle forming a tube, whereas in the latter species, the sepals are free.

Cleisostoma Blume,

Bijdr. Fl. Ned. Ind. 8: 362. 1825.

Cleisostoma tenuifolium (L.) Garay, Bot. Mus. Leafl. 23(4): 175. 1972; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 448. 2004. *Epidendrum tenuifolium* L., Sp. Pl. 2: 952. 1753. *Sarcanthus peninsularis* Dalzell, Hooker's J. Bot. Kew Gard. Misc. 3: 343. 1851; Hook.f., Fl. Brit. India 6: 67. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1447. 1928.

Pendulous, epiphytic herbs, 13–15 cm tall. Internodes *c.* 10 × 3–5 mm, ribbed. Leaves linear-oblong, 4–10 × 0.4–0.5 cm, acuminate at apex, coriaceous, glabrous. Racemes axillary, 3–6 cm long, lax. Flowers yellowish brown; pedicels 2–3 mm

long; bracts lanceolate, *c.* 1.5 × 1 mm, acute at apex, cuneate at base, glabrous. Sepals 3; dorsal sepal obovate, 3.5–4 × 1–1.2 mm, acute at apex, sub-truncate at base, glabrous, 3-nerved, yellow with maroon along margin; lateral sepals elliptic, 2.8–3 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, 3-nerved, yellow with maroon along margin. Lateral petals falcate, oblong, 2.8–3 × 0.5–0.8 mm, acute at apex, cuneate at base, glabrous, 1-nerved. Lips 3-lobed, *c.* 2.5 × 2 mm; mid-lobe ovate, *c.* 2 × 1 mm, with 2 fleshy calli; lateral lobes ovate, *c.* 1.5 × 1 mm, apiculate at apex, glabrous, pale violet. Spur conical, *c.* 3 mm long. Column short, yellow. Pollinia 4 in 2 loci. Ovary obovate, 2–3 mm long, glabrous. Capsules obovate, 1–1.5 × 0.3–0.5 cm, glabrous.

Distribution: W. India, Sri Lanka, and E. Myanmar to Thailand (POWO, 2023); *Habitat*: Semi-evergreen and evergreen forests; *Fl. & Ft.*: March-August.
Specimens examined: Neriyamangalam to Valara forest, 20.08.1965, *K.M. Sebastine* 25100 (MH); way to Panamkutty, 10.03.2017, *Dani Francis & Santhosh Nampy* 152061 (CALI).
Notes: This species is included in the CITES Appendix II (De, 2022).

Coelogyne Lindl.,
Coll. Bot. sub. t. 33.1821.

Key to the species

1. Racemes pendulous; bracts bifarious, imbricating; flowers numerous …….. …….. *C. imbricata*
1. Racemes erect or drooping; bracts not bifarious, not imbricating; flowers 3–8 2
2. Pseudobulbs distantly placed, green; leaves linear ……..…..…... *C. breviscapa*
2. Pseudobulbs crowded, lemon yellow; leaves elliptic-oblong …….. 3
3. Bracts elliptic; flowers 6–8; pseudobulbs smooth, angled ……..…... *C. mossiae*
3. Bracts lanceolate; flowers 3 or 4; pseudobulbs rugose ……..…….. *C. nervosa*

Coelogyne breviscapa Lindl., Fol. Orchid. 5: 4. 1854; Hook.f., Fl. Brit. India 5: 833. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1430. 1928; Abraham & Vatsala, Intr. Orchids 277. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 449. 2004.

Epiphytic herbs. Pseudobulbs ovate, 2.5–4 × 0.8–1 cm, tapering towards apex, partially covered by scaly bracts, ridged, distantly placed, glabrous, green. Leaves 2, linear, 12–17 × 1–1.5 cm, acute at apex, attenuate at base, coriaceous, glabrous, green. Racemes terminal, 4–12 cm long, slender, drooping, 4–6-flowered. Flowers *c.* 1.5 cm, white; bracts lanceolate, 2–3 × 0.8–1 mm, acute at apex, sub-truncate at base, glabrous, pale brown. Sepals 3; dorsal sepal oblong-lanceolate, 11–13 × 3–4 mm, acute at apex, sub-truncate at base, glabrous, white; lateral sepals oblong-lanceolate, 11–11.5 × 3.5–4 mm, acute at apex, glabrous, white. Lateral petals 2, linear, 10.5–11 × 2–2.5 mm, acute at apex, cuneate at base, glabrous, white. Lips oblong, 1–1.2 × 0.3–0.4 mm, 3-lobed; mid-lobe oblong, retuse at apex; lateral lobes auricular, narrowly oblong, obtuse at apex; disc with two crenate keels, yellowish at apex. Spur 0. Column *c.* 6 mm long, winged, hooded. Pollinia 4, clavate. Ovary cylindrical, glabrous. Capsules obovate, glabrous.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Semi evergreen and evergreen forests; *Fl. & Ft.*: September-April.

Specimens examined: Kuttikkanam-Peermade, 19.11.1975, *K. Vivekananthan* 46732; *Ibid.*, 25.09.1964, *K. Vivekananthan* 21401; Meenmutty, 15.02.1982, *C.N. Mohanan* 73284 (MH).

Coelogyne imbricata (Hook.) Rchb.f. in Walpers, Ann. Bot. Syst. 6(2): 238. 1861. *Pholidota imbricata* Hook., Exot. Fl. 2: t. 138. 1825; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1431. 1928; Abraham & Vatsala, Intr. Orchids 288. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 469. 2004. **Fig. 12F**

Epiphytic herbs, 15–50 cm long. Pseudobulbs crowded, ovate-cylindrical, 2–5.5 × 1–2 cm, covered by scaly bracts, glabrous, green. Leaves 1 or 2, from pseudobulb, oblanceolate-obovate, 6–30 × 2–4 cm, acute at apex, cuneate at base, glabrous. Racemes terminal, 15–44 cm long, pendulous, with bifarious imbricating bracts. Flowers *c.* 1 × 0.6 cm, many-flowered, white; bracts ovate, 5–8 × 4–5 mm, acute at apex, sub-truncate at base, glabrous, purplish green, persistent. Sepals 3, sub-equal, 3-nerved; dorsal sepal ovate, 5–7 × 4.5–5 mm, obtuse at apex, sub-truncate at base, glabrous, off-white; lateral sepals cymbiform, 6–6.5 × 2.5–3 mm, obtuse at apex, with a dorsal median wing, glabrous, off-white. Lateral petals 2, linear-

falcate, 5–6 × 1.5–3 mm, acute at apex, cuneate at base, 1-nerved, glabrous, off-white. Lips deeply saccate, *c.* 7 × 6 mm, 3-lobed; mid-lobe bifid, with a shallow median sinus, lobules auricular; lateral lobes broadly triangular, obtuse at apex, erect, glabrous. Spur 0. Column *c.* 3 mm long, glabrous. Pollinia 4, clavate. Ovary cylindrical, glabrous. Capsules elliptic, 1.5–2.5 × 0.5–1 cm, glabrous.

Distribution: Tropical and Subtropical Asia to SW. Pacific (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: April-January.

Specimens examined: Anjuruli, Thekkady, 04.10.1972, *B.D. Sharma* 42400; Cheruthoni, 16.02.1982, *C.N. Mohanan* 73304 (MH); Ezhuthupara, 05.12.2018, *Dani Francis & Santhosh Nampy* 168869 (CALI); Kanchiar, 17.12.1982, *C.N. Mohanan* 76178; Kulamavu, 01.06.1982, *C.N. Mohanan* 74135 (MH); Neriamangalam wayside, 11.09.2018, *Dani Francis & Santhosh Nampy* 159451 (CALI); Neriamangalam to Valara forest, 20.08.1965, *K.M. Sebastine* 25324; Peermade, 26.09.1964, *K. Vivekananthan* 21418; Santhanpara, 21.04.1964, *K.M. Sebastine* 18363; Thekkady, 08.10.1976, *K. Vivekananthan* 48615 (MH); *Ibid.*, 26.07.1993, *Jomy Augustine* 12193 (CALI); Vandanmedu, 26.08.1977, *K. Vivekananthan* 50517 (MH).

Notes: *Coelogyne imbricata* is also known as the 'common rattlesnake orchid' or 'necklace orchid'. It is a widely distributed clump forming epiphyte or lithophyte with crowded pseudobulbs and is widely grown as an ornamental plant (Sarkar & Agarwal, 1978). This species is included in the CITES Appendix II (De, 2022).

Coelogyne mossiae Rolfe, Bull. Misc. Inform. Kew 1894(89): 156. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1430. 1928; Abraham & Vatsala, Intr. Orchids 285. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 705. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 449. 2004. **Fig. 11G**

Epiphytic herbs with creeping rhizomes, 20–30 cm tall. Pseudobulbs crowded, 2-leaved (rarely 1), ovate, 3–3.5 × 1.8–2 cm, lemon yellow, smooth, angled. Leaves elliptic, 15–20 × 2.2–3.4 cm, obtuse-acute at apex, sheathing at base, 9–12-nerved, glabrous. Racemes 15–22 cm long. Flowers 6–8, *c.* 6.5 × 6 cm, white; pedicels *c.* 11 mm long; bracts elliptic, 1.7–4.6 × 1.5 cm, obtuse at apex, truncate at base, entire, glabrous, papery, light brown, longer than ovary. Sepals 3, ovate, 3–3.2 × 1.2 cm,

obtuse at apex, truncate at base, 11-nerved, glabrous, white. Lateral petals 2, elliptic, 1.8–2 × 1.5–1.9 cm, obtuse at apex and base, 6–7-nerved, glabrous, white. Lips 3-lobed, *c.* 2.5 × 1.5 cm; lateral lobes *c.* 1.6 × 0.6 cm, smaller than mid-lobe, lobes ovate, acute at apex, 9-nerved, mid veins 2, thick and flap-like towards base, glabrous, yellow tinch at base. Spur 0. Column *c.* 15 × 4 mm, 3 yellow ridges and others white. Pollinia 2, obovate, *c.* 3 × 1 mm, glabrous, yellow. Ovary *c.* 1 × 4 mm; ovules in 3 vertical rows, glabrous, light green. Capsules obovate, *c.* 2.5 × 0.9 cm, glabrous.

Distribution: S. India (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: August-June.

Specimens examined: Devikulam, 25.06.1981, *Nambiar & Mukthesh Kumar* 1655; Eravikulam, 13.02.1985, *C. Renuka* 3462 (KFRI); Mesthirikettu, Lower Vaguvarai, 30.12.2017, *Dani Francis & Santhosh Nampy* 158074; Pettimudi, near Munnar, 19.03.2019, *Dani Francis* & *Santhosh Nampy* 159111; near Subranshed, 30.12.2019, *Dani Francis & Santhosh Nampy* 164897 (CALI).

Coelogyne nervosa A.Rich., Ann. Sci. Nat., Bot. Ser. 2, 15: 16. 1841; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1430. 1928; Abraham *&* Vatsala, Intr. Orchids 285. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 449. 2004. *Coelogyne corrugata* Wight, Icon. Pl. Ind. Orient. 5. t. 1639. 1851; Hook.f., Fl. Brit. India 5: 835. 1890.

Epiphytic herbs with creeping rhizomes, 15–20 cm tall. Pseudobulbs crowded, 2-leaved, ellipsoid or ovoid, 2–3 × 1.5–2 cm, rugose, lemon yellow. Leaves 2, elliptic-oblong 4–10 × 2–3 cm, acute at apex, cuneate at base, 6–9-nerved, glabrous, green. Racemes 8–15 cm long. Flowers 3–4, *c.* 3 × 2 cm, white; pedicels 0.5–1 cm long; bracts lanceolate, 1.8–2 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous. Sepals 3; dorsal sepal oblong, 2.5–3 × 0.6–1 cm, obtuse at apex, cuneate at base, 7-nerved, glabrous, white; lateral sepals oblong, 2.5–3 × 0.5–0.8 mm, obtuse at apex, cuneate at base, 7-nerved, glabrous, white. Lateral petals oblong-obovate, 2.5–3 × 0.3–0.5 cm, obtuse at apex, cuneate at base, 7-nerved, glabrous, white. Lips ovate, *c.* 2.5 × 1.5 cm, 3-lobed; mid-lobe triangular, crenulate, white with deep yellow at base. Spur 0. Pollinia 4, obovate, *c.* 2.5 × 1 mm, yellow. Ovary cylindrical, *c.* 1.5 × 0.2 cm, green, glabrous. Capsules obovate, *c.* 2.5 × 1 cm, glabrous, ribbed.

Distribution: SW. and S. India (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: June-April.

Specimens examined: Anamudi slopes, 23.04.1966, *B.V. Shetty* 27361 (MH); Devikulam, 27.07.1982, *Nambiar & N. Sasidharan* 1809 (KFRI); Devikulam, Munnar Road, 06.04.1963, *N.C. Rathakrishnan* 16241; western slope Eravikulam, 05.12.1987, *P. Bhargavan* 87340 (MH); Mathikettan shola National Park, 11.12.2016, *Dani Francis & Santhosh Nampy* 151400; Sivanpara, 23.08.2014, *Syam Radh S. & Santhosh Nampy* 143543; *Ibid*., 28.07.2016, *Syam Radh S. & Santhosh Nampy* 149179 (CALI); Meenmutty, 25.02.1983, *C.N. Mohanan* 77991; Painavu-Kulamavu Road, 21.08.1981, *K. Vivekananthan & V.S. Raju* 71139; Puliyanmala, 14.12.1982, *C.N. Mohanan* 76144 (MH); Rajamala, 5th mile, Munnar, 28.01.1994, *Mukthesh Kumar & Stephen Sequiera* 7238; Vattavada, Munnar, 09.03.1979, *Nambiar* 00239 (KFRI).

Cottonia Wight,

Icon. Pl. Ind. Orient. 5(1): 21. 1851.

Cottonia peduncularis (Lindl.) Rchb.f., Cat. Orch.-Samml. Schiller, ed. 3. 22. 1857; Abraham & Vatsala, Intr. Orchids 456. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 449. 2004. *Vanda peduncularis* Lindl., Gen. Sp. Orchid. Pl. 216. 1833. *Cottonia macrostachya* Wight, Icon. Pl. Ind. Orient. t. 1755. 1851; Hook.f., Fl. Brit. India 6: 26. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1439. 1928.

Epiphytic herbs, 10–30 cm tall. Stems woody. Leaves spirally arranged, oblong, 8–10 × 0.8–1 cm, bilobed at apex, cuneate at base, glabrous, green. Inflorescence 20–40 cm long. Flowers *c.* 1.5 cm across, yellowish brown; pedicels 0.8–1 cm long; bracts lanceolate, 1.8–2 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, pale brown. Sepals 3; dorsal sepal oblong, 8.5–9 × 3.5–4 cm, acute at apex, cuneate at base, strongly inflexed, glabrous, yellow striped with brown; lateral sepals oblong, 7.5–8 × 4–4.5 mm, obtuse at apex, cuneate at base, glabrous, yellow striped with brown. Lateral petals linear-oblong, *c.* 8 × 3 mm, obtuse at apex, cuneate at base, glabrous, yellow faintly striped with brown. Lips sub-panduriformis, *c.* 1.3 × 0.4 cm, 3-lobed; mid-lobe 3-fid, ciliate along margin, deep purple with yellow; lateral

lobes orbicular. Spur 0. Pollinia 2, pyriform. Ovary cylindrical, *c.* 1.5 mm long, glabrous, purplish yellow. Capsules obovate, glabrous.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Semi-evergreen and evergreen forests; *Fl. & Ft.*: March-May.

Specimen examined: Pachakkanam, 19.03.1973, *B.D. Sharma* 42486 (MH).

Crepidium Blume,

Bijdr. Fl. Ned. Ind. 8: 387.1825.

Key to the species

1. Plants pseudobulbous; flowers 10–12 mm across; lips ovate-sagittate, 2-lobed at apex ……..…….…….. *C. acuminatum*

1. Plants stoloniferous; flowers 2–4 mm across; lips widely obovate, dentate or with setae at apex ……..…….. *C. resupinatum*

Crepidium acuminatum (D.Don) Szlach., Fragm. Florist. Geobot. Suppl. 3: 123. 1995. *Malaxis acuminata* D.Don, Prodr. Fl. Nepal. 29. 1825; Hook.f., Fl. Brit. India 5: 690. 1890; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 473. 2004.

Annual terrestrial herbs, 20–35 cm tall, pseudobulbous at base. Stems erect, fleshy, glabrous. Leaves ovate-lanceolate, 7–13 × 2–5 cm, acute-acuminate at apex, narrowed to sheathing at base, undulate, glabrous, green with purple or violet margin, papery. Racemes terminal, 15–20 cm long. Flowers 1–1.2 cm across, pale purple; pedicels *c.* 3 mm long; bracts reflexed, lanceolate, 5–6 × 1.2–1.5 mm, sub-acute at apex, truncate at base, glabrous, green. Sepals 3; dorsal sepal lanceolate, 4–6 × 2–3 mm, acute at apex, cuneate at base, glabrous, purple; lateral sepals ovate, *c*. 2 × 3 mm, acute at apex, sub-truncate at base, glabrous, purple. Lateral petals 2, falcate, 6–8 × 1–1.2 mm, obtuse at apex, truncate at base, recurved at margin, glabrous, pale purple. Lips ovate-sagittate, 8–10 × 2.8–3 mm, 2-lobed at apex, lobes acute-obtuse, with 2 appendages at base, glabrous, pale purple. Spur *c.* 5 mm long. Column *c.* 5 × 1.5 mm, pale purple. Pollinia 4 in 2 groups, yellow. Ovary *c.* 2 × 1 mm; ovules in 3 vertical rows, glabrous, greenish. Capsules obovate, glabrous.

Distribution: Indian Subcontinent to S. China and Philippines (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: July-December.

Specimens examined: Way to Anamudi basecamp, 10.12.2019, *Dani Francis & Santhosh Nampy* 170037; Eravikulam, 29.09.2017, *Dani Francis & Santhosh Nampy* 156305; way to Kanketty, Mankulam, 20.12.2019, *Dani Francis & Santhosh Nampy* 164598; Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164883 (CALI); Vallakkadavu, 04.10.1976, *K. Vivekananthan* 48593 (MH); Vattavada, Munnar, 28.07.1982, *Nambiar & N. Sasidharan* 1857 (KFRI).

Crepidium resupinatum (G.Forst.) Szlach., Fragm. Florist. Geobot. Supp. 3: 131. 1995. *Epidendrum resupinatum* G.Forst., Fl. Ins. Austr. 61. 1786. *Mycrostylis rheedei* (Sw.) Lindl., Gen. Sp. Orchid. Pl. 21. 1830; Hook.f., Fl. Brit. India 5: 690. 1890. *Seidenfia rheedei* (Sw.) Szlach., Fragm. Florist. Geobot. Suppl. 3: 122. 1995; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 473. 2004. **Fig. 15A**

Lithophytic, annual terrestrial stoloniferous herbs, 10–25 cm tall. Stems slender, fleshy, glabrous. Leaves ovate-lanceolate, 5.5–15.5 × 3–3.5 cm, acute-acuminate at apex, attenuate at base, undulate, 6-nerved, glabrous, green with purple or violet at margin, papery. Racemes 10–20 cm long. Flowers 2–4 mm long, spirally arranged; pedicels *c.* 4.5 mm long, slightly winged, green; bracts lanceolate, 1–1.3 × 0.8–1 mm, acute at apex, truncate at base, entire, 1-nerved, glabrous, green with light purple. Sepals 3, falcate, 3–5 × 1–2 mm, obtuse-rounded at apex, cuneate at base, 3-nerved, glabrous, greenish yellow with violet at margins, thick. Lateral petals 2, falcate-ovate, 2.8–3 × 1.8–2 mm, obtuse at apex, truncate at base, prominently 1-nerved, glabrous, greenish yellow with reddish orange. Lips not lobed, widely obovate, *c.* 2 × 3 mm, dentate or with setae apically, with 2 appendages at base, glabrous, yellow-red. Spur *c.* 5 mm long. Column *c.* 2 × 1 mm, greenish. Pollinia 4 in 2 groups, *c.* 0.5 mm long, yellow. Ovary *c.* 2 × 1 mm; ovules in 3 vertical rows, glabrous, greenish. Capsules obovate, 1–1.2 cm long, glabrous.

Distribution: E. Sulawesi, Papua New Guinea to S. Pacific (POWO, 2023); *Habitat*: Evergreen forests and forest margins; *Fl. & Ft.*: June-November.

Specimens examined: Meenmutty-Kulamavu, 09.06.1983, *A.G. Pandurangan* 76668 (MH); Nallathannikallar, 10.06.2018, *Dani Francis & Santhosh Nampy* 159306;

Pachakkanam, 12.08.1993, *Jomy Augustine* 12321 (CALI); Pervanthanam, 24.09.1964, *K. Vivekananthan* 21356 (MH); Rhodovalley, Silent valley, Munnar, 22.11.2018, *Dani Francis & Santhosh Nampy* 168823 (CALI); Umayamala, 09.08.1967, *B.V. Shetty* 28347; *Ibid.*, 22.11.1965, *B.V. Shetty* 26626 (MH); Vellimala, 20.08.1994, *Jomy Augustine* 14060; Venmani to Kattappana way side, 16.07.2021, *Dani Francis & Santhosh Nampy* 176036 (CALI).

Cylindrolobus Blume,

Fl. Javae Praef 6. 1828.

Key to the species

1. Flowers 1–3; lips cuneately oblong, lobes inconspicuous; capsules cylindrical ……. *C. pauciflorus*

1. Flower 1; lips broadly ovate, 3-lobed; capsules oblong …….. *C. pseudoclavicaulis*

Cylindrolobus pauciflorus (Wight) Schuit., Y.P.Ng & H.A.Pedersen, Bot. J. Linn. Soc. 186(2): 195. 2018. *Eria pauciflora* Wight, Icon. Pl. Ind. Orient. 5(1): 4, t. 1636. 1851; Hook.f., Fl. Brit. India 5: 799. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1425. 1928; Abraham & Vatsala, Intr. Orchids 377. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 455. 2004.

Perennial epiphytic herbs with a creeping rhizome. Stems tufted, clavate, 4–10 cm long, with a long slender pleurinodal stalk-like portion. Pseudobulbs stem like, ovate-elliptic, 1.8–2 × 0.5–0.8 cm, wrinkled, bearing 2 or 3 leaves at apex. Lower nodes with scaly leaves, 0.8–1.5 cm long, clasped to stem, mucronulate at apex. Leaves 2, simple, elliptic-lanceolate, 3.5–5 × 1–1.3 cm, obtuse at apex, auriculate at base, glabrous. Racemes 1–3 flowered, 6–8 cm long. Flowers 1–3, white; pedicels 5–8 mm long; bracts ovate-lanceolate, 2–5 × 1–2 mm, obtuse at apex, cuneate at base, glabrous. Sepals 3; dorsal sepal oblong, 6–8 × 2–3 mm, obtuse at apex, cuneate at base, 3-nerved, glabrous; lateral sepals triangular or ovate, 9–10 × 5–6 mm, obtuse at apex, broad at base, 3-nerved, glabrous. Lateral petals linear-oblong, 8–8.5 × 2–2.5 mm, obtuse at apex, sub-truncate at base, 3-nerved, glabrous, white. Lips cuneately oblong, 5–6 × 3–4 mm, lobes inconspicuous. Spur 0. Column *c.* 2 mm long. Pollinia 8, pyriform, yellow. Ovary cylindrical, green. Capsules cylindrical.

Distribution: S. India (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: June-December.

Specimens examined: Bison valley, Devikulam, 27.07.1982, *Nambiar & N. Sasidharan* 1835 (KFRI); Mathikettan Shola National Park, Perattakkalam, 29.12.2014, *Syam Radh S. & Santhosh Nampy* 137891; Pachakkanam, 07.08.1993, *Jomy Augustine* 12268 (CALI); Rajamala, Munnar, 25.06.1981, *Nambiar & Mukthesh Kumar* 1576 (KFRI).

Notes: This species is one of the most common epiphytes in the southern Western Ghats, growing gregariously in the main branches and tree trunks. It is characterized by an abruptly swollen apical internode or otherwise stem-like pseudobulbs (Agrawala, 2009).

Cylindrolobus pseudoclavicaulis (Blatt.) Schuit., Y.P.Ng & H.A.Pedersen, Bot. J. Linn. Soc. 186(2): 195. 2018. *Eria pseudoclavicaulis* Blatt., J. Bombay Nat. Hist. Soc. 32. 519. 1928; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1426. 1928; Abraham & Vatsala, Intr. Orchids 380. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 455. 2004.

Perennial epiphytic herbs with creeping rhizomes. Stems tufted, clavate, 15–20 cm long. Pseudobulbs not well prominent, seen as continuation of stem. Scale leaves ovate, 3–4 × 1–2 cm, acute-acuminate at apex, clasping at base, glabrous. Leaves 3 or 4 per pseudobulb, ovate to elliptic-oblong, 10–15 × 2–3.5 cm, acute at apex, cuneate at base, glabrous, green. Racemes 3–10 cm long, 1-flowered. Flowers *c.* 3 × 2 cm, white; bracts oblong, 8–10 × 3–5 mm, obtuse at apex, glabrous, green. Sepals 3; dorsal sepal elliptic-oblong, 1–1.5 × 0.3–0.5 cm, acute at apex, sub-truncate at base, 5–7-nerved, glabrous, white; lateral sepals triangular, falcate, 0.8–1 × 0.3–0.5 cm, acute at apex, broad at base, 5-nerved, glabrous, white. Lateral petals oblong, 0.8–1 × 0.3–0.5 cm, acute at apex, cuneate at base, glabrous, white. Lips 3-lobed, broadly ovate, *c.* 1.5 × 1 cm, white bordered with purple; mid-lobe puberulous; lateral lobes ovate, glabrous. Column 1–1.5 mm long. Spur 0. Pollinia 8, pyriform. Ovary cylindrical, green. Capsules oblong, *c.* 2.5 × 0.5 cm, glabrous.

Distribution: SW. India (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: April-September.

Specimens examined: Mathikettan Shola National Park, Onnamthodu, 08.05.2015, *Syam Radh S. & Santhosh Nampy* 137973 (CALI); Rajamala, way to Pettimudi,

12.07.1994, *Mukthesh Kumar & Stephen Sequiera* 7570; Viripara, 29.09.1983, *Mukthesh Kumar* 2979 (KFRI).

Cymbidium Sw.,

Nova Acta Regiae Soc. Sci. Upsal. ser 2, 6: 70. 1799.

Cymbidium aloifolium (L.) Sw., Nova Acta Regiae Soc. Sci. Upsal. 6: 73. 1799; Hook.f., Fl. Brit. India 6: 10. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1436. 1928; Abraham & Vatsala, Intr. Orchids 305. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 714. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 450. 2004. *Epidendrum aloifolium* L., Sp. Pl. 2: 953. 1753.

Epiphytic herbs, densely clustered with numerous clinging roots. Scale leaves at swollen base, ovate-oblong, 1–4 × 1–2 cm, obtuse at apex, glabrous. Leaves oblong, distichous, 25–35 × 2–2.5 cm, emarginate at apex, sheathing and articulate at base, glabrous, pale green. Racemes dense, 25–38 cm long, pendulous. Flowers deep pinkish brown, 4–5 cm in diam.; pedicels 1–1.5 cm long, glabrous; bracts lanceolate, 3–5 × 1.5–2 mm, acute at apex, cuneate at base, glabrous, smaller than ovary. Sepals sub-equal, linear-oblong, 16–20 × 4–6 mm, obtuse to sub-acute at apex, sub-truncate at base, 3-nerved, glabrous. Lateral petals linear-lanceolate, 15–20 × 4–5.5 mm, obtuse at apex, cuneate at base, glabrous, pinkish brown. Lips 3-lobed, 14–15 × 10 mm; mid-lobes ovate-oblong, mucronate at apex, sinuate, reflexed; lateral lobes oblong, erect, obtuse at apex. Spur 0. Column 8–9 mm long. Pollinia 2, globular, *c.* 1.5 mm long. Ovary elliptic, 1.5–2 cm long. Capsules elliptic, 6–7.5 × 1.5–2 cm, perianth persistent.

Distribution: Himalaya to W. Malesia (POWO, 2023); *Habitat*: Moist deciduous forests; *Fl. & Ft.*: April-December.

Specimens examined: Chinnakkanal, Munnar, 18.05.1994, *Mukthesh Kumar & Stephen Sequiera* 7547; Chinnar, 08.06.1995, *N. Sasidharan & K.K. Sajeev* 15699 (KFRI); Thekkady, 07.07.1993, *Jomy Augustine* 12008 (CALI); *Ibid*., 23.12.1974, *K. Vivekananthan* 45661; *Ibid.*, 28.09.1972, *B.D. Sharma* 42089 (MH).

Notes: *Cymbidium aloifolium* has leathery green leaves and long pendant showy inflorescences. It is frequently used as a hybrid parent for breeding new varieties and has great horticultural value. In addition, it is used in traditional medicine (Chen *et al.*, 2020).

Dendrobium Sw.,

Nova Acta Regiae Soc. Sci. Upsal. ser. 2, 6: 82. 1799, *nom. cons.*

Key to the species

1. Plants pseudobulbous; pseudo bulbs uninodal; leaves 1–3 …….. 2

1. Plants with or without pseudobulbs; pseudobulbs if present pleurinodal; leaves many…. ……4

2. Stems unbranched; leaves 2 or 3; flowers and lips pinkish white ……. 3

2. Stems branched; leaves solitary; flowers creamy white with maroon dots within lips …… *D. nodosum*

3. Leaves elliptic; lateral petals obovate, clawed …….. *D. anamalayanum*

3. Leaves linear-oblong; lateral petals oblanceolate, cuneate ……. *D. microbulbon*

4. Plants leafless when flowering …….. 5

4. Plants leafy when flowering …… 9

5. Lithophytic and epiphytic herbs …….. 6

5. Epiphytic herbs …….. 7

6. Racemes 9–15 cm long; flowers pink; mid-lobe of lips widely ovate ……. ……. *D. kallarense*

6. Racemes 5–8 cm long; flowers white; mid-lobe of lips widely obovate …….. ……. *D. barbatulum*

7. Plants erect; inflorescence racemose; lips entire …….. 8

7. Plants drooping; inflorescence leaf opposed fascicles; lips irregularly fimbriate …….. *D. macrostachyum*

8. Flowers 2–4, white with yellowish brown in the mid-lobe of lips, white hairy; lateral petals lanceolate …….. *D. heterocarpum*

8. Flowers many, creamy white with green at base of lips and column, yellow green hairy; lateral petals spathulate …….. *D. ovatum*

9. Lips not lobed …….. 10

9. Lips 3-lobed …….. 11

10. Leaves narrowly elliptic; flowers white; lips pandurate …….. *D. herbaceum*

10. Leaves linear; flowers yellow with deep red lip; lips oblanceolate-oblong …….. *D. salaccense*

11. Plants pseudobulbous; leaves 1–4 …….. 12

11. Plants without pseudobulbs; leaves numerous …….. 13

12. Leaves solitary, linear-oblong; flowers 1 or 2, white with pink on lips ……..
…….. *D. macraei*

12. Leaves 3 or 4, lanceolate; flowers many, white with green on lips ….. *D. nanum*

13. Stems clavate …….. 14

13. Stems not clavate …….. 15

14. Leaf sheaths persistent; pedicels 3–4 mm long; bracts ovate; sepals sub-equal; petals oblanceolate …….. *D. heyneanum*

14. Leaf sheaths not persistent; pedicels 6–8 mm long; bracts lanceolate; sepals unequal; petals obovate …….. *D. aqueum*

15. Leaves ovate-lanceolate; inflorescence short from leaf opposed tubercles, 2–3 cm long; flowers white; mid-lobe of lips ovate-lanceolate; spur conical
…….. *D. nutantiflorum*

15. Leaves linear; inflorescence racemose, 6–10 cm long; flowers pinkish white; mid-lobe of lips orbicular; spur cylindric …….. *D. wightii*

Dendrobium anamalayanum Chandrab., V.Chandras. & N.C.Nair, J. Bombay Nat. Hist. Soc. 78(3): 575. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 450. 2004.

Fig. 14I

Epiphytic herbs, *c.* 8.5 cm tall. Pseudo bulbs uninodal, ovoid, *c.* 5 mm long, covered with numerous scales. Leaves 2 or 3, elliptic, 1.5–4 × 0.7–0.8 cm, sessile, obtuse at apex, attenuate at base, glabrous. Racemes *c.* 7 cm long. Flowers *c.* 13 × 3 mm, pinkish white; pedicels 4–6 mm long; bracts rhombic, 4–4.4 × 1–3 mm, cuspidate at apex, cuneate at base, entire, 3–4-nerved, glabrous, green with maroon, smaller than ovary. Sepals 3; dorsal sepal lanceolate-ovate, 4–5 × 2–3 mm, obtuse at apex, truncate at base, 5-nerved, glabrous, light pink, fleshy; lateral sepals ovate, 7.1–8 × 2.5–3 mm, mucronate at apex, truncate at base, 5-nerved, glabrous, light pink. Lateral petals 2, obovate, 7–8 × 2–3 mm, cuspidate at apex, attenuate at base, glabrous, clawed, pinkish white. Lips 3-lobed, broadly obovate; mid-lobe rhomboid-ovate, *c.* 8 × 4 mm, cuspidate at apex, dentate, glabrous; disc 3-toothed at apex, light pink; lateral lobes falcate, *c.* 6 × 1.5 mm, entire, glabrous. Spur conical, *c.* 5 mm long. Column globose, 2–3 × 0.5–1 mm. Pollinia 4 in 2 groups, oblong, *c.* 0.5 mm long, glabrous, yellow. Ovary twisted, 1–1.5 mm long; ovules in 3 vertical rows, glabrous, green.

Distribution: S. India (POWO, 2023); *Habitat*: Shola forests and grasslands; *Fl. & Ft.*: February-June.

Specimens examined: Way to Anamudi peak, 26.04.2019, *Dani Francis & Santhosh Nampy* 159120; *Ibid.*, 26.04.2019, *Dani Francis & Santhosh Nampy* 159118; Devikulam, 04.05.2017, *Dani Francis & Santhosh Nampy* 152137 (CALI); Eravikkulam, 13.02.1985, *C. Renuka* 3447; Kottamala, Periyar Tiger Reserve, 31.05.1995, *N. Sasidharan* 15362; Lockhert gap, Munnar, 17.05.1994, *Stephen Sequiera & Joy C.C.* 7543 (KFRI); way to Meesapulimala, 06.05.2019, *Dani Francis & Santhosh Nampy* 159170; Murukanmukku, Mankulam, 11.06.2018, *Dani Francis & Santhosh Nampy* 159321 (CALI); Rajamala, 02.02.1970, *B.V. Shetty* 31796 (MH); *Ibid.*, 25.06.1981, *Nambiar & Mukthesh Kumar* 1573; Sundermala, Periyar Tiger Reserve, 16.04.1994, *Jomy Augustine* 13596 (KFRI); Umayamala, 17.04.1966, *B.V. Shetty* 27302 (MH).

Notes: *Dendrobium anamalayanum* is morphologically close to *D. nanum*, but differs in having broadly obovate and non-clawed lips, rhomboid-ovate mid-lobe, distinct lateral lobes and apically 3-toothed disc. The gregarious flowering of these plants, with their white-pink flowers is a spectacular and alluring sight in the forests (Chandrabose *et al.*, 1981).

Dendrobium aqueum Lindl., Edwards's Bot. Reg. 29: 5. 1843; Hook.f., Fl. Brit. India 5: 739. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1417. 1928; Abraham & Vatsala, Intr. Orchids 349. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 450. 2004.

Epiphytic herbs. Stems tufted, clavate, 10–20 cm long, leafy during flowering. Leaves bifarious, ovate-lanceolate, 5–8 × 1–2 cm, acute to sub-acuminate at apex, cuneate at base, glabrous, green; sheaths caducous. Flowers 2 or 3 from leaf axils, *c.* 4 cm across; pedicels 6–8 mm long; bracts lanceolate, *c.* 2 × 1 mm, acute at apex, cuneate at base, glabrous, green. Sepals 3, unequal, ovate, 2.3–2.5 × 1–1.2 mm, acute at apex, truncate at base, glabrous, white; lateral sepals connate with column. Lateral petals 2, obovate, 1.5–2.5 × 0.8–1.2 mm, acute at apex, cuneate at base, glabrous, white. Lips rhombic, faintly 3-lobed, 2–2.5 × 2–2.3 mm, rounded and curved at apex, erose at margins, white; mid-lobe triangular; disc yellow,

puberulous. Spur 0. Column 4–5 mm long, greenish white. Pollinia 2, yellow. Ovary 2–3 × 1 mm; ovules in 3 vertical rows, glabrous, light green.

Distribution: S. India (POWO, 2023); *Habitat*: Evergreen and Shola forests; *Fl. & Ft.*: September-March.

Specimen examined: Pachakkanam, 19.03.1973, *B.D. Sharma* 43942 (MH).

Dendrobium barbatulum Lindl., Gen. Sp. Orchid. Pl. 84. 1830; Hook.f., Fl. Brit. India 5: 719. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1416.1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 451. 2004. **Fig. 14C**

Epiphytic or lithophytic herbs, *c.* 38 cm tall. Stems terete, 5–10 cm long, leafless when flowering. Racemes 5–8 cm long. Flowers *c.* 2.5 × 1.7 cm long, 5–6-flowered, white; pedicels 1–1.5 cm long; bracts lanceolate, *c.* 2 × 1 mm, acute at apex, cuneate at base, glabrous. Sepals 3, lanceolate-ovate, 9–11 × 2.5–3 mm, acute at apex, truncate at base, 5-nerved, glabrous, white. Lateral petals 2, obovate, 9–12 × 5–6 mm, obtuse at apex, attenuate at base, glabrous, veins obscure, white. Lips 3-lobed, mid-lobe, widely obovate, *c.* 10 × 0.7 mm, rounded at apex, cuneate at base, light pink, yellow hairy at base; lateral lobes 2, elliptic, *c.* 5 × 2 mm, rounded at apex, white, yellow hairy on inner surface. Spur obconical, *c.* 0.5 mm long. Column *c.* 6 × 3 mm, yellow. Pollinia 2, orbicular, *c.* 1.2 × 0.6 mm, glabrous, yellow. Ovary *c.* 3 × 1 mm; ovules in 3 vertical rows, glabrous, light green.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: December-January.

Specimens examined: Anaward, Nagarampara range, 23.01.2019, *Dani Francis & Santhosh Nampy* 168918 (CALI); Lower Periyar, 27.01.1983, *A.G. Pandurangan* 76654 (MH); MPCA, Vairamani, Kulamavu, 22.01.2019, *Dani Francis & Santhosh Nampy* 168915 (CALI); Thekkady, 26.01.1995, *K.P. Rajesh* 14594 (KFRI); Thommankuthu waterfalls, 10.12.2017, *Dani Francis & Santhosh Nampy* 151301 (CALI).

Notes: It is a perennial species growing in bright sunlight, and is commonly called 'small bearded dendrobium'. The leaves would have withered by the time it begins to produce new inflorescence, and when in bloom, it produces flowers profusely.

Dendrobium herbaceum Lindl., Edwards's Bot. Reg. 26 (Misc.): 69. 1840; Hook.f., Fl. Brit. India 5: 719. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3:1416.1928; Abraham & Vatsala, Intr. Orchids 368. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 451. 2004.

Epiphytic or lithophytic herbs, *c.* 50 cm tall. Stems striated, glabrous. Leaves narrowly elliptic, 3–6 × 0.4 cm, sessile, obtuse at apex, attenuate at base, glabrous, green. Racemes *c.* 5 cm long, terminal. Flowers *c.* 8 × 5 mm, white; pedicels 1.3–1.5 cm long; bracts lanceolate, 3–3.3 × 0.8–1 mm, acute at apex, cuneate at base, entire, 1-nerved, glabrous, light green, smaller than ovary. Sepals 3; dorsal sepal elliptic-lanceolate, 5–7 × 2–2.1 mm, obtuse at apex, cuneate at base, 5-nerved, glabrous, white; lateral sepals falcate, 6–8 × 2–2.9 mm, sub-acute at apex, oblique at base, 5-nerved, glabrous, white. Lateral petals 2, narrowly elliptic, 5.5–6.1 × 1–1.2 mm, obtuse at apex, cuneate at base, 3-nerved, glabrous, white. Lips not lobed, pandurate, *c.* 6.2 × 1 mm, sub-acute at apex, 5-nerved, glabrous, white to light yellow. Spur conical, 0.5–1 mm long. Column *c.* 2.5 × 1 mm. Pollinia obovate, *c.* 0.4 × 0.2 mm, longitudinal, glabrous, yellow-brown. Ovary 3–3.5 mm long; ovules in 3 vertical rows, glabrous, light green.

Distribution: India to Bangladesh (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: December-March.

Specimens examined: Arjunankotta, 21.01.1994, *Jomy Augustine* 13149 (CALI); Kalvary mount, 21.02.1983, *C.N. Mohanan* 77905; *Ibid.*, 21.02.1984, *A.G. Pandurangan* 78064; Cheruthoni, 16.02.1982, *C.N. Mohanan* 73309 (MH); Karadippara, Mathikettan shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 151403 (CALI); Kuttikkanam-Peermade, 25.01.1965, *K. Vivekananthan* 23004; Lockhert gap, 23.01.1964, *K.M. Sebastine* 18417 (MH); Mathikettan shola National Park, 11.12.2016, *Dani Francis & Santhosh Nampy* 151379; Munnar, 13.12.1970, Premavally O.K. 1250; *Ibid.*, 12.02.1970, *Raveendranathen P.P.* 2; *Ibid.*, 13.12.1970, *Sreedharan Nambiar M.K*. 244; *Ibid.*, 13.12.1970, *Sivadasan M.* 632; Perattakkalam, 29.12.2014, *Syam Radh S. & Santhosh Nampy* 137890 (CALI); Vallakkadavu R.F., 11.03.1973, *B.D. Sharma* 43816 (MH).

Notes: *Dendrobium herbaceum* is commonly known as 'grassy dendrobium' and is quite frequent in the study area.

Dendrobium heterocarpum Wall. ex Lindl., Gen. Sp. Orchid. Pl. 78. 1830; Hook.f., Fl. Brit. India 5: 737. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1416. 1928; Abraham & Vatsala, Intr. Orchids 361. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 451. 2004.

Epiphytic herbs. Stems erect, clavate, 15–30 × 0.5–2 cm, slender towards base, covered by ribbed sheaths, glabrous, green-yellow; sheaths completely clasping the stem, 2–2.5 × 0.5–1.5 cm, glabrous. Leaves a few, oblong-lanceolate, 2.5–8.5 × 1–2 cm, acuminate at apex, cuneate at base, glabrous, green. Racemes 2–4-flowered, from the uppermost nodes, appearing after leaves fall off. Flowers 4–5 mm across, white with yellowish brown in the mid-lobe of lip; pedicels *c.* 1 cm long; bracts broadly ovate, 4–7 × 1–2 cm, obtuse at apex, cuneate at base, glabrous, membranous. Sepals 3; dorsal sepal oblong-lanceolate, 25–28 × 6–8 mm, obtuse at apex, sub-truncate at base, 5-nerved, glabrous, white-yellow; lateral sepals lanceolate, 27–29 × 6–8 mm, obtuse at apex, oblique at base, 7-nerved, glabrous. Lateral petals elliptic, 23–25 × 9–10 mm, acute at apex, cuneate at base, 5-nerved, glabrous. Lips 3-lobed, ovate; mid-lobe acute; lateral lobes erect, entire. Spur conical, *c.* 2 mm long. Column *c.* 3 mm long. Pollinia 2, *c.* 2 mm long. Capsules elliptic-obovate, 3–5 × 1.5–2 cm, glabrous.

Distribution: China to tropical Asia (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: September-March.

Specimens examined: Arjunankotta, 21.01.1994, *Jomy Augustine* 13148; Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154371 (CALI); Lockhert gap, 12.02.1997, *Stephen Sequiera & Michael* 008166; Munnar, on the way to Chokanad estate, 26.12.1994, *Stephen Sequiera* 007695 (KFRI).

Dendrobium heyneanum Lindl., Gen. Sp. Orchid. Pl. 90. 1830; Hook.f., Fl. Brit. India 5: 718. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1415. 1928; Abraham & Vatsala, Intr. Orchids 358. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 451. 2004.

Fig. 14A

Epiphytic herbs, 15–20 cm long. Stems 5–10 cm long, erect, clavate, covered by numerous scales. Leaves opposite, linear-lanceolate, 3–12 × 0.6–0.7 cm, acute-acuminate at apex, sheathing at base, deciduous leaving a sheath on stem; leaf sheaths hyaline, as long as or longer than internode. Racemes 4–6 cm long,

spreading. Flowers *c.* 11 × 5 mm, white; pedicels 3–4 mm long; bracts ovate, 8–10 × 3.5–4.5 mm, cuspidate at apex, cuneate at base, entire, 3-nerved, glabrous, white. Sepals 3; dorsal sepal lanceolate-ovate, 7–8.1 × 2–2.6 mm, obtuse at apex, truncate at base, 3-nerved, glabrous, white; lateral sepals ovate, 8–9.1 × 2–2.8 mm, obtuse at apex, truncate at base, 3-nerved, glabrous, white. Lateral petals 2, oblanceolate, 8–8.5 × 1.5–2 mm, obtuse at apex, attenuate at base, glabrous, white. Lips 3-lobed, *c.* 12 × 5.7, mid-lobe widely obovate-rounded, *c.* 12 × 5.7 mm, rounded at apex, crenate, glabrous, with a small thickening at base, white, lateral lobes lanceolate, *c.* 5 × 1.1 mm, obtuse at apex, entire, 4-nerved, glabrous. Spur conical, *c.* 2 × 1.2 mm, emarginate at apex. Column *c.* 10 × 2.7 mm. Pollinia 2, oblong, *c.* 0.9 × 0.3 mm, glabrous, yellow. Ovary twisted, *c.* 1.5 mm long; ovules in 3 vertical rows, glabrous, green.

Distribution: S. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: July-March.

Specimens examined: Edamalakkudi, 15.03.2019, *Dani Francis & Santhosh Nampy* 168964 (CALI); Kuttiyar valley, Munnar, 29.07.1982, *Nambiar & N. Sasidharan* 1867 (KFRI); Pachakkanam, 07.08.1993, *Jomy Augustine* 12270 (CALI); Vandanmedu, 26.08.1977, *K. Vivekananthan* 50531 (MH).

Dendrobium kallarense J.Mathew, Kad.V.George, Yohannan & K.Madhus., Int. J. Advanced Res. 2(2): 799. 2014. **Fig. 14B**

Lithophytic herbs, *c.* 30 cm tall. Stems elongate, nodose, smooth, covered by scaly sheaths, leafless when flowering. Racemes 9–15 cm long. Flowers *c.* 2 × 0.9 cm, pink; pedicels 1.8–2 mm long; bracts lanceolate, 3–3.1 × 1.8–2 mm, obtuse at apex, cuneate at base, entire, 5-nerved, puberulous-glabrous, straw coloured. Sepals 3; dorsal sepal elliptic-oblanceolate, 1–1.1 × 0.2–0.3 cm, obtuse at apex, truncate at base, glabrous, 5-nerved, light pink; lateral sepals lanceolate-ovate, 1–1.1 × 0.3–0.4 cm, acute at apex, truncate at base, 5-nerved, glabrous, light pink. Lateral petals 2, obovate, 1–1.2 × 0.9–1 cm, rounded at apex, cuneate at base, 5–6-nerved, glabrous, light pink. Lips 3-lobed; mid-lobe widely ovate, *c.* 1.1 × 0.8 cm, rounded at apex, cuneate at base, yellow hairy at base, light pink; lateral lobes, elliptic, *c.* 7 × 4 mm, rounded at apex, yellow hairy on inner surface, light pink. Spur *c.* 3 mm long, bulged at base. Column *c.* 6 × 1.1 mm. Pollinia 4 in 2 groups, orbicular, *c.* 1 ×

0.2 mm, glabrous, yellow. Ovary *c.* 4 mm long; ovules in 3 vertical rows, glabrous, light green.

Distribution: India (Kerala) (POWO, 2023); *Habitat*: Rocky surfaces; *Fl. & Ft.*: December-March.

Specimens examined: Above Cheeyappara waterfalls, 27.12.2017, *Dani Francis & Santhosh Nampy* 156512; Cheruthoni, on the way to Painav, 22.01.2019, *Dani Francis & Santhosh Nampy* 168916 (CALI); *Ibid*., river bank, 18.02.1982, *V.S. Raju* 71263 (MH); Karimanal, 09.03.2017, *Dani Francis & Santhosh Nampy* 152037 (CALI).

Notes: This recently described species is common in the undisturbed wet rock-strewn pockets of montane grasslands and is closely related to *D. barbatulum* and *D. wightii*, but can be differentiated from the field by its habitat and pink flowers.

Dendrobium macraei Lindl., Gen. Sp. Orchid. Pl. 75. 1830; Hook.f., Fl. Brit. India 5: 714. 1890. *Ephemerantha macraei* (Lindl.) P.F.Hunt & Summerh., Taxon 10: 105. 1961; Abraham & Vatsala, Intr. Orchids 370. 1981.

Epiphytic herbs. Rhizomes creeping. Pseudobulbs fusiform, ribbed, 2.5–3.5 × 1–1.2 cm, greenish yellow or yellow. Leaves solitary, linear-oblong, 5–12 × 1.7–2.5 cm, sub-acute at apex, cuneate at base, glabrous, green. Inflorescence from base of leaf or tip of pseudo bulb. Flowers 1 or 2, *c.* 2 cm across, white with pink on lips; pedicels 1–2 cm long, glabrous; bracts ovate, 1.8–2 × 1–2 mm, acute at apex, cuneate at base, glabrous. Sepals 3; dorsal sepal lanceolate, 8–10 × 2.5–3 mm, acute at apex, sub-truncate at base, 3-nerved, glabrous, white; lateral sepals lanceolate, 8–10 × 3.5–4 mm, acuminate at apex, sub-truncate at base, 5-nerved, glabrous, white. Lateral petals lanceolate, 8–9 × 1.5–2 mm, acute at apex, cuneate at base, 3-nerved, glabrous, white. Lips 3-lobed, oblong, *c.* 10 × 12 mm; mid-lobe oblong, 2-lobes at apex, crenulate along margin, white with pink dots on lips; lateral lobes orbicular, crenulate at apex. Spur short. Column 10–12 mm long. Pollinia 2. Ovary obovate, 1–1.5 mm long. Capsules obovate, *c.* 5 cm long.

Distribution: E. India, Sri Lanka and E. Himalaya to Japan (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: April-June.

Specimen examined: Melmanalar, Periyar Tiger Reserve, 26.05.1994, *Jomy Augustine* 13777 (KFRI).

Dendrobium macrostachyum Lindl., Gen. Sp. Orchid. Pl. 78. 1830; Hook.f., Fl. Brit. India 5: 735. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1416. 1928; Abraham & Vatsala, Intr. Orchids 355. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 713. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 451. 2004.

Epiphytic, drooping herbs. *c.* 50 cm long. Stems scandent, pendulous, terete, pleurinodal, leafless when flowering, glabrous. Leaves lanceolate, 1.5–8 × 0.5–2 cm, acute at apex, cuneate at base, glabrous, green. Inflorescence leaf opposed fascicles. Flowers 2 or 3 from sub-leafless stems, *c.* 2 cm long, creamy yellow; pedicels 1–1.3 cm long, glabrous; bracts lanceolate, 2.5–3 × 1–2 mm, acute at apex, cuneate at base, glabrous. Sepals 3; dorsal sepal elliptic-lanceolate, 10–13 × 2.5–3 mm, acute at apex, sub-truncate at base, 3-nerved, glabrous; lateral sepals obliquely lanceolate, 13–16 × 6–9 mm, acute at apex, oblique at base, 7-nerved, glabrous. Lateral petals lanceolate, 12–14 × 3–4 mm, acute at apex, cuneate at base, 4-nerved, glabrous. Lips oblong, *c.* 18 × 10 mm, crenulate at base, hairy on dorsal side, irregularly fimbriate. Spur conical, *c.* 5 mm long. Column 3.5–4 mm long. Pollinia 2. Ovary obovate, 1–1.5 mm long. Capsules obovate, *c.* 5 cm long.

Distribution: Tropical Asia to N. Queensland (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: March-October.

Specimens examined: Karimala, 10.04.1994, *Jomy Augustine* 13684 (CALI); Anjuruli, Thekkady, 04.10.1972, *B.D. Sharma* 42408; Okkrai, Thekkady, 16.03.1973, *B.D. Sharma* 43887 (MH); Thannikkudy, Periyar Tiger Reserve, 15.06.1994, *Jomy Augustine* 13828 (KFRI); Thekkady, 28.05.1965, *K. Vivekananthan* 24361 (MH).

Dendrobium microbulbon A.Rich., Ann. Sci. Nat., Bot., ser. 2. 15: 19. 1841. Hook.f., Fl. Brit. India 5: 716. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1415. 1928; Abraham & Vatsala, Intr. Orchids 358. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 452. 2004.

Epiphytic or lithophytic herbs. Pseudobulbs ovoid, *c.* 1.5 × 1 cm, uninodal, occurring in clusters, green. Leaves 2 or 3, linear-oblong, 5–8 × 1.8–2 cm, acute at apex, cuneate at base, glabrous, green. Racemes terminal, *c.* 5 cm long, flexuous.

Flowers *c.* 1.5 cm long, pinkish white; pedicels 2–3 cm long, green; bracts ovate, *c.* 2 × 1 mm, cuspidate at apex, cuneate at base, glabrous, green. Sepals 3; dorsal sepal ovate-oblong, 5.5–6 × 0.8–1 mm, obtuse at apex, sub-truncate at base, 3-nerved, glabrous, white; lateral sepals ovate, 5–6 × 2.5–3 mm, acute at apex, cuneate at base, 3-nerved, glabrous, white. Lateral petals oblanceolate, 5–6 × 1.5–2 mm, obtuse at apex, cuneate at base, 3-nerved, glabrous white. Lips 3-lobed, *c.* 5 × 4 mm, greenish white; mid-lobe orbicular, retuse at apex, truncate at base, thick, wrinkled; lateral lobes orbicular; disc with thick calli. Spur 0. Column 2–3 mm long. Pollinia 2. Ovary obovate. Capsules obovate.

Distribution: S. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: December-July.

Specimen examined: Vavalmala, Periyar Tiger Reserve, 24.12.1994, *Jomy Augustine & K.P. Rajesh* 14408 (KFRI).

Dendrobium nanum Hook.f., Hooker's Icon. Pl. 19: t. 1853. 1889; Hook.f., Fl. Brit. India 5: 717. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1415. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 452. 2004.

Epiphytic herbs. Pseudobulbs ovoid, yellowish green. Leaves 3 or 4, lanceolate, 1.5–4.5 × 0.3–0.8 cm, acute at apex, sheathing at base, glabrous, green. Racemes terminal, 1 or 2 per plant, 4–12 cm long. Flowers many, *c.* 1 cm across, white with green lips; pedicels 1–2 cm long, green; bracts ovate-lanceolate, *c.* 5 × 1 mm, acute at apex, cuneate at base, glabrous, green. Sepals 3; dorsal sepal narrowly lanceolate-oblong, 5–9 × 2–3 mm, faintly beaked at apex, sub-truncate at base, dorsally ridged, glabrous, greenish white; lateral sepals obliquely lanceolate, 5–8 × 2–4 mm, acuminate at apex, cuneate at base, glabrous, greenish white. Lateral petals spathulate, 5–8 × 3–5 mm, obtuse at apex, cuneate at base, glabrous, greenish white. Lips 3-lobed, 5–8 × 3–5 mm, greenish with purple spots; mid-lobe sub-orbicular, acute at apex, ciliate along ridges; lateral lobes narrow, erect, incurved; disc with ridged calli. Spur 1.5–2.5 mm long. Column 1–2 mm long. Pollinia 4. Ovary obovate. Capsules obovate.

Distribution: S. India (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: May-July.

Specimens examined: Devikulam, 02.06.1944, *K.C. Jacob* 20518; Old Devikulam, 14.06.1963, *K.M. Sebastine* 16484 (MH).

Dendrobium nodosum Dalzell, Hooker's J. Bot. Kew Gard. Misc. 4: 292. 1852. *Flickingeria nodosa* (Dalzell) Seidenf., Dansk Bot. Ark. 34(1): 41. 1980; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 456. 2004.

Epiphytic herbs with creeping rhizomes. Branches sub-erect or pendulous, pleurinodal, 15–45 cm long, glabrous, shining, yellowish brown. Pseudobulbs at irregular intervals, uninodal, obovate-elliptic, 3.5–4.5 × 0.5–1.5 cm, glabrous, yellowish brown. Leaves sessile, solitary on tip of pseudobulb, linear-elliptic, 8–10 × 0.5–2.5 cm, acute at apex, cuneate at base, glabrous, green. Flowers 1–3 from pseudobulb, creamy white with maroon dots within the lateral lobes of lip; pedicels 0.5–1 cm long, sheathed by bracts; sterile bracts 3 or more; fertile bracts lanceolate, 5–6 × 2–3 mm, obtuse at apex, cuneate at base, glabrous. Sepals 3; dorsal sepal oblong-lanceolate, 5–7 × 2–3 mm, obtuse at apex, sub-truncate at base, 5-nerved, glabrous; lateral sepals lanceolate, conduplicate, 7–9 × 4–6 mm, obtuse at apex, oblique at base, 5-nerved, glabrous, white. Lateral petals 2, lanceolate, 5–6 × 2–2.2 mm, obtuse at apex, cuneate at base, 3-nerved, glabrous, white. Lips 3-lobed; mid-lobe quadrate, *c.* 4 mm long, contracted at base, crenulate, two winged towards tip; lateral lobes oblong, *c.* 6 × 2.5 mm, obtuse at apex. Spur conical, *c.* 2 mm long. Column *c.* 1.5 × 1.5 mm. Pollinia 2, *c.* 0.5 mm long. Ovary obovate, glabrous.

Distribution: S. India (POWO, 2023); *Habitat*: Semi-evergreen forest ground; *Fl. & Ft.*: March-July.

Specimens examined: Karadikkavala, Periyar Tiger Reserve, 31.07.1993, *N. Sasidharan & Jomy Augustine* 12194; Mangaladevi, *N. Sasidharan & Jomy Augustine* 14173 (KFRI); Painav, 04.04.2018, *Dani Francis & Santhosh Nampy* 158429; Thekkady, 28.07.1993, *Jomy Augustine* 12194 (CALI).

Notes: *Dendrobium nodosum* occurs in large colonies on tree trunks, as a tuft of rhizomatous spread on the host branch with 3 or 4 noded-pseudobulbs bearing a solitary thick coriaceous leaf. This feature makes this species easy to identify even when it is not in flower (Bhat, 2015).

Dendrobium nutantiflorum A.D.Hawkes & A.H.Heller, Lloydia 20. 122. 1957; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 452. 2004. *Dendrobium nutans* Lindl., Gen. Sp. Orchid. Pl. 90. 1830, *nom*. *illeg*.; Hook.f., Fl. Brit. India 5: 734. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1416. 1928; Abraham & Vatsala, Intr. Orchids 363. 1981.

Epiphytic herbs. Stems terete, 15–25 cm long, tufted, ridged. Leaves sessile, ovate-lanceolate, 3.5–5 × 0.5–2.5 cm, obliquely bifid at apex, cuneate at base, glabrous, green. Inflorescence short from leaf opposed tubercles, 2–3 cm long, 3–6-flowered. Flowers *c.* 2 cm across, white; pedicels 1–1.3 cm long; bracts lanceolate, 2–3 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous. Sepals 3; dorsal sepal oblong-lanceolate, 14–15 × 2–3 mm, acute at apex, sub-truncate at base, 5-nerved, glabrous, white; lateral sepals linear-lanceolate, 12–13 × 2–3 mm, acute at apex, cuneate at base, 5-nerved, glabrous, white. Lateral petals oblong-lanceolate, 13–14 × 2–3 mm, acute at apex, cuneate at base, 5-nerved, glabrous, white with pale purple. Lips 3-lobed, obovate-lanceolate, 16–17 × 4–4.5 mm, purple; mid-lobe ovate-lanceolate, acute at apex, purple; lateral lobes oblong, rounded, purple; disc with 3-crenulate ridges. Spur conical, *c.* 1 mm long. Column *c.* 1.5 × 1.5 mm. Pollinia 2, yellow. Ovary obovate, glabrous.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: March-May.
Specimens examined: Upper melmanalar, Periyar Tiger Reserve, 11.04.1995, *N. Sasidharan* 15016 (KFRI).

Dendrobium ovatum Kraenzl., in Engler, Pflanzenr. Orch.-Dendrob. Pars 1, 71. 1910; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1416. 1928; Abraham & Vatsala, Intr. Orchids 353. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 452. 2004. *Dendrobium chlorops* Lindl., Edwards's Bot. Reg. 30: 44. 1844; Hook.f., Fl. Brit. India 5: 719. 1890. **Fig. 14E**

Epiphytic herbs. Stems tufted, 10–25 cm long; internode 2–3 cm long. Leaves appears before flowering, elliptic-lanceolate, 5–7 × 2–2.5 cm, acute at apex, sheathing at base, glabrous, green. Racemes terminal and lateral, from axils of fallen leaves, 3–10 cm long. Flowers many, 1.5–2 cm across, creamy white with green at base of lip and column; pedicels *c.* 2 cm long; bracts ovate-lanceolate, 2–

2.5 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, pale green. Sepals 3, elliptic-oblong, 12–15 × 4–6 mm, acute at apex, sub-truncate at base, glabrous, creamish white. Lateral petals spathulate, 12–15 × 5–10 mm, acute at apex, sub-truncate at base, glabrous, creamish white. Lips 3-lobed, 12–15 × 4–6 mm, yellow green hairy on dorsal side; mid-lobe large, obovate, rounded and retuse at apex, sub-truncate at base, yellow green hairy; lateral lobes small, falcate, rounded at apex; disc greenish yellow. Spur conical, *c.* 1 mm long. Column *c.* 3–4 mm long. Pollinia 2, yellow. Ovary obovate, 1–1.5 mm long, glabrous.

Distribution: SW. India (POWO, 2023); *Habitat*: Forest margins and plains; *Fl. & Ft.*: December-March.

Specimens examined: Cheruthoni, riverbank, 26.01.1983, *A.G. Pandurangan* 76640; Meenmutty, 13.12.1982, *C.N. Mohanan* 76043; Valara R.F., 07.02.1984, *K. Ramamurthy* 80415 (MH).

Dendrobium salaccense (Blume) Lindl., Gen. Sp. Orchid. Pl. 86. 1830. *Grastidium salaccense* Blume, Bijdr. Fl. Ned. Ind. 333. 1825. *Dendrobium haemoglossum* Thwaites, Enum. Pl. Zeyl. 429. 1864; Hook.f., Fl. Brit. India 5: 727. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1416. 1928; Abraham & Vatsala, Intr. Orchids 365. 1981.

Epiphytic herbs. Stems terete, woody, 15–40 cm long. Leaves linear, 10–16 × 7–10 cm, acute at apex, sheathing at base, glabrous, coriaceous, green. Flowers 2 or 3 on leaf opposed tubercles, *c.* 1.5 cm across, yellow with deep red lip; pedicels *c.* 1.2–2 cm long; bracts ovate-lanceolate, 1.5–2 × 1–1.2 mm, acute at apex, cuneate at base, glabrous, pale brown. Sepals 3, dorsal sepal oblong-lanceolate, 8–9 × 2–4 mm, acute at apex, sub-truncate at base, glabrous, yellow; lateral sepals obliquely oblanceolate, sub-acute at apex, fused at base, glabrous, yellow. Lateral petals lanceolate, 8–8.5 × 2.5–3 mm, sub-acute at apex, sub-truncate at base, glabrous, yellow. Lips not lobed, oblanceolate-oblong, 9–10 × 3–3.5 mm, sub-acute at apex, undulate, glabrous, deep red. Spur conical, *c.* 1 mm long. Column *c.* 3–4 mm long. Pollinia 2, yellow. Ovary obovate, 1–1.5 mm long, glabrous.

Distribution: India to China and W. Malaysia (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: September-April.

Specimens examined: Pachakkanam, 19.03.1973, *B.D. Sharma* 43942 (MH); *Ibid.*, 24.04.1995, *N. Sasidharan* 15157 (KFRI).

Dendrobium wightii A.D.Hawkes & A.H.Heller, Orquidea 24. 16. 1962; Abraham & Vatsala, Intr. Orchids 351. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 453. 2004. *Dendrobium graminifolium* Wight, Icon. Pl. Ind. Orient. 5: t. 1649. 1851, *nom. illeg*.; Hook.f., Fl. Brit. India 5: 718. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1415. 1928.

Epiphytic or lithophytic herbs. Stems slender, terete, 8–20 cm long, reddish. Leaves linear, 3–7 × 0.5–0.7 cm, acute at apex, sheathing at base, membranous, glabrous, green with a tinch of red. Racemes terminal, slender, 6–10 cm long, flexuous, 4–7-flowers. Flowers *c.* 2 cm across, pinkish white; pedicels *c.* 2–3 cm long, pinkish; bracts ovate-lanceolate, 1–1.5 × 1–1.2 mm, acute at apex, cuneate at base, glabrous, pinkish. Sepals 3, dorsal sepal oblong-lanceolate, 12–13 × 2.8–3 mm, acute at apex, sub-truncate at base, 3-nerved, glabrous, pinkish white; lateral sepals *c.* 12 × 2 mm, acute at apex, cuneate at base, glabrous, pinkish white. Lateral petals ovate-oblong, 6–8 × 1.8–2 mm, acute at apex, sub-truncate at base, glabrous, pinkish white. Lips 3-lobed, 10–11 × 3–6 mm, pink with a prominent callus at throat; mid-lobe orbicular, 5–6 × 5–6 mm, obtuse at apex, crenate; lateral lobes ovate-oblong, *c.* 2 × 1 mm, obtuse at apex; disc greenish yellow. Spur cylindric, *c.* 3 × 1 mm, bifid at apex. Column white-light pink. Pollinia 2, yellow. Ovary obovate, glabrous.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen and semi-evergreen forests; *Fl. & Ft.*: August-October.

Specimens examined: Kulamavu, 03.10.1983, *C.N. Mohanan* 79921 (MH); Vallakkadavu, Periyar Tiger Reserve, 26.08.1995, *Jomy Augustine & K.P.Rajesh* 16812 (KFRI).

Diplocentrum Lindl.,

Edwards's Bot. Reg. 18: t. 1522. 1832.

Key to the species

1. Leaves linear, bilobed at apex; panicles rarely branched; pedicels 2–3 mm long; lips ovate-lanceolate ……..…….. *D. congestum*

1. Leaves sub-terete, acute at apex; panicles branched; pedicels 1–1.5 mm long; lips elliptic-oblong ……..…….. *D. recurvum*

Diplocentrum congestum Wight, Icon. Pl. Ind. Orient. 5: t. 1682. 1851; Hook.f., Fl. Brit. India 6: 78. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1449. 1928; Abraham & Vatsala, Intr. Orchids 469. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 453. 2004.

Epiphytic herbs. Stems tufted, terete, 2–4 cm long. Leaves distichous, linear, 10–15 × 0.4–0.5 cm, bilobed at apex, sheathing at base, thick, coriaceous, glabrous, green with a tinch of purple. Panicles axillary, rarely branched, 10–20 cm long, drooping. Flowers *c.* 1.2 cm across, pinkish white; pedicels *c.* 2–3 mm long, pinkish green; bracts clasped to peduncle, triangular, 1–1.2 × 0.6–0.8 mm, sub-acute at apex, truncate at base, entire, puberulous-glabrous, brown, smaller than ovary. Sepals 3, pale green with a pink; dorsal sepal elliptic, 3–3.5 × 1.5–2 mm, bimucronate at apex, cuneate at base, glabrous; lateral sepals obovate, 3.5–4 × 2.5–3 mm, obtuse at apex, truncate at base, glabrous. Lateral petals 2, oblong-elliptic, *c.* 3 × 1.5 mm, obtuse at apex, obtuse at base, glabrous, pale green with pink. Lips not lobed, ovate-lanceolate, *c.* 6 × 3 mm, obtuse at apex, entire, pink. Spur 2, conical, *c.* 1 mm long. Column *c.* 2 × 1.5 mm, with 2 prominent pink bulges, connection between column and lip bear numerous small white hairs. Pollinia 2, *c.* 0.4 mm long, yellow. Ovary *c.* 1 cm long; ovules in 3 vertical rows.

Distribution: SW. India (POWO, 2023); *Habitat*: Forest margins; *Fl. & Ft.*: April-October.

Specimen examined: Thannikkudy, Periyar Tiger Reserve, 02.10.1995, *N. Sasidharan & K.K. Sajeev* 16868 (KFRI).

Diplocentrum recurvum Lindl., Edwards's Bot. Reg. 18. t. 1522. 1832. Hook.f., Fl. Brit. India 6: 78. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1449. 1928; Abraham & Vatsala, Intr. Orchids 469. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 453. 2004.

Fig. 11F

Epiphytic herbs. Leaves distichous, sub-terete, 15–20 × *c.* 0.5 cm, acute at apex, glabrous, green. Panicles axillary, branched, 18–20 cm long. Flowers *c.* 1.3 × 0.5 cm; pedicels 1–1.5 mm long; bracts clasped to peduncle, triangular, 1–1.2 × 0.6–0.8 mm, sub-acute at apex, truncate at base, entire, puberulous-glabrous, brown, smaller than ovary. Sepals 3; dorsal sepal elliptic, 3–4 × 1–1.3 mm, obtuse at apex, cuneate at base, glabrous, cream with a pink central line, rugose; lateral sepals elliptic, 3.5–4.1 × 1.5–2 mm, obtuse at apex, truncate at base, glabrous, white

flushed with pink. Lateral petals 2, narrowly oblong, 3–3.1 × 1–1.1 mm, round at apex, obtuse at base, glabrous, cream with a light pink. Lips elliptic-oblong, *c.* 6 × 2 mm, obtuse at apex, 2 notched at basal region, papillate, undulate, pink. Spurs 2, conical, *c.* 1 mm long. Column *c.* 2 × 1.7 mm, with 2 prominent pink bulges, connection between column and lip bear numerous small white hairs. Pollinia 2, *c.* 0.4 mm long, connected on a single filament, glabrous, yellow. Ovary *c.* 1 cm long; ovules in 3 vertical rows.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Open land; *Fl. & Ft.*: March-June.

Specimens examined: Anakkara, 8th mile, 17.03.2017, *Dani Francis & Santhosh Nampy* 158404; Mathikettan Shola National Park, 24.04.2016, *Syam Radh S. & Santhosh Nampy* 149133 (CALI); Samplampetty, Chinnar Wildlife Sanctuary, 27.04.1995, *N. Sasidharan & K.K. Sajeev* 15600; way to Suryanelli, Munnar, 22.04.1994, *Stephen S.* 7530 (KFRI).

Disperis Sw.,

Kongl. Vetensk. Acad. Nya Handl. Ser. 2. 21. 218. 1800.

Disperis neilgherrensis Wight, Icon. Pl. Ind. Orient. 5(1): t. 1719. 1851; Hook.f., Fl. Brit. India 6: 169. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1478. 1928; Abraham & Vatsala, Intr. Orchids 208. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 453. 2004. **Fig. 14G**

Terrestrial annual, herbs, 15–30 cm tall. Tubers ellipsoid, 2–5 × 1–2 cm, pilose. Stems slender, glabrous, green. Leaves cordate, 1–4 × 0.8–4 cm, acute or obtuse at apex, amplexicaul at base, glabrous, green. Racemes 1 or 2-flowered, terminal. Flowers pinkish white; pedicels 0.5–1 cm long; bracts leafy, cordate, 2–2.5 × 2–2.3 cm, obtuse at apex, sub-truncate at base, glabrous. Sepals 3; dorsal sepal linear-lanceolate, 0.5–1 × 0.2–0.3 cm, acute at apex, adnate to petals to form a shallow hood with reflexed margin, glabrous; lateral sepals obliquely obovate, 1.2–1.6 × 0.5–0.6 cm, obtuse at apex, fused at base, undulate, with a shallow conical sac in lower half, pubescent. Lateral petals elliptic, 5.5–1.2 × 0.2–0.5 cm, obtuse at apex, cuneate at base, glabrous. Lips anchor-shaped, *c.* 0.6 × 0.6 cm, 2-lobed with long

linear recurved arms and yellow papillae. Spur 0. Column *c.* 0.3 cm long. Pollinia 2, granular. Ovary 1.5–2 cm long. Capsules elliptic-ovate, 1.5–2 cm long.

Distribution: India to Nansei-shoto, Jawa to Caroline Islands (POWO, 2023); *Habitat*: Shola forests and grasslands; *Fl. & Ft.*: May-September.
Specimens examined: Anamudi basecamp, 31.08.2019, *Dani Francis & Santhosh Nampy* 170256 (CALI); Bison valley, Devikulam, 27.07.1982, *Nambiar & N. Sasidharan* 1837 (KFRI); Eravikulam National Park, 29.09.2017, *Dani Francis & Santhosh Nampy* 156301 (CALI); Kottamala, Periyar Tiger Reserve, 26.05.1994, *Jomy Augustine* 13778 (KFRI).
Notes: *Disperis neilgherrensis* is the only species of *Disperis* found in Asia. The size and structure of most plant parts vary greatly, particularly the structure of the lip appendage.

Epipogium J.G.Gmel. ex Borkh.,

Tent. Disp. Pl. German. 139.1792.

Epipogium roseum Lindl., J. Proc. Linn. Soc. Bot. 1: 177. 1857; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 454. 2004. *Epipogium nutans* (Blume) Rchb.f., Bonplandia 5: 36. 1857; Hook.f., Fl. Brit. India 6: 124. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1460. 1928. **Fig. 14H**

Tuberous rooted saprophytic herbs 25–35 cm long. Tubers ovoid-fusiform, *c.* 2.5 × 1.3 cm, wrinkled. Stems slender, glabrous, white. Leaves reduced to scales, 5–6 at basal region and also at particular intervals, ovate, 8–9 mm long, obtuse at apex, hyaline. Racemes 25–30 cm long. Flowers *c.* 2 cm long, white, resupinate; pedicels 4–6 mm long; bracts ovate, 8–9 × 3–4 mm, obtuse at apex, truncate at base, entire, 3-nerved, puberulous, hyaline, smaller than ovary. Sepals 3, lanceolate, 8–10 × 1.5–2 mm, sub-acute at apex, truncate at base, 3-nerved, glabrous, white. Lateral petals 2, lanceolate, 7–9 × 1.5–2 mm, obtuse at apex, truncate at base, 3-nerved, glabrous, white. Lips sessile, not lobed, widely ovate, *c.* 10 × 8.3 mm, acute at apex with a small protuberant, papillate, dentate, 2-nerved, glabrous, white with pink blotches. Spur short, oblong, *c.* 4 × 3 mm. Column obconial, *c.* 4 × 3 mm. Pollinia 2, pyriform, *c.* 2.1 × 0.7 mm, 2-loculed, with 2 caudicle, yellow. Ovary *c.* 6 × 3 mm; ovules many, in 3 vertical rows, glabrous, white.

Distribution: Tropical Africa, Tropical and Subtropical Asia to SW. Pacific (POWO, 2023); *Habitat*: Rain forests ground; *Fl. & Ft.*: January-May.

Specimens examined: Arjunankotta, 21.01.1994, *Jomy Augustine* 13165 (CALI); way to Kalvary mount, 25.04.1982, *V.S. Raju* 71299 (MH); Kuttikkanam, way to Ammachikottaram, 28.04.2018, *Dani Francis & Santhosh Nampy* 159248 (CALI); Meenmutty, 19.02.1983, *C.N. Mohanan* 76249 (MH); Onnamthodu, Mathikettan Shola National Park, 08.05.2015, *Syam Radh S. & Santhosh Nampy* 137967 (CALI).

Notes: *Epipogium roseum*, also known as the 'ghost orchid', is a leafless terrestrial mycoheterotrophic orchid that grows on thick humus in wet deciduous forest beds protected by a dense canopy (Arekal & Karanth, 1981; Aravindhan & Rajendran, 2021).

Eulophia R.Br.,

Bot. Reg. 7: t. 573. 1821, *nom. et orth. cons.*

Key to the species

1. Inflorescence sub-corymbose, pendent, hooked at apex; flowering axis produced separately ……..…….. *E. picta*

1. Inflorescence paniculate or racemose, straight, not hooked at apex; flowering axis produced from tubers ……..…….…… 2

2. Tubers ovoid or conical; leaves absent during flowering ……..…. 3

2. Tubers globose or horizontally oblong; leaves present during flowering ……..

…….. *E. nuda*

3. Tubers with annular rings; inflorescence a branched panicle; capsules oblong-obovoid ……..…… *E. epidendraea*

3. Tubers without annular rings; inflorescence an unbranched raceme; capsules elliptic ……..…….. *E. graminea*

Eulophia epidendraea (J.Koenig ex Retz.) C.E.C.Fisch. in Gamble, Fl. Madras 3: 1435. 1928; Abraham & Vatsala, Intr. Orchids 294. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 455. 2004. *Serapias epidendraea* J.Koenig ex Retz., Observe. Bot. 6: 65. 1791.

Terrestrial herbs. Tubers ovate-conical, 2.5–10 × 3–5 cm, bearing 6–8 greenish brown annular rings. Leaves distichous, absent or rarely present at time of flowering, linear-lanceolate, 15–40 × 0.5–2 cm, acute-acuminate at apex, sheathing at base, glabrous, pale green. Inflorescence paniculate, 30–90 cm tall, arising from side of tubers, branched. Flowers 1.2–2.5 cm across; pedicel 3–6 mm long, green; bracts ovate-lanceolate, 4–8 × 2–3 mm, acute-acuminate at apex, sub-truncate at base, glabrous, green or pale green with tessellate reddish nerves. Sepals 3, yellowish green to pale yellow with purple veins; dorsal sepals oblong-oblanceolate, 10–20 × 2–5 mm, acute-acuminate at apex, sub-truncate at base, recurved, glabrous; lateral sepals oblong-oblanceolate, 10–17 × 2–5 mm, acute at apex, sub-truncate at base, glabrous. Lateral petals obliquely elliptic-oblanceolate, 10–15 × 3–6 mm, acute-acuminate at apex, sub-truncate at apex, recurved, glabrous, yellowish green to pale yellow with purple veins. Lips 3-lobed, obovate-oblong, 10–18 × 5–7 mm; midlobe obovate-oblong, *c.* 8 × 7 mm, retuse or narrowly emarginate at apex, undulate, reflexed, surface covered with long papilla along nerves, green or greenish-white towards apex blotched with dark purple; lateral lobes erect, *c.* 10 × 3 mm, slightly undulate or crenate, pale green with red margin and diverging dark-purple veins; disc with 3–5 raised parallel hairy lamellae arising from base and extend up to midlobe, whitish purple, hairs pink-purple; spur greenish white to purple-green or with purple dots. Spur cylindrical, 5–7 mm long, obtuse at apex. Column oblong, 4–7 × 2–3 mm. Pollinia 2, obpyriform. Capsules oblong-obovoid, 2–4 × 0.8–1.2 cm, 3-ridged.

Distribution: Indian Subcontinent (POWO, 2023); *Habitat*: Dry deciduous forests; *Fl. & Ft.*: August-January.
Specimens examined: Athiyodai, Chinnar Wildlife Sanctuary, 10.01.1995, *N. Sasidharan & K.K. Sajeev* 11767; Koruthode, Periyar Tiger Reserve, 14.08.1995, *N. Sasidharan & Jomy Augustine* 16276 (KFRI).

Eulophia graminea Lindl., Gen. Sp. Orchid. Pl. 182. 1833; Hook.f., Fl. Brit. India 6: 2. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1435. 1928; Abraham & Vatsala, Intr. Orchids 296. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 456. 2004.

Terrestrial herbs, 30–60 cm tall. Tubers erect, ovoid, 2–5 × 1.5–3 cm, sheathing, numerous roots arising from pseudobulb. Leaves 2–6, distichous, enclosing stem,

linear, 8–10 × 0.5–1 cm, acute at apex, sheathing at base, glabrous, green. Racemes 1 or 2 from lateral side of tuber, erect, 20–50 cm long, few to many flowered, unbranched. Flowers resupinate, 1.5–2.5 cm long; pedicels 4–5 mm long, glabrous; bracts lanceolate, 5–6 × 1.5–2 mm, acuminate at apex, cuneate at base, glabrous. Sepals 3, pale green with maroon veins; dorsal sepal spreading, apically reflexed, oblanceolate, 9–11 × 2–2.5 mm, acuminate at apex, cuneate at base, 5-nerved, glabrous; lateral sepals oblanceolate, 10–12 × 2–2.5 mm, acuminate at apex, cuneate at base, 5-nerved, glabrous. Lateral petals narrowly elliptic, 8.5–10 × 2.2–2.5 mm, acuminate at apex, cuneate at base, 5-nerved, glabrous, green with maroon veins. Lips 3-lobed, 10–11 × 4–5 mm, lower portion forming a tube with the column, with 3 prominent ridges extend to base of the midlobe, flanked by about 3 angling ridges on each side; midlobe ovate, 6–6.5 × 4.5–5 mm, white, margins white to pale purple, crisped; lateral lobes ovate-oblong, rounded, *c.* 2 mm long. Spur 2.5–3.5 mm long, swollen towards apex. Column clavate, *c.* 4 mm long. Pollinia 4 in unequal pairs. Capsules elliptic, 18–20 × 7–8 mm, glabrous.

Distribution: Tropical and Subtropical Asia to Marianas (POWO, 2023); *Habitat*: Forests; *Fl. & Ft.*: February-May.
Specimen examined: Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 18887 (CALI).
Notes: *Eulophia graminea* is commonly known as 'Grass-leaved Eulophia' or 'The beautiful crown orchid'. Within its native range, it has considerable ecological amplitude growing in open areas, grasslands, beaches, lawns, roadsides, shrubby habitats, and open forests (Ackerman & González-Orellana, 2021).

Eulophia nuda Lindl., Gen. Sp. Orchid. Pl. 180. 1833; Hook.f., Fl. Brit. India 6: 5. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1435. 1928; Abraham & Vatsala, Intr. Orchids 300. 1981. *Eulophia spectabilis* Suresh in D.H.Nicolson, C.R.Suresh & K.S.Manilal, Interpr. Van Rheede's Hort. Malab. 300. 1988, *nom*. *superfl*.; K.M.Matthew, Illustr. Fl. Palni Hills 716. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 456. 2004.

Terrestrial herbs. Tubers sub-terranean, globose or horizontally oblong, 2.5–8 × 2–4 cm, wrinkled-irregular, with transverse ridge, joined to form a chain, brownish green. Leaves 2–4, present during flowering, arising from side of tuber,

oblong-lanceolate, 25–60 × 1–6 cm, acute-acuminate at apex, sheathing at base, plicate, glabrous, green. Racemes 20–90 cm long, arising laterally from base of tubers, 6–12 flowered. Flowers not open widely, 2.5–4.5 cm across; pedicels 1–2 cm long, greenish purple; bracts linear-lanceolate, 10–20 × 2–5 mm, acuminate at apex, cuneate at base, persistent, greenish purple. Sepals 3, crimson or pale-green, yellowish white or red sometimes with rose-purple marking; dorsal sepal elliptic-oblong, 15–25 × 3–6 mm, acute-acuminate at apex, sub-truncate at base, slightly reflexed at tip, glabrous; lateral sepals falcate, obliquely lanceolate, acute-acuminate at apex, fused at base, glabrous. Lateral petals ovate-oblong, 12–25 × 3–10 mm, acute-obtuse, reflexed at apex, sub-truncate at base, glabrous, crimson or pale-green, yellowish white or red sometimes with rose-purple marking. Lips 3-lobed, obovate-oblong, 15–25 × 9–16 mm, strongly deflexed from middle, base dilated and becomes narrow forming a short-flattened spur, pale-green, pinkish, white or rose purple; midlobe oblong-ovate, 8–12 mm long, obtuse at apex, undulate at margins; side-lobes obscure, *c.* 3 mm broad, rounded at apex, crenulate; disc with 2–11 thick, vertical, tuberculate lamellae disappearing towards apex; spur obconical, 3–6 mm long, obtuse at apex, pointing backward. Column 7–12 × 3–4 mm, curved; pollinia 2, yellow. Ovary 3-ridged, glabrous. Capsules obovoid, fusiform, 2–6 × 1–1.5 cm, strongly ridged.

Distribution: Tropical and Subtropical Asia to W. Pacific (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: April-August.

Specimens examined: Pachakkanam, Periyar Tiger Reserve, 17.08.1993, *N. Sasidharan & Jomy Augustine* 12269; Vallakkadavu, Periyar Tiger Reserve, 12.04.1995, *Jomy Augustine* 15040 (KFRI).

Eulophia picta (R.Br.) Ormerod, Checkl. Papuasian Orchids 293. 2017. *Cymbidium pictum* R.Br., Prodr. Fl. Nov. Holland. 331. 1810. *Geodorum densiflorum* (Lam.) Schltr., Repert. Spec. Nov. Regni Veg. Beih. 4: 259. 1919; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1437. 1928; Abraham & Vatsala, Intr. Orchids 327. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 457. 2004.

Terrestrial herbs. Tubers globose to sub-globose, 2.5–6 × 2–3.5 cm, apiculate, greenish light brown. Leaves 2 to 4, elliptic-lanceolate, 10–40 × 3.5–10 cm, acute to acuminate at apex, attenuate at base, plicate, glabrous, green; petiole 3–7 cm

long. Inflorescence sub-corymbose, pendent, longer than leaves, 18–40 cm long, hooked at apex, arising from base of tubers, sub-densely to compact, many-flowered; peduncle 16–32 cm long, terete, covered by sheaths. Flowers not fully opening, 8–l5 mm long; pedicels 2–2.5 mm long, green; bracts linear-lanceolate, 6–14 × 1–2.5 mm, acuminate at apex, sub-truncate at base, glabrous, green. Sepals 3, white to pale green or rose purple, with yellow and purple markings; dorsal sepal elliptic-oblong, 8–12 × 3–5 mm, acute to obtuse at apex, apiculate, sub-truncate at base, glabrous; lateral sepals obliquely obovate, 9–9.5 × 4–4.5 mm, acute at apex, fused at base, glabrous. Petals obovate-oblong, 8–12 × 5–6 mm, acute-apiculate at apex, cuneate at base, glabrous, white to pale green or rose purple, with yellow and purple markings. Lips sub-panduriform, oblong, 6–15 × 4–9 mm, white or cream or rose-purple, with deep purple veins, sessile at apex of column foot, base weakly saccate with an incurved opening leading into a nectar sac, base with W-shaped brown coloured throat; midlobe crenulated, apex obscurely 2-lobed, with rounded lobes, undulate; lateral lobe obscure, broad, reflexed; disc with 2 or 3 wart-like, tubercular, ridged calluses; pollinia 2, globose-ellipsoid. Ovary 3-ridged, 3–5 mm long, glabrous. Column oblong, 3–5 × 1.8–2 mm, sub-clavate. Pollinia 2. Capsules oblong-ellipsoid, 3–4 × 1.5–2 cm, pendent, drooping, ridged.

Distribution: Tropical and Subtropical Asia to W. Pacific (POWO, 2023); *Habitat*: Semi-evergreen forests; *Fl. & Ft.*: April-June.

Specimens examined: Idukki reservoir, 14.06.1983, *A.G. Pandurangan* 79227; Kulamavu, 02.06.1982, *C.N. Mohanan* 74142 (MH); Thekkady, Periyar Tiger Reserve, 10.06.1996, *Jomy Augustine* 17835 (KFRI).

Gastrochilus D.Don,

Prodr. Fl. Nepal. 32. 1825.

Gastrochilus acaulis (Lindl.) Kuntze, Revis. Gen. Pl. 2: 661. 1891; K.M.Matthew, Illustr. Fl. Palni Hills 728. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 457. 2004. *Cleisostoma acaule* Lindl., Gen. Sp. Orchid. Pl. 227. 1833. *Saccolabium acaule* (Lindl.) Hook.f., Fl. Brit. India 6: 61. 1890. *Gastrochilus pulchellus* Schltr., Repert.

Spec. Nov. Regni Veg. 12: 315. 1913; Abraham & Vatsala, Intr. Orchids 466. 1981. *Saccolabium pulchellum* (Wight) C.E.C.Fisch., in Gamble, Fl. Madras 3: 1446. 1928.

Epiphytic drooping herbs. Stems pendent, branched. Leaves distichous, oblong, 5–18 × 1–1.8 cm, coriaceous, unequally bilobed at apex, sheathing and articulate at base, glabrous, green. Inflorescence corymbose, lateral, 1.5–4 cm long. Flowers many, *c.* 1 × 0.8 cm, green with pink patches; pedicels 1–1.1 cm long; bracts ovate, 3–3.5 × 2–3 mm, obtuse at apex, clasping at base, glabrous. Sepals 3, unequal, green with brownish spots; dorsal sepal obovate-oblong, 6–7 × 2–3 mm, obtuse at apex, sub-truncate at base, glabrous; lateral sepals obovate-oblong, 5–6 × 2.5–3 mm, obtuse at apex, sub-truncate at base, glabrous. Lateral petals oblong-obovate, 6–8 × 2–3 mm, obtuse at apex, sub-truncate at base, glabrous, green with brownish spot. Lips cup shaped, *c.* 0.7 × 0.8 cm, fleshy, retuse at apex, white, apical lobe narrow, semilunar, reflexed, flap-like. Spur 0. Pollinia 2, globose. Ovary cylindrical. Capsules elliptic, *c.* 2.5 cm long, glabrous.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: October-March.

Specimens examined: Kanchiar, 24.02.1983, *C.N. Mohanan* 77971 (MH); Olippara, Chinnar Wildlife Sanctuary, 03.01.1996, *N. Sasidharan & K.K. Sajeev* 17243 (KFRI); Rajamala, way to Pettimudi, 28.01.1994, *Mukthesh Kumar & Stephen Sequiera* 7245 (KFRI); Thekkady, 23.11.1988, *Jayakumar E.* 2235 (CALI); Vallakkadavu, Periyar Tiger Reserve, 13.03.1994, *Jomy Augustine* 13433 (KFRI).

Goodyera R.Br.,
Hort. Kew. ed. 2. 5: 197. 1813.

Goodyera procera (Ker Gawl.) Hook., Exot. Fl. 1: t. 39. 1823; Hook.f., Fl. Brit. India 6: 111. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1456. 1928; Abraham & Vatsala, Intr. Orchids 199. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 682. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 457. 2004. *Neottia procera* Ker Gawl., Bot. Reg. 8: t. 639. 1822.

Terrestrial herbs, 25–32 cm long. Tubers absent. Stems woody, with remnant of leaf sheaths. Leaves elliptic, 3–7 × 1.8–2 cm, acute at apex, cuneate at base, entire, glabrous; petioles 3–4 cm long. Racemes 10–15 cm long. Flowers numerous, 8–10

mm long, greenish white; pedicels 0.8–1 mm long; bracts lanceolate, 7–9 × 1.7–2.3 mm, narrowly acute at apex, truncate at base, 3-nerved, puberulous, green with maroon. Sepals 3, ovate, 2.8–3.1 × 1.8–2 mm, obtuse at apex, truncate at base, 3-nerved, glabrous, greenish white. Lateral petals 2, oblanceolate-ovate, 1.8–2 × 0.8–1 mm, obtuse at apex, cuneate at base, 1-nerved, glabrous, greenish white. Lips 1-lobed, oblong to widely ovate, *c.* 3 × 1.9–2 mm, apex folded to back, sub-rounded, with two thickened regions inside and numerous fimbriae like projections from both sides, upper surface with numerous projections, entire, greenish white. Spur 0. Column *c.* 2 × 1 mm, glabrous, off white. Pollinia 4 in 2 groups, *c.* 1 mm long, pyriform, glabrous, yellow. Ovary twisted, *c.* 3.9 × 1 mm; ovules in 3 vertical rows, puberulous, greenish. Capsules elliptic, *c.* 7 × 3 mm, glabrous, with remnant of flower.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: February-March.

Specimens examined: Edamalakkudi, 15.03.2019, *Dani Francis & Santhosh Nampy* 168965 (CALI); Meenmutty, 20.02.1983, *C.N. Mohanan* 76294 (MH); Mlappara, 21.02.1994, *Jomy Augustine* 13338 (CALI); *Ibid.,* 21.03.1995, *N. Sasidharan & K.P. Rajesh* 14903 (KFRI); Paloda, way to Mlappara, 07.02.1981, *N.C. Nair* 70104; Vallakkadavu R.F., 11.03.1973, *B.D. Sharma* 43826 (MH).

Habenaria Willd.,

Sp. Pl., ed. 4, 4(1): 44. 1805.

Key to the species

1. Lips tripartite …… 2

1. Lips up to median united then lobed …… 8

2. Inflorescence lax flowered …… 3

2. Inflorescence dense flowered …… 5

3. Lateral petals 2-lobed; bracts ovate …… *H. rariflora*

3. Lateral petals not lobed; bracts lanceolate …… 4

4. Leaves ovate-elliptic; flowers greenish white; dorsal sepal elliptic; lateral lobes of lip filiform, recurved …… *H. periyarensis*

4. Leaves oblong-lanceolate; flowers greenish yellow; dorsal sepal cymbiform; lateral lobes of lip linear, not recurved …….. *H. barnesii*

5. Leaves 2, lying flat on ground, cordate to sub-orbicular; lateral sepals arising at right angle to the dorsal sepal then spread outward and afterward reflexed at distal 1/3rd …….. *H. brachyphylla*

5. Leaves more than 2, elliptic, lanceolate or ovate; lateral sepals arising right angle, not reflexed ……..…….. 6

6. Flowers green; spur shorter than ovary…….. *H. furcifera*

6. Flowers greenish white or creamy white; spur equaling or slightly longer than ovary ……..... 7

7. Racemes 20–25 cm long; lateral petals triangular-ovate; lips unequal; spur not appressed to ovary ……..…….. *H. elliptica*

7. Racemes 3–8 cm long; lateral petals falcate; lips sub-equal; spur appressed to ovary … ……..… *H. heyneana*

8. Flowers yellow; bracts leafy; spur shorter than ovary …… *H. perrottetiana*

8. Flowers white; bracts not leafy; spur longer than ovary …… 9

9. Dorsal sepals orbicular; midlobe of lip flabelliform, serrate, clawed, 2-lobulate with small protuberance at sinus; lateral lobes of lip cuneiform with a slender tail ……..…….. *H. crinifera*

9. Dorsal sepals ovate; midlobe of lip oblong, linear, ensiform or lanceolate; lateral lobes of lip without a tail ……..…… 10

10. Inflorescence dense flowered; spur 2–4 cm long ……..…….. 11

10. Inflorescence lax flowered; spur 5.5–11.5 cm long …….…… 13

11. Leaves radical, appressed to ground; inflorescence 20–30 cm long; dorsal sepal not hooded; lateral lobes of lip ovate-triangular …….. *H. roxburghii*

11. Leaves radical as well as cauline, not appressed to ground; inflorescence 4–6 cm long; dorsal sepal hooded; lateral lobes of lip oblanceolate-obovate ……..…… ……..…….. *H. cephalotes*

12. Inflorescence 10–12 cm long; midlobe of lip linear; spur linear, *c.* 5.5 cm long …….. *H. longicornu*

12. Inflorescence 32–50 cm long; midlobe of lip ensiform-lanceolate; spur obconical, *c.* 11.5 cm long …….. *H. longicorniculata*

Habenaria barnesii Summerh. ex C.E.C.Fisch., in Gamble, Fl. Madras 3: 1887. 1936; Abraham & Vatsala, Intr. Orchids 235. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 458. 2004.

Terrestrial tuberous herbs, 15–25 cm tall. Tubers globose, *c.* 1.1 mm across, hairy. Stems erect, slender, 13–15 cm long, sheathing. Sheaths tubular, clasping to stem. Leaves oblong-lanceolate, 2–4 × 0.5–1 cm, acute at apex, sheathing at base, glabrous, green. Spikes sub-secund, lax, 4–8 cm long. Flowers greenish yellow, *c.* 2 × 1.2 cm; pedicels 1–1.5 cm long; bracts leafy, lanceolate, 1.5–2.5 × 0.5–1 cm, acuminate at apex, cuneate at base, glabrous, green. Sepals 3, unequal, 3-nerved, glabrous, green; dorsal sepal cymbiform or broadly ovate, 5–6 × 3.5–5 mm, acute at apex, sub-truncate at base; lateral sepals obliquely lanceolate, 7–7.5 × 3.5–4 mm, acute at apex, cuneate at base, curved. Lateral petals lanceolate, falcate, 4–6 × 1.5–2 mm, acute at apex, sub-truncate at base, 2-nerved, glabrous, greenish yellow. Lips 3-lobed, clawed, *c.* 9 × 13 mm; midlobe oblong, *c.* 6 × 1.5 mm, obtuse at apex; lateral lobes linear, *c.* 5 × 1 mm, obtuse at apex. Spur cylindrical, 1.3–1.5 cm long. Column broad, *c.* 4 × 6 mm. Pollinia 2, pyriform, 1–1.2 mm long. Ovary cylindrical, 1.5–2 cm long, glabrous.

Distribution: SW. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-November.

Specimens examined: Meesapulimala, 21.11.2018, *Dani Francis & Santhosh Nampy* 167757; waterfalls near Rhodovalley, 222.11.2018, *Dani Francis & Santhosh Nampy* 168806 (CALI).

Habenaria brachyphylla (Lindl.) Aitch., J. Linn. Soc. Bot. 19: 188. 1882. *Platanthera brachyphylla* Lindl., Gen. Sp. Orchid. Pl. 293. 1835. *Habenaria crassifolia* A.Rich., Ann. Sci. Nat., Bot., ser. 2. 15: 72. 1841; Hook.f., Fl. Brit. India 6: 151. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1471. 1928; Abraham & Vatsala,

Intr. Orchids 231. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 690. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 458. 2004.

Terrestrial tuberous herbs, 15–40 cm tall. Tubers horizontal, 1 or 2, unequal, ovoid-oblong, 1.5–3.5 × 0.4–2 cm. Stems slender, *c*. 3–5 mm, thick, sheathing. Sheaths tubular, 0.5–1 cm long, clasping to stem. Leaves 2, distichous, lying flat on ground, cordate-sub-orbicular, 4–9 × 4.5–7.5 cm, obtuse at apex, sheathing at base, bluish green, sessile. Inflorescence erect, 14–35 cm long. Spike densely flowered, 5–24 cm long. Flowers 5–7 × 8–9 mm, white, fleshy; pedicels ribbed, 6–7 mm long; bracts leafy, ovate-lanceolate, l–3 × 0.4–0.8 cm, acuminate at apex, sub-truncate at base, glabrous, green. Sepals 3; dorsal sepal orbicular-obovate, 3–3.5 × 3–3.2 mm, obtuse at apex, sub-truncate at base, involute apically, white; lateral sepals arising at right angle to dorsal sepal then spread outward and afterward reflexed at distal 1/3rd, obliquely oblong-ovate, 4.5–4.7 × 2.5–2.7 mm, obtuse at apex, sub-truncate at base, glabrous, white. Lateral petals oblong-ovate, 3–3.2 × 1.8–2 mm, obtuse at apex, sub-truncate at base, glabrous, white. Lips ovate, 3-lobed, lobes slightly curved downward and inward, sub-equal, sub-acute at apex, white; midlobe oblong-lanceolate, 2–2.3 × 0.8–1 mm; lateral lobes hardly spreading, slightly longer than midlobe, oblong, c. 2.5 × 0.7 mm. Spur as long as ovary, adhering at its inflated base with ovary and then bent forward, slender, 13–13.5 mm long. Column oblong, *c*. 2 × 1.5 mm. Pollinia 2, obovoid; caudicles slightly curved. Ovary cylindrical, 6–7 mm long, glabrous.

Distribution: India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-October.

Specimen examined: Lockhert gap, 02.10.1976, *K. Vivekananthan* 48394 (MH).

Habenaria cephalotes Lindl., Gen. Sp. Orchid. Pl. 322. 1835; Hook.f., Fl. Brit. India 6: 139. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1469. 1928; Abraham & Vatsala, Intr. Orchids 219. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 458. 2004.

Terrestrial tuberous herbs, *c.* 12.5 cm long. Tubers 2, elongate, 1–2 × 0.8–1 cm. Stems slender, 9–12 cm long, sheathing. Leaves oblong-lanceolate, 3–6 × 0.5–1.2 cm, obtuse at apex, sheathing at base, glabrous, green. Spikes dense, 4–6 cm long. Flowers white, *c.* 1.5 cm across; pedicels 1–2 cm long; bracts leafy, lanceolate, 1.3–2.5 × 0.5–0.8 cm, acuminate at apex, cuneate at base, glabrous, green. Sepals 3,

unequal, obtuse at apex, 5-nerved, white, glabrous; dorsal sepal broadly ovate, 7–8 × 8–9 mm, hooded; lateral sepals elliptic, 7–9 × 9.5–10 mm. Lateral petals oblanceolate, 4–6 × 1.5–2 mm, acute at apex, sub-truncate at base, glabrous, white. Lips 3-lobed, obovate, *c.* 8 × 6 mm, pubescent; midlobe oblong, 4.8–5 × 1–3 mm, obtuse at apex, lateral lobes oblanceolate-obovate, 2.5–3 × 3.5–4 mm, sub-truncate at apex, fimbriate. Spur 2–3.5 cm long, longer than ovary. Column short. Pollinia 2, pyriform. Ovary 2–3 cm long, glabrous.

Distribution: S. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-November.

Specimens examined: Mangaladevi, 10.11.1993, *Jomy Augustine* 12464; Umayamala, 30.08.2019, *Dani Francis & Santhosh Nampy* 170279 (CALI).

Habenaria crinifera Lindl., Gen. Sp. Orchid. Pl. 323. 1835; Hook.f., Fl. Brit. India 6: 142. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1471. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 458. 2004.

Terrestrial or partially epiphytic, tuberous herbs, 14–25 cm long. Tubers 1 or 2, oblong, *c.* 2 × 1 cm. Stems terete, slender. Leaves 2–4, clustered at base, oblanceolate-oblong, 5–10 × 1–2 cm, acute at apex, attenuate at base, glabrous, green. Racemes lax, 10–15 cm long. Flowers 2–4; bracts leafy, lanceolate, acuminate at apex, cuneate at base, scaberulous at margins, green. Sepals 3, sub-equal, 3-nerved, greenish white; dorsal sepal orbicular, 6–7 × 4–5 mm, slightly retuse at apex, cuneate at base, glabrous, keeled; lateral sepals obliquely ovate, 6–7 × 4.5–5 mm, obtuse at apex, glabrous. Lateral petals linear, 5–7 × 1–1.5 mm, acute at apex, cuneate at base, 1-nerved, glabrous, white. Lips 3-lobed, clawed, *c.* 2 cm long, 3 times as long as sepals; midlobe flabelliform, serrate, clawed, 2-lobulate, with a small protuberance at sinus, lateral lobes cuneiform, serrate, with a slender tail. Spur 3–3.5 cm long, slender, greenish white. Column short. Pollinia 2, pyriform. Ovary beaked, 2–3.5 cm long. Capsules elliptic, 2–4 cm long, beaked.

Distribution: Indian Subcontinent (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: August-October.

Specimen examined: Pachakkanam, 02.10.1976, *K. Vivekananthan* 48394 (MH).

Notes: This species is easily recognized by its habitat, which can be either epiphytic or terrestrial, as well as its delicate white flowers. The flower structure resembles a doll, hence the common name 'doll orchid' (Dangat, 2015).

Habenaria elliptica Wight, Icon. Pl. Ind. Orient. 5: t. 1706. 1851; Hook.f., Fl. Brit. India 6: 147. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1471. 1928; Abraham & Vatsala, Intr. Orchids 233. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 692. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 458. 2004.

Terrestrial tuberous herbs, 20–40 cm tall. Tubers 1 or 2, ovoid-oblong, 2–3 × 1–1.5 cm. Stems terete, sheathing at base, glabrous. Leaves 3 or 4, elliptic-lanceolate, 6–12 × 0.5–1.7 cm, acute at apex, cuneate at base, glabrous, green. Racemes 20–25 cm long, dense flowered. Flowers *c.* 8 mm across, greenish white; pedicels 3–5 mm long, green; bracts leafy, linear-lanceolate, 10–15 × 2.5–3 mm, acuminate at apex, cuneate at base, glabrous, green. Sepals 3; dorsal sepal ovate, 3.5–4 × 2.5–3 mm, obtuse at apex, sub-truncate at base, glabrous, white; lateral sepals ovate-lanceolate, 5–5.5 × 2.5–3 mm, obtuse at apex, sub-truncate at base, puberulous, white. Lateral petals triangular-ovate, *c.* 3 × 2.5 mm, acute at apex, sub-truncate at base, gibbous, glabrous, white. Lips deflexed, 3-lobed, clawed at base, claw *c.* 3 mm long, puberulous, white; midlobe tounge shaped, 1.8–2 × 1–1.5 mm, obtuse at apex; lateral lobes linear-lanceolate, acute or obtuse at apex, *c.* 2 mm long, sparsely fimbriate towards apex. Spur stout, filiform, *c.* 1.6 cm long, apex clavate, obtuse, equaling the ovary or slightly longer. Column *c.* 2 × 1.5 mm. Pollinia 2, pyriform, yellow; caudicle thin, slender, curved. Ovary fusiform, 2–3 mm long, incurved, longitudinally ribbed.

Distribution: SW. India (POWO, 2023); *Habitat*: Margins of forests; *Fl. & Ft.*: June-September.

Specimen examined: Lockhert gap, Devikulam, 15.06.1963, *K.M. Sebastine* 16502 (MH).

Habenaria furcifera Lindl., Gen. Sp. Orchid. Pl. 319. 1835; Hook.f., Fl. Brit. India 6: 149. 1890; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 458. 2004. *Habenaria modesta* Dalzell, Hooker's J. Bot. Kew Gard. Misc. 2: 262. 1850; Hook.f., Fl. Brit. India 6: 166.

1890. *Habenaria ovalifolia* Wight, Icon. Pl. Ind. Orient. 5: t. 1708. 1851; Hook.f., Fl. Brit. India 6: 149. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1471. 1928.

Terrestrial tuberous herbs, 40–70 cm tall. Tubers ovate-elliptical, 4–5 × 2–3 cm, fleshy. Stems erect, terete, glabrous, green, sheathed at base. Leaves elliptic-ovate, 8–15 × 1.5–3 cm, acute at apex, amplexicaul at base, glabrous, green. Racemes many flowered, 10–30 cm long. Flowers 6–15 mm long, glabrous, green; pedicels 3–5 mm long; bracts lanceolate, 8–12 × 1–1.5 mm, acuminate at apex, cuneate at base, glabrous, green. Sepals unequal, 3-nerved; dorsal sepal ovate-oblong, cucullate, 3.8–4 × 2.8–3 mm, obtuse at apex, cuneate at base, glabrous, green; lateral sepals reflexed, obliquely ovate, 3–4.5 × 1.3–1.6 mm, acute at apex, sub-truncate at base, glabrous, green. Lateral petals 2, broadly lanceolate, 4–6 × 1.5–2 mm, obtuse at apex, attenuate at base, 2-nerved, glabrous, green. Lips 3-lobed, 6–14 × 4–8 mm; midlobe linear oblong, 2–5.5 × 0.2–0.4 mm; lateral lobes linear, 4.5–12 × 0.4–0.8 mm, deflexed, filiform, slightly curved, blunt at apex. Spur 1–1.3 mm long, glabrous. Column 2–3 mm long. Pollinia ovate, 3–5 mm long. Ovary cylindrical, 7–8 mm long, glabrous.

Distribution: Indian Subcontinent to China and Philippines (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: October-December.

Specimens examined: Kumily, 22.11.1988, *Jayakumar K.V.* 735 (CALI).

Notes: In *H. furcifera* flowers are large with straight, linear, spreading segments of lip. Due to the peculiar structure of the labellum, the species is known as 'forked habenaria' (Dangat, 2015).

Habenaria heyneana Lindl., Gen. Sp. Orchid. Pl. 320. 1835; Hook.f., Fl. Brit. India 6: 148. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1471. 1928; Abraham & Vatsala, Intr. Orchids 231. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 459. 2004.

Fig. 15F

Terrestrial herbs with tuberous roots, 17–35 cm long. Tubers ovoid, 0.5–1.5 × 0.3–0.5 cm, wrinkled. Stems slender, glabrous, greenish. Leaves lanceolate, 2–6 × 0.5–1 cm, acute at apex, sheathing at base, glabrous, green. Racemes 3–8 cm long. Flowers 1–1.5 cm long, creamy white; pedicels 0.5–1 cm long; bracts foliaceous, ovate-lanceolate, 1–1.5 × 0.5–0.6 cm, acute at apex, cuneate at base, entire, 5-

nerved, glabrous, green. Sepals 3; dorsal sepal elliptic-ovate, 6–8 × 3–4 mm, obtuse at apex, cuneate at base, 3-nerved, glabrous, white; lateral sepals 2, ovate-elliptic, 5–7 × 1.8–2 mm, obtuse-slightly acute at apex, sub-truncate at base, 1-nerved, glabrous, white. Lateral petals 2, falcate, 5–7 × 2.5–3 mm, obtuse at apex, cuneate at base, 2-nerved, glabrous, white. Lips 3-lobed, sub-equal, obovate to oblanceolate, *c.* 9 × 3 mm, glabrous, white. Spur narrowly linear, *c.* 1 cm long, appressed to ovary. Column *c.* 2 × 1 mm. Pollinia 2, clavate, *c.* 5 mm long, yellow. Ovary 3-locular, *c.* 1 cm long; ovules many, in 3 vertical rows, twisted, glabrous, green.

Distribution: SW. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-October. *Specimens examined*: Dhanas valley, upper Vaguvarai, 17.10.1989, *P. Bhargavan* 90991 (MH); Elaveezhapoonchira, 08.09.2017, *Dani Francis & Santhosh Nampy* 152996 (CALI); Kulamavu, 19.08.1977, *K. Vivekananthan* 50423 (MH); Kumarikulam, 10.07.1993, *Jomy Augustine* 12079 (CALI); Kuttikkanam, Peermade, 21.09.1964, *K. Vivekananthan* 20350; Painavu, 20.08.1981, *K. Vivekananthan & V.S. Raju* 71107 (MH); Panchalimedu, 13.09.2019, *Dani Francis & Santhosh Nampy* 170306 (CALI); Umayamala, 06.08.1967, *B.V. Shetty* 28320 (MH).

Habenaria longicorniculata J.Graham, Cat. Pl. Bombay. 202. 1839; Abraham & Vatsala, Intr. Orchids 238. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 693. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 459. 2004. *Habenaria longecalcarata* A.Rich., Ann. Sci. Nat., Bot., sér. 3, 15: 71. 1841; Hook.f., Fl. Brit. India 6: 141. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1470. 1928. **Fig. 15D**

Terrestrial herbs with tuberous roots, 40–60 cm long. Tubers ovoid-fusiform, 2–2.2 × 0.8–1 cm, wrinkled. Stems terete, glabrous, greenish. Leaves elliptic, 5.1–9 × 1.5–2 cm, obtuse to sub-acute at apex, green. Inflorescence lax, 32–50 cm long. Flowers 1–4, *c.* 6 cm long, white; pedicels 3–3.5 cm long; bracts ovate-lanceolate, 2.5–2.7 × 1–1.4 cm, acuminate at apex, truncate at base, entire, 9-nerved, glabrous, green. Sepals 3; dorsal sepal widely ovate, 10–13 × 5–7 mm, obtuse at apex, truncate at base, 5-nerved, puberulous, green; lateral sepals falcate, 12–15 × 3.5–5 mm, cuspidate at apex, truncate at base, 4–5-nerved, glabrous, greenish white. Lateral petals 2, falcate, 10–12 × 1.8–2 mm, obtuse at apex, truncate at base, 2–3-nerved, glabrous, white. Lips 3-lobed, *c.* 2.6 × 2.5 cm; midlobe ensiform-lanceolate,

slender, *c.* 2 mm wide; lateral lobes falcate, *c.* 8 mm wide, acute-obtuse at apex, dentate, glabrous, white, with 2 finger like green callus at base. Spur obconical, *c.* 11.5 cm long, tapering towards end. Column oblong, *c.* 10 × 5 mm, glabrous. Pollinia 2, pyriform, *c.* 5 mm long, with 2 yellow caudicles. Ovary 3-locular, *c.* 2.5 cm long; ovules many, in 3 vertical rows, glabrous, green.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: June-October.

Specimens examined: Devikulam, 28.09.1983, *Mukthesh Kumar* 2968 (KFRI); Dhanas valley hill top, Upper Vaguvarai, 17.10.1989, *P. Bhargavan* 90980 (MH); Eravikulam National Park, 29.09.2017, *Dani Francis & Santhosh Nampy* 156304; Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154394 (CALI); Kulamavu, 08.06.1984, *C.N. Mohanan* 82022; Kuttikkanam, Peermade, 21.09.1964, *K. Vivekananthan* 20331; Lakshmi estate, Munnar, 12.09.1968, *D.B. Deb* 30784; Lockhert gap, 10.10.1963, *K.M. Sebastine* 17490 (MH); Mangaladevi hills, 15.07.2017, *Dani Francis & Santhosh Nampy* 154126; *Ibid*., 08.08.1993, *Jomy Augustine* 12176 (CALI); *Ibid*., 09.10.1976, *K. Vivekananthan* 48638; Painavu, 20.08.1981, *K. Vivekananthan & V.S. Raju* 71112; Vandanmedu, 28.09.1981, *C.N. Mohanan & B. Ramanujan* 72067 (MH).

Notes: Because of its extremely long spur, *Habenaria longicorniculata* is popularly known as 'long-tailed habenaria'.

Habenaria longicornu Lindl., Gen. Sp. Orchid. Pl. 322. 1835; Hook.f., Fl. Brit. India 6: 139. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1470. 1928; Abraham & Vatsala, Intr. Orchids 229. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 459. 2004.

Fig. 15G

Tuberous rooted terrestrial herbs, 30–35 cm long. Tubers ovoid, 2.5–3 × *c.* 1 cm, wrinkled. Stems glabrous, green. Leaves elliptic, 7–9 × 1–1.1 cm, obtuse to sub-acute at apex, glabrous, green. Racemes 10–12 cm long. Flowers *c.* 6 cm long, white; pedicels 3–3.5 cm long; bracts ovate, 15–17 × 1–3 mm, narrowly acute at apex, truncate at base, crenulate, glabrous, green. Sepals 3; dorsal sepal ovate, 8–10 × 4–5 mm, mucronate at apex, obtuse at base, 3-nerved, glabrous, white, rugose on surface and margin; lateral sepals ovate-falcate, 10–11 × 4.5–5 mm, obtuse at apex, truncate at base, entire at margins, 3-nerved, glabrous, white with green at

mid vein. Lateral petals 2, lanceolate, 8.5–9 × 1.8–2 mm, acute at apex, cuneate at base, with a single obscure vein, glabrous, white, rugose. Lips 3-lobed; midlobe (*c.* 11 × 1 mm) smaller than lateral lobes (*c.* 17 × 4 mm), linear, dentate, glabrous, white. Spur linear, *c.* 5.5 cm long. Column *c.* 3 × 4 mm, hairy at tip. Pollinia 2, clavate, *c.* 5 mm long, yellow. Ovary 3-locular, *c.* 1 cm long; ovules many, in 3 vertical rows, glabrous, green.

Distribution: SW. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-October.

Specimens examined: Kuttikkanam, Peermade, 21.09.1964, *K. Vivekananthan* 20305 (MH); Mangaladevi hills, 12.10.2017, *Dani Francis & Santhosh Nampy* 156340 (CALI).

Habenaria periyarensis Sasidh., K.P.Rajesh & Augustine, Rheedea 8(2): 167. 1998; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 460. 2004.

Terrestrial tuberous herbs, 15–22 cm long. Tuber ovoid-fusiform, 2–2.5 × 0.5 cm, wrinkled. Leaves sessile, ovate-elliptic, 3–5 × 1.5–2 cm, acute at apex, cuneate at base, glabrous. Spikes 12–16 cm long, few flowered. Flowers greenish-white, *c.* 10 × 5 mm; pedicels 5–9 mm long, green; bracts lanceolate, 8–10 × 1–3 mm, acuminate at apex, cuneate at base, glabrous, green. Sepals 3, green; dorsal sepal elliptic, 8–10 × 4–6 mm, acute at apex, sub-truncate at base, 5-nerved, glabrous, green, forming a hood over column; lateral sepals ovate, 9–11 × 4–6 mm, acute at apex, sub-truncate at base, 5-nerved, glabrous, white. Lateral petals linear-lanceolate, 7–9 × 1–2 mm, obtuse at apex, cuneate at base, 2-nerved, glabrous, greenish white. Lips 3-lobed, greenish white; midlobe linear, *c.* 10 × 1 mm, obtuse at apex; lateral lobes filiform, 12–16 × 0.6–0.8 mm, recurved. Spur cylindrical, 2–2.5 cm long, greenish white. Column *c.* 4 mm long. Pollinia 2, pyriform. Ovary cylindrical, *c.* 1.5 cm long, glabrous.

Distribution: SW. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-August.

Specimen examined: Pachakkanam, 10.08.1993, *Jomy Augustine* 12294 (CALI).

Habenaria perrottetiana A.Rich., Ann. Sci. Nat., Bot., sér. 2. 15: 74. 1841; Hook.f., Fl. Brit. India 6: 164. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1471. 1928; Abraham & Vatsala, Intr. Orchids 236. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 695. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 460. 2004. **Fig. 15E**

Tuberous rooted terrestrial herbs, 15–40 cm long. Tubers ovoid-fusiform, 2–2.5 × 1–1.3 cm, wrinkled. Leaves ovate, 4–6 × 2–3 cm, obtuse at apex, cuneate at base, glabrous, greenish. Racemes 15–40 cm long. Flowers *c.* 6 × 2 cm, yellow; pedicels *c.* 0.5 mm long; bracts leafy, ovate, 4–4.6 × 2–2.3 cm, acuminate at apex, cuneate at base, entire, 3-nerved, glabrous, green. Sepals 3; dorsal sepal ovate, 15–17 × 7–9 mm, acute at apex, cuneate at base, 7-nerved, glabrous, greenish yellow, rugose; lateral sepals ovate, 16–18 × 9–11 mm, acute at apex, truncate at base, 7-nerved, glabrous, greenish yellow. Lateral petals 2, falcate, 14–16 × 3–5 mm, obtuse at apex, cuneate at base, 5-nerved, glabrous, yellow, fleshy. Lips 3-lobed, *c.* 16 × 10 mm, glabrous, thick and fleshy; midlobe ovate, *c.* 10 × 7 mm; lateral lobes lanceolate, *c.* 7 × 3 mm, obtuse at apex. Spur fusiform, 1.7 cm long, shorter than ovary. Column conical, *c.* 7 × 4 mm. Pollinia 2, pyriform, *c.* 6 mm long, yellow. Ovary 3-locular, *c.* 15 × 5 mm; ovules many, in 3 vertical rows, glabrous, light green.

Distribution: SW. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: June-December.

Specimens examined: Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154392 (CALI); Kulamavu, 08.06.1984, *C.N. Mohanan* 82021; Umayamala, 19.11.1965, *B.V. Shetty* 26538; Upper Vaguvarai, 06.12.1982, *P. Bhargavan* 87352; Uppupara, 26.09.1972, *B.D. Sharma* 42002 (MH); Vakavanam near Valakode, 14.09.2019, *Dani Francis & Santhosh Nampy* 170292 (CALI).

Habenaria rariflora A.Rich., Ann. Sci. Nat., Bot., sér. 2, 15: 70. 1841; Hook.f., Fl. Brit. India 6: 136. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1469; Abraham & Vatsala, Intr. Orchids 216. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 696. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 460. 2004.

Tuberous rooted terrestrial herbs, 10–12 cm long. Tubers 1–2, ovoid or oblong, 1–2.5 × 0.5–1 cm. Stems slender, glabrous, green. Leaves linear, 2.5–3.5 × 0.3–0.4 cm, acute at apex, green. Racemes 8–10 cm long. Flowers 1–4, 15–20 × 3–5 mm long, lax, white; pedicels 3–4.5 cm long; bracts ovate, 9–11 × 4–5 mm, cuspidate at apex, truncate at base, 9-nerved, glabrous, green. Sepals 3; dorsal sepal widely ovate, 6–8 × 4–5.3 mm, mucronate at apex, truncate at base, 7-nerved, glabrous, white; lateral sepals ovate-falcate, 6–8 × 4–4.2 mm, mucronate at apex, truncate at base, entire, 5-nerved, glabrous, greenish white. Lateral petals 2, each divided into two,

one linear and one falcate, 5–6 × 2.5–3 mm, 3-nerved, acute at apex, cuneate at base, glabrous, white. Lips 3-lobed, linear, acute at apex, glabrous, white; midlobe 10–11 × *c.* 2 mm; lateral lobes 10–11 × *c.* 1 mm. Spur 3.7–6 cm long, emarginate, bulged at apex. Column *c.* 5 × 4 mm. Pollinia 2, 3–5 mm long, pyriform, 2-loculed, with 2 caudicles, light yellow. Ovary 3-locular, *c.* 1 cm long; ovules many, in 3 vertical rows, glabrous, green.

Distribution: SW. India (POWO, 2023); *Habitat*: Grasslands; *Fl. &Ft.*: July-September.

Specimens examined: Mangaladevi hills, 15.07.2017, *Dani Francis & Santhosh Nampy* 154127; *Ibid*., 07.07.1993, *Jomy Augustine* 12032; Pandippara, 16.07.2021, *Dani Francis & Santhosh Nampy* 176047 (CALI).

Habenaria roxburghii Nicolson, in Saldanha & Nicolson, Fl. Hassan Dist. 834. 1976; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 460. 2004. *Habenaria platyphylla* Spreng., Syst. Veg., ed. 16. 3: 690. 1826, *nom. superfl.*; Hook.f., Fl. Brit. India 6: 140. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1470; Abraham & Vatsala, Intr. Orchids 229. 1981.

Terrestrial tuberous herbs, 25–35 cm tall. Tuber 1, large, ellipsoid or oblong-ovoid, 3–4 × 1.2–1.5 cm. Stem short, cylindric. Leaves 2–3, radical, appressed to ground, oblong-orbicular, 4–11 × 2–8 cm, rounded at apex, rounded or cordate at base, waxy, dark green above, pale green below, sessile. Racemes 20–30 cm long, cylindric, densely flowered. Flowers 10–11.5 × 13–14 mm, white; bracts narrow-lanceolate, 13–17 × 2.5–3 mm, acuminate at apex, sub-truncate at base, glabrous, green. Sepals 3; dorsal sepal broadly ovate, 6–7 × 5–6 mm, acute at apex, sub-truncate at base, glabrous, involute at margins, white; lateral sepals spreading and drooping, ovate, 6–9 × 4–5 mm, acute at apex, sub-truncate at base, glabrous, white. Lateral petals oblong-lanceolate, 5–6 × 0.8–1 mm, acute at apex, sub-truncate at base, glabrous, white. Lips sessile, 3-lobed a little above middle, 8–8.5 × 5–6 mm, white; midlobe sometimes decurved, oblong-lanceolate, 5–6 × 1–1.5 mm, acute to acuminate at apex, glabrous; lateral lobes ovate-triangular, 2–3 × 1–1.6 mm, truncate at apex, crenulate at apex. Spur longer than ovary, 25–40 mm long, white. Column *c.* 3 × 3 mm. Pollinia pyriform, yellow; caudicles 2–2.5 mm long. Ovary ribbed, curved, 4 mm long, greenish white.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Dry deciduous forests; *Fl. & Ft.*: August-October.

Specimen examined: Mangappara, Chinnar Wildlife Sanctuary, 20.09.1995, *N. Sasidharan & K.K. Sajeev* 15856 (KFRI).

Liparis Rich.,

De Orchid. Eur. 21, 30, 38. 1817, *nom. cons.*

Key to the species

1. Plants epiphytic; flowers white 2
1. Plants terrestrial; flowers purple 3
2. Leaves linear-elliptic; racemes lax; flowers white ..... *L. elliptica*
2. Leaves oblanceolate; racemes dense; flowers cream to pale green ..... *L. viridiflora*
3. Leaves widely ovate; racemes 10–25 cm long 4
3. Leaves ovate; racemes 5–10 cm long ..... *L. wightiana*
4. Lips obovate-turbinate; lateral petals ovate ..... *L. odorata*
4. Lips ovate-orbicular; lateral petals linear ..... *L. walkerae*

Liparis elliptica Wight, Icon. Pl. Ind. Orient. 5. t. 1735. 1851; Abraham & Vatsala, Intr. Orchids 412. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 462. 2004. *Liparis viridiflora sensu* Hook.f., Fl. Brit. India 5: 704. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1411. 1928 *non* Lindl., 1830. **Fig. 15C**

Annual epiphytic herbs. Pseudobulbs ovate, 1–2 × 0.5–1 cm, laterally compressed. Leaves 2, linear-elliptic, 8–10 × 1–2 cm, acute at apex, cuneate at base, glabrous; petiole, 1 cm long. Racemes lax, 10–26 cm long. Flowers *c.* 8 mm long, white; pedicels 1.8–2 mm long; bracts lanceolate-ovate, 3–3.1 × 1–1.2 mm, acute at apex, truncate at base, 1-nerved, glabrous, green. Sepals 3, equal, ovate, 3–4 × 1–1.1 mm, obtuse at apex, sub-truncate at base, 1-nerved, glabrous, white. Lateral petals 2, linear, 2.8–3 × 0.2–0.3 mm, obtuse at apex, cuneate at base, 1-nerved, glabrous, white. Lips not lobed, widely ovate, *c.* 3.5 × 3 mm, fan-like, with 2 flaps at base, obtuse at apex, cuneate at base, margins crenulate at middle, remaining portions entire, 3-nerved, glabrous, white. Spur 0. Column *c.* 2.1 × 0.8 mm, with a sinus at

apex, white. Pollinia 2 in pairs, *c.* 0.3 × 0.2 mm, yellow. Ovary *c.* 3 mm long; ovules in 3 vertical rows, glabrous, green.

Distribution: Himalaya to Japan and Fiji (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: December-July.

Specimens examined: Arumadam, Mathikettan Shola National Park, 30.12.2014, *Syam Radh S. & Santhosh Nampy* 137930; way to Kanketty, 20.12.2019, *Dani Francis & Santhosh Nampy* 164830 (CALI); Kundalai, Munnar, 28.07.1982, *Nambiar & N. Sasidharan* 1844 (KFRI); Mathikettan Shola National Park, Sivanpara, 28.07.2016, *Syam Radh S. & Santhosh Nampy* 149168 (CALI).

Liparis odorata Lindl., Gen. Sp. Orchid. Pl. 26. 1830; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 462. 2004. *Liparis paradoxa* Rchb.f., in Walpers, Ann. Bot. Syst. 6(2): 218. 1861; Hook.f., Fl. Brit. India 5: 697. 1890. *Liparis nervosa sensu* C.E.C.Fisch. in Gamble, Fl. Madras 3: 1410. 1928, *non* Lindl., 1830.

Annual terrestrial herbs, 10–30 cm tall. Pseudobulbs globose, *c.* 2 cm long. Stems slender, fleshy, with 2 or 3 purple sheaths basally. Leaves 2 or 3, widely ovate, 9–14 × 5.8–10 cm, sessile, acute at apex, cuneate at base, 7-nerved, glabrous. Racemes dense, 10–25 cm long. Flowers *c.* 2.5 × 8 mm, deep purple; pedicels *c.* 1 mm long; bracts lanceolate to subulate, 3–5 × 1–2 mm, acute at apex, truncate at base, 3-nerved, glabrous, deep purple. Sepals 3; dorsal sepal ensiform, 1–1.3 × 1.8–2 mm, acute at apex, truncate at base, 5-nerved, glabrous, deep purple; lateral sepals falcate, 12–14 × 0.8–1 mm, obtuse at apex, truncate at base, 5–6-nerved, glabrous, with purple spots. Lateral petals 2, ovate and slightly curved, 9–11 × 3–4 mm, obtuse at apex, truncate at base, 7-nerved, glabrous, deep purple. Lips not lobed, obovate-turbinate, *c.* 6 × 11 mm, apex with a small projection dividing it in to three, puberulous, crenate or slightly dentate, abaxial surface glabrous, violet. Spur 0. Column *c.* 1 × 2 mm, yellowish to purple. Pollinia 2, obovate, *c.* 0.5 mm long, yellow. Ovary *c.* 8 mm long; ovules in 3 vertical rows, glabrous, purple green.

Distribution: Indian Subcontinent to S. Japan and Guam (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-September.

Specimens examined: Elaveezhapoonchira, 08.09.2017, *Dani Francis & Santhosh Nampy* 152995 (CALI); Idukki to Kattappana, 26.09.1981, *C.N. Mohanan* 72011 (MH).

Liparis viridiflora (Blume) Lindl., Gen. Sp. Orchid. Pl. 31. 1830; Abraham & Vatsala, Intr. Orchids 410. 1981. *Liparis longipes* Lindl., Gen. Sp. Orchid. Pl. 30. 1830; Hook.f., Fl. Brit. India 5: 703. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1411; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 462. 2004. *Malaxis viridiflora* Blume, Bijdr. Fl. Ned. Ind. 392. 1825.

Annual eiphytic herbs, 30–40 cm tall. Pseudobulbs ovoid, 2–7 × 1.5–2 cm, sheathing, glabrous. Stems short with a few imbricating sheaths. Leaves 2, oblanceolate, 20–23 × 1.5–2.1 cm, acute at apex, attenuate at base, glabrous. Racemes 25–30 cm long, many flowered. Flowers creamy; pedicels 1–3 mm long; bracts lanceolate, 3–4 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, pale green. Sepals 3, cream to pale green; dorsal sepal lanceolate, 2.5–3 × 0.8–1 mm, obtuse at apex, sub-truncate at base, revolute, glabrous; lateral sepals obliquely oblong, 2.5–2.7 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous. Lateral petals 2, linear, 2.5–2.7 × 0.1–0.2 mm, acute at apex, sub-truncate at base, glabrous, cream to pale green. Lips ovate, *c.* 2.5 × 1.5 mm, acute at apex, obtuse at base, reflexed beyond middle. Spur 0. Column *c.* 1 mm long, glabrous. Pollinia 2, obovate. Ovary obovate, 2–4 mm long. Capsules obovate, *c.* 5 mm long, glabrous, green.

Distribution: Indian Subcontinent to S. China and Papua New Guinea (POWO, 2023); *Habitat*: Forests; *Fl. & Ft.*: September-May.

Specimens examined: Idukki-Kattappana, 08.11.1981, *B. Ramanujan* 72420 (MH); Mankulam, Tiger caves, 04.12.2018, *Dani Francis & Santhosh Nampy* 168855 (CALI); Meenmutty, 14.02.1982, *C.N. Mohanan* 73258; *Ibid.*, 13.12.1982, *C.N. Mohanan* 76046; Peermade, 26.09.1964, *K. Vivekananthan* 21411; Pullupara-Peruvanthanam, 22.05.1965, *K. Vivekananthan* 23971 (MH).

Liparis walkerae Graham, Edinburgh New Philos. J. 1836: 194. 1836; Hook.f., Fl. Brit. India 5: 698. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1410. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 463. 2004.

Annual terrestrial herbs, 20–30 cm tall. Pseudobulbs ovate, *c.* 1 cm long. Stems slender, terete, fleshy, basally with 2 or 3 sheaths basally. Leaves 2 or 3, widely ovate, 5–6.5 × 3–3.5 cm, sessile, acute at apex, cuneate at base, glabrous. Racemes lax, 18–23 cm long. Flowers *c.* 10 × 7.5 mm, yellowish purple; pedicels *c.* 1 mm long; bracts lanceolate, 5–7 × 0.5–1 mm, acuminate at apex, cuneate at base, 3-nerved, glabrous, purple green. Sepals 3; dorsal sepal oblong, 2–2.5 × 1.5–2 mm, obtuse at apex, truncate at base, 3-nerved, glabrous, purple; lateral sepals falcate, 2.5–3 × 1–2 mm, obtuse at apex, truncate at base, 5-nerved, glabrous, purple with white at tip. Lateral petals 2, linear, 3–6 × 0.8–1 mm, pointed at apex, attenuate at base, 1-nerved, glabrous, purple, slightly curved. Lips not lobed, ovate-orbicular, *c.* 4 × 10 mm, emarginate at apex, cuneate at base, crenate, glabrous, yellow with purple at centre. Spur 0. Column *c.* 1 × 2 mm, yellow to purple. Pollinia 2, obovate, *c.* 0.5 mm long, yellow. Ovary *c.* 3 mm long; ovules in 3 vertical rows, glabrous, purple green.

Distribution: SW. India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-September.
Specimen examined: Kottamala, *s.d.*, *Jomy Augustine* 14162 (CALI).

Liparis wightiana Thwaites, Enum. Pl. Zeyl. 295. 1861; Hook.f., Fl. Brit. India 5: 695. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1410. 1928; Abraham & Vatsala, Intr. Orchids 405. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 463. 2004. **Fig. 15B**

Annual terrestrial herbs, 4–10 cm tall. Pseudobulbs ovoid, 1–2 × 0.8–1.2 cm, sheathing. Stems slender, fleshy, puberulous, deep purple. Leaves ovate, 3.5–5 × 3–4 cm, acuminate at apex, cuneate at base, glabrous. Racemes 5–10 cm long. Flowers *c.* 2.5 × 8 mm, deep purple; pedicels 2–3 mm long, glabrous; bracts lanceolate, 3–5 × 1–1.5 mm, obtuse at apex, truncate at base, scaberulous at margin, glabrous, green. Sepals 3; dorsal sepal narrowly triangular, 5–7 × 1–1.8 mm, obtuse at apex, truncate at base, 3-nerved, glabrous, green; lateral sepals lanceolate, 4–6 × 1.5–2 mm, obtuse at apex, sub-rounded at base, 3-nerved, glabrous, green. Lateral petals 2, linear, 6–8 × 0.2–0.3 mm, sub-acute at apex, cuneate at base, 3-nerved, glabrous, purple. Lips reniform with an apical notch, *c.* 9 × 9 mm, papillate at margin, basal disc 3-lobed, glabrous, deep purple. Spur 0. Column *c.* 4 × 1 mm, glabrous, green with purple striations. Pollinia 2, obovate, *c.*

0.4 mm long, yellow. Ovary *c.* 4 mm long; ovules in 3 vertical rows, glabrous, purple green. Capsules obovate, *c.* 1 × 0.5 cm, glabrous, green-purple.

Distribution: S. India, Sri Lanka and Peninsula Thailand to Jawa (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-January.

Specimens examined: Devikulam, 27.07.1982, *Nambiar & N. Sasidharan* 1814; Kottamala, Periyar Tiger Reserve, 26.08.1994, *N. Sasidharan & Jomy Augustine* 14007; near Kuttiar valley, Munnar, 17.07.1995, *Stephen Sequiera* 007854 (KFRI); Nyamakkad, 8th mile, 24.01.2018, *Dani Francis & Santhosh Nampy* 158185; Puthukkad, Nallathanni Kallar, 15.09.2018, *Dani Francis & Santhosh Nampy* 161922 (CALI); Umayamala, 20.11.1965, *B.V. Shetty* 26567; Upper Vaguvarai, 08.08.1967, *B.V. Shetty* 26567 (MH); Vellimala, 20.08.1994, *Jomy Augustine* 14007 (CALI).

Luisia Gaudich.,

Voy. Uranie, Bot. 426, t.37. 1829.

Key to the species

1. Leaves tufted; lateral petals narrowly lanceolate …….. *L. tenuifolia*

1. Leaves not tufted; lateral petals linear-oblong …….. *L. zeylanica*

Luisia tenuifolia Blume, Rumphia 4: 50. 1849; Hook.f., Fl. Brit. India 6: 24. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1438. 1928. *Luisia birchea* Blume, Mus. Bot. 1: 64. 1849; K.M.Matthew, Illustr. Fl. Palni Hills 726. 1996; Abraham & Vatsala, Intr. Orchids 481. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 463. 2004.

Epiphytic herbs. Roots thick, light green. Stems thick, woody, terete, 10–15 cm long, sheathing; sheaths oblong, 1–2 × 1–1.5 cm, glabrous, striated. Leaves tufted, terete, linear, 15–25 × 0.2–0.4 cm long, obtuse at apex, obtuse at base, grooved on one side, glabrous. Racemes arising through leaf sheaths, stout. Flowers solitary, axillary, *c.* 25 × 15 mm, pale green with dark purple lip; pedicels 3–5 mm long; bracts triangular, 1.5–2 × 1.8–2 mm, obtuse at apex, sub-truncate at base, glabrous, persistent, brown. Sepals 3, unequal, cream or pale green with purplish tinch; dorsal sepal ovate-lanceolate, 8–13 × 3.5–6 mm, acute at apex, sub-truncate at base, glabrous; lateral sepals lanceolate, 10–16 × 3.5–6 mm, acute at apex, sub-truncate at base, glabrous. Lateral petals narrowly lanceolate, 12–18 × 5–5.5 mm, obtuse at apex, sub-truncate at base, glabrous, pale green with purple tinch. Lips

fleshy, 3-lobed, *c.* 20 × 13 mm, glabrous, creamy with purple violet; with 2 triangular lobes at base, quadrate depression near apex; upper portion purple with a single erect keel, uneven at margin, prolonged in to 2 lobules. Spur 0. Column *c.* 3 × 2 mm, cream purple. Pollinia 2, yellow. Ovary *c.* 3 × 1.5 mm, elliptic. Capsules elliptic, 2–3 × 0.3–0.5 cm, glabrous.

Distribution: SW. India, Sri Lanka (POWO, 2023); *Habitat*: Moist deciduous forests; *Fl. & Ft.*: May-September.

Specimen examined: Ichampetty, Idukki Wildlife Sanctuary, 10.05.1995, *N. Sasidharan & K.K. Sajeev* 15649 (KFRI).

Luisia zeylanica Lindl., Fol. Orchid. 4: 3. 1853; K.M.Matthew, Illustr. Fl. Palni Hills 727. 1996; Abraham & Vatsala, Intr. Orchids 486. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 463. 2004.

Epiphytic herbs. Roots thick, light green. Stems thick, woody, terete, 4–8 cm long, sheathing; sheaths oblong, 1–2 × 1–1.5 cm, glabrous, striated. Leaves terete, 10–20 cm long, acute or blunt at apex, obtuse at base, glabrous. Racemes arising through leaf sheaths, 1–3- flowered, 5–15 mm long. Flowers axillary, 6–8.1 × 9–9.2 mm, greenish pink; pedicels 3–5 mm long; bracts triangular, 1.8–2 × 2–2.5 mm, obtuse at apex, sub-truncate at base, glabrous, persistent. Sepals 3, unequal, greenish with brown striations; dorsal sepal oblong-ovate, 3–5 × 2–2.5 mm, obtuse at apex, sub-truncate at base, 1-nerved, glabrous; lateral sepals ovate-lanceolate, 5–6 × 2–2.1 mm, obtuse at apex, sub-truncate at base, 1-nerved, glabrous. Lateral petals linear-oblong, 4.5–6 × 1–1.5 mm, obtuse at apex, sub-truncate at base, glabrous, green. Lips fleshy 3-lobed, rhomboid, greenish yellow with purple at base, glabrous. Spur 0. Column *c.* 3 × 2 mm, greenish purple. Pollinia 2, *c.* 1 × 1 mm. Ovary *c.* 3 × 1.5 mm, elliptic. Capsules elliptic, 2–3 × 0.3–0.5 cm, glabrous.

Distribution: Indian Subcontinent to Myanmar, Andaman Islands to Nicobar Islands (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: December-July.

Specimens examined: Ezhuthupara, near Viripara, 05.12.2018, *Dani Francis & Santhosh Nampy* 168870; Thekkady, Nellikkampetty Range, 14.07.2017, *Dani Francis & Santhosh Nampy* 152861 (CALI); Vandiperiyar, 25.05.1965, *K. Vivekananthan* 24334 (MH).

Malaxis Sol. ex Sw.,

Prodr. Veg. Ind. Occ. 8: 119. 1778.

Malaxis densiflora (A.Rich.) Kuntze, Revis. Gen. Pl. 2: 673. 1891; Abraham & Vatsala, Intr. Orchids 486. 1981. *Liparis densiflora* A.Rich., Ann. Sci. Nat., Bot., ser. 2. 15: 18. 1841. *Microstylis densiflora* (A.Rich.) Alston, Handb. Fl. Ceylon 6: 272. 1931; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1408. 1928. *Seidenfia densiflora* (A.Rich.) Szlach., Fragm. Florist. Geobot., supp. 3: 122. 1995; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 473. 2004. *Microstylis versicolor* Wight, Icon. Pl. Ind. Orient. 3: t. 901. 1844; Hook.f., Fl. Brit. India 5: 691. 1890.

Lithophytic or terrestrial annual herbs, 6–12 cm tall. Pseudobulbs ovate, 3–3.5 × 2–2.5 cm, wrinkled, glabrous, covered with a fibrous sheath. Leaves arising from one side of pseudobulb, ovate, 2–10 × 1.5–4 cm, acute at apex, sheathing at base, entire, 5–7- nerved, glabrous, green with purple veins. Racemes 5–12 cm long, dense. Flowers 5–6 × 5–5.5 mm, purple; pedicels 1.2–1.5 mm long, glabrous, purple; bracts lanceolate, 4–6 × 1–2 mm, acute at apex, truncate at base, entire, 1-nerved, glabrous, purple. Sepals 3; dorsal sepal ovate, 2.5–3 × *c.* 1.5 mm, acute at apex, truncate at base, 1–2-nerved, glabrous, purple; lateral sepals obliquely ovate, 2–2.3 × 1–1.1 mm, deflexed, acute at apex, sub-truncate at base, 1-nerved, glabrous, purple. Lateral petals 2, linear, falcate, 3–3.3 × *c.* 0.1 mm, acute at apex, attenuate at base, margins curved, glabrous, purple. Lips not lobed, laciniate, rhomboid, 2–3 × 2–2.2 mm, dentate apically, with 2 appendages at base, acute at apex, glabrous, purple. Spur 0. Column oblong, *c.* 1.3 × 0.5 mm, glabrous, yellowish purple. Pollinia 4 in 2 groups, obovate, *c.* 0.3 mm long, yellow. Ovary ovate, 2–2.3 mm long; ovules in 3 vertical rows, glabrous, purple.

Distribution: SW. India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: June-September.

Specimens examined: Anamudi slopes, 07.08.1967, *B.V. Shetty* 28331; Lockhert gap, 15.06.1963, *K.M. Sebastine* 16507 (MH); Umayamala, 02.06.2022, *Vishnu Mohan, Harishma K.H. & Ashna Toms* 177106 (CALI); Uppupara, 26.09.1972, *B.D. Sharma* 42008 (MH).

Nervilia Comm. ex Gaudich.,

Voy. Uranie, Bot. 422, t. 35. 1829.

Key to the species

1. Scapes 4–8 cm long; flowers solitary; sepals linear-oblanceolate; lips rhombic ……..... *N. simplex*

1. Scapes 10–12 cm long; flowers 2 or 3; sepals oblong-lanceolate; lips ovate-oblong ……. ……..... *N. plicata*

Nervilia simplex (Thouars.) Schltr., Bot. Jahrb. Syst. 45(3): 401. 1911. *Arethusa simplex* Thouars, Hist. Orchid. t. 24. 1822. *Nervilia monantha* Blatt. & McCann, J. Bombay Nat. Hist. Soc. 35: 724. 1932; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1886. 1928. *Nervilia crociformis* (Zoll. & Moritzi) Seidenf., Dansk Bot. Ark. 32(2): 151. 1978; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 464. 2004.

Terrestrial erect herbs, 2–10 cm long. Tubers sub-globose to ovate, 0.5–2 cm diam., 3–6 noded. Leaves orbicular, cordate, 4–6 × 5–7 cm, rounded at apex, cordate at base, slightly undulate, pubescent, green with fine white reticulation. Scapes 4–8 cm long, 1-flowered. Flowers pink, 2–4 cm across; pedicels *c.* 1 mm long, green; bracts ovate-lanceolate, 0.8–1 × 0.2–0.4 cm, acute at apex, cuneate at base, glabrous. Sepals linear-oblanceolate, 2–2.5 × 1.2–2.5 mm, acute-acuminate at apex, sub-truncate at base, 3-nerved, glabrous, green. Lateral petals linear-oblanceolate, 1.8–2.2 × 1–2 mm, acute at apex, sub-truncate at base, 1-nerved, glabrous, green. Lips 3-lobed, rhombic, 1.5–1.8 × 0.8–1.3 cm, reflexed at apex, white-purple; midlobe truncate, lacerate; lateral lobes oblong, obtuse at apex, entire. Spur 0. Column clavate, 6–8 mm long. Pollinia 2, 0.5–1 mm long. Ovary obovate, 4–5 mm long, glabrous, green.

Distribution: Tropical and Subtropical Old World to SW. Pacific (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: May-June.

Specimen examined: Kalvarimala, *s.d., Jomy Augustine* 13906 (CALI).

Nervilia plicata (Andrews) Schltr., Bot. Jahrb. Syst. 45(3): 403. 1911; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1886. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 464. 2004. *Arethusa plicata* Andrews, Bot. Repos. 5: 321. 1803. *Pogonia plicata* (Andrews)

Lindl., Gen. Sp. Orchid. Pl. 415. 1840; Hook.f., Fl. Brit. India 6: 119. 1890. *Nervilia biflora* (Wight) Schltr., Bot. Jahrb. Syst. 39: 48. 1906; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1459. 1928.

Terrestrial erect herbs. Tubers sub-globose, 1.5 × 2 cm across, white. Leaves orbicular, 6–7 × 5–6 cm, acute at apex, cordate at base, slightly undulate, pubescent, green or purple. Scapes 10–12 cm long, 2 or 3-flowered. Flowers greenish pink, 2–4 cm across; pedicels *c.* 5–7 mm long, greenish; bracts ovate-lanceolate, 4–5 × 1.5–2 mm, acute at apex, sub-truncate at base, glabrous, purplish green. Sepals oblong-lanceolate, 17–20 × 3.5–4 mm, acute at apex, sub-truncate at base, glabrous, greenish purple. Lateral petals oblong-lanceolate, 17–20 × 3.5–4 mm, acute at apex, sub-truncate at base, glabrous, greenish purple. Lips indistinctly lobed, obovate-oblong, *c.* 15 × 10 mm, slightly saccate at base; midlobe oblong-ovate, 5–6 × 5–6 mm, obtuse at apex, narrowly emarginate, faintly crisped and crenulate along margins; lateral lobes very small, obtuse at apex, purple nerved. Spur 0. Column clavate, 10–12 mm long. Pollinia 2, 0.5–1 mm long. Ovary obovate, 2–3 mm long, glabrous, green.

Distribution: Tropical and Subtropical Asia to N. Australia (POWO, 2023); *Habitat*: Moist deciduous forests; *Fl. & Ft.*: August-March.

Specimen examined: Painavu, 20.08.1981*, K. Vivekananthan & V.S. Raju* 71105 (MH).

Oberonia Lindl.,

Gen. Sp. Orchid. Pl. 15. 1830, *nom. cons.*

Key to the species

1. Scapes flattened or two winged laterally ……..…….…….. 2
1. Scapes terete, not winged, often insignificant ……..…….. 5
2. Lateral lobes of lip laterally elongated; disc crescent shaped ……. *O. sebastiana*
2. Lateral lobes of lip longitudinally elongated; disc ovate or concave ……. 3
3. Lips papillose ……..…….. *O. chandrasekharanii*
3. Lips glabrous ……..…….. 4
4. Flowers *c.* 4 mm long; bracts equal or longer than ovary; lateral petals lanceolate-narrowly elliptic; disc concave ……..…….. *O. brunoniana*

4. Flowers 5–5.2 mm long; bracts shorter than ovary; lateral petals linear; disc ovate-lanceolate ..... *O. anamalayana*

5. Plants brownish 6

5. Plants greenish 7

6. Leaves ensiform; spikes *c.* 10 cm long; bracts oblong; lips 3-lobed .....
..... *O. brachystachys*

6. Leaves ovate-oblong; spikes *c.* 7 cm long; bracts sub-orbicular; lips not lobed
.... *O. proudlockii*

7. Leaves not articulate; pedicels 4–5 mm long; dorsal sepal lanceolate .....
..... *O. bicornis*

7. Leaves articulate; pedicels 0.5–1 mm long; dorsal sepal ovate-oblong 8

8. Flowers 2–2.5 mm long; disc indistinct ..... *O. thwaitesii*

8. Flowers 3–4 mm long; disc distinct 9

9. Dorsal sepal ovate; lips ligulate; lateral lobes of lip oblong ..... *O. wightiana*

9. Dorsal sepal oblong; lips not ligulate; lateral lobes of lip rounded or cuneate
..... *O. ensiformis*

Oberonia anamalayana J.Joseph, J. Indian Bot. Soc. 42: 222. 1964; Abraham & Vatsala, Intr. Orchids 425. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 464. 2004.

Epiphytic erect or pendulous herbs. Leaves oblong, 18–20 × 3–4 cm, acute at apex, articulate at base, glabrous, brown. Scapes flattened, *c.* 7 cm long, adnate to uppermost leaf. Spikes up to 40 × 1 cm thick, without any definite sterile tip. Flowers 5–5.2 × 1.8–2 mm across, greenish yellow-brown, in verticils 3.5–4 mm apart; pedicels 0.5–1 mm long; bracts shorter than ovary and pedicel, oblong, 2.5–2.7 × 1–1.2 mm, acute at apex, cuneate at base, irregularly denticulate along margins, gland-dotted. Sepals 3, sub-similar, obtuse at apex, sub-truncate at base, glabrous, reflexed, entire; dorsal sepal oblong, *c.* 2.2 × 0.75 mm; lateral sepals oblong-ovate, *c.* 2.2 × 1 mm. Lateral petals linear, 2–2.2 × 0.2 mm, obtuse at apex, sub-truncate at base, entire and decurved along margins, reflexed, glabrous. Lip 3-lobed, reflexed in flower, ovate, gland-dotted, glabrous; midlobe 2-lobuled; lobules orbicular, shallowly crenate, diverging; sinus shallow with a rounded protuberance; lateral lobes narrow and longitudinally elongated oblong around the disc, shallowly crenate, spreading in flower, not encircling column; disc ovate-

lanceolate, cushion-like. Column cylindric, *c.* 1 × 0.7 mm. Spur 0. Ovary obovate, *c.* 1 × 0.5 mm, glabrous.

Distribution: S. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: January-March.

Specimens examined: Kalvary mount, 26.01.1983, *A.G. Pandurangan* 76637 (MH); Munnar, 12.02.1997, *Stephen Sequiera & Michael* 008169 (KFRI); Nellippara slopes-way to Mlappara, 07.02.1981, *N.C. Nair* 70113; Pachakkanam, 19.03.1973, *B.D. Sharma* 42487 (MH).

Oberonia bicornis Lindl., Gen. Sp. Orchid. Pl. 16. 1830; Hook.f., Fl. Brit. India 5: 682. 1888; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 465. 2004.

Erect or pendulous epiphytes. Leaves linear-oblong, *c.* 6 × 0.5 cm, acute and apiculate at apex, not articulate at base, uppermost one much reduced. Scapes terete, indistinct or *c.* 0.5 cm long. Spikes *c.* 10 cm long. Flowers 1.7–3 × 1–2.2 mm across, orange-red, in verticils,2.5–3 mm apart on the rachis. Pedicels 4–5 mm long; bracts longer than pedicel and ovary, lanceolate, 1.2–3 × 0.2–0.5 mm, acuminate at apex, sub-truncate at base, glabrous. Sepals 3, gland-dotted; dorsal sepal lanceolate, 1–1.5 × 0.2–0.7 mm, acuminate at apex, sub-truncate at base, glabrous; lateral sepals much shorter than dorsal one, obliquely ovate, 0.5–0.7 × 0.5-0.7 mm, sub-acuminate at apex, sub-truncate at base, glabrous. Lateral petals elliptic-linear 0.7–1.2 × *c.* 0.2 mm, acute at apex, sub-truncate at base, glabrous. Lips 3-lobed, 1–1.5 × 0.7–1.2 mm; midlobe broadly cuneate, indistinctly 2-lobuled, gland-dotted; lobules ovate-triangular, acute at apex, curved upwards in flower, with an indistinct or triangular protuberance in between; lateral lobes linear, 0.7–1.2 × 0.1–0.2 mm, acute at apex, arise backward and clasp the column as horns with tips diverging, erect or incurved; disc crescent-shaped, narrow, cushion-like, running to the base of lateral lobes. Spur 0. Column 0.3 × 0.3 mm, semi-globose. Pollinia clavate, yellow. Ovary obovate, *c.* 1.2 mm long.

Distribution: Assam to Bangladesh, S. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: October-December.

Specimen examined: Melmala, Periyar Tiger Reserve, 24.12.1994, *Jomy Augustine & K.P. Rajesh* 14406 (KFRI).

Oberonia brachystachys Lindl., Sert. Orchid. 2. t. 8 B. 1838. *Oberonia brachyphylla* Blatt. & McCann, J. Bombay Nat. Hist. Soc. 35. 257. 1931; Abraham & Vatsala, Intr. Orchids 416. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 465. 2004.

Erect or pendulous epiphytic herbs. Leaves distichous, ensiform, 2–9 × 0.5–1.2 cm, acute at apex, not articulated, glabrous, brown. Scapes terete, up to 0.5 cm long, adnate to reduced uppermost leaf. Spikes slender, *c.* 10 cm long. Flowers 2.8–3 × 0.8–1 mm, orange yellow; pedicels 0.5–1 mm long; bracts oblong, 0.7–1 × 0.5–0.7 mm, obtuse at apex, cuneate at base, glabrous, wavy, gland dotted. Sepals 3, unequal; dorsal sepal ovate, *c.* 0.5 × 0.4, acute at apex, sub-truncate at base, glabrous; lateral sepals obliquely ovate, *c.* 0.7 × 0.5 mm, acute at apex, cuneate at base, glabrous. Lateral petals 2, linear-oblong, 1–1.5 × 0.5–0.7 mm, obtuse at apex, sub-truncate at base, glabrous, orange-red. Lips 3-lobed, *c.* 2 × 1.5 mm; lateral lobes semi-circular; midlobe bilobulate, orbicular, dentate at apex. Spur 0. Column globose, *c.* 0.2 × 0.3 mm. Pollinia 4, *c.* 0.2 mm long, yellow. Ovary obovate, *c.* 1 × 0.5 mm, glabrous.

Distribution: Indian Subcontinent to Peninsula Malaysia (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: November-January.

Specimens examined: Mathikettan Shola National Park, Perattakkalam, 29.12.2014, *Syam Radh S. & Santhosh Nampy* 137887; Thekkady, *s.d.*, *Jomy Augustine & K.P. Rajesh* 14826 (CALI).

Notes: This species shows similarities with *O. proudlockii* King & Pantl. in habit and habitat. However, the latter species have clavate spikes with sunken sessile flowers and orbicular lip whereas *O. brachystachys* has slender spikes, pedicellate flowers, and trilobed lip with a bilobulate midlobe (Joseph & Vajravelu, 1978).

Oberonia brunoniana Wight, Icon. Pl. Ind. Orient. 5. t. 1622. 1851; Hook.f., Fl. Brit. India 5: 681. 1888; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1406. 1928; Abraham & Vatsala, Intr. Orchids 422. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 465. 2004.

Erect or pendulous epiphytic herbs. Leaves distichous, ensiform, 20–25 × 2–2.5 cm, sessile, acute at apex, articulate at base. Scapes flattened, up to 16 cm long, adnate to uppermost leaf. Spikes 16–20 cm long. Flowers *c.* 4 × 2 mm long, yellow; pedicels 2.5–3 mm long; bracts lanceolate-ovate, 2.8–3 × 0.8–1 mm, clawed at apex, attenuate at base, puberulous at margin, light green, equal or longer than

ovary. Sepals 3, ovate, 1–1.3 × 0.8–1 mm, obtuse at apex, truncate at base, not nerved, glabrous. Lateral petals 2, lanceolate-narrowly elliptic, 1–1.3 × 0.1 mm, slightly scabrid along margin, yellow. Lips 3-lobed, *c.* 2.25 mm diam., gland dotted; midlobe 2-lobulate, lobules diverging, sinus broad, disc concave; lateral lobes longitudinally elongated, oblong, sub-entire. Spur 0. Column *c.* 1 × 1.8 mm, hairy at tip, deep orange-brown. Pollinia 2, *c.* 2.5 mm long, yellow. Ovary twisted, *c.* 1 cm long; ovules in 3 vertical rows, pilose, light green. Capsules elliptic, *c.* 4 × 2 mm.

Distribution: SW. India and Assam to N. Bangladesh (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: November-December.

Specimens examined: Choondal, 23.11.2014, *Syam Radh S. & Santhosh Nampy* 137854; way to Kanketty, Mankulam, 20.12.2019, *Dani Francis & Santhosh Nampy* 164802; Mathikettan shola National Park, 11.12.2016, *Dani Francis & Santhosh Nampy* 151401; *Ibid.*, 06.01.2017, *Dani Francis & Santhosh Nampy* 151624; Peermedu, 10.12.1970, *Sivadasan M.* 584 (CALI).

Oberonia chandrasekharanii V.J.Nair, V.S.Ramach. & R.Ansari, Blumea 28: 361. 1983; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 465. 2004.

Pendulous, epiphytic herbs. Leaves distichous, ensiform, 10–15 × 1.3–1.5 cm, acute at apex, articulate at base, glabrous, green. Scape flattened, *c.* 9 cm long. Spikes *c.* 25 cm long, pendulous. Flowers 2–4 × 1–2 mm, pale greenish yellow; pedicels 1.9–2 mm long; bracts ovate-lanceolate, 2–3 × 1–1.2 mm, narrowly acute at apex, attenuate at base, puberulous, crenate. Sepals 3, ovate-oblong, 0.9–1 × 0.6–1 mm, obtuse at apex, truncate at base, glabrous. Lateral petals 2, linear, 1.2–1.4 × 0.2–0.5 mm, obtuse at apex, truncate at base, slightly scabrous at margins, glabrous, reflexed. Lips 3-lobed, semi-orbicular or reniform, 1–2 × 1.8–2 mm, papillose, gland dotted; midlobe 2-lobulate, *c.* 0.5 × 0.7 mm, sinus broad; lateral longitudinally elongated, lobes cuneate, folded upwards and encircle the column; disc ovate. Spur 0. Column cylindric, *c.* 0.5 × 0.4 mm. Pollinia 2, obovate, *c.* 0.3 × 0.1 mm. Ovary obovate, *c.* 2 mm long. Capsules elliptic, *c.* 4 × 2 mm.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: June-February.

Specimens examined: Edathattu, Mankulam, 13.09.2018, *Dani Francis & Santhosh Nampy* 159486 (CALI); Elavathuruthu, Periyar Tiger Reserve, 08.12.1994, *N. Sasidharan & Jomy Augustine* 14287 (KFRI); Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154372; way to Kanketty, Mankulam, 20.12.2019, *Dani Francis & Santhosh Nampy* 164824 (CALI); Meenmutty, 13.02.1982, *C.N. Mohanan* 73206 (MH); Murukanmukku, Nallathanni Kallar, 11.06.2018, *Dani Francis & Santhosh Nampy* 159318 (CALI); midway, Painavu-Kulamavu, 21.08.1981, *K. Vivekananthan & V.S. Raju* 71135 (MH); on the way to Painav, 06.09.2017, *Dani Francis & Santhosh Nampy* 154398 (CALI); Peermade, 26.09.1964, *K. Vivekananthan* 21417 (MH).

Notes: *Oberonia chandrasekharanii* is closely related to *O. sebastiana* B.V.Shetty & Vivek., but differs by its reniform, pubescent lip with an ovate disc, ear shaped lateral lobes and the orbicular lobules of midlobe (Nair *et al.*, 1983).

Oberonia ensiformis (Sm.) Lindl., Fol. Orchid. 8: 4. 1859; Hook.f., Fl. Brit. India 5: 679. 1888; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1406. 1928; Abraham & Vatsala, Intr. Orchids 419. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 709. 1996. *Malaxis ensiformis* Sm., in A.Rees, Cycl. 22: n°. 14. 1812.

Epiphytic annual pendulous herbs. Leaves distichous, ensiform, 3–25 × 1–1.5 cm, acute at apex, articulate at base, glabrous, pale green. Scapes terete, up to 10 cm long. Spikes *c.* 10 cm long. Flowers pendulous, 3–4 × 1.5 mm, pale or brownish yellow; pedicels *c.* 1 mm long; bracts longer than pedicel and ovary, oblong-ovate, 2.5–3.5 × 1.3–1.5 mm, acuminate at apex, cuneate at base, glabrous, denticulate. Sepals 3, gland dotted; dorsal sepal ovate, 1.2–1.5 × 0.7–1 mm, acute at apex, cuneate at base, glabrous; lateral sepals ovate, 1–1.5 × 1–1.2 mm, acute at apex, cuneate at base, glabrous. Lateral petals 2, linear-oblong, 1.2–1.5 × 0.5–0.7 mm, obtuse at apex, sub-truncate at base, papillate, yellowish-green. Lips 3-lobed, quadrate, 1.7–2 × 1.5–2 mm, gland dotted; midlobe obreniform, bifid; lateral lobes rounded or cuneate; disc with two rounded calli laterally at base and a median longitudinal groove. Spur 0. Column sub-globose, *c.* 0.3 × 0.5 mm, Pollinia 2, oblong, *c.* 0.2 × 0.1 mm, yellow. Ovary obovate, *c.* 1 × 0.5 mm, glabrous.

Distribution: Indian Subcontinent to China (POWO, 2022); *Habitat*: Shola forests; *Fl. & Ft.*: July-March.

Specimens examined: Kanchiar, 29.12.1983, *A.G. Pandurangan* 62577 (MH); Mathikettan Shola National Park, Sivanpara, 23.08.2014, *Syam Radh S. & Santhosh Nampy* 143536 (CALI); Mullakkudy, 14.03.1973, *B.D. Sharma* 43857 (MH).

Oberonia proudlockii King & Prantl., J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 66: 580. 1897; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1406. 1928; Abraham & Vatsala, Intr. Orchids 422. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 466. 2004.

Erect or pendulous epiphytes. Leaves ovate-oblong, 2–2.5 × 0.8–1 cm, acute at apex, not articulate at base, glabrous, brown. Scapes terete, *c.* 2 cm long. Spike *c.* 7 cm long. Flowers *c.* 1 × 0.7 mm, pale or greenish yellow, scattered and adpressed to rachis giving the spike a fleshy appearance; pedicels *c.* 2 mm long; bracts longer than ovary and pedicel, sub-orbicular, *c.* 0.7 × 0.7 mm, obtuse at apex, sub-truncate at base, lacerate, gland-dotted. Sepals 0.6–0.7 × 0.4–0.5 mm, glabrous; dorsal sepal ovate, acute at apex, reflexed in flower; lateral sepals obliquely ovate, acuminate at apex, not reflexed. Lateral petals linear-oblong, 0.5–0.7 × 0.1–0.2 mm, acute at apex, sub-truncate at base, erect in flower, glabrous. Lips antrorse, not lobed, sub-orbicular 0.6–0.7 × 0.6–0.7 mm, with rounded or triangular protuberances at apex, irregularly denticulate, gland-dotted; disc sub-orbicular to obovate, cushion-like. Column c. 0.1 × 0.3 mm. Pollinia 2, ovoid, *c.* 0.1 × 0.1 mm. Ovary obovate, 1.2–1.5 mm long.

Distribution: S. and NE. India (POWO, 2023); *Habitat*: Moist deciduous forests; *Fl. & Ft.*: September-February.

Specimen examined: Thannikkudy, Periyar Tiger Reserve, 02.10.1995, *Jomy Augustine* 16864 (KFRI).

Oberonia sebastiana B.V.Shetty & Vivek., Bull. Bot. Surv. India 17: 157. 1978; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 467. 2004. **Fig. 13A**

Epiphytic pendulous herbs, *c.* 35 cm long. Leaves distichous, 2–20 × 0.9–1.5 cm, ensiform, acute to sub-acuminate at apex, articulate at base, glabrous, green. Scapes flattened, up to 10 cm long, adnate to reduced uppermost leaf. Spikes 17–32 cm long, pendulous. Flowers 2–2.5 × 1–1.7 mm long, yellow, sub-verticillate; pedicels *c.* 1 mm long; bracts ovate, 1.3–1.5 × 0.8–1 mm, sub-acuminate at apex,

cuneate at base, denticulate, glabrous. Sepals 3; dorsal sepal oblong, 2–2.1 × 1.3–1.5 mm, obtuse at apex, truncate at base, glabrous; lateral sepals ovate, 1.5–1.7 × 1.3–1.5 mm, obtuse at apex, truncate at base, glabrous. Lateral petals 2, 1–1.4 × 0.2–0.4 mm, oblong, obtuse at apex, sub-truncate at base, glabrous. Lips 3-lobed, 0.8–1.2 × 1.4–2.2 mm, gland dotted, glabrous; midlobe 2-lobulate, obovate-cuneate, sinus broad; lateral lobes laterally elongated, oblong-obovate, *c.* 0.7 × 0.6 mm; disc crescent shaped. Spur 0. Column obovate, *c.* 0.3 × 0.4 mm. Pollinia 2, obovate, *c.* 0.2 × 0.1 mm. Ovary obovate, 1.2–1.5 mm long. Capsules obovate, 3.5–4.5 mm long, glabrous.

Distribution: S. India (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: October-January.

Specimens examined: Anamudi peak, 11.12.2019, *Dani Francis & Santhosh Nampy* 164553; way to Anamudi base camp, 10.12.2019, *Dani Francis & Santhosh Nampy* 170022 (CALI); Dhanas valley, upper Vaguvarai, 16.10.1989, *P. Bhargavan* 90959; Kulamavu, 14.12.1982, *C.N. Mohanan* 76084-A (MH); Mesthirikettu, Lakkam, Vaguvarai, 30.12.2017, *Dani Francis & Santhosh Nampy* 158061; Nyamakkad, 8th mile, 24.01.2017, *Dani Francis & Santhosh Nampy* 158164; Waterfalls near Rhodovalley, Silent valley, 22.11.2018, *Dani Francis & Santhosh Nampy* 168815 (CALI).

Notes: This species is closely allied to *O. wightiana* Lindl., but differs in having longer inflorescence with a scape flattened and adnate to the upper leaf and the lip much broader than long with two larger wings like lateral lobes and a small 2-lobuled midlobe (Shetty & Vivekananthan, 1975).

Oberonia thwaitesii Hook.f., Fl. Brit. India 5(15): 678. 1888; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 467. 2004.

Epiphytic erect or pendulous herbs. Leaves distichous, 2.5–10 × 0.5–1 cm, oblong-ensiform, acute at apex, articulate at base, glabrous, green. Scapes indistinct. Spikes 15–23 cm long. Flowers 2–2.5 × 1–1.5 mm long, pale orange-yellow; pedicels 0.5–1 mm long; bracts slightly longer than ovary and pedicel, oblong, 1.7–2 × 0.7–1 mm, acute at apex, cuneate at base, denticulate, glabrous. Sepals 3,

unequal; dorsal sepal ovate, 0.7–1 × 0.3–0.5, acute at apex, cuneate at base, glabrous; lateral sepals obliquely ovate, 0.7–1 × 0.7–1 mm, acute at apex, cuneate at base, glabrous. Lateral petals 2, ovate, *c.* 0.7 × 0.5 mm, obtuse at apex, sub-truncate at base, glabrous. Lips 3-lobed, cuneiform-obcordate, *c.* 1.5 × 1.2 mm, gland dotted, glabrous; midlobe 2-lobulate, oblong, denticulate, sinus obtuse; lateral lobes orbicular, folded upwards, not encircle the column; disc indistinct. Spur 0. Column sub-globose, *c.* 0.3 × 0.4 mm. Pollinia 2, obovate, 0.1–0.2 mm long, yellow. Ovary obovate, *c.* 1 mm long, glabrous.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Moist deciduous forests; *Fl. & Ft.*: June-September.

Specimen examined: Koruthode, 20.09.1994, *Jomy Augustine* 14110 (CALI).

Notes: *Oberonia thwaitesii* is allied to *O. verticillata* Wight, but can be easily distinguished from the latter by a 3-lobed, cuneiform-obcordate lip, small, orbicular, lateral lobes extend beyond the column and the 2-lobulate midlobe with an obtuse sinus in between (Manilal & Kumar, 1984).

Oberonia wightiana Lindl., Edwards's Bot. Reg. 25(Misc.): 14. 1839; Hook.f., Fl. Brit. India 5: 683. 1888; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1407. 1928; K.M.Matthew, Illustr. Fl. Palni Hills 711. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 467. 2004.

Epiphytic pendulous herbs, 4–14 cm long. Leaves distichous, oblong-ensiform, 1.5–10 × 0.4–1 cm, acute at apex, articulate at base, glabrous, green. Scapes terete, up to 4.5 cm long. Spikes 3–15 cm long. Flowers 3–3.5 × 1–1.5 mm, pale orange-yellow; pedicels 1 mm long; bracts ovate-lanceolate, 1.5–1.7 × 0.7–0.9 mm, acute at apex, attenuate at base, glabrous. Sepals 3, sub-equal, 0.7–1 × 0.4–0.5 mm; dorsal sepal oblong, obtuse at apex, sub-truncate at base, glabrous; lateral sepals ovate-oblong, sub-acute at apex, sub-truncate at base, glabrous. Lateral petals 2, linear-oblong, 0.7–1 × 0.1–0.2 mm, obtuse at apex, sub-truncate at base, glabrous. Lips 3-lobed, quadrate, 0.5–1.5 × 1–2 mm, gland dotted, glabrous; midlobe 2-lobulate, ligulate, oblique or variously toothed at apex; lateral lobes oblong-ligulate, rounded at apex, folded upwards and round the column; disc ovate. Spur

0. Column cylindric, *c.* 0.4 × 0.3 mm. Pollinia 2, obovate, *c.* 0.1 × 0.1 mm. Ovary obovate, *c.* 1.2 mm long.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: August-February.

Specimens examined: Anamudi slope-Rajamala side, 06.02.1970, *B.V. Shetty* 33426 (MH); Meesapulimala, 15.10.2019, *Dani Francis & Santhosh Nampy* 170394 (CALI).

Pachystoma Blume,

Bijdr. Fl. Ned. Ind. 8: 376. 1825.

Pachystoma pubescens Blume, Bijdr. Fl. Ned. Ind. 8: 376. 1825. *Pachystoma senile* Rchb.f., Bonplandia 3: 251. 1855; Hook.f., Fl. Brit. India 5: 812. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1426. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 468. 2004.

Terrestrial herbs with underground tubers, 20–25 cm long. Stems terete, pubescent. Leaves linear, 12–18 × 1–1.5 cm, acute at apex, attenuate at base, dry upon flowering, glabrous. Racemes terminal, 5–13-flowered, 20–23 cm long. Flowers *c.* 2 × 0.8 cm, glandular hairy, pale purple; pedicels 2–3 mm long, glandular hairy; bracts lanceolate, 1.2–2.5 × 0.2–0.3 cm, acuminate at apex, clasping to base, 6-nerved, puberulous-glabrous. Sepals 3, glandular hairy; dorsal sepal oblong-obovate, 1.1–1.4 × 0.3–0.5 cm, obtuse at apex, sub-truncate at base, 5-nerved, purple; lateral sepals falcate, lanceolate, 1.1–1.3 × 0.3–0.4 cm, obtuse and mucronate at apex, sub-saccate at base, 5-nerved, purple. Lateral petals 2, oblanceolate, 1.1–1.2 × *c.* 0.2 cm, obtuse at apex, sub-truncate at base, pubescent, pale purple. Lips 3-lobed, 1–1.2 × 0.5–0.7 cm; midlobe ovate with 5 lines of corrugated yellow patches; lateral lobes triangular, obtuse at apex. Spur very short. Column *c.* 6 mm long, puberulous. Pollinia 8. Ovary oblanceolate, *c.* 5 × 2 mm, glandular hairy.

Distribution: Tropical and Subtropical Asia to New Caledonia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: January-March.

Specimens examined: Kumarikulam, 03.01.1994, *Jomy Augustine* 13116 (CALI); Uppupara, 18.03.1973, *B.D. Sharma* 43912 (MH).

Papilionanthe Schltr.,

Orchis 9. 78. 1915.

Papilionanthe cylindrica (Lindl.) Seidenf., Descr. Epidendrorum J.G.König 33. 1995; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 468. 2004. *Aerides cylindrica* Lindl., Gen. Sp. Orchid. Pl. 240. 1833; Hook.f., Fl. Brit. India 6: 44. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1442. 1928. **Fig. 13C**

Epiphytic herbs, 33–45 cm tall. Stems terete, acute at apex, glabrous. Leaves terete, 6–8 cm long. Inflorescence solitary or simple cymes, 3–4 cm long. Flowers 1–3, *c.* 4 × 3 cm; pedicels 1–1.8 mm long; bracts widely ovate, 4–5 × 3–4 mm, rounded at apex, truncate at base, slightly crenulate, 5-nerved, glabrous, fleshy, dark brown, smaller than ovary. Sepals 3; dorsal sepal elliptic, 1.2–1.4 × 0.5–0.7 cm, slightly emarginate at apex, truncate at base, 9-nerved, glabrous, white with dark pink shade; lateral sepals ovate, 1.4–1.5 × 0.8 cm, obtuse at apex, little projecting outwards and form a well like appearance, truncate at base, 8–9-nerved, glabrous, white with dark pink. Lateral petals 2, ovate, 1–1.2 × 0.6–0.8 cm, rounded at apex, truncate at base, glabrous, 8-nerved, white with light pink. Lips 3-lobed; midlobe very thick, oblong, *c.* 7 × 3 mm, obtuse at apex, glabrous, yellow with pink striations, with 2 lateral flaps; lateral lobes widely elliptic-orbicular, *c.* 1 × 0.7 cm, rounded at apex, 8-nerved, glabrous, white with pink striations. Spur conical, 7–8 mm long. Column *c.* 5 mm long, sometimes divided into 3 lobes, 2 lateral lobes and a midlanceolate lobe. Pollinia 2, orbicular, *c.* 2 × 2 mm, glabrous, light yellow. Ovary twisted, *c.* 6 mm long; ovules in 3 vertical rows, glabrous, light green with purple.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Shola forests and open land; *Fl. & Ft.*: December-June.

Specimens examined: Anakkara, 8th mile, 03.04.2018, *Dani Francis & Santhosh Nampy* 158405; Mannakudi, 06.01.2017, *Dani Francis & Santhosh Nampy* 151632 (CALI); Olikkudy, Chinnar Wildlife Sanctuary, 01.03.1996, *N. Sasidharan & K.K. Sajeev* 17255 (KFRI); Puliyanmala, 25.12.1983, *A.G. Pandurangan* 66487 (MH); Rajamala, Munnar, 28.01.1994, *Mukthesh Kumar & Stephen Sequiera* 7237 (KFRI); Rajapparamedu, Santhanpara, 10.02.2017, *Dani Francis & Santhosh Nampy* 151693 (CALI).

Pecteilis Raf.,

Fl. Tellur. 2: 37. 1837.

Pecteilis gigantea (Sm.) Raf., Fl. Tellur. 2: 38. 1837; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 468. 2004. *Orchis gigantea* Sm., Exot. Bot. 2: 79. 1806. *Habeneria susannae auct*. Hook.f., Fl. Brit. India 6: 137. 1890 *non* R.Br., 1810.

Terrestrial tuberous herbs. Tubers 1 or 2, terete, 5–6.5 × 1.5–2.5 cm, thick. Stems erect, terete, 20–60 cm long, glabrous, pale green. Leaves elliptic-ovate, 4–16 × 2–7 cm, acute to acuminate at apex, sheathing at base, sessile, glabrous. Racemes terminal, densely 2-6-flowered; peduncle 20–35 cm long, pale green. Flowers 6–10 cm across, white, strongly fragrant, spreading, resupinate; pedicels 2–3 cm long; bracts lanceolate, 5–10 × 1 .5–3 cm, acuminate at apex, sub-truncate at base, glabrous, green. Sepals 3, glabrous, white; dorsal sepal rhomboidal, 4–5.5 × 3–3.5 mm, obtuse at apex, deflexed; lateral sepals sub-quadrately oblong, 3.5–4.5 × 2–2.5 mm, obtuse at apex, narrowly oblique at base. Petals linear falcate, 3–4 cm long, obtuse at apex, incurved, approaching to length of dorsal sepal. Lips 3-lobed, *c*. 5 × 10 cm, white; midlobe approximately equal to side lobe, deeply laciniate; side-lobes split up in 10–16 thin, long, linear-filiform, segments, forming obtuse angle with ovary. Spur 9–14 cm long, spur stretched backward, conical, terete, sub-acute with a broad mouth. Column *c.* 12 × 10 mm, white. Pollinia 5–8 × 1–1.5 mm, bright yellow; caudicle 5–7 mm long, curved above. Ovary fusiform, constricted in distal third, strongly ribbed. Capsules obovate, 4–5 × 1–1.3 cm, beaked above.

Distribution: Indian Subcontinent to Myanmar (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-October.

Specimens examined: Kulamavu, 10.10.1982, *C.N. Mohanan* 74538; *Ibid*., 03.10.1983, *C.N. Mohanan* 79955; *Ibid*., 20.08.1977, *K. Vivekananthan* 50445; Meenmutty, 24.09.1984, *C.N. Mohanan* 80161; Uppupara, 26.09.1972, *B.D. Sharma* 41699 (MH).

Peristylus Blume,

Bijdr. Fl. Ned. Ind. 8: 404. 1825, *nom. cons*.

Key to the species

1. Lateral lobes of lip curved upwards; spur clavate …….…….. 2

1. Lateral lobes of lip not curved upwards; spur fusiform or globose ……..... 3

2. Lateral petals elliptic, forming a hood with dorsal sepal; midlobe of lip oblong ……..…….. *P. densus*

2. Lateral petals ovate, not forming a hood with dorsal sepal; midlobe of lip conical ……. ……..…….. *P. richardianus*

3. Inflorescence a raceme; bracts widely ovate; dorsal sepal elliptic; spur fusiform ……..…….....…….. *P. aristatus*

3. Inflorescence a spike; bracts lanceolate; dorsal sepal broadly ovate or lanceolate; spur globose ……..…….....…….. 4

4. Tubers creeping, terete; leaves elliptic-ovate; spikes not twisted; flowers white-cream ……..…….. *P. goodyeroides*

4. Tubers not creeping, oblong; leaves linear-lanceolate; spikes twisted; flowers green or greenish yellow ……..…….. *P. spiralis*

Peristylus aristatus Lindl., Gen. Sp. Orchid. Pl. 300. 1835; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1474. 1928; Abraham & Vatsala, Intr. Orchids 246. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 468. 2004. *Habenaria aristata* (Lindl.) Hook.f., Syst. Cat. Fl. Pl. Ceylon 91. 1885; Hook.f., Fl. Brit. India 6: 158. 1890. **Fig. 13D**

Terrestrial herbs with tuberous roots, 25–35 cm long. Tubers ovoid-fusiform, 1–2 × 0.5 cm, wrinkled. Stems terete, glabrous, greenish. Leaves elliptic, 3–7.5 × 1.5–2 cm, obtuse-sub-acute at apex, attenuate at base, entire, green, glabrous. Racemes 15–30 cm long. Flowers 1–2 cm long, green; pedicels *c.* 2 mm long; bracts widely ovate, *c.* 3.1 × 3 mm, cuspidate at apex, truncate at base, entire, 1-nerved, glabrous, green. Sepals 3; dorsal sepal elliptic, *c.* 4.5 × 2 mm, obtuse at apex, cuneate at base, glabrous, green; lateral sepals elliptic, *c.* 3.5 × 1–1.5 mm, sub-rounded at apex, cuneate at base, 1-nerved, glabrous, light green. Lateral petals obovate-elliptic, *c.* 2.5 × 2 mm, apex obtuse, slightly emarginate, cuneate at base, 1-nerved, glabrous,

white. Lips 3-lobed; midlobe ensiform-lanceolate, *c.* 2 × 0.7 mm; lateral lobes linear, *c.* 7 × 0.5 mm, rounded at apex, glabrous, white. Spur fusiform, *c.* 3.1 × 2 mm, blunt-emarginate at apex. Column obovate, *c.* 1.5 × 1.5 mm, glabrous. Pollinia 2, pyriform, *c.* 2 mm long, with 2 caudicles, yellow. Ovary *c.* 2 mm long; ovules many, in 3 vertical rows, glabrous, green. Capsules elliptic, *c.* 1 × 2 mm, glabrous, green.

Distribution: Indian Subcontinent to Myanmar (POWO, 2023); *Habitat*: Evergreen forests and grasslands; *Fl. & Ft.*: July-November.

Specimens examined: Eravikulam, near range office, 29.09.2017, *Dani Francis & Santhosh Nampy* 156306; way to Edathattu, Mankulam, 13.09.2018, *Dani Francis & Santhosh Nampy* 159499 (CALI); Kulamavu, 03.10.1983, *C.N. Mohanan* 79961; *Ibid.,* 23.09.1984, *C.N. Mohanan* 28350; Umayamala, 09.08.1967, *B.V. Shetty* 28350 (MH).

Peristylus densus (Lindl.) Santapau & Kapadia, J. Bombay Nat. Hist. Soc. 57: 128. 1960; Abraham & Vatsala, Intr. Orchids 243. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 468. 2004. *Coeloglossum densum* Lindl., Gen. Sp. Orchid. Pl. 302. 1835. *Habenaria stenostachya* (Lindl. ex Benth.) Benth., Fl. Hongk. 362. 1861; Hook.f., Fl. Brit. India 6: 159. 1890. *Peristylus stenostachyus* (Lindl. ex Benth.) Kraenzl., Orchid. Gen. et Sp. 1: 502. 1898; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1474. 1928.

Terrestrial herbs with tuberous roots, 11–17 cm long. Tubers ovoid-fusiform, *c.* 1 × 0.5 cm, wrinkled. Stems terete, glabrous, green. Leaves elliptic, 2–4 × 0.2–0.6 cm, acute at apex, attenuate at base, entire, green, glabrous. Racemes 7–13 cm long. Flowers 3–6 mm long, greenish yellow; pedicels, 1–2 mm long; bracts lanceolate, 3–5 × 0.5–1 mm, cuspidate at apex, truncate at base, entire, 1-nerved, glabrous, green. Sepals 3, obtuse at apex; dorsal sepal oblong-elliptic, 3–5 × 1.5–2 mm, cuneate at base, glabrous, green; lateral sepals oblong-elliptic, 3–5 × 1–1.6 mm, fused at base, 1-nerved, glabrous, greenish yellow, curved. Lateral petals elliptic, forming a hood with dorsal sepal, 3.5–5.2 × 1.3–2 mm, obtuse at apex, cuneate at base, 3-nerved, glabrous, greenish yellow. Lips 3-lobed, 4–6 mm, midlobe oblong, 2–3 × 1–1.5 mm, obtuse at apex; lateral lobes linear, curved upwards, 4–6 × 0.4–1 mm, obtuse at apex, glabrous, greenish yellow. Spur cylindrical, clavate, 2.5–3.5 mm long, blunt at apex. Column obovate, *c.* 1 × 1 mm, glabrous. Pollinia 2, pyriform,

c. 2 mm long, with 2 caudicles, yellow. Ovary 2–5 mm long; ovules many, in 3 vertical rows, glabrous, green.

Distribution: Indian Subcontinent to S. China, S. Korea, S. Central & S. Japan to Nansei-shoto (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-November.

Specimens examined: Kulamavu, 03.10.1983, *C.N. Mohanan* 79964; Kuttikkanam, Peermade, 21.09.1964, *K. Vivekananthan* 20351; Uppupara, 26.09.1972, *B.D. Sharma* 41692 (MH); Vakavanm, 14.09.2019, *Dani Francis & Santhosh Nampy* 170294 (CALI).

Peristylus goodyeroides (D.Don) Lindl., Gen. Sp. Orchid. Pl. 299. 1835; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1475. 1928; Abraham & Vatsala, Intr. Orchids 249. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 686. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 469. 2004. *Habenaria goodyeroides* D.Don, Prodr. Fl. Nepal 25. 1825; Hook.f., Fl. Brit. India 6: 161. 1890.

Terrestrial tuberous herbs, 30–80 cm tall. Tubers creeping, terete, 4–5 × 1.5–2.5 cm, pale green. Stems erect, terete, glabrous, pale green. Leaves clustered, elliptic-ovate, 3–7, 5–12.5 × 2–6.5 cm, acute at apex, sheathing at base, glabrous, dark green. Inflorescence a terminal spike, densely to sub-densely many flowered, glabrous. Flowers 5–8 × 0.8–1 cm, white-cream, resupinate; bracts lanceolate, 1–1.7 × 0.2-0.4 cm, acuminate at apex, sub-truncate at base, glabrous, green. Sepals 3, tinged brown, glabrous; dorsal sepal broadly ovate-lanceolate, 3–5.5 × 1–2 mm, apiculate at apex, forming hood with petals; lateral sepals oblong, 4–6 × 1–2 mm, apiculate at apex. Lateral petals rhombic, 3–4.5 × 3–4.5 mm, obtuse at apex, cuneate at base, glabrous. Lips 3-lobed, broadly triangular to sub-quadrate, broadly quadrate at base, spurred; midlobe oblong, tapering to obtuse apex; lateral lobes linear-oblong, *c.* 2 mm long, falcate. Spur 1.8–2 × 1.8-2 mm, globose, saccate. Column broad, 2–2.5 mm long. Pollinia 2, clavate; caudicles small. Ovary 6–7 mm long, twisted, ribbed.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Grasslands and forest margins; *Fl. & Ft.*: August-November.
Specimen examined: Okkrai, Thekkady, 29.09.1972, *B.D. Sharma* 42361 (MH).

Peristylus richardianus Wight, Icon. Pl. Ind. Orient. 5: t. 1697. 1851; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1474. 1928; Abraham & Vatsala, Intr. Orchids 246. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 688. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 469. 2004. *Habenaria bicornuta* Hook.f., Fl. Brit. India 6: 156. 1890.

Terrestrial tuberous herbs, 20–35 cm long. Tubers 2, ovoid-fusiform, 1–1.2 × 0.5–1 cm, wrinkled. Stems terete, glabrous, green. Leaves elliptic, 3–4 × 0.3–0.6 cm, acuminate at apex, attenuate at base, entire, green, glabrous. Racemes 7–15 cm long. Flowers *c.* 1.2 × 0.5 cm, greenish yellow; pedicels 1–3 mm long; bracts lanceolate, 5–7 × 2–3 mm, acuminate at apex, truncate at base, entire, 3-nerved, glabrous, green. Sepals 3; dorsal sepal oblong, 4–5 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, greenish yellow; lateral sepals lanceolate, 3–4 × 1–1.5 mm, obtuse at apex, cuneate at base, 1-nerved, glabrous, greenish yellow, curved. Lateral petals ovate, 3.5–4 × 1.5–2 mm, obtuse at apex, cuneate at base, 1-nerved, glabrous, greenish yellow. Lips 3-lobed, clawed towards base; midlobe conical, *c.* 2.5 × 1 mm, obtuse at apex, slightly reflexed; lateral lobes horn-like, filiform, curved upwards, *c.* 5 mm long, glabrous, greenish yellow. Spur clavate, *c.* 4 mm long, blunt at apex. Column obovate, *c.* 1 mm long, glabrous. Pollinia 2, pyriform, *c.* 2 mm long, with 2 caudicles, yellow. Ovary 6–8 × 2–3 mm, ovules many, in 3 vertical rows, glabrous, green.

Distribution: E. Nepal to Assam and S. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-November.

Specimens examined: Eravikulam, 29.11.1979, *Nambiar* 1108 (KFRI); Lakshmi estate, Munnar, 12.09.1968, *D.B. Deb* 30783 (MH); Munnar, Silent valley, Waterfalls near Rhodovalley, 22.11.2018, *Dani Francis & Santhosh Nampy* 186647 (CALI).

Peristylus spiralis A.Rich., Ann. Sci. Nat., Bot., Ser 2. 15: 69. 1841; Hook.f., Fl. Brit. India 6: 159. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1474. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 469. 2004.

Terrestrial tuberous herbs, 20–45 cm tall. Tubers 1 or 2, oblong, 1–2 × 0.5–0.8 cm. Stems erect, terete, pale-green, glabrous with large sterile bracts at base. Leaves 3 or 4, linear-lanceolate, 2–6 × 0.5–1 cm, acute at apex, sheathing at base, glabrous, dark green. Inflorescence a terminal spike, slender, lax-many flowered, twisted.

Flowers 0.5–1.5 cm long, resupinate, green or greenish-yellow, spirally twisted; pedicels 2–3 mm long; bracts lanceolate, 7–9 × 2–3 mm, acuminate at apex, sub-truncate at base, pubescent out, pale green. Sepals 3, glabrous, greenish-yellow; dorsal sepal lanceolate, 4–5 × 1–2 mm, obtuse at apex, cuneate at base, sparsely gland-dotted; lateral sepals falcate, 2–4 mm long, sub-acute at apex, cuneate at base. Lateral petals lanceolate, 3–4 × 1–1.5 mm, sub-acute at apex, slightly oblique at base, ligulate. Lips 3-lobed, 2–4 × 2–3 mm, as long as sepals, deflexed, fleshy; midlobe broader than side lobe; side lobes, linear, more or less spreading, rounded at apex. Spur globose, 1.3–1.5 mm long. Pollinia 2, pyriform; caudicle short. Ovary 5–6 × 2–3 mm; ovules many, in 3 vertical rows, glabrous, green.

Distribution: SW. India and Sri Lanka (POWO, 2023); *Habitat*: forest margins; *Fl. & Ft.*: July-October.

Specimen examined: Kulamavu, 08.10.1982, *C.N. Mohanan* 74522 (MH).

Pinalia Lindl.,

Orchid. Scelet. 14, 21, 23, t. 71. 1826.

Key to the species

1. Leaves petiolate; racemes drooping; capsules obpyriform …….. *P. mysorensis*

1. Leaves sessile; racemes erect or slightly arching; capsules elliptic-oblong …….. *P. polystachya*

Pinalia mysorensis (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679. 1891. *Eria mysorensis* Lindl., J. Proc. Linn. Soc., Bot. 3: 54. 1858; Abraham & Vatsala, Intr. Orchids 380. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 455. 2004. *Eria pubescens* Wight, Icon. Pl. Ind. Orient. 5(1): t. 1634. 1851, *nom. illeg.*; Hook.f., Fl. Brit. India 5: 793. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1425. 1928.

Epiphytic herbs. Pseudobulbs crowded, ovate to lanceolate, 1.5–6 × 0.8–2 cm, becomes purplish brown and wrinkled on maturity, sheathing. Leaves 3–5, oblanceolate-elliptic, 5.5–20 × 0.8–2.5 cm, acute-acuminate at apex, base sheathing, articulate, narrowed in to a short, channeled petiole. Racemes 2, axillary from lower leaves, *c.* 10 cm long, lax to sub-densely 10-many flowered, drooping. Flowers 1.3–2 cm long, creamy-white, tipped with pink. Pedicel 6–8 cm

long; bracts ovate-lanceolate, 8–12 × 3–4 mm, acuminate at apex, sub-truncate at base, glabrous, reflexed, glabrous, greenish brown. Sepals 3; dorsal sepal oblong-lanceolate, 9–15 × 2–3 mm, obtuse at apex, sub-truncate at base, glabrous; lateral sepals lanceolate-falcate, 7–12 × 3.5–5 mm, acuminate at apex, broad and fused at base, glabrous. Lateral petals narrowly elliptic, falcate, 9–11 × 2–3 mm, acute at apex, sub-truncate at base, glabrous. Lips sub-cordate to panduriform in outline, 7–8 × 3–4 mm, obscurely 3-lobed, minutely clawed at base, purple blotches at base, yellow at apical portion; midlobe sub-cordate, 2.5–3 mm long, obtuse-apiculate at apex, reflexed, irregularly crenulate to undulate; lateral lobes narrowly lanceolate, falcate, *c.* 4 mm long, obtuse at apex. Column 2.5–4 mm long, erect, with two auricular wings below apex. Pollinia 8, pyriform, yellow, in 2-groups of 4. Ovary 1–1.2 cm long, curved, ridged. Capsules obpyriform, 3–3.5 cm long.

Distribution: S. India (POWO, 2023); *Habitat*: Semi-evergreen, shola forests; *Fl. & Ft.*: July-February.

Specimens examined: Painavu-Kulamavu, 27.08.1981, *V.S. Raju* 71191 (MH); Rajamala, Munnar, 28.09.1983, *Mukthesh Kumar* 2972 (KFRI).

Pinalia polystachya (A.Rich.) Kuntze, Revis. Gen. Pl. 2: 679. 1891. *Eria polystachya* A.Rich., Ann. Sci. Nat., Bot. ser. 2. 15: 20. 1841; Hook.f., Fl. Brit. India 5: 792. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1425. 1928; Abraham & Vatsala, Intr. Orchids 382. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 455. 2004.

Epiphytic herbs. Pseudobulbs crowded, oblong-lanceolate, 2.5–10 × 0.8–2 cm, reddish-brown and wrinkled on maturity, sheathing. Leaves 3–7, elliptic-oblanceolate, 7–22 × 0.8–2.5 cm, acute-acuminate at apex, base sheathing, articulate, narrow, sessile. Racemes 1–5, arising from or opposite the axil of leaves, and sometimes from the axil of basal sheaths, *c.* 9 cm long, erect to slightly arched, lax to sub-densely many-flowered. Flowers 0.7–2.2 cm long, creamy-white to pale-yellow; bracts ovate-lanceolate, 6–9 × 1.5–2.5 mm, acuminate and shortly denticulate towards apex, strongly reflexed, sub-truncate at base, sparsely hairy; pedicels 3–5 mm long. Sepals 3, hairy; dorsal sepal narrowly lanceolate, 7–12 × 1.5–2.5 mm, obtuse to sub-acute at apex, slightly fleshy and concave, sub-truncate at base, pubescent; lateral sepals lanceolate, falcate, 6–10 × 3–4.5 mm, acute-

acuminate at apex, broad and fused at base, pubescent. Lateral petals elliptic-lanceolate, falcate, 5.5–11 × 1.5–2 cm, sub-acute to obtuse at apex, sub-truncate at base, glabrous. Lips panduriform, 5.5–8 × 3.5–4 mm, obscurely 3-lobed, minutely clawed at base, strongly reflexed, minutely gland-dotted throughout, lip creamy with purple lamellae, yellow at apex; midlobe ovate-cordate, acute-apiculate at apex, crenulate-undulate, fleshy; lateral lobes short, falcate, round, sometimes ciliate at apical margin; disc with 2 arched, entire, oblong lamellae along lateral veins. Column 2.5–3 mm long. Pollinia 8, in 2-groups of 4-each, yellow. Ovary 5–6 mm long. Capsules elliptic-oblong, 1.2–2 cm long, ridged.

Distribution: S. India (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: July-February.

Specimens examined: Kalvary mount, 06.10.1983, *A.G. Pandurangan* 79226; Kuttikkanam, 25.09.1964, *K. Vivekananthan* 21394 (MH); Pachakkanam, Periyar Tiger Reserve, 17.08.1993, *N. Sasidharan & Jomy Augustine* 12266 (KFRI); Vandanmedu, 26.08.1977, *K. Vivekananthan* 50524 (MH).

Podochilus Blume,

Bijdr. Fl. Ned. Ind. 7: 295, t. 12. 1825.

Podochilus malabaricus Wight, Icon. Pl. Ind. Orient. 5: t. 1748, f. 2. 1851; Hook.f., Fl. Brit. India 6: 80. 1890; Abraham & Vatsala, Intr. Orchids 390. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 470. 2004.

Epiphytic herbs, 4–20 cm long. Leaves many, distichous, oblong, equitant, 5–10 × 1–3 mm, obtuse at apex, sheathing at base, glabrous, green. Racemes terminal, 2–6 cm long. Flowers *c.* 3.2 × 1.2 mm, purplish white; pedicels 1–2 mm long, glabrous; bracts ovate, 1.5–3 × 0.5–1 mm, acuminate at apex, cuneate at base, 1-nerved, glabrous, keeled. Sepals 3; dorsal sepal ovate-lanceolate, 1.8–2 × 1.3–1.7 mm, acute at apex, cuneate at base, 1-nerved, glabrous, white with purple tinch; lateral sepals falcate, 2–2.2 × 1–1.2, acute at apex, cuneate at base, 1-nerved, glabrous, white with purple tinch. Lateral petals lanceolate, 1.5–1.8 × 0.7–1 mm, acute at apex, cuneate at base, 1-nerved, glabrous, white. Lips oblong-lanceolate, 2.5–2.8 × 0.7–0.8 mm, sub-acute at apex. Spur *c.* 1.5 × 1.2 mm, white. Column conical, ellipsoid, *c.* 1.1 mm long. Pollinia 4. Capsules elliptic, 5–7 mm long, glabrous.

Distribution: S. India, Sri Lanka and N. Borneo (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: September-January.

Specimen examined: Valara waterfalls, 27.12.2017, *Dani Francis & Santhosh Nampy* 156519 (CALI).

Polystachya Hook.,

Exot. Fl. 2: t. 103. 1824, *nom. cons.*

Polystachya concreta (Jacq.) Garay & H.R.Sweet, Orquideologia 9(3): 206. 1974; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 470. 2004. *Epidendrum concretum* Jacq., Enum. Syst. Pl. 30. 1760. *Polystachya purpurea* Wight, Icon. Pl. Ind. Orient. 5: t. 1679. 1851; Hook.f., Fl. Brit. India 6: 21. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1437. 1928. *Polystachya flavescens* (Blume) J.J.Sm., Orch. Java 284. 1905; Abraham & Vatsala, Intr. Orchids 392. 1981.

Epiphytic herbs. Pseudobulbs ovoid, *c.* 1 × 1 cm, green. Leaves 3 or 4 per pseudobulb, linear-lanceolate, 6–10 × 0.8–1 cm, obtuse at apex, attenuate at base, glabrous, green. Racemes terminal, 10–15 cm long, dense flowered. Flowers *c.* 0.5 cm across, greenish yellow sometimes with purple tinch; pedicels 3–5 mm long. Sepals 3, yellowish green; dorsal sepal oblong-ovate, 2.5–5 × 1.5–3 mm, acute at apex, sub-truncate at base, glabrous; lateral sepals ovate, 3.5–6.5 × 3–4 mm, acute at apex, basally connate and jointed with column, glabrous. Lateral petals oblanceolate, 2.5–3 × 0.5–1, obtuse at apex, sub-truncate at base, glabrous, greenish yellow. Lips 3-lobed, 3.5–6 × 3–5 mm, greenish yellow; midlobe orbicular-ovate, 1.8–3 × 1.5–3 mm, truncate at apex, undulate, pubescent; lateral lobes obliquely oblong-lanceolate, 1–1.8 × 0.5–1 mm, acute at apex; disc with a longitudinal callus; column 2–3.5 mm long. Pollinia 2, yellow. Ovary 6–8 mm long, glabrous, green.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Semi-evergreen forests; *Fl. & Ft.*: August-March.

Specimens examined: Kulamavu, 03.10.1983, *C.N. Mohanan* 79856; Narakakkanam, 18.08.1977, *K. Vivekananthan* 49677; Pachakkanam, 02.10.1976, *K. Vivekananthan* 48395; Painavu, 20.08.1981, *K. Vivekananthan & V.S. Raju* 71101; Vandiperiyar-Pambanar, 23.09.1964, *K. Vivekananthan* 21337 (MH).

Porpax Lindl.,

Edwards's Bot. Reg. 31 (Misc.): 62. 1845.

Key to the species

1. Leaves ovate, netted, tomentose; flowers reddish purple, tomentose; bracts obovate ... . *P. jerdoniana*

1. Leaves elliptic, oblong, lanceolate or oblanceolate, glabrous; flowers white, yellow or yellowish green, glabrous; bracts linear, ovate or lanceolate 2

2. Flowers solitary, white 3

2. Flowers 2–16, yellow or greenish yellow 4

3. Pseudobulbs with a loose net like reticulate sheath; lips distinctly 3-lobed .... *P. reticosa*

3. Pseudobulbs without loose reticulate sheath; lips entire or obscurely 3-lobed ..... *P. braccata*

4. Leaves 3–5; flowers 6–16; bracts ovate-lanceolate; lips pandurate, obscurely 3-lobed ..... *P. filiformis*

4. Leaves 2; flowers 2–4; bracts linear; lips oblong, not lobed ..... *P. nana*

Porpax braccata (Lindl.) Schuit., Y.P.Ng & H.A.Pedersen, Bot. J. Linn. Soc. 186: 199. 2018. *Dendrobium braccatum* Lindl., Gen. Sp. Orchid. Pl. 75. 1830. *Eria braccata* (Lindl.) Lindl., J. Proc. Linn. Soc., Bot. 3: 46. 1858; Hook.f., Fl. Brit. India 5: 787. 1890; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 454. 2004.

Epiphytic or lithophytic herbs. Pseudobulbs crowded, dorsiventrally compressed, disc-like, 0.5–1.6 cm across, with strongly adpressed, dark-brown reticulate veins radiating from apex to base. Leaves 2, oblong-lanceolate, 3–7.5 × 0.8–1.8 cm, acute to obtuse at apex, attenuate at base, glabrous, green. Inflorescence solitary, arising from top of pseudobulb. Flowers sessile, 1.7–2 × 2.8–3 cm, white, lip yellowish inside, column edged with purple; bracts broadly ovate, 7–8 × 5–6 mm, obtuse to sub-acute at apex, sub-truncate at base, green. Sepals 3; dorsal sepal oblong-lanceolate, 10–20 × 3–5 mm, obtuse at apex, sub-truncate at base, glabrous; lateral sepals lanceolate, falcate, 10–22 × 8–10 mm, sub-acute at apex, fused at base, glabrous. Lateral petals elliptic-lanceolate, falcate, 8–15 × 4–5 mm, obtuse to sub-acute at apex, sub-truncate at base, glabrous. Lips entire or obscurely 3-lobed, 14–

16 × 7–8 mm; midlobe oblong-ovate, obtuse-truncate at apex, undulate; lateral lobes obscure, entire; disc with 2 crenulate to undulate crests from base to near apex. Column *c.* 2.5 × 2.5 mm. Pollinia 8, in 4-pairs, clavate, yellow. Ovary *c.* 3 mm long, ridged. Capsules obovate, 1–1.5 cm long, ridged.

Distribution: S. India, Sri Lanka and E. Himalaya (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: October-November.

Specimens examined: Kottamala, Periyar Tiger Reserve, 29.10.1995, *K.P. Rajesh* 16874; Mangaladevi, Periyar Tiger Reserve, 12.11.1993, *N. Sasidharan & Jomy Augustine* 12675 (KFRI).

Porpax filiformis (Wight) Schuit., Y.P.Ng & H.A.Pedersen, Bot. J. Linn. Soc. 186: 199. 2018. *Dendrobium filiforme* Wight, Icon. Pl. Ind. Orient. 5: t. 1642. 1851. *Eria dalzelli* (Hook. ex Dalzell) Lindl., J. Proc. Linn. Soc., Bot. 3: 47. 1858; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1425. 1928; Hook.f., Fl. Brit. India 5: 789. 1890; Abraham & Vatsala, Intr. Orchids 375. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 454. 2004. *Dendrobium filiforme* Wight, Icon. Pl. Ind. Orient. 5: t. 1642. 1851.

Epiphytic herbs, *c.* 10 cm long. Pseudobulbs crowded, dorsiventrally compressed, 0.5–1.5 cm across, button-like. Leaves 3–5, oblanceolate-spathulate, 3–7 × 0.5–1.2 cm, obtuse at apex, slightly crenulate, glabrous, green. Racemes erect, longer than leaves, 6–10 cm long, 6–16-flowered. Flowers secund, 3–5 mm apart on rachis, 7–9 mm long, creamy-yellow with greenish tinge; bracts ovate-lanceolate, 4.5–6 × 1–1.2 mm, acuminate at apex, sub-truncate at base, glabrous, green. Sepals 3, sub-similar; dorsal sepal lanceolate, 4–6.2 × 1.5–2.2 mm, acute-acuminate at apex, glabrous; lateral sepals 2–3 mm broad at base, slightly falcate. Lateral petals elliptic-lanceolate, falcate, 3–5.5 × 1–1.5 mm, acuminate at apex, sub-truncate at base, glabrous. Lip pandurate, 1.8–2.5 cm long, shortly clawed at base, strongly folded at middle giving an obscurely 3-lobed appearance, fleshy at base and middle, membranous towards margin and apex, reflexed from middle, entire, crenulate towards apex, slightly notched, with 2-oblong callus along lateral veins ending at middle. Column 0.8–1.2 mm long. Pollinia 8, in 4 unequal pairs, clavate. Ovary sessile, curved, ridged. Capsules obovate, 3.5–6 × 1–1.5 mm, ridged, glabrous, greenish-yellow.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl.* & *Ft.*: August-December.

Specimens examined: Kulamavu, 03.10.1983, *C.N. Mohanan* 79920; Painavu-Kulamavu, 10.11.1981, *V.S. Raju* 71225; Painavu, 22.08.1977, *K. Vivekananthan* 50467; Umayamala, 17.11.1965, *B.V. Shetty* 26485 (MH).

Porpax jerdoniana (Wight) Rolfe, Orchid Rev. 16: 8. 1908; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1422. 1928; Abraham & Vatsala, Intr. Orchids 387. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 470. 2004. *Lichenora jerdoniana* Wight, Icon. Pl. Ind. Orient. 5: t. 1738. 1851. *Eria lichenora* Lindl., J. Proc. Linn. Soc., Bot. 3: 46. 1858; Hook.f., Fl. Brit. India 5: 787. 1890. **Fig. 13B**

Epiphytic herbs, 7 cm long. Pseudobulbs discoid, 0.5–1 cm in diam., enclosed in a sheath of reticulated fiber, green. Leaves ovate, 4–4.2 × 1.5–1.8 cm, sub-acute at apex, attenuate at base, margin entire, netted, tomentose hairy, green with light brown. Inflorescence terminal, 2 flowered in between leaves. Flowers 1–1.4 cm long; pedicels 1.8–2 mm long, tomentose hairy; bracts obovate, 2.8–3 × 3.5–4 mm, emarginate at apex, truncate at base, pilose hairy, hyaline. Sepals 3; dorsal sepal ovate, 5–5.5 × 4–4.1 mm, slightly emarginate at apex, truncate at base, tomentose hairy, reddish purple; lateral sepals oblanceolate, 4–5 × *c.* 2 mm, mucronate at apex, narrowly cuneate at base, tomentose hairy, inner surface rugose. Lateral petals 2, linear, 3–4 × *c.* 0.2 mm, apex mucronate, papillate, sub-truncate at base, glabrous, reddish purple. Lips pandurate, *c.* 3 × 1 mm, obtuse at apex, sub-truncate at base, crenulate, papillate, black at base. Spur 0. Column *c.* 1 × 0.4 mm, glabrous. Pollinia oblanceolate, 0.2–0.4 mm long, yellow. Ovary *c.* 0.5 mm long; ovules in 3 vertical rows.

Distribution: S. India and N. Andaman Islands (POWO, 2023); *Habitat*: Evergreen forests; *Fl.* & *Ft.*: July-October.

Specimens examined: Kozhiyalakkudi, Anakkulam, 18.09.2017, *Dani Francis & Santhosh Nampy* 161981 (CALI); Meenmutty, 02.10.1983, *C.N. Mohanan* 79910; Neriamangalam-Valara forest, 20.08.1965, *K.M. Sebastine* 25329 (MH).

Porpax nana (A.Rich.) Schuit., Y.P.Ng & H.A.Pedersen, Bot. J. Linn. Soc. 186: 200. 2018. *Eria nana* A.Rich., Ann. Sci. Nat. Bot. ser. 2, 15: 19. 1841; Hook.f. Fl. Brit. India

5: 789. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1425. 1928; Abraham & Vatsala, Intr. Orchids 377. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 712. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 455. 2004. **Fig. 14F**

Lithophytic or epiphytic herbs, 3–5 cm long. Pseudobulbs discoid, *c.* 5 × 4 mm, green, striated. Leaves 2, oblanceolate, 17–25 × 2.5–3 mm, acute at apex, attenuate at base, glabrous, green. Racemes 2–4-flowered, 3–4 cm long. Flowers 0.7–1 cm long, yellow; pedicels 0.5 mm long; bracts linear, 2–4 × 0.5–1 mm, acute at apex, sub-truncate at base, 1-nerved, glabrous, pale green. Sepals lanceolate, acute at apex, glabrous, yellow; dorsal sepal 4.5–5 × 1–1.1 mm, cuneate at base; lateral sepals 4–4.1 × 0.9–1 mm, fused basally to form spur. Lateral petals lanceolate, 7.9–8.5 × 1.3–1.5 mm, acute at apex, cuneate at base, glabrous, yellow. Lips not lobed, oblong, 4.9–5 × 1.3–1.5 mm, abruptly narrowed into a claw, closely 3-nerved along median line, papillose abaxially, reflexed at apex. Spur fusiform, *c.* 1.5 mm long. Pollinia 4 in 2 groups, *c.* 0.3 × 0.1 mm. Ovary *c.* 1.3 mm long. Capsules elliptic, 5–6 × 2 mm, glabrous.

Distribution: S. India (POWO, 2023); *Habitat*: Grasslands and shola forests; *Fl. & Ft.*: July-January.

Specimens examined: Anamudi Shola National Park, 25.01.2018, *Dani Francis & Santhosh Nampy* 158260; grassland near Painav, 06.08.2017, *Dani Francis & Santhosh Nampy* 154310 (CALI); Kottamala, Periyar Tiger Reserve, 29.10.1995, *K.P. Rajesh* 16873 (KFRI); way to Mamalakandam, 27.12.2017, *Dani Francis & Santhosh Nampy* 156529 (CALI).

Notes: Kumar *et al.* (2001) reported this species as Critically Endangered (CR).

Porpax reticosa (Wight) Schuit., Malesian Orchid J. 24: 107. 2020. *Eria reticosa* Wight, Icon. Pl. Ind. Orient. 5. t. 1637. 1852; Hook.f., Fl. Brit. India 5: 787. 1890; Abraham & Vatsala, Intr. Orchids 373. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 455. 2004. **Fig. 14D**

Epiphytic herbs, 6–7.5 cm long. Pseudobulbs flattened, with a loose net-like reticulate sheath. Leaves 1 or 2, elliptic-lanceolate, 2.5–6 × *c.* 1 cm, obtuse at apex, green. Inflorescence solitary, 2–3 cm long. Flowers 12–16 × 6–8 mm; pedicels 2–2.6 cm long; bracts widely ovate, 7–8 × 2–8 mm, acute-cuspidate at apex, base

truncate, clasped to pedicel, undulate or wavy, 7-nerved, glabrous, longer than ovary. Sepals 3; dorsal sepal lanceolate, 17–19 × 4–6 mm, acute at apex, truncate at base, 7-nerved, glabrous, white; lateral sepals falcate, 15–20 × 7–8 mm, acute at apex, conduplicate, glabrous, white. Lateral petals 2, lanceolate, 15–17 × *c.* 5 mm, acute at apex, truncate at base, entire, 5-nerved, glabrous, white. Lips 3-lobed, obovate, *c.* 1.9 × 1–6 mm, acute at apex, dentate, 3-nerved, 2 lateral nerves rugose, white shaded with yellow. Column conical, *c.* 3 × 3 mm, white with pink at apical portion. Pollinia 2 with 4 segments in each, orbicular, *c.* 1 mm long, glabrous, yellow. Ovary obovate, *c.* 5 × 2 mm; ovules in 3 vertical rows, glabrous, slightly winged, light green.

Distribution: Uttarakhand and S. India (POWO, 2023); *Habitat*: Evergreen, shola forests and grasslands; *Fl. & Ft.*: June-October.

Specimens examined: Erattayar dam, 28.09.1981, *C.N. Mohanan & B. Ramanujan* 72195 (MH); Kottamala, 06.08.1994, *Jomy Augustine* 14001 (CALI); Kulamavu, 04.10.1983, *C.N. Mohanan* 80004; Lockhert gap, 15.06.1963, *K.M. Sebastine* 16505; Mangaladevi temple, 09.10.1976, *K. Vivekananthan* 48637 (MH); *Ibid.*, 07.07.1993, *Jomy Augustine* 12038; Periyar Tiger Reserve, 15.07.2017, *Dani Francis & Santhosh Nampy* 154128 (CALI).

Notes: This species is closely related to *Eria braccata* (Lindl.) Lindl. but frequently considered synonymous. However, the reticulate sheath of the pseudobulb, the more acute to acuminate sepals and petals, and the distinctly 3-lobed lip clearly distinguish it from the latter. The presence of loose reticulate sheath also indicates the relationship with members of the genus *Porpax*, but all the members of *Porpax* have the sepaline tube formed by the adhesion of two lateral sepals (Agrawala, 2009).

Rhynchostylis Blume,

Bijdr. Fl. Ned. Ind. 7: 285, t. 49. 1825.

Rhynchostylis retusa (L.) Blume, Bijdr. Fl. Ned. Ind. 7: 286. 1825; Hook.f., Fl. Brit. India 6: 32. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1440. 1928; Abraham & Vatsala, Intr. Orchids 445. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 471. 2004. *Epidendrum retusum* L., Sp. Pl. 2: 953. 1753.

Epiphytic herbs with thick spreading roots, 40–60 cm long. Stems thick, stout, woody, 11–20 cm long, covered by persistent sheathing bases of fallen leaves. Leaves distichous, linear-oblong, 15–25 × 2–3 cm, obliquely bilobed at apex, articulate and sheathing at base, glabrous, green. Racemes axillary, drooping, 30–40 cm long. Flowers dense, *c.* 1.8 cm across, pink; pedicels *c.* 1.2 cm long, pinkish purple; bracts ovate-lanceolate, 4–5 × 3–4 mm, acute at apex, clasping at base, glabrous. Sepals 3, white with pink patches; dorsal sepal sub-orbicular, 6–8 × 4–6 mm, obtuse at apex, sub-truncate at base, 5–7-nerved, glabrous; lateral sepals obliquely ovate, 8–9 × 7–7.5 mm, obtuse at apex, cuneate at base, 5–7-nerved, glabrous. Lateral petals ovate-elliptic, 7–7.5 × 4–4.5 mm, obtuse at apex, cuneate at base, glabrous, white with pinkish tinch. Lips bent inwards, *c.* 10 × 4 mm, deeply cleft at tip, pink. Spur conical, *c.* 6 mm long, pubescent within. Column *c.* 2 mm long, glabrous, pink. Ovary obovate, *c.* 1.5 cm long. Capsules obovate, 2–2.5 cm long, glabrous.

Distribution: China to tropical Asia (POWO, 2023); *Habitat*: Semi evergreen forests; *Fl. & Ft.*: June**-**August.

Specimens examined: Koruthode, *s.d*., *Jomy Augustine* 12203 (CALI); near Kulamavu, 25.08.1981, *V.S. Raju* 71177 (MH).

Notes: *Rhynchostylis retusa* is also known as 'foxtail orchid.' It is grown as an ornamental because of its fragrant flowers, which are numerous, small, and typically white with light to deep magenta, red, or lavender-blue spots produced on multiple pendent racemes. The species is listed in the CITES Appendix II (De, 2022).

Robiquetia Gaudich,

Voy. Uranie. 426. 1829.

Robiquetia josephiana Manilal & C.S.Kumar, Orchid Rev. 92: 293. 1984; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 471. 2004.

Epiphytic herbs, *c.* 8 cm tall. Leaves distichous, linear, 4–8 × 0.3–0.4 cm, grooved, blunt at apex, sheathing at base, glabrous, green. Racemes axillary, 5–6 cm long.

Flowers white with a tinch of purple; pedicels 6–7 mm long, pale purple; bracts ovate, *c.* 2 × 1 mm, acuminate at apex, sub-truncate at base, glabrous, purplish white. Sepals 3, obovate, 2.7–3 × 1.8–2 mm, acute at apex, sub-truncate at base, glabrous, 1-nerved, white, gland dotted. Lateral petals 2, obovate, 2.7–3 × 1.8–2 mm, acute at apex, sub-truncate at base, glabrous, white, gland dotted. Lips obscurely 3-lobed with a conspicuous spur, 6–7 × 2–2.5 mm, obtuse at apex, glabrous, white with purple; lateral lobes insignificant; midlobe triangular. Spur 6–8 mm long, blunt at apex, white-pale purple. Column 1–2 mm long, deep purple. Pollinia 2, yellow. Ovary 3–4 mm long, pale purple.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: August-November.

Specimen examined: Upper melmanalar, Periyar Tiger Reserve, 23.08.1994, *Jomy Augustine* 13970 (KFRI).

Satyrium Sw.,

Kongl. Vetensk. Acad. Nya Handl. 21: 214. 1800, *nom. cons.*

Satyrium nepalense D.Don, Prodr. Fl. Nepal. 26. 1825; Hook.f., Fl. Brit. India 5: 823. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1428. 1928; Abraham & Vatsala, Intr. Orchids 210. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 699. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 471. 2004. **Fig. 12E**

Annual terrestrial herbs with underground tubers, 30–60 cm tall. Stems terete, glabrous. Leaves 2 or 3, widely ovate, 9–14 × 5.8–10 cm, sessile, acute at apex, cuneate at base, 7-nerved, glabrous. Racemes dense, 15–30 cm long. Flowers *c.* 15 × 5 mm long, pink; pedicels 0.8–1 mm long; bracts leafy, ovate, 2.5–2.9 × 1–1.1 cm, acute at apex, cuneate at base, 3–4-nerved, glabrous, green, margin light pink, longer than ovary. Sepals 3; dorsal sepal oblanceolate, 1–1.3 × 1.5–2 mm, rounded at apex, attenuate at base, 3-nerved, glabrous, scabrous hairy at tip, pink, slightly clawed; lateral sepals oblong-concave, 1.4–1.5 × *c.* 3 mm, truncate at apex, clawed at base, 4-nerved, glabrous, pink. Lateral petals 2, oblanceolate, 6–8 × 1–1.3 mm, apex obtuse, curved, base attenuate, clawed, 1-nerved, glabrous, pink. Lips not lobed, elliptic, *c.* 8 × 6 mm, apex slightly curved, crenulate, sparsely puberulous on basal region, pink. Spur 2, obconical, 1.3–1.4 cm long, glabrous. Column *c.* 3 × 2

mm. Pollinia 2, pyriform, *c.* 2 mm long, caudicle yellow. Ovary twisted, *c.* 9 × 3 mm, ovules in 3 vertical rows, glabrous, purple green.

Distribution: Indian Subcontinent to E. Central China (POWO, 2023); *Habitat*: Grass lands;

Fl. & Ft.: July-November.

Specimens examined: Chittavurai, Munnar, 27.11.1979, *Nambiar* 1007; Devikulam, 27.07.1982, *Nambiar & N. Sasidharan* 1826 (KFRI); Eravikulam, 29.09.2017, *Dani Francis & Santhosh Nampy* 156302; Mangaladevi hills, Periyar Tiger Reserve, 15.07.2017, *Dani Francis & Santhosh Nampy* 154125 (CALI); Mattupetty dam site, Munnar, 27.09.1983, *Mukthesh Kumar* 2961 (KFRI); Puthukkad, Nallathanni Kallar, 15.09.2018, *Dani Francis & Santhosh Nampy* 161926 (CALI).

Notes: *Satyrium nepalense* exhibits a wide range of variations in vegetative and floral characters. They are extensively grown as ornamentals and used in various traditional medicine systems (Kurzweil, 2015).

Schoenorchis Reinw. ex Blume,

Revis. Gen. Pl. 2: 681. 1891.

Key to the species

1. Leaves linear-flat, apex acute, not channelled; flowers white, numerous; petals linear-lanceolate ……..…….…… *S. jerdoniana*

1. Leaves oblong, apex unequally bilobed, channelled; flowers yellow, 6–8; petals ovate-oblong ……..…….... *S. smeeana*

Schoenorchis jerdoniana (Wight) Garay, Bot. Mus. Leafl. 23: 202. 1972; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 472. 2004. *Taeniophyllum jerdonianum* Wight, Icon. Pl. Ind. Orient. 5: t. 1756. 1851. *Saccolabium jerdonianum* (Wight) Rchb.f. in Walpers, Ann. Bot. Syst. 6: 886. 1864; Hook.f., Fl. Brit. India 6: 59. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1446. 1928.

Epiphytic herbs. Stems slender, terete, 2.5–15 cm long. Leaves distichous, flat, linear, 2.5–3.5 × 0.3–0.5 cm, acute at apex, sheathing at base, glabrous, green. Racemes lateral, branched, many flowered. Flowers 1–2.5 mm long, white;

pedicels *c.* 1 mm long; bracts minute, lanceolate, 1.5–2 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, brown. Sepals 3, ovate, acute at apex, sub-truncate at base, glabrous, white. Lateral petals linear-lanceolate, acute at apex, cuneate at base, glabrous, white. Lips obscurely 3-lobed, undulate along margins, glabrous, white; midlobe oblong, concave; lateral lobes small, rounded. Spur saccate, 2–3 mm long. Column *c.* 1 × 1.2 mm. Pollinia 4. Ovary obovate, glabrous.

Distribution: S. India (POWO, 2023); *Habitat*: Dam sides and open areas; *Fl. & Ft.*: August-March.

Specimens examined: Anchuruli-Thekkady, 04.10.1972, *B.D. Sharma* 42404; Vandanmettu, 26.08.1977, *K. Vivekananthan* 50562 (MH).

Schoenorchis smeeana (Rchb.f.) Jalal, Jayanthi & Schuit., Kew Bull. 69(2)-9508: 4. 2018. *Saccolabium smeeanum* Rchb.f., Gard. Chron., ser. 3. 2: 214. 1887. *Rhynchostylis latifolia* C.E.C.Fisch., Bull. Misc. Inform. Kew 1927: 358. 1927, in Gamble, Fl. Madras 3: 1440. 1928. *Schoenorchis latifolia* (C.E.C.Fisch.) C.J.Saldanha, J. Bombay Nat. Hist. Soc. 70: 415. 1974; Abraham & Vatsala, Intr. Orchids 473. 1981. *Xenikophyton smeeanum* (Rchb.f.) Garay, Bot. Mus. Leafl. 23: 375. 1974; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 477. 2004.

Epiphytic herbs. Stems woody, 3–5 cm long, sheathed with fallen leaf bases. Leaves distichous, oblong, 3.5–7.5 × 1.5–2.5 cm, unequally bilobed at apex, channelled above, sheathing at base, glabrous, green sometimes purplish abaxially. Racemes branched, *c.* 10 cm long, arising from axil of fallen leaves. Flowers 6–8, 3–4 mm across, yellow; pedicels short, *c.* 1 mm long; bracts ovate-lanceolate, 1.8–2 × 0.8–1 mm, acuminate at apex, sub-truncate at base, glabrous, green. Sepals 3, ovate-oblong, 2.5–3 × 1.8–2 mm, obtuse at apex, sub-truncate at base, glabrous, yellow. Lateral petals 2, ovate-oblong, 2.5–3 × 1.8–2 mm, obtuse at apex, sub-truncate at base, glabrous, yellow. Lips obscurely 3-lobed, 2.5–3 × 2–2.5 mm, strongly reflexed, thick, with a central pubescent channel, yellow. Spur saccate, 1–2 mm long. Column *c.* 1.2 mm long. Pollinia 4 in 2 groups. Ovary 1–1.5 mm long.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: May-August.

Specimen examined: Vandanmedu, 26.08.1977, *K. Vivekananthan* 50523 (MH).

Sirhookera Kuntze,

Revis. Gen. Pl. 2: 681. 1891.

Key to the species

1. Leaves linear-oblong; flowers white, tinched with purple …… *S. lanceolata*

1. Leaves broadly oblong to sub-rotund; flowers yellow with purple stripes ……..
…… *S. latifolia*

Sirhookera lanceolata (Wight) Kuntze, Revis. Gen. Pl. 2: 681. 1891; Abraham & Vatsala, Intr. Orchids 258. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 473. 2004. *Josephia lanceolata* Wight, Icon. Pl. Ind. Orient. 5: 19. 1851; Hook.f., Fl. Brit. India 5: 823. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1428. 1928.

Epiphytic herbs, *c.* 40 cm tall. Leaves broadly oblong or sub-rotund, 4.5–12.5 × 2–3 cm, round at apex, attenuate at base, glabrous, green. Panicles with 4 or 5 flowers in each group, sheaths clasped to branch, terete, glabrous, dark brown to cream. Flowers *c.* 2.2 × 1.2 mm; pedicels 0.4–0.5 mm long, light green; bracts lanceolate-ovate, 3–3.1 × 1.8–2 mm, cuspidate at apex, truncate at base, entire, 4-nerved, glabrous, pale green. Sepals 3, boat-shaped to widely ovate, 1.4–2 × 0.9–1.3 mm, obtuse at apex, deflexed, cuneate at base, glabrous, greenish white. Lateral petals 2, lanceolate-falcate, 1.3–1.4 × *c.* 0.5 mm, truncate at apex, cuneate at base, glabrous, greenish white. Lips not lobed, obovate, *c.* 2 × 0.9 mm, rounded at apex, cuneate at base, with a callus-like structure at centre, glabrous, light green, white spotted. Spur 0. Column obovate-orbicular, *c.* 1 × 1 mm. Pollinia 4 in 2 groups, obovate, *c.* 1 × 0.5 mm, yellow. Ovary *c.* 1 × 0.5 mm; ovules in 3 vertical rows, glabrous.

Distribution: SW. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen, shola forests and forest margins; *Fl. & Ft.*: June-January.

Specimens examined: Kalvary mount, 06.10.1983, *A.G. Pandurangan* 79272 (MH); Kannadippara, Mankulam, 08.06.2018, *Dani Francis & Santhosh Nampy* 159265; Ibid., 17.09.2018, *Dani Francis & Santhosh Nampy* 161948 (CALI); Kulamavu, 23.09.1984, *C.N. Mohanan* 80154; Meenmutty, 27.09.1981, *C.N. Mohanan & B. Ramanujan* 72133 (MH); Mathikettan Shola National Park, Sivanpara, 23.08.2014, *Syam Radh S. & Santhosh Nampy* 143538; *Ibid*., *s.d.*, *Syam Radh S. & Santhosh*

Nampy 149170; Pachakkanam, 07.08.1993, *Jomy Augustine* 12312 (CALI); Rajamala, 5th mile, Munnar, 28.01.1994, *Mukthesh Kumar & Stephen Sequiera* 7241 (KFRI).

Sirhookera latifolia (Wight) Kuntze, Revis. Gen. Pl. 2: 681. 1891; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 473. 2004. *Josephia latifolia* Wight, Icon. Pl. Ind. Orient 5: 19. 1851; Hook.f., Fl. Brit. India 5: 823. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1428. 1928. **Fig. 13E**

Epiphytic herbs, *c.* 40 cm tall. Leaves linear or oblong-lanceolate, 5–12.5 × 2–3 cm, sub-acute to obtuse at apex, cuneate at base, glabrous, green. Panicles 7.5–30 cm long. Flowers 2–2.2 × 1–1.2 mm, white tinched with purple; pedicels 1–1.2 mm long, purple; bracts ovate, 1.8–2 × 1–1.2 mm, obtuse at apex, truncate at base, 1-nerved, puberulous, straw coloured. Sepals 3; dorsal sepal oblong, 3.8–4.1 × 1.8–2 mm, rounded to obtuse at apex, truncate at base, 3-nerved, glabrous, reddish green; lateral sepals lanceolate-ovate, 3–4 × 1.8–2 mm, obtuse at apex, sub-truncate at base, 3-nerved, glabrous, reddish green. Lateral petals 2, lanceolate-elliptic, 3–3.1 × 0.8–1 mm, obtuse at apex, cuneate at base, 1-nerved, glabrous, greenish yellow. Lips pandurate, with 2 flaps, *c.* 4 × 4 mm, obtuse to rounded at apex, truncate at base, 3-nerved, thickened at base, with a bulging near apex, pinkish white. Spur 0. Column narrowly oblong, *c.* 3.1 × *c.* 1 mm, glabrous. Pollinia 4, clavate, *c.* 1 mm long, yellow, glabrous. Ovary *c.* 1.5 mm long; ovules in 3 vertical rows, glabrous. Capsules oblong, *c.* 5 × 2 mm, glabrous, purple.

Distribution: SW. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen forests, shola forests and forest margins; *Fl. & Ft.*: August-November.

Specimens examined: Kuttikkanam-Peermade, 19.11.1975, *K. Vivekananthan* 46733 (MH); Thommankuthu, 30.11.2019, *Dani Francis & Santhosh Nampy* 164657; way to Viripara, Mankulam, 13.09.2018, *Dani Francis & Santhosh Nampy* 159469 (CALI).

Smithsonia C.J.Saldanha,

J. Bombay Nat. Hist. Soc. 71: 73. 1974.

Smithsonia viridiflora (Dalzell) C.J.Saldanha, J. Bombay Nat. Hist. Soc. 71: 75. 1974; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 474. 2004. *Micropera viridiflora* Dalzell, Hooker's J. Bot. Kew Gard. Misc. 3: 282. 1851.

Epiphytic herbs, *c.* 1 cm tall. Stems terete. Leaves distichous, elliptic-oblong, 3–10 × 1.5–2 cm, obliquely bilobed at apex, sheathing at base, glabrous, green. Inflorescence lateral corymbose racemes, 1–1.5 cm long. Flowers greenish white; bracts lanceolate, acute at apex, cuneate at base, glabrous, brown; pedicels 3–4 mm long. Sepals obovate, 5.5–6 × 1.8–2 mm, obtuse at apex, sub-truncate at base, glabrous, gland-dotted, pale green. Lateral petals obovate, 5–5.5 × 1.8–2 mm, obtuse at apex, sub-truncate at base, glabrous, pale green. Lips 3-lobed, white with pink patches, *c.* 7 × 5 mm, glabrous; lateral lobes conical, obtuse at apex, pink; midlobe ovate, obtuse at apex; spur conical, 3–4 mm long, pale green. Column pale green with pink patches. Pollinia 2, yellow. Ovary twisted; ovules in 3 vertical rows, green.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: January-April.

Specimen examined: Koruthode, Periyar Tiger Reserve, 17.03.1994, *Jomy Augustine* 13464 (KFRI).

Spiranthes Rich.,

De Orchid. Eur. 28. 1817 *nom. cons.*

Spiranthes sinensis (Pers.) Ames, Orchidaceae 2: 53. 1908; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1454. 1928. K.M.Matthew, Illustr. Fl. Palni Hills 679. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 474. 2004. *Neottia sinensis* Pers., Syn. Pl. 2: 511. 1807. *Spiranthes australis sensu* Hook.f., Fl. Brit. India 6: 102. 1890 *non* Lindl., 1824.

Slender terrestrial herbs, 20–25 cm tall. Roots fasciculate, sometimes tuberous. Leaves in clusters at base, linear-lanceolate, 3–7 × *c.* 0.5 cm, acute at apex, sheathing at base, green. Spike erect, *c.* 25 cm long, twisted. Scapes glandular hairy, covered with few tubular sterile bracts. Flowers many, secund, *c.* 1 cm long, white; pedicels, 0.8–1 mm long; bracts lanceolate-ovate, 5–6 × 1.8–2 mm, caudate at apex, cuneate at base, crenulate, glandular hairy, green. Sepals 3, lanceolate-ovate, 3–4 × 1–1.2 mm, cuspidate at apex, truncate at base, glandular hairy, white. Lateral petals 2, oblanceolate to narrowly oblong, 3–3.2 × 0.8–1 mm, obtuse at apex, sub-truncate at base, glabrous, white. Lips geniculate at middle, obscurely 3-lobed, *c.* 3 × 2 mm, midlobe flabellate, strongly reflexed, crumpled at, retuse at tip, two lateral

calli at each side of base; lateral lobes erect narrow. Spur 0. Column *c.* 2 mm long. Pollinia 2, pyriform, *c.* 1 mm long, yellow. Ovary twisted, *c.* 3 × 1.2 mm; ovules in 3 vertical rows, glandular hairy, green. Capsules elliptic-obovate, *c.* 6 × 4 mm, glandular hairy.

Distribution: Reunion, Assam to S. Central Japan and New Caledonia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: April-May.

Specimens examined: Devikulam lake, 15.04.1960, *K. Subramanyam* 10239 (MH); Eravikulam, 21.05.1980, *s.coll* 129 (KFRI); *Ibid*., 02.05.2017, *Dani Francis & Santhosh Nampy* 152112; way to Anamudi peak, 26.04.2019, *Dani Francis & Santhosh Nampy* 159129 (CALI); Umayamala, 19.04.1966, *B.V. Shetty* 27338 (MH).

Tainia Blume,

Bijdr. Fl. Ned. Ind. 7: 354. 1825.

Tainia bicornis Rchb.f., Bonplandia 5: 54. 1857; Hook.f., Fl. Brit. India 5: 820. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1427. 1928; Abraham & Vatsala, Intr. Orchids 291. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 474. 2004.

Terrestrial herbs, 40–80 cm long. Pseudobulbs cylindrical, 4–6 × 0.4–1 cm, swollen towards base, uninodal. Leaves solitary; petioles terete, 17–20 cm long, glabrous; blades broadly elliptic, 14–17 × 7–7.5 cm, acuminate at apex, cuneate at base, entire, glabrous, green. Inflorescence terminal, 35–60 cm long, arising from base of pseudobulbs, 10–17 flowered; peduncles 30–37 cm long, glabrous. Flowers open simultaneously, *c.* 2 × 2 cm, glabrous; pedicels 5–6 mm long, glabrous; bracts lanceolate, 0.7–1.5 × 0.1–0.2 cm, acuminate at apex, cuneate at base, glabrous, pale green. Sepals 3, glabrous, green; dorsal sepal elliptic, 1.9–2.5 × 0.2–0.5 mm, obtuse at apex, cuneate at base, 1-nerved; lateral sepals elliptic, slightly falcate, 1.8–2.5 × 0.2–0.3 cm, obtuse at apex, cuneate at base, 1-nerved. Lateral petals obliquely elliptic, 1.9–2.3 × 0.2–0.3 cm, obtuse at apex, cuneate at base, glabrous, green. Lips 3-lobed, obovate, 1.5–1.9 × 1–1.2 cm, yellow with maroon dots; midlobe elliptic, 4–6 × 10–12 mm, slightly retuse at apex, minutely papillose or glabrous; lateral lobes ovate, blunt at apex. Spur 0. Column 8–9 mm long. Pollinia 8. Ovary obovate, 0.9–1 cm long, glabrous.

Distribution: India to Java (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: November-February.

Specimens examined: Meenmutty, Kulamavu, 24.01.1983, *A.G. Pandurangan* 76618 (MH); Mlappara, 12.02.1994, *Jomy Augustine* 13348 (CALI).

Taprobanea Christenson,

Lindleyana 7: 90. 1992.

Taprobanea spathulata (L.) Christenson, Lindleyana 7: 91. 1992; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 475. 2004. *Epidendrum spathulatum* L., Sp. Pl. 2: 952. 1753. *Vanda spathulata* (L.) Spreng., Syst. Veg., ed. 16. 3: 719. 1826; Hook.f., Fl. Brit. India 6: 50. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1444. 1928; Abraham & Vatsala, Intr. Orchids 438. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 721. 1996.

Epiphytic shrubs. Stems terete, 30–50 cm long. Leaves conduplicate, oblong, 4–8 × 1.5–2 cm, 2-lobed at apex, sheathing at base, thick, coriaceous, sessile, glabrous, green speckled with brown. Racemes leaf opposed, 30–40 cm long. Flowers 6–8, 3.5–4 cm across, yellow; pedicels 1.8–2 cm long; bracts broadly ovate, 4–6 × 4–5 mm, obtuse at apex, sub-truncate at base, glabrous, green dotted with purple. Sepals 3, yellow; dorsal sepal oblanceolate, 15–20 × 9–10 mm, obtuse at apex, sub-truncate at base, glabrous; lateral sepals oblanceolate, 15–17 × 8–10 mm, obtuse at apex, sub-truncate at base, glabrous. Lateral petals obovate-spathulate, 15–18 × 9–11 mm, obtuse at apex, cuneate at base, glabrous. Lips 3-lobed, *c.* 18 × 10 mm, yellow with red dots; midlobe obscurely 3-lobed, flabellate, *c.* 10 × 15 mm, narrowed at base; lateral lobes erect, oblong *c.* 8 × 5 mm. Spur conical, 20 mm long, glabrous. Column *c.* 1 × 0.5 cm, yellow. Pollinia 2, obovoid, yellow. Ovary 1.3–1.6 mm long, ridged, green. Capsules obovate, ridged, glabrous, green.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Dry deciduous forests; *Fl. & Ft.*: August-January.

Specimen examined: Champakkad, Chinnar Wildlife Sanctuary, 25.08.1995, *N. Sasidharan & K.K. Sajeev* 15796 (KFRI).

Thelasis Blume,

Bijdr. Fl. Ned. Ind. 8: 385. 1825.

Thelasis pygmaea (Griff.) Lindl., J. Proc. Linn. Soc., Bot. 3: 63. 1858; Hook.f., Fl. Brit. India 6: 86. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1450. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 475. 2004. *Euproboscis pygmaea* Griff., Culcutta J. Nat.

Hist. 5: 372. 1845.

Epiphytic herbs, 6–8 cm tall. Pseudobulbs tufted, sub-globose, 1–1.5 × 1–1.2 cm, green. Leaves solitary, rarely 2, oblong-lanceolate, 2–6.5 × 0.7–0.9 cm, obtuse at apex, cuneate at base, glabrous, green. Spikes congested at apex of spike arising from base of pseudobulb, 5–12 cm long. Flowers 2–2.5 mm long, yellowish-green, not opening widely; pedicels 1–2 mm long; bracts ovate, 1.5–1.8 × 1–1.2 mm, acuminate at apex, sub-truncate at base, glabrous, green. Sepals 3, yellowish green; dorsal sepal 2–2.5 × 0.8–1 mm, oblong-lanceolate, acute at apex, sub-truncate at base, glabrous, gland-dotted; lateral sepals boat-shaped, truncate at apex, strongly keeled. Lateral petals elliptic-oblong, 1.8–2 × 0.5–0.7 mm, acute at apex, sub-truncate at base, glabrous, glandular, yellowish green. Lips ovate, *c.* 2.5 × 1 mm, acute at apex, glabrous, greenish yellow; lateral lobes, orbicular, glandular. Spur 0. Column *c.* 1–2 mm long. Pollinia 8 in 2-groups, yellow. Ovary obovate, truncate at apex, green. Capsules obovate, glabrous.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Evergreen forests margins; *Fl. & Ft.*: April-May.

Specimens examined: Arjunankotta, 14.04.1995, *Jomy Augustine* 15100 (KFRI); Kuttikkanam, 26.05.1965, *K. Vivekananthan* 24344 (MH).

Trichoglottis Blume,

Bijdr. Fl. Ned. Ind. 8: 359. 1825.

Trichoglottis tenera (Lindl.) Rchb.f., Gard. Chron. 699. 1872; Abraham & Vatsala, Intr. Orchids 460. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 719. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 476. 2004. *Oeceoclades tenera* Lindl., Gen. Sp. Orchid. Pl. 236. 1833. *Cleisostoma tenerum* Hook.f., Fl. Brit. India 6: 73. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1448. 1928.

Epiphytic, scrambling herbs, *c.* 30 cm long with long wiry aerial roots. Stems branched; terete, glabrous, pale green dotted with maroon. Leaves lanceolate to ovate-oblong, 2–5 × 1–1.5 cm, obtuse or notched at apex, sheathing at base, glabrous, green. Racemes 2 or 3-flowered. Flowers *c.* 1.2 × 1 cm, brownish yellow; pedicels *c.* 1 mm long; bracts triangular, *c.* 1 × 0.5 mm, acute at apex, cuneate at base, glabrous, green. Sepals 3; dorsal sepal boat-shaped, 9–9.7 × 2.5–3.5 mm, obtuse at apex, sub-truncate at base, 5-nerved, glabrous; lateral sepals

oblanceolate-ovate to falcate, 7–8 × 2.5–3 mm, obtuse at apex, sub-truncate at base, 3-nerved, glabrous. Lateral petals 2, falcate, 7–8 × 2–3 mm, obtuse at apex, cuneate at base, 5-nerved, glabrous. Lips fleshy, 3-lobed, *c.* 7 × 5 mm, white; midlobe 3-lobulate, *c.* 4 mm long, lateral lobules rounded, mid lobule broadly lanceolate, narrowly winged on lower side; lateral lobes conical, obtuse or erose at tip. Spur conical, *c.* 2 mm long. Pollinia 2. Ovary cylindrical, 3–5 mm long, glabrous. Capsules elliptic-obovate, *c.* 2.5 × 1 cm, glabrous.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Shola forests margins; *Fl. & Ft.*: December-July.

Specimens examined: Anakkulam, 16.05.1986, *K.K.N. Nair* 4433 (KFRI); Mathikettan Shola National Park, Karipara, 29.12.2014, *Syam Radh S. & Santhosh Nampy* 137904 (CALI); Munnar, riverside, 06.04.1963, *N. Rathakrishnan* 16239 (MH); Olikkudy, Chinnar Wildlife Sanctuary, 18.04.1996, *N. Sasidharan & K.K. Sajeev* 17303 (KFRI); Sunderamala, 07.04.1994, *Jomy Augustine* 13585; Udumbupara, 09.05.2015, *Syam Radh S. & Santhosh Nampy* 145001 (CALI).

Tropidia Lindl.,

Edwards's Bot. Reg. 19: t. 1618. 1833.

Tropidia angulosa (Lindl.) Blume, Coll. Orchid. pt. 9-10:122. 1859; Hook.f., Fl. Brit. India 6: 92. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1452. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 476. 2004. *Cnemidia angulosa* Lindl., Edward's Bot. Reg. 19: t. 1618. 1833.

Terrestrial woody herbs, *c.* 30 cm tall. Stems branched, terete, woody, sheathing at base. Leaves elliptic or obovate, 7–10 × 1.5–3.5 cm, 2–3 towards apex, acute at apex, clasping at base, glabrous, membranous. Spikes erect, *c.* 11 cm long, dense, many-flowered. Flowers *c.* 1 × 0.6 cm, white; pedicels 2–4 mm long; bracts linear, 16–18 × 0.8–1 mm, acuminate at apex, cuneate at base, glabrous, green. Sepals 3; dorsal sepal narrowly oblong, 8–9 × 1–1.5 mm, acuminate and pointed at apex, cuneate at base, glabrous, white; lateral sepals lanceolate-oblong, 8–10 × 2–2.5 mm, acuminate and pointed at apex, fused at base, glabrous, white. Lateral petals 2, ovate-lanceolate, 8–9 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, white. Lips oblong, *c.* 2 × 0.1 cm, obtuse at apex, white. Spur cylindrical, *c.* 4 × 1,

obtuse at apex, glabrous. Column *c.* 6 mm long. Pollinia 2, clavate, yellow. Ovary cylindrical, glabrous.

Distribution: Bhutan to South China and Lesser Sunda Islands (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: June-September.

Specimens examined: Kallar, Periyar Tiger Reserve, 09.09.1993, *Jomy Augustine & N. Sasidharan* 12374 (KFRI); Mathikettan Shola National Park, Choondal, 24.06.2016, *Syam Radh S. & Santhosh Nampy* 149159 (CALI).

Vanda Jones ex R.Br.,

Bot. Reg. 6: t. 506. 1820.

Key to the species

1. Flowers yellow tessellated with brown stripes, lips lilac blue; bracts sub-orbicular; sepals equal; midlobe of lip pandurate; spur 5–7 mm long; capsules obovate …… *V. tessellata*

1. Flowers yellow with purple lips; bracts ovate; sepals unequal; midlobe of lip oblong; spur *c.* 2 mm long; capsules oblong …… *V. Testacea*

Vanda tessellata (Roxb.) Hook. ex G.Don, in Loudon, Hort. Brit. 372. 1830; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1445. 1928; Abraham & Vatsala, Intr. Orchids 438. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 722. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 476. 2004. *Epidendrum tessellatum* Roxb., Pl. Coromandel 1: 34. 1795.

Epiphytic shrubs. Stems stout, woody, 30–40 cm long. Leaves conduplicate, oblong, 15–20 × 1.5–2.2 cm, 2-lobed at apex, with a central acute tip, sheathing at base, recurved, coriaceous, closely packed, glabrous, green. Racemes axillary, 10–25 cm long; flowers 6–10, 3–5 cm across, fleshy; pedicels 8–10 mm long; bracts sub-orbicular, 2.5–3 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, pale green. Sepals 3, obovate, 3–5 × 1–1.5 cm, obtuse at apex, sub-truncate at base, undulate, glabrous, yellow, tessellated with brown stripes and white margins. Lateral petals obovate, 2–4.5 × 0.8–1 cm, obtuse at apex, sub-truncate at base, undulate, glabrous, yellow, tessellated with brown stripes and white margins. Lips 3-lobed, fleshy; midlobe pandurate, 2-lobed at tip, lilac-blue; lateral lobes erect,

ovate, *c.* 7 mm long, acute at apex, white speckled with purple inside; disc with fleshy ridges. Spur conical, 5–7 mm long. Column *c.* 5 mm long, white. Pollinia 2, obovoid. Ovary 8–10 mm long, white. Capsules obovate, 6–8 cm long, ridged, glabrous.

Distribution: Indian Subcontinent to China and Indo-China (POWO, 2023); *Habitat*: Dry and moist deciduous forests, plains; *Fl. & Ft.*: May-September.

Specimens examined: Chinnar, 08.06.1995, *N. Sasidharan & K.K. Sajeev* 15703; Marayur, 12.05.1983, *Nambiar & N. Sasidharan* 1997 (KFRI).

Vanda testacea (Lindl.) Rchb.f., Gard. Chron., n.s., 8: 166. 1877; Abraham & Vatsala, Intr. Orchids 437. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 723. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 476. 2004. *Aerides testacea* Lindl., Gen. Sp. Orchid. Pl. 238. 1833.

Epiphytic herbs with woody stem. Stems 3–20 cm long, thick, sheathed. Leaves distichous, linear-oblong, 5–25 × 0.8–1.7 cm, praemorse at apex, sheathing and articulate at base, glabrous, green. Racemes axillary, 2-many per plant, 1–12 cm long. Flowers yellow; pedicels *c.* 1.5 cm long, glabrous; bracts ovate, 1.5–2 × 1.5–2 mm, acute at apex, sub-truncate at base, glabrous. Sepals 3, yellow; dorsal sepal oblong, 6–8 × 2.5–3 mm, obtuse at apex, sub-truncate at apex, glabrous; lateral sepals obovate, 6–6.5 × 3–4 mm, obtuse at apex, sub-truncate at base, glabrous. Lateral petals oblanceolate, 6.5–7 × 2–2.5 mm, obtuse at apex, sub-truncate at base, glabrous. Lips 3-lobed, reflexed; midlobe oblong, *c.* 5 × 2 mm, 2-ridged dorsally, warty, dilated or crenulate at apex; lateral lobes falcately ovate-lanceolate. Spur conical, *c.* 2 mm long. Pollinia 2, *c.* 0.5 mm long. Ovary cylindrical, *c.* 1.5 mm long. Capsules oblong, *c.* 6 mm long.

Distribution: Indian Subcontinent to Thailand (POWO, 2023); *Habitat*: Moist deciduous forests, also in plains; *Fl. & Ft.*: April-September.

Specimens examined: Chinnar-Marayur, 19.04.1964, *K.M. Sebastine* 18302 (MH); Koruthode, 08.09.1993, *Jomy Augustine* 13485 (CALI); Okkrai, Thekkady, 29.09.1972, *B.D. Sharma* 42097 (MH).

Zeuxine Lindl.,

Coll. Bot., Append. [no. 18]. 1826, *nom.cons.*

Key to the species

1. Flowers slightly opening, creamy white with yellow at center; lip margin entire without an incision …….. *Z. gracilis*

1. Flowers widely opening, white; lip margin dentate with a deep or shallow incision …….. *Z. longilabris*

Zeuxine gracilis (Breda) Blume, Coll. Orchid. 69. 1858; Abraham & Vatsala, Intr. Orchids 205. 1981; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 478. 2004. *Psychechilos gracilis* Breda, Gen. Sp. Orchid. Asclep. 2: t. 9. 1829.

Terrestrial annual herbs with underground creeping rhizomes. Stems slender, fleshy, tomentose. Leaves ovate, 2–4 × 1–1.5 cm, acute-obtuse at apex, round at base; petiole sheathing. Racemes terminal, 15–25 cm long. Flowers 3–4 × 2–3 cm, slightly opening, creamy white with yellow at centre; pedicels 2–2.5 mm long, pubescent; bracts ovate-lanceolate, 3–5 × 1–1.5 mm, acuminate at apex, truncate at base, pilose hairy, reddish green, smaller than ovary. Sepals 3, sub-equal, ovate-lanceolate, 3–3.5 × 1.8–2 mm, obtuse at apex, cuneate at base, pilose, reddish green. Lateral petals 2, ovate-lanceolate, 3–3.5 × 1.8–2 mm, obtuse at apex, cuneate at base, glabrous, creamy white. Lips 3-lobed, adnate to the column, 3.5–4 × 2.5–3 cm, glabrous, creamy white with yellow patch at middle; midlobe 2-fid, entire; lateral lobes small, saccate. Spur 0. Column *c.* 2.5 × 1.8 mm, 2 appendages completely cover the column. Pollinia 4, pyriform, *c.* 3 mm long, yellow. Ovary twisted, *c.* 3–5 mm; ovules in 3 vertical rows, pilose hairy, light green. Capsules oblong, 8–10 × 2–3 mm, pubescent.

Distribution: Indian Subcontinent and W. Maleysia (POWO, 2023); *Habitat*: Evergreen forests; *Fl.* & *Ft.*: January-May.

Specimens examined: Kalvary mount, 26.01.1983, *A.G. Pandurangan* 76638; Puliyanmala, 26.02.1984, *A.G. Pandurangan* 78098 (MH).

Zeuxine longilabris Trimen, Syst. Cat. Fl. Pl. Ceylon 90. 1885; Hook.f., Fl. Brit. India 6: 107. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1456. 1928; Abraham & Vatsala, Intr. Orchids 202. 1981; K.M.Matthew, Illustr. Fl. Palni Hills 683. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 478. 2004. **Fig. 13F**

Annual terrestrial herbs with underground creeping rhizomes, 20–35 cm tall. Stems slender, fleshy, tomentose. Leaves ovate, 3–5 × 1.3 cm, obtuse at apex, sessile, veins netted. Racemes 20–30 cm long. Flowers *c.* 1.6 × 0.6 cm, widely opening; pedicels 2.8–3 mm long; bracts spathulate, 8–9 × 2.5–3 mm, acuminate at apex, truncate at base, entire, 3-nerved, pilose, reddish green, smaller than ovary. Sepals 3, free, lanceolate-ovate; dorsal sepal 5–7 × 1.8–2 mm; lateral sepals 5.5–6 × *c.* 2 mm, obtuse at apex, cuneate at base, veins obscure, pilose, reddish green. Lateral petals 2, free, oblanceolate to ovate, 6–8 × 2–2.5 mm, obtuse at apex, 1-nerved from which veinlets arises, glabrous, white. Lips 2-lobed, adnate to column, *c.* 1.5 × 0.4 cm, each lobe *c.* 2 mm in diam., cleft up to middle of lip (*c.* 5 mm long), 5–6-nerved, dentate only at margin, incisions deep or shallow, glabrous, papillate basally, bearing 2 curved appendages, entire, white. Spur short or absent. Column *c.* 3 × 2 mm, 2-appendages completely cover the column. Pollinia 4, pyriform, *c.* 3.2 mm long, yellow. Ovary twisted, *c.* 9 × 2 mm; ovules in 3 vertical rows, pilose, light green. Capsules oblong, 10–12 × 2–3 mm, pubescent.

Distribution: Indian Subcontinent to Indo-China (POWO, 2023); *Habitat*: Evergreen, semi-evergreen and shola forests; *Fl.* & *Ft.*: December-April.

Specimens examined: Chinnarkuthu, Mankulam, 06.12.2018, *Dani Francis & Santhosh Nampy* 168883; way to Irumbupalam, 27.12.2017, *Dani Francis & Santhosh Nampy* 156390; Kattadikadavu, near Venmani, 07.12.2018, *Dani Francis & Santhosh Nampy* 167817; Kodikulam, 08.02.2021, *Dani Francis & Santhosh Nampy* 173399; Pettimudi, near Munnar, 18.03.2019, *Dani Francis & Santhosh Nampy* 168994 (CALI); Thekkady, 27.04.1994, *Jomy Augustine* 13628 (KFRI).

Notes: This species shows variation in the serration of the lobes and length of the sinus of the lip.

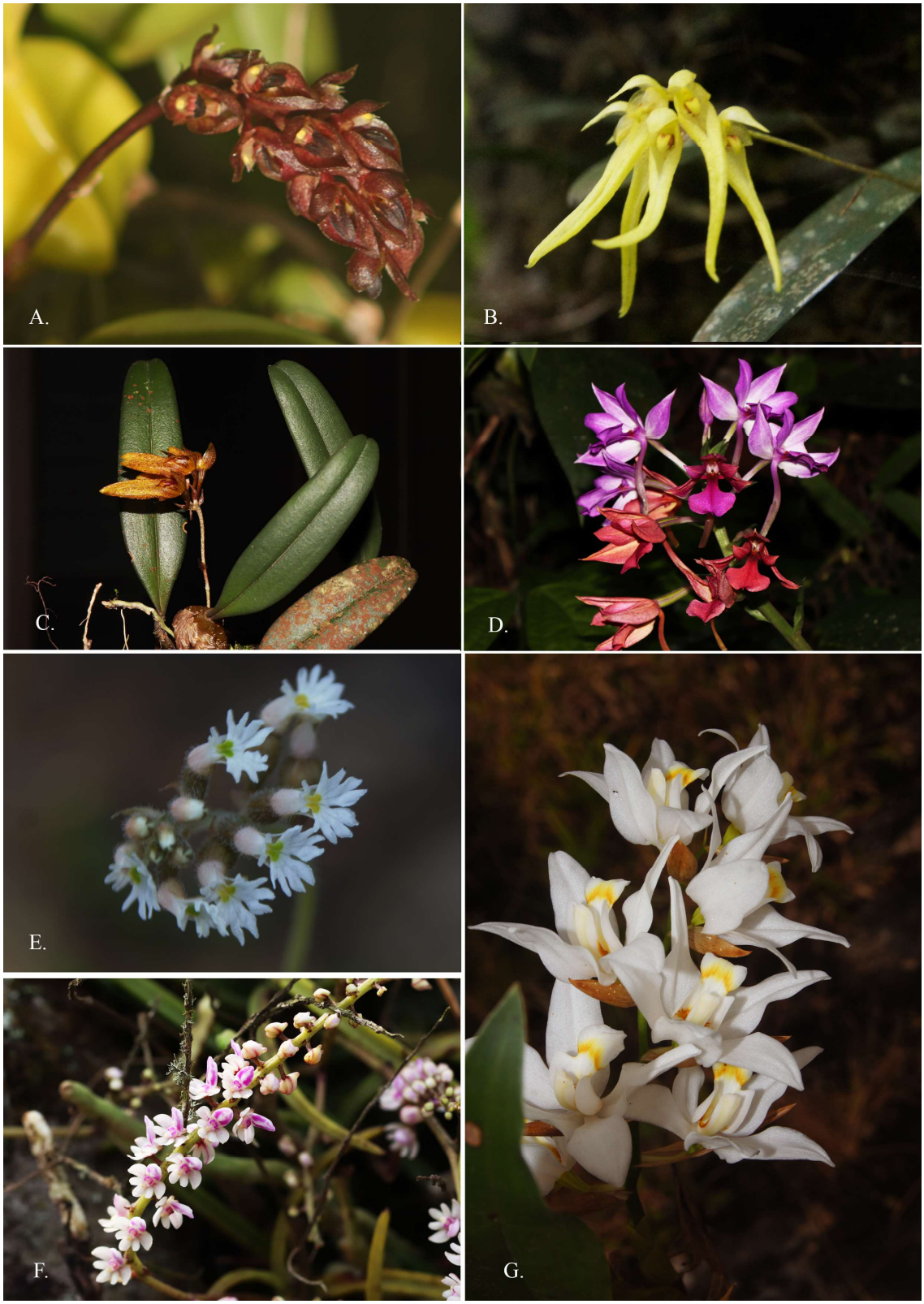


Fig. 11. A. *Bulbophyllum sterile* (Lam.) Suresh; **B.** *Bulbophyllum kaitiense* Rchb.f.; **C.** *Bulbophyllum fischeri* Seidenf.; **D.** *Calanthe masuca* (D.Don) Lindl.; **E.** *Anoectochilus elatus* Lindl.; **F.** *Diplocentrum recurvum* Lindl.; **G.** *Coelogyne mossiae* Rolfe.

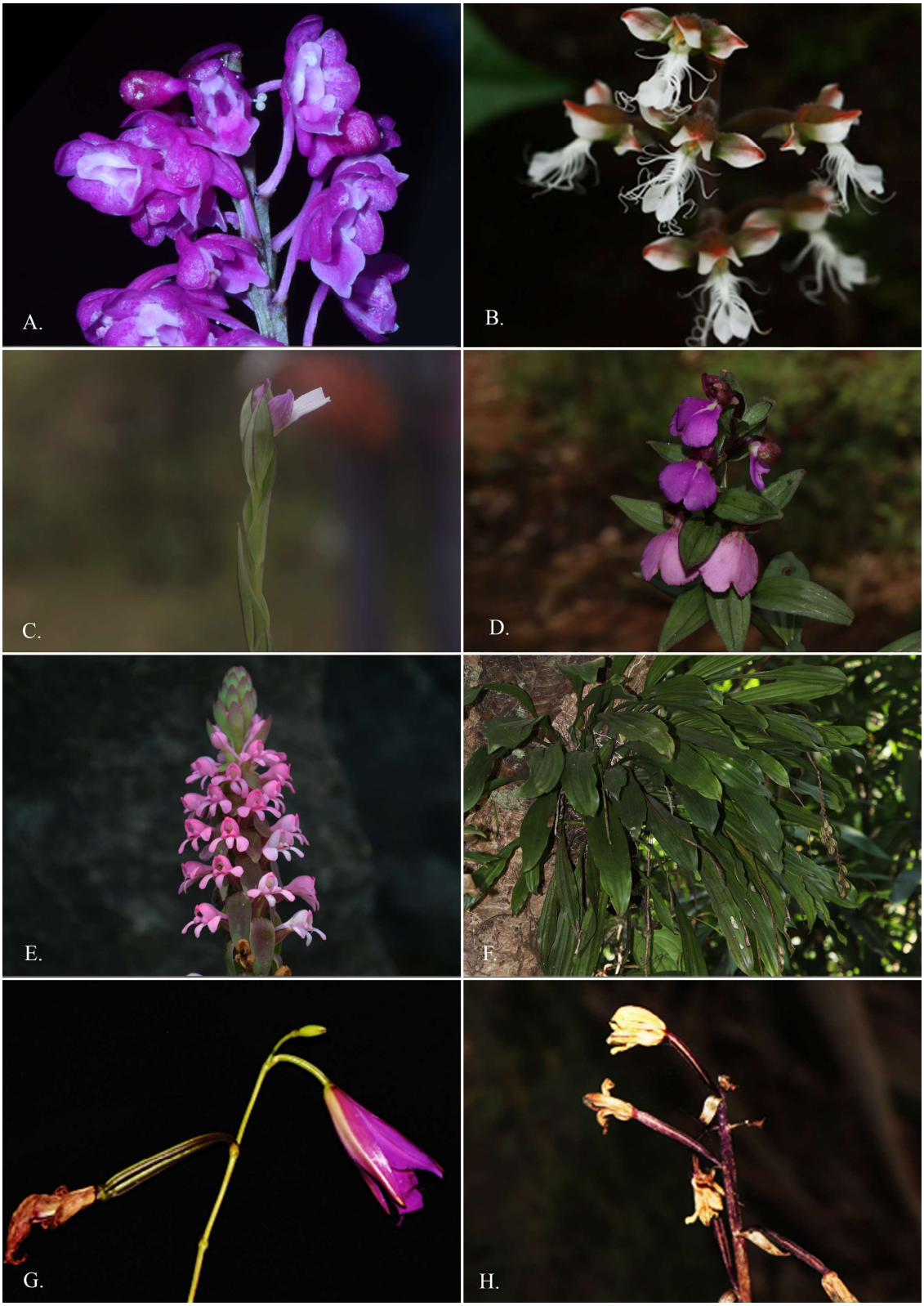


Fig. 12. A. *Aerides ringens* (Lindl.) C.E.C.Fisch.; **B.** *Anoectochilus elatus* Lindl.; **C.** *Brachycorythis iantha* (Wight) Summerh.; **D.** *Brachycorythis splendida* Summerh.; **E.** *Satyrium nepalense* D.Don; **F.** *Coelogyne imbricata* (Hook.) Rchb.f.; **G.** *Arundina graminifolia* (D.Don) Hochr.; **H.** *Aphyllorchis montana* Rchb.f.

Fig. 13. A. *Oberonia sebastiana* B.V.Shetty & Vivek.; **B.** *Porpax jerdoniana* (Wight) Rolfe; **C.** *Papilionanthe cylindrica* (Lindl.) Seidenf.; **D.** *Peristylus aristatus* Lindl.; **E.** *Sirhookera latifolia* (Wight) Kuntze; **F.** *Zeuxine longilabris* Trimen.

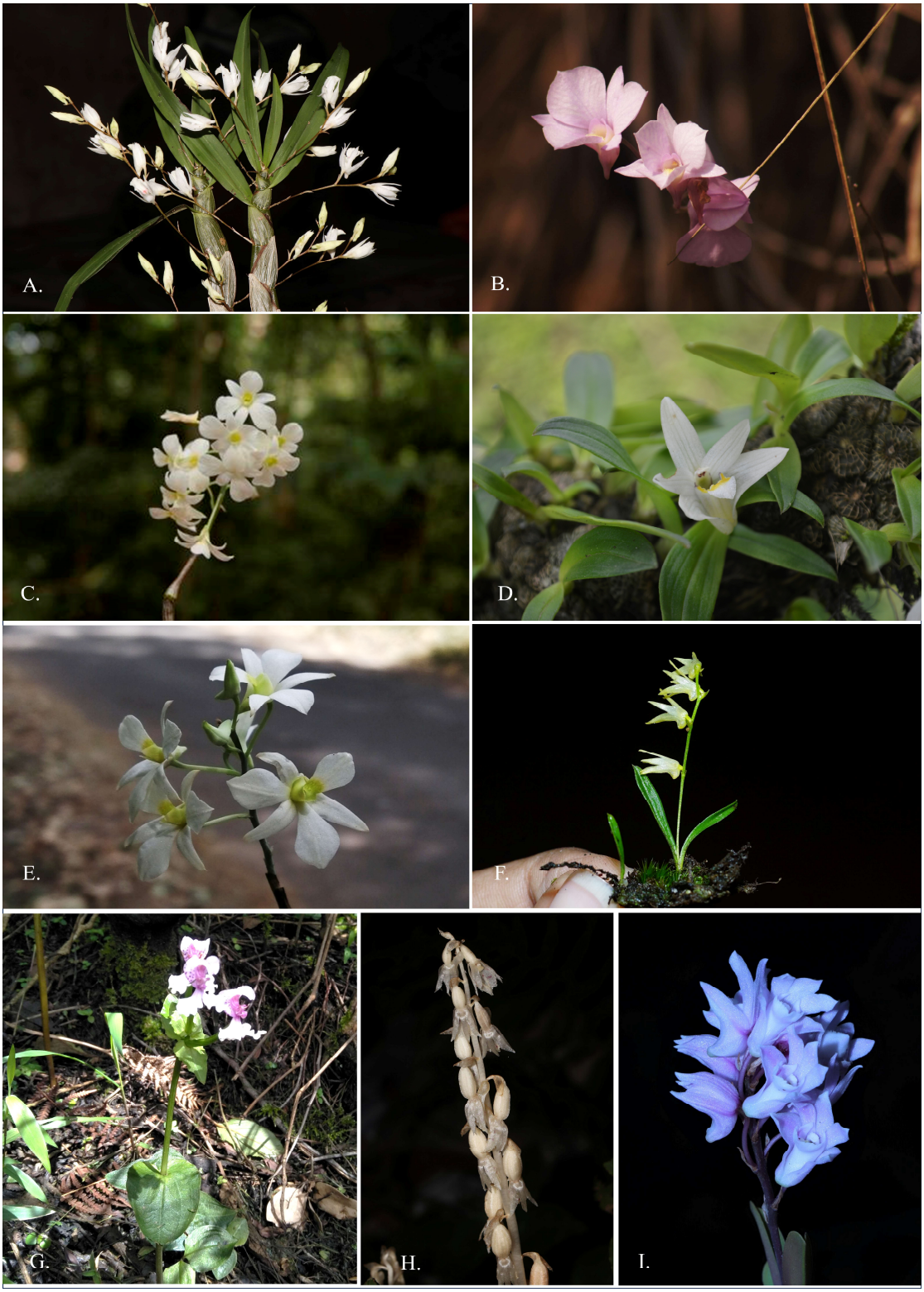


Fig. 14. A. *Dendrobium heyneanum* Lindl.: **B.** *Dendrobium kallarense* J.Mathew, Kad.V.George, Yohannan & K.Madhus.; **C.** *Dendrobium barbatulum* Lindl.; **D.** *Porpax reticosa* (Wight) Schuit.; **E.** *Dendrobium ovatum* Kraenzl.; **F.** *Porpax nana* (A.Rich.) Schuit.; **G.** *Disperis neilgherrensis* Wight; **H.** *Epipogium roseum* Lindl.; **I.** *Dendrobium anamalayanum* Chandrab., V.Chandras. & N.C.Nair.

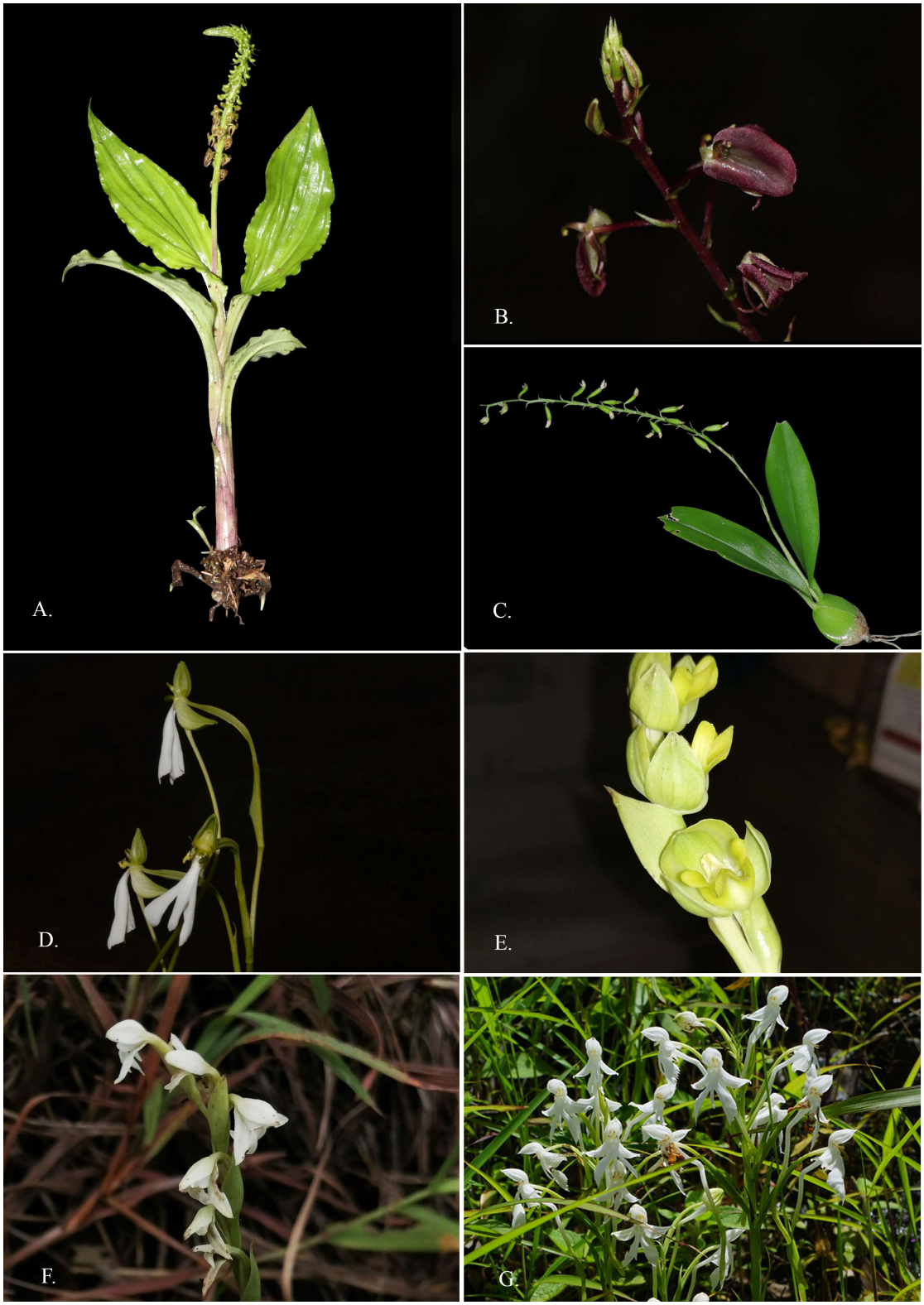


Fig. 15. A. *Crepidium resupinatum* (G.Forst.) Szlach.; **B.** *Liparis wightiana* Thwaites; **C.** *Liparis elliptica* Wight; **D.** *Habenaria longicorniculata* J.Graham; **E.** *Habenaria perrottetiana* A.Rich.; **F.** *Habenaria heyneana* Lindl.; **G.** *Habenaria longicorniculata* J.Graham.

ZINGIBERACEAE Martinov,

Tekhno-Bot. Slovar 682. 1820, *nom. cons.*

Annual or perennial rhizomatous terrestrial herbs. Rhizomes usually present, rarely absent, conical or obovate, usually fleshy or rarely hard, variously coloured, covered by scale leaves. Roots many, fleshy or fibrous, sometimes ending in root tubers. Leafy shoot single or in tufts, unbranched; leaf sheaths open or closed. Leaves distichous, sessile or petiolate; lamina elliptic to oblong-lanceolate or circular, ligulate; ligules short or long. Inflorescence terminal on the leafy shoot or separate shoot arises from the base or from rhizomes, subterranean, erect or pendulous. Bracts subtend 1–many flowered cincinni. Bracteoles tubular, or open to the base, rarely absent. Flowers bisexual, rarely unisexual, trimerous, zygomorphic. Calyx tubular or truncate, 3-toothed, persistent or deciduous. Corolla tubular or funnel-shaped; lobes 3, equal or sub-equal, tip hooded. Labellum adnate to the base of corolla tubes, 3-lobed or entire. Stamen 1, sessile or with filament; anther dehiscing longitudinally or by apical pore. Epigynous glands 2, free or united at the top of ovary, rarely absent. Ovary inferior, 1 or 3-locular, parietal. Fruit a capsule or berry. Seeds small arillate, aril lacerate or cover the seed completely or basal cushion only.

The 'ginger family' consists of 57 genera and approximately 1200 species worldwide (POWO, 2023). It is distributed throughout tropical Africa, Asia, and America. India has 21 genera and about 200 species (Sabu, 2006). The majority of the species are important ornamental, spice, or medicinal plants. Ten genera 28 species are reported from the study area.

Key to the genera

1. Ovary 1-locular …….. *Globba*

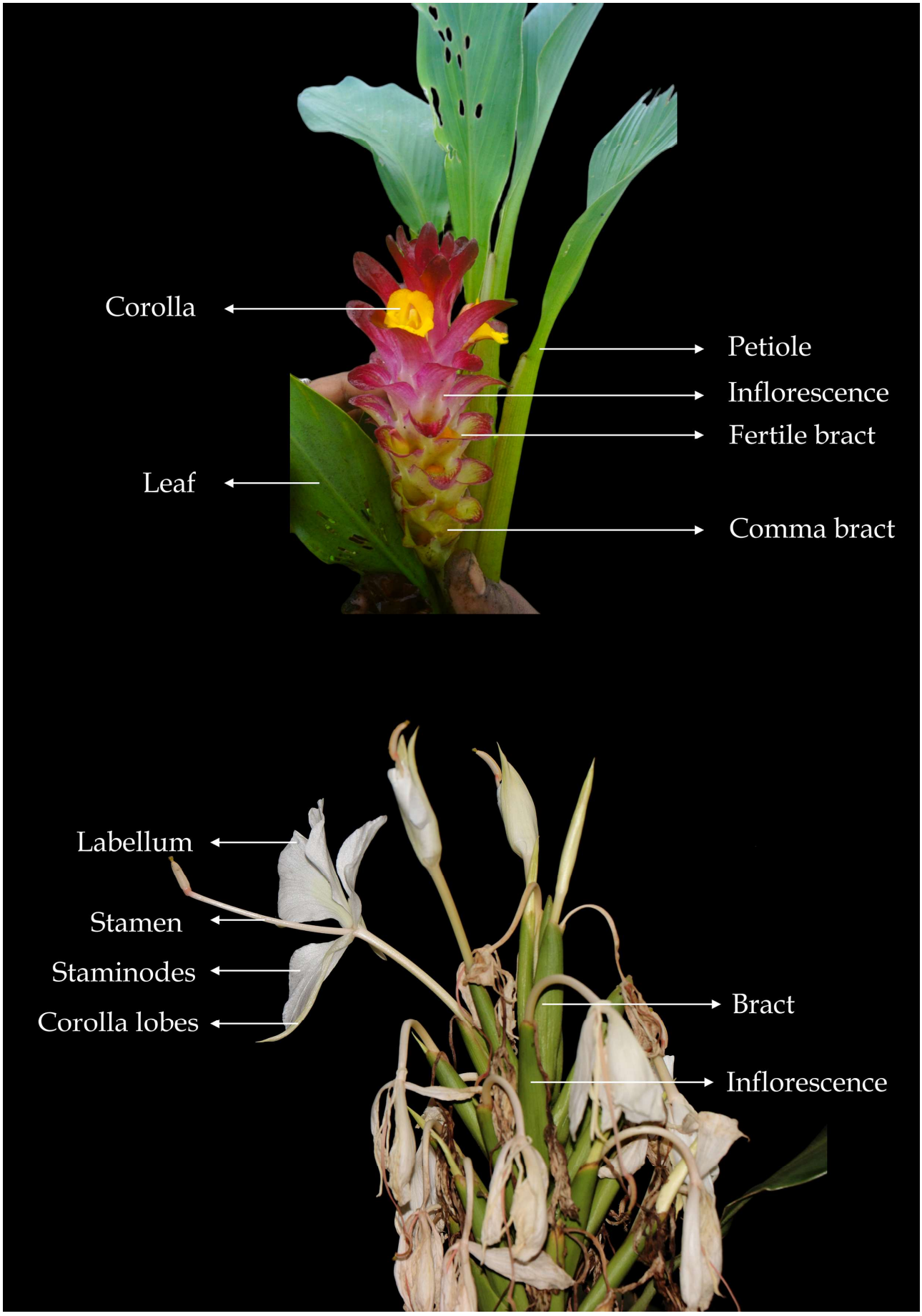
1. Ovary 3-locular …….. 2

2. Lateral staminodes large and broad …….. 3

2. Lateral staminodes small and narrow …….. 4

3. Coma bracts present; corolla tubes funnel shaped …….. *Curcuma*

3. Coma bracts absent; corolla tubes long and slender …….. *Hedychium*


Corolla
Petiole
Inflorescence
Fertile bract
Leaf
Comma bract
Labellum
Stamen
Staminodes
Corolla lobes
Bract
Inflorescence

4. Flowers in cone-like spikes ……..…….. 5

4. Flowers in spikes, racemes or panicles ……..…….. 9

5. Lateral staminodes present……..……..6

5. Lateral staminodes absent……..……..8

6. Filaments and anthers about equal length; bracteoles not split to the base ……..…… 7

6. Filaments shorter than anther; bracteoles split to the base ……..…… *Zingiber*

7. Fruits winged, smooth ……..…….. *Meistera*

7. Fruits not winged, echinate ……..…….. *Amomum*

8. Leaves glabrous on both sides; labellum creamy yellow, lateral lobes with reddish brown stripes ……..…….. *Costus*

8. Leaves hairy abaxially; labellum white with a creamy yellow median band ……..…….. *Hellenia*

9. Calyx unilaterally split; corolla tube more or less equal or shorter than calyx ……..…….. *Alpinia*

9. Calyx not unilaterally split; corolla tube little longer than bract ……..…….. *Boesenbergia*

Alpinia Roxb.,

Asiat. Res. 11: 350. 1810.

Key to the species

1. Inflorescence capitate, borne separately on a leafless peduncle; sterile bracts present …. ……..……2

1. Inflorescence paniculate or racemose, terminal on a leafy shoot; sterile bracts absent ……..…… 3

2. Inflorescence globose; sterile bracts form a cup-shaped structure ……..…….. *A. abundiflora*

2. Inflorescence elongates considerably with age; sterile bracts not forming a cup-shaped structure ……..…….. *A. fax*

3. Inflorescence branched; labellum clawed ……..…….. 4

3. Inflorescence not branched; labellum not clawed …….. 5

4. Bracts lanceolate; labellum not lobed ……. *A. galanga*

4. Bracts ovate; labellum 3-lobed ……. *A. nigra*

5. Bracts present; corolla tubes equal to calyx …….. *A. calcarata*

5. Bracts absent; corolla tubes shorter than calyx …….. *A. malaccensis*

Alpinia abundiflora Burtt & R.M.Sm., Notes Roy. Bot. Gard. Edinburgh 34(2): 179. 1975; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 478. 2004; M.Sabu, Zingiberaceae & Costaceae South India 48. 2006. *Amomum floribundum* (Thwaites) Trimen, Syst. Cat. Fl. Pl. Ceylon 92. 1885; Baker in Hook.f., Fl. Brit. India 6: 233. 1892. *Amomum involucratum auct.* C.E.C.Fisch. in Gamble, Fl. Madras 3: 1487. 1928 *non* Trimen, 1885. **Fig. 16B**

Perennial rhizomatous herbs. Leafy shoot 2–4 m high. Leaves oblong or lanceolate, 25–65 × 6–10 cm, acuminate at apex, attenuate at base, glabrous, rarely puberulous abaxially and on midrib, green; petioles 2–3 cm long; ligules membranous, 1–1.5 cm long, obtuse at apex, glabrous. Inflorescence capitate, globose, 8–10 cm across; peduncles 30–50 cm long, covered with sheaths; sheaths lanceolate, 10–15 × 2–4 cm, obtuse at apex, glabrous, pale red. Sterile bracts, oblong, 3–10 × 2–5 cm, mucronate at apex, glabrous, red, form a cup-shaped structure. Fertile bracts glabrous, red; outer resembling the sterile bract, subtending a single flower; inner narrower, lanceolate, 3.5–5 × 2–3 cm, obtuse at apex, subtending short-stalked cincinni up to 7 flowers. Bracteoles tubular, oblong, *c.* 2.5 cm long, apiculate at apex, slightly 2-keeled. Calyx tubular, 1–1.5 cm long, unilaterally split, pale pink. Corolla tubes equal to calyx or slightly longer; dorsal lobe broadly ovate, 4–5 × 2–3 mm, rounded at apex, glabrous; lateral lobes narrow, *c.* 2 mm long, glabrous. Labellum obovate, 3-lobed, rounded at apex, slightly undulate towards margins, white with pink stripes. Lateral staminodes absent. Anthers sessile. Ovary 3-locular, glabrous; ovules many. Epigynous glands 2. Capsules spherical-oblong, thin walled, smooth.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: January-December.

Specimens examined: Between Eravikulam & Munnar, 23.01.2018, *Dani Francis & Santhosh Nampy* 158130; Munnar-Chinnar Road, near Eravikulam National Park, 23.01.2008, *Thomas* 103019; near Subranshed, Pettimudi, 30.12.2019, *Dani Francis & Santhosh Nampy* 170073 (CALI).

Alpinia calcarata Roscoe, Trans. Linn. Soc. London 8: 347. 1807; Baker in Hook.f., Fl. Brit. India 6: 254. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1493. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 478. 2004; M.Sabu, Zingiberaceae & Costaceae South India 50. 2006.

Perennial herbs. Leafy shoots 1–1.5 m tall. Leaves lanceolate, 15–40 × 2–3 cm, acuminate at apex, attenuate at base, scabrous at margins, glabrous, green, sessile; ligules membranous, lanceolate, 0.5–1.5 cm long, slightly bifid at apex, ciliate at margins, glabrous. Panicles dense, terminal, 9–14 cm long; lower cincinni 4-flowered, upper 2-flowered; peduncles 9–12 cm long, densely hairy; bracts deciduous, triangular, *c.* 1 mm long, obtuse at apex, pubescent; bracteoles deciduous, ovate, obtuse at apex, slightly pubescent, pale pink. Flowers pale pink with red; pedicels *c.* 2 mm long, densely pubescent. Calyx tubular, *c.* 1 cm long, pubescent. Corolla tubes *c.* 1 cm long, equal to calyx, densely pubescent; dorsal lobes oblong, 1.5–2 × 0.5–0.8 cm, obtuse at apex, pubescent out; lateral lobes oblong, 1–1.5 × 0.4–0.5 cm, obtuse at apex, pubescent. Labellum obovate, 2.5–3 × 1.5–2 cm, sub-rounded at apex, sub-rounded at base, glabrous, variegated with dark purple and yellow. Lateral staminodes subulate, glabrous. Stamens *c.* 2 cm long; anthers *c.* 8 mm long, ecrestate. Ovary 3-locular, densely pubescent; ovules many; style projected above anthers; stigma rounded with ciliate opening. Epigynous glands 2, thick. Capsules globose, pubescent, orange red.

Distribution: S. India, China to Indo-China (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: May-December.

Specimens examined: Myladumpara, 10.07.2018, *Dani Francis & Santhosh Nampy* 188995 (CALI); Panamkutty, 04.05.1984, *C.N. Mohanan* 81770 (MH).

Notes: This species is closely allied to *A. smithiae* M.Sabu & Mangaly but can be easily distinguished by its linear leaves, smaller flowers and abscence of an anther

crest. It has high medicinal value and is widely used in traditional medicinal systems (Sabu, 2006).

Alpinia fax Burtt & R.M.Sm., Notes Roy. Bot. Gard. Edinburgh 34(2): 177. 1975; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 478. 2004; M.Sabu, Zingiberaceae & Costaceae South India 53. 2006. *Amomum involucratum* (Thwaites) Trimen, Syst. Cat. Fl. Pl. Ceylon 92. 1885; Baker in Hook.f., Fl. Brit. India 6: 233. 1892.

Perennial rhizomatous herbs. Leafy shoots 2–3 m tall. Leaves lanceolate, 50–60 × 8–15 cm, acuminate at apex, attenuate at base, glabrous, midvein densely pubescent abaxially, green, sessile; ligules oblong, *c.* 1 cm long, rounded at apex, glabrous, green; sheaths 20–35 cm long, glabrous. Spike radical, 9–15 × 4–6 cm, elongates considerably with age; peduncles 51–60 cm long, densely pubescent, covered with coriaceous bracts, red. Sterile bracts lanceolate, 4–12 × 1.5–2 cm, obtuse at apex, sheathing at base, puberulous, red. Fertile bracts lanceolate, 2–5 × 1–1.5 cm, obtuse at apex, truncate at base, pubescent, dense towards apex, each bracts subtends a cincinni of 4–5 flowers; bracteoles tubular, *c.* 1 cm long, keeled, densely pubescent, creamy white. Flowers 2–5 cm long, white. Calyx tubular, 1–1.4 cm long, bidentate at apex, persistent, densely pubescent. Corolla tubes 0.8–1 cm long, puberulous, white; dorsal lobe broadly ovate, *c.* 1 × 0.5 cm, obtuse at apex, glabrous, white; lateral lobes lanceolate, *c.* 1.5 × 0.5 cm, obtuse at apex, glabrous, white. Labellum orbicular, 1.5–2 × 1.5–2 cm, slightly 3-lobed, crenulate at margins, glabrous, white with purple red striations. Lateral staminodes reduced to 2 pointed structures. Stamens *c.* 9 mm long; filaments slender; anthers *c.* 6 mm long, crestate. Ovary ovate, *c.* 1 mm long, puberulous; style slender; stigma glandular, ciliate, yellow. Epigynous glands 2, needle-shaped. Capsules obovate, red, glabrous with persistent calyx.

Distribution: Sri Lanka (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: January-May.

Specimens examined: Deviyar mettu, 21.02.2003, *Prasanth Kumar M.G.* 86134; Deviyar medu hilltop, Periyar Tiger Reserve, 23.03.2009, *Thomas V.P. & Prabhu Kumar K.M.* 115559; Madalakottithode, 20.05.1994, *Jomy Augustine* 13747;

Periyar Medu, Periyar Tiger Reserve, 23.03.2009, *Thomas V.P. & Prabhu Kumar K.M.* 115558 (CALI).

Notes: *Alpinia fax* is closely related to *A. abundiflora* but can be differentiated by its sessile leaves, involucre of sterile, lanceolate bracts, flowers longer than the bract, densely pubescent bracts, bracteoles, calyx and corolla tube and obscurely 3-lobed labellum (Sabu, 2006). In Kerala, this species has been collected only from the study area.

Alpinia galanga (L.) Willd., Sp. Pl. ed. 4. 1(1): 12. 1797; Baker in Hook.f., Fl. Brit. India 6: 253. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1492. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 479. 2004; M.Sabu, Zingiberaceae & Costaceae South India 57. 2006. *Maranta galanga* L., Sp. Pl. 2: 3. 1762.

Perennial aromatic herbs. Leafy shoot 2–3 m tall. Leaves oblong-lanceolate, 17–50 × 5–15 cm, acuminate at apex, cuneate at base, glabrous, green; petioles 0.8–1 cm long; ligules triangular, 1–1.2 cm long, acute at apex, puberulous, ciliate at margins, brownish green. Panicle terminal, 20–30 cm long, branched, subtended by a sheath; sheaths 2, lanceolate, 13–24 × 1–1.5 cm, obtuse at apex, cuneate at base, glabrous, golden yellow; peduncle branched, densely pubescent. Bracts deciduous, membranous, lanceolate, *c.* 2 × 0.5 cm, obtuse at apex, sparsely pubescent, each subtending a cincinni of 4–5 flowers; bracteoles lanceolate, *c.* 1.5 × 0.5 cm, obtuse at apex, puberulous, enclosing buds. Flowers white; pedicels 4–5 mm long, pubescent; Calyx cylindrical, 0.8–1 cm long, lobed at apex, puberulous, green. Corolla tubes 1–1.3 cm long, greenish white; lobes unequal, spreading, pubescent along margins, dorsal lobes 1.5–2 × 0.5–0.6 cm, rounded at apex, greenish white, lateral lobes *c.* 1.5 × 0.6 cm, greenish white. Labellum not lobed, obovate, 1.5–2 × 0.8–1 cm, emarginate at apex, clawed at base, wavy at margins, glabrous, white with a few lilac lines on either side of the midrib. Lateral staminodes subulate. Stamens 2–2.5 cm long; filaments slender; anthers *c.* 6 mm long, ecrestate. Ovary ellipsoid, *c.* 4 mm long, hairy; style *c.* 1.2 cm long; stigma capitate. Epigynous glands 2. Capsules globose, orange red.

Distribution: S. China to W. and Central Malesia (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: April-December.

Specimens examined: Kattappana, Cardamom plantation, 28.09.1981, *C.N. Mohanan & B. Ramanujan* 72175 (MH); Myladumpara, Cardamom Research Station, 24.05.1983, *Mangaly & Sabu* 10324 (CALI); Thannikkudy, Periyar Tiger Reserve, 26.07.1993, *N. Sasidharan & Jomy Augustine* 12155 (KFRI); Venmani-Kattappana, 16.07.2021, *Dani Francis & Santhosh Nampy* 176045 (CALI).

Notes: *Alpinia galanga* commonly called as 'greater galangal' is a medicinal plant with diverse properties.

Alpinia malaccensis (Burm.f.) Roscoe, Trans. Linn. Soc. London 8: 345. 1807; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1493. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 479. 2004; M.Sabu, Zingiberaceae & Costaceae South India 58. 2006. *Maranta malaccensis* Burm.f., Fl. Indica 2. 1768. *Alpinia nutans* Roscoe var. *sericea* Baker in Hook.f., Fl. Brit. India 6: 256. 1892. **Fig. 16A**

Perennial rhizomatous herbs. Leafy shoot up to 3 m tall. Leaves lanceolate, 50–70 × 5–12 cm, acuminate at apex, attenuate at base, glabrous, green; petioles 2–4 cm long, pubescent; ligules ovate, 0.5–1 cm long, obtuse at apex, densely pubescent; sheaths 10–20 cm long, pubescent. Racemes terminal, rarely branched; peduncles 15–17 cm long, densely villous; bracts 0; bracteoles deciduous, open to the base, lanceolate, 1.5–1.8 × 1–1.5 cm, slightly pubescent at apex, white. Cincinni 1–2-flowered; pedicels 5–9 mm long, densely villous. Calyx tubular, 1.5–2 cm long, 3-lobed and acuminate at apex, deeply split on one side, white, pubescent towards apex. Corolla tubes *c.* 1 cm long, shorter than calyx, white; lobes sub-equal, 3 × 1–1.5 cm, rounded at apex, ciliate at margins, white. Labellum obovate, 3–4 × 2.8–3 cm, emarginate at apex, 2 papillose fleshy swelling at base, crenulate at margins, incurved at both sides, yellow, striped scarlet. Lateral staminodes subulate. Stamens *c.* 2.5 cm long; filaments *c.* 1 cm long; anthers *c.* 1.3 cm long, ecrestate. Ovary 3-locular, 0.5–0.7 cm long, densely villous; ovules many; style filiform; stigma funnel-shaped. Capsules globose, turning red at maturity. Seeds numerous, ovate or obovate with aril.

Distribution: Assam to China and Indo-China (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: March-January.

Specimens examined: Kozhiyalakkudi, Anakkulam, 18.09.2018, *Dani Francis & Santhosh Nampy* 161959; Mayiladumpara, Cardamom Research Station, 24.05.1983, *Mangaly & Sabu* 10326 (CALI); Panamkutty, 04.05.1984, *C.N. Mohanan* 81769 (MH); Periyar Tiger Reserve, 10.01.2004, *M.G. Prasanthkumar* 92623; *Ibid*., 10.01.2004, *M.G. Prasanthkumar* 92622; Thannikkudy, Periyar Tiger Reserve, 24.03.2009, *Thomas V.P. & Prabhu Kumar K.M.* 115569 (CALI); Thekkady, 06.10.1972, *B.D. Sharma* 42427 (MH).

Notes: This species is similar to *A. zerumbet* (Pers.) B.L.Burtt & R.M.Sm., but differs in its smaller flowers, erect inflorescence, large white bracteoles, and longer petioles (Sabu, 2006).

Alpinia nigra (Gaertn.) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 35(2): 213. 1977; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 479. 2004; M.Sabu, Zingiberaceae & Costaceae South India 66. 2006. *Zingiber nigrum* Gaertn., Fruct. Sem. Pl. 1: 35. 1788. *Alpinia allughas* (Retz.) Roscoe, Trans. Linn. Soc. London 8: 346. 1807; Baker in Hook.f., Fl. Brit. India 6: 253. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1493. 1928;

Perennial rhizomatous herbs. Leafy shoot 2–3 m tall. Leaves linear-lanceolate, 30–50 × 9–15 cm, acuminate at apex, attenuate at base, glabrous or slightly pubescent on either side of the midrib below, green, sessile or very shortly petiolate; ligules ovate, *c.* 5 mm long, rounded at apex, tip pubescent; sheaths 10–20 cm long, glabrous. Panicles terminal on the leafy stem, branched, 20–30 cm long, erect or slightly bend to one side, main axis and branches pubescent; bracts membranous, ovate, upper smaller, *c.* 5 mm long, lower larger; bracteoles tubular, membranous. Cincinni remote, up to 4 shortly pedicellate flowers. Flowers numerous, small, 3–3.5 cm long. Calyx tubular, 0.8–1.2 cm long, 3 toothed at apex, pubescent outside, persistent. Corolla tubes slightly smaller or equal to the calyx; lobes equal, linear-oblong, pubescent outside, glabrous within, greenish white; dorsal lobe cucullate, 1.2–1.4 × 0.5–0.7 cm; lateral lobes 1–1.2 × 0.4–0.5 cm. Labellum 3-lobed, 2–2.2 × 0.9–1.2 cm, clawed at base, glabrous, pink; mid lobe divided in to 2 triangular lobes; lateral lobes rounded. Lateral staminodes reduced, subulate, 1–2 mm long. Stamens 10–15 mm long; filaments 8–10 mm long; anthers 5–6 mm, ecrestate.

Ovary 3-locular, 4–6 mm long, pubescent. Capsules globose, glabrous, black when ripe.

Distribution: Indian Subcontinent to China (POWO, 2023); *Habitat*: Evergreen and moist deciduous forests; *Fl. & Ft.*: January-May.

Specimen examined: Koruthode, Periyar Tiger Reserve, 02.03.1994, *N. Sasidharan & Jomy Augustine* 13418 (KFRI).

Amomum Roxb.,

Pl. Coromandel 3(4): 75. 1820, *nom. cons.*

Amomum hypoleucum Thwaites, Enum. Pl. Zeyl. 318. 1861; Baker in Hook.f., Fl. Brit. India 6: 240. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1487. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 480. 2004; M.Sabu, Zingiberaceae & Costaceae South India 84. 2006.

Perennial rhizomatous herbs. Rhizomes slender, extensively creeping. Leafy shoot 1–1.5 m tall, covered by loosely arranged sheaths. Leaves oblong-lanceolate, 33–55 × 3.5–11 cm, acuminate at apex, acute at base, silvery woolly hairy abaxially, glabrous adaxially, green; petioles 4–8 cm long; ligules oblong, 2–4 mm long, bilobed at apex, glabrous-puberulous. Spikes born on long, slender, creeping, sheath-covered underground runners, 2–5 cm long, 2–3-flowered; peduncles slender, 2–5 cm long; bracts oblong, 2–3 × 0.5–0.8 cm, obtuse at apex, glabrous; bracteoles tubular when young, trilobed, 2.5–4 cm long; dorsal lobe apiculate, glabrous. Calyx 3-lobed, 3–4 cm long; dorsal lobe apiculate, glabrous. Corolla white; tube *c.* 4 cm long, equal to or slightly longer than calyx; lobes equal, 2–2.5 cm long; dorsal lobe cucullate, mucronate at apex; lateral lobes narrow. Labellum obovate, *c.* 3 × 2 cm, rounded at apex, crenulate at margins, hairy at the throat, yellow with pink striations. Lateral staminodes reduced to teeth-like projections at base of labellum. Stamens 1.6–2 cm long; filamentss slender; anthers 9–11 mm long, connectives extend to form a truncate crest. Ovary *c.* 4 mm long, pubescent; style slender; stigma simple. Capsules globose, ridged. Seeds ovate with a groove on one side, arillate.

Distribution: S. India, Sri Lanka and Peninsula Malaysia (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: March-November

Specimens examined: Mlappara, Periyar Tiger Reserve, 22.03.2009, *Thomas V.P. & Prabhu Kumar K.M.* 115557; 5 km from Mlappara, 24.03.2009, *Thomas V.P. & Prabhu Kumar K.M.* 115567 (CALI).

Notes: This species can be easily distinguished by the abaxial silvery silky leaves, long slender runners from which inflorescence are produced at intervals (Sabu, 2006).

Boesenbergia Kuntze,

Revis. Gen. Pl. 2: 685. 1891.

Boesenbergia tiliifolia Kuntze, Revis. Gen. Pl. 2: 685. 1891; M.Sabu, Zingiberaceae & Costaceae South India 124. 2006. *Gastrochilus tiliifolius* Baker, in Hook.f., Fl. Brit. India 6: 218. 1890.

Perennial rhizomatous herbs. Rhizomes small, 1.5–2 × 0.4–0.5 cm; root tubers cylindrical, 2.5 cm long. Leafy shoot 20–40 cm tall. Leaves ovate-elliptic, 5–20 × 2–8 cm, acute at apex, unequal at base, glabrous; petioles 1–2 cm long; ligules membranous, *c.* 1 × 0.5 cm, obtuse at apex, glabrous, hyaline. Inflorescence sub-sessile, 2–6 cm long, enclosed in terminal leaf sheaths; bracts distichous, oblong-lanceolate, 1.5–2 × 0.8–1 cm, obtuse at apex, puberulous adaxially, pale green, subtends a single flower; bracteoles equal to bract, lanceolate, 1.5–2.5 × 0.3–0.5 cm, bilipped at apex, densely hairy, white or pale green. Calyx tubular, 3–7 mm long, slightly 3-lobed at apex, truncate at base, split on one side, hyaline, glabrous. Corolla tubes slender, 1.5–2 cm long, white with pink tinch; lobes 3, oblong, 1–1.5 cm long, deeply pouched at apex, glabrous, white. Labellum obovate, 2–2.5 × 1–1.5 cm, sub-rounded at apex, wavy at margins, glabrous, white with laterally radiating pink bands in the depression, pink towards tip. Lateral staminodes obovate, 1–2 cm long, white, glabrous. Stamens 6–7 mm long; filaments slender; anthers *c.* 5 mm long, ecrestate. Ovary 1-locular, 2-ovuled; style filiform; stigma cup-shaped, white. Epigynous glands 2, linear. Capsules 2–4 seeded. Seeds sparsely hairy; aril lacerate.

Distribution: SW. India and Assam (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: July-October.

Specimens examined: Koruthode, Periyar Tiger Reserve, 11.08.1993, *N. Sasidharan & Jomy Augustine* 12205 (KFRI); Kozhiyalakkudi, Anakulam, 18.09.2018, *Dani Francis & Santhosh Nampy* 161973 (CALI).

Notes: This species is closely allied to *B. pulcherrima* (Wall.) Kuntze, but it can be distinguished by its cylindrical rhizomes, distinctly petioled leaves and lateral staminode equal to or shorter than the corolla lobes (Aishwarya & Sabu, 2015).

Costus L.,

Sp. Pl. 1: 2. 1753.

Costus pictus D.Don, Edwards's Bot. Reg. 19: t. 1594. 1833; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 480. 2004; M.Sabu, Zingiberaceae & Costaceae South India 258. 2006.

Fig. 17C

Perennial rhizomatous herbs. Leafy shoot 1–1.5 m tall. Leaves obovate-oblanceolate, 7–20 × 3–6 cm, acuminate at apex, sub-cordate at base, wavy at margins, glabrous, green. Spike terminal, compact. Bracts numerous, broadly ovate; ligules 2–3 mm long, completely encircles the pseudo stem, ciliate at margins, glabrous, green. Spike terminal, compact, 4–8 cm long; bracts numerous, closely imbricating, widely ovate, 2–3.5 × 2–2.5 cm, acute at apex, entire at margin, glabrous, green, one flower per bract; bracteoles boat-shaped, *c.* 2 × 1 cm, acute at apex, glabrous, green. Flowers 5–7 cm long, yellow with reddish stripes towards apex. Calyx cup-shaped, 0.7–1 cm long, 3-lobed at apex, glabrous, pale green. Corolla tubes 0.5–0.6 cm long, glabrous, lemon yellow; dorsal lobe ovate, 3–4 × 1.8–2 cm, acute and pointed at apex, glabrous, yellow; lateral lobes ovate, 3–4 × 1–1.1 cm, acute and pointed at apex, glabrous, yellow. Labellum tubular, funnel-shaped, 3.5–4 × 3–4 cm, 3-lobed; mid lobe yellow, with reddish brown stripes at margins; lateral lobes light yellow with reddish-brown stripes, glabrous out, puberulous in. Lateral staminodes 0. Stamens *c.* 2.5 cm long; filaments broad, pubescent; anthers ovate, white, crested. Ovary *c.* 0.5 cm long, villous.

Distribution: Mexico to Central America (POWO, 2023); *Habitat*: Wayside and forest margins; *Fl. & Ft.*: August-April.

Specimen examined: Marykulam, 30.04.2018, *Dani Francis & Santhosh Nampy* 159254 (CALI).

Notes: According to latest classification this species is included in the family Costaceae. The spiral arrangement of the leaves, closed leaf sheaths, sunken nectar glands, lack of aromatic substances in the plant, complete absence of lateral staminodes, very large, convoluted lip and very broad petaloid stamen distinguish Costaceae from Zingiberaceae. *Costus pictus* is an introduced species commonly called as 'insulin plant'. It is easily identified by its dark green, glabrous leaves, dark green floral parts and brown striped yellow labellum (Sabu, 2006).

Curcuma L.,

Sp. Pl. 1: 2. 1753, *nom. cons.*

Key to the species

1. Leaves with a purple patch along the midrib …….. *C. zanthorrhiza*

1. Leaves without a purple patch along the midrib …….. 2

2. Inflorescence lateral; labellum orbicular …….. *C. aromatica*

2. Inflorescence lateral and central; labellum obovate…….. 3

3. Leaves coriaceous; anther thecae not hooded …….. *C. coriacea*

3. Leaves not coriaceous; anther thecae hooded …….. 4

4. Comma bracts oblong; labellum with a deep yellow band …….. *C. neilgherrensis*

4. Comma bracts lanceolate; labellum without a deep yellow band …… *C. montana*

Curcuma aromatica Salisb., Parad. Lond. t. 96. 1808; Baker in Hook.f., Fl. Brit. India 6: 210. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1483. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 481. 2004; M.Sabu, Zingiberaceae & Costaceae South India 141. 2006.

Perennial rhizomatous herbs. Leafy shoot *c.* 1 m. Leaves distichous; petiole often as long as lamina; lamina broadly lanceolate, 30–65 × 6–15 cm, acuminate at apex, attenuate at base, glabrous adaxially, pubescent abaxially, green. Inflorescence lateral, 12–30 cm long; peduncle 4–7 cm long, covered by sheaths. Coma bracts ovate, *c.* 5 × 3 cm, acute at apex, glabrous, green. Fertile bracts ovate, 4–6 × 2–3 cm, recurved at apex, puberulous out, greenish white. Bracteoles ovate, 1.8–2 cm

long, puberulous, white. Calyx tubular, 1.5–2 cm long, 3-lobed at apex, puberulous, greenish white. Corolla tubes funnel-shaped, just exceeding calyx; lobes unequal, pinkish white; dorsal lobe broadly ovate, *c.* 1.5 × 1 cm, arching over the anther, hooded; lateral lobes oblong, *c.* 1.2 × 1 cm. Labellum orbicular, 1.5–1.8 × 0.8–1 cm, obscurely 3-lobed at apex, glabrous, deep yellow. Lateral staminodes oblong, as long as corolla lobes, obtuse at apex, glabrous, yellow. Anther thecae parallel, each ending in a long sharp spur at base. Ovary ovate; style filiform; stigma 2-lobed with a perforation in the centre. Capsules ovoid. Seeds ovoid, brown.

Distribution: Indian Subcontinent to S. Central China and Indo-China (POWO, 2023); *Habitat*: Forests and open lands; *Fl. & Ft.*: March-September.

Specimens examined: Kulamavu, 16.04.2004, *Jana Skornickova* 84183; *Ibid*., 15.05.2015, *s.coll. s.n.*; *Ibid*., 23.09.2003, *Jana Skornickova* 84170; 4 km. from Mlappara, 24.03.2009, *Thomas V.P. & Prabhu Kumar K.M.* 115566 (CALI); Valiyakanam, Periyar Tiger Reserve, 20.08.1994, *N. Sasidharan & Jomy Augustine* 13941 (KFRI).

Notes: It is an aromatic medicinal plant that is widely used in the cosmetic industry (Anoop, 2015).

Curcuma coriacea Mangaly & M.Sabu, Notes Roy. Bot. Gard. Edinburgh 45(3): 429. 1989; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 481. 2004; M.Sabu, Zingiberaceae & Costaceae South India 145. 2006. **Fig. 17A**

Perennial, rhizomatous herbs. Root tubers cylindrical, non-aromatic, white inside. Leafy shoot 25–35 cm tall. Leaves distichous; petioles 10–30 cm long; lamina elliptic, 25–45 × 7–14 cm, acuminate at apex, attenuate at base, coriaceous, plicate, densely pubescent, green; ligules not prominent. Inflorescence lateral, later central; peduncles 5–10 cm long. Coma bracts lanceolate, 3–4 × 1–1.5 cm, deep pink to violet. Fertile bracts ovate, 2–4 × 1–2 cm, acute and slightly recurved at apex, fused about half way from base, glabrous, greenish pink. Bracteoles small, 1–1.5 cm long. Flowers as long as or slightly longer than bracts, yellow, 3–5 in each bract. Calyx tubular, 0.8–1 cm long, 3-lobed at apex, deeply split on one side, pubescent. Corolla tubes funnel-shaped; lobes unequal; dorsal lobe concave, hooded at apex, yellow; lateral lobes linear. Labellum obovate, *c.* 2 × 2 cm, deeply

split at apex, lobes rounded, deep yellow. Lateral staminodes ovate, rounded at apex, yellow. Anther thecae with a small crest, spurred at base, spurs divergent, pointing forward. Epigynous glands 2. Ovary 3-locular, many ovuled; style filiform; stigma bilipped. Capsules ovoid, hairy. Seeds with white lacerate aril.

Distribution: SW. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: April-October.

Specimens examined: Idukki, 16.10.1975, *Jos K. Mangaly* 6739; *Ibid*., 16.10.1975, *Jos K. Mangaly* 6728; *Ibid*., 16.10.1976, *Jos K. Mangaly* 6730; Kulamavu, 23.09.2003, *Jana Skornickova* 84171; *Ibid*., 29.09.2003, *Jana Skornickova* 73447; Painav, 06.08.2017, *Dani Francis & Santhosh Nampy* 154314; *Ibid*., 16.05.2015, *s.coll.* 6954; 6km from Pinavu, 25.05.1983, *Jos K. Mangaly & M. Sabu* 10329; *Ibid*., 25.05.1983, *Jos K. Mangaly & M. Sabu* 10336; *Ibid*., 25.05.1983, *Jos K. Mangaly & M. Sabu* 10332; Panchalimedu, 13.09.2019, *Dani Francis & Santhosh Nampy* 170283 (CALI); Thekkady, 12.09.1994, *N. Sasidharan & Jomy Augustine* 14118 (KFRI).

Notes: The coriaceous dense pubescent leaves, lateral inflorescence, and bright yellow corolla distinguish this species from *C. plicata* Wall. ex Baker (Sabu, 2006).

Curcuma montana Roxb., Pl. Coromandel 2: 28. 1800; Baker in Hook.f., Fl. Brit. India 6: 214. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1483. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 482. 2004; M.Sabu, Zingiberaceae & Costaceae South India 163. 2006.

Perennial, rhizomatous herbs. Root tubers fusiform, non-aromatic, light orange yellow inside. Leafy shoot 60–80 cm tall. Leaves distichous oblanceolate, 15–17 × 7–10 cm, acuminate at apex, attenuate at base, plicate, puberulous abaxially, green; ligules not prominent. Inflorescence central; peduncles *c.* 20 cm long. Coma bracts lanceolate, 4–5 × 2–3 cm, white with pink in the distal half. Fertile bracts obovate, 4–5 × 3–4 cm, acute and slightly recurved at apex, fused about half way from base, puberulous, green with pink patches. Bracteoles large, *c.* 2.5 cm long. Flowers as long as or slightly smaller than bracts, yellow. Calyx tubular, 0.8–1 cm long, 3-lobed at apex, lobes broad and round. Corolla tubes funnel-shaped; lobes unequal; dorsal lobe concave, hooded at apex, white, hood pubescent; lateral lobes linear. Labellum obovate, *c.* 2 × 2 cm, lobes rounded, deep yellow. Lateral staminodes ovate, incurved at apex, yellow. Stamens pale yellow; filaments broad;

anther thecae spurred at base, spurs *c.* 3 mm long, connective prolonged in to a hood. Epigynous glands 2. Ovary 3-locular, many ovuled; style filiform; stigma bilipped.

Distribution: E. Himalaya to Assam (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-October.

Specimens examined: Vallakkadavu, Periyar Tiger Reserve, 13.09.1994, *K.P. Rajesh & Jomy Augustine* 14122 (KFRI).

Curcuma neilgherrensis Wight, Icon. Pl. Ind. Orient. t. 2006. 1853; Baker in Hook.f., Fl. Brit. India 6: 210. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1482. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 482. 2004; M.Sabu, Zingiberaceae & Costaceae South India 169. 2006.

Perennial rhizomatous herbs. Leafy shoot 15–30 cm tall. Leaves distichous; petioles 7–15 cm long; lamina elliptic-obovate, 15–25 × 5–9 cm, acute at apex, attenuate at base, glabrous adaxially, pubescent abaxially, green; ligules *c.* 5 mm long, hyaline. Inflorescence both lateral and central, 9–15 × 2–4 cm; peduncles 3–7 cm long. Coma bracts oblong, 1.5–2 × 0.5–1 cm, obtuse at apex, fused at base, pubescent, pink. Fertile bracts ovate, 2–3 × 1–1.5 cm, slightly recurved at apex, fused at base, densely pubescent, pinkish green. Bracteoles triangular, 2–3 × 1.5–2 cm, obtuse at apex, puberulous. Calyx tubular, 1–1.5 cm long, 3-lobed at apex, densely pubescent, violet dotted. Corolla tubes 1.5–1.8 cm long, pale yellow; lobes unequal, pubescent; dorsal lobe ovate, 1.5–2 cm long, hooded at apex; lateral lobes linear, *c.* 1.5 × 0.5 cm. Labellum obovate, 1.5–2 × 1.5–2 cm, clefted at apex, glabrous, yellow with deep yellow median band. Lateral staminodes oblong, *c.* 2 × 1 cm, obtuse at apex, glabrous, yellow. Anther thecae parallel, hooded, spurred, glandular hairy abaxially. Ovary 3-locular, many-ovuled; style filiform; stigma 2-lobed, appressed within in thecae. Epigynous glands 2, linear. Fruits pubescent with persistent calyx, green. Seeds with white lacerate aril.

Distribution: W. & S. India, and Indo-China (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-May.

Specimens examined: Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154356 (CALI); Kulamavu, 23.09.1981, *C.N. Mohanan & B. Ramanujan* 71904, 71932; Painavu-Kulamavu, 21.08.1981, *K. Vivekananthan & V.S. Raju* 71138 (MH); Parunthanpara, 29.04.2018, *Dani Francis & Santhosh Nampy* 159242 (CALI); Vandiperiyar, 25.05.1965, *K. Vivekananthan* 24323 (MH).

Curcuma zanthorrhiza Roxb., Fl. Ind. 1:25. 1820; M.Sabu, Zingiberaceae & Costaceae South India 183. 2006.

Perennial rhizomatous herbs. Tubers fusiform, fleshy, orange yellow inside. Leafy shoot *c.* 1 m. Leaves distichous; petioles 40–50 cm long; lamina oblong, 30–60 × 10–15 cm, acuminate at apex, attenuate at base, glabrous, green with a purple patch on upper surface along the whole length of the midrib. Inflorescence lateral, 15–20 × 4–8 cm; peduncles 15–20 cm long, covered by sheaths. Coma bracts ovate, 4–5 × 3–4 cm, acute at apex, fused only at base, glabrous, dark pink. Fertile bracts ovate, 4–5 × 3–4 cm, recurved at apex, lower half fused, puberulous, green, margin pink. Bracteoles ovate, 1.5–2 cm long, glabrous, white. Calyx tubular, *c.* 1 cm long, 3-lobed at apex, split on one side, pubescent, greenish white. Corolla tubes funnel shaped, 2–3 cm long, pinkish white; dorsal lobe broadly triangular, *c.* 1.5 × 1 cm, arching over the anther, hooded; lateral lobes oblong, *c.* 1–1.5 × 0.8–1 cm, hooded at apex; lateral lobes narrow, *c.* 1 × 0.8 cm, obtuse at apex, glabrous. Labellum orbicular, 1.5–2 × 1.5–2 cm, obscurely 3-lobed at apex, mid lobe emarginate at apex, glabrous, pale yellow with a deep yellow band. Lateral staminodes oblong, 1–1.5 × 0.8–1 cm, obtuse at apex, glabrous, pale yellow. Anther thecae ecrestate, spurred. Ovary 3-locular, many ovuled, pubescent; style filiform; stigma 2-lobed. Epigynous glands 2, linear. Fruits ovoid, smooth.

Distribution: SW. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: April-September.

Specimens examined: Kulamavu, 23.09.2003, *Jana Skornickova* 84172; *Ibid*., 16.04.2004, *Jana Skornickova* 84182; Kulamavu, near police station, 23.09.2003, *Jana Skornickova* 84166 (CALI).

Globba L.,

Mant. Pl. 2: 143. 1771.

Key to the species

1. Bracts persistent; anthers winged …….. *G. marantina*

1. Bracts deciduous; anthers not winged …….. *G. sessiliflora*

Globba marantina L., Mant. Pl. 2: 170. 1771; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 483. 2004; M.Sabu, Zingiberaceae & Costaceae South India 106. 2006. *G. bulbifera* Roxb., Asiat. Res. 11: 358. 1810; Baker in Hook.f., Fl. Brit. India 6: 206. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1481.1928. **Fig. 16F**

Perennial rhizomatous herbs. Leafy shoots 25–80 cm tall. Leaves oblanceolate, 4–20 × 1.5–5 cm, acuminate at apex, cuneate at base, glabrous, green; petioles 0.3–0.8 cm long; ligules membranous, 1–3 mm long, ciliate at margins. Inflorescence terminal, 3–8 cm long, straight, sometimes the whole inflorescence produces bulbils in the axil of bracts; peduncles slender, 2.5–4 cm long, densely hairy, green; bracts closely imbricating, persistent; lower larger, ovate, 1.5–2 × 1–2 cm, obtuse at apex, cuneate at base, glabrous, subtended by ovoid or conical, densely pubescent bulbils; upper ovate, *c.* 1 × 0.3 cm, obtuse at apex, cuneate at base, glabrous, subtended by a cincinni of 8–10 flowers; bracteoles triangular, 3–5 × 3.8–4.8 mm, obtuse at apex, distichous, densely hairy, green. Flowers orange; pedicels 3–4 mm long. Calyx truncate, 3–5 mm long, slightly trilobed at apex, glabrous, orange. Corolla tubes slender, 1–1.2 cm long; lobes cup-shaped, 4–5 mm long, obtuse at apex, glabrous, orange. Labellum triangular, 4–6 × 2–3 mm, lobed, orange. Lateral staminodes elliptic, 5–6 × 2–3 mm, rounded at apex, glabrous, orange. Stamens 1; filaments slender; anthers small, winged, with two triangular appendages in each side. Ovary smooth, 1-locular; ovules many; style filiform; stigma exserted from anther lobes. Epigynous glands 2, linear, pointed at apex. Capsules globose, warty. Seeds ovoid, hairy with lacerate aril.

Distribution: China to tropical Asia and Queensland (POWO, 2023); *Habitat*: Moist deciduous forests; *Fl. & Ft.*: June-November.

Specimens examined: Neriamangalam to Adimali Road, 17.11.2020, *Dani Francis & Santhosh Nampy* 173303; Thekkady, Nellikkampetty range, 14.07.2017, *Dani Francis & Santhosh Nampy* 152839 (CALI).

Notes: Winged anthers, closely imbricating bracts, and smooth ovary distinguish this species from other species of *Globba* (Sabu, 2006).

Globba sessiliflora Sims, Bot. Mag. 35: t. 1428. 1811. *G. ophioglossa* Wight, Icon. Pl. Ind. Orient. 6: 16. 1853; Baker in Hook.f., Fl. Brit. India 6: 202. 1890; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1480. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 483. 2004; M.Sabu, Zingiberaceae & Costaceae South India 109. 2006. **Fig. 16E**

Perennial rhizomatous herbs. Leafy shoots 30–100 cm tall. Leaves oblong-lanceolate, 9–20 × 2.5–5 cm, acuminate at apex, cuneate at base, pubescent abaxially, puberulous adaxially; green, petiolate or sessile; ligules membranous, 2–3 mm long, bipartite at apex, densely pubescent. Inflorescence terminal, erect, 7–20 cm long, bearing few-many slender branches in the axil of bracts, bulbils at the basal bracts; bracts ovate, 3–5 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, deciduous, greenish yellow; bracteoles triangular, 2–3 × 1.5–2 mm, acute at apex, glabrous, orange. Calyx truncate, 6–8 mm long, slightly 3-lobed at apex, glabrous, yellowish green. Corolla tubes slender, 1.5–2 cm long, densely pubescent, orange; lobes unequal, spreading; dorsal lobe cup-shaped, 5–6 × 2–3 mm, hooded at apex, minutely pubescent at the lower middle, orange yellow; lateral lobes ovate, 3–5 × 1.5–3 mm, obtuse at apex, glabrous, orange yellow. Labellum linear, 9–11 × 3.5–4 mm, emarginate at apex, sub-truncate at base, glabrous, orange yellow. Lateral staminodes linear, 10–12 × 2–3 mm, acuminate at apex, pubescent abaxially, orange. Stamens *c.* 6 cm long; filaments slender, white at base, orange towards apex; anthers *c.* 4 mm long, connectives slightly projecting to form a hood at apex. Ovary 1-locular, glabrous; ovules many. Epigynous glands 2. Capsules globose, warty. Seeds ovoid, hairy with lacerate aril.

Distribution: India to Thailand (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: July-September.

Specimens examined: Neriamangalam, 06.08.2002, *Prasanth Kumar M.G.* 86383; Painavu, 07.08.2017, *Dani Francis & Santhosh Nampy* 154328 (CALI).

Notes: *Globba sessiliflora* closely resembles to *G. orixensis* Roxb., but differs by its large orange-yellow flowers, longer corolla tube and large slightly warted capsules (Sabu, 2006).

Hedychium J.Koenig

in A.J.Retzius, Observe. Bot. 3: 73. 1783.

Key to the species

1. Bracts closely imbricating; labellum shortly bifid …….. 2

1. Bracts irregularly arranged; labellum deeply bifid …….. 3

2. Calyx shorter than bract; stamens shorter than labellum …….. *H. coronarium*

2. Calyx equal to or slightly longer than bract; stamens longer than labellum …….. *H. flavescens*

3. Labellum white-pale yellow; stamens yellow …….. *H. venustum*

3. Labellum yellow with a red blotch at mouth; stamens red …….. *H. spicatum*

Hedychium coronarium J.Koenig in A.J.Retzius, Observe. Bot. 3: 73. 1783; Baker in Hook.f., Fl. Brit. India 6: 225. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1485. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 483. 2004; M.Sabu, Zingiberaceae & Costaceae South India 196. 2006. **Fig. 16D**

Perennial rhizomatous shrubs. Leafy shoots erect, forming a cluster covered by leaf sheaths. Leaves bifarious, sessile, oblong-lanceolate, 20–60 × 4–10 cm, acuminate at apex, attenuate at base, glabrous, dark green; ligules membranous, closely appressed to stem, 1–3 cm long, obtuse at apex, pubescent, brown. Inflorescence terminal, solitary, 15–20 × 4–7 cm, dense flowered; bracts oblong-ovate, 2–8 × 2–2.5 cm, rounded with a pointed tip at apex, glabrous, green, basally larger, smaller towards apex, subtending 4–5 flowers; bracteoles triangular, 2.8–3 × 1–1.5 cm, acuminate at apex, glabrous. Flowers white, fragrant. Calyx tubular, shorter than bract, 3–4 cm long, unilaterally split, glabrous. Corolla tubes slender, 6–8 cm long, white; lobes linear-lanceolate, 3–4 × 0.5–1 cm, obtuse at apex, glabrous, white. Labellum orbicular, 4–5 × 4–5 cm, bifid at apex, attenuate at base, glabrous, white, greenish yellow at centre. Lateral staminodes lanceolate, 3–3.5 × 1.5–2 cm, obtuse at apex, attenuate at base, glabrous, white. Stamens shorter than

labellum, 3.5–3.8 cm long; filaments slender; anthers white with a green connective. Ovary 3-locular; many-ovuled; style slender; stigma exerted. Epigynous glands 2. Capsules oblong. Seeds many with a lacerate aril.

Distribution: Indian Subcontinent to Taiwan (POWO, 2023); *Habitat*: Near streams and ponds; *Fl. & Ft.*: Throughout the year.

Specimens examined: Kulamavu, 07.06.1984, *C.N. Mohanan* 82001; *Ibid*., 15.12.1982, *C.N. Mohanan* 76097 (MH); Mangaladevi Hills, 15.07.2017, *Dani Francis & Santhosh Nampy* 154101 (CALI); Meenmutty, 02.10.1983, *C.N. Mohanan* 79908 (MH); 6 km from Mlappara, 24.03.2009, *Thomas V.P. & Prabhu Kumar K.M.* 115568 (CALI); Nellippara slopes, way to Mlappara, 07.02.1981, *N.C. Nair* 70100 (MH); Poonkavanam, Periyar Tiger Reserve, 09.04.1995, *N. Sasidharan & Jomy Augustine* 14959 (KFRI); Uppupara, 19.12.1974, *K. Vivekananthan* 45362; Vallakadavu R.F., 23.09.1972, *B.D. Sharma* 40843 (MH).

Notes: *Hedychium coronarium* is popularly known as 'white garland lily', and is used as an ornamental and medicinal plant. It is considered as a riparian weed in some regions (Soares & Barreto, 2008; Hu *et al.*, 2020).

Hedychium flavescens Carey ex Roscoe, Monandr. Pl. Scitam. t. 50. 1825; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1485. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 484. 2004; M.Sabu, Zingiberaceae & Costaceae South India 199. 2006. *Hedychium coronarium* var. *flavescens* (Carey ex Roscoe) Baker in Hook.f., Fl. Brit. India 6: 226. 1892.

Perennial rhizomatous shrubs. Leafy shoots 2–3 m tall. Leaves bifarious, lanceolate, 25–45 × 4–7 cm, acuminate at apex, attenuate at base, glabrous, green; sessile or petiolate, petiole *c.* 0.5 cm long; ligules membranous, 1–2 cm long, pubescent. Inflorescence terminal, 7–10 × 3.5–5 cm; bracts broadly ovate, 4–5 × 1–2 cm, acute at apex, puberulous, green, subtending a cincinni of 3–4 flowers; bracteoles obtuse, 2–3 × 1–1.5 cm, obtuse at apex, slightly 2-keeled towards apex, pubescent abaxially. Calyx tubular, equal to or slightly longer than bracts, 3–4 cm long, 3-toothed at apex, unilaterally split about half, puberulous, green. Corolla tubes 6–8 cm long, greenish cream; lobes unequal, linear, 4–4.5 cm long, pointed at apex, glabrous, creamish white. Labellum broadly obcordate, 3–4 × 3–4 cm,

cordate and bifid at apex, clawed at base, glabrous, creamish yellow. Lateral staminode oblanceolate, 3–4 × 0.8–1.5 cm, obtuse at apex, clawed at base, glabrous, creamish yellow. Stamens longer than labellum, 5–6 cm long; filaments slender; anthers *c.* 1.4 cm long, yellow. Ovary densely pubescent; style filiform; stigma club-shaped. Epigynous glands 2. Capsules globular. Seeds numerous.

Distribution: E. Nepal to China (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: February-December.

Specimens examined: Koymanchola, 10.02.2021, *Dani Francis & Santhosh Nampy* 188720; Mannavan Shola, 21.11.2002, *Ramesh M.* 86114 (CALI); *Ibid.,* 27.11.1979, *Nambiar* 1030 (KFRI); Meenmutty, 30.05.1982, *C.N. Mohanan* 74113 (MH); Munnar, near bridge, 20.05.1999, *Sabu M.* 78809; *Ibid.*, 22.12.2018, *Jana Skornickova* 75264; Onnamthodu (Mathikettan Shola National Park), 24.04.2016, *Syam Radh S.* 149122 (CALI).

Notes: This species is allied to *H. coronarium,* but distinguished by its ciliate bracts, longer calyx than bracts, yellow staminodes and the stamen longer than the lip (Sabu, 2006).

Hedychium spicatum Sm. in A.Rees, Cycl., (London ed.) xvii. n 8. 1811; M.Sabu, Zingiberaceae and Costaceae of South India 202. 2006. *Hedychium spicatum* var. *acuminatum* (Roscoe) Wall., Hooker's J. Bot. Kew Gard. Misc. 5: 328. 1853; Baker in Hook.f., Fl. Brit. India 6: 227. 1894; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 484. 2004.

Perennial rhizomatous shrubs. Leafy shoot 1–1.5 m tall. Leaves distichous, oblong-lanceolate, 15–40 × 5–10 cm, acuminate at apex, attenuate at base, glabrous-puberulous, green; petioles 2–3 cm long; ligules membranous, 1–2 cm long, obtuse at apex, puberulous. Spikes terminal, dense flowered, 9–18 cm long; bracts ovate-oblong, 2–5 × 1–1.5 cm, obtuse at apex, ciliate at apex, glabrous-puberulous, green, subtended by 1–3-flowered cincinni; bracteoles *c.* 2 × 1 cm, obtuse at apex, glabrous. Flowers 5–6 cm long. Calyx tubular, 3–3.5 cm long, unilaterally split on one side. Corolla tubes slender, 5–6 cm long, glabrous, reddish white; lobes equal, linear, 2.5–3 × 0.3–0.5 cm, pointed at apex, glabrous, pale green. Labellum obovate, 3–4 × 1.5–2 cm, deeply 2-lobed, clawed at base, glabrous, yellow with a red blotch at mouth. Lateral staminodes linear, 3–4 cm long, bifid at apex, glabrous, reddish white. Stamens shorter than labellum, curved; filaments and anthers red. Ovary

ovate; style filiform; stigma protruding. Epigynous glands 2. Capsules globose. Seeds many; aril lacerate.

Distribution: India, Himalaya to S. Central China and Indo-China (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: June-February.

Specimens examined: Kalvary Mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154365; Mankulam, way to Edathattu, 13.09.2018, *Dani Francis & Santhosh Nampy* 159488; Mathikettan Shola National Park, Sivanpara, 23.08.2014, *Syam Radh S. & Santhosh Nampy* 143551; Munnar, 09.02.2017, *Dani Francis & Santhosh Nampy* 151675; *Ibid*., 06.08.2002, *M.G. Prasanth Kumar* 86382 (CALI).

Notes: *Hedychium spicatum* is morphologically close to *H. griffithianum* Wall. but differs by its stamen being shorter than the labellum. It also related to *H. venustum* Wight, but can be distinguished by its yellow labellum with a red blotch at the mouth and red stamen (Sabu, 2006).

Hedychium venustum Wight, Icon. Pl. Ind. Orient. t. 2012. 1853; Baker in Hook.f., Fl. Brit. India 6: 226. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1485. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 484. 2004; M.Sabu, Zingiberaceae & Costaceae South India 205. 2006. **Fig. 16C**

Perennial rhizomatous shrubs. Leafy shoot *c.* 1 m tall. Leaves distichous, oblong-lanceolate, 18–35 × 6–10 cm, acuminate at apex, attenuate at base, glabrous or puberulous, green; petioles 1–2 cm long; ligules membranous, 1–1.5 cm long, glabrous or puberulous. Inflorescence central, 15–20 cm long; bracts lax, lanceolate, 2–2.5 × 0.5–1 cm, obtuse at apex, glabrous, green, folded around a single flower; bracteoles ovate, *c.* 2 × 0.5 cm, obtuse and hairy at apex, glabrous. Flowers 7–9 cm long. Calyx tubular, 3.5–4 cm long, 3-toothed at apex, slightly unilaterally split on one side. Corolla tubes slender, 7–8 cm long, glabrous; lobes equal, linear, 3–3.5 × 0.1–0.2 cm, acute at apex, glabrous. Labellum obovate, 4–5 × 1–1.5 cm, deeply 2-lobed, clawed at base, glabrous, white-pale yellow. Lateral staminodes linear, 3–4 × 0.1–0.2 cm, pointed at apex, glabrous, white. Stamens shorter than labellum, yellow; filaments slender; anthers *c.* 1 cm long. Ovary 3-locular, glabrous; style filiform; stigma protruding. Epigynous glands 2. Capsules globular. Seeds numerous.

Distribution: S. India and Myanmar (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: June-November.

Specimen examined: Pachakkanam, 08.10.1993, *Jomy Agustine* 12322.

Hellenia Retz.,

Observe. Bot. 6: 18. 1791.

Hellenia speciosa (J.Koenig) S.R.Dutta, Pleone 7(1): 228. 2013. *Banksea speciosa* J.Koenig in A.J.Retzius, Observ. Bot. 3: 75. 1783. *Costus speciosus* (J.Koenig) Sm., Trans. Linn. Soc. London 1: 249. 1791; Baker in Hook.f., Fl. Brit. India 6: 249. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1490. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 481. 2004; M.Sabu, Zingiberaceae & Costaceae South India 259. 2006.

Fig. 17D

Perennial rhizomatous herbs. Leafy shoot 1–2 m tall; sheaths closed, green, hairy or glabrous. Leaves spirally arranged, oblong, 15–25 × 3–6 cm, acuminate at apex, attenuate at base, densely pubescent abaxially, puberulous adaxially; petioles 2–4 cm long, hairy; ligules truncate, densely hairy. Inflorescence globose, 4–8 × 3–4 cm, red; bracts ovate-lanceolate, 1.5–2.5 × 0.5–1 cm, acute at apex, glabrous, red, subtended by a single flower; bracteoles ovate, 1–1.5 × 0.5 cm, obtuse at apex, glabrous, red. Calyx tubular, 2–2.5 cm long, 3-lobed at apex, glabrous. Corolla tubes equal or shorter than calyx, 2–2.4 cm long; lobes ovate, 3–4 cm long, acuminate at apex, densely hairy, pinkish white. Labellum orbicular, white with a creamy-yellow median band, hairy along the band. Lateral staminodes 0. Stamens hairy on back, tip flattened, upturned, yellow at apex. Ovary flattened, hairy; style terete; stigma ovoid, hairy. Fruits dehiscing loculicidally, red. Seeds black with a fleshy white aril.

Distribution: Tropical and Subtropical Asia and NE. Queensland (POWO, 2023); *Habitat*: Way side and forest margins; *Fl. & Ft.*: April-December.

Specimens examined: Kulamavu, 24.09.1981, *C.N. Mohanan & B. Ramanujan* 71948; way to Mangaladevi temple, 27.08.1977, *K. Vivekananthan* 50536; Neriamangalam-Valara R.F., 20.08.1965, *K.M. Sebastine* 25323; Okkrai, Thekkady, 29.09.1972, *B.D. Sharma* 42350; Pachakkanam, 13.11.1975, *K. Vivekananthan* 466667 (MH); Painavu, 07.08.2017, *Dani Francis & Santhosh Nampy* 154325

(CALI); Pullupara-Peermade, 24.09.1964, *K. Vivekananthan* 21365 (MH); Thekkady, 16.08.1994, *N. Sasidharan & Jomy Augustine* 13844 (KFRI).

Notes: This species was previously known as *Costus speciosus* (Koenig) Smith, but it found to be an invalid name.The correct name is *H. speciosa* and its correct basionym is *Banksea speciosa* Koenig (Dutta, 2010).

Meistera Giseke,

Prael. Ord. Nat. Pl. 199, 205. 1792.

Key to the species

1. Leaves sessile; anther crest quadrate …….. *M. cannicarpa*

1. Leaves petiolate; anther crest semilunar …….. 2

2. Peduncles creeping; corolla tubes shorter than calyx …….. *M. acuminata*

2. Peduncles straight; corolla tubes as long as calyx …….. 3

3. Calyx 3-lobed at apex; labellum clawed …….. *M. masticatorium*

3. Calyx 2-lobed at apex; labellum not clawed …….. *M. ghatica*

Meistera acuminata (Thwaites) Skornick. & M.F.Newman, Taxon 67(1): 26. 2018. Amomum acuminatum Thwaites, Enum. Pl. Zeyl. 317. 1861. *Amomum muricatum* Bedd., Madras J. Lit. Sci., ser. 3, 1: 59. 1864; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1487. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 480. 2004; M.Sabu, Zingiberaceae & Costaceae South India 88. 2006.

Perennial rhizomatous herbs. Rhizomes thick, woody, creeping. Leafy shoot 1.5–2 m long. Leaves broadly lanceolate, 15–40 × 3–7 cm, acuminate at apex, attenuate at base, glabrous, green; petioles 1–2 mm long; ligules membranous, 1–2 mm long, pubescent at margins, green. Spikes sub-globose, dense flowered, 10–15 cm long; peduncle slender, creeping, 15–20 cm long, covered with sheaths; bracts oblong-obovate, 2–3 × 1–1.3 cm, acute at apex, puberulous at margins, glabrous, pale pink; bracteoles tubular, 1–1.3 cm long, 2-lobed at apex, hairy at tip, glabrous. Calyx tubular, 1.5–2 cm long, 3-lobed at apex, densely pubescent at apex. Corolla tubes shorter than calyx, 1–1.5 cm long, pubescent; lobes white-pale yellow, pubescent; dorsal lobe, ovate, *c.* 2 × 1 cm, apiculate at apex, puberulous; lateral lobes narrow, *c.* 1 × 0.5 cm. Labellum broadly obovate, 2–3 cm long, deeply 3-lobed, yellow with

a broad band of red spots towards centre. Lateral staminodes subulate. Stamens *c.* 2 cm long; filaments 1.2 cm long; anthers crested, semi lunar, entire, yellow. Ovary 3-locular, hairy; style slender; stigma cup shaped, hairy at apex. Epigynous glands 2. Capsules globose, slightly 3-lobed, echinate. Seeds ovoid, arillate.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: December-May.

Specimen examined: Myladumpara-cardamom board research station, 24.05.1983, *Jos K. Mangaly & M. Sabu* 10322 (CALI); way to Vallakkadavu, 15.12.1981, *N.C. Nair* 70221 (MH).

Notes: This species is similar to *M. cannicarpa*, but can be distinguished by the small size of the plant, deeply 3-lobed labellum, and entire, lunate anthers crest (Sabu, 2006).

Meistera cannicarpa (Wight) Skornick. & M.F.Newman, Taxon 67(1): 26. 2018. *Elettaria cannicarpa* Wight, Icon. Pl. Ind. Orient. 6: t. 2007. 1853. *Amomum cannicarpum* (Wight) Benth. ex Baker in Hook.f., Fl. Brit. India 6: 240. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1487. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 479. 2004; M.Sabu, Zingiberaceae & Costaceae South India 81. 2006.

Perennial rhizomatous herbs. Rhizomes hard and woody. Leafy shoot *c.* 5 m tall, swollen at base. Leaves sessile; lamina oblong-lanceolate, 15–20 × 2.5–4 cm, acuminate at apex, attenuate at base, glabrous, green, sessile or petiolate; petioles 2–3 mm long; ligules membranous, 5–7 mm long, entire at margins, glabrous. Spike ovoid, 5–10 cm long, from base of rhizomes; peduncles 10–15 cm long, covered by red sheaths; bracts obovate, 2–3 × 1.5–2 cm, rounded at apex, puberulous, reddish brown; bracteoles tubular, 1.5–2 cm long, 3-lobed at apex, glabrous, white with lines of pink. Calyx tubular, *c.* 2 cm long, 3-lobed at apex, pubescent, white. Corolla tubes as long as calyx, pale yellow; dorsal lobe obovate, *c.* 2 × 2 cm, obtuse and curved at apex, glabrous; lateral lobes oblong, *c*. 2 × 1 cm, white. Labellum obovate, 3–3.5 × 2–3 cm, minutely 3-lobed, emarginate at apex, hairy towards apex, pale yellow in sides, yellow at tip, reddish spots towards centre. Lateral staminodes reduced, subulate. Stamens *c.* 1.5 cm long; anthers crestate; crest quadrate, obscurely 3-lobed. Epigynous glands 2. Ovary 3-locular,

densely pubescent; ovules many; style slender, pubescent; stigma projected, hairy at mouth. Capsules red, densely echinate. Seeds ovoid, arillate.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: February-July.

Specimen examined: Meenmutty-Kulamavu, 24.02.1984, *A.G. Pandurangan* 78077 (CALI).

Notes: This species is allied to *Meistera fulviceps* (Thwaites) Skornick. & M.F.Newman in having a stout habit with thick rhizomes, red bracts, and smaller flowers, but differs by its bifid densely pubescent ligules, leaves with prominently raised veins, oblong to lanceolate bracts, bright yellow corolla lobes, creamy entire labellum, sub-cuspidate dorsal corolla lobe, and entire anthers crest. It is endemic to the southern Western Ghats and is assessed as endangered (Thomas *et al.*, 2012).

Meistera ghatica (K.G.Bhat) Skornick. & M.F.Newman, Taxon 67(1): 26. 2018. *Amomum ghaticum* K.G.Bhat, Indian J. Forest. 11: 322. 1988; M.Sabu, Zingiberaceae & Costaceae South India 82. 2006.

Perennial rhizomatous herbs. Rhizomes creeping. Leafy shoot *c.* 4 m tall. Leaves oblong-lanceolate, 40–55 × 8–12 cm, acuminate at apex, attenuate at base, glabrous adaxially, pubescent abaxially, green; petioles 1–1.5 mm long; ligules membranous, 8–10 mm long, entire at margins, pubescent. Spikes cylindrical, 6–10 cm long; peduncles 15–20 cm long, covered by red sheaths; bracts obovate, 1.8–2 × 0.8–1 cm, acute at apex, ciliate at margin towards apex, glabrous-puberulous; bracteoles tubular, 1.2–1.4 cm long, 2-lobed at apex, 2-keeled, puberulous, white. Calyx tubular, *c.* 1 cm long, 2-lobed at apex, pubescent at apex, white. Corolla tubes as long as calyx; lobes oblong, 0.8–1 × 0.4–0.7 cm, glabrous, pale yellow. Labellum obovate, 1–1.5 × 0.8–1 cm, 3-lobed at apex, mid lobe emarginate at apex, puberulous, yellow streaked with red. Lateral staminodes small, subulate, 1.5–2 mm long. Stamens *c.* 4 mm long; filaments slender; anthers pubescent, crestate; crest semilunar. Epigynous glands 2, linear. Ovary 3-locular, densely pubescent; ovules many; style slender, pubescent; stigma projected, hairy at mouth. Capsules red, densely echinate. Seeds ovoid, arillate.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: February-June.

Specimens examined: 1km from Deviyar medu towards Mlappara, 23.03.2009, *Thomas V.P. & Prabhu Kumar K.M.* 115561; 2 km from Deviyar medu, 23.03.2009, *Thomas V.P. & Prabhu Kumar K.M.* 115562 (CALI).

Meistera masticatorium (Thwaites) Skornick. & M.F.Newman, Taxon 67(1): 26. 2018. *Amomum masticatorium* Thwaites, Enum. Pl. Zeyl. 317. 1861; Baker in Hook.f., Fl. Brit. India 6: 238. 1892; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 480. 2004; M.Sabu, Zingiberaceae & Costaceae South India 87. 2006. **Fig. 17B**

Perennial rhizomatous herbs. Rhizomes creeping. Leafy shoot 2–3 m tall. Leaves oblong-lanceolate, 10–20 × 1.5–3 cm, acuminate at apex, cuneate at base, glabrous, green; petioles 0.3–0.5 mm long; ligules membranous, 0.3–0.8 cm long, obtuse at apex, glabrous, green. Inflorescence globose, 2–6 × 2–3 cm; peduncles 2–5 cm long, covered with membranous sheath; bracts obovate, 2–2.5 × 1–1.5 cm, obtuse at apex, pubescent, ciliate at margins, maroon; bracteoles tubular, 1.5–2 cm long, 2-lobed at apex, glabrous, maroon. Calyx tubular, 2–3 cm long, 3-lobed and puberulous towards apex; lobes triangular, apiculate. Corolla tubes as long as calyx, puberulous, white; lobes oblong, rounded at apex, glabrous, white-pale yellow; dorsal lobe *c.* 2 × 1 cm; lateral lobes *c.* 2 × 0.5 cm. Labellum broadly obovate, 1.5–2 × 1.2–1.6 cm, clawed at base; limb 3-lobed, mid lobe bifid at apex, yellow streaked with red. Lateral staminodes linear, 3–5 mm long, obtuse at apex, glabrous, pale yellow. Stamens 5–7 mm long; filaments filiform; anthers sparsely pubescent, crestate, semilunar. Ovary 3-locular, sparsely pubescent. Epigynous glands 2, united. Capsules globose, echinate. Seeds ovoid, arillate.

Distribution: SW. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: March-June.

Specimen examined: Peermade, 27.04.2018, *Dani Francis & Santhosh Nampy* 159217 (CALI).

Notes: The species is distinguished by its long ligules with a deciduous upper part, smaller leaves, slightly larger labellum, and densely pubescent ovary (Sabu, 2006).

Zingiber Mill.,

Gard. Dict. Abr. ed. 4. 3: 1545. 1754, *nom. cons.*

Key to the species

1. Bracts rounded at apex; seeds black …… 2

1. Bracts acuminate at apex; seeds dark red …… *Z. nimmonii*

2. Spikes cylindrical; dorsal lobe of corolla hooded; labellum white with pink spots and stripes …… *Z. neesanum*

2. Spikes globose or oblong; dorsal lobe of corolla not hooded; labellum yellow without spots and stripes …… *Z. zerumbet*

Zingiber neesanum (J.Graham) Ramamoorthy in Saldanha & Nicolson, Fl. Hassan Dist. 769. 1976; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 484. 2004; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 484. 2004; M.Sabu, Zingiberaceae & Costaceae South India 247. 2006. *Alpinia neesana* J.Graham, Cat. Pl. Bombay: 207. 1839. **Fig. 17E**

Perennial rhizomatous, herbs. Rhizomes creeping. Leafy shoot erect, thick, covered with reddish green sheath. Leaves linear-lanceolate, 10–30 × 1–2.5 cm, acuminate at apex, attenuate at base, glabrous or puberulous, sessile or shortly petiolate; ligule membranous, 3–5 mm long, obtuse at apex, pale green, glabrous; sheaths hairy. Inflorescence separate from leafy shoot; peduncles 12–30 cm long, covered with red or green sheaths. Spike cylindrical, 6–15 cm long; bracts ovate, 1.5–3.5 × 0.5–1 cm, rounded at apex, closely imbricating, puberulous, reddish green; bracteoles lanceolate, 1–3 × 0.5–1 cm, split to base, puberulous, green with purple spot in outer surface, persistent. Flowers longer than bract, *c.* 4 cm long, 1 in each bract. Calyx tubular, 1–1.5 cm long, split on one side, glabrous. Corolla tubes slender, 2–2.5 cm long; lobes 3, unequal, longitudinally nerved, white; dorsal lobe *c.* 2 × 1 cm, hooded at apex, glabrous; lateral lobes linear, *c.* 1.5 × 0.5 cm, obtuse at apex. Labellum obovate, 3-lobed, 1.5–2 × 1–1.5 cm, mid lobe rounded, emarginate at apex, glabrous, white with pink spots and stripes. Lateral staminodes oblong, *c.* 1 × 0.6 cm, obtuse at apex, glabrous, white. Stamens 1; filaments short, broad, glabrous; anthers *c.* 1 mm long, connectives with violet stripes on upper surface. Ovary 3-locular, glabrous-puberulous; style filiform; stigma with an apical circular aperture surrounded by stiff hairs. Epigynous glands 2. Fruits ellipsoid, glabrous. Seeds black with a white membranous aril.

Distribution: SW. India (POWO, 2023); *Habitat*: Forests, grasslands; *Fl. & Ft.*: May-September.

Specimens examined: Cheriyakanam, 31.07.1993, *N. Sasidharan & Jomy Augustine* 12198 (KFRI); Kulamavu, 02.10.1983, *A.G. Pandurangan* 79251 (MH); 13 km from Kulamavu, 23.05.1984, *s.coll.* 37328; Neriamangalam, 11.09.2018, *Dani Francis & Santhosh Nampy* 159460; *ibid*., 06.08.2002, *Prasanth Kumar M.G.* 86384; Painavu, 07.08.2017, *Dani Francis & Santhosh Nampy* 154327; Ramakalmedu, 07.09.2017, *Dani Francis & Santhosh Nampy* 152930; Thekkady, 15.07.1993, *Jomy Agustine* 12198 (CALI).

Zingiber nimmonii Dalzell, Hooker's J. Bot. Kew Gard. Misc. 4: 341. 1852; Hook.f., Fl. Brit. India 6: 244. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1489. 1928; M.Sabu, Zingiberaceae & Costaceae South India 237. 2006. **Fig. 17F**

Perennial rhizomatous herbs. Leafy shoot erect, thick, covered with reddish green sheath. Leaves oblong-lanceolate, 10–30 × 4–7 cm, acuminate at apex, attenuate at base, glabrous or puberulous adaxially, densely pubescent abaxially; petioles 0.3–0.6 cm long; ligule membranous, 3–5 mm long, 2-lobed, rounded at apex, pale green, glabrous, green; sheaths glabrous. Inflorescence directly from rhizomes; peduncles 3–6 cm long, covered with red or green sheaths. Spikes ovate, *c.* 6 × 5 cm long; bracts lanceolate, 3–4 × 0.8–1 cm, acuminate at apex, closely imbricating, puberulous in, densely pubescent out, reddish green; bracteoles lanceolate, 2–2.5 × 0.5–1 cm, slightly 3-lobed at apex, puberulous in, densely pubescent out, reddish white. Flowers longer than bract, *c.* 5 cm long. Calyx tubular, 1–1.5 cm long, obscurely 3-lobed, unilaterally split, puberulous, white. Corolla tubes slender, 2–3 cm long, pubescent, white; lobes 3, sub-equal, yellowish-orange; dorsal lobe lanceolate, *c.* 2.5 × 1 cm, acuminate at apex, hairy; lateral lobes lanceolate, *c.* 2 × 0.5 cm, upcurved at apex, hairy. Labellum 3-lobed, *c.* 2.5 × 1 cm, light yellow with purple spot; mid lobe ovate, bifid at apex, glabrous. Lateral staminodes ovate, *c.* 1 × 0.5 cm, obtuse at apex, glabrous, deep yellow with purple red spots. Stamens 1; anthers almost sessile, yellow. Ovary 3-locular, densely hairy; style filiform; stigma projected from anthers with a row of short bristles all around. Epigynous glands 2. Capsules trigonous, exceeding bracts, deep red. Seeds dark red with a white membranous aril.

Distribution: S. India and Myanmar (POWO, 2023); *Habitat*: Forests; *Fl. & Ft.*: July-December.

Specimens examined: Moolamattam, 30.12.2021, *Dani Francis & Santhosh Nampy* 176530 (CALI); Thekkady, 12.07.1993, *N. Sasidharan & Jomy Augustine* 12001 (KFRI).

Zingiber zerumbet (L.) Roscoe ex Sm., Exot. Bot. 2: 105. t. 112. 1806; Baker in Hook.f., Fl. Brit. India 6: 267. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1490. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 485. 2004; M.Sabu, Zingiberaceae & Costaceae South India 237. 2006. *Amomum zerumbet* L., Sp. Pl. 1: 1. 1753.

Perennial rhizomatous herbs. Leafy shoot erect, fleshy, basal portion enclosed by bracts. Leaves oblong-lanceolate, 10–35 × 5–10 cm, acuminate at apex, attenuate at base, glabrous or puberulous adaxially, densely pubescent abaxially; petioles 0.4–0.5 cm long; ligule membranous, 2.5–3.5 mm long, 2-lobed, rounded at apex, pale green, glabrous, green; sheaths glabrous. Inflorescence lateral, separate from leafy shoot; peduncles 20–50 cm long. Spikes globose or oblong, 5–7 × 4–6 cm; bracts ovate-obovate, *c.* 3 × 5 cm, rounded at apex, closely imbricating, glabrous in, sparsely pubescent out, green; bracteoles ovate-oblong, *c.* 3 × 1.5 cm, obtuse at apex, sparsely pubescent, green. Flowers longer than bract, *c.* 5 cm long. Calyx tubular, 1.5–2 cm long, obscurely 3-lobed, unilaterally split, puberulous, white. Corolla tubes slender, 2.5–3 cm long, white; dorsal lobe lanceolate, *c.* 2.5 × 1 cm, acuminate at apex, glabrous; lateral lobes lanceolate, *c.* 1.5 × 0.5 cm, acuminate at apex, glabrous. Labellum 3-lobed, crumbled along margins, yellow; mid lobe sub-orbicular, emarginate at apex, glabrous; lateral lobes crumbled. Lateral staminodes ovate, *c.* 1 × 0.5 cm, obtuse at apex, glabrous, deep yellow. Stamens 1; filaments broad; anthers almost sessile, yellow. Ovary 3-locular, sparsely hairy towards apex; style filiform; stigma projected with ciliate margins. Epigynous glands 2. Capsules white with persistent calyx. Seeds numerous, black with a white to light green lacerate aril.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: open marshy areas; *Fl. & Ft.*: June-October.

Specimens examined: Koruthode, Periyar Tiger Reserve, 13.08.1995, *K.P. Rajesh & Jomy Augustine* 16247 (KFRI); Valara, 21.08.1965, *K.M. Sebastine* 25352 (MH).

Fig. 16. A. *Alpinia malaccensis* (Burm.f.) Roscoe; **B.** *Alpinia abundiflora* Burtt & R.M.Sm.; **C.** *Hedychium venustum* Wight; **D.** *Hedychium coronarium* J.Koenig; **E.** *Globba sessiliflora* Sims; **F.** *Globba marantina* L.

Fig. 17. A. *Curcuma coriacea* Mangaly & M.Sabu; **B.** *Meistera masticatorium* (Thwaites) Skornick. & M.F.Newman; **C.** *Costus pictus* D.Don; **D.** *Hellenia speciosa* (J.Koenig) S.R.Dutta; **E.** *Zingiber neesanum* (J.Graham) Ramamoorthy; **F.** *Zingiber nimmonii* Dalzell.

MARANTACEAE R.Br.,

Voy. Terra Austral. 2: 575.1814, *nom. cons.*

Leaves arranged in two rows; petioles sheathing at base. Inflorescence a spike or panicle usually subtended and enclosed by a spathe like bract. Flowers bisexual, irregular. Sepals free, rarely loosely cohering. Stamens 1; anthers 1-celled, laterally adnate to the perianth; staminodes petaloid. Ovary 1–3 locular, inferior, 1-ovuled; style excentric, incurved or involute. Capsules fleshy or loculicidal.

Marantaceae is a pan-tropical family of large-leaved herbaceous plants with 29 genera and 577 species worldwide (POWO, 2023). Eight genera and an estimated 55 species occur in tropical Asia (Suksathan *et al.,* 2009). Seven genera and 12 species have been identified in India (Sreejith *et al.,* 2013). Three species are found in the study area.

Key to the genera

1. Inflorescence a panicle, terminal, branches dichotomous; fruits rugose……..
……..…… *Indianthus*

1. Inflorescence a capitate heads or spikes, basal or interfoliar, branches not dichotomous; fruits smooth …….. 2

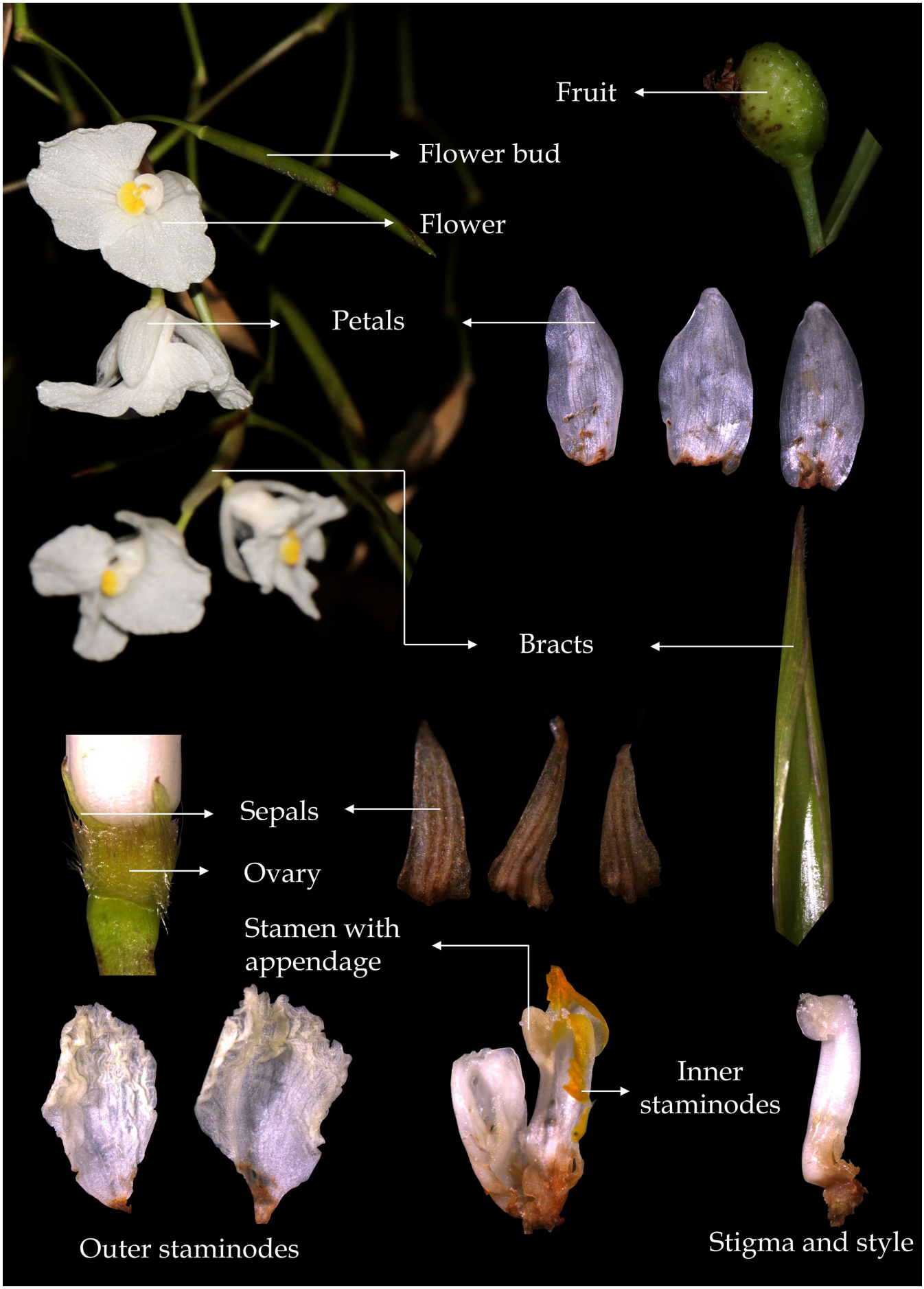
2. Fruits elongate-triangular, bright red; inflorescence interfoliar; Sepals subulate; seeds arillate ……..…….. *Phrynium*

2. Fruits ovoid, green; inflorescence basal; sepals linear; seeds not arillate …… *Stachyphrynium*

Indianthus Suksathan & Borchs.,

Bot. J. Linn. Soc. 159(3): 393. 2009.

Indianthus virgatus (Roxb.) Suksathan & Borchs., Bot. J. Linn. Soc. 159(3): 393. 2009. *Maranta virgata* (Roxb.) Wall., Numer. List. n. 6616. 1832; Wight, Icon. Pl. Ind. Orient. t. 2015. 1853. *Schumannianthus virgatus* (Roxb.) Rolfe, J. Bot. 45: 244. 1907; C.E.C.Fisch. in Gamble, Fl. Madras 3:1494. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 485. 2004. *Clinogyne virgata* (Roxb.) Benth. & Hook.f., Gen. Pl. 3(2): 651. 1883; Hook.f., Fl. Brit. India 6: 258. 1892.


Fruit
Flower bud
Flower
Petals
Bracts
Sepals
Ovary
Stamen with appendage
Inner staminodes
Outer staminodes
Stigma and style

Erect herbs. Stems knotted at nodes, *c.* 4 m tall, glabrous. Leaves bifarious, ovate-oblong, 12–44 × 3.5–10 cm, acuminate at apex, cuneate at base, glabrous, green; petioles terete, 0.9–2.3 cm long, glabrous; sheaths encircle the stem, 5–13 cm long, pubescent. Panicles terminal, effuse, 20–42 cm long, lax flowered; branches dichotomous; bracts lanceolate, 2–7 × 0.5 cm, acute at apex, cuneate at base, glabrous, green. Flowers paired in each bract, *c.* 9 × 6 mm, strigose hairy at base. Sepals small, elliptic-ovate, pointed at apex, truncate at base, glabrous, deciduous. Corolla 3; lobes oblong or turbinate-spathulate, crumbled, 11–12 × 7–8 mm, sub-rounded at apex, clawed at base, glabrous, white; tube short. Stamens 1; outer staminodes petaloid, obovoid, 1.5–3 mm long, glabrous, white; inner staminodes small. Ovary oblong, 3-carpellary, villous; style flattened, thick; stigma hooded. Berry obovoid, 1–3 cm long, rugose.

Distribution: South India, Sri Lanka and Andaman Islands (POWO, 2023); *Habitat*: Forest margins and river banks; *Fl. & Ft.*: June-March.

Specimens examined: Anchal, way to Vellathooval, 13.06.1963, *K.M. Sebastine* 16426 (MH); 4 km from Deviyarmedu, 23.03.2009, *Thomas V.P. & Prabhu Kumar K.M.* 115564; Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154367; Kulamavu, 23.09.2003, *Jana Skornickova* 84168; Pambla dam, 08.03.2017, *Dani Francis & Santhosh Nampy* 152012; near Valara waterfalls, 27.12.2017, *Dani Francis & Santhosh Nampy* 156530 (CALI).

Notes: This species was earlier treated under *Schumannianthus* Gagnep., now it is placed under *Indianthus* (Suksathan *et al.*, 2009). It is used for the treatment of hepatic disorders and the fibres obtained from the stems are used to produce economic products (Neethu *et al.*, 2017).

Phrynium Willd.,

Sp. Pl., ed. 4. 1: 17. 1797, *nom. cons.*

Phrynium pubinerve Blume, Enum. Pl. Javae. 1: 38. 1827; Hook.f., Fl. Brit. India 6: 259. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1495. 1928. *Phrynium capitatum* Willd., Sp. Pl. ed. 4, 1: 17. 1797; Wight, Icon. Pl. Ind. Orient. t. 2016. 1853. *Phrynium rheedei* Suresh & Nicolson, Taxon 35(2): 355. 1986; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 485. 2004.

Herbs with creeping root stock, 0.7–3.5 m tall. Leaves 2–3 per shoot; sheaths clasping the petiole, 20–100 cm long, acute at apex, lanose hairy, dense towards margin; petioles 10–150 cm long, pubescent, green; pulvinus 4–12 cm long, slightly compressed laterally; blades oblong, 30–75 × 10–25 cm, acute at apex, sub-rounded at base, glabrous or puberulous, green. Inflorescence interfoliar, erect, usually appearing to protrude from the petiole of the accompanying leaf; peduncle 25–160 cm long, glabrous, green; synflorescence capitate, densely congested, 3–5 cm in diameter, made up of 3 or more branches. Outer bracts oblong, 3.5–4 × 1.5–2 cm, sub-truncate at apex, truncate at base, lanate, partially sheathing the entire synflorescence; fertile bracts spirally arranged, oblong, 1.5–2 × 1.2–1.4 cm long, sub-acute at apex, lanate. Flowers 2–4 per bract, *c.* 1.8 cm long, pinkish white. Sepals subulate, 10–12 × 1–1.5 mm. Corolla pink; lobes subulate, 7–7.5 × 3–3.5 mm, deflexed and curled at apex; tube 4–4.5 mm long. Stamens *c.* 3 mm long. Outer staminodes slightly unequal; lobes petaloid, 3–4 × 2–3 mm; cucullate staminode *c.* 3 × 2 mm, brown dotted; callose staminode 3.4– 3.6 × 1.4–1.6 mm. Ovary *c.* 3 mm long, tomentose; style curved; stigma blunted. Fruits elongate-triangular, dehiscent, bright red. Seeds 3; aril basal, translucent, bifid.

Distribution: S. China to tropical Asia (POWO, 2023); *Habitat*: Semi evergreen forests; *Fl. & Ft.*: March-July.

Specimens examined: Pambla dam, 08.03.2017, *Dani Francis & Santhosh Nampy* 152026; way side Neriamangalam, 11.09.2018, *Dani Francis & Santhosh Nampy* 159441 (CALI).

Notes: *Phrynium pubinerve* is a widespread and variable species in the genus, found throughout Southeast Asia. It is characterized by red fruits, capitate inflorescence with tattering inflorescence bracts, and flowers with two outer staminodes. It shows a continuous variation in overall size (0.7–3.5 m tall), leaf shape (narrowly oblong to broadly elliptic), bract shape (narrowly lanceolate, oblong to broadly ovate), and bract colour (green, yellowish-green, red, or brown). Herbarium material of this species is frequently identified as *P. capitatum* Willd. which, is an illegitimate name synonymous with *P. pubinerve* (Clausager & Borchsenius, 2003; Suksathan & Borchsenius, 2005).

Stachyphrynium K.Schum.,

in Engler, Pflanzenr. 4, 48: 45. 1902, *nom. cons.*

Stachyphrynium spicatum (Roxb.) K.Schum., in Engler, Pflanzenr. 4, 48: 46. 1902; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1494. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 486. 2004.

Herbs with creeping, nodose rhizomes, *c.* 40 cm tall. Leaves 2–5; sheaths clasping to the stem, 3–10 cm long, acute at apex; petiole to 30 cm long, glabrous, green; blades ovate-oblong, 15–20 × 5–7 cm, abruptly acuminate at apex, rounded at base, glabrous, green. Spike 1 or 2, arising from the base, 3–5 cm long, sessile or shortly peduncled. Flowers 3–8, sessile, white; bracts ovate, 12–15 × 5–7 mm, acute at apex, cuneate at base, glabrous, green. Sepals narrow, linear, 3–5 mm long, obtuse at apex, cuneate at base, glabrous, white. Petals oblong, 20–25 × 8–10 mm, obtuse at apex, clawed at base, glabrous, dull white. Stamens 1, petaloid, white with yellow tinch; anthers adnate on the margin; staminodes obovate, clawed. Ovary 3-loculed; ovule solitary in each locule. Fruits ovoid, smooth, glabrous, green. Seeds wrinkled.

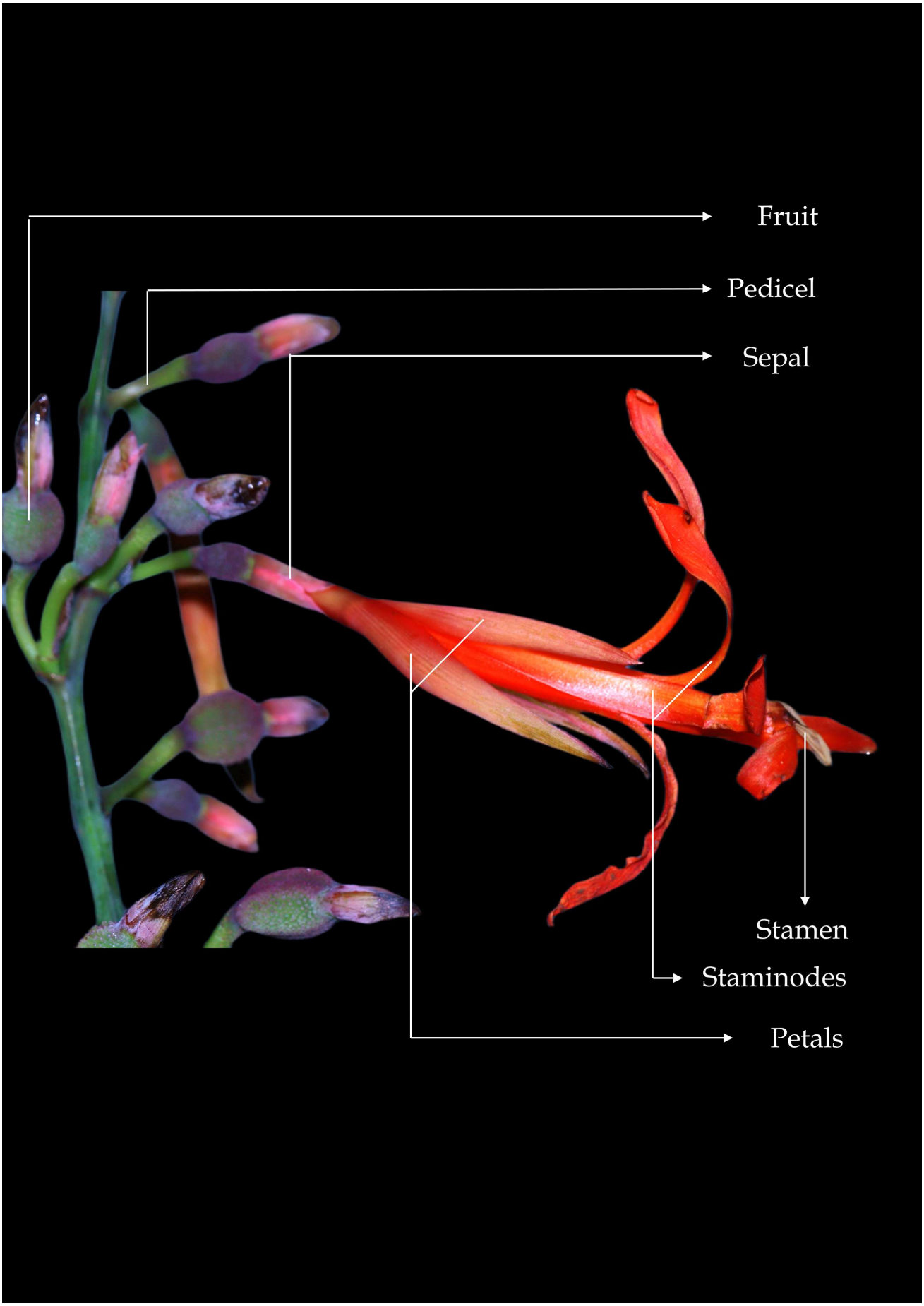
Distribution: SE. India, Sri Lanka and China to Indo-China (POWO, 2023); *Habitat*: Semi evergreen forests; *Fl. & Ft.*: March-August.

Specimen examined: Koruthode, Periyar Tiger Reserve, 12.08.1995, *N. Sasidharan* & *Jomy Augustine* 16239 (KFRI).

CANNACEAE Juss.,

Gen. Pl. 62. 1789, *nom. cons.*

Large perennial leafy herbs. Rhizomes tuberous, swollen. Leaves large, broad, pinnately nerved. Petiole sheathing. Inflorescence a terminal raceme or panicle of 1- or 2-flowered cincinni. Flowers bisexual, showy, asymmetric. Bracts ovate. Sepals 3, small, oblong or lanceolate. Corolla tubes cylindric; lobes 3, lanceolate, one always smaller. Staminodes and stamens in 2 whorls: outer whorl with (2 or) 3 conspicuous, petaloid staminodes, usually red or yellow; inner whorl with a reflexed staminode (labellum), narrower than outer staminodes, and a fertile stamen; filaments petaloid; anthers 1-loculed, adnate to apical margin of filament.


Fruit
Pedicel
Sepal
Stamen
Staminodes
Petals

Ovary 3-celled, inferior; ovules many; style adnate at the base to the staminal tube, free above; stigma capitate. Fruit globose, echinate, indehiscent. Seeds large, globose.

Cannaceae, a distinct monotypic family, is native to Tropical and Subtropical America with 10 species worldwide. It was brought from the Neotropics very long ago, and is now considered to be naturalized in Asia and grown as ornamentals (De Kamer & Maas, 2008). *C. flaccida* Salisb. and *C. indica* L. have been reported from India (POWO, 2023). One species is known from the study area.

Canna L.,

Sp. Pl. 1: 1. 1753.

Canna indica L., Sp. Pl. 1: 1. 1753; Hook.f., Fl. Brit. India 6: 260. 1890; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 486. 2004; H.Maas & P.J.M.Maas, Blumea 53: 277. 2008. *Canna orientalis* Roscoe, Monandr. Pl. Scitam. t. 12. 1826; C.E.C.Fisch. in Gamble, Fl. Madras 3:1496. 1928.

Perennial herbs, rhizomes short, creeping, tuberous; aerial stems erect. Leaf sheaths lanuginose or glaucous. Leaves ovate-elliptic, 20–50 × 7–15 cm, acute-acuminate at apex, obtuse-narrowly cuneate at base, glabrous, entire at margins. Inflorescence often branched with 1 or 2 flowered cincinni, 30–54 cm long. Pedicels 1–1.5 cm long. Bracts lanceolate, 7–15 × 1.5–2 cm, acute at apex, cuneate at base, glabrous. Flowers paired, 3.5–10 cm long, deep red or yellow; floral bracts ovate or narrowly linear, 3–12 × 1–2 cm, acute at apex, cuneate at base, glabrous, persistent; bracteoles orbicular, 1–2 × 0.5 cm, acute at apex, cuneate at base, glaucous. Sepals 3, ovate-triangular, 0.8–2 × 0.3–0.5 cm, acute at apex, cuneate at base, glabrous, whitish green to red. Petals 3, united at base, erect narrowly triangular, 3–6 × 0.3–1 cm, acute at apex, glabrous, red. Staminodes 3 or 4, petaloid, oblanceolate-spathulate, 4.5–6 cm long, red. Stamens red. Ovary 3-celled; ovules many; style flattened, as long as the staminode. Capsules ellipsoid-sub-globose, 1.5–3 × 1–1.6 cm, warty, bright green. Seeds sub-globose, 4–8 mm across.

Distribution: Tropical and Subtropical America (POWO, 2023); *Habitat*: Grown as garden plants; *Fl. & Ft.*: December-July.

Specimens examined: Kanthallur, Mannavan shola, 25.02.2003, *Nishitha I.K.* 90445; *Ibid.,* 25.02.2003, *Shylaja N.* 88344; Kudimala, Lakkamkudi, 09.12.2019, *Dani Francis & Santhosh Nampy* 170001; Mathikettan Shola National Park, Sivanpara, 28.07.2016, *Syam Radh S.* 149172; Pethotti, 06.01.2017, *Dani Francis & Santhosh Nampy* 151584; way to Karimutty, near Cheruthoni, 29.12.2017, *Dani Francis & Santhosh Nampy* 158022 (CALI).

Notes: *Canna indica* is a highly variable species that has been extensively cultivated for decoration and as an ornamental. The species is also used in hybridization (De Kamer & Maas, 2008).

MUSACEAE Juss.,

Gen. Pl. 61. 1789, *nom. cons.*

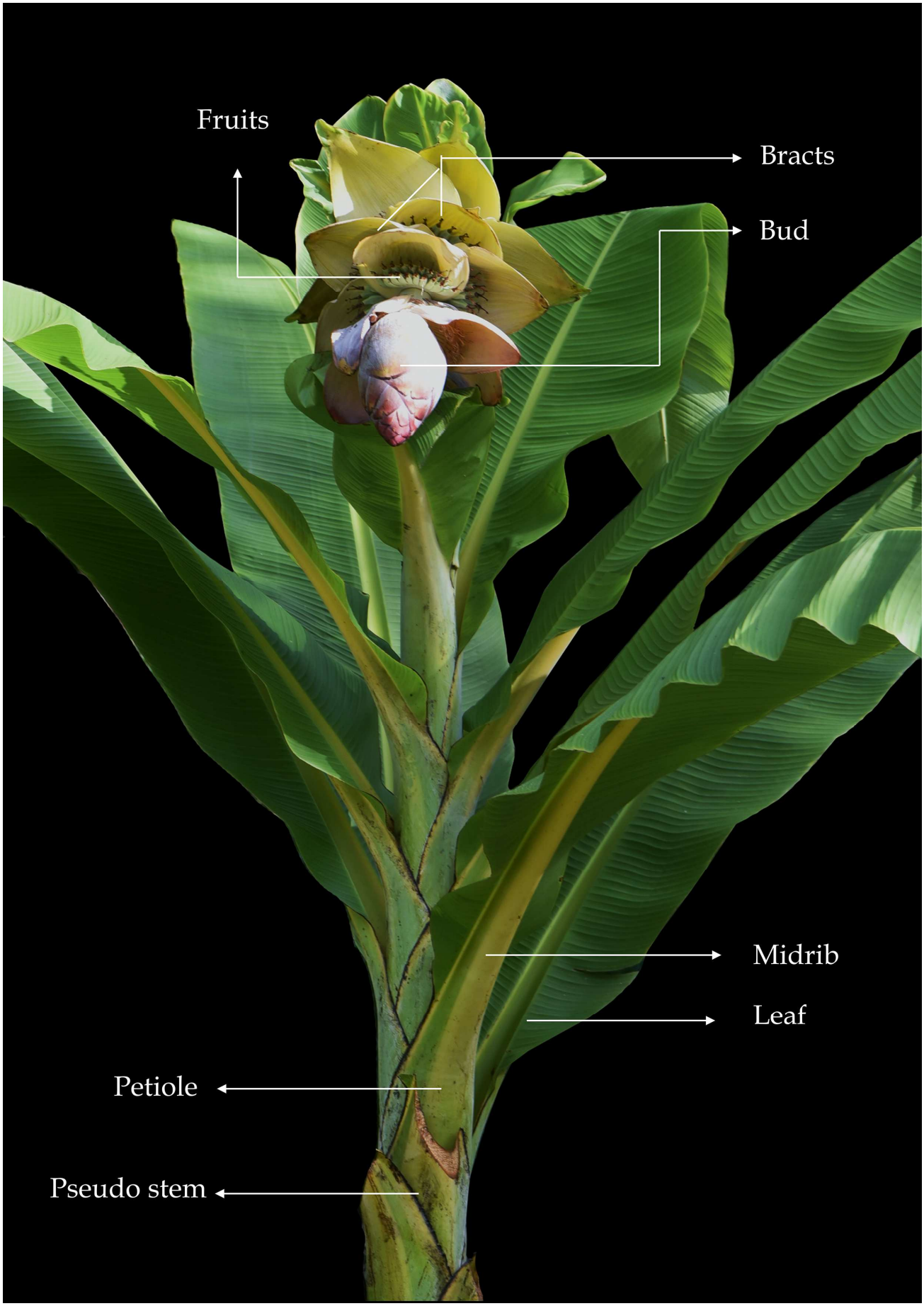
Stems erect, formed by the imbricate bases of the petioles. Leaves spirally arranged, very large, with a thick midrib and numerous pinnately parallel nerves. Flowers mostly unisexual, clustered, subtended by large green spathaceous bracts, male flowers within the upper bracts, female within the lower. Calyx elongated, narrowly tubular first, soon splitting on one side, variously toothed at apex. Corolla more or less 2-lipped. Stamens 5 perfect, with a rudimentary sixth or 6 perfect; filaments filiform; anthers 2-locular, locules parallel and contiguous. Ovary inferior, 3-locular; ovules numerous, axile; style filiform; stigma lobulate. Fruit fleshy, indehiscent, 3-locular. Seeds with a thick hard testa.

Musaceae is also known as the 'banana family' and include a lot of wild seeded species to seedless cultivars. It is native to the tropics of Africa and Asia. There are three genera and 90 species reported worldwide (POWO, 2023) 34 species in two genera recognized from India (Joe & Sabu, 2019). Two species occur in the study area.

Key to the genera

1. Plants not suckering; pseudo stems conical; bracts and flowers integral with each other and with axis …… *Ensete*

1. Plants suckering; pseudo stems cylindrical; bracts and flowers inserted independently on the axis …… *Musa*


Fruits
Bracts
Bud
Midrib
Leaf
Petiole
Pseudo stem

Ensete Bruce ex Horan.,

Prodr. Monogr. Scitam. 40. 1862.

Ensete superbum (Roxb.) Cheesman, Kew Bull. 2(2): 100. 1948; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 486. 2004; A.Joe & M.Sabu, Revis. Ind. Musaceae 77. 2019. *Musa superba* Roxb., Pl. Coromandel 3: 17. 1811; Wight, Icon. Pl. Ind. Orient. 3: t. 2017-18. 1853; Hook.f., Fl. Brit. India 6: 261. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1497.1928.

Monocarpic, erect herbs with globose leaf sheaths formed into a pseudostem. Pseudostems conical, distinctly swollen at base, congested, 1–5 × 0.5–2 m, glaucous towards apex. Leaves spirally arranged; lamina oblanceolate, 0.9–3 × 0.2–0.5 m, acute at apex, symmetric at base, glabrous, green. Petioles 15–40 cm long, winged at base, margins open with black blotches at base, clasping the pseudostem. Inflorescence pendulous; peduncles 30–50 cm long, glabrous, arched. Sterile bracts 4–7, ovate, persistent, 15–25 × 5–12 cm, light green or pinkish purple adaxially, pinkish-purple abaxially, glaucous. Female buds lanceolate; bracts ovate, 14–20 × 5–15 cm, glaucous, rounded at apex, open and reflexed, persistent; flowers 6–15 per bract in two rows, 7–10 cm long; compound tepals 2.5–3.5 × 0.6–1 cm, divided nearly to the base, lobes 5, outer three larger, 2.2–2.3 cm long, inner two lobes linear, 1.9–2 cm long; free tepals with 2 lateral sub-orbicular lobes and a narrow elongated central lobe, cream or white; stamens 0–5, 3–3.5 cm long, filaments cream, anthers creamy yellow; staminodes 4–5, 0.5–1.5 cm long; glaucous; ovules in two rows per locule; style straight or slightly curved, inserted; stigma globose. Male bud lanceolate; bracts ovate-rotund, 15–20 × 12–15 cm, glaucous, deciduous; male flowers 12–28 per bract in two rows; compound tepals 3.5–4.5 cm long, divided nearly to the base, lobes 5; free tepals 0.8–1.3 × 0.8–1.2 cm, with two lateral sub-orbicular lobes, and a narrow elongated central lobe; stamens 3–6, exserted; ovary rudiment, straight; style reduced; stigma not developed. Infructescence compact; fruits straight, 5.5–9.5 cm long, yellow when ripe. Seeds many, sub-globose, black.

Distribution: S. India (POWO, 2023); *Habitat*: Moist deciduous and semi-evergreen forests; *Fl. & Ft.*: Throughout the year.

Specimens examined: Marykulam, 30.04.2018, *Dani Francis & Santhosh Nampy* 188995 (CALI); Peermade, Travancore, December 1909, *A. Meebold* 13056 (CAL); Vallakkadavu, 21.08.1995, *N. Sasidharan & Jomy Augustine* 16805 (KFRI).

Notes: This species is also known as 'cliff banana' which shows a wide range of variations in size, number of fruits, flowers, and stamens in male flowers. These plants might be disjunct populations or escapees from gardens since they were reported from populated areas (Joe & Sabu, 2019). It is edible as well as ornamental, and seeds are used in traditional medicine (Kumar *et al.*, 2010; Vasundharan *et al.*, 2015).

Musa L.,

Sp. Pl. 2: 1043. 1753.

Musa kattuvazhana K.C.Jacob, Monogr. Madras Bananas 129. 1952; A.Joe & M.Sabu, Revis. Ind. Musaceae 168. 2019.

Perennial rhizomatous herbs. Suckers 2–4, clumpy. Pseudostems slender, cylindrical, 1.5–4 m high, glabrous, light green or greenish yellow with large reddish-brown patches. Leaves intermediate between erect and drooping; lamina oblong, 120–190 × 42–60 cm, truncate at apex, base asymmetric, both pointed, continues as petiole margins, shiny, glabrous, midrib yellowish green adaxially, yellow abaxially; petioles 20–38 cm long, glabrous, yellowish green, petiole canal opens with spreading margins, base with reddish-brown blotches or spots, petiole bases winged with scarious smooth margins that clasp the pseudostem. Inflorescence pendulous or sub-pendulous; peduncle 15–20 cm long, puberulent with short hairs, green. Female bud and male bud lanceolate, strongly imbricate at apex. Female bracts oblanceolate or lanceolate, *c.* 24 × 10 cm, purplish maroon with yellow tip adaxially, light creamy maroon abaxially, lifting 1 bract at a time, reflexed and revolute, acute at apex. Female flowers 8–14 in each bract arranged in 2 rows, 6.5–7 cm long, creamy yellow; compound tepals 5 lobed, 3–3.2 × 0.5–1 cm, creamy with yellow at apex; free tepals curved, *c.* 2 × 1 cm, transparent white; ovary straight or curved, glabrous, ovules in two rows per locule. Male bracts lanceolate, 14–18 × 8.5–10 cm, acute at apex, lifting one or two bracts at a time, reflexed and revolute before falling, scars prominent, shiny, dark brown-purple with yellow apex adaxially, sparsely glaucous, red with yellow apex abaxially, glabrous. Male flowers 12–16 per bract in two rows, 5–6 cm long, falling with the

bract. Fruit bunch compact, 3–10 hands, 8–14 fruits per hand, in two rows, fruits pointed upwards from a pendulous axis. Fruits straight or curved, 7–10 cm long, slightly ridged, pointed at apex, pericarp green at maturity, greenish yellow or pale-yellow when ripe, pulp cream. Seeds many, warty, rounded to angled, black.

Distribution: SW. India and China to Indo-China (POWO, 2023); *Habitat*: Moist deciduous and evergreen forests; *Fl. & Ft.*: Throughout the year.

Specimen examined: On the way to Munnar from Adimali, near Valara waterfalls, 05.04.2016, *Alfred Joe* 148737 (CALI).

Notes: This species is allied to *M. acuminata* Colla, but differs by its brown markings on the pseudo stem which lacks wax, yellowish and waxless petiole, compact fruit bunches, hairy peduncles and strongly imbricate purple bracts (Joe *et al.*, 2016).

HAEMODORACEAE R.Br.,

Prodr. Fl. Nov. Holland. 299. 1810.

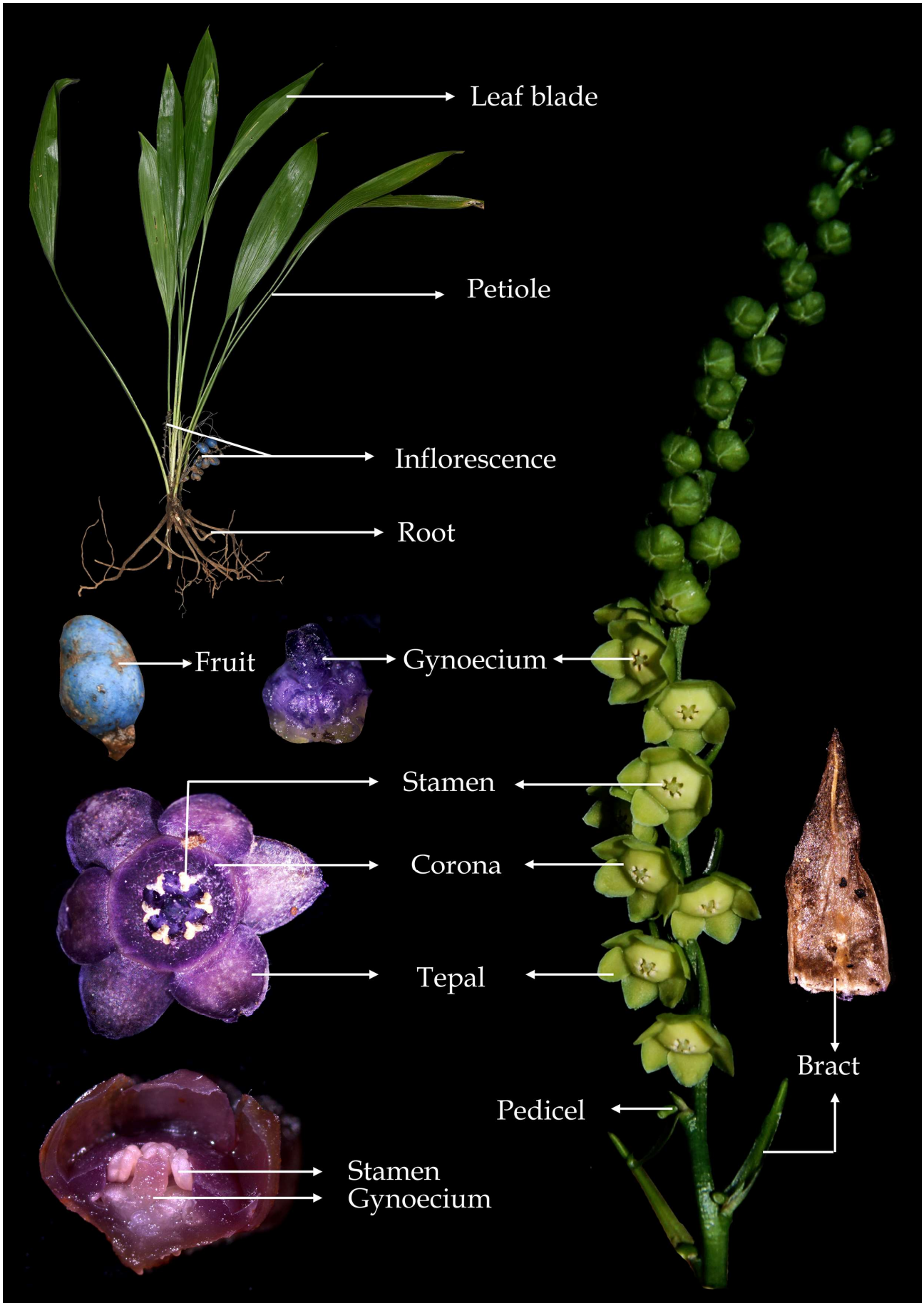
Herbs. Roots fibrous; tubers, rhizomes or stolons present. Leaves linear, hairy or glabrous, veins closely parallel or fan like, sheathing at base. Inflorescence cymes, racemes or panicles, covered with thick layer of woolly hairs. Flowers bisexual, regular or slightly irregular. Perianth persistent, 1 or 2 whorls in three segments; perianth tube straight or curved. Stamens 3 or 6; filaments free, inserted on the inner perianth lobe; anthers 2-loculed, dehiscing longitudinally. Carpels 3; ovary inferior; ovules 1-many, placentation axile; style filiform; stigma capitate. Fruit capsule or berry, 3-valved. Seeds various, embryo small.

The family possesses an unusually disjunct distribution, with Australia, New Guinea as its centre of diversity. There are 14 genera and about 120 species currently recognized (Pellegrini *et al.*, 2020). According to APG IV (2016), *Ophiopogon* Ker Gawl. and *Peliosanthes* Andrews belong to the family Asparagaceae. Two genera and three species are reported from the study area.

Key to the genera

1. Inflorescence a cyme; stigma capitate; leaves linear-lanceolate ..... *Ophiopogon*

1. Inflorescence a raceme; stigma triangular; leaves elliptic-lanceolate ..... *Peliosanthes*


Leaf blade
Petiole
Inflorescence
Root
Fruit
Gynoecium
Stamen
Corona
Tepal
Bract
Pedicel
Stamen
Gynoecium

Ophiopogon Ker Gawl.,

Bot. Mag. 27: t. 1063. 1807.

Ophiopogon intermedius D.Don, Prodr. Fl. Nepal. 48. 1825; Hook.f., Fl. Brit. India 6: 269. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1499. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 486. 2004.

Perennial herbs, densely tufted. Rootstock rhizomatous. Roots fibrous, filiform. Cataphylls a few at base, imbricate, 5–8 cm long, withering in to dry fibrous remnants. Leaves clustered, linear-lanceolate, 18–40 × 0.3–0.5 cm, acute at apex, attenuate at base, glabrous, entire. Cymes 2-flowered; peduncles 13–20 cm long. Flowers 0.5–1.2 cm in diam.; pedicels 4–5 mm long. Bracts 2, dissimilar, larger one linear-lanceolate, 10–12 × 1–1.2 mm, acute at apex, sub-truncate at base, glabrous, scabrous along margins, pale purple; smaller one, lanceolate, 4–5 × 0.5–1 mm, acute at apex, cuneate at base, sparsely scabrous along margins, pale purple. Tepals 6, 2–5.1 × 2 mm, ovate-oblong, obtuse at apex, sub-truncate at base, entire, glabrous, purple-white. Stamens 6; filaments 1–3 mm long; anthers sagittate, 3–3.1 × *c*. 1 mm, glabrous, yellowish green. Ovary ovoid; ovules 6; style striated, *c.* 5 mm long, glabrous; stigma capitate. Berries blue. Seeds ellipsoid.

Distribution: India to central and S. China and Indo-China (POWO, 2023); *Habitat*: In forests; *Fl. & Ft.*: June-December.

Specimens examined: Anamudi shola National Park, 22.06.2018, *Dani Francis & Santhosh Nampy* 159362; before tea estate, way to Kannadippara, 08.06.2018, *Dani Francis & Santhosh Nampy* 159269 (CALI); Kattappana, cardamom plantation, 28.09.1981, *C.N. Mohanan & B. Ramanujan* 72184; Kulamavu, 04.10.1983, *C.N. Mohanan* 79995 (MH); Mangaladevi Hills, Periyar Tiger Reserve, 15.07.2017, *Dani Francis & Santhosh Nampy* 152891; *Ibid*., 15.07.2017, *Dani Francis & Santhosh Nampy* 152873; Puthukkad, Nallathannikallar, 15.09.2018, *Dani Francis & Santhosh Nampy* 161912; Survikal para, MSNP, 17.07.2015, *Syam Radh S.* 145056; Thekkady, Nellikampetty Range, 14.07.2017, *Dani Francis & Santhosh Nampy* 152844 (CALI); Upper Vaguvarai, 16.11.1965, *B.V. Shetty* 26459 (MH); Vellimala, 22.12.1995, *Dani Francis & Santhosh Nampy* 14350 (CALI).

Peliosanthes Andrews,

Bot. Repos. 10: t. 605. 1808.

The genus *Peliosanthes* comprises 63 species worldwide (POWO, 2023). Thirteen species are reported from India (POWO, 2023). Wight (1853) described two species, *P. courtallensis* Wight and *P. neilgherrensis* Wight from South India and were recognized as distinct species by Hooker (1894) and Gamble (1928). However, Jessop (1976) in his revision of *Peliosanthes*, recognized only a single species, *P. teta* with two sub-species, *P. teta* subsp. *teta* and *P. teta* subsp. *humilis*. The South Indian species were treated under the synonymy of *P. teta* subsp. *humilis*. Several new species were recently described (Roy *et al.*, 2017; Odyuo *et al.*, 2020; Roy *et al.*, 2020; Taram *et al.*, 2020; Borah *et al.*, 2020) and many names were resurrected (Tanaka, 2018; Tanaka, 2019). However, the South Indian names remained untouched. During our study we have collected specimens of this genus from different areas of Idukki district. Critical examination revealed that these specimens are quite distinct and belong to *P. courtallensis* and *P. neilgherrensis*, which however, has long been treated as synonyms of *P. teta* subsp. *humilis*. The two species are reinstated here based on the following key.

Key to the species

1. Scapes 20–40 cm long, longer than petioles; flowers green; corona *c.* 1.8 mm across ……. *P. courtallensis*

1. Scapes 7–15 cm long, shorter than petioles; flowers purple; corona *c.* 2.3 mm across ……. *P. neilgherriensis*

Peliosanthes courtallensis Wight, Icon. Pl. Ind. Orient. t. 2051. 1853; Hook.f., Fl. Brit. India 6: 266. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1499. 1928.

Perennial herbs, densely tufted. Rootstock rhizomatous. Roots fibrous, fleshy. Cataphylls a few at base, imbricate, 3–11 cm long, withering in to dry fibrous remnants, transparent. Leaves elliptic-lanceolate, 20–40 × 4–5 cm, acuminate at apex, attenuate at base, glabrous, entire, green; petioles sub-terete, 20–35 cm long, glabrous. Scapes racemose, 20–40 cm long, many flowered, 1–2 per plant, longer than petiole, shorter than leaves. Peduncles 10–30 cm long. Flowers solitary in a bracteal axil, 0.8–1.2 cm across, light green; pedicels terete, 0.2–0.4 cm long,

glabrous. Bracts 2 per flower; outer bracts ovate-lanceolate, 3–10 × 1–3 mm, acuminate at apex, cuneate at base, entire, glabrous, dark green; inner bracts ovate, 2–4 × 1–2 mm, acute-cuspidate at apex, cuneate at base, entire, glabrous, dark green. Tepals 6, in two whorls, widely ovate, 3–4.5 × 3–4 mm, sub-rounded or obtuse at apex, truncate at base, entire, glabrous, green. Coronas hexagonal, *c.* 1.8 mm across, green. Stamens 6, monadelphous, sessile, introrse, inserted at the inner margin of the corona, oblong, 1–1.5 × 1–1.2 mm, cream. Ovary half inferior, trilocular, basally broad *c.* 2.5 mm across; ovules 4 per locule; style thick, short, 0.7–1 mm long; stigma triangular. Berries orbicular-circular, 1–1.3 × *c*. 1 cm, blue. Seeds 1, globose.

Distribution: S. India; *Habitat*: Forest margins; *Fl. & Ft.*: December-March.

Specimens examined: Edamalakkudi, 17.03.2019, *Dani Francis & Santhosh Nampy* 168978; way to Kanketty, 20.12.2019, *Dani Francis & Santhosh Nampy* 164600; Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164880; Tiger caves, Mankulam, 04.12.2018, *Dani Francis & Santhosh Nampy* 168856 (CALI).

Notes: *P. courtallensis* is placed under the synonymy of *P. teta* subsp. *humilis* by Jessop (1976), but during the critical examination of live specimens, this species found to be quite distinct by having 20–40 cm long scapes, which is longer than petioles, greenish flowers and slightly thickened corona. Thus, the species is resurrected from the synonymy of *P. teta* subsp. *humilis*.

Peliosanthes neilgherriensis Wight, Icon. Pl. Ind. Orient. t. 2052. 1853; Hook.f., Fl. Brit. India 6: 266. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1499. 1928.

Perennial herbs, densely tufted. Rootstock rhizomatous. Roots fibrous, fleshy. Cataphylls a few at base, imbricate, 3–8 cm long, withering in to dry fibrous remnants, transparent. Leaves elliptic, 20–35 × 3–5 cm, acuminate at apex, attenuate at base, glabrous, entire, green; petioles sub-terete, 18–35 cm long, glabrous. Scapes racemose, 7–15 cm long, many flowered, 1–5 per plant, shorter than petiole and leaves. Peduncles 2–3 cm long. Flowers solitary in a bracteal axil, 0.8–1 cm across, dark purple; pedicels terete, 0.2–0.3 cm long, glabrous. Bracts 2 per flower; outer bracts ovate-lanceolate, 5–10 × 1–3 mm, acuminate at apex, cuneate at base, entire, glabrous, pale purple; inner bracts ovate, 2–3 × 1–2 mm,

acute-cuspidate at apex, cuneate at base, entire, glabrous, pale purple. Tepals 6, in two whorls, widely ovate, 2.5–4 × 3–3.4 mm, sub-rounded or obtuse at apex, truncate at base, entire, glabrous, purple. Coronas rounded or slightly hexagonal, *c.* 2.3 mm across, purple. Stamens 6, monadelphous, sessile, introrse, inserted at the inner margin of the corona, oblong, *c.* 0.5 × 0.2 mm, cream. Ovary half inferior, trilocular, basally broad *c.* 2 mm across; ovules 4 per locule; style thick, short, 1–1.5 mm long; stigma triangular. Berries orbicular-circular, 1–1.5 × *c*. 1 cm, blue. Seeds 1, globose.

Distribution: S. India; *Habitat*: Forest margins; *Fl. & Ft.*: December–March.

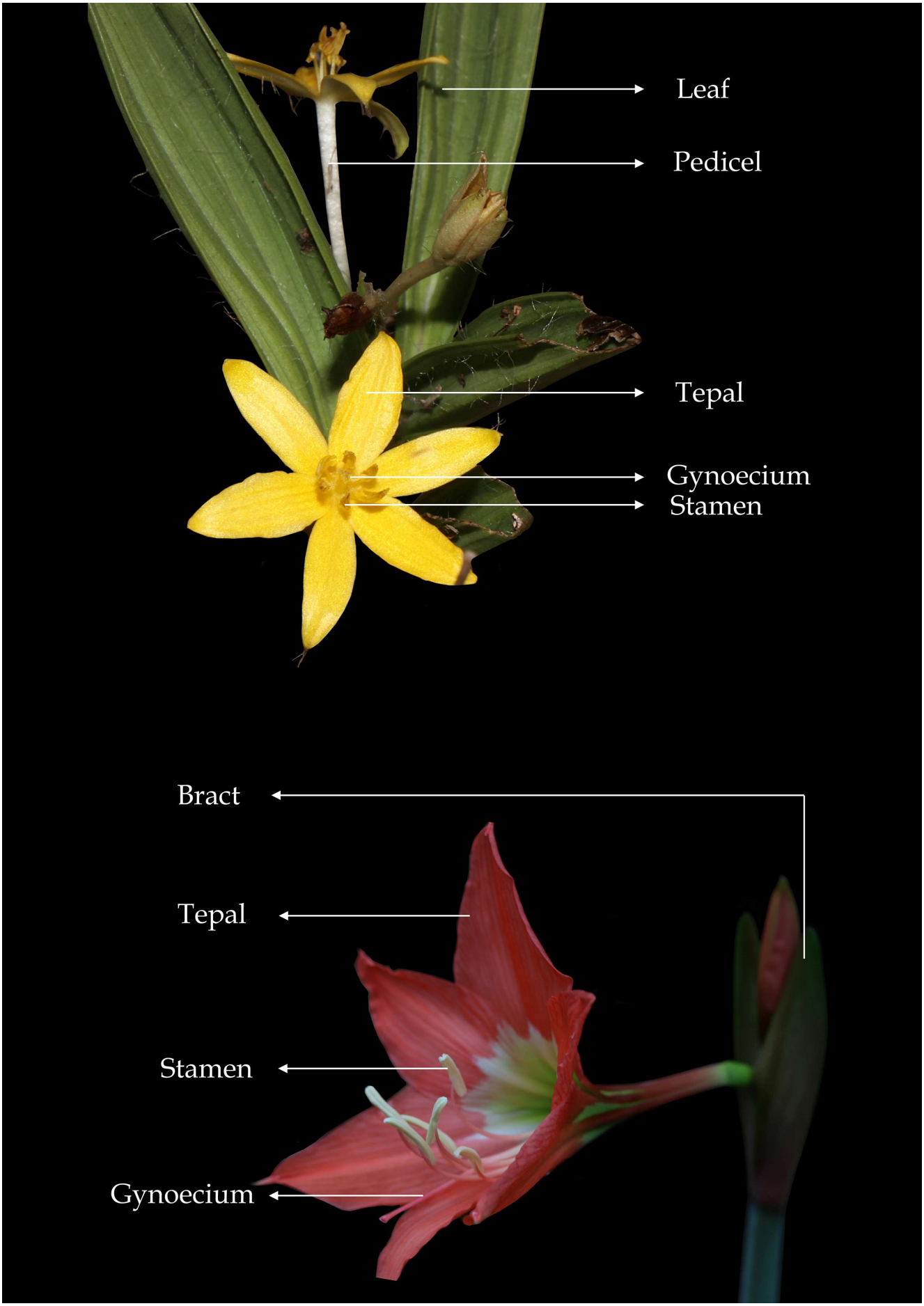
Specimens examined: Meenuliyanpara, 12.12.2016, *Dani Francis & Santhosh Nampy* 151423; *Ibid*., 11.12.2022, *Dani Francis & Santhosh Nampy* 176138 (CALI).

Notes: *P. neilgherriensis* is placed under the synonymy of *P. teta* subsp. *humilis* by Jessop (1976), but during the critical examination of live specimens, this species found to be quite distinct by having 7–15 cm long scapes, which is shorter than petioles, purplish flowers and more thickened corona. Thus, the species is resurrected from the synonymy of *P. teta* subsp. *humilis*.

AMARYLLIDACEAE J.St.-Hil.,

Expos. Fam. Nat. 1: 134. 1805.

Herbs with a tunicate bulbous rootstock or rarely a rhizome. Leaves a few from the base of stem or apex of bulb, more or less linear, with parallel nerves and transverse secondary nerves. Flowers usually showy, bisexual, actinomorphic, solitary to many or umbellate at the top of scape, subtended b 2 or more (rarely 1) involucre; bracts membranous. Perianth petaloid, often withering, persistent, with or without a tube; lobes 6, 3 + 3, equal, or the inner smaller or larger than the outer; corona often present. Stamens 6, antitepalous, hypogynous or inserted on the tube or towards the base of segments; filaments free or expanded at the base and connate forming a "false" corona; anthers 2-locular, introrse, basifixed or versatile, opening by slits lengthwise. Ovary inferior, 3-locular, placentation axile; ovules many; style slender; stigma capitate or 3-lobed. Fruit a capsule or berry. Seeds sometimes winged.


Leaf
Pedicel
Tepal
Gynoecium
Stamen
Bract
Tepal
Stamen
Gynoecium

It is a cosmopolitan (predominantly pantropical) petaloid monocot family (Meerow, 1999) consisting of about 69 genera and 800 species (POWO, 2023) and includes important horticultural and ornamental species (Zimudzi *et al.*, 2006). The genera *Hypoxis* L. and *Curculigo* Gaertn. belong to the family Hypoxidaceae, but due to their inferior ovary, species in this family were previously classified as Amaryllidaceae (Judd, 2000). Three genera and 4 species have been identified in the study area.

Key to the genera

1. Leaves flat, usually succulent, never plicate; scape 30–50 cm long, always above ground…….. *Hippeastrum*

1. Leaves rigid, not succulent, usually plicate; scape 1–10 cm long, sometimes subterranean ……..… 2

2. Ovary produced upwards in to a filamentous rostrum; fruit a berry … *Curculigo*

2. Ovary not produced upwards in to a rostrum; fruit a capsule ……..…….. *Hypoxis*

Hippeastrum Herb.,

Appendix 31. 1821.

Hippeastrum reginae (L.) Herb., Appendix 31. 1821. *Amaryllis reginae* L., Syst. Nat. ed. 10. 2: 977. 1759.

Annual herbs with a bulbous base. Bulbs globular, 2–4.5 × 2.5–4.5 cm. Leaves thick, succulent, flat, oblong-oblanceolate, 20–40 × 2–4 cm, acute or cuspidate at apex, attenuate at base, sessile, waxy, glabrous, green. Umbels 2–4-flowered; scape terete, 30–50 cm long, glabrous, hollow, green. Flowers large, red; bracts spathaceous, linear-lanceolate, 3–4 × 0.5–1 cm, acute at apex, sheathing at base, glabrous, cream; pedicels 3–5 cm long, terete, glabrous, green. Perianth 6, elliptic-lanceolate, 6–10 × 3–5 cm, acute and apiculate at apex, attenuate at base, glabrous; inner tepals larger than the outer tepals. Stamens 6; filaments 5–6 cm long, glabrous, pale green; anthers linear, 4–5 mm long, yellow. Ovary ovoid; style slender, 5–6 cm long, glabrous; stigma trifid. Capsules globular, trigonal. Seeds numerous, flattened, black.

Distribution: Peru to Bolivia and Central Brazil (POWO, 2023); *Habitat*: Forests and open lands; *Fl. & Ft.*: September-May.

Specimen examined: Kannadippara, Mankulam, 17.09.2018, *Dani Francis & Santhosh Nampy* 161947 (CALI).

Notes: This species is widely grown as an ornamental plant.

Curculigo Gaertn.,

Fruct. Sem. Pl. 1: 63, t. 16. 1788.

Key to the species

1. Flowers bisexual; berries ovate ……..…..... *C. orchioides*

1. Flowers bisexual towards base and male towards apex; berries cylindric or fusiform ……..…..... *C. trichocarpa*

Curculigo orchioides Gaertn., Fruct. Sem. Pl. 1: 63, t. 16. 1788; Hook.f., Fl. Brit. India 6: 279. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1502. 1928. Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 491. 2004.

Perennial herbs, 5–25 tall. Rootstock elongate, covered with the remnants of older leaves. Leaves plicate, linear-lanceolate, 2–20 × 0.3–2.5 cm, acute at apex, attenuate at base, pilose, green, rigid, prominently nerved, sessile or petiolate; petiole 1–3 cm long. Inflorescence solitary or racemed; scapes 1–3, 1.5–5 cm long, hidden among the bases of leaves, white, pilose. Flowers bisexual. Perianth lanceolate, *c.* 7 × 3 mm, obtuse or sub-acute at apex, cuneate at base, pilose, yellow. Stamens 6; filaments filiform 2–3.5 mm long, glabrous, yellow; anthers lanceolate, *c.* 4 mm long, dehiscing longitudinally, yellow. Ovary inferior, hidden among leaves, 3-locular, many ovuled, villous; rostrum filamentous; style filiform; stigma connate. Berry ovate, 1–2 cm long. Seeds few to many, sub-globose.

Distribution: Tropical and Subtropical Asia to W. Pacific (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: February-December.

Specimens examined: Eravikulam, 26.02.2003, *M.B. Reena* 89098 (CALI); Kuttiar valley, Munnar, 29.07.1982, *Nambiar & N. Sasidharan* 1864 (KFRI); Mangaladevi hills, 15.07.2017, *Dani Francis & Santhosh Nampy* 152896; Nakshathrakuthu waterfalls, Mankulam, 04.12.2018, *Dani Francis & Santhosh Nampy* 168842; Parunthanpara, 29.04.2018, *Dani Francis & Santhosh Nampy* 159238 (CALI).

Notes: This species is known as 'Golden eye grass or Black Musale' and rich in medicinal properties.

Curculigo trichocarpa (Wight) Bennet & Raizada, Indian J. Forest. 4(1): 68. 1981. *C. finlaysoniana* (Baker) Wall. ex Hook.f., Fl. Brit. India 6: 279. 1892. *Molineria finlaysoniana* Baker, J. Linn. Soc. Bot. 17: 121. 1878; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1502. 1928. *Molineria trichocarpa* (Wight) N.P.Balakr., J. Bombay Nat. Hist. Soc. 63: 330. 1967; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 491. 2004.

Perennial herbs, 30–65 cm tall. Rootstock tuberous, oblong-cylindric. Leaves plicate, lanceolate, 8–36 × 2–4 cm, acute-acuminate at apex, attenuate at base, puberulous or glabrous, green; petioles erect, slender, 4–25 cm long, puberulous. Racemes bracteate, 4–8 cm long; peduncles branched, hairy; bracts linear, 4–7 × 0.5–0.8 cm, obtuse at apex, cuneate at base, glabrous-puberulous, white. Flowers bisexual towards base, male towards apex; bracts lanceolate, *c.* 2 × 1 mm, acuminate at apex, cuneate at base, pilose, pale green. Perianth oblong-obovate, 4–5 × 1.5–3 mm, obtuse at apex, cuneate at base, pilose hairy, 5-nerved, yellow. Stamens 6; filaments filiform; anthers lanceolate, 1.8–2 mm long. Ovary 3-locular, *c.* 2 mm long, pilose; rostrum filamentous; style filiform, 1–1.2 mm long, glabrous; stigma papillate. Berry cylindric or fusiform.

Distribution: S. and E. India to Assam and Sri Lanka (POWO, 2023); *Habitat*: Evergreen and semi-evergreen forests; *Fl. & Ft.*: August-April.

Specimens examined: Erattayar dam, 28.09.1981, *C.N. Mohanan & B. Ramanujan* 72194 (MH); Eravangalar, 10.04.1995, *Jomy Augustine* 15029; Koruthode, 10.08.1993, *Jomy Augustine* 12207; way to Panamkutty, 10.03.2017, *Dani Francis & Santhosh Nampy* 152056; Poongavanam, 10.06.1995, *Jomy Augustine* 15484; Vellappara, 05.08.2017, *Dani Francis & Santhosh Nampy* 154168 (CALI).

Hypoxis L.,

Syst. Nat. ed. 10. 2: 986. 1759.

Hypoxis aurea Lour., Fl. Cochinch. 1: 200. 1790; Hook.f., Fl. Brit. India 6: 277. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1501. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 491. 2004.

Perennial, rhizomatous herbs, *c.* 18 cm tall. Rhizomes bulbous, globose, 2–3 × 1.5–2 cm, brown. Leaves radical, linear, 5–15 × 0.2–0.5 cm, acute at apex, sheathing at base, pilose, green. Scapes 1–3, 8–15 cm long, slender, pilose, green. Flowers 2 or 3, 1–1.7 cm long, yellow; bracts lanceolate, 5–6 × 0.5–0.6 mm, acute at apex, cuneate at base, hairy, green; pedicels 3–5 mm long, pilose. Perianth 6, 3 + 3, elliptic-lanceolate, 0.8–1 × 0.1–0.2 cm, obtuse at apex, cuneate at base, one nerved, pilose out, glabrous in, yellow. Stamens 6; filaments *c.* 0.5 cm long, yellow; anthers sagittate, yellow. Ovary 3-locular, oblong, slightly curved at base, green, pilose; ovules many; style short; stigma 3-fid. Capsules cylindric, 1.2–1.5 cm long, pilose. Seeds sub-globose.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Evergreen forests and grasslands; *Fl. & Ft.*: May-August.

Specimens examined: Eravangalar, 10.05.1995, *Jomy Augustine* 15271 (CALI); Kalvary mount, 14.06.1983, *A.G. Pandurangan* 79239 (MH); Kuttiar valley, Munnar, 29.07.1982, *Nambiar & N. Sasidharan* 1862 (KFRI); Kuttikkanam-Peermade, 25.09.1964, *K. Vivekananthan* 21392; *Ibid*., 23.05.1965, *K. Vivekananthan* 23979 (MH); Onnamthodu, Mathikettan Shola National Park, *s.d.*, *Syam Radh S.* 137975 (CALI); Painavu, 20.08.1981, *K. Vivekananthan & V.S. Raju* 71124 (MH).

Notes: This species is commonly called as 'star grass or star lily' and is well known for its medicinal properties.

DIOSCOREACEAE R.Br.,

in A.P.de Candolle, Prodr. 294. 1810, *nom. cons.*

Climbing, rarely erect herbs or shrubs; root stock tuberous or with a rhizome. Leaves opposite or alternate, simple, lobed or 3–9 foliate; petioles often angular,

twisted at base. Inflorescence spike, raceme or panicle. Flowers regular, small, minute, monoecious or dioecious. Perianth tubular, rotate, 6-partite. Stamens of male flower 3 or 6; anthers small. Pistillodes sometimes absent. Staminodes 6, 3 or 0. Ovary inferior, triquetrous, usually 3-celled; ovules 2; style 3, short; stigma 2-fid, recurved. Fruit a berry or 3-valved capsule. Seeds flat or sub-globose, winged or not.

The pantropical family Dioscoreaceae ('yam family') is considered to be categorized among the families of the earliest angiosperms, which might have originated in Southeast Asia (Waris *et al.,* 2021), and comprises four genera and approximately 653 species (POWO, 2023). They are usually vines and are found in various habitats, mainly in tropical forests. In India, the family is represented by three genera and 37 species (POWO, 2023), of which *Dioscorea* accounts for 33 species and 24 varieties (Karthikeyan *et al.,* 1989). A single genus with eight species occur in the study area.

Dioscorea L.,

Sp. Pl. 2: 1032. 1753.

Key to the species

1. Stems unarmed 2

1. Stems armed with prickles 5

2. Bulbils present in the leaf axils and inflorescence 3

2. Bulbils not present in the leaf axils and inflorescence 4

3. Stems twining to right, angular, 4–5 winged ..... *D. alata*

3. Stems twining to left, terete, not winged ..... *D. bulbifera*

4. Tubers solitary; leaves opposite ..... *D. oppositifolia*

4. Tubers numerous; leaves alternate ..... *D. wallichii*

5. Leaves 3–5 foliolate 6

5. Leaves simple 7

6. Male spikes axillary or terminal; capsules glabrous ..... *D. pentaphylla*

6. Male spikes axillary; capsules tomentose …… *D. tomentosa*

7. Leaves broadly ovate-cordate; capsules sub-orbicular ..... *D. esculenta*

7. Leaves obovate-oblanceolate; capsules sub-quadrate ..... *D. spicata*

Dioscorea alata L., Sp. Pl. 2: 1033. 1753; Hook.f., Fl. Brit. India 6: 296. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1512. 1928. Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 487. 2004.

Climbing herbs. Tubers solitary-many, polymorphic, variously branched or lobed; skin and flesh purple. Stems angular, twining to right, glabrous, bulbils present in the leaf axils and in inflorescence, 4–5 winged. Leaves opposite, ovate or sagittate, 4–20 × 3–10 cm, acuminate at apex, cordate with obtuse lobes at base, glabrous, green. Male spikes panicled, axillary or terminal, 2–10 cm long, rachis winged. Male flowers sessile, glabrous; bracts ovate-deltoid, 0.8–1 × 0.3–0.5 mm, acuminate at apex, truncate at base, glabrous. Tepals 6, widely ovate, 1–1.5 × 0.3–0.5 mm, obtuse at apex, cuneate at base, glabrous, greenish yellow. Stamens 6, *c.* 0.5 mm long; filaments *c.* 0.3 mm long; anthers *c.* 0.2 mm long; pistillodes conical. Female spikes 8–20 cm long, solitary in axils. Female flowers lax, sessile; bracts ovate, *c.* 1–1.5 × 0.8 mm, acute at apex, cuneate at base, glabrous. Tepals 6, broadly ovate, *c.* 2 × 1 mm, obtuse at apex, cuneate at base, glabrous. Ovary triquetrous, oblanceolate, *c.* 3 mm long, winged, glabrous; Staminodes 6. Capsules broadly obcordate. Seeds winged all round with a slightly unequal reddish-brown wing which is conform to the loculus.

Distribution: Tropical Asia (POWO, 2023); *Habitat*: Cultivated, also naturalized; *Fl. & Ft.*: Throughout the year.

Specimen examined: Thodupuzha, 06.06.2001, *Elsamma Joseph* 75032 (CALI).

Notes: *Dioscorea alata,* also known as 'purple yam', has great potency due to its high nutritional content, medicinal properties, and the presence of natural purple dye (Makiyah & Djati, 2018).

Dioscorea bulbifera L., Sp. Pl. 2: 1033. 1753; Hook.f., Fl. Brit. India 6: 296. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1511. 1928. Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 487. 2004.

Climbing herbs. Tubers solitary, ovoid, 1–6 × 1–6 cm, warty. Stems terete, twining to left, unarmed, glabrous, bulbils present in the leaf axils and in inflorescence. Leaves alternate, cordate, 3–17 × 3–16 cm, acuminate at apex, cordate with rounded lobes at base, glabrous, green. Male spikes panicled, axillary, pendulous, 15–22 cm long. Male flowers purple, sessile or pedicelled; bracts subulate-lanceolate, 0.6–0.8 × *c.* 0.3 mm, cuspidate at apex, truncate at base, glabrous. Tepals 6, biseriate, lanceolate, 1–1.5 × 0.3–0.5 mm, obtuse at apex, cuneate at base, glabrous, purple. Stamens 6, inserted at the base of the perianth, 0.8–1 mm long; filaments 0.6–0.8 mm long; anthers *c.* 0.2 mm long; pistillodes *c.* 0.1 mm long. Female spikes 1–3 together, 4–25 cm long. Female flowers 5–7 mm long, short pedicelled, *c.* 0.1 mm long; bracts lanceolate, *c.* 2 × 1 mm, acute at apex, cuneate at base, glabrous. Tepals 6, lanceolate, 2–2.5 × 0.3–0.8 mm, obtuse at apex, cuneate at base, glabrous. Ovary triquetrous, oblanceolate, *c.* 5 × 1.1 mm, winged, glabrous; staminodes 6. Capsules oblong, 1.5–2 × 1–1.5 cm, 3-winged. Seeds ovoid-ellipsoid, *c.* 4 × 4 mm, winged, with a small apical projection.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Moist deciduous forests; *Fl. & Ft.*: August-November.

Specimens examined: Erattayar, 15.10.1982, *C.N. Mohanan* 74677; Meenmutty, 04.10.1983, *C.N. Mohanan* 80006; Neriamangalam-Valara forest, 20.08.1965, *K.M. Sebastine* 25313 (CALI).

Notes: *Dioscorea bulbifera* is the only wild species in *Dioscorea* that has worldwide distribution, and produces a large number of bulbils in comparison to other species. It is a rich source of starch and is used as both cultivated and as wild cultivar (Sheikh *et al.*, 2009; Elsamma & Pandurangan, 2015; Chen *et al.*, 2022).

Dioscorea esculenta (Lour.) Burkill, Gard. Bull. Straits Settlem. 1: 396. 1917; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1511. 1928. Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 487. 2004. *D. spinosa* Roxb. ex Hook.f., Fl. Brit. India 6: 291. 1892. *Oncus esculentus* Lour., Fl. Cochinch. 1: 194. 1790.

Climbing herbs. Tubers numerous, shortly stalked, globose, 15–25 cm long; skin brown; flesh white. Stems twining to left, terete, prickled, glabrous. Leaves alternate, broadly ovate-cordate, 3–12 × 3.5–11 cm, acuminate at apex, cordate with

rounded lobes at base, glabrous; petioles slender, 3–8 cm long, glabrous. Male spikes solitary, dense, 10–15 cm long, axillary. Male flowers 1, 2 to 4, sessile or sub-sessile; bracts ovate, 0.8–1 × 0.3–0.5 mm, cuspidate at apex, truncate at base, glabrous. Outer tepals lanceolate, 1.5–1.8 × 0.6–0.8 mm, acute at apex, truncate at base, glabrous; inner tepals slightly shorter than the outer. Stamens 6, *c.* 0.6 mm long; filament *c.* 0.1 mm long; anthers *c.* 0.5 mm long; pistillodes *c.* 0.5 mm long. Female spikes solitary, 20–40 cm long. Female flowers 50–60 per spike, shortly pedicelled, *c.* 2 mm long; bracts ovate, *c.* 2 × 0.5 mm, acuminate at apex, cuneate at base, sparsely hairy at margins. Tepals 6, orbicular, 0.8–1 × 0.5–0.6 mm, acute at apex, obtuse at base, glabrous, greenish yellow. Ovary ovate-elliptic, triquetrous, 2–4 mm long, glabrous; staminodes 6. Capsules sub-orbicular, *c.* 2 × 3 cm, emarginate at apex, truncate at base, glabrous. Seeds inserted near middle of capsule, winged all round, glabrous.

Distribution: Tropical Asia (POWO, 2023); *Habitat*: Cultivated; *Fl. & Ft.*: Throughout the year.

Specimen examined: Thodupuzha, 06.06.2001, *Elsamma Joseph* 75044 (CALI).

Notes: *Dioscorea esculenta,* commonly known as 'lesser yam', is the most important commercially cultivated species, grown throughout the tropics, but its production is mainly in South East Asia. The tuber is a staple food in many areas (Mhaskar *et al.*, 2020).

Dioscorea oppositifolia L., Sp. Pl. 2: 1033. 1753; Hook.f., Fl. Brit. India 6: 292. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1512. 1928.; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 488. 2004.

Climbing herbs. Tubers solitary, cylindrical, 15–25 cm long, skin brown, flesh white. Stems twining to right, terete, twisted, unarmed, glabrous. Leaves opposite or sub-opposite, obovate-elliptic, 2–12 × 1.2–5 cm, acute at apex, cuneate at base, glabrous; petioles slender, 0.9–4 cm long, glabrous. Male spikes panicled, 9–12 cm long, axillary, 3–6 together. Male flowers greenish yellow; bracts lanceolate, 0.8–1 × 0.3–0.5 mm, cuspidate at apex, truncate at base, glabrous. Outer tepals widely ovate, 1.3–1.5 × 0.6–0.8 mm, acute at apex, truncate at base, glabrous; inner tepals ovate, *c.* 1.1 × 0.5 mm, acute at apex, truncate at base, glabrous. Stamens 6, *c.* 0.6

mm long; filament *c.* 0.1 mm long; anthers *c.* 0.5 mm long; pistillodes *c.* 0.5 mm long. Female spikes solitary or fascicled, 4–10 cm long. Female flowers 2–15 per spike, sessile; bracts ovate, *c.* 1 × 0.8 mm, acuminate at apex, cuneate at base, glabrous. Tepals 6, orbicular, 0.8–1 × 0.5–0.6 mm, acute at apex, obtuse at base, glabrous, greenish yellow. Ovary ovate-elliptic, triquetrous, 4–5 mm long, glabrous; staminodes 6. Capsules sub-orbicular, 1.8–2 × 2.2–3 cm, sub-bilobed at apex, acute at base, glabrous, yellow. Seeds 1.5–1.7 × 1–1.3 cm, winged, glabrous.

Distribution: S. India, Sri Lanka, E. Himalaya to Myanmar (POWO, 2023); *Habitat*: Moist deciduous and evergreen forests; *Fl. & Ft.*: May-December.

Specimens examined: Ezhuthupara, 05.12.2018, *Dani Francis & Santhosh Nampy* 168868 (CALI); Idukki reservoir, 14.06.1983, *C.N. Mohanan* 79235; near Kamashi, way to Kattappana, 23.08.1977, *K. Vivekananthan* 50503; Kozhikkanam, 24.09.1972, *B.D. Sharma* 41641; Kulamavu-Ayyappancoil, 27.05.1982, *C.N. Mohanan* 74046; Kuttikkanam-Peermade, 23.11.1967, *K. Vivekananthan* 29322; Meenmutty, 26.09.1981, *C.N. Mohanan & B. Ramanujan* 71993, 71999; *Ibid.*, 10.06.1983, *A.G. Pandurangan* 76686; Pachakkanam, 13.11.1975, *K. Vivekanathan* 46666; Periyar river bed, 07.11.1981, *B. Ramanujan* 72407; Thekkady, 08.10.1976, *K. Vivekananthan* 48620 (MH); *Ibid*., 08.10.1993, *Jomy Augustine.* 12547 (CALI); Vandanmettu, 26.08.1977, *K. Vivekananthan* 50518; Vandiperiyar-Pambanar, 23.09.1964, *K. Vivekananthan* 21334 (MH).

Notes: *Dioscorea oppositifolia* is also called 'air potato' or 'cinnamon yam' and the flowers smell like cinnamon. It is a fast growing, twining vine that has escaped from cultivation and can rapidly invade pristine habitats. It reduces native species' richness and abundance by outcompeting and eliminating native plant species. It does this by quickly outgrowing the native herbs and seedlings, thickly blanketing all adjacent vegetation, and competitively excluding light. It may also weigh down and break branches of large trees and shrubs. It can also able to completely cover the ground, excluding all native herbaceous ground cover (Global invasive species database, 2022).

Dioscorea pentaphylla L., Sp. Pl. 2: 1032. 1753; Hook.f., Fl. Brit. India 6: 289. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1511. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 488. 2004.

Twining herbs, tuberous. Tubers solitary, cylindrical, starchy; flesh white or lemon yellow. Stems slender, terete, twining to the left, armed with prickles, glabrous. Leaves 3–5 foliolate; bulbils numerous in the axil; leaflets obcordate, 3–10 × 1.5–10 cm, acuminate at apex, cuneate at base, glabrous abaxially, pubescent adaxially, green; petioles 5–11 cm long, pubescent. Male spikes panicled, axillary or terminal, hairy. Male flowers pedicelled, 0.8–1 mm long; bracts reniform, forming an involucre around the perianth, *c.* 2 × 1.8 mm, acuminate at apex, truncate at base, pubescent. Tepals 6, ovate-lanceolate, 1–1.2 × 0.3–0.5 mm, obtuse at apex, sub-truncate at base, pubescent, grey. Stamens 3, *c.* 0.5 mm long; staminodes 3; pistillodes a small cone with three scarsely separated tips. Female spikes 2–3 from each axis, 6–12 cm long. Female flowers 5–7 mm long, densely hairy. Tepals 6, ovate, *c.* 2 mm long, obtuse at apex, cuneate at base, pubescent. Ovary oblong, triquetrous, ribbed, 3–5 mm long, densely hairy. Capsules oblong, 1.5–2.5 × 1–1.5 cm, reflexed, 3-winged, glabrous. Seeds ovate, 0.8–1 × 0.4–0.6 mm, inserted near the apex, wings towards the base, black.

Distribution: Tropical and Subtropical Asia to N. Australia (POWO, 2023); *Habitat*: Moist deciduous forests; *Fl. & Ft.*: August-January.

Specimens examined: Way to Anakulam via Pazhampillichal, 26.12.1988, *P. Bhargavan* 90094 (MH); Koruthode, Periyar Tiger Reserve, 27.01.1995, *K.P. Rajesh & Jomy Augustine* 14713 (KFRI); Kuttikkanam, 15.08.2001, *Elsamma Joseph* 75073 (CALI); way to Mangaladevi temple, 11.10.1976, *K. Vivekanthan* 48668; Painavu-Kulamavu Road, 21.08.1981, *K. Vivekananthan & V.S. Raju* 71127; Vandiperiyar-Pambanar, 23.09.1964, *K. Vivekananthan* 21333, 21332 (MH); Vellappara, Idukki Wildlife Sanctuary, 05.08.2017, *Dani Francis & Santhosh Nampy* 154149 (CALI).

Notes: This species is found in both cultivated and wild habitats and is used as medicine.

Dioscorea spicata Roth, Nov. Pl. Sp. 371. 1821; Hook.f., Fl. Brit. India 6: 291. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1512. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 489. 2004.

Twining herbs, tuberous. Tubers 1 or 2, cylindrical; skin brown; flesh white. Stems terete, slender, sometimes prickly, twining to the right. Leaves opposite or alternate, widely obovate-oblanceolate, 5–19 × 4–9 cm, acuminate at apex, sub-rounded at base, glabrous, green; petioles 3–15 cm long. Male spikes 7–20 cm long, axillary. Male flowers solitary, or two together, sessile; bracts ovate, 3–3.5 × 1.3–1.5 mm, acuminate at apex, sub-truncate at base, glabrous. Tepals ovate, *c.* 1.5 × 1 mm, obtuse at apex, cuneate at base, glabrous. Stamens 6, *c.* 0.6 mm long; filaments *c.* 0.5 mm long; anthers *c.* 0.1 mm long; pistillodes conical. Female spikes 5–15 cm long, axillary. Female flowers *c.* 15 flowers per spike, sessile; bracts ovate, *c.* 1mm long, acute at apex, cuneate at base, glabrous. Tepals ovate, *c.* 1 × 0.8 mm, acute at apex, sub-truncate at base, glabrous. Ovary triquetrous, with style connate; staminodes minute. Capsules sub-quadrate, *c.* 4 × 4 mm, retuse at apex, winged. Seeds with a broad wing all round, more or less conform to the locule.

Distribution: S. India, Sri Lanka and SE. Bangladesh (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: August-March.

Specimen examined: Melmala, 17.03.1997, *Jomy Augustine* 16248 (CALI).

Dioscorea tomentosa Spreng., Pl. Min. Cogn. Pug. 2: 92. 1815; Hook.f., Fl. Brit. India 6: 289. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1511. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 488. 2004.

Climbing herbs. Tubers numerous, starchy, traversed by fibres; flesh white or butter yellow. Stems terete, slender, twining to the left, prickles towards base, tomentose. Leaves compound, 3–5 foliolate; leaflets 5–12 × 4.5–10 cm, obovate, acuminate at apex, oblique at base, tomentose abaxially, pubescent or glabrous adaxially; petioles 15–18 cm long. Male spikes panicled, axillary, 15–25 cm long, tomentose, ternate on branches. Male flowers pedicelled 1–1.3 mm long, tomentose, green; bracts lanceolate, *c.* 0.5 × 0.1 mm, acute at apex, cuneate at base, pubescent. Tepals sub-equal, ovate, 1–1.3 × 0.5–1 mm, obtuse at apex, sub-truncate at base, tomentose, greenish yellow. Stamens 3, 0.3–0.5 mm long; filaments 0.2–0.3 mm long; anthers 0.1–0.2 mm long; staminodes 3; pistillodes short, columnar. Female spikes 13–25 cm long, axillary. Female flowers *c.* 1 cm long, sessile; bracts ovate, *c.* 5 × 2 mm, acute at apex, truncate at base, densely

hairy. Tepals 6, oblong, 1–1.3 × 0.8–1 mm, obtuse at apex, cuneate at base, tomentose, greenish yellow. Ovary lanceolate, 6–7 mm long, tomentose; staminodes 3. Capsules oblong, reflexed, 2–3.2 × 1–2 cm, acute at apex, tomentose. Seeds obovate, 7 × 2 mm, glabrous, winged.

Distribution: India to Bangladesh and Sri Lanka (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: June-December.

Specimens examined: Lower camp to Kumily, 26.12.1974, *K. Vivekananthan* 45708 (MH); Koruthode, 07.06.1995, *Jomy Augustine* 15469 (CALI); Kulamavu, 01.06.1982, *C.N. Mohanan* 74139 (MH); Thekkady, 08.10.1993, *Jomy Augustine* 12496 (CALI).

Dioscorea wallichii Hook.f., Fl. Brit. India 6(18): 295. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1512. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 489. 2004.

Twining herbs, tuberous. Tubers numerous, fibrous; skin brown; flesh white-yellow. Stems terete, woody, stout, glabrous, prickled at the base, twining to right. Leaves alternate, simple, ovate-cordate, 4–13 × 4–12 cm, acuminate at apex, cordate with rounded lobes at base, shiny, glabrous, green; petioles slender, 4–12 cm long, glabrous. Male spikes panicled, axillary and terminal, 3–10 cm long. Male flowers 25–30 per spike, sessile bracts ovate, 0.5–1 × 0.5–0.8 mm, obtuse at apex, sub-truncate at base, glabrous. Tepals 6, ovate, 1–1.3 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous. Stamens 6, *c.* 0.5 mm long; pistillodes rudimentary. Female spikes simple or branched, straight, 8–25 cm long. Female flowers 0.8–1 cm long, *c.* 20 flowers per spike, pedicellate, *c.* 0.1 mm long; bracts ovate, 0.8–1 × 0.6–0.8 mm, acute at apex, sub-truncate at base, glabrous. Tepals 6, ovate, 1.8–2 × 1.6–1.8 mm, obtuse at apex, cuneate at base, glabrous. Ovary obovate, 0.5–1 cm long, triquetrous, acute at apex; staminodes very minute. Capsules broadly obovate, 2–2.5 × 1.8–2 cm, emarginated at apex, glabrous, winged. Seeds inserted near middle of capsule, winged all round.

Distribution: India to Bangladesh and Sri Lanka (POWO, 2023); *Habitat*: Evergreen forest margins; *Fl. & Ft.*: October-November.

Specimen examined: Pambavalley, 20.11.1993, *Jomy Augustine* 12735 (CALI).

LILIACEAE Juss.,

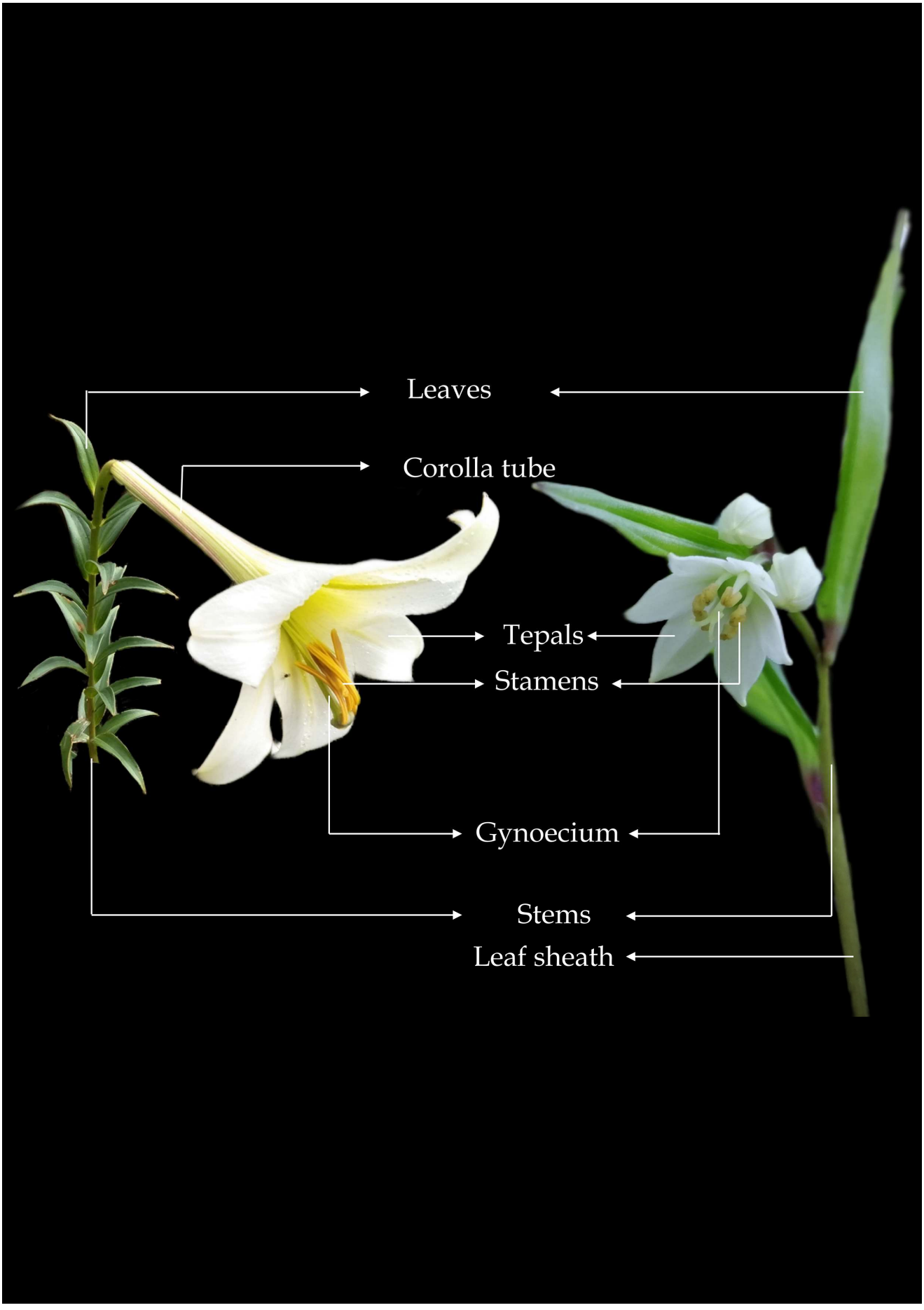
Gen. Pl. 48. 1789, *nom. cons.*

Herbs, perennial, or rarely shrubs. Roots arising from rhizomes, corm or bulb, or tubers. Stems erect or climbing, leafy or scapose. Flowers bisexual or rarely unisexual, actinomorphic or slightly zygomorphic, sometimes large and showy. Perianth mostly petaloid, with or without a tube; tepals usually 6, rarely 4 or more, imbricate or outer valvate. Stamens 6, adnate to and always opposite to tepals; filaments usually free; anthers 2-celled, opening usually by longitudinal slits. Ovary superior, 3-locular with axile placentas or rarely 1-locular with parietal placentas; ovules numerous. style entire or divided, rarely style free. Fruit a capsule or berry.

Liliaceae, or 'Lily family,' are mostly found in the Northern hemisphere and include 15 genera and over 600 species worldwide (APG IV, 2016). They are petaloid herbaceous monocots with a storage organ (bulb or rhizome) and flowers with six petaloid tepals, six stamens, and a superior ovary. Their large, colourful flowers, in particular, are commercially, pharmaceutically, and ethnobotanically valuable. Taxonomically, Liliaceae have been used in a wider range of circumscriptions than any other family, and the classification of the family has changed dramatically based on modern molecular phylogenetic studies (Kim & Kim, 2018). According to the latest classification (APG IV, 2016), the genera of this family were included in different families such as Liliaceae, Colchicaceae, Smilacaceae, Asphodelaceae and Asparagaceae. These families were included in the order Liliales and Asparagales respectively. Ten genera 19 species are discovered from the study area.

Key to the genera

1. Plants climbers ……. 2
1. Plants erect ……. 4
2. Cladodes present; armed ……. *Asparagus*
2. Cladodes absent; unarmed ……. 3
3. Leaf tendrils present; flowers yellow and red ……. *Gloriosa*
3. Leaf tendrils absent; flowers white or green ……. *Smilax*


Leaves
Corolla tube
Tepals
Stamens
Gynoecium
Stems
Leaf sheath

4. Leaves thick, cartilaginous ……. *Dracaena*

4. Leaves thin, non-cartilaginous ……. 5

5. Fruits a capsule ……. 6

5. Fruits a berry ……. 9

6. Inflorescence arises before the emergence of leaves ……. *Drimia*

6. Inflorescence arising with the leaves ……. 7

7. Leaves radical; flowers many on simple or branched scapes …….. *Chlorophytum*

7. Leaves cauline; flowers 1–3, not in scapes ……. 8

8. Flowers 3–5 cm long, dark purple; leaves linear; style absent or very minute …… ……. *Iphigenia*

8. Flowers 15–20 cm long, white to light cream; leaves elliptic-lanceolate; style 5–6 cm long ……. *Lilium*

9. Leaves sheathing at base; flowers in cymose panicles …….. *Dianella*

9. Leaves not sheathing, sessile or shortly petiolate; flowers in few flowered umbels ……. ……. *Disporum*

Asparagus L.,

Sp. Pl. 1: 313. 1753.

Key to the species

1. Cladodes 0.5–1 mm long, pointed at apex; perianth lobes 2–2.5 mm long ……. *A. racemosus*

1. Cladodes 1–1.5 mm long, acuminate at apex; perianth lobes 4–5 mm long ……. *A. gonoclados*

Asparagus gonoclados Baker, J. Linn. Soc., Bot. 14: 627. 1875; Hook.f. Fl. Brit. India 6: 318. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1517. 1928. *Protasparagus gonoclados* (Baker) Kamble in J. Econ. Taxon. Bot. 15: 709. 1992; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 494. 2004.

Climbing shrubs. Roots tuberous. Stems woody, terete, twining, branched, armed with spines, glabrous; spines short, recurved. Leaves scaly, lanceolate, *c.* 10 mm long; cladodes 4–6 facicles, triquetrous or trigonous, sickle shaped, 1–1.5 × 0.08–0.15 cm, acuminate at apex, cuneate at base, glabrous, dark green. Racemes axillary, fascicled; peduncles 3–10 cm long, green. Flowers solitary or clustered, bisexual, *c.* 1 × 0.8 cm; pedicels slender, 3–5 mm long, articulated at middle; bracts

triangular, 1.5–2 × 0.5–1 mm, cuspidate at apex, sub-truncate at base, glabrous. Perianth 3 + 3, basally connate, obovate, 4–5 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, pale yellow. Stamens 6, adnate to perianth lobes; filaments free, 0.5–0.6 cm long, white; anthers oblong, brown. Ovary obovoid, glabrous, pale green; ovules 2 in each cell; style short; stigma 3, recurved. Berries globose, 6–8 mm across, green when young, reddish at maturity. Seeds 1–6, globose.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Moist deciduous and evergreen forests; *Fl. & Ft.*: August-November.

Specimens examined: Devikulam, 11.09.1968, *D.B. Deb* 30703; Idukki-Kattappana, 08.11.1981, *B. Ramanujan* 72414; near Kamashi, way to Kattappana, 23.08.1977, *K. Vivekananthan* 50496; Kulamavu, 10.10.1982, *C.N. Mohanan* 74541; *Ibid*., 25.09.1984, *C.N. Mohanan* 80187; Kuttikkanam-Peermade, 21.09.1964, *K. Vivekananthan* 20333; Umayamala, 17.11.1965, *B.V. Shetty* 26488; Vallakkadavu, 04.10.1976, *K. Vivekananthan* 48590 (MH).

Asparagus racemosus Willd., Sp. Pl. ed. 4. 2(1): 152. 1799; Hook.f. Fl. Brit. India 6: 316. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1517. 1928. *Protasparagus racemosus* (Willd.) Oberm., S. African J. Bot. 2(3): 244. 1983; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 495. 2004. **Fig. 18D**

Climbing shrubs. Roots tuberous. Stems woody, terete, branched, armed with spines. Leaves scaly; cladodes from the axils of scale leaves in clusters, linear, falcate, leafy, 0.5–1 × 0.2–0.3 cm, pointed at apex, armed, glabrous, green. Racemes axillary, simple or branched; peduncles 3–10 cm long, green. Flowers solitary or clustered, bisexual, *c.* 1 × 0.8 cm; pedicels slender, 2–3 mm long, articulated at middle; bracts triangular, 1.5–2 × 0.5–1 mm, cuspidate at apex, sub-truncate at base, glabrous. Perianth 3 + 3, basally connate, oblong-obovate, 2–2.5 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, greenish white. Stamens 6, adnate to perianth lobes; filaments free, 0.5–0.6 cm long, white; anthers oblong, brown. Ovary obovoid, glabrous, pale green; ovules 2 in each cell; style short; stigma 3, recurved. Berries globose, 5–6 × 5–6 mm, green when young, reddish at maturity. Seeds 1–6, globose.

Distribution: Tropical Africa to N. Australia (POWO, 2023); *Habitat*: Forests and open lands; *Fl. & Ft.*: July-January.

Specimens examined: Devikulam, 27.07.1982, *Nambiar & N. Sasidharan* 1817; Kalvarimala, Periyar Tiger Reserve, 18.08.1994, *N. Sasidharan & Jomy Augustine* 13875 (KFRI); Kannadippara, Mankulam, 17.09.2018, *Dani Francis & Santhosh Nampy* 161947; Mannakkudi, 06.01.2017, *Dani Francis & Santhosh Nampy* 151579 (CALI); Pachakkanam, Periyar Tiger Reserve, 18.08.1993, *N. Sasidharan & Jomy Augustine* 12272 (KFRI); Umikuppa, 06.12.1994, *Jomy Augustine* 14423 (CALI).

Notes: *Asparagus racemosus* is a widely distributed species and have high medicinal and ornamental value.

Chlorophytum Ker Gawl.,

Bot. Mag. 27: t. 1071. 1807.

According to APG system of classification (2016), the genus is presently included under the family Asparagaceae.

Key to the species

1. Leaves petiolate or pseudo petiolate …….. 2

1. Leaves sessile…….. 3

2. Scapes 9–15 cm long, shorter than leaves, unbranched; seeds 8–9 in each cell ……. *C. heynei*

2. Scapes 35–70 cm long, longer than leaves, branched; seeds 1–2 in each cell ……. *C. nimmonii*

3. Pedicels articulated above middle; scapes unbranched or rarely branched …….. 4

3. Pedicels articulated below middle; scapes unbranched …….. 5

4. Floral bracts caducous; outer perianth linear …….. *C. laxum*

4. Floral bracts persistent; outer perianth lanceolate-elliptic …….. *C. tuberosum*

5. Scapes 2–3 per tufts; flowers 7–9 in clusters …… *C. malabaricum*

5. Scapes solitary; flowers 4–8 in clusters …….. 6

6. Leaves linear, serrulate at margins; floral bract triangular; outer perianth lanceolate …… *C. sharmae*

6. Leaves elliptic, wavy at margins; floral bract ovate; outer perianth elliptic …….. *C. indicum*

Chlorophytum heynei Baker, J. Linn. Soc. Bot. 15: 322. 1876; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1525. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 493. 2004. *Chlorophytum heyneanum* Wall. ex Hook.f., Fl. Brit. India 6: 333. 1892.

Perennial, tufted herbs, 15–30 cm tall. Roots fasciculated, tuberous. Leaves radical, elliptic, 10–30 × 2–5 cm, mucronate at apex, channelled, thick, partially succulent, glabrous, green; petiole winged, *c.* 7 cm long. Scapes 9–15 cm long, 1–3 per tuft, shorter than leaves, unbranched; sterile bracts absent; floral bracts linear, 1–3.3 × 0.3–0.5 cm, acute to acuminate at apex, cuneate at base, glabrous, green; bracteoles 2–5 per floral bracts, elliptic-obovate, 1–1.5 × 0.1–0.2 cm, acuminate at apex, cuneate at base, glabrous, greenish brown. Flowers rarely recurved, usually in sub-opposite and rarely alternate 6–8 flowered clusters, 1–1.2 cm across, greenish white; pedicels cylindrical, 0.4–0.5 cm long, articulated at tip, glabrous, green. Perianth 3 + 3, green; outer perianth lanceolate, 5–7 × 3–5 mm, acute at apex, cuneate at base, glabrous, green; inner perianth lanceolate, 5–8 × 3–4 mm, acute and papillose at apex, cuneate at base, glabrous, greenish white. Stamens 6, erect, 6–7 mm long, introse, divaricated; filaments papillose, inflated at middle, white; anthers basifixed, 1–2 mm long, dehiscing longitudinally, yellow. Ovary sessile, cylindrical-triquetrous, green; style shorter than stamens, straight; stigma minutely papillose. Capsules triquetrous, 1–1.5 × 0.4–1 cm, glabrous, green. Seeds 8–9 in each cell, orbicular, discoid, papery, minutely papillose, black.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: July-October.

Specimen examined: Koruthode, Periyar Tiger Reserve, 10.08.1993, *Jomy Augustine* 12258 (CALI).

Notes: Long petioles, thick leaves with mucronate apex, very short scapes, linear floral bracts, greenish flowers, many seeded capsules and smaller seeds distinguish this species from other Indian *Chlorophytum* species (Adsul & Yadav, 2015).

Chlorophytum indicum (Willd.) Dress, Baileya 9: 43. 1961. *Ornithogalum indicum* Willd., in Roemer & Schultes, Syst. Veg. ed. 15. 7(1): 535. 1829. *C. attenuatum* Baker, J. Linn. Soc. Bot. 15: 332. 1876; Hook.f., Fl. Brit. India 6: 335. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1526. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 493. 2004.

Perennial, solitary herbs, 20–40 cm tall. Roots fibrous, tuberous. Leaves radical, elliptic, 15–35 × 1.5–3 cm, acute at apex, attenuate at base, wavy at margins, glabrous, green; sessile. Scapes solitary, 20–40 cm long, longer than leaves, unbranched; sterile bracts absent or rarely present; floral bracts ovate, 0.8–2 × 0.3–0.5 cm, acute to acuminate at apex, cuneate at base, caducous, glabrous, green; bracteoles 2–4 per floral bracts, ovate, 0.6–1.5 × 0.1–0.2 cm, acute-acuminate at apex, cuneate at base, glabrous, green. Flowers alternate-sub-opposite 5–8 flowered clusters, 1–1.5 cm across, white; pedicels cylindrical, 0.5–1 cm long, articulated above middle, swollen at articulation, glabrous, white. Perianth 3 + 3, white; outer perianth elliptic, 7–9 × 3–4 mm, acute at apex, cuneate at base, glabrous, white; inner perianth elliptic-lanceolate, 6–8 × 3–4 mm, acute at apex, cuneate at base, glabrous, white. Stamens 6, erect, 8–10 mm long, introse; filaments papillose, inflated at middle, white; anthers basifixed, 4–5 mm long, dehiscing longitudinally, yellow. Ovary sessile, globose, green; style longer than stamens; stigma minutely papillose. Capsules triquetrous, 1.2–1.5 × 0.8–1 cm, glabrous, green. Seeds 3–5 in each cell, orbicular-reniform, discoid, minutely papillose, black.

Distribution: SW. India (POWO, 2023); *Habitat*: On dripping rocks; *Fl. & Ft.*: July-December.

Specimens examined: Anamudi slopes, 19.11.1965, *B.V. Shetty* 26547; Devikulam, 27.07.1982, *Nambiar & N. Sasidharan* 1820 (KFRI); Idukki-Kattappana, 26.09.1981, *C.N. Mohanan* 72014; Kalvary mount, 23.08.1981, *V.S. Raju* 71160; Lockhert gap, 15.06.1963, *K.M. Sebastine* 16500 (MH).

Chlorophytum laxum R.Br., Prodr. Fl. Nov. Holland. 277. 1810; Hook.f., Fl. Brit. India 6: 336. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1526. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 493. 2004.

Perennial, solitary or tufted herbs, 5–20 cm tall. Roots fibrous, tuberous. Leaves radical, linear-lanceolate, 3–15 × 0.5–1 cm, acute at apex, sub-truncate at base, glabrous, dark green adaxially, glaucous green abaxially, sessile. Scapes 1–10 cm long, 2–4 per tuft, as long as or shorter than leaves, branched; sterile bracts absent; floral bracts triangular, 1–1.5 × 0.3–0.5 cm, acute to acuminate at apex, cuneate at base, glabrous, brown or green; bracteoles 2–5 per floral bracts, ovate, 0.8–1 × 0.5–1 cm, acuminate at apex, cuneate at base, glabrous, greenish brown. Flowers in alternate 3–4 flowered clusters, 0.7–0.9 cm across, white; pedicels cylindrical, 0.5–0.8 cm long, articulated below middle, swollen at articulation, glabrous, greenish white. Perianth 3 + 3, green; outer perianth linear, 5–7 × 2–3 mm, acute at apex, cuneate at base, glabrous, white; inner perianth linear-lanceolate, 5–7 × 2–3 mm, acute at apex, cuneate at base, glabrous, white. Stamens 6, erect, 4–5 mm long, introse; filaments glabrous, white; anthers basifixed, 0.7–1 mm long, dehiscing longitudinally, yellow. Ovary sessile, globose-triquetrous, green; style longer than stamens, straight; stigma minutely papillose. Capsules triquetrous, 1–1.5 × 0.8–1 cm, glabrous, green. Seeds 2–5 in each cell, orbicular-reniform, discoid, minutely papillose, black.

Distribution: NE. Tropical Africa, Arabian Peninsula, India to W. Malesia and N. Australia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-December.

Specimens examined: Dam site, Periyar Tiger Reserve, 25.09.1995, *K.P. Rajesh & Jomy Augustine* 16848 (KFRI); Meenmutty, 04.10.1983, *C.N. Mohanan* 79976 (MH).

Notes: It is a widely distributed species with a wide range of morphological variations. It has fibrous roots with large ellipsoid tubers or thick, fasciculate roots without tubers. The size and shape of the leaves vary as well. Scape length is also variable; it might be shorter than the leaves, the same length as the leaves, or even longer than the leaves (Adsul & Yadav, 2015).

Chlorophytum malabaricum Baker, J. Linn. Soc. Bot. 15: 331. 1876; Hook.f., Fl. Brit. India 6: 335. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1526. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 493. 2004.

Perennial solitary or tufted herbs, 12–30 cm tall. Roots fasciculated, rarely tuberous. Leaves radical, elliptic-oblong, falcate to recurved, 7–25 × 0.5–1.5 cm,

acute to acuminate at apex, attenuate at base, sessile, glabrous, leathery, green, sessile. Scapes 12–25 cm tall, 2–3, unbranched or rarely branched, shorter than leaves; sterile bracts absent or rarely present; floral bracts ovate or triangular, 1–2.5 × 0.3–0.5 cm, acute to acuminate at apex, cuneate at base, glabrous, persistent, translucent green; bracteoles 2–5 per floral bracts, ovate, 0.5–1 × 0.3–0.4 cm, acute at apex, cuneate at base, glabrous, brown. Flowers in alternate to sub-opposite 7–9-flowered clusters, 1–1.6 cm across, white; pedicels 0.4–0.8 cm long, cylindrical, articulated above middle, glabrous, white. Perianth 3 + 3, white; outer perianth elliptic, 5–8 × 3–4 mm, acute at apex, sub-truncate at base, glabrous, white; inner perianth elliptic-lanceolate, 5–8 × 3–4 mm, acute at apex, sub-truncate at base, glabrous, white. Stamens 6, erect, 6–8 cm long, introse, divaricated; filaments 5–7 mm long, smooth or papillose, inflated at middle, white; anthers basifixed, dehiscing longitudinally, yellow. Ovary sessile, globose-triquetrous, green; style straight, white, included in stamens; stigma minutely papillose. Capsules triquetrous, 3-sulcate, 1–1.5 × 0.9–1 cm, glabrous, green. Seeds 2–4 in each cell, orbicular-reniform, discoid, black, minutely papillose.

Distribution: SW. India (POWO, 2023); *Habitat*: On wet rocks and grasslands; *Fl. & Ft.*: July-December.

Specimen examined: Anamudi, 11.12.2019, *Dani Francis & Santhosh Nampy* 164575 (CALI).

Notes: *Chlorophytum malabaricum* is also known as 'Malabar lily'. It is a small herb with a stem closely attached to leaves and star-shaped, highly fragrant flowers.

Chlorophytum nimmonii Dalzell, Hooker's J. Bot. Kew Gard. Misc. 2: 142; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 493. 2004. 1850. *Chlorophytum orchidastrum sensu* Hook.f., Fl. Brit. India 6: 333. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1524. 1928 *non* Lindl., 1824. **Fig. 18F**

Perennial solitary herbs, 30–60 cm tall. Roots fasciculated. Leaves radical, lanceolate-elliptic, 45–75 × 3–6 cm, acute at apex, attenuate at base, pseudopetiolate, glabrous, leathery, green; pseudopetiole winged. Scapes 35–70 cm tall, 1–3 per tuft, branched, longer than leaves; sterile bracts absent; branching of panicle guarded by large foliaceous bracts, elliptical, 6–9 × 0.5–1.5 cm, acute to

acuminate apex, glabrous, green; floral bracts reduced, linear-lanceolate, 1.5–5.5 × 0.5–1.5 cm, acute to acuminate at apex, cuneate at base, glabrous, persistent, translucent green; bracteoles 2–4 per floral bracts, ovate, 0.5–1 × 0.3–0.4 cm, acute at apex, cuneate at base, glabrous, brown. Flowers in alternate or rarely sub-opposite 5–9-flowered clusters, 1.2–1.6 cm across, drooping, white; pedicels 0.6–1 cm long, cylindrical, articulated below middle, glabrous, white. Perianth 3 + 3, white; outer perianth linear-lanceolate, 7–9 × 3–4 mm, acute at apex, sub-truncate at base, glabrous, white; inner perianth ovate-elliptic, 7–10 × 4–6 mm, obtuse at apex, sub-truncate at base, glabrous, white. Stamens 6, erect, 8–10 mm long, connate; filaments 2–5 mm long, smooth, white; anthers basifixed, dehiscing longitudinally, yellow. Ovary sessile, globose, green; style straight, white; stigma minutely papillose. Capsules triquetrous, 3-sulcate, 0.3–0.5 × 0.3–0.5 cm, glabrous, green. Seeds 1–2 in each cell, orbicular, discoid, black, minutely papillose.

Distribution: S. India (POWO, 2023); *Habitat*: Evergreen and moist deciduous forests; *Fl. & Ft.*: June-November.

Specimens examined: Devikulam, 02.06.1944, *K.C. Jacob* 20512; way to Kattappana, 25.09.1984, *C.N. Mohanan* 80199 (MH).

Chlorophytum sharmae Adsul, Lekhak & S.R.Yadav, Kew Bull. 69(2)-9503: 1. 2014.

Perennial, tuberous herbs, *c.* 35 cm tall. Roots cylindrical, forming tubers at distal parts. Leaves radical, narrow, linear, 20–30 × 0.8–2 cm, acute at apex, attenuate at base, margin serrulate, hyaline, glabrous, green, sessile. Scape usually solitary, unbranched or rarely branched, 30–45 cm long. sterile bracts 3–4, triangular, 9–12 × 0.5–0.7 cm, acute at apex, sub-truncate at base, glabrous, green; floral bracts triangular, 3–5 × 0.5–0.7 cm, acute at apex, sub-truncate at base, glabrous, green. Flowers in alternate to sub-opposite 4–7-flowered clusters, *c.* 3 mm across, white; pedicels cylindrical, 1–1.4 cm long, articulated above the middle, glabrous. Perianth 3 + 3, recurved; outer perianth lanceolate, 10–13 × 2.5–3 mm, acute at apex, cuneate at base, glabrous, white; inner perianth linear-lanceolate, 10–12 × 2.5–3 cm, acute at apex, cuneate at base, glabrous, white. Stamens 6, 1.1–1.3 cm long, divaricate; filaments 6–9 mm long, smooth, white; anthers 4–5 mm long,

apiculate at apex, dull yellow. Ovary turbinate, sessile, green, septal nectaries present; style persistent, white; stigma minutely papillose. Capsules triquetrous, 0.7–1 × 0.7–1 cm, glabrous, green. Seeds 2– 5 in each cell, orbicular, discoid, black.

Distribution: India (POWO, 2023); *Habitat*: Slopes and margins of shola forests; *Fl. & Ft.*: August-January.

Specimens examined: Mathikettan Shola National Park, 11.12.2016, *Dani Francis & Santhosh Nampy* 151402 (CALI); Munnar, 01.08.2013, *Adsul Avinash* 2553 (K, K001045851 digital image); Munnar, Silent valley, Rhodovalley, 1820 m, 22.11.2018, *Dani Francis & Santhosh Nampy* 168824 (CALI).

Notes: *Chlorophytum sharmae* differs from other Indian species by having narrow linear leaves with serrulate hyaline margins and blooming late in the season (October-December) (Adsul *et al.*, 2014).

Chlorophytum tuberosum Baker, J. Linn. Soc., Bot. 15. 332. 1876; Hook.f., Fl. Brit. India 6: 334. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1526. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 493. 2004.

Perennial solitary or tufted herbs, 10–30 cm tall. Roots fibrous, tuberous. Leaves radical, sessile, linear-lanceolate, recurved, 15–25 × 0.5–3 cm, acute at apex, attenuate at base, glabrous, green, sessile. Scapes 10–25 cm tall, 1–2 per tufts, unbranched, glabrous; sterile bracts absent; floral bracts persistent, triangular to ovate, rarely reduced to scale, 0.5–2 × 0.3–0.5 cm, acute to acuminate at apex, cuneate at base, glabrous, green; bracteoles 2–5 per floral bracts, ovate, 0.5–1.5 × 0.2–0.3 cm, acute at apex, cuneate at base, glabrous, green. Flowers in alternate to sub-opposite 3–5-flowered clusters, 2.5–3 cm across, white; pedicels cylindrical, 0.5–1 cm long, articulated below middle, swollen at articulation, glabrous, greenish white. Perianth 3 + 3, white; outer perianth lanceolate to elliptic, 1.5–1.8 × 0.5–0.8 cm, acute at apex, sub-truncate at base, glabrous, white; inner perianth lanceolate-elliptic, 1.4–1.8 × 0.5–1 cm, acute at apex, sub-truncate at base, glabrous, white. Stamens 6, erect, 0.6–1.5 cm long, introse; filaments 0.3–0.5 cm long, glabrous, white; anthers basifixed, 0.4–0.8 cm long, dehiscing longitudinally, yellow. Ovary sessile, cylindrical-triquetrous, white; style 0.5–0.8 cm long, white, longer than stamens, turns away from the base and form sharp curvature at tip;

stigma minutely papillose. Capsules triquetrous, 3-sulcate, 1.5–1.7 × 0.8–1 cm, glabrous, green. Seeds 2–5 in each cell, orbicular, discoid.

Distribution: Nigeria to Eritrea and Tanzania, C. and S. India to Myanmar (POWO, 2023); *Habitat*: Slopes and margins of shola forests; *Fl. & Ft.*: September-January. *Specimens examined*: Devikulam grassy slopes, 14.10.1963, *K.M. Sebastine* 17553 (MH); Thankamani, 559 m, 06.09.2017, *Dani Francis & Santhosh Nampy* 154375 (CALI).

Dianella Lam. ex Juss.,

Gen. Pl. 41. 1789.

Dianella ensifolia (L.) Redoute, Liliac. 1: t. 1. 1802; Hook.f., Fl. Brit. India 6: 337. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1521. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 494. 2004. *Dracaena ensifolia* L., Mant. Pl. 63. 1767.

Perennial erect herbs. Leaves distichous, equitant, linear-lanceolate, 15–65 × 0.5–2 cm, acute at apex, sheathing at base, glabrous, green; sheaths open, distichous, keeled, keel and margin smooth or scabrous. Inflorescence cymose panicles, 30–50 cm long, few flowered; scapes slender, angled, glabrous, green. Flowers white; pedicels *c.* 5 mm long, articulated at tip; bracts lanceolate, 0.5–1.5 × 0.5–1 cm, acute at apex, cuneate at base, glabrous, brownish green; tepals 6, ovate-lanceolate, 5–7 × 2–4 mm, obtuse at apex, cuneate at base, glabrous, white. Stamens 6; filaments thickened, pale yellow; anthers oblong, *c.* 5 mm long, yellow. Ovary 3-locular, ovoid, green; style slender; stigma minute. Berries ovoid, *c.* 10 × 5 mm, deep blue. Seeds a few, compressed.

Distribution: S. Tropical Africa to Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Grasslands and evergreen forests; *Fl. & Ft.*: July-February.

Specimens examined: Mlappara, 12.07.1993, *Jomy Augustine* 12082 (CALI); way to Mlappara, 06.02.1987, *P. Bhargavan* 69895 (MH); Munnar, 13.12.1970, *P. Rugmini* 1013; Top station, 13.01.1989, *Ciji Scaria* 7534; *Ibid.*, 09.01.1989, *N. Latha* 1065 (CALI).

Notes: *Dianella ensifolia* is commonly called as ‘Cerulean flaxlily’. This species was previously classified in Liliaceae, but according to the APG system of classification (2016), it is placed under Asphodelaceae.

Disporum Salisb.,

Trans. Hort. Soc. London 1: 331. 1812.

Disporum cantoniense (Lour.) Merr., Philipp. J. Sci. 15(3): 229. 1919. *Fritillaria cantoniensis* Lour., Fl. Cochinch. 1: 206. 1790. *Disporum leschenaultianum* D.Don, Proc. Linn. Soc. London 1: 45. 1839; Hook.f., Fl. Brit. India 6: 360. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1522. 1928; K.M.Matthew, Illustr. Fl. Palni Hills 731. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 494. 2004. **Fig. 18E**

Erect herbs, 20–60 cm tall. Rhizomes ovoid, brown. Stems angular, branched, glabrous. Sheaths lanceolate, 2–3 cm long, obtuse at apex, clasping at base, glabrous, brown. Leaves ovate, 2–10 × 0.5–5 cm, acute-acuminate at apex, cuneate at base, serrulate towards apex, glabrous, green; sessile or shortly petiolate. Umbels sessile or rarely peduncled, arising from axil of leaves, few flowered. Flowers 3–6, *c.* 2 × 1 cm, white; pedicels 2–6 cm long. Perianth 6, free, obovate, 1–3 × 0.5–1 cm, acute at apex, cuneate at base, glabrous, white. Stamens 6; filaments broadened below, *c.* 4 mm long, white; anthers oblong, pale yellow. Ovary ovate, *c.* 2 mm long; style slender, *c.* 4 mm long; stigma 3-fid, recurved. Berry globose, dark blue. Seeds orbicular-oblong, pale brown.

Distribution: S. China to tropical Asia (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: March-August.

Specimens examined: Anamudi slopes, 07.08.1967, *B.V. Shetty* 28330 (MH); Eravikulam, 02.05.2017, *Dani Francis & Santhosh Nampy* 152128 (CALI); Kottamala, Periyar Tiger Reserve, 23.08.1994, *N. Sasidharan & Jomy Augustine* 15288 (KFRI); Mannankudi, Mathikettan Shola National Park, 09.05.2015, *Syam Radh S.* 137990; Meesapulimala, 06.05.2019, *Dani Francis & Santhosh Nampy* 159157; Melmanalar, 22.03.1997, *Jomy Agustine* 17765 (CALI); Old Devikulam, 14.06.1963, *K.M. Sebastine* 16479; Umayamala, 19.04.1966, *B.V. Shetty* 27335 (MH); Upper melmanalar, 23.08.1994, *N. Sasidharan & Jomy Augustine* 13965 (KFRI).

Notes: According to the APG system of classification (2016), *Disporum cantoniense* belongs to the family Colchicaceae.

Dracaena Vand.,

Mant. Pl. 9. 1767.

Dracaena roxburghiana (Schult.f.) Byng & Christenh., Global Fl. 4: 66. 2018. *Sansevieria roxburghiana* Schult.f., in Roemer & Schultes, Syst. Veg. ed. 15. 7(1): 357. 1829; Hook.f., Fl. Brit. India 6: 271. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1520. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 491. 2004.

Fig. 18C

Acaulescent herbs. Root stock creeping. Leaves linear-lanceolate, 15–35 × 2–6 cm, acute and pointed at apex, truncate at base, channelled, fleshy, thick, cartilaginous, sessile, glabrous, pale green with dark green patches. Racemes 25–50 cm long, many flowered; scapes terete, 20–45 cm long, glabrous, green; bracts lanceolate, 1.5–2 × 0.8–1 cm, acute at apex, truncate at base, membranous, glabrous, cream. Flowers *c.* 4 in a cluster, 1.5–2 cm long, white; pedicels articulated near the middle. Perianth tube slender, 5–10 mm long; lobes 6, oblanceolate, 12–15 × 0.5–2 mm, deflexed, narrow, glabrous, pale green to white. Stamens 6, on perianth tube, 7–8 mm long, glabrous; anthers narrowly oblong, *c.* 3 × 1 mm, dehiscing longitudinally. Ovary 3-locular, obovoid, *c.* 2 × 1 mm; ovules 1; style filiform, *c.* 1.3 cm long; stigma simple. Berry globose. Seeds globose, fleshy.

Distribution: S. and E. India to Bangladesh (POWO, 2023); *Habitat*: Plains; *Fl. & Ft.*: December-February.

Specimen examined: Rajapparamedu, near Santhanpara, 10.02.2017, *Dani Francis & Santhosh Nampy* 151691 (CALI).

Notes: This species, is commonly known as "Indian bowstring-hemp". As per APG classification (1998, 2003, 2009, 2016), it is placed under Asparagaceae family and has both economic and medicinal value (Obydulla, 2016).

Drimia Jacq. ex Willd.,

Sp. Pl. ed. 4. 2(1): 165. 1799.

Drimia nagarjunae (Hemadri & Sawhni) An.Kumar, J. Econ. Taxon. Bot. 5(4): 962. 1984.

Bulbous geophytes. Bulbs sub-globose. Leaves dry at flowering, oblong-lanceolate, 25–45 × 3–5 cm, acute at apex, sub-truncate at base, glaucous, glabrous, green.

Scape solitary, erect, cylindrical, 55–80 cm long, glabrous, greenish brown to reddish purple. Racemes dense, 30–40 cm long. Flowers closely arranged, greenish white, diurnal; bracts caducous, broadly ovate, acute at apex, spurred, auriculate, lowest bract flat, ribbon like, middle one smaller with free spur; pedicels 1.5–2.5 cm long, drooping, glabrous, greenish brown. Tepals 6, connate at base, not reflexed, oblong-lanceolate, 1.4–1.7 × 0.3–0.5 cm, with a prominent mid rib, mucronate at apex, truncate at base, glabrous, greenish white. Stamens 6; filaments 1.2–1.5 cm long, glabrous, white; anthers *c.* 4 mm, orange yellow. Ovary ovate, *c.* 5–8 × 3–4 mm, 3-carpellary, 2-ovuled, green; style stout, grooved, *c.* 9 mm long; stigma trifid. Capsules ellipsoid. Seeds oblong-orbicular, flat, winged, black.

Distribution: S. India (POWO, 2023); *Habitat*: Thorny forests; *Fl. & Ft.*: December-January.

Specimen examined: Chinnar, 27.01.2018, *Dani Francis & Santhosh Nampy* 158360 (CALI).

Notes: *Drimia nagarjunae* is classified as a member of the Asparagaceae family (APG, 2016). It was previously considered as a synonym for *D. indica* (Roxb.) Jessop, but because of its stout scapes, closely arranged flowers, non-reflexed perianth lobes, broader leaves, and diurnal anthesis it is treated as a distinct species (Lekhak *et al.,* 2014; Saha & Jha, 2019).

Gloriosa L.,

Sp. Pl. 1: 305. 1753.

Gloriosa superba L., Sp. Pl. 1: 305. 1753; Hook.f., Fl. Brit. India 6: 358. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1519. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 494. 2004.

Climbing herbs with tuberous roots. Tubers cylindric, large, white. Leaves ovate-lanceolate, 4–15 × 1–5 cm, tapering towards apex with a coiled tendril, sub-rounded at base, glabrous, sessile, green. Racemes terminal. Flowers large, axillary, solitary; pedicels stout, 5–15 cm long, glabrous. Perianth 6, linear, 3–8 × 0.5–1.5 cm, acute at apex, attenuate at base, undulate at margins, yellow at base, red above. Stamens 6; filaments filiform, 2–6 cm long, glabrous, light green; anthers versatile, 1–1.5 cm long, glabrous, yellowish green. Ovary ovate, *c.* 1 × 0.4

cm, 3-locular, glabrous, green; ovules many; style filiform, deflexed, *c.* 5 cm long, glabrous; stigma 3-fid, subulate. Capsules linear-oblong, *c.* 6 cm long, glabrous. Seeds many, globose, warty, red-brown.

Distribution: Tropical and S. Africa, W. Indian Ocean, Indian Subcontinent to Lesser Sunda Islands (POWO, 2023); *Habitat*: Forests and plains; *Fl. & Ft.*: July-December.

Specimens examined: Alampetty, Marayur range, 28.11.1979, *Nambiar* 1039 (KFRI); Anchuruli, 07.09.2017, *Dani Francis & Santhosh Nampy* 152949 (CALI); Mullakkudy, 16.08.1994, *N. Sasidharan & Jomy Augustine* 13842; Neriyamangalam, 30.11.1979, *Nambiar* 1128 (KFRI); Painavu-Cheruthoni Road, 11.11.1981, *C.N. Mohanan* 71233 (MH).

Notes: *Gloriosa superba* is the only species found in India that belongs to the family Colchicaceae (APG, 2016), also known as the flame lily. It contains toxic alkaloids such as colchicine and gloriosine, indicating the high medicinal value of this species. In several countries, it is listed as an invasive species (Dounias, 2006). This species is closely allied to *G. simplex* L., in its climbing habit but can be differentiated by the much-undulated margin of the perianth (Maroyi *et al.*, 2013).

Iphigenia Kunth,

Enum. Pl. 4: 212. 1843.

Iphigenia indica (L.) Kunth, Enum. Pl. 4: 213. 1843; Hook.f., Fl. Brit. India 6: 357. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1528. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 494. 2004.

Perennial herbs, 10–25 cm long. Corms sub-globose, 0.5–1 cm in diam. Stems slender, terete, minutely papillose. Leaves linear, 5–15 × 0.4–1 cm, acute-acuminate at apex, sheathing at base, glabrous, green with prominent midrib. Corymb 2–10 flowered, 8–15 cm long. Flowers 3–5 cm long, dark purple; pedicels 2.5–5 cm long; bracts linear, 1–2.5 × 0.5–0.8 cm, acute at apex, clasping at base, glabrous, green. Tepals 6, linear-subulate, 7–11 × 0.8–1.5 mm, narrowly acuminate at apex, attenuate at base, recurved, glabrous, dark purple. Stamens 6, 2.5–4 mm long; filaments hirsute, papillose, purple; anthers oblong, dehiscing longitudinally, purplish yellow. Ovary oblong, c. 6 × 4 mm, triquetrous, green; ovules numerous in each cell; style absent or very minute; stigma 3-fid, recurved,

dark purple. Capsules triquetrous, oblong-ellipsoid, 7–12 × 2.5–3.5 mm, glabrous, green. Seeds numerous, orbicular, brown.

Distribution: Tropical and Subtropical Asia to N. Australia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: May-September.

Specimens examined: Devikulam, 17.06.1963, *K.M. Sebastine* 16542 (MH); Mangaladevi, Periyar Tiger Reserve, 10.06.1995, *N. Sasidharan & Jomy Augustine* 16215 (KFRI); Vandiperiyar, 25.05.1965, *K. Vivekananthan* 24322 (MH).

Lilium L.,

Sp. Pl. 1: 302. 1753.

Lilium wallichianum var. **neilgherrense** (Wight) H.Hara, Fl. E. Himalaya 3rd. Rep. 132. 1975; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 494. 2004. *Lilium neilgherrense* Wight, Icon. Pl. Ind. Orient. 6: 20, t. 2031. 1853; Hook.f., Fl. Brit. India 6: 350. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1523. 1928; K.M.Matthew, Illustr. Fl. Palni Hills 737. 1996. **Fig. 18B**

Erect, unbranched, leafy herbs. Roots bulbous. Leaves elliptic-lanceolate, 4–10 × 0.3–1.5 cm, acute at apex, sub-rounded at base, glabrous, sessile, green. Flowers 1–3 together, terminal or in the upper axils, 15–20 cm long, white-light cream. Perianth campanulate; lobes 6, ovate, 8–10 × 2–3 cm, acute-acuminate and puberulous at apex, glabrous, white-light cream; tube 7–8 cm long, glabrous, greenish white. Stamens 6, hypogynous; filaments 8–11 cm long, slender, glabrous, yellowish green; anthers linear-oblong, 2–3 cm long, versatile, yellow. Ovary sessile, oblong, 1.5–2 cm long, 3-locular, glabrous, green; ovules many; style 5–6 cm long, yellowish green; stigma globose, 3-lobed. Capsules 3-valved, loculicidal. Seeds vertically compressed.

Distribution: Central Nepal and S. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-December.

Specimens examined: Mattupetty, Munnar, 28.07.1982, *Nambiar & N. Sasidharan* 1841 (KFRI); Umayamala, 30.08.2019, *Dani Francis & Santhosh Nampy* 170264 (CALI).

Smilax L.,

Sp. Pl. 2: 1028. 1753.

According to Hutchinson (1959) and APG classification (2016), it is treated under a separate family Smilacaceae based on differences in habit, anthers and pistil.

Key to the species

1. Leaves cuspidate at apex; pedicels 0.5–0.8 cm long; ovary globose ……..
……..*S. zeylanica*

1. Leaves rounded at apex; pedicels 1–1.5 cm long; ovary obovoid ……. *S. wightii*

Smilax zeylanica L., Sp. Pl. 2: 1029. 1753; Hook.f., Fl. Brit. India 6: 309. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1518. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 490. 2004. **Fig. 18A**

Perennial, climbing shrubs. Stems woody, terete or angled, prickly, glabrous, brownish green. Leaves ovate-oblong or elliptic, 4–10 × 2.5–6.5 cm, cuspidate at apex, rounded at base, slightly undulate at margin, glabrous, shiny, coriaceous, green; petioles *c.* 1.5 cm long; tendrils simple, woody, twining, brown. Umbels axillary, many flowered; peduncles 1–3 cm long, glabrous, green. Flowers unisexual, *c.* 1.5 × 0.6 cm; pedicels 0.5–0.8 cm long, green; bracts oblong, 5–7 mm long, glabrous, green. Male flowers: tepals 6, free, oblong, curved backwards at apex, white; stamens 6, free; filaments flat, *c.* 0.5 mm long, callose at apex; anthers oblong, white; pistillode 0. Female flowers: tepals 6, free, oblong, *c.* 7 × 3 mm, curved backward towards pedicel, green; ovary globose, 3-carpellary, green; style short; stigma 3, reflexed, white; staminodes 3–6. Berry globose, *c.* 10 × 6 mm, brownish green. Seeds 1–3, globose.

Distribution: Tropical Asia (POWO, 2023); *Habitat*: Moist deciduous and semi-evergreen forests; *Fl. & Ft.*: January-December.

Specimens examined: Anamudi shola National Park, 22.06.2018, *Dani Francis & Santhosh Nampy* 159363; Erumadam, Mathikettan Shola National Park,

30.12.2014, *Syam Radh S.* 137926 (CALI); Kulamavu, 15.12.1982, *C.N. Mohanan* 76074; *Ibid*., 24.09.1981, *C.N. Mohanan & B. Ramanujan* 71938; Kuttikkanam-Peermade, 21.09.1964, *K. Vivekananthan* 20337; way to Old Devikulam, 22.04.1964, *K.M. Sebastine* 18381; Painavu, 20.08.1977, *K. Vivekananthan* 20337 (MH); Peerumedu, 27.04.2018, *Dani Francis & Santhosh Nampy* 159220; Rajapparamedu, near Santhanpara, 10.02.2017, *Dani Francis & Santhosh Nampy* 151697; Sivanpara, Mathikettan Shola National Park, 24.04.2016, *Syam Radh S.* 149128 (CALI).

Smilax wightii A.DC., Monogr. Phan. 1: 174. 1878; Hook.f., Fl. Brit. India 6: 310. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1519. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 490. 2004.

Perennial, climbing shrubs. Stems woody, terete or angled, prickly, glabrous, green. Leaves widely elliptic, 6–10 × 5–8 cm, rounded at apex, obtuse-rounded at base, entire at margins, glabrous, shiny, coriaceous, green; petioles 1–2 cm long; tendrils simple, woody, twining, green. Umbels axillary, many flowered; peduncles 4–5 cm long, glabrous, green. Flowers unisexual, *c.* 2 × 0.6 cm; pedicels 1–1.5 cm long, green. Male flowers: tepals 6, free, oblong, *c.* 8 × 3 mm, curved backwards at apex, white; stamens 6, free; filaments flat, *c.* 0.6 mm long; anthers oblong, white; pistillode 0. Female flowers: tepals 6, free, oblong, *c.* 7 × 3 mm, curved backward towards pedicel, green; ovary obovoid, 3-carpellary, glabrous, pale green; style short; stigma 3, reflexed, white; staminodes 3–6. Berry globose, brownish green.

Distribution: Central and E. Himalaya and S. India (POWO, 2023); *Habitat*: Moist deciduous and shola forests; *Fl. & Ft.*: June-April.

Specimens examined: Eravikulam National Park, 24.04.2012, *K.D. Prathapan* 417 (CALI); Kulamavu-Ayyappancoil, 27.05.1982, *C.N. Mohanan* 74049 (MH); Thekkady, 03.06.1995, *N. Sasidharan & Jomy Augustine* 15432 (KFRI); Vattappara, Mathikettan Shola National Park, 24.02.2018, *Syam Radh S.* 145125 (CALI).

Fig. 18. A. *Smilax zeylanica* L.; **B.** *Lilium wallichianum* var. *neilgherrense* (Wight) H.Hara; **C.** *Dracaena roxburghiana* (Schult.f.) Byng & Christenh.; **D.** *Asparagus racemosus* Willd.; **E.** *Disporum cantoniense* (Lour.) Merr.; **F.** *Chlorophytum nimmonii* Dalzell.

PONTEDERIACEAE Kunth,

Nov. Gen. Sp. 1(3): 265. 1816.

Freshwater or marshy herbs. Leaves erect or floating, nerves parallel. Spikes or racemes arise from the sheath of the uppermost leaf. Flowers bisexual; bracts sheathing, irregular. Perianth unequally 6-partite, white or blue, marcescent. Stamens 1–6, inserted at the base of the perianth lobes; anthers erect or versatile, one usually longer than the others. Ovary free, 3- or 1-celled, superior; placentation parietal; ovules one or more; style 1 or 3, slender; stigma sub-entire or lobed; ovules anatropous. Capsules membranous, loculicidally 3-valved. Seeds small.

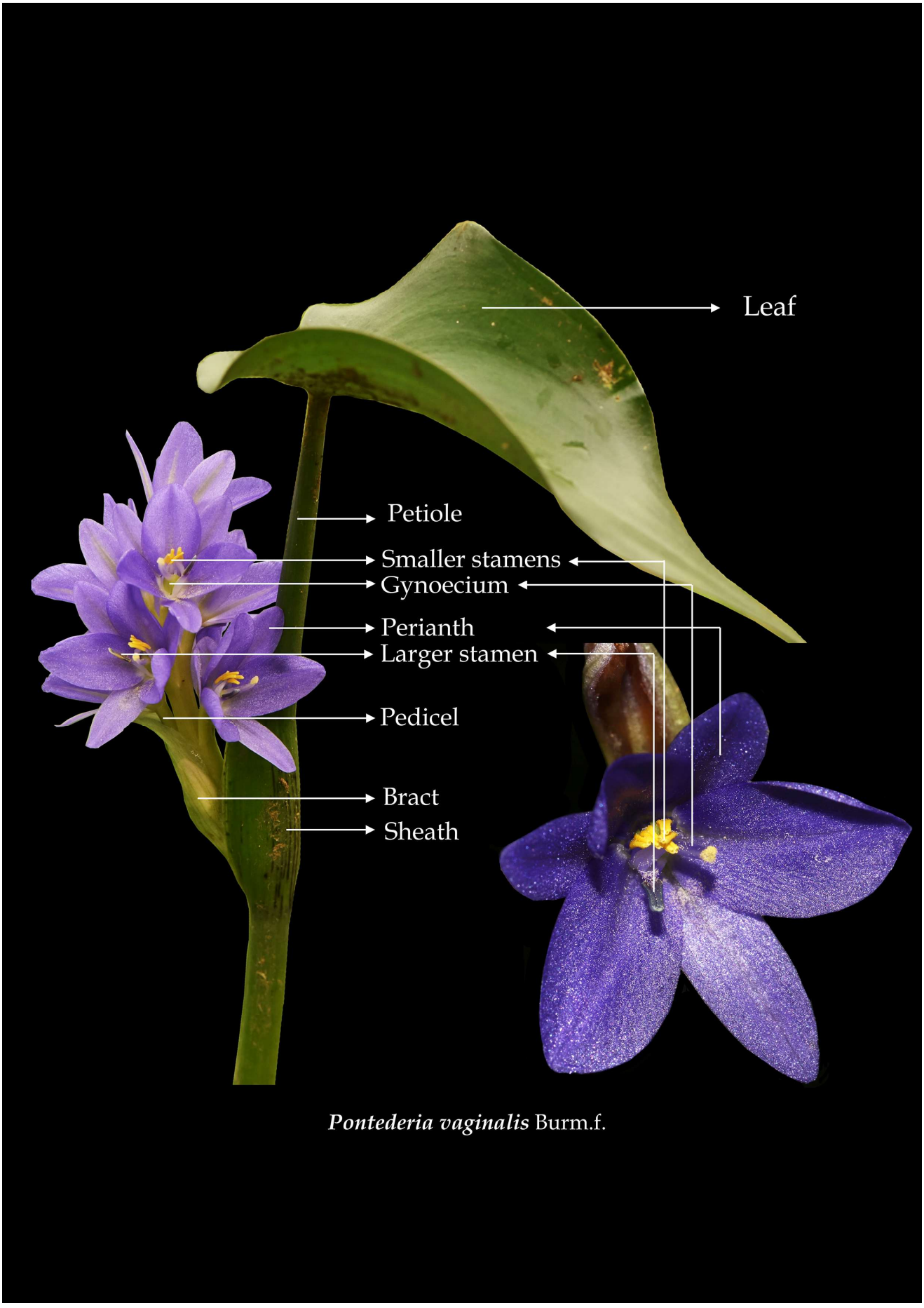
Pontederiaceae is the only tristylous monocotyledonous family. It includes two genera and 46 species worldwide (POWO, 2023). Hooker (1894) reported one genus and two species; one species is reported from the study area.

Pontederia L.,

Sp. Pl. 1: 288. 1753.

Pontederia vaginalis Burm.f., Fl. Ind. 80. 1768. *Monochoria vaginalis* C.Presl, Reliq. Haenk. 1: 128. 1827; Hook.f., Fl. Brit. India 6: 363. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1529. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 495. 2004.

Annual, erect, semi-aquatic herbs, 20–60 cm tall. Roots fibrous. Stems straggling, fleshy. Leaves cordate or ovate-lanceolate, 1.5–8 × 0.7–3 cm, acute at apex, cordate at base, glabrous, green. Sheaths ovate, 2–5 × 0.3–0.7 cm, obtuse-sub-truncate at apex, clasping at base, glabrous, greenish-purple. Petioles 3–15 cm long, glabrous, green. Cymes solitary, terminal, 9–12 cm long, 3–8-flowered, reflexed after anthesis. Peduncles 1–3 cm long. Flowers 1.5–2 cm across, violet; bracts ovate, membranous, 1.7–3 × 0.3–0.5 cm, obtuse at apex, cuneate at base, glabrous. Perianth campanulate, deeply lobed; lobes 3 + 3, oblong-obovate, 0.8–1.5 × 0.5–0.6 cm, deep blue. Stamens 6, unequal; larger stamen filaments appendaged; anthers 1.8–4 mm long; smaller stamen filaments filiform; anthers 1.5–3 mm long. Ovary oblong, *c.* 6 × 5 mm, many ovuled; style *c.* 4 mm long; stigma 3-lobed. Capsules oblong, *c.* 9 × 5 mm, glabrous, style persistent, loculicidally 3-valved. Seeds numerous, oblong, ribbed, with a small projection at the apex; testa vertically striated.



Pontederia vaginalis Burm.f.

Distribution: Tropical and Subtropical Asia to N. Australia (POWO, 2023); *Habitat*: Wetlands; *Fl. & Ft.*: February-November.

Specimens examined: Churuli, Kanjikkuzhi, 12.11.1981, *V.S. Raju* 71237 (MH); Kattappana, near Government College, 16.03.2018, *Dani Francis & Santhosh Nampy* 158377; Karimutty, 1st bridge, 09.02.2021, *Dani Francis & Santhosh Nampy* 188787; Kodikulam, 08.12.2021, *Dani Francis & Santhosh Nampy* 188940 (CALI); Koruthode, Periyar Tiger Reserve, 21.01.1995, *N. Sasidharan & Jomy Augustine* 16381 (KFRI); Kulamavu, 05.06.1982, *C.N. Mohanan* 74188; Thekkady, 18.10.1993, *N. Sasidharan & Jomy Augustine* 12531 (KFRI); Vandiperiyar, 22.09.1964, *K. Vivekananthan* 20400 (MH).

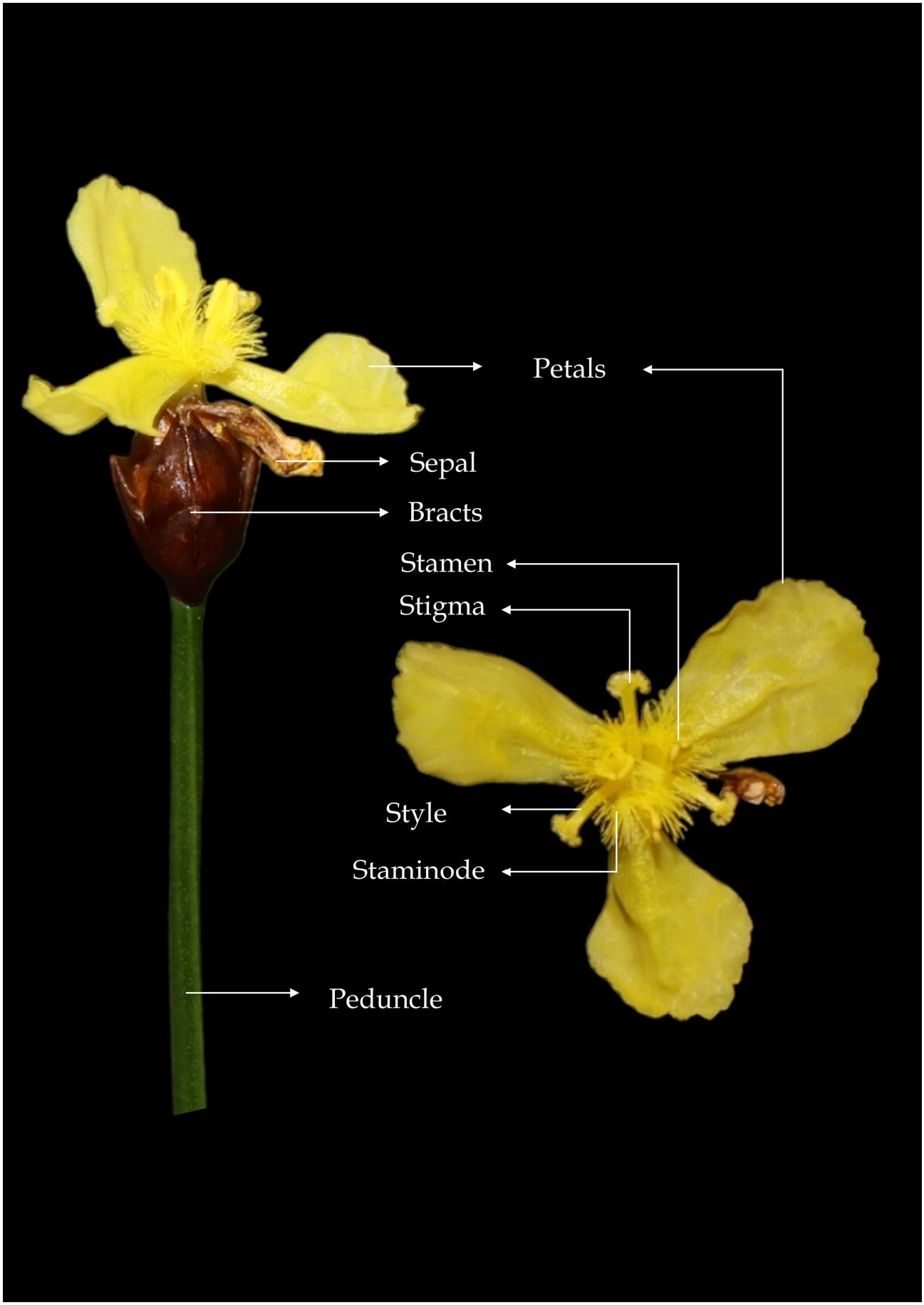
Notes: *Pontederia vaginalis,* also known as pickerel weed, is introduced to many parts of the world and became invasive in rice fields and other water bodies. It is also listed as an obnoxious invasive weed by the United States Federal Noxious Weed List (2010).

XYRIDACEAE C.Agardh,

Aphor. Bot. 158. 1823.

Tufted rigid herbs. Leaves radical linear or subulate; sheaths short. Scapes simple, glabrous. Inflorescence a terminal spike or head. Flowers sessile, bisexual; bracts orbicular, obovate, imbricate, coriaceous, persistent. Perianth inferior, 2-seriate. Sepals 3, deciduous; lateral 2 smaller scarious, narrow, arched, keeled or winged; dorsal broader, arching over the corolla, sometimes absent. Petals 2 or 3, yellow, clawed, claws connate in to a tube below. Stamens 3, inserted at the base of the petal; anthers sagittate. Staminodes 3, alternating with the petals, filiform, sometimes 0. Ovary superior, free, 1 or imperfectly 3-celled; placentas 3, basal or parietal; ovules many; style 3-fid; stigma capitate or dilated; ovules anatropous. Capsules loculicidal, 3-valved or splitting lid like round at the top. Seeds numerous, minute, linear or ellipsoid, ribbed.

The family Xyridaceae, also known as "yellow-eyed grasses" comprises of five genera and 407 species (POWO, 2023). The majority of its species are distributed in the neotropics, however the largest genus *Xyris* L. representing 95% of the species diversity (Morel & Munzinger, 2021), can be found in other parts of the


Petals
Sepal
Bracts
Stamen
Stigma
Style
Staminode
Peduncle

southern hemisphere. Morphologically, the family is easily recognized by its ensiform leaves and imbricate-bracteate spikes with showy flowers and only three antepetalous fertile stamens (Sajo *et al.*, 2017). In Asia, the family is represented by a single genus *Xyris*. Six species in India (POWO, 2023). Two species are reported from the study area.

Xyris Gronov.,

in Linnaeus, Sp. Pl. 1: 42. 1753.

Key to the species

1. Leaves without transverse ribs; stomatal field absent …… *X. capensis*

1. Leaves with transverse ribs; stomatal field triangular …….. *X. indica*

Xyris capensis Thunb., Prodr. Pl. Cap. 1: 12. 1794. *Xyris schoenoides* Mart. Wallich, Pl. Asiat. Rar. 3: 30. 1832; Hook.f., Fl. Brit. India 6: 365. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 1532. 1928. *Xyris capensis* var. *schoenoides* (Mart.) L.A.Nilsson, Ofvers. Kongl. Vetensk.-Akad. Forh. 24(14): 41. 1892; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 496. 2004.

Erect, annual tufted herbs, 30–50 cm tall. Leaves ensiform, 10–20 × 0.2–0.4 cm, acute at apex, sheathing at base, entire and slightly thickened at margins, glabrous, green, basally reddish green. Scape terete with 1 or 2 ridges, 20–40 cm long, entire at margins, glabrous. Heads terminal, solitary, globose; sterile bracts 5–6, imbricate, ovate, 3–4 × 2–3 mm, obtuse and apiculate at apex, sub-truncate at base, glabrous, dark brown, persistent. Fertile bracts imbricate, ovate, 3–6 × 3–4 mm, obtuse and apiculate at apex, sub-truncate at base, glabrous, brown; stomatal field absent. Sepals 3, ovate, 2–5 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, brown. Petals 3, obovate, 6–10 × 6–8 mm, lacerate towards apex, clawed at base, glabrous, yellow. Stamens 3; filaments 1.5–2 mm long; anthers sagittate, *c.* 2 mm long, yellow. Staminodes 3, branched, 3–4 mm long. Ovary *c.* 1 mm long, 1-loculed, many ovuled; style 3-fid, 4–5 mm long; stigma papillose. Capsules ovoid, dark brown. Seeds ovoid-ellipsoid, ribbed, dark brown.

Distribution: Tropical and Subtropical Old World and Brazil (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: May-November.

Specimens examined: Devikulam, 17.06.1963, *K.M. Sebastine* 16544; *Ibid*., 11.09.1968, *D.B. Deb* 30719 (MH); Eravikulam, 02.05.2017, *Dani Francis & Santhosh Nampy* 152134 (CALI); *Ibid*., 29.11.1979, *Nambiar* 1125 (KFRI); Munnar, Silent valley, Waterfalls near Rhodovalley, 22.11.2018, *Dani Francis & Santhosh Nampy* 168803 (CALI); Umayamala, 23.11.1965, *B.V. Shetty* 26630 (MH).

Notes: This species is easily distinguished by the absence of a stomatal field in its bracts. It is found primarily in moss covered areas with shallow water (Phonsena *et al.*, 2013).

Xyris indica L., Sp. Pl. 1: 42. 1753; Hook.f., Fl. Brit. India 6: 364. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 1532. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 496. 2004.

Erect, annual, solitary or tufted herbs, 30–50 cm tall. Leaves ensiform, 10–20 × 0.3–0.4 cm, acute at apex, sheathing at base, entire at margins, with short transverse ribs, glabrous, green. Scapes terete, 6–15 ridged, 20–50 cm long, entire at margins, glabrous. Heads terminal, solitary, ovoid-cylindrical; sterile bracts 4–6, imbricate, ovate, 4–6 × 3–5 mm, obtuse at apex, sub-truncate at base, glabrous, greenish brown, persistent. Fertile bracts imbricate, ovate, 4–7 × 4–5 mm, obtuse at apex, sub-truncate at base, glabrous, greenish brown; stomatal field triangular. Sepals 3, ovate, 10–12 × 2–2.5 mm, obtuse and slightly serrate at apex, cuneate at base, glabrous. Petals 3, ovate, 12–15 × 10–12 mm, lacerate towards apex, glabrous, yellow, clawed at base, *c.* 3 mm long. Stamens 3; filaments 2.5–3 mm long; anthers sagittate, *c.* 4 mm long, yellow. Staminodes 3, branched, 3–3.5 mm long. Ovary *c.* 1 mm long, 1-loculed, many ovuled; style 3-fid, 3–5 mm long; stigma papillose. Capsules obovoid, brown. Seeds ovoid, ribbed, pale brown.

Distribution: Tropical and Subtropical Asia to N. Australia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: June-December.

Specimen examined: Adimali, Padikkappu, 28.12.2017, *Dani Francis & Santhosh Nampy* 156583 (CALI).

Notes: This species is characterized by the presence of transverse ribs along the leaves. It has both medicinal and ornamental value (Phonsena *et al.*, 2013).

COMMELINACEAE Mirb.,

Hist. Nat. Pl. 8: 177. 1804.

Prostrate or erect herbs, rarely climbing, shrubby. Leaves alternate, sheathing at base. Inflorescence various, often cymes, scorpioid, or panicle. Flowers bisexual, more or less irregular, often enclosed in spathe like bracts. Perianth inferior, 6-partite, 2-seriate. Sepals 3, persistent. Petals free or united in to a tube below, spreading above, marcescent. Stamens 6, adnate to the base of perianth, perfect, 2 or more reduced to staminodes; filaments often bearded with jointed hairs; anthers oblong or globose, often dissimilar. Ovary superior, 2–3 loculed; ovules 1–several, orthotropous; style terminal; stigma small. Capsules loculicidal or indehiscent. Seeds angled; testa smooth or rugose.

The spiderwort family consists of 41 genera and approximately 730 species, widely distributed in both the Old and New Worlds, except in Europe (Jung *et al.*, 2021). They are ecologically diverse and occur mostly in humid and mesic habitats from sea level to higher elevations. The family is represented by 14 genera and 90 species in India (Karthikeyan, 2000). Members are grown as ornamentals and also used in medicines and fodder. There are six genera and 41 species in the study area.

Key to the genera

1. Fertile stamens 3 2

1. Fertile stamens 6 5

2. Inflorescence subtended by leaves 3

2. Inflorescence subtended by folded spathe ..... *Commelina*

3. Capsules hairy ..... *Rhopalephora*

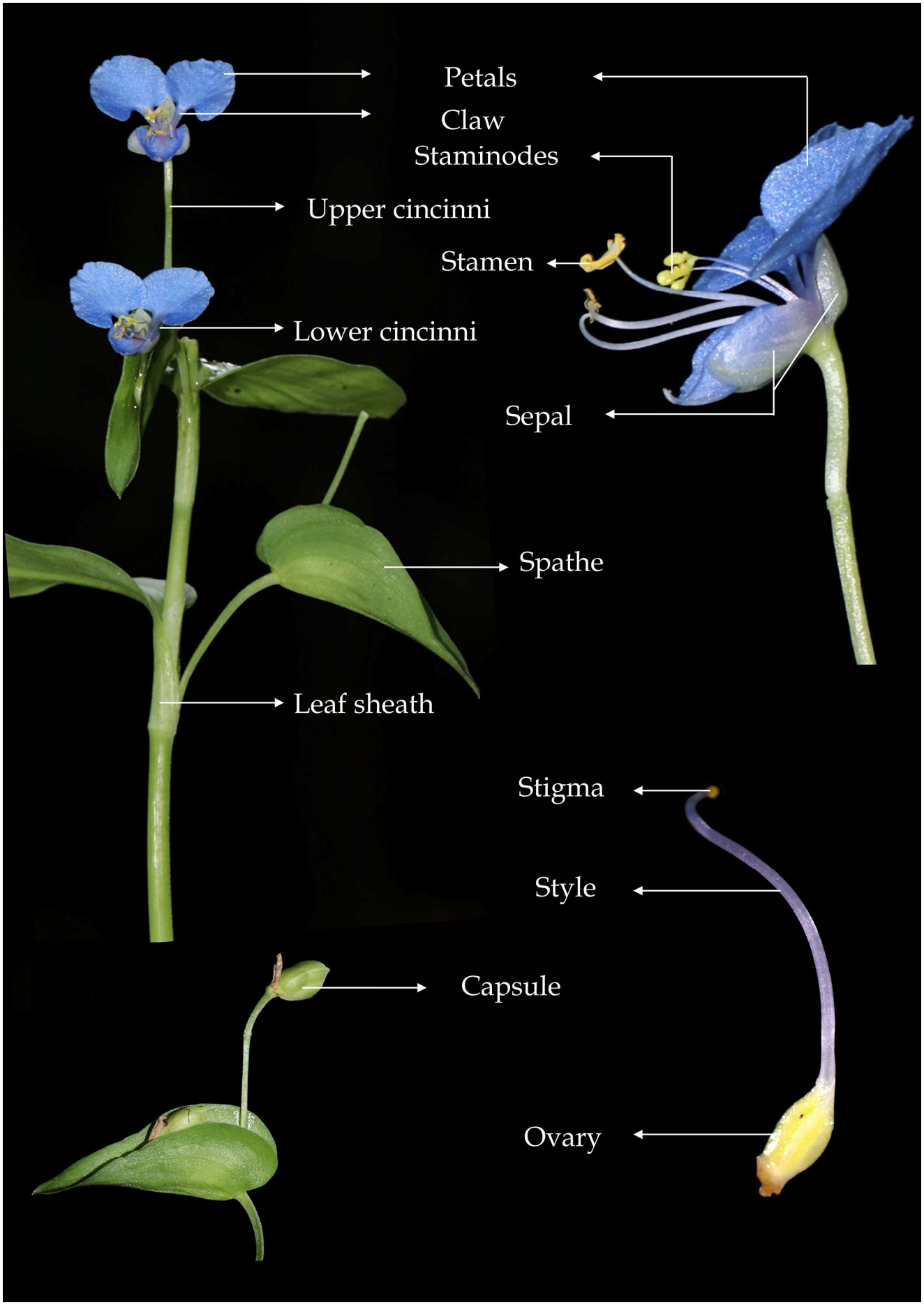
3. Capsules glabrous 4

4. Staminal filaments bearded; staminodes present ..... *Murdannia*

4. Staminal filaments glabrous; staminodes absent ..... *Dictyospermum*

5. Inflorescence a scorpioid cymes; bracteoles present ..... *Cyanotis*

5. Inflorescence a thyrse; bracteoles absent ..... *Floscopa*


Petals
Claw
Staminodes
Upper cincinni
Stamen
Lower cincinni
Sepal
Spathe
Leaf sheath
Stigma
Style
Capsule
Ovary

Commelina L.,

Sp. Pl. 1: 40. 1753.

Key to the species

1. Plants with a definite base …… 2

1. Plants without a definite base …… 9

2. Upper cincinni present …… 3

2. Upper cincinni lacking …… 5

3. Cleistogamous flowers present …… *C. benghalensis*

3. Cleistogamous flowers absent …… 4

4. Lower cincinni with 2 or 3 bisexual flowers …… *C. clavata*

4. Lower cincinni with 6 or 7 bisexual flowers …… *C. clavatoides*

5. Odd petals lanceolate …… 6

5. Odd petals obovate ……8

6. Spathe solitary; odd petals clawed …… *C. ensifolia*

6. Spathes clustered; odd petals not clawed ……7

7. Leaves distichous; lower cincinni 2–5 bisexual flowered …… *C. undulata*

7. Leaves spiral; lower cincinni 5 or 6 bisexual flowered …… *C. paludosa*

8. Roots tuberous; capsules 3-seeded; testa smooth …… *C. maculata*

8. Roots thick; capsules 2-seeded; testa reticulate …… *C. suffruticosa*

9. Capsules dehiscent, 5-seeded …… 10

9. Capsules indehiscent, 1-seeded …… *C. indehiscens*

10. Paired petals deltoid, claws *c*. 4 mm long; testa doubly reticulate ……*C. diffusa*

10. Paired petals orbicular, claws *c.* 2 mm long; testa smooth with white farinose …… *C. longifolia*

Commelina benghalensis L., Sp. Pl. 1: 41. 1753; Hook.f., Fl. Brit. India 6: 370. 1892; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1539. 1931; K.M.Matthew, Illustr. Fl. Palni Hills 740. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 497. 2004.

Annual sub-scandent herbs, rooting from basal nodes with a definite base. Cleistogamous flowers on underground stems. Stems branched, terete, green with

red striations; internodes 5–11 cm long. Leaves distichous; petioles 0.8–1 cm long; sheaths 1.5–2 cm long, strigose, rufous hairy at the summit; lamina ovate-lanceolate, 2–6 × 1.5– 3 cm, acute at apex, obtuse at base, undulate at margins, puberulous. Spathe basally fused, cucullate, 0.5–1.5 × 0.5–1 cm, pilose out, glabrous in, green. Upper cincinni 1-male flowered, vestigial or exserted, 8–10 mm long, ciliate; lower cincinni 2-bisexual flowered, 4–5 mm long, glabrous. Sepals 3, obtuse at apex, cuneate at base, glabrous, white; dorsal sepal boat shaped; lateral sepals oblong, fused at base. Petals 3; paired petals widely ovate-deltoid, rounded at apex, base clawed, 2–3 mm long, crenulate at margins, blue; odd petals ovate, obtuse at apex, light blue. Stamens 3; medial stamen *c.* 3 mm long, anther curved, yellow, connectives white; lateral stamens *c.* 4 mm long, anthers blue. Staminodes 3; filaments blue; antherodes 4-lobed, yellow. Ovary globose, yellow; style *c.* 4 mm long, blue; stigma capitate. Capsule 1 per spathe, oblong-elliptic, trilocular, dorsal locule 1-seeded, ventral locules 2-seeded. Seeds 5, ovoid; testa furrowed, reticulate, with white farinose; hilum linear, embryotega lateral.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Waysides and forest margins; *Fl. & Ft.*: June-February.

Specimens examined: on the way to Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 175973; Kattappana-Nedumkandam roadside, 27.12.2001, *Santhosh Nampy* 437; Pius Nagar, 22.06.2018, *Dani Francis & Santhosh Nampy* 159341 (CALI); Thannikkudy, 24.10.1993, *N. Sasidharan & Jomy Augustine* 12617; Thekkady, 20.08.1995, *K.P. Rajesh* 16340 (KFRI).

Notes: This species is commonly known as 'Tropical spider wort' or 'Benghal day flower'. It is easily distinguished by its cleistogamous flowers, ovate and puberulous leaves with red hairs on the sheath summit. It is considered as a noxious weed in agricultural lands (Isaac *et al.*, 2013; Ferrell *et al.*, 2020).

Commelina clavata C.B.Clarke, Commelyn. Cyrtandr. Bengal. t. 5. 1874; Hook.f., Fl. Brit. India 6: 371. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1539. 1931; K.M.Matthew, Illustr. Fl. Palni Hills 740. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 497. 2004. **Fig. 19F**

Perennial herbs, rooting at nodes with a definite base, roots thick. Stems branched, terete, green with purple striations; internodes 3–14 cm long. Leaves distichous; sheaths 1.5–3 cm long, strigose, ciliate at apex, mottled with red striations; lamina ovate-lanceolate, 2–12 × 0.7–2 cm, acuminate at apex, cuneate at base, serrulate at margins, strigose or glabrous. Spathes leaf opposed, conduplicate, cordate, 1–3.5 × 0.9–2 cm, acute-acuminate at apex, cordate and ciliate at base, glabrous-pilose, green; peduncles 1.5–5 cm long, a band of hairs on one side, green. Upper cincinni 2-male flowered, exserted, 1–2 cm long, ciliate; lower cincinni 2–3 bisexual flowered, 0.8–1 cm, glabrous. Sepals 3, pale blue, obtuse-sub-rounded at apex, cuneate at base, glabrous; medial sepal boat shaped; lateral sepals oblong, basally fused. Petals 3, dark blue; paired petals orbicular, rounded at apex, base clawed, 4–5 mm long, undulate at margins, glabrous; odd petals deltoid, obtuse at apex, cuneate at base, undulate at margin, glabrous. Stamens 3; filaments blue; anthers yellow with central maroon spots; medial stamen 4–5 mm long; anther lobe curved; connectives white; lateral stamens 5–6 mm long. Staminodes 3; filaments *c.* 5 mm long, blue; antherodes yellow, 4-lobed with lateral appendages, deep red or maroon at the centre. Ovary elliptic, *c.* 2 mm long, green; style 6–8 mm long, white; stigma blunt. Capsules 2–3 per spathe, oblong-elliptic, bilocular, dorsal locule absent, ventral locules 2-seeded. Seeds 4, ovoid; testa shallow-reticulate; hilum linear, embryotega lateral.

Distribution: S. India, Sri Lanka and Indo-China to W. Malesia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: March-January.

Specimens examined: Aduvizhunthankudi, Mathikettan Shola National Park, 22.11.2014, *Syam Radh S.* 137803; Anamudi peak, 11.12.2019, *Dani Francis & Santhosh Nampy* 164549; way to Anamudi base camp, 10.12.2019, *Dani Francis & Santhosh Nampy* 170017; Choondal, 21.11.2014, *Syam Radh S.* 143568 (CALI); Devicolam, 10.08.1967, *B.V. Shetty* 28367 (CAL); *Ibid*., 11.09.1968, *D.B. Deb* 30724 (MH); Elaveezhapoonchira, 25.08.2002, *Joby Paul* 805; Elappara-Kattappana roadside, 26.12.2001, *Santhosh Nampy* 428; Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 153000; Kattadikadavu, 07.12.2018, *Dani Francis & Santhosh Nampy* 167807; *Ibid.,* 07.12.2018, *Dani Francis & Santhosh Nampy* 167818; *Ibid.,* 07.10.2019, *Dani Francis & Santhosh Nampy* 170333; Mathikettan

shola National Park, 23.08.2014, *Syam Radh S.* 143530; Munnar, 08.12.2010, *Sheba & Santhosh Nampy* 3706; Munnar, Eravikulam, 19.11.2010, *Sheba & Santhosh Nampy* 4017; Munnar-Rajamala road, 18.11.2020, *Dani Francis & Santhosh Nampy* 173328; Nedumkandam, 19.10.2010, *Sheba & Santhosh Nampy* 3282; Painavu, *s.d., Joby Paul & Sibichen M. Thomas* 1205; Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164891; *Ibid.,* 30.12.2019, *Dani Francis & Santhosh Nampy* 170068; Pothadi, Marayur, 26.01.2018, *Dani Francis & Santhosh Nampy* 158323; Rhodomansion, way to Meesapulimala, 21.11.2018, *Dani Francis & Santhosh Nampy* 167785 (CALI); Uppupara, 26.09.1972, *B.D. Sharma* 41688; Vaguvarai-Devicolam, 10.08.1967, *B.V. Shetty* 28367 (MH). Venmany, 16.07.2021, *Dani Francis & Santhosh Nampy* 176026 (CALI).

Notes: This species is much common in the study area.

Commelina clavatoides Nampy & S.M.Joseph, J. Bot. Res. Inst. Texas 6: 119. 2012.

Perennial herbs, rooting at nodes with a definite base. Stems branched, terete, green with red striations; internodes 3–15 cm long. Leaves distichous; sheaths 2.5–3 cm long, ciliate at apex, strigose, mottled with red striations; lamina linear-lanceolate, 6–10 × 0.5–1 cm, acuminate at apex, cuneate at base, serrulate at margins, scabrous or glabrous. Spathes leaf opposed, broadly cordate, 3–4 × 1.5–2 cm, conduplicate, acute-acuminate at apex, cordate at base, puberulent, green; peduncles 5–8 cm long, a band of hairs on one side, green. Upper cincinni 1 or rarely 2-male flowered, exserted, 2–2.5 cm long, ciliate; lower cincinni, 6–7-bisexual flowered, 1.5–2 cm long, glabrous. Sepals 3, free, obtuse-sub-rounded at apex, cuneate at base, glabrous, transparent, pale blue; medial sepal boat shaped, *c.* 2.8 × 0.8 mm; lateral sepals oblong, *c.* 3 × 1 mm. Petals 3, dark blue; paired petals orbicular, 1–2 × 2.5–3 mm, rounded at apex, base clawed, *c.* 2 mm long, undulate at margins, glabrous; odd petals deltoid, 1.5–2 × 1.5–2 mm, obtuse at apex, base clawed, *c.* 1 mm long, glabrous. Stamens 3; medial stamen 4–5 mm long; anther curved, yellow with purple at the centre; lateral stamens straight, 2–3 mm long, yellow with purple at the centre. Staminodes 3, equal; antherodes 4-lobed with 2 lateral appendages, yellow with cream or purple at the centre. Ovary elliptic, 0.8–1 mm long, green; style white, 2–2.5 mm long; stigma capitate. Capsules 5–6 per spathe, oblong, compressed, bilocular, dorsal locule absent, ventral locules 2-

seeded. Seeds 4, ovoid-oblong; testa black, pits shallow; hilum linear; embryotega lateral.

Distribution: India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-November.

Specimens examined: Adimali-Munnar road, 19.11.2010, *Sheba M. Joseph & Santhosh Nampy* 4016; Lockhart gap, Devikulam, 25.07.2013, *K.M. Manudev* 135320; *Ibid.,* 25.07.2013, *K.M. Manudev* 135318; Meenuliyanpara, 29.11.2019, *Dani Francis & Santhosh Nampy* 164630; Munnar, 07.12.2010, *Sheba & Santhosh Nampy* 40 (CALI).

Notes: *Commelina clavatoides* shows similarity with *C. clavata* in having scabrous leaf, ciliate navicular spathe, and 4-seeded capsules, but differs by its 6–10 cm long peduncles, free lateral sepals, 5–6 capsules per spathes, and shallow-pitted, ovoid to oblong seeds (Sheba *et al.*, 2012).

Commelina diffusa Burm.f., Fl. Indica 18. 1768; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 497. 2004. **Fig. 19E**

Annual herbs, rooting at nodes without a definite base. Stems diffusely branched, extensively spreading, terete, puberulous, green; internodes 3–10 cm long. Leaves distichous; sheaths 1.5–3 cm long, ciliate at apex, strigose, mottled with red striations; lamina ovate-lanceolate, 2–12 × 0.5–1.5 cm, acute-acuminate at apex, attenuate at base, glabrous or puberulous, green. Spathes leaf-opposed, conduplicate, 1.5–5 × 1–2 cm, acute-acuminate at apex, cordate at base, glabrous, green; peduncles 1.5–4 cm long, strigose, green. Upper cincinni 1 or 2-male flowered, exserted, 1.5–2 cm long, ciliate; lower cincinni, 2–5 bisexual flowered, 0.8–1 cm long, glabrous. Sepals 3, obtuse at apex, cuneate at base, glabrous, transparent; medial sepal boat shaped, 1.5–1.8 × 0.8–1 mm; lateral sepals oblong, 2–2.3 × 1–1.2 mm, basally fused half of its length. Petals 3, blue; paired petals deltoid, 3–4 × 3–4 mm, sub-rounded at apex, base clawed, *c.* 4 mm long, glabrous; odd petals deltoid, 2–2.2 × 2–2.2 mm, blunt at apex, base clawed, *c.* 1 mm long, glabrous. Stamens 3; medial stamen 4–5 mm long, anthers curved, yellow; lateral stamens 5–6 mm long, yellowish-brown; connectives white. Staminodes 2 or 3, 4–5 mm long, filaments slender, blue; antherodes 4-lobed with 2 lateral appendages, yellow. Ovary elliptic, *c.* 2 mm long, green; style 4–6 mm long, purple; stigma

capitate. Capsules 1–3 per spathe, oblong, trilocular, dorsal locule 1-seeded, ventral locules 2-seeded. Seeds 5, oblong; testa doubly reticulate; hilum linear, embryotega lateral.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Wastelands; *Fl. & Ft.*: March-January.

Specimens examined: Adimali, 19.11.2010, *Sheba & Santhosh Nampy* 4014; *Ibid*., 07.08.2019, *Dani Francis & Santhosh Nampy* 170211; Chinnar, 27.01.2018, *Dani Francis & Santhosh Nampy* 158339; Kaliyar, 27.10.2001, *Santhosh Nampy* 154; Kallarpara, Near Nedumkandam, 27.12.2001, *Santhosh Nampy* 440; Kattappana field near Govt. College, 16.03.2018, *Dani Francis & Santhosh Nampy* 158374; Kudimala-Lakkamkudi, 09.12.2019, *Dani Francis & Santhosh Nampy* 170005; Pambadumshola, 20.12.2018, *Dani Francis & Santhosh Nampy* 167867; Pandippara, 16.07.2021, *Dani Francis & Santhosh Nampy* 176070; River side, way to Mankulam, 21.12.2019, *Dani Francis & Santhosh Nampy* 164848 (CALI); Thannikudy, Periyar Tiger Reserve, 26.07.1993, *N. Sasidharan & Jomy Augustine* 12157 (KFRI); Vellakkayam, 04.04.2018, *Dani Francis & Santhosh Nampy* 158451 (CALI).

Notes: This species is known as the 'climbing or spreading day flower'. The size of the leaves, internodes, and spathes varies depending on the habitat (Sheba & Nampy, 2012). In agricultural lands, it is considered a noxious weed (Isaac *et al.*, 2013).

Commelina ensifolia R.Br., Prodr. Fl. Nov. Holland 269. 1810; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 497. 2004.

Perennial rhizomatous herbs, with a definite base, roots thick. Stems branched, extensively spreading, terete, glabrous, green; internodes 3.5–11 cm long. Leaves distichous; sheaths 2–4 cm long, ciliate at apex, pubescent, green or red; lamina ovate-lanceolate, 2–11 × 0.5–1.5 cm, acute-acuminate at apex, attenuate at base, glabrous or puberulous adaxially, puberulous abaxially, green. Spathes leaf-opposed, solitary, triangular, cucullate, 1–2 × 0.8–1.6 cm, acute at apex, basally fused at margins, hirsute, pale green; peduncles 0.3–0.5 cm long, pubescent, green. Upper cincinni usually absent; lower cincinni 2–3 bisexual flowered, *c.* 0.5 cm long,

glabrous. Sepals 3, obtuse at apex, cuneate at base, glabrous, white; medial sepal boat shaped; lateral sepals oblong, basally fused. Petals 3, pale blue; paired petals orbicular, lateral, 3–4 × 3–5 mm, sub-rounded at apex, base clawed, *c.* 3 mm long, glabrous; odd petals lanceolate, *c.* 2 mm long, obtuse at apex, cuneate at base, glabrous. Stamens 3; medial stamen *c.* 5 mm long; anthers large, yellow; lateral stamens 7–10 mm long, anthers white; connectives white. Staminodes 3, 4–5 mm long, filaments slender; antherodes 4-lobed with 2 lateral appendages, yellow. Ovary globose, *c.* 0.8 mm long; style 8–11 mm long, pale purple; stigma trilobed. Capsules 1–2 per spathe, obovate, 2–3-locular, dorsal rarely absent, ventral locules 1-seeded. Seeds 2, ovate; testa smooth, farinose white, a torus of soft whitish material around the periphery; hilum linear, embryotega lateral.

Distribution: India, Sri Lanka and Australia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: June-January.

Specimens examined: Grassland near Painav, 06.08.2017, *Dani Francis & Santhosh Nampy* 154305 (CALI); Vallakkadavu, Periyar Tiger Reserve, 03.06.1995, *K.P. Rajesh & Jomy Augustine* 15402 (KFRI); Venmany-Kattappana road, 16.07.2021, *Dani Francis & Santhosh Nampy* 176046; way side Venmany, 16.07.2021, *Dani Francis & Santhosh Nampy* 176030 (CALI).

Notes: It is commonly known as 'Scurvy weed'.

Commelina indehiscens E.Barnes, J. Bombay Nat. Hist. Soc. 46: 74. 1946; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 498. 2004.

Perennial, decumbent herbs, rooting at nodes without a definite base. Cleistogamous flowers present at basal nodes. Stems branched, terete, green with red striations. Leaves distichous; sheaths 1.5–2.5 cm long, ciliate at apex, puberulous to pilose, mottled with red striations; lamina ovate-lanceolate, 3–8.5 × 1–2.5 cm, acuminate at apex, attenuate at base, slightly unequal sided, serrulate at margins, both surfaces pubescent, green. Spathes leaf opposed, conduplicate, broadly cordate, 3–4 × 1.5–2 cm, acuminate at apex, cordate at base, puberulous adaxially, pilose abaxially, green; peduncles 1.5–3 cm long, strigose. Upper cincinni usually lacking, when present exserted, 1–2 male flowered, 1–1.2 cm long, puberulous; lower cincinni, 3–6 bisexual flowered, *c.* 1 cm long. Sepals 3, free,

obtuse at apex, cuneate at base, glabrous, hyaline; medial sepal boat shaped; lateral sepals orbicular. Petals 3, blue; paired petals deltoid, 4–5 × 4–5 mm, rounded at apex, base clawed, *c.* 5 mm long, undulate at margins, glabrous; odd petals orbicular, 2.5–3 × 3–4 mm, rounded at apex, base clawed, *c.* 1 mm long, glabrous. Stamens 3; medial stamen 2–2.5 mm long; anthers yellow, curved; lateral stamens 2.5–3 mm long, anthers white. Staminodes 2 or 3; medial staminode vestigial, filaments white-pale blue or absent; antherodes 4-lobed with 2 lateral appendages, yellow. Capsules indehiscent, 1–3 per spathe, oblong, apiculate, trilocular, laterally compressed; dorsal locule 1-seeded; ventral locules aborted. Seeds 1ovoid-elliptic; testa reticulate, dark brown-black; hilum linear; embryotega lateral.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Semi evergreen forests; *Fl. & Ft.*: June-March.

Specimens examined: Adimali, 19.11.2010, *Sheba* & *Santhosh Nampy* 4015; Anchuruli, 07.09.2013, *Dani Francis & Santhosh Nampy* 152913; Kaliyar, 16.10.2010, *Santhosh Nampy & Sheba M. Joseph* 3830; Mathikettan shola National Park, 11.12.2016, *Dani Francis & Santhosh Nampy* 151392; Palkulamedu, 01.12.2019, *Dani Francis & Santhosh Nampy* 164666; Pallivasal, Munnar, *s.d.*, *Joby Paul s.n.*; Pooppara, Munnar road, 27.12.2001, *Santhosh Nampy* 438 (CALI).

Notes: The 'closed pod day flower' can be easily distinguished by its cleistogamous flowers, 1-seeded indehiscent capsules, and reticulately pitted seeds (Sheba & Nampy, 2012).

Commelina undulata R.Br., Prodr. Fl. Nov. Holland. 270. 1810. *Commelina kurzii* C.B.Clarke, J. Linn. Soc. Bot. 11: 444. 1871. *Commelina erecta* L., Sp. Pl. 1: 41.1753; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 497. 2004.

Perennial herbs, with a definite base. Stems terete, glabrous, green; internodes 3–8 cm long. Leaves distichous; sheaths 1.5–2 cm long, ciliate at apex, strigose; lamina lanceolate, 3–10 × 1–2 cm, acuminate at apex, cuneate and oblique at base, undulate at margins, scabrous adaxially, glabrous abaxially, green. Spathes terminal, clustered, cucullate, *c.* 2 × 1.4 cm, acute at apex, basally fused, pilose out, glabrous in, green; peduncles 0.5–2 cm long, puberulous. Upper cincinni usually

absent; lower cincinni 2–5 bisexual flowered, *c.* 1 cm long, glabrous. Sepals 3, obtuse at apex, cuneate at base, glabrous, hyaline; medial sepal boat shaped; lateral sepals orbicular, basally fused. Petals 3, blue; paired petals orbicular, 5–6 × 9–10 mm, rounded at apex, base clawed, *c.* 4–5 mm long, glabrous; odd petals lanceolate, *c.* 2.5 × 1 mm, obtuse at apex, cuneate at base, glabrous. Stamens 3; medial stamen *c.* 5 mm long, anthers large, curved, yellow; lateral stamens 6–8 mm long, anthers brown; connectives white-purple. Staminodes 3, *c.* 5 mm long, filaments slender; antherodes 4-lobed with 2 lateral appendages, yellow. Ovary globose, *c.* 1 mm long; style 6–8 mm long, white; stigma capitate. Capsules 1–2 per spathe, globose, 3-locular, locules 1-seeded. Seeds 3, sub-orbicular; testa smooth, brown material around the periphery; hilum linear; embryotega lateral.

Distribution: Tropical and Subtropical Asia to N. Australia (POWO, 2023); *Habitat*: Grasslands, forests; *Fl. & Ft.*: June-March.

Specimens examined: Koruthode, Periyar Tiger Reserve, 22.09.1993, *N. Sasidharan & Jomy Augustine* 12443 (KFRI); Nellikkampetty Range, Thekkady, 14.07.2017, *Dani Francis & Santhosh Nampy* 152846 (CALI).

Notes: This species can be easily identified by its lavender or white flowers, 3-seeded capsules and smooth seeds with a torus of brown material around the periphery (Sheba & Nampy, 2012).

Commelina longifolia Lam., Tabl. Encycl. 1: 129. 1791; K.M.Matthew, Illustr. Fl. Palni Hills 743. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 498. 2004.

Annual herbs, rooting at nodes without a definite base. Stems branched, terete, glabrous, green; internodes 2.5–8 cm long. Leaves distichous; sheaths 1.5–2.5 cm long, ciliate at apex, mottled with red striations; lamina lanceolate, 4–10 × 0.6–0.8 cm, acute at apex, attenuate at base, glabrous or puberulous, green. Spathes leaf opposed, solitary, cordate, conduplicate, *c.* 2 × 1.8 cm, acute-acuminate at apex, glabrous, green; peduncles 1–3 cm long, green. Upper cincinni 1-male flowered, exserted, *c.* 1 cm long, densely ciliate; lower cincinni, 3–4 bisexual flowered, *c.* 0.5 cm long, sparsely ciliate. Sepals 3, obtuse at apex, cuneate at base, glabrous, white tinted with blue; medial sepal boat shaped; lateral sepals oblong, basally fused. Petals 3, blue; paired petals orbicular, 5–10 × 8–1 mm, sub-rounded at apex, base clawed, *c.* 2 mm long, glabrous; odd petals deltoid, *c.* 3 × 4 mm, obtuse at apex,

cuneate at base, glabrous. Stamens 3; medial stamen *c.* 3 mm long, anthers curved, yellow; lateral stamens 2–3 mm long, anthers yellow; connectives white. Staminodes 3, 3–4 mm long, filaments slender; antherodes 4-lobed with 2 lateral appendages, yellow. Ovary elliptic, *c.* 1 mm long; style 5–6 mm long, pale purple; stigma trilobed. Capsules 1–2 per spathe, oblong, 3-locular, dorsal 1-seeded, ventral locules 2-seeded. Seeds 5, ovate; testa smooth, white farinose, white outgrowth at the rounded end; hilum linear; embryotega lateral.

Distribution: Seychelles, India to S. China and Jawa (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: October-June.

Specimen examined: Chinnar, 09.06.2017, *Dani Francis & Santhosh Nampy* 152200 (CALI).

Commelina maculata Edgew., Trans. Linn. Soc. London 20: 89. 1846; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 498. 2004.

Perennial herbs, rooting at nodes with a definite base, roots tuberous. Stems branched, terete, pubescent, green; internodes 6–9 cm long. Leaves distichous; sheaths 1.5–2 cm long, ciliate at apex, green; lamina ovate-lanceolate, 3–10 × 1–2 cm, acuminate at apex, attenuate at base, pilose or puberulous, green. Spathes terminal, solitary or clustered, cucullate, 0.5–1.5 × 0.8–1.3 cm, acute at apex, basally fused, ciliate out, glabrous in, green; peduncles sessile. Upper cincinni absent; lower cincinni, 3-bisexual flowered, *c.* 0.5 cm long, glabrous. Sepals 3, obtuse at apex, cuneate at base, glabrous, white; medial sepal boat shaped; lateral sepals orbicular, basally fused. Petals 3, blue; paired petals orbicular, 8–10 × 8–10 mm, rounded at apex, base clawed, *c.* 5 mm long, glabrous; odd petals obovate, 3–5 × 2–2.2 mm, obtuse at apex, cuneate at base, glabrous. Stamens 3; medial stamen *c.* 7 mm long, anthers curved, yellow; lateral stamens *c.*10 mm long, anthers yellow; connectives white. Staminodes 3, *c.* 5 mm long, filaments slender; antherodes 4-lobed with 2 lateral appendages, yellow. Ovary globose, *c.* 0.8 mm long; style 8–9 mm long; stigma capitate. Capsules 1–2 per spathe, ovate, trilocular, locules 1-seeded. Seeds 3, oblong; testa smooth, farinose white, reddish brown; hilum linear; embryotega lateral.

Distribution: Himalaya to Peninsula Malaysia (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: July-February.

Specimens examined: Mankulam, 15.10.2019, *Dani Francis & Santhosh Nampy* 176335; Mlappara, 11.07.1993, *Jomy Augustine* 12143 (CALI); *Ibid*., 24.10.1993, *N. Sasidharan & Jomy Augustine* 12610 (KFRI).

Notes: *Commelina maculata* is allied to *C. paludosa* but can be differentiated by its smaller and more slender habit, hairy spathes and reddish-brown seeds (Sheba & Nampy, 2012).

Commelina paludosa Blume, Enum. Pl. Javae. 1: 2. 1827; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 498. 2004. *Commelina obliqua* Buch.-Ham. ex D.Don, Prodr. Fl. Nepal: 45. 1825; Hook.f., Fl. Brit. India 6: 372. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1539. 1931.

Perennial erect or scrambling herbs, rooting at nodes with a definite base. Stems terete, green with purple striations; internodes 3–6 cm long. Leaves spiral; sheaths 2–2.5 cm long, pubescent, ciliate at apex with red hairs that continue along the petiole adaxially; lamina lanceolate, 4–15 × 2–5 cm, acuminate at apex, cuneate and oblique at base, serrate at margins, scabrous adaxially, glabrous abaxially. Spathes clustered at the apex of the shoot, cucullate, 2–3 × 1.5–2 cm, acuminate at apex, sub-sessile, glabrous, green; peduncles *c.* 0.5 cm long. Upper cincinni lacking; lower cincinni 5–6 bisexual flowered, *c.* 1 cm long. Sepals 3, obtuse at apex, cuneate at base, glabrous, white; medial sepal lanceolate; lateral sepals oblong. Petals 3; paired petals orbicular, *c.* 8 × 8 mm, rounded at apex, base clawed, *c.* 10 mm long, glabrous, blue or white; odd petals lanceolate, *c.* 6 × 2 mm, obtuse at apex, cuneate at base, glabrous, pale purple. Stamens 3; medial stamen *c.* 11 mm long, anthers curved, large, yellow; lateral stamens *c.* 9 mm long, anthers white-yellow. Staminodes 3, *c.* 4 mm long; filaments slender; antherodes yellow, 4-lobed, lateral appendages yellow. Capsules 1–3 per spathe, obovoid, 3-locular, locules equal, 1-seeded. Seeds 3, ellipsoid; testa smooth, minutely white farinose, dark brown; hilum linear; embryotega lateral.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: September-March.

Specimens examined: Way to Kanketty, Mankulam, 20.12.2019, *Dani Francis & Santhosh Nampy* 164828 (CALI); Kulamavu, 14.12.1982, *C.N. Mohanan* 76058

(MH); Neriamangalam, 02.12.1993, *Anilkumar* 19108 (TBGT); Tigercave, Mankulam, 04.12.2018, *Dani Francis & Santhosh Nampy* 168846 (CALI).

Notes: *Commelina paludosa* is a robust, perennial herb with long red hairs at the sheath summit and terminal clustered, glabrous, cucullate spathes and dark brown seeds (Sheba & Nampy, 2012).

Commelina suffruticosa Blume, Cat.Gew. Buitenzorg 35. 1823; Hook.f., Fl. Brit. India 6: 374. 1892; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 498. 2004.

Perennial erect herbs, with a definite base, roots thick. Stems terete, puberulous with thick band of cilia, green; internodes 4–11 cm long. Leaves cauline, distichous; sheaths 2–3.5 cm long, ciliate at apex, pubescent, red; lamina lanceolate, 5–17 × 3–5 cm, acuminate at apex, oblique at base, pubescent, green. Spathes terminal, clustered, broadly cordate, 1.5–2 × 0.8–1.6 cm, conduplicate, acute at apex, pubescent out, glabrous in, green; peduncles 0.8–1 cm long, puberulous, pale green. Upper cincinni absent; lower cincinni 6–7 bisexual flowered, *c.* 0.5 cm long, puberulous. Sepals 3, obtuse at apex, cuneate at base, glabrous, white; medial sepal boat shaped; lateral sepals ovate, basally fused. Petals 3, white; paired petals orbicular, lateral, *c.* 2 × 2.3 mm, sub-rounded at apex, base clawed, *c.* 2 mm long, glabrous; odd petals obovate, *c.* 1.5 × 1.3 mm, obtuse at apex, base clawed, *c.* 1 mm long, glabrous. Stamens 3; medial stamen *c.* 6 mm long, anthers curved, yellow; lateral stamens *c.* 6 mm long, anthers yellow; connectives yellow. Staminodes 3, 3–4 mm long, filaments slender; antherodes 4-lobed with 2 lateral appendages, yellow. Ovary ovate, *c.* 2 mm long; style *c.* 9 mm long, white; stigma trilobed. Capsules 5–6 per spathe, obovate, 3-locular, dorsal locule aborted, ventral locules 1-seeded. Seeds 2, elliptic; testa reticulate, white farinose, dark brown; hilum linear, embryotega lateral.

Distribution: Himalaya to W. Malesia (POWO, 2023); *Habitat*: Open lands; *Fl. & Ft.*: May-February.

Specimen examined: On the way to Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 175943 (CALI).

Notes: This species can be differentiated by its oblique lanceolate leaves, white flowers, shield shaped antherodes, 2-seeded capsules and reticulate-foveate seeds (Sheba & Nampy, 2012).

Cyanotis D.Don,

Prodr. Fl. Nepal. 45: 1825, *nom. cons.*

Key to the species

1. Plants epiphytic ……. *C. vivipara*
1. Plants terrestrial ……. 2
2. Leaves basal and cauline ……. 3
2. Leaves cauline ……. 7
3. Tubers present ……. 4
3. Tubers absent ……5
4. Lateral shoots usually ascending, rarely looping; style densely bearded below the sub-apical bulging…… *C. tuberosa*
4. Lateral shoots usually looping along the ground; style less bearded below the sub-apical bulging ……. *C. adscendens*
5. Testa striate; hilum rounded ……. *C. pilosa*
5. Testa pitted; hilum linear ……. 6
6. Cymes arising from distal half of flowering shoot; ovary truncate; capsules elliptic ……. *C. obtusa*
6. Cymes terminal or axillary; ovary ovate; capsules ovate-oblong ……. ……. *C. arachnoidea*
7. Bracts present ……. 8
7. Bracts absent ……. *C. axillaris*
8. Sepals lanceolate ……. 9
8. Sepals oblanceolate ……. *C. racemosa*
9. Cymes terminal ……. *C. burmanniana*
9. Cymes axillary and terminal ……. 10
10. Ovary globose ……11
10. Ovary ovate-oblong …… *C. fasciculata*
11. Capsules ovoid; hilum spotted as a streak ……. *C. cristata*
11. Capsules elliptic; hilum dotted ……. *C. villosa*

Cyanotis adscendens Dalzell, Hooker's J. Bot. Kew Gard. Misc. 4: 343.1852.

Perennial herbs with a basal rosette. Roots tuberous, 3–8 cm long, from base and lower nodes. Lateral shoots ascending-erect, looping along the ground by forming stolons. Radical leaves distichous-spiral, linear-lanceolate, 4–15 × 0.8–1 cm, acute at apex, cuneate at base, pubescent; sheaths 0.5–1.5 cm long, cobwebby, mouth ciliate, purple-green. Cauline leaves linear-lanceolate, 2–4 × 0.5–3 cm, acute at apex, cordate at base, upper surface sparsely woolly, lower surface wooly. Cymes axillary and terminal; peduncles *c.* 2 × 1.5 cm, pilose, very thick in terminal cluster of cymes; bracts foliaceous, ovate, 1–2 × 0.5–0.7 cm, acute at apex, ciliate at margins, pilose on both surfaces. Sepals 3, linear-lanceolate, 3–4 × 0.3–0.5 mm, acute at apex, cuneate at base, pilose, pale white or green. Petals 3, 6–7 × 2–3 mm, obtuse at apex, cuneate at base, glabrous, blue. Stamens 6; filaments 8–10 mm long, blue, densely bearded below a sub-apical bulging, hairs blue. Ovary globose, ciliate at apex; style equal to the filaments, less bearded below a sub-apical bulging. Capsules elliptic, ciliate at apex. Seeds 2 per locule; testa slightly reticulate, irregularly pitted; hilum ventral, rounded; embryotega terminal.

Distribution: India (POWO, 2023); *Habitat*: Rocky areas and grasslands; *Fl. & Ft.*: February-December.

Specimens examined: Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 188855; on the way to Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 175904 (CALI).

Cyanotis arachnoidea C.B.Clarke, in A.DC. & C.DC., Monogr. Phan. 3: 250. 1881; Hook.f., Fl. Brit. India 6: 386. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1546. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 499. 2004.

Perennial herbs with a basal rosette. Roots fibrous, arise from the bulbous base. Vegetative shoots 10–15 cm long. Flowering shoots arising from the axil of outer rosette leaves, 12–30 cm long. Radical leaves distichous, oblong, 5–10 × 0.8–1 cm, acute-acuminate at apex, cuneate at base, arachnoid; sheaths 2–2.4 cm long, mouth ciliate, purple-green. Cauline leaves linear-lanceolate, 3–5 × 0.5–0.7 cm, acute at apex, cuneate at base, white cobwebby. Cymes terminal rarely axillary, globose, compact; sessile or shortly stipitate; bracts foliaceous, lanceolate, 1.5–2 ×

0.2–0.5 cm, acute at apex, ciliate at margins, arachnoid on both surfaces. Sepals 3, lanceolate, 3–4 × 1–1.5 mm, apiculate at apex, fused at base, arachnoid, pale blue. Petals 3, ovate, 2–3 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, blue. Stamens 6; filaments 4–5 mm long, bearded, blue. Ovary ovate, hairy; style sub-equal to the filaments, bearded below a sub-apical bulging. Capsules ovate-oblong, ciliate at apex. Seeds 2 per locule; testa irregularly pitted dorsally; hilum linear; embryotega lateral.

Distribution: W. Tropical Africa to Tanzania, India to Taiwan (POWO, 2023); *Habitat*: Rocky areas; *Fl. & Ft.*: July-December.

Specimens examined: Dhanar valley-Vaguvarai, 17.10.1989, *P. Bharghavan* 90984 (MH); Kattappana, 27.09.1981, *C.N. Mohanan & B. Ramanujan* 72048 (CAL); Mangaladevi, Periyar Tiger Reserve, 14.07.1993, *N. Sasidharan & Jomy Augustine* 12044; Mullakkudy, Periyar Tiger Reserve, 17.08.1994, *N. Sasidharan & Jomy Augustine* 13850 (KFRI).

Notes: It is an arachnoid pubescent rosette herb similar to *C. obtusa*, but it has a bulbous base and more compact, globose cymes (Resmi & Nampy, 2015).

Cyanotis axillaris (L.) D.Don ex Sweet, Hort. Brit. 430. 1826; Hook.f., Fl. Brit. India 6: 388. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1550. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 499. 2004. *Commelina axillaris* L., Sp. Pl. 1: 42. 1753. **Fig. 19B**

Annual herbs, sometimes arise from a short-lived rosette, lateral shoots erect or trailing. Roots arise from lower nodes. Stems terete, puberulous-glabrous, green; nodes purple; internodes 1.5–6 cm long. Leaves distichous, sessile; sheaths 0.5–1 cm long, densely ciliate; lamina linear-lanceolate, 1.5–4 × 0.5–1 cm, acute-acuminate at apex, cuneate at base, puberulous, ciliate at margins, purplish green. Cymes axillary, enclosed within sheath, sessile or sub-sessile; bracts absent; bracteoles lanceolate, 4–5 × 1 mm, acute at apex, cuneate at base, ciliate at margin. Sepals 3, lanceolate, 5–10 × 2 mm, acute at apex, cuneate at base, ciliate at margins, pubescent on outer surface, pale green. Petals 3, fused, ovate, 4–8 × 3–5 mm, acute at apex, cuneate at base, glabrous, white, blue or bluish purple. Stamens 6, exserted; filaments *c.* 4 mm long, white, densely bearded below a sub-apical bulging; anthers oblong, yellow. Ovary ovate, hairy; style *c.* 4 mm long, same length

as the filaments, glabrous with a sub-apical bulging. Capsules beaked, 4–6 mm long, ciliate at apex. Seeds 2 per locule, uniseriate; testa reticulate, deeply pitted, brown; hilum ventral; embryotega terminal.

Distribution: India to N. Australia (POWO, 2023); *Habitat*: Rocky areas; *Fl. & Ft.*: June-December.

Specimen examined: Pius Nagar, Kanthallur, 22.06.2018, *Dani Francis & Santhosh Nampy* 159339 (CALI).

Notes: *Cyanotis axillaris* is characterized by the axillary cymes enclosed within the leaf sheath and glabrous style with a sub-apical bulging (Resmi & Nampy, 2015).

Cyanotis burmanniana Wight, Icon. Pl. Ind. Orient. 6: 34, t. 2089. 1853; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 499. 2004.

Annual, erect or decumbent herbs with a definite base. Roots arising from base and lower nodes. Stems branched, slender, terete, hispid, purple with a line of cilia; internodes 1–6 cm long. Leaves fleshy, green-reddish brown; sheaths 0.4–0.8 cm long, ciliate, purple; lamina ovate-lanceolate, 1–7 × 0.3–0.7 cm, acute at apex, cuneate at base, ciliate at margins, densely pilose. Cymes terminal; peduncles 1–3, 1–5 cm long, ciliate; bracts ovate-lanceolate, 5–10 × 2–4 mm, acute at apex, cordate at base, pubescent, green; bracteoles 2–6 pairs, falcate, 4–6 × 3–4 mm, acute at apex, cuneate at base, ciliate at margins, outer surface densely hairy, green, purple at margin and apex. Sepals linear-lanceolate, 3–4 × 0.8–1 mm, acute at apex, cuneate at base, upper surface and margin densely hairy, pale green, purple at apex. Petals 3, obovate, 4–5 × 2–3 mm, acute at apex, cuneate at base, glabrous, purple with a central white band. Stamens 6, equal; filaments *c.* 7 mm long, bearded below a sub-apical bulging, hairs 2–3 mm long, bluish purple; anthers black. Ovary globose, densely ciliate at apex, green; style bearded with a sub-apical bulging, hair bluish purple; stigma capitate. Capsules globose, 2.5–3.5 mm long, hirsute at apex. Seeds 2 per locule, pyramidal, brownish black; testa rugose, minutely reticulate; hilum rounded; embryotega terminal.

Distribution: India to Myanmar and Sri Lanka (POWO, 2023); *Habitat*: Waste lands; *Fl. & Ft.*: August-December.

Specimens examined: Kattadikadavu, 12.10.2019, *Dani Francis & Santhosh Nampy* 170348; Meenuliyanpara, 25.10.2020, *Dani Francis & Santhosh Nampy* 170089; *Ibid*., 29.11.2019, *Dani Francis & Santhosh Nampy* 164618; Neriyamangalam-Adimali road side, 17.11.2021, *Santhosh Nampy & Vishnu Mohan* 173309; Vakavanam, 14.09.2019, *Dani Francis & Santhosh Nampy* 170318 (CALI).

Notes: It is much branched, densely hispid or pilose annual herb with a definite base. The leaves are usually green, but can become very fleshy and reddish brown at times. It can be easily recognized by the black anthers (Resmi & Nampy, 2015).

Cyanotis cristata (L.) D.Don, Prodr. Fl. Nepal. 46. 1825; Hook.f., Fl. Brit. India 6: 385. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1549. 1931; K.M.Matthew, Illustr. Fl. Palni Hills 746. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 499. 2004. *Commelina cristata* L., Sp. Pl. 1: 42. 1753.

Annual, erect-decumbent herbs. Roots arise from base and lower nodes. Stems branched-unbranched, terete, green; internodes 2.5–10 cm long, purple-green with a line of cilia. Leaves distichous, sessile, glabrous, ciliate at margins; sheaths 0.5–2.5 cm long, glabrous-pubescent, ciliate at mouth; lamina ovate-lanceolate, 2–5 × 0.5–2 cm, acute-acuminate at apex, cuneate-rounded at base, both surfaces glabrous, green. Cymes axillary-terminal; peduncles 3–10 cm long with a line of cilia, sessile in young stages; bracts foliaceous, longer than cymes, ovate-lanceolate, 2–5 × 1–2 cm, acute at apex, cuneate at base, recurved, glabrous, green; bracteoles 10–11, ovate-falcate, 1–1.2 × 0.5–1 cm, acute at apex, glabrous on both surfaces with a tuft of cilia at the apex, purple lined at margins. Sepals 3, lanceolate, 3–4.5 × 1–1.5 mm, acute at apex, cuneate at base, pilose out, glabrous in, pale green. Petals 3, tubular, glabrous, blue; lobes ovate, obtuse at apex. Stamens 6; filaments 7–9 mm long, white, bearded below a sub-apical bulging; anthers yellow. Ovary globose, ciliate; style equal to filaments, glabrous with a sub-apical bulging, white; stigma capitate. Capsules ovoid, with a middle construction, fruiting calyx exceeds capsule. Seeds 2 per locule, pyramidal-globose, brown with a mid-ventral ridge, two large pits on ventral side; hilum spotted as a streak; embryotega terminal.

Distribution: NE. Tropical Africa, Indian Ocean, Indian Subcontinent to S. China and Peninsula Malaysia (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: June-February.

Specimens examined: Adimali, 07.08.2019, *Dani Francis & Santhosh Nampy* 170207; Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 188821; Koyimanchola, 10.02.2021, *Dani Francis & Santhosh Nampy* 188762 (CALI); Thannikkudy, Periyar Tiger Reserve, 24.10.1993, *N. Sasidharan & Jomy Augustine* 12616 (KFRI).

Notes: *Cyanotis cristata* varies considerably in leaf size and shape, length of internodes, peduncle, *etc.* (Resmi & Nampy, 2015).

Cyanotis fasciculata (B.Heyne ex Roth) Schult. & Schult.f. in J.J.Roemer & J.A.Schultes, Syst. Veg. ed. 15 bis 7: 1152. 1830; Hook.f., Fl. Brit. India 6: 387. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1550. 1931; K.M.Matthew, Illustr. Fl. Palni Hills 747. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 499. 2004. *Tradescantia fasciculata* B.Heyne ex Roth, Nov. Pl. Sp. 189. 1821.

Annual, ascending herbs. Roots from lower nodes. Stems branched, reddish purple or green, cobwebby; internodes 0.5–8 cm long, villous-densely cobwebby. Leaves villous-cobwebby, reddish purple or green; sheaths 0.5–2 cm long, loose, cobwebby, ciliate or glabrous at mouth; lamina linear, 1.5–2.5 × 0.2–0.4 cm, acute at apex, cuneate at base. Cymes axillary or terminal; peduncles 0.5–4 cm long, villous, cobwebby or glabrous; bracts foliaceous, slightly exceeding the cymes, ovate-lanceolate, 1–1.5 × 0.2 cm, acuminate at apex, ciliate or glabrous at margins, lower surface lanate or glabrous; bracteoles 3–6 pairs, lanceolate, 2–9 × 1–2 mm, acuminate at apex, cuneate at base, wooly or ciliate at margins, cobwebby. Sepals 3, lanceolate, 3–5 × 0.8–1 mm, obtuse at apex, connate at base, ciliate at margins, pale white. Petals 3, 3–4 × 1.5–2 mm, obtuse at apex, glabrous, pink-purple. Stamens 6; filaments 5–7 mm long, bearded below a sub-apical bulging, blue-purple. Ovary oblong, ciliate at apex or glabrous; style blue, bearded below a sub-apical bulging; stigma capitate. Capsules ovate, ciliate at apex. Seeds 2 per locule, deltate or pyramidal, brown-reddish or grey with a mid-ventral ridge; hilum ventral; embryotega terminal.

Distribution: E. Himalaya to Assam, S. India and Sri Lanka (POWO, 2023); *Habitat*: Wet rocks in evergreen forests; *Fl. & Ft.*: May-January.

Specimens examined: Choondal, 04.01.2017, *Dani Francis & Santhosh Nampy* 151532 (CALI); Kottamala, Periyar Tiger Reserve, 26.08.1994, *N. Sasidharan & Jomy Augustine* 14002 (KFRI); Pambadum shola National Park, 20.12.2018, *Dani Francis & Santhosh Nampy* 167869; Udumbanchola, 19.10.2010, *Akhila P. Kurian & Santhosh Nampy* 3813 (CALI); Vallakkadavu, Periyar Tiger Reserve, 19.08.1995, *K.P.Rajesh* 16321 (KFRI).

Cyanotis obtusa (Trimen) Trimen, Handb. Fl. Ceylon 4: 812. 1898. *Cyanotis arachnoidea* var. *obtusa* Trimen in J. Bot. 23: 266. 1885. **Fig. 19A**

Perennial, succulent herbs with a definite base and large rosette, whole plant covered with cobwebby hairs. Vegetative and flowering shoots distinct. Vegetative shoots erect, 10–13 cm long. Flowering shoots 30–40 cm long, arising from the axil of outer rosette leaves, ascending, sometimes rooted at basal nodes; internodes 3–6 cm long. Rosette leaves distichous, alternate, sessile, succulent; sheaths *c.* 2 × 1 cm, densely white arachnoid pubescent; lamina oblong, 3–17 × 0.5–2 cm, obtuse at apex, cuneate at base, pubescent. Cauline leaves similar in shape and pubescence but smaller than rosette leaves, 1.5–7 × 0.6–1.5 cm, acute at apex, amplexicaul base. Cymes arising from distal half of flowering shoot, pubescent; cincinni numerous, 5–6 flowered, more or less capitate at base, entire at margins; bracts equal to or exceeding the cincinni, lanceolate, 1–2 × 0.5–0.8 cm, acute at apex, cuneate at base, wooly on both surfaces, green; bracteoles 10–11, ovate-lanceolate, 0.5–0.9 × 0.2–0.4 cm, apiculate at apex, cuneate at base, arachnoid. Sepals 3, lanceolate, 5–7 × 2–3 mm, acute-apiculate at apex, fused at base, wooly on outer surface, ciliate at margins. Petals 3, ovate-spathulate, 2.5–3 × 1–1.2 mm, obtuse at apex, cuneate at base, glabrous, violet. Stamens 6, exserted; filaments *c.* 2 mm long, white, bearded below a sub-apical bulging; anthers oblong, yellow. Ovary truncate, hairy; style equal to filaments, bearded below a sub-apical bulging; stigma simple. Capsules elliptic, 3-locular, pubescent. Seeds 2 per locule; testa longitudinally striated, irregularly pitted, brownish black; hilum linear; embryotega lateral.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-January.

Specimens examined: Anamudi peak, 11.12.2019, *Dani Francis & Santhosh Nampy* 164579; Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 176425; *Ibid*., 06.09.2017, *Dani Francis & Santhosh Nampy* 152904; Kattadikadvu, 12.10.2019, *Dani Francis & Santhosh Nampy* 170344; *Ibid*., 07.12.2018, *Dani Francis & Santhosh Nampy* 167827; Mangaladevi hills, 15.07.2017, *Dani Francis & Santhosh Nampy* 154123; *Ibid*., 15.07.2017, *Dani Francis & Santhosh Nampy* 152897; Mathikettan shola National Park, 23.08.2014, *Syam Radh S.* 143501; Meenuliyanpara, 12.12.2016, *Dani Francis & Santhosh Nampy* 151433; Meesapulimala, 21.11.2018, *Dani Francis & Santhosh Nampy* 167759; Vagamon, 26.10.2020, *Dani Francis & Santhosh Nampy* 170096 (CALI).

Notes: *Cyanotis obtusa* is a large perennial arachnoid herb and is of common occurrence compared to other rosette species. It differs from *C. archnoidea* by having a thick fibrous rootstock and less compact cymes (Resmi & Nampy, 2015).

Cyanotis pilosa Schult & Schult.f. in J.J.Roemer & J.A.Schultes, Syst. Veg. ed. 15. 7: 1154. 1830. Hook.f., Fl. Brit. India 6: 387. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1549. 1931; K.M.Matthew, Illustr. Fl. Palni Hills 748. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 500. 2004.

Perennial rosette herbs. Roots arising from lower nodes. Flowering shoots prostrate or decumbent, *c.* 90 cm long, purple to green; internodes 5–15 cm long, pilose. Rosette leaves spirally arranged, pilose; lamina linear-lanceolate, 6–16 × 0.6–1.2 cm, acute-acuminate at apex, cuneate at base. Cauline leaves distichous, green-purple; sheaths 0.5–2 cm long, pilose, ciliate at mouth; lamina lanceolate-ovate, 2–8 × 1–2 cm, acute at apex, cuneate at base, upper surface glabrous, rarely pilose, lower surface densely pilose or velutinous. Cymes terminal on main shoot, axillary and terminal on branches; peduncles 1–9 cm long with a line of cilia; cincinni 2–3 cm long; bracts longer than cymes, cordate-lanceolate, 3–4 × 1–2.5 cm, acute at apex, cordate at base, ciliate at margins, outer surface pilose, green; bracteoles falcate-lanceolate, 1–1.5 × 0.4–0.7 cm, acute at apex, oblique at base, ciliate at margin, pilose on outer surface. Sepals 3, lanceolate, 4–5 × 0.8–1 mm, acute at apex, connate at base, pilose on outer surface, pale white-green. Petals 3,

ovate, obtuse at apex, cuneate at base, glabrous, purple with a white band at centre. Stamens 6; filaments 1–1.3 cm long, bearded below a sub-apical bulging, moniliform; anthers yellow. Ovary ovate, ciliate at apex; style equal or exceeds the filaments, glabrous with a sub-apical bulging; stigma simple, blue. Capsules stramineous, globose-ovate, ciliate at apex. Seeds deltate or pyramidal, brown-black; testa striate; hilum ventral, rounded; embryotega terminal without prominent ventral ridge but with shallow grooves on both side or pits on either side, dorsal surface with 4–8 pits.

Distribution: SW. India and Sri Lanka (POWO, 2023); *Habitat*: Forest margins; *Fl. & Ft.*: Throughout the year.

Specimens examined: Anamudi peak, 11.12.2019, *Dani Francis & Santhosh Nampy* 164562; Munnar, 19.11.2010, *Sheba & Santhosh Nampy* 4196; *Ibid*., *s.d.*, *Joby Paul & Sibichen M. Thomas* 1218; way to Rhodomansion, Meesapulimala, 21.11.2018, *Dani Francis & Santhosh Nampy* 167787 (CALI).

Notes: This rosette species is easily distinguished by its thick fibrous roots, pilose habit, larger bracts exceeding the cymes and glabrous style (Resmi & Nampy, 2015).

Cyanotis racemosa Heyne ex Hassk., Commelin. Ind. 125. 1870. **Fig. 19C**

Annual-perennial, procumbent or trailing herbs with roots arise from lower nodes. Stems terete, much branched; internodes 3–7 cm long, glabrous, with a dense line of pubescence below the fused edge of sheath. Leaves distichous, sessile; sheaths 1–2 cm long, densely sericeous or pilose, long ciliate at mouth; lamina lanceolate, 3–14 × 0.5–3 cm, acuminate at apex, cuneate at base, glabrous and lustrous bright green above, densely appressed sericeous and green or maroon below, appressed ciliate at margin. Inflorescence clustered at the end of shoots, composed of 4 or 5 stalked cincinni; stalks 1–2 cm long; bracts longer than cincinni, ovate-lanceolate, 2–2.5 × 1–1.5 cm, acute at apex, cuneate at base, ciliate at margin, glabrous-pubescent; bracteoles ovate-lanceolate, 1–2 × 0.3–0.5 cm, acuminate at apex, oblique at base, ciliate at margins, pilose. Sepals 3, oblanceolate, 4–5 × 1–2 mm, acuminate at apex, sub-truncate at base, pilose along keel, pale green. Petals 3, united for ½ the length from base, 4–5 × 1.5–2 mm, acute

at apex, cuneate at base, white or blue. Stamens 6, exceeding the corolla, 6–8 mm long; filaments densely bearded below a sub-apical bulging; anthers oblong, yellow. Ovary oblong, densely tomentose at apex; style equal or exceeding stamens, with a fusiform sub-apical bulging, glabrous. Capsules puberulous at apex, constricted at middle; Seeds 2 per locule, ovoid; testa striate, pitted, pale to dark brown.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: September-March.

Specimens examined: Anamudi shola National Park, 03.04.2017, *Dani Francis & Santhosh Nampy* 152073; *Ibid*., 25.01.2018, *Dani Francis & Santhosh Nampy* 158291; Chinnar, 27.01.2018, *Dani Francis & Santhosh Nampy* 158337; Edathattu, Mankulam, 13.09.2019, *Dani Francis & Santhosh Nampy* 159490; way to Kanketty, Mankulam, 20.12.2019, *Dani Francis & Santhosh Nampy* 164810; *Ibid*., 20.12.2019, *Dani Francis & Santhosh Nampy* 164593; Kurinji valley, Munnar, 15.12.2012, *Dani Francis & Santhosh Nampy* 4355; Lakkam waterfalls, 24.01.2018, *Dani Francis & Santhosh Nampy* 158210; MPCA, Vairamani, Kulamavu, 22.01.2019, *Dani Francis & Santhosh Nampy* 168914; Mathikettan Shola National Park, Aduvizhunthankudi, 22.11.2014, *Syam Radh S.* 137821; Nyamakkad, 8th mile, 24.01.2017, *Dani Francis & Santhosh Nampy* 158181; *Ibid*., 24.01.2017, *Dani Francis & Santhosh Nampy* 158168; Silent Valley, way to plot no. 8, Munnar, 17.12.2012, *K.M. Manudev* 5601; Pettimudi, 19.03.2019, *Dani Francis & Santhosh Nampy* 159112; *Ibid*., 29.12.2019, *Dani Francis & Santhosh Nampy* 164862; Rajapparamedu, near Santhanpara, 10.02.2017, *Dani Francis & Santhosh Nampy* 151686; waterfalls near rhodovalley, Silent valley, Munnar, 22.11.2018, *Dani Francis & Santhosh Nampy* 168814 (CALI).

Notes: *Cyanotis racemosa* is without a definite base and has strongly discolored leaves, that are glabrous and lustrous green above and densely appressed sericeous and green or maroon below. The cymes with with 4 or 5 stalked cincinni are clustered at the ends of shoots.

Cyanotis tuberosa (Roxb.) Schult & Schult.f. in J.J.Roemer & J.A.Schultes, Syst. Veg. ed. 15. 7(2): 1153. 1830; Hook.f., Fl. Brit. India 6: 386. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1549. 1931; K.M.Matthew, Illustr. Fl. Palni Hills 749. 1996; Sasidh.,

Biodiv. Doc. Kerala-Fl. Pl. 500. 2004. *Tradescantia tuberosa* Roxb., Pl. Coromandel 2: 5. 1799.

Perennial rosette herbs. Roots tuberous, fusiform, minutely hairy; tubers 6–12 × 0.4–0.7 cm. Lateral shoots usually ascending, rarely looping. Rosette leaves distichous, thick; lamina linear-lanceolate, 6–20 × 0.5–2 cm, acute at apex, cuneate at base, densely ciliate on both surfaces, hairs golden yellow, green to purple; sheaths 1–2 cm long, pubescent, mouth ciliate, purple green. Cauline leaves alternate, thick; lamina linear-lanceolate, 2–10 × 0.3–1 cm, acute at apex, cordate at base, ciliate on both surfaces, margin entire, ciliate, purple green. Cymes axillary to terminal; peduncles 1–5 cm long, densely pubescent; bracts foliaceous, ovate-lanceoate, 1–2 × 0.3–0.6 cm, acute at apex, cuneate at base, pilose, green; bracteoles ovate-lanceolate, 0.4–1.2 × 0.4–0.7 cm, acute at apex, ciliate at margin, woolly, purple at margin and apex. Sepals 3, linear-lanceolate, 3–5 × 0.1–0.2 mm, acute at apex, fused at base, densely ciliate, green, purple at apex. Petals 3, ovate, 4–5 × 3–4 mm, obtuse at apex, glabrous on both surfaces, white-pale purple. Stamens 6; filaments 6–8 mm long, densely bearded below a sub-apical bulging, hairs blue or light-purple; anthers yellow. Ovary globose, 3-locular, ciliate at apex; style equal to filaments, densely bearded below a sub-apical bulging. Capsules elliptic, ciliate at apex. Seeds 2 per locule, brown; testa slightly reticulate, irregularly pitted; hilum ventral, rounded; embryotega terminal.

Distribution: India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: May-January.

Specimens examined: Chokramudi gap, Devikulam, 04.05.2017, *Dani Francis* & *Santhosh Nampy* 152140; Choondal, Mathikettan Shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 151523 Munnar-Pooppara road, 23.05.2011, *Manudev K.M.* & *Santhosh Nampy* 4425; Silent valley, way to Meesapulimala, Munnar, 16.12.2012, *Manudev* 4393 (CALI); Thekkady, 20.08.1995, *N. Sasidharan & Jomy Augustine* 16352 (KFRI).

Notes: *Cyanotis tuberosa* is a tuberous species that grows at higher altitudes.

Cyanotis villosa (Spreng.) Schult. & Schult.f., Syst. Veg. ed. 15 bis 7: 1155. 1830; K.M.Matthew, Illustr. Fl. Palni Hills 750.1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 500. 2004. *Tradescantia villosa* Spreng., Syst. Veg., ed. 16. 2: 116. 1825.

Perennial herbs with roots arising from base and lower nodes. Stems branching, terete, pubescent, green purple; internodes 2–11 cm long. Leaves distichous, sessile, dark green; sheaths 0.5–2 cm long, ciliate at mouth, purple lined; lamina lanceolate, 2–7 ×1–3 cm, acute-acuminate at apex, cuneate at base, glabrous adaxially, sparsely hairy abaxially. Cymes axillary-terminal, sessile or peduncled, *c.* 1 cm long; bracts foliaceous, lanceolate, 1.5–3 × 1–1.2 cm, acute at apex, cuneate at base, margin with a line of cilia; bracteoles ovate-lanceolate, 1–1.5 × 0.5–1 cm, falcate, ciliate at apex, sparsely pilose out, with a purple line at apex. Sepals 3, lanceolate, 3–5 × 1–1.5 mm, acute at apex, connate at base, ciliate, pale green. Petals 3, tubular, glabrous; lobes ovate, acute at apex. Stamens 6; filaments 6–7 mm long, bearded with a blue-purple hairs, below a sub-apical bulging; anthers yellow-orange. Ovary globose, ciliate at apex; style glabrous; stigma capitate. Capsules elliptic, ciliate at apex. Seeds 2 per locule, triangular-pyramidal; testa dark brown with a mid-ventral ridge and two large pits on ventral side; hilum dotted; embryotega terminal.

Distribution: SW. India and Sri Lanka (POWO, 2023); *Habitat*: Forests; *Fl. & Ft.*: October-February.

Specimens examined: Kattadikadavu, 07.12.2018, *Dani Francis & Santhosh Nampy* 167816; Koyimanchola, 10.02.2021, *Dani Francis & Santhosh Nampy* 188765 (CALI); Kumily, 02.10.1993, *N. Sasidharan & Jomy Augustine* 12500; Mangaladevi, Periyar Tiger Reserve, 18.10.1993, *N. Sasidharan & Jomy Augustine* 12540 (KFRI); way to Marayur, 09.01.2004, *K.C. Ragendu* 97157; way to Munnar, near Kattappana, 27.12.2002, *Joby Paul* 5124; Perattakkalam, Mathikettan Shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 151528 (CALI).

Notes: *Cyanotis villosa* is a perennial herb with a green purple stem and glabrous style. Its peduncles are up to 1 cm long and bracteoles are pilose out with a purple line at the apex (Resmi & Nampy, 2015).

Cyanotis vivipara Dalzell, Hooker's J. Bot. Kew Gard. Misc. 3: 226. 1851; Hook.f., Fl. Brit. India 6: 388. 1892. *Belosynapsis vivipara* (Dalzell) C.E.C.Fisch., Bull. Misc. Inform. Kew 1928: 254. 1928; Gamble, Fl. Madras 3: 1551. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 497. 2004. **Fig. 19D**

Epiphytic creeping herbs. Rootstock small. Stems terete, hairy. Leaves radical and cauline; radical leaves oblong-lanceolate, 2–10 × 0.5–1.5 cm, acute at apex, attenuate at base, pilose, green; cauline leaves elliptic-lanceolate, 0.4–1 × 0.2–0.5 cm, acute at apex, cuneate at base, pilose, green. Cymes sessile, 2–4-flowered along the creeping branches. Flowers few; pedicels 3–6 mm long, pilose; bracts lanceolate, 5–10 × 1–3 mm, acute at apex, cuneate at base, pilose, purplish green. Sepals 3, lanceolate-elliptic, 3–5 × 1–2 mm, obtuse at apex, fused at base, pilose, purplish green. Petals 3, obovate, 2.5–3 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, pale purple. Stamens 6, 5–7 mm long; filaments bearded; anthers orange yellow. Ovary obovate, 5–10 cm long, pilose, green. Capsules elliptic, 5–10 mm long, 6-seeded, pilose. Seeds cylindric, smooth.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: August-December.

Specimens examined: Anakkulam, Kozhiyalakkudi, 18.09.2018, *Dani Francis & Santhosh Nampy* 161965; Arjunankotta, 10.10.1996, *Jomy A.* 16286 (CALI); Chenthamara kokka, Periyar Tiger Reserve, 19.08.1993, *N. Sasidharan & Jomy Augustine* 12283 (KFRI); way to Cholamala, Nallathannikallar, 16.09.2018, *Dani Francis & Santhosh Nampy* 161943; way to Edathattu, 13.09.2018, *Dani Francis & Santhosh Nampy* 159474; Kattadikadavu, 07.10.2019, *Dani Francis & Santhosh Nampy* 170332; *ibid*., 12.10.2019, *Dani Francis & Santhosh Nampy* 170341; Mesthirikettu, near Eravikulam, 30.12.2017, *Dani Francis & Santhosh Nampy* 158089 (CALI).

Dictyospermum Wight,

Icon. Pl. Ind. Orient. 6: 29. 1853.

Key to the species

1. Panicle lax; hilum punctiform …….. *D. montanum*

1. Panicle congested; hilum linear …….. *D. ovalifolium*

Dictyospermum montanum Wight, Icon. Pl. Ind. Orient. 6: t. 2069. 1853. *Aneilema montanum* (Wight) Thwaites, Enum. Pl. Zeyl. 322. 1864; Hook.f., Fl. Brit.

India 6: 381. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1546. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 496. 2004. **Fig. 20H**

Perennial erect-ascending herbs. Roots fibrous from lower nodes; internodes 2–10 cm long, glabrous. Leaves clustered towards apex of stem; sheaths 1.5–3 cm long, with a line of cilia along fused margins, mouth ciliate; lamina elliptic-lanceolate, 5–17 × 1.5–4.5 cm, acuminate at apex, attenuate at base, scabrous, green. Panicles lax, terminal; peduncles 6–8 cm long, puberulous. Flowers white; bracts leafy, ovate, 2–2.5 × 0.6–0.9 mm, acute at apex, puberulous; pedicels recurved, 3–4 mm long, glabrous. Sepals 3, ovate, 2–2.5 × 1–1.5 mm, rounded at apex, sub-truncate at base, glabrous, pale green. Petals 3, ovate, 3–3.5 × 2–2.5 mm, obtuse at apex, cuneate at base, glabrous, white. Stamens 3; lateral stamen filaments *c.* 1 mm long, middle stamen filament *c.* 2.5 mm long, glabrous, violet band on one side, white; anthers yellow; connectives yellow. staminodes 0. Ovary globose-ovate, *c.* 1 × 1 mm, glabrous; style *c.* 0.5 mm long, glabrous, white; stigma simple. Capsules globose, 2–3 × 2–3 mm, glabrous. Seeds pyriform, foveolate, minutely reticulate; hilum punctiform in a furrow; embryotega lateral.

Distribution: S. India, Sri Lanka and Assam to Indo-China (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: June-March.

Specimens examined: Adimali R.F., 29.03.1980, *K. Ramamurthy* 66572 (MH); near Adhbutha Urava, 08.06.2022, *Dani Francis & Santhosh Nampy* 164833; Edathattu, Mankulam, 13.09.2018, *Dani Francis & Santhosh Nampy* 159483; Elaveezhapoonchira, 25.08.2002, *Joby Paul* 806; Guruthikkalam, near Moolamattam, 25.08.2002, *Joby Paul & Santhosh Nampy* 802; Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 152902 (CALI); *Ibid*., 05.10.1983, *A.G. Pandurangan* 79257 (MH); Karadikkavala, 15.09.1994, *N. Sasidharan & Jomy Augustine* 14178 (KFRI); Kattappana-Munnar road, 27.12.2001, *Santhosh Nampy* 435 (CALI); Kulamavu, 03.10.1983, *C.N. Mohanan* 79951 (MH); Mangaladevi hills, 15.07.2017, *Dani Francis & Santhosh Nampy* 154105 (CALI); way to Mangaladevi hills, 27.08.1977, *K. Vivekananthan* 50538; Meenmutty, 27.09.1981, *C.N. Mohanan & B. Ramanujan* 72105 (MH); Mathikettan Shola National Park, Choondal, 24.06.2016, *Syam Radh S.* 149153 (CALI); Mullakkudy, Periyar Tiger Reserve, 16.08.1994, *N. Sasidharan & Jomy Augustine* 13846 (KFRI); Thekkady, 22.12.1974,

K. Vivekananthan 45387 (MH); Thookupalam, 09.06.2018, *Dani Francis & Santhosh Nampy* 159301; Vellappara, 05.08.2017, *Dani Francis & Santhosh Nampy* 154166; way side in Neriamangalam, 11.09.2018, *Dani Francis & Santhosh Nampy* 159449 (CALI).

Dictyospermum ovalifolium Wight, Icon. Pl. Ind. Orient. 6: t. 2070. 1853. *Aneilema ovalifolium* (Wight) Bedd., in H.B.Grigg, Man. Nilagiri 122. 1880; Hook.f., Fl. Brit. India 6: 382. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1546. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 496. 2004.

Perennial decumbent herbs. Roots fibrous from lower nodes; internodes 2–6 cm long, glabrous. Leaves clustered towards apex of stem; sheaths 1.5–2 cm long, glabrous, ciliate at mouth; lamina elliptic-lanceolate, 5–11 × 1.5–3 cm, acuminate at apex, attenuate at base, scabrous, green. Panicle congested, terminal; peduncles *c.* 1 cm long, puberulous. Flowers white; pedicels *c.* 4 mm long, glabrous. Sepals 3, ovate-cup shaped, *c.* 3 × 2 mm, rounded at apex, sub-truncate at base, glabrous, pale green. Petals 3, ovate, 3–4 × 2–2.5 mm, obtuse at apex, cuneate at base, glabrous, white. Stamens 3; filaments 2–4 mm long, glabrous, white; anthers yellow; connectives yellow. staminodes 0. Ovary ovate, *c.* 1 × 1 mm, glabrous; style 0.7 mm long, glabrous, white; stigma capitate. Capsules ovoid, 3–5 × 2.5–3 mm, glabrous. Seed 1 per locule, elliptic, white foveolate, minutely reticulate; hilum linear in a deep pit; embryotega lateral.

Distribution: Laccadive Islands, S. India, Sri Lanka and Assam to Indo-China (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: August-December.

Specimens examined: Koruthode, Periyar Tiger Reserve, 11.08.1993, *N. Sasidharan & Jomy Augustine* 12208 (KFRI); Kulamavu-Meenmutty, 11.12.1982, *C.N. Mohanan* 76011; Painav, 22.08.1977, *K. Vivekananthan* 50468 (MH); Thannikkudy, 10.08.1994, *Jomy Augustine* 14212 (CALI).

Notes: The condensed inflorescence and larger capsules on distinctly deflexed pedicels distinguish this species from the closely related *D. montanum*. The ascending stem is supported by roots that grow from its basal nodes.

Floscopa Lour.,

Fl. Cochinch. 192. 1790.

Floscopa scandens Lour., Fl. Cochinch. 193. 1790; Hook.f., Fl. Brit. India 6: 390. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1551. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 500. 2004.

Annual scandent, herbs. Stems terete, branching, glabrous to puberulous; internodes 3–6 cm long, pubescent; nodes pubescent. Leaves lanceolate-ovate, 1.5–6 × 0.5–2 cm, acuminate at apex, obtuse at base, pubescent abaxially, puberulent adaxially, green; sheaths 0.5–2 cm long, completely clasping the internode, tomentose hairy, long multicellular trichomes towards mouth. Inflorescence a terminal thyrse, 2–6 cm long, glandular hairy; bracts lanceolate-ovate, 2.8–3 × 0.8–1 mm, obtuse at apex, cuneate at base, few hairy at margin, green. Flowers *c.* 4 mm in diam., deep purple to lilac. Sepals 3, free, oblong-widely elliptic, 2–2.2 × 1–1.5 mm, obtuse-sub-rounded at apex, obtuse-sub-truncate at base, glandular hairy out, glabrous in, purple. Petals 3, dimorphic, upper ones elliptic to ovate, 2.8–3 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, purple; lower one narrower, linear, 3–3.1 × 0.3–0.5 mm, obtuse at apex, cuneate at base, glabrous, purple. Stamens 6, fertile, dimorphic, basally fused, 2.5–3 mm long; filaments 2.3–3 mm long, hyaline, glabrous; anthers oblong, 0.2–0.3 mm, purple, glabrous, connectives narrow, white. Gynoecium 4–4.5 mm long; Ovary 0.8–1 mm long, ovate-orbicular, bilocular, ovule single in each locule, glabrous; style *c.* 3 mm long, slender, glabrous, purple, straight; stigma capitate, yellow. Capsules oblong, *c.* 1.8 × 2 mm, 2 loculed, glabrous. Seeds 2, hemispherical, 1.2–1.3 × 0.9–1 mm; testa radiate striate, slightly farinose white; hilum linear, narrow, deep; embryotega dorsal, circular.

Distribution: Tropical and Subtropical Asia to N. Queensland (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: August-March.

Specimens examined: Kulamavu, 22.01.2019, *Dani Francis & Santhosh Nampy* 168905 (CALI); Meenmutty-Kulamavu, 25.01.1983, *A.G. Pandurangan* 76631 (MH); Meenuliyanpara, 12.12.2016, *Dani Francis & Santhosh Nampy* 151430; way to Munnar from Kattappana, 26.12.2002, *Joby Paul* 5125; Pachakkanam, 08.08.1994, *Jomy Augustine* 14376 (CALI); *Ibid*., 10.11.1993, *N. Sasidharan & Jomy*

Augustine 12663 (KFRI); near Painavu, 26.12.2007, *Joby Paul* 5120; Pooppara to Munnar, 27.12.2002, *Santhosh Nampy* 433 (CALI); Thannikkudy-Karaynoda, 08.02.1987, *N.C. Nair* 70158; Thekkady, 12.03.1973, *B.D. Sharma* 43842 (MH); Thodupuzha, 12.12.2011, *Santhosh Nampy* 5267; Topstation, 14.01.1989, *V.N. Ushakumari* 4855 (CALI).

Notes: *Floscopa scandens* is also known as the 'climbing flower cup'. It grows in aquatic habitats and is the only species of *Floscopa* found in India.

Murdannia Royle,

Ill. Bot. Himal. Mts.: 403. 1840, *nom. cons.*

Key to the species

1. Inflorescence scapose ..... *M. fadeniana*

1. Inflorescence not scapose 2

2. Leaves both cauline and rosettiform 3

2. Leaves cauline 6

3. Bracteoles persistent; capsules 3 or 4-seeded ..... *M. japonica*

3. Bracteoles caducous; capsules 2-seeded 4

4. Flowering shoot lateral in the rosette 5

4. Flowering shoot terminal in the rosette ..... *M. gigantea*

5. Roots thick ..... *M. simplex*

5. Roots thin ..... *M. loriformis*

6. Leaves filiform, falcate; stamens and staminodes fused ..... *M. semiteres*

6. Leaves ovate or elliptic-lanceolate or linear-lanceolate; stamens and staminodes free 7

7. Flowers yellow-orange 8

7. Flowers blue-lilac, purple or white 10

8. Perennials; seeds biseriate ..... *M. lanuginosa*

8. Annuals; seeds uniseriate 9

9. Leaves cordate at base; seeds 4 per locule; testa smooth..... *M. pauciflora*

9. Leaves obtuse at base; seeds 2 or 3 per locule; testa rugose .....
..... *M. satheeshiana*

10. Stamens 2; staminodes 4 ..... *M. nudiflora*

10. Stamens 3; staminodes 3 11

11. Sepals oblong 12

11. Sepals elliptic 13

12. Testa foveate; seeds not pitted ..... *M. zeylanica*

12. Testa smooth; seeds pitted ..... *M. dimorpha*

13. Roots tuberous; flowers *c.* 20; petals obovate ..... *M. esculenta*

13. Roots fibrous; flowers *c.* 13; petals orbicular ..... *M. spirata*

Murdannia dimorpha (Dalzell) G.Brückn., Nat. Pflanzenfam. ed. 2. 15a: 173. 1930; K.M.Matthew, Illustr. Fl. Palni Hills 751. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 500. 2004; Ancy & Nampy, *Murdannia* Royle (Commelinaceae) India 46. 2015. *Aneilema dimorphum* Dalzell, in Hooker's J. Bot. Kew Gard. Misc. 3: 138. 1851; Hook.f., Fl. Brit. India 6: 377. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1541. 1931. **Fig. 20D**

Annuals, erect to ascending to decumbent herbs. Roots fibrous from base and from nodes in touch with soil. Internodes 2–8 cm long, glabrous with a line of cilia. Leaves cauline, alternate-distichous; sheaths 1–3 cm long, glabrous with a line of cilia along fused edges, green or purple; lamina elliptic-lanceolate, 1–10 × 0.3–1 cm, acute apex, rounded-amplexicaul at base, margin scabrous towards tip, ciliate towards base, glabrous adaxially, sparsely pubescent to glabrous abaxially, green or with a purple tinge. Inflorescence terminal and axillary thyrse with 2–4 alternate, ascending cincinni or 1–2 sub-opposite pseudoumbellate cincinni; peduncles 1–5 cm long, glabrous; cincinni 1–5 cm long, *c*. 10 flowered; bracts leafy, lanceolate, 1.5–3.5 cm long, obtuse at apex, amplexicaul at base, glabrous, green; bracteoles persistent, ovate, 2–4 mm long, obtuse at apex, amplexicaul at base, glabrous, green. Flowers bisexual and male; pedicels 3–7 mm long. Sepals 3, free, oblong, 2–4 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, pale green, tip slightly purple. Petals 3, free, obovate, 2–4 × 2.5–4 mm, truncate at apex, sub-truncate at base, glabrous, lavender. Stamens 3, 2–3 mm long, bending to one side in bisexual flowers, symmetrical in male flower; filaments free, bearded, lavender, hairs attached to lower half; anthers blue-brown. Staminodes 3, 2–2.5 mm long; filaments free, bearded to glabrous; antherodes 3-lobed to hastate, creamy yellow.

Ovary elliptic, *c.* 1.5 × 0.5 mm, green, glabrous; style purple, bending to one side, glabrous; stigma papillate, white. Capsules oblong-elliptic, 3–6 × 1.5–4 mm, glabrous, brown. Seeds 3–5 per locule, uniseriate, ovate-rectangular; testa smooth with several raised flattish warts, granular; hilum linear, on side of a deep pit; embryotega semidorsal.

Distribution: S. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-February.

Specimens examined: On the way to Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 175910; Kalvary Mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 152903; Kanthallur, Sandal reserve, 22.11.2013, *A.K. Pradeep* 134103; Karimutty, 1st bridge, 09.02.2021, *Dani Francis & Santhosh Nampy* 188778; Kudimala, Lakkamkudi, 09.12.2019, *Dani Francis & Santhosh Nampy* 170014; Mangaladevi hills, Periyar Tiger Reserve, 15.07.2017, *Dani Francis & Santhosh Nampy* 154110; Mathikettan shola National Park, 06.01.2017, *Dani Francis & Santhosh Nampy* 151613; Mathikettan Shola National Park, Choondal, 21.11.2014, *Syam Radh S.* 143569 (CALI); Mlappara, 22.07.1993, *N. Sasidharan & Jomy Augustine* 12087 (KFRI); Panchalimedu, 13.09.2019, *Dani Francis & Santhosh Nampy* 170285 (CALI); Vallakkadavu, Periyar Tiger Reserve, 19.08.1995, *K.P. Rajesh* 16327 (KFRI).

Notes: The deep ventral pit and several raised flattish warts on the seed testa distinguish this species from others. Plants that thrive in dry conditions have thick, leathery leaves, short internodes, and basal rosettes of leaves (Ancy & Nampy, 2015).

Murdannia esculenta (Wall. ex C.B.Clarke) R.S.Rao & Kammathy, Bull. Bot. Surv. India 3: 394. 1962; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 501. 2004; Ancy & Nampy, *Murdannia* Royle (Commelinaceae) India 59. 2015. *Aneilema esculentum* Wall. ex C.B.Clarke, in A.DC. & C.DC., Monogr. Phan. 3: 206. 1881; Hook.f., Fl. Brit. India 6: 377. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1541. 1931.

Perennial, erect to ascending herbs. Roots thick or tuberous from base and fibrous from lower nodes in touch with soil. Internodes 2–5 cm long, glabrous. Leaves cauline or rarely forming rosette, alternate-distichous; sheaths 1–1.5 cm long, glabrous, reddish purple; lamina elliptic-lanceolate, 1–10 × 0.7–1.5 cm, acute-

acuminate at apex, rounded-amplexicaul at base, slightly undulate at margin, glabrous, green or with a purple tinge. Inflorescence terminal thyrse with 2–8 alternate, or sometimes sub-opposite ascending cincinni; peduncles 1–5 cm long, glabrous; cincinni 4–9 cm long, *c*. 20 flowered; bracts persistent, leafy, lanceolate, 1.5–2.5 cm long, obtuse and curved at apex, amplexicaul at base, glabrous, green; bracteoles persistent, ovate, 2–4 mm long, obtuse at apex, amplexicaul at base, glabrous, green. Flowers bisexual and male; pedicels 2–5 mm long. Sepals 3, free, elliptic, 4–5.5 × 2–2.5 mm, obtuse at apex, cuneate at base, glabrous, pale green, tip slightly purple. Petals 3, free, obovate, 4.5–6 × 4–5 mm, rounded and slightly incurved at apex, sub-truncate at base, glabrous, lavender. Stamens 3, 3–4 mm long, bending to one side in bisexual flowers, symmetrical in male flower; filaments free, bearded, lavender, hairs attached to lower half; anthers reddish purple. Staminodes 3, 1.5–3 mm long; filaments free, bearded; antherodes 3-lobed, creamy yellow. Ovary elliptic, *c.* 1 × 0.5 mm, green, glabrous; style purple or white, bending away from stamen and staminodes, glabrous; stigma papillate, white. Capsules oblong-elliptic, 5–6.5 × 2–3 mm, glabrous, brown. Seeds 4 or 5 per locule, uniseriate, ovate-rectangular; testa smooth with several raised flattish warts and ridges; hilum elliptic-linear; embryotega semidorsal.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: April-January.

Specimens examined: Uppupara grasslands, 26.09.1972, *B.D. Sharma* 80292; Dhanas valley, Vaguvarai, 17.10.1989, *P. Bhargavan* 157570 (MH).

Notes: According to Ancy and Nampy (2015), this species can be easily identified by its tuberous roots, terminal thyrse alternate cincinni, and seeds with flattish raised warts uniformly distributed in the testa.

Murdannia fadeniana Nampy & Joby, Candollea 58: 79. 2003; Ancy & Nampy, Murdannia Royle (Commelinaceae) India 63. 2015. **Fig. 20C**

Perennial, erect herbs. Roots from base. Leaves spiral in basal rosettes; lamina oblong-lanceolate, 3–17 × 1–3 cm, acute-acuminate at apex, amplexicaul at base, undulate at margin, glabrous, upper surface green, lower surface green to reddish in older leaves. Inflorescence scapose, 4–10 cm long, terminal or axillary thyrse

with 4–6 alternate, erect to ascending cincinni; cincinnus bracts amplexicaul, 8–1 mm long, obtuse at apex, glabrous, pale white with green towards tip. Cincinni 3–6 cm long, 4–8 flowered; bracteoles persistent, lanceolate, 2–4 mm long, cuspidate at apex, amplexicaul at base, glabrous, green or purple. Flowers bisexual and male; pedicels 3–6 mm long. Sepals 3, free, oblong, 3–4.5 × 1.5–2.5 mm, obtuse at apex, cuneate at base, glabrous, purple, pale green at apex. Petals 3, free, elliptic, 5–6 × 4–5mm, obtuse at apex, cuneate at base, glabrous, purplish white. Stamens 3, 2–4 mm long, slightly curving inwards in flower; filaments free, bearded, hairs attached to lower half, purplish white; anthers bluish black, connectives white. Staminodes 3, 2–2.5 mm long; filaments free, bearded, purplish white; antherodes hastate to 3-lobed, third lobe reduced, yellow. Ovary oblong to elliptic, 1.5–2 × 0.5–1 mm, glabrous, pale white; style bending away from stamens, glabrous; stigma papillate, white. Capsules oblong to elliptic, 5–10 × 2–4 mm, 3-locular, glabrous. Seeds 10–16 per locule, biseriate, triangular to polygonal; testa smooth, deposition of white flaky material, pitted on lateral side; hilum rounded to elliptic; embryotega dorsal.

Distribution: India (Kerala) (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: July-December.

Specimens examined: Aluva-Munnar Road, Mankulam, 14.09.2018, *Dani Francis* & *Santhosh Nampy* 161904; Banglavuthara, Mankulam, 21.12.2019, *Dani Francis & Santhosh Nampy* 164835; Kozhiyalakkudi, Anakulam, 18.09.2018, *Dani Francis & Santhosh Nampy* 161958; Tiger cave, Mankulam, 04.12.2018, *Dani Francis & Santhosh Nampy* 168845; Vagamon hills, near waterfall, 18.07.2002, *Joby Paul* 459 (CALI); Vellimala, 04.10.1998, *K.P. Rajesh & Jomy Augustine* 18414 (KFRI).

Notes: *Murdannia fadeniana* is allied to *M. glauca* (Thwaites ex C.B.Clarke) G.Brückn. in having a perennial rosette habit, thin roots, and a scapose inflorescence but differs by 10–16 seeds biseriately arranged in each locule of the capsule (*vs.* 5–8 seeds uniseriately arranged in each locule) and possessing 3 staminodes (*vs.* 2 staminodes) (Nampy & Joby, 2003).

Murdannia gigantea (Vahl) G.Brückn., Nat. Pflanzenfam. ed. 2, 15a: 173. 1930; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 501. 2004; Ancy & Nampy, Murdannia Royle (Commelinaceae) India 66. 2015. *Commelina gigantea* Vahl, Enum. Pl. Obs. 2: 177.

1805. *Aneilema giganteum* (Vahl) R.Br., Prodr. Fl. Nov. Holland. 271. 1810; Hook.f., Fl. Brit. India 6: 379. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1545. 1931.

Perennial erect herbs. Roots arise from base, fibrous, thick. Internodes 9–24 cm long, glabrous, green. Sheath 2.5–6 cm long, pilose, pale green with a slight purple tinge. Rosette leaves alternate to spiral; lamina linear, 15–45 × 1–1.5 cm, acute at apex, cuneate at base, glabrous, green; cauline leaves alternate or distichous; lamina linear-lanceolate, 4–10 × 1–1.5 cm, acute–acuminate at apex, narrow at base, margin scabrous at apex, both surfaces glabrous. Flowering shoot terminal in the rosette, 25–90 cm tall. Inflorescence terminal and axillary, on the main stem, consisting of 1–2–(3) cincinni; peduncle 1–4 cm long, glabrous; cincinni 3–9 cm long, 8–20 flowered; bracteoles caducous, ovate, 5–10 mm long, obtuse at apex, cuneate at base, glabrous, greenish purple. Flowers bisexual and male; pedicels 2–5 mm long, ascending, erect in fruit, glabrous. Sepals 3, free, elliptic-lanceolate, 6–8 × 3–4 mm, obtuse at apex, sub-truncate at base, glabrous, pale green. Petals 3, free, obovate, 8–10 × 7–8 mm, rounded at apex, cuneate at base, glabrous, lavender. Stamens 2 or 3, curving outwards towards lateral petals; filaments free, 5–15 mm long, densely bearded, hairs attached to the lower half, lilac; anthers deep blue, connectives white to pale blue. Staminodes 3 or 4, 3 antepetalous, with filaments 2–6 mm long, bearded, purple, antherodes 3-lobed, yellow; 1 antesepalous, with filaments 9–14 mm long, densely bearded, antherode minute reduced to a knob. Ovary ovate, pale green, glabrous; style bending away from stamens, glabrous; stigma papillate, white. Capsules ovate-elliptic, 5–10 × 3–6 mm. Seeds 2 per locule, uniseriate, ovate to elliptic; testa with flattish warts, ridges and furrows in lines radiating from embryotega or sometimes foveolate, granular; hilum linear; embryotega dorsal.

Distribution: Madagascar, tropical Asia to N. Australia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-December.

Specimen examined: Vagavanam, 14.09.2019, *Dani Francis & Santhosh Nampy* 170312 (CALI).

Notes: *Murdannia gigantea* exhibits variation in plant size and hairiness, number and size of stamens and staminodes, number of stigma and antherode lobes, and testa ornamentation (Ancy & Nampy, 2015).

Murdannia japonica (Thunb.) Faden, Taxon 26: 142. 1977; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 501. 2004; Ancy & Nampy, Murdannia Royle (Commelinaceae) India 73. 2015. *Commelina japonica* Thunb., Trans. Linn. Soc. London 2: 332. 1794. *Aneilema lineolatum* (Blume) Kunth, Enum. Pl. 4: 69. 1843; Hook.f., Fl. Brit. India 6: 376. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1544. 1931. **Fig. 20F**

Perennial, erect herbs. Roots thick. Internodes 3–15 cm long, glabrous. Sheaths 1–2.5 cm long, green with a purple tinge, glabrous with a line of cilia along fused edges. Rosette leaves alternate to spiral; lamina lanceolate, 10–20 × 2.5–4 cm, acute at apex, glabrous, green. Cauline leaves alternate to spiral; lamina elliptic-lanceolate, 6–17 × 2–6 cm, acute at apex, amplexicaul at base, margin undulate, scabrous towards tip, ciliate towards base, both surfaces glabrous. Inflorescence a terminal thyrse with 3–8 alternate, ascending cincinni, sometimes secondary thyrse with 2–5 cincinni arises from inflorescence bract; peduncle 2–4.5 cm long, glabrous; cincinni 2–4 cm long, *c*. 14 flowered; bracteoles persistent, ovate, *c.* 2 × 1 mm, acute at apex, amplexicaul at base, glabrous. Flowers bisexual and male; pedicels 3–5 mm long. Sepals 3, free, oblong, 3–4.5 × 2–2.5 mm, rounded at apex, cuneate at base, glabrous, green with a purple tinge. Petals 3, free, oblong, 4–6 × 4–4.5 mm, rounded at apex, clawed at base, glabrous, white. Stamens 3, 4–5 mm long, bending to one side in bisexual flowers, symmetrical in male flower; filaments free, white, bearded, hairs attached to lower half, violet; anthers blue, connectives creamy yellow. Staminodes 3, 2–3 mm long; filaments free, white, bearded, hairs violet; antherodes 3-lobed, one lobe reduced, yellow. Ovary globose, glabrous, white; style white, bending to one side, curved at apex; stigma papillate. Capsules sub-globose, 2–5 × 1–4 mm, glabrous. Seeds 3 or 4 per locule, uniseriate, ovate-triangular; testa smooth with tubercles, sometimes tubercles radiating down from embryotega or ventral surface pitted; hilum rounded; embryotega dorsal.

Distribution: Himalaya to Japan and W. Malaysia (POWO, 2023); *Habitat*: Evergreen, semi-evergreen and moist deciduous forests; Fl. *& Ft.*: July-March.

Specimens examined: Anchuruli-Thekkady, 04.10.1972, *B.D. Sharma* 42397; Idukki reservoir, 14.06.1983, *A.G. Pandurangan* 79234; Kalvary mount, 08.11.1981, *B. Ramanujan* 72428 (MH); Kokkara, 17.07.1993, *N. Sasidharan &*

Jomy Augustine 12054 (KFRI); Kulamavu, 19.08.1977, *K. Vivekananthan* 50411 (MH); Neriamangalam, way side, 11.09.2018, *Dani Francis & Santhosh Nampy* 159464; Thekkady, 07.07.1993, *Jomy Augustine* 12054 (CALI).

Notes: This is a very robust and distinct perennial species, distinguished by its large ovate-lanceolate leaves with undulate margins, large terminal inflorescences, afternoon flowering, clawed petals and seeds with a tuberculate testa and rounded hilum (Ancy & Nampy, 2015).

Murdannia lanuginosa G.Brückn., in Engler, Nat. Pflanzenfam. ed. 2. 15a: 173. 1930; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 501. 2004; Ancy & Nampy, Murdannia Royle (Commelinaceae) India 85. 2015. *Aneilema lanuginosum* Wall. ex C.B.Clarke, in A.DC. & C.DC., Monogr. Phan. 3: 214. 1881; Hook.f., Fl. Brit. India 6: 376. 1892; C.E.C.Fisch., in Gamble, Fl. Madras 3: 1545. 1931.

Perennial, erect to ascending herbs. Roots tuberous, fibrous from lower nodes that touch with soil. Internodes 3–6 cm long, green or purplish, densely ciliate or with a line of cilia. Leaves cauline, distichous, oblong-lanceolate, 1.5–5 × 0.8–1.2 cm, acute at apex, rounded or amplexicaul at base, pubescent adaxially, glabrous-pubescent abaxially, green, prominently ribbed; sheaths 0.5–0.7 mm long, pubescent-glabrous with a line of cilia along fused edges. Inflorescence terminal and axillary cymes; peduncles 1–5 cm long; cincinni 1.5–3 cm long, 1–3 fascicles of 4–8 single flowers; bracts leafy, *c.* 4 × 1 mm, acute at apex, amplexicaul at base, puberulous, green; bracteoles caducous, lanceolate, 3–5 mm long, obtuse at apex, sub-rounded at base, glabrous, green. Flowers bisexual and male; pedicels 2–4 mm long, once jointed, pubescent. Sepals 3, free, elliptic, 3–3.7 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, pale green. Petals 3, free, ovate-orbicular, 2.8–3 × 1.8–2 mm, sub-rounded at apex, cuneate at base, glabrous, yellow orange. Stamens 3; filaments free, 4–5 mm long, densely bearded; anthers deep blue, connectives white. Staminodes 3, antepetalous; filaments 3–3.5 mm long, yellow orange, glabrous to few hairy; antherodes 3-lobed, yellow. Ovary elliptic, glabrous, pale green; style yellow orange, bending to one side, glabrous; stigma papillate. Capsules oblong-elliptic, 5–10 × 3–3.5 mm, glabrous. Seeds 12–16 per locule, biseriate, rectangular; testa foveolate-reticulate, flattish raised warts, light brown flaky material present; hilum rounded; embryotega dorsal.

Distribution: S. India (POWO, 2023); Habitat: Grasslands; *Fl. & Ft.*: August-October.

Specimen examined: Meenmutty, 04.10.1983, *C.N. Mohanan & V.S. Ramachandran* 152292 (MH).

Notes: This species can be easily identified by its tuberous roots, yellow orange flowers and prominently ribbed leaves (Ancy & Nampy, 2015).

Murdannia loriformis (Hassk.) R.S.Rao & Kammathy, Bull. Bot. Surv. India 3: 393. 1962; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 502. 2004; Ancy & Nampy, Murdannia Royle (Commelinaceae) India 88. 2015. *Aneilema loriforme* Hassk., in Miquel, Pl. Jungh. 2: 143. 1852.

Perennial herbs. Roots from base and lower nodes that touch with soil. Internodes 3–6 cm long, green, with a line of cilia. Rosette leaves spirally arranged, oblong-linear, 3–12 × 0.3–1.5 cm, acute at apex, glabrous, green. Cauline leaves alternate or distichous, oblong-lanceolate, 3.5–10 × 0.5–1.5 cm, acute at apex, cuneate at base, glabrous, green; sheaths 0.5–1 mm long, glabrous with a line of cilia along fused edges. Inflorescence terminal and axillary on lateral branches, consisting of a single pedunculate cincinni, sometimes seen as paired terminally; peduncles 1–8 cm long; cincinni 1.5–3 cm long, *c*. 10 flowered; bracteoles caducous, lanceolate, 3–5 mm long, obtuse at apex, sub-rounded at base, glabrous, green. Flowers bisexual and male; pedicels 2–4 mm long, ascending, mostly recurved in fruit, glabrous. Sepals 3, free, elliptic-lanceolate, 2–3 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, pale green. Petals 3, free, obovate-elliptic, 4–5 × 2–3 mm, obtuse-sub-rounded at apex, cuneate at base, glabrous, lilac. Stamens 2; filaments free, 5–6 mm long, densely bearded, hairs lilac; anthers deep blue, connectives white–blue. Staminodes 4, 3 antepetalous filaments 3–4 mm long, purple, glabrous to few hairy, antherodes 3-lobed, lobes white; 1 antesepalous, filaments 1.5–2.5 mm long, densely bearded, antherode reduced to a knob. Ovary ovate, glabrous, pale green; style white, glabrous; stigma papillate. Capsules ovate to elliptic, 3.5–5 × 1.5–3 mm, glabrous. Seeds 2 per locule, uniseriate, ovate to elliptic; testa foveolate-reticulate, pale warty brown flaky depositions around depressions, slightly ridged and furrowed, farinose granules present; hilum linear to oblong; embryotega semidorsal.

Distribution: Tropical and Subtropical Asia (POWO, 2023); Habitat: Grasslands; *Fl. & Ft.*: June-January.

Specimens examined: Mangaladevihills, Periyar tiger Reserve, 15.07.2017, *Dani Francis & Santhosh Nampy* 154124; Mathikettan shola National Park, 06.01.2017, *Dani Francis & Santhosh Nampy* 151613; Neriyamangalam, 3rd mile, 12.09.2018, *Dani Francis & Santhosh Nampy* 159477; Painavu, *s.d.*, *Joby Paul & Sibichen M. Thomas* 1203; Thekkady, 14.07.2017, *Dani Francis & Santhosh Nampy* 152850 (CALI).

Notes: *Murdannia loriformis* has a prominent basal rosette and the main axis is reduced. The flowering shoots are always lateral. The presence of caducous bracteoles, single terminal or axillary cincinni, and two seeded capsule locules distinguishes this species from others. This species is found at low to medium (100–1500 m) elevations (Ancy & Nampy, 2015).

Murdannia nudiflora (L.) Brenan, Kew Bull. 7: 189. 1952; K.M.Matthew, Illustr. Fl. Palni Hills 753. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 502. 2004; Ancy & Nampy, Murdannia Royle (Commelinaceae) India 92. 2015. *Commelina nudiflora* L., Sp. Pl. 1: 41. 1753. *Aneilema nudiflorum* (L.) Sweet, Hort. Brit. 430. 1826; Hook.f., Fl. Brit. India 6: 378. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1545. 1931. **Fig. 20E**

Annual herbs. Roots fibrous, from basal nodes that touch with soil. Internodes 2–10 cm long, with a line of cilia, purplish green. Sheaths 0.3–1cm long, glabrous with a line of cilia along fused edges, green. Leaves alternate or distichous, linear-lanceolate, 2–9 × 0.4–0.6 cm, acute-acuminate at apex, rounded at base, glabrous to ciliate, sometimes forming a prominent to less prominent basal rosette. Inflorescence terminal and axillary, consisting of single pedunculate cincinni, sometimes seen as paired terminally; peduncles 3–7 cm long; cincinni 1–1.5 cm long, *c*. 12 flowered; bracteoles caducous, ovate, 1.5–3 mm long, acute at apex, cuneate at base, glabrous, purplish green. Flowers bisexual and male; pedicels 2.5–4.5 mm long, straight to ascending, glabrous. Sepals 3, free, elliptic, 2–3 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, pale green. Petals 3, free, obovate, 3–5 × 4–6 mm, rounded at apex, cuneate at base, glabrous, lilac. Stamens 2; filaments free, 4.5–5 mm long, densely bearded, hairs attached to lower half, pink;

anthers deep blue, connectives white. Staminodes 4, 3 antepetalous, 1 antesepalous; filaments free, *c*. 1 mm long, purple, glabrous to few hairy; antherodes 3-lobed, white; antesepalous staminode with bearded filaments, antherode reduced to a knob. Ovary obovate, 0.8–1.5 mm long, glabrous, pale green; style glabrous; stigma papillate. Capsules ovate, 3–4 × 2–3 mm. Seeds 2 per locule, uniseriate, ovate to oblong; testa foveolate-reticulate, pale warts around depressions, granular, white flaky material present; hilum elliptic; embryotega semidorsal.

Distribution: Tropical and Subtropical Asia to W Pacific (POWO, 2023); *Habitat*: Grasslands and plains; *Fl. & Ft.*: June-February.

Specimens examined: Dam site, 11.11.1994, *Jomy A.* 14095; way to Eravikulam National Park, 10.09.2003, *Joby Paul & Santhosh Nampy* 951; Kaliyar, near Thodupuzha, 27.10.2001, *Santhosh Nampy* 153; Kozhiyalakudi, Anakulam, 18.09.2018, *Dani Francis & Santhosh Nampy* 161962; Marayur village, 29.12.2017, *Dani Francis & Santhosh Nampy* 158043 (CALI); Mlappara, Periyar Tiger Reserve, 22.07.1993, *N. Sasidharan & Jomy Augustine* 12083; Thommankuthu, 10.12.2016, *Dani Francis & Santhosh Nampy* 151327; Vallakadavu, 18.08.1996, *Jomy Augustine* 16395 (CALI).

Notes: This species is commonly known as 'Doveweed'. It is a noxious weed in landscape beds, turfgrass, and a variety of agricultural crops (Khamare *et al.*, 2019). It can be easily identified by its caducous bracteoles, single terminal cincinni, and two seeded capsule locules (Ancy & Nampy, 2015).

Murdannia pauciflora (G.Brückn.) G.Brückn., Nat. Pflanzenfam. ed. 2, 15a: 173. 1930; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 502. 2004; Ancy & Nampy, Murdannia Royle (Commelinaceae) India 97. 2015. *Aneilema pauciflorum* Wight, Icon. Pl. Ind. Orient. t. 2077. 1853; Hook.f., Fl. Brit. Ind. 6: 378. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1545. 1931. **Fig. 20A**

Annual herbs. Roots arise from basal nodes that touch with soil. Internodes 1.5–6.5 cm long, green. Leaves alternate or distichous, ovate, 0.5–4 × 0.5–1 cm, acute at apex, cordate at base; serrulate at margin, glabrous or pubescent, green; Sheaths 0.5–0.8 mm long, glabrous with a line of cilia along fused edges, green. Inflorescence terminal and axillary, 1–3 single flowered cincinni. Flowers male

and bisexual; pedicels 0.5–1 cm long, pubescent. Sepals 3, free, ovate-elliptic, 2.5–3 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous or puberulous, pale green. Petals 3, free, elliptic-ovate, 3.5–4.5 × 2–4 mm, rounded at apex, sub-rounded at base, glabrous, yellow-orange to golden-yellow to brick red. Stamens 3; filaments free, 2–2.5 mm long, bearded, hairs attached laterally to the lower half, yellow orange; anthers deep blue to purple, connectives brown-purple. Staminodes 3, antepetalous; filaments free, *c*. 1 mm long, glabrous to few hairy, yellowish orange to purple; antherodes 3-lobed, yellow. Ovary elliptic-obovate, 1.5–2 mm long, glabrous, pale green; style glabrous, yellow-orange; stigma papillate. Capsules narrowly elliptic, 4–6 × 1.5–2 mm, fruiting pedicel recurved. Seeds 4 per locule, uniseriate, oblong to rectangular; testa smooth, regularly pitted in lines, raised farinose depositions in the depressions, finely granular with flattish raised warts and 1 or 2 ridges on each surface; hilum elliptic; embryotega semidorsal.

Distribution: S. India (POWO, 2023); *Habitat*: Grasslands and open areas; *Fl. & Ft.*: August-January.

Specimens examined: Elaveezhapoonchira, 25.08.2002, *Joby Paul* 803; Guruthikkalam, *s.d., Joby Paul & Sibichen M. Thomas* 1201; Kallarpara, 27.12.2002, *Joby Paul* 5129 (CALI); Kalvarimala, Periyar Tiger Reserve, 06.12.1993, *N. Sasidharan & Jomy Augustine* 12795 (KFRI); Karimkunnam, near Thodupuzha, 22.10.2002, *Santhosh Nampy* 852; Kattadikadavu, 12.10.2019, *Dani Francis & Santhosh Nampy* 170343; way to Mamalakandam, near Yakobaya church, 27.12.2017, *Dani Francis & Santhosh Nampy* 156521; Munnar, *s.d.*, *Santhosh Nampy s.coll.*; Myladumpara, 13.12.2013, *S. Syam Radh & Janeesha* 138142; Neriyamangalam to Adimali road, 17.11.2018, *Dani Francis & Santhosh Nampy* 173301 (CALI); Pachakkanam, Periyar Tiger Reserve, 09.11.1993, *N. Sasidharan & Jomy Augustine* 12662 (KFRI); Thannikkudy, 16.08.1996, *Jomy Augustine* 16284; Thodupuzha, 22.09.2008, *Santhosh Nampy* 2335; Thommankuthu waterfalls, 30.11.2019, *Dani Francis & Santhosh Nampy* 164661 (CALI); Valara R.F., 24.09.1982, *K. Ramamurthy* 74802 (MH).

Notes: This species is easily distinguished by its leaves cordate at base, narrowly ellipsoid capsules, and usually strongly recurved fruiting pedicels (Ancy & Nampy, 2015).

Murdannia satheeshiana Joby, Nisha & Unni, Phytotaxa 22: 41. 2011.

Annual herbs. Roots fibrous, from lower nodes that touch with soil. Internodes 0.5–2.5 cm long, with a thick band of multicellular hairs from mouth of sheath to the base of internode, green. Leaves cauline, alternate to distichous; lamina ovate, 0.5–2 × 0.5–1 cm, acute at apex, amplexicaul at base, slightly undulate at margins, sparsely pubescent; sheaths 0.3–0.6 cm long, with a line of cilia along fused edges, green. Inflorescence axillary cymes; cincinni 1–4, 2–3 mm long, glabrous, pale green; bracts lanceolate, bifid at apex, acute at base, glabrous, pale green; pedicels 0.5–0.8 cm long, erect–slightly bending, sparsely hairy, pale green; bracteoles lanceolate, 3.5–4 × 0.8–1 mm, acute at apex, cuneate at base, pubescent abaxially, pale green. Flowers bisexual, 1 per cincinnus. Sepals 3, lanceolate, 3–4 × 2–2.5 mm, obtuse at apex, cuneate at base, minutely ciliate at margins, glabrous, pale green, purple inside. Petals ovate, 3–4 × 2–3 mm, rounded at apex, cuneate at base, glabrous, orange-yellow. Stamens 3; filament 2–2.5 mm long, bearded, hairs on outer side of filament, purple-orange-yellow; anthers upper dark purple, lower cream-white; connectives cream-white. Staminodes 3, antipetalous; filaments glabrous, purple-orange yellow; antherodes 3-lobed, yellow. Ovary globose-triangular, 1.5–2 mm long, pale green; style slightly bent towards fertile stamens, glabrous, purple; stigma feathery, white. Capsules ovate-oblong, 3–4 × 1.5–2 mm, glabrous, green. Seeds uniseriate, 2–3 per locule, rectangular in ventral view, cylindrical to heart-shaped in apical view; testa rugose, with ridges and furrows, white farinose granules in the furrows, small ventral pit near the hilum, filled with white flakey material and farinose granules, apex rounded in basal and apical seeds, cupulate in middle ones; hilum ovate-elliptic; embryotega lateral.

Distribution: SW. India (POWO, 2023); *Habitat*: Grasslands and open areas; *Fl. & Ft.*: August-January.

Specimen examined: Munnar-Rajamala roadside, 18.11.2020, *Dani Francis & Santhosh Nampy* 173332 (CALI).

Notes: This species is allied to *Murdannia pauciflora*, but differs by its shoots 2.5–10 cm long (*vs.* 20–60 cm), erect to ascending branches (*vs.* abrupt to ascending), flowers 0.5–0.6 cm diam. (*vs.* 1–1.2 cm), ovate-oblong capsules (*vs.* elliptic), rough

seeds with ridges and furrows, furrows with white material and floury granules (*vs.* floury rounded packages) (Paul *et al.,* 2011).

Murdannia semiteres (Dalzell) Santapau, Poona Agric. Coll. Mag. 41 (4): 15. 1951; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 502. 2004; Ancy & Nampy, Murdannia Royle (Commelinaceae) India 104. 2015. *Aneilema semiteres* Dalzell, Hooker's J. Bot. Kew Gard. Misc. 3: 138. 1851. *A. paniculatum* Wall. ex C.B.Clarke,Monogr. Phan. 3: 215. 1881; Hook.f., Fl. Brit. India 6: 381. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1546. 1931. **Fig. 20G**

Annual, erect herbs. Roots thin fibrous from base. Internodes 1–1.5 cm long, glabrous, green or red. Sheaths 1.5–4 mm long, green or with a reddish tinge, glabrous. Leaves cauline, alternate; lamina filiform, falcate towards base, 3–10 × 0.1–0.2 cm, acute at apex, acute at base, glabrous. Inflorescence terminal and axillary; consisting of 2–3 pedunculate or non-pedunculate, pseudo umbellate cincinii. Peduncles 1–2 cm long, glabrous; bracts filiform, obtuse at apex, glabrous; cincinni 2–5 cm long, 8–10 flowered; bracteoles persistent, lanceolate, 1–2.5 mm long, obtuse at apex, amplexicaul at base, glabrous. Flowers bisexual and male; pedicels 2–3 mm long, glabrous. Sepals 3, free, elliptic-oblong, 2–2.5 × 1–1.2 mm, glabrous, reddish. Petals 3, free, oblong, 3–5 × 2–3 mm, acuminate at apex, cuneate at base, glabrous, purplish-blue. Stamens 3, 2–3 mm long, bending to one side in bisexual flowers, symmetrical in male flower; filaments basally fused, glabrous, white with slight purple tinge; anthers red; connectives creamy yellow. Staminodes 3, 1.5–2 mm long; filaments basally fused with stamen filaments, glabrous, purplish white; antherodes 3-lobed, one lobe reduced, creamy white. Ovary globose, 1.5–2 mm long, purplish green; style bending to one side, glabrous; stigma papillate. Capsules elliptic, 2–2.5 × 1–1.5 mm, glabrous, brown. Seeds biseriate, 6–8 per locule, ovate-rectangular; testa dark brown, smooth with white farinose forming minute striations; hilum dotted; embryotega dorsal.

Distribution: Uganda to Zambia and Iran to Indo-China (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: June-December.

Specimens examined: Kallarpara, near Nedumkandam, 27.12.2001, *Santhosh Nampy* 436; Kalvary mount, near Idukki dam, 26.12.2002, *Joby Paul* 5122; way to

Kanketty, Mankulam, 20.12.2019, *Dani Francis & Santhosh Nampy* 164592; Kattadikadavu, 12.10.2019, *Dani Francis & Santhosh Nampy* 170359; Meenuliyanpara, 12.12.2016, *Dani Francis & Santhosh Nampy* 151432; Mathikettan Shola National Park, Perattakkalam, 29.12.2014, *Syam Radh S.* 137894; Vagamon, Munnar, 14.06.2013, *Santhosh Nampy & Anna Ancy Antony s.coll.* (CALI).

Notes: *Murdannia semiteres,* the 'panicled dew flower', is easily recognized by its filiform falcate leaves, basally fused stamens and staminodes, and petals with abruptly acuminate apex (Ancy & Nampy, 2015).

Murdannia simplex (Vahl) Brenan, Kew Bull. 7: 186. 1952; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 502. 2004; Ancy & Nampy, Murdannia Royle (Commelinaceae) India 109. 2015. *Commelina simplex* Vahl, Enum. Pl. Obs. 2: 177. 1805. *Aneilema sinicum* Ker Gawl., Bot. Reg. 8: t. 659. 1822; Hook.f., Fl. Brit. India 6: 379. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1545. 1931. **Fig. 20B**

Perennial herbs with a basal rosette; lateral branches from the axils of radical leaves. Roots thick fibrous from base. Sheaths 1–2.5 cm long, green. Leaves radical and cauline; rosette leaves linear-lanceolate, 5–20 × 0.5–1 cm, acuminate at apex, glabrous, green; cauline leaves narrowly lanceolate-linear, 1.5–5 × 0.3–0.5 cm, acute to acuminate at apex, rounded at base, glabrous, green. Flowering shoots lateral in rosette, ascending, unbranched or scarcely branched. Inflorescence terminal and axillary, consisting of single, pedunculate cincinni, often appearing paired terminally, but one cincinnus terminal and the other axillary; peduncles 2–10 cm long, glabrous; cincinni 3–4 cm long; bracteoles caducous, lanceolate, 3–4 mm long, obtuse at apex, cuneate at base, glabrous, purplish green. Flowers bisexual and male; pedicels 0.3–2 cm long. Sepals 3, lanceolate, 2–2.5 × 1–1.2 mm, obtuse at apex, cuneate at base, glabrous, pale green. Petals 3, broadly obovate, obtuse-sub-rounded at apex, cuneate at base, glabrous, lavender. Stamens 2, curving on to one side and the style to the other, filaments densely bearded. Staminodes 4; 3 antepetalous, filaments bearded, antherodes 3-lobed; 1 antesepalous, filaments bearded, antherodes reduced to a knob. Ovary ovate, *c.* 1 mm long, green; style white; stigma papillate. Capsules ovate, 4–5 × 2–3 mm, glabrous. Seeds 2 per locule, uniseriate, ovate-elliptic; testa foveolate to

scrobiculate, white flaky material in the depressions, finely granular; hilum linear-oblong; embryotega semidorsal.

Distribution: Tropical and S Africa, Madagascar, Tropical and Subtropical Asia to N Australia (POWO, 2023); *Fl. & Ft.*: July-April.

Specimens examined: Kalvarimala, Periyar Tiger Reserve, 18.08.1994, *N. Sasidharan & Jomy Augustine* 13398 (KFRI); Mangaladevi hills, Periyar Tiger Reserve, 15.07.2017, *Dani Francis & Santhosh Nampy* 152874; Panchalimedu, 13.09.2019, *Dani Francis & Santhosh Nampy* 170302; Parunthanpara, 29.04.2018, *Dani Francis & Santhosh Nampy* 152943; Vallakkadavu, 10.12.1996, *Jomy Augustine* 16950; Vakavanam, 14.09.2019, *Dani Francis & Santhosh Nampy* 170319 (CALI).

Notes: *Murdannia simplex* is allied to *M. loriformis,* but can be differentiated by its tuberous roots, afternoon flowering, and large flowers (Ancy & Nampy, 2015).

Murdannia spirata (L.) G.Brückn., Nat. Pflanzenfam. ed. 2. 15a: 173. 1930; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 502. 2004; Ancy & Nampy, Murdannia Royle (Commelinaceae) India 113. 2015. *Commelina spirata* L., Mant. Pl. 2: 176. 1771. *Aneilema spiratum* (L.) Sweet, Hort. Suburb. Lond.: 12. 1808; Hook.f., Fl. Brit. India 6: 377. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1545. 1931.

Annual herbs. Tufted to diffusely spreading with or without a definite base. Roots thin fibrous from base and nodes. Internodes 1–4 cm long, glabrous with a line of hairs or pubescent throughout, green. Sheaths 0.2–0.5 cm long, glabrous with a line of cilia along fused edges, green. Leaves cauline, alternate to spiral; lamina ovate-lanceolate, 1–4 × 0.3–1 cm, acute at apex, amplexicaul at base, glabrous to minutely pubescent. Inflorescence terminal or axillary thyrse; terminal pedunculate with 1–3 alternate cincinni; axillary with or without peduncle, 1–3 cincinni; peduncles 1–4 cm long, glabrous; cincinni 2–4 cm long, *c*. 13 flowered; bracteoles persistent, ovate, 1.5–3 mm long, obtuse at apex, amplexicaul at base, glabrous. Flowers bisexual and male; pedicels 2–6 mm long, glabrous. Sepals 3, free, elliptic, 1.5–3 × 0.5–2 mm, glabrous, green. Petals 3, free, orbicular, 3–7 × 2–

4 mm, sub-rounded at apex, cuneate at base, glabrous, lavender. Stamens 3, 0.8–1.5 mm long, bending to one side in bisexual flowers, symmetrical in male flower; filaments free, bearded, hairs attached to lower half, purple; anthers purple; connectives broad, purple. Staminodes 3, 0.8–1.2 mm long; filaments free, bearded, purple; antherodes 3-lobed, white. Ovary elliptic, 1–1.5 mm long, glabrous, pale green; style with a purple tinge towards base, bending to one side, glabrous; stigma papillate. Capsules ovate-elliptic, 1.5–3 × 1–2 mm, glabrous. Seeds uniseriate, 3 or 4 per locule, ovate to elliptic; testa with flattish raised warts, furrowed, rugose; hilum elliptic; embryotega semidorsal.

Distribution: Tropical and Subtropical Asia (POWO, 2023); Habitat: Grasslands and moist areas; *Fl. & Ft.*: June-March.

Specimens examined: Kaliyar, near Thodupuzha, 28.08.2002, *Santhosh Nampy* 812; Nadugani, 26.12.2002, *Joby Paul & Sibichen M. Thomas* 1238; Pius Nagar, 22.06.2018, *Dani Francis & Santhosh Nampy* 164610 (CALI); Thannikkudy, Periyar Tiger Reserve, 24.10.1993, *N. Sasidharan & Jomy Augustine* 12619 (KFRI).

Notes: The 'Asiatic dew flower' is the most common and variable species of this genus. It varies mainly in its petals shape, size and striations.

Murdannia zeylanica (C.B.Clarke) G.Brückn., Nat. Pflanzenfam. Ed. 2, 15a: 173. 1930; K.M.Matthew, Illustr. Fl. Palni Hills 754. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 503. 2004; Ancy & Nampy, Murdannia Royle (Commelinaceae) India 132. 2015. *Aneilema zeylanicum* C.B.Clarke in A.L.P.P.de Candolle & A.C.P.de Candolle, Monogr. Phan. 3: 204. 1881; Hook.f., Fl. Brit. India 6: 376. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1544. 1931.

Perennial herbs. Roots fibrous from nodes that touch with soil. Internodes 5–8 cm long, glabrous with a line of cilia, green. Sheaths 0.5–2.5 cm long, glabrous with a line of cilia along the fused edges, green. Leaves cauline, alternate to distichous; lamina elliptic-lanceolate, 3.5–11 × 0.5–2 cm, acute at apex, amplexicaul at base, undulate at margin, glabrous adaxially, pubescent to glabrous abaxially. Inflorescence terminal and axillary thyrse with 3–12 alternate, ascending cincinni;

peduncles 2–8 cm long, glabrous; cincinni 5–10 cm long, *c*. 15 flowered; bracteoles persistent, ovate, 2–4 mm long, obtuse at apex, amplexicaul at base, glabrous. Flowers bisexual and male; pedicels 5–8 mm long. Sepals 3, free, oblong, 3–4 × 1.4–2 mm, obtuse at apex, cuneate at base, glabrous or puberulous, pale green, slightly purple at tip. Petals 3, free, ovate, 4–6 × 4–5 mm, obtuse at apex, cuneate at base, glabrous, pale purple. Stamens 3, 3–4 mm long, bending to one side in bisexual flowers, symmetrical in male flower; filaments free, bearded, hairs attached to lower half, white; anthers reddish brown. Staminodes 3, 2–2.5 mm long; filaments free, bearded, white; antherodes 3-lobed, yellow. Ovary elliptic, *c*. 1.5 mm long, white, glabrous; style white, bending to one side, glabrous; stigma papillate. Capsules oblong-elliptic, 4–8 × 2–2.5 mm, glabrous. Seeds 4–5 per locule, uniseriate, ovate-rectangular; testa foveate, with fine flattish raised ridges and warts, white farinose on surface or around hilum; hilum elliptic to linear; embryotega semidorsal.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-March.

Specimens examined: Chinnar, 03.10.1996, *N. Sasidharan & Jomy Augustine* 17441; Chokkampetty, Periyar Tiger Reserve, 21.02.1994, *N. Sasidharan & Jomy Augustine* 13363 (KFRI); Elaveezhapoonchira, 25.08.2003, *Joby Paul* 807; Kalvary Mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154370 (CALI).

Notes: This species is distinguished by its broad succulent leaves with wavy margins and white flowers (Ancy & Nampy, 2015).

Rhopalephora Hassk.,

Bot. Zeitung 22: 58. 1864.

Rhopalephora scaberrima (Blume) Faden, Biosyst. Study Gen. Aneilema 2: 395. 1975. *Commelina scaberrima* Blume, Enum. Pl. Javae 1: 4. 1827. *Aneilema scaberrimum* Kunth, Enum. Pl. 4: 69. 1843; Hook.f., Fl. Brit. India 6: 382. 1892;

C.E.C.Fisch. in Gamble, Fl. Madras 3: 1546. 1928; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 496. 2004.

Perennial scrambling herbs. Roots fibrous. Internodes 5–10 cm long, scabrous, green. Leaves distichous or spiral; sheaths 1–4 cm long, pubescent, ciliate at apex, green with purple lines; lamina elliptic-lanceolate, 5–20 × 1–4 cm, acuminate at apex, attenuate at base, scabrous adaxially, glabrous abaxially, green. Inflorescence terminal umbellate panicles; peduncles 5–8 cm long; bracts lanceolate, 0.5–1 cm long, obtuse at apex, cuneate at base, glabrous-puberulous; bracteoles lanceolate, 2–3 mm long, obtuse at apex, amplexicaul at base, glabrous-puberulous, purplish green. Flowers bisexual, purple; pedicels 1–1.5 cm long. Sepals 3, ovate, 2–5 × 1.5–2 mm, curved at apex, cuneate at base, pubescent, green. Petals 3, orbicular, 4–5 × 4–5 mm, sub-rounded at apex, base clawed, 2–3 mm long, glabrous, purple. Stamens 3; filaments 6–8 mm long, pink with small white hairs; anthers yellow. Staminodes 3; filaments white; antherodes yellow. Ovary 3-locular, 1-ovuled, densely pubescent with white hooked hairs; style *c.* 1 cm long, glabrous; stigma capitate. Capsules globose, *c.* 4 × 3 mm, pubescent. Seeds planoconvex, glandular, grey-blue.

Distribution: Himalaya to W. Central Malaysia (POWO, 2023); *Habitat*: Forest margin; *Fl. & Ft.*: July-January.

Specimens examined: Kattadikadavu, 18.11.2020, *Dani Francis & Santhosh Nampy* 173340 (CALI); Kulamavu, 03.10.1983, *C.N. Mohanan* 79960 (MH); Mathikettan Shola National Park, Aduvizhanthankudi, 22.11.2014, *Syam Radh S.* 137843; way to Mathikettan shola National Park, 06.01.2017, *Dani Francis & Santhosh Nampy* 151601; Pallivasal, *s.d.*, *Joby & Sibichen* 1222 (CALI).

Notes: *Rhopalephora scaberrima* is known as the 'Rough dayflower' because of the scabrous nature of its leaves. The stickiness of the capsule is due to the presence of hooked hairs which aid in seed dispersal by animals.

Fig. 19. A. *Cyanotis obtusa* (Trimen) Trimen; **B.** *C. axillaris* (L.) D.Don ex Sweet; **C.** *C. racemosa* Heyne ex Hassk.; **D.** *C. vivipara* Dalzell; **F.** *Commelina diffusa* Burm.f.; **G.** *C. clavata* C.B.Clarke.

Fig. 20. A. *Murdannia pauciflora* (G.Brückn.) G.Brückn.; **B.** *M. simplex* (Vahl) Brenan; **C.** *M. fadeniana* Nampy & Joby; **D.** *M. dimorpha* (Dalzell) G.Brückn.; **E.** *M. nudiflora* (L.) Brenan; **F.** *M. japonica* (Thunb.) Faden; **G.** *M. semiteres* (Dalzell) Santapau; **H.** *Dictyospermum montanum* Wight.

JUNCACEAE Juss.,

Gen. Pl. 43.1789, *nom. cons.*

Erect, perennial, rarely annual herbs. Stems tufted or with a creeping rootstock. Leaves flat, terete, or reduced to sheaths. Flowers in axillary or terminal cymes, bisexual, bracteate, green or white. Perianth inferior, 6 in two whorls, persistent, imbricate, membranous, or coriaceous, white or brown. Stamens 6, rarely 3, hypogynous or on the base of segments; anthers basifixed. Ovary 1 or 3-celled, superior; style filiform or short or 0; stigma 3, filiform; ovules few to numerous on axile or parietal placentas. Capsules 1–3-celled, loculicidally 3-valved. Seeds few-many, testa membranous, often produced at each end.

The 'rush family' is a cosmopolitan family distributed mainly in temperate and Polar regions in both the hemispheres, and comprises eight genera and 472 species (POWO, 2023). In India, it is represented by two genera *Juncus* L. and *Luzula* DC., with 53 species and two varieties (Chhetri *et al.*, 2011). Three species found in the study area.

Juncus L.,

Sp. Pl. 1: 325. 1753.

Key to the species

1. Annual herbs; leaf sheaths without an awn; cymes terminal ……..2

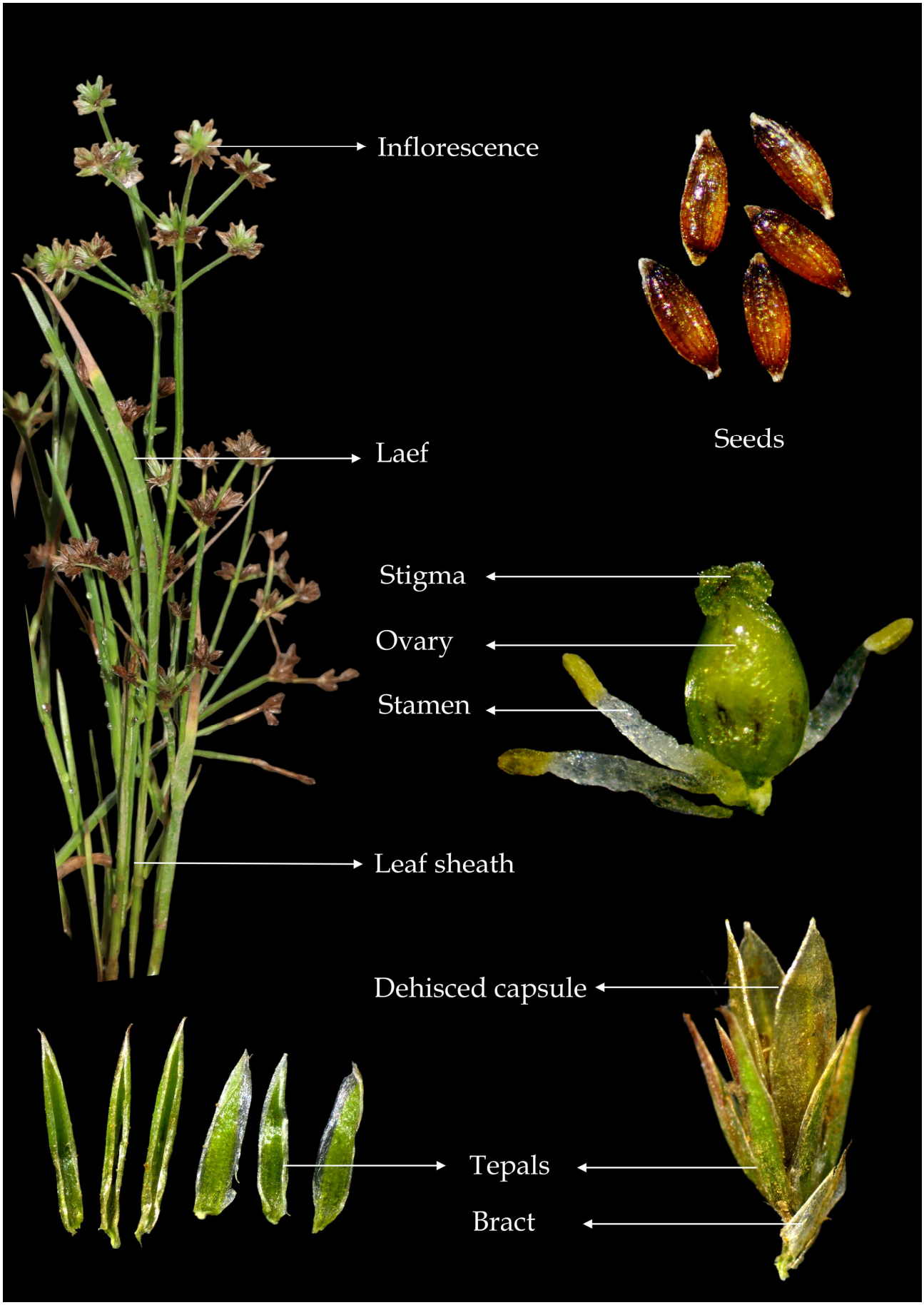
1. Perennial herbs; leaf sheaths with a caducous awn; cymes pseudo lateral ……..
…….. *J. effusus*

2. Leaves terete, septate; flowers in capitate clusters ..... *J. prismatocarpus*

2. Leaves flat, not septate; flowers mostly paired, sometimes one or in clusters
…….. *J. bufonius*

Juncus bufonius L., Sp. Pl. 1: 328. 1753; Hook.f., Fl. Brit. India 6: 392. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1553. 1931; K.M.Matthew, Illustr. Fl. Palni Hills 755. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 503. 2004.

Annual herbs. Culms tufted, erect, slender, terete, branched, 5–8 cm, glabrous. Leaves linear, 1–7 cm long, flat, tapering at apex, cuneate at base, glabrous, reddish-brown; sheaths linear-lanceolate, *c.* 3 cm long, margin hyaline, pale


Inflorescence
Seeds
Laef
Stigma
Ovary
Stamen
Leaf sheath
Dehisced capsule
Tepals
Bract

brown. Inflorescence erect, terminal, branched, usually a flower at forks, 4–7 cm long, reddish brown. Flowers mostly paired, sometimes one or in clusters, obovate, 3–6 mm long, glabrous; pedicels 1–3 mm long. Bracts ovate, 2–2.5 × 1–1.1 mm, acute at apex, truncate at base, glabrous, 6-nerved; bracteoles 2, ovate, 1–2 × 1–1.2 mm, acute at apex, truncate at base, glabrous. Tepals 6, in two whorls, outer 3 longer than the inner, lanceolate, 4.9–5.1 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, entire at margins; inner lanceolate, 3.8–4 × 0.6–0.9 mm, acute apex, cuneate at base, glabrous, entire at margins. Stamens 6; filaments 0.8–1.2 mm long; anthers 0.5–0.8 mm, brown. Ovary trigonous, oblong, *c.* 3 × 1 mm, glabrous; style distinct; stigma *c.* 0.5 mm long. Capsules oblong, trigonous, 3.2–3.5 × 1–1.1 mm, obtuse at apex, sub-rounded at base, glabrous. Seeds numerous, elliptic, *c.* 0.4 × 0.2 mm, reticulate, brown.

Distribution: Temperate and Subtropics to Tropical mountains (POWO, 2023); *Habitat*: Wet, open areas; *Fl. & Ft.*: November-March.

Specimens examined: Anamudi National Park, 25.01.2018, *Dani Francis & Santhosh Nampy* 158282; way to Anamudi base camp, 10.12.2019, *Dani Francis & Santhosh Nampy* 164680; on the way to 8th plot, Silent valley, Munnar, 20. 11.2018, *Dani Francis & Santhosh Nampy* 167712 (CALI); Kanthallur, 30.03.1978, *Nambiar* 00286 (KFRI).

Notes: *Juncus bufonius,* commonly known as 'toad rush', thrives in moist and muddy areas, often in wetlands and riparian areas and considered as a weed in many areas (Balslev, 1996).

Juncus effusus L., Sp. Pl. 1: 326. 1753; Hook.f., Fl. Brit. India 6: 392. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1553. 1931; K.M.Matthew, Illustr. Fl. Palni Hills 756. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 503. 2004.

Perennial herbs. Rhizomes creeping. Culms tufted, erect, slender, terete, up to 80 cm long, glabrous. Leaves reduced to sheath; sheaths rounded, clasping around the culm, 1.5–8 cm long, reddish green, with a caducous awn, glabrous. Cymes pseudo lateral, *c.* 2 cm long, solitary, green. Flowers many, *c.* 2 mm long, glabrous; pedicels 2–5 mm long, sessile at forks. Bracts ovate, 1.8–2 × 0.8–1 mm, acute at apex, truncate base, glabrous, 1-nerved; bracteoles 2, broadly ovate, 0.8–1 × 0. 1–0.3 mm, obtuse at apex, truncate at base, glabrous, 1-nerved. Tepals 6 in two

whorls, outer 3, longer than the inner, lanceolate, 1.8–2 × 0.3–0.5 mm, acute at apex, sub-truncate at base, glabrous, entire at margins, hyaline, green; inner 3, lanceolate, 1.6–1.8 × 0.1–0.2 mm, acute at apex, cuneate at base, glabrous, entire at margins, hyaline, green. Stamens 3, *c.* 1.1 mm long; filaments *c.* 0.7 mm long; anthers 0.3–0.4 mm long, brown. Ovary trigonous, obovoid, *c.* 0.8 mm long, glabrous; style distinct, *c.* 0.1 mm long; stigma trifid, *c.* 0.5 mm long. Capsules obovoid, trigonous, *c.* 3 × 2 mm, acute at apex, glabrous. Seeds numerous, oblong, *c.* 0.7 × 0.3 mm, brown.

Distribution: Temperate northern hemisphere to western South America, Rwanda to South Africa and West Indian Ocean (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: November-May.

Specimens examined: Eravikulam, 02.05.2017, *Dani Francis & Santhosh Nampy* 152133 (CALI); Lakshmi estate, Munnar, 12.09.1968, *D.B. Deb* 30763; Munnar, 16.10.1963, *K.M. Sebastine* 17579 (MH); Nyamakkad, 8th mile, 24.01.2017, *Dani Francis & Santhosh Nampy* 158170; Pambadum shola National Park, 20.12.2018, *Dani Francis & Santhosh Nampy* 167866 (CALI); Rajamala, 26.12.1983, *A.G. Pandurangan* 62548; Upper Vaguvarai, 16.11.1965, *B.V. Shetty* 26446-B; *Ibid*., 25.04.1966, *B.V. Shetty* 27385 (MH); Vellimala, 20.05.1995, *Jomy Augustine* 15336 (CALI).

Notes: This species is closely allied to *J. inflexus* L., in its perennial habit and pseudo lateral inflorescence but can be differentiated by the number of stamens (3 *vs.* 6) and nature of cymes (dense *vs.* lax) (Backer, 1948).

Juncus prismatocarpus subsp. **leschenaultii** (J.Gay ex Laharpe) Kirschner, Preslia 74: 249. 2002. *Juncus prismatocarpus sensu* Hook.f., Fl. Brit. India 6: 395. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1553. 1931 *non* R.Br., 1810.

Annual herbs. Culms tufted, erect, slender, terete, 15–35 cm long, glabrous. Leaves radical and cauline, terete, septate, acute at apex, base clasped to the stem, 3–12 cm long, glabrous, green. Leaf sheaths linear, 3–7 cm long, with broad margins, membranous, green; auricles 0.2–0.5 mm long. Cymes terminal, corymbose, 5–10 cm long, reddish green. Flowers 2-many, in a capitate cluster, 3–4.5 mm long, glabrous; sub-sessile or with a 0.2–3 mm long pedicel. Bracts ovate-lanceolate, 3–

5 × 1–2 mm, acuminate at apex, truncate at base, glabrous, 7-nerved; bracteoles ovate, 1.8–2 × 0.8–1 mm, acuminate at apex, truncate at base, glabrous, 3-nerved. Tepals 6 in two whorls, outer 3, longer than the inner, lanceolate, 3–3.1 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, entire at margins, slightly involute; inner 3, lanceolate, 2.8–3 × 0.1–0.2 mm, acute at apex, cuneate at base, glabrous, entire at margins. Stamens 3, *c.* 1 mm long; filaments *c.* 0.8 mm long; anthers 0.2–0.3 mm long, brown. Ovary trigonous, elliptic, *c.* 0.8 mm long, glabrous; style distinct, *c.* 0.1 mm long; stigma trifid, *c.* 0.5 mm long. Capsules oblong, *c.* 4 × 1 mm, narrowly prismatic, trigonous, acute at apex, glabrous, rostrum *c.* 0.3 mm long. Seeds numerous, elliptic, *c.* 0.7 × 0.3 mm, striate, apiculate at apex, obtuse at base, brown.

Distribution: Kamchatka to Tropical Asia (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: November-April.

Specimens examined: Anamudi shola National park, 05.04.2017, *Dani Francis & Santhosh Nampy* 152101 (CALI); Eravikulam, 16.04.1980, *s.coll.* 118 (KFRI); Kattappana, field near Government College, 16.03.2018, *Dani Francis & Santhosh Nampy* 158379; Mathikettan shoal National Park, Sivanpara, 23.08.2014, *Syam Radh S.* 143507; Melmanalar, 15.04.1995, *Jomy Augustine* 15027 (CALI); Meenmutty, 18.02.1982, *C.N. Mohanan* 73333 (MH); Mesthirikettu, Eravikulam National Park, 30.12.2017, *Dani Francis & Santhosh Nampy* 158084 (CALI); Munnar, 16.10.1963, *K.M. Sebastine* 17580 (MH); Near Subranshed, Pettimudi, 30.12.2019, *Dani Francis & Santhosh Nampy* 170069 (CALI); Old Devikulam, 14.06.1963, *K.M. Sebastine* 16463; Poosanampara, Eravikulam, 19.10.1989, *P. Bhargavan* 91829 (MH); Thannikkudy, Periyar Tiger Reserve, 11.03.1995, *N. Sasidharan & Jomy Augustine* 14837 (KFRI); Upper Vaguvarai, 16.11.1965, *B.V. Shetty* 26446-A; Uppupara, 26.09.1972, *B.D. Sharma* 41693 (MH); Valara-Adimali, *Dani Francis & Santhosh Nampy* 173314 (CALI).

Notes: *Juncus prismatocarpus* ssp. *leschenaultii* can be differentiated from ssp. *prismatocarpus* R.Br. by its narrowly prismatic-trigonous to almost cylindric capsules, gradually tapering apex with *c.* 0.3 mm long rostrum and the distal broad margins of the sheath (Snogerup *et al.*, 2002).

ARECACEAE Bercht. & J.Presl,

Prir. Rostlin 266. 1820, *nom. cons.*

Stems solitary or clustered, short, subterranean, erect or climbing. Leaves pinnate, palmate, or costa palmate, spirally or rarely distichously arranged, sometimes spiny; sheaths usually open, sometimes closed; petioles short or absent, if present short or long, smooth, spiny; rachis short to elongate, absent in palmate leaves, sometimes extended into cirrus; pinnae in pinnate leaves either regularly or irregularly arranged along rachis, spreading in 1 or several planes, variously shaped, mostly reduplicate, rarely induplicate, sometimes jagged or lobed at apices; segments in palmate leaves variously arranged, single or multi-fold, split to varying degrees, mostly induplicate, rarely reduplicate. Plants monoecious, sometimes dioecious, pleonanthic or less often semelparous. Inflorescences born among or below leaves, solitary or rarely multiple at each node; peduncle bearing a prophyll, usually 1 or more peduncular bracts; rachillae 1 to many, bearing flowers, often solitary, paired, in three or more; flowers usually with 3 sepals, 3 petals, 6 stamens, 3 carpels. Fruits variously shaped, sometimes covered with overlapping scales.

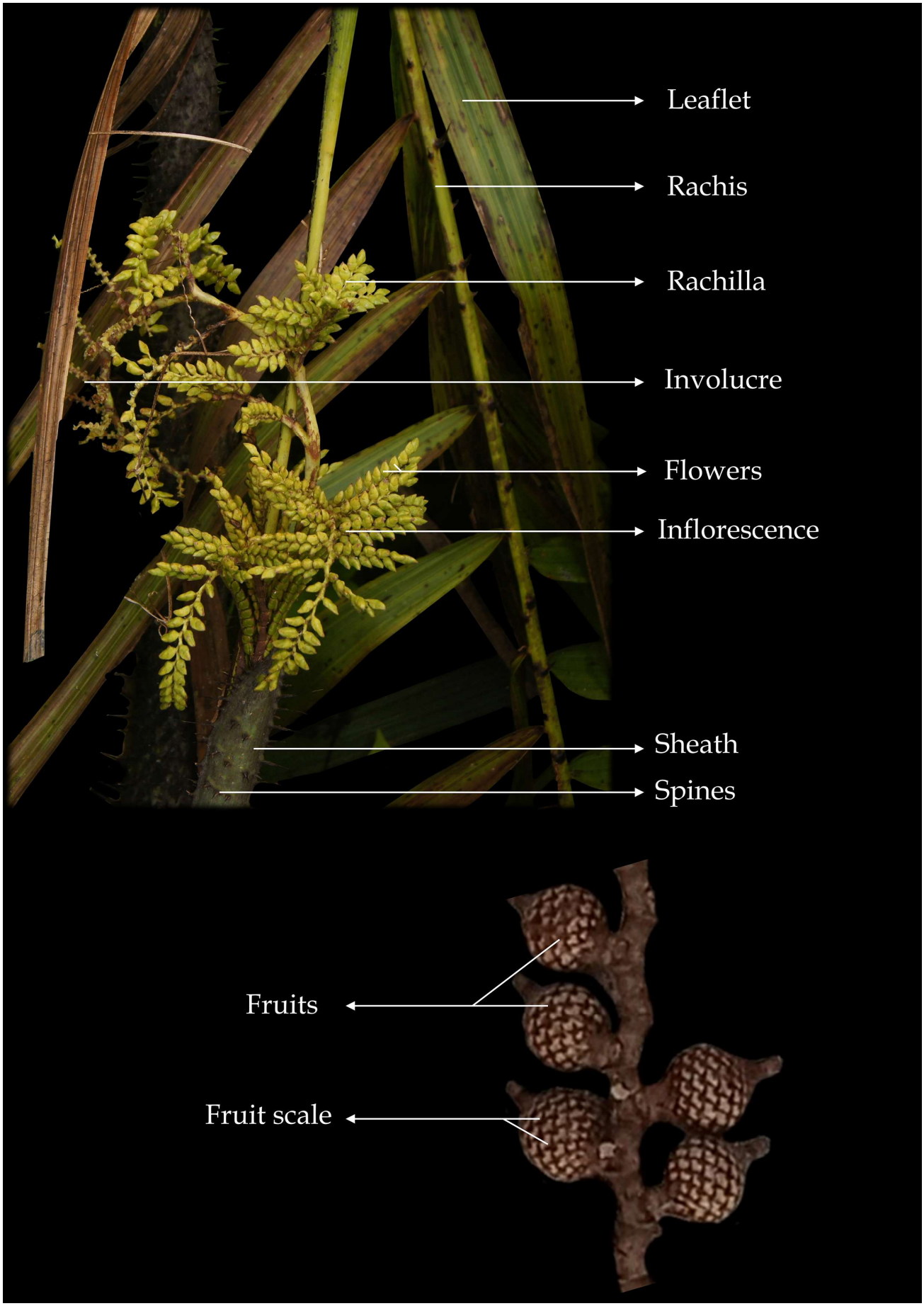
The 'palm family' comprises 180 genera and about 2500 species worldwide (POWO, 2023), with a variety of growth forms such as shrubs, lianas, and trees. Palms are commonly distributed in the Tropics and Subtropics, which exhibit a unique and complex pattern of species distribution (Hameed *et al.*, 2022). They are considered to be the most economically important plants, second only to the grasses, and are used for food, medicine, household materials, furniture, and other purposes (Mehmud & Roy, 2021). The family is represented in India by 22 genera and 105 species (Renuka & Sreekumar, 2012). Six genera and 12 species occur in the study area.

Key to the genera

1. Monocarpic palms; leaves palmate …….. *Corypha*

1. Polycarpic palms; leaves pinnate, bipinnate or simple …….. 2

2. Climbing shrubs; fruits scaly…….. *Calamus*


Leaflet
Rachis
Rachilla
Involucre
Flowers
Inflorescence
Sheath
Spines
Fruits
Fruit scale

2. Erect trees or shrubs; fruits not scaly …… 3

3. Leaflets transformed in to spines; inflorescence in the caudex …… *Phoenix*

3. Leaflets not transformed in to spines; inflorescence below the caudex …… 4

4. Leaves pinnate; flowers bisexual …… 5

4. Leaves bipinnate; flowers unisexual …… *Arenga*

5. Leaflets linear-lanceolate; inflorescence with male flowers above and female flowers below; stamens 6 …… *Bentinckia*

5. Leaflets cuneate or fan-shaped; inflorescence with two lateral male flowers and mid female flower; stamens numerous …… *Caryota*

Arenga Labill.,

Bull. Sci. Soc. Philom. Paris 2: 162. 1800.

Arenga wightii Griff., Culcutta J. Nat. Hist. 5: 475. 1845; Hook.f., Fl. Brit. India 6: 422. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1588. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 504. 2004.

Monoecious, cluster forming palms. Stems 1–9 m tall, covered with persistent leaf sheaths, caudex 10–15 m across. Leaves pinnatisect, 4–8.5 m long; leaflets alternate, linear-ensiform, to 100–105 × 4–5 cm, praemorse at apex, 2 auricled at base, distantly toothed in the upper part, glaucous below; auricles unequal; petiole to 3 m long. Spadices 1–1.2 m long, decurved, pendulous, with numerous drooping branches, *c.* 60 cm long, basipetal. Male flowers in pairs; sepals orbicular, imbricate; petals 3, connate at base, valvate. Stamens numerous, free. Female flowers solitary; sepals 3, globose, imbricate; petals 3, connate at base, valvate; Ovary sub-globose, 3-locular; ovule one in each locule; stigma conic. Infructescence to 1.5 m long, fruits many, globose. Seeds 3.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: May to September.

Specimen examined: Panamkutty, 04.05.1984, *C.N. Mohanan* 81778 (MH).

Bentinckia Berry ex Roxb.,

Fl. Ind. ed. 3: 621. 1832.

Bentinckia condapanna Berry ex Roxb., Fl. Ind. ed. 1832. 3: 621. 1832; Hook.f., Fl. Brit. India 6: 418. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1555. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 504. 2004.

Monoecious palms, *c.* 25 m tall. Stems solitary, slender, annulate, smooth. Leaves pinnately compound, 90–150 cm long; leaflets opposite, linear-lanceolate, 60–75 × 2.5–3.7 cm, acuminate at apex, truncate at base, glabrous, green; petioles 25–55 cm long; sheaths rounded, clasping the stem. Spadix axillary, branched, produced below the caudex, purple; spathes many, widely elliptic, obtuse at apex, glabrous. Flowers minute, sunken in spirally arranged pits in branches; male flowers above, bisexual below. Male flowers glumaceous. Perianth 6, biseriate, fused at base, outer orbicular, inner ovate. Stamens 6; pistillode conical. Female flowers ovoid, larger, opening after falling the male flowers; staminodes 6. Ovary 3-locular, 1-ovuled. Fruits sub-globose, 1.2–1.5 × 0.5–1 cm, reddish brown. Seeds solitary.

Distribution: SW. and S. India (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: Throughout the year.

Specimens examined: Uppupara, Periyar Tiger Reserve, 07.12.1993, *Jomy Augustine* 12712 (CALI); Vallakkadavu, Periyar Tiger Reserve, 19.10.1996, *Anto* 6662 (KFRI).

Notes: The genus is represented by two endemic species, *B. condapanna* and *B. nicobarica* (Kurz) Becc. The former is found on the slopes of the southern Western Ghats, while the latter is a native of the Nicobar Islands. The species has a narrow natural distribution among the evergreen forests, at an elevation of around 1000–1400 m along the steep cliffs of the hills of the Western Ghats (Abhilash & Brijesh, 2013; Gangaprasad & Mathew, 2017).

Calamus L.,

Sp. Pl. 1: 325. 1753.

Key to the species

1. Stems solitary; fruits oblong ..... *C. vattayila*

1. Stems clustered; fruits globose, sub-globose or ovate 2

2. Leaflets fascicled 3

2. Leaflets not fascicled 4

3. Ocrea present; involucrophorum shortly pedicellate ..... *C. rheedei*

3. Ocrea absent; involucrophorum sessile ..... *C. thwaitesii*

4. Sheaths with brown tomentum; fruit scales in 18 rows 5

4. Sheaths without brown tomentum; fruit scales in 17 and 23 rows 6

5. Ocrea caducous; fruits sub-globose ..... *C. hookerianus*

5. Ocrea persistent; fruits ovoid ..... *C. pseudotenuis*

6. Spines of rachis straight; inflorescence attached at the mouth of sheath; involucre cupular ..... *C. brandisii*

6. Spines of rachis hooked; inflorescence attached above the mouth of sheath; involucre disc-shaped ..... *C. gamblei*

Calamus brandisii Becc. in Hook.f., Fl. Brit. India 6: 448. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1567. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 504. 2004; Renuka, K.V.Bhat & R.C.Pandalai, Rattans India 46. 2010.

Scandent shrubs. Stems slender, armed with spines. Leaves pinnate, ecirrate; sheaths minute, bristle-like, spiny, mouth with longer spines, *c.* 4 cm long, green; knee present; ocrea absent; petioles 20–60 cm long, spiny, spines interspersed with smaller spines; rachis armed at each node; arms 1–2 cm long, stout, solitary, straight; leaflets lanceolate, 30–55 × 2–2.5 cm, acuminate at apex, sessile, distantly spaced spines on margins, glabrous, green. Male and female inflorescence carries 3 partial inflorescences, attached at the mouth of sheath, slender. Primary sheath tightly sheathing basally, splits open distally, spiny. Secondary sheath narrowed

at base, prickly. Flowers unisexual, small. Rachilla 5–8 pairs, distichous; involucrophorum not stalked; involucre cupular. Fruits ovoid; scales 17 vertical rows, slightly channelled along the middle, brown with dark brown border; fruiting perianth explanate.

Distribution: SW. and S. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: October-May.

Specimens examined: Chokkampetty, Periyar Tiger Reserve, 26.12.1994, *N. Sasidharan & Jomy Augustine* 14466; Mankulam, 09.12.2003*, V.B. Sreekumar* 24260 (KFRI); Melmala, 03.01.1995, *Jomy Augustine* 14466 (CALI).

Calamus gamblei Becc., in Hook.f., Fl. Brit. India 6: 453. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1568. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 504. 2004; Renuka, K.V.Bhat & R.C.Pandalai, Rattans India 64. 2010.

Climbing canes. Stems covered with persistent leaf sheaths, armed with spines. Leaves pinnate, ecirrate, flagellate; sheaths armed with spines, green; spines 0.5–2 cm long, horizontal, bulbous at base, tip slightly pointing upwards; knee present; ocrea papery; petioles 20–25 cm long, spiny; rachis armed with hooked spines; leaflets lanceolate, 35–45 × 2–2.5 cm, acuminate at apex, sessile, veins ciliate, armed at tip with short bristles, green. Inflorescence flagellate; partial inflorescence 5–6, arising above the mouth of sheath. Male inflorescence branched; primary sheath tightly sheathing, distally produced into a lanceolate point, spiny; secondary sheaths tight, narrow at base, expanded distally; rachilla *c.* 2 cm long. Female inflorescence branched, primary sheath tight, prickly; secondary sheaths *c.* 2 cm long, cylindrical at base, slightly expanded distally; rachilla 6–8 cm long. Involucrophorum pedicellate; involucre disc-shaped. Flowers unisexual, small. Fruits globose, 1.5–2 × 1.5–2 cm, short stalked; scales in 23 rows, deeply channelled, yellow.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: December-April.

Specimens examined: Chokkampetty, Periyar Tiger Reserve, 04.03.1996, *N. Sasidharan & Jomy Augustine* 17767; Eravikulam, 12.02.1985, *C. Renuka* 3444; Mankulam, *s.d., V.B. Sreekumar* 24259 (KFRI); Old Devikulam, 25.01.1964, *K.M.*

Sebastine 18474 (MH); Pannithavarna chola, Munnar, 28.12.1984, *C. Renuka* 3401; Peerumedu, *s.d., V.B. Sreekumar* 22660 (KFRI); Upper Vaguvarai, 25.04.1966, *B.V. Shetty* 27375 (MH); Vellimala, 16.12.1994, *Jomy Augustine* 14304 (CALI).

Calamus hookerianus Becc., Ann. Roy. Bot. Gard. 11(1): 226. 1908; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1568. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 505. 2004; Renuka, K.V.Bhat & R.C.Pandalai, Rattans India 72. 2010.

Climbing shrubs. Stems slender, clustering with leaf sheaths. Leaves pinnate, ecirrate, flagellate; sheaths densely armed, brownish green; spines triangular, 2–2.5 cm long, interspersed with numerous smaller spines and brown tomentum, long papery spines at the mouth; knee present or inconspicuous; ocrea caducous; petioles 50–60 cm long, spiny, spines triangular, brown-black; rachis with single row of spines, straight; leaflets linear, 10–30 × 0.5–1.5 cm, acuminate at apex, sessile, ciliate at veins, short bristly at tips. Inflorescence long; primary sheath closely sheathing, small spiny; partial inflorescence 60–70 cm long; male branching in to 3 orders; secondary sheath closely sheathing, narrow at base, expanded in to a cup at apex, armed with one or rows of small spines at the region of expansion; rachilla *c.* 1 cm long; female branch to 2 orders; rachilla *c.* 15 cm long; involucrophorum sessile; involucre cup-shaped. Flowers unisexual, small. Fruits sub- globose, 0.8–1.3 × 0.3–0.8 cm, scales in 18 rows, yellowish brown with dark brown border. Seeds sub-globose.

Distribution: S. India (POWO, 2023); *Habitat*: Evergreen and semi evergreen Forests; *Fl. & Ft.*: September-April.

Specimens examined: Ezhuthupara, Mankulam, 05.12.2018, *Dani Francis & Santhosh Nampy* 164878; Kozhiyalakkudi, 18.09.2018, *Dani Francis & Santhosh Nampy* 161968; Painav, 04.04.2018, *Dani Francis & Santhosh Nampy* 158469; Sabarimala, 03.02.1994, *Jomy Augustine* 13157; Uppupara, 20.03.1994, *Jomy Augustine* 13481 (CALI).

Calamus pseudotenuis Becc., in Hook.f., Fl. Brit. India 6: 445. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1567. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 505. 2004; Renuka, K.V.Bhat & R.C.Pandalai, Rattans India 116. 2010.

Climbing shrubs. Stems slender, smooth, clustering with leaf sheaths. Leaves pinnate, ecirrate, flagellate; sheaths spiny, yellowish green; spines needle-like, 3–3.5 cm long, pointing in different directions, yellow, mingled with small spines, brown tomentum between spines, 3–4 longer spines at the mouth; knee present or absent; ocrea present; petioles 16–22 cm long, spines *c.* 3 cm long, yellow; rachis armed on lower part, arms straight or clawed; leaflets linear-lanceolate, 25–45 × 2.5–3 cm, acuminate at apex, sessile, sparsely ciliate at veins abaxially, green. Male inflorescence branching to 3 orders; primary sheath tightly sheathing, sometimes split open at mouth, small spiny; partial inflorescence numerous; secondary sheath narrow towards base, expanding distally; rachilla *c.* 1 cm long. Female inflorescence decompound, branching to 2-orders; partial inflorescence attached at mouth of respective bracts; primary sheath tightly sheathing, splitting open at mouth, long spiny; rachilla *c.* 8 cm long; secondary sheath narrow at base, expanding upwards, minute spiny; involucrophorum very short, involucre shallowly cupular. Flowers unisexual, small. Fruits ovoid, *c.* 1 × 0.5 cm, scales in 18 rows, greenish yellow with a dark brown border.

Distribution: SW. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: October-April.

Specimens examined: Fourth mile, Periyar Tiger Reserve, 22.03.1994, *N. Sasidharan & Jomy Augustine* 13481; Karadikkavala, Periyar Tiger Reserve, 23.03.1990, *C. Renuka* 6614; Kozhikkanam, Peerumedu, 24.11.1982, *Nambiar & C. Renuka* 2620 (KFRI); Melmala, 03.01.1995, *Jomy Augustine* 14440 (CALI); Vazhathope, 18.02.1982, *V.S. Raju* 71257 (MH); Viripara, Mankulam, 15.03.1988, *C. Renuka* 4053; Thalavanmedu, Thannikkudy, Thekkady, *C. Renuka* 6610 (KFRI).

Calamus rheedei Griff., Calcutta J. Nat. Hist. 5: 73. 1845; Renuka, K.V.Bhat & R.C.Pandalai, Rattans India 119. 2010. *C. travancoricus* Bedd. ex Hook.f., Fl. Brit. India 6: 452. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1567. 1931; Sasidh., Fl. Pl. Kerala 506. 2004.

Climbing canes. Stems covered with persistent leaf sheaths, armed with spines. Leaves pinnate, ecirrate; sheaths spiny, spines *c.* 5 mm long, straight; knee absent; ocrea distinct, thin, bristly at upper margins; petioles spiny along margins; rachis armed with claws; leaflets linear-lanceolate, clustered, in opposite groups of 2–5,

deflected from rachis in one plane, not pointed to different directions, narrowly oblanceolate, 18–40 × 10–15 cm, acuminate at apex, sessile, ciliate along veins, green. Inflorescence flagelliform, slender; primary sheath longer than partial inflorescence, enclosing the fertile part until splitting longitudinally. Male rachilla 7–8 cm long, delicate, 7–8-distichous flowered. Female partial inflorescence 7–10 cm long, shorter than bracts; rachilla simple, zig-zag, 3–4-flowered; involucrophorum shortly pedicellate. Flowers unisexual, small. Fruits globose, 8–10 mm long, scales 24 rows, yellow with deep brown margins, faintly channelled at middle.

Distribution: SW. India (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: October-May.

Specimen examined: Mathikettan Shola National Park, Sivanpara, 20.12.2017, *Syam Radh S. & Santhosh Nampy* 167338 (CALI).

Calamus thwaitesii Becc., in Hook.f., Fl. Brit. India 6: 441. 1892; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 505. 2004; Renuka, K.V.Bhat & R.C.Pandalai, Rattans India 133. 2010. *C. thwaitesii* var. *canaranus* Becc., Ann. Roy. Bot. Gard. 11(1): 71. 1908; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1567. 1931.

Climbing canes. Stems slender, clustering with leaf sheaths. Leaves pinnate, ecirrate, flagellate; sheaths spiny, yellow; spines arising from a raised rim-like surface, large and smaller spines intermingled, yellowish black; knee absent; ocrea absent; petioles and rachis spiny, yellow, spines arranged in oblique whorls, flat, black; leaflets fascicled, narrowly linear-lanceolate, 17–35 × 1.5–2 cm, acuminate at apex, sessile, ciliate along the veins and margins, bristly at the apex, green. Inflorescence clustered; primary sheath split open distally, densely spiny, spines arranged in semi-circular row, reflexed; partial inflorescence 30–70 cm long; secondary sheaths tightly sheathing. Male rachilla *c.* 8 cm long, flowers distichous. Female rachilla *c.* 15 cm long. Involucrophorum sessile; involucre cupular. Flowers unisexual, small. Fruits ovoid, 1.5–2 × 1.9–2 cm, scales 12 vertical rows, broad, median grooved, yellow with deep brown margin.

Distribution: SW. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen and semi-evergreen forests; *Fl. & Ft.*: March-January.

Specimens examined: Chenthamara kokka, Periyar Tiger Reserve, 07.04.1995, *Jomy Augustine* 15135; way to Panamkutty, 10.03.2017, *Dani Francis & Santhosh Nampy* 152060; Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164878 (CALI).

Calamus vattayila Renuka, Curr. Sci. 56: 1012. 1987; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 506. 2004; Renuka, K.V.Bhat & R.C.Pandalai, Rattans India 142. 2010.

Climbing canes. Stems solitary, *c.* 30 m long. Leaves ecirrate, *c.* 1 m long; sheaths dark green, sparingly spiny; spines *c.* 2 cm long, pointing upwards; knee conspicuous; ocrea small; flagellum with grouped recurved spines, dark green; petioles 20–25 cm long, spiny; rachis with claw like spines in 3 rows; rachis spiny; leaflets alternate, elliptic, 30–40 × 6–10 cm, acute-acuminate at apex, narrowed at base, sessile, puberulous, bristly at apex, green. Female inflorescence in heavy bunches; primary sheath flattened; biconvex, short stout spiny; partial inflorescence 20–40 cm long; secondary sheath funnel-shaped, short, stout spiny; rachilla decreasing in length distally; involucrophorum sessile; involucre cup-shaped, fruiting perianth explanate. Flowers unisexual, small. Fruits oblong, 2–2.5 × 0.8–1 cm, scales longer than broad, not channelled, chest nut brown.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen Forests; *Fl. & Ft.*: February-August.

Specimen examined: Periyar Tiger Reserve, Arjunankotta, 25.02.1994, *Jomy Augustine* 13390 (CALI).

Caryota L.,

Sp. Pl. 2: 1189. 1753.

Caryota urens L., Sp. Pl. 2: 1189. Hook.f., Fl. Brit. India 6: 422. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1560. 1931; Biodiv. Doc. Kerala-Fl. Pl. 506. 2004.

Monoecious stout palms. Stems 16–20 × 0.3–0.5 m, smooth with prominent annular leaf-scars on trunk. Leaves bipinnate, 4–6 × 3–3.6 m long; pinnae 5–7 pairs, *c.* 1.5 m long; leaflets broadly cuneate, fan-shaped, 12–20 × 7–10 cm, praemorse at apex, serrate on the apical margin, many ribbed, glabrous, green. Spadix interfoliar, shortly peduncled, much branched, pendulous, 3.5–4 m long; spathes few, 40–50 cm long. Prophyll and peduncular bracts acuminate at apex,

tubular at base. Flowers many, spirally arranged on the rachilla in triads with female flower in the middle and 2 lateral male flowers. Male flowers c. 1.5 cm long, cylindrical in bud; sepals 3, rounded, imbricate; petals 3, rounded, linear-oblong, valvate, larger than sepals. Stamens 40 or more. Female flowers sub-globose; sepals 3, rounded, imbricate; petals 3, rounded, valvate; ovary trigonous, 3-locular, 1–2 locules fertile; ovule 1-per locule; stigma sessile, 3-lobed. Fruit globose, 1.8–2 cm across, reddish; seeds 1–2, plano-convex, sub-reniform.

Distribution: SW. & S. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen Forests; *Fl. & Ft.*: January-May.

Specimen examined: Panamkutty, 04.05.1984, *C.N. Mohanan* 81781 (MH).

Corypha L.,

Sp. Pl. 2: 1187. 1753.

Corypha umbraculifera L., Sp. Pl. 2: 1187. 1753; Hook.f., Fl. Brit. India 6: 428. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1561. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 506. 2004.

Monocarpic palms; stems solitary, cylindrical, erect, 20–25 m tall, annulate, dark grey with distinct leaf scars. Leaves costa palmate, orbicular, 2.5–8 m in diam., plicate, cleft to the middle into 80–100 cm, bifid lobes, leaf base split into two halves; sheaths with a conspicuous triangular cleft below the petiole; petiole *c.* 3 m long, stout, margins armed with short compressed dark-coloured spines. Inflorescence terminal, decompound, pyramidal, *c.* 6 m long, subtended by reduced scale like leaves; primary flower branches arise horizontally from the main axis; ultimate flower branches (rachillae) 12–40 cm long, white, smooth. Flowers bisexual, arranged in clusters of 3–6 flowers, white. Calyx basally tubular, 3-lobed. Petals 3, basally imbricate. Stamens 6. Ovary 3-lobed, 3-locular. Fruits globose, 3–3.5 cm in diam., 2 abortive carpels at its base; seeds globose, smooth, hard.

Distribution: SW. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen Forests also cultivated; *Fl. & Ft.*: November-June.

Specimen examined: Panamkutty, 04.05.1984, *C.N. Mohanan* 81780 (MH).

Notes: This species, also known as the 'Talipot Palm', is native to SW. India and Sri Lanka. Its largest inflorescence is a fascinating feature and the, American botanist W.H. Hodge called it as 'nature's biggest bouquet'. This large inflorescence is made up of thousands of blooms arranged in a massive panicle. It grows in the wild or semi wild habitats in India and is rapidly approaching the threat of extinction. Habitat degradation, over exploitation, economic uses, monocarpic flowering and seed viability are some of the reason (Jacob *et al.*, 2007).

Phoenix L.,

Sp. Pl. 2: 1188. 1753.

Phoenix loureiroi var. **pedunculata** (Griff.) Govaerts, World Checkl. Palms: 171. 2005. *P. pedunculata* Griff., in Palms Brit. E. Ind. 139. 1850. *P. humilis* var. *pedunculata* (Griff.) Becc., Malesia 3: 384. 1890; Hook.f., Fl. Brit. India 6: 427. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1560. 1931. *P. loureiroi* var. *humilis* S.Barrow, Kew Bull. 53: 563. 1998; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 507. 2004.

Dioecious bushy shrubs, *c.* 1 m tall. Stems covered with persistent leaf sheaths. Leaves pinnate, in a dense caudex; lower leaflets transformed in to sharp spines; upper ones linear, folded, 20–70 × 1–2 cm long, acute and pointed at apex, sub-truncate at base, sessile, glabrous, green. Spadices axillary, branched, glabrous, produced in the caudex; spathe simple, 15–20 cm long, coriaceous, fringed at margins, glabrous. Flowers unisexual, pale green. Male spadix *c.* 40 cm long. Perianth 6, 3 + 3, outer copular; inner ovate, glabrous, yellowish green. Stamens 6; pistillode 0. Female spadix *c.* 80 cm long. Flowers globose Perianth 6, glabrous. Ovary ovoid, 3-carpellary, free, 1-ovuled; stigma sessile, uncinate; staminodes 6. Fruits oblong, 1.5–2 × 0.5–1 cm, mucronate at apex, glabrous, yellowish green. Seed 1, oblong.

Distribution: Indian Subcontinent (POWO, 2023); *Habitat*: Grass lands; *Fl. & Ft.*: January-December.

Specimens examined: Devikulam, 27.01.1964, *K.M. Sebastine* 18477 (MH); Kumarikulam, 30.12.1993, *Jomy Augustine* 13028 (CALI); Kuttiar valley, Munnar, 29.07.1982, *Nambiar & N. Sasidharan* 1866; Kuttikkanam, 21.08.2001, *V.B.*

Sreekumar 22643 (KFRI); Kuttikkanam-Peermade, 21.01.1965, *K. Vivekananthan* 22910 (MH); near Mangaladevi temple, 23.03.1990, *C. Renuka* 6615 (KFRI); Parunthanpara, 29.04.2018, *Dani Francis & Santhosh Nampy* 159241 (CALI); Peerumedu, 25.11.1982, *Nambiar & C. Renuka* 2627; *Ibid.,* 20.11.1996, *Anto* 6663; *Ibid.,* 20.08.2001, *V.B. Sreekumar & V.V. Rangan* 22642 (KFRI).

Notes: *Phoenix loureiroi* is commonly known as the 'mountain date palm' found in montane grasslands.

PANDANACEAE R.Br.,

in A.P.de Candolle, Prodr. 340. 1810, *nom. cons.*

Dioecious shrubs or small trees, sometimes scandent, often throwing out aerial roots which form struts. Leaves simple, narrow, acuminate at apex, sheathing at base, sessile, usually arranged in tristichous spirals, usually spinulose beneath margins and keels. Spadices axillary or terminal, simple or branched, clothed with leafy, sometimes coloured spathes. Flowers small, usually crowded or catkin-like; perianth usually absent. Male flowers: Stamens usually numerous; filaments free or connate; anthers erect, basifixed; pistillode 0 or minute. Female flowers: ovary 1-many celled, superior, free or connate with those of adjoining flowers; ovules solitary and sub-erect or many and parietal; style short or 0; stigma papillose; staminodes 0 or small. Fruits globose with oblong syncarp of free or connate, 1-many celled, woody or fleshy angular drupes or berries. Seeds minute, testa striate.

The 'screw pine family' represents palm like trees with long, narrow, rigid, spirally arranged pineapple like leaves and prop roots. It is botanically significant due to its pivotal role in the evolution of monocotyledons, unusual growth forms, and breeding systems (Nadaf & Zanan, 2012). There are five genera and 962 species worldwide (POWO, 2023). Three genera and 21 species are represented in India (Nadaf *et al.*, 2011). The family includes economically important species that are used as food, flavours, fibres, and ornamentals. One species is reported from the study area.

Pandanus Parkinson,

J. Voy. South Seas: 46. 1773.

Pandanus unipapillatus Dennst., Schlussel Hortus Malab. 27. 1818. *Pandanus canaranus* Warb., Pflanzenr. (Engler) Pandan. 75. 1900; C.E.C.Fisch. in Gamble, Fl. Madras 1570. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 507. 2004.

Perennial, large shrubs to small trees, up to 8 m tall. Stems more or less erect, smooth, branching towards apex, with a few prop roots at base. Leaves linear-ensiform, 1.5–2 × 0.3–0.5 m, attenuate at apex, base adnate to the stem, sessile, sharp curved prickles along the margins and midrib, glabrous, green; spines arranged in three rows along mid rib and margins, *c.* 3 mm long, 7–8 on midrib, 15–16 on margin. Male inflorescence terminal, ephemeral, less fragrant, columnar, white to cream; bracts 10–12, linear-lanceolate, prickly at margins and midrib; composite spike dense, 12–20 cm long; stamens 6–8, 5–8 mm long, anthers 3–5 mm long; androphore 7–9 mm long, stemonophore 3–6 mm long. Female inflorescence terminal, solitary, oblong, 25–30 × 18–20 cm, rounded at apex; bracts 6–8; carpels simple, compressed, attached to each other; style *c.* 1 cm long, brown; stigma on the ventral side of the style, 1–2 mm long, forked. Drupes hexagonal, pileus, rounded at apex, smooth; mesocarp fibrous; 1 seeded.

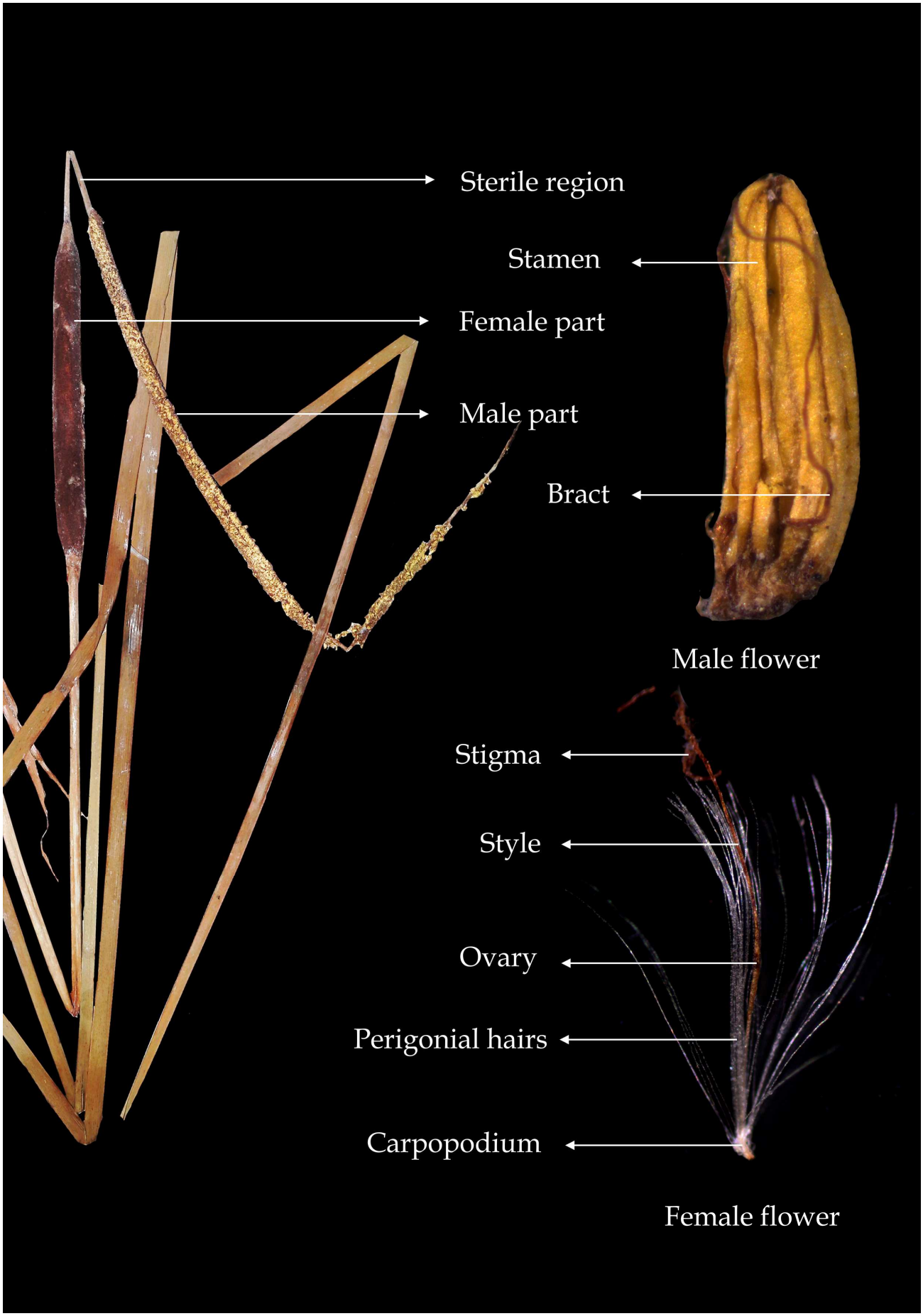
Distribution: S. India (POWO, 2023); *Habitat*: Forests and open lands; *Fl. & Ft.*: July-December.

Specimens examined: Kulamavu, 10.12.2022, *Dani Francis & Santhosh Nampy* 176136; Dam site, near Thodupuzha Range office, 10.12.2022, *Dani Francis & Santhosh Nampy* 176135 (CALI).

TYPHACEAE Juss.,

Gen. Pl. 25. 1789.

Aquatic or marshy perennial monoecious, herbs. Leaves erect or floating, linear. Racemes with numerous hypogynous flowers grouped into very dense cylindric spikes; male flowers at the apex, female flowers at the base. Male flowers: Stamens 1–7; filaments free or connate; anthers basifixed. Female flowers: ovary superior,


Sterile region
Stamen
Female part
Male part
Bract
Male flower
Stigma
Style
Ovary
Perigonial hairs
Carpopodium
Female flower

1 or 2-celled, 1-ovuled; ovules pendulous; style persistent; stigma laterally papillose. Fruits small, dry, indehiscent or dorsally dehiscent. Seeds pendulous.

The family is characterized by monoecious, perennial, herbaceous, rhizomatous, and marsh-dwelling plants with two genera and 61 species worldwide (POWO, 2023). Three species of one genus found in India (POWO, 2023). The family was considered to be monotypic earlier, but now it includes two genera, *Typha* L. and *Sparganium* L. (Thieret & Luken, 1996). One species is found in the study area.

Typha L.,

Sp. Pl. 1: 971. 1753.

Typha angustifolia L., Sp. Pl. 1: 971. 1753; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 508. 2004. *Typha angustata sensu* Hook.f., Fl. Brit. India 6: 489. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1571. 1931, *non* Bory & Chaub., 1832.

Perennial rhizomatous erect herbs, 1.5–3 m high. Rhizomes creeping. Stems unbranched, terete, green, glabrous, terminating in a spike. Leaves distichous, linear, flat; blades 18–96 × 0.4–1.2 cm, acute at apex, sheathing at base, entire at margins, glabrous; sheaths membranous, linear-oblong, auriculate at tip, mucilage glands present adaxially, brown; distal blades usually exceeding inflorescence. Spike cylindrical, compact, with staminate and pistillate flowers separately. Male part of spikes 20–26 × 0.6–0.8 cm, relatively less dense, yellow; female part of spikes 11–17 × 0.5–0.6 cm, brown; separated from male part by an axis 4–4.5 cm long, naked. Male flowers: Stamens 2–2.5 mm long; filaments 0.2–0.5 mm long; anthers 2–4, linear-oblong, 1–2.3 × 0.2– 0.3 mm, yellow, turn dark brown at apex when dry, twisted when old, dehiscing longitudinally; bracts 3–5, filiform, 2–2.5 mm long, forked at apex, white when young, turn brown when dry. Female flowers originate on peg-like 0.5–0.7 mm long compound pedicels; carpels filiform, 3–4 mm long, borne on a carpopodium; ovary fusiform, pale green, unilocular, small, with a single pendulous ovule; style slender, 0.3–0.4 mm long; stigma simple, erect, bending to form surface mat in flower; dark brown, deciduous in fruit; perigonial hairs linear, arising from carpopodium, remain below the stigma; pistillate bracts arise from carpopodium, slender, spathulate at tip, dark brown.

Follicles, fusiform, 1-seeded. Seed oblanceolate, 0.8–0.9 mm long; testa thin-walled; surface vertically ribbed with papillae.

Distribution: Temperate northern hemisphere (POWO, 2023); Habitat: Marshy fields; *Fl. & Ft.*: November-February.

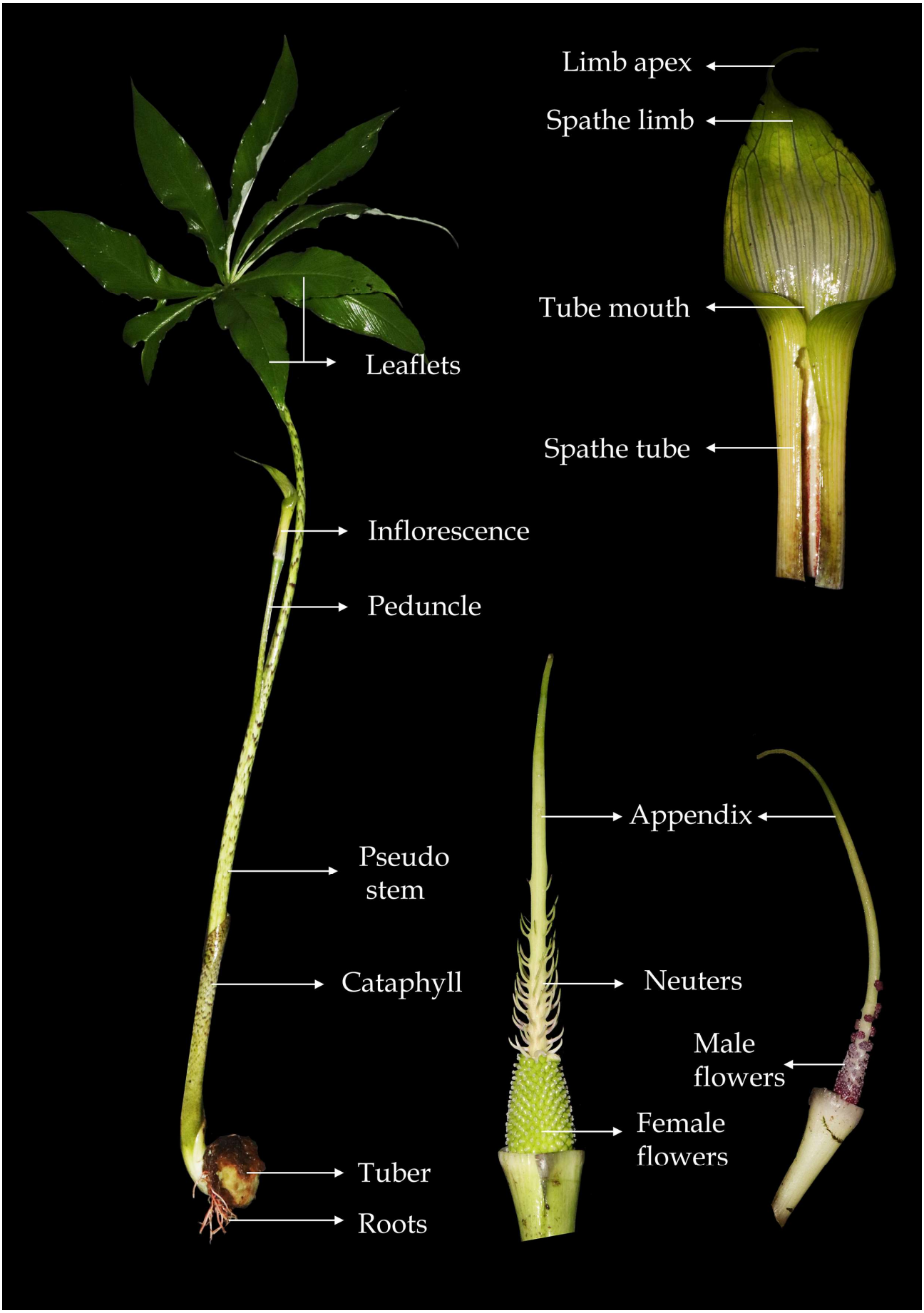
Specimen examined: Chinnar, 28.11.1979, *Nambiar* 1086 (KFRI); Way to Karimutty, near Marayur, 29.12.2017, *Dani Francis & Santhosh Nampy* 156589 (CALI).

Notes: This species is commonly called as 'cattail', a gregarious weed that grows in marshes and on the margins of shallow lotic systems particularly canals along with agricultural fields and railway tracks. It is considered to be a dominant competitor in wetlands in many areas, and its dense canopies frequently drive out competing species. *Typha angustata* Baury & Chaub. has been placed under the synonymy of *T. angustifolia* L. in many floras, but the former is actually a synonym of *T. domingensis* Pers. It differs from *T. angustifolia* in having leaf sheath taper into lamina, absence of brown spots on the leaf surface, dark brown and stumpy compound pedicels of female flowers, perigonial hairs as equal to stigma, translucent female flower bracts, laciniate staminate bracts and anthers not twisted after dehiscence (Halder *et al.*, 2014).

ARACEAE Juss.,

Gen. Pl. 23. 1789.

Herbs with tuberous or elongated rhizomes, rarely woody and climbing. Leaves solitary or few, sometimes appear after flowering, mostly radical; sometimes cauline, alternate, distichous or spirally arranged, entire or variously divided, often hastate or sagittate with a membranous sheath at base. Flowers small, arranged on a spadix enclosed in a spathe, bisexual or monoecious, males above, females below, rarely dioecious. Perianth present in bisexual flowers, absent in unisexual flowers. Stamens hypogynous, 2, 4 or 8, antitepalous; anthers dehiscing by pores or slits, free or united. Ovary superior or immersed, 1–many-locular; ovules parietal, axile or basal; style various or absent. Fruit a berry, coriaceous and rupturing. Seeds 1–many.


Limb apex
Spathe limb
Tube mouth
Spathe tube
Leaflets
Inflorescence
Peduncle
Appendix
Pseudo stem
Cataphyll
Neuters
Male flowers
Female flowers
Tuber
Roots

Araceae (arum family) is a large herbaceous family comprising of 114 genera and about 3750 known species (Christenhusz & Byng, 2016). It is most diverse in the New World tropics but is also found in the Old-World tropics and northern temperate regions. Members of the family are highly diverse in life form, leaf morphology, and inflorescence characteristics. The family is best characterized by its distinct inflorescence, a spadix with bisexual or unisexual flowers (sometimes with a sterile region) subtended by a solitary pedunculate spathe. The family is represented by *c.* 25 genera and 140 species in India (Islam & Rahman, 2017). 12 genera 25 species were documented from the study area.

Key to the genera

1. Floating herbs; leaves in a close spiral ……. *Pistia*

1. Terrestrial or marshy herbs; leaves not in close spiral ……. 2

2. Plants scandent with adventitious aerial roots ……. 3

2. Plants erect, not scandent, without aerial roots ……..4

3. Leaves perforate or more or less pinnatifid; ovules numerous ……..
…….. *Rhaphiodophora*

3. Leaves not perforate, entire; ovules solitary ……..…….. *Pothos*

4. Plants marshy; root stock creeping, not tuberous …….. 5

4. Plants terrestrial or epiphytic; root stock not creeping, tuberous …… 6

5. Leaves usually grass like; seeds numerous ……..…….. *Cryptocoryne*

5. Leaves ovate-lanceolate; seeds 1–6 ……..…….. *Lagenandra*

6. Bulbiferous shoots present ……..…….. *Remusatia*

6. Bulbiferous shoots absent ……..…….. 7

7. Leaves simple (rarely lobed), peltate or cordate ……..…… 8

7. Leaves compound, not peltate or cordate ……..…….. 11

8. Spathes divided in to tube, mouth and a limb; male flowers not embedded in the spadix …… 9

8. Spathes simple without any division; male flowers embedded in the spadix …… *Ariopsis*

9. Leaves peltate …… *Colocasia*

9. Leaves ovate-hastate or sagittate, …… 10

10. Spadix usually exserted from the spathe; ovules 1 or 2 ……*Typhonium*

10. Spadix included in the spathe; ovules many …… *Theriophonum*

11. Plants tuberous; perianth lobes 0 …… *Arisaema*

11. Plants not tuberous; perianth lobes 4 …… *Anaphyllum*

Anaphyllum Schott,

Gen. Aroid. t. 83. 1858.

Anaphyllum wightii Schott, Gen. Aroid. t. 83. 1858; Hook.f., Fl. Brit. India 6: 551. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1589. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 509. 2004. **Fig. 22D**

Tall herbs with creeping rhizomes, *c.* 2 m tall. Leaves broad, sagittate in young stage, later pinnatifid, apical leaflet sometimes 3-lobed, basal pair undivided; lobes 3–6 pairs, elliptic-oblong, 15–50 × 5–15 cm, acuminate at apex, obliquely cuneate at base, glabrous, slightly wavy at margins, green, sessile or petiolulate; petioles *c.* 130 cm long, smooth or transversely rugose, brownish green. Peduncles terete, *c.* 2 m tall, glabrous, pale brown with dark brown spots. Spadix 15–30 × 5–9 cm, glabrous, brown; spathe ovate-lanceolate, twisted or convoluted, acuminate at apex, cuneate at base, glabrous, brown; spikes short, cylindric, 4–9 × 0.5–1 cm, blunt at apex, stipitate. Flowers bisexual, 4–6 mm across, dense, brown; perianth lobes 4, obovate, 2–4 × 4–6 mm, truncate and incurved at apex, truncate at base, glabrous, brown. Stamens free, 6, 1–2 mm long; filaments broad, thick, *c.* 0.5 mm long; anthers sagittate, 1–1.5 mm long, dehisced by apical pore, brown. Ovary ovoid, 1-celled, 1-ovuled; style short; stigma sessile, disciform. Infructescence

cylindric, with many compactly arranged berries; berries obovoid, initially green and become red or orange.

Distribution: Laccadive Islands and SW. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: July-February.

Specimens examined: Anakkulam, Kozhiyalakkudi, 18.09.2018, *Dani Francis & Santhosh Nampy* 161972; Banglavuthara, Mankulam, 21.12.2019, *Dani Francis & Santhosh Nampy* 164844 (CALI); Koruthode, 08.09.1994, *N. Sasidharan & Jomy Augustine* 14115 (KFRI); Mlappara, 20.07.1993, *Jomy Agustine* 12152 (CALI).

Notes: *Anaphyllum* is a small genus with only two species worldwide, *A. wightii* and *A. beddomei* Engl., both endemic to India (Sivadasan *et al.*, 2016). *Anaphyllum wightii* differs from *A. beddomei* by its pinnatifid (*vs.* trisect) mature leaves and twisted (*vs.* not twisted) spathe. The genus is morphologically similar to *Anaphyllopsis* A.Hay. (Bown, 2000).

Ariopsis Nimmo,

in J.Graham, Cat. Pl. Bombay 252. 1839.

Ariopsis idukkiana Dani, Nampy & Vishnu *sp. nov.* **Fig. 21**

Annual, lithophytic, acaulescent, tuberous herbs, 4–25 cm long. Roots thin. Tubers depressed, discoid, 0.7–2 × 0.5–2 cm, clustered, covered with fibrous brown cataphylls. Sheaths *c.* 2 cm long, brown, enclosing the petiole and peduncle. Leaves 1 or 2, green; petiole slender, terete, 2–15 cm long, glabrous, green; lamina cordate, 3–13 × 3–16 cm, obtuse-rounded at apex with mucronate tip, rounded-reniform at base, glabrous, green adaxially, glaucous abaxially, entire at margin; veins 9–12, primary lateral veins palmately radiating from petiole insertion forming sub-marginal collective veins. Inflorescence 2–5; peduncles slender, erect, reflexed when fruiting, 2–8 cm long, glabrous, green; spathe cymbiform, widely ovate, 9–15 × 6–15 mm, acute at apex, cuneate at base, glabrous, pale green-cream coloured, opening wide at anthesis and exposing the spadix; spadix shorter than the spathe, 0.2-–1 × *c.* 0.3 cm; female flowers 4–8 basally, secund, 4

mm long, dorsally adnate to the spathe, pale green; ovary ovate, 1–2 × 0.5–0.9 mm, oblique at base, green; stigma sessile, stellar, 3–5 radiate. Sterile interstice free, naked, *c.* 2 mm long, green; male flowers apically, ovate, *c.* 5 mm long, dome shaped at apex, fertile apically, curved at maturity, pale green-creamish; stamens sunken inside the holes on spadix; anthers connate in groups of 3, each 2 celled, surrounding a pore in to which all open. Berries 4-–8, ovate, 2–4 mm long, secund, slightly angled, green; stigma persistent. Seeds 12–17, fusiform, 3–3.5 × 1–1.1 mm, striate.

Distribution: Known only from the type locality; *Habitat*: Open wet rocks in shady regions; *Fl. & Ft.*: June-July.

Specimen examined: Anakkulam, Mavinchuvadu way to 96, ± 371 m, N10°09.341'E076°55.371', 04.06.2022, *Vishnu Mohan, Harishma K.H. & Ashna Toms* 177104 (CALI).

Notes: *Ariopsis idukkiana* is closely allied to *A. peltata* in its habitat, habit, stamens embedded in the spadix, but differs by the acute spathe apex (*vs.* acuminate), ovate, dome shaped male spadix (*vs.* cylindric, obtuse or acute-pointed), slightly angled fruit (*vs.* winged). Moreover, in *A. idukkiana* petiole is attached at or near the leaf base, whereas in *A. peltata* younger leaves have attachment just above the leaf base and mature leaves are peltate. Among the three species of *Ariopsis*, in *A. protanthera* (Engl. & K.Krause) N.E.Br. ex Govaerts & Frodin, the inflorescence arises before leaf emergence while in *A. macrosperma* N.V.Page, Ingalh. & Sardesai, the seeds are large, ovoid, and ribbed.

Conservation status: This species is known only from the type locality with about 100 mature individuals. The type locality is part of protected area and there are no threats recorded on its continued existence. I suspect the species has a wider range than is presently recorded. Hence the species is provisionally categorized as Data Deficient (DD) based on the IUCN Categories and Criteria (IUCN 2022).

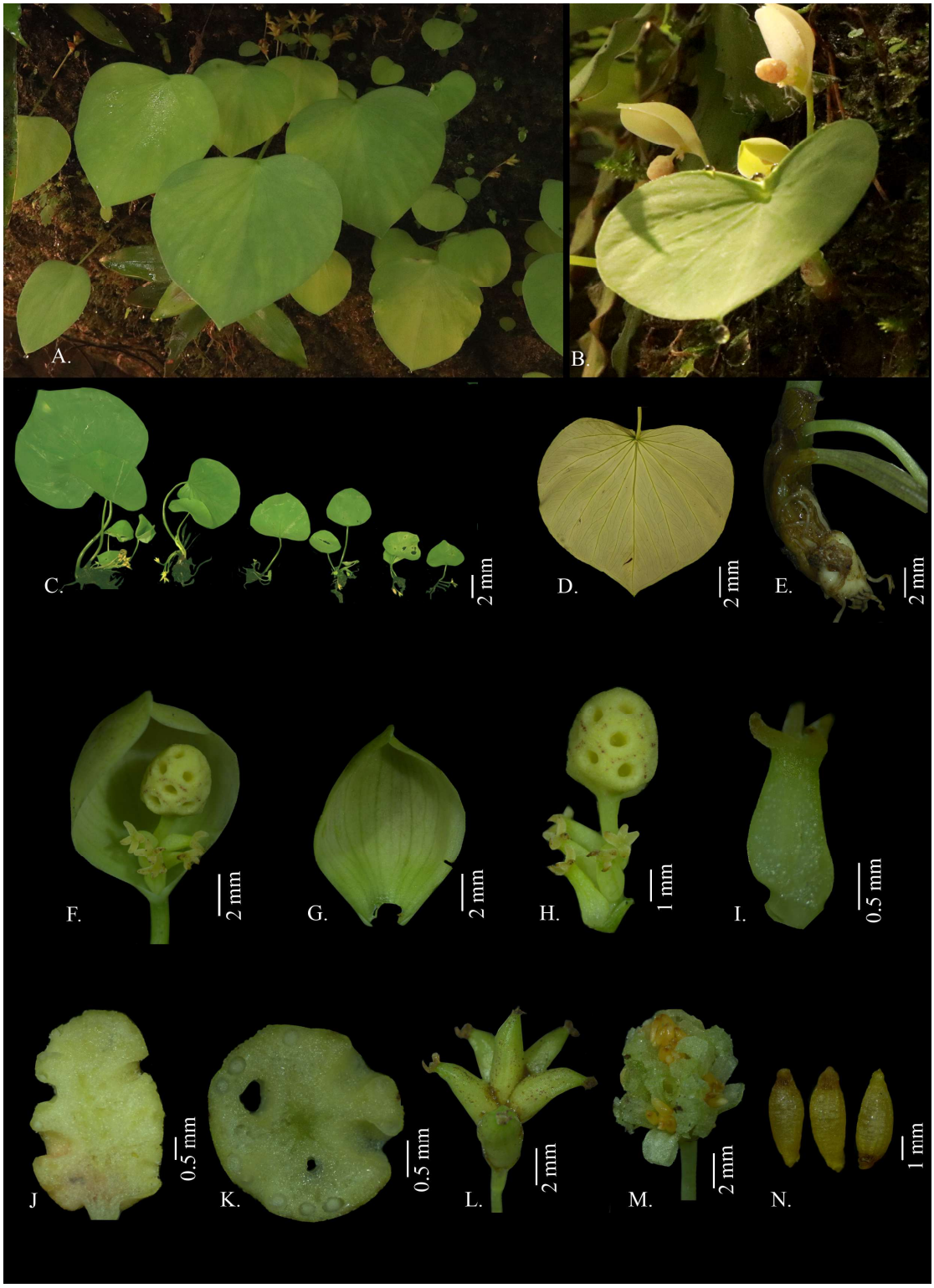


Fig. 21. *Ariopsis idukkiana sp. nov.*: **A & B.** Habitat; **C.** Habit; **D.** Abaxial surface of leaf showing veins and attachment of petiole; **E.** Discoid tuber with initiation of leaf and inflorescence; **F.** Inflorescence with spathe and spadix; **G.** Spathe; **H.** Spadix; **I.** Female flower showing ovary and stigma; **J. & K.** T.S and C.S of male spadix showing anthers; **L.** Infructescence; **M.** Dehisced fruits; **N.** Seeds.

Arisaema Mart.,

Flora 14(2): 459. 1831.

Key to the species

1. Leaves 2 2

1. Leaf solitary 3

2. Peduncles and petioles not mottled; leaves emerged before inflorescence, palmate or digitate ..... *A. jacquemontii*

2. Peduncles and petioles mottled; leaves emerged after the inflorescence or together, pedatisect ..... *A. tortuosum*

3. Spathe limbs ending in a tail 4

3. Spathe limbs without a tail 7

4. Leaves emerging after inflorescence; limbs ovate or ovate-lanceolate 5

4. Leaves unfolds with emergence of inflorescence; limbs cucullate 6

5. Spathes 5–10 cm long; female spadix 6–7 cm long; appendix fusiform ..... *A. barnesii*

5. Spathes 12–25 cm long; female spadix 10–12 cm long; appendix cylindrical ..... *A. peltatum*

6. Limb apex curved like a parrot beak; appendix slightly shorter than tube ..... *A. psittacus*

6. Limb apex ending in an ovate hanging lobe with short tail; appendix exserted from the tube ..... *A. sarracenioides*

7. Anthers dehisced by an apical slit ..... *A. madhuanum*

7. Anthers dehisced by an apical pore 8

8. Leaflets oblong-lanceolate; limbs triangular ..... *A. attenuatum*

8. Leaflets elliptic-obovate; limbs ovate-lanceolate ..... *A. leschenaultii*

Arisaema attenuatum E.Barnes & C.E.C.Fisch., Bull. Misc. Inform. Kew 1936(4): 275. 1936; Hook.f., Fl. Brit. India 6: 504. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1585. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 510. 2004; Manudev *et al.*, Rheedea 29(2): 124. 2019.

Perennial succulent, dioecious herbs. Corms tuberous, sub-globose, smooth or wrinkled; roots arising from the upper side of the corm. Pseudostems 25–30 cm long, mottled with brownish-purple patches. Cataphylls 3–4, acute or obtuse at apex, slightly keeled towards tip, mucronate. Leaf solitary, radiatisect; petiole slender, *c.* 60 cm long, light green mottled with brownish-purple patches; leaflets 5–7, oblong-lanceolate, 10–20 × 3–5 cm, acuminate at apex, sessile, undulate at margin, green. Spadix held below the leaf; peduncle slender, 30–32 cm long, dark purple or greenish white. Spathes 6–10 cm long; tube cylindrical, slightly funnel shaped towards mouth, 6–6.5 × 1–1.5 cm, white or greenish white basally, green distally with purplish striations, margin of mouth revolute; limb triangular, 2–4 × 1.5–2.5 cm, narrowly acuminate-tapering towards apex, green with a large roundish white patch at base with radiating stellate arms. Female spadix: sessile, 8–10 cm long, exceeding the tube and arching forward; fertile region 2–2.5 cm long; pistils many, crowded, sub-globose, sessile, green; ovules 2 or 3; style 0; stigma papillate, stellate; neuters subulate, few, 2–3 mm long, upcurved; appendix slender, tapering distally, green or purplish yellow towards base. Male spadix: sessile, slender, similar to female, 5–8 cm long; fertile region 2–3 cm long; flowers scattered over or crowded at base, 2–4-androus; anthers sessile, dehisced by an apical pore; neuters usually absent, rarely 1 or 2 present. Fruiting spike cylindrical, berries globose.

Distribution: India (POWO, 2023); *Habitat*: Grasslands and forests; *Fl. & Ft.*: May-July.

Specimens examined: Devikulam, 27.07.1982, *N. Sasidharan* 4173, 4178 (KFRI); Nallathanni Kallar, 10.06.2018, *Dani Francis & Santhosh Nampy* 159312; *Ibid.*, 10.06.2018, *Dani Francis & Santhosh Nampy* 159313; Nymakkad, Eravikulam National Park, 20.07.1997, *V. Abdul Jaleel & Bobby Thomas* 113; Pothamedu, Pallivasal, Munnar, 24.05.2011, *K.M. Manudev* 4440 (CALI).

Notes: This species shows similarity with *A. leschenaultii* but differs by its shorter spathe limb with basal whitish spot and slender spadix appendix. It also shows close similarity with *A. tylophorum*, in having a shorter spathe limb and a slender, filiform, tapering spadix appendix (Manudev *et al.*, 2019).

Arisaema barnesii C.E.C.Fisch., Bull. Misc. Inform. Kew 1933(7): 342. 1933; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 510. 2004; Manudev *et al.*, Rheedea 29(2): 125. 2019.

Perennial succulent dioecious herbs. Corms tuberous, sub-globose, wrinkled, cream-greenish white. Roots arising from the upper side of corm. Pseudostem 20–30 cm long, covered by cataphylls, pale green mottled with brownish purple patches. Cataphylls 3 or 4, acute-obtuse at apex. Leaf solitary, radiatisect, emerging after the inflorescence; leaflets 7–9, oblong-lanceolate, 8–20 × 2.5–4 cm, acuminate at apex, cuneate at base, undulate at margin, glabrous, green. Spadix held below the leaves; peduncles slender, 25–35 cm long, glabrous, dark purple or greenish white. Spathes 5–10 cm long; tube cylindrical, slightly funnel shaped towards mouth, 5–7 × 1–1.5 cm, purplish towards base, greenish towards distal end, with longitudinal greenish white stripes along veins; margin of mouth slightly revolute; limb ovate, 3–5 × 2–3 cm, tapering in to a filiform tail, green outside with white stripes, purple inside with white stripes at base. Female spadix: sessile, 6–7 cm long; fertile region 2–3 cm long; pistils many, crowded, sub-globose, green; style short; stigma papillate; neuters subulate, 0.5–1 cm long, scattered, upcurved, green; appendix narrowly fusiform, wide at middle, tapering in to a short tail with a warted apical knob. Male spadix: similar to female, 5–6 cm long; fertile region 2–3 cm long; flowers scattered over or crowded at base, 2–7-androus; anthers sessile, dehisced by an apical pore, purple.

Distribution: SW. India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: March-September.

Specimens examined: Melmanalar, Periyar Tiger Reserve, 15.06.1994, *N. Sasidharan & Jomy Augustine* 13821 (KFRI); Munnar, 18.05.1999, *P. Omana* 78715 (CALI).

Notes: This species is allied to *A. peltatum* and *A. leschenaultii*, but can be easily distinguished by its petiolulate leaflets and narrowly fusiform appendix widest at the middle, tapering to a short tail with a small warted apical knob and a ridged basal portion (Manudev *et al.*, 2019).

Arisaema jacquemontii Blume, Rumphia 1: 95. 1836; Hook.f., Fl. Brit. India 6: 505. 1893; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 510. 2004. *Arisaema wightii* Schott, Bonplandia 7: 26. 1859; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1585. 1931.

Perennial dioecious herbs. Corms tuberous, globose-sub-globose, smooth or wrinkled; roots arising from the upper side of the corm. Pseudostems 25–30 cm long, green-brownish green, not mottled. Cataphylls 2 or 3, obtuse-orbicular at apex. Leaves 2, palmate or digitate, emerge before the inflorescence; petiole slender, 36–45 cm long, green-brownish green, not mottled; leaflets 5–7, ovate-elliptic, 10–20 × 4–9 cm, acuminate at apex, cuneate at base, sessile, entire at margin, green. Spadix held at the level leaves; peduncle 35–40 cm long, green to brownish green, not mottled. Spathes *c.* 20 cm long, with a tail *c.* 8 cm long; tube cylindrical, funnel shaped towards mouth, 7–7.5 × 1.5–2.5 cm, green abaxially with white striped, whitish green within, margin of mouth recurved or slightly revolute; limb ovate, 12–14 × 4–4.5 cm, caudate apex, ending in a tail, *c.* 8 cm long, green out, white striped, glaucus in. Female spadix: sessile, cylindric, 15–16.5 cm long; fertile region 6.5–9 cm long at the base; pistils crowded, spindle shaped, green with white stripes; style 0; stigma sessile, discoid, surrounded by a black ring; neuters absent; appendix conical or truncate at base and gradually tapering to a blunt apex, long exerted from the tube, pale green below, brownish to purplish distally, stipitate. Male spadix: sessile, slender, similar to female, shortly stipitate; fertile region 2–3 cm long; flowers sparsely arranged, 2–4-androus; anthers dehisced by an oblong slit; neuters absent. Fruiting spike cylindrical, berries spindle shaped.

Distribution: Afghanistan to China and SW. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-November.

Specimen examined: Anamudi, 07.08.1967, *B.V. Shetty* 28332 (MH).

Arisaema leschenaultii Blume, Rumphia 1: 93. 1836; Hook.f. Fl. Brit. India 6: 504. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1585. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 510. 2004; Manudev *et al.*, Rheedea 29(2): 140. 2019. **Fig. 22A & C**

Perennial succulent dioecious herbs. Corms tuberous, depressed globose to sub-globose, 1.5–4.5 cm diam., wrinkled, creamish white. Roots arising from the upper side of corm. Pseudostem 15–54 cm long, covered by cataphylls, pale green to dark brownish green. Cataphylls 3 or 4, acute-obtuse at apex, mucronate. Leaf solitary, radiatisect, usually unfolds completely after the emergence of inflorescence; leaflets 6–11, elliptic-obovate, 4–15 × 1.5–5.5 cm, acuminate at apex, attenuate at base, entire at margin, glabrous, green. Spadix held below the leaves; peduncle 15–35 cm long, glabrous, pale green mottled with purple or brown. Spathes 8–16 cm long; tube cylindrical, slightly funnel shaped towards mouth, 3–5.5 × 1.5–2 cm, greenish white, white with longitudinal purple stripes along veins; margin of mouth revolute-auricular; limb ovate-lanceolate, 5–15 × 2–4 cm, acuminate at apex, green or greenish purple with white striations, arched over and drooping. Female spadix: sessile, 6–9 cm long; fertile region 2–3 cm long; pistils many, sessile, globose, compactly packed, green; ovules 3–5, white; style 0; stigma papillate, stellate; neuters few, subulate, 0.5–1 cm long, scattered, upcurved, green; appendix cylindric, blunt at apex, green. Male spadix: similar to female, 6–10 cm long; fertile region 2–3 cm long; flowers scattered over or crowded at base, 3–4-androus, sessile or stipitate; anthers purple, dehisced by an apical pore; neuters few or absent, subulate, green. Fruiting spike cylindrical; berries globose, compactly arranged, green, 3–5 seeded.

Distribution: W. Central and Central Himalaya, SW. India, Sri Lanka (POWO, 2023); *Habitat*: Margins of evergreen, shola forests and grasslands; *Fl. & Ft.*: April-October.

Specimens examined: Anamudi Shola National Park, 05.04.2017, *Dani Francis & Santhosh Nampy* 152102; way to Anamudi National Park, 23.06.2018, *Dani Francis & Santhosh Nampy* 159377; Chunduvarrai-Mannavan Chola, 12.04.2013, *K.M. Manudev & Santhosh Nampy* 135202; *Ibid*., 12.04.2013, *K.M. Manudev & Robi* 135204; Eravikulam National Park, Idukki, 19.07.1997, *V. Abdul Jaleel & Bobby Thomas* 109; Meesapulimala, 06.05.2019, *Dani Francis & Santhosh Nampy* 159142;

Ibid., 06.05.2019, *Dani Francis & Santhosh Nampy* 159143; *Ibid*., 06.05.2019, *Dani Francis & Santhosh Nampy* 159145; *Ibid*., 06.05.2019, *Dani Francis & Santhosh Nampy* 159146; *Ibid*., 06.05.2019, *Dani Francis & Santhosh Nampy* 159147; Munnar-Poopara road, 14 km from Munnar, 23.05.2011, *K.M. Manudev* 4430; Munnar, Naduppara Junction, 25.05.2012, *P. Anisha & K.M. Manudev* 4563; Peerumedu, 24.05.1997, *V. Abdul Jaleel & Bobby Thomas* 60; Vallakadavu, 17.11.1998, *Jomy Augustine* 17955 (CALI).

Notes: *Arisaema leschenaultii* is the most widely collected species from the study area.

Arisaema madhuanum Nampy & Manudev, Ediburgh J. Bot. 71(2): 269. 2014; Manudev *et al.*, Rheedea 29(2): 153. 2019.

Perennial, dioecious herbs. Corms tuberous, depressed globose to sub-globose, wrinkled, cream-brown. Roots arising from the upper side of corm. Pseudostem 35–50 cm long, covered by cataphylls, pale green mottled with brown. Cataphylls 3 or 4, acute-obtuse at apex. Leaf solitary, radiatisect; leaflets 7–10, sessile, obovate, 12–38 × 2.5–10 cm, acuminate at apex, cuneate at base, undulate at margin, glabrous, green. Spadix emerging after the leaves; peduncle 30–60 cm long, glabrous, pale green mottled with brown vertical streaks. Spathes 18–20 cm long; tube cylindrical, funnel shaped towards mouth, 7–9 × 1–2.5 cm, pale purple basally, green distally; margin of mouth open, wide, dilated in to a prominent auricular extension and slightly revolute; limb oblong-lanceolate, 10–11 × 2–2.5 cm, acuminate at apex with a slightly swollen tip, erect and arching forward at distal end, yellowish green. Male spadix: sessile, terete, 8–9 cm long, slender, slightly thickened at base, gradually tapering to a filiform often curved distal portion; fertile region 2–3 cm long; flowers 2–9-androus, sessile or stipitate; anthers purple, dehisced by an apical slit; neuters 8–9, subulate, curved down, purplish green. Female flowers not seen. Fruiting spike cylindrical; 4–6 cm long; berries ovoid-globose, compactly arranged, green, 2 seeded.

Distribution: India (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: July.

Specimen examined: Eravikulam National Park, 18.07.1997, *V. Abdul Jaleel & Bobby Thomas* 107 (CALI).

Notes: This species is morphologically close to *A. attenuatum* and *A. tylophorum* in having a slender almost filiform appendix, but can be differentiated in chaving a wide mouthed spathe tube and by the erect to arching limb with a narrow base (Manudev & Nampy, 2014).

Arisaema peltatum C.E.C.Fisch., Bull. Misc. Inform. Kew 1936(4): 277. 1936; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 511. 2004; Manudev *et al.*, Rheedea 29(2): 159. 2019.

Perennial succulent dioecious herbs. Corms tuberous, globose, smooth or wrinkled, stoloniferous. Pseudostem 25–50 cm long, glabrous, light green mottled with brownish streaks. Cataphylls 2 or 3, acute-obtuse at apex. Leaf solitary, radiatisect, emerging after the inflorescence; leaflets 5–10, oblong-oblanceolate, 10–20 × 2–8 cm, acuminate at apex, cuneate at base, undulate at margins, glabrous, green. Spadix not exceeding leaf; peduncle slender, 25–80 cm long, light green mottled with purple. Spathes 12–25 cm long, glossy; tube cylindric towards base, funnel shaped distally, 5–10 × 2–2.3 cm, purple to brownish towards base, green distally with white striations on veins; margin of mouth revolute; limb ovate-lanceolate, 5–15 × 3–5 cm, green with white striations, narrowly acuminate at apex tapering in to a tail, arching forward and upcurved with erect tip. Female spadix: sessile, 10–12 cm long; fertile region 3–4 cm long; pistils crowded, green; ovules up to 5, white; style 0; stigma papillate, stellate; neuters subulate, many, 0.5–1 cm long, upcurved; appendix cylindric, blunt at apex. Male spadix: sessile, slightly tapering to a blunt tip, 4–6 cm long, not exceeding tube; appendix sessile; flowers scattered, 3–4-androus; anthers dehisced by an apical pore, purple.

Distribution: India (POWO, 2023); *Habitat*: Moist deciduous forests; *Fl. & Ft.*: April-July.

Specimens examined: Anamudishola National Park, 03.04.2017, *Dani Francis & Santhosh Nampy* 152064; Eravikulam, 18.05.1999, *K. Lisha* 78622; Mankulam, Thookkupalam, 09.06.2018, *Dani Francis & Santhosh Nampy* 159303 (CALI).

Notes: This species can be differentiated from *A. leschenaultii* by its sessile, narrow leaflets glaucous underneath and strong wavy margins, hyaline to white striped, yellowish green limb tapering into a slender tail and sessile slender spadix appendix with neuters along half the length (Manudev *et al.,* 2019).

Arisaema psittacus E.Barnes, Hooker's Icon. Pl. 35: t. 3405. 1940; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 511. 2004; Manudev *et al.*, Rheedea 29(2): 161. 2019.

Perennial succulent dioecious herbs. Corms tuberous, sub-globose, wrinkled, stoloniferous, greenish yellow inside. Roots arising from the upper side of corm. Pseudostem 10–70 cm long, covered by cataphylls, pale green mottled with brownish purple patches. Cataphylls 2 or 3, obtuse-orbicular at apex. Leaf solitary, radiatisect, usually unfolds with emergence of the inflorescence; leaflets 7–13, obovate, 7–35 × 2–8 cm, acute at apex, cuneate at base, undulate at margin, glabrous, green. Spadix held below the leaves; peduncles slender, 25–35 cm long, glabrous, green. Spathes 10–25 cm long; tube funnel shaped, 3-angled, 5–9 × 1–3 cm, pale green or brownish green with white stripes along veins; margin of mouth straight or slightly recurved; limb cucullate, 8–15 × 2.5–5 cm, green or brownish green with 5 wide, translucent or white stripes, gradually acuminate apex ending in a tail, drooping downward and curved like a parrot beak. Female spadix: sessile, 8–10.5 cm long; fertile region 2–2.7 cm long; pistils many, sessile, crowded, bottle shaped, green; style short; stigma papillate, white with black neck; neuters subulate, 0.5–1 cm long, scattered, upcurved, green; appendix cylindric, slightly longer than the tube, inserted inside the spathe, greenish yellow, constricted in the middle, ending in a knobby ovoid, verruculose and yellow apex. Male spadix: similar to female, slender, 6.5–8 cm long; fertile region 2–2.5 cm long, green-yellow; flowers scattered over or crowded at base, 3–4-androus; anthers sessile, dehisced by an elliptic pore, purple. Neuters absent. Fruiting spike cylindric to conical, born on upright peduncle; berries orange-red, 3–6-seeded.

Distribution: S. India (POWO, 2023); *Habitat*: shola forests; *Fl. & Ft.*: May-September.

Specimens examined: Mannavan shola, May 1937, *E. Barnes* 1579; *Ibid.,* May 1937, *E. Barnes* 1680 (CAL).

Notes: This species is closely allied to *A. leschenaulti*, but can be differentiated by its cucullate spathes with a curved tail, dialated ovoid spadix appendix with a constriction in the middle. This species is only once collected from the Idukki district (Manudev *et al.*, 2019).

Arisaema sarracenioides E.Barnes & C.E.C.Fisch., Hooker's Icon. Pl. 34: t. 3307. 1936; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 511. 2004; Manudev *et al.*, Rheedea 29(2): 163. 2019.

Perennial succulent dioecious herbs. Corms tuberous, depressed globose, wrinkled. Roots arising from the upper side of corm. Pseudostem 15–20 cm long, covered by cataphylls, pale green to brownish green, mottled with pale brown. Cataphylls 3, acute-obtuse at apex, mucronate. Leaf solitary, radiatisect, usually unfolds completely after the emergence of inflorescence; leaflets 5–7, elliptic-obovate, 10–20 × 5–10 cm, acuminate at apex, cuneate at base, glabrous, green. Spadix held below the leaf; peduncles 20–30 cm long, pale green mottled with brown or purple. Spathes 8–10 cm long; tube cylindric, funnel shaped towards mouth, 6–8 cm long, white with longitudinal purple stripes; margin of mouth recurved; limb cucullate with a narrow opening, 6–8 cm long, white purple striped, ending in an ovate hanging lobe with a short tail. Female spadix: sessile, conical, 8–10 cm long, fertile region 2–2.5 cm long; appendix stipitate, cylindric, 8–9 cm long, exserted from spathe tube, fusiform, gradually tapering to a verrucose apex, white; neuters subulate, 0.5–1 cm long, upcurved, white; pistils crowded, sessile, globose, green; ovules 3–5; style 0; stigma papillate. Male spadix: similar to female, 8–10 cm long; flowers scattered over or crowded at base and distant above, 4–6-androus; anthers sessile, dehisced by an elliptic pore, purple; neuters absent. Fruiting spike cylindrical; berries globose, 2–4 seeded, red.

Distribution: India (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: April-October.

Specimens examined: Eravikulam, 18.05.1999, *Satheesh George* 79213; Mathikettan shola National Park, 04.10.2017, *Dani Francis & Santhosh Nampy* 151495; Mathikettan Shola National Park, Sivanpara, 23.04.2016, *Syam Radh S.* 149114 (CALI).

Notes: This species is close to *A. translucens* C.E.C.Fisch. in having cucullate spathe limb but can be easily distinguished by the presence of a terminal hanging ovate lobe at the spathe apex (Manudev *et al.*, 2019).

Arisaema tortuosum (Wall.) Schott, Melet. Bot. 1:17. 1832; Hook.f. Fl. Brit. India 6: 502. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1584. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 511. 2004. **Fig. 22B**

Perennial succulent monoecious herbs. Corms tuberous, sub-globose, smooth or wrinkled. Roots arising from the upper side of corm. Pseudostem 50–70 cm long, pale green mottled with greyish brown patches. Cataphylls 3 or 4, obtuse or acute at apex, mucronate. Leaves 2, pedatisect, emerged after the inflorescence or together; leaflets 7–11, lanceolate, 3–15 × 2–5 cm, acute-acuminate at apex, attenuate at base, entire at margins, glabrous, green. Spadix held above the leaf; peduncles slender, 50–80 cm long, dark purple or green. Spathes 9–15 × 1.5–3 cm, green; tube cylindric, slightly funnel shaped towards mouth, 4–7 cm long; margin of mouth revolute; limb ovate-lanceolate, 6–8 × 3–5 cm, acute-acuminate at apex, arching forward and drooping. Spadix sessile, andro-gynoecious, 3–5 cm long, slender, tapering distally, long exceeding the tube; fertile region 2–3 cm long; pistils many, ovoid; ovules 2–4; style short; stigma papillate, stellate. Male flowers stipitate, scattered and distant above, 2–4-androus; anthers sessile, dehisced by an apical pore, creamy white. Neuters usually absent or rarely a few; appendix sigmoid, slightly thickened at base, arching forward and turns backwards to an erect tip. Fruiting spike cylindrical, 2.5–5 cm long; berries globose, 2–4 seeded, green turns red when mature.

Distribution: Indian Subcontinent to S. Central China (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: May-September.

Specimens examined: Eravikulam, 02.05.2017, *Dani Francis & Santhosh Nampy* 152136; *Ibid*., 18.07.1997, *V. Abdul Jaleel & Bobby Thomas* 108; Kattappana, 26.09.1981, *C.N. Mohanan* 72016 (MH); Devikulam, Lockhart Gap, 25.07.2013, *K.M. Manudev* 135309; Mangaladevi hills, 15.07.2017, *Dani Francis & Santhosh Nampy* 154111; Munnar, Mattupetti, 04.05.2017, *Dani Francis & Santhosh Nampy* 152150; Meesapulimala, 06.05.2019, *Dani Francis & Santhosh Nampy* 159144 (CALI); Mlappara, 31.07.1993, *N. Sasidharan & Jomy Augustine* 12190 (KFRI);

Munnar, Poopara, near Great Escapes Resort, 23.05.2011, *K.M. Manudev* 4423; Munnar-Poopara Road, Lockhart Gap, 23.05.2011, *K.M. Manudev* 4436; Pallivasal, way to Munnar, 25.07.2013, *K.M. Manudev & Santhosh Nampy* 135304 (CALI); Uppupara, 26.09.1972, *B.D. Sharma* 41698 (MH).

Notes: This species is wide spread in the district.

Colocasia Schott,

Melet. Bot. 18. 1832, *nom. cons.*

Colocasia esculenta (L.) Schott, Melet. Bot. 18. 1832; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 512. 2004. *Arum esculentum* L., Sp. Pl. 2: 965. 1753. *Colocasia antiquorum* Schott, Melet. Bot. 1: 18. 1832; Hook.f. Fl. Brit. India 6: 523. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1580. 1931.

Tuberous, stoloniferous herbs, 30–130 cm long. Cataphylls covering the pseudostem at base. Leaves few to many, appearing with the flowers, ovate, orbicular or peltate, 15–50 × 3–30 cm, rounded or widely acute and apiculate at apex, cordate at base, undulate at margins, glabrous, green; nerves 6 pairs; petioles cylindrical, 25–120 cm long, glabrous, green or purple. Peduncles solitary or clustered, 10–25 cm long, stout. Spathes lanceolate, 15–45 cm long, acuminate at apex, constricted above the base, bright yellow out, pale yellow in; tube oblong, 4–8 cm long; limb narrowly lanceolate, acuminate at apex, 10–39 cm long, much longer than tube. Spadix cylindrical, shorter than spathe, 8–10 cm long, appendages cylindric, obtuse. Male flowers above, 5–7 cm long; stamens 6, connate in an obpyramidal synandrium, dehisced by short slits; female flowers at base, 2.5–3 cm long; ovary ovoid, 1-celled, ovules many; stigma sessile, flat. Neutral flowers many, peltate, in between male and female flowers. Berries globose. Seeds oblong.

Distribution: India to S. China and Sumatera (POWO, 2023); *Habitat*: Waterlogged areas; *Fl. & Ft.*: May-October.

Specimen examined: Vellappara, 05.08.2017, *Dani Francis & Santhosh Nampy* 154139 (CALI).

Notes: *Colocasia esculenta*, commonly known as 'Taro', has environmental, social, and medicinal applications. Corm of this species is a staple food all over the world

and is sometimes referred to as the "potato of the tropical world" (Kurniawan *et al.*, 2011; Gogoi & Borah, 2013).

Cryptocoryne Fisch. ex Wydler,

Linnaea 5(3): 428. 1830.

Key to the species

1. Limbs 1-2 times twisted; pistillate region *c.* 2.5 mm long; staminal region ellipsoid; seeds ellipsoid …….. *C. consobrina*

1. Limbs closely twisted; pistillate region 4–6 mm long; staminal region sub-cylindric; seeds sub-fusiform …….. *C. retrospiralis*

Cryptocoryne consobrina Schott, Bonplandia 5: 222. 1857; Hook.f. Fl. Brit. India 6: 493. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1575. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 512. 2004. **Fig. 22E**

Perennial herbs with creeping rhizomes. Leaves dimorphic; submerged leaves: petioles 2–5 cm long; leaf blades linear-lanceolate, 2–8 × 0.5–1 cm, acuminate at apex, attenuate at base, undulate at margins, glabrous, green; emergent leaves: petiole 5–20 cm long, glabrous; blades linear-lanceolate, 5–15 × 0.5–3 cm, acute-acuminate at apex, attenuate at base, entire at margins, glabrous, green. Inflorescence 1–8 cm long. Spathes with a slightly swollen cylindrical tube (Kettle) at base, 1.5–3 × 0.6–0.8 cm, pale purple out and deep purple in, transverse septum creamy with purple spots; upper tube terete, 3–10 cm long, slightly twisted, with a collar around mouth, pale purple; limb ovate-lanceolate, 3–5 × 0.5–1 cm, acuminate at apex, reflexed and 1–2 times twisted at tip, purple warty teeth like projection at margins, greenish brown out, creamy yellow with purple spots inside, verrucose. Spadix enclosed in tube, 1.5–2 cm long. Pistillate region towards base, conoid, *c.* 2.5 mm long; female flowers 5–6, connate in a whorl, 2–3 × 3.5–4 mm, 1-locular; stigma sessile, circular with a central depression and short papillae. Sterile interstice in the middle, 7–10 mm long, neuter flowers few, cream with purple spots. Staminate region ellipsoid, 2.5–3 mm long; male flowers numerous, stamens sessile, purple, dehisced by an apical pore. Appendix top shaped, *c.* 1 mm long, sterile. Infructescence conoid, 1–1.7 × 9–12 mm. Seeds numerous, ellipsoid.

Distribution: SW. India (POWO, 2023); *Habitat*: Near streams; *Fl. & Ft.*: December-March.

Specimen examined: Chinnar, 12.02.2021, *Dani Francis & Santhosh Nampy* 176419 (CALI).

Notes: *Cryptocoryne consobrina* resembles *C. sivadasanii* Bogner by spathe limb with a distinct collar at the base and warty within. However, it can be distinguished by the presence of leaves during flowering (*vs.* normal leaves absent during flowering) (Sunil & Sivadasan, 2009).

Cryptocoryne retrospiralis Kunth, Enum. Pl. 3: 12. 1841; Hook.f. Fl. Brit. India 6: 493. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1575. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 512. 2004.

Perennial aquatic herbs with short rhizomes. Leaves dimorphic; submerged leaves: petioles 2–5 cm long; leaf blades linear-lanceolate, 2–8 × 0.5–1 cm, acuminate at apex, attenuate at base, undulate at margins, glabrous, green; emergent leaves: petiole 5–20 cm long, glabrous; blades linear-lanceolate, 5–15 × 0.5–3 cm, acute-acuminate at apex, attenuate at base, entire at margins, glabrous, green. Inflorescence 2.5–3 cm long. Spathes with a slightly expanded tube at base, 2–2.5 × 0.7–0.8 cm, purple in, transverse septum white; upper tube narrower, terete, 10–12.5 cm long, slightly twisted, dark purple spot inside; limb linear-lanceolate, 3–4 × 0.5–1 cm, acuminate at apex, closely twisted at tip, recurved at margins, greenish brown out, dark purple spots inside, glabrous. Spadix enclosed in tube, 1.5–2 cm long. Pistillate region towards base, conoid, 4–6 mm long; female flowers 4–6, connate in a whorl, 2–3 × 3.5–4 mm, 1-locular; style short, thick, decurved; stigma orbicular. Sterile interstice in the middle, 9–10 mm long, neuter flowers few, clavate, purple. Staminate region sub-cylindric-ellipsoid, 2.5–3 mm long; male flowers numerous, stamens sessile, purple, dehisced by an apical pore. Appendix conical, sterile. Infructescence conoid. Seeds numerous, sub-fusiform, longitudinally ridged.

Distribution: India to Myanmar (POWO, 2023); *Habitat*: Banks of streams; *Fl. & Ft.*: November-March.

Specimen examined: Vallakkadavu, Periyar Tiger Reserve, 26.11.1993, *N. Sasidharan & Jomy Augustine* 12766 (KFRI).

Lagenandra Dalzell,

Hooker's J. Bot. Kew Gard. Misc. 4: 289. 1852.

Key to the species

1. Ovules 2–4; berries obovoid ……..…….…… *L. meeboldii*

1. Ovule 1; berries globose ……..…… *L. ovata*

Lagenandra meeboldii (Engl.) C.E.C.Fisch. in Gamble, Fl. Madras 3: 1576. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 513. 2004. *Cryptocoryne meeboldii* Engl., Pflanzenr., 4, 23F: 234. 1920.

Creeping herbs. Rhizomes 1.5–2.5 cm thick; roots stout, fibrous. Leaves ovate-lanceolate, 15–25 × 2–3.5 cm, acute at apex, sub-cordate at base, undulate or smooth along margins, dark green; stipules 3–5 × 1.5–2.5 cm, acute at apex, keeled. Inflorescence axillary. Spathes tubular below; limb cucullate with a slender long erect tail, dark purple with unicellular hairs outside, irregularly lamellate inside; spadix included in the basal tube, 1–1.5 cm long. Staminate flower portion *c.* 0.5 cm long, conical; staminate flowers many; stamens with tubular projections. Pistillate flowers many, arranged at the base in a sub-globose form; ovules 2–4 on a basal placenta. Berries obovoid, 3–5 mm long, dark green. Seeds 2–4 in each locule, longitudinally grooved.

Distribution: SW. India (POWO, 2023); *Habitat*: Marshy riversides in evergreen forests; *Fl. & Ft.*: January-March.

Specimen examined: Puthussery, Periyar Tiger Reserve, 27.03.1994, *N. Sasidharan & Jomy Augustine* 13511 (KFRI).

Lagenandra ovata (L.) Thwaites, Enum. Pl. Zeyl. 334. 1864; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1576. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 513. 2004. *Arum ovatum* L., Sp. Pl. 2: 967. 1753.

Creeping herbs. Rhizomes *c.* 5 cm thick; roots fibrous. Leaves ovate-lanceolate, 12–30 × 4–9.5 cm, acute at apex, obtuse at base, entire to slightly undulate along margins, glabrous, green; petioles 9–52 cm long, clasping at base. Inflorescence axillary; peduncle 10–18 cm long. Spathes broadly ellipsoid, *c.* 20 × 4 cm, caudate and twisted at apex, swollen at base, dark purplish and warted outside; spadix *c.* 4.5 cm long, included in the basal tube. Pistillate flower portion at base, *c.* 1 cm

long; naked interstice above *c.* 2.5 cm long; staminate flower portion *c.* 1 cm long. Staminate flowers numerous, crowded, oblong–elliptic; anthers 2-celled; pollen extruding through a horn like projection. Pistillate flowers numerous, spirally arranged; ovary ovoid, 1-loculed, 1-ovuled; stigma sessile, discoid. Berries globose, *c.* 4 × 3.5 cm. Seeds 1–3, longitudinally grooved.

Distribution: W. & S. India and SW. Sri Lanka (POWO, 2023); *Habitat*: Marshy areas and near streams; *Fl. & Ft.*: August-February.

Specimen examined: Periyar Tiger Reserve, Fourth mile, 14.09.1994, *N. Sasidharan & Jomy Augustine* 14156 (KFRI).

Pistia L.,

Sp. Pl. 2: 963. 1753.

Pistia stratiotes L., Sp. Pl. 2: 963. 1753; Hook.f. Fl. Brit. India 6: 497. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1573. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 513. 2004.

Aquatic free floating stoloniferous herbs. Roots fibrous, tufted. Leaves rosette, arranged spirally, obovate, 5–15 × 2–10 cm, sessile, rounded at apex, truncate at base, wavy at margins, woolly hairy, green. Inflorescence axillary, solitary, pistillate flowers at base, staminate flowers at apex. Spathes 6–10 mm long; tube short, 2–4 mm long; limb ovate, 3–7 × 2.5–4 mm, obtuse at apex, pubescent abaxially, pale green. Spadix adnate to the back of tube of spathe. Male flowers a whorl of connate stamens towards apex, 2–8; stamens 2. Female flowers solitary; ovary ovate, *c.* 0.5 mm long, 1-loculed; adnate to the spadix at base, free at apex; style conical; stigma discoid; ovules many. Neuters few, minute, separating the staminate and pistillate flowers. Berry ovoid, green. Seeds numerous, oblong.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: October-March.

Specimen examined: Anakkulam, Mangappara, 15.02.2019, *Dani Francis & Santhosh Nampy* 168936 (CALI).

Notes: *Pistia stratiotes*, also known as water lettuce or tropical duckweed, is the sole species of the genus. It is an invasive weed but has numerous medicinal applications. It is also used as a source of organic matter and to remove toxins

from polluted water (Neuenschwander *et al.*, 2009). Sometimes it is grown as an ornamental (Tulika & Mala, 2015).

Pothos L.,

Sp. Pl. 2: 968. 1753.

Key to the species

1. Stems armed at nodes …… 2

1. Stems unarmed …… 3

2. Flowers arranged in a zig-zag manner; spathes ovate-lanceolate ..... *P. armatus*

2. Flowers arranged not in a zig-zag manner; spathes linear-oblong ……..... …….. *P. thomsonianus*

3. Petioles broadly winged; stipe of spadix deflexed ……..…….. *P. scandens*

3. Petioles canaliculate, sheathing; stipe of spadix not deflexed ……. *P. keralensis*

Pothos armatus C.E.C.Fisch., Bull. Misc. Inform. Kew 1929(4): 126. 1929; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1592. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 514. 2004.

Climbing shrubs. Stems branched, terete, spiny at nodes, glabrous. Leaves elliptic-lanceolate, 5–15 × 1.5–4 cm, acute at apex, cuneate at base, glabrous, green, coriaceous; petioles 0.8–1.5 cm long. Inflorescence on short lateral branchlets; peduncles 3–5 cm long, embraced by 3–4 cataphylls at base; cataphylls obtuse, 0.4–2 cm long, apiculate at apex. Spathes cymbiform, ovate-lanceolate, 10–12 × 5–8 mm, narrowly acute at apex, clasped at base, glabrous, brown; spadix slender, elongate, 3–8 cm long, stipitate, stipe 0.5–0.8 cm long. Flowers 0.5–0.6 mm across, sunken in pits, distant groups of 3–5 together with a zig-zag arrangement, sessile. Tepals 6, oblong, 0.5–1 × 0.5–1 mm, truncate at apex and base, pubescent, brown. Stamens 6; filaments flat, *c.* 1 mm long; anthers oblong, 0.1–0.4 mm long, dehisced by longitudinal slits. Ovary globose, 3-locular, 1-ovuled; stigma sessile. Berries obovoid, *c.* 1.2 cm long.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: September-May.

Specimens examined: Arjunankotta, Periyar Tiger Reserve, 16.03.1994, *N. Sasidharan & Jomy Augustine* 13448 (KFRI); Nakshathrakuthu waterfalls, 04.12.2018, *Dani Francis & Santhosh Nampy* 168841 (CALI).

Pothos keralensis Pandur. & V.J.Nair, Indian J. Forest. 17(1): 64. 1994; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 514. 2004.

Climbing shrubs. Stems branched, terete, not armed, glabrous. Leaves elliptic-oblong, 10–25 × 4–8.5 cm, cuspidate at apex, sub-rounded-emarginate at base, undulate at margins, glabrous, green, coriaceous; petioles sheathing, 6–13 cm long, slightly winged, distinctly channeled, partially convolute at nodal region. Inflorescence on short lateral branchlets axillary; peduncles 3–4 cm long, puberulous. Spathes oblong, 10–11 × 3–4 mm, acute at apex, clasped at base, glabrous in, puberulous out, orange; spadix slender, axillary, cylindric, 5–6 cm long, curved, rusty pubescent; stipe *c.* 0.5 cm long. Flowers 1.5–2 mm across, closely arranged. Tepals 6, triangular, 0.8–1 × 0.7–1 mm, fleshy, incurved at apex, truncate at base, rusty pubescent, pale yellow. Stamens 6, 0.5–1 mm long; filaments flat, *c.* 1 mm long; anthers sub-globose, dorsifixed, dehisced by apical pore. Ovary truncate, 3-locular, 1-ovuled, pubescent; stigma globose.

Distribution: India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: February-March.

Specimens examined: Meenmutty, Kulamavu, 24.02.1983, *A.G. Pandurangan 78069* (MH); Valara, 5th mile, 06.07.1999, *Binosh M.B.* 77331 (CALI).

Pothos scandens L., Sp. Pl. 2: 968. 1753; Hook.f. Fl. Brit. India 6: 551. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1592. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 514. 2004.

Climbing shrubs. Stems branched, angled, glabrous. Leaves ovate-lanceolate or linear-lanceolate, 3–17 × 1–5 cm, acute at apex, cuneate at base, glabrous, green, coriaceous; petioles broadly winged, 1–5 × 0.2–0.6 cm, sub-truncate at apex, cuneate at base, glabrous, green. Inflorescence axillary; peduncles 3–7 mm long, embraced by 3–6 cataphylls at base; cataphylls ovate, 0.3–0.5 cm long, acute at apex. Spathes cymbiform, ovate-oblong, erect, 3–5 × 2–3 mm, cuspidate at apex, clasped at base, glabrous, brown; spadix globose-obovoid, 3–4 × 1.5–2 cm; stipe

0.2–0.5 cm long, deflexed. Flowers bisexual, *c.* 1 mm across, green. Tepals 6, oblong, 0.5–1 × 0.4–0.6 mm, truncate at apex and base, pale green. Stamens 6; filaments flat, *c.* 1 mm long; anthers oblong, 0.1–0.4 mm long, dehisced by longitudinal slits. Ovary ellipsoid or obovoid, 3-locular, 1-ovuled; stigma raised. Berries ellipsoid, *c.* 0.5–2 cm long, red.

Distribution: W. Indian Ocean, Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: October-December.

Specimen examined: Nakshathrakuthu, Mankulam, 04.12.2018, *Dani Francis & Santhosh Nampy* 168850 (CALI).

Pothos thomsonianus Schott, Aroid. 24. t. 51. 1856; Hook.f. Fl. Brit. India 6: 555. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1592. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 514. 2004.

Climbing herbs. Stems branched, slender, armed just below nodes; internodes 1–1.5 cm long. Leaves elliptic or oblong-lanceolate, 4–19 × 1–5 cm, cuspidate or caudate, acuminate at apex, cuneate at base, thinly coriaceous, rather unequal sided, glabrous, yellow when dry; petioles 0.5–1.7 cm long, sub-channelled above, not winged, pulvinate at apex, sheathing to 1 cm long; sheaths with a collar-like ligule. Inflorescence solitary in groups of 2–3, lateral, terminal or extra-axillary from very short branchlets; peduncles slender, terete, 2.5–4.5 cm long, reflexed. Flowers 1.5–2 mm across. Spathes linear-oblong, 0.6–3 × 0.2–1 cm, apiculate at apex, not overlapping at base, involute. Spadix narrowly cylindric, 1.3– 3.5 × 0.3–0.7 cm, dense-flowered, sub-sessile or stipitate; stipe 0.1–4 mm long. Tepals 6, flat, 0.8–1 × l–1.2 mm, triangular at apex, truncate at apex, glabrous, pale green. Stamens 6; filament 0.8–1 mm long; anthers exserted, dorsifixed, *c.* 0.2 mm long. Ovary cylindric or oblong, 3-locular; ovules 1; stigma sessile, punctate. Berries oblong-obovoid, 0.6–1 cm long.

Distribution: SW. India (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: January-March.

Specimen examined: Arjunankotta, Periyar Tiger Reserve, 27.01.1994, *N. Sasidharan & Jomy Augustine* 13167 (KFRI).

Raphidophora Hassk.,

Flora 25 (2, Beibl.): 11. 1842.

Rhaphidophora pertusa (Roxb.) Schott, Bonplandia 5: 45. 1857; Hook.f. Fl. Brit. India 6: 546. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1598. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 514. 2004. *Pothos pertusa* Roxb., Fl. Ind. 1: 455. 1820.

Climbing shrubs. Leaves lanceolate-ovate or pinnatisect, 30–35 × 25–30 cm, occasionally foraminate with striate venation, glabrous, green; petiole channelled, 25–32 × 1–1.5 cm, pulvinate, sheathing. Inflorescence solitary, axillary; peduncle 5–8 × 1–1.5 cm. Spathes ovate-oblong, 10–15 × 2.5–3.5 cm, acute at apex, deciduous, glabrous, yellowish when mature. Flowers unisexual, naked, 2-merous. Stamens 4; filaments flattened. Female flowers basal; ovary obconical, truncate, l-loculed; ovule solitary; stigma sessile, punctate. Male flowers above; stamens 4-6, free. Berries shedding the upper stylar portion at maturity. Seeds many, narrowly oblong.

Distribution: Maldives, S. India, Andaman Islands, Bangladesh to N. Thailand and Sri Lanka (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: August-January.

Specimen examined: Arjunankotta, Periyar Tiger Reserve, 27.01.1994, *N. Sasidharan & Jomy Augustine* 13163 (KFRI).

Remusatia Schott,

Melet. Bot. 1: 18. 1832.

Remusatia vivipara (Roxb.) Schott., Melet. Bot. 18. 1832; Hook.f. Fl. Brit. India 6: 521. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1583. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 514. 2004. *Arum viviparum* Roxb., Hort. Bengal. 65. 1814.

Fig. 22F

Perennial epiphytic or lithophytic, tuberous herbs. Bulbiferous shoots arising from the lateral side of tuber, erect, slender, 30–45 cm long, bulbils at the nodes oblong, squarr osely scaly, 2–6 mm long, brown. Stem a tuberous corm, subterranean. Leaves 3–5, ovate-peltate, 15–20 × 10–15 cm, acute at apex, cordate at base, undulate at margins, glabrous, green; petioles terete, 15–30 cm long, attached to the blade above sinus. Inflorescence solitary, terminal, erect; peduncles covered with 2–4 cataphylls. Spathes 6–12.5 cm long; tube cylindrical, 2–4 cm long, green; limb ovate, 4–8 × 2–4 cm, caudate at apex, golden yellow.

Spadix longer than the spathe tube, 4–5 cm long, male and female flowers separated by neuters. Female flowers: numerous; ovary globose, 1-loculed; style absent; stigma 3-lobed. Male flowers: numerous, crowded at apex of spadix; stamens usually 6. Berries obovoid. Seeds small ovoid.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Moist deciduous, semi-evergreen, shola forests; *Fl. & Ft.*: January-September.

Specimens examined: Kurisumala, Periyar Tiger Reserve, 21.01.1994, *N. Sasidharan & Jomy Augustine* 13127 (KFRI); Mathikettan Shola National Park (Sivanpara Checkpost), *s.d., Syam Radh S.* 149191; Narakakkanam, 06.09.2017, *Dani Francis & Santhosh Nampy* 154377 (CALI).

Notes: This species is commonly known as the "hitchhiker elephant ear." Flowering is rare in this plant, but propagates primarily through the aerial bulbils. It is a rare medicinal plant (Bhurat *et al.*, 2021).

Theriphonum Blume,

Rumphia 1: 127. 1837.

Theriophonum infaustum N.E.Br., J. Linn. Soc. Bot. 18: 260. 1880; Hook.f. Fl. Brit. India 6: 513. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1579. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 515. 2004.

Corms 0-5-2 cm long, 1-2 cm diam. Leaves with petiole 5-12-5(-25) cm long; lamina narrowly to broadly hastate-sagittate, rarely broadly ovate-cordate; central lobe 6-12-5 x 1-5-6 cm, tip acute to mucronate; lateral lobes rounded to ovate with a wide sinus. Peduncle 1-5-5-5 cm long. Spathes 2-5-5 cm long, greenish to purplish, the basal convolute portion c. 1 cm long, the blade oblong, 3-4-5 x 1-1-5 cm. Spadix 4--4-5 cm long with pistillate portion at base contiguous with sterile flowers, followed by a naked interstice c. 6 mm long, staminate portion 3-4 mm long with a creamy-purplish appendix 1-5-2-5 cm long with a distinct stipe 3-3.5 mm long. Pistillate flowers few, + in a single whorl, unilocular with 4-5 pendulous and erect ovules; stigma sessile, discoid. Sterile flowers subulate to sub-clavate, verruculose, creamy-purplish, 3-3-5 mm long. Staminate flowers dense, purplish, sessile and truncate, each with 2 rather distant anther lobes. Berries 6-9 x 3-4 mm, each with 2-3 seeds. Seeds broadly ovoid to obovoid, with a basal white tissue.

Distribution: W. and S. India (POWO, 2023); *Habitat*: Moist deciduous forests; *Fl. & Ft.*: May-September.

Specimen examined: Koruthode, Periyar Tiger Reserve, 27.05.1995, *N. Sasidharan & Jomy Augustine* 16209 (KFRI).

Typhonium Schott,

Wiener Z. Kunst 1829(3): 732. 1829.

Typhonium trilobatum (L.) Schott, Wiener Z. Kunst 1829(3): 732. 1829; Hook.f. Fl. Brit. India 6: 509. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1578. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 514. 2004. *Arum trilobatum* L., Sp. Pl. 2: 965. 1753.

Perennial cormous herbs. Corms sub-globose, white. Leaves solitary or two, deeply 3-lobed, hastate, acute-acuminate at apex, entire at margins, glabrous, green; terminal lobe ovate-lanceolate, 5–15 × 2.5–8.5 cm; lateral lobes ovate, 3.5–10 × 1.5–5 cm, unequal, slightly smaller than terminal, rarely again lobed on its outer surface; petioles terete, 10–35 cm long, purplish green. Peduncles slender, 2–10 cm long. Spathes 6–20 × 3–7 cm; tube oblong, convolute, 2–3 × 1–1.5 cm, oblique at base, reddish green out, purple in; limb ovate-lanceolate, 7–15 × 2–7 cm, acuminate at apex, dark red or reddish brown in, reddish green out, deciduous. Spadix erect, 10–17 cm long. Pistillate region cylindric, 7–9 × 3–5 mm, pink; ovary sub-cylindric, *c.* 1.8 × 0.6 mm, white; stigma purple or reddish brown. Sterile region 0.6–2 cm long, covered with white, intertwined filaments; neuters clustered, *c.* 1 cm long, white. Interstice naked, 1–3 cm long, white. Staminate region 1.5–3 cm long, pink; flowers 6–7 × 6–8 mm. Appendix linear-cylindric or conical, 4–7.5 cm long, truncate at base, brownish red, stipitate; stipe 3–6 mm long. Berries ovoid, 1–2-seeded.

Distribution: India to S. China and Malaya (POWO, 2023); *Habitat*: Wasteland and roadsides; *Fl. & Ft.*: February-December.

Specimen examined: Moolamattam, 30.12.2021*, Dani Francis & Santhosh Nampy* 176535 (CALI).

Notes: *Typhonium trilobatum* has a high medicinal value, but the tubers are extremely poisonous (Anandhi *et al.*, 2020).

Fig. 22. A. & C. *Arisaema leschenaultia* Blume; **B.** *Arisaema tortuosum* (Wall.) Schott; **D.** *Anaphyllum wightii* Schott; **E.** *Cryptocoryne consobrina* Schott; **F.** *Remusatia vivipara* (Roxb.) Schott.

ALISMATACEAE Vent.,

Tabl. Regn. Veg. 2: 157. 1799, *nom. cons.*

Marshy or aquatic plants. Leaves radical, entire. Flowers regular, uni- or bisexual. Perianth segments 6, 2-seriate; outer (sepals) 3, persistent, green; inner petaloid, rarely 0, deciduous, white or yellow. Stamens 6 or more; anthers erect, basifixed, 2-celled, slits lateral or dorsal. Carpels 3–6 or more, 1-celled, sessile or stipitate on a flat or raised receptacle; ovary superior; style short, sub-terminal or ventral; stigma simple; ovules 1 or more. Fruit an achene or follicle. Seeds exalbuminous; embryo straight or conduplicate.

The family includes 18 genera and 114 species (POWO, 2023) of aquatic or semi aquatic herbs with a cosmopolitan distribution. Hooker (1894) reported six genera and nine species. One species is found in the study area.

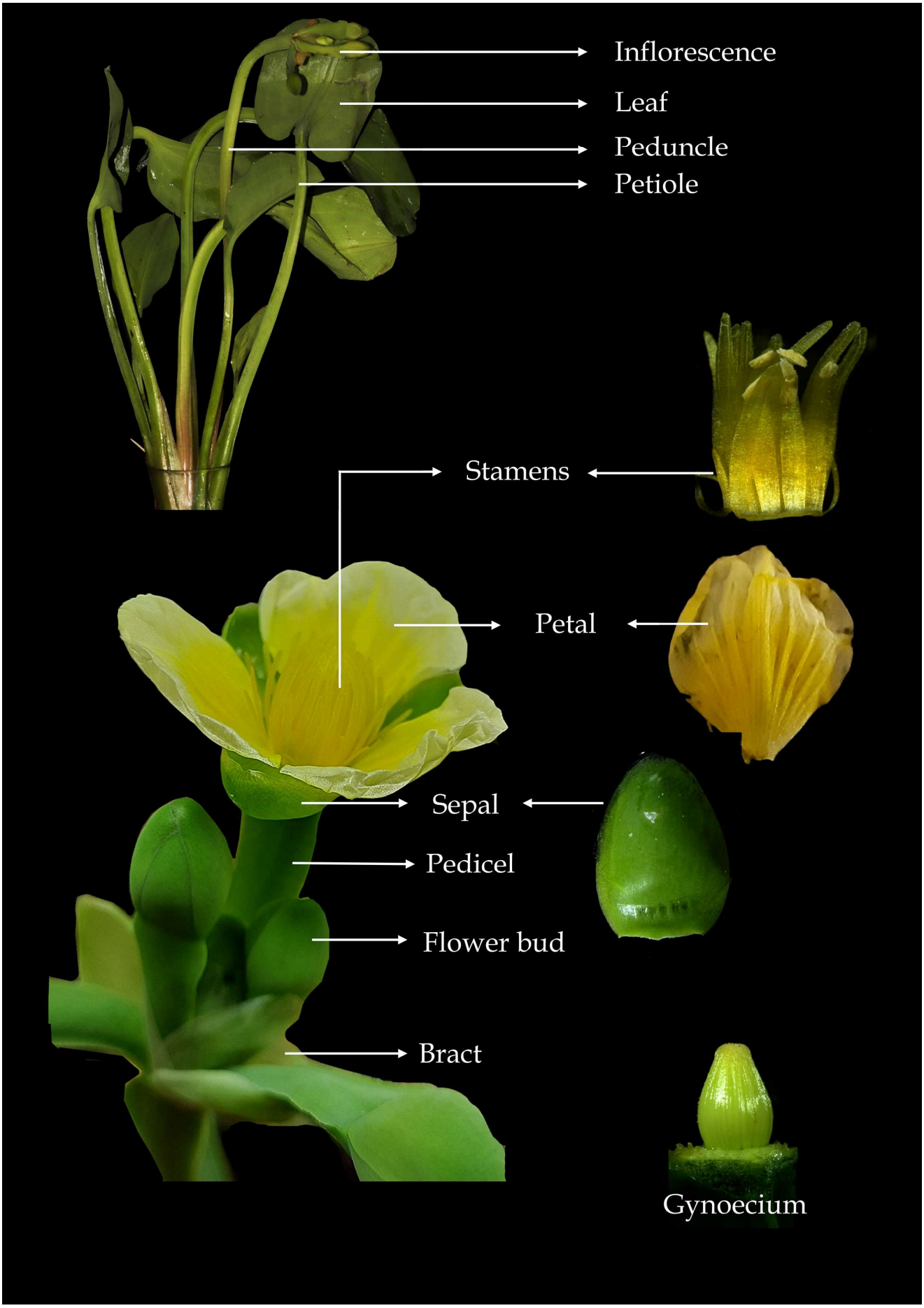
Limnocharis Bonpl.,

in Humboldt & Bonpland, Pl. Aequinoct. 1(5): 116, t. 34. 1807.

Limnocharis flava (L.) Buchenau, Index Crit. Butom. Alism. Juncag. 13. 1868; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 516. 2004. *Alisma flavum* L., Sp. Pl. 1: 343. 1753.

Perennial aquatic herbs with stout rhizomes, 30–50 cm long. Roots fibrous. Leaves ovate-oblong, 6–10 × 4.5–8.5 cm, apiculate at apex, cordate and sheathing at base, glabrous, green. Petioles 30–50 × 0.8–1 cm, trigonous, spongy, green. Inflorescence umbel-like, 25–50 cm long, 4–6-flowered, axillary, glabrous. Peduncles 25–45 cm long, spongy, glabrous, green. Flowers 6–10 cm across, yellow; pedicels winged. Bracts broadly elliptic-rounded, *c.* 10 × 9 mm, delicate, mucronate-obtuse at apex, rounded at base, hyaline, glabrous, green. Sepals 3, widely ovate, 1.6–2 × 1.2–1.5 cm, emarginate at apex, truncate at base, persistent, glabrous. Petals broadly ovate-orbicular, 2–3 × 1–2 cm, obtuse-sub-rounded at apex, cuneate-sub-truncate at base, glabrous, deep yellow at the center, pale yellow or white towards periphery. Stamens numerous, surrounded by a whorl of staminodes; anthers oblong, *c.* 2 × 1 mm, yellow. Carpels numerous, laterally flattened, firmly pressed together, yellow. Fruitlets sub-orbicular, glabrous, green. Seeds numerous.

Distribution: Mexico to Tropical America (POWO, 2023); *Habitat*: Still and flowing fresh and occasionally brackish waters; *Fl. & Ft.*: Throughout the year.


Inflorescence
Leaf
Peduncle
Petiole
Stamens
Petal
Sepal
Pedicel
Flower bud
Bract
Gynoecium

Specimen examined: Vellakkayam, near Cheruthoni, 04.04.2018, *Dani Francis & Santhosh Nampy* 158459 (CALI).

Notes: *Limnocharis flava*, commonly known as 'water cabbage', is native to Tropical and Subtropical America. It is an invasive species that has become a pest in some wetlands around the world. The species was introduced as an ornamental species because of its attractive foliage and colorful flowers. It has subsequently naturalized and became a noxious aquatic weed in wetlands, paddy fields, and irrigation canals in Southeast Asia and has now attained the status as an alien invader (Karthigeyan *et al.*, 2004; Nishan & George, 2018).

POTAMOGETONACEAE Bercht. & J.Presl,

Přir. Rostlin Aneb. Rostl. 1: 1, 3. 1823.

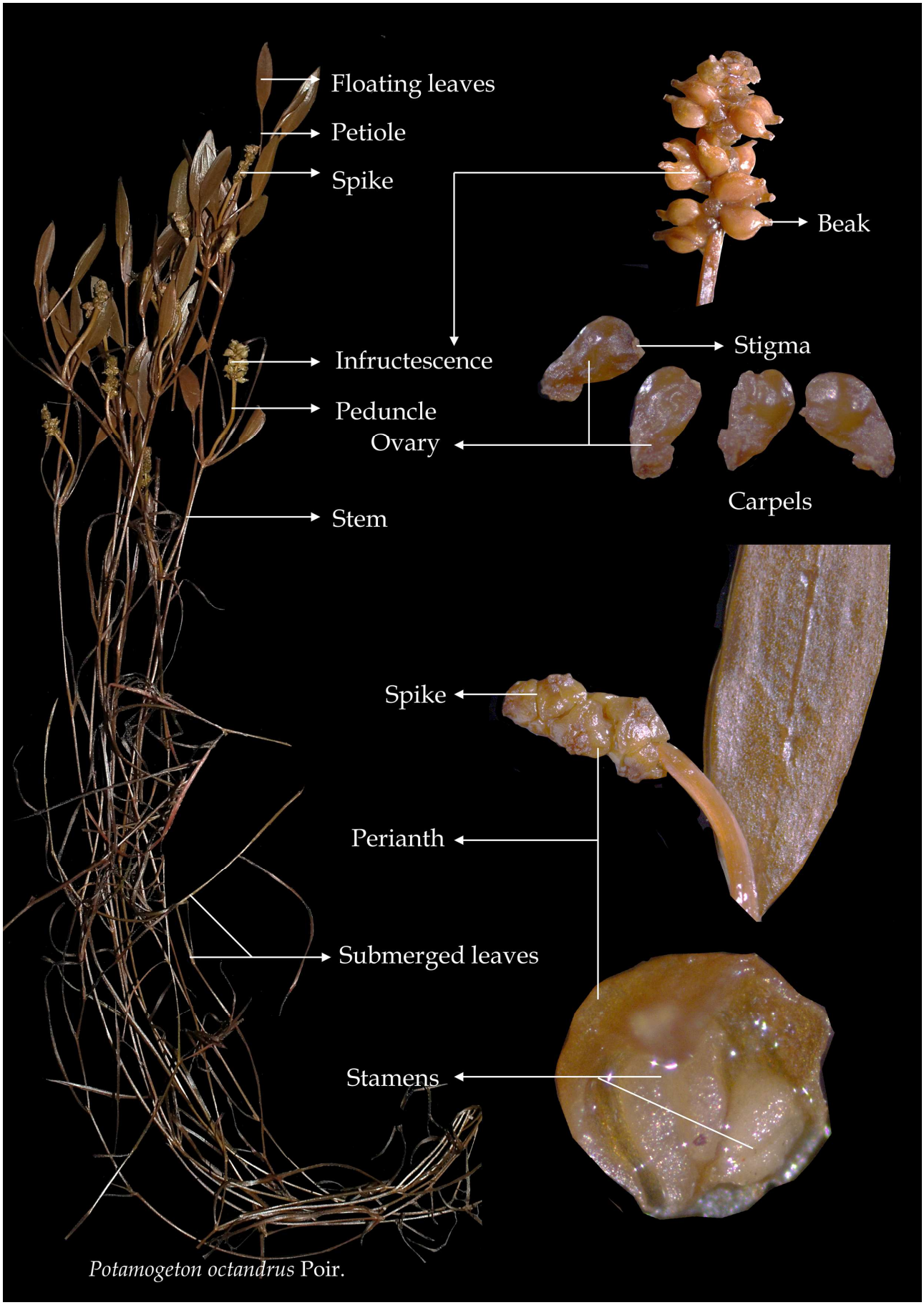
Submerged water-plants with creeping rootstock. Leaves submerged or floating, opposite or alternate, entire or toothed; stipules intrafoliaceous. Flowers small, spicate on a scape rising from a membranous spathe, ebracteate. Perianth segments 4, concave, green, valvate. Stamens 1–4; anthers sessile, didynamous, extrorse. Carpels 1–4, free, sessile, 1-celled, 1-ovuled; ovary superior; stigma, sub-sessile or decurrent, persistent; ovules inserted in the inner angle of the cell. Drupelets small, coriaceous or spongy. Seeds sub-reniform.

Potamogetonaceae is commonly referred to as the pond weed family and includes five genera and 111 species worldwide (POWO, 2023). Kothari (2001) in his revision included two genera, 18 species and two varieties from India. Chowdhury *et al.* (2015) reported *Potamogeton gramineus* L. as a new addition to the flora of Indian Subcontinent. One species is reported from the study area.

Potamogeton L.,

Sp. Pl. 1: 126. 1753.

Potamogeton octandrus Poir. in J.Lamarck & al., Encycl. Suppl. 4. 534. 1816; Kothari, Nelumbo 43(1–4): 151–194. 2001. *Potamogeton javanicus sensu* Hook.f., Fl. Brit. India 6: 566. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1600. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 518. 2004, *non* Hassk, 1856.


Floating leaves
Petiole
Spike
Beak
Infructescence
Stigma
Peduncle
Ovary
Carpels
Stem
Spike
Perianth
Submerged leaves
Stamens
Potamogeton octandrus Poir.

Annual submerged, aquatic herbs. Stems terete, branched, slender, glabrous, brownish; internodes 6.1–8 cm long. Stipules axillary. Leaves dimorphic, submerged ones numerous, linear, 7–10 cm long, acute at apex, 3-nerved, parallel, midrib prominent, sometimes reticulate, puberulous, alternate; floating leaves only at the fertile axis, elliptic, *c.* 1.9 × 0.5 cm, acute at apex, 6-nerved, opposite, glabrous, brown; petiole *c.* 1.2 cm long; leaf sheaths arising from each node. Spikes axillary, dense flowered, 2.8–3 cm long; peduncles terete, glabrous, 2.6–2.8 cm long. Flowers sessile, 1–1.1 mm long. Perianth 4, covers the entire flower, widely ovate-elliptic, 1–1.3 × 0.8–1 mm, glabrous, green. Stamens 4, filaments fused with tepals, *c.* 0.3 mm long, brown; anthers 4, cordate, basifixed, *c.* 0.4 × 0.4 mm, with a small beak at the apex, dehiscing longitudinally. Gynoecium 4-carpellary, free; carpels slightly curved, 1-loculed, 1-ovuled; ovary narrowly oblong, *c.* 1 × 0.3 mm; style absent; stigma flattened. Infructescence drooping; drupelets, *c.* 2.1 × 1.2 mm, orbicular, with a short beak, glabrous, 1-seeded, with a hooked beak and ribs, green.

Distribution: Tropics and Subtropics of Old World (POWO, 2023); *Habitat*: Still and flowing fresh and occasionally brackish waters; *Fl. & Ft.*: Throughout the year.

Specimens examined: Neriyamangalam river, 26.12.2017, *Dani Francis & Santhosh Nampy* 156518; Thodupuzha river, 10.12.2022, *Dani Francis & Santhosh Nampy* 176124; Vellakkayam, near Cheruthoni, 04.04.2018, *Dani Francis & Santhosh Nampy* 158464 (CALI).

NAJADACEAE Juss.,

Gen. Pl. 18. 1789, *nom. cons.*

Slender submerged herbs. Stems rooting from the nodes, branched, filiform. Leaves alternate, opposite or ternate, linear, sheathing at base; sheaths truncate, rounded or 2-auriculate at apex, margins more or less toothed. Flowers minute, axillary, solitary or a few together, monoecious, rarely dioecious, naked or enclosed in a tubular or inflated spathe. Perianth 0 or tubular, hyaline. Stamen 1, adnate to the perianth, 1–4 celled. Carpel 1, sessile, superior; style cylindric; stigma 2–4, slender; ovule 1, basal, erect, anatropous. Achenes oblong or ellipsoid. Seeds erect; testa thin, areolate.

Najadaceae is a monogeneric family of herbaceous submerged monocotyledons with 39 species worldwide, with the greatest diversity in the Tropics and Subtropics (Haynes, 1977). According to the recent studies, the family is most closely related to Hydrocharitaceae, and the monotypic genus *Najas* L., is placed in this family (Haynes & Holm-Nielsen, 2001). In India, the genus is represented by 15 species (POWO, 2023). One species is documented from the study area.

Najas L.,

Sp. Pl. 2: 1015. 1753.

Najas indica (Willd.) Cham., Linnaea 4(4): 501. 1829; C.E.C.Fisch. in Gamble, Fl. Madras 1604. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 517. 2004. *Caulinia indica* Willd. in Mém. Acad. Roy. Sci. Hist. 1798: 89. 1801. *Najas falciculata* A.Braun, J. Bot. 2: 278. 1864; Hook.f., Fl. Brit. India 6: 569. 1894.

Submerged, monoecious herbs. Stems unarmed, *c.* 25 cm long, rooting from the nodes. Leaves linear-lanceolate, flat, 10–25 × 0.5–1 mm, acute at apex, spiny and serrulate at margins, midrib spineless, septate, clearly visible up to the margin; sheaths auricled, 1.5–3.5 mm long, serrulate or lacerate, spiny, obtuse at apex. Inflorescence axillary, male and female flowers on different branches. Male flowers enclosed in a spathe, 1.5–3 × 0.5–0.8 mm, tapering and spiny at apex; stamen 1, anther tetrasporangiate; pedicels *c.* 1 mm long. Female flowers naked; ovary ellipsoid, *c.* 1 × 0.4 mm, 1-ovuled; style cylindric, 3 mm long; stigma 2–3-lobed. Fruits sub-terete or trigonous with persistent, thin, membranous pericarp, remnant of style at the apex. Seeds straight, elliptic; testa pitted with areoles, arranged in longitudinal rows.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Stagnant ponds; *Fl. & Ft.*: August-December.

Specimens examined: Kumarikulam, 10.12.1995, *N. Sasidharan & Jomy Augustine* 17000 (KFRI); Ponnambalamedu, 16.12.1996, *Jomy Augustine* 16999 (CALI).

Notes: This species can be distinguished from other species by its leaves with large teeth and septa visible up to the margin, auricled leaf sheath, tetrasporangiate anthers and seed testa with regularly arranged areoles (Triest, 1988).

ERIOCAULACEAE Martinov,

Tekhno-Bot. Slovar. 237. 1820, *nom. cons.*

Marsh or aquatic scapigerous herbs. Stems corm like or elongate. Leaves in basal rosette or cauline, linear, grass like. Heads solitary or umbel. Flowers regular, unisexual in involucrate heads. Peduncles longer than leaves, sheathing. Male flowers: Sepals 2 or 3, free or fused. Petals 2 or 3, equal or unequal, often very obscure, inserted on a clavate elongate stipe. Stamens 6 or fewer; anthers dorsifixed. Pistillode minute or 0. Female flowers: Sepals 2 or 3, caducous. Petals 3 (rarely 2 or 0), persistent, spathulate or oblanceolate, usually with a black gland. Ovary 3, superior, rarely 2-celled; style short, persistent; stigma 2 or 3, slender. Ovules solitary, orthotropous, pendulous. Capsules deeply 3-lobed, membranous, loculicidally dehiscing. Seeds pendulous; testa coriaceous, floury endosperm; embryo small.

Commonly called pipewort family, Eriocaulaceae is distributed mainly in tropical and warm temperate regions and comprises seven genera and approximately 1206 species (POWO, 2023). *Eriocaulon* is the sole representative of the family in India, which consists of 108 species (Darshetkar *et al.,* 2021; Nampy & Akhil, 2021; Anoop & Robi, 2021; Harishma *et al.,* 2022). Eighteen species are recorded from the study area.

Eriocaulon L.,

Sp. Pl. 1: 87. 1753.

Key to the species

1. Female petals 2.7–3.2 mm broad, distinctly clawed ..... *E. rhodae*

1. Female petals 0.1–1 mm broad, not clawed 2

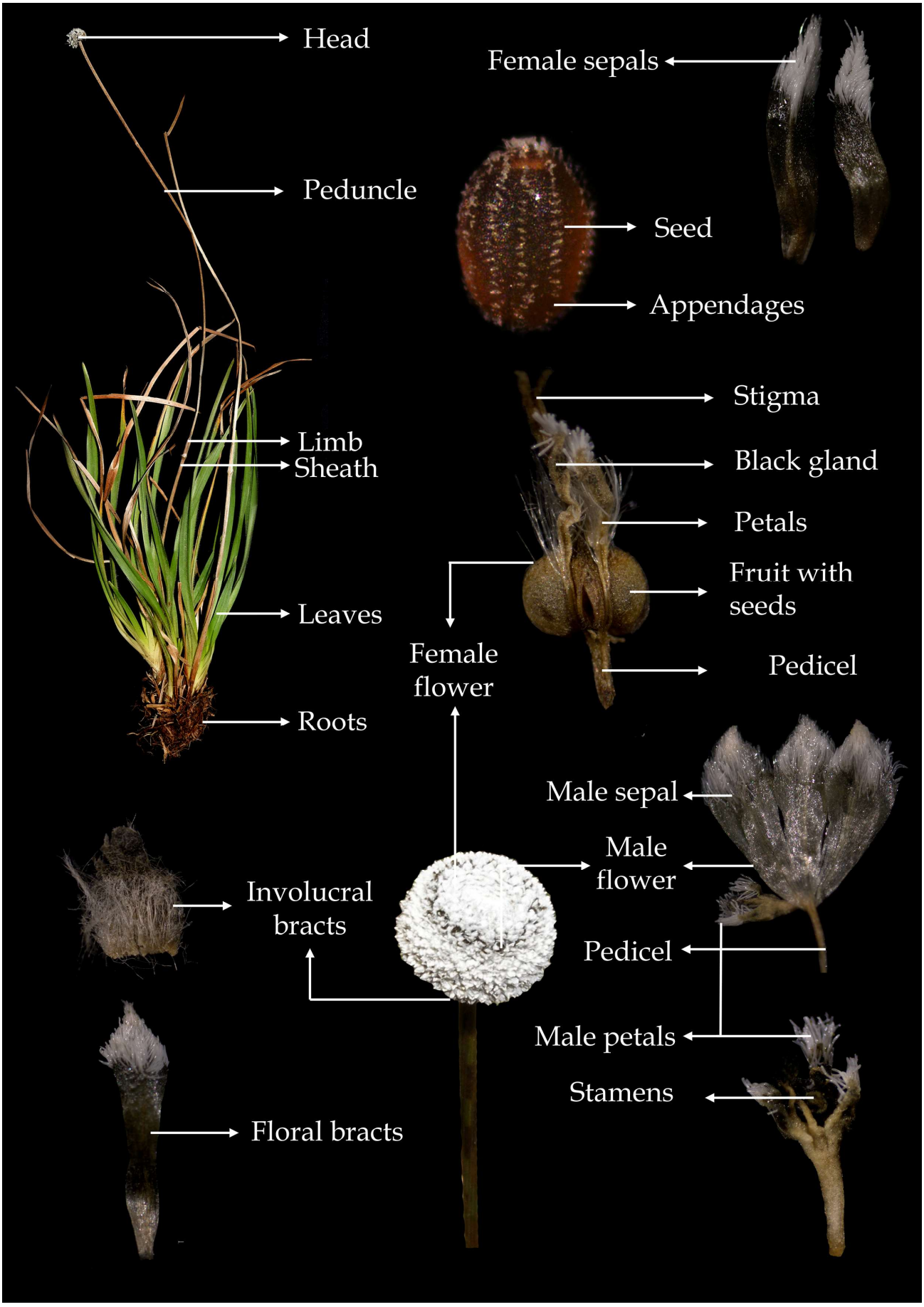
2. Seed surface furnished with appendages or ridges 4

2. Seed surface without appendages or ridges 3

3. Plants tuberous; anthers white ..... *E. tuberiferum*

3. Plants not tuberous; anthers black ..... *E. pectinatum*

4. Seed coat cells transversely or vertically elongated 6


Head
Peduncle
Limb
Sheath
Leaves
Roots
Female sepals
Seed
Appendages
Stigma
Black gland
Petals
Fruit with seeds
Pedicel
Female flower
Male sepal
Male flower
Pedicel
Male petals
Stamens
Involucral bracts
Floral bracts

4. Seed coat cells isodiametric …… 5

5. Root stock present; peduncles 1–3 …… *E. nairi*

5. Root stock absent; peduncles 4–8 …… *E. biappendiculatum*

6. Seed coat appendages ribbon-like or rectangular …… 7

6. Seed coat appendages setiform …… 9

7. Seed coat cells laterally elongated; male sepals 2 or 3 ……8

7. Seed coat cells vertically elongated; male sepals 2 …… *E. truncatum*

8. Limbs ovate; male sepals fused; seeds oblong or ovoid ……. *E. quinquangulare*

8. Limbs lanceolate; male sepals free; seeds elliptic…… *E. pandeyana*

9. Male sepals fused laterally at least at base to form a closed or open spathes ……
…… 10

9. Male sepals free …… 12

10. Spathe of male flowers closed and tubular ..... *E. Sexangulare*

10. Spathe of male flowers split on abaxial side 11

11. Female sepals broadly keeled outside …… *E. eurypeplon*

11. Female sepals not keeled outside …… *E. vamanae*

12. Appendages arising from angles of seed coat cells …… *E. vasudevanii*

12. Appendages arising from transverse radial walls of seed coat cells…….. 13

13. Male petals unequal …… *E. odoratum*

13. Male petals equal or sub-equal …… 14

14. Seed coat appendages solitary from transverse radial wall …… 15

14. Seed coat appendages 2 to many from transverse radial wall …… 16

15. Leaves 4–10 × 0.1–0.2 cm, glabrous …… *E. thwaitesii*

15. Leaves 15–40 × 1.2 cm, pubescent …… *E. brownianum*

16. Appendages arranged in vertical rows on surface of seeds ..... *E. nepalense*

16. Appendages arranged in transverse ring on surface of seeds …… 17

17. Male sepals obtuse or acute at apex …….. *E. parviflorum*

17. Male sepals truncate at apex …….. *E. xeranthemum*

Eriocaulon biappendiculatum Manudev, Robi & Nampy, Edinburgh J. Bot. 72: 219. 2015; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 716. 2021.

Caulescent herbs, 13–24 cm tall, branched; stems 3 cm long. Root stock absent. Leaves cauline, linear-ensiform, 2–9 × 0.1–0.4 cm, acuminate at apex, cuneate at base, entire at margin, glabrous, green. Peduncles 4–8, 8–17 cm long, glabrous. Sheaths terete, *c.* 4 cm long, glabrous; limb lanceolate, *c.* 1 × 0.2 cm, acute at apex, glabrous. Heads globose or cylindric, *c.* 7 mm across, black. Receptacle cylindrical, pilose. Involucral bracts obovate, 2.3–2.5 × *c.* 1.3 mm, obtuse-acute at apex, truncate at base, glabrous, black, entire at margins, incurved. Floral bracts oblanceolate, 2.5–2.7 × *c.* 1 mm, acuminate at apex, cuneate at base, hoary at apex, black. Male flowers: Pedicels *c.* 0.3 mm long, basally hairy. Sepals 3, free, sub-equal, obtuse at apex, cuneate at base, sparsely hoary at apex, black, mid one lanceolate, 1.5–1.8 × 0.2–0.3 mm, laterals conduplicate, oblanceolate, 1.8–2 × 0.3–0.4 mm. Stipe of corolla *c.* 0.4 mm long; petals 3, unequal, oblong, obtuse at apex, hoary towards apex with a black gland, hyaline, mid one *c.* 1 × 0.1 mm, lateral ones 0.3–0.4 mm long; stamens 6; filaments *c.* 0.5 mm long, white; anthers black. Female flowers: Pedicels 0.6–0.8 mm long. Sepals 3, free, sub-equal, oblong-oblanceolate, *c.* 2.1 × 1 mm, obtuse at apex, cuneate at base, sparsely hoary towards apex, black. Petals 3, unequal, spathulate, obtuse at apex, attenuate at base, glandular, hoary at apex, pilose at margins, hyaline, mid one 2–2.1 × 0. 1–0.2 mm, laterals *c.* 2 × 0.1 mm; stipitate between sepals and petals, *c.* 0.1 mm long. Ovary oblong, *c.* 0.3 × 0.3 mm; style *c.* 1.3 mm long; stigma trifid. Seeds ovoid, *c.* 0.4 × 0.4 mm, seed coat cells isodiametric, appendages two types: continuous ribbon like bands from walls, and solitary seta from angles of cells, bifid at apex.

Distribution: India (POWO, 20233); *Habitat*: Marshes near streams; *Fl. & Ft.*: December-January.

Specimens examined: Kurinji valley, way to Pachakkad from KFDC base camp, Silent valley, Munnar,15.12.2012, *Manudev & Robi* 4364; Nyamakkad, 8th mile, 24.01.2018, *Dani Francis & Santhosh Nampy* 158189 (CALI).

Notes: This species falls into Section VIII of Ansari and Balakrishnan (2009), which is characterized by free female sepals, narrow hyaline petals, black or dark brown anthers, and isodiametric seed coat cells. This section consists of three species in India, *Eriocaulon nairii* Chandrab. & V.Chandras., *E. robustum* Steud. and *E. collettii* Hook.f. *E. biappendiculatum* is distinct from all the above species in having both continuous ribbon-like and setiform appendages on the seeds (Manudev *et al.*, 2015).

Eriocaulon brownianum Mart. in Wall., Pl. Asiat. Rar. 3: 25. 1832; Hook.f., Fl. Brit. India 6: 576. 1894; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 518. 2004; R.Ansari & N.P.Balakr., Eriocaul. India 20. 2009; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 693–723. 2021. *E. brownianum* var. *nilagirense* (Steud.) Fyson, J. Indian Bot. 2: 262. 1921; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1619. 1931. **Fig. 25A**

Acaulescent herbs, 25–60 cm tall. Root stock present. Leaves ensiform, 15–40 × *c.* 1.2 cm, acute at apex, slightly broadened towards base, entire at margin, hispid hairy, green. Peduncles 1 or 2, 15–60 cm long, hispid hairy. Sheaths terete, 10–21 cm long, pilose; limb lanceolate, 1–2 × 0.5 cm, acute at apex, pilose. Heads hemispherical, *c.* 1.5 cm across, white. Receptacles globose, villous. Involucral bracts obovate-oblong, 3.5–6.5 × 3.3–4.5 mm, obtuse at apex, truncate at base, tomentose, rarely 1–3 cut at apex, entire at margins, black. Floral bracts oblanceolate, 3–3.1 × 1–1.3 mm, acute at apex, attenuate at base, hoary towards apex, straw-coloured, black towards apex. Male flowers: Pedicels *c.* 2 mm long, basally hairy. Sepals 3, fused, obovate, *c.* 2 × 1 mm, acute at apex, cuneate at base, hoary towards apex, straw-coloured, black towards apex. Stipe of corolla *c.* 0.9 mm long. Petals 3, unequal, mid one *c.* 1 mm long, laterals *c.* 0.7 mm long, linear, acute at apex, hoary towards apex with a black gland, hyaline. Stamens 6; filaments 0.3–0.9 mm long, glabrous, white; anthers oblong, *c.* 0.4 × 0.4 mm, black. Female flowers: Pedicels *c.* 0.2 mm long, basally hairy. Sepals 3, free, sub-equal, obtuse at apex, attenuate at base, hoary towards apex, black; lateral ones conduplicate, boat-shaped, 3–3.1 × 0.3–0.4 mm; mid one lanceolate-ovate, *c.* 3 × 0.4 mm. Petals 3, linear, 2–3 mm long, glandular, acute at apex, clawed at base, fully hairy, hyaline, stipitate between sepals and petals, *c.* 0.2 mm long. Ovary oblong, *c.* 1 × 1 mm, glabrous; style *c.* 1.1 mm long; stigma trifid. Seeds orbicular, *c.* 0.8 × 0.8 mm, seed

coat cells transversely elongated, appendages solitary from the middle of transverse radial wall, setiform, minutely dilated at apex.

Distribution: South India to South China and Malaysia (POWO, 2023); *Habitat*: Marshy areas, near streams; *Fl. & Ft.*: August-March.

Specimens examined: Anamudy grassy slopes, 19.11.1965, *B.V. Shetty* 26528; Devikulam, 11.09.1968, *D.B. Deb* 30720; *Ibid*., 02.06.1944, *K.C. Jacob* 20509 (MH); *Ibid*., 07.02.2017, *Dani Francis & Santhosh Nampy* 151661 (CALI); Eravikulam, 17.10.1979, *s.coll. s.n.* (KFRI); Old Devikulam, 14.06.1963, *K.M. Sebastine* 16461 (MH); Meesapulimala, near Munnar, 21.11.2018, *Dani Francis & Santhosh Nampy* 167793; Mathikettan Shola National Park (Vattachola), 05.11.2015, *Syam Radh S.* 145110; Mayiladum Para NC, 13.11.2013, *Syam Radh S. & Janeesha* 138169; Munnar, 13.12.1970, *M. Sivadasan* 647; Pettimudi, 19.03.2019, *Dani Francis & Santhosh Nampy* 159116 (CALI); Rajamala, 26.12.1983, *A.G. Pandurangan* 62538 (MH); Umayamala, base camp, 30.08.2019, *Dani Francis & Santhosh Nampy* 170282 (CALI); Uppupara, 26.09.1972, *B.D. Sharma* 41694 (MH); Vagamon, 29.04.2018, *Dani Francis & Santhosh Nampy* 159252 (CALI).

Notes: The specimens collected at high altitudes such as Anamudi, Meesapulimala, Pettimudi and Umayamala, are densely hairy in all parts, but similar in other respects.

Eriocaulon eurypeplon Korn., Linnaea 27(6): 685. 1856; Hook.f., Fl. Brit. India 6: 585. 1894; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 519. 2004; R.Ansari & N.P.Balakr., Eriocaul. India 80. 2009; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 693–723. 2021. *E. vanheurckii* Mull.Arg., in Van Heurck, Observ. Bot. 1: 98. 1870; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1619. 1931.

Acaulescent herbs, 8–22 cm tall. Root stock absent. Leaves linear-lanceolate, 2–7 × 0.1–0.2 cm, acute at apex, cuneate at base, entire at margin, glabrous, green. Peduncles 1-many, 7–21 cm long, glabrous. Sheaths terete, 2–7 cm long, glabrous; limbs ovate, 1–5 × 1.8–2 mm long, acute at apex, glabrous. Heads globose, 2–5 mm across, grey. Receptacles ovoid or cylindrical, pilose. Involucral bracts ovate, *c.* 1.5 × 1.5 mm, obtuse to sub-acute at apex, truncate at base, sparsely hoary, entire at margins, straw-coloured. Floral bracts widely obovate, 1–1.1 × 0.6–0.8 mm, acute

at apex, sub-truncate at base, hoary towards apex, black. Male flowers: Pedicels absent. Sepals 2, free, oblanceolate, conduplicate, *c.* 1.3 × 0.3 mm, obtuse at apex, cuneate at base, sparsely hoary towards apex, black, keeled. Stipe of corolla *c.* 0.6 mm long. Petals 3, equal, oblong, *c.* 0.2 mm long, obtuse at apex, hoary towards apex with a black gland, hyaline. Stamens 6; filaments *c.* 0.2 mm long, white; anthers black. Female flowers: Pedicels absent. Sepals 2, free, equal, boat-shaped, 1.3–1.5 mm long, acute-obtuse at apex, cuneate at base, broadly keeled, sparsely hoary at apex, black. Petals 3, linear, *c.* 0.8 mm long, barbate at apex, glandular, hyaline, not clawed, not stipitate between sepals and petals. Ovary ovoid, *c.* 0.5 × 0.4 mm; style *c.* 1 mm long; stigma trifid. Seeds elliptic-oblong, *c.* 0.5 × 0.3 mm, seed coat cells transversely elongated, in vertical rows, appendages 1–2 from middle of transverse radial wall, setiform, dilated at apex.

Distribution: SW. India (POWO, 2023); *Habitat*: Marshy areas and crevices of wet rocks; *Fl. & Ft.*: July-December.

Specimen examined: Way sides in Neriamangalam, 11.09.2018, *Dani Francis & Santhosh Nampy* 159450 (CALI).

Notes: *Eriocaulon eurypeplon* has free male sepals hence it belongs to the section VI of Ansari and Balakrishnan (2009) but shows affinity to section V by its closely and regularly imbricated floral bracts. The species also has extremities in size and is endemic to South West India (Ansari & Balakrishnan, 2009).

Eriocaulon nairii Chandrab. & V.Chandras., J. Bombay Nat. Hist. Soc. 79(1): 165. 1982; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 520. 2004; R.Ansari & N.P.Balakr., Eriocaul. India 120. 2009. **Fig. 25B**

Caulescent herbs, 10–15 cm tall, branched. Root stocks *c.* 4 cm long. Leaves cauline, linear-ensiform, 1–3 × 0.1–0.2 cm, acuminate at apex, attenuate at base, entire at margins, glabrous, green. Peduncles 1–3, 5–11 cm long, glabrous. Sheaths terete, *c.* 2.2 cm long, glabrous; limb lanceolate, *c.* 1 × 0.2 cm long, acute at apex, glabrous. Heads ovoid, 6–7 mm across, black. Receptacles ovoid or cylindric, pilose. Involucral bracts obovate, 2–2.1 × 1–1.2 mm, obtuse at apex, truncate at base, entire at margins, hoary towards apex, black. Floral bracts oblanceolate, 2.9–3 × 1–1.1mm, acuminate at apex, cuneate at base, hoary towards apex, black. Male

flowers: Pedicels 0.2–0.3 mm long, basally hairy. Sepals 3, free, obovate-oblanceolate, *c.* 1 × 0.8 mm, obtuse-acute at apex, cuneate at base, sparsely hoary towards apex, straw-coloured. Stipe of corolla *c.* 0.6 mm long. Petals 3, equal, oblong, *c.* 0.2 mm long, obtuse at apex, hoary towards apex with a black gland, hyaline. Stamens 6; filaments *c.* 0.2 mm long, white; anthers black. Female flowers: Pedicels *c.* 0.5 mm long, glabrous. Sepals 3, free, oblanceolate, sub-equal, 2.3–2.5 × 0.8–1 mm; lateral ones conduplicate, mid one flat, acute at apex, attenuate at base, hoary towards apex, pilose at margin, black. Petals 3, unequal, spathulate, obtuse at apex, attenuate at base, glandular, hoary at apex, pilose at margins, hyaline, mid one *c.* 3 × 0.5 mm, laterals *c.* 2 × 0.1 mm, stipitate between sepals and petals, *c.* 0.1 mm long. Ovary ovate, *c.* 0.5 × 0.4 mm; style *c.* 2 mm long; stigma trifid. Seeds ovoid-spherical, *c.* 0.5 × 0.4 mm, seed coat cells isodiametric, appendages a few from all radial walls, setiform, dilated at apex.

Distribution: South India, endemic (POWO, 2023); *Habitat*: Moist grassy slopes; *Fl. & Ft.*: November-February.

Specimens examined: Eravikulam, northern slopes, 04.12.1987, *P. Bhargavan* 87323 (MH); Mesthirikettu, near Eravikulam, 30.12.2017, *Dani Francis & Santhosh Nampy* 158094; Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164900; Silent Valley, waterfalls near Rhodovalley, 22.11.2018, *Dani Francis & Santhosh Nampy* 168809 (CALI); Umayamala slopes, 17.11.1965, *B.V. Shetty* 26484 (MH).

Notes: *Eriocaulon nairii* is similar to *E. vasudevanii* R.Ansari & N.P.Balakr. in having solitary appendages from angles of cells, but the former has an elongated stem and the latter is an acaulescent species (Ansari & Balakrishnan, 2009).

Eriocaulon nepalense J.D.Prescott ex Bong., Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 6, Sci. Math. 1: 610. 1831; Hook.f., Fl. Brit. India 6: 581. 1894; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 520. 2004; R.Ansari & N.P.Balakr., Eriocaul. India 26. 2009; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 693–723. 2021.

Acaulescent herbs, 13–25 cm tall. Root stock absent. Leaves rosulate, linear-lanceolate, 3–7.5 × 0.3–0.6 cm, obtuse at apex, cuneate at base, entire at margin, glabrous, green. Peduncles many, 5–11 cm long, glabrous. Sheaths terete, 2.5–5 cm long, glabrous; limb ovate, *c.* 2 × 0.2 mm, obtuse at apex, glabrous. Heads globose-

hemispherical, 4–5 mm across, black. Receptacles ovoid-cylindric, pilose. Involucral bracts obovate, 1.5–2 × 0.5–0.6 mm, lacerate at apex, truncate at base, glabrous, entire at margins, straw-coloured. Floral bracts oblanceolate, 1.5–2.1 × 0.6–1 mm, acuminate at apex, cuneate at base, sparsely hoary towards apex, black. Male flowers: Pedicels 0.2–0.3 mm long, glabrous. Sepals 3, fused, obovate, 1.1–1.5 × 0.8–1 mm, obtuse at apex, cuneate at base, sparsely hoary towards apex, black. Stipe *c.* 0.5 mm long. Petals 3, sub-equal, minute, oblong, *c.* 0.2 mm long, glabrous, eglandular. Stamens 6; filaments *c.* 0.2 mm long, white; anthers black. Female flowers: Pedicels *c.* 0.5 mm long, glabrous. Sepals 3, free, sub-equal, linear, 1.1–1.5 × 0.1–0.2 mm, acute at apex, attenuate at base, minutely keeled, sparsely hoary towards apex, black. Petals 3, equal, spathulate, 1–1.3 mm long, obtuse at apex, attenuate at base, with or without glands, glabrous, hyaline; stipitate between sepals and petals, *c.* 0.2 mm long. Ovary ovate, *c.* 0.5 × 0.5 mm; style *c.* 2 mm long; stigma trifid. Seeds elliptic, *c.* 0.5 × 0.3 mm, seed coat cells transversely elongated, aligned in vertical rows, appendages 1–4 from middle of transverse radial walls, appear in vertical rows, setiform, truncate at apex.

Distribution: Indian Subcontinent to Indo-China and Japan, Sulawesi and New Guinea (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: August-January.

Specimens examined: Kavalappara, 01.01.1995, *Jomy Augustine* 14558; Thannikkudy, 08.10.1996, *Jomy Augustine* 16853 (CALI).

Eriocaulon odoratum Dalzell, Hooker's J. Bot. Kew Gard. Misc. 3: 280. 1851; Hook.f., Fl. Brit. India 6: 574. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1618. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 520. 2004; R.Ansari & N.P.Balakr., Eriocaul. India 38. 2009; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 693–723. 2021.

Fig. 25D

Acaulescent herbs, 8–44 cm tall. Root stock absent. Leaves linear-ensiform, 3–9 × 0.2–0.9 cm, acute-acuminate at apex, broadened towards base, entire at margins, glabrous, green. Peduncles 1–3, 5–39 cm long, glabrous. Sheaths terete, 2–7 cm long, glabrous; limb ovate, 0.5–1.2 × 0.2–0.3 cm, acute at apex, glabrous. Heads globose, 5–10 mm across, black. Receptacles globose, villous. Involucral bracts elliptic-obovate, 1.8–2 × 0.6–2 mm, rounded at apex, sub-truncate at base, glabrous, entire at margins, straw-coloured. Floral bracts obovate-oblanceolate,

2.3–2.5 × 0.9–1 mm, acute-acuminate at apex, truncate at base, sparsely hoary towards apex, straw-coloured. Male flowers: Pedicels *c.* 0.9 mm long. Sepals 3, fused, obovate, *c.* 1 × 1 mm, obtuse at apex, cuneate at base, sparsely hoary towards apex, straw-coloured. Stipe of corolla *c.* 0.1 mm long. Petals 3, unequal, oblong, obtuse at apex, sparsely hoary towards apex with a black gland, hyaline, mid one 0.6–0.9 mm long, smaller one *c.* 0.1 mm long. Stamens 6; filaments *c.* 0.6 mm long, white; anthers black. Female flowers: Pedicels 0.3–0.7 mm long, ciliate hairy. Sepals 3, free, boat shaped, 1.3–1.5 × 0.2–0.3 mm, obtuse at apex, cuneate at base, hoary towards apex, black, keeled. Petals 3, unequal, spathulate, obtuse at apex, clawed at base, pilose hairy along margin, glandular, mid one 1.7–2 × 0.2–0.3 mm, lateral ones 1.3–1.8 × 0.1–0.2 mm, stipitate between sepals and petals, *c.* 0.1 mm long. Ovary ovoid, *c.* 0.4 × 0.2 mm; style *c.* 0.8 mm long; stigma trifid. Seeds elliptic-ovoid, *c.* 0.7 × 0.5 mm, seed coat cells transversely elongated, aligned in vertical rows, appendages 4–13 from transverse and one (sometimes absent) from vertical radial wall, appear in transverse rings, setiform, truncate at apex.

Distribution: India to Indo-China (POWO, 2023); *Habitat*: Marshy places and wet grass lands; *Fl. & Ft.*: November-May.

Specimens examined: Brook's peak, 16.12.1996, *Jomy Augustine* 17025 (CALI); Devikulam, 07.02.2017, *Dani Francis & Santhosh Nampy* 151662 (CALI); near Devikulam lake, 15.04.1960, *K. Subramanyam* 10241 (MH); Eravikulam, 02.05.2017, *Dani Francis & Santhosh Nampy* 152132; on the way to 8th plot, Silent valley, 20.11.2018, *Dani Francis & Santhosh Nampy* 167734; way to Eravikulam, 25.04.2019, *Dani Francis & Santhosh Nampy* 159133; Mathikettan Shola National Park, Choondal, 16.07.2015, *Syam Radh S.* 145046 (CALI); way to Top station, 13.09.1968, *D.B. Deb* 30817 (MH).

Notes: It is one of the most variable species, thriving in altitudinal differences and found in a variety of habitats including road sides, marshy areas, and grasslands. The size of the species varies with altitude (Ansari & Balakrishnan, 2009).

Eriocaulon pandeyana Nampy, Harishma & Vishnu, *Phytotaxa* 539(3): 273–279. 2022.

Acaulescent herbs, erect. Root stock absent. Leaves rosulate, linear-lanceolate, 3–6 cm long, acuminate at apex, sub-truncate at base, entire at margin, glabrous, green, straw-coloured when dry. Peduncles many, 5–22 cm long, glabrous. Sheaths terete, 3.5–4 cm long, glabrous; limbs lanceolate, *c.* 0.2 mm long, acute at apex, glabrous. Heads spherical, 0.4–0.7 mm across, off white or cream-coloured. Receptacle globose, pilose. Involucral bracts oblong-lanceolate, smaller than floral bracts, 1.2–2.0 × 0.8–1.0 mm, acute at apex, truncate at base, reflexed, chartaceous, glabrous, entire or lobed at margins, hyaline, straw-coloured when dry. Floral bracts oblanceolate, 1.7–1.9 × 0.5–1 mm, acuminate at apex, truncate at base, hoary towards apex, chartaceous, hyaline. Male flowers: Pedicels 0.5 mm long. Sepals 2 or 3, free, oblanceolate, falcate, 1–1.2 mm long, glabrous, sparsely hoary towards apex, hyaline. Stipe of corolla 0.7–1.3 mm long. Petals 3, sub-equal, free, oblong, one petal slightly longer than other two, 0.35–1.0 mm long, hoary towards apex with a black gland, hyaline. Stamens 6; filaments *c.* 0.5 mm long, white; anthers 0.27–0.29 mm long, black. Female flowers: Pedicels 0.07–0.08 mm long. Sepals 3, free, unequal, oblong, 1.5–1.9 mm long, hair *c.* 0.4 mm long, one smaller and narrower than other 2, sparsely hoary, blackish towards apex. Petals 3, free, sub-equal, oblanceolate, 1.5–1.7 mm long, hoary at apex, not clawed, hyaline with a black gland at apex, stipitate between sepals and petals, *c.* 0.2 mm long. Ovary sessile, ovoid, *c.* 0.5 mm long; style 1–1.2 mm long; stigma trifid. Seeds elliptic, *c.* 0.5 × 0.3 mm, apiculate or acute, yellow, brownish at both ends, seed coat cells transversely elongated or isodiametric, appendages continuous ribbon like bands from transverse and vertical walls conforming its length; testa granular.

Distribution: Known only from the type locality, Koymanchola in Idukki district, Kerala; *Habitat*: Near streams; *Fl. & Ft.*: January-February.

Specimen examined: Koymanchola, 10°16'52''N, 77°08'49''E, 1457 m, 10.02.2021, *Santhosh Nampy, Vishnu Mohan & Harishma K.H.* 188713 (CALI).

Notes: This species belongs to the section VII of Ansari and Balakrishnan (2009). There are 13 species in this section from India. The species closely resembles *E. ramnadense* R.Ansari & N.P.Balakr. but differs by having oblong-lanceolate, lobed, acute, hyaline involucral bracts (vs oblong-obovate, entire, obtuse, black involucral bracts), oblanceolate, acuminate floral bracts (vs cuneate, obtuse floral

bracts), 3 sub-equal male petals (vs 3 equal male petals), 3 unequal, sparsely hoary female sepals (vs 2 equal, glabrous female sepals) and yellow, elliptic seeds with transversely elongated or isodiametric seed coat cells (vs pale purple, ovoid) (Harishma *et al.*, 2022).

Eriocaulon parviflorum (Fyson) R.Ansari & N.P.Balakr., Fam. Eriocaul. India: 53. 1994; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 520. 2004; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 693–723. 2021. *E. dianae* var. *parviflorum* Fyson, J. Indian Bot. 2: 260. 1921.

Acaulescent herbs, 20–25 cm tall. Root stock absent. Leaves linear, 2.5–5 × 0.2–0.3 cm, acute at apex, sub-truncate at base, entire at margins, glabrous, green. Peduncles few to many, 20–27 cm long, glabrous. Sheaths terete, 4–4.5 cm long, glabrous; limb ovate, obtuse at apex, glabrous. Heads *c.* 5 mm across, globose or hemispherical, grey. Receptacle ovoid, villous. Involucral bracts oblong-oblanceolate, *c.* 2 × 1 mm, obtuse at apex, sub-truncate at base, glabrous, entire at margins, straw-coloured. Floral bracts oblanceolate, 2.5–2.7 × 0.9–1 mm, cuspidate at apex, truncate at base, sparsely hoary towards apex, straw-coloured. Male flowers: Pedicels *c.* 0.5 mm long. Sepals 3, fused, obovate, *c.* 1 × 0.9 mm, 3-lobed, obtuse or acute at apex, cuneate at base, sparsely hoary towards apex, straw-coloured. Stipe of corolla *c.* 0.5 mm long. Petals 3, equal, linear, *c.* 0.5 × 0.2 mm, obtuse at apex, sparsely hoary towards apex with a black gland, hyaline. Stamens 6; filaments *c.* 0.5 mm long, white; anthers black. Female flowers: Pedicels 0.5–0.6 mm long, hairy at base. Sepals 3, free, unequal; laterals conduplicate, oblanceolate, 2–2.1 × 0.1–0.2 mm, obtuse at apex, cuneate at base, hoary towards apex, black, keeled, hairy along keels; mid one linear, flat, *c.* 1.6 × 0.1 mm, obtuse at apex, attenuate at base, glabrous. Petals 3, sub-equal, spathulate, 1.3–1.6 mm long, obtuse at apex, not clawed, hoary, glandular, stipitate between sepals and petals, *c.* 0.2 mm long. Ovary ovoid, *c.* 0.4 × 0.2 mm; style *c.* 1.2 mm long; stigma trifid. Seeds *c.* 0.5 × 0.3 mm, oblong-ovoid, seed coat cells transversely elongated, aligned in vertical rows, appendages 5–7 from transverse radial wall, appear in transverse rings, setiform, minutely dilated at apex.

Distribution: Central and W. India (POWO, 2023); *Habitat*: Paddy fields; *Fl. & Ft.*: August-February.

Specimen examined: Thannikkudy, 10.08.1994, *Jomy Augustine* 14518 (CALI).

Eriocaulon pectinatum Ruhland, Pflanzenr. IV, 30: 85. 1903; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1620. 1931; R.Ansari & N.P.Balakr., Eriocaul. India: 139. 2009; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 520. 2004; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 693–723. 2021.

Acaulescent herbs, 5–25 cm tall. Root stock 0.5–1 cm long, tubers absent. Leaves rosulate, linear, 2.5–5 × 0.2–0.3 cm, acute at apex, cuneate at base, entire at margin, glabrous, green. Peduncles 1–3, 5–25 cm long, glabrous. Sheaths 1.5–5 cm long, terete, glabrous; limb incised, glabrous. Heads spherical, 4–10 mm across, black or grey. Receptacles spherical, glabrous. Involucral bracts oblong-obovate, 2–2.3 × 0.8–1 mm, obtuse at apex, sub-truncate at base, glabrous, straw-coloured. Floral bracts oblanceolate, 2–2.9 × 0.5–1 mm, acuminate at apex, truncate at base, hoary towards apex, black. Male flowers. Pedicels *c.* 0.2 mm long. Sepals 3, fused, obovate, 1.8–2 × 0.9–1 mm, 3-lobed, obtuse or acute at apex, cuneate at base, hoary towards apex, black. Stipe of corolla 0.8–1 mm long. Petals 3, equal, oblong, *c.* 0.5 × 0.2 mm, obtuse at apex, hoary towards apex with a black gland, hyaline. Stamens 6; filaments 0.5 mm long, white; anthers black. Female flowers: Pedicels *c.* 0.2 mm long, glabrous. Sepals 3, free, equal, lanceolate, 1.8–2 × 0.1–0.2 mm, obtuse at apex, cuneate at base, hoary towards apex, black, minutely keeled, hairy along margins. Petals 3, free, sub-equal, spathulate, *c.* 2 × 0.1 mm, obtuse at apex, not clawed, hoary, glandular, stipitate between sepals and petals. Ovary ovoid, *c.* 0.5 × 0.5 mm; style *c.* 1 mm long; stigma trifid. Seeds *c.* 0.8 × 0.6 mm, oblong, obtuse, seed coat cells transversely elongated, aligned in vertical rows, appendages absent.

Distribution: S. India (POWO, 2023); *Habitat*: Damp areas in high altitude; *Fl. & Ft.*: August-December.

Specimens examined: Pachakkanam, Periyar Tiger Reserve, 23.12.1995, *K.P. Rajesh & Jomy Augustine* 17050 (KFRI); Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164892; Pettimudi, near Subranshed, 30.12.2019, *Dani Francis & Santhosh Nampy* 170042 (CALI).

Notes: Although this species has black anthers, it belongs to Ansari and Balakrishnan's Section X, which has white anthers. However, it shares

characteristics with white anther species, such as unequal petals and seeds without appendages (Darshetkar *et al.*, 2021).

Eriocaulon quinquangulare L., Sp. Pl. 1: 87. 1753; Hook.f., Fl. Brit. India 6: 582. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1618. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 520. 2004; R.Ansari & N.P.Balakr., Eriocaul. India 97. 2009; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 693–723. 2021.

Acaulescent herbs, 20–30 cm tall. Root stock absent. Leaves rosulate, lanceolate, 3–8 × 0.2–0.4 cm, acute at apex, cuneate at base, entire at margin, glabrous, green, turning to pale or deep purple on drying. Peduncles many, 5–30 cm long, glabrous. Sheaths terete, 2–4 cm long, glabrous; limbs ovate, acute at apex, glabrous. Heads globose, 2–5 mm across, grey. Receptacles globose, pilose. Involucral bracts oblong-obovate, 1.5–2 × 1–1.2 mm, obtuse and lacerate at apex, sub-truncate at base, glabrous, straw-coloured. Floral bracts oblanceolate, 2–2.2 × 0.8–1 mm, acuminate at apex, truncate at base, sparsely hoary towards apex, black. Male flowers: Pedicels *c.* 0.6 mm long. Sepals 3, fused, obovate, 1–1.2 × 0.9–1 mm, 3-lobed, obtuse at apex, cuneate at base, sparsely hoary towards apex, black. Stipe of corolla *c.* 0.5 mm long. Petals 3, sub-equal, oblong, *c.* 0.5 × 0.2 mm, obtuse at apex, sparsely hoary towards apex with a black gland, hyaline. Stamens 6; filaments *c.* 0.4 mm long, white; anthers black. Female flowers: Pedicels *c.* 0.3 mm long, glabrous. Sepals 3, free, minute, linear-spathulate, sub-equal, 0.5–1.5 × 0.1–0.2 mm, obtuse at apex, attenuate at base, hoary towards apex. Petals 3, free, unequal, spathulate, 1–1.6 × 0.1–0.2 mm, obtuse at apex, not clawed, hoary towards apex, glandular, stipitate between sepals and petals, *c.* 0.4 mm long. Ovary oblong-ovoid, *c.* 0.5 × 0.5 mm; style *c.* 1.2 mm long; stigma trifid. Seeds oblong-ovoid, 0.4–0.5 × 0.2–0.3 mm, seed coat cells transversely elongated, aligned in vertical rows, appendages 2–4 from transverse radial walls, rectangular or as ribbon like bands.

Distribution: Indian Subcontinent to Indo-China (POWO, 2023); *Habitat*: Marshy or moist lands, banks of river, paddy fields and open lands; *Fl. & Ft.*: July-March.

Specimens examined: Koyimanchola, 10.02.2021, *Dani Francis & Santhosh Nampy* 176337; Pius Nagar, way to Kanthallur, 26.01.2018, *Dani Francis & Santhosh*

Nampy 158331; Pothadi, near Marayur, 26.01.2018, *Dani Francis & Santhosh Nampy* 158311; Thannikkudy, 10.08.1994, *Jomy Augustine* 14510 (CALI).

Notes: *Eriocaulon quinquangulare* is one of the most variable species, grows in a wide range of habitats. Differences in the colour of leaves and shape of seed coat appendages are common (Ansari & Balakrishnan, 2009).

Eriocaulon rhodae Fyson, Journ. Ind. Bot. ii: 264. 1921; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1619. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 520. 2004; R.Ansari & N.P.Balakr., Eriocaul. India: 12. 2009; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 693–723. 2021. **Fig. 25F**

Acaulescent herbs, 30–40 cm long. Root stock absent. Leaves linear-lanceolate, 4–11 × 0.5–1 cm, acute at apex, truncate at base, entire at margins, puberulous, green. Peduncles many, 3–25 cm long, glabrous. Sheaths terete, 6–8 cm long, pilose. Heads spherical, 0.5–1 cm across, white. Receptacles ovoid-cylindric, villous. Involucral bracts widely elliptic, 2–2.1 × 1.1–1.2 mm, rounded at apex, truncate at base, sparsely hoary, white to straw-coloured, entire at margins. Floral bracts oblanceolate, 3–3.2 × 0.9–1 mm, acuminate at apex, cuneate at base, sparsely hoary towards apex, hairy at base, white. Male flowers: Pedicels *c.* 1 mm long, basally hairy. Sepals 3, fused, oblong, 1.3–1.5 × 0.4–0.5 mm, truncate at apex, cuneate at base, hoary towards apex, white. Stipe of corolla *c.* 0.3 mm long. Petals 3, unequal, linear, *c.* 0.2 mm long, obtuse at apex, hoary towards apex with a black gland, hyaline, mid one *c.* 0.3 × 0.1 mm, laterals *c.* 0.1 × 0.1 mm. Stamens 6; filaments *c.* 0.2 mm long, white; anthers black. Female flowers basally hairy. Sepals 3, free, equal, boat-shaped, 2–2.2 × 0.8–0.9 mm, obtuse at apex, cuneate at base, hoary at apex, keeled, white. Petals 3, narrowly elliptic, 2.7–3.2 × *c.* 1 mm, eglandular, hyaline, hoary at apex, ciliate hairy at margin, clawed, stipitate between sepals and petals, *c.* 0.9 mm long. Ovary oblong, *c.* 1 × 1 mm; style *c.* 1.4 mm long; stigma trifid. Seeds oblong, *c.* 1.5 × 0.5 mm, seed coat cells transversely elongated, appendages solitary from the centre of each transverse radial wall, curved and connate with the adjacent ones of the same vertical row forming longitudinal parallel ribs.

Distribution: SW. India, Sri Lanka and Myanmar (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: November-February.

Specimens examined: Above Cheeyappara falls, 27.12.2017, *Dani Francis & Santhosh Nampy* 156508; way to Mamalakandam, near Yakobaya church, 27.12.2017, *Dani Francis & Santhosh Nampy* 156520; Padikkappu, rocky area, 28.12.2017, *Dani Francis & Santhosh Nampy* 156575; above Valara waterfalls, 27.12.2017, *Dani Francis & Santhosh Nampy* 156549; Venmany, 11.12.2016, *Dani Francis & Santhosh Nampy* 151346 (CALI).

Notes: *Eriocaulon rhodae is closely allied to E. robustobrownianum* Ruhland, but can be differentiated by linear-lanceolate leaves (*vs.* oblong-ensiform leaves), acuminate floral bracts (*vs.* acicular floral bracts) and eglandular female petals (*vs.* glandular female petals).

Eriocaulon sexangulare L., Sp. Pl. 1: 87. 1753; Hook.f., Fl. Brit. India 6: 580. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1618. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 521. 2004; R.Ansari & N.P.Balakr., Eriocaul. India 72. 2009; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 693–723. 2021.

Acaulescent herbs, 10–20 cm tall. Root stock absent. Leaves rosulate, linear-lanceolate, 3–7 × 0.1–0.2 cm, acute at apex, cuneate at base, entire at margins, glabrous, green. Peduncles many, 5–20 cm long, glabrous. Sheaths terete, 3–5 cm long, glabrous; limbs lanceolate, 2–3 × 1.8–2 mm, acuminate at apex, glabrous. Heads hemispherical, 2–4 mm across, grey. Receptacles ovoid, sparsely pilose. Involucral bracts obovate-orbicular, 1.8–2 × 1–1.2 mm, obtuse at apex, truncate at base, glabrous, entire at margins, straw-coloured. Floral bracts obovate, 1.5–2 × 0.8–1 mm, closely imbricating, cuspidate at apex, sub-truncate at base, hoary towards apex. Male flowers: Pedicels *c.* 0.1 mm long, glabrous. Sepals obovate, connate in to a closed spathe, tubular, 0.8–1 × 0.8–1 mm, not distinctly lobed, glabrous, straw-coloured, laterally keeled, black. Stipe of corolla 0.7–1 mm long. Petals 3, equal, minute, oblong, *c.* 0.3 mm long, obtuse at apex, sparsely hoary towards apex with a black gland, hyaline. Stamens 6; filaments *c.* 0.2 mm long, white; anthers black. Female flowers: Pedicels minute, *c.* 0.1 mm long. Sepals 3, free, unequal, 1.8–2 × 0.1–0.3 mm; laterals obovate, conduplicate, obtuse at apex,

cuneate at base, keeled, glabrous; mid one narrow, oblong, flat, obtuse at apex, cuneate at base, not keeled, glabrous. Petals 3, sub-equal, linear, *c.* 1.1 mm long, barbate towards apex, glandular, hyaline, not clawed, not stipitate between sepals and petals. Ovary ovate, *c.* 0.4 mm long; style *c.* 1.1 mm long; stigma trifid. Seeds *c.* 0.5 × 0.4 mm, globose, seed coat cells transversely elongated, in vertical rows, appendages solitary from transverse radial walls, setiform, dilated at apex.

Distribution: Madagascar, Tropical and Subtropical Asia to Caroline Islands (POWO, 2023); *Habitat*: Paddy fields; *Fl. & Ft.*: September-February.

Specimens examined: Munnar, 13.12.1970, *Sivadasan M.* 645 (CALI); Periyar Tiger Reserve, Kavalappara, 01.01.1995, *N. Sasidharan & Jomy Augustine* 14554 (KFRI).

Notes: This species is characterized by completely closed tubular male sepals and keeled male and female sepals (Ansari & Balakrishnan, 2009).

Eriocaulon thwaitesii Korn., Linnaea 27(5): 627. 1856; Hook.f., Fl. Brit. India 6: 573. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1620. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 521. 2004; R.Ansari & N.P.Balakr., Eriocaul. India 60. 2009; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 718. 2021.

Acaulescent herbs, 7–25 cm tall. Root stock absent. Leaves linear, 4–10 × 0.1–0.2 cm, acuminate at apex, cuneate at base, entire at margin, glabrous, green. Peduncles many, 5–24 cm long, glabrous. Sheaths terete, 3–7 cm long, glabrous; limbs ovate, 2–3 × 1.8–2 mm long, acuminate at apex, glabrous. Heads hemispherical, 3–5 mm across, straw-coloured. Receptacles convex, villous. Involucral bracts oblong, 2.2 × 1.5 mm, obtuse at apex, truncate at base, pilose hairy, straw-coloured, entire at margins. Floral bracts oblanceolate, 2.3 × 1.5 mm, acute at apex, attenuate at base, sparsely hoary towards apex, basally hairy, black. Male flowers: Pedicels *c.* 0.1 mm long, basally hairy. Sepals 2 or with a third minute protuberance in between lobes, fused, obovate, *c.* 1.1 × 0.3 mm, obtuse at apex, sparsely hoary towards apex, black. Stipe of corolla *c.* 0.1 mm long. Petals 3, equal, ovate, *c.* 0.3 mm long, obtuse at apex, hoary towards apex with a black gland, hyaline. Stamens 6; filaments *c.* 0.2 mm long, white; anthers black. Female flowers: Pedicels 0.05–0.1 mm long. Sepals 3 or 2, free, equal or unequal, oblanceolate, *c.* 1.8 × 0.3 mm, acute at apex, cuneate at base, glabrous, black to straw-coloured,

keeled. Petals 3, narrow, barbate, *c.* 1.1 mm long, glandular, hyaline, not clawed, stipitate between sepals and petals, 0.1–0.2 mm long. Ovary obovate, *c.* 0.4 mm long; style *c.* 1.1 mm long; stigma trifid. Seeds obovate, *c.* 0.6 × 0.2 mm, seed coat cells transversely elongated, in vertical rows, appendages solitary from middle of each transverse radial wall, setiform, dilated at apex.

Distribution: S. India, Sri Lanka and Myanmar (POWO, 2023); *Habitat*: Moist or marshy areas; *Fl. & Ft.*: June-March.

Specimens examined: Above Cheeyappara waterfalls, 30.12.2017, *Dani Francis & Santhosh Nampy* 156511; Kalvary Mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154353; Kattadikadavu, 12.10.2019, *Dani Francis & Santhosh Nampy* 170361; Kudimala, Lakkamkudi, 09.12.2019, *Dani Francis & Santhosh Nampy* 170007; *Ibid*., 09.12.2019, *Dani Francis & Santhosh Nampy* 170011 (CALI); Kuttikkanam-Peermade, 21.09.1964, *K. Vivekananthan* 20346; Lockhert gap, 10.10.1963, *K.M. Sebastine* 17486 (MH); Mathikettan shola National Park, 06.01.2017, *Dani Francis & Santhosh Nampy* 151614 (CALI); Microwave station, Painavu, 08.11.1981, *V.S. Raju* 71211 (MH); Mathikettan Shola National Park, Choondal, 23.11.2014, *Syam Radh S.* 137865; Mathikettan Shola National Park, Mannakkudi, 06.01.2017, *Dani Francis & Santhosh Nampy* 151633; Mathikettan Shola National Park, Santhanpara, 11.12.2016, *Dani Francis & Santhosh Nampy* 151365; Mayiladumpara, 13.12.2013, *Syam Radh S. & Janeesha* 138143; Meenuliyanpara, 29.11.2019, *Dani Francis & Santhosh Nampy* 164633; *Ibid.,* 29.11.2019, *Dani Francis & Santhosh Nampy* 164645; *Ibid.,* 12.12.2016, *Dani Francis & Santhosh Nampy* 151420; Meesapulimala, 20.11.2018, *Dani Francis & Santhosh Nampy* 167748; 8th plot, Meesapulimala, 20.11.2018, *Dani Francis & Santhosh Nampy* 167736; *Ibid.,* 15.09.2019, *Dani Francis & Santhosh Nampy* 170381; Mesthirikettu, Near Eravikulam, 30.12.2017, *Dani Francis & Santhosh Nampy* 158095; *Ibid.,* 30.12.2017, *Dani Francis & Santhosh Nampy* 158086 (CALI); Painavu, 20.08.1981, *K. Vivekananthan & V.S. Raju* 71114; Painavu-Kulamvu Road, 07.11.1981, *V.S. Raju* 71202 (MH); Panchalimedu, 13.09.2019, *Dani Francis & Santhosh Nampy* 170303; Parunthanpara, 29.04.2018, *Dani Francis & Santhosh Nampy* 159231; Pothadi, Marayur, 26.01.2018, *Dani Francis & Santhosh Nampy* 158305 (CALI); Thekkady, 14.06.1994, *N. Sasidharan & Jomy Augustine* 13819

(KFRI); Thottapuzha, 11.12.2013, *Syam Radh S. & Janeesha* 138171; Vagamon, 26.10.2020, *Dani Francis & Santhosh Nampy* 170092; Vakavanam, 14.09.2019, *Dani Francis & Santhosh Nampy* 170313 (CALI); Vandiperiyar-Pambanar, 23.09.1964, *K. Vivekananthan* 21328 (MH); way to Vandiperiyar, 55th mile, 13.10.2017, *Dani Francis & Santhosh Nampy* 156376 (CALI).

Notes: *Eriocaulon thwaitesii* is the most common species in the study area with a wide range of variations. The sepals of male flowers are 2-lobed, sometimes with a minute protuberance at the middle. In female flowers, mid sepal flattened or absent.

Eriocaulon truncatum Buch.-Ham. ex Mart. in Wall., Pl. Asiat. Rar. 3: 29. 1832; Hook.f., Fl. Brit. India 6: 578. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1619. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 522. 2004; R.Ansari & N.P.Balakr., Eriocaul. India 110. 2009; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 693–723. 2021. **Fig. 25E**

Acaulescent herbs, 2.5–10 cm tall. Root stock absent. Leaves linear, 0.9–3 × 0.1–0.2 cm, acute at apex, truncate at base, entire at margins, glabrous, green. Peduncles many, 2–10 cm long, glabrous. Sheaths terete, 1–2.5 cm long, glabrous; limbs lanceolate, 5–9 × 1.8–2 mm long, acuminate at apex, glabrous. Heads hemispherical, 2–3 mm across, black to straw-coloured. Receptacles convex or cylindric, glabrous or pilose. Involucral bracts oblong, 2–3 × 2 mm, obtuse at apex, truncate at base, glabrous, straw-coloured, entire at margins. Floral bracts obovate, 1.9–2 × 1.2–1.3 mm, obtuse at apex, cuneate at base, glabrous, hyaline. Male flowers: Pedicels *c.* 0.2 mm long. Sepals 2, fused, obovate, 0.8–1 × 0.8–1 mm, obtuse-acute at apex, cuneate at base, sparsely hoary towards apex, black. Stipe of corolla *c.* 0.6 mm long. Petals 3, equal, *c.* 0.2 mm long, oblong, obtuse at apex, hoary towards apex with a black gland, hyaline. Stamens 6; filaments *c.* 0.2 mm long, white; anthers black. Female flowers: Pedicels *c.* 0.1 mm long, not hairy. Sepals 2 or 3, free, sub-equal, boat-shaped, 1.2–1.3 × 0.1 mm, obtuse at apex, cuneate at base, glabrous, black. Petals 3, oblanceolate, hyaline, unequal, sparsely hoary at apex, glandular, apiculate; lateral ones *c.* 1.1 × 0.1 mm, middle one *c.* 1.3 × 0.1 mm, stipitate between sepals and petals, 0.2–0.3 mm long. Ovary oblong, *c.* 0.4 × 0.4 mm; style *c.* 1.1 mm long; stigma trifid. Seeds ovoid-oblong, *c.* 0.4 × 0.3 mm, obtuse

or apiculate at apex, seed coat cells rectangular, vertically elongated, aligned in vertical rows, appendages a pair of continuous ribbon like bands from vertical walls and solitary incomplete bands from transverse radial walls seen as rectangular reticulations of ribbon-like bands.

Distribution: Tropical and Subtropical Asia to N. Australia (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: September-January.

Specimens examined: Above Cheeyappara falls, 27.12.2017, *Dani Francis & Santhosh Nampy* 156508; Mangappara, near Anakkulam, 15.12.2019, *Dani Francis & Santhosh Nampy* 168961; Mlappara, *s.d.*, *Jomy Augustine* 12086; MPCA, grassland near dam site, 22.01.2019, *Dani Francis & Santhosh Nampy* 168928; Padikkappu, near Valara, 28.12.2017, *Dani Francis & Santhosh Nampy* 156580; Valara, 28.12.2017, *Dani Francis & Santhosh Nampy* 156586; *Ibid.*, 27.12.2017, *Dani Francis & Santhosh Nampy* 156517 (CALI).

Eriocaulon tuberiferum A.R.Kulk. & Desai, J. Bombay Nat. Hist. Soc. 71(1): 81. 1974; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 693–723. 2021. *E. idukkianum* Manudev, Robi & Nampy, Phytotaxa 324(3): 289. 2017. **Fig. 25C**

Acaulescent herbs, 10–21 cm tall. Root stock up to 5 cm long with a subterranean tuber; tuber globose, *c.* 1 × 1 cm, glabrous. Leaves linear-ensiform, 2–7 × 0.2–0.4 cm, acute at apex, cuneate at base, entire at margin, glabrous, green. Peduncles 1–9, 10–21 cm long, glabrous. Sheaths terete, *c.* 7 cm long, glabrous; limbs ovate, 1–3 × 1.8–2 mm, 3–4 lobed at apex, glabrous. Heads cylindrical, 3–8 mm across, white. Receptacles cylindrical, pilose. Involucral bracts elliptic-obovate, 2.8–3 × 1–1.2 mm, obtuse at apex, truncate at base, glabrous, entire at margins, black. Floral bracts oblanceolate, 3–3.1 × 0.9–1 mm, acuminate at apex, sub-truncate at base, hoary towards apex, black. Male flowers: Pedicels *c.* 1 mm long, glabrous. Sepals 3, free, sub-equal, oblanceolate, *c.* 1.7 × 0.5 mm, obtuse at apex, cuneate at base, hoary towards apex, black. Stipe of corolla *c.* 0.5 mm long. Petals 3, unequal, oblong, obtuse at apex, hoary towards apex with a black gland, hyaline, mid one 1.2–1.3 mm long, laterals *c.* 0.9 mm long. Stamens 6; filaments *c.* 0.2 mm long, white; anthers white. Female flowers: Pedicels *c.* 0.6 mm long, glabrous. Sepals 3, free, sub-equal, oblanceolate, 2.3–2.5 × 0.4–0.5 mm, acute at apex, cuneate at base,

hoary towards apex, black, slightly keeled. Petals 3, free, sub-equal, spathulate, *c.* 2.1 × 0.2 mm, glandular, hyaline, not clawed, hoary towards apex, pilose at margins, stipitate between sepals and petals, c. 0.1 mm long. Ovary ovoid, *c.* 0.6 × 0.5 mm; style *c.* 1.2 mm long; stigma trifid. Seeds oblong, *c.* 0.6 × 0.6 mm, seed coat cells transversely elongated, in longitudinal rows, appendages absent.

Distribution: W. India (POWO, 2023); *Habitat*: Marshy areas and wet dripping rocks; *Fl. & Ft.*: September-December.

Specimens examined: Anamudi peak**,** 11.12.2019, *Dani Francis & Santhosh Nampy* 164564; *Ibid.*, 11.12.2019, *Dani Francis & Santhosh Nampy* 164572; Meesapulimala top, 21.11.2018, *Dani Francis & Santhosh Nampy* 167794; way to Meesapulimala, 15.09.2019, *Dani Francis & Santhosh Nampy* 170379; *Ibid.*, 21.11.2018, *Dani Francis & Santhosh Nampy* 167789; Mesthirikettu, 30.12.2017, *Dani Francis & Santhosh Nampy* 158093; Munnar, Silent valley, waterfalls near Rhodovally, 22.11.2018, *Dani Francis & Santhosh Nampy* 168808; Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164900 (CALI).

Notes: *Eriocaulon tuberiferum* is characterized by the presence of root tubers, ribbon-like bands of appendages on the seed coat, and white anthers (Ansari & Balakrishnan, 2009). Because of the similarities in root tubers, seed appendages, and root stock characters, *E. idukianum* is treated conspecific to *E. tuberiferum*, and molecular data support the same (Darshetkar *et al.*, 2021).

Eriocaulon vamanae Dani & Nampy, Edinburgh J. Bot. 77(2): 281. 2020.

Figs. 23, 24

Acaulescent herbs, 1–3 cm tall. Root stock absent. Leaves linear, 0.9–2 × 0.1–0.2 cm, apex acute, broadening slightly towards base, margin entire, ciliate, green. Peduncles many, 0.6–2.7 cm long, pubescent. Sheaths terete, 0.6–2 cm long, ciliate; limbs lanceolate, 6–9 × 2 mm, apex narrowly acute, ciliate. Heads hemispherical, 2–3 mm across, black to straw-coloured. Receptacles obovoid, *c.* 1 × 1 mm, pilose. Involucral bracts oblong, 2–2.1 × 1–2 mm, obtuse to sub-truncate at apex, truncate at base, glabrous to sparsely hoary, entire at margins, black. Floral bracts oblanceolate, *c.* 2 × 0.8 mm, acuminate at apex, cuneate at base, sparsely hoary towards apex, straw-coloured. Male flowers: Pedicels 0.2–0.3 mm, basally hairy.

Sepals 3, free, obovate to oblanceolate, *c.* 1 × 0.8 mm, obtuse to acute at apex, cuneate at base, sparsely hoary towards apex, straw-coloured. Stipe of corolla *c.* 0.6 mm. Petals 3, equal, oblong, *c.* 0.2 mm long, obtuse at apex, hoary towards apex with a black gland, hyaline. Stamens 6; filaments *c.* 0.2 mm, white; anthers black. Female flowers: Pedicels *c.* 0.2 mm long, basally hairy. Sepals 3, free, sub-equal, boat-shaped, 1.6–2 mm long, not keeled; lateral sepals, conduplicate, obtuse to sub-acute at apex, cuneate at base, glabrous, blackish to straw-coloured. Petals 3, linear, *c.* 1.1 mm long, narrow, barbate, eglandular, hyaline, not clawed, stipitate between sepals and petals, *c.* 0.1 mm long. Ovary oblong, *c.* 0.4 × 0.4 mm; style *c.* 1.1 mm long; stigma trifid. Seeds elliptic to oblong, *c.* 0.4 × 0.3 mm, seed coat cells transversely elongated, appendages solitary or very rarely two from the middle of each transverse radial wall, setiform, dilated at apex.

Distribution: Endemic to Kerala; *Habitat*: Wet meadows around mountain springs; *Fl. & Ft.*: November-January.

Specimens examined: Way to Meesapulimala, near Munnar, 21.12.2018, *Dani Francis & Santhosh Nampy* 167894; *Ibid.,* 31.12.2018, *Dani Francis & Santhosh Nampy* 167894 (CALI).

Notes: *Eriocaulon vamanae* is morphologically close to *E. nepalense* var. *luzulifolium* (Mart.) Praj. & J.Parn. but differs in the shape of involucral bracts (oblong *vs.* broadly ovate), receptacle (obovoid *vs*. convex), nature of male sepals (free *vs.* fused), shape and hairiness of female sepals (boat-shaped and glabrous *vs*. linear to narrowly oblanceolate and hoary at apex), size and hairiness of female petals (1.1 mm long, barbate *vs*. 1.5 mm long, hairy at apex) and number of seed coat appendages (1 or very rarely 2 *vs.* 1–4). The species is provisionally assessed as Critically Endangered (CR).

Fig. 23. *Eriocaulon vamanae* Dani & Nampy: **A.** Habit; **B.** Involucral bract; **C.** Floral bract; **D.** Male flower; **E.** Male flower with sepals and petals spread out; **F.** Female sepals; **G.** Female petals; **H.** Gynoecium with petals; **I.** Seeds.

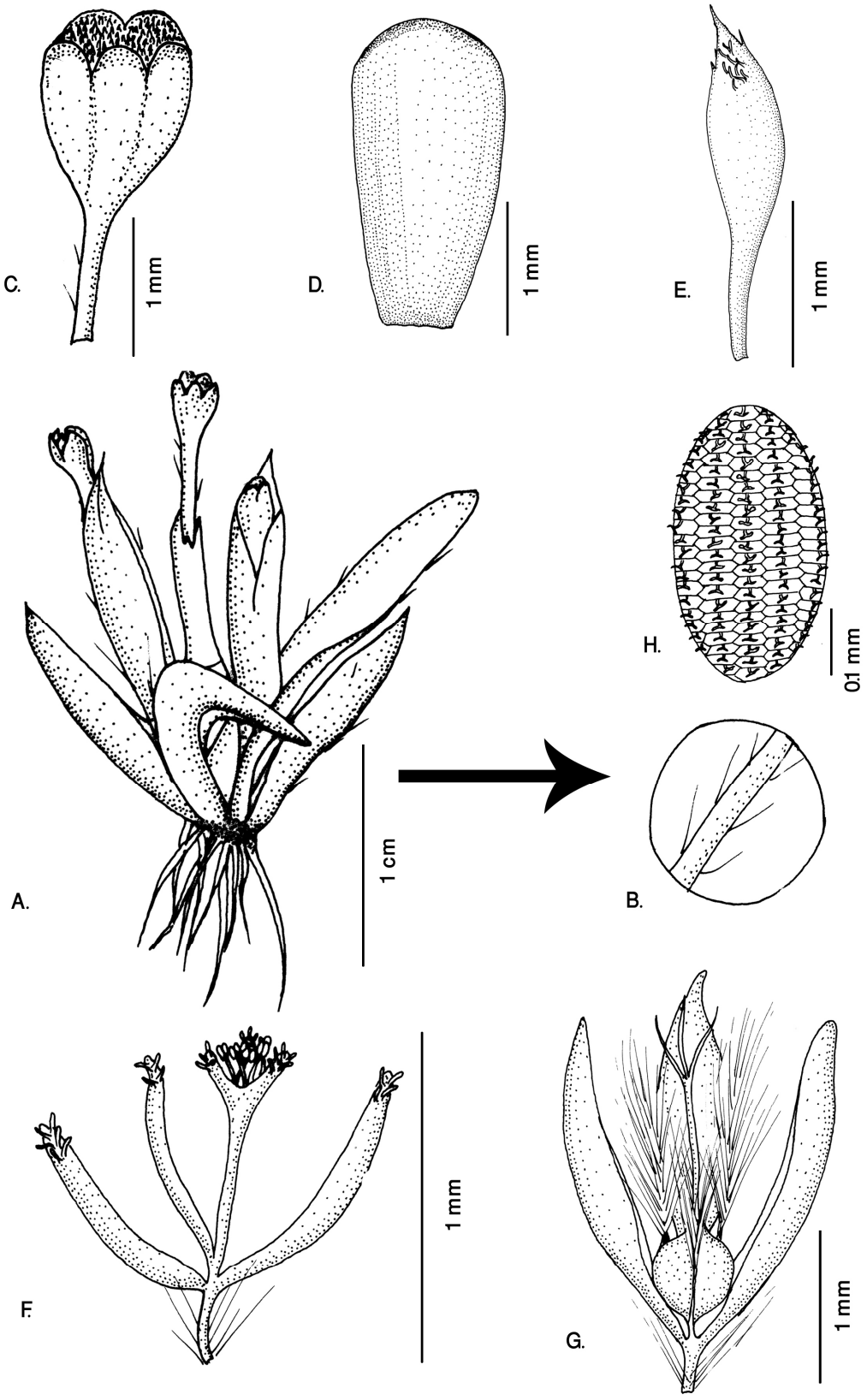


Fig. 24. *Eriocaulon vamanae* Dani & Nampy: **A.** Habit; **B.** Hair pattern; **C.** Head; **D.** Involucral bract; **E.** Floral bract; **F.** Male flower; **G.** Female flower; **H.** seed.

Eriocaulon vasudevanii R.Ansari & N.P.Balakr., Fam. Eriocaulac. in India: 68. 1994; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 522. 2004; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 693–723. 2021. **Fig. 25G**

Acaulescent herbs, 4.5–14 cm tall. Root stock absent. Leaves linear, 0.5–4 × 0.5–0.1 cm, acute at apex, cuneate towards base, entire at margins, glabrous, green. Peduncles many, 3–12 cm long, glabrous. Sheaths terete, 0.5–3 cm long, glabrous; limbs ovate, 2–6 × *c.* 1 mm long, acute at apex, pilose. Heads hemispherical, 1.5–3 mm across, black. Receptacles convex, glabrous. Involucral bracts oblong, 1.8–2.5 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous, entire at margins, dentate at apex, straw-coloured. Floral bracts obovate, *c.* 1.6 × 0.8 mm, obtuse at apex, cuneate at base, glabrous, black. Male flowers: Pedicels *c.* 0.1 mm long. Sepals 3, fused, obovate, 0.8–1 × *c.* 0.8 mm, obtuse at apex, cuneate at base, glabrous, black. Stipe of corolla *c.* 0.5 mm long. Petals 3, equal, ovate, *c.* 0.2 mm long, obtuse at apex, glabrous with a black gland, hyaline. Stamens 6; filaments *c.* 0.1 mm long, white; anthers black. Female flowers: Pedicels *c.* 0.1 mm long, glabrous. Sepals 3, free, unequal; laterals linear, *c.* 1 × 0.1 mm, acuminate at apex, cuneate at base, glabrous, black; mid one minute, acicular, black. Petals 3, sub-equal, spathulate, *c.* 1 mm long, glandular, sparsely barbate towards apex, hyaline, stipitate between sepals and petals, *c.* 0.2 mm long. Ovary ovoid, *c.* 0.3 × 0.2 mm; style *c.* 1 mm long; stigma trifid. Seeds oblong, *c.* 0.3 × 0.2 mm, seed coat cells transversely elongated, in vertical rows, appendages solitary from the angles of cells, setiform, bifid at apex.

Distribution: India (POWO, 2023); *Habitat*: Banks of river and grassy slopes; *Fl. & Ft.*: August-March.

Specimens examined: Koruthode, Periyar Tiger Reserve, 15.08.1995, *N. Sasidharan & Jomy Augustine* 16295; Vallakadavu, near Periyar Tiger Reserve, 13.10.2017, *Dani Francis & Santhosh Nampy* 156368 (CALI).

Notes: *Eriocaulon vasudevanii* is allied to *E. nairii* by the appendages arising from the angles of seed coat cells, but differs by the absence of stem, shape, size and hairiness of floral structures (Ansari & Balakrishnan, 2009).

Eriocaulon xeranthemum Mart. In Wall., Pl. Asiat. Rar. 3: 29. 1832; Hook.f., Fl. Brit. India 6: 584. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1620. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 522. 2004; R.Ansari & N.P.Balakr., Eriocaul. India 54. 2009; Darshetkar *et al.*, Syst. Biodiverse. 19(7): 693–723. 2021. **Fig. 25H**

Acaulescent herbs, 1–3 cm tall. Root stock absent. Leaves linear, 0.5–2 × 0.1–0.2 cm, acute at apex, cuneate at base, margin entire, glabrous, green. Peduncles a few, 0.5–3 cm long, glabrous. Sheaths terete, 0.6–1.5 cm long, glabrous; limbs ovate, 6–9 × *c.* 2 mm, acute at apex, glabrous. Heads hemispherical, 2–5 mm across, white. Receptacles convex, glabrous. Involucral bracts oblong-lanceolate, 2–4 × 0.5–1 mm, acute-acuminate at apex, truncate at base, glabrous, entire at margins, white. Floral bracts obovate, *c.* 1.5 × 0.6 mm, truncate at apex, cuneate at base, sparsely hoary towards apex, white. Male flowers: Pedicels 0.2–0.3 mm long, not hairy. Sepals 3, fused, cuneate, *c.* 1 × 1 mm, truncate at apex, cuneate at base, hoary towards apex, straw coloured. Stipe of corolla *c.* 0.2 mm long. Petals 3, sub-equal, *c.* 0.2 mm long, with a black gland, hyaline. Stamens 6; filaments *c.* 0.2 mm long, white; anthers black. Female flowers: Sessile. Sepals 3, free, unequal, *c.* 1 mm long, obtuse at apex; lateral ones oblanceolate, hoary at apex, straw-coloured; mid one narrower than the laterals, linear, glabrous or few hairy. Petals 3, sub-equal, spathulate, *c.* 1.1 mm long, obtuse at apex, not clawed, barbate, glandular, stipitate between sepals and petals, *c.* 0.2 mm long. Ovary ovoid, *c.* 0.4 × 0.2 mm; style *c.* 1.1 mm long; stigma trifid. Seeds elliptic-oblong, *c.* 0.4 × 0.3 mm, seed coat cells transversely elongated, appendages 2–4 from transverse radial walls, appear as transverse ring on the surface of seeds, setiform, truncate at apex.

Distribution: India to W. Malesia (POWO, 2023); *Habitat*: Open moist or marshy areas, crevices of moist rocks; *Fl. & Ft.*: July-November.

Specimens examined: Kaliyar, 30.11.2019, *Dani Francis & Santhosh Nampy* 164646; Padikkappu, 28.12.2017, *Dani Francis & Santhosh Nampy* 156580 (CALI); Painavu-Kulamavu Road, 21.08.1981, *K. Vivekananthan & V.S. Raju* 71131 (MH); Periyar Tiger Reserve, Vellimala, 18.08.1995, *N. Sasidharan & Jomy Augustine* 16304 (KFRI); above Valara waterfalls, 27.12.2017, *Dani Francis & Santhosh Nampy* 156548 (CALI).

Fig. 25. A. *Eriocaulon brownianum* Mart.; **B.** *Eriocaulon nairii* Chandrab. & V.Chandras.; **C.** *Eriocaulon tuberiferum* A.R.Kulk. & Desai; **D.** *Eriocaulon odoratum* Dalzell; **E.** *Eriocaulon truncatum* Buch.-Ham. ex Mart.; **F.** *Eriocaulon rhodae* Fyson; **G.** *Eriocaulon vasudevanii* R.Ansari & N.P.Balakr.; **H.** *Eriocaulon xeranthemum* Mart.

CYPERACEAE Juss.,

in Gen. Pl. 26. 1789.

Annual or perennial herbs, rhizomatous to stoloniferous. Culms simple, often triangular. Leaves basal or cauline, often 3-ranked; sheaths open or closed; ligules often present, sometimes opposite to blade; leaf blade usually linear, grass like, sometimes basally broader and constricted into a pseudo petiole. Involucral bracts 1 to several, leaflike or glumelike. Inflorescence unbranched, spicate or capitate, to branched umbel-like or paniculate. Spikelets sometimes reduced to a single flower, aggregated into unisexual spikes. Glumes membranous to leathery, spirally arranged or 2-ranked, each subtending a single flower. Pseudo spikelets comprising 2–12 membranous scale-like floral bracts; lowest 2 bracts opposite, keeled; bracts spirally arranged and aggregated in to spikes. Flowers bisexual or unisexual. Perianth absent or reduced to bristles or scales. Stamens 1–3; anthers basifixed. Ovary superior, 2 or 3-carpellary, unilocular; ovules 1; style divided or rarely undivided, base sometimes persistent and variously shaped in fruit; stigma 2 or 3. Fruits nutlets, rarely with a succulent or corky exocarp, surface smooth or variously minutely patterned, sometimes partially or completely enclosed by an enlarged basal utricle.

Sedges are the third largest monocot family, comprising 95 genera and over 5600 species, which are economically and ecologically significant (Larridon *et al.*, 2021). They are mostly perennial or annual herbs with a global distribution (Bhandari *et al.*, 2021). In India, it is represented by 28 genera and 500 species (Wadoodkhan, 2015). Thirteen genera and 99 species in the study area.

Key to the genera

1. Florets unisexual …… 2

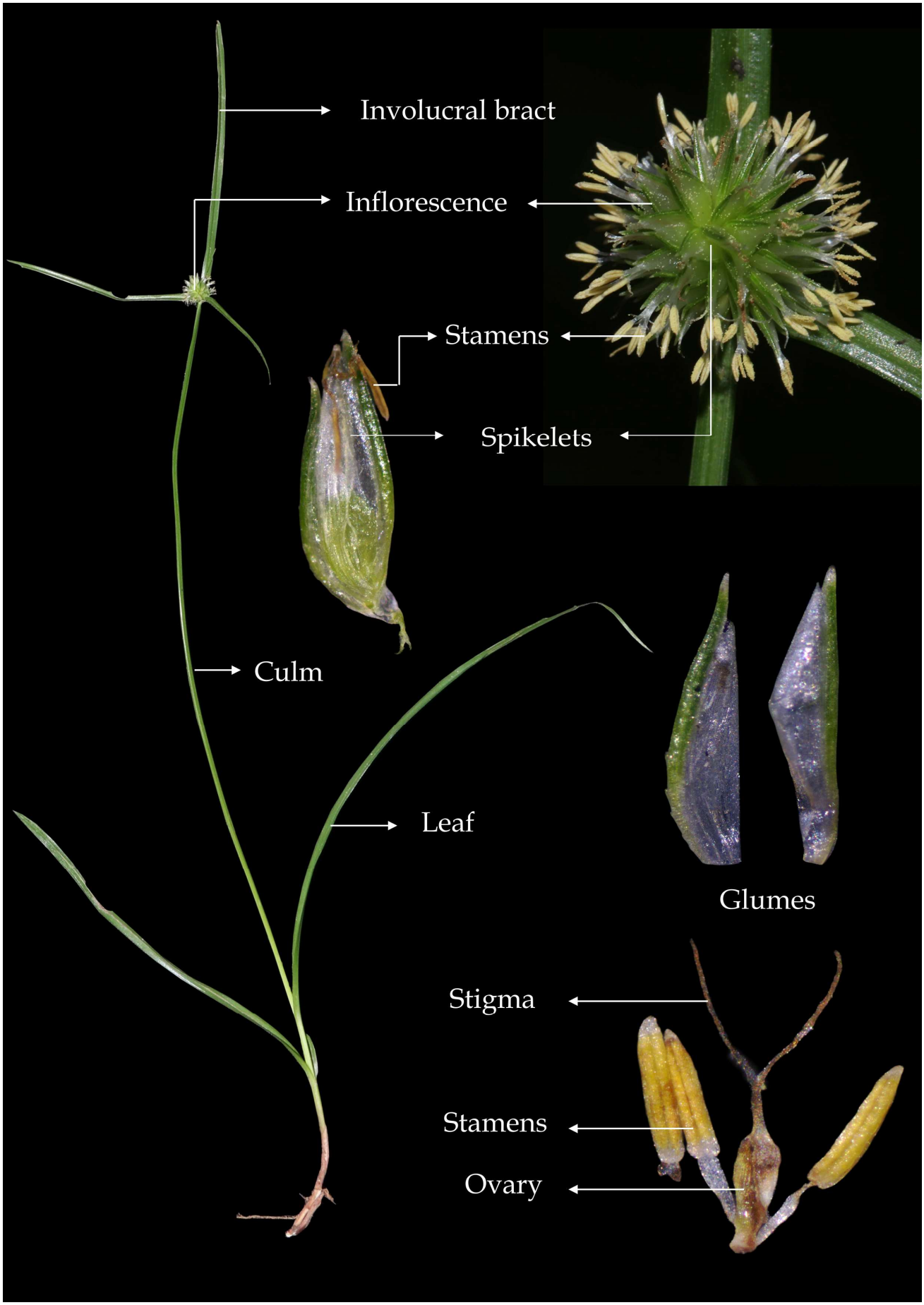
1. Florets bisexual …… 4

2. Nuts enclosed in a utricle …… *Carex*

2. Nuts not enclosed in a utricle …… 3

3. Disc present below the nut …… *Scleria*

3. Disc obsolete …… *Diplacrum*


Involucral bract
Inflorescence
Stamens
Spikelets
Culm
Leaf
Glumes
Stigma
Stamens
Ovary

4. Hypogynous bristles or scales present ……. 5

4. Hypogynous bristles absent ……..…….... 9

5. Leaves reduced to sheaths ……..…….... 6

5. Leaves well developed ……..…….... 7

6. Style base dilated, constricted above the ovary ……..…….. *Eleocharis*

6. Style base not dilated, not constricted above the ovary ……..…….. *Schoenoplectiella*

7. Hypogynous scales present ……..…….…. *Hypolytrum*

7. Hypogynous bristles present ……..…….... 8

8. Leaves with a prominent ligule ……..…….…. *Fuirena*

8. Leaves eligulate ……..…….…. *Rhyncospora*

9. Glumes at least the lower ones distichous……..…….…. 10

9. Glumes spirally arranged ……..…….…. 11

10. Style articulate with the nuts ……..…….…….. *Abildgaardia*

10. Style continuous with the nuts ……..…….…….. *Cyperus*

11. Spikelets often in capitate heads, numerous and crowded; mostly aquatic ……..
……. *Isolepis*

11. Spikelets in heads not crowded; mostly terrestrial ……..…….. 12

12. Style fimbriate, base conical ……..…….. *Fimbristylis*

12. Style glabrous, base depressed globose ……..…….. *Bulbostylis*

Abildgaardia Vahl.,

Enum. Pl. Obs. 2: 296. 1805.

Abildgaardia ovata (Burm.f.) Kral, Sida 4: 72. 1971. *Carex ovata* Burm.f., Fl. Indica 194. 1768. *Fimbristylis ovata* (Burm.f.) J.Kern, Blumea 15: 126. 1967; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 537. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 221. 2014. *F. monostachya* (L.) Hassk., Pl. Jav. Rar. 61. 1848; C.B.Clarke in Hook.f., Fl. Brit. India 6: 649. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1660. 1931.

Perennial rhizomatous herbs, 10–40 cm tall. Culms filiform, angular, scabrous along margins. Leaves linear, shorter than culms, 5–15 × 0.05–0.1 cm, acute at apex, sheathing at base, glabrous, incurved and scabrid along margins, green, eligulate; sheaths membranous, 1–8 cm long, glabrous, green. Inflorescence single terminal spikelets, rarely 1 or 2. Involucral bracts glume-like, distichous, ovate, 3–4 × 2–2.5 mm, awned at apex, cuneate at base, scabrous. Spikelets elliptic-ovate, 1–2 cm long, acute at apex, cuneate at base, green; rachis prominently winged. Glumes widely ovate, 5–6 × 3–5 mm, acute, mucronate at apex, cuneate at base, glabrous, keeled; keel 3–5-nerved, green, sides nerveless. Stamens 3; filaments *c.* 2 mm long; anthers linear, 2–2.5 mm long, crested at apex. Style filiform, *c.* 1 mm long, ciliate, dilated at base; stigma 3. Nuts triquetrous, pyriform, 2.5–3 × 1–1.2 mm, obtuse at apex, densely tubercled, white; stipe *c.* 1 mm long.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Open grasslands; *Fl. & Ft.*: June-December.

Specimen examined: Vallakkadavu, 03.06.1995, *Jomy Augustine* 15401 (CALI).

Bulbostylis Kunth,

Enum. Pl. 2: 205. 1837, *nom. cons.*

Key to the species

1. Inflorescence a single globose head; rays absent; involucral bracts filiform; stamen 1; nuts smooth …… 2

1. Inflorescence simple-sub compound, spreading; rays present; involucral bracts glume like, ovate; stamens 2; nuts granular, puncticulate …….. *B. densa*

2. Spikelets 2–20; head hemispherical; glume apex mucronate ……. *B. barbata*

2. Spikelets numerous; head globose; glume apex cuspidate ……..
…….. *B. barbata* subsp. *pulchella*

Bulbostylis barbata (Rottb.) C.B.Clarke in Hook.f., Fl. Brit. India 6: 651. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1662. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 522. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 32. 2014. *Scirpus barbatus* Rottb., Descr. Icon. Rar. Pl. 52. 1773. **Fig. 27C**

Annual herbs, 5–25 cm tall. Culms densely tufted, slender, erect, striate, glabrous. Leaves basal, capillary-filiform, 3–10 cm long, acute at apex, sheathing at base, glabrous- sparsely scabrous, green; sheaths membranous, 3–8 cm long, brown; orifice scattered white hairy, hyaline. Inflorescence a terminal head, hemispherical, 3–11 mm across, loosely arranged, reddish yellow. Involucral bracts 1–3, filiform, 4–15 mm long, acute at apex, dilated at base, scaberulous. Rays 0. Spikelets 2–20, sessile, lanceolate, 3–6 × 1–2 mm, abruptly sub-acute at apex, cuneate at base, pale brown, few-flowered. Glumes ovate, 1.5–2 × 1–1.2 mm, mucronate at apex, cuneate at base, glabrous, prominently keeled; keels 3-nerved, sides without nerves. Stamen 1; anther linear-oblong, *c.* 0.5 mm long. Style filiform, *c.* 1 mm long, depressed globular at base; stigma 3, shorter than style. Nuts triquetrous, broadly obovate, 0.5–0.8 × 0.4–0.6 mm, obtuse at apex, smooth, finely reticulate; epidermal cell isodiametric, minute in many rows.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Open grasslands and paddy fields; *Fl. & Ft.*: June-November.

Specimens examined: Pius Nagar, 22.06.2018, *Dani Francis & Santhosh Nampy* 159348, 159343 (CALI).

Notes: This species shows a wide variation in its morphology. It differs from other species by having elongated, loosely arranged reddish-yellow hemispherical heads, 1.5–2 mm long, glabrous glumes with a short mucro, and a single stamen (Wadoodkhan, 2015).

Bulbostylis barbata subsp. **pulchella** (Thwaites) T.Koyama, Bot. Mag. (Tokyo) 93: 341. 1980; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 522. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 34. 2014. *Bulbostylis barbata* var. *pulchella* (Thwaites) C.B.Clarke in Hook.f., Fl. Brit. India 6: 652. 1893. *Isolepis pulchella* Thwaites, Enum. Pl. Zeyl. 350. 1864.

Annual herbs, 5–25 cm tall, rigid. Culms densely tufted, slender, erect, striate, glabrous. Leaves basal, capillary-filiform, 3–10 cm long, acute at apex, sheathing at base, glabrous- sparsely scabrous, green; sheaths membranous, 3–8 cm long, purplish brown; orifice scattered white hairy, hyaline. Inflorescence a terminal head, globose, 4–9 mm across, dense. Involucral bracts 1–3, filiform, 4–15 mm

long, acute at apex, dilated at base, scaberulous. Spikelets numerous, sessile, oblong, 3–5 × 1–2 mm, abruptly sub-acute at apex, cuneate at base, pale brown, many-flowered. Glumes ovate, 2–2.5 × 0.8–1 mm, cuspidate at apex, cusp *c.* 1 mm long, cuneate at base, glabrous-puberulous, prominently keeled; keels 3-nerved, sides without nerves. Stamen 1; anther linear-oblong, *c.* 0.5 mm long. Style filiform, *c.* 1 mm long, depressed globular at base; stigma 3. Nuts triquetrous, broadly obovate, 0.5–0.8 × 0.3–0.5 mm, obtuse at apex, smooth, finely reticulate; epidermal cell isodiametric, minute in many rows.

Distribution: South India, Sri Lanka and Indo-China (POWO, 2023); *Habitat*: Open grasslands, near water courses; *Fl. & Ft.*: October-January.

Specimen examined: Chinnar, 27.01.2018, *Dani Francis & Santhosh Nampy* 158345 (CALI).

Bulbostylis densa subsp. **densa** (Wall.) Hand.-Mazz., Vegetationsbilder 20(7): 16. 1930; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 522. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 34. 2014. *Scirpus densus* Wall., in Carey & Wallich, Fl. Ind. 1: 231. 1820. *Bulbostylis capillaris* var. *trifida* (Nees) C.B.Clarke in Hook.f., Fl. Brit. India 6: 652. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1662. 1931.

Annual herbs, 1–37 cm tall. Culms densely tufted, capillary, slender, striate, glabrous. Leaves basal, filiform, shorter than culms, 1–20 cm long, acute at apex, sheathing at base, glabrous, green; sheaths membranous, brownish green; orifice long white hairy, hyaline. Inflorescence simple-sub compound, spreading or contracted. Involucral bracts 1–3, glume like, ovate, 2–6 × 0.5–1 mm, cuspidate at apex, dilated at base, glabrous. Rays 1–5, capillary, 2–5 cm long, glabrous. Spikelets solitary or clustered, oblong-ovoid, 3–7 × 1–2 mm, sub-acute at apex, cuneate at base, chestnut brown, 5–18-flowered. Glumes ovate, 1.5–2 × 0.6–1 mm, sub-acute, muticous at apex, cuneate at base, ciliolate, glabrous, light chestnut brown, prominently keeled, sides without nerves. Stamens 2; filaments *c.* 2 mm long; anthers oblong, *c.* 0.4 mm long. Style filiform, 0.6–1 mm long, glabrous; stigma 3. Nuts triquetrous, broadly obovate, 0.7–1 × 0.5–0.6 mm, obtuse at apex, minutely stipitate, densely granular, puncticulate; epidermal cell isodiametric, minute.

Distribution: Tropical and Subtropical Asia to E. Australia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-January.

Specimens examined: Anamudi peak, 11.12.2019, *Dani Francis & Santhosh Nampy* 164563 (CALI); Eravikulam, near subsidiary turnerivalley, 03.12.1987, *P. Bhargavan* 87305 (MH); Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154341 (CALI); Karadikkavala, 15.09.1994, *N. Sasidharan & Jomy Augustine* 14176 (KFRI); Kudimala, Lakkam kudi, 09.12.2019, *Dani Francis & Santhosh Nampy* 170010 (CALI); Kuttikkanam-Peermade, 21.09.1964, *K. Vivekananthan* 20348 (MH); Marayur, Pothadi, 26.01.2018, *Dani Francis & Santhosh Nampy* 158306 (CALI); Periyar Tiger Reserve, Mangaladevi, 31.07.1993, *N. Sasidharan & Jomy Augustine* 12202; *Ibid*., 26.09.1993, *N. Sasidharan & Jomy Augustine* 12452 (KFRI); Ramakkalmedu, 07.09.2017, *Dani Francis & Santhosh Nampy* 152966 (CALI); Vallakkadavu, 12.11.1975, *K. Vivekananthan* 46655 (MH).

Notes: This species is widely distributed in the study area and exhibits a great variation in its morphological characters, including habit, inflorescence, and nut characters.

Carex L.,

Sp. Pl. 2: 972. 1753.

Key to the species

1. Stigma 2-fid; nuts biconvex …… 2

1. Stigma 3-fid; nuts trigonous …… 4

2. Utricles distinctly beaked; spikelets androgynous, terminal spikelets always bisexual …… 3

2. Utricles not beaked; spikelets unisexual, terminal male, lateral ones female …… *C. phacota*

3. Utricles 7–11-nerved ventrally, 9–13-nerved dorsally, hispid …… *C. lenta*

3. Utricles 4–5-nerved ventrally, 5–6-nerved dorsally, glabrous …… *C. longicruris*

4. Inflorescence of 1–3, rarely up to 5 spikelets …… *C. speciosa*

4. Inflorescence of 5–many spikelets …… 5

5. Terminal spikelets always bisexual; all spikelets androgynous with male part terminal, female part below; inflorescence paniculate, fasciculate or congested in heads …….. 6

5. Terminal spikelets male; all spikelets unisexual, female spikelets lateral; inflorescence racemose with a single spikelet at each node ……..…11

6. Spikelets 3–8 cm long, often cylindrical; beak of utricle indistinct or under 0.8 mm long; female glumes hyaline margined at least near the apex ……..…….. 7

6. Spikelets 0.5–2 cm long, ovoid, linear, cylindrical or ellipsoid; beak as long as to slightly shorter than the utricle, 1 mm long or more; female glumes not hyaline margined ……..…. 8

7. Utricles narrowly ellipsoid, tapering at both ends, not inflated …… *C. myosurus*

7. Utricles broadly ellipsoid, not tapering at both ends, strongly inflated ……. ……..... *C. baccans*

8. Panicles compound, branched ……..…… 9

8. Panicles head like, unbranched ……..... *C. lindleyana*

9. Female glumes lanceolate ……..... *C. condensata*

9. Female glumes ovate ……..…… 10

10. Spikelets linear-oblong; utricles 3–5-nerved ……..... *C. cruciata*

10. Spikelets cylindrical; utricles 2–4-nerved ……..... *C. filicina*

11. Utricles nerveless, densely hispid ……..…….... *C. ligulata*

11. Utricles 3–5-nerved, densely papillose ……..…….. *C. maculata*

Carex baccans Nees in Wight, Contr. Bot. India 122. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 722. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1687. 1931; K.M.Matthew, Illustr. Fl. Palni Hills 760. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 523. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 44. 2014.

Perennial, loosely tufted herbs, up to 150 cm tall. Culms erect, trigonous, glabrous. Leaves linear-lanceolate, 30–80 × 0.8–1.5 cm, acute at apex, sheathing at base, glabrous abaxially, scabrous adaxially, coriaceous; sheaths tightly enclosing the stem, reddish brown towards base. Panicles compound, interrupted; secondary

panicles 5–8, single at each node, 4–15 × 3–5 cm. Involucral bracts leafy, overtopping inflorescence, 15–30 cm long, acute at apex, glabrous, scaberulous at margins; bracteoles utriculiform. Spikelets numerous, sessile, cylindrical, 3–6 cm long, densely-flowered, terminal ones bisexual. Female part 2–4 cm long; male part 0.5–2 cm long. Male glumes lanceolate, 6–8 × 2–3 mm, mucronate-awned at apex, cuneate at base, puberulous; stamens 3. Female glumes broadly ovate, 3–4 × 2–2.4 mm, acute and awned at apex, cuneate at base, glabrous-scaberulous, hyaline margined, brown. Utricles obscurely trigonous, inflated, loosely enveloping the nut, broadly ellipsoid, 4–4.5 × 1.8–2 mm, curved at apex, distinctly nerved, red; beak *c.* 0.5 mm long, bidentate at apex. Style 3-fid, short; stigma 3. Nuts trigonous, ellipsoid, 2.5–3.5 × 0.8–1 mm, beaked, shortly stipitate, dark brown.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: September-February.

Specimens examined: Shola near Eravikulam hut, 18.10.1989, *P. Bhargavan* 91813; Kumarikulam shola-Thannikkudy, 10.02.1981, *N.C. Nair* 70166; Lockhert gap, 12.10.1963, *K.M. Sebastine* 17540 (MH); Mathikettan Shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 176147; Pambadum Shola National Park, 19.12.2018, *Dani Francis & Santhosh Nampy* 167841; Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164884 (CALI).

Carex condensata Nees in Wight, Contr. Bot. India 123. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 716. 1894; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 47. 2014. **Fig. 27D**

Perennial, loosely tufted herbs, up to 100 cm tall. Culms erect, trigonous, glabrous. Leaves basal and cauline, linear-lanceolate, 40–70 × 1–2.5 cm, acuminate at apex, sheathing at base, scabrid along the veins, coriaceous; sheaths enclosing the stem, green. Panicles compound, lax to very dense; secondary panicles 3–6, distant, branched; peduncles 2–5 cm long. Involucral bracts leafy, overtopping inflorescence, 10–40 cm long, acuminate at apex, scaberulous; bracteoles lanceolate, scabrous. Spikelets sessile or shortly pedicelled, cylindrical-oblong, 5–20 mm long, androgynous, densely flowered. Female part 5–8 cm long; male part 2–6 cm long. Male glumes ovate, 2.5–3 × 0.5–1 mm, aristate at apex, cuneate at

base, puberulous, golden brown; stamens 3. Female glumes lanceolate, 3–3.2 × 0.8–1 mm, acute, mucronate at apex, cuneate at base, glabrous-scabrous, brown. Utricles ellipsoid, trigonous, 4–4.5 × 0.8–1 mm, straight at apex, 3–5-nerved, sub-inflated, dark green to white with purplish brown dotted, pubescent; beak *c.* 2 mm long, bidentate at apex. Style 3-fid, *c.* 3 mm long; stigma 3. Nuts trigonous, ellipsoid, triquetrous, 1.5–2.5 × 0.8–1 mm, shortly stipitate, with a short-curved beak, yellow.

Distribution: E. Himalaya to Thailand (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: October-February.

Specimens examined: Anamudi peak, 11.12.2019, *Dani Francis* & *Santhosh Nampy* 164547; Koyimanchola, 10.02.2021, *Dani Francis & Santhosh Nampy* 188738 (CALI).

Carex cruciata Wahlenb., Kongl. Vetensk. Acad. Nya Handl. 24: 149. 1803; C.B.Clarke in Hook.f., Fl. Brit. India 6: 715. 1894; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 47. 2014. **Fig. 27E**

Perennial, tufted herbs, up to 100 cm tall. Culms erect, trigonous, glabrous. Leaves basal and cauline, linear-lanceolate, 40–70 × 0.6–1.5 cm, acuminate at apex, sheathing at base, glabrous; sheath enclosing the stem, green. Panicles compound, lax to dense, *c.* 50 cm long; secondary panicles 3–6, distant, 5–8 cm long, branched. Involucral bracts leafy, overtopping inflorescence, 10–40 × 0.2–0.5 cm, acuminate at apex, glabrous; bracteoles oblong-lanceolate, long aristate at apex, scabrous. Spikelets sessile or shortly pedicelled, linear-oblong, 8–15 mm long, androgynous, lax-flowered. Female part basal, 3–12 mm long; male part terminal, 2–4 mm long. Male glumes ovate-lanceolate, 2.5–3 × 0.5–1 mm, mucronate at apex, cuneate at base, glabrous, scabrid along veins, brown; stamens 3. Female glumes ovate, 2–2.5 × 0.5–1 mm, aristate at apex, cuneate at base, shorter than utricle, scaberulous, brown. Utricles ellipsoid-ovoid, trigonous, 2–3 × 0.8–1 mm, obtuse at apex, 3–5-nerved, sub-inflated, dark green to white with purplish brown dots, pubescent; beak *c.* 1 mm long, bidentate at apex. Style 3-fid, *c.* 1.5 mm long; stigma 3. Nuts trigonous, ellipsoid, triquetrous, 1.5–2.5 × 0.8–1 mm, shortly stipitate, with a short-curved beak, style base thickened, yellow.

Distribution: Nepal to Japan and W. Malesia (POWO, 2023); *Habitat*: Forests; *Fl. & Ft.*: June-September.

Specimens examined: Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 152901; Mankulam, way to Edathattu, 13.09.2018, *Dani Francis & Santhosh Nampy* 159487; Pius Nagar, 22.06.2018, *Dani Francis & Santhosh Nampy* 159372; Puthukkad, Nallathannikallar, 15.09.2018, *Dani Francis & Santhosh Nampy* 161927 (CALI).

Carex filicina Nees in Wight, Contr. Bot. India 123. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 717. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1686. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 523. 2004.

Perennial, tufted herbs, up to 100 cm tall. Culms erect, trigonous, glabrous with 3–6 nodes. Leaves basal and cauline, linear-lanceolate, 25–50 × 0.5–1 cm, acuminate at apex, sheathing at base, glabrous; sheaths enclosing the stem, reddish brown. Panicles compound, lax, *c.* 50 cm long; secondary panicles 3–7, solitary or binate, branched; peduncles 5–6 cm long. Involucral bracts leafy, overtopping inflorescence, 10–40 × 0.2–0.5 cm, acuminate at apex, sheathing at base, glabrous; bracteoles oblong-lanceolate, long aristate at apex, scabrous. Spikelets sessile, narrow, cylindrical, 7–12 mm long, androgynous, lax-flowered. Female part basal, 2–8 mm long; male part terminal, 2–4 mm long. Male glumes ovate-oblong, 2.5–3.5 × 0.5–1 mm, mucronate at apex, cuneate at base, glabrous, scabrid along veins, chestnut brown; stamens 3. Female glumes ovate, 1.5–2.5 × 1–1.5 mm, obtuse at apex, cuneate at base, shorter than utricle, glabrous-scaberulous, awned, awn scabrous, brown. Utricles trigonous, ellipsoid-ovoid, 2–3.5 × 0.8–1 mm, obtuse, recurved at apex, 2–4-nerved, green to stramineous, glabrous; beak *c.* 1 mm long. Style 3-fid, *c.* 1.5 mm long; stigma 3. Nuts trigonous, ellipsoid, triquetrous, 2–2.5 × 0.8–1 mm, shortly beaked.

Distribution: China to Tropical Asia (POWO, 2023); *Habitat*: Forests; *Fl. & Ft.*: January- December.

Specimens examined: Devikulam-Bodi Road, 24.03.1980, *R. Rajan* 66352; Kuttikkanam-Peermade, 21.01.1965, *K. Vivekananthan* 22930 (MH); Mannakudi, Mathikettan Shola National Park, 06.01.2017, *Dani Francis & Santhosh Nampy* 151572 (CALI); Munnar, Lakshmi estate, 12.09.1968, *D.B. Deb* 30754 (MH);

Nelliparakandam, 12.08.1994, *Jomy Augustine* 13908 (CALI); *Ibid*., 18.01.1994, *N. Sasidharan & Jomy Augustine* 13100 (KFRI); Pachakkanam, 22.09.1972, *B.D. Sharma* 40836 (MH); Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164884; *Ibid.*, near Subranshed, 30.12.2019, *Dani Francis & Santhosh Nampy* 170071 (CALI); *Ibid*., 21.11.1965, *B.V. Shetty* 26603; Poosanampara grassy slopes, Eravikulam, 19.10.1989, *P. Bhargavan* 91833 (MH).

Carex lenta D.Don, Trans. Linn. Soc. London 14: 327. 1824; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 523. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 53. 2014. *Carex brunnea sensu* C.B.Clarke in Hook.f., Fl. Brit. India 6: 705. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1686. 1931 *non* Thunb., 1784.

Perennial, rhizomatous herbs, up to 80 cm tall. Culms erect, slender, rigid, glabrous. Leaves basal and sub-basal, linear-lanceolate, 20–50 × 0.5–1 cm, acuminate at apex, sheathing at base, glabrous; sheaths enclosing the stem. Panicle loose, interrupted, *c.* 10–25 cm long. Involucral bracts leafy, linear, 7–10 × 0.2–0.5 cm, acuminate at apex, sheathing, glabrous; bracteoles 0. Spikelets solitary or 2–4 at each node, linear-cylindrical, 1.5–5 cm long, terminal bisexual. Female part basal, 1.5–2 cm long; male part terminal, 0.1–0.5 cm long. Male glumes ovate-lanceolate, 2.5–3 × 0.5–1 mm, mucronate at apex, cuneate at base, glabrous; stamens 3. Female glumes lanceolate, 3–3.5 × 0.8–1 mm, mucronate at apex, cuneate at base, glabrous, pale yellow. Utricle erect, longer than glume, trigonous, elliptic, 3–5 × 1–1.2 mm, obtuse at apex, distinctly beaked, 9–13-nerved dorsally, 7–11-nerved ventrally, hispid, orange brown; beak compressed, *c.* 1.2 mm long, bidentate at apex. Style 2-fid, *c.* 2 mm long; stigma 2. Nut elliptic, lenticular, 2–2.5 × 1–1.5 mm, shortly beaked, short stipitate.

Distribution: Central to S. Japan to Tropical Asia (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: December-June.

Specimen examined: Kottamala, 17.05.1995, *Jomy Augustine* 13902 (CALI).

Notes: *Carex lenta* differs from its closely allied *C. longicruris* Nees by its much shorter style (Wadoodkhan, 2015).

Carex ligulata Nees in Wight, Contr. Bot. India 127. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 747. 1894; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 523. 2004. *C. hebecarpa*

var. *ligulata* (Nees) Kuk. in Engler (ed.), Pflanzenr. IV. 20(38): 745. 1909; K.M.Matthew, Illustr. Fl. Palni Hills 764. 1996; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1686. 1931; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 49. 2014. *Carex hebecarpa* subsp. *ligulata* (Nees) T.Koyama, Fl. E. Himal., 3rd. Rep. 123. 1975.

Perennial rhizomatous herbs, up to 50 cm tall. Culms erect, slender, glabrous. Leaves mostly cauline, linear-lanceolate, 20–50 × 0.5–1 cm, acute at apex, sheathing at base, glabrous; sheaths enclosing the stem, reddish. Racemes loose, interrupted, unbranched, 8–10 cm long. Involucral bracts leafy, linear, overtopping the inflorescence, 10–15 × 0.2–0.5 cm, acute at apex, sheathing, scaberulous; bracteoles 0. Spikelets unisexual, solitary at each node, cylindrical, 1.5–2 cm long, androgynous, terminal male, lateral female. Female part 1.5–2 cm long; male part 1–1.5 cm long. Male glumes ovate-lanceolate, 4–5.5 × 0.8–1 mm, awned at apex, cuneate at base, hispid; stamens 3. Female glumes lanceolate, 3–3.5 × 0.8–1 mm, aristate at apex, cuneate at base, scabrous, stramineous with red patches. Utricles erect, longer than glumes, elliptic, 4–5 × 1–1.2 mm, obtuse at apex, attenuate at base, densely hispid, nerveless; beak compressed, *c.* 2 mm long, bidentate at apex. Style 3-fid, *c.* 2 mm long; stigma 3. Nut elliptic, trigonous, 2–2.5 × 1–1.5 mm, with a short-curved beak, short stipitate.

Distribution: India to temperate E. Asia (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: January-June.

Specimen examined: Kottamalapallam, 25.05.1995, *Jomy Augustine* 15215 (CALI).

Carex lindleyana Nees in Wight, Contr. Bot. India 121. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 721. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1686. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 523. 2004. Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 54. 2014.

Perennial small herbs, 20–40 cm tall. Culms erect, slender, glabrous. Leaves basal, linear, flat, 8–20 × 0.2–0.6 cm, acute at apex, sheathing at base, glabrous-puberulous; sheaths enclosing the stem, greenish brown. Panicles head-like, congested, *c.* 10 cm long, unbranched, brown. Involucral bracts leaflike, 5–7 × 0.2–0.4 cm, acuminate at apex, sheathing, glabrous; bracteoles lanceolate, 2.5–2.7 cm long, acuminate at apex, clasping at base, glabrous. Spikelets sessile, ovoid-

ellipsoid, 5–10 mm long, androgynous. Female part basal, 2–5 mm long; male part terminal, 0.5–3 mm long. Male glumes ovate-oblong, 3–5 × 1–1.2 mm, shortly aristate at apex, cuneate at base, glabrous, chestnut brown; stamens 3. Female glumes ovate-lanceolate, 3–4 × 0.8–1 mm, mucronate or shortly aristate at apex, cuneate at base, faintly many nerved, keeled, glabrous, dark reddish brown. Utricles ellipsoid-oblong, trigonous, 3.5–4 × 0.9–1 mm, acute at apex, glabrous, scaberulous on margins, green to stramineous; beak *c.* 1 mm long, bidentate at apex, much shorter than the body. Style 3-fid, *c.* 1 mm long; stigma 3. Nut trigonous, obovoid, *c.* 2 × 1 mm, beak short, often curved.

Distribution: S. India, Sri Lanka and Indo-China (POWO, 2023); *Habitat*: Open grasslands; *Fl. & Ft.*: August-January.

Specimens examined: Anamudi peak, 11.12.2019, *Dani Francis & Santhosh Nampy* 164558; Chinna Anamudi, 31.08.2019, *Dani Francis & Santhosh Nampy* 170276 (CALI); Eravikulam, 03.11.1979, *s.coll. s.n.* (KFRI); *Ibid*., northern slope, 03.01.1987, *P. Bhargavan* 87319; *Ibid.*, Poosanampara, 19.10.1989, *P. Bhargavan* 91825 (MH); waterfall, way to Meesapulimala, 22.11.2018, *Dani Francis & Santhosh Nampy* 168813 (CALI).

Notes: This species is morphologically allied to *C. nubigena* D.Don, but differs by its flat leaves and much longer bracteoles. It also shows some similarity with *C. leucantha* Arn. ex Boott, but can be differentiated by the brown inflorescence and glabrous utricle (Wadoodkhan, 2015).

Carex longicruris Nees in Wight, Contr. Bot. India 124. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 705. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1686. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 524. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 55. 2014.

Perennial rhizomatous herbs, up to 60 cm tall. Culms erect, stiff, glabrous. Leaves basal, 1 or 2 upper one cauline, enrolled and flat, 15–40 × 0.2–0.4 cm, acute at apex, sheathing at base, glabrous, scaberulous at margins, green; sheaths enclosing the stem, greenish brown, glabrous. Panicles slender, compound, contiguous above, interrupted below, *c.* 15 cm long, with 8–9 nodes. Involucral bracts leafy, 10–15 × 0.1–0.2 cm, acuminate at apex, sheathing at base, glabrous; bracteoles lanceolate, 4–5 mm long, acuminate at apex, base clasping the stem, glabrous. Spikelets sub-

sessile, cylindrical, *c.* 2.5 cm long, terminal bisexual, basal male. Female part 6–10 mm long; male part 4–6 mm long. Male glumes ovate-oblong, 3–3.5 × 0.8–1 mm, muticous at apex, cuneate at base, glabrous, stramineous; stamens 3. Female glumes ovate-lanceolate, 3–4 × 0.8–1 mm, acuminate at apex, cuneate at base, faintly many nerved, keeled, glabrous, yellowish brown. Utricles lenticular, ellipsoid, *c.* 4 × 1 mm, acute at apex, cuneately stipitate at base, distinctly beaked, faintly 5–6-nerved dorsally, 4–5-nerved ventrally, glabrous, orange brown; beak *c.* 1.2 mm long, bidentate at apex, scaberulous. Style 2-fid, *c.* 3 mm long; stigma 2. Nut biconvex, obovoid, *c.* 1.5 × 1 mm, muticous.

Distribution: Himalaya, India and Sri Lanka (POWO, 2023); *Habitat*: Semi-evergreen forests; *Fl. & Ft.*: September-December.

Specimen examined: Pambadum Shola National Park, 20.12.2018, *Dani Francis & Santhosh Nampy* 167855 (CALI).

Carex maculata Boott, Trans. Linn. Soc. London 20(1): 128. 1846; C.B.Clarke in Hook.f., Fl. Brit. India 6: 735. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1686. 1931; K.M.Matthew, Illustr. Fl. Palni Hills 765. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 524. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 57. 2014.

Perennial, tufted herbs, 40–80 cm tall. Culms erect, trigonous, glabrous. Leaves linear-lanceolate, 15–35 × 0.5–1 cm, acute at apex, sheathing at base, glabrous; sheaths tightly enclosing the stem, reddish brown with red spots. Racemes spike like, 3–5, erect, upper ones sub-sessile, lower ones long peduncled. Involucral bracts leafy, overtopping inflorescence, 5–10 cm long, acute at apex, glabrous, scaberulous at margins; bracteoles lanceolate, 2.5–2.7 cm long, acuminate at apex, clasping at base, glabrous. Spikelets unisexual, linear-cylindrical, 1.5–5 cm long, densely-flowered, terminal male, lateral female. Male glumes oblong, 3–3.5 × 1–1.5 mm, acute at apex, cuneate at base, membranous, glabrous; stamens 3. Lateral spikes pistillate, cylindrical, 1–4.5 cm long, dense flowered. Female glumes oblong-ovate, 1.5–2 × 0.8–1 mm, acute at apex, cuneate at base, glabrous. Utricles trigonous, broadly ellipsoid, 2.5–3 × 1.2–1.5 mm, beaked at apex, 3–5-nerved, densely papillose, brown; beak *c.* 0.3 mm long, pointed at apex. Style 3-fid, short;

stigma 3. Nut trigonous, ellipsoid, 1.5–1.8 × 0.8–1 mm, beaked, shortly stipitate, dark brown.

Distribution: Tropical and Subtropical Asia to New Caledonia (POWO, 2023); *Habitat*: margins of forests; *Fl. & Ft.*: October-April.

Specimen examined: Along Devikulam lake, 15.04.1960, *K. Subramanyam* 10242 (MH).

Carex myosurus Nees in Wight, Contr. Bot. India 122. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 723. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1687. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 524. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 57. 2014. **Fig. 27F**

Perennial tufted herbs, up to 150 cm tall. Culms erect, trigonous, glabrous. Leaves sub-basal and few, cauline, lanceolate, 40–70 × 0.5–1 cm, acuminate at apex, sheathing at base, glabrous; sheaths enclosing the stem, purplish, glabrous. Panicles simple to decompound, *c.* 50 cm long; secondary panicles solitary at each node, peduncled, 3–6 cm long. Involucral bracts leafy, 10–15 × 0.2–0.4 cm, acuminate at apex, sheathing at base, glabrous; bracteoles lanceolate, obtuse at apex, glabrous. Spikelets sessile, cylindrical, 3–5 cm long, dense-flowered, terminal bisexual. Female part 2–3 cm long; male part 1–2.5 cm long. Male glumes ovate-oblong, 3.5–4 × 1–1.2 mm, shortly aristate at apex, cuneate at base, glabrous, scabrid along the vein, chestnut brown; stamens 3. Female glumes lanceolate, 3–4 × 1–1.2 mm, triangular and mucronulate at apex, cuneate at base, glabrous, brown, white hyaline towards apex, keel 3-nerved, sides without nerves. Utricles narrowly ellipsoid, compressed trigonous, 3–4 × 0.8–1 mm, tapering at both ends, not inflated, faintly 6–8-nerved, stramineous, sparsely hairy near apex; beak *c.* 0.8 mm long, bidentate at apex. Style 3-fid, *c.* 2.5 mm long; stigma 3. Nut broadly ellipsoid, triquetrous, 2–2.5 × 0.8–1 mm, one face broader, dark brown-chestnut black, shortly beaked.

Distribution: China to Tropical Asia (POWO, 2023); *Habitat*: Road sides; *Fl. & Ft.*: August-December.

Specimens examined: Way to Anamudi base camp, 10.12.2019, *Dani Francis & Santhosh Nampy* 164677; Meesapulimala, way to 8th plot, 20.11.2018, *Dani Francis*

& Santhosh Nampy 167727; Pambadum Shola National Park, 19.12.2018, *Dani Francis & Santhosh Nampy* 167841; Vellimala, 12.08.1994, *Jomy Augustine* 14315 (CALI).

Carex phacota Spreng., Syst. Veg. ed. 16. 3: 826. 1826; C.B.Clarke in Hook.f., Fl. Brit. India 6: 708. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1686. 1931. Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 524. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 59. 2014. **Fig. 27G**

Perennial, tufted herbs, up to 80 cm tall. Culms erect, trigonous, glabrous. Leaves basal and few cauline, lanceolate, 40–60 × 0.5–1 cm, acuminate at apex, sheathing at base, glabrous; sheaths enclosing the stem, yellowish brown, glabrous. Inflorescence paniculate spikes, 4–6, linear, 2–7 cm long, peduncled, pale brown. Involucral bracts leafy, overtopping the inflorescence, 7–20 × 0.2–0.4 cm, acuminate at apex, sheathing, glabrous; bracteoles setaceous, obtuse at apex, shorter than or as long as the inflorescence, glabrous. Spikelets unisexual, cylindrical, 2–9 cm long, dense-flowered, terminal male, lateral ones female. Female part 2–7 cm long; male part 0.3–2 cm long. Male glumes lanceolate, 3–3.5 × 0.8–1 mm, mucronulate at apex, cuneate at base, glabrous, green; stamens 3. Female glumes oblong, 2–3 × 0.5–1 mm, sub-truncate, aristate at apex, truncate at base, glabrous, arista scabrous, greenish brown with brown patches, prominently keeled, 3-nerved, sides without nerves. Utricles broadly elliptic-obovoid, compressed, 2–3 × 1–2 mm, sub-acute at apex, faintly 1–few-nerved on dorsal side towards the base, orange, sparsely hairy; beak absent or very short. Style 2-fid, *c.* 2.5 mm long; stigma 2. Nut sub-loosely enveloped, orbicular, compressed lenticular, 1.8–2 × 1–1.5 mm, shortly beaked.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Marshy areas in evergreen forests; *Fl. & Ft.*: October-April.

Specimens examined: Arjunankotta, Periyar Tiger Reserve, 18.01.1994, *Jomy Augustine* 13152; Choondal, Mathikettan Shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 151502; Devikulam, 07.02.2017, *Dani Francis & Santhosh Nampy* 151663 (CALI); along Devikulam lake, 15.04.1960, *K. Subramanyam* 10243 (MH); Eravikulam, 15.10.1979, *s. coll.* 117 (KFRI); Nyamakkad, 8th mile, 24.01.2018, *Dani Francis & Santhosh Nampy* 158188 (CALI);

Old Devikulam, 25.01.1964, *K.M. Sebastine* 18460; Pettimudi, 08.02.1970, *B.V. Shetty* 33448 (MH).

Notes: *Carex phacota* is characterised by unisexual spikelets with one or two male florets at the tip and female florets in the remaining portion of the inflorescence, as well as short-beaked utricles. They are commonly known as lakeshore sedges because they grow on wetlands, stream banks, or lakes (Udupa *et al.*, 2019).

Carex speciosa Kunth, Enum. Pl. 2: 504. 1837; C.B.Clarke, in Hook.f., Fl. Brit. India 6: 729. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1686. 1931; K.M.Matthew, Illustr. Fl. Palni Hills 767. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 524. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 60. 2014. **Fig. 26**

Perennial herbs, 55–65 cm long. Culms tufted. Leaves arising from the base, ensiform, 50–60 × 0.7–1 cm, acuminate at apex, attenuate at base, glabrous, margins scabrous, green; sheaths lanceolate, glabrous-scaberulous. Involucral bracts leafy, ensiform, 30–33 × 0.5–1 cm, acuminate at apex, attenuate at base, glabrous, scabrous along margin. Inflorescence spike, bearing female flowers at the base and male flowers at the apex, arising from the base, 2–10 cm long, 1–3 or rarely up to 5 spikelets; peduncles 30–45 cm long, branched; pedicels of spike *c.* 1.6 cm long; sheaths cover each spike, terete, obtuse at apex, glabrous, light greenish; female spikelets, greenish; male spikelets pale green, smaller than the female spikelets. Male glumes elliptic-ovate, 3–3.3 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous, entire; stamens 3. Female glumes oblong-elliptic, *c.* 4 × 3 mm, rounded-obtuse at apex, truncate at base, glabrous, margin slightly undulate towards apex, midvein prominent, others obscure, smaller than the spikelet, light greenish. Utricles elliptic-ovate, 4.5–5.2 × 2–2.3 mm, apex obtuse, beaked, cuneate at base, glabrous, scabrous at margin, many nerved, green. Style 3-fid, *c.* 2.1 mm long, scabrous, greenish with brown tinch; stigma 3. Nuts trigonous, obovate, 2–2.1 × 0.6–1 mm, beaked, brown.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Marshy areas in evergreen forests; *Fl. & Ft.*: November-June.

Specimens examined: Mankulam, Kannadippara, 08.06.2018, *Dani Francis & Santhosh Nampy* 159274; Kokkara, 02.05.1994, *Jomy Augustine* 13524 (CALI).

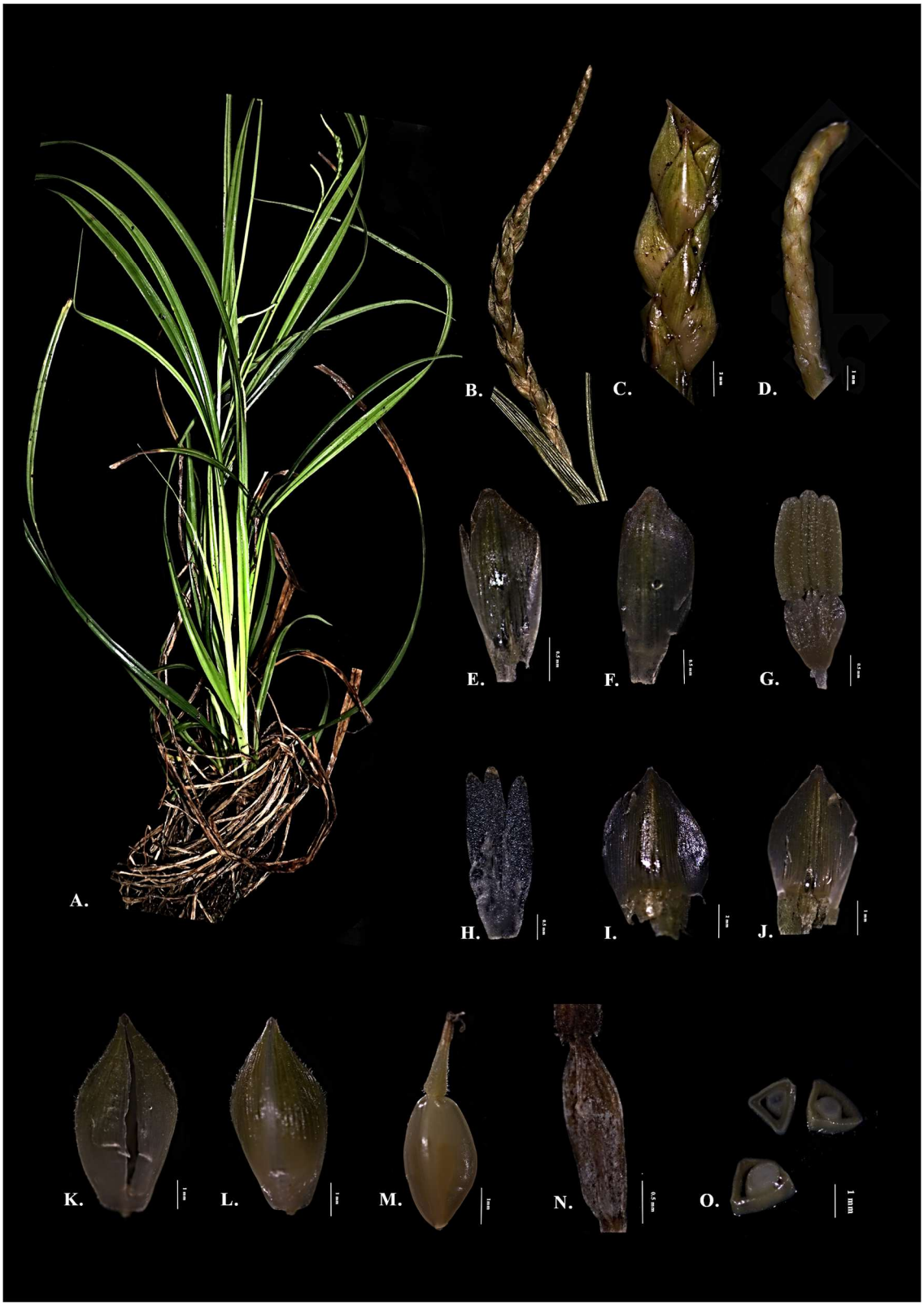


Fig. 26. *Carex speciosa* Kunth: **A.** Habit; **B.** Spike; **C.** Female spike; **D.** Male spike; **E. & F.** Male bracts inner and outer view; **G.** Stamens; **H.** Filament; **I. & J.** Female bract inner and outer view; **K. & L.** Utricle inner and outer view; **M.** Gynoecium; **N.** Fruit; **O.** C.S. of ovary.

Cyperus L.,

Sp. Pl. 1: 44. 1753.

Key to the species

1. Glumes at least the lower ones distichous 2

1. Glumes spirally arranged 42

2. Plants leafless; inflorescence pseudolateral; longest involucral bracts stem like as though continuing stem 3

2. Plants leafy; inflorescence terminal; involucral bract leaflike 23

3. Spikelets digitate, stellately radiating on much shortened or condensed rachis of spikes forming clusters or inflorescence capitate 4

3. Spikelets spicately arranged at some distant from one another upon a more or less elongated rachis..... 11

4. Heads or clusters of spikelets single, terminal or pseudo lateral; rays absent..... *C. cuspidatus*

4. Heads or clusters 2-many on primary or secondary rays or in decompound umbels 5

5. Glumes muticous or mucronulate with 0.2–0.4 mm long subula 6

5. Glumes mucronate with 0.7–1 mm long, straight or recurved mucro 9

6. Nuts smooth 7

6. Nuts densely verruculose 8

7. Inflorescence compound with many globose heads ..... *C. difformis*

7. Inflorescence decompound, diffuse ..... *C. diffusus*

8. Annual herbs; involucral bracts 4 or 5; keel of glumes 1 or 2-nerved ..... *C. tenuispica*

8. Perennial herbs; involucral bracts 2 or 3; keel of glumes 3-nerved ..... *C. haspan*

9. Spikelets 3–5 mm broad; awns of glume slightly recurved ..... *C. compressus*

9. Spikelets 1.5–2 mm broad; awns of glume strongly recurved 10

10. Glumes sparsely keeled; nuts cylindrically oblong ..... *C. maderaspatanus*

10. Glumes not keeled; nuts obovoid-oblong ..... *C. neochinensis*

11. Spikes oblong or cylindrically oblong, several times longer than broad; spikelets many; rachis visible or invisible 12

11. Spikes ovate, as long as broad; spikelets 3–15 on visible rachis 14

12. Glume sides 3-nerved; rachilla wings not caducous ..... *C. nutans*

12. Glume sides nerveless; rachilla wings caducous 13

13. Spikes digitately clustered; glumes elliptic ..... *C. digitatus*

13. Spikes not digitately clustered; glumes sub-orbicular ..... *C. exaltatus*

14. Rachilla distinctly winged; sides of glumes nerved or nerveless 15

14. Rachilla wingless; sides of glumes always nerved 21

15. Plants leafless or reduced to bladeless sheath 16

15. Plants leafy 17

16. Spikelets spreading to almost at right angles, distant ..... *C. corymbosus*

16. Spikelets erect, closely spicate ..... *C. pangorei*

17. Glumes with a dark purple-brown spot on one or both sides giving appearance of purple brown stripes in the centre of green spikelets ..... *C. sphacelatus*

17. Glumes and spikelets without spots or stripes 18

18. Stolons present ..... *C. rotundus*

18. Stolons absent 19

19. Perennial rhizomatous herbs; glumes keeled 20

19. Annual, non-rhizomatous herbs; glumes not keeled ..... *C. zollingeri*

20. Glumes distantly arranged; nuts minutely puncticulate ..... *C. distans*

20. Glumes closely arranged; nuts smooth ..... *C. tenuiculmis*

21. Spikes oblong, longer than broad; glumes strongly keeled ..... *C. iria*

21. Spikes broadly ovate, as long as broad or slightly longer; glumes slightly keeled …… 22

22. Involucral bracts setiform; glumes mucronulate at apex …… *C. pilosus*

22. Invucral bracts linear-flat; glumes muticous at apex …… *C. procerus*

23. Rachilla articulated; spikelets falling entirely …… 28

23. Rachilla not articulated; spikelets persistent …… 24

24. Spikelets stellately arranged; glumes with elliptic depressions on either side and reddish band around …… *C. sanguinolentus*

24. Spikelets spicately arranged; glumes without depressions and bands …… 25

25. Rachilla narrowly winged …… 26

25. Rachilla wingless …… 27

26. Rays present; rachilla flexuous …… *C. intactus*

26. Rays absent; rachilla not flexuous …… *C. polystachyos*

27. Stamens 1; nuts smooth …… *C. pumilus*

27. Stamens 2; nuts transversely rugulose or minutely puncticulate …… 28

28. Leaves canaliculate, coriaceous; glumes straight …… 29

28. Leaves not canaliculate, papery; glumes curved …… *C. diaphanus*

29. Nuts minutely puncticulate; epidermal cells isodiametric …… *C. flavidus*

29. Nuts finely transversely undulate; epidermal cells longitudinally oblong …… *C. substramineus*

30. Style 2-fid; nuts biconvex …… 31

30. Style 3-fid; nuts trigonous …… 36

31. Keel of glumes winged …… 32

31. Keel of glumes not winged …… 34

32. Annual herbs; keels winged with a prominently toothed crest …… *C. metzii*

32. Perennial herbs; keel lunate crested glandular or serrulate …… 33

33. Spikelets falling as a whole; keels narrowly winged …….. *C. melanospermus*

33. Spikelets falling entirely by leaving 2–3 empty glumes; keels broadly winged …….. *C. mindorensis*

34. Rhizomes short and not creeping; inflorescence of 1–3 spikes …….. 35

34. Rhizomes horizontally creeping; inflorescence usually single a spike ……..
…….. *C. brevifolius*

35. Inflorescence a terminal head with 3 spikes; spikelets oblong-lanceolate ……. *C. richardii*

35. Inflorescence a terminal head with 1–3 spikes; spikelets elliptic …….. *C. sesquiflorus* subsp. *cylindricus*

36. Inflorescence of a single capitate more or less lobed head or spikes or glomerules; rays absent …… 37

36. Inflorescence anthelate; spikelets in oblong or globose heads; rays present …… 40

37. Spikelets 3-few in a head; involucral bracts 5–6; glumes 11–13-nerved 38

37. Spikelets numerous in a head; involucral bracts 3–5; glumes 7–9 or 4–5-nerved …… 39

38. Spikelets oblong; glumes 2, sides 3–4 nerved; keels inflated with inrolled margin…….. *C. clarkei*

38. Spikelets lanceolate; glumes 4, sides 2-nerved; keels not inflated ... *C. paniceus*

39. Inflorescence single capitate heads, semi-globose; rachilla wingless; glumes narrowly elliptic-lanceolate …….. *C. mollipes*

39. Inflorescence single or lobed heads, globose; rachilla winged; glumes widely ovate-lanceolate …….. *C. dubius*

40. Annual herbs; spikes broadly ellipsoid to sub-globose; rachilla wingless; stamen 1; glumes awned and awn recurved …….. *C. squarrossus*

40. Perennial herbs; spikes cylindrical, rachilla broadly winged; stamens 3; glumes obtuse or mucronulate …… 41

41. Inflorescence compound or decompound; glumes broadly ovate ……..
…….. *C. javanicus*

41. Inflorescence simple, open; glumes oblong-ovate …….. *C. cyperoides*

42. Nuts beaked at apex; glumes reddish brown …….. *C. raynalianus*

42. Nuts minutely apiculate at apex; glumes purplish brown …….. *C. albescens*

Cyperus albescens (Steud.) Larridon & Govaerts, Kew Bull. 71(2)-30: 1. 2016. *Kyllinga albescens* Steud., Syn. Pl. Glumac. 2: 68. 1854. *Lipocarpha chinensis* (Osbeck) J.Kern, Blumea, Suppl. 4: 167. 1958; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 541. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 279. 2014. *Lipocarpha argentea* R.Br., Narr. Exped. Zaire 477. 1818; C.B.Clarke in Hook.f., Fl. Brit. India 6: 667. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1670. 1931.

Annual herbs, 25–50 cm tall. Culms tufted, trigonous, glabrous. Leaves shorter than stem, coriaceous, flat, lanceolate, 5–20 × 0.2–0.4 cm, obtuse at apex, glabrous, involute at margins; sheaths 2–5 cm long, glabrous. Inflorescence terminal heads, 3–6 in number, brown. Involucral bracts 2–3, leafy, 2–6 × 0.05–0.1 cm, exceeding inflorescence, obtuse at apex, glabrous. Spikelets 3–6, ovoid-oblong, 5–15 × 1.3–1.5 mm, obtuse at apex, 5–7 × 4–5 mm, brown, many-flowered. Rachilla wingless. Glumes membranous, spathulate, 1.5–2.5 × 1–1.2 mm, obtuse with triangular tip at apex, mid nerve prominent, sides faintly 1–2-nerved, not keeled, purplish brown. Hypogynous scales oblong, longer than nut, 1.2–2 mm long, 5–7-nerved. Stamens 1 or 2, *c.* 2.5 mm long; anther linear. Style *c.* 1 mm long; stigma 3. Nuts trigonous, oblong-obovate, 1–1.5 × 0.3–0.5 mm, minutely apiculate at apex, smooth, straw-coloured; epidermal cells isodiametric.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Marshes, paddy fields and margins of streams; *Fl. & Ft.*: May-January.

Specimens examined: Choondal, Mathikettan Shola National Park, 24.06.2016, *Syam Radh S. & Santhosh Nampy* 149156 (CALI); Devikulam, 11.09.1968, *D.B. Deb* 30722 (MH); Kavalappara, 06.01.1995, *Jomy Augustine* 14552(CALI); Kulamavu, 01.06.1982, *C.N. Mohanan* 74130; Kulamavu-Ayyappancoil, 26.05.1982, *C.N. Mohanan* 74040; Lockhert gap, 12.10.1963, *K.M. Sebastine* 17534; Vallakkadavu R.F., 23.09.1972, *B.D. Sharma* 40844 (MH).

Cyperus brevifolius (Rottb.) Endl. ex Hassk., Cat. Hort. Bot. Bogor. 24. 1844. *Kyllinga brevifolia* Rottb., Descr. Icon. Rar. Pl. 13. 1773; C.B.Clarke in Hook.f., Fl. Brit. India 6: 588. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1624. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 540. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 266. 2014.

Perennial herbs, 15–30 cm tall. Rhizomes horizontally creeping. Culms trigonous, slender, glabrous. Leaves linear, 5–25 × 0.15–0.2 cm, acuminate at apex, glabrous, green; sheaths 1–3 cm long, glabrous. Inflorescence usually a terminal single spike, rarely 1–3, sessile, white. Involucral bracts leafy, 3–6 × 0.1–0.2 cm, exceeding the inflorescence, acute at apex, glabrous. Spikes solitary, globose, 3–6 × 3–6 mm, bearing numerous spikelets, rarely with 1–2 lateral glomerules at base. Spikelets ellipsoid, 2–3 × 0.8–1 mm, obtuse at apex, 1–2 fruited, with 2-fruiting glumes, falling entirely leaving 2 or 3 empty glumes. Rachilla wingless. Glumes equal or sub-equal, ovate-elliptic, 2–2.5 × 0.8–1 mm, mucronate and recurved at apex, sides 2–3-nerved, keeled, not winged, stramineous. Stamens 2, *c.* 1.2 mm long; anther linear. Style *c.* 1 mm long; stigma 2. Nuts biconvex, ellipsoid, 1–1.2 × 0.4–0.6 mm, apiculate at apex, smooth, brown.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Grasslands and marshes; *Fl. & Ft.*: August-January.

Specimens examined: Karimutty 1st bridge, 09.02.2021, *Dani Francis & Santhosh Nampy* 188789; way to Karimutty, 29.12.2017, *Dani Francis & Santhosh Nampy* 158032; Koruthode, *s.d.*, *Jomy Augustine* 15337; Mathikettan Shola National Park, Sivanpara, 23.08.2014, *Syam Radh S. & Santhosh Nampy* 154342; Munnar, 23.01.2018, *Dani Francis & Santhosh Nampy* 176149 (CALI); Peermade, 24.01.1965, *K. Vivekananthan* 22999 (MH); Thekkady, *s.d.*, *Jomy Augustine* 13946 (CALI).

Notes: This species is a common turf grass weed (Molin *et al.*, 1997) and is known as 'green kyllinga'.

Cyperus clarkei T.Cooke, Fl. Bombay 2: 873. 1908; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 83. 2014. *Mariscus bulbosus* C.B.Clarke in Hook.f.,

Fl. Brit. India 6: 620. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1644. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 541. 2004.

Perennial rhizomatous herbs, 30–50 cm tall. Culms trigonous, glabrous, green. Leaves linear, 3–18 × 0.2–0.3 cm, acute at apex, undulate at margins, glabrous; sheaths 2–4 cm long, glabrous, white. Inflorescence simple, with 4–5 lobed spikes. Involucral bracts 5–6, spreading, leafy, 3–10 × 0.2–0.3 cm, exceeding inflorescence, acute at apex, undulate at margins, glabrous. Rays 0. Spikes cylindric, 1–2.5 × 0.5–0.8 cm, bearing numerous spikelets, sessile or peduncled. Spikelets 3 or a few, oblong, 2–3 × 1–1.5 mm, obtuse at apex, deciduous as a whole, green-stramineous. Glumes 2, unequal, elliptic-oblong, 2.5–3 × 1–1.5 mm, mucronate-muticous at apex, sides 3–4-nerved, hyaline at margins, keeled; keel inflated with enrolled margins, brown. Stamens 3, *c.* 1.5 mm long. Style 1.5–2 mm long; stigma 3. Nuts trigonous, elliptic-oblong, 2–3 × 0.8–1 mm, slightly curved and apiculate at apex, white dotted with pale yellow to brown.

Distribution: S. India, Sri Lanka and Vietnam (POWO, 2023); *Habitat*: Grasslands and wet hill slopes; *Fl. & Ft.*: September-December.

Specimen examined: Munnar, *s.d.*, *Rejani* 42447 (CALI).

Cyperus compressus L., Sp. Pl. 1: 46. 1753; C.B.Clarke in Hook.f., Fl. Brit. India 6: 605. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1640. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 526. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 84. 2014.

Annual herbs, 5–35 cm tall. Culms obtusely trigonous, rigid, glabrous. Leaves linear, 3–20 × 0.1–0.5 cm, acute at apex, glabrous; sheaths 2–5 cm long, glabrous, purple basally. Inflorescence simple, open, 3–10 cm long. Involucral bracts 3–5, lower ones exceeding inflorescence, acute at apex, glabrous. Rays spreading, 2–10 cm long. Spikes broadly ovate, sub-digitate, 1–2 × 0.2–0.5 cm, bearing 3–12 spikelets. Spikelets spreading, strongly compressed, oblong-lanceolate, 10–30 × 3–3.5 mm, sub-acute at apex, cuneate at base, 6–40 flowered, yellowish green. Glumes ovate, 3–4 × 2–2.5 mm, awned at apex, sides 4-nerved, hyaline at margins, keeled; keel 3-nerved; mucro slightly excurved. Stamens 3, 4–4.5 mm long. Style 1.5–2 mm long; stigma 3. Nuts trigonous, broadly obovate, 1.3–1.6 × 0.8–1 mm,

minutely apiculate and obtuse at apex, white, greyish to black; epidermal cells hexagonal.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Disturbed forests; *Fl. & Ft.*: August-December.

Specimens examined: Adimaly, 07.08.2019, *Dani Francis & Santhosh Nampy* 170212; Mesthirikettu, 30.12.2017, *Dani Francis & Santhosh Nampy* 176143 (CALI).

Notes: *Cyperus compressus* can be easily distinguished by the green spikelets arranged in either digitate groups or sub-digitate spikes and mucronate or aristate glumes (De Oliveira *et al.*, 2015).

Cyperus corymbosus Rottb., Descr. Pl. Rar. 19. 1772; C.B.Clarke in Hook.f., Fl. Brit. India 6: 612. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1641. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 526. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 86. 2014.

Perennial rhizomatous herbs, 40–120 cm tall. Culms erect, sub-terete, glabrous, green, clothed with 3–4 membranous sheath. Leaves linear, 4–20 × 0.1–0.2 cm, acute at apex, glabrous, lower ones reduced to sheaths; sheaths loosely covering the culms, 2.5–8 cm long, glabrous, reddish brown. Inflorescence compound, 6–15 × 3–8 cm. Involucral bracts 2–4, lower ones shorter or slightly exceeding inflorescence, acute at apex, glabrous. Primary rays 5–12, unequal, *c.* 10 cm long; secondary rays short, *c.* 4 cm long, bearing 4–10 spikelets. Spikelets spreading to almost at right angles, distant, linear, 6–25 × 1–1.5 mm, sub-acute at apex, cuneate at base, 12–24-flowered, brown. Rachilla broadly winged. Glumes membranous, imbricate, oblong-ovate, 1.5–2.5 × 1–1.5 mm, obtuse at apex, 2–3-nerved, sides nerveless, hyaline at margins, not keeled. Stamens 3, *c.* 4 mm long. Style 0.5–1 mm long; stigma 3. Nuts trigonous, broadly elliptic-oblong, 1–1.5 × 0.2–0.4 mm, apiculate at apex, greyish brown; epidermal cells smooth.

Distribution: Africa to Indo-China and Tropical America (POWO, 2023); *Habitat*: Banks of River; *Fl. & Ft.*: Throughout the year.

Specimens examined: Kaliyar River, 07.12.2018, *Dani Francis* & *Santhosh Nampy* 167828; Thommankuthu, 10.12.2016, *Dani Francis & Santhosh Nampy* 151326 (CALI).

Notes: The unseptate leafless terete stems, dense inflorescence, and strongly aromatic rhizomes distinguish this species from other tall robust sedges (Wadoodkhan, 2015).

Cyperus cuspidatus Kunth Nov. Gen. Sp. 1: 204. 1816; C.B.Clarke in Hook.f., Fl. Brit. India 6: 598. 1893; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 526. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 86. 2014. *Cyperus uncinatus* Poir in J.B.A.M.de Lamarck, Encycl. 7: 247. 1806; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1639. 1931.

Annual herbs, 5–20 cm tall. Culms tufted, trigonous, glabrous, green. Leaves linear, 5–13 × 0.1–0.2 cm, acute at apex, glabrous; sheaths 2–3 cm long, glabrous, purple. Inflorescence simple, often reduced to a single head, 5–1.5 × 0.6–1 cm. Involucral bracts 3–4, lower ones exceeding inflorescence, 1–8 × 0.05–0.1 cm, acute at apex, glabrous. Rays 0. Spikelets digitate, spreading, compressed, linear, 0.5–1.5 × 2–3 mm, obtuse at apex, cuneate at base, many-flowered, falls as a unit. Rachilla articulate at base, wingless. Glumes oblong-spathulate, 1–1.5 × 0.5–1 mm, emarginate and mucronate at apex, sides nerveless, 7–9-nerved medially, dark brown, persistent; keeled, 3-nerved, acute at apex, green-purple; mucro *c.* 0.7 mm long, recurved. Stamens 2–3, *c.* 0.4 mm long. Style 0.3 mm long; stigma 3. Nuts trigonous, oblong-obovoid, 0.5–1 × 0.3–0.4 mm, apiculate at apex, brown; epidermal cells smooth.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Wet areas; *Fl. & Ft.*: August-April.

Specimens examined: Thekkady, 15.08.1994, *Jomy Augustine* 13944 (CALI); Valara, 21.08.1965, *K.M. Sebastine* 25347; Vandiperiyar, 23.04.1964, *K. Vivekananthan* 21323 (MH).

Notes: This species may be confused with *C. squarrosus* since it possesses a recurvate mucro; but it can be differentiated by its rachilla articulate at the base, the spikelet falls as a unit, and the glumes persistent and medially 7–9-nerved (De Oliveira *et al.*, 2015).

Cyperus cyperoides (L.) Kuntze, Revis. Gen. Pl. 3(3): 333. 1898; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 89. 2014. *Scirpus cyperoides* L., Mant. Pl. 2: 181. 1771. *Mariscus sieberianus* Nees, Linnaea 9(3): 286. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 622. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1645. 1931. *Mariscus sumatrensis* (Retz.) J.Raynal, Adansonia 15(1): 110. 1975; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 542. 2004. **Fig. 28B**

Perennial rhizomatous herbs, 15–80 cm tall. Culms solitary or clustered, erect, triquetrous, glabrous. Leaves linear, flat, 6–30 × 0.2–0.5 cm, acuminate at apex, glabrous; sheaths loosely covering the culms, 2–5 cm long, glabrous, reddish brown. Inflorescence simple, open, 3–10 × 3–10 cm. Involucral bracts 5–10, spreading, lower ones exceeding inflorescence, leafy, 4–10 × 0.4–0.5 cm, acute at apex, glabrous. Rays 3–15, slender, straight, *c.* 8 cm long. Spikes cylindrical, 1–4 × 0.5–1 cm, obtuse at apex, bearing numerous spikelets. Spikelets at right angles to the rachis, lower one more or less reflexed, sub-terete, linear-lanceolate, 3–5 × 0.5–1 mm, acute at apex, cuneate at base, glabrous, green. Rachilla broadly winged. Glumes membranous, oblong-ovate, 3–3.5 × 0.8–1 mm, obtuse at apex, sides many nerved, keeled; keels 3-nerved, green. Stamens 3, *c.* 5 mm long. Style 0.5–1 mm long; stigma 3. Nuts linear-oblong, 1.8–2 × 0.3–0.5 mm, apiculate at apex, slightly curved, stramineous, minutely puncticulate.

Distribution: Africa to Pacific (POWO, 2023); *Habitat*: Marshes and wet areas of forests; *Fl. & Ft.*: June-January.

Specimens examined: Choondal, Mathikettan Shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 151526; Kaliyar River, 07.12.2018, *Dani Francis & Santhosh Nampy* 167813 (CALI); Meenmutty, 11.06.1983, *A.G. Pandurangan* 76690 (MH); Pallivasal, *s.d., Ramesh* 37815 (CALI); Thekkady, 03.06.1994, *N. Sasidharan & Jomy Augustine* 13812 (KFRI); Vellappara, 05.08.2017, *Dani Francis & Santhosh Nampy* 154148 (CALI).

Cyperus diaphanus Schrad. ex Schult., Mant. 2: 477. 1824. *Pycreus diaphanus* (Schrad. ex Schult.) S.S.Hooper & T.Koyama, J. Jap. Bot. 51(10): 316. 1976; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 295. 2014. *Pycreus latespicatus* C.B.Clarke, in Hook.f., Fl. Brit. India 6: 590. 1893.

Annual herbs, 10–40 cm tall. Culms tufted, trigonous, glabrous, green. Leaves linear, 7–20 × 0.1–0.2 cm, acute at apex, papery, glabrous, green; sheaths 2–4 cm long, glabrous, reddish brown. Inflorescence simple, contracted, sometimes reduced to single head, 0.8–1.5 × 0.7–2 cm. Involucral bracts 2 or 3, lower ones exceeding inflorescence, 2–15 cm long, acute at apex, glabrous. Primary rays 2–7, 7–10 cm long. Spikes broadly ovate. Spikelets spreading, spicately arranged, oblong, 1–2 × 3–4 mm, sub-obtuse at apex, cuneate at base, many-flowered, brown. Rachilla wingless. Glumes membranous, ovate, 2.5–3.5 × 1.5–2 mm, obtuse at apex, sides nerveless; keeled, curved, 3–5-nerved. Stamens 2, *c.* 4 mm long. Style 0.5–1 mm long; stigma 2. Nuts biconvex, compressed, obovate-elliptic, 1–1.5 × 0.5–1 mm, transversely rugulose, yellow-brown.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Wet hill slopes and marshes; *Fl. & Ft.*: October-December.

Specimen examined: Vellimala, *s.d.*, *Jomy Augustine* 14351 (CALI).

Cyperus difformis L., Cent. Pl. 2: 6. 1756; C.B.Clarke in Hook.f., Fl. Brit. India 6: 599. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1631. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 526. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 89. 2014. **Fig. 28F**

Annual herbs, 15–60 cm tall. Culms tufted, erect, triquetrous, glabrous, greenish brown. Leaves flat, 5–20 × 0.1–0.5 cm, acuminate at apex, glabrous, green; sheaths 2–5 cm long, glabrous, reddish brown. Inflorescence compound with many globose heads, 1–2 × 0.5–1.5 cm, numerous spikelets. Involucral bracts 2–3, lower ones exceeding inflorescence, acuminate at apex, glabrous. Primary rays 3–9, unequal, 1–5 cm long. Spikes dense, globose, 0.5–2 cm across, bearing numerous spikelets, brownish green. Spikelets stellately arranged, linear, 2–5 × 1–1.5 mm, obtuse at apex, cuneate at base, brownish green. Rachilla not winged. Glumes loosely arranged, membranous, orbicular, 0.5–0.8 × 0.6–1 mm, rounded at apex, sub-rounded at base, sides nerveless, green with purplish brown, slightly keeled; keel faintly 3-nerved. Stamens 1 or 2, *c.* 1.5 mm long. Style *c.* 1 mm long; stigma 3. Nuts trigonous, obovate-elliptic, 0.5–0.8 × 0.2–0.3 mm, apiculate at apex, shortly stipitate at base, smooth, yellow.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Marshes; *Fl. & Ft.*: September-June.

Specimens examined: Kalvary mount, 21.02.1983, *C.N. Mohanan* 77920 (MH); Kattappana, 16.03.2018, *Dani Francis & Santhosh Nampy* 158382 (CALI); Kulamavu, 05.06.1982, *C.N. Mohanan* 74186; *Ibid*., 01.06.1982, *C.N. Mohanan* 74138 (MH); Mesthirikettu, 30.12.2017, *Dani Francis & Santhosh Nampy* 176142 (CALI); Panamkutty, 18.12.1982, *C.N. Mohanan* 76184; Vandiperiyar, 23.09.1964, *K. Vivekananthan* 21325 (MH).

Cyperus diffusus Vahl, Enum. Pl. Obs. 2: 321. 1805; C.B.Clarke in Hook.f., Fl. Brit. India 6: 603. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1639. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 526. 2004.

Perennial herbs, 30–80 cm tall. Rhizomes short, corm like, clothed with brown scales. Culms solitary or tufted, erect, triquetrous, glabrous, greenish brown. Leaves flat, linear, 10–30 × 0.2–1 cm, acute at apex, glabrous, scabrous at margins, green; sheaths 2–8 cm long, glabrous, purplish brown. Inflorescence decompound, diffuse. Involucral bracts 4–6, spreading, leafy, linear, 5–12 × 0.2–0.6 cm, exceeding inflorescence, acute at apex, glabrous. Primary rays many, unequal, 10–15 cm long; secondary rays 1–4 cm long. Spikelets digitately arranged in groups of 2–7, sometimes solitary, linear-oblong, 3–10 × 1.5–3 mm, obtuse at apex, cuneate at base, 6–12-flowered. Rachilla narrowly winged. Glumes membranous, orbicular-ovate, 1.2–2 × 1.4–1.8 mm, mucronate at apex, obtuse at base, sides faintly nerved, white hyaline at margin, keeled; keel 3-nerved. Stamens 3, *c.* 2.5 mm long. Style *c.* 1.5 mm long; stigma 3. Nuts trigonous, elliptic, 1–1.5 × 0.5–0.8 mm, minutely apiculate at apex, smooth, dark brown.

Distribution: Tropical and Subtropical Asia to Queensland (POWO, 2023); *Habitat*: Marshy areas of evergreen forests; *Fl. & Ft.*: December-May.

Specimens examined: Neriyamangalam, 26.12.2017, *Dani Francis & Santhosh Nampy* 156388; Palkulamedu, 01.12.2019, *Dani Francis & Santhosh Nampy* 164668; Thommankuthu, 10.12.2016, *Dani Francis & Santhosh Nampy* 151329 (CALI).

Cyperus digitatus Roxb., Fl. Ind. 1: 209. 1820; C.B.Clarke in Hook.f., Fl. Brit. India 6: 618. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1642. 1931. Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 527. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 90. 2014.

Perennial rhizomatous herbs, 60–150 cm tall. Culms solitary or tufted, obtusely trigonous, glabrous. Leaves lanceolate, flat-plicate, 40–70 × 0.5–1 cm, acute at apex, glabrous, scabrous at margins; sheaths 20–30 cm long, glabrous, purple brown basally. Inflorescence compound or decompound. Involucral bracts 3–8, spreading, lower ones exceeding inflorescence, leafy, 35–60 × 0.5–1 cm, acute at apex, glabrous, scabrous at margins, green. Rays 4–10, spreading, unequal, 10–30 cm long, glabrous. Spikes 4–10, digitately clustered, cylindrical, 3–5 × 1.5–3 cm, bearing numerous spikelets. Rachis narrowly winged. Spikelets right angles to the rachis, linear, 5–20 × 1–1.5 mm, obtuse at apex, cuneate at base, many-flowered, stramineous. Rachilla winged, wings caducous. Glumes membranous, elliptic, 2–2.2 × 0.8–1 mm, apiculate and acute at apex, sides nerveless, reddish brown, keeled; keel 3–5-nerved. Stamens 3, *c.* 2.5 mm long. Style 1–1.2 mm long; stigma 3. Nuts trigonous, elliptic-oblong, 0.8–1 × 0.4–0.5 mm, apiculate at apex, yellowish brown.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Marshy fields; *Fl. & Ft.*: September-December.

Specimens examined: Kumali, 22.09.1925, *K.C. Jacob* 17763 (MH); Munnar, 13.12.1970, *Sreedharan Nambiar M.K.* 240; *Ibid.*, 13.12.1970, *Dhanalakshmi C.* 455; *Ibid.*, 13.12.1970, *Raveendranathen P.P.* 39993 (CALI); Uppupara, 26.09.1972, *B.D. Sharma* 42007 (MH).

Cyperus distans L.f., Suppl. Pl. 103. 1782; C.B.Clarke in Hook.f., Fl. Brit. India 6: 607. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1640. 1931. Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 527. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 90. 2014.

Perennial rhizomatous herbs, 30–90 cm tall. Culms erect, triquetrous, glabrous. Leaves flat, lanceolate, 30–40 × 0.3–0.7 cm, acute at apex, glabrous, scabrid at margins, green; sheaths 5–15 cm long, glabrous, purple at base. Inflorescence

compound or decompound, 25–30 cm long. Involucral bracts 4–6, spreading, leafy, 5–30 × 0.3–0.6 cm, lower one exceeding inflorescence, acute at apex, glabrous. Spikes ovoid-pyramidal, 2–5 × 1–1.3 cm, spreading, brown, bearing 20 spikelets. Spikelets spreading, narrowly linear, 10–20 × 0.8–1 mm, brown, 6–10-flowered. Rachilla winged. Glumes distantly arranged, oblong-ovate, 1.8–2 × 0.8–1 mm, obtuse at apex, sides without nerves, reddish-brown, white-hyaline at margins, slightly keeled, 3–5-nerved. Stamens 3, *c.* 1 mm long. Style *c.* 0.5 mm long; stigma 3. Nuts trigonous, oblong, 1.2–1.5 × 0.4–0.5 mm, apiculate at apex, minutely puncticulate, dark brown; epidermal cells isodiametric.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Deciduous forests; *Fl. & Ft.*: August-December.

Specimens examined: Kulamavu, 23.09.1981, *C.N. Mohanan* 71962; Meenmutty, 02.10.1983, *C.N. Mohanan* 79916; *Ibid.*, 27.09.1981, *C.N. Mohanan & B. Ramanujan* 72145; Munnar, 16.10.1963, *K.M. Sebastine* 17587; Pachakkanam, 22.09.1972, *B.D. Sharma* 40838; Thadiampadu, Idukki, 24.08.1977, *K. Vivekananthan* 50514 (MH); Thekkady, 18.08.1994, *Jomy Augustine* 13938 (CALI).

Cyperus dubius Rottb., Descr. Icon. Rar. Pl. 20. t. 4. f. 5. 1773; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 93. 2014. *Mariscus dubius* (Rottb.) Kuk. ex C.E.C.Fischer in Gamble, Fl. Madras 3: 1644. 1931. Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 542. 2004. **Fig. 27A**

Perennial rhizomatous herbs, 5–20 cm tall. Culms erect, glabrous, with a bulbous base and thickened basal sheaths. Leaves linear, 5–10 × 0.2–0.3 cm, acute at apex, glabrous; sheaths scarious, 1–5 cm long, glabrous. Inflorescence dense globose or lobed heads, capitate-ovate, 4–10 × 4–9 mm. Involucral bracts 3–5, spreading-reflexed, leafy, 2–6 × 0.05–0.1 cm, exceeding head, rounded at apex, glabrous. Spikes widely ovate, bearing 6–24 spikelets, compactly arranged, greenish white. Spikelets ovate-lanceolate, 3–6 × 1.5–2 mm, 3–6-flowered, deciduous as a whole, greenish white. Rachilla winged. Glumes membranous, widely ovate-lanceolate, 2.5–3.5 × 2–3 mm, obtuse at apex, many nerved, hyaline at margins, not keeled. Stamens 3, *c.* 3 mm long. Style *c.* 1 mm long; stigma 3. Nuts trigonous, elliptic-oblong, 1.5–1.8 × 0.5–0.6 mm, apiculate at apex, pale brown; epidermal cells hexagonal, smooth.

Distribution: Tropical and S. Africa to Tropical Asia (POWO, 2023); *Habitat*: Wet rocky places; *Fl. & Ft.*: May-February.

Specimens examined: Way to Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 175918; Pius Nagar, 22.06.2018, *Dani Francis & Santhosh Nampy* 159345 (CALI); Thekkady, 15.05.1996, *Jomy Augustine* 17884 (KFRI).

Cyperus exaltatus Retz., Observ. Bot. 5: 11. 1788; C.B.Clarke in Hook.f., Fl. Brit. India 6: 617. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1642. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 527. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 94. 2014.

Perennial robust rhizomatous herbs, 60–130 cm tall. Culms erect, trigonous, glabrous. Leaves coriaceous, canaliculate, lanceolate, 30–60 × 0.8–1.3 cm, acute at apex, glabrous, convolute at margins, tessellately nerved; sheaths 3–15 cm long, glabrous, brown. Inflorescence compound or decompound, 25–30 cm long. Involucral bracts 5–6, leafy, 3–10 × 0.1–0.2 cm, not exceeding inflorescence, acute at apex, glabrous. Spikes cylindrically oblong, 3–5 × 1–1.2 cm, spreading, brown. Spikelets linear-oblong, 5–15 × 1.3–1.5 mm, compressed, dense, golden brown with green margin, 16–22 flowered. Rachilla winged, wing caducous. Glumes sub-orbicular, 1–1.5 × 1–1.5 mm, obtuse and shortly mucronate at apex, sides nerveless, keeled; keels 3-nerved, dark green. Stamens 3, *c.* 3 mm long; anther shortly appendiculate at apex. Style *c.* 1 mm long; stigma 3. Nuts trigonous, obovoid, 0.8–1 × 0.5–0.7 mm, apiculate at apex, smooth, brown-orange yellow.

Distribution: Tropical Africa, Tropical and Subtropical Asia to Australia, Argentina (POWO, 2023); *Habitat*: Marshy fields, banks of rivers; *Fl. & Ft.*: June-January.

Specimens examined: Erattayar dam, 28.09.1981, *C.N. Mohanan* 72185; Kulamavu, 04.06.1982, *C.N. Mohanan* 74180; Kumali, 22.09.1925, *K.C. Jacob* 17763 (MH); Thekkady, 22.12.1996, *Jomy Augustine* 17039 (CALI).

Notes: This species is economically significant because of its valuable fibers (Bhunia *et al.*, 2022).

Cyperus flavidus Retz., Observ. Bot. 5: 13. 1788. *Pycreus flavidus* (Retz.) T.Koyama in J. Jap. Bot. 51: 316. 1976; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 543. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 297. 2014. *Pycreus*

capillaris (J.Koenig ex Roxb.) Nees ex C.B.Clarke, in Hook.f., Fl. Brit. India 6: 591. 1893. *Pycreus globosus* Rchb., Fl. Germ. Excurs. 140. 1830; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1627. 1931.

Annual herbs, 15–60 cm tall. Culms tufted, slender, trigonous, glabrous. Leaves coriaceous, canaliculate, linear-lanceolate, 15–40 × 0.1–0.15 cm, acuminate at apex, glabrous; sheaths 2–6 cm long, glabrous, purple brown. Inflorescence simple or sub-compound or congested in to a head-like cluster of spikelets. Involucral bracts 2–4, leafy, 3–12 × 0.1–0.2 cm, lower ones exceeding inflorescence, acuminate at apex, glabrous. Primary rays 3–6, slender, glabrous. Spikes ovate, 2–2.5 × 0.5–1 cm, bearing 5–20 spikelets, brown. Spikelets spreading, linear-oblong, 5–20 × 1.5–3 mm, compressed, reddish brown, numerous-flowered, falling entirely. Rachilla articulated, wingless, 4-angled. Glumes oblong-ovate, 1.5–2.5 × 1–1.5 mm, obtuse and muticous at apex, straight, sides without nerves, reddish brown with hyaline margin; distinctly keeled, 3-nerved, green. Stamens 2, *c.* 2 mm long. Style *c.* 0.8 mm long; stigma 2. Nuts biconvex, obovoid, 0.8–1 × 0.5–0.7 mm, apiculate at apex, minutely puncticulate, dark brown; epidermal cells isodiametric.

Distribution: S. Europe to Japan and S. Africa to E. Australia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: December-June.

Specimens examined: Brook's peak, 06.12.1996, *Jomy Augustine* 17026 (CALI); Kavalappara, Periyar Tiger Reserve, 01.01.1995, *K.P. Rajesh, Jomy Augustine & N. Sasidharan* 14528 (KFRI); Kulamavu-Ayyappancoil, 27.05.1982, *C.N. Mohanan* 74041; Kulamavu, 01.06.1982, *C.N. Mohanan* 74131; Meenmutty, 18.02.1982, *V.S. Raju* 71254 (MH).

Notes: *Cyperus flavidus* is a highly variable species in respect of the size, shape, and colour of spikelets and nuts (Prasad & Simpson, 2013).

Cyperus haspan L., Sp. Pl. 1: 45.1753; C.B.Clarke in Hook.f., Fl. Brit. India 6: 600. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1640. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 527. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 96. 2014.

Perennial herbs, 10–35 cm tall. Culms slender, trigonous, glabrous. Leaves linear, 5–20 × 0.2–0.5 cm, acute at apex, glabrous; sheaths 2–5 cm long, glabrous, reddish purple. Inflorescence compound-decompound, 3–15 cm long. Involucral bracts 2–3, lower ones exceeding inflorescence, leafy, 3–12 × 0.1–0.2 cm, acute at apex, glabrous. Primary rays 6–12, unequal, *c.* 10 cm long. Spikelets digitately arranged at apex of rays, 3–6, linear-oblong, 5–10 × 1–1.5 mm, acute at apex, cuneate at base, 10–20-flowered, reddish green. Glumes closely arranged, ovate, 1–1.5 × 0.5–0.8 mm, muticous and obtuse at apex, sides nerveless, pale brown or variegated with purple brown, slightly keeled; keel 3-nerved, green. Stamen 1, 1.7 mm long. Style 1.5–2 mm long; stigma 3. Nuts trigonous, broadly obovate, 0.3–0.5 × 0.2–0.3 mm, minutely apiculate at apex, prominently stipitate at base, granulate-verruculose, white.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Marshy grasslands; *Fl. & Ft.*: October-May.

Specimen examined: Chinnar W.L.S., 19.05.1999, *P. Prashy* 79452 (CALI).

Notes: *Cyperus tenuispica* Steud. is a close relative of this species. However, it is distinguished by its closely arranged glumes, which do not expose the rachis and nuts (Wadoodkhan, 2015).

Cyperus intactus Vahl, Enum. Pl. Obs. 2: 332. 1805. *Pycreus micans* (Kunth) Karthik., Fl. Ind. Enum.- Monocot 65. 1989; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 303. 2014. *Pycreus ferrugineus* (Boeckler) C.B.Clarke in Hook.f., Fl. Brit. India 6: 593. 1893.

Perennial rhizomatous herbs, 10–60 cm tall. Culms slender, tufted, triquetrous, glabrous, green. Leaves flat, 15–30 × 0.1–0.2 cm, acuminate at apex, glabrous, green; sheaths 2–5 cm long, glabrous, brown-purple. Inflorescence simple or sub-compound, contracted or open, 4–5 cm long with numerous spikelets. Involucral bracts 3–6, lower ones exceeding inflorescence, leafy, 4–15 cm long, acuminate at apex, glabrous. Primary rays 3–8, unequal, 5–7 cm long. Spikes lanceolate, 0.8–1.5 cm long, bearing 2–15 spikelets, brownish green. Spikelets fasciculate-divergent, linear-lanceolate, 0.5–2 × 1–1.5 mm, acute at apex, cuneate at base, compressed, brownish green, persistent. Rachilla not articulated, flexuous, narrowly winged.

Glumes elliptic-ovate, 1.5–2 × 0.8–1 mm, muticous or slightly mucronate at apex, cuneate at base, sides nerveless, margin hyaline, green with purplish brown, keeled; keel 3-nerved. Stamens 2, *c.* 1.5 mm long. Style *c.* 1 mm long; stigma 2. Nuts biconvex, laterally compressed, oblong, 1–1.5 × 0.5–1 mm, apiculate at apex, smooth, brown; epidermal cells isodiametric.

Distribution: W. Tropical Africa, Tanzania to S. Africa, W. Indian Ocean, S. India and Bangladesh (POWO, 2023); *Habitat*: Forests and grasslands; *Fl. & Ft.*: December-January.

Specimen examined: 2 km before Munnar, 23.01.2018, *Dani Francis & Santhosh Nampy* 158109 (CALI).

Cyperus iria L., Sp. Pl. 1: 45. 1753; C.B.Clarke in Hook.f., Fl. Brit. India 6: 606. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1640. 1931. Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 528. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 98. 2014.

Annual herbs, 20–60 cm tall. Culms tufted, trigonous, glabrous. Leaves linear, 5–35 × 0.2–0.5 cm, acute at apex, glabrous; sheaths 2–5 cm long, glabrous, purple. Inflorescence compound, 5–20 cm long, loosely arranged, diffuse. Involucral bracts 3–5, lower ones exceeding inflorescence, leafy, linear, 5–30 cm long, acute at apex, glabrous. Rays 3–7, unequal, 3–10 cm long, glabrous. Spikes more or less inclined, oblong-ovate, 1–5 × 0.3–0.6 cm, bearing many spikelets. Spikelets loosely arranged, oblong-elliptic, 4–8 × 1.8–2 mm, obtuse at apex, cuneate at base, 4–16-flowered, yellowish green. Rachilla wingless. Glumes obovate-orbicular, 1–1.5 × 1–1.4 mm, rounded-shallowly emarginate and shortly mucronulate at apex, yellow-stramineous, white hyaline at margins, narrowly winged abaxially, strongly keeled; keel 3–5-nerved, green. Stamens 2 or 3, *c.* 1.3 mm long. Style *c.* 1 mm long; stigma 3. Nuts trigonous, elliptic-obovate, 1.2–1.4 × 0.5–0.8 mm, minutely apiculate at apex, broadly stipitate at base, smooth, dark brown.

Distribution: Tropical and Subtropical Old World to Central Asia (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: September-June.

Specimens examined: Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 188830; Erattayar, near Kattappana, 03.03.2021, *Dani Francis & Santhosh Nampy* 176015 (CALI); Kozhikkanam, 24.09.1972, *B.D. Sharma* 41634; Kulamavu,

04.06.1982, *C.N. Mohanan* 74183; Vandiperiyar-Pambanar, 23.09.1964, *K. Vivekananthan* 21327 (MH).

Notes: This species is morphologically close to *Cyperus alulatus* J.Kern in its habit, but can be differentiated by the smooth rachis of spikes and the smooth, narrowly winged back of the glumes (Wadoodkhan, 2015).

Cyperus javanicus Houtt., Nat. Hist. 2(13): 68. t. 88, f. 1. 1782. *Mariscus albescens* Gaudich, Voy. Uranie, Bot. 415. 1829; C.B.Clarke in Hook.f., Fl. Brit. India 6: 623.1893. *Mariscus pennatus* Domin, Biblioth. Bot. 20 (85): 440. 1915; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1645. 1931. Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 99. 2014.

Perennial herbs, 40–70 cm tall. Culms tufted, trigonous, glabrous. Leaves linear, 10–45 × 0.5–1 cm, acuminate at apex, sheathing at base, coriaceous, septate, canaliculate, glabrous, scabrous along margins; sheaths 2–8 cm long, septate, glabrous, purplish brown. Inflorescence compound to decompound, 10–30 cm long, closely arranged. Involucral bracts leafy, 5–7, lower ones exceeding inflorescence, linear, 15–50 cm long, acuminate at apex, glabrous. Primary rays 6–12, spreading, 5–15 cm long, glabrous; secondary rays short, divericate. Spikes cylindrical, 1.5–3 × 1–1.5 cm, bearing up to 50 spikelets. Spikelets spicately arranged at right angles to the rachis, lanceolate, 4–10 × 1–2.5 mm, obtuse at apex, cuneate at base, 6–10-flowered, yellowish green. Rachilla flexuous, broadly winged. Glumes broadly ovate, 2.5–3.5 × 2–2.5 mm, shortly mucronulate at apex, sub-truncate at base, sub-coriaceous, brown-purplish, white hyaline at margins, keeled; keel green. Stamens 3, *c.* 4 mm long. Style 1–1.2 mm long; stigma 3. Nuts trigonous, elliptic-obovate, 1.2–1.5 × 0.7–1 mm, apiculate at apex, smooth, dark brown.

Distribution: Indian Ocean, Tropical and Subtropical Asia to Pacific (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: July-April.

Specimen examined: Nellipparakandam, Periyar Tiger Reserve, 26.07.1993, *N. Sasidharan & Jomy Augustine* 12165 (KFRI).

Cyperus maderaspatanus Willd., Sp. Pl. ed. 4. 1: 278. 1797; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 528. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra

104. 2014. *Mariscus squarrosus sensu* C.B.Clarke in Hook.f., Fl. Brit. India 6: 623. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1645. 1931.

Annual herbs, 4–12 cm tall. Culms tufted, slender, triquetrous, narrowly 3-winged, glabrous, yellowish green. Leaves flat-filiform, 2–4 × 0.05–0.1 cm, acuminate at apex, glabrous, green; sheaths 0.5–1 cm long, glabrous, green-purple. Inflorescence simple or sub-compound, sometimes contracted and reduced in to single head, 0.5–1 cm across with numerous spikelets. Involucral bracts 3, foliaceous, lower ones exceeding inflorescence, leafy, 5–10 mm long, acuminate at apex, glabrous. Primary rays 3, 2–3 cm long. Spikes sub-globose-oblong, 0.5–1 × 0.5–1 cm, brownish green. Spikelets linear, 8–10 × 1.5–1.8 mm, compressed, not squarrose, densely crowded, 10–25-flowered. Rachilla wingless. Glumes ovate-oblong, 2.5–3 × 0.4–0.5 mm, awned at apex, cuneate at base, sides nerveless, margin hyaline, sparsely keeled; keel 5–7-nerved, green; awns slightly recurved. Stamens 1, *c.* 1 mm long. Style *c.* 1 mm long, glabrous; stigma 3. Nuts trigonous, narrowly or cylindrically oblong, 1–1.2 × 0.1–0.3 mm, apiculate at apex, smooth or obscurely puncticulate, brown.

Distribution: East and S. Tropical Africa and India (POWO, 2023); *Habitat*: Marshy open grasslands; *Fl. & Ft.*: August-February.

Specimens examined: Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 188810; way to Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 175981; Mathikettan Shola National Park, Sivanpara, 23.08.2014, *Syam Radh S. & Santhosh Nampy* 143510 (CALI).

Notes: The spreading, greenish or greenish yellow, narrow spikelets, nerveless sides of glumes, and narrow, almost cylindrically oblong, longer nuts distinguish this species from *C. squarrossus* L. (Wadoodkhan, 2015).

Cyperus melanospermus (Nees) Valck.Sur., Geslacht Cyperus Mal. Archipel. 50. 1898. *Kyllinga melanosperma* Nees in Wight, Contr. Bot. 91. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 588. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1624. 1931. Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 540. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 268. 2014.

Perennial rhizomatous herbs, 30–70 cm tall. Rhizomes shortly creeping. Culms triquetrous, glabrous, reddish green. Leaves shorter than stem, reduced, lanceolate, 5–9 × 0.2–0.4 cm, obtuse at apex, glabrous, green; sheaths 2.5–5 cm long, glabrous, purple brown. Inflorescence terminal spikes, 1–3, 8–10 mm long, greenish white. Involucral bracts 3–4, spreading, leafy, lanceolate, 5–12 × 0.1–0.4 cm, exceeding inflorescence, acuminate at apex, glabrous. Spikelets compressed, ellipsoid, 2–2.5 × 0.5–0.7 mm, acute at apex, numerous-flowered, falling as a whole, green-stramineous. Glumes 4, membranous, ovate, 1.8–2.5 × 0.4–0.5 mm, acute and mucronulate or apiculate or muticous at apex, sides 3–4-nerved, keeled narrowly winged, serrulate, green. Stamens 2, *c.* 1 mm long. Style *c.* 2 mm long; stigma 2. Nuts biconvex, compressed, ellipsoid, 0.8–1 × 0.4–0.5 mm, minutely apiculate at apex, smooth, orange yellow.

Distribution: Tropical Old World (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-January.

Specimen examined: Munnar, 23.01.2018, *Dani Francis & Santhosh Nampy* 158114 (CALI).

Cyperus metzii (Hochst. ex Steud.) Mattf. & Kuk. in Engler, Pflanzenr. Cyperac.-Scirp.-Cyp. 25. 1935. *Kyllinga metzii* Hochst. ex Steud., Syn. Pl. Glumac. 2: 70. 1854. *Kyllinga squamulata* Vahl, Enum. Pl. 2: 381. 1805; C.B.Clarke in Hook.f., Fl. Brit. India 6: 589. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1624. 1931. Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 541. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 275. 2014.

Annual herbs, 5–30 cm tall. Culms triquetrous, slender, glabrous, green. Leaves longer than culm, linear, 5–35 × 0.1–0.2 cm, acute at apex, glabrous, scabrid along margins, green; sheaths 2–5 cm long, glabrous, green. Inflorescence a solitary terminal spike, sometimes 1 or 2 lateral ones, 8–10 mm long, sub-globose or ovoid, greenish white. Involucral bracts 3–4, leafy, lanceolate, 5–15 × 0.1–0.4 cm, exceeding inflorescence, acuminate at apex, glabrous. Spikelets compressed, ovate-lanceolate, 3–3.5 × 1–1.3 mm, acute at apex, few to numerous-flowered, green-stramineous. Glumes 4; lower 2, narrow, small, *c.* 1 mm long; upper 2, boat shaped, 2.5–3 × 0.4–0.5 mm, acute or mucronate at apex, hyaline or with purple spots, sides 3–5-nerved, keeled, winged, with prominently toothed crest. Stamens

2, *c.* 2.5 mm long. Style *c.* 0.5 mm long; stigma 2. Nuts biconvex, broadly ellipsoid-oblong, 1.5–1.8 × 0.8–1 mm, with persistent style, brown.

Distribution: Africa to Indo-China and Queensland (POWO, 2023); *Habitat*: Banks of lakes; *Fl. & Ft.*: August-September.

Specimen examined: Thekkady, 20.08.1994, *N. Sasidharan & Jomy Augustine* 13946 (CALI).

Cyperus mindorensis (Steud.) Huygh, Phytotaxa 166(1): 39. 2014. *Kyllinga mindorensis* Steud., Syn. Pl. Glumac. 2: 67. 1854. *Kyllinga nemoralis* (J.R. Forst. & G.Forst.) Dandy in Hutch. & Dalziel, Fl. W. Trop. Afr. 2(2): 487. 1936; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 540. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 270. 2014. *Kyllinga monocephala sensu* C.B.Clarke in Hook.f., Fl. Brit. India 6: 588. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1624. 1931 *non* Rottb., 1773.

Perennial rhizomatous herbs, 10–40 cm tall. Rhizomes horizontally creeping, with slender stolons, brown scaly. Culms triquetrous, slender, striated, glabrous. Leaves shorter than the culm, linear-lanceolate, 5–20 × 0.2–0.4 cm, acuminate at apex, puberulous-glabrous, green; sheaths 2.5–6 cm long, glabrous, purple brown. Inflorescence solitary, sub-globose, sessile terminal spikes, 4–10 mm long, with numerous spikelets, greenish white. Involucral bracts 3, leafy, lanceolate, 3–9 × 0.1–0.4 cm, exceeding inflorescence, acuminate at apex, glabrous-puberulous. Spikelets elliptic, 2–2.5 × 0.8–1 mm, acute at apex, single-flowered, falling entirely leaving 2–3 empty glumes, green-stramineous. Glumes 4 or 5, equal or sub-equal, elliptic-oblong, 2–2.5 × 0.4–0.5 mm, mucronate at apex, sides faintly 4–5-nerved; strongly keeled, distinctly winged on back, wings lunate crested, brown gland dotted, glabrous, pale brown. Stamens 1 or 2, *c.* 1 mm long. Style *c.* 2 mm long; stigma 2. Nuts biconvex, compressed, ellipsoid, 1–1.3 × 0.5–0.7 mm, minutely apiculate at apex, smooth, brown.

Distribution: Tropical and Subtropical Old World to Caucasus (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-March.

Specimens examined: Cheeyappara waterfalls, 21.08.1965, *K.M. Sebastine* 25346 (MH); way to Karimutty, 29.12.2017, *Dani Francis & Santhosh Nampy* 156587;

Kattappana, 16.03.2018, *Dani Francis & Santhosh Nampy* 158381 (CALI); Thekkady, Okkrai, 29.09.1972, *B.D. Sharma* 42347; Thekkady, 28.05.1964, *K. Vivekananthan* 24360 (MH); Thommankuthu, 10.12.2016, *Dani Francis & Santhosh Nampy* 151324 (CALI); Vandiperiyar-Pambanar, 23.09.1964, *K. Vivekananthan* 21322 (MH); Vellappara, 05.08.2017, *Dani Francis & Santhosh Nampy* 154145 (CALI).

Notes: It is a troublesome weed in turf grass and is known as 'whitehead spike sedge'.

Cyperus mollipes K.Schum. in Engler, Pflanzenw. Ost-Afrikas, C: 122. 1895; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 106. 2014. *Ascopholis gamblei* C.E.C.Fisch., Bull. Misc. Inform. Kew 1931(2): 105. 1931; Gamble, Fl. Madras 3: 1679. 1931.

Perennial rhizomatous herbs, 15–30 cm tall. Culms tufted, sub-triquetrous, bulbous at base, glabrous, green. Leaves linear-flat, 7–15 × 0.2–0.3 cm, acute at apex, glabrous, green; sheaths membranous, 3–6 cm long, glabrous, rusty brown. Inflorescence single capitate head, semi globose, rarely 3-lobed, 0.5–1 × 0.5–1.5 cm, greenish white. Involucral bracts 3, foliaceous, exceeding inflorescence, 4–6 × 0.1–0.2 cm, acuminate at apex, glabrous. Spikelets numerous, narrowly elliptic-lanceolate, 3–4 × 0.6–1 mm, sub-terete, deciduous as a whole. Rachilla wingless. Glumes narrowly elliptic-lanceolate, 2.5–4 × 0.8–1 mm, muticous at apex, cuneate at base, sub-coriaceous, 7–9-nerved, white-pale brown, not keeled. Stamens 3, *c.* 2 mm long. Style *c.* 1 mm long, glabrous; stigma 3. Nuts cylindrically trigonous, narrowly ellipsoid, 2–2.5 × 0.4–0.5 mm, smooth or obscurely puncticulate, pale brown; epidermal cells isodiametric.

Distribution: Central African Republic to Ethiopia and S. Tropical Africa, India to Thailand (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: June-December.

Specimens examined: Pius Nagar, 22.06.2018, *Dani Francis & Santhosh Nampy* 159357; Thekkady, Nellikkampetty range, 14.07.2017, *Dani Francis & Santhosh Nampy* 152845 (CALI).

Cyperus neochinensis (Tang & F.T.Wang) Bauters, Phytotaxa 166(1): 21. 2014. *Scirpus neochinensis* Tang & F.T.Wang, Fl. Reipubl. Popularis Sin. 11: 223. 1961. *Scirpus squarrosus* L., Mant. Pl. Altera 2: 181. 1771; C.B.Clarke in Hook.f., Fl. Brit. India 6: 663. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1666. 1931; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 346. 2014. *Rikliella squarrosa* (L.) J.Raynal, Adansonia ser. 2, 13(2): 154. 1973; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 546. 2004.

Annual herbs, 3–15 cm tall. Culms tufted, angular, glabrous, green. Leaves linear-filiform, 1.5–3 × 0.05–0.1 cm, acute-acuminate at apex, glabrous, green; sheaths 0.5–1 cm long, glabrous, reddish brown. Inflorescence reduced to solitary, more often pseudo lateral, rarely terminal cluster of 1–3 spikelets. Involucral bracts 2, setiform, exceeding inflorescence, 1.5–3 cm long, acuminate at apex, glabrous. Spikelets ovoid to sub-globose, 4–5 × 1.5–2 mm, obtuse at apex, squarrose, densely crowded, green tinged with reddish brown. Rachilla wingless. Glumes ovate-oblong, 0.5–1 × 0.3–0.5 mm, awned at apex, cuneate at base, sides 3–5-nerved, margin hyaline, not keeled; awns 0.5–0.9 mm long, recurved, as long as the body of glume. Stamen 1, *c.* 1.2 mm long. Style obscure or very short; stigma 3. Nuts trigonous, narrowly obovoid, 0.3–0.4 × 0.1–0.2 mm, apiculate at apex, smooth, white.

Distribution: Indian Subcontinent to S. China and Peninsula Malaysia (POWO, 2023); *Habitat*: Open wet grasslands; *Fl. & Ft.*: November-February.

Specimens examined: Way to Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 175907; Swamikkayam, 03.01.1994, *Jomy Augustine* 13111 (CALI).

Cyperus nutans Vahl, Enum. Pl. Obs. 2: 363. 1805; C.B.Clarke in Hook.f., Fl. Brit. India 6: 607. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1640. 1931; K.M.Matthew, Illustr. Fl. Palni Hills 768. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 529. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 107. 2014.

Perennial rhizomatous herbs, 50–100 cm tall. Culms trigonous, glabrous, green. Leaves linear-filiform, 5–25 × 0.3–1 cm, acute at apex, glabrous, green; sheaths 2–5 cm long, glabrous, reddish brown. Inflorescence compound to decompound, lax, *c.* 20 cm long. Involucral bracts 4–6, leafy, exceeding inflorescence, 6–15 cm long,

acute at apex, glabrous. Spikes narrow, spreading, 3–4 × 0.5–1 cm, bearing 10–25 spikelets. Spikelets compressed, linear-oblong, 4–15 × 1.5–2 mm, obtuse at apex, stramineous. Rachilla winged, persistent. Glumes imbricate, oblong, 2–2.5 × 0.8–1 mm, obtuse and mucronate at apex, cuneate at base, sides 3-nerved, margin hyaline, keeled, yellowish brown. Stamens 3, *c.* 1.3 mm long. Style short, *c.* 0.7 mm long; stigma 3. Nuts triquetrous, oblong, 1.2–1.5 × 0.3–0.5 mm, shortly apiculate at apex, smooth, brown; epidermal cells isodiametric.

Distribution: Tropical Africa and Asia to Vanuatu (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: September-April.

Specimen examined: Chenthamara, 19.04.1995, *Jomy Augustine* 15138 (CALI).

Cyperus pangorei Rottb., Descr. Icon. Rar. Pl. 31. 1773; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1641. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 529. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 109. 2014. *Cyperus tagetum* Roxb., Fl. Ind. 1: 211. 1820; C.B.Clarke in Hook.f., Fl. Brit. India 6: 613. 1893.

Perennial rhizomatous herbs, 50–120 cm tall. Rhizomes creeping. Culms tufted, trigonous, glabrous, green. Leaves reduced to 3–6 sub-phyllus sheaths surrounding the culm base, sometimes developed in to c. 10 cm long blade; sheaths 2–5 cm long, glabrous, brown-purple, septate. Inflorescence compound, lax, 6–12 cm long. Involucral bracts 4–5, leafy, exceeding inflorescence, 6–15 cm long, acute at apex, glabrous. Spikes narrow, spreading, 17–35 × 0.5–1 cm, 5–12 spikelets. Primary rays 5–7, spreading, unequal, 5–9 cm long, acute at apex, glabrous. Spikelets erect, closely spicate, linear, 10–20 × 1–1.5 mm, sub-acute at apex, cuneate at base, reddish brown. Rachilla winged; wings lanceolate, caducous, reddish brown. Glumes oblong-lanceolate, 2.5–3 × 1–1.5 mm, obtuse at apex, cuneate at base, sides nerveless, margin hyaline, keeled, reddish brown. Stamens 3, *c.* 4 mm long. Style *c.* 1.5 mm long; stigma 3. Nuts trigonous, oblong, 1.2–1.5 × 0.3–0.5 mm, shortly apiculate at apex, smooth, brown.

Distribution: Pakistan to S. China and Sri Lanka (POWO, 2023); *Habitat*: Along streams and rivers; *Fl. & Ft.*: September-June.

Specimens examined: Cheruthoni, 16.02.1982, *C.N. Mohanan* 73315; Kulamavu, 04.06.1982, *C.N. Mohanan* 74179; *Ibid*., 02.06.1982, *C.N. Mohanan* 74141 (MH).

Cyperus paniceus (Rottb.) Boeckeler, Linnaea 36(3): 381. 1870; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 110. 2014. *Mariscus paniceus* (Rottb.) Vahl, Enum. Pl. Obs. 2: 373. 1805; C.B.Clarke in Hook.f., Fl. Brit. India 6: 620. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1644. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 542. 2004.

Perennial rhizomatous herbs, 10–60 cm tall. Culms slender, trigonous, glabrous. Leaves lanceolate, 8–25 × 0.2–0.3 cm, acute at apex, glabrous, green; sheaths 2–5 cm long, glabrous, purplish green. Inflorescence simple, 2–5 cm long. Involucral bracts 3–5, leafy, 5–10 × 0.1–0.3 cm, exceeding inflorescence, acute at apex, glabrous. Rays 0. Spikes cylindrical, 8–15 × 4–6 mm, spreading, brown, bearing numerous spikelets. Spikelets horizontally divergent, lanceolate, 2.5–3.5 × 0.5–1 mm, slightly curved. Rachilla wingless. Glumes 4, ovate-lanceolate, 1–3 × 0.8–1 mm, acute at apex, sides 2-nerved, keeled. Stamens 3, *c.* 1.2 mm long. Style *c.* 0.5 mm long; stigma 3. Nuts trigonous, elliptic-oblong, 1.8–2 × 0.6–0.8 mm, apiculate at apex, smooth, slightly curved, yellowish brown.

Distribution: Seychelles and Indian Subcontinent to Indo-China, Jawa (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: August-December.

Specimen examined: Koruthode, 15.08.1996, *Jomy Augustine* 16259 (CALI).

Cyperus pilosus Vahl, Enum. Pl. Obs. 2: 354. 1805; C.B.Clarke in Hook.f., Fl. Brit. India 6: 609. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1641. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 529. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 112. 2014.

Perennial rhizomatous herbs, 30–90 cm tall. Culms tufted, triquetrous, glabrous, scabrid on angles. Leaves flat-plicate, 5–15 × 0.06–1.5 cm, acute at apex, glabrous, scabrid on margins, green; sheaths 1.5–3 cm long, glabrous, green to purplish brown. Inflorescence dense, compound to decompound. Involucral bracts 3–5, setiform, few exceeding inflorescence, linear, 15–50 cm long, acute at apex, glabrous. Spikes broadly ovate, 2–2.5 × 1–1.5 cm, with 6–20 spikelets, sessile or peduncled. Spikelets spreading, linear-lanceolate, 5–20 × 1.5–2.5 mm, acute at apex, reddish brown. Rachilla wingless. Glumes loosely disposed, ovate-oblong, 2–2.5 × 1–1.5 mm, acute and mucronulate at apex, cuneate at base, broadly hyaline

at margin, slightly keeled; keel 5–7-nerved, brown. Stamen 3, *c.* 1.2 mm long. Style *c.* 1 mm long; stigma 3. Nuts trigonous, broadly elliptic to obovoid, 1–1.2 × 0.5–0.7 mm, apiculate at apex, smooth, dark brown; epidermal cells isodiametric.

Distribution: Tropical and Subtropical Asia to E. Australia (POWO, 2023); *Habitat*: Riverbanks and grasslands; *Fl. & Ft.*: June-October.

Specimen examined: Waterfall, Kannadippara, 08.06.2018, *Dani Francis & Santhosh Nampy* 159286 (CALI).

Cyperus polystachyos Rottb., Descr. Icon. Rar. Pl. 39. 1773. *Pycreus polystachyos* (Rottb.) P.Beauv., Fl. Oware 2: 48. 1816; C.B.Clarke in Hook.f., Fl. Brit. India 6: 592. 1893; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 544. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 306. 2014. *P. odoratus* Urb., Symb. Antill. 2: 164. 1900; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1627. 1931.

Annual or perennial herbs, 20–60 cm tall. Culms tufted, triquetrous, glabrous, green. Leaves shorter than culms, linear, 2–7 × 0.1–0.2 cm, acute at apex, glabrous; sheaths 1–1.5 cm long, glabrous, reddish brown. Inflorescence sub-globose or head-like, 1.5–3 × 2–4 cm. Involucral bracts 3–5, leafy, linear, 2–4 × 0.1–0.2 cm, lower ones shorter or slightly exceeding inflorescence, acute at apex, glabrous. Rays absent. Spikelets flattened, 1–1.7 × 1.5–2 mm, acute at apex, cuneate at base, 10–20-flowered, stramineous-brown, persistent. Rachilla narrowly winged, not articulated. Glumes membranous, oblong-ovate, 1.5–2.5 × 0.8–1 mm, acute and muticous at apex, sides nerveless, hyaline at margins; keeled, 3-nerved, green. Stamens 2, *c.* 2 mm long. Style 1 mm long; stigma 2. Nuts biconvex, oblong-obovate, 1–1.5 × 0.4–0.5 mm, slightly apiculate at apex, constricted at base, smooth, greyish brown.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: December-April.

Specimens examined: Munnar, 18.03.1984, *Madhu* 37821, 37820; *Ibid.,* 23.12.1986, *s.coll.* 12019; *Ibid.*, 23.12.1986, *s.coll.* 12024; Thekkady, 06.04.1995, *Jomy Augustine* 15059 (CALI).

Cyperus procerus Rottb., Descr. Icon. Rar. Pl. 29. 1773; C.B.Clarke in Hook.f., Fl. Brit. India 6: 610. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1641. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 530. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 114. 2014. **Fig. 27B**

Perennial herbs, 30–90 cm tall. Culms triquetrous, arising from the tuberous base, glabrous. Leaves flat-plicate, 10–25 × 0.04–0.1 cm, acuminate at apex, puberulous, green, arising from just above the base; sheaths 3–5 cm long, glabrous, green to stramineous. Inflorescence simple or sub-compound, 5–8 × 5–8 cm. Involucral bracts 3–4, leafy, exceeding inflorescence, linear-flat, 5–15 cm long, acuminate at apex, puberulous. Spikes ovate-oblong, 1.5–3 × 0.5–1 cm, with 4–12 spikelets, sessile or peduncled. Spikelets linear, 1.5–2 × 2.5–3.5 mm, acute at apex, sub-compressed, lower ones right angles to the culms, yellowish brown. Rachilla wingless. Glumes ovate, 2.5–3 × 1.5–2 mm, muticous at apex, cuneate at base, 7-nerved, sides nerved, broadly hyaline at margin, slightly keeled, brown. Stamen 3, *c.* 2.3 mm long. Style *c.* 1 mm long; stigma 3. Nuts triquetrous, obovoid, 0.8–1 × 0.6–0.8 mm, apiculate at apex, smooth, pale yellow.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Marshes and paddy fields; *Fl. & Ft.*: September-March.

Specimen examined: Kattappana, field near Govt. College, 16.03.2018, *Dani Francis & Santhosh Nampy* 158385 (CALI).

Cyperus pumilus L., Cent. Pl. 2: 6. 1756. *Pycreus pumilus* (L.) Nees, Linnaea 9. 283. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 591. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1627. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 544. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 307. 2014.

Annual herbs, 6–15 cm tall. Culms densely tufted, slender, angular, glabrous. Leaves linear, setiform, 2–7 × 0.1–0.15 cm, acuminate at apex, puberulous, green; sheaths membranous, 1–3 cm long, glabrous, green. Inflorescence simple or sub-compound, or contracted. Involucral bracts 3 or 4, leafy, exceeding inflorescence, linear, 2–6 cm long, acuminate at apex, glabrous. Rays spicate, compressed, 5–10 × 1–1.5 cm, acute at apex, radiating from a short rachis. Spikelets linear, 1.5–2 × 1–2 mm, acute at apex, yellowish brown, persistent. Rachilla wingless, persistent.

Glumes ovate to sub-orbicular, 1–1.5 × 0.8–1 mm, mucronate at apex, slightly recurved, cuneate at base, sides nerveless, broadly hyaline at margin, keeled, greenish yellow; keels 3–5-nerved. Stamen 1, *c.* 2 mm long. Style *c.* 1 mm long; stigma 2. Nuts biconvex, obovoid, 0.4–0.5 × 0.5–0.6 mm, apiculate at apex, minutely stipitate, smooth, white; epidermal cells isodiametric.

Distribution: Tropical and Subtropical Old World to N. Australia (POWO, 2023); *Habitat*: Riverbanks and grasslands; *Fl. & Ft.*: August-March.

Specimens examined: Anchuruli, 07.09.2017, *Dani Francis & Santhosh Nampy* 152918; way to Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 175909 (CALI); Thekkady, 26.11.1995, *Jomy Augustine & K.P. Rajesh* 16953 (KFRI); Thommankuthu, 10.12.2016, *Dani Francis & Santhosh Nampy* 151323 (CALI); near Valara, 21.08.1965, *K.M. Sebastine* 25351 (MH).

Cyperus raynalianus (Govind.) Bauters, Phytotaxa 166. 23. 2014. *Lipocarpha raynaliana* Govind., Adansonia 20: 369. 1981; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 280. 2014.

Annual herbs, 5–30 cm tall. Culms tufted, slender, angular, striate, glabrous. Leaves linear, 6–20 × 0.1–0.2 cm, acute at apex, glabrous, green; sheaths membranous, 1.5–2.5 cm long, glabrous, reddish green. Inflorescence in terminal heads, mostly 3, rarely solitary, 4–10 × 5–11 mm. Involucral bracts 2, leafy, exceeding inflorescence, linear, 2–8 cm long, acute at apex, glabrous. Spikelets ovoid, 3–5 × 3–4 mm, obtuse at apex, stramineous. Rachilla wingless, thick. Glumes spirally arranged, spathulate, 2–2.5 × 0.5–0.9 mm, triangular and acute at apex, sub-truncate at base, not keeled, hyaline with reddish brown stripes. Hypogynous scales 2, 1.8–2 mm long. Stamens 2, *c.* 0.6 mm long. Style *c.* 0.5 mm long; stigma 3. Nuts triquetrous, oblong, 1.3–1.5 × 0.3–0.4 mm, with a short beak at apex, constricted at base, smooth, brown; epidermal cells isodiametric.

Distribution: SW. India (POWO, 2023); *Habitat*: Riverbanks and grasslands; *Fl. & Ft.*: September-December.

Specimen examined: Palkulamedu, 01.12.2019, *Dani Francis & Santhosh Nampy* 164664 (CALI).

Cyperus richardii Steud., Syn. Pl. Glumac. 2: 8. 1854. *Kyllinga bulbosa* P.Beauv., Fl. Oware 1: 11. 1805; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 544. 2004.

Perennial herbs, 5–20 cm tall. Rhizomes not stoloniferous. Culms tufted, slender, trigonous, glabrous, corm like at base, clothed with brown scales. Leaves a few, linear, 2–10 × 0.1–0.2 cm, acuminate at apex, glabrous, green; sheaths membranous, 1–3 cm long, glabrous, brown at base. Inflorescence terminal heads, with mostly 3 spikes, pale green; mid one globose, 5–8 × 4–5 mm, obtuse at apex; laterals globose, smaller. Involucral bracts 3–4, leafy, exceeding inflorescence, linear, 2–10 cm long, acuminate at apex, glabrous. Spikelets numerous, oblong-lanceolate, 1.5–2 × 0.6–0.8 mm, obtuse at apex, pale green-white, 1-flowered. Rachilla wingless. Glumes 4, ovate-lanceolate, 0.3–2.5 × 0.3–0.9 mm, acute-mucronulate at apex, sub-truncate at base, keeled, not winged, hyaline. Stamens 2, *c.* 2.5 mm long. Style *c.* 0.5 mm long; stigma 2. Nuts biconvex, compressed laterally, oblong, 1–1.4 × 0.4–0.6 mm, apiculate at apex, smooth, brown.

Distribution: Tropical Africa to Indo-China (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: August-November.

Specimen examined: Thekkady, 08.11.1996, *Jomy Augustine* 16944 (CALI).

Notes: *Cyperus richardii* is readily distinguished from its congeners by its persistent ellipsoidal to globose tubers, white capitate inflorescences of 1–several dense spikes, slender white stolons that become threadlike and purplish black to brown with age (Carter *et al.*, 2016).

Cyperus rotundus L., Sp. Pl. 45. 1753; C.B.Clarke in Hook.f., Fl. Brit. India 6: 614. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1641. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 530. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 117. 2014.

Perennial herbs, 25–50 cm tall. Rhizomes stoloniferous. Culms slender, trigonous, glabrous, arising from a tuberous base. Leaves linear, 3–14 × 0.2–0.4 cm, acuminate at apex, glabrous, scabrous at margins, green; sheaths membranous, 2–3 cm long, glabrous, stramineous to greenish yellow. Inflorescence compound. Involucral bracts 4–5, leafy, lower one exceeding inflorescence, spreading, linear, 2–5 cm long, acuminate at apex, glabrous. Spikes ovate, 1.5–4 cm long, bearing 8–

10 spikelets. Spikelets linear, 1–2 × 1.5–2 mm, acute at apex, compressed, greenish yellow. Rachilla winged. Glumes elliptic-oblong, 3–3.5 × 1.5–2 mm, acute at apex, cuneate at base, sides 1–2-nerved, narrowly hyaline at margin, keeled; keels 3-nerved, recurved at apex. Stamens 3, *c.* 2.5 mm long. Style *c.* 2 mm long; stigma 3. Nuts trigonous, obovoid-ellipsoid, 1–1.5 × 0.3–0.4 mm, apiculate at apex, sessile, smooth, grey.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: September-May.

Specimen examined: Manakkavala, 06.05.1995, *Jomy Augustine* 15172 (CALI).

Notes: *Cyperus rotundus* is a common and troublesome weed especially in lawns and fertile soils, and is also known as "nut grass". It is nearly impossible to eradicate this weed due to its perennating tubers, which are never carefully removed from the soil. It has numerous medicinal and pharmacological applications (Sivapalan, 2013; Wadoodkhan, 2015).

Cyperus sanguinolentus Vahl, Enum. Pl. Obs. 2: 351. 1805, *nom. cons*. *Pycreus sanguinolentus* (Vahl) Nees, Linnaea 9: 283. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 590. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1627. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 544. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 309. 2014.

Annual herbs, 10–30 cm tall. Culms tufted, angular, swollen at base, glabrous, rooting at nodes, groove-like depressions on either side. Leaves linear, 5–15 × 0.2–0.4 cm, acute-acuminate at apex, canaliculate, glabrous, in the lower third to half of the culms; sheaths 2–5 cm long, glabrous, reddish brown. Inflorescence simple to sub-compound, or contracted to heads. Involucral bracts 3, lower ones exceeding inflorescence, leafy, 8–10 × 0.2–0.3 cm, acute-acuminate at apex, deflexed, glabrous. Rays spreading, 1.5–3 cm long. Spikelets strongly compressed, stellately arranged, linear, 1–1.5 × 1.5–2 mm, acute at apex, cuneate at base, blood red-coloured. Rachilla wingless, persistent. Glumes ovate, 2–2.5 × 1.8–2 mm, obtuse at apex, sides nerveless, hyaline, elliptic depression on either side with reddish band around it; keel acute, 3–5-nerved. Stamens 2 or 3, *c.* 3 mm long. Style *c.* 2.5 mm long; stigma 2. Nuts biconvex, laterally compressed, broadly obovate-

orbicular, 1–1.5 × 0.8–1 mm, apiculate at apex, white-brownish black; epidermal cells hexagonal.

Distribution: Eritrea to Zambia, Asia to Australia (POWO, 2023); *Habitat*: Marshy areas and grasslands; *Fl. & Ft.*: September-January.

Specimens examined: Kulamavu, 12.10.1982, *C.N. Mohanan* 74595; Lockhert gap, 10.10.1963, *K.M. Sebastine* 17485 (MH); Munnar, *s.d.*, *Rejani* 37819; Pallivasal, *s.d., Rejani* 37816 (CALI); Peermade, 24.01.1965, *K. Vivekananthan* 22997 (MH); Rajamala, *s.d., Ramesh* 37817 (CALI); Thekkady, 26.01.1995, *K.P. Rajesh* 14876 (KFRI).

Notes: The diagnostic characters of this species are the glumes with acute keels and groove-like depressions on either side, the swollen culms, rooting at nodes, and the leaves being in the lower third to half of the culms (Khan & Choudhari, 2014).

Cyperus sesquiflorus subsp. cylindricus (Nees) T.Koyama, Bot. Mag. (Tokyo) 83: 187. 1970. *Kyllinga odorata* subsp. *cylindrica* (Nees) T.Koyama, Gard. Bull. Singapore 30. 161. 1977; K.M.Matthew, Illustr. Fl. Palni Hills 771. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 540. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 271. 2014. *Kyllinga cylindrica* Nees in R.Wight, Contr. Bot. India 91. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 588. 1893.

Perennial herbs, 10–30 cm tall. Rhizomes very short, clothed with brown scales. Culms slender, triquetrous, glabrous, thickened at base. Leaves a few, narrowly linear, 5–15 × 0.2–0.3 cm, acuminate at apex, glabrous, entire at margins, green; sheaths membranous, 1–4 cm long, glabrous, purplish brown. Inflorescence a terminal head of 1–3 spikes, white-stramineous, mid one cylindrical, laterals sub-globose. Involucral bracts 3–5, reflexed, leafy, exceeding inflorescence, linear, 4–10 cm long, acuminate at apex, glabrous. Spikelets numerous, flattened, elliptic, 2–2.5 × 1–1.5 mm, acute at apex, 1 or 2-flowered, greenish white. Rachilla wingless. Glumes 4; lower 2, ovate, smaller, *c.* 2 mm long, 9–11-nerved; upper 2, broadly ovate, *c.* 2.5 × 1 mm, acute and apiculate at apex, cuneate at base, sides 1 or 2-nerved, narrowly hyaline at margin, keeled, not winged; keels spinulose, 5–7-nerved. Stamens 2, *c.* 2 mm long. Style *c.* 2 mm long; stigma 2. Nuts biconvex,

laterally compressed, obovoid-ellipsoid, 1–1.5 × 0.8–1 mm, truncate and minutely apiculate at apex, smooth, dark brown.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: August-November.

Specimens examined: Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154342; Mangaladevi, 07.08.1993, *Jomy Augustine* 12185; Panchalimedu, 13.09.2019, *Dani Francis & Santhosh Nampy* 170286 (CALI).

Cyperus sphacelatus Rottb., Descr. Icon. Rar. Pl. 26. 1773; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 120. 2014.

Annual or perennial rhizomatous herbs, 15–30 cm tall. Culms tufted, trigonous, glabrous, green. Leaves lanceolate, 5–20 × 0.3–0.4 cm, acuminate at apex, glabrous, scabrous at margins, green; sheaths 1–3 cm long, glabrous, pale brown. Inflorescence simple to sub-compound, 5–10 × 6–7 cm. Involucral bracts 3–4, leafy, exceeding inflorescence, lanceolate, 5–12 × 0.2–0.4 cm, acuminate at apex, glabrous. Spikes ovate. Spikelets linear-lanceolate, 1–2 × 1.5–2 mm, acute at apex, green with dark purple-brown stripes on both faces. Rachilla winged. Glumes elliptic-ovate, 2–2.5 × 1.2–1.5 mm, acute at apex, cuneate at base, dark purple-brown spot on one or both sides giving appearance of purple brown stripes in the centre of green spikelets; keel 5–7-nerved, green, sides nerveless, slightly incurved. Stamens 2 or 3, *c.* 0.5 mm long. Style *c.* 0.5 mm long, slender; stigma 3. Nuts triquetrous, obovoid, 0.8–1.3 × 0.4–0.5 mm, apiculate at apex, constricted at base, smooth, brown.

Distribution: Tropical America, Tropical Africa and Madagascar (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: October-February.

Specimen examined: Kaliyar, 07.02.2021, *Dani Francis & Santhosh Nampy* 173387 (CALI).

Notes: It is an introduced species with brown or greenish spikelets, ornate with a longitudinal red line at the centre of each lateral side (De Oliveira *et al.*, 2015).

Cyperus squarrosus L., Cent. Pl. 2: 6. 1756; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 121. 2014. *Mariscus squarrosus* (L.) C.B.Clarke in Hook.f., Fl. Brit. India 6: 623. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1645. 1931. *Cyperus*

aristatus Rottb., Descr. Icon. Rar. Pl. 22. 1773; C.B.Clarke in Hook.f., Fl. Brit. India 6: 606. 1893. **Fig. 28D**

Annual herbs, 5–12 cm tall. Culms tufted, slender, triquetrous, angles winged, glabrous. Leaves flat, linear, 2–7 × 0.1–0.3 cm, acute at apex, glabrous, green; sheaths membranous, 0.5–2 cm long, glabrous, purple. Inflorescence anthelate, open or often reduced to a single hemispherical spike. Involucral bracts 2–4, leafy, lowest exceeding inflorescence, linear-lanceolate, 2–4 cm long, acute at apex, glabrous. Spikes broadly ellipsoid to sub-globose, 0.5–2 × 0.5–1 cm, echinate, yellowish green. Spikelets spreading, densely spicate, oblong, 5–15 × 1.5–2 mm, many-flowered. Rachilla wingless. Glumes oblong-ovate, 1–2 × 0.5–1.5 mm, recurved awns at apex, cuneate at base, 7–9-nerved, not keeled, reddish brown. Stamen 1, *c.* 2 mm long. Style *c.* 0.7 mm long; stigma 3. Nuts trigonous, oblong-ovoid, 0.7–1 × 0.2–0.5 mm, obtuse and minutely apiculate at apex, smooth, brown; epidermal cells isodiametric.

Distribution: Tropical and Subtropical to N. America (POWO, 2023); *Habitat*: Paddy fields and wet rocky areas; *Fl. & Ft.*: June-January.

Specimens examined: Chottupara, 07.09.2017, *Dani Francis & Santhosh Nampy* 152965, 152978; way to Karimutty, 29.12.2017, *Dani Francis & Santhosh Nampy* 156588; Mangaladevi hills, 15.07.2017, *Dani Francis & Santhosh Nampy* 152870; Mathikettanshola National Park, 11.12.2016, *Dani Francis & Santhosh Nampy* 151387; Perattakkalam, 04.01.2017, *Dani Francis & Santhosh Nampy* 151456; Pius Nagar, 22.06.2018, *Dani Francis & Santhosh Nampy* 159358 (CALI); Vandiperiyar-Pambanar, 22.09.1964, *K. Vivekananthan* 20398 (MH).

Cyperus substramineus Kuk. in Engler, Pflanzenr. 20(101): 10. 1935. *Pycreus stramineus* C.B.Clarke in Hook.f., Fl. Brit. India 6(19): 589. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1627. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 545. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 312. 2014.

Annual herbs, 8–40 cm tall. Culms tufted, slender, trigonous, glabrous. Leaves basal, shorter than or nearly equalling the culm, linear, 2–5 × 0.08–0.1 cm, acuminate at apex, sheathing at base, canaliculate, coriaceous, puberulous, green; sheaths membranous, 3–5 cm long, glabrous, green. Inflorescence simple, usually

a single cluster of 5–16 spikelets. Involucral bracts 2 or 3, leafy, exceeding inflorescence, linear, 2–10 cm long, acute at apex, glabrous. Rays linear, 0.8–1 × 0.1–0.15 cm, acute at apex. Spikelets strongly compressed, oblong-lanceolate, 15–35 × 1.8–2.2 mm, acute at apex, yellow, persistent. Rachilla straight, wingless, persistent. Glumes ovate, 1.5–2 × 1.2–1.5 mm, mucronulate at apex, cuneate at base, sides nerveless, broadly hyaline at margin, keeled, greenish yellow; keels 3-nerved, green. Stamen 2, *c.* 2 mm long. Style *c.* 1 mm long; stigma 2. Nuts biconvex, obovate, 0.8–1 × 0.5–0.6 mm, apiculate at apex, minutely stipitate, smooth, finely transversely undulate with 13–17 weak wrinkles; epidermal cells longitudinally oblong.

Distribution: Indian Subcontinent to Peninsula Malaysia (POWO, 2023); *Habitat*: Moist grasslands; *Fl. & Ft.*: August-November.

Specimen examined: Near Valara, 21.08.1965, *K.M. Sebastine* 25350 (MH).

Cyperus tenuiculmis Boeckeler, Linnaea 36. 286. 1870; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 530. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 122. 2014. *Cyperus zollingeri sensu* C.B.Clarke in Hook.f., Fl. Brit. India 6: 613. 1893 *non* Steud., 1854.

Perennial rhizomatous herbs, 30–70 cm tall. Culms tufted, triquetrous, glabrous. Leaves linear-lanceolate, 6–20 × 0.1–0.2 cm, acuminate at apex, glabrous, green; sheaths membranous, 2–3 cm long, glabrous, greenish purple. Inflorescence simple or sub-compound, lax. Involucral bracts 2–7, leafy, folded, lowest exceeding inflorescence, linear, 2–12 cm long, acute at apex, glabrous. Spikes ovoid-oblong, 1–2 × 0.1–0.2 cm, yellowish green. Spikelets linear, 1–1.5 × 0.1–0.2 mm, acute at apex, stramineous or yellow. Rachilla winged. Glumes closely arranged, broadly elliptic-oblong, 3–4 × 2–5 mm, acute at apex, cuneate at base, 7–9-nerved, keel 4–5-nerved, broadly hyaline on margins, golden yellow. Stamens 3, *c.* 2 mm long. Style *c.* 0.7 mm long; stigma 3. Nuts trigonous, ellipsoid, turbinate, 1.7–2 × 0.8–1 mm, obtuse and minutely apiculate at apex, smooth, grey.

Distribution: Tropical and S. Africa to N. Australia (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: July-November.

Specimens examined: Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154343; Panchalimedu, 13.09.2019, *Dani Francis & Santhosh Nampy* 170304, 176144; Thekkady, 07.07.1993, *Jomy Augustine* 12066 (CALI).

Notes: This species shows similarity with *Cyperus zollingeri* Steud., but is distinguished by its perennial habit, golden-yellow glume sides, and ellipsoid nuts that do not turbinate or truncate at the apex (Wadoodkhan, 2015).

Cyperus tenuispica Steud., Syn. Pl. Glumac. 2: 11. 1854; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1640. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 530. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 123. 2014.

Annual herbs, 5–30 cm tall. Culms densely tufted, triquetrous, glabrous. Leaves linear-flat, 10–20 × 0.05–0.1 cm, acute at apex, glabrous, scabrid at margins, green; sheaths membranous, 2–5 cm long, glabrous, greenish purple. Inflorescence compound or decompound, 10–15 × 10–15 cm. Involucral bracts 4 or 5, leafy, spreading, lowest equaling inflorescence, linear, 2–6 cm long, acute at apex, glabrous. Spikes ovate with 3–10 finger like radiating sessile spikelets, yellowish green. Spikelets linear-oblong, 3–5 × 0.5–1 mm, acute at apex, compressed, digitately disposed and stellately spreading, reddish green. Rachilla wingless, flexuous, slender. Glumes ovate, 0.7–0.8 × 0.5–0.6 mm, muticous at apex, cuneate at base; keel 1–2-nerved, sides nerveless, hyaline on margins, tinged with purple. Stamen 1 or 2, *c.* 1 mm long. Style *c.* 0.5 mm long; stigma 3. Nuts trigonous, obovoid, 0.2–0.3 mm long, muticous at apex, constricted at base, densely verruculose, white.

Distribution: Tropical and Subtropical Old World to Central Asia (POWO, 2023); *Habitat*: Marshy grasslands and paddy fields; *Fl. & Ft.*: June-March.

Specimens examined: Chinnar, 09.06.2017, *Dani Francis & Santhosh Nampy* 152174; Kaliyar, 30.11.2019, *Dani Francis & Santhosh Nampy* 164662; *Ibid*., 07.02.2021, *Dani Francis & Santhosh Nampy* 173385; Kattappana, 16.03.2018, *Dani Francis & Santhosh Nampy* 158387 (CALI); Kulamavu, 01.06.1982, *C.N. Mohanan* 74132 (MH); Kuttar, Chinnar, 30.01.1996, *N. Sasidharan & K.K. Sajeev* 15949 (KFRI); Neriamangalam, 26.12.2017, *Dani Francis & Santhosh Nampy* 156388 (CALI).

Cyperus zollingeri Steud., Syn. Pl. Glumac. 2: 17. 1854; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 531. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 124. 2014.

Annual herbs, 10–30 cm tall. Culms tufted, slender, triquetrous, glabrous. Leaves linear, 3–20 × 0.1–0.3 cm, acute at apex, glabrous; sheaths 1–8 cm long, glabrous, stramineous to purple. Inflorescence simple, lax, 5–15 cm long. Involucral bracts 3–6, lower ones exceeding inflorescence, leafy, linear, 3–10 × 0.1–0.2 cm, acute at apex, glabrous. Spikes ovate, 1–3 mm long. Spikelets sub-spicate, linear, 1–3 × 0.15–0.2 cm, acute at apex, cuneate at base, 6–18-flowered, green. Rachilla broadly winged. Glumes ovate-elliptic, 3–3.5 × 1.5–2 mm, sub-acute and recurved at apex, 7–9-nerved, green, sides broadly hyaline margined, stramineous to pale brown, not keeled. Stamens 3, *c.* 1.5 mm long. Style *c.* 2 mm long; stigma 3. Nuts trigonous, obovate, 1.2–1.5 × 1–1.5 mm, minutely apiculate at apex, cuneate at base, brown to black.

Distribution: Tropical and S. Africa to W. Pacific (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: August-December.

Specimen examined: Munnar, 23.12.1986, *Rejani* 12004 (CALI).

Diplacrum R.Br.,

Prodr. Fl. Nov. Holland. 241. 1810.

Diplacrum caricinum R.Br., Prodr. Fl. Nov. Holland. 241. 1810; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1678. 1931. *Scleria caricina* (R.Br.) Benth., Fl. Austral. 7: 426. 1878; C.B.Clarke in Hook.f., Fl. Brit. India 6: 688. 1894; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 547. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 357. 2014.

Annual herbs, 3–15 cm tall. Culms triquetrous, glabrous. Leaves linear, 1–4 × 0.1–0.2 cm, acute at apex, cuneate at base, puberulous, green; sheaths 3–5 mm long, glabrous. Inflorescence an axillary panicle. Involucral bracts leafy, linear, some setiform, 0.9–2 × 1–1.3 mm, acute at apex, cuneate at base, puberulous. Spikelets unisexual. Male flowers fewer in clusters, sessile, often lateral, smaller than female; glumes elliptic-lanceolate, 1–1.2 × 0.3–0.5 mm, obtuse at apex, cuneate at

base, glabrous, cream with purple spots; stamens 1 or 2, *c.* 0.8 mm long; female flowers sub-sessile or shortly peduncled; glumes obovate-oblong, 1.5–2 × 0.8–1 mm, 3-lobed at apex with lateral lobes slightly shorter than mid-lobe, cuneate at base, glabrous, keel 3-nerved, sides 2–3-nerved, hyaline; style 3-fid, glabrous. Nuts sub-globose, 0.6–1 × 0.3–0.4 mm, irregularly reticulate, white-greyish purple, smaller and enveloped by 2 glumes, falling with the glumes. Disk obsolete.

Distribution: Tropical and Subtropical Asia to NW. Pacific (POWO, 2023); *Habitat*: Wet grasslands and marshes; *Fl. & Ft.*: September-December.

Specimen examined: Thannikkudy, 26.12.1994, *Jomy Augustine* 14516 (CALI).

Eleocharis R.Br.,

Prodr. Fl. Nov. Holland. 224. 1810.

Key to the species

1. Annual herbs; hypogynous bristles longer than nut …….. 2

1. Perennial herbs; hypogynous bristles as long as or longer than nut …….. 3

2. Spikelets few flowered; hypogynous bristles unequal; an acute angle projecting from the apex of nut …….. *E. retroflexa* subsp. *chaetaria*

2. Spikelets many flowered; hypogynous bristles sub-equal; no projection from the apex of nut …….. *E. congesta*

3. Culms terete; involucral bracts 2; spikelets cylindrical; glumes many nerved; stamens 3; nuts biconvex …….. *E. dulcis*

3. Culms acutely 4-angled; involucral bracts 0; spikelets oblong-lanceolate; glumes 1-nerved; stamens 2; nuts trigonous …….. *E. tetraquetra*

Eleocharis congesta D.Don, Prodr. Fl. Nepal 41. 1825; C.B.Clarke in Hook.f., Fl. Brit. India 6: 630. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1648. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 531. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 133. 2014.

Annual rhizomatous herbs, 15–50 cm tall. Culms slender, terete or slightly angular, transversely septate basally, glabrous. Leaf sheath membranous, 1–5 cm long, oblique at apex, glabrous, purplish or reddish brown at base; blades reduced.

Inflorescence terminal, single, spikelet. Involucral bracts 0. Spikelets ovoid-oblong, 2–10 × 1–3 mm long, obtuse at apex, terete, many flowered, sessile. Glumes membranous, oblong-ovate, 1.8–2.3 × 1.6–2 mm, obtuse to sub-rounded at apex, sub-truncate at base, 1-nerved, glabrous, hyaline towards margin, green at middle, purplish towards margin. Perianth bristles 6, sub-equal, 1–1.5 mm long, as long as or slightly longer than nut, retrorsely scabrous, light brown. Stamens 2, *c.* 1 mm long. Style 3-fid, slender, *c.* 1.5 mm long, conical at base; stigma 3, minutely scabrid. Nuts trigonous, obovate, 0.8–1 × 0.4–0.6 mm, smooth, greenish yellow, style base triangular or conical, wider than nut apex, dark brown, usually persistent; epidermal cells faint.

Distribution: Himalaya to Russian Far East and Caroline Islands (POWO, 2023); *Habitat*: Marshy grasslands; *Fl. & Ft.*: September-April.

Specimens examined: Munnar, 10.01.1987, *Madhu* 42465 (CALI); Old Devikulam, 22.04.1964, *K.M. Sebastine* 18383; Peermade, 24.01.1965, *K. Vivekananthan* 22998 (MH); Thannikkudy, 11.03.1995, *K.P. Rajesh* 14835 (KFRI).

Eleocharis dulcis (Burm.f.) Trin. ex. Hensch., Vita Rumphii. 186. 1833; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 531. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 134. 2014. *Eleocharis plantaginea* (Retz.) Roem. & Schult., Syst. Veg. ed. 15. 2: 150. 1817; C.B.Clarke in Hook.f., Fl. Brit. India 6: 625. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1647. 1931.

Perennial rhizomatous herbs, 15–120 cm tall. Culms terete, fistular, 3–5 mm thick, faintly striate, transversely septate, compressed, glabrous, dark green. Leaf sheath membranous, 5–20 cm long, oblique at apex, glabrous, purplish brown at base; blades reduced or absent. Inflorescence a single elongated spikelet, terminated by culms. Involucral bracts 2, glume like, broadly ovate, 4–5 × 3–4 mm, obtuse at apex, truncate at base, glabrous. Spikelets cylindrical, 2–4 cm long, obtuse at apex, terete, many-flowered, sessile, white-stramineous. Glumes oblong-ovate, 4–5 × 2–4 mm, obtuse to sub-acute at apex, sub-truncate at base, many-nerved, glabrous, hyaline towards margin, with purplish-brown spots inside. Perianth bristles 6–8, rigid, 3–4 mm long, sub-equal, longer than nut, retrorsely spinulose, scabrous, light brown. Stamens 3, 5–7 mm long. Style slender, *c.* 5 mm long, flat and conical at base; stigma 3, minutely scabrid. Nuts biconvex, obovate, 1.5–2 × 1.4–1.8 mm,

with shallow longitudinal furrows, style base triangular, flat, dark brown, usually persistent; epidermal cells hexagonal in vertical rows.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: July-December.

Specimens examined: Kokkarakandam, Periyar Tiger Reserve, 18.07.1993, *N. Sasidharan & Jomy Augustine* 12067 (KFRI); Thannikkudy, 16.10.1996, *Jomy Augustine* 16854 (CALI).

Notes: *Eleocharis dulcis* grows in wetlands and used in waste water treatment (Ghazanfar, 2001; Santosa & Zaman, 2021).

Eleocharis retroflexa subsp. **chaetaria** (Roem. & Schult.) T.Koyama, Bull. Natl. Sci. Mus. Tokyo 17(1): 68. 1974; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 532. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 140. 2014. *Eleocharis chaetaria* Roem. & Schult., Syst. Veg. ed. 15. 2: 154. 1817; C.B.Clarke in Hook.f., Fl. Brit. India 6: 629. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1648. 1931.

Annual herbs, 3–20 cm tall. Culms slender, angular, curved, glabrous. Leaf sheath membranous, 0.5–2 cm long, acute at apex, glabrous, scarious towards apex, purple at base; uppermost sheath with a well-developed orifice; blades reduced. Inflorescence terminal, single spikelet. Involucral bracts 0. Spikelets ovoid, slightly flattened, 3–4 × 2–3 mm, acute at apex, few flowered, sessile, light brown. Glumes membranous, oblong-ovate, 2.5–3 × 1.5–1.7 mm, obtuse at apex, sub-truncate at base, 1-nerved, glabrous, hyaline towards margin, keeled. Perianth bristles 6, unequal, 0.3–0.5 mm long, longer than or as long as nut, white. Stamens 2, *c.* 1 mm long. Style 3-fid, slender, *c.* 2.5 mm long, conical at base; stigma 3, scabrid. Nuts trigonous, obovate, 1–1.2 × 0.5–0.7 mm, with 3 acute angles projecting from the apex, smooth, yellow, style base pyramidal, persistent; epidermal cells prominently pitted.

Distribution: Congo to Zambia, Mauritius to NE. Australia (POWO, 2023); *Habitat*: Marshy grasslands; *Fl. & Ft.*: September-March.

Specimen examined: Thekkady, 17.09.1993, *N. Sasidharan & Jomy Augustine* 12407 (CALI).

Eleocharis tetraquetra Nees in Wight., Contr. Bot. India 113. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 630. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1648. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 532. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 143. 2014.

Perennial short rhizomatous herbs, 25–90 cm tall. Culms tufted, acutely 4-angled, rigid, glabrous. Leaf sheath thick, membranous, 8–10 cm long, triangular and mucronate at apex, glabrous, purplish brown or reddish brown at base; blades reduced. Inflorescence a terminal single spikelet. Involucral bracts 0. Spikelets oblong-lanceolate, 5–12 × 2–4 mm, acute at apex, sub-terete, many flowered, sessile, light brown. Glumes membranous, oblong-ovate, 2–3.5 × 1.5–2 mm, obtuse to sub-rounded at apex, sub-truncate at base, 1-nerved, glabrous, hyaline towards margin, green at middle, obscurely keeled. Perianth bristles 6–8, sub-equal, 1–1.5 mm long, longer than nut, densely retrorsely scabrous, light brown. Stamens 2, *c.* 1 mm long. Style 3-fid, slender, *c.* 2.5 mm long, conical at base; stigma 3, minutely scabrid. Nuts flattened, trigonous, obovate, 1.5–2 × 1–1.2 mm, smooth, greenish brown, style base triangular, large cap-like, dark brown, usually persistent; epidermal cells vertically oblong, obscure.

Distribution: Afghanistan to E. Australia (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: May-July.

Specimens examined: Devikulam, 02.06.1944, *K.C. Jacob* 20517 (MH); Periyar Tiger Reserve, Mlappara, 26.07.1993, *N. Sasidharan & Jomy Augustine* 12154 (KFRI); Vellimala, 20.05.1995, *Jomy Augustine* 15335 (CALI).

Fimbristylis Vahl,

Enum. Pl. Obs. 2: 285. 1805.

Key to the species

1. Style 2-fid; nuts biconvex 2

1. Style 3-fid; nuts trigonous 9

2. Leaves eligulate 3

2. Leaves ligulate 7

3. Inflorescence compound, sub-compound or decompound 4

3. Inflorescence capitate heads or simple cluster …….. 6

4. Rachis wingless …….. *F. aestivalis*

4. Rachis narrowly or broadly winged ……..…….. 5

5. Nuts smooth; rachis narrowly winged ……..…. *F. squarrosa*

5. Nuts verruculose; rachis broadly winged …… *F. velata*

6. Annual non-rhizomatous herbs; nuts with a lateral clavate appendage disappearing with age ……..…….. *F. dispacea*

6. Perennial rhizomatous herbs; nuts without lateral clavate appendage ……..
……. *F. argentea*

7. Keel of glumes 3-nerved; style hairy towards apex ……..…. *F. bisumbellata*

7. Keel of glumes 4 or 5-nerved; style hairy all along ……..……..…….. 8

8. Epidermal cells with 7–10 vertical ridges …… *F. dichotoma* Subsp. *dichotoma*

8. Epidermal cells with 12–24 vertical ridges ..…... *F. dichotoma* Subsp. *podocarpa*

9. Glumes distichous ……..…… 10

9. Glumes spiral ……..…… 13

10. Annual herbs …….. 11

10. Perennial herbs ……..…….. 12

11. Stamen 1; nuts verruculose ……..……. *F. tenera*

11. Stamens 3; nuts minutely tubercled ……..…….. *F. narayanii*

12. Spikelets oblong; epidermal cells linear-oblong ……..….. *F. cinnamometorum*

12. Spikelets ovate-lanceolate; epidermal cells isodiametric ……..….. *F. eragrostis*

13. Leaves reduced to bladeless sheath ……..…… 14

13. Leaves well developed ……..…… 15

14. Culms winged; stamens 3; style glabrous ……..…….. *F. salbundia*

14. Culms not winged; stamens 1 or 2; style ciliate towards apex …….. *F. aphylla*

15. Leaves falcate, incurved at margins ……..….. *F. falcata*

15. Leaves linear-lanceolate, entire at margins ……..…… 16

16. Inflorescence solitary ……..…… *F. kingii*

16. Inflorescence compound or decompound ……..…….. 17

17. Spikelets solitary; nuts verruculose, trabeculate or muricate ……..…… 18

17. Spikelets 2–7 clustered; nuts smooth ……..…….. *F. uliginosa*

18. Culms 5-angled; stamen 1 ……..…… *F. quinquangularis*

18. Culms 3 or 4-angled; stamens 3 ……..…….. 19

19. Spikelets globose to sub-globose ……..…….. *F. littoralis*

19. Spikelets ovate-lanceolate ……..…….. 20

20. Culms 4-angled; nuts verruculose ……..…… *F. complanata*

20. Culms 3-angled; nuts trabeculate ……..…….. *F. monticola*

Fimbristylis aestivalis (Retz.) Vahl, Enum. Pl. Obs. 2: 288. 1805; C.B.Clarke in Hook.f., Fl. Brit. India 6: 637. 1893; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 532. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 165. 2014. *Scirpus aestivalis* Retz., Observ. Bot. 4: 12. 1786.

Annual herbs, 10–30 cm tall. Culms densely tufted, slender, angled, pilose. Leaves setaceous- filiform, shorter than or as long as culms, flat, 4–20 × 0.05–0.1 cm, acute at apex, canaliculate, densely pubescent, green, eligulate; sheaths membranous, 1–5 cm long, pubescent, green. Inflorescence decompound with few to numerous spikelets. Involucral bracts few, leafy, linear, shorter or some overtopping the inflorescence, 1–10 mm long, pointed at apex, ciliate at base. Rays short, capillary, 1–1.5 cm long, glabrous. Spikelets oblong-ovoid, 2–5 × 1–1.5 mm, acute at apex, cuneate at base, greenish brown; rachis wingless. Glumes spiral, ovate, 1–1.5 × 0.5–0.7 mm, acute and mucronate at apex, cuneate at base, glabrous, keeled; mucro *c.* 0.3 mm long. Stamen 1; filaments *c.* 0.2 mm long; anthers oblong, *c.* 0.5 mm long. Style 2-fid, filiform, 0.5–1 mm long, ciliate towards apex, dilated at base; stigma 2. Nuts triquetrous, biconvex, obovate, 0.5–0.9 × 0.3–0.4 mm, sub-rounded at apex, minutely stipitate, smooth, pale brown.

Distribution: Tropical and Subtropical Asia to Russian Far East and Australia (POWO, 2023); *Habitat*: Marshes and swamps; *Fl. & Ft.*: October-April.

Specimens examined: Koruthode, 21.11.1995, *Jomy Augustine* 14762 (CALI); *Ibid*., 28.01.1995, *K.P. Rajesh & Jomy Augustine* 14744 (KFRI); Meenmutty, 18.02.1982, *V.S. Raju* 71255 (MH); Panchalimedu, 10.01.2018, *Dani Francis & Santhosh Nampy* 176145; Thekkady, 28.04.1995, *Jomy Augustine* 15057 (CALI); Valara waterfalls, 19.03.1982, *R. Rajan* 73078 (MH).

Notes: This species resembles *Fimbristylis bisumbellata* (Forssk.) Bubani but can be distinguished by ligulate, densely hairy leaves and sheaths. It also shows similarity with *F. velata* R.Br., but differs in the absence of long hairs on the style base and smaller glumes and style (Wadoodkhan, 2015).

Fimbristylis aphylla Steud., Syn. Pl. Glumac. 2: 114. 1855; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 533. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 170. 2014. *Fimbristylis qinquangularis* var. *crassa* C.B.Clarke in Hook.f., Fl. Brit. India 6: 644. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1659. 1931.

Perennial herbs, 40–60 cm tall. Culms 4–5 angled, glabrous. Leaves reduced to bladeless sheath, 2–15 × 0.5–1 cm, acute to sub-acuminate at apex, glabrous, green. Inflorescence compound-decompound, loosely arranged, 5–8 cm long, with numerous spikelets. Involucral bracts setaceous, linear, shorter than inflorescence, 1–1.5 cm long, acute at apex, glabrous. Spikelets terete, ovate-elliptic, 2–4 × 1.5–2.5 mm, acute at apex, cuneate at base, many-flowered, pale brown or greenish brown; rachis winged. Glumes spiral, broadly ovate, 2–2.5 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, hyaline at margins, not keeled. Stamens 1 or 2; filaments *c.* 0.4 mm long; anthers oblong, *c.* 0.8 mm long. Style 3-fid, trigonous, *c.* 1 mm long, ciliate towards apex, slightly thickened at base; stigma 3. Nuts triquetrous, obovate, 0.5–0.7 × 0.3–0.5 mm, obtuse at apex, minutely stipitate, verruculose; epidermal cells transversely linear.

Distribution: W. Tropical Africa to KwaZulu-Natal, China to Tropical Asia (POWO, 2023); *Habitat*: Marshy and waterlogged areas; *Fl. & Ft.*: September-November.

Specimen examined: Vallakkadavu, 06.09.1994, *Jomy Augustine* 14084 (CALI).

Notes: In the absence of cauline leaves, this species is closely related to *Fimbristylis salbundia* (Nees) Kunth, but can be distinguished by the pale brown or greenish brown, terete spikelets, non-keeled glumes, and 1 or2 stamens (Wadoodkhan, 2015).

Fimbristylis argentea (Rottb.) Vahl, Enum. Pl. Obs. 2: 294. 1805; C.B.Clarke in Hook.f., Fl. Brit. India 6: 640. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1659. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 533. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 171. 2014. *Scirpus argenteus* Rottb., Descr. Icon. Rar. Pl. 51. 1773.

Perennial rhizomatous herbs, 10–20 cm tall. Culms tufted, compressed-trigonous, glabrous. Leaves linear-filiform, shorter than or as long as culms, flat, 4–8 × 0.05–0.1 cm, acute at apex, canaliculate, glabrous, green, eligulate; sheaths membranous, 1–3 × 0.2–0.3 cm, green. Inflorescence a capitate head, sub-globose, 4–12 × 6–20 mm, with few–many spikelets. Involucral bracts 2–4, leafy, linear-filiform, overtopping the inflorescence, 1–4 cm long, acute at apex, canaliculate, glabrous. Spikelets oblong, 3–12 × 1–1.2 mm, acute-obtuse at apex, cuneate at base, sessile, many-flowered; rachis thick, cylindrical, narrowly winged. Glumes spiral, broadly ovate, 1–1.2 × 0.7–0.1 mm, obtuse and slightly apiculate at apex, cuneate at base, glabrous, 3-nerved. Stamen 1; filaments *c.* 0.2 mm long; anthers oblong, *c.* 0.5 mm long. Style 2-fid, flat, 0.5–1 mm long, sparsely ciliate towards apex, dialated at base; stigma 2. Nuts biconvex, broadly obovate, 0.5–0.7 × 0.3–0.5 mm, subrounded at apex, minutely stipitate, smooth or faintly trabeculate, pale yellow.

Distribution: India to Peninsula Malaysia (POWO, 2023); *Habitat*: Paddy fields and marshy areas; *Fl. & Ft.*: June-November.

Specimens examined: Chinnar, near river, 09.06.2017, *Dani Francis & Santhosh Nampy* 152159; Thekkady, Nellikkampetty range, 14.07.2017, *Dani Francis & Santhosh Nampy* 152859 (CALI); *Ibid*., 26.11.1995, *N. Sasidharan & Jomy Augustine* 16948 (KFRI).

Fimbristylis bisumbellata (Forssk.) Bubani, Dodecanthea 30. 1850; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1898. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 533. 2004;

Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 173. 2014. *Scirpus bisumbellatus* Forssk., Fl. Aegypt.-Arab. 15. 1775.

Annual herbs, 5–20 cm tall. Culms densely tufted, angular, pubescent. Leaves linear, shorter than or as long as culms, 5–15 × 0.1–0.3 cm, acute at apex, pubescent, green, ligulate; sheaths membranous, 2–8 cm long, stramineous. Inflorescence compound or decompound, sometimes contracted, with numerous spikelets. Involucral bracts 2–4, leafy, linear, shorter or overtopping the inflorescence, 1–8 cm long, acute at apex, pubescent. Rays 2–4, with many spikelets, 2–3 cm long. Spikelets, ovate-oblong, 3–6 × 1–1.5 mm, sub-acute at apex, cuneate at base, many-flowered; rachis narrowly winged. Glumes ovate, 1–1.5 × 0.8–0.1 mm, acute and mucronate at apex, cuneate at base, glabrous, keeled, 3-nerved, sides nerveless, hyaline at margin, brown. Stamen 1; filaments *c.* 0.2 mm long; anthers oblong, *c.* 0.5 mm long. Style 2-fid, slender, flat, 0.5–1 mm long, pubescent towards apex, dilated at base; stigma 2. Nuts biconvex, obovate, 0.5–0.7 × 0.3–0.5 mm, apiculate at apex, minutely stipitate and discoid at base, trabeculate; epidermal cell transversely oblong, pale yellow.

Distribution: Old World (POWO, 2023); *Habitat*: Rice fields and open lands; *Fl. & Ft.*: November-March.

Specimen examined: Narakakkanam, 10.03.2017, *Dani Francis & Santhosh Nampy* 176147 (CALI).

Notes: This species is allied to *Fimbristylis dichotoma* (L.) Vahl, but can be distinguished by smaller 4 or 5 vertically ridged nuts, angular spikelets and much smaller glumes (Wadoodkhan, 2015).

Fimbristylis cinnamometorum (Vahl) Kunth, Enum. Pl. 2: 229. 1837; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 533. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 176. 2014. *Scirpus cinnamometorum* Vahl, Enum. Pl. Obs. 2: 278. 1805. *Fimbristylis cyperoides* R.Br., Prodr. Fl. Nov. Holland. 229. 1810; C.B.Clarke in Hook.f., Fl. Brit. India 6: 650. 1893.

Perennial rhizomatous herbs, 20–50 cm tall. Culms compressed-trigonous, glabrous. Leaves setaceous, rigid, half or as long as the culms, flat, 7–25 × 0.3–0.5 cm, acute at apex, canaliculate, glabrous, green, eligulate; sheaths membranous, 1–

2 cm long, glabrous, green. Inflorescence compound or decompound, 3–6 cm long, with numerous spikelets. Involucral bracts 1 or 2, leafy, erect, setaceous, shorter or overtopping the inflorescence, 1–4 cm long, acute at apex, glabrous. Primary rays 5–8, filiform, glabrous. Spikelets oblong, 3–5 × 0.8–1 mm, acute at apex, cuneate at base, peduncled, few-flowered; rachis winged. Glumes distichous, membranous, ovate-lanceolate, 3–4 × 1–2 mm, acute and muticous at apex, cuneate at base, glabrous, keel 3-nerved, sides nerveless, red gland dotted. Stamens 3; filaments *c.* 2 mm long; anthers linear, *c.* 2 mm long. Style 3-fid, slender, 3–4 mm long, pyramidally thickened at base, glabrous towards apex, sparsely hairy at base; stigma 3. Nuts trigonous, obovate, 0.5–0.8 × 0.3–0.5 mm, apiculate at apex, verruculose; epidermal cells linear-oblong, brown.

Distribution: Tropical and Subtropical Asia to N. & E. Australia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-December.

Specimens examined: Elaveezhapoonchira, 08.09.2017, *Dani Francis & Santhosh Nampy* 152997; Kumarikulam, 26.12.1993, *Jomy Augustine* 13091 (CALI); Mangaladevi, 30.07.1993, *N. Sasidharan & Jomy Augustine* 12177 (KFRI); Panchalimedu, 13.09.2019, *Dani Francis & Santhosh Nampy* 170309 (CALI).

Fimbristylis complanata (Retz.) Link., Hort. Berol. 1: 292. 1827; C.B.Clarke in Hook.f., Fl. Brit. India 6: 646. 1893; C.E.C.Fisch in Gamble, Fl. Madras 3: 1659. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 534. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 177. 2014. *Scirpus complanatus* Retz., Observ. Bot. 5: 14. 1788.

Perennial rhizomatous herbs, 25–80 cm tall. Culms compressed, 4-angled, glabrous. Leaves flat, lanceolate, shorter than culms, 10–35 × 0.3–0.5 cm, acute at apex, glabrous, green, eligulate; sheaths compressed, flat, 3–15 cm long, keeled, glabrous, green; lower leaves reduced to bladeless sheaths. Inflorescence compound or decompound, 4–10 cm long, with numerous spikelets. Involucral bracts 3 or 4, leafy, shorter than inflorescence, 1–8 cm long, acute at apex, glabrous. Primary rays a few, unequal, compressed, glabrous. Spikes ovate-lanceolate. Spikelets lanceolate, 4–7 × 1–2 mm, acute at apex, cuneate at base, peduncled, fewflowered. Glumes spiral, membranous, ovate-oblong, 1–3 × 1.5–2 mm, acute and mucronulate at apex, cuneate at base, glabrous, keeled, margin

hyaline. Stamens 3; filaments *c.* 2 mm long; anthers linear, *c.* 1.5 mm long, apiculate. Style 3-fid, slender, *c.* 1 mm long, glabrous; stigma 3. Nuts trigonous, widely obovate, 0.8–1 × 0.3–0.5 mm, apiculate at apex, verruculose, tubercles arranged in rows.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Grasslands and marshy areas; *Fl. & Ft.*: Throughout the year.

Specimen examined: Munnar, 03.03.1984, *Madhu* 12037 (CALI).

Fimbristylis dichotoma (L.) Vahl, Enum. Pl. Obs. 2: 287. 1805; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1658. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 534. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 181. 2014. *Scirpus dichotomus* L., Sp. Pl. 1: 50. 1753. *Fimbristylis diphylla* (Retz.) Vahl, Enum. Pl. Obs. 2: 289. 1805; Hook.f., Fl. Brit. India 6: 636. 1893.

Annual or perennial herbs, 20–100 cm tall. Culms tufted, trigonous, glabrous. Leaves linear, flat, 5–15 × 0.1–0.4 cm, obtuse and blunt at apex, glabrous, scabrous at margins, green, ligulate; sheaths membranous, 1–3 cm long, pubescent, pale brown with brown-purple dots. Inflorescence simple to compound or decompound, diffuse or dense, 2–5 cm long, with few to many spikelets. Involucral bracts 3 or 4, leafy, erect, shorter or overtopping the inflorescence, 1–5 cm long, acute and blunt at apex, puberulous. Primary rays 1 or 2, filiform, puberulous. Spikelets solitary or clustered, ovate-oblong, 2–5 × 1.5–2 mm, obtuse at apex, cuneate at base, peduncled, few to many flowered, chestnut brown; rachis winged. Glumes ovate, chartaceous, 2–3.5 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, muticous or apiculate, keeled, 4–5-nerved, sides nerveless, brownish. Stamens 1 or 2; filaments *c.* 1 mm long; anthers linear, *c.* 1 mm long, apiculate. Style 2-fid, slender, *c.* 3 mm long, hairy all along; stigma 2. Nuts biconvex, obovate, 0.5–1 × 0.5–0.8 mm, apiculate at apex, shortly stipitate at base, trabeculate; epidermal cells transversely oblong, with 7–10 vertical ridge, pale white.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-February.

Specimens examined: Chottupara, 07.09.2017, *Dani Francis & Santhosh Nampy* 152985; Karadikkavala, 12.08.1994, *Jomy Augustine* 13934; Karimutty, 1st bridge,

09.02.2021, *Dani Francis & Santhosh Nampy* 188774 (CALI); Kokkarakkandam, Periyar Tiger Reserve, 17.07.1993, *N. Sasidharan & Jomy Augustine* 12061; Uppupara, 14.09.1994, *N. Sasidharan & Jomy Augustine* 14153 (KFRI).

Notes: It is a highly variable species with respect to pubescence, nature of inflorescence, and number of spikelets (Khan & Patil, 2015).

Fimbristylis dichotoma subsp. **podocarpa** (Nees) Koyama, Micronesica 1: 87. 1964; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 534. 2004; K.M.Matthew, Illustr. Fl. Palni Hills 769. 1996. *Fimbristylis podocarpa* Nees in Wight, Contr. Bot. India 98. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 638. 1893. *Fimbristylis tomentosa* Vahl, Enum. Pl. Obs. 2: 290. 1805; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 246. 2014.

Annual herbs, 25–80 cm tall. Culms tufted, angular, glabrous or puberulous. Leaves linear, flat, 8–15 × 0.1–0.4 cm, obtuse, glabrous or hairy, green, ligulate; sheaths membranous, 1–3 cm long, pubescent or glabrous, pale green. Inflorescence simple or compound, loosely arranged, 4–6 cm long, with 3–15 spikelets. Involucral bracts 3–5, leafy, erect, shorter or overtopping the inflorescence, 2–8 cm long, acute at apex, puberulous. Primary rays 2–5, unequal, filiform, 2–3 cm long, puberulous. Spikelets ovate-oblong, 3–6 × 3–5 mm, acute at apex, cuneate at base, many flowered, stramineous to brown; rachis winged. Glumes broadly ovate, chartaceous, 2–2.5 × 2–2.5 mm, mucronate at apex, cuneate at base, glabrous, keeled, keel 4–5-nerved, sides nerveless, stramineous-brown. Stamens 2; filaments *c.* 3 mm long; anthers linear, *c.* 1 mm long. Style 2-fid, slender, *c.* 1.5 mm long, hairy all along; stigma 2. Nuts biconvex, widely obovate, 1–1.3 × 0.5–0.8 mm, apiculate at apex, shortly stipitate at base, sparsely tubercled; epidermal cells transversely oblong, 12–24 vertical ridges, pale white.

Distribution: Tropical and Subtropical Old World to Pacific (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-May.

Specimens examined: Chinnar, Koottar, 19.05.1999, *Thushara K.V.* 79353; Munnar, 07.09.2018, *Dani Francis & Santhosh Nampy* 176151; (CALI).

Fimbristylis dipsacea (Rottb.) C.B.Clarke in Hook.f., Fl. Brit. India 6: 635. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1658. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl.

535. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 190. 2014. *Scirpus dispaceus* Rottb., Descr. Icon. Rar. Pl. 56. 1773.

Annual herbs, 4–12 cm tall. Culms densely tufted, slender, trigonous, glabrous. Leaves reduced to short-bladed sheaths, narrowly linear to setaceous, 2–5 × 0.03–0.05 cm, acute at apex, glabrous, green, eligulate; sheaths cylindrical, glabrous, green. Inflorescence simple, cluster of 2–3 spikelets or sometimes reduced to a single spikelet, 1–3 cm long. Involucral bracts 2–6, filiform, erect, setaceous, 1–3 cm long, acute at apex, glabrous. Primary rays filiform, 1–3 cm long, glabrous. Spikelets ovate-globose, 3–5 × 2–4 mm, squarrose, densely flowered, green. Glumes spirally imbricated, oblong-elliptic, 0.8–1 × 0.2–0.4 mm, awned and 2-toothed at apex, cuneate at base, obscurely 3-nerved, keeled, red gland dotted, awn recurved. Stamens 1; filaments *c.* 2 mm long; anthers elliptic. Style 2-fid, slender, 0.3–0.4 mm long, dilated at base, glabrous; stigma 2. Nuts linear-oblong, 0.4–0.8 mm long, with lateral clavate appendage disappearing with age; epidermal cells transversely oblong, brown.

Distribution: W. Tropical Africa to Tanzania, Russian Far East to Tropical Asia, N. Australia, S. Venezuela to Brazil (POWO, 2023); *Habitat*: River banks; *Fl. & Ft.*: February-May.

Specimen examined: Thekkady, 30.02.1997, *Jomy Augustine* 17883 (CALI).

Fimbristylis eragrostis (Nees) Hance, J. Linn. Soc. Bot. 13: 132. 1873; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 535. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 193. 2014. *Fimbristylis nigrobrunnea* Thwaites, Enum. Pl. Zeyl. 434. 1884; C.B.Clarke in Hook.f., Fl. Brit. India 6: 648. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1659. 1931. *Abildgaardia eragrostis* Nees, in Wight, Contr. Bot. India 95. 1834.

Perennial herbs, 5–40 cm tall. Culms stout, compressed, glabrous. Leaves shorter than stems, linear, flat, 2–15 × 0.1–0.3 cm, obtuse at apex, glabrous, green, eligulate; sheaths membranous, 1–3 cm long, glabrous, green; orifice ovate, ciliate at apex. Inflorescence compound to decompound, 1.5–4 × 1–4 cm, with few to many spikelets. Involucral bracts 2–4, leafy, erect, shorter or slightly overtopping the inflorescence, 1–3 × 0.05–0.15 cm, obtuse at apex, glabrous. Spikelets

compressed or sub-terete, ovate-lanceolate, 5–10 × 2–3 mm, acute at apex, cuneate at base, peduncled, few-flowered, brown; rachis winged. Glumes distichous, ovate, chartaceous, 2.5–3.5 × 2.5–3 mm, mucronulate at apex, cuneate at base, glabrous, keeled. Stamens 3; filaments *c.* 1 mm long; anthers linear, *c.* 2 mm long, apiculate. Style 3-fid, slender, triquetrous, *c.* 2.5 mm long, pyramidally thickened at base, glabrous or puberulous at apex; stigma 3. Nuts trigonous, obovate, 0.5–1 × 0.5–0.8 mm, apiculate at apex, shortly stipitate at base, trabeculate; epidermal cells isodiametric, pale white.

Distribution: Tropical and Subtropical Asia to N. Queensland (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: April-August.

Specimens examined: Grassland, near Painavu, 06.08.2017, *Dani Francis & Santhosh Nampy* 154303; Pandippara, 16.07.2021, *Dani Francis & Santhosh Nampy* 176044 (CALI); Uppupara, 10.04.1995, *K.P. Rajesh & Jomy Augustine* 15007 (KFRI).

Fimbristylis falcata (Vahl) Kunth, Enum. Pl. 2: 239. 1837; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 535. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 194. 2014. *Scirpus falcatus* Vahl., Enum. Pl. Obs. 2: 275. 1805. *Fimbristylis junciformis* (Nees) Kunth, Enum. Pl. 2: 239. 1837; Hook.f., Fl. Brit. India 6: 647. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1660. 1931.

Perennial rhizomatous herbs, 10–40 cm tall. Culms angular, rigid, glabrous. Leaves basal, coriaceous, falcate, 5–15 × 0.2–0.3 cm, obtuse at apex, sheathing at base, glabrous, incurved and scabrous at margins, green, eligulate; sheaths membranous, 1–2 cm long, glabrous, brown. Inflorescence compound, open, 1–5 cm long, with few-many spikelets. Involucral bracts 3 or 4, shorter than inflorescence, 1–2 cm long, acuminate at apex, glabrous. Spikelets in clusters, often in pairs or 3–5, ovate, 3–7 × 1–1.5 mm, acute at apex, cuneate at base, peduncled, few-many-flowered; rachis winged. Glumes spiral, widely ovate, 2–3 × 2–3 mm, acute and minutely apiculate at apex, cuneate at base, glabrous, keel hyaline at apex, sides broadly hyaline margined. Stamens 3; filaments *c.* 2 mm long; anthers linear-oblong, connectives distinctly produced with white bristles at apex, caducous with age. Style 3-fid, triquetrous, 2 mm long, pyramidally thickened at base, glabrous-ciliate towards apex; stigma 3. Nuts trigonous, obovate, 0.8–1 ×

0.5–0.6 mm, umbonulate at apex, shortly stipitate, verruculose; epidermal cells transversely linear-oblong, reddish brown.

Distribution: W. Indian Ocean and Tropical Asia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-November.

Specimen examined: Chenthamara, 10.11.1995, *Jomy Augustine* 15242 (CALI).

Fimbristylis kingii Gamble, Beitr. Cyper. 2: 40. 1890; Hook.f., Fl. Brit. India 6: 633. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1658. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 536. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 204. 2014.

Perennial rhizomatous herbs, 10–40 cm tall. Culms densely tufted, slender, glabrous. Leaves smaller than culms, linear, 5–15 × 0.2–0.3 cm, acute at apex, sheathing at base, canaliculate, scabrous, green, eligulate; sheaths membranous, 3–4 cm long, glabrous, brown. Inflorescence solitary, terminal spikelets. Involucral bracts glume like, 2–3, shorter than inflorescence, oblong-ovate, 4–6 × 1.5–2 mm, acute at apex, sub-truncate at base, glabrous, strongly keeled, with a *c.* 1 mm long mucro at apex. Spikelets oblong-ovate, 6–12 × 4–6 mm, acute at apex, cuneate at base, many flowered; rachis winged. Glumes spiral, widely ovate, 2.5–4 × 2–3 mm, acute at apex, cuneate at base, glabrous, keeled, sparsely fimbriate towards apex. Stamens 3; filaments *c.* 4 mm long; anthers linear-oblong. Style 3-fid, triquetrous, *c.* 2 mm long, thickened at base, glabrous-ciliate towards apex; stigma 3. Nuts trigonous, obovate, 1–1.5 × 0.8–1 mm, obtuse at apex, shortly stipitate, sub-papillose.

Distribution: S. India (POWO, 2023); *Habitat*: Rocky grasslands; *Fl. & Ft.*: April-December.

Specimens examined: Anamudi slopes, 19.11.1965, *B.V. Shetty* 26534 (MH); Eravikulam, 16.04.1980, *s.coll.* 119 (KFRI).

Fimbristylis littoralis Gaudich., Voy. Uranie, Bot. 413. 1829.

Annual herbs, 20–70 cm tall. Culms 4-angular, compressed, glabrous. Leaves shorter than stems, linear-lanceolate, flat, 5–30 × 0.2–0.3 cm, obtuse at apex, glabrous, green, eligulate; sheaths membranous, 1–5 cm long, glabrous, purplish green with purple spots. Inflorescence compound to decompound, 4–10 × 1–5 cm,

with many spikelets. Involucral bracts 2–4, leafy, erect, shorter or slightly overtopping the inflorescence, 1–10 cm long, obtuse at apex, glabrous. Spikelets globose or sub-globose, 1–3 × 1–2 mm, obtuse or sub-rounded at apex, cuneate at base, peduncled, many flowered, brown; rachis not winged, scabrid. Glumes spiral, ovate, 1–1.5 × 0.8–1 mm, muticous at apex, cuneate at base, glabrous, 1-nerved, keeled, keels hyaline. Stamens 3; filaments *c.* 1 mm long; anthers linear, *c.* 2 mm long, apiculate. Style 3-fid, slender, triquetrous, *c.* 0.8 mm long, pyramidally thickened at base, glabrous or puberulous at apex; stigma 3. Nuts trigonous, compressed, obovate, 0.9–1 × 0.5–0.6 mm, apiculate at apex, shortly stipitate at base, muricate; epidermal cells isodiametric, pale white.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Marshy grasslands; *Fl. & Ft.*: December-April.

Specimens examined: Neriamangalam, 26.12.2017, *Dani Francis & Santhosh Nampy* 156389 (CALI); Thannikkudy, 29.12.1994, *K.P. Rajesh & Jomy Augustine* 14057 (KFRI); Uppupara, 07.04.1995, *Jomy Augustine* 15010 (CALI).

Notes: This species is allied to *Fimbristylis miliacea* (L.) Vahl, but differs in having laterally compressed leaves without a prominent midrib and small globose spikelets (Khan & Patil, 2015).

Fimbristylis monticola Hochst. ex Steud., Syn. Pl. Glumac. 2: 111. 1855; C.B.Clarke in Hook.f., Fl. Brit. India 6: 642. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1660. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 536. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 216. 2014.

Perennial rhizomatous herbs, 15–50 cm tall. Culms trigonous, filiform, glabrous. Leaves capillary, short or as long as culms, 10–13 × 0.2–0.5 mm, acute at apex, involute at margins, glabrous, green-brown, eligulate; sheaths membranous, 0.5–2 cm long, glabrous, brown. Inflorescence simple, with 2–6 spikelets, 1–2 cm long. Involucral bracts 2 or 3, setaceous, shorter than inflorescence, 2–6 mm long, acute at apex, glabrous. Rays 1–4, sub-equal, 3–15 mm long, bearing 1 or 2 spikelets, glabrous. Spikelets ovate-lanceolate, 5–9 × 2–3 mm, acute at apex, cuneate at base, pedicelled, few flowered, brown. Glumes spiral, broadly ovate, 2–3 × 1.5–2 mm, mucronate at apex, cuneate at base, glabrous, brown, keel 3-nerved. Stamens 3;

filaments *c.* 1 mm long; anthers linear, *c.* 1 mm long. Style 3-fid, slender, *c.* 1.5 mm long, pyramidally thickened at base, glabrous; stigma 3. Nuts trigonous, broadly obovate, 0.5–0.7 × 0.5–0.6 mm, rounded at apex, trabeculate; epidermal cells transversely oblong, brown.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-December.

Specimen examined: Vellimala, 16.08.1994, *Jomy Augustine* 14046 (CALI).

Fimbristylis narayanii C.E.C.Fisch., Bull. Misc. Inform. Kew 1931: 46. 1931, in Gamble, Fl. Madras 3: 1660. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 536. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 220. 2014.

Annual herbs, 10–20 cm tall. Culms tufted, slender, 4-angular, glabrous. Leaves shorter than stems, linear-lanceolate, 5–10 × 0.05–0.1 cm, obtuse at apex, glabrous, green, eligulate; sheaths membranous, 1–1.5 cm long, striate, glabrous, green. Inflorescence simple, 3–6 cm long, with a few spikelets. Involucral bracts 2 or 3, leafy, 3–5 mm long, inconspicuous, obtuse at apex, glabrous. Spikelets oblong-lanceolate, 4–6 × 1–2 mm, acute at apex, cuneate at base, peduncled, 10–12-flowered; rachis winged. Glumes distichous, ovate-lanceolate, 2–2.5 × 1.2–1.5 mm, mucronate at apex, cuneate at base, glabrous, keeled, hyaline. Stamens 3; filaments *c.* 1 mm long; anthers linear. Style 3-fid, slender, *c.* 2 mm long, pyramidally thickened at base, glabrous; stigma 3. Nuts trigonous, obovate, 0.8–1 × 0.3–0.4 mm, shortly stipitate at base, sparsely tubercled; epidermal cells broad, isodiametric, white.

Distribution: S. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-October.

Specimens examined: Kattadikadavu, 07.10.2019, *Dani Francis & Santhosh Nampy* 170330; Koruthode, 16.08.1996, *Jomy Augustine* 16263 (CALI); Kulamavu, 08.10.1982, *C.N. Mohanan* 74524 (MH).

Fimbristylis quinquangularis (Vahl) Kunth, Enum. Pl. 2: 229. 1837; C.B.Clarke in Hook.f., Fl. Brit. India 6: 644. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1659. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 537. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 230. 2014. *Scirpus quinquangularis* Vahl, Enum. Pl. Obs. 2: 279. 1805. **Fig. 28E**

Annual or perennial rhizomatous herbs, 20–60 cm tall. Culms stout, 5-angled, scabrous. Leaves eligulate; cauline leaves reduced to bladeless sheath; blades flat, 0.8–3 × 0.15–0.3 cm, obtuse-acute at apex, glabrous, green; sheaths membranous, flat, 1–3 cm long, glabrous, green. Inflorescence compound to decompound, 4–10 × 3–7 cm, with many spikelets. Involucral bracts 3–5, setaceous, shorter than inflorescence, 3–15 mm long, acute at apex, glabrous. Spikelets ovate, 2–5 ×1–1.5 mm, sub-acute at apex, peduncled, many flowered, rusty brown; rachis winged. Glumes spiral, ovate, 1–2 × 0.8–1 mm, mucronate at apex, cuneate at base, glabrous, keeled, 3-nerved, mid-nerve green, sides dark brown. Stamen 1; filaments *c.* 1 mm long. Style 3-fid, slender, *c.* 0.7 mm long, dilate at base, glabrous; stigma 3. Nuts trigonous, obovate, 0.5–0.8 × 0.4–0.5 mm, shortly stipitate at base, trabeculate, verruculose; epidermal cells transversely oblong.

Distribution: Tropical Africa, Iraq to Tropical and Subtropical Asia and N. Australia (POWO, 2023); *Habitat*: Open grasslands; *Fl. & Ft.*: August-March.

Specimens examined: Kaliyar, 07.02.2021, *Dani Francis & Santhosh Nampy* 173386; Kattappana, field near Govt. College, 16.03.2018, *Dani Francis & Santhosh Nampy* 158380; Moolamattam, 30.12.2021, *Dani Francis & Santhosh Nampy* 176553 (CALI).

Fimbristylis salbundia (Nees) Kunth, Enum. Pl. 2: 230. 1837; C.B.Clarke in Hook.f., Fl. Brit. India 6: 646. 1894; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 537. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 232. 2014. *Trichelostylis salbundia* Nees in Wight, Contr. Bot. India 105. 1834.

Perennial rhizomatous herbs, 30–70 cm tall. Rhizomes creeping. Culms tufted, slender, 4–5-angular, glabrous, winged. Leaves reduced to 2–4 bladeless sheaths, 5–10 × 0.05–0.1 cm, acute at apex, glabrous, green, eligulate. Inflorescence compound or decompound, 5–15 cm long, lax or dense with many spikelets. Involucral bracts 2–5, lanceolate, setaceous, recurved, 1–1.5 cm long, acute at apex, glabrous. Spikelets ellipsoid, 3–5 × 1–2 mm, acute at apex, cuneate at base, peduncled, many flowered; rachis narrowly winged. Glumes spiral, ovate, 2–2.5 × 1–1.2 mm, muticous at apex, cuneate at base, glabrous, hyaline, sides nerveless; keel ending below the apex. Stamens 3; filaments *c.* 1 mm long; anthers linear. Style 3-fid, slender, *c.* 2 mm long, pyramidally thickened at base, glabrous; stigma

3. Nuts trigonous, broadly obovate, 0.8–1 × 0.3–0.4 mm, shortly stipitate at base, sparsely reticulate; epidermal cells transversely elliptic, white-brown.

Distribution: China to Tropical Asia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: October-May.

Specimen examined: Eravikulam, 30.05.1980, *s. coll.* 132 (KFRI).

Fimbristylis squarrosa Vahl, Enum. Pl. Obs. 2: 289. 1805; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 538. 2004. *Scirpus squarrossus* (Vahl) Poir., J.B.A.M.de Lamarck, Encycl. Suppl. 5: 100; C.B.Clarke in Hook.f., Fl. Brit. India 6: 663. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1666. 1931; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 346. 2014.

Annual herbs, 5–15 cm tall. Culms densely tufted, slender, glabrous. Leaves shorter than stems, linear-setaceous, 2–5 × 0.08–0.1 cm, obtuse at apex, glabrous, green, eligulate; sheaths 3–7 mm long, puberulous, green. Inflorescence compound or decompound, loose, 2–5 cm long, numerous spikelets. Involucral bracts 3–7, setaceous, short or as long as culms, 0.3–2 cm long, obtuse at apex, puberulous. Primary rays 5–6, slender, filiform, 2–2.5 cm long. Spikelets lanceolate, 4–7 × 1–1.5 mm, acute at apex, cuneate at base, peduncled, stramineous; rachis narrowly winged. Glumes ovate-oblong, 1.5–2 × 0.8–1 mm, acute and mucronate at apex, cuneate at base, glabrous-puberulous; keels 3-nerved, glabrous; sides nerveless; mucro *c.* 0.4 mm long, curved. Stamens 1; filaments *c.* 0.5 mm long. Style 2-fid, slender, *c.* 1 mm long, dilated at base, sparsely hairy towards apex, lower margins fringed with a whorl of long pendent hairs at base; stigma 2. Nuts biconvex, obovate, 0.5–0.7 × 0.4–0.5 mm, smooth, obscurely reticulate; epidermal cells hexagonal.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Open grasslands; *Fl. & Ft.*: August-November.

Specimen examined: Vellappara, Idukki wildlife Sanctuary, 05.08.2017, *Dani Francis & Santhosh Nampy* 154158 (CALI).

Fimbristylis tenera Schult., Mant. 2: 57. 1824; C.B.Clarke in Hook.f., Fl. Brit. India 6: 642. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1660. 1931; Sasidh., Biodiv. Doc.

Kerala-Fl. Pl. 538. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 244. 2014.

Annual herbs, 5–15 cm tall. Culms slender, angular, glabrous. Leaves shorter than stems, setaceous, 1.5–3 × 0.05–0.1 cm, obtuse at apex, glabrous, green, eligulate; sheaths tick, 5–10 mm long, glabrous, green. Inflorescence simple or sub-compound, 1–1.5 cm long, with a few spikelets. Involucral bracts 2 or 3, setaceous, 2–3 mm long, obtuse at apex, glabrous. Spikelets lanceolate, 4–5 × 1–1.5 mm, acute at apex, cuneate at base, peduncled, few flowered, brown; rachis broadly winged. Glumes distichous, ovate, 2–2.5 × 1–1.5 mm, acute at apex, cuneate at base, glabrous; keels deltoid, 3-nerved, glabrous; sides nerveless, hyaline. Stamen 1; filaments *c.* 1 mm long; anthers oblong, muticous. Style 3-fid, slender, *c.* 1 mm long, dilated at base, glabrous; stigma 3. Nuts trigonous, obovate, 0.8–1 × 0.5–1 mm, verruculose; epidermal cells reticulate, small, white-brown.

Distribution: Indian Subcontinent (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: November-June.

Specimens examined: Koruthode, 16.06.1996, *Jomy Augustine* 16240; Vallakkadavu, 06.04.1998, *Jomy Augustine* 17939 (CALI).

Fimbristylis uliginosa Hochst. ex Steud., Syn. Pl. Glumac. 2: 109. 1855; C.B.Clarke in Hook.f., Fl. Brit. India 6: 648. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1660. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 538. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 250. 2014.

Perennial rhizomatous herbs, 5–25 cm tall. Culms angular, glabrous. Leaves cauline, shorter than culms, linear-lanceolate, 2–5 × 0.1–0.4 cm, obtuse at apex, glabrous, scaberulous at margins, green, eligulate; sheaths membranous, flat, 3–10 mm long, glabrous, green. Inflorescence simple to sub-compound, contracted, 0.5–2 cm long. Involucral bracts 3, linear, 3–7 mm long, obtuse at apex, glabrous; rays 1–1.5 cm long. Spikelets 2–7 clustered, elliptic, 4–8 × 2–3 mm, sub-acute at apex, peduncled, many-flowered, dark brown. Glumes spiral, ovate-oblong, 3–4 × 2–2.5 mm, mucronate at apex, cuneate at base, glabrous, keeled, 5-nerved, hyaline at margins, chest nut brown. Stamens 3; filaments *c.* 1 mm long; anther linear, *c.*

1.5 mm long. Style 3-fid, *c.* 2 mm long, fimbriate towards apex, pyramidally thickened at base, glabrous; stigma 3. Nuts trigonous, obovate, 0.5–1 × 0.5–0.8 mm, rounded at apex, smooth; epidermal cells isodiametric.

Distribution: S. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: December-May.

Specimens examined: Chokramudi, 04.05.2017, *Dani Francis & Santhosh Nampy* 152147; Mangaladevi, 06.04.1998, *Jomy Augustine* 17970; Parunthanpara, 29.04.2018, *Dani Francis & Santhosh Nampy* 159229; Uppupara, 21.04.1995, *Jomy Augustine* 15007 (CALI).

Notes: This species is characterized by lesser number of spikelets, obovate fimbriate style and glabrous glumes (Wadoodkhan, 2015).

Fimbristylis velata R.Br., Prodr. Fl. Nov. Holland. 227. 1810; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 251. 2014.

Annual herbs, 5–15 cm tall. Culms slender, angular, glabrous. Leaves shorter than stems, setaceous, 1.5–3 × 0.05–0.1 cm, obtuse at apex, glabrous, green, eligulate; sheaths thick, 5–10 mm long, glabrous, green. Inflorescence simple or sub-compound, 1–1.5 cm long, with a few spikelets. Involucral bracts 2 or 3, setaceous, 2–3 mm long, obtuse at apex, glabrous. Spikelets solitary, lanceolate, 4–5 × 1–1.5 mm, acute at apex, cuneate at base, peduncled, few-flowered, brown; rachis broadly winged. Glumes ovate, 2–2.5 × 1–1.5 mm, acute at apex, cuneate at base, glabrous; keels deltoid, 3-nerved, glabrous; sides nerveless, hyaline. Stamens 1; filaments *c.* 1 mm long; anthers oblong, muticous. Style 2-fid, slender, *c.* 1 mm long, dilated at base, glabrous; stigma 2. Nuts biconvex, obovate, 0.8–1 × 0.5–1 mm, verruculose; epidermal cells reticulate, small, white-brown.

Distribution: S. Russian Far East to Tropical Asia and SW. Pacific (POWO, 2023); *Habitat*: Grasslands and marshy areas; *Fl. & Ft.*: December-March.

Specimen examined: Narakakkanam, 10.03.2017, *Dani Francis & Santhosh Nampy* 176148 (CALI).

Notes: This species is related to *Fimbristylis aestivalis*, but differs by its longer style, long pendent hairs at base and somewhat larger nuts (Wadoodkhan, 2015).

Fuirena Rottb.,

Descr. Icon. Rar. Pl. 70. 1773.

Fuirena umbellata Rottb., Descr. Icon. Rar. Pl. 70. 1773; C.B.Clarke in Hook.f., Fl. Brit. India 6: 666. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1669. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 539. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 261. 2014. **Fig. 28C**

Perennial herbs with short creeping rhizomes, 50–80 cm tall. Culms solitary or tufted, 4 or 5 angled, pubescent. Leaves, lanceolate, 5–15 × 0.8–1.5 cm, acute at apex, sheathing at base, puberulous, hispid hairy along margin, 5-nerved, green; sheaths terete, striated, 2.5–10 cm long, pilose; ligule membranous with a fringe of hairs at apex, brown. Inflorescence a terminal cluster of 3-few spikelets or with axillary peduncled clusters. Involucral bracts 2 or 3, lowest overtopping the inflorescence, leafy, lanceolate, 3–9 × 0.3–1 cm long, acute at apex, sheathing at base, pubescent. Spikelets oblong, 6–10 × 3–4 mm, sub-acute at apex, green, many flowered. Glumes oblong, 2–2.5 × 0.8–1 mm, obtuse and awned at apex, cuneate at base, hispid, keeled, 3-nerved, sides nerved; awn *c.* 1 mm long, hairy. Hypogynous bristles membranous, as long as nuts, broadly obovate, 0.5–0.7 × 0.3–0.4 mm, truncate or broadly obtuse at apex, narrowed and clawed at base, with a short curved mucro at apex, ciliolate; bristles needle like, shorter than nut, minutely scabrid. Stamens 2 or 3; anther linear-oblong, *c.* 1 mm long. Style 3-fid, *c.* 2 mm long; stigma 3. Nuts triquetrous, elliptic-obovate, 0.5–1 × 0.3–0.5 mm, narrowed at apex in to a beak, smooth.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Marshes along road sides; *Fl. & Ft.*: September-February.

Specimens examined: Cheruthoni, 18.02.1982, *C.N. Mohanan* 73332; Okkrai, Thekkady, 29.09.1972, *B.D. Sharma* 42093 (MH); Kulamavu, 10.12.2022, *Dani Francis & Santhosh Nampy* 176137 (CALI).

Hypolytrum Pers.,

Syn. Pl. 1: 70. 1805.

Hypolytrum nemorum (Vahl) Spreng.,Fl. Oware 2: 13. 1810; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 539. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 263. 2014. *Schoenus nemorum* Vahl, Symb. Bot. 3: 8. 1794. *Hypolytrum latifolium* Rich. in C.H.Persoon, Syn. Pl. 1: 70. 1805; Hook.f., Fl. Brit. India 6: 678. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1673. 1931.

Perennial rhizomatous herbs, 50–90 cm tall. Culms solitary, 3-angular, woody, glabrous, scabrid along the angles towards apex, distinctly noded. Leaves basal and 1 or 2 cauline; basal leaves clustered, cauline leaves widely spaced; lamina broadly linear, 55–120 × 1.3–2 cm, acute at apex, sheathing at base, folded towards base, flattish-plicate towards upper region, 3-nerved, glabrous, serrulate at margins, green adaxially, pale green abaxially; cauline sheaths 3–5 cm long, tightly enclosing the internode, glabrous, green tinched with brown, orifice membranous, obliquely truncate at apex; basal sheaths 2–13 cm long, glabrous, tinched reddish brown. Panicle terminal, compound to decompound, 4–6 cm long. Primary rays 1 or 2, spreading, 1.5–3 cm long, clothed at base with a bifid prophyll, 4–10 mm long. Involucral bracts 2, lowest overtopping the inflorescence, leafy, lanceolate, 15–30 × 0.5–1.5 cm, acute at apex, sheathing at base, glabrous. Spikelets oblong-ovoid, 2–7 mm long, many flowered. Glumes membranous, ovate, 1.5–2.5 × 1–2 mm, obtuse at apex, cuneate at base, 1-nerved, glabrous, brown throughout. Hypogynous scales not connate, 1.5–2 mm long, folded; keel spinulose. Stamens 2; anthers *c.* 1 mm long. Style *c.* 2 mm long; stigma 2. Nuts slightly compressed, ovoid to sub-globose, 2–4 × 1.5–2 mm, smooth or rugulose, constricted near apex in to a conical beak.

Distribution: Tropical and Subtropical Asia to W. Pacific (POWO, 2023); *Habitat*: Wet open lands and marshy areas; *Fl. & Ft.*: August-April.

Specimens examined: Meenmutty, 18.04.1982, *V.S. Raju* 71265 (MH); Munnar, 11.03.1985, *Madhu* 41476; Thommankuthu, 03.11.2019, *Dani Francis & Santhosh Nampy* 164652 (CALI).

Isolepis R.Br.,

Prodr. Fl. Nov. Holland. 221. 1810.

Isolepis fluitans (L.) R.Br., Prodr. Fl. Nov. Holland. 221. 1810. *Scirpus fluitans* L., Sp. Pl. 1: 48. 1763; C.B.Clarke in Hook.f., Fl. Brit. India 6: 653. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1666. 1931; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 334. 2014.

Annual herbs, 8–50 cm tall. Culms floating on water or somewhat terrestrial, slender, branched, terete, spongy. Leaves cauline, dense, narrowly linear, 2–6 × 0.05–0.1 cm, blunt at apex, sheathing at base, slightly incurved at margins, glabrous, brownish green; sheaths 5–15 mm long, shorter than internodes, glabrous, pale reddish brown. Inflorescence single, with a terminal erect spikelet. Involucral bracts 1, scaly, linear, *c.* 4 mm, blunt at apex, glabrous. Spikelets ovate, 3–5 × 1.5–2 mm, acute at apex, *c.* 15-flowered, green. Glumes membranous, elliptic, 1.5–2.3 × 0.8–1.2 mm, obtuse at apex, cuneate at base, 4–6-nerved, glabrous, sides pale green tinched with purple, purple dotted line all over the glumes. Stamens 2; anthers *c.* 1 mm long. Style *c.* 2 mm long, 2-fid, as long as nut; stigma 2. Nuts obovate, 1.2–1.5 × 0.5–1 mm, plano convex, distinctly beaked at apex, long stipitate at base, epidermal cells isodiametric, smooth, white-pale brown.

Distribution: Old World (POWO, 2023); *Habitat*: Brackish water on hills; *Fl. & Ft.*: October-December.

Specimens examined: Eravikulam hut, 05.12.1987, *P. Bhargavan* 87346 (MH); Pettimudi, near Subranshed, 30.12.2019, *Dani Francis & Santhosh Nampy* 170070 (CALI); Umayamala, 23.11.1965, *B.V. Shetty* 26644 (MH).

Notes: This species can be easily identified by its many branched floating stems at base and branches fascicled bearing a single terminal spikelet (Wadoodkhan, 2015).

Rhynchospora Vahl,

Enum. Pl. Obs. 2: 229. 1805.

Key to the species

1. Involucral bracts overtopping the inflorescence; spikelets numerous; glumes sub-distichously arranged; style shortly bilobed at apex; style base conspicuously furrowed on both sides ……. *R. corymbosa*

1. Involucral bracts as long as the inflorescence; spikelets solitary or in small clusters; glumes spirally arranged; style deeply bilobed to half at apex; style base not furrowed ……. *R. rugosa*

Rhynchospora corymbosa (L.) Britton, Trans. New York Acad. Sci. 11: 84. 1892; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1672. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 545. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 318. 2014. *Rhynchospora aurea* Vahl, Enum. Pl. obs. 2: 229. 1805; C.B.Clarke in Hook.f., Fl. Brit. India 6: 670. 1893. *Scirpus corymbosus* L., Cent. Pl. 2: 7. 1756. **Fig. 28A**

Perennial rhizomatous herbs, 90–120 cm tall. Culms stout, 3-angular, glabrous, nodes distinct. Leaves basal and cauline, lanceolate, 50–90 × 0.9–1.5 cm, acuminate at apex, sheathing at base, glabrous, scabrous at margins, green; sheaths 2–6 cm long, tightly enclosing the internode, glabrous, green, orifice membranous, pale brown. Panicle anthelate, compound or decompound, 8–15 cm long, many branched. Involucral bracts 1 or 2, lowest overtopping the inflorescence, leafy, lanceolate, 7–25 × 0.5–1 cm, acuminate at apex, sheathing at base, glabrous. Spikelets numerous, elliptic-lanceolate, 6–8 mm long, 2 or 3 flowered, rusty brown or chestnut brown. Glumes 5–7, sub-distichous, membranous, 3–12 × 1–2 mm, acute or mucronate at apex, cuneate at base, glabrous, brown; lower ones ovate; upper one oblong-ovate. Flowers bisexual at basal region; 1 or 2 in the upper region male. Hypogynous bristles in bisexual flowers, unequal, 4–8 mm long, exceeding nut, antrorsely scabrous; in male flower 1–3, 2–3 mm long. Stamens 3; anthers *c.* 2 mm long. Style conical, 4–5 mm long, shortly bilobed at apex, elongated-conical and compressed at base, conspicuously

furrowed on both sides. Nuts biconvex, compressed, obovate-oblong, 2.5–3.5 × 1.5–2 mm, truncate at apex, finely transversely wrinkled in middle, brown.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Marshes and margins of water courses; *Fl. & Ft.*: July-May.

Specimens examined: Dam site, 20.04.1995, *Jomy Augustine* 15049; Kulamavu, 10.12.2022, *Dani Francis & Santhosh Nampy* 176141; Painavu, 07.08.2017, *Dani Francis & Santhosh Nampy* 154316 (CALI); Thekkady, 27.01.1965, *K. Vivekananthan* 23036; *Ibid*., 29.05.1965, *K. Vivekananthan* 24384 (MH).

Notes: This species is a common member of the tropical sedge marshes and can be easily recognised by its densely corymbose branches (Dey & Prasanna, 2010).

Rhynchospora rugosa (Vahl) Gale, Rhodora 46: 275. 1944; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 546. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 321. 2014. *Schoenus rugosus* Vahl, Eclog. Amer. 2: 5. 1798. *Rhynchospora glauca* Vahl, Enum. Pl. Obs. 2: 233. 1805; Hook.f., Fl. Brit. India 6: 671. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1672. 1931.

Perennial rhizomatous herbs, 50–90 cm tall. Culms slender, 3-angular, glabrous. Leaves basal and cauline, linear, canaliculate, 20–30 × 0.1–0.3 cm, acuminate at apex, sheathing at base, glabrous, green; sheaths 2–3 cm long, tightly enclosing the internode. Panicles narrow, with 3–4 corymbiform anthelas, 2–5 cm long; lateral panicle solitary or two together, long exserted from sheaths; branches unequal. Involucral bracts erect, as long as inflorescence, leafy, linear, 4–9 × 0.05–0.1 cm, acuminate at apex, sheathing at base, glabrous. Spikelets solitary or in small clusters, ovate-lanceolate, 3–6 mm long, 2–4-flowered, short peduncled, rusty brown. Glumes 5–8, spiral, membranous, ovate-lanceolate, 2–4 × 1–2 mm, acute or mucronate at apex, cuneate at base, glabrous. Flowers bisexual basally; 1 or 2 males apically. Hypogynous bristles 5–6 in number, 2–4 mm long, shorter or exceeding nut, antrorsely scabrous. Stamens 1–3; anthers *c.* 2.5 mm long. Style conical, 1–3 mm long, deeply bilobed to half, base conical, glabrous, half to as long as nut. Nuts biconvex, dorsiventrally compressed, obovate, 1.5–2 × 1–1.5 mm, truncate at apex, finely transversely wrinkled, pale brown.

Distribution: N. Pacific, Mexico to Tropical America (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-April.

Specimens examined: Chenthamara, 06.01.1997, *Jomy Augustine* 17098 (CALI); Eravikulam hut western slope, 04.12.1987, *P. Bhargavan* 87326; *Ibid*., Poosanampara, 19.10.1989, *P. Bhargavan* 91830 (MH); Pettimudi, near Subranshed, 30.12.2019, *Dani Francis & Santhosh Nampy* 170056 (CALI); Thannikkudy, 07.09.1993, *N. Sasidharan & Jomy Augustine* 12365 (KFRI); Umayamala, 03.02.1970, *B.V. Shetty* 31800 (MH); Vagamon, 29.04.2018, *Dani Francis & Santhosh Nampy* 159253 (CALI).

Schoenoplectiella Lye,

Lidia 6(1): 20. 2003.

Key to the species

1. Annuals or short lived perennials; glumes 1-nerved; hypogynous bristles retroresely scabrous; nuts biconvex …….. *S. juncoides*

1. Perennials; glumes many nerved; hypogynous bristles retroresely barbellate except at base; nuts trigonous ……. *S. mucronata*

Schoenoplectiella juncoides (Roxb.) Lye, Lidia 6(1): 25. 2003. *Scirpus juncoides* Roxb., Fl. India 1: 218. 1820; *Schoenoplectus juncoides* (Roxb.) Palla, Bot. Jahrb. Syst. 10(4): 229. 1888; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 546. 2004. Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 336. 2014. *Scirpus erectus* Poir. ex C.B.Clarke in Hook.f., Fl. Brit. India 6: 656. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1666. 1931. **Fig. 28G**

Annual or short-lived perennial herbs. Culms tufted, 25–40 cm high, terete or angular. Leaves reduced to sheaths; cylindrical, 3–6 cm long, obliquely truncate and mucronate at apex, glabrous. Inflorescence capitate, pseudo lateral. Involucral bract 1, continuation of the culm, erect, shorter than culm, 3–8 cm long, acute at apex, 1-furrowed, dilated at base. Spikelets ovoid-oblong, 2–6 in a cluster, 0.5–1 × 0.3–0.5 cm, obtuse at apex, many flowered, sessile. Glumes widely ovate, 3–4 × 2–3 mm, obtuse and mucronate at apex, truncate at base, 1-nerved, slightly keeled at

apex, ciliolate at margins, streaked with brown. Hypogynous bristles 4–6, shorter than or as long as nut, retrorsely scabrous. Stamens 3; filaments 2–3 mm long; anthers linear, 0.3–1 mm long, acute at apex, yellow with purplish brown at apex. Style 2–2.3 mm long, ciliolate; stigma 2-fid. Nuts unequally biconvex, broadly obovate, 2–2.1 × 1.8–2 mm, apiculate at apex, thinly transversally rugose, brown.

Distribution: W. Indian Ocean and Asia to Pacific (POWO, 2023); *Habitat*: Paddy fields and marshes in open grasslands; *Fl. & Ft.*: September-May.

Specimens examined: Kattappana, 18.03.2018, *Dani Francis & Santhosh Nampy* 151540 (CALI); Manakkavala, Periyar Tiger Reserve, 05.05.1996, *Jomy Augustine & K.P. Rajesh* 17813 (KFRI).

Notes: This species, also known as "rock bulrush,' is one of the twelve most troublesome weeds in South and Southeast Asian rice fields, with a cosmopolitan distribution (Umkhulzum *et al.*, 2019).

Schoenoplectiella mucronata (L.) J.Jung & H.K.Choi, J. Pl. Biol. 53(3): 230. 2010. *Schoenoplectus mucronatus* (L.) Palla, Bot. Jahrb. Syst. 10(4): 299. 1888; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 547. 2004. *Scirpus mucronatus* L., Sp. Pl. 50. 1753; C.B.Clarke in Hook.f., Fl. Brit. India 6: 657. 1893; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1666. 1931; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 342. 2014.

Perennial rhizomatous herbs. Culms tufted, 25–70 cm high, 3-angled. Leaves reduced to sheaths; cylindrical, 3-angled, 10–20 cm long, rounded and mucronate at apex, glabrous. Inflorescence capitate, pseudo lateral. Involucral bract 1, continuation of culm, 3-angled, erect or bent downwards, shorter than culm, 1.5–5 cm long, acute at apex, dilated at base. Spikelets ovoid-oblong, 3–10 in a cluster, 0.5–1 × 0.2–0.5 cm, obtuse at apex, many flowered, sessile. Glumes widely ovate-orbicular, 3–4 × 2–3 mm, obtuse and mucronate at apex, truncate at base, many nerved, slightly keeled at apex, ciliolate at upper margins, streaked with brown. Hypogynous bristles 6, shorter than or longer than nut, 1–2.5 mm long, retrorsely barbellate except at base. Stamens 3; filaments 1–2.5 mm long; anthers linear, 1–1.8 mm long, cuspidate at apex, yellow with purplish brown at apex. Style 2–2.5 mm long; stigma 3-fid. Nuts unequally compressed-trigonous, broadly obovate,

1.2–2.2 × 1.8–2 mm, rounded and apiculate at apex, thinly transversally rugose, brown.

Distribution: Old World to Australia (POWO, 2023); *Habitat*: Paddy fields and marshes in open grasslands; *Fl. & Ft.*: August-June.

Specimens examined: Anayirangal dam, 05.01.2017, *Dani Francis & Santhosh Nampy* 151540 (CALI); along Devikulam lake, 15.04.1960, *K. Subramanyam* 10244; Kalvary mount, 21.02.1983, *C.N. Mohanan* 77921 (MH); Kumarikulam, Periyar Tiger Reserve, 12.03.1995, *K.P. Rajesh* 14861 (KFRI); Munnar, 23.12.1986, *Rejani* 12013; *Ibid*., 13.12.1970, *Rugmini P.* 1007; *Ibid*., 13.12.1970, *Raveendranathen P.P.* 58; *Ibid*., *s.d., Prabhakaran A.* 58 (CALI); Old Devikulam, 14.06.1963, *K.M. Sebastine* 16471 (MH); Thannikkudy, 09.08.1993, *Jomy Augustine* 12337 (CALI); *Ibid*., 11.03.1995, *K.P. Rajesh & Jomy Augustine* 14833 (KFRI); Thekkady, September 1925, *K.C. Jacob* 17757; *Ibid*., Okkrai, 29.09.1972, *B.D. Sharma* 42095; *Ibid*., 23.12.1974, *K. Vivekananthan* 45658 (MH).

Notes: This species, also known as 'Bog bulrush', is a common weed in rice fields with a high economic value. It is a potential wetland species for water treatment in the tropics (Suhesti *et al.*, 2021).

Scleria P.J.Bergius,

Kongl. Vetensk. Acad. Handl. 26: 142. 1765.

Key to the species

1. Perennial herbs 2

1. Annual herbs 5

2. Panicle branched 3

2. Panicle solitary or binate 4

3. Leaves arising from base; spikelets unisexual ..... *S. levis*

3. Leaves arising from middle of the culm; spikelets bisexual ..... *S. lithosperma*

4. Sheaths winged; nuts shortly beaked at apex; disc deeply 3-lobed.... *S. terrestris*

4. Sheaths wingless; nuts rostrate at apex, disc shallowly 3-lobed ……..….. *S. swamyi*

5. Inflorescence paniculate; involucral bracts present; spikelets unisexual; disc deeply 3-lobed ……..…….…….…….. 6

5. Inflorescence spiciform; involucral bracts absent; spikelets bisexual; disc obsolete, concrete with the nuts ……..…….. *S. pergracilis*

6. Testa irregularly lacunose or foveolate with many shallow depressions; disc lobes obovate ……. *S. multilacunosa*

6. Testa tessellate in vertical lines; disc lobes broadly oblong ……..…… *S. parvula*

Scleria levis Retz., Observ. Bot. 4: 13. 1786; C.B.Clarke in Hook.f., Fl. Brit. India 6: 694. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1678. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 547. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 358. 2014. *Scleria hebecarpa* Nees in Wight, Contr. Bot. India 117. 1834; C.B.Clarke in Hook.f., Fl. Brit. India 6: 689. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1677. 1931.

Perennial rhizomatous herbs, 40–70 cm tall. Culms tufted, trigonous, glabrous-puberulous, green with pale purple. Leaves linear, 10–40 × 0.4–0.7 cm, obtuse at apex, sheathing at base, glabrous, prominently nerved; sheaths winged, mouth with ovate hairy flap. Panicles terminal, 6–15 cm long, branched; partial panicles 1 or 2, distant, not branched, spike like on exserted peduncles. Involucral bracts leafy, linear, overtopping the inflorescence, 2–10 × 0.1–0.3 cm. Spikelets unisexual, clusters of 2–4. Male spikelets oblong-lanceolate, 3–4 mm long, pedicels *c.* 5 mm long glabrous; glumes ovate-oblong, 3–4 × 1–2 mm, truncate at apex, glabrous, purplish; stamens 2 or 3, *c.* 1.3 mm long. Female spikelets obovoid, 4–6 × 2–3 mm, sessile; glumes ovate, 2–5 × 1–3 mm, cuspidate at apex, 1-nerved, glabrous, brown. Nuts globose-ovoid, *c.* 3 × 2 mm, apiculate at apex, smooth or faintly rugulose, puberulous-glabrous, white. Disk deeply 3-lobed; lobes ovate-lanceolate, acute at apex, appressed to nut, almost half as long as nut.

Distribution: Tropical and Subtropical Asia to W. Pacific (POWO, 2023); *Habitat*: Grasslands and deciduous forests; *Fl. & Ft.*: August-December.

Specimens examined: Koruthode, 16.08.1996, *Jomy Augustine* 16289; Neriamangalam, 11.09.2018, *Dani Francis & Santhosh Nampy* 159455; Painavu, 07.08.2017, *Dani Francis & Santhosh Nampy* 154317 (CALI).

Scleria lithosperma (L.) Sw., Prodr. Veg. Ind. Occ. 18. 1788; C.B.Clarke in Hook.f., Fl. Brit. India 6: 685. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1677. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 548. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 359. 2014. *Scirpus lithospermus* L., Sp. Pl. 1: 51. 1753.

Perennial herbs, 70–110 cm tall. Culms tufted, trigonous, glabrous. Leaves arising from middle of culm, linear, 25–40 × 0.2–0.5 cm, narrowed at apex, sheathing at base, glabrous, dull green; sheaths slightly winged, puberulous along each face; orifice ovate, ciliate hairy flap. Panicles terminal, loose, 10–25 cm long, slightly branched; partial panicles 2–3, not branched. Involucral bracts leafy, linear, overtopping the inflorescence, 8–15 × 0.1–0.3 cm. Spikelets bisexual, solitary or in cluster of 2 or 3, with one female flower and few to several male flowers, 3–4 mm long. Male glumes ovate-lanceolate, 3–4 × 1–2 mm, acute at apex, glabrous; stamens 1 or 2, *c.* 1.3 mm long. Female glumes ovate-lanceolate, 2–3 × 1–3 mm, acuminate at apex, 1-nerved, glabrous, brown. Nuts oblong-obovoid, *c.* 2.5 × 2 mm, obtuse at apex, cuneate with a depression on each face at base, smooth, glabrous, white. Disk reduced to a dark brown ring adnate to extreme nut base, with or without ferruginous viscid pubescent on basal depressions.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: August-December.

Specimens examined: Way side Neriamangalam, 11.09.2018, *Dani Francis & Santhosh Nampy* 159454 (CALI); Pullupara, 24.09.1964, *K. Vivekananthan* 21363 (MH); Thommankuthu, 30.11.2019, *Dani Francis* & *Santhosh Nampy* 164653 (CALI).

Scleria multilacunosa T.Koyama, Bull. Natl. Sci. Mus., Tokyo17(1): 71. 1974; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 361. 2014.

Annual herbs, *c.* 60 cm tall. Culms tufted, trigonous, glabrous or puberulous. Leaves shorter than stem, linear, 5–25 × 0.2–0.5 cm, obtuse-blunt at apex, sheathing at base, glabrous, green; sheaths triquetrous, 3–5 cm long, puberulous along each face, scabrous at margins; orifice hairy, brown. Panicles terminal or axillary, 2–6 cm long; partial panicles 2–4, sub-spiciform, 1–2 cm long, intermingled with 3–5 female spikelet and 1–3 male spikelets. Involucral bracts leafy, linear, overtopping the inflorescence, 7–13 × 0.3–0.4 cm, obtuse at apex, glabrous. Male spikelets lanceolate, 3–3.5 mm long, short peduncled; glumes ovate-lanceolate, 3–5 × 1–2 mm, acuminate at apex, glabrous, pale brown; stamens 1 or 2, *c.* 1 mm long. Female spikelets 3–4 mm long; glumes ovate-lanceolate, boat-shaped, 3.5–4.5 × 2–3 mm, acuminate at apex, keeled, glabrous, brown; style 3-fid, *c.* 1 mm long. Nuts globose, 2–2.5 × 1.8–2 mm, mucronate and rounded at apex, testa irregularly lacunose or foveolate with many shallow depressions, glabrous, white-ceramic. Disk deeply 3-lobed; lobes obovate, *c.* 0.7–0.4 mm, contracted at cuspidate apex, sub-coriaceous, yellow.

Distribution: S. India and N. Sri Lanka (POWO, 2023); *Habitat*: Shady forests; *Fl. & Ft.*: October-December.

Specimen examined: Vallakkadavu, 16.11.1997, *Jomy Augustine* 16894 (CALI).

Notes: This species is similar to *Scleria benthamii* C.B.Clarke and *S. tessellata* Willd., but can be distinguished by its irregularly lacunose or foveolate nuts with many shallow depressions and obovate disc lobes that are often appressed at the base (Wadoodkhan, 2015).

Scleria parvula Steud., Syn. Pl. Glumac. 2: 174. 1855; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 548. 2004.

Annual rhizomatous herbs, 30–40 cm tall. Culms tufted, trigonous, pubescent, green with a maroon tinch. Leaves linear, 10–20 × 0.3–0.4 cm, acute at apex, sheathing at base, glabrous, scabrous abaxially, green; sheaths triquetrous, 2.5–5 cm long, pubescent; orifice ovate, obtuse at apex, truncate at base, ciliate, brown. Panicles terminal, 4–6 cm long; partial panicles 4 or 5, sub-spiciform, 1–3 cm long,

male and female spikelets intermingled. Involucral bracts leafy, linear, overtopping the inflorescence, 5–12 × 0.3–0.4 cm, obtuse at apex, glabrous. Male spikelets lanceolate, 3–4 mm long, short peduncled; glumes ovate-lanceolate, 3–4 × 1–2 mm, acuminate at apex, glabrous, pale brown; stamens 2, *c.* 1 mm long. Female spikelets ovate, 5–6 mm long; glumes ovate-lanceolate, 4–5 × 2–3 mm, shortly aristate at apex, keeled, glabrous, pale brown; style 3-fid, *c.* 1 mm long. Nuts globose, 2.5–3.2 × 1.8–2 mm, minutely beaked and rounded at apex, testa tessellate in vertical lines, white. Disk deeply 3-lobed, thick; lobes broadly oblong, *c.* 1 mm long, truncate at apex, sub-coriaceous, cream.

Distribution: Tropical and Subtropical Old World to S. Russian Far East (POWO, 2023); *Habitat*: Deciduous forests; *Fl. & Ft.*: September-January.

Specimens examined: Chenthamara, 06.01.1997, *Jomy Augustine* 17096 (CALI); Eravikulam hut, 04.12.1987, *P. Bhargavan* 87335 (MH).

Scleria pergracilis (Nees) Kunth, Enum. Pl. 2: 354. 1837; Hook.f., Fl. Brit. India 6: 685. 1894; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 548. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 362. 2014. *Hypoporum pergracile* Nees, Edinburgh New Philos. J. 1834: 267. 1834.

Annual herbs, 10–50 cm tall. Culms slender, trigonous, glabrous, green. Leaves linear, 10–20 × 0.1–0.2 cm, acute at apex, sheathing at base, glabrous, scabrous at margins, green; sheaths 3–3.5 cm long, glabrous; orifice oblong, membranous, truncate at apex, puberulous, hyaline. Inflorescence spiciform, linear, 8–20 cm long, unbranched with clusters of spikelets. Involucral bracts absent or inconspicuous. Spikelets bisexual, ovate-lanceolate, 3–4 mm long, sessile; glumes ovate-lanceolate, 2.5–3 × 1–2 mm, acute and muticous at apex, cuneate at base, glabrous, with reddish glandular streaks. Stamens 2, *c.* 1.5 mm long. Style 3-fid, *c.* 1 mm long. Nuts globose-obovate, 1.5–2 × 0.8–1 mm, strongly beaked and rounded at apex, thick stipitate at base; testa densely tuberculate or muricate, white-pale black. Disk obsolete, concrete with the nuts forming a brown triquetrous, 0.3–0.5 mm long stipe.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-April.

Specimens examined: Kavalappara, 20.04.1995, *Jomy Augustine* 14529 (CALI); Thannikkudy, 04.09.1993, *N. Sasidharan & Jomy Augustine* 12338 (KFRI).

Notes: This species can be easily identified by its very slender annual habit, clustered spikelets in the axil of several foliaceous bracts, and the nature of nuts and disk (Wadoodkhan, 2015).

Scleria swamyi Govind., Proc. Indian Acad. Sci., Pl. Sci. 94: 19. 1985; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 366. 2014.

Perennial non-creeping rhizomatous herbs, 30–70 cm tall. Culms tufted, acutely trigonous, slender, retrorsely scabrid. Leaves shorter than stem, linear-lanceolate, 15–25 × 0.2–0.4 cm, obtuse-acute at apex, sheathing at base, glabrous, serrulate at margins, green; sheaths narrow, 3–6 cm long, wingless, glabrous, serrulate at margins; orifice ovate, truncate at apex, puberulous, brown. Panicle terminal, solitary, 2–3 × 1–1.5 cm. Involucral bracts leafy, linear, overtopping the inflorescence, 3–6 × 0.2–0.3 cm, obtuse-acute at apex, glabrous. Spikelets unisexual, clusters of 2 or 3; Male spikelets oblong-ovate, 4–5 mm long, short peduncled; glumes ovate-lanceolate, 4–5 × 1–2 mm, acuminate at apex, glabrous; stamens 3, *c.* 1.3 mm long. Female spikelets elliptic-ovate, 2.5–3 mm long; glumes broadly ovate, 2.5–3 × 2–2.5 mm, acute at apex, glabrous; style 3-fid, *c.* 1 mm long. Nuts sub-globose, 2–2.5 × 1.8–2 mm, rostrate at apex, testa rugulose by transverse undulate, ferruginous or yellow viscid ridges with three depressions at base, marble white. Disk distinctly shallowly 3-lobed; lobes oblong, 0.5–0.7 mm long, rounded at apex, more or less adpressed to nut, sub-coriaceous, white.

Distribution: S. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: October-November.

Specimen examined: Meenuliyanpara, 29.11.2019, *Dani Francis & Santhosh Nampy* 164611 (CALI).

Scleria terrestris (L.) Fassett, Rhodora 26: 159. 1924; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. Biodiv. Doc. Kerala-Fl. Pl. 549. 2004; Wad.Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 366. 2014. *Zizania terrestris* L., Sp. Pl. 2: 991. 1753. *Scleria cochinchinensis* (Lour.) Druce, Bot. Soc. Exch. Club Brit. Isles 1916: 646. 1917; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1678. 1931. **Fig. 28H**

Perennial rhizomatous herbs, 60–150 cm tall. Culms tufted, slender to very robust, trigonous, retrorsely scabrid on sharp angles. Leaves lanceolate, 40–70 × 0.4–1.5 cm, acuminate at apex, sheathing at base, glabrous, scabrous along margins and veins, green; sheaths winged, 4–25 cm long, puberulous; orifice ovate, sub-truncate at apex, pilose, brown. Panicle terminal or axillary, solitary or binate, cluster of spikes, 8–20 cm long. Involucral bracts leafy or setaceous, linear, 6–8 × 0.2–0.3 cm, acute at apex, glabrous. Spikelets unisexual. Male spikelets 3–4 mm long, pedunculate, pilose; glumes ovate-lanceolate, 3–4 × 1–2 mm, shortly aristate at apex, glabrous; stamens 3, *c.* 1.3 mm long; anthers bristly appendiculate at tips. Female spikelets 4–5 mm long, sessile or sub-sessile; glumes broadly ovate-lanceolate, 4.5–5 × 3–4 mm, awned at apex, glabrous, strongly keeled; style 3-fid, *c.* 1 mm long. Nuts ovoid-sub-globose, 2–3 × 2–2.1 mm, shortly beaked at apex; testa smooth or obscurely warted, purple hairy, marble white or blackish white. Disk deeply 3-lobed; lobes obovate, 0.4–0.5 mm long, obtuse at apex, sub-coriaceous, reddish white.

Distribution: Tropical and Subtropical Asia to N. Australia (POWO, 2023); *Habitat*: Semi evergreen forests; *Fl. & Ft.*: August-December.

Specimens examined: Karadikkavala, 12.08.1994, *Jomy Augustine* 13930; Puthukkad, Nallathannikallar, 14.09.2018, *Dani Francis & Santhosh Nampy* 161909 (CALI).

Notes: It is a large, robust species with larger inflorescence and white nuts seen among the purplish glumes and bracteoles (Wadoodkhan, 2015).

Fig. 27. A. *Cyperus dubius* Rottb. **B.** *Cyperus procerus* Rottb. **C.** *Bulbostylis barbata* (Rottb.) C.B.Clarke; **D.** *Carex condensata* Nees; **E.** *Carex cruciata* Wahlenb.; **F.** Carex myosurus Nees; **E.** *Carex phacota* Spreng.; **F.** *Carex speciosa* Kunth.

Fig. 28. A. *Rhynchospora corymbosa* (L.) Britton; **B.** *Cyperus cyperoides* (L.) Kuntze; **C.** *Fuirena umbellata* Rottb.; **D.** *Cyperus squarrosus* L.; **E.** *Fimbristylis quinquangularis* (Vahl) Kunth; **F.** *Cyperus difformis* L.; **G.** *Schoenoplectiella juncoides* (Roxb.) Lye; **H.** *Scleria terrestris* (L.) Fassett.

POACEAE Barnhart,

Bull. Torrey Bot. Club 22(1): 7. 1895.

Annual or perennial herbs or tall woody bamboos. Culms jointed; internodes hollow or solid. Leaves differentiated into sheath, blade, and ligule; leaf sheath surrounding culms, split to base or infrequently tubular with partially or completely fused margins; leaf blades usually long, narrow flat; veins parallel, sometimes with cross-connecting veinlets. Ligules membranous or a line of hairs. Inflorescence terminal or axillary, an open, contracted, or spike like panicle, or composed of lax-spike like racemes arranged along an elongate central axis, or digitate, paired, or occasionally solitary, axillary inflorescences often many. Spikelets composed of rachilla; 2 glumes, subtending 1 to many florets. Florets having lemmas, clasping the more delicate, usually 2-keeled palea; base of florets often with callus. Lemmas often with apical or dorsal awn, glumes sometimes awned. Flowers bisexual or unisexual. Lodicules 2, rarely 3 or absent. Stamens 3 rarely 1, 2, 6, or more; filaments capillary; anthers versatile. Ovary 1-celled; style (1 or) 2 (3), free or united at base; stigma feathery. Fruits dry indehiscent caryopsis with thin pericarp firmly adherent to seed, pericarp rarely free, fleshy in some bamboos.

Poaceae are commonly known as the grass family, with 779 genera (POWO, 2023) and approximately 11,500 species worldwide (Hodkinson, 2018; Huang *et al.*, 2022). It is the fifth-largest plant family in terms of the number of species. However, it stands first in its economic and ecological importance (Hodkinson, 2018). Although the family shows a cosmopolitan distribution, some species are confined to a particular area. In India, Poaceae are the largest family represented by 1,334 species under about 261 genera (Karthikeyan, 2005). Eighty four genera and 186 species under 14 tribes are reported from the study area.

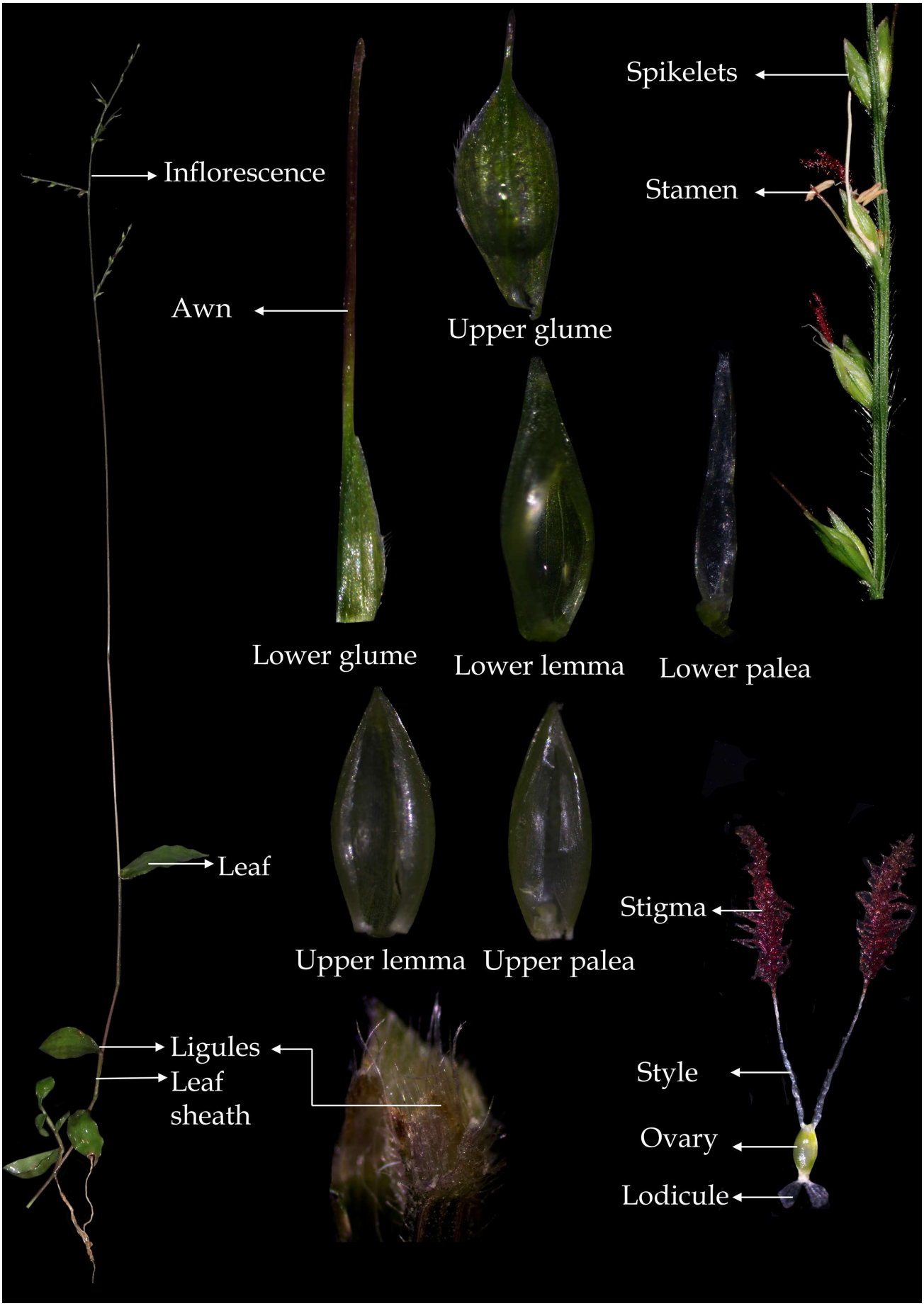
Key to the tribes

1. Plants shrubs; culms woody ……..…….…… Bambuseae

1. Plants herbs, cane like, reed like or suffrutescent grasses; culms not woody … 2

2. Spikelets 1-many flowered, if 2-flowered then both bisexual or the upper barren ……..... 3

2. Spikelets 2-flowered, lower florets male or barren, upper bisexual ……..…… 13


Spikelets
Inflorescence
Stamen
Awn
Upper glume
Lower glume
Lower lemma
Lower palea
Leaf
Upper lemma
Upper palea
Stigma
Ligules
Leaf
sheath
Style
Ovary
Lodicule

3. Spikelets with 1-fertile florets, with or without additional male or barren florets …….. 4

3. Spikelets with 2 or more fertile florets ……..…… 12

4. Stamens 6 ……. Oryzeae

4. Stamens 1–3 ……..…… 5

5. Leaf blades tessellately nerved …….. Centotheceae

5. Leaf blades not tessellately nerved …….. 6

6. Inflorescence a panicle ……..…….. 7

6. Inflorescence composed of racemes …….. Cynodonteae

7. Ligules membranous; lower florets barren ……..…….. 8

7. Ligules a line of hairs; lower florets fertile ……..…… 9

8. Fertile spikelets deciduous in triads or accompanied by sterile spikelets ……..…… ……..... Poeae

8. Fertile spikelets not deciduous in triads or not accompanied by sterile spikelets ……... Aveneae

9. Spikelets disarticulating above glumes, rarely falling entire and then strongly laterally compressed …….. 10

9. Spikelets falling entire ……. Arundinelleae

10. Lemmas awned ……..…… 11

10. Lemmas awnless …….…… Eragrostideae

11. Paleas as long as lemma ……. Arundineae

11. Paleas less than half of the lemmas …….. Aristideae

12. Stigma spirally coiled and retroresely barbed ……..…… Streptogyneae

12. Stigma not spirally coiled, often plumose ……..…… Isachneae

13. Spikelets similar, solitary or paired; upper lemmas usually without awns ……..…… ……... Paniceae

13. Spikelets dissimilar, often in pairs or threes; upper lemmas usually awned ……..…….. Andropogoneae

Tribe Bambuseae Kunth ex Dumort,

Anal. Fam. Pl. 63. 1829.

Key to the genera

1. Ovary with conspicuous apical appendage 2

1. Ovary without appendage or inconspicuous ..... *Kuruna*

2. Ovary appendage broadly conical and fleshy ..... *Bambusa*

2. Ovary appendage long, stiff, tapering 3

3. Fruits a caryopsis with thin pericarp; stamens 6 4

3. Fruits a berry with fleshy pericarp; stamens numerous ..... *Ochlandra*

4. Spikelets disarticulating above glumes ..... *Schizostachyum*

4. Spikelets disarticulating with 1–4 glumes ..... *Pseudoxytenanthera*

Bambusa Schreb.,

Gen. Pl. ed. 8[a]. 1: 236. 1789.

Bambusa bambos (L.) Voss, Vilm. Blumengartn. ed., 3. 1: 1189. 1895; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 554. 2004. *Arundo bambos* L., Sp. Pl. 1: 81. 1753. *Bambusa arundinacea* (Retz.) Willd., Sp. Pl. ed., 4. 2: 245. 1799; Hook.f., Fl. Brit. India 7: 395. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1859. 1934. **Fig. 12G**

Perennial thick stoloniferous rhizomatous shrubs. Culms erect, densely tufted, cylindrical, branches at all nodes; nodes slightly swollen and a few lower nodes with short aerial roots. Culm sheaths broadly triangular, 10–12 × 4–8 cm, acuminate at apex, truncate at base, densely brownish-hairy within, and scattered hairy out. Leaves 10 in each compliment, linear-lanceolate, 15–30 × 0.8–1.5 cm long, acuminate at apex, cuneate at base, glabrous, green, petiolate; sheaths *c.* 12 × 0.2 cm, glabrous; ligule short, entire. Inflorescence a compound panicle with the spikelets in heads; rachis smooth, striate. Spikelets with 3 or 4 fertile florets and 1 or 2 sterile florets, lanceolate, 1.2–2.5 cm long, sessile, caducous, glabrous. Glumes 1–3, broadly ovate, 4–5.5 mm long, mucronate at apex, cuneate at base, glabrous abaxially, sparsely hairy towards apex, many nerved. Lemmas ovate-lanceolate, 6–8 × 2–3 mm, mucronate at apex, sub-truncate at base, glabrous, ciliate, many

nerved. Paleas lanceolate, 6–7 × 2–2.5 mm, obtuse at apex, cuneate at base, 2-keeled, keels ciliate, broadly winged. Lodicules 3. Stamens 6. Ovary elliptic, hairy at apex, appendage broadly conical, fleshy; stigma 3, plumose. Caryopsis elliptic, short beaked, grooved on one side.

Distribution: Indian Subcontinent to Indo-China (POWO, 2023); *Habitat*: Deciduous forests and open lands; *Fl. & Ft.*: July-March.

Specimen examined: Mullakkudy, 14.03.1973, *B.D. Sharma* 43848 (MH).

Kuruna Attigala, Kaththr. & L.G.Clark,

Phytotaxa 174: 182. 2014.

Key to the species

1. Culm leaves linear-lanceolate; spikelets 2.5–3.5 cm long; lower glumes 5-nerved ……..…….. *K. floribunda*

1. Culm leaves narrowly ovate; spikelets 1.4–2 cm long; lower glumes 6–7-nerved ……. 2

2. Foliage leaves cordate; synflorescence 20–30 cm long; paleas with a tuft of cilia at apex ……..…….. *K. walkeriana*

2. Foliage leaves ovate-lanceolate; synflorescence 10–15 cm long; paleas without a tuft of cilia at apex …….. *K. wightiana*

Kuruna floribunda (Thwaites) Attigala, Kaththr. & L.G.Clark, Phytotaxa 174: 200. 2014. *Arundinaria floribunda* Thwaites, Enum. Pl. Zeyl. 375. 1864; Hook.f., Fl. Brit. India 7: 377. 1896; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 552. 2004; Attigala *et al.*, Syst. Bot. 41(1): 185. 2016.

Perennial shrubs. Culms erect, 2–3.5 m tall; internodes terete, 7–30 cm long, hollow, light green and spotted with purplish-black when young, becoming lighter in colour with age, ring of purple hairs at summit when young, glabrous when old. Culm leaves deciduous, linear-lanceolate, 2.5–3 × 0.2–0.3 cm, acuminate at apex, cuneate at base, initially erect, becoming reflexed, glabrous; sheaths 7–16 cm long, abaxially sparsely hirsute throughout with maroon hairs, symmetrically concave at apex; auricles absent; inner ligule a short membrane, puberulent abaxially. Primary branch producing 2 secondary branches, followed by other branches

from these axes to form a whorl of usually 5 more or less equal branches, the latter occasionally rebranching but at maturity the whole branch complement not crowded. Foliage leaves 6–10 per complement, lanceolate, 6.5–17 × 1–1.8 cm, acuminate at apex, attenuate at base, glabrous, tessellate, trichomes *c.* 0.1 mm long, pseudo petiolate; sheath summit fimbriate; auricles absent; inner ligule a minute short rim; outer ligule a minute ciliolate rim. Synflorescences paniculate, 15–20 cm long, branches pulvinate, spreading, glabrous. Spikelets 2.5–3.5 cm long, 4–6 fertile florets per spikelet, one rudimentary apical sterile floret. Lower glumes ovate-triangular, 3.5–5.5 × 2–2.5 mm, mucronate at apex, sub-truncate at base, puberulous, ciliate, 5-nerved; upper glumes ovate-lanceolate, 5.5–6 × 2–2.6 mm, mucronate at apex, sub-truncate at base, puberulous, ciliate, 7-nerved. Lemmas ovate-lanceolate, 8.5–10 × 4–5 mm, mucronate at apex, sub-truncate at base, scabrous, 7–8-nerved. Paleas lanceolate, 3.8–6.3 × 2.5–3.5 mm long, biapiculate at apex, sub-truncate at base, scabrous, 2-keeled, keel wings present, sulcate between the keels, sulcus well developed for the full length. Lodicules anterior pair rhomboid, narrowed at the base, posterior lanceolate, all apically ciliate. Stamens 3. Ovary ovate; stigma plumose.

Distribution: India (Kerala) and S. Central Sri Lanka (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: Flowers in long intervals.

Specimens examined: Mannavanshola, 07.02.1996, *Mukthesh Kumar, Stephen Sequiera & M. Ramesh* 7890; *Ibid.*, 27.06.1995, *Kishore Kumar K.* 16401; Nyamakkad gap, 17.01.1998, *Stephen Sequiera & Viswakumar* 008865; near Top station, 27.07.2000, *M. Ramesh* 20738; Rajamala, Munnar, 27.07.2000, *M. Ramesh & Stephen Sequiera* 20737 (KFRI).

Notes: This species is characterized by thick, prominent supra-nodal ridge and small clumps with culms 2–3.5 m tall with the internodes somewhat scabrous and speckled with purplish markings (Attigala *et al.*, 2016).

Kuruna walkeriana (Munro) Attigala, Kaththr. & L.G.Clark, Phytotaxa 174: 200. 2014. *Arundinaria walkeriana* Munro, Trans. Linn. Soc. London 26: 21. 1868; Hook.f., Fl. Brit. India 7: 377. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1857. 1934; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 552. 2004; Attigala *et al.*, Syst. Bot. 41(1): 191. 2016.

Perennial shrubs. Culms erect, *c.* 2 m long, dense; internodes terete, 5.5–15 cm long, hollow, light green when young, becoming brownish-dark green with age, glabrous. Culm leaves deciduous, narrowly ovate, 2–3 × 0.05 cm, acuminate at apex, cuneate at base, reflexed, glabrous, ciliate; sheaths 5.5–6.5 cm long, symmetrically concave at apex, hispid with non-irritating white hairs abaxially, densely hirsute and remaining as a hairy ring after the sheath falls at the base; auricles absent; inner ligules membranous. Primary branch producing 2 lateral branches, quickly followed by the development of tertiary branches to produce a complement of up to 30 branches, these rarely rebranching, but continuing in length to *c.* 40 cm, with 10–20 leaves, with production of new leaves and shedding of old blades, covered by only hard, persistent, overlapping sheaths. Foliage leaves 6–14 per complement, cordate, 3–9 × 0.8–2 cm, acute at apex, rounded and clasping at base, glabrous, thick and leathery, tessellate, trichomes *c.* 0.1 mm long, pseudo petiolate; sheath summit fimbriate with white silky fimbriae; auricles absent; inner ligules 0.7–1.2 mm long; outer ligules absent. Synflorescences paniculate, 20–30 cm long, smaller on the leafy branches, branches pulvinate, spreading, glabrous. Spikelets 14–20 mm long, 3–4 fertile florets per spikelet, with a rudimentary apical sterile floret. Lower glumes ovate-lanceolate, 5.5–5.8 × 2–3 mm, acute at apex, sub-truncate at base, 7-nerved, glabrous, ciliate. Upper glumes 6.3–6.5 × 3–3.5 mm, acute at apex, sub-truncate at base, glabrous, ciliate. Lemmas ovate, 7–7.3 × 4.5–5 mm, acute at apex, sub-truncate at base, 9-nerved, glabrous, ciliate on the upper margin. Paleas lanceolate-ovate, 6–7 × 3–3.5 mm long, acute at apex, cuneate at base, pubescent, tuft of cilia at the apex, 2-keeled, 2 broad keel wings present, sulcus well developed for the full length. Lodicules lanceolate, upper margins ciliate, many-nerved. Stamens 3. Ovary ovate; stigma plumose.

Distribution: S. India and Central Sri Lanka (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: Flowers in long intervals.

Specimens examined: Eravikulam, 11.01.2001, *Manju C. Nair* 20648; Munnar, way to Rajamala, 07.04.2009, *M. Ramesh & Sathish Kumar* 26426 (KFRI).

Notes: The thick, leathery cordate-shaped clasping foliage leaves distinguishes this species from the other species of this genus (Attigala *et al.*, 2016).

Kuruna wightiana (Nees) Attigala, Kaththr. & L.G.Clark, Syst. Bot. 41: 191. 2016. *Arundinaria wightiana* Nees, Linnaea 9: 482. 1835; Hook.f., Fl. Brit. India 7: 377. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1857. 1934; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 553. 2004.

Perennial shrubs. Culms erect, *c.* 8 m long, dense; internodes terete, *c.* 30 cm long, hollow, dark green when young, becoming yellowish-brown with age, scaberulous. Culm leaves deciduous, narrowly ovate, 2.5–4 × 0.03–0.06 cm, acute at apex, cuneate at base, reflexed, glabrous; sheaths 8–18 cm long, more or less horizontal at apex, hispid with golden brown irritating hairs abaxially, densely hirsute at base; auricles absent; inner ligules short ciliolate. Primary branch producing 2 lateral branches, quickly followed by the development of basal buds to produce 6–12 smaller sub-equal branches. Foliage leaves 6–9 per complement, ovate-lanceolate, 2.5–18 × 0.6–1.8 cm, acuminate at apex, obtuse at base, tessellate, trichomes *c.* 0.2 mm long, pseudo-petiolate; sheath summit fimbriate with light brown long fimbriae; auricles absent, inner ligules truncate; outer ligules a minute glabrous rim. Synflorescences paniculate, 10–15 cm long, branches pulvinate, spreading. Spikelets 1.5–2 cm long, 2–3 fertile florets per spikelet, with a rudimentary apical sterile floret. Lower glumes oblong, *c.* 3 × 1.3 mm long, acute at apex, sub-truncate at base, 6-7-nerved, glabrous, ciliate at the tips. Upper glumes oblong, *c.* 3.5 × 1.5 mm, acute at apex, sub-truncate at base, 6–7-nerved, glabrous, ciliate at tips. Lemmas ovate, 4–5 mm long, mucronate at apex, sub-truncate at base, 7–11- nerved, glabrous. Paleas lanceolate, 4–5 mm long, biapiculate at apex, sub-truncate at base, 2-keeled, keel wings absent, ciliate on the keels, sulcus well developed for the full length. Lodicules *c.* 1.4 mm long. Stamens 3. Ovary ovate; stigma plumose.

Distribution: S. India and Central Sri Lanka (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: Flowers in long intervals.

Specimen examined: Near Kappakkanam, 28.05.1982, *C.N. Mohanan* 74060 (MH).

Notes: This species is closely allied to *K. debilis* (Thwaites) Attigala, Kaththr. & L.G.Clark, and *K. floribunda* by the presence of a well-developed supra-nodal ridge, abaxially hispid culm leaves, and fimbriate culm leaf and foliage leaf sheath summits, but can be differentiated by the presence of irritating golden-brown hairs

on the abaxial surface of the culm leaf sheath, the scaberulous culm internodes, and consistently three stigma. So far, this is the only *Kuruna* species endemic to India (Attigala *et al.*, 2016).

Ochlandra Thwaites,

Enum. Pl. Zeyl. 376. 1864.

Ochlandra travancorica (Bedd.) Gamble, Ann. Roy. Bot. Gard. 7: 125. 1896; Hook.f., Fl. Brit. India 7: 419. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1863. 1934; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 582. 2004. *Beesha travancorica* Bedd., Fl. Sylv. S. India 234. 1873.

Erect shrubby or arborescent reed like bamboo. Root-stock rhizomatous, branched. Culms densely clumped, hollow, covered with culm sheaths; nodes marked with fallen sheath base; internodes 45–130 cm long. Culm sheaths subulate, 15–20 cm long, truncate, bristly at apex, longitudinally wrinkled, striate, with dense appressed golden or black bulbous based hairs when young, glabrous when mature; ligules narrow, entire. Leaves broadly oblong-lanceolate, 9–35 × 5–12 cm, acuminate at apex, truncate, or cuneate at base, glabrous; sheaths tubular, striate, keeled, glabrous, mouth with stiff bristles; ligules short, truncate. Panicles large, sub-verticillate, spicate with a few large fertile spikelets and few small sterile spikelets. Spikelets 3–9 together, oblong-ovate, 5–6 cm long, sessile, striate, glabrous. Glumes 2–5, unequal, ovate-lanceolate, *c.* 5 cm long, mucronate at apex, cuneate at base, puberulous. Florets one, bisexual. Lemmas elliptic-oblong, 4–5 cm long, muticous at apex, cuneate at base, glabrous. Paleas lanceolate, 4–4.5 cm long, acute at apex, cuneate at base, membranous, glabrous, slightly 2-keeled. Stamens Monadelphous, numerous. Ovary narrow, surrounded by perigynium enclosing the style; stigma plumose, 5–6. Caryopsis ovoid-oblong, beaked.

Distribution: S. India (POWO, 2023); *Habitat*: Evergreen and semi-evergreen forests; *Fl. & Ft.*: November-May.

Specimens examined: Edamalayar, 13.12.1988, *Mukthesh Kumar* 6457 (KFRI); Vallakadavu R.F., 19.03.1973, *B.D. Sharma* 43940 (MH).

Notes: It is one of the economically important endemic reed bamboos (Sijimol *et al.*, 2022).

Pseudoxytenanthera Soderstr. & R.P.Ellis,

Smithsonian Contr. Bot. 72: 52. 1988.

Key to the species

1. Nodes not swollen; auricles absent; branches arise from the upper node …….. …….. *P. bourdillonii*

1. Nodes slightly swollen; auricles ear shaped; branches arise from the lower node ……. *P. monadelpha*

Pseudoxytenanthera bourdillonii (Gamble) H.B.Naithani, J. Bombay Nat. Hist. Soc. 87: 440. 1991. *Oxytenanthera bourdillonii* Gamble, Ann. Roy. Bot. Gard. 7: 76. 1896; Hook.f., Fl. Brit. India 7: 403. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1861. 1934; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 583. 2004.

Perennial arborescent straggling bamboo. Rhizomes sympodial, pachymorph, very thick, solid. Culms erect, 15–20 m tall, hollow; nodes not swollen, marked by a nodal ring and a single nodal bud enclosed by prophyllum; internodes 40–60 cm long, pale green, smooth. Culm sheaths striate, 15–35 cm long, coriaceous, hirsute at base, golden yellow; blades foliose in young shoots, triangular, 6–12 × 12–18 cm, mucronate at apex, coriaceous, glabrous; auricles absent; inner ligules membranous, faintly serrate, outer ligule not prominent. Branches arise from the upper nodes, just above the nodal line. Leaves arise on branches and branchlets, lanceolate, 10–25 × 1.5–3.5 cm, acute-acuminate at apex, attenuate at base, glabrous, petiolate; sheaths imbricate, thin, papery, striate, sparsely hirsute, keeled, the tip on each side of the petiole form raised callus; auricles not prominent, oral setae absent; inner ligules serrate, outer very short. Inflorescence a panicle bearing semi-verticillate heads of spikelets on leafy branches, composed of pseudo spikelets. Spikelets 3-flowered, ovate-lanceolate, 1.2–2 cm long, glabrous, shining, almost sessile, supported by 2 bracts at the base. Sterile glumes 3, ovate-lanceolate, 3–9 mm long, mucronate at apex, glabrous, many nerved. Fertile glumes ovate-lanceolate, 10–14 × 2–3 mm, mucronate at apex, cuneate at base, membranous, glabrous, many nerved. Lemmas ovate-lanceolate, 12–14 × 2–3 mm, mucronate at apex, cuneate at base, membranous, glabrous, many nerved. Paleas oblong, 10–12 × 2–2.5 mm, retuse at apex, cuneate at base, thin,

membranous, 3-nerved, 2-keeled, keels strongly ciliate, paleas of the terminal flower not keeled, grooved, ciliate along the groove. Lodicules absent. Stamens 6. Ovary ovate, ciliate, surmounted by a style; stigma 3, plumose. Caryopsis elliptic.

Distribution: India (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: October-March.

Specimen examined: Kurisumala, Kumili, 12.03.1997, *Jomy Augustine* 13057 (KFRI).

Pseudoxytenanthera monadelpha (Thwaites) Soderstr. & R.P.Ellis, Smithsonian Contr. Bot. 72: 52. 1988. *Dendrocalamus monadelphus* Thwaites, Enum. Pl. Zeyl. 376. 1864. *Oxytenanthera monadelpha* (Thwaites) Alston in Trim., Handb. Fl. Ceylon 6: 342. 1931; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 584. 2004; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1861. 1934. *Oxytenanthera thwaitesii* Munro, Trans. Linn. Soc. London 26: 129. 1868; Hook.f., Fl. Brit. India 7: 333. 1896.

Perennial caespitose gregarious bamboo. Rhizomes sympodial, pachymorph, solid. Culms erect, hollow, 7–10 m tall, tip gradually become curved and whip like; nodes slightly swollen; sheath scar very prominent forming a girdle, supranodal ridge not clear, with a single dormant branch bud at each node enclosed inside a prophyllum; internodes 30–35 cm long, hirsute, dull green. Culm sheaths striate, 15–25 × 7–11 cm, coriaceous, ciliate, covered with bulbous based brown hairs, purplish-green, yellowish orange when young; blade reflexed, foliose, lanceolate, 7–12 × 1.2–3 cm, acuminate at apex, truncate at base, glabrous adaxially, sparsely hirsute abaxially, deciduous when old; auricles ear-shaped, falcate, with stiff bristles, oral setae numerous, persistent; inner ligule prominent in large sheaths, short in smaller sheaths, erose, outer ligule not clear. Branches arises from the lower nodes, arise just above the sheath scar, branches numerous, forming semi verticillate clusters on the nodes, whip like. Leaves arise on branches, linear-lanceolate, 4–30 × 0.5–3.2 cm, acuminate at apex, attenuate at base, glabrous, petiolate; sheaths striate, smooth, keeled, tip ends in a callus; auricle prominent, falcate with stiff bristles, bristles deciduous; inner ligule prominent in mature branches, erose, membranous, outer ligule short. Inflorescence a compound spicate panicle on leafy branches, later shed all leaves and the whole plant converted to a huge inflorescence, spikelets arise on the nodes of all branches, composed of pseudo spikelets form semi verticillate clusters or as very large

globose heads. Spikelets 1–3- flowered, ovate-lanceolate, 1–1.4 cm long, acute at apex, supported by two bracts. Sterile glumes 2, ovate-lanceolate, 4–8 mm, mucronate at apex, cuneate at base, stiff, coriaceous, many nerved, hirsute. Fertile glumes ovate-lanceolate, 10–14 × 2–3 mm, mucronate at apex, cuneate at base, membranous, glabrous, many nerved. Lemmas ovate-lanceolate, 10–12 × 3–4 mm, strongly mucronate at apex, cuneate at base, ciliate along the sides and apex, many nerved. Paleas concave, thin, membranous, 8–10 × 2–2.5 mm, slightly bifid at apex, convolute, tip ciliate, 2-keeled, ciliate on the keels. Lodicules absent. Stamens 6. Ovary fusiform, glabrous; stigma 3, plumose. Caryopsis fusiform.

Distribution: India, Sri Lanka and Indo-China (POWO, 2023); *Habitat*: Evergreen and shola forests; *Fl. & Ft.*: February-December.

Specimens examined: Edamalakkudy, 23.02.1995, *Stephen Sequiera & M. Ramesh* 7594; Munnar, 27.07.2000, *M. Ramesh* 20736 (KFRI).

Schizostachyum Nees,

Fl. Bras. Enum. Pl. 2: 535. 1829.

Schizostachyum beddomei (C.E.C.Fisch.) R.B.Majumdar in S.Karthikeyan & al., Fl. Ind. Enum.-Monocot 281. 1989. *Teinostachyum beddomei* C.E.C.Fisch. in Gamble, Fl. Madras 3: 1860. 1934; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 594. 2004.

Perennial semi-scandent bamboo. Rhizomes sympodial, pachymorph. Culms tufted, 10–12 m tall, hollow, erect below, gradually become whip-like terminally and strongly arching; nodes not swollen, sheath scars prominent, a single branch bud enclosed inside prophyllum; internodes cylindrical, 30–50 cm long, pale green, having a white band towards the summit. Culm sheaths 15–40 cm long, truncate at apex, coriaceous, covered with scattered appressed black hairs when young, smooth and striate when old; auricles absent; blades reflexed, linear-lanceolate, 3–5 × 0.1–0.2 cm, acuminate at apex, narrow, striate, sparsely hirsute; inner ligules membranous, entire, fimbriate. Branches arise from the 5th or 6th node, primary branch develops first followed by 2 or 3 lateral secondary branches, additional orders of branches develop to form a cluster of 20–25 branches, the primary branch elongates, become whip-like. Leaves arise on branches, lanceolate, 8–32 × 1.5–4.5 cm, acuminate at apex, attenuate at base, glabrous

adaxially, minute silky pubescence abaxially, petiolate; sheaths striate, glabrous; auricles and oral setae absent; inner ligules very short, outer not prominent. Inflorescence terminal, drooping panicles, arise on short leaf less branches clustered at the nodes, rachilla flat below and becomes thickened upwards, each spike at the base supported by bracts. Spikelets lanceolate, 3–4 fertile flowers and a terminal sterile flower, 4–4.5 cm long, glabrous, disarticulating above glumes. Sterile glumes 1, lanceolate, 8–10 × 2–2.5 mm, mucronate at apex, cuneate at base, coriaceous, faintly hirsute, many nerved. Lemmas ovate-lanceolate, 12–14 × 2–3 mm, mucronate at apex, cuneate at base, glabrous, many nerved. Paleas lanceolate, 10–12 × 2–2.5 mm, obtuse at apex, cuneate at base, membranous, thin, 1-2-nerved, 2-keeled, ciliate on the keels. Lodicules 3. Stamens 6. Ovary globose, tip gradually narrow in to a perigynium enclosing a style; stigma 3, plumose. Caryopsis ovoid, short beaked.

Distribution: India (POWO, 2023); *Habitat*: Moist deciduous and semi-evergreen forests; *Fl. & Ft.*: August-December.

Specimen examined: Lakshmi estate, Munnar, 12.09.1968, *D.B. Deb* 30762 (MH).

Tribe Streptogyneae C.E.Hubb. ex C.E.Calderon & Soderstr.,

Smithsonian Contr. Bot. 44: 18. 1980.

Streptogyna P.Beauv.,

Ess. Agrostogr. 80. 1812.

Streptogyna crinita P.Beauv., Ess. Agrostogr. 80. 1812; Hook.f., Fl. Brit. India 7: 333. 1896; Bor, Grasses Burma, Ceylon, India & Pakistan 649. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 441. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 593. 2004. *S. gerontogaea* Hook.f. in Trim., Handb. Fl. Ceylon 5: 301. 1900; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1854. 1934.

Perennials. Culms tufted, stoloniferous; nodes hairy. Leaves oblong-lanceolate, 10–30 × 0.5–2.5 cm, acuminate at apex, attenuate at base, glabrous, pseudopetiolate; sheaths 5–15 cm long, glabrous. Ligules ovate, membranous. Panicles contracted, spiciform, 10–20 cm long. Spikelets lanceolate, 1–6-flowered, callus hairy. Lower glumes oblong-lanceolate, 10–20 × 3–5 mm, acute at apex, sub-truncate at base, chartaceous, glabrous, 7–9-nerved. Upper glumes elliptic-oblong,

15–25 × 5–6 mm, acuminate at apex, sub-truncate at base, chartaceous, glabrous, 11–13-nerved. Florets 1–6, 2–4 fertile, others reduced. Lemmas linear, narrow, 1–25 mm long, bifid and awned at apex, cuneate at base, convolute, chartaceous, glabrous, 3-nerved; awn 10–20 mm long. Paleas linear, 1–20 mm long, obtuse at apex, cuneate at base, glabrous, 2-nerved. Stamens 2 or 3. Ovary oblong, pubescent at apex; stigma 2, spirally coiled, retrorsely barbed.

Distribution: Tropical Africa, India and Sri Lanka (POWO, 2023); *Habitat*: Evergreen forests; *Fl. & Ft.*: August-December.

Specimen examined: Koruthode, 22.12.1996, *Jomy Augustine* 16983 (CALI).

Notes: The genus *Streptogyna* is represented by only two species *S. crinita* and *S. americana* C.E.Hubb., the latter is distributed in neotropics. *Streptogyna crinita* can be differentiated from *S. americana* by its oblong-lanceolate leaves spaced along the culms, glabrous ligules and retrorsely barbed two stigma (Soderstrom & Judziewicz, 1987).

Tribe Oryzeae Dumort,

Observ. Gramin. Belg. 83. 1824.

Key to the genera

1. Lemmas fertile and sterile, fertile lemmas with two empty scales; tip of pedicels with 2 obscure lips …….. *Oryza*

1. Lemmas fertile, without empty scales; tip of pedicels without lips ……. *Leersia*

Leersia Sw.,

Prodr. Veg. Ind. Occ. 21. 1788, *nom. cons.*

Leersia hexandra Sw., Prodr. Veg. Ind. Occ. 21. 1788; Hook.f., Fl. Brit. India 7: 94. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1845. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 599. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 430. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 843. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 580. 2004.

Perennials. Culms erect or trailing, slender, glabrous; nodes villous. Leaves linear-lanceolate, 8–15 × 0.2–1 cm, acuminate at apex, rounded or cordate at base,

glabrous, green; sheaths 5–7 cm long, glabrous. Ligules ovate, membranous. Panicles lax, 2–10 cm long. Spikelets ovate-oblong, 3–4 mm long, obtuse at apex, pubescent, compressed, cream yellow; pedicels without lips at tip. Glumes reduced to a rim. Lemmas oblong, 3–4 × 1–2 mm, acute at apex, cuneate at base, coriaceous, laterally compressed, scabrid, 5-nerved, keeled, spinulose along the keels. Paleas oblong-linear, 2–3 × 0.8–1 mm, obtuse at apex, cuneate at base, coriaceous, 3-nerved, keeled, ciliate along the keels. Stamens 6. Ovary ovate, 0.3 mm long; stigma plumose, golden yellow.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Wetlands and marshes; *Fl. & Ft.*: August-June.

Specimen examined: Kattappana, 12.02.2019, *Dani Francis & Santhosh Nampy* 176155 (CALI).

Notes: It is a weed, that commonly found in irrigation canals supplying water to low land rice fields in Asia (Heinrichs & Medrano, 1984). It superficially resembles to some species of *Oryza,* but smaller spikelets and slender culms distinguish this species.

Oryza L.,

Sp. Pl. 1: 333. 1753.

Oryza rufipogon Griff., Not. Pl. Asiat. 3: 5. 1851; Bor, Grasses Burma, Ceylon, India & Pakistan 605. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 432. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 583. 2004. **Fig. 31C**

Annuals. Culms tufted, erect; nodes glabrous. Leaves linear-lanceolate, 10–35 × 1–1.5 cm, acuminate at apex, rounded at base, scabrid along margin, green; sheaths compressed, 8–18 cm long, keeled towards apex. Ligules ovate, membranous. Panicles lax, 10–30 cm long. Spikelets oblong, 5–10 mm long, deciduous, reddish brown; pedicels with two obscure lips at tip. Glumes ovate-oblong, unequal, 2–3 mm long, acute at apex, chartaceous, glabrous, 1-nerved, sometimes absent or reduced to a rim. Sterile Lemmas 2, similar, lanceolate, 2.5–3 × 0.8–1 mm, acute at apex, cuneate at base, chartaceous, scabrid, 1-nerved, keeled. Fertile lemmas oblong, 5–9 × 2–3 mm, acute and awned at apex, cuneate at base, coriaceous, scabrous, 5-nerved, keeled, supported by two empty scales; awn 3–7 mm long, straight with a knob like

bulge at base. Paleas oblong, 5–9 × 1–2 mm, apiculate at apex, cuneate at base, scabrous, 1-nerved, 1-keeled. Stamens 6. Ovary oblong; stigma plumose.

Distribution: Tropical and Subtropical Asia and N. Australia (POWO, 2023); *Habitat*: Marshy grasslands; *Fl. & Ft.*: September-March.

Specimen examined: Thannikkudy, 02.01.1995, *Jomy Augustine* 14509 (CALI).

Notes: *Oryza rufipogon* is considered as the ancestor of cultivated rice *O. sativa* L., and can be differentiated by its long awned, readily falling reddish brown spikelets. It is regarded as an excellent fodder (Sreekumar & Nair, 1991).

Tribe Poeae R.Br.,

Voy. Terra Austral. 2: 583. 1814.

Key to the genera

1. Margins of lemmas appressed and superposed to the flanks of the florets above ……..…….. *Briza*

1. Margins of lemmas not appressed and superposed to the florets ……..…… 2

2. Floret callus hairy; ovary glabrous ……..…….. *Poa*

2. Floret callus glabrous; ovary hairy ……..…. *Festuca*

Briza L.,

Sp. Pl. 1: 70. 1753.

Briza minor L., Sp. Pl. 1: 70. 1753; Hook.f., Fl. Brit. India 7: 336. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1849. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 528. 1960; K.M.Matthew, Illustr. Fl. Palni Hills 793. 1996; Essi *et al.*, Ann. Missouri Bot. Gard. 102: 466–519. 2017. **Fig. 29H**

Tufted annuals or short-lived perennials. Culms erect to geniculate, 25–40 cm long; nodes glabrous, brown. Leaves linear-lanceolate, 2–10 × 0.1–0.4 cm, acute or sub-rounded at apex, sub-rounded at base, scabrellate at margins, glabrous, green. Sheaths 2–7 cm long, finely serrulate, continuous with leaves, wing like towards apex. Ligules narrowly lanceolate, 0.8–1 cm long, membranous, hyaline. Panicles erect, 4–8 cm long, pyramidal, effuse. Peduncles 4–8 cm long, glabrous, green. Racemes 2–3 per node, 2–3.5 cm long. Spikelets broadly ovate, pendulous, 2–5 ×

2–4 mm, acute at apex, rounded at base, glabrous, green; pedicels 0.8–2 cm long, thin, sometimes curved at apex, scabrellate. Lower glumes obovate, boat shaped, 2–2.5 × 1.2–1.5 mm, obtuse-sub-rounded at apex, rounded at base, broadly hyaline at margins, glabrous, 3-nerved. Upper glumes obovate, boat shaped, 2–2.3 × 1.5–2 mm, obtuse-sub-rounded and dome like at apex, rounded at base, broadly hyaline at margins, glabrous, 3–5-nerved. Florets 5–8, imbricate. Lemmas broadly ovate, 1.5–2 × 1.8–2 mm, inflexed at apex, rounded at base, chartaceous, broadly winged, 3–7 nerved, gibbous at back, with translucent thick trichomes abaxially, membranous margins appressed and superposed to the flanks of the florets above. Paleas elliptic, 1.5–1.8 × 0.8–1 mm, acute-obtuse at apex, cuneate at base, ciliate, glabrous, slightly 2-keeled, 2-nerved. Lodicules linear, 0.3–0.5 mm long, membranous, hyaline. Stamens 3, 1.1 mm long. Ovary obovate, 0.5 × 0.4 mm, glabrous; style 2.1 mm long; stigma plumose. Caryopsis obovate, 0.8 × 0.6 mm, shallowly furrowed along one side, tightly enclosed by lemmas and paleas.

Distribution: Macaronesia, Medit. and Iran (POWO, 2023); *Habitat*: Marshy and shady areas of hilly tracks; *Fl. & Ft.*: July-March.

Specimen examined: Meesapulimala, 20.11.2018, *Dani Francis & Santhosh Nampy* 167725 (CALI).

Notes: This species can be easily identified by the laterally compressed and trembling spikelets, which is due to the usually curved pedicels. It can be used as an ornamental and forage grass (Essi *et al.*, 2017).

Festuca L.,

Sp. Pl. 1: 67. 1753.

Festuca bromoides L., Sp. Pl. 1: 75. 1753; Kabeer & V.J.Nair, Fl. Tamil Nadu: Grasses 61. 2009.

Annuals. Culms tufted, erect, geniculate; nodes glabrous. Leaves linear, 6–20 × 0.1–0.2 cm, acuminate at apex, rounded at base, pubescent, green; sheaths 3–7 cm long, glabrous. Ligules membranous, hyaline. Panicles spiciform, 1–7 cm long. Spikelets obovate, 10–13 mm long, 3–7-flowered; callus bulged, glabrous. 1 or 2 uppermost florets reduced to lemmas, others bisexual. Lower glumes lanceolate, 2.5–5 × 0.3–0.5 mm, acuminate at apex, truncate at base, chartaceous, glabrous, 1-

nerved, keeled. Upper glumes lanceolate, 4–7 × 0.4–0.6 mm, acuminate at apex, truncate at base, glabrous, 3-nerved. Lemmas oblong-lanceolate, 5–7 × 1–1.2 mm, acuminate and awned at apex, truncate at base, chartaceous, faintly 5-nerved, scabrid along nerves; awns 6–14 mm long. Paleas oblong-lanceolate, 4–6 × 0.4–0.6 mm, acuminate at apex, narrowly truncate at base, chartaceous, scabrid, 2-nerved, 2-keeled. Lodicules 2. Stamen 1. Ovary obovate, hairy; stigma plumose.

Distribution: Macaronesia, Europe to Caucasus, Sahara to Kenya, SW. Cameroon and SW. Arabian Peninsula (POWO, 2023); *Habitat*: Forest margins and grasslands; *Fl. & Ft.*: October-March.

Specimen examined: Pambadum Shola National Park, Banther, 21.12.2018, *Dani Francis & Santhosh Nampy* 167871 (CALI).

Notes: It is an introduced weedy species commonly found in the lawns and roadsides at higher elevations. It is closely allied to *F. myuros* L., but can be differentiated by the well-developed lower glumes that is over half the length of the upper glumes (Kabeer & Nair, 2009).

Poa L.,

Sp. Pl. 1: 67. 1753.

Poa annua L., Sp. Pl. 1: 68. 1753; Hook.f., Fl. Brit. India 7: 345. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1850. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 555. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 406. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 588. 2004. **Fig. 31D**

Annuals. Culms tufted, erect; nodes glabrous. Leaves linear-lanceolate, 1–8 × 0.1–0.5 cm, acute at apex, rounded at base, serrulate, glabrous, green. Sheaths 2–3 cm long, compressed, keeled. Ligules ovate, membranous. Panicles lax, 2–8 cm long. Spikelets ovate-oblong, 3–8 mm long, 3–6-flowered. Lower glumes lanceolate, 1.5–2 × 0.5–1 mm, acuminate at apex, cuneate at base, chartaceous, glabrous, 1-nerved. Upper glumes elliptic-oblong, 2–3 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, 3-nerved. Florets 4–6, similar, callus hairy. Lemmas elliptic, 2.5–3 × 0.8–1 mm, acute at apex, cuneate at base, chartaceous, faintly 5-nerved, keeled,

ciliate along keels and nerves. Paleas oblong-lanceolate, 2–3 × 0.3–0.5 mm, acute at apex, cuneate at base, delicate, glabrous, 2-nerved, 2-keeled, ciliate along keels. Lodicules 2. Stamens 3. Ovary ovate, glabrous; stigma plumose.

Distribution: Temparate Old World to Tropical mountains (POWO, 2023); *Habitat*: Weed in tea estates and road sides; *Fl. & Ft.*: July-April.

Specimens examined: Anamudi Shola National Park, 05.04.2017, *Dani Francis & Santhosh Nampy* 152100; Kannimala way side, 24.01.2018, *Dani Francis & Santhosh Nampy* 158158; Munnar ghat road side, 15.12.2014, *A.K. Pradeep & Thoiba K.* 137579 (CALI); Vaguvarai estate, 29.08.1980, *P.V. Sreekumar* 68425; *Ibid*., 27.08.1980, *P.V. Sreekumar* 67796 (MH).

Notes: *Poa annua* is commonly known as 'annual blue grass' and is considered as the second most troublesome weed of all grass crops. The specific epithet refers to its annual habit, but it also has a perennial habit (Carrol *et al.*, 2022).

Tribe Aveneae Dumort,

Observ. Gramin. Belg. 82. 1824.

Key to the genera

1. Spikelets with one floret …….. *Agrostis*

1. Spikelets with 2-many florets …… 2

2. Panicles contracted; spikelets 6–8 mm long; lower florets male or barren ……..
…….. *Anthoxanthum*

2. Panicles lax; spikelets 10–12 mm long; lower florets bisexual …… *Trisetopsis*

Agrostis L.,

Sp. Pl. 1: 61. 1753, *nom. cons.*

Agrostis pilosula Trin., Mem. Acad. Imp. Sci. Saint-Petersbourg, Ser. 6, Sci. Math. Seconde Pt. Sci. Nat. 6(2): 372. 1841; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1810. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 388. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 324. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 549. 2004. *Calamagrostis pilosula* (Trin.) Hook.f., Fl. Brit. Ind. 7: 263. 1896. *Agrostis pilosula* var.

filifolia Bor, Kew Bull. 9: 459. 1954; Bor, Grasses Burma, Ceylon, India & Pakistan 389. 1960; K.M.Matthew, Illustr. Fl. Palni Hills 779. 1996.

Annuals or perennials. Culms tufted, erect; nodes glabrous. Leaves linear, 2–12 × 0.1–4 cm, acuminate at apex, rounded at base, pubescent; sheaths 3–5 cm long, keeled, glabrous. Ligules fimbriate, ovate, membranous. Panicles lax, 3–25 cm long. Spikelets elliptic-lanceolate, 2–3 mm long, 1-flowered. Lower glumes lanceolate, 2–3 × 0.5–1 mm, acute at apex, cuneate at base, chartaceous, glabrous, 1-nerved, keeled, keel scabrid. Upper glumes lanceolate-oblong, 2–2.5 × 0.5–1 mm, acute at apex, cuneate at base, chartaceous, glabrous, 1–3-nerved, keeled, keel scabrid. Lemmas oblong-lanceolate, 1.5–2 × 0.5–1 mm, notched and awned at apex, cuneate at base, chartaceous, villous, 5-nerved; awn 3–6 mm long. Paleas oblong, 0.5–1 × *c.* 0.2 mm, truncate at apex, cuneate at base, delicate, hyaline, glabrous, nerveless. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Indian Subcontinent to China (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-January.

Specimens examined: Anamudi Shola National Park, 25.01.2018, *Dani Francis & Santhosh Nampy* 158281; *Ibid*., 25.01.2018, *Dani Francis & Santhosh Nampy* 158277; Kannimala way side, 24.01.2018, *Dani Francis & Santhosh Nampy* 158159; Meesapulimala, 21.11.2018, *Dani Francis & Santhosh Nampy* 167756; *Ibid*., 21.11.2018, *Dani Francis & Santhosh Nampy* 167776; way to Rhodomansion, Meesapulimala, 21.11.2018, *Dani Francis & Santhosh Nampy* 167783 (CALI).

Notes: This species is allied to *A. peninsularis* Hook.f., but can be distinguished by the smaller spikelets, hairy lemmas, and the paleas that are less than half the length of lemmas (Sreekumar & Nair, 1991).

Anthoxanthum L.,

Sp. Pl. 1: 28. 1753.

Anthoxanthum borii S.K.Jain & Pal, J. Bombay Nat. Hist. Soc. 72: 92. 1975; Bor, Grasses Burma, Ceylon, India & Pakistan 432. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 349. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 781. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 550. 2004.

Perennials. Culms rhizomatous, erect; nodes glabrous. Leaves linear-lanceolate, 5–30 × 0.5–1.2 cm, acuminate at apex, rounded at base, glabrous or sparsely hairy. Sheaths 3–10 cm long, glabrous or sparsely tubercled hairy. Ligules ovate, membranous, fimbriate. Panicles contracted, 3–10 cm long. Spikelets oblong-lanceolate, 6–8 mm long, glabrous, golden yellow. Lower glumes ovate-lanceolate, 4.5–5 × 1.8–2 mm, acute at apex, cuneate at base, glabrous, 1-nerved, keeled. Upper glumes ovate-lanceolate, 6–8 × 2–3 mm, acuminate at apex, cuneate at base, glabrous, 3-nerved, keeled. Lower florets male or barren. Middle florets neuter. Upper florets bisexual. First lemmas linear-oblong, 5–6 × 1.5–2 mm, bifid and awned at apex, cuneate at base, villous; awn 3–4 mm long, straight. Paleas linear-lanceolate, 4–5 × 0.5–1 mm, obtuse at apex, hyaline, 2-nerved, 2-keeled. Stamens 2 or 3. Second lemmas empty, linear-oblong, 5–6 × 1–1.5 mm, deeply bifid and awned at apex, cuneate at base, villous, faintly 5-nerved; awns geniculate, 8–10 mm long. Third lemmas ovate-oblong, 2–3 × 1.5–2 mm, obtuse at apex, cuneate at base, delicate, hyaline, glabrous, shiny, faintly 3–7-nerved. Paleas elliptic-lanceolate 1.5–2 × 0.4–0.5 mm, obtuse at apex, cuneate at base, delicate, glabrous, 2-nerved, 2-keeled. Lodicules 2, cuneate. Stamens 2 or 3. Ovary oblong; stigma plumose.

Distribution: India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-December.

Specimens examined: Anamudi slopes, 19.11.1965, *B.V. Shetty* 26542 (MH); way to Anamudi base camp, 09.12.2019, *Dani Francis & Santhosh Nampy* 170023 (CALI); Eravikulam, 25.08.1980, *P.V. Sreekumar* 67786; northern slope of Eravikulam, 03.12.1987, *P. Bhargavan* 87315 (MH); way to Honeymoon cottage, 20.11.2018, *Dani Francis & Santhosh Nampy* 167740; Meesapulimala, 21.11.2018, *Dani Francis & Santhosh Nampy* 167755; *Ibid*., 15.10.2019, *Dani Francis & Santhosh Nampy* 170378; Mesthirikettu, Lakkam, 30.12.2017, *Dani Francis & Santhosh Nampy* 158062; near Subranshed, Pettimudi, 30.12.2019, *Dani Francis & Santhosh Nampy* 170058 (CALI); Umayamala, 20.11.1965, *B.V. Shetty* 26563 (MH).

Notes: One specimen from Anamudi base camp differs significantly from the other collections in having loosely arranged, 1 or 2-branched inflorescence, second lemmas with retuse apex and no arista, and paleas with a single nerve.

Trisetopsis Roser & A.Wolk,

Schlechtendalia 25: 57. 2013.

Trisetopsis virescens (Nees ex Steud.) Roser & A.Wolk, Taxon 66: 38. 2017. *Trisetum virescens* Nees ex Steud., Syn. Pl. Glumac. 1: 226. 1854. *Helictotrichon virescens* (Nees ex Steud.) Henrard, Blumea 3: 425. 1940; Bor, Grasses Burma, Ceylon, India & Pakistan 439. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 351. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 574. 2004.

Perennials. Culms tufted, erect, glabrous; nodes glabrous or sparsely hairy. Leaves linear, 8–30 × 0.2–0.5 mm, acuminate at apex, attenuate at base, glabrous or puberulous; sheaths 5–12 cm long, villous towards apex. Ligules ovate, membranous. Panicles lax, 10–20 cm long. Spikelets elliptic-lanceolate, 10–12 × 3–4 mm, 2–3-flowered, greenish yellow. Lower glumes lanceolate, 6–8 × 1–2 mm, acuminate at apex, cuneate at base, chartaceous, scaberulous, 3-nerved. Upper glumes elliptic-lanceolate, 8–10 × 2–3 mm, acuminate at apex, cuneate at base, chartaceous, scaberulous, 3–5-nerved. Lower florets bisexual. Upper florets bisexual. Lemmas ovate-lanceolate, 8–10 × 2–3 mm, notched and awned at apex, cuneate at base, coriaceous, slightly muricate, 5–7-nerved; awns recurved, 10–14 mm long; lobes acuminate at apex. Paleas linear-oblong, 5–6.1 × 1–1.5 mm, obtuse and sparsely fimbriate at apex, cuneate at base, delicate, hyaline, 2-nerved, 2-keeled; keels ciliate towards apex. Stamens 3. Ovary ovate, densely hirsute at apex; stigma plumose.

Distribution: Pakistan to China (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-December.

Specimens examined: Anamudi, 11.12.2019, *Dani Francis & Santhosh Nampy* 164565; Meesapulimala, 21.11.2018, *Dani Francis* & *Santhosh Nampy* 167754 (CALI); Umayamala, 20.11.1965, *B.V. Shetty* 26565 (MH).

Tribe Centotheceae Ridl.,

Mat. Fl. Malay. Penins. 3: 122. 1907.

Centotheca Desv.,

Nouv. Bull. Sci. Soc. Philom. Paris 2: 189. 1810.

Centotheca lappacea (L.) Desv., Nouv. Bull. Sci. Soc. Philom. Paris 2: 189. 1810; Hook.f., Fl. Brit. India 7: 332. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1848. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 457. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 354. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 558. 2004. *Cenchrus lappaceus* L., Sp. Pl. ed. 2. 2: 1488. 1763.

Stoloniferous perennials. Culms erect, puberulous; nodes hairy. Leaves elliptic-lanceolate, 7–10 × 1.2–1.5 cm, narrowly acute-acuminate at apex, cuneate at base, serrulate, puberulous, tessellately nerved; sheaths terete, 3–4.3 cm long, ciliate. Ligules ovate-truncate, membranous, hyaline. Panicles lax, 6–30 cm long. Spikelets oblong, 4–8 × 1–1.5 mm, 2–3-flowered, branches alternate, each branch bearing compactly arranged spikelets; pedicels 3–7 mm long, scabrous. Lower glumes ovate-oblong, 2.5–3 × 1–1.5 mm, mucronate at apex, truncate at base, puberulous at margins, scabrous along the midvein, coriaceous, 5-nerved, 2-keeled, scabrid on keels. Upper glumes ovate, 3–3.5 × 1–1.2 mm, mucronate at apex, truncate at base, scabrous on midveins, sub-coriaceous, 5-nerved, 2-keeled. Lower florets bisexual. Upper florets bisexual, with a short stalk, sparsely scabrous. Third florets sterile, not hairy at the base. First lemmas ovate-elliptic, 4–5 × 1–1.5 mm, aristate at apex, truncate at base, puberulous-glabrous, 8–9-nerved. Paleas narrowly elliptic, 3–3.5 × 0.5–0.7 mm, acute at apex, cuneate at base, 2-nerved, scabrous along the veins, coriaceous, 2-keeled. Second lemmas elliptic-oblong, 3–4 × 1–1.4 mm, aristate at apex, cuneate at base, with tubercled hairs from the middle to apex, 5–7-nerved. Paleas narrowly elliptic, 3–3.1 × 0.2–0.5 mm, acute at apex, cuneate at base, 2-nerved, nerves scabrous, 2-keeled. Lodicules 2, obovate, glabrous. Stamens 3. Ovary oblong; stigma, plumose. Caryopsis elliptic-obovate, *c.* 1.4 × 0.4 mm, smooth.

Distribution: W. and W. Central Tropical Africa, Madagascar, Tropical and Subtropical Asia to Pacific (POWO, 2023); *Habitat*: Forest margins; *Fl. & Ft.*: July-March.

Specimens examined: Mlappara, Periyar Tiger Reserve, 08.07.1993, *Jomy Augustine* 12123; way to Mamalakandam, 27.12.2017, *Dani Francis & Santhosh Nampy* 156525; *Ibid.,* 27.12.2017, *Dani Francis & Santhosh Nampy* 156534 (CALI); Narakathode, 18.12.1988, *P. Bhargavan* 89985 (MH); Pambla dam way side, 08.03.2017, *Dani Francis & Santhosh Nampy* 152029 (CALI).

Notes: This species is often confused with *Lophatherum gracile* Brongn., but can be differentiated by the lemmas without an awn and the tubercled bristly hairs along the margin.

Tribe Arundineae Dumort,

Observ. Gramin. Belg. 82. 1824.

Zenkeria Trin.,

Linnaea 11: 150. 1837.

Key to the species

1. Leaves linear-lanceolate; lower glumes 1–1.5 mm long; ovary ovate... *Z. elegans*

1. Leaves ovate-elliptic; lower glumes 2–3 mm long; ovary elliptic ….. *Z. sebastinei*

Zenkeria elegans Trin., Linnaea 11: 150. 1837; Hook.f., Fl. Brit. India 7: 270. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1805. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 482. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 363. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 596. 2004.

Perennials. Culms densely tufted, erect; nodes glabrous or hairy. Leaves flat or convolute, linear-lanceolate, 5–45 × 0.1–0.5 cm, acute-acuminate at apex, rounded at base, glabrous or puberulous; sheaths 5–12 cm long, glabrous or villous. Ligules a tuft of hairs. Panicles lax, densely spiculate, 6–28 cm long. Spikelets lanceolate, 3–4 mm long, 2-flowered. Lower glumes ovate-lanceolate, 1–1.5 × 0.4–0.5 mm, obtuse at apex, cuneate at base, glabrous, 1-nerved. Upper glumes ovate-lanceolate, 1.5–2 × 0.5–1 mm, obtuse at apex, cuneate at base, glabrous, 1-nerved. Lemmas ovate-lanceolate, 3–4 × 1–1.5 mm, acuminate at apex, villous, 5-nerved. Paleas elliptic-lanceolate, 2.5–3 × 0.8–1 mm, acute at apex, cuneate at base, delicate, hyaline, 2-nerved, 2-keeled, villous. Stamens 3. Ovary ovate; stigma plumose.

Distribution: India (POWO, 2023); *Habitat*: Open lands; *Fl. & Ft.*: May-December.

Specimen examined: Way side in Kanthallur, 23.06.2018, *Dani Francis & Santhosh Nampy* 159360 (CALI).

Zenkeria sebastinei A.N.Henry & Chandrab., Bull. Bot. Surv. India 15(1-2): 142. 1976; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 596. 2004.

Perennials. Culms densely tufted, erect; nodes hairy. Leaves ovate-elliptic, 4–30 × 0.5–2 cm, acute and tapering at apex, tapering at base, rigid, coriaceous, sparsely hairy; sheaths 5–12 cm long, glabrous, basal ones breaking up into fibres. Ligules a tuft of hairs. Panicles lax, 5–15 cm long. Spikelets elliptic-lanceolate, 4–5 mm long, 2-flowered. Lower glumes ovate-lanceolate, 2–3 × 0.8–1 mm, acute at apex, cuneate at base, puberulous, 1–3-nerved, keeled, keel ciliate. Upper glumes ovate-lanceolate, 3–4 × 1–1.5 mm, acute at apex, cuneate at base, puberulous, 1–3-nerved. Lemmas ovate-lanceolate, 4–5 × 1–1.5 mm, acute-acuminate at apex, cuneate at base, densely villous, 5–7-nerved. Paleas lanceolate, 2–3 × 0.5–1 mm, acute at apex, cuneate at base, delicate, hyaline, 2-nerved, 2-keeled, ciliate along the keels. Lodicules 2. Stamens 3. Ovary elliptic; stigma plumose.

Distribution: India (Kerala) (POWO, 2023); *Habitat*: Crevices of moist rocks; *Fl. & Ft.*: August-December.

Specimen examined: Way to Cholamala, Nallathannikallar, Munnar, 16.09.2018, *Dani Francis & Santhosh Nampy* 161935 (CALI).

Tribe Aristideae C.E.Hubb.

in Bor, Grasses Burma, Ceyl. Ind. & Pakist. 685. 1960.

Aristida L.,

Sp. Pl. 1: 82. 1753.

Aristida adscensionis L., Sp. Pl. 1: 82. 1753; Hook.f., Fl. Brit. Ind. 7: 224. 1896; Bor, Grasses Burma, Ceylon, India & Pakistan 407. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 326. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 551. 2004. *Aristida depressa* Retz., Observ. Bot. 4: 22. 1786; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1809. 1934.

Annuals or perennials. Culms tufted, erect or geniculate; nodes glabrous. Leaves linear, 1–25 × 0.1–0.4 cm, acuminate at apex, rounded at base, ciliate, glabrous,

green; sheaths 3–7 cm long, glabrous. Ligules membranous, fimbriate. Panicles flabelliform, 3–20 cm long, contracted. Spiketes linear-lanceolate, 5–10 mm long; callus sparsely hairy. Lower glumes oblong-lanceolate, 4–5.5 × 0.5–1 mm, acuminate and shortly aristate at apex, cuneate at base, chartaceous, glabrous, 1–nerved, keeled. Upper glumes linear-lanceolate, 6–10 × 0.5–1 mm, acuminate at apex, cuneate at base, chartaceous, scabrous or glabrous, 1-nerved, keeled. Lemmas linear-oblong, 7–10 × 0.5–1 mm, laterally compressed, convolute, 3-awned at apex, rounded at base, infolded at margins, 3-nerved, scabrid on keel; awns 3, 5–20 mm long. Paleas oblanceolate, *c.* 1 × 0.4 mm, minute, hyaline, glabrous, nerveless. Stamens 3. Ovary elliptic; stigma plumose.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Grasslands and waste lands; *Fl. & Ft.*: February-August.

Specimen examined: Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 176177 (CALI).

Tribe Eragrostideae Stapf,

Fl. Cap. 7(2): 316. 1898.

Key to the genera

1. Spikelets with one fertile floret, sunk in the rachis of raceme …… *Oropetium*

1 Spikelets with more than one fertile floret, not sunk in the rachis …….. 2

2. Paleas 2-keeled …….. 3

2. Paleas not keeled ……. *Sporobolus*

3. Inflorescence a spike ……. 4

3. Inflorescence a panicle …….. 7

4. Spikes 2-many, digitate or sub-digitate …….. 5

4. Spikes solitary, never digitate or sub-digitate …….. 6

5. Lemmas aristate or awned; axis of spikes terminating in a sharp point ……..
……. *Dactyloctenium*

5. Lemmas not aristate or awned; axis of spikes terminating in a spikelet ……..
…….. *Eleusine*

6. Lemmas 2–4-lobed at apex, often awned ……. *Tripogon*

6. Lemmas entire at apex, not awned …….. *Eragrostiella*

7. Nerves on the lemmas hairy; lemmas often lobed or toothed …….. *Trigonochloa*

7. Nerves on the lemmas glabrous; lemmas entire …….. *Eragrostis*

Dactyloctenium Willd.,

Enum. Pl. 1029. 1809.

Dactyloctenium aegyptium (L.) Willd., Enum. Pl. 1029. 1809; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1840. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 489. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 367. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 562. 2004. *Cynosurus aegyptius* L., Sp. Pl. 1: 72. 1753. *Eleusine aegyptia* (L.) Desf., Fl. Atlant. 1: 85. 1798; Hook.f., Fl. Brit. India 7: 295. 1896.

Fig. 30C

Annuals. Culms creeping or geniculate, rooting at nodes; nodes glabrous. Leaves oblong-lanceolate, 2–20 × 0.2–0.5 cm, acuminate or obtuse at apex, rounded at base, hispid, green; sheaths 2–4 cm long, keeled, glabrous, pubescent towards apex. Ligules ovate, membranous, fimbriate at apex. Spikes digitate, 1–6, 2–6 cm long, axis of spikes terminating in a sharp point. Spikelets ovate, 2–4 mm long, 3–4-flowered. Lower glumes boat shaped, 1.5–2 × 1–1.5 mm, acute at apex, cuneate at base, keeled, keel minutely winged, scabrous. Upper glumes ovate-elliptic, 1.5–3 × 1–1.5 mm, aristate at apex, cuneate at base, keeled, keel minutely winged, scabrous. Lemmas ovate-lanceolate, 1.5–2.5 × 1–1.5 mm, acuminate-shortly aristate at apex, cuneate at base, keeled, keel scabrous. Paleas ovate-lanceolate, 1–1.5 × 1 mm, acuminate at apex, cuneate at base, glabrous, keeled. Stamens 3. Ovary ovate; stigma plumose. Caryopsis obovate, transversely rugose.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Open areas; *Fl. & Ft.*: Throughout the year.

Specimens examined: Thekkady, 03.08.1994, *Jomy Augustine* 13833; Thommankuthu waterfalls, 10.12.2016, *Dani Francis & Santhosh Nampy* 151330 (CALI).

Notes: It is a highly variable annual weed, with characteristically short stoloniferous, geniculately ascending culms and linear or oblanceolate spikes radiating in a star-like pattern. The number of spikes can vary greatly (Sreekumar & Nair, 1991).

Eleusine Gaertn.,

Fruct. Sem. Pl. 1: 7. 1788.

Eleusine indica (L.) Gaertn., Fruct. Sem. Pl. 1: 8. 1788; Hook.f., Fl. Brit. India 7: 293. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1839. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 493. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 371. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 568. 2004. *Cynosurus indicus* L., Sp. Pl. 1: 72. 1753.

Annuals. Culms tufted, erect; nodes glabrous. Leaves linear-lanceolate, 1–30 × 0.1–0.5 cm, acuminate at apex, shallowly cordate at base, glabrous, green; sheaths 3–5 cm long, keeled, glabrous, pubescent towards apex. Ligules membranous, truncate. Spikes digitate or sub-digitate, 1–15, 2–12 cm long, axis of spikes terminating in a spikelet. Spikelets oblong-lanceolate, 4–6 mm long, 3–6-flowered. Lower glumes oblong, 1.5–2 × 0.5–1 mm, acute at apex, cuneate at base, glabrous, 3-nerved, keeled, keels scabrid. Upper glumes oblong, 2–3 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, 5-nerved, keeled. Lemmas ovate-lanceolate, 2–3 × 1.5–2 mm, acute at apex, cuneate at base, chartaceous, 3-nerved. Paleas oblong-elliptic, 2–2.5 × 0.5–1 mm, acute at apex, cuneate at base, delicate, glabrous, 2-nerved, 2-keeled. Stamens 3. Ovary elliptic; stigma plumose. Caryopsis ovate, transversely rugose.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Waste lands and cultivated lands; *Fl. & Ft.*: Throughout the year.

Specimens examined: Kudimala-Lakkamkudi, 09.12.2019, *Dani Francis & Santhosh Nampy* 164695 (CALI); Kulamavu, 24.09.1982, *C.N. Mohanan* 71963 (MH); Mathikettan Shola National Park, 23.08.2014, *Syam Radh S.* 143508 (CALI); Meenmutty, 11.06.1983, *A.G. Pandurangan* 76692 (MH).

Notes: It is an annual weed that grows in waste lands and road sides, and is considered as a natural hub for both food and medicine (Zakri *et al.*, 2021).

Eragrostiella Bor,

Indian Forester 66: 269. 1940.

Key to the varieties

1. Leaves narrow, pallid, filiform, never reaching the base of spikes; spikelets olive green to straw coloured or leaden green …….. *E. bifaria* var. *bifaria*

1. Leaves narrow rolled or convolute, almost reaching to the base of spikes; spikelets leaden green …….. *E. bifaria* var. *secunda*

Eragrostiella bifaria var. **bifaria** (Vahl) Bor, Indian Forester 66: 270. 1940, Grasses Burma, Ceylon, India & Pakistan 494. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 374. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 569. 2004. *Poa bifaria* Vahl., Symb. Bot. 2: 19. 1791. **Fig. 29F**

Perennials. Culms tufted, geniculate; nodes glabrous, 1–2-noded. Leaves narrow, pallid, filiform, 5–20 × 0.1–0.2 cm, attenuate at apex, attenuate at base, pubescent; sheaths 3–9 cm long, ciliate towards apex. Ligules membranous with long ciliate hairs. Spikes compactly arranged, 10–25 cm long, with alternate sessile spikelets. Spikelets narrow, ovate-lanceolate, 6–20 mm long, 5–20-flowered, pallid, olive green to straw coloured or leaden green. Lower glumes lanceolate, 2–5 × 0.5 –1 mm, acute at apex, cuneate at base, chartaceous, glabrous, 1-nerved, 1-keeled, keel serrulate. Upper glumes ovate-lanceolate, 2.5–5 × 0.5–1 mm, acute-acuminate at apex, cuneate at base, chartaceous, glabrous, 1-nerved, 1-keeled, keel scabrid. Lemmas ovate-lanceolate, 2–3 × 1.2–1.7 mm, acute or obtuse at apex, cuneate at base, muticous, punctuate, caducous, glabrous, 3-nerved. Paleas ovate-elliptic, 1.8–2 × 0.8–1 mm, acute at apex, cuneate at base, sub-persistent, puberulous, 2-nerved, 2-keeled, keel ciliate. Stamens 3. Ovary globose; stigma plumose.

Distribution: Ethiopia to Tanzania, Indian Subcontinent to Indo-China and Queensland (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-January.

Specimens examined: Chinnar, 27.01.2018, *Dani Francis & Santhosh Nampy* 158346; Pius Nagar, Kanthallur, 13.11.2012, *Thoiba K.* 134402 (CALI).

Notes: This variety is characterized by narrow, pallid, usually very long spikelets with numerous florets at the mature stage (Thoiba, 2018).

Eragrostiella bifaria var. **secunda** (Nees ex Steud.) Lazarides, Contr. Herb. Austral. 22: 6. 1976. *Eragrostis secunda* Nees ex Steud., Syn. Pl. Glumac 1: 264. 1854; Stapf in Hook.f., Fl. Brit. India 7: 326. 1896; Hook.f. in Trim., Handb. Fl. Ceylon 5: 298. 1900; Bor, Grass. Burma Ceylon India Pakistan 495. 1960. *Eragrostiella secunda* (Nees ex Steud.) Bor, Indian Forester 66: 270. 1940; Bor, Grass. Burma Ceylon India Pakistan 495. 1960.

Perennials. Culms tufted, geniculate; nodes glabrous, 1–2-noded. Leaves linear-lanceolate, 5–20 × 0.2–0.3 cm, attenuate at base and apex, narrow rolled or convolute, pubescent, almost reaching to the base of spikelets; sheaths 3–10 cm long, ciliate towards apex. Ligules membranous with long ciliate hairs. Spikes compactly arranged, 10–25 cm long, with alternate sessile spikelets. Spikelets ovate-lanceolate, 9–20 mm long, 5–20-flowered, leaden green, strongly compressed, closely imbricate. Lower glumes lanceolate, 3–5 × 0.5 –1 mm, acute to acuminate at apex, cuneate at base, chartaceous, glabrous, 1-nerved, 1-keeled, keel serrulate. Upper glumes ovate-lanceolate, 3–5.5 × 0.5–1 mm, acute-acuminate at apex, cuneate at base, chartaceous, glabrous, 1-nerved, 1-keeled, keel scabrid. Lemmas ovate-lanceolate, 2–3 × 1–2 mm, acute at apex, cuneate at base, muticous, punctuate, caducous, glabrous, 3-nerved. Paleas ovate-elliptic, 2–2.8 × 1–1.5 mm, acute at apex, cuneate at base, sub-persistent, puberulous, 2-nerved, 2-keeled, keel broadly winged, ciliate. Stamens 3. Ovary globose; stigma plumose.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-February.

Specimens examined: Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 188817; way to Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 175914; Ramakkalmedu, 16.12.2014, *Thoiba K. & A.K. Pradeep* 137585; Kumarikulam, Periyar Tiger Reserve, 09.01.1994, *Jomy Augustine* 13079 (CALI).

Notes: This variety can be distinguished from the typical variety by narrow rolled or convolute leaves that almost reaching to the base of spikelets and leaden green spikelets (Thoiba, 2018).

Eragrostis Wolf.,

Gen. Pl. 23. 1776.

Key to the species

1. Spiklets breaking up from above downwards 2

1. Spikelets breaking up from below upwards 3

2. Plants viscid ..... *E. viscosa*

2. Plants not viscid ..... *E. amabilis*

3. Plants glandular 4

3. Plants eglandular 6

4. Lowest branches of panicles fascicled or whorled, axis pilose ..... *E. Pilosa*

4. Lowest branches of panicles alternate, axis not pilose 5

5. Lower glumes nerveless; lemmas broadly elliptic, acute at apex .....
..... *E. maderaspatana*

5. Lower glumes 1-nerved; lemmas broadly ovate, obtuse at apex ..... *E. minor*

6. Spikelets olive green to purple tinged 7

6. Spikelets leaden green or blackish 9

7. Lemmas 2–3 mm long; stamens 3 ..... *E. cilianensis*

7. Lemmas 1.5–2 mm long; stamens 2 or 3 8

8. Panicles primary branches with *c.* 15 or more spikelets; stamens 2 .....
..... *E. unioloides*

8. Panicles primary branches with *c.* 10 spikelets; stamens 3 ..... *E. collinensis*

9. Panicles effuse-lax or drooping ..... *E. nigra*

9. Panicles contracted or densely spiculate ..... *E. tenuifolia*

10. Paleas deciduous 11

10. Paleas persistent ..... *E. nutans*

11. Ligules a fringe of hairs ..... *E. paniciformis*

11. Ligules a ciliate rim 12

12. Stamens 2 ..... *E. gangetica*

12. Stamens 3 ..... *E. atrovirens*

Eragrostis amabilis (L.) Wight & Arn., Cat. Indian Pl. 2: 105. 1834; Hook.f., Fl. Brit. India 7: 315. 1896; Bor, Grass. Burma Ceylon India Pakistan 513. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 390. 1991. *Poa amabilis* L., Sp. Pl. 1: 68. 1753.

Fig. 29B

Perennials. Culms tufted; nodes glabrous. Leaves linear-lanceolate, 5–15 × 0.5–1 cm, acuminate at apex, slightly cordate at base, pubescent, green; sheaths 5–15 cm long, with tubercled hairs along the margin, ciliate towards apex. Ligules ciliate rim. Panicles effuse, 5–20 cm long, branches alternate, branch node long villous. Spikelets ovate, 2–3.5 mm long, 4–8-flowered, florets disarticulated from above downwards. Lower glumes oblong-lanceolate, 0.5–0.7 × 0.4–0.6 mm, obtuse at apex, cuneate at base, puberulous, 1-nerved, 1-keeled, keel scaberulous. Upper glumes lanceolate, 0.5–1 × 0.4–0.5 mm, obtuse at apex, cuneate at base, puberulous, 1-nerved, 1-keeled, keel serrulate. Lemmas ovate-lanceolate, 0.8–1.3 × 0.5–0.7 mm, acute or emarginate at apex, cuneate at base, deciduous, chartaceous, glabrous, 3-nerved, 1-keeled. Paleas elliptic-lanceolate, 0.5–1 × 0.4–0.6 mm, acute at apex, cuneate at base, winged, puberulous, 2-nerved, 2-keeled, keel ciliate. Stamens 3. Ovary globose; stigma plumose.

Distribution: India (POWO, 2023); *Habitat*: Cultivated fields; *Fl. & Ft.*: July-February.

Specimens examined: Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 188847; *Ibid*., 09.02.2021, *Dani Francis & Santhosh Nampy* 188805; Kumali, Theni Road, 10.08.2017, *C.N. Sunil & Thoiba K.* 4916 (CALI).

Eragrostis atrovirens (Desf.) Trin. ex Steud., Nomencl. Bot. ed. 2. 1: 562. 1840; Bor, Grass. Burma Ceylon India Pakistan 503. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 377. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 569. 2004. *Poa atrovirens* Desf., Fl. Atlant. 1: 73. 1798. **Fig. 29A**

Perennials. Culms tufted; nodes glabrous. Leaves linear-lanceolate, 10–35 × 0.5–2 cm, acute-acuminate at apex, shallowly cordate at base, glabrous, green; sheaths 5–15 cm long, slightly keeled. Ligules membranous with a ciliate rim. Panicles effuse-lax, 10–40 cm long, branches alternate. Spikelets ovate-lanceolate, 4–6 mm long, 5–40-flowered, florets disarticulated from below upwards; rachilla stout,

persistent; internodes winged, ribbed. Lower glumes lanceolate, 1.2–2 × 0.8–1.5 mm, obtuse at apex, cuneate at base, glabrous, 1-nerved, 1-keeled. Upper glumes lanceolate, 1.5–2.5 × 0.8–1.2 mm, obtuse at apex, cuneate at base, glabrous, 1-nerved, 1-keeled. Lemmas ovate-lanceolate, 1.5–3 × 0.5–2 mm, acute at apex, cuneate at base, deciduous, chartaceous, glabrous, 3-nerved. Paleas elliptic-lanceolate, 2–3 × 1–2 mm, acute at apex, cuneate at base, winged, puberulous, 2-nerved, 2-keeled, keel scaberulous. Stamens 3. Ovary globose; stigma plumose.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Wetlands; *Fl. & Ft.*: Throughout the year.

Specimens examined: Devikulam, 16.12.2014, *Thoiba K.* 137586; *Ibid*., 16.12.2014, *Thoiba K.* 137582; Idukki Wildlife Sanctuary, 05.08.2017, *Dani Francis & Santhosh Nampy* 154182; Kannadippara, near waterfall, 08.06.2018, *Dani Francis & Santhosh Nampy* 159287; Mattupetty, 15.12.2014, *Thoiba K.* 137567; *Ibid*., 12.12.2014, *Thoiba K.* 137575; Moolamattam, 30.10.2021, *Dani Francis & Santhosh Nampy* 176552; Thannikkudy, 25.03.1994, *Jomy Augustine* 14155; Thekkady, Nellikkampetty range, 14.07.2017, *Dani Francis & Santhosh Nampy* 152866; way to Vellathooval, 11.12.2016, *Dani Francis & Santhosh Nampy* 151409 (CALI).

Notes: The blue-green and glaucous appearance of this species makes it easy to identify from the field. The persistent and stout rachilla with winged and ribbed internodes, florets falling entire upwards, and paleas with relatively short entirely scaberulous keels are distinguishing features of this species (Thoiba, 2018).

Eragrostis cilianensis (All.) Vignolo ex Janch., Mitt. Naturwiss. Vereins Univ. Wien 5: 110. 1907; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1820. 1934; Bor, Grass. Burma Ceylon India Pakistan 503. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 379. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 822. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 569. 2004. *Poa cilianensis* All., Fl. Pedem. 2: 246. 1785.

Annuals. Culms tufted, erect or geniculate; nodes glabrous. Leaves linear-lanceolate, 5–20 × 0.3–0.7 cm, acute-acuminate at apex, slightly cordate at base, villous, green; sheaths 5–8 cm long, keeled, ciliate towards apex. Ligules tuft of hairs. Panicles effuse, open, 5–30 cm long. Spikelets ovate-oblong, 5–20 mm long, 5–40-flowered, florets disarticulated from below upwards. Lower glumes

lanceolate, 2–2.5 × 0.5–1 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled. Upper glumes ovate-lanceolate, 2.2–2.6 × 0.5–1 mm, acute at apex, cuneate at base, glabrous, 3-nerved, 1-keeled. Lemmas oblong-lanceolate, 2–3 × 1–1.5 mm, acuminate at apex, cuneate at base, deciduous, chartaceous, ciliate, glabrous, 3-nerved, minutely keeled. Paleas elliptic-oblong, 1–2.5 × 0.5–1 mm, obtuse at apex, cuneate at base, winged, caducous, puberulous, 2-nerved, 2-keeled, keel ciliate. Stamens 3. Ovary globose; stigma plumose.

Distribution: Old World (POWO, 2023); *Habitat*: River beds, foot hills and dry evergreen and deciduous forests; *Fl. & Ft.*: May-December.

Specimen examined: Eravikulam National Park, 15.12.2014, *Thoiba K. & A.K. Pradeep* 137577 (CALI).

Eragrostis collinensis Vivek, G.V.S.Murthy & V.J.Nair, Indian J. Forest. 36: 401. 2013.

Perennials. Culms tufted; nodes glabrous. Leaves linear-lanceolate, 10–25 × 0.5–1 cm, acute-acuminate at apex, slightly cordate at base, pubescent, green; sheaths 3–5 cm long, ciliate towards apex. Ligules a ciliate rim. Panicles open, 5–13 cm long, branches alternate, primary branches with *c.* 10 spikelets. Spikelets ovate-lanceolate, 4–10 mm long, 5–40-flowered, florets disarticulated from below upwards. Lower glumes lanceolate, 1.5–2 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keels scaberulous. Upper glumes lanceolate, 1.5–2 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keel scaberulous. Lemmas elliptic-lanceolate, 1.5–2 × 0.5–2 mm, acute at apex, cuneate at base, deciduous, chartaceous, glabrous, 3-nerved. Paleas elliptic-lanceolate, 1.5–2 × 0.5–1 mm, acute at apex, cuneate at base, winged, puberulous, 2-nerved, 2-keeled, keel scabrid. Stamens 3. Ovary globose; stigma plumose.

Distribution: SW. India (POWO, 2023); *Habitat*: Hilly areas; *Fl. & Ft.*: Throughout the year.

Specimens examined: Anamudi Shola National Park, 25.01.2018, *Dani Francis & Santhosh Nampy* 158275; *Ibid*., 25.01.2018, *Dani Francis & Santhosh Nampy* 158279; Devikulam, 16.12.2014, *Thoiba K.* 137592; *Ibid.,* 16.12.2014, *Thoiba K.* 137587; Eravikulam, 02.05.2017, *Dani Francis & Santhosh Nampy* 152131; *Ibid*.,

s.d., *Thoiba K. & A.K. Pradeep* 144106; Kannadippara, Mankulam, 08.04.2018, *Dani Francis & Santhosh Nampy* 159326; *Ibid*., 08.06.2018, *Dani Francis & Santhosh Nampy* 159263; Mathikettan Shola National Park, 19.12.2016, *Shinoj K. & Thoiba K.* 146767; Mattupetty, 15.12.2014, *Thoiba K.* 137566; Mattupetty, Yellampetty, 16.12.2014, *Thoiba K. & A.K. Pradeep* 137600; *Ibid.,* 16.12.2014, *Thoiba K. & A.K. Pradeep* 137596; Mesthirikettu, 30.12.2017, *Dani Francis & Santhosh Nampy* 158092; Munnar, 06.10.2014, *Alfred Joe* 137534; Parunthanpara, 16.10.2015, *Thoiba K. & A.K. Pradeep* 146615; Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164856; Thannikkudy, Periyar Tiger Reserve, 06.01.1994, *Jomy Augustine* 13077; Thrisangu hills, Peerumedu, 17.10.2015, *Thoiba K. & A.K. Pradeep* 146639; Top station, Mattupetty, 15.12.2014, *Thoiba K. & A.K. Pradeep* 137578; Vagamon, 15.11.2014, *Thoiba K. & A.K. Pradeep* 137549 (CALI).

Notes: *Eragrostis collinensis* is allied to *E. unioloides*, but differs in having the lemmas much longer and erect with straight lateral nerves, wingless keels of the palea and having 3 stamens (Thoiba, 2018).

Eragrostis gangetica (Roxb.) Steud., Syn. Pl. Glumac. 1: 266. 1854; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1826. 1934; Bor, Grass. Burma Ceylon India Pakistan 508. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 380. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 569. 2004. *Poa gangetica* Roxb., Fl. Ind. 1: 341. 1820.

Perennials. Culms tufted, roots fibrous; nodes glabrous. Leaves linear-lanceolate, 5–20 × 0.3–0.4 cm, acute-acuminate at apex, slightly cordate at base, glabrous, green; sheaths 3–10 cm long, slightly keeled. Ligules membranous with a ciliate rim. Panicles lax, open, 6–30 cm long. Spikelets lanceolate, 3–8 mm long, 5–20-flowered, florets disarticulated from below upwards. Lower glumes lanceolate, 0.7–1 × 0.3–0.5 mm, obtuse at apex, cuneate at base, glabrous, 1-nerved, 1-keeled. Upper glumes lanceolate, 1–1.3 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keel scabrid. Lemmas ovate-lanceolate, 1–1.3 × 0.7–1 mm, acute or obtuse at apex, cuneate at base, deciduous, chartaceous, glabrous, 3-nerved. Paleas elliptic-lanceolate, 1–1.2 × 0.5–0.8 mm, acute at apex, cuneate at base, disarticulated, winged, glabrous, 2-nerved, 2-keeled, keel scabrid. Stamens 2. Ovary globose; stigma plumose.

Distribution: Africa and Indian Subcontinent to Borneo (POWO, 2023); *Habitat*: Cultivated fields, road sides and sandy soil; *Fl. & Ft.*: Throughout the year.

Specimen examined: Idukki Wildlife Sanctuary, 05.08.2017, *Dani Francis & Santhosh Nampy* 154182 (CALI).

Notes: This species morphologically close to *E. atrovirens* and *E. nutans*, but can be distinguished by a smaller habit and disarticulated paleas (Thoiba, 2018).

Eragrostis maderaspatana Bor, Grass. Burma, Ceylon, India & Pakistan 509. 1960.

Annuals or short-lived perennials. Culms tufted; nodes glabrous, glandular ring below the node. Leaves linear-lanceolate, 5–8 × 0.2–0.3 cm, acute-acuminate at apex, shallowly cordate at base, with tubercled hairs, green; sheaths 2–6 cm long, glabrous, sparsely long hairy on one margin. Ligules membranous, with a fringe of cilia at apex. Panicles contracted, 6–20 cm long, branches alternate. Spikelets linear-lanceolate, 5–17 mm long, 10–35-flowered, florets disarticulated from below upwards. Lower glumes ovate, 0.5–1.5 × 0.3–0.5 mm, obtuse at apex, cuneate at base, scabrellate, glabrous, nerveless. Upper glumes ovate-lanceolate, 1–1.5 × 0.5–1 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keel scaberulous. Lemmas broadly elliptic, 1–2 × 0.6–1 mm, acute at apex, cuneate at base, deciduous, chartaceous, glabrous, 3-nerved, slightly keeled. Paleas elliptic-oblanceolate, 1.5–1.7 × 0.5–0.8 mm, acute at apex, cuneate at base, minutely winged, glabrous, 2-nerved, 2-keeled, keel ciliate towards apex. Stamens 3. Ovary globose; stigma plumose.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Open areas and road sides; *Fl. & Ft.*: August-May.

Specimen examined: Kumaly, Theni Road, 10.08.2017, *C.N. Sunil & Thoiba K.* 146756 (CALI).

Eragrostis minor Host, Fl. Austriaca 1: 135. 1827; Stapf, in Hook.f., Fl. Brit. India 7: 321. 1896; Sreek. & V.J.Nair, Fl. Kerala-Grasses 383. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 570. 2004. *Eragrostis pooides* P.Beauv., Ess. Agrostogr. 162. 1812, *nom. superfl.*; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1827. 1934; Bor, Grass. Burma Ceylon India Pakistan 512. 1960.

Annuals. Culms tufted; nodes glabrous, with a glandular ring below the node. Leaves linear-lanceolate, 3–10 × 0.3–0.5 cm, acuminate at apex, shallowly cordate at base, pubescent, glands pitted on midnerve, green; sheaths 2–6 cm long, glandular, sparsely long hairy on one margin. Ligules membranous, with a fringe of cilia at apex. Panicles open, dense or effuse, contracted, 5–20 cm long, branches alternate, with 6–9 spikelets. Spikelets linear-lanceolate, 5–15 mm long, 10–45-flowered, florets disarticulated from below upwards. Lower glumes ovate, 0.5–1 × 0.3–0.5 mm, acute at apex, cuneate at base, pubescent, 1-nerved, 1-keeled, keels glandular. Upper glumes oblong-lanceolate, 1–1.5 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keel scaberulous. Lemmas broadly ovate, 1.2–1.5 × 0.7–1 mm, obtuse at apex, cuneate at base, deciduous, glandular, glabrous, 3-nerved, slightly keeled, keels scaberulous. Paleas elliptic-oblanceolate, 1–1.5 × 0.4–0.6 mm, acute at apex, cuneate at base, minutely winged, glabrous, 2-nerved, 2-keeled, keels scabrid. Stamens 3. Ovary globose; stigma plumose.

Distribution: Old World (POWO, 2023); *Habitat*: Grasslands and way sides; *Fl. & Ft.*: June-March.

Specimen examined: Kumaly, Theni Road, 16.10.2015, *Thoiba K. & A.K. Pradeep* 146756 (CALI).

Eragrostis nigra Nees ex Steud., Syn. Pl. Glumac. 1: 267. 1854; Stapf in Hook.f., Fl. Brit. India 7: 324. 1896; Bor, Grass. Burma Ceylon India Pakistan 511. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 384. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 570. 2004.

Perennials. Culms tufted, erect or geniculate; nodes glabrous. Leaves linear-lanceolate, 10–30 × 0.2–0.4 cm, acuminate at apex, slightly cordate at base, sparsely pubescent, green; sheaths 3–15 cm long, keeled, ciliate towards apex. Ligules a fringe of hairs. Panicles effuse-lax or drooping, 15–40 cm long, branches alternate. Spikelets oblong-lanceolate, 3–7 mm long, 3–14-flowered, florets disarticulated from below upwards. Lower glumes ovate-lanceolate, 1–2 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keels scabrid. Upper glumes lanceolate, 1.5–2 × 0.4–0.6 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keel scabrid. Lemmas ovate-lanceolate, 1.5–2.5 × 0.7–1 mm, acute at apex, cuneate at base, deciduous, chartaceous, glabrous, 3-

nerved, 1-keeled, keel scaberulous. Paleas elliptic-ovate, 1–1.5 × 0.3–0.5 mm, acute at apex, cuneate at base, winged, caducous, glabrous, 2-nerved, 2-keeled, keels serrulate. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Caucasus to China and Indo-China (POWO, 2023); *Habitat*: Way sides and forest margins; *Fl. & Ft.*: June-March.

Specimens examined: Anamudi Shola National Park, 25.01.2018, *Dani Francis & Santhosh Nampy* 158274; Chinnar, 22.11.2017, *A.K. Pradeep* 146751; Devikulam, 16.12.2014, *Thoiba K. & A.K. Pradeep* 137594; Mattupetty, Yellampetty, 16.12.2014, *A.K. Pradeep & Thoiba K.* 137597; *Ibid.,* 16.12.2014, *Thoiba K. & A.K. Pradeep* 137598; Meesapulimala, 20.11.2018, *Dani Francis & Santhosh Nampy* 167731; Munnar, 06.10.2014, *Alfred Joe* 137535; Top station, Mattupetty, 15.12.2014, *Thoiba K.* 137568; *Ibid*., 15.12.2014, *Thoiba K. & A.K. Pradeep* 137574; Vandiperiyar, 10.08.2017, *C.N. Sunil & Thoiba K.* 4917 (CALI).

Eragrostis nutans (Retz.) Nees ex Steud., Nomencl. Bot. ed. 2. 1: 563. 1840; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1826. 1934; Bor, Grass. Burma Ceylon India Pakistan 511. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 385. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 570. 2004. *Poa nutans* Retz., Observ. Bot. 4: 19. 1786.

Perennials. Culms tufted; nodes glabrous. Leaves linear-lanceolate, 10–20 × 0.5–0.8 cm, acute-acuminate at apex, shallowly cordate at base, glabrous, green; sheaths 5–15 cm long, slightly keeled. Ligules membranous, ciliate at apex. Panicles effuse, linear, narrow, congested, 10–40 cm long, branches alternate. Spikelets ovate-oblong, 4–5 mm long, 7–12-flowered, florets disarticulated from below upwards. Lower glumes lanceolate, 1–1.2 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keels scabrid. Upper glumes lanceolate, 1–1.5 × 0.4–0.6 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keel scabrid. Lemmas oblong, 1–1.5 × 0.5–0.7 mm, acute at apex, cuneate at base, deciduous, chartaceous, glabrous, 3-nerved. Paleas elliptic-lanceolate, 1–1.5 × 0.3–0.5 mm, acute at apex, cuneate at base, winged, glabrous, 2-nerved, 2-keeled, keels scabrid, persistent. Stamens 3. Ovary globose; stigma plumose.

Distribution: Indian Subcontinent to S. China and Malesia (POWO, 2023); *Habitat*: Paddy fields, cultivated fields and forest margins; *Fl. & Ft.*: Throughout the year.

Specimens examined: Thekkady, Nellikkampetty range, 14.07.2017, *Dani Francis & Santhosh Nampy* 152865; Thekkady, 28.11.1996, *Jomy Augustine* 16954; Uppermanalar, Periyar Tiger Reserve, 28.08.1994, *Jomy Augustine* 16954 (CALI).

Notes: *Eragrostis nutans* is more similar to *E. atrovirens* and *E. gangetica*, but can be differentiated by its linear, narrow, somewhat congested panicles, very long ovate-oblong spikelets and persistent paleas (Thoiba, 2018).

Eragrostis paniciformis (A.Braun) Steud., Syn. Pl. Glumac. 1: 268. 1854; Veldkamp, Thoiba & Pradeep, Rheedea 27(1): 46–49. 2017. *Poa paniciformis* A.Braun, Flora 24: 274. 1841.

Perennials. Culms tufted, erect or geniculate; nodes glabrous. Leaves linear-lanceolate, 10–25 × 0.5–1.5 cm, acute-acuminate at apex, slightly cordate at base, glabrous-puberulous, green; sheaths 6–15 cm long, ciliate towards apex. Ligules a fringe of hairs. Panicles effuse-lax, 10–30 cm long, branches alternate. Spikelets ovate-lanceolate, 2.5–14 mm long, 10–30-flowered, florets disarticulated from below upwards. Lower glumes ovate-lanceolate, 1.8–2 × 0.5–1 mm, acute-acuminate at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keels scabrid. Upper glumes ovate-lanceolate, 2–2.3 × 0.7–1 mm, acute-acuminate at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keel scabrid. Lemmas oblong-lanceolate, 2–2.5 × 1.5–2 mm, acute at apex, cuneate at base, deciduous, chartaceous, glabrous, 3-nerved. Paleas elliptic-oblong, 2–2.3 × 1–1.3 mm, obtuse at apex, cuneate at base, ciliate, winged, caducous, glabrous, 2-nerved, 2-keeled, keels scabrid. Stamens 3. Ovary globose; stigma plumose.

Distribution: Eritrea to Zambia (POWO, 2023); *Habitat*: Grasslands, stream sides and road sides; *Fl. & Ft.*: October-April.

Specimen examined: Mattupetty, Yellampetty, 16.12.2014, *Thoiba K. & A.K. Pradeep* 137599 (CALI).

Eragrostis pilosa (L.) P.Beauv., Ess. Agrostogr. 71. 1812; Stapf in Hook.f., Fl. Brit. India 7: 323. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1827. 1934; Bor, Grass. Burma Ceylon India Pakistan 512. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 385. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 570. 2004. *Poa pilosa* L., Sp. Pl. 1: 68. 1753.

Annuals. Culms tufted; nodes glabrous. Leaves linear-lanceolate, 5–15 × 0.5–1 cm, acute-acuminate at apex, slightly cordate at base, glabrous, green; sheaths 2–6 cm long, ciliate towards apex. Ligules a ciliate rim, fimbriate. Panicles open, 10–25 cm long, branches alternate or whorled, lowest branches fascicled or whorled, axis pilose. Spikelets ovate-lanceolate, 3–8 mm long, 8–10-flowered, florets disarticulated from below upwards. Lower glumes lanceolate, 0.5–1 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keels scabrid. Upper glumes lanceolate, 1–1.5 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keel scabrid. Lemmas ovate-lanceolate, 1.5–2.5 × 1–1.2 mm, acute at apex, cuneate at base, deciduous, chartaceous, glabrous, 3-nerved. Paleas elliptic-lanceolate, 1.5–2 × 0.3–1 mm, acute at apex, cuneate at base, winged, glabrous, 2-nerved, 2-keeled, keels ciliolate. Stamens 3. Ovary globose; stigma plumose.

Distribution: Old world (POWO, 2023); *Habitat*: Cultivated fields and forest margins; *Fl. & Ft.*: August-March.

Specimens examined: Top station, Mattupetty, 15.12.2014, *Thoiba K.* 137569; Vellimala, Periyar Tiger Reserve, 16.08.1994, *Jomy Augustine* 14047 (CALI).

Eragrostis tenuifolia (A.Rich.) Hochst. ex Steud., Syn. Pl. Glumac. 1: 268. 1854; Stapf in Hook.f., Fl. Brit. India 7: 322. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1827. 1934; Bor, Grass. Burma Ceylon India Pakistan 514. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 391. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 571. 2004. *Poa tenuifolia* A.Rich., Tent. Fl. Abyss. 2: 425. 1850.

Perennials. Culms tufted, erect; nodes glabrous. Leaves linear-lanceolate, 4–30 × 0.2–0.3 cm, acute-attenuate at apex, slightly cordate at base, glabrous, green; sheaths 3–10 cm long, keeled, ciliate towards apex. Ligules a row of hairs. Panicles ovate, contracted or densely spiculate, 6–20 cm long, branches alternate. Spikelets linear-lanceolate, 4–12 mm long, 4–15-flowered, florets disarticulated from below upwards. Lower glumes ovate-lanceolate, 0.5–1.5 × 0.4–0.5 mm, acute at apex, cuneate at base, glabrous, nerveless. Upper glumes ovate-oblong, 1–1.5 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keel serrulate. Lemmas elliptic-lanceolate, 1–2 × 1–1.5 mm, acute at apex, cuneate at base, deciduous, chartaceous, glabrous, 3-nerved. Paleas elliptic-lanceolate, 1–1.2 × 0.3–

0.6 mm, obtuse at apex, cuneate at base, winged, glabrous, 2-nerved, 2-keeled, keels scabrid. Stamens 3. Ovary globose; stigma plumose.

Distribution: Africa to Indo-China (POWO, 2023); *Habitat*: Way sides and grasslands; *Fl. & Ft.*: March-December.

Specimens examined: Adimali, 14.12.2014, *Thoiba K. & A.K. Pradeep* 137564; Idukki, 14.11.2014, *A.K. Pradeep* 137548; Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154359; Kanthallur, 22.11.2013, *Thoiba K.* 138007; Panchalimedu, 17.10.2015, *Thoiba K. & A.K. Pradeep* 146636; Ramakkalmedu, 23.10.2017, *A.K. Pradeep & Thoiba K.* 146750; Thekkady, 10.01.1994, *Jomy Augustine* 13082; Theni Road, 10.08.2017, *C.N. Sunil & Thoiba K.* 4918; Top station, Mattupetty, 15.12.2014, *Thoiba K.* 137570; *Ibid*., 15.12.2014, *Thoiba K. & A.K. Pradeep* 137576; Vagamon, Pullikkanam, 15.10.2015, *Thoiba K. & A.K. Pradeep* 146613 (CALI).

Eragrostis unioloides (Retz.) Nees ex Steud., Syn. Pl. Glumac. 1: 264. 1854; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1826. 1934; Bor, Grass. Burma Ceylon India Pakistan 515. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 392. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 571. 2004. *Poa uniloides* Retz., Observ. Bot. 5: 19. 1789.

Perennials. Culms tufted, erect or geniculate; nodes glabrous. Leaves linear-lanceolate, 2–20 × 0.5–1.5 cm, acute-acuminate at apex, slightly cordate at base, entire and eglandular at margins, pubescent or glabrous, green; sheaths 3–8 cm long, ciliate towards apex. Ligules membranous, with a ciliate rim. Panicles effuse-lax, 4–35 cm long, branches alternate, base of primary branch eglandular, with *c.* 15 or more spikelets. Spikelets broad elliptic or ovate-lanceolate, 4–12 mm long, 5–80-flowered, florets disarticulated from below upwards. Lower glumes lanceolate, 1–2 × 0.2–0.4 mm, acute-acuminate at apex, cuneate at base, glabrous, 1-nerved, 1-keeled. Upper glumes lanceolate, 1.5–2.5 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, 1-nerved, 1-keeled. Lemmas elliptic-lanceolate, 1–2.2 × 0.5–1 mm, acute at apex, cuneate at base, deciduous, chartaceous, granular, glabrous, 3-nerved. Paleas elliptic-lanceolate, 1.5–2 × 0.4–0.8 mm, acute at apex, cuneate at base, winged, caducous, glabrous, 2-nerved, 2-keeled, keels ciliolate. Stamens 2. Ovary globose; stigma plumose.

Distribution: Tropical and Subtropical Asia to N. and E. Queensland (POWO, 2023); *Habitat*: Open lands; *Fl. & Ft.*: Throughout the year.

Specimens examined: Anamudi Shola National Park, 25.01.2018, *Dani Francis & Santhosh Nampy* 158279; Chottupara near Ramakkalmedu, 07.09.2017, *Dani Francis & Santhosh Nampy* 152968; *Ibid*., 07.09.2017, *Dani Francis & Santhosh Nampy* 152980; Anchuruli, 17.10.2015, *Thoiba K. & A.K. Pradeep* 146642; Eravikulam National Park, 22.10.2017, *A.K. Pradeep & Thoiba K.* 146748; between Eravikulam and Munnar, near stream, 23.01.2018, *Dani Francis & Santhosh Nampy* 158126; Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154357; Kattappana, 16.03.2018, *Dani Francis & Santhosh Nampy* 158386; Kulamavu, 10.11.2015, *Drisya V.* 146695; Mathikettan Shola National Park, Aduvizhunthankudi, 22.11.2014, 137833; Panchalimedu, 17.10.2015, *Thoiba K. & A.K. Pradeep* 146635; Parunthanpara, 16.10.2015, *Thoiba K. & A.K. Pradeep* 146630; Pius Nagar, 11.12.2015, *A.K. Pradeep* 146713; way to Pullikkanam, Vagamon, 15.10.2015, *Thoiba K. & A.K. Pradeep* 146609; Thannikkudy, 06.09.1993, *Jomy Augustine* 13902; Thrisangu hills, Peerumedu, 17.10.2015, *Thoiba K & A.K. Pradeep* 146640; Udumbanchola, Mundiyeruma, 16.12.2014, *Thoiba K. & A.K. Pradeep* 144102; Vagamon, 20.09.2013, *Thoiba K.* 138047 (CALI).

Notes: *Eragrostis unioloides* is a widely distributed and an extremely variable species in the shape and structure of panicles and spikelets, although it is easily recognized by its broad elliptic or slightly ovate, pinkish or purplish or sometimes pale spikelets (Thoiba, 2018).

Eragrostis viscosa (Retz.) Trin., Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 6, Sci. Math. 1: 397. 1830; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1826. 1934; Bor, Grass. Burma Ceylon India Pakistan 515. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 393. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 571. 2004. *Poa viscosa* Retz., Observ. Bot. 4: 20. 1786. *Eragrostis tenella* var. *viscosa* (Retz.) Stapf in Hook.f., Fl. Brit. India 7: 315. 1896.

Annuals or perennials. Culms tufted; nodes glabrous. Leaves linear-lanceolate, 4–12 × 0.3–0.6 cm, acute-acuminate at apex, slightly cordate at base, entire and eglandular at margins, glabrous, green, particles of soil adhering to the sticky areas; sheaths 3–7 cm long, keeled, viscous below mouth, fimbriate at apex, particles of

soil adhering to the sticky areas. Ligules fimbriate, membranous. Panicles spiciform-effuse, 5–20 cm long, branches alternate, basally whorled; axils viscous, yellow spotted; peduncles glandular, viscid, sticky glandular yellow spot. Spikelets ovate-lanceolate, 2.5–5 mm long, 4–11-flowered, florets disarticulated from above upwards or entire floret falling or sometimes paleas persistent. Lower glumes ovate-lanceolate, 0.5–1.5 × 0.2–0.4 mm, acute-acuminate at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keel scabrid. Upper glumes ovate-lanceolate, 1–1.5 × 0.3–0.4 mm, acute-acuminate at apex, cuneate at base, glabrous, 1-nerved, 1-keeled. Lemmas ovate-elliptic, 1–1.2 × 0.5–1 mm, obtuse at apex, cuneate at base, deciduous, chartaceous, glabrous, 3-nerved. Paleas falcate, 1–1.2 × 0.4–0.6 mm, acute at apex, cuneate at base, winged, glabrous, 2-nerved, 2-keeled, keels ciliate. Stamens 3. Ovary globose; stigma plumose.

Distribution: Tropical and S. Africa, S. Arabian Peninsula and Tropical Asia (POWO, 2023); *Habitat*: Road sides and waste lands; *Fl. & Ft.*: Throughout the year.

Specimens examined: Kumily, Theni Road, 10.08.2017, *C.N. Sunil & Thoiba K.* 146757; Thekkady, 16.09.1993, *Jomy Augustine* 12406 (CALI).

Notes: This species is closely allied to *E. amabilis*, but differs by having sticky glandular yellow spots below the panicles (Thoiba, 2018).

Oropetium Trin.,

Fund. Agrost. 98. 1820.

The genus *Oropetium* is represented by six species worldwide and three species in India (POWO, 2023). These grasses are commonly referred to as desiccation tolerant grasses, which grows in gravelly, rocky and sandy soils. This genus is easily identified from other genera by its unique 1–2-flowered spikelets sunken in the rachis (Siddabathula *et al.*, 2022).

Oropetium thomaeum (L.f.) Trin., Fund. Agrost. 98. 1820; Hook.f., Fl. Brit. India 7: 366. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1830. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 474. 1960; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 583. 2004. *Nardus thomaea* L.f., Suppl. Pl. 105. 1782.

Perennials. Culms tufted; nodes glabrous. Leaves linear, 1–7 × 0.05–0.1 cm, acute at apex, cuneate at base, hairy along margins; sheaths auriculate, 6–7 mm long,

glabrous. Ligules thin, fimbriate. Racemes spicate, 2.5–5 cm long, curved or straight; rachis furrowed, winged, wavy on margins. Spikelets sessile, sunk and adpressed to rachis, lanceolate, 2–2.5 mm long, disarticulating just above the upper glumes. Lower glumes linear, 0.3–0.4 × 0.1 mm, acute and tapering at apex, cuneate at base, membranous, hyaline, glabrous, nerveless. Upper glumes oblong, 1.5–2 × 0.2–0.3 mm, acute at apex, cuneate at base, thick at margins, glabrous, nerveless. Florets 1, bisexual; callus hairy. Lemmas obovate, 0.8–1 × 0.3–0.4 mm, obtuse at apex, cuneate at base, hyaline, 3-nerved, keeled, finely serrulate. Paleas oblong, 0.8–1 × 0.1–0.2 mm, acute at apex, cuneate at base, membranous, hyaline, 2-nerved. Stamens 3. Ovary elliptic; stigma plumose.

Distribution: NE. and E. Tropical Africa, Indian Subcontinent to Indo-China (POWO, 2023); *Habitat*: Dry grasslands; *Fl. & Ft.*: Throughout the year.

Specimen examined: On the way to Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 175908 (CALI).

Sporobolus R.Br.,

Prodr. Fl. Nov. Holland. 169. 1810, *nom. cons.*

Key to the species

1. Panicle effuse ……. *S. indicus*

1. Panicle spiciform, interrupted ……..…….. *S. pilifer*

Sporobolus indicus (L.) R.Br., Prodr. Fl. Nov. Holland. 170. 1810; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1817. 1934; Hook.f., Fl. Brit. India 7: 247. 1896; Bor, Grasses Burma, Ceylon, India & Pakistan 630. 1960. *Agrostis indica* L., Sp. Pl. 1: 63. 1753.

Perennials. Culms erect, tufted, glabrous; nodes glabrous. Leaves linear-lanceolate, 3–25 × 0.1–0.5 cm, acuminate at apex, sub-cordate at base, glabrous, green; sheaths 2–7 cm long, glabrous. Ligules membranous, fimbriate. Panicles effuse, 5–30 cm long. Spikelets obovate, 1.5–2 mm long, acute at apex, glabrous, grey. Lower glumes oblong-lanceolate, 0.2–0.5 × 0.2–0.3 mm, truncate at apex, sub-truncate at base, glabrous, nerves not clear. Upper glumes ovate-lanceolate, 0.5–1 × 0.3–0.4 mm, acute at apex, cuneate at base, glabrous, 1-nerved. Lemmas ovate-lanceolate, 1.5–2 × 0.5–0.6 mm, obtuse at apex, cuneate at base, chartaceous, glabrous, 1-nerved. Paleas elliptic, 1–1.5 × 0.4–0.5 mm, obtuse at apex, cuneate at base, delicate, 2-

nerved, not keeled. Lodicules 2. Stamens 2–3, 0.5 mm long. Ovary oblong; stigma plumose. Caryopsis elliptic-oblong, truncate at apex.

Distribution: Tropical and Subtropical America (POWO, 2023); *Habitat*: Grasslands and wastelands; *Fl. & Ft.*: March-December.

Specimens examined: Chottupara, 07.09.2017, *Dani Francis & Santhosh Nampy* 152977; Pandippara, 16.07.2021, *Dani Francis & Santhosh Nampy* 176049; Thekkady, 07.08.1993, *Jomy Augustine* 12417; *Ibid*., 14.07.2017, *Dani Francis & Santhosh Nampy* 152862; way to Top station, Mattupetty, 15.12.2014, *Thoiba K. & A.K. Pradeep* 137573 (CALI); *Ibid.*, 05.06.1944, *K.C. Jacob* 20526 (MH).

Sporobolus pilifer (Trin.) Kunth, Enum. Pl. 1: 211. 1833; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1817. 1934; Hook.f., Fl. Brit. India 7: 251. 1896; Bor, Grasses Burma, Ceylon, India & Pakistan 632. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 438. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 593. 2004. *Vilfa pilifera* Trin., Gram. Unifl. Sesquifl. 157. 1824.

Perennials. Culms erect, densely tufted; nodes glabrous. Leaves linear, 2–12 × 0.2–0.3 cm, acuminate at apex, sub-cordate at base, puberulous, green; sheaths 1–2 cm long, ciliate, sparsely hairy at mouth. Ligules a ring of hairs. Panicles spiciform, 2–10 cm long, interrupted. Spikelets elliptic-lanceolate, 1–2 mm long, greenish yellow. Lower glumes lanceolate, 1–1.5 × 0.3–0.5 mm, acuminate at apex, sub-truncate at base, glabrous, nerves not clear. Upper glumes ovate-lanceolate, 2–2.5 × 0.5–1 mm, acute at apex, cuneate at base, glabrous, 1-nerved. Lemmas ovate-lanceolate, 2–2.5 × 0.8–1 mm, obtuse at apex, cuneate at base, chartaceous, glabrous, 1-nerved. Paleas lanceolate, 1.5–2 × 0.8–1 mm, obtuse at apex, cuneate at base, delicate, glabrous, 2-nerved, not keeled. Lodicules 2. Stamens 2. Ovary oblong; stigma plumose. Caryopsis ovate, apiculate at apex.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: June-December.

Specimens examined: Mangaladevi, 16.10.1993, *Jomy Augustine* 12678 (CALI); Munnar, 12.11.1980, *P.V. Sreekumar* 68427; Peermade, 02.12.1941, *K.C. Jacob* 20219 (MH); Pius Nagar, 22.06.2018, *Dani Francis & Santhosh Nampy* 159332 (CALI).

Trigonochloa P.M.Peterson & N.Snow,

Ann. Bot. (Oxford) 109: 1327. 2012.

Trigonochloa uniflora (Hochst. ex A.Rich.) P.M.Peterson & N.Snow, Ann. Bot. (Oxford) 109: 1328. 2012. *Leptochloa uniflora* Hochst. ex A.Rich. in Tent., Fl. Abyss. 2: 409. 1850; Hook.f., Fl. Brit. India 7: 297. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1820. 1934; Bor, Grass. Burma Ceylon India Pakistan 517. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 396. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 845. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 580. 2004.

Annuals. Culms tufted, creeping or geniculate; nodes glabrous. Leaves elliptic-lanceolate, 5–12 × 1–1.5 cm, acute-acuminate at apex, slightly cordate at base, glabrous, green; sheaths 2–7 cm long, keeled towards apex, glabrous. Ligules ovate, membranous. Panicles lax, 5–30 cm long; racemes alternate or sub-whorled, 4–8 cm long; rachis flat, winged, scabrid. Spikelets secund, oblong-lanceolate, 2–2.5 mm long, distant, 1-flowered. Lower glumes oblong-lanceolate, 2–2.5 × 0.3–0.5 mm, acuminate at apex, cuneate at base, scabrous, 1-nerved, keeled. Upper glumes lanceolate, 2–2.5 × 0.3–0.5 mm, acuminate at apex, cuneate at base, scabrous, 1-nerved, keeled. Lemmas ovate-oblong, 1.5–2 × 0.5–1 mm, acute at apex, cuneate at base, chartaceous, pubescent, 3-nerved, 1-keeled. Paleas elliptic-oblong, 1–1.5 × 0.5–1 mm, acute at apex, cuneate at base, glabrous, 2-nerved, 2-keeled, keel ciliolate. Stamens 3. Ovary obovate; stigma plumose.

Distribution: Tropical and S. Africa, SW. Arabian Peninsula, India and Sri lanka (POWO, 2023); *Habitat*: Road sides and waste lands; *Fl. & Ft.*: October-May.

Specimens examined: Kottamala, 04.05.1995, *Jomy Augustine* 15356; Vandanmedu, Theni Road, 11.10.2017, *Thoiba K.* 146787 (CALI).

Tripogon Roem. & Schult.,

Syst. Veg. ed. 15 bis 2: 34. 1817.

Key to the species

1. Culms thickened below by the persistent leaf sheaths; leaves equitant, rigid and pungent …… *T. pungens*

1. Culms not thickened by leaf sheaths; leaves not equitant, rigid and pungen ….. 2

2. Lemmas cleft at apex in to 2-lobes, awned in the cleft ……..…….. 3

2. Lemmas cleft at apex in to 4–6-lobes, with or without a definite lobe between each lateral awn and median awn ……..... 4

3. Spikelets appressed in concavities in rachis ……. *T. sivarajanii*

3. Spikelets loosely arranged in rachis …….. *T. velliangiriensis*

4. Lemmas 4-lobed ……..... 5

4. Lemmas 6-lobed …….. *T. zeylanicus*

5. Median awn shorter than or nearly equal to lemmas; stout grass ……..... 6

5. Median awn twice as long as the lemma or more; slender grass …..... *T. filiformis*

6. Leaves convolute or flat; lateral awns subequal to median awn ……..... 7

6. Leaves flat; lateral awns unequal to median awn …….. *T. bromoides*

7. Spikelets loosely spaced on rachis, 4–6-flowered ……..... *T. narayanae*

7. Spikelets contracted on rachis, 10–16-flowered …….. *T. munnarensis*

Tripogon bromoides Roem. & Schult., Syst. Veg. ed. 15 bis 2: 600. 1817; Hook.f., Fl. Brit. India 7: 287. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1834. 1934; Bor, Grass. Burma Ceylon India Pakistan 521. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 399. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 595. 2004; Thoiba & Pradeep, Rheedea 30(3): 334. 2020.

Perennials. Culms erect, tufted; nodes glabrous. Leaves flat, linear-lanceolate, 15–50 × 0.3–0.5 cm, acuminate at apex, rounded at base, flat-convolute, villous, green; sheaths 4–10 cm long, glabrous or hairy. Ligules a tuft of hairs. Racemes 10–30 cm long, stiff, spikelets tightly or loosely arranged in rachis. Spikelets linear, 7–10 mm long, 5–16-flowered; callus hairy. Lower glumes ovate-lanceolate, 1.5–3.5 × 0.7–1.3 mm, acuminate at apex, sub-truncate at base, notched on one side, puberulous, 1-nerved, 1-keeled. Upper glumes elliptic-lanceolate, 2.5–5.5 × 0.5–1 mm, dentate and shortly aristate or awned at apex, sub-truncate at base, 1-awned, puberulous, 1-nerved, 1-keeled; awn 0.3–0.8 mm long. Lemmas ovate-lanceolate, 2–4.5 × 1–2 mm, 4-lobed and awned at apex, sub-truncate at base, lateral lobes and lateral awns almost equal, glabrous, 3-nerved, slightly keeled; awns scabrid, median awn

1.5–3.5 mm long, lateral awns 0.5–2 mm long. Paleas elliptic, 2–4 × 0.5–1 mm, emarginate or bilobed at apex, cuneate at base, hyaline, pubescent, 2-nerved, 2-keeled, keels ciliate towards upper half. Stamens 3. Ovary obovate; stigma plumose.

Distribution: Indian Subcontinent to Myanmar (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: June-April.

Specimens examined: Way to Anamudi base camp, 10.12.2019, *Dani Francis & Santhosh Nampy* 170018, 170021; Bodimettu, 10.08.2017, *C.N. Sunil & Thoiba K.* 146758; Cheruthoni, Pinav, 17.10.2015, *Thoiba K. & A.K. Pradeep* 146633; Kattappana, 16.12.2014, *Thoiba K. & A.K. Pradeep* 137589; Koyimanchola, 10.02.2021, *Dani Francis & Santhosh Nampy* 188744; Kudimala, Lakkamkudi, 09.12.2019, *Dani Francis & Santhosh Nampy* 164682, 170003; Kumali-Theni Road, 16.10.2015, *Thoiba K. & A.K. Pradeep* 146625; Mangaladevi hills, 15.07.2017, *Dani Francis & Santhosh Nampy* 152892; Mathikettan Shola National Park, 27.06.2016, *Syam Radh S. & Thoiba K.* 146772; *Ibid*., 23.07.2016, *Shimi Cherian & Thoiba K.* 146771; *Ibid*., 11.12.2016, *Dani Francis & Santhosh Nampy* 151368; Mattupetty tea estate, Munnar, 16.12.2014, *A.K. Pradeep & Thoiba K.* 137590, 144104; Meenuliyanpara, 12.12.2016, *Dani Francis & Santhosh Nampy* 151428, 151437; Meesapulimala, 21.11.2018, *Dani Francis & Santhosh Nampy* 167764; Munnar, Devikulam, 16.12.2014, *Thoiba K. & A.K. Pradeep* 137588, 137590, 137591; Pallivasal, Munnar, 14.12.2014, *Thoiba K. & A.K. Pradeep* 137565; Parunthanpara, 15.10.2015, *Thoiba K. & A.K. Pradeep* 146618, 146620; *Ibid*., 29.04.2018, *Dani Francis & Santhosh Nampy* 159237, 159260; Pettimudi, near Subranshed, 30.12.2019, *Dani Francis & Santhosh Nampy* 170046; Pothadi, Marayur, 26.01.2018, *Dani Francis & Santhosh Nampy* 158324; way to Pullikkanam, Vagamon, 15.10.2015, *Thoiba K. & A.K. Pradeep* 146611; Ramakkalmedu, 23.10.2017, *A.K. Pradeep & Thoiba K.* 146749; Thrisangu hills, Peerumedu, 17.10.2015, *Thoiba K. & A.K. Pradeep* 146637, 146638, 146643 (CALI).

Tripogon filiformis Nees ex Steud., Syn. Pl. Glumac. 1: 301. 1854; Hook.f., Fl. Brit. India 7: 288. 1896; Bor, Grass. Burma Ceylon India Pakistan 521. 1960; Thoiba & Pradeep, Rheedea 30(3): 342. 2020.

Perennials. Culms erect, tufted, slender; nodes glabrous. Leaves linear-lanceolate, filiform, 5–15 × 0.5–2 cm, acuminate at apex, rounded at base, convolute, villous, green; sheaths 2–10 cm long, hairy. Ligules a tuft of hairs. Racemes 5–25 cm long, spikelets tightly or loosely appressed to concavities in rachis. Spikelets linear, 6–8 mm long, 4–10-flowered; callus hairy. Lower glumes ovate-lanceolate, 1.5–2.5 × 0.5–1 mm, obtuse at apex, sub-truncate at base, notched on one side, pubescent, 1-nerved, 1-keeled, keels scabrid. Upper glumes elliptic-lanceolate, 2.5–4 × 0.5–1 mm, dentate at apex, sub-truncate at base, 1-awned, puberulous, 1-nerved, 1-keeled; awn 1–1.2 mm long. Lemmas oblong-lanceolate, 5–8 × 1–1.5 mm, 4-lobed and 3-awned at apex, sub-truncate at base, glabrous, 3-nerved, slightly keeled; awns scabrid, median awn 10–20 mm long, lateral awns 1–1.2 mm long. Paleas elliptic, 2–3 × 0.5–0.7 mm, obtuse or bilobed at apex, cuneate at base, hyaline, pubescent, slightly winged, 2-nerved, 2-keeled, keels ciliate towards the upper half. Stamens 3. Ovary obovate; stigma plumose.

Distribution: Indian Subcontinent to Central & S. China and Jawa to Lesser Sunda Islands (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-November.

Specimens examined: Meenuliyanpara, 26.10.2020, *Dani Francis & Santhosh Nampy* 170097; Vagamon, 26.10.2020, *Dani Francis & Santhosh Nampy* 170093, 170095 (CALI).

Notes: It is a high altitude (1000–4500 m) species, often confused with *T. bromoides* and *T. longe-aristatus* Hack. ex Honda, but can be distinguished by its densely villous leaves, dense feathery racemes and long awned lemmas (Thoiba & Pradeep, 2020).

Tripogon munnarensis Thoiba & Manudev, Phytotaxa 272(2): 130. 2016; Thoiba & Pradeep, Rheedea 30(3): 356. 2020.

Perennials. Culms tufted, erect; nodes glabrous. Leaves lanceolate, 5–15 × 0.1–0.2 cm, acuminate at apex, rounded at base, convolute, pubescent, green; sheaths 2–5 cm long, hairy. Ligules obscure, fringed with long hairs at apex. Racemes 5–15 cm long, contracted, spikelets contracted on rachis. Spikelets linear-lanceolate, 10–16 mm long, 10–16-flowered; callus hairy. Lower glumes oblong-lanceolate, 1–2.5 ×

0.5–1 mm, acute at apex, sub-truncate at base, pubescent, 1-nerved. Upper glumes elliptic-lanceolate, 3–4.5 × 0.5–1 mm, awned and notched at apex, sub-truncate at base, puberulous, 1-nerved, 1-keeled; awn 0.3–0.5 mm long. Lemmas narrowly elliptic-lanceolate, 3–3.5 × 1–1.5 mm, 4-lobed and 3-awned at apex, sub-truncate at base, glabrous, 3-nerved, slightly keeled; awns scabrid, median awn 1–1.5 mm long, lateral awns 0.5–0.8 mm long. Paleas elliptic-lanceolate, 1.5–2 × 0.5–0.7 mm, sub-acute or notched at apex, cuneate at base, hyaline, glabrous, 2-nerved, 2-keeled, slightly winged, keels minutely ciliolate along the margin. Stamens 3. Ovary obovate; stigma plumose.

Distribution: India (POWO, 2023); *Habitat*: Grasslands and ghat road sides; *Fl. & Ft.*: September-December.

Specimens examined: Kambakal Medu, Munnar, 26.09.2014, *Manudev K.M.* 138906; Munnar, Udumbanchola, near Mundiyaruma, 16.12.2014, *Thoiba K., A.K. Pradeep & T. Mohammed Yoonus* 144105; Ramakkalmedu, 23.10.2017, *A.K. Pradeep & Thoiba K.* 146752 (CALI).

Notes: *Tripogon munnarensis* is allied to *T. narayanae*, but differs in having 10–16 mm long spikelets with 10–16 florets, apically acute asymmetrical lower glumes, 1–1.5 mm long, almost straight or curved median awns, and 0.5–0.8 mm long lateral awns (Thoiba & Pradeep, 2020).

Tripogon narayanae Sreek., V.J.Nair & N.C.Nair, J. Bombay Nat. Hist. Soc. 80: 196. 1983; Sreek. & V.J.Nair, Fl. Kerala-Grasses 401. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 879. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 595. 2004; Thoiba & Pradeep, Rheedea 30(3): 357. 2020.

Perennials. Culms tufted, erect; nodes glabrous. Leaves linear-lanceolate, 10–20 × 0.1–0.2 cm, acuminate at apex, rounded at base, flat-convolute, pubescent, green; sheaths 4–10 cm long, hairy. Ligules thin, membranous, with a ciliate rim at apex. Racemes 6–10 cm long, stiff, spikelets loosely arranged in rachis. Spikelets linear-lanceolate, 5–10 mm long, 4–6-flowered; callus hairy. Lower glumes ovate-lanceolate, 2–3.5 × 0.5–1 mm, acuminate at apex, sub-truncate at base, notched on one side, puberulous, 1-nerved, 1-keeled. Upper glumes elliptic-lanceolate, 4–5.5 × 0.5–0.7 mm, dentate and shortly awned at apex, sub-truncate at base,

puberulous, 1-nerved, 1-keeled; awn 0.5–0.8 mm long. Lemmas ovate-lanceolate, 3–4 × 1–1.5 mm, 4-lobed and 3-awned at apex, sub-truncate at base, glabrous, 3-nerved, slightly keeled; awns scabrid, median awn 1.5–3.5 mm long, lateral awns 0.5–2 mm long, almost half the length of median awn. Paleas elliptic, 2–3 × 0.5–0.7 mm, emarginate or bilobed at apex, cuneate at base, hyaline, pubescent, 2-nerved, 2-keeled, keels ciliate towards upper half. Stamens 3. Ovary obovate; stigma plumose.

Distribution: Endemic to Peninsular India (Thoiba & Pradeep, 2020); *Habitat*: Grasslands; *Fl. & Ft.*: August-January.

Specimens examined: Chinnar Wildlife Sanctuary, 09.12.2016, *A.K. Pradeep & Thoiba K.* 146764; Kanthallur, 22.11.2013, *Thoiba K.* 138008; way to Karimutty, 29.12.2017, *Dani Francis & Santhosh Nampy* 158009; Kumaly-Theni Road, 16.10.2015, *Thoiba K. & A.K. Pradeep* 146627; Mannakkudy, Mathikettan Shola National Park, 06.01.2017, *Dani Francis & Santhosh Nampy* 151636; Mathikettan Shola National Park, 25.11.2014, *Syam Radh S.* 143587; Meesapulimala, way to 8th plot, 20.11.2018, *Dani Francis & Santhosh Nampy* 167705; near Subranshed, Pettimudi, 30.12.2019, *Dani Francis & Santhosh Nampy* 170057; Nyamakkad, 8th mile, 24.01.2018, *Dani Francis & Santhosh Nampy* 158183; Pius Nagar, 13.11.2012, *Thoiba K.* 134401; Udumbanchola, Mundiyeruma, 16.12.2014, *Thoiba K. & A.K. Pradeep* 144103 (CALI).

Tripogon pungens C.E.C.Fisch., Bull. Misc. Inform. Kew 1934: 170. 1934; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1834. 1934; Bor, Grass. Burma Ceylon India Pakistan 522. 1960; Thoiba & Pradeep, Rheedea 30(3): 359. 2020. **Fig. 31H**

Perennials. Culms densely tufted, branched, thickened by persistent leaf sheaths; nodes covered by sheaths. Leaves equitant, convolute or involute, 1–5 cm long, rigid, pungent towards apex, coriaceous, pubescent, green; sheaths 5–10 cm long, imbricate, striate. Ligules membranous, fimbriate. Racemes 2–8 cm long, erect or curved, spikelets arranged loosely or tightly arranged in rachis. Spikelets narrowly elliptic, 2–6 mm long, 3–9-flowered; callus hairy. Lower glumes ovate-lanceolate, 2–3 × 0.5–1 mm, obtuse at apex, cuneate at base, glabrous, 1-nerved. Upper glumes oblong, 3–4 × 0.5–1 mm, acute and notched at apex, cuneate at base, glabrous, 1-nerved, 1-keeled. Lemmas broadly ovate, 1.5–2.5 × 1–1.5 mm, upper

lemmas gradually smaller, obtuse and shortly 2-lobed at apex, hairy at base, lobes obtuse, glabrous; awns or arista 0.6–1.2 mm long. Paleas oblanceolate, 2–2.3 × 0.5–0.8 mm, obtuse at apex, cuneate at base, glabrous, 2-nerved, 2-keeled; keels ciliolate. Stamens 3. Ovary sub-globose; stigma plumose.

Distribution: S. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-February.

Specimens examined: Koyimanchola, 10.02.2021, *Dani Francis & Santhosh Nampy* 188707; Pothadi, Marayur, 26.01.2018, *Dani Francis & Santhosh Nampy* 158302 (CALI).

Notes: *Tripogon pungens* is quite distinct in having thickened culms by persistent leaf sheaths and equitant, rigid and pungent leaves (Thoiba & Pradeep, 2020). This species is only recently reported from Kerala.

Tripogon sivarajanii Sunil, Sida 18(3): 809. 1999; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 595. 2004; Thoiba & Pradeep, Rheedea 30(3): 365. 2020.

Perennials. Culms erect, tufted; nodes glabrous. Leaves linear-lanceolate, 10–35 × 0.2–0.3 cm, acuminate at apex, rounded at base, flat-convolute, villous adaxially, glabrous abaxially, green; sheaths 6–10 cm long, glabrous. Ligules membranous, glabrous. Racemes 10–40 cm long, stout. Spikelets linear, 7–11 mm long, 5–8-flowered, distant, appressed concavities in rachis, callus hairy. Lower glumes oblong-lanceolate, 2–2.5 × 0.5–1 mm, acuminate at apex, sub-truncate at base, asymmetrical, glabrous, 1-nerved, 1-keeled, keel scabrid. Upper glumes elliptic-lanceolate, 3–4 × 0.5–1 mm, acuminate at apex, sub-truncate at base, puberulous, 1-nerved, 1-keeled. Lemmas oblanceolate, 3–4 × 1.5–2 mm, 2-lobed and 1-awned at apex, sub-truncate at base, glabrous, 3-nerved, slightly keeled; awns scabrid, 3–3.5 mm long. Paleas obovate, 2–3 × 1–1.5 mm, acute or bilobed with a minute central notch at apex, cuneate at base, hyaline, pubescent, 2-nerved, narrowly winged, 2-keeled, keels ciliate. Stamens 3. Ovary obovate; stigma plumose.

Distribution: S. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-December.

Specimens examined: Devikulam, 16.12.2014, *Thoiba K. & A.K. Pradeep* 137583; Kalvarymount, Kattappana, 17.10.2015, *A.K. Pradeep & Thoiba K.* 146634;

Kattappana, 16.12.2014, *A.K. Pradeep & Thoiba K.* 144101; Kuttikkanam, Mundakkayam, 15.10.2015, *Thoiba K. & A.K. Pradeep* 146607; Meenuliyanpara, Thodupuzha, 23.12.2009, *Santhosh Nampy* 2735; *Ibid*., 12.12.2016, *Dani Francis & Santhosh Nampy* 151429, 151435, 151436; *Ibid*., 26.10.2020, *Dani Francis & Santhosh Nampy* 170097; Parunthanpara, 16.10.2015, *Thoiba K. & A.K. Pradeep* 146632; Peerumedu, ghat road side, 16.10.2015, *Thoiba K. & A.K. Pradeep* 146614; Periya canal water falls, way to Kattappana, 14.11.2014, *Pradeep A.K.* 137547; way to Pullikkanam, 15.10.2015, *Thoiba K. & A.K. Pradeep* 146610, 146612; Valakettimala, near Moolamattam, 02.09.1997, *C.N. Sunil* 2117; Vagamon, 26.10.2020, *Dani Francis & Santhosh Nampy* 170095 (CALI).

Tripogon velliangiriensis Murug. & V.Balas., Indian J. Forest. 31(1): 109. 2008; Thoiba & Pradeep, Rheedea 30(3): 371. 2020.

Perennials. Culms erect, tufted; nodes glabrous. Leaves linear-lanceolate, 5–15 × 0.1–0.2 cm, acuminate at apex, rounded at base, convolute or equitent, pubescent adaxially, glabrous abaxially, green; sheaths 3–5 cm long, glabrous. Ligules membranous, ciliate. Racemes 6–12 cm long, spikelets loosely arranged in rachis. Spikelets linear, 10–25 mm long, 6–9-flowered, distant; callus hairy. Lower glumes ovate-lanceolate, 4–4.5 × 1.5–2 mm, acuminate at apex, sub-truncate at base, asymmetrical, glabrous, 1-nerved, 1-keeled, keel scabrid. Upper glumes elliptic-lanceolate, 4.5–5.5 × 1.5–2 mm, dentate and mucronate at apex, sub-truncate at base, puberulous, 1-nerved, 1-keeled; mucro 0.3–0.4 mm long. Lemmas elliptic-lanceolate, 8–9 × 1.5–2 mm, 2-lobed and 1-awned at apex, sub-truncate at base, glabrous, 3-nerved, slightly keeled, lateral lobs sharply acuminate sometimes like an awn; awns scabrid, straight, slightly bent when mature, 3–5 mm long. Paleas elliptic, 3–3.5 × 1.3–1.5 mm, emarginate or bilobed with a minute central notch at apex, cuneate at base, broadly winged, hyaline, pubescent, 2-nerved, 2-keeled, keels ciliate. Stamens 3. Ovary obovate; stigma plumose.

Distribution: S. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-October.

Specimens examined: Parunthanpara, 16.10.2015, *Thoiba K. & A.K. Pradeep* 146621, 146628, 146629; *Ibid*., 16.10.2019, *Dani Francis & Santhosh Nampy* 176167; Valakettimala, near Moolamattam, 09.09.1998, *C.N. Sunil* 2115 (CALI)

Tripogon zeylanicus Nees ex Steud., Syn. Pl. Glumac. 1: 301. 1854. *Tripogon anantaswamianus* Sreek., V.J. Nair & N.C. Nair, Bull. Bot. Surv. India 25(1–4): 185. 1983; Sreek. & V.J.Nair, Fl. Kerala-Grasses 399. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 595. 2004; Thoiba & Pradeep, Rheedea 30(3): 374. 2020.

Perennials. Culms erect, tufted; nodes glabrous. Leaves linear-lanceolate, 20–40 × 0.3–0.5 cm, acuminate at apex, rounded at base, flat-convolute, pubescent, green; sheaths 4–10 cm long, glabrous or hairy. Ligules membranous with a tuft of hairs. Racemes 10–30 cm long, spikelets alternate on both sides of raceme, leaden green. Spikelets ovate-lanceolate, 8–15 mm long, 7–13-flowered; callus hairy. Lower glumes ovate-lanceolate, 4–5 × 0.8–1 mm, awned at apex, sub-truncate at base, notched on one side, puberulous, 1-nerved, 1-keeled; awns 1–1.5 mm long. Upper glumes elliptic-lanceolate, 7–9 × 0.5–1 mm, apex 2-lobed, 1-awned, sub-truncate at base, puberulous, 1-nerved, 1-keeled; awn 1–2 mm long. Lemmas oblong-lanceolate, 7–8 × 1.5–2.5 mm, 6-lobed and awned at apex, sub-truncate at base, glabrous, 3-nerved, slightly keeled; awns scabrid, median awn *c.* 4 mm long, lateral awns 0.5–3 mm long. Paleas elliptic, 3–4 × 1–1.5 mm, acuminate at apex, cuneate at base, hyaline, ciliate, 2-nerved, 2-keeled. Stamens 3. Ovary obovate; stigma plumose.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-January.

Specimens examined: Alampetty, Marayur-Chinnar Road, 26.10.2017, *A.K. Pradeep & Thoiba K.* 146753; Choondal, Mathikettan Shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 151634; Chottupara, near Ramakkalmedu, 07.09.2017, *Dani Francis & Santhosh Nampy* 152967, 152974; Eravikulam National Park, 15.12.2014, *Thoiba K. & A.K. Pradeep* 137571; *Ibid.*, 12.12.2015, *Thoiba K. & A.K. Pradeep* 146697 (CALI).

Tribe Cynodonteae Dumort,

Observ. Gramin. Belg. 83. 1824.

Key to the genera

1. Racemes persistent; spikelets breaking up at maturity …… 2

1. Racemes deciduous; spikelets falling entire …… *Perotis*

2. Spikelets 2-many flowered …….. 3

2. Spikelets 1-flowered ……. *Cynodon*

3. Rachilla terminating in 1 or more reduced lemmas; spikelets laterally compressed ……. ……. *Chloris*

3. Rachilla terminating in an awned rudiment; spikelets dorsally compressed ……. ……. *Enteropogon*

Chloris Sw.,

Prodr. Veg. Ind. Occ. 25. 1788.

Chloris barbata Sw., Fl. Ind. Occid. 1: 200. 1797; Hook.f., Fl. Brit. India 7: 292. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1838. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 465. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 357. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 558. 2004.

Annuals or short-lived perennials. Culms tufted, erect; nodes glabrous. Leaves linear-lanceolate, 5–20 × 0.1–0.5 cm, acuminate at apex, rounded at base, glabrous, green; sheaths 2–4 cm long, keeled. Ligules truncate, membranous. Spikes 3–16, digitate, 1–8 cm long. Spikelets sub-sessile, 2-seriate, obovate, 2–3 mm long, laterally compressed, 2–3-flowered; rachilla terminating in 1 or more reduced lemmas. Lower glumes lanceolate, 1–2 × *c*. 1 mm, obtuse at apex, cuneate at base, hyaline, 1-nerved, 1-keeled, scabrid along the keel. Upper glumes lanceolate, 2–3 × *c*. 1 mm, obtuse at apex, cuneate at base, hyaline, 1-nerved, 1-keeled, scabrid along the keel. Fertile lemmas ovate-elliptic, 2–3 × 1–1.5 mm, awned at apex, cuneate at base, coriaceous, with a sub-marginal fringe of hairs along the margin; awns 4–8 mm long, scabrid. Paleas elliptic, 2–2.5 × 0.8–1 mm, obtuse at apex, cuneate at base, hyaline, glabrous, 2-nerved, 2-keeled. Sterile lemmas 1 or 2 on a stalk, obovate, 1–2 × 0.5–1 mm, truncate at apex, coriaceous, 3-nerved; awns 4–8 mm long. Stamens 3. Ovary ovate; stigma plumose.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Road sides and open lands; *Fl. & Ft.*: March-December.

Specimens examined: Chinnar Wildlife sanctuary, 18.05.1999, *P.K. Sabitha* 79176; *Ibid*., 18.05.1999, *P. Prashy* 79445 (CALI).

Cynodon Rich.

in Persoon, Syn. Pl. 1: 85. 1805.

Cynodon dactylon (L.) Pers., Syn. Pl. 1: 85. 1805; Hook.f., Fl. Brit. India 7: 288. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1835. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 469. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 360. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 561. 2004. *Panicum dactylon* L., Sp. Pl. 1: 58. 1753.

Stoloniferous perennials. Culms slender, creeping; nodes glabrous. Leaves linear-lanceolate, 1–6 × 0.2–0.5 cm, acuminate at apex, rounded at base, glabrous; sheaths 1–3 cm long, keeled, glabrous. Ligules thin, membranous, fimbriate. Racemes 3–6, digitate, 1–6 cm long. Spikelets elliptic-lanceolate, 2–3 mm long, 1-flowered. Lower glumes lanceolate, 1.5–2 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, keeled, 1-nerved. Upper glumes lanceolate, 1.8–2 × 0.5–0.7 mm, acute at apex, cuneate at base, glabrous, keeled, 1-nerved. Lemmas boat shaped, 2–3 × 1.5–2 mm, acute at apex, cuneate at base, 3-nerved, keeled, ciliate along keels and margins. Paleas oblong-lanceolate, 2–2.5 × 0.5–1 mm, acute at apex, cuneate at base, 2-nerved, 2-keeled, keels serrulate towards apex. Stamens 3. Ovary ovate-oblong; stigma plumose.

Distribution: Temperate and Subtropical Old World to Australia (POWO, 2023); *Habitat*: Open lands; *Fl. & Ft.*: March-October.

Specimen examined: Kokkara, 07.07.1993, *Jomy Augustine* 12058 (CALI).

Notes: It is a perennial species and one of the most common weeds in India with some medicinal properties (Umamaheswari *et al.*, 2021).

Enteropogon Nees,

Intr. Nat. Syst. Bot. ed. 2. 448. 1836.

Enteropogon monostachyos (Vahl) K.Schum., Abh. Konigl. Akad. Wiss. Berlin 1894: 17. 1894; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1834. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 472. 1960; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 568. 2004. *Cynosurus monostachyos* Vahl, Symb. Bot. 2: 20. 1791. *Enteropogon melicoides*

(J.Koenig ex Rottler) Nees in Lindley, Intr. Nat. Syst. Bot., ed. 2. 449. 1836; Hook.f., Fl. Brit. India 7: 284. 1896.

Perennials. Culms tufted, geniculate; nodes glabrous. Leaves linear-lanceolate, 10–30 × 0.4–0.7 cm, acuminate at apex, attenuate at base, pubescent; sheaths 6–12 cm long, keeled, hairy on margins. Ligules membranous with long hairs. Racemes spicate, 8–15 cm long, curved at maturity. Spikelets closely imbricate, secund, oblong-lanceolate, 7–10 mm long, dorsally compressed; rachilla terminating in an awned rudiment. Lower glumes narrowly lanceolate, 2–3.5 × 0.3–0.5 mm, acuminate at apex, truncate at base, glabrous, 1-nerved, 1-keeled, scabrellate on keel. Upper glumes lanceolate, 4.5–5.5 × 0.8–1 mm, acuminate and shortly awned at apex, cuneate at base, glabrous, 1-nerved, 1-keeled, keel scabrellate. Lower florets 2, bisexual. Upper florets male or reduced. First lemmas elliptic-lanceolate, 5–7 × 1–1.5 mm, acuminate at apex, cuneate at base, 3-nerved, keeled, scabrellate on keels; awn 4–8 mm long. Paleas elliptic-lanceolate, 4–7 × 0.8–1 mm, acuminate at apex, cuneate at base, 2-nerved, 2-keeled, keels scabrellate. Stamens 3. Ovary elliptic; stigma plumose. Middle florets similar to lower florets. Upper florets reduced, 1.5–3 × *c.* 0.3 mm; awns 2–4 mm long.

Distribution: Somalia to S. Africa, S. India, Sri Lanka and W. Indo-China (POWO, 2023); *Habitat*: Rocky areas; *Fl. & Ft.*: June-March.

Specimen examined: Chinnar Wildlife Sanctuary, 11.12.2015, *A.K. Pradeep* 146714 (CALI).

Perotis Aiton,

Hort. Kew. 1: 85. 1789.

Perotis indica (L.) Kuntze, Revis. Gen. Pl. 2: 787. 1891; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1814. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 611. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 434. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 587. 2004. *Anthoxanthum indicum* L., Sp. Pl. 1: 28. 1753. *Perotis latifolia* Aiton, Hort. Kew. 1: 85. 1789, *nom. superfl.*; Hook.f., Fl. Brit. India 7: 98. 1896.

Annuals. Culms erect or geniculate; nodes glabrous. Leaves lanceolate, 1–4 × 0.5–0.7 cm, acuminate at apex, rounded at base, wavy and scabrid along margin,

glabrous, green; sheaths slightly keeled. Ligules truncate, membranous. Racemes spiciform, 5–15 cm long, deciduous. Spikelets lanceolate, 2–3 mm long, pubescent, falling entire. Glumes sub-equal, linear-lanceolate, 2–3 × 0.3–0.5 mm long, awned at apex, cuneate at base, chartaceous, pubescent, 1-nerved; awns straight, 5–20 mm long. Florets one, bisexual. Lemmas linear-lanceolate, 0.8–1 mm long, membranous, hyaline, delicate, glabrous, nerves obscure. Paleas linear-lanceolate, 0.8–1 mm long, membranous, hyaline, delicate, glabrous, nerves obscure. Stamens 3. Ovary ovate; stigma plumose.

Distribution: W. Tropical Africa to Tanzania, W. Indian Ocean, Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Waste lands; *Fl. & Ft.*: Throughout the year.

Specimens examined: Chinnar Wildlife Sanctuary, 19.05.1999, *K.V. Thushar* 79374; *Ibid*., 09.02.2021, *Dani Francis & Santhosh Nampy* 188814; Vellimala, 10.09.1997, *Jomy Augustine* 17856 (CALI).

Tribe Paniceae R.Br.

in Flinders, Voy. Terra Austral. 2: 582. 1814.

Key to the genera

1. Inflorescence 1–3 stiff racemes; rachis of racemes broad, flat, disarticulating; spikelets in groups of 1–6, mixed with scale like glumes …… *Trachys*

1. Inflorescence often in panicles, spikes or racemes; rachis of racemes not disarticulating; spikelets without scale like glumes …… 2

2. Spikelets awned or subtended by bristles or atleast aristate …… 3

2. Spikelets not awned, not subtended by bristles or aristate …… 9

3. Spikelets awned or aristate …… 4

3. Spikelets subtended by a solitary or an involucre of bristles …… 7

4. Inflorescence an open panicle; upper glumes and first lemmas notched, awned or mucronate from the sinus …… *Melinis*

4. Inflorescence spiciform or digitate racemes or panicles of secund spikes; glumes and lemmas entire, awned or not …… 5

5. Second lemmas mucronate or aristate; glumes villous along margins ……..
……. *Alloteropsis*

5. Second lemmas not mucronate or aristate; glumes not ciliate …….. 6

6. Leaf blades ovate-elliptic or elliptic-lanceolate; lower glumes awned ……..
……. *Oplismenus*

6. Leaf blades linear; lower glumes not awned ……. *Echinochloa*

7. Aquatic or marshy herbs; second lemmas glabrous, shining; bristles solitary …..
……..... *Pseudoraphis*

7. Terrestrial herbs; second lemmas transversely rugose; bristles numerous, forming an involucre ……..... 8

8. Bristles falling with the spikelets …….. *Cenchrus*

8. Bristles persistent …….. *Setaria*

9. Inflorescence in an open panicle or the panicle contracted, spiciform …….. 10

9. Inflorescence spiciform, subsecund racemes digitate, sub-digitate or scattered on central axis, rarely solitary ……... 17

10. Panicles contracted, narrow, spiciform or cylindrical ……..…….. *Sacciolepis*

10. Panicles often lax, rarely contracted, never spiciform ……..…… 11

11. Spikelets gibbous, laterally compressed …….. 12

11. Spikelets not gibbous, not laterally compressed ……..…….. 13

12. Upper glumes with rows of transparent hooked bristles of glands between the nerves ……... *Pseudechinolaena*

12. Upper glumes without rows of glands or bristles between the nerves, glabrous or hairy …….. *Cyrtococcum*

13. Upper glumes as long as or longer than the second lemma; spikelets solitary at each node ……... 14

13. Upper glumes shorter than the second lemma; spikelets in groups of 2–10 at each node.……. *Ottochloa*

14. Second lemmas with two lateral basal appendages …….. *Ichnanthus*

14. Second lemmas without lateral basal appendages …….. 15

15. Nerves of upper glumes and first lemmas obscure; second lemmas transversely rugose ……. *Megathyrsus*

15. Nerves of upper glumes and first lemmas conspicuous; second lemmas smooth ……. 16

16. Culms spongy …… *Lousiella*

16. Culms tough …….. *Panicum*

17. Lower glumes well developed …… *Urochloa*

17. Lower glumes absent or reduced to a minute scale or rim 18

18. Spikelets binate or ternate, rarely solitary; second lemmas thin, cartilaginous with flat hyaline margins ……. *Digitaria*

18. Spikelets usually solitary, rarely binate; second lemmas more or less crustaceous, with narrow inrolled margins …….. 20

19. Lower glumes strictly absent; spikelets solitary, oblong-lanceolate; culms stoloniferous, mat forming …… *Axonopus*

19. Lower glumes reduced to minute scale or absent; spikelets solitary or paired, ovate-elliptic; culms not stoloniferous, not mat forming …… *Paspalum*

Alloteropsis J.Presl,

Reliq. Haenk. 1: 343. 1830.

Alloteropsis cimicina (L.) Stapf. in D.Oliver *et al.* (eds.), Fl. Trop. Afr. 9: 487. 1919; C.E.C.Ficsh. in Gamble, Fl. Madras 3: 1766. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 276. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 214. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 550. 2004. *Milium cimicinum* L., Mant. Pl. 2: 184. 1771. *Axonopus cimicinus* (L.) P.Beauv., Ess. Agrostogr. 12. 1812; Hook.f., Fl. Brit. India 7: 64. 1896.

Annuals. Culms tufted, erect or decumbent; nodes glabrous or with tubercled hairs. Leaves ovate-lanceolate, 2–10 × 0.5–1.5 cm, acute at apex, rounded or cordate at base, glabrous, tubercled hairy at margin, mid rib hairy, green; sheaths 3–8 cm long, densely tubercled hairy. Ligules truncate, membranous, fimbriate. Racemes usually 3–10 digitate, umbellate or corymbose, 2–15 cm long; rachis angular, scabrous; pedicels angular, 2–4 mm long, dilated at apex, scabrid. Spikelets broadly elliptic, 2–4 mm long, hairy, green with purple margins. Lower glumes ovate-lanceolate, 1.5–2 × 0.8–1 mm, acuminate at apex, cuneate at base, 3-nerved, midrib serrulate towards apex, ciliate along margin. Upper glumes ovate-lanceolate, 3–4 × 1–1.2 mm, acuminate at apex, cuneate at base, chartaceous, 5-nerved, keeled, keels villous, purple. Lower florets male. Upper florets bisexual. First lemmas ovate, 2–3 × 1–1.5 mm, acute at apex, cuneate at base, chartaceous, puberulous, faintly 5–7 nerved. Paleas narrowly elliptic, 1–1.5 × 0.4–0.5 mm, 2-lobed at apex, hyaline, 2-nerved. Second lemmas ovate-lanceolate, 2–3 × 0.8–1 mm, acute and aristate at apex, cuneate at base, sub-coriaceous, glabrous or ciliate at margin, glabrous, faintly 5-nerved. Paleas ovate-elliptic, 2–3 × 0.8–1 mm, obtuse at apex, cuneate at base, sub-coriaceous, glabrous, 2-nerved, 2-keeled, with faint tubercled warts dorsally. Lodicules 2. Stamens 3, *c*. 1 mm long; anthers yellow. Ovary ovate; stigma plumose. Caryopsis dorsally compressed, oblong, brown.

Distribution: Tropical and S. Africa, Madagascar, Hainan to Tropical Asia and N. Australia (POWO, 2023); *Habitat*: Grasslands, roadsides and banks of streams; *Fl. & Ft.*: Throughout the year.

Specimens examined: Chottupara, 07.09.2017, *Dani Francis & Santhosh Nampy* 152974; Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154347; Mangaladevi hills, 15.07.2017, *Dani Francis & Santhosh Nampy* 152886; *Ibid*., 16.02.1997, *Jomy Augustine* 17184; Mamalakandam, near Yakobaya church, 27.12.2017, *Dani Francis* & *Santhosh Nampy* 156522 (CALI); Pullupara-Peruvanthanam, 22.05.1965, *K. Vivekananthan* 23965 (MH).

Axonopus P.Beauv.,

Ess. Agrostogr. 12. 1812.

Axonopus compressus (Sw.) P.Beauv., Ess. Agrostogr. 12. 1812; Bor, Grasses Burma, Ceylon, India & Pakistan 278. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 216.

1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 554. 2004. *Milium compressum* Sw., Prodr. Veg. Ind. Occ. 24. 1788.

Perennial herbs. Culms slender, 20–50 cm high, geniculate, stoloniferous, mat forming; nodes glabrous. Leaves oblong, 3–20 × 0.3–0.5 cm, rounded-obtuse at apex, sub-rounded at base, glabrous, scabrous at margin, green; sheaths keeled, 3–10 cm long, sparsely hairy along one margin. Ligules truncate, *c.* 1.5 mm long, membranous, fimbriate. Racemes usually 2-3 digitate, 2–10 cm long; rachis triquetrous, 0.5–0.8 mm wide, winged, scabrous; pedicels triquetrous, sunken in the rachis, 2–5 mm long, abscission discoid. Spikelets oblong-lanceolate, solitary, 1.5–2.2 mm long, hairy. Lower glumes absent. Upper glumes ovate, 1.5–2.1 × 0.8–1 mm, acute at apex, cuneate at base, softly hairy, 5–6-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas ovate, 1.5–2.1 × 0.8–1 mm, acute at apex, cuneate at base, softly hairy, 4–5-nerved. Second lemmas ovate-elliptic, 1.3–1.5 × 0.5–1 mm, obtuse at apex, cuneate at base, glabrous, crustaceous. Paleas elliptic, 1.2–1.5 × 0.5–1 mm, obtuse at apex, cuneate at base, infolded at margin, glabrous, 2-keeled, faintly 2-nerved, crustaceous. Lodicules 2, cuneate, 0.8 mm long, membranous, hyaline, truncate at apex. Stamens 3, 1 mm long; anthers yellow. Ovary ovate, *c*. 3 × 1 mm; style 2, *c*. 1.1 mm long; stigma plumose.

Distribution: Tropical and Subtropical America (POWO, 2023); *Habitat*: Open lands, wet areas and grass lands; *Fl. & Ft.*: Throughout the year.

Specimens examined: Between Eravikulam and Munnar, 23.01.2018, *Dani Francis & Santhosh Nampy* 158135 (CALI); Munnar, 30.05.1944, *K.C. Jacob* 20492; Peermade, 02.12.1941, *K.C. Jacob* 20223 (MH); Ponnambalamedu, 06.12.1996, *Jomy Augustine* 17001 (CALI).

Notes: This species is commonly knowns as 'Carpet grass' and shows much variation in the shape and size of leaves. Leaves are either oblong, oblanceolate, linear-oblong, lanceolate or linear-lanceolate. This grass grows gregariously and forms mats and is an excellent sand binder (Sreekumar & Nair, 1991).

Cenchrus L.,

Sp. Pl. 2: 1049. 1753.

Cenchrus hohenackeri (Hochst. ex Steud.) Morrone, Ann. Bot. 106: 128. 2010. *Pennisetum hohenackeri* Hochst. ex Steud., Syn. Pl. Glumac. 1: 103. 1854; C.E.C.Fisch.

in Gamble, Fl. Madras 3: 1792. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 344. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 289. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 587. 2004.

Perennials. Culms densely tufted; nodes glabrous. Leaves linear, 10–50 × 0.2–0.5 cm, acuminate at apex, rounded at base, convolute, glabrous or pubescent, green; sheaths distichous, 10–13 cm long, keeled, mouth bearded with long cilia. Ligules a rim of hairs, fimbriate. Panicles spiciform, 8–25 cm long; rachis not winged. Involucre enclosing one sessile spikelet; bristles 2–8 cm long, glabrous or barbellate, falling with spikelets. Spikelets elliptic-lanceolate, 6–8 mm long, sessile. Lower glumes ovate, 1–2 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous, 0–3-nerved. Upper glumes ovate-lanceolate, 4–5 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, 5–7-nerved. Lower florets male or empty, epaleate. Upper florets bisexual. First lemmas ovate-lanceolate, 6–8 × 2–3 mm, acuminate at apex, cuneate at base, glabrous, 9–13-nerved. Second lemmas ovate-lanceolate, 6–8 × 1.5–2 mm, acuminate at apex, cuneate at base, 5–7-nerved. Paleas lanceolate, 6–8 × 1–1.5 mm, acuminate at apex, cuneate at base, glabrous, 2-nerved, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: E. Tropical Africa, Madagascar and Indian Subcontinent (POWO, 2023); *Habitat*: Bank of streams; *Fl. & Ft.*: February-August.

Specimen examined: Kumarikulam, Periyar Tiger Reserve, 12.03.1995, *Jomy Augustine* 14879 (CALI).

Cyrtococcum Stapf

in Oliver *et al.* (eds.), Fl. Trop. Afr. 9: 15. 1917.

Key to the species

1. Panicles contracted; pedicels as long as or shorter than the spikelets 2

1. Panicles lax; pedicels much longer than the spikelets 3

2. Culms slender; leaves up to 5 × 0.6 cm; panicles up to 5 cm long ..... *C. trigonum*

2. Culms stouter; leaves up to 20 × 1.5 cm; panicles up to 20 cm long ……..
…… *C. oxyphyllum*

3. Spikelets very few in a panicle, 2–3 mm long …….. *C. deccanense*

3. Spikelets numerous in a panicle, 1–2 mm long …… 4

4. Glumes and lemmas obtuse at apex; branches of panicle not flabellate ……
…….. *C. patens*

4. Glumes and first lemmas acute or cuspidate at apex; branches of panicle flabellate ..... *C. longipes*

Cyrtococcum deccanense Bor, Kew Bull. 11: 255. 1956, Grasses Burma, Ceylon, India & Pakistan 291. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 227. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 808. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 562. 2004.

Annuals. Culms creeping or decumbent; nodes glabrous or sparsely hairy. Leaves elliptic-lanceolate, 1–7 × 0.2–0.5 cm, acuminate at apex, attenuate at base, glabrous or hairy, green; sheaths 2–3 cm long, with sparse tubercled hairs, ciliate towards apex. Ligules thin, membranous. Panicle lax, 2–15 cm long; pedicels 1–16 mm long. Spikelets ovate or obovate, 2–3 mm long. Lower glumes ovate, 1.5–2 × 0.8–1 mm, acute at apex, sub-truncate at base, glabrous, 3-nerved. Upper glumes boat shaped, 1.8–2 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, 7-nerved. Lower florets empty. Upper florets bisexual. First lemmas ovate-oblong, 1.5–2 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, 7-nerved. Paleas rudimentary. Second lemmas deltoid, 1.5–2 × 1–1.5 mm, obtuse at apex, cuneate at base, crustaceous, shining, glabrous, faintly 5–7-nerved. Paleas ovate-oblong, 1–2 × 0.8–1 mm, obtuse at apex, cuneate at base, crustaceous, 2-nerved, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands and forest fringes; *Fl. & Ft.*: June-October.

Specimens examined: Way to Eravikulam, 28.08.1980, *P.V. Sreekumar* 68423; Munnar, 01.06.1944, *K.C. Jacob* 20508 (MH).

Notes: This species is similar to *C. patens*, but can be distinguished by the few and larger spikelets with long pedicels and narrow, elliptic-lanceolate leaves with a narrow base (Sreekumar & Nair, 1991).

Cyrtococcum longipes (Wight & Arn. ex Hook.f.) A.Camus, Bull. Mus. Natl. Hist. Nat. 27: 118. 1921; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1786. 1934; Bor, Grasses

Burma, Ceylon, India & Pakistan 291. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 229. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 562. 2004. *Panicum longipes* Wight & Arn. ex Hook.f., Fl. Brit. India 7: 58. 1896.

Perennials. Culms erect or trailing; nodes glabrous or sparsely hairy. Leaves linear-lanceolate, 8–20 × 0.5–2 cm, acuminate at apex, attenuate at base, glabrous, green; sheaths 2–5 cm long, glabrous or with sparse tubercled hairs. Ligules ovate, membranous. Panicle lax, 5–30 cm long, with 4–8 alternate flabelliform branches. Spikelets ovate, gibbous, 1.5–2 mm long, glabrous; pedicels angular, 0.5–2 mm long, scabrid. Lower glumes ovate-lanceolate, 1–1.2 × 0.8–1 mm, acute at apex, sub-truncate at base, glabrous, 3-nerved. Upper glumes boat shaped, 1.5–2 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, 5–7-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas ovate 1.5–2 × 1–1.5 mm, cuspidate at apex, cuneate at base, glabrous, 5-nerved. Second lemmas deltoid, gibbous, 1.5–2 × 1–1.5 mm, obtuse at apex, cuneate at base, crustaceous, shining, glabrous, faintly 5–7-nerved. Paleas oblong, 1–1.5 × 0.3–0.5 mm, obtuse at apex, cuneate at base, crustaceous, 2-nerved, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: S. India and Myanmar to Andaman Islands (POWO, 2023); *Habitat*: Forest margins; *Fl. & Ft.*: December-May.

Specimens examined: Meenmutty, 13.02.1982, *C.N. Mohanan* 73217 (MH); way to Nakshathrakuthu, Mankulam, 04.12.2018, *Dani Francis & Santhosh Nampy* 168859; Pambla dam, 08.03.2017, *Dani Francis & Santhosh Nampy* 152031; Thannikkudy, Periyar Tiger Reserve, 02.01.1994, *Jomy Augustine* 13088; Thommankuthu, 09.02.2021, *Dani Francis & Santhosh Nampy* 188948 (CALI).

Notes: This species can be differentiated by its robust habit, longer panicles with drooping flabellate branches and very long pedicels (Sreekumar & Nair, 1991).

Cyrtococcum oxyphyllum (Hochst. ex Steud.) Stapf, Hooker's Icon. Pl. 31: t. 3096. 1922. C.E.C.Fisch. in Gamble, Fl. Madras 3: 1786. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 291. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 231. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 562. 2004. *Panicum oxyphyllum* Hochst. ex Steud., Syn. Pl. Glumac. 1: 65. 1853. *Panicum pilipes* Nees & Arn. ex Buse in Miquel, Pl. Jungh. Prepr. 36. 1854; Hook.f., Fl. Brit. India 7: 57. 1896.

Annuals or perennials. Culms erect or creeping, stouter; nodes glabrous. Leaves linear-lanceolate, 2–20 × 0.4–1.5 cm, acuminate at apex, rounded at base, sparsely hairy or glabrous, green; sheaths 2–5 cm long, sparsely villous, ciliate. Ligules ovate, membranous. Panicles congested, 5–15 cm long. Spikelets obovate, gibbous, 1.5–2 mm long; pedicels 0.5–1 mm long, scaberulous. Lower glumes ovate, 1–1.5 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, 3-nerved. Upper glumes boat shaped, 1.5–2 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas ovate, 1.5–2 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, 5-nerved. Second lemmas deltoid, gibbous, 1–1.5 × 0.8–1 mm, obtuse at apex, cuneate at base, crustaceous, shining, glabrous, faintly 5-nerved. Paleas ovate, 1–1.5 × 0.5–1 mm, obtuse at apex, cuneate at base, crustaceous, 2-nerved, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Tropical and Subtropical Asia to Pacific (POWO, 2023); *Habitat*: Semi-evergreen forests; *Fl. & Ft.*: August-March.

Specimens examined: Kulamavu, 24.09.1981, *C.N. Mohanan & B. Ramanujan* 71950, 71955; *Ibid.*, 25.09.1981, *C.N. Mohanan & B. Ramanujan* 71972; Meenmutty, 27.09.1981, *C.N. Mohanan & B. Ramanujan* 72104 (MH); Pachakkanam, 22.12.1996, *Jomy Augustine* 17052 (CALI); Pullupara, 22.01.1965, *K. Vivekananthan* 22970; Thekkady, 22.12.1974, *K. Vivekananthan* 45385 (MH).

Cyrtococcum patens (L.) A.Camus, Bull. Mus. Natl. Hist. Nat. 27: 118. 1921; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1786. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 292. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 231. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 809. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 562. 2004. *Panicum patens* L., Sp. Pl. 58. 1753. **Fig. 29G**

Annuals. Culms creeping, rooting at lower nodes; nodes glabrous. Leaves ovate-lanceolate, 2–8 × 0.5–1.5 cm, acuminate at apex, cuneate at base, glabrous or puberulous, green; sheaths 1–3 cm long, glabrous or softly villous. Ligules ovate, membranous. Panicle lax, rarely congested, 5–20 cm long. Spikelets obovate, 1–2 mm long, glabrous or muricate. Lower glumes ovate, 1–1.2 × 0.8–1 mm, oobtuse at apex, cuneate at base, glabrous, 3–5-nerved. Upper glumes ovate, 1–1.5 × 1–1.1 mm, obtuse at apex, cuneate at base, glabrous or muricate, 5-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas ovate, 1.5–2 × 1–1.5 mm,

obtuse at apex, cuneate at base, softly hairy or muricate, 5-nerved. Second lemmas deltoid, 1.5–2 × 0.8–1 mm, obtuse at apex, cuneate at base, gibbous, crustaceous, shining, faintly 5-nerved. Paleas ovate-oblong, 1–1.5 × 1 mm, obtuse at apex, cuneate at base, crustaceous, shining, glabrous, 2-nerved, 2-keeled. Stamens 3. Ovary ovate; stigma plumose.

Distribution: Tropical and Subtropical Asia to W. Pacific (POWO, 2023); *Habitat*: Forests and shady areas; *Fl. & Ft.*: Throughout the year.

Specimens examined: Idukki wildlife sanctuary, 05.08.2017, *Dani Francis & Santhosh Nampy* 154178; Kattappana, field near Govt. College, 16.03.2018, *Dani Francis & Santhosh Nampy* 158378; Kokkara, Periyar Tiger Reserve, 11.09.1993, *Jomy Augustine* 12418; Pambla dam, 08.03.2017, *Dani Francis & Santhosh Nampy* 152031 (CALI).

Cyrtococcum trigonum (Retz.) A.Camus, Bull. Mus. Natl. Hist. Nat. 27: 118. 1921; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1785. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 292. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 232. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 562. 2004. *Panicum trigonum* Retz., Observ. Bot. 3: 9. 1783; Hook.f., Fl. Brit. India 7: 56. 1896.

Annuals. Culms slender, creeping, rooting at nodes; nodes sparsely hairy or glabrous. Leaves lanceolate-elliptic, 1–5 × 0.1–0.4 cm, acute-acuminate at apex, cuneate at base, villous, green; sheaths 0.6–1.3 cm long, villous, ciliate. Ligules ovate, membranous. Panicles contracted, 1–4 cm long. Spikelets obovate, 1–2 mm long, sparsely hairy. Lower glumes ovate, 1–1.5 × 0.8–1 mm, acute at apex, cuneate at base, puberulous, 3-nerved. Upper glumes ovate, 1.5–2 × 0.8–1, acute at apex, cuneate at base, puberulous, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas ovate, 1.5–2 × 0.8–1 mm, obtuse at apex, cuneate at base, puberulous, 5–7-nerved. Second lemmas gibbous, deltoid, 1–1.5 × 0.8–1 mm, obtuse at apex, cuneate at base, crustaceous, glabrous, 5-nerved. Paleas oblong, *c.* 1 × 0.5 mm, obtuse at apex, cuneate at base, glabrous, 2-nerved, 2-keeled. Stamens 3. Ovary ovate; stigma plumose.

Distribution: E. Tropical Africa, W. Indian Ocean and Tropical Asia to S. Pacific. (POWO, 2023); *Habitat*: Open lands and forests; *Fl. & Ft.*: July-October.

Specimen examined: Kokkara, 07.07.1993, *Jomy Auguustine* 12057 (CALI).

Digitaria Haller,

Hist. Stirp. Helv. 2: 244. 1768, *nom. cons.*

Key to the species

1. Spikelets verrucose 2

1. Spikelets not verrucose 3

2. Stoloniferous perennials; leaf sheaths pubescent ..... *D. longiflora*

2. Non-stoloniferous annuals; leaf sheaths glabrous ..... *D. violascens*

3. Spikelets with clavate hairs ..... *D. ternata*

3. Spikelets without clavate hairs 4

4. Rachis flat ..... *D. setigera*

4. Rachis triquetrous 5

5. Lower glumes absent ..... *D. wallichiana*

5. Lower glumes present as triangular scale 6

6. Spikelets homomorphous 7

6. Spikelets heteromorphous 9

7. Rachis glabrous ..... *D. radicosa*

7. Rachis serrate 8

8. Abscission of pedicels truncate; spikelets 3–4 mm long ..... *D. ciliaris*

8. Abscission of pedicels discoid; spikelets 2.5–3 mm long ..... *D. griffithi*

9. Annuals; racemes 12–15 cm long ..... *D. bicornis*

9. Perennials; racemes 3–10 cm long ..... *D. didactyla*

Digitaria bicornis (Lam.) Roem. & Schult., Syst. Veg. ed. 15. 2: 470. 1817; Bor, Grasses Burma, Ceylon, India & Pakistan 299. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 235. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 563. 2004. *Paspalum bicorne* Lam., Tabl. Encycl. 1: 176. 1791. *Paspalum heteranthum sensu* Hook.f., Fl. Brit. India 7: 16. 1896, *non* Nees & Meyen, 1843.

Annuals. Culms tufted, geniculate, rooting at lower nodes; nodes glabrous or hispid. Leaves linear-lanceolate, 2–20 × 0.3–1.3 cm, acuminate at apex, rounded at base, undulate on one margin, glabrous or pubescent, green; sheaths keeled, 5–10 cm long, tubercled hairy. Ligules ovate, membranous. Racemes 2–5, digitate or sub-digitate, 12–15 cm long; rachis winged, triquetrous, 0.7–0.9 mm wide, serrulate; pedicels triquetrous, 1.8–2 mm long, abscission truncate. Spikelets elliptic-lanceolate, 3–3.5 mm long, binate, heteromorphous, one sessile and one pedicelled, hairy. Lower glumes triangular, 0.3–0.5 × 0.1–0.2 mm, glabrous, nerveless. Upper glumes lanceolate, 1–2.5 × 0.4–0.5 mm, acute at apex, cuneate at base, pubescent, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas elliptic-lanceolate, 2.5–3.5 × 0.8–1 mm, acuminate at apex, cuneate at base, pubescent, 5-nerved. Second lemmas elliptic-lanceolate, 2.5–3 × 0.8–1 mm, acuminate at apex, cuneate at base, hyaline, glabrous, faintly 3-nerved. Paleas lanceolate, 2.5–3 × 0.8–1 mm, acuminate apex, cuneate at base, hyaline, glabrous, faintly 2-nerved, 2-keeled. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose.

Distribution: W. Indian Ocean, Tropical & Subtropical Asia to N. Australia (POWO, 2023); *Habitat*: Deciduous forests; *Fl. & Ft.*: March-September.

Specimens examined: Kalvary mount, 18.07.2016, *Shimi Cherian & Drisya V.* 148132; Kalyanathand, 8th mile, Kattappana, 18.07.2016, *Shimi Cherian* 148146; Nedumkandam, 19.07.2016, *Shimi Cherian & Drisya V.* 148157; Vazhavara, Kattappana, 18.07.2016, *Shimi Cherian & Drisya V.* 148128; Vellayamkudi, Kattappana, 18.07.2016, *Shimi Cherian & Drisya V.* 148147 (CALI).

Digitaria ciliaris (Retz.) Koeler, Descr. Gramin. 27. 1802; Sreek. & V.J.Nair, Fl. Kerala-Grasses 237. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 564. 2004. *Panicum ciliare* Retz., Observ. Bot. 4: 16. 1786. *Digitaria adscendens* (Kunth) Henrard, Blumea 1: 92. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 298. 1960. *Digitaria marginata* Link, Enum. Hort. Berol. Alt. 1: 102. 1821; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1764. 1934.

Annuals or perennials. Culms slender, 20–100 cm long, tufted, erect or decumbent, rooting at lower nodes; nodes glabrous. Leaves linear-lanceolate, 2–20 × 0.2–1 cm, acuminate at apex, rounded at base, glabrous, undulate on one margin, green; sheaths keeled, 2–10 cm long, glabrous. Ligules lanceolate, 1–3 mm

long, membranous. Racemes usually 2–10 digitate or sub-digitate, 6–20 cm long; rachis winged, 0.5–1 mm wide, serrate; pedicels triquetrous, 3.2–3.5 mm long, abscission truncate. Spikelets lanceolate, 3–4 × 0.8–1 mm, binate, homomorphous, one sessile and one pedicelled, hairy. Lower glumes triangular, 0.2–0.6 × 0.2–0.3 mm, glabrous. Upper glumes lanceolate, 2.5–3 × 0.5–0.8 mm, acuminate at apex, cuneate at base, pubescent, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas elliptic-lanceolate, 3–3.2 × 0.9–1.3 mm, acute at apex, cuneate at base, pubescent, 5–7-nerved. Second lemmas elliptic-lanceolate, 2.5–3 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, crustaceous. Paleas lanceolate, 2–2.5 × 0.8–1.2 mm, acute at apex, cuneate at base, glabrous, 2 keeled, faintly 2-nerved. Lodicules 2, cuneate, *c*. 0.8 mm long, membranous, hyaline, truncate at apex. Stamens 3, *c*. 1 mm long; anthers yellow. Ovary ovate, 1–1.5 mm long; style 2, *c*. 1.1 mm long; stigma plumose.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Waste lands and road sides; *Fl. & Ft.*: Throughout the year.

Specimens examined: Chottupara near Ramakalmedu, 07.09.2017, *Dani Francis & Santhosh Nampy* 152972; Chundal, Mathikettan Shola National Park, 22.07.2016, *Shimi Cherian & Drisya V.* 148188; Churuli, Adimali, 20.07.2016, *Shimi Cherian & Drisya V.* 148168; Kalvary mount, 18.07.2016, *Shimi Cherian & Drisya V.* 148141, 150632; Karimbam, Adimali, 20.08.2016, *Shimi Cherian* 148175; Kattippara, Adimali, 20.07.2016, *Shimi Cherian & Drisya V.* 148171, 148172; Neriamangalam, 2nd mile, 23.07.2016, *Shimi Cherian & Drisya V.* 150608; Thondimala, Santhanpara, 22.07.2016, *Shimi Cherian & Drisya V.* 148199 (CALI).

Digitaria didactyla Willd., Enum. Pl. 1: 91. 1809; Bor, Grasses Burma, Ceylon, India & Pakistan 300. 1960.

Perennials. Culms decumbent or prostrate, rooting at lower nodes; nodes glabrous, subtending one leaf. Leaves flat, lanceolate, 3–10 × 0.1–0.5 cm, acuminate at apex, attenuate at base, undulate on one margin, glabrous, green; sheaths keeled, 2–5 cm long, pubescent. Ligules ovate or truncate, membranous. Racemes 2 or 3, digitate, 3–10 cm long; rachis narrowly winged, triquetrous, 0.8–0.9 mm wide, serrulate; pedicels triquetrous, 1.8–2 mm long, abscission truncate. Spikelets elliptic-lanceolate, 3–3.5 mm long, binate, heteromorphous, one sessile

and one pedicelled, pubescent. Lower glumes triangular scale, 0.3–0.5 mm long, glabrous, nerveless. Upper glumes lanceolate, 2–3 × 0.3–0.5 mm, acute at apex, cuneate at base, pubescent, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas elliptic-lanceolate, 3–3.5 × 0.8–1 mm, acuminate at apex, cuneate at base, pubescent, 5-nerved. Second lemmas elliptic-lanceolate, 1.5–2.5 × 0.5–0.7 mm, acuminate at apex, cuneate at base, hyaline, glabrous, faintly 3-nerved. Paleas lanceolate, 1.5–2.5 × 0.5–0.6 mm, acuminate at apex, cuneate at base, hyaline, glabrous, faintly 2-nerved, 2-keeled. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Malawi to Mozambique and W. Indian Ocean (POWO, 2023); *Habitat*: Open grasslands and road sides; *Fl. & Ft.*: Throughout the year.

Specimen examined: Jimmykkad, 22.07.2016, *Shimi Cherian & Drisya V.* 148190 (CALI).

Digitaria griffithii (Hook.f.) Henrard, Blumea 1: 100. 1934; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1765. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 301. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 238. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 815. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 564. 2004. *Paspalum sanguinale* var. *griffithii* Hook.f., Fl. Brit. India 7: 15. 1896.

Annuals or perennials. Culms creeping or geniculate, rooting at lower nodes; nodes glabrous. Leaves linear-lanceolate, 3–40 × 0.3–1.5 cm, acuminate at apex, rounded at base, undulate on one margin, glabrous or sparsely villous, green; sheaths keeled, 6–8 cm long, tubercled hairy or glabrous. Ligules ovate or truncate, membranous. Racemes 5–9, digitate or sub-digitate, 12–15 cm long; rachis narrowly winged, triquetrous, *c.* 0.3 mm wide, serrulate; pedicels triquetrous, 3–3.5 mm long, abscission discoid. Spikelets elliptic-lanceolate, 2.5–3 mm long, binate, homomorphous, one sub-sessile and one pedicelled, pubescent. Lower glumes triangular scale, 0.3–0.6 mm long, glabrous, nerveless. Upper glumes oblong-lanceolate, 2–3 × 0.5–0.8 mm, acuminate at apex, cuneate at base, pubescent, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas elliptic-lanceolate, 2.5–3.5 × 0.8–1 mm, acuminate at apex, cuneate at base, pubescent, 5-nerved. Second lemmas elliptic-lanceolate, 2.5–3 × 0.8–1 mm, acuminate at apex, cuneate at base, glabrous, faintly 3-nerved. Paleas elliptic-

lanceolate, 2.5–3 × 0.8–1 mm, acuminate at apex, cuneate at base, hyaline, glabrous, faintly 2-nerved, 2-keeled. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Indian Subcontinent, Andaman and Nicobar Islands (POWO, 2023); *Habitat*: Forest margins; *Fl. & Ft.*: March-September.

Specimens examined: Kulamankuzhy, Neriamangalam, 23.07.2016, *Shimi Cherian* 150606; Neriamangalam forest, 23.07.2016, *Shimi Cherian* 150607 (CALI).

Digitaria longiflora (Retz.) Pers., Syn. Pl. 1: 85. 1805; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1765. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 302. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 239. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 564. 2004. *Paspalum longiflorum* Retz., Observe. Bot. 4: 15. 1786; Hook.f., Fl. Brit. India 7: 17. 1896, *p.p*.

Perennials, stoloniferous. Culms slender, 10–40 cm high, creeping or geniculate; nodes glabrous. Leaves lanceolate, 1–10 × 0.2–1 cm, acute at apex, cordate at base, with tubercled hairs, entire, green; sheaths keeled, 2–3.5 cm long, tubercled hairy. Ligules ovate, *c.* 2.2 cm long, membranous. Racemes usually 2 or 3 digitate, 2–10 cm long; rachis flat, 0.5–1 mm wide, winged; pedicels terete, 0.2–2 mm long, abscission discoid or cupuliform. Spikelets elliptic-ovate, solitary, 1–2 mm long, hairy. Lower glumes absent. Upper glumes ovate-elliptic, 1.2–2 × 0.5–1 mm, acute at apex, cuneate at base, softly hary, 5–9-nerved. Lower florets empty. Upper florets bisexual. First lemmas ovate-elliptic, 1.2–2 × 0.5–1 mm, acute at apex, cuneate at base, softly hairy, 5–9-nerved. Second lemmas ovate-elliptic, 1–1.5 × 0.5–0.8 mm, acute at apex, cuneate at base, glabrous, crustaceous. Paleas broadly elliptic, 1–1.4 × 0.5–1.1 mm, acute apex, cuneate at base, glabrous, 2-keeled, faintly 2-nerved. Lodicules 2, cuneate, *c.* 0.8 mm long, membranous, hyaline, truncate at apex. Stamens 3, *c.* 1 mm long; anthers yellow. Ovary ovate, *c.* 3 × 1 mm; style 2, *c.* 1.1 mm long; stigma plumose. Caryopsis oblong, *c.* 1 × 0.6 mm, turgid.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Open grasslands; *Fl. & Ft.*: Throughout the year.

Specimens examined: Choondal, Mathikettan Shola National Park, 22.07.2016, *Shimi Cherian & Drisya V.* 148187; Kalvary mount, 18.07.2016, *Shimi Cherian &*

Drisya V. 148134; Kokkara, 08.07.1993, *Jomy A.* 13846; Ramakalmedu, 07.09.2017, *Dani Francis & Santhosh Nampy* 152944; Thondimala, Cardamom plantation, 22.07.2016, *Shimi Cherian* 148194 (CALI).

Digitaria radicosa (J.Presl) Miq., Fl. Ned. Ind. 3: 437. 1857; Sreek. & V.J.Nair, Fl. Kerala-Grasses 240. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 564. 2004. *Panicum radicosum* J.Presl, Reliq. Haenk. 1: 297. 1830. *Digitaria timorensis* (Kunth) Balansa, J. Bot. (Morot) 4: 138. 1890; Bor, Grasses Burma, Ceylon, India & Pakistan 306. 1960.

Annuals. Culms tufted, geniculate, rooting at lower nodes; nodes glabrous. Leaves elliptic-lanceolate, 2–9 × 0.2–0.5 cm, acuminate at apex, rounded at base, undulate on one margin, glabrous, green; sheaths keeled, 3–5 cm long, pubescent. Ligules ovate or truncate, membranous. Racemes 2–4, digitate or sub-digitate, 3–8 cm long; rachis winged, triquetrous, 0.1–0.2 mm wide, glabrous; pedicels triquetrous, 1.5–2.5 mm long, abscission truncate. Spikelets lanceolate, 3–4 mm long, binate, homomorphous, one sub-sessile and one pedicelled, pubescent. Lower glumes triangular scale, 0.1–0.2 mm long, glabrous, nerveless. Upper glumes lanceolate, 1–3 × 0.2–0.5 mm, acuminate at apex, cuneate at base, pubescent, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas elliptic-lanceolate, 3–4 × 0.8–1 mm, acuminate at apex, cuneate at base, pubescent, 5-nerved. Second lemmas elliptic-lanceolate, 2.5–3 × 0.8–1 mm, acute at apex, cuneate at base, hyaline, glabrous, faintly 3-nerved. Paleas lanceolate, 2.5–3 × 0.5–1 mm, acuminate at apex, cuneate at base, hyaline, glabrous, faintly 2-nerved, 2-keeled. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Tropical and Subtropical Asia to Pacific (POWO, 2023); *Habitat*: Road sides, river banks and agricultural fields; *Fl. & Ft.*: Throughout the year.

Specimens examined: Kalvary mount, 18.07.2016, *Shimi Cherian & Drisya V.* 148138; Kalyanathand, Kattappana, 18.07.2016, *Shimi Cherian & Drisya V.* 148135; Karimanal, 26.03.2016, *Drisya V.* 148117; Nedumkandam, 19.07.2016, *Shimi Cherian & Drisya V.* 148159, 148161; Neriyamangalam, 23.07.2016, *Shimi Cherian* 150604; Vattappara, Mathikettan Shola National Park, 22.07.2016, *Shimi Cherian & Drisya V.* 148193; Vellayamkudi, Kattappana, 18.07.2016, *Shimi Cherian & Drisya V.* 148143; *Ibid*., 20.07.2016, *Shimi Cherian & Drisya V.* 148163 (CALI).

Notes: *Digitaria radicosa* is distinguished by having slender culms, few racemes, smooth rachis and lanceolate spikelets (Boonsuk *et al.*, 2016).

Digitaria setigera Roth in Roemer & Schultes, Syst. Veg. ed. 15. 2: 474. 1817; Bor, Grasses Burma, Ceylon, India & Pakistan 305. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 241. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 564. 2004. *Paspalum sanguinale* var. *extensum* Hook.f., Fl. Brit. India 7: 15. 1896.

Annuals. Culms 20–100 cm, creeping and geniculate, rooting at lower nodes; nodes glabrous or hairy. Leaves elliptic-lanceolate, 2–12 × 0.2–0.6 cm, acuminate at apex, sub-cordate at base, margin undulate on one side, pubescent; sheaths keeled, 5–8 cm long, tubercled hairy. Ligules ovate, 1.3–1.6 mm long, membranous. Racemes usually 3–12, digitate, each 5–20 cm long; rachis flat, 0.3–0.6 mm long, winged, scabrous; pedicels triquetrous, 0.2–3 mm long, scabrous, abscission truncate. Spikelets elliptic, 2–3 × 0.5–0.8 mm, lower sub-sessile, upper pedicelled, homomorphous, pubescent. Lower glumes usually absent. Upper glumes lanceolate, 1–1.2 × 0.3–0.5 mm, pubescent, cilia overtopping, 0–3-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas elliptic, 2.5–3 × *c*. 1 mm, acute at apex, cuneate at base, pubescent, ciliate, 5-nerved. Second lemmas elliptic-lanceolate, 2–2.5 × 0.8–1 mm, acute at apex, cuneate at base, crustaceous, glabrous, faintly 3-nerved, hyaline. Paleas lanceolate, 2–2.3 × 0.5–0.8 mm, acute at apex, cuneate at base, glabrous, hyaline, faintly 2-nerved, 2-keeled. Lodicules 2, *c.* 0.3 mm long, membranous, hyaline, truncate at apex. Stamens 3, 0.6–0.7 mm long, yellowish brown. Ovary ovate, 0.5 mm long; style 1.2 mm long; stigma plumose. Caryopsis oblong, *c.* 2.1 × 0.8 mm, turgid.

Distribution: Tanzania to Pacific (POWO, 2023); *Habitat*: Waste places; *Fl. & Ft.*: Throughout the year.

Specimens examined: Aduvizhuthankudy, 22.07.2016, *Shimi Cherian & Drisya V.* 148184; Balanpilla, near Ramakkalmedu, 19.07.2016, *Shimi Cherian & Drisya V.* 148155; Churuli, Adimali, 20.07.2016, *Shimi Cherian & Drisya V.* 148170; Karimban, Adimali, 20.07.2016, *Shimi Cherian & Drisya V.* 148176; Kattappana, 18.07.2016, *Shimi Cherian & Drisya V.* 148149; Kattappana, 10th mile, 18.07.2016, *Shimi Cherian & Drisya V.* 148136; Kattippara, Adimali ghat side, 20.07.2016, *Shimi Cherian & Drisya V.* 148174; Kokkara, 08.07.1993, *Jomy Augustine* 12062;

Nedumkandam, 19.07.2016, *Shimi Cherian & Drisya V.* 148158; Pambla dam, 08.03.2017, *Dani Francis & Santhosh Nampy* 152028 (CALI); Thekkady, 16.01.1995, *Jomy Augustine* 14598; Thondimala, near Santhanpara, 22.07.2016, *Shimi Cherian & Drisya V.* 148197; Thookupalam, 19.07.2016, *Shimi Cherian & Drisya V.* 148162; Vazhavara, near Kattappana, 18.07.2016, *Shimi Cherian & Drisya V.* 148128; Vellakkayam, near Cheruthoni, 04.04.2018, *Dani Francis & Santhosh Nampy* 158457; Vellayamkudi, Kattappana, 18.07.2016, *Shimi Cherian & Drisya V.* 148144 (CALI).

Notes: This species is morphologically allied to *D. ciliaris*, but can be distinguished by the lower glumes which is either absent or reduced to a rim and a smaller upper glume which is usually less than half the length of the spikelets. It is also similar to *D. griffithi*, but differs by its smaller upper glumes, reduced lower glumes and shorter pedicels (Sreekumar & Nair, 1991).

Digitaria ternata (A.Rich.) Stapf in Harvey, Fl. Cap. 7(2): 376. 1898; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1765. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 306. 1960; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 564. 2004. *Cynodon ternatus* A.Rich., Tent. Fl. Abyss. 2: 405. 1850. *Paspalum ternatum* (A.Rich.) Hook.f., Fl. Brit. India 7: 17. 1896.

Annuals or short-lived perennials. Culms tufted, rhizomatous; nodes glabrous. Leaves lanceolate, 8–20 × 0.3–0.5 cm, acuminate at apex, rounded at base, entire, glabrous, green; sheaths keeled, 3–5 cm long, pubescent. Ligules membranous. Racemes 5–9, digitate or sub-digitate, 7–9 cm long; rachis winged, flat, 0.3–0.5 mm wide, serrulate; pedicels triquetrous, *c.* 1.5 mm long. Spikelets oblong-elliptic, 1–1.5 mm long, ternate, dorsally bulged, arranged on ribbon like rachis, clavate hairy. Lower glumes absent. Upper glumes ovate-lanceolate, 1–1.5 × 0.2–0.5 mm, acute at apex, cuneate at base, pubescent, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas elliptic-lanceolate, 1–1.5 × 0.3–0.6 mm, acute at apex, cuneate at base, pubescent, 5-nerved. Second lemmas ovate-elliptic, 1–1.5 × 0.4–0.6 mm, acute at apex, cuneate at base, hyaline, glabrous, faintly 3-nerved. Paleas ovate-elliptic, 1–1.3 × 0.3–0.5 mm, acute at apex, cuneate at base, hyaline, glabrous, faintly 2-nerved, 2-keeled. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Waste lands; *Fl. & Ft.*: July-February.

Specimen examined: Kalvary mount, near tea plantation, 18.07.2016, *Shimi Cherian & Drisya V.* 148142 (CALI).

Digitaria violascens Link, Hort. Berol. 1: 229. 1827; Bor, Grasses Burma, Ceylon, India & Pakistan 307. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 242. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 817. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 564. 2004. *Digitaria chinensis* (Nees) A.Camus, Notul. Syst. 4: 48. 1923, *non* Hornem, 1819; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1765. 1934. *Paspalum longiflorum auct*. Hook.f., Fl. Brit. India 7: 17. 1896 *non* Retz., 1786.

Annuals. Culms erect or geniculate; nodes glabrous. Leaves linear-lanceolate, 3–8 × 0.2–0.6 cm, acuminate at apex, rounded at base, entire, glabrous, green; sheaths keeled, 3–5 cm long, glabrous. Ligules ovate or truncate, membranous. Racemes 3–8, digitate or sub-digitate, 5–9 cm long; rachis winged, flat, 0.3–0.5 mm wide, serrulate; pedicels sub-terete or angular, *c.* 1.5 mm long, glabrous. Spikelets ovate-elliptic, 1.5–2 mm long, ternate, dorsally bulged. Lower glumes absent. Upper glumes oblong-elliptic, 1.5–2 × 0.5–0.7 mm, acute at apex, cuneate at base, pubescent, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas elliptic-lanceolate, 1–2 × 0.8–1 mm, acute to acuminate at apex, cuneate at base, pubescent, 7-nerved. Second lemmas elliptic-lanceolate, 1–2 × 0.8–1 mm, acute at apex, cuneate at base, hyaline, glabrous, faintly 3-nerved. Paleas ovate-elliptic, 1–1.5 × 0.8–1 mm, acute at apex, cuneate at base, hyaline, glabrous, faintly 2-nerved, 2-keeled. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Tropical and Subtropical Asia to N. and E. Australia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-November.

Specimens examined: Choondel, Mathikettan Shola National Park, 22.07.2016, *Shimi Cherian & Drisya V.* 148186, 148189; Thondimala, Santhanpara, 22.07.2016, *Shimi Cherian & Drisya V.* 148195; Vattappara, near Santhanpara, 22.07.2016, *Shimi Cherian & Drisya V.* 148192 (CALI).

Notes: This grass shows much variation, especially in the number of racemes and indumentum on the spikelets (Sreekumar & Nair, 1991).

Digitaria wallichiana (Wight & Arn. ex Steud.) Stapf in Oliver *et al.* (eds.), Fl. Trop. Afr. 9: 436. 1919; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1765. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 307. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 243. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 818. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 565. 2004. *Panicum wallichianum* Wight & Arn. ex Steud., Syn. Pl. Glumac. 1: 41. 1853. *Paspalum perrottetii* Hook.f., Fl. Brit. India 7: 20. 1896, *non* Kunth 1831.

Annuals or perennials. Culms erect or decumbent; nodes sparsely hairy. Leaves linear-lanceolate, 5–8 × 0.3–1 cm, acuminate at apex, cordate at base, undulate on one margin, sparsely hairy or glabrous, green; sheaths slightly keeled, 2.5–5 cm long, pubescent. Ligules ovate or truncate, membranous. Inflorescence pseudo paniculate, 4–10 cm long; racemes 10–20, verticillate or sub-verticillate, 2–10 cm long; rachis narrowly winged, triquetrous, *c.* 0.3 mm wide, serrulate; pedicels terete to triquetrous, 2–4 mm long, serrate. Spikelets oblong-elliptic, 2–2.5 mm long, binate, homomorphous, one sub-sessile and one pedicelled. Lower glumes absent. Upper glumes lanceolate, 1.5–2 × 0.3–0.5 mm, acute at apex, cuneate at base, pubescent, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas oblong-lanceolate, 2–2.5 × 0.5–1 mm, acuminate at apex, cuneate at base, pubescent, 7-nerved. Second lemmas elliptic-lanceolate, 1.7–2 × 0.5–1 mm, acute at apex, cuneate at base, hyaline, glabrous, faintly 3-nerved. Paleas elliptic-lanceolate, 1.5–2 × 0.5–1 mm, acute at apex, cuneate at base, hyaline, glabrous, 2-nerved, 2-keeled. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose.

Distribution: S. India, Sri Lanka and Jawa to Lesser Sunda Islands (POWO, 2023); *Habitat*: Grasslands and road sides; *Fl. & Ft.*: June-August.

Specimen examined: Thondimala, Santhanpara, 22.07.2016, *Shimi Cherian & Drisya V.* 148198 (CALI).

Echinochloa P.Beauv.,

Ess. Agrostogr. 53. 1812.

Key to the species

1. Ligules present ..... *E. stagnina*

1. Ligules absent 2

2. Spikelets awned …… *E. crus-galli*

2. Spikelets awnless …… 3

3. Racemes incurved at maturity; spikelets densely crowded …… …… *E. colonum* subsp. *edulis*

3. Racemes straight at maturity; spikelets openly spaced …… *E. colonum*

Echinochloa colonum (L.) Link, Hort. Berol. 2: 209. 1833; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1776. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 308. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 245. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 567. 2004. *Panicum colonum* L., Syst. Nat. ed. 10. 2: 870. 1759; Hook.f., Fl. Brit. India 7: 32. 1896.

Annuals. Culms erect, tufted; nodes glabrous. Leaves lanceolate, 3–25 × 0.3–1 cm, acuminate at apex, rounded at base, undulate at one margin, glabrous or puberulous, green; sheaths 3–15 cm long, keeled, glabrous. Ligules absent. Panicles with spiciform racemes alternating the axis, 5–15 cm long; racemes 4–12, 1–3.5 cm long, straight; rachis triquetrous, scabrellate. Spikelets ovate-elliptic, 2–4 mm long, paired, openly spaced, hispid. Lower glumes ovate, 1–2 × 1–1.5 mm, acuminate at apex, cuneate at base, hispid, 5-nerved. Upper glumes boat shaped, 2–4 × 1.5–2 mm, acuminate at apex, cuneate at base, hispid, chartaceous, 7–11-nerved. Lower florets empty. Upper florets bisexual. First lemmas ovate, 2–4 × 1.5–2 mm, acuminate at apex, cuneate at base, pubescent, 7-nerved. Paleas oblong-ovate, 1.5–2 × 0.8–1 mm, mucronate at apex, cuneate at base, hyaline, glabrous, 2-nerved, 2-keeled. Second lemmas ovate-elliptic, 2–3 × 0.8–1 mm, acute at apex, obtuse at base, glabrous, 3–5-nerved. Paleas ovate-elliptic, 1.5–2 × 0.8–1 mm, mucronate at apex, cuneate at base, sub-coriaceous, glabrous, 2-nerved, 2-keeled. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Paddy fields and wastelands; *Fl. & Ft.*: Throughout the year.

Specimens examined: Kulamavu, 03.06.1982, *C.N. Mohanan* 74170 (MH); Thekkady, 10.01.1995, *Jomy Augustine* 14575 (CALI).

Notes: This species is considered as one of the very good fodder grasses and also an obnoxious weed in paddy fields (Sreekumar & Nair, 1991).

Echinochloa colonum subsp. **edulis** (Honda) Banfi & Galasso, Nat. Hist. Sci. 8(1): 71. 2021. *Echinochloa frumentacea* Link, Hort. Berol. 1: 204. 1827; Bor, Grasses Burma, Ceylon, India & Pakistan 311. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 247. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 568. 2004. *Echinochloa colonum* var. *frumentacea* (Link) Ridl., Fl. Malay Penins. 5: 223. 1925; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1777. 1934. *Panicum crusgalli* var. *frumentaceum* (Link) Trim., Syst. Cat. Fl. Pl. Ceylon 104. 1885; Hook.f., Fl. Brit. India 7: 31. 1896.

Annuals or perennials. Culms robust, tufted; nodes glabrous. Leaves linear-lanceolate, 10–28 × 1–2 cm, acuminate at apex, slightly narrowed and oblique at base, mid rib prominent, serrulate, scaberulous, green; sheaths 7–10 cm long, keeled towards apex, scaberulous. Ligules absent. Panicle 6–15 cm long, with alternate closely arranged racemes. Racemes 1–2.5 cm long, straight when young and curved at maturity; rachis angled, scabrellate. Spikelets obovoid, 3–3.5 mm long, paired, densely crowded, hairy, greenish yellow. Lower glumes broadly ovate, 1.2–1.5 × 1.5–1.8 mm, cuspidate at apex, truncate at base, scabrellate, greenish yellow, 3–5-nerved. Upper glumes broadly ovate-elliptic, 3–3.5 × 1.8–2 mm, acute at apex, cuneate at base, scabrous, chartaceous, 5-nerved. Lower florets barren. Upper florets bisexual. First lemmas broadly ovate, 2.8–3 × 1.6–1.8 mm, acute at apex, cuneate at base, scabrous, faintly 5–7-nerved. Paleas oblong, 2–2.2 × 0.5–0.7 mm, obtuse at apex, cuneate at base, delicate, 2-nerved, 2-keeled, keels sparsely ciliate. Second lemmas ovate-elliptic, 2–2.5 × 1–1.5 mm, coriaceous, acute at apex, obtuse at base, glabrous, shiny, faintly 5–7-nerved. Paleas broadly elliptic, 1.5–2 × 1–1.4 mm, rounded at apex, narrowly truncate at base, coriaceous, glabrous, 2-nerved. Lodicules 2, membranous, truncate. Stamens 3. Ovary oblong; stigma plumose. Caryopsis elliptic, dorsally compressed.

Distribution: Tropical Africa (POWO, 2023); *Habitat*: Near streams and paddy fields; *Fl. & Ft.*: April-September.

Specimen examined: Peerumedu, 27.04.2018, *Dani Francis & Santhosh Nampy* 159216 (CALI).

Echinochloa crus-galli (L.) P.Beauv., Ess. Agrostogr. 53. 1812; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1777. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 310. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 246. 1991; K.M.Matthew, Illustr. Fl.

Palni Hills 819. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 567. 2004. *Panicum crus-galli* L., Sp. Pl. 56. 1753; Hook.f., Fl. Brit. India 7: 30. 1896.

Annuals. Culms erect, tufted; nodes glabrous. Leaves linear-lanceolate, 5–35 × 0.2–1.5 cm, acuminate at apex, rounded at base, scabrous, green; sheaths 5–15 cm long, slightly keeled, glabrous. Ligules absent. Panicles congested, 5–20 cm long with alternate racemes; racemes 5–15, 1–6 cm long. Spikelets ovate-lanceolate, 3–5 mm long, awned. Lower glumes ovate, 2–3 × 1.5–2 mm, acute at apex, cuneate at base, scabrous, 5-nerved. Upper glumes ovate-lanceolate, 3–5 × 1–2 mm, cuspidate at apex, cuneate at base, scabrous, 5-nerved. Lower florets male or empty. Upper florets bisexual. First lemmas ovate-lanceolate, 3–4 × 1.5–2 mm, cuspidate or awned at apex, cuneate at base, scabrous, 5–7-nerved. Paleas elliptic-oblong, 2.5–3 mm long, acute-emarginate at apex, cuneate at base, hyaline, puberulous, 2-nerved, 2-keeled. Second lemmas ovate, 3–4 × 1.5–2 mm, acuminate at apex, cuneate at base, chartaceous, glabrous, faintly 3–5-nerved. Paleas elliptic, 2–3 × 0.8–1 mm, acute at apex, cuneate at base, chartaceous, glabrous, 2-nerved, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: S. and E. Europe to Asia, W., E. and S. Tropical Africa to S. Africa, Madagascar (POWO, 2023); *Habitat*: Marshy lands; *Fl. & Ft.*: March-December.

Specimen examined: Thekkady, 16.12.1996, *Jomy Augustine* 16989 (CALI).

Notes: 'Barnyard grass' is a common weed in paddy fields, and is allied to *E. stagnina*, but can be distinguished by the racemes not spreading in panicles and in the absence of ligules (Sreekumar & Nair, 1991).

Echinochloa stagnina (Retz.) P.Beauv., Ess. Agrostogr. 161. 1812; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1777. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 311. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 248. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 821. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 568. 2004. *Panicum stagninum* Retz., Observ. Bot. 5: 17. 1789.

Annuals. Culms erect, tufted; nodes glabrous. Leaves linear-lanceolate, 2–20 × 0.2–0.5 cm, acuminate at apex, rounded at base, puberulous, green; sheaths 3–7 cm long, slightly keeled. Ligules a row of hairs. Panicles congested, 3–10 cm long; racemes 5–15, secund, 1–6 cm long. Spikelets ovate-elliptic, 4–6 mm long, awned.

Lower glumes ovate, 2–3 × 1–1.5 mm, acuminate at apex, cuneate at base, pubescent, 5-nerved. Upper glumes ovate-lanceolate, 5–6 × 2–3 mm, acuminate at apex, cuneate at base, pubescent, 7–9-nerved. Lower florets male. Upper florets bisexual. First lemmas ovate-lanceolate, 4–6 × 2–3 mm, acuminate or awned at apex, cuneate at base, pectinate along nerves, pubescent, 7-nerved; awns 5–10 mm long. Second lemmas elliptic, 4–5 × 1.5–2 mm, acuminate at apex, cuneate at base, chartaceous, glabrous, faintly 5-nerved. Paleas elliptic, 4–5 × 1.5–2 mm, acuminate at apex, cuneate at base, chartaceous, glabrous, 2-nerved, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Africa and Tropical Asia (POWO, 2023); *Habitat*: Marshy lands; *Fl. & Ft.*: January-November.

Specimens examined: Cheruthoni, 18.02.1982, *V.S. Raju* 71259; Kattappana, 13.11.1981, *C.N. Mohanan* 72492; Kulamavu, 04.06.1982, *C.N. Mohanan* 74176 (MH); Thekkady, 10.01.1995, *Jomy Augustine* 14577 (CALI).

Ichnanthus P.Beauv.,

Ess. Agrostogr. 56. 1812.

Ichnanthus pallens var. **major** (Nees) Stieber, Syst. Bot. 12: 207. 1987; Hook.f., Fl. Brit. India 7: 60. 1896. *Panicum pallens* var. *majus* Nees, Fl. Bras. Enum. Pl. 2: 138. 1829. *Ichnanthus vicinus* (F.M.Bailey) Merr., Philip. J. Sci. 20. 367. 1922; Bor, Grasses Burma, Ceylon, India & Pakistan 314. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 253. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 574. 2004.

Annuals. Culms creeping or geniculate, rooting at lower nodes; nodes glabrous. Leaves linear-lanceolate, 2–8 × 0.5–2 cm, acuminate at apex, oblique at base, pubescent, dark green; sheaths slightly inflated, 1–5 cm long, ciliate. Ligules a tuft of hairs. Panicle 3–10 cm long; racemes 6–12, alternate, closely arranged, 1–3 cm long; rachis triquetrous, scabrellate. Spikelets elliptic, 4–6 mm long, widely gaping, scabrid, greenish. Lower glumes ovate-lanceolate, 3–4 × 1–1.5 mm, shortly aristate at apex, truncate at base, scabrellate, 3–5-nerved. Upper glumes ovate-lanceolate, 4–5 × 1–1.5 mm, acute at apex, cuneate at base, scabrous, chartaceous, 5–7-nerved, keeled. Lower florets barren. Upper florets bisexual. First lemmas ovate-lanceolate, 3–5 × 1–2 mm, acute at apex, cuneate at base, scabrous, 5–7-

nerved. Paleas elliptic, 2–2.5 × 0.8–1 mm, obtuse at apex, cuneate at base, hyaline, 2-nerved, 2-keeled, keels sparsely ciliate. Second lemmas elliptic-oblong, 2–3 × 1–1.2 mm, crustaceous, acute at apex, obtuse at base, glabrous, shiny, faintly 3–5-nerved, with 2 scales at base. Paleas elliptic, 2–3 × 0.8–1 mm, obtuse at apex, cuneate base, crustaceous, glabrous, 2-nerved, slightly 2-keeled. Lodicules 2, membranous, cuneate. Stamens 3. Ovary oblong; stigma plumose.

Distribution: W. and W. Central Tropical Africa, Tropical & Subtropical Asia to NE. Australia, Tropical & Subtropical America (POWO, 2023); *Habitat*: Forest margins; *Fl. & Ft.*: March-August.

Specimens examined: Kannadippara, Mankulam, 08.06.2018, *Dani Francis & Santhosh Nampy* 159277; Vellimala, 22.08.1994, *Jomy Augustine* 14015 (CALI).

Notes: This species grows in the shade of trees and shrubs, and is distinguished by glumes with a hyaline margin and widely gaping spikelets (Sreekumar & Nair, 1991).

Louisiella C.E.Hubb. & J.Leonard,

Bull. Jard. Bot. Elat Bruxelles 22: 316. 1952.

Louisiella paludosa (Roxb.) Landge, Phytotaxa 512. 109. 2021. *Panicum paludosum* Roxb., Fl. Ind. 1: 310. 1820; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1783. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 329. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 268. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 585. 2004.

Perennials. Culms erect or geniculate, spongy below, rooting at lower nodes, glabrous; nodes glabrous. Leaves linear-lanceolate, 5–20 × 0.4–1 cm, acute at apex, rounded or sub-cordate at base, scaberulous, glabrous, green; sheaths 4–8 cm long, glabrous or ciliate towards apex. Ligules a ring of white hairs. Panicles effuse, 10–25 cm long, widely spreading; branches world at lower nodes or alternate above, 2–10 cm long;rachis angular, serrulate; pedicels angular, 2–6 mm long, slightly dilated at apex, scaberulous. Spikelets elliptic-lanceolate, 3–4 mm long, obtuse at apex. Lower glumes ovate-orbicular, 0.8–1 × 1–1.2 mm, obtuse at apex, clasping at base, glabrous, faintly 0–5-nerved. Upper glumes ovate-elliptic, 3–3.5 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, 7–9-nerved. Lower florets barren or male. Upper florets bisexual. First lemmas elliptic-lanceolate, 3–3.5 × 0.8–1 mm, acute or

acuminate at apex, cuneate at base, chartaceous, glabrous, 7–9-nerved. Paleas absent or present. Stamens 3. Second lemmas ovate-elliptic, 2–2.2 × 1–1.1 mm, acute at apex, cuneate at base, sub-coriaceous, glabrous, faintly 7-nerved. Paleas elliptic, *c.* 2 × 1 mm, acute at apex, cuneate at base, sub-coriaceous, glabrous, 2-keeled, auricled at base. Lodicules 2, obovate, 0.5 × 0.4 mm, oblique at apex, glabrous. Stamens 3. Ovary ovate, stipitate; stigma plumose.

Distribution: Iran to Tropical Asia and Nansei-shoto, N. & E. Australia to SW. Pacific (POWO, 2023); *Habitat*: Marshes; *Fl. & Ft.*: March-December.

Specimens examined: Munnar, 04.04.2017, *Dani Francis & Santhosh Nampy* 176154 (CALI); *Ibid.*, 30.05.1944, *K.C. Jacob* 20495 (MH).

Notes: This species is allied to *Panicum repens* L., but can be differentiated by the spongy under water culms, broader flat green leaves, widely spreading panicles and narrowly lanceolate spikelets which are parallel and adpressed to the branches (Sreekumar & Nair, 1991).

Megathyrsus (Pilg.) B.K.Simon & S.W.L.Jacobs,

Austrobaileya 6: 572. 2003.

Megathyrsus maximus (Jacq.) B.K.Simon & S.W.L.Jacobs, Austrobaileya 6: 572. 2003. *Panicum maximum* Jacq., Icon. Pl. Rar. 1: t. 13. 1781; Hook.f., Fl. Brit. India 7: 49. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1783. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 327. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 266. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 584. 2004.

Perennials. Culms tufted, erect, robust, glabrous; nodes hairy. Leaves linear-lanceolate, 10–60 × 0.5–2 cm, acuminate at apex, narrowly rounded or cordate at base, scaberulous, glabrous or sparsely hairy, green; sheaths 10–20 cm long, glabrous or with dense tubercled hairs, lower one keeled, mouth bearded. Ligules ovate, 4–5 mm long, thin, membranous, a tuft of hairs behind. Panicles 10–40 cm long, effuse, decompound, branches world at lower nodes; rachis angular, bearded at lower nodes, serrulate upwards; pedicels slender, 2–10 mm long. Spikelets oblong, 2–4 × 1–1.2 mm, obtuse at apex, glabrous or puberulous, green or tinched with purple. Lower glumes broadly ovate, 1–1.2 × *c*. 1 mm, obtuse at apex, clasping at base, glabrous, faintly 0–3-nerved, greenish purple. Upper glumes ovate-oblong,

2.5–3 × 1–1.1 mm, obtuse at apex, cuneate at base, glabrous, nerves obscure, greenish purple. Lower florets male. Upper florets bisexual. First lemmas ovate-oblong, 2.5–3 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, nerves obscure. Paleas elliptic, 2–2.5 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous, 2-nerved, 2-keeled; keel winged, hyaline. Stamens 3. Second lemmas ovate-elliptic, 2–2.1 × 1–1.2 mm, acute at apex, cuneate at base, transversely rugose, glabrous, faintly 5-nerved, sub-coriaceous. Paleas elliptic, *c.* 2 × 2 mm, obtuse at apex, cuneate at base, dorsally transversely rugose, glabrous, 2-keeled. Lodicules 2, obovate, *c*. 0.2 × 0.1 mm, denticulate at apex, glabrous. Stamens 3. Ovary elliptic, *c.* 0.5 mm long; stigma plumose.

Distribution: Tropical and S. Africa, W. Indian Ocean and Arabian Peninsula (POWO, 2023); *Habitat*: Open lands; *Fl. & Ft.*: May-December.

Specimens examined: Anchuruli, 07.09.2017, *Dani Francis & Santhosh Nampy* 152917; *Ibid*., 07.09.2017, *Dani Francis & Santhosh Nampy* 152971; *Ibid*., 07.09.2017, *Dani Francis* & *Santhosh Nampy* 152975; Chottupara, 07.09.2017, *Dani Francis & Santhosh Nampy* 152970; Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154345; *Ibid*., 06.09.2017, *Dani Francis & Santhosh Nampy* 154351; *Ibid*., 06.09.2017, *Dani Francis & Santhosh Nampy* 154354; Narakakkanam, 12.10.2019, *Dani Francis & Santhosh Nampy* 176153; Vellimala, 16.08.1994, *Jomy Augustine* 14599 (CALI).

Notes: This introduced species is cultivated as a fodder grass, and can be readily identified by its rugose upper lemmas and faintly nerved lower lemmas (Sreekumar & Nair, 1991).

Melinis P.Beauv.,

Ess. Agrostogr. 54. 1812.

Key to the species

1. Spikelets glabrous; lower glumes reduced, scaly, ovate, nerveless …….. …… *M. minutiflora*

1. Spikelets villous; lower glumes well developed, oblong, 1-nerved …… *M. repens*

Melinis minutiflora P.Beauv., Ess. Agrostogr. 54. 1812; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 581. 2004. **Fig. 31B**

Annuals or short-lived perennials. Culms tufted, 20–80 cm high, decumbent, rooting at lower nodes; nodes densely villous. Leaves linear-lanceolate, 3–25 × 0.3–1.5 cm, acuminate at apex, rounded at base, with tubercled hairs, green; sheaths 4–12 cm long, with dense tubercled hairs. Ligules membranous with long fimbriae. Panicles 4–20 cm long; racemes 6–many, 1–3 cm long. Spikelets oblong, 1.5–2.5 mm long, glabrous; pedicels slender, 0.3–1mm long, abscission cupuliform, scabrellate. Lower glumes reduced, scaly, ovate, *c.* 0.2 × 0.2 mm, obtuse at apex, cuneate at base, glabrous, nerveless. Upper glumes oblong, 1.5–2.2 × 0.8–1 mm, notched at apex, cuneate at base, chartaceous, glabrous, 7-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas oblong-lanceolate, 1.8–2.5 × 0.8–1 mm, acute and 2-lobed at apex, awned from the sinus, cuneate at base, chartaceous, 5-nerved, nerves scabrellate; awn 0.5–1 mm long, straight. Second lemmas ovate-lanceolate, 1.5–2 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, faintly 3-nerved. Paleas ovate-lanceolate, 1.3–1.6 × 0.3–0.6 mm, acute at apex, cuneate at base, glabrous, 2-nerved, not keeled. Stamens 3. Ovary elliptic; stigma plumose.

Distribution: Tropical and S. Africa, Comoros, Madagascar (POWO, 2023); *Habitat*: Grasslands and semi-evergreen forests; *Fl. & Ft.*: November-March.

Specimens examined: Anakkara, 17.03.2017, *Dani Francis & Santhosh Nampy* 158398; on the way to Eravikulam, 23.01.2018, *Dani Francis & Santhosh Nampy* 158124; Ezhuthupara, Mankulam, 05.12.2018, *Dani Francis & Santhosh Nampy* 168878; Mattupetty, 15.12.2014, *Thoiba K. & A.K. Pradeep* 137572; 2 km before Munnar, 23.01.2018, *Dani Francis & Santhosh Nampy* 158115 (CALI).

Notes: *Melinis minutiflora* is commonly called 'Molasses grass. This' introduced species is an excellent fodder source, and produces an essential oil which is used as an insect repellent (Ravi *et al.*, 2004).

Melinis repens (Willd.) Zizka, Biblioth. Bot. 38(138): 55. 1988. *Saccharum repens* Willd., Sp. Pl., ed. 4. 1: 322. 1797. *Rhynchelytrum repens* (Willd.) C.E.Hubb., Bull. Misc. Inform. Kew 1934: 110. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 355. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 297. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 589. 2004. *Rhynchelytrum villosum* Chiov., Ann. Ist. Bot. Roma 8. 310. 1908; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1791. 1934.

Annuals or perennials. Culms tufted, 20–80 cm high, erect or willowy; nodes softly villous. Leaves lanceolate-linear, 2–18 × 0.1–0.6 cm, acuminate at apex, sub-rounded at base, scabrellous, glabrous or pubescent; sheaths 2–10 cm long, with tubercled hairs or glabrous. Ligules a row of hairs, 1 mm long. Panicles 3–20 cm long, silvery white, purple or reddish brown. Spikelets obovate-oblong, 3–6 × 1.5–2.2 mm, villous; pedicels slender, curved, 1–8 mm long, abscission cupuliform, long pilose at tip. Lower glumes oblong, 1–1.5 × 0.4–0.5 mm, emarginated at apex, sub-truncate at base, villous, 1-nerved, separated from the upper glumes by a stipe 0.5–0.8 mm long. Upper glumes ovate-lanceolate, boat shaped, 3.5–4 × 1.5–2 mm, emarginate at apex, cuneate at base, gibbous, densely villous, chartaceous; arista 1–2 mm long, barbellate, 1-nerved. Lower florets male or barren. Upper florets bisexual. First lemmas ovate-lanceolate, boat shaped, 3–4.5 × 1.5–2 mm, emarginated at apex, cuneate at base, gibbous, densely villous, chartaceous; arista 1.8–2 mm long, barbellate, 5-nerved. Paleas elliptic-lanceolate, 3.5–4 × 0.5–1 mm, acuminate at apex, attenuate at base, 2-keeled, keels ciliate, 2-nerved. Second lemmas ovate-oblong, 2–2.5 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, coriaceous, shining, faintly 5-nerved. Paleas elliptic, 2–2.5 × 0.5–1 mm, obtuse at apex, cuneate at base, coriaceous, shining, glabrous, 2-keeled. Stamens 3, 2–2.5 mm long, yellow. Ovary oblong, 0.5–1 mm long; style 0.5–1 mm long; stigma plumose.

Distribution: Africa to Arabian Peninsula (POWO, 2023); *Habitat*: Grasslands, roadsides, rocky hill slopes; *Fl. & Ft.*: January-December.

Specimens examined: Anayirangal dam, 05.01.2017, *Dani Francis & Santhosh Nampy* 151560 (CALI); Cardamom hills, Mankulam, 22.06.1976, *C.E. Ridsdale* 238 (NHN); Chottupara, 07.09.2017, *Dani Francis & Santhosh Nampy* 152969 (CALI); Idukki to Kattappana, 25.09.1981, *C.N. Mohanan* 72028 (MH); Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154352; Way to Karimutty, 29.12.2017, *Dani Francis & Santhosh Nampy* 158006; Pambla dam, 08.03.2017, *Dani Francis & Santhosh Nampy* 152030; Vallakkadavu, 22.08.1996, *Jomy Augustine* 16379; way to Mannavanshola, 08.01.2004, *N.K. Sairabhanu* 97042; *Ibid*., 08.01.2004, *L.R. Sajeena* 96844 (CALI).

Notes: This species can be distinguished by its peculiar feathery white or pink, shining panicles. It is a polymorphic species with considerable variation in size, colour and pubescence of spikelets (Sreekumar & Nair, 1991).

Oplismenus P.Beauv.,

Fl. Oware 2: 14. 1810, *nom. cons.*

Key to the species

1. Leaves ovate-elliptic; lower florets paleate ..... *O. compositus*

1. Leaves lanceolate; lower florets epaleate ..... *O. undulatifolius*

Oplismenus compositus (L.) P.Beauv., Ess. Agrostogr. 54. 1812; Hook.f., Fl. Brit. India 7: 66. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1778. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 317. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 257. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 582. 2004. *Panicum compositum* L., Sp. Pl. 1: 57. 1753.

Annuals or perennials. Culms 20–90 cm long, trailing, creeping, rooting at lower nodes; nodes glabrous or sparsely hairy. Leaves ovate-elliptic, 2–15 × 0.5–2.5 cm, acute-sub-acuminate at apex, oblique at the base, wavy, glabrous-pubescent, green; sheaths more or less ribbed, 1.2–9 cm long, ciliate on one margin, mouth bearded. Ligules membranous with row of hairs at the top. Inflorescence 5–50 cm long; racemes 4–8, 2–6 cm long; rachis triquetrous, glabrous or pilose. Spikelets paired, elliptic-lanceolate, 3–4 mm long, awned; pedicels triquetrous, 0.1–0.5 mm long, bristly at base. Lower glumes lanceolate, 2.3–3 × *c*. 1 mm, obtuse at apex, sub-truncate at base, glabrous, awned, awn straight, 4–6.1 mm long, puberulous. Upper glumes ovate-elliptic, 2–3 × 1–1.5 mm, arista *c.*1 mm long, sub-truncate at base, glabrous, 7-nerved. Lower florets empty. Upper florets bisexual. First lemmas ovate, 3.3–4 × 1–2 mm, obtuse at apex, cuneate at base, sparsely ciliate at margins, glabrous, 7–11-nerved. Paleas lanceolate, 1–2 mm long, obtuse at apex, cuneate at base, glabrous. Second lemmas elliptic, 2–2.8 × *c*. 1 mm, obtuse at apex, cuneate at base, glabrous, 5 nerved, slightly 2-keeled. Paleas elliptic, *c*. 2.3 × 0.6 mm, obtuse at apex, cuneate at base, glabrous, 2-nerved, 2-keeled. Stamens 3, 1–1.5 mm long. Ovary ovate, 0.8–1 mm long; style 2 mm long; stigma plumose.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Degraded forests; *Fl. & Ft.*: Throughout the year.

Specimens examined: Chinnarkuthu, Mankulam, 06.12.2018, *Dani Francis & Santhosh Nampy* 168886 (CALI); way to Eravikulam, 24.08.1980, *P.V. Sreekumar* 67776; Kuttikkanam-Peermade, 23.11.1967, *K. Vivekananthan* 29309; Munnar, 12.11.1980, *P.V. Sreekumar* 68432 (MH); 2 km before Munnar, 23.01.2018, *Dani Francis & Santhosh Nampy* 158110; way to Nakshathrakuthu falls, 04.12.2018, *Dani Francis & Santhosh Nampy* 168861 (CALI); Thekkady, 15.03.1973, *B.D. Sharma* 43881 (MH).

Oplismenus undulatifolius (Ard.) P.Beauv., Ess. Agrostogr. 54. 171. 1812; Hook.f., Fl. Brit. India 7: 66. 1896; Bor, Grasses Burma, Ceylon, India & Pakistan 318. 1960; K.M.Matthew, Illustr. Fl. Palni Hills 849. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 583. 2004; Kabeer & V.J.Nair, Fl. Tamil Nadu: Grasses 265. 2009.

Annuals. Culms decumbent, 15–50 cm long, creeping or trailing, rooting at lower nodes, sparsely ciliate; nodes glabrous or sparsely hairy. Leaves lanceolate, 2–15 × 0.2–1 cm, acuminate at apex, narrowly rounded at base, entire or sparsely serrulate, sparsely tubercled hairy, green; sheaths 3–5 cm long, margin long ciliate on one side, mouth bearded. Ligules ovate, 0.4 mm long, membranous. Spikelets in alternate groups on central axis; axis finely serrulate, nodes hairy; peduncle 18–20 cm long, serrulate; rachis triquetrous, serrulate; each group with 3–4 spikelets, elliptic, 4–6 mm long; pedicels 0–1 mm long, triquetrous, bristly at base. Lower glumes ovate, 2.2–3 × *c*. 1.5 mm, acute at apex, cuneate at base, glabrous, awned, awn straight, 6–8 mm long, puberulous, 5-nerved. Upper glumes ovate-boat shaped, 3–3.2 × 1.3–1.5 mm, acute or aristate at apex, arista 1–1.3 mm long, cuneate at base, glabrous, sometimes awned, *c.* 2.3 mm long, 5–7 nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas ovate-lanceolate, 4–4.5 × 1–2 mm, acuminate at apex, cuneate at base, glabrous, 5–7-nerved. Second lemmas ovate-lanceolate, 3–3.3 × 1–1.3 mm, acuminate at apex, sub-truncate at base, glabrous, 5-nerved, slightly 2-keeled. Paleas elliptic, 2.9–3 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, 2-nerved, 2-keeled. Lodicules 2, cuneate, glabrous. Stamens 3. Ovary oblong; stigma plumose.

Distribution: S. Central & S. Europe to Iran, Cameroon, Ethiopia to S. Africa, W. Indian Ocean, Central & S. China to Japan and Tropical Asia, E. Australia (POWO, 2023); *Habitat*: Shola forests; *Fl. & Ft.*: January-April.

Specimen examined: Anamudi National Park, 25.01.2018, *Dani Francis & Santhosh Nampy* 158252 (CALI).

Ottochloa Dandy,

J. Bot. 69: 54. 1931.

Ottochloa nodosa (Kunth) Dandy, J. Bot. 69: 55. 1931; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1778. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 318. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 258. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 583. 2004. *Panicum nodosum* Kunth, Enum. Pl. 1: 97. 1833; Hook.f., Fl. Brit. India 7: 43. 1896.

Annuals or perennials. Culms creeping, rooting at lower nodes; nodes glabrous. Leaves ovate-lanceolate, 2–12 × 0.5–1.5 cm, acuminate at apex, rounded at base, sparsely tubercled hairy or glabrous; sheaths 2–5 cm long, densely ciliate. Ligules ovate, membranous. Panicles lax, 5–20 cm long; racemes 4–12, alternate, opposite or whorled, 1–10 cm long. Spikelets elliptic-lanceolate, 3–4 mm long, group of 2–10 at each node. Lower glumes ovate-lanceolate, 1–1.5 × 0.5–1 mm, acute at apex, cuneate at base, puberulous, 3–5-nerved. Upper glumes elliptic-lanceolate, 1.5–2 × 0.8–1 mm, acute at apex, cuneate at base, puberulous, 7-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas lanceolate, 3–4 × 0.8–1 mm, acute at apex, cuneate at base, puberulous, 7–9-nerved. Second lemmas elliptic, 3–3.5 × 0.8–1 mm, acute at apex, cuneate at base, sub-coriaceous, glabrous, faintly 5-nerved. Paleas elliptic, 2–3 × 0.8–1 mm, acute at apex, cuneate at base, sub-coriaceous, glabrous, 2-nerved, 2-keeled. Stamens 3. Ovary elliptic; stigma plumose.

Distribution: W. Central Tropical Africa, Tropical and Subtropical Asia to N. & NE. Australia (POWO, 2023); *Habitat*: Forest margins and streams; *Fl. & Ft.*: July-December.

Specimen examined: Kokkara, 12.07.1993, *Jomy Augustine* 12068 (CALI).

Notes: This true forest grass is characterized by a shorter upper glume than its second lemma (Sreekumar & Nair, 1991).

Panicum L.,

Sp. Pl. 1: 55. 1753.

Key to the species

1. Leaves broadly ovate; spikelets slightly gibbous ..... *P. brevifolium*

1. Leaves elliptic, lanceolate or linear; spikelets not gibbous 2

2. Lower glumes less than half the length of spikelet ..... *P. sumatrense*

2. Lower glumes more than half the length of spikelet 3

3. Spikelets 1–1.5 mm long ..... *P. humidorum*

3. Spikelets more than 2 mm long 4

4. Panicles effuse; spikelets not crowded 5

4. Panicles contracted; spikelets crowded ..... *P. antidotale*

5. Spikelets 4–6 mm long; lower florets paleate ..... *P. gardneri*

5. Spikelets 2.5–3 mm long; lower florets epaleate ..... *P. notatum*

Panicum antidotale Retz., Observ. Bot. 4: 17. 1786; Hook.f., Fl. Brit. India 7: 52. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1783. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 322. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 260. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 584. 2004.

Perennials. Culms erect or creeping with stout rhizomes; nodes glabrous or puberulous. Leaves linear-lanceolate, 8–40 × 0.5–1.5 cm, acuminate at apex, rounded at base, scabrous, green; sheaths 6–8 cm long, keeled towards apex. Ligules a tuft of hairs. Panicles contracted, 10–30 cm long, branched; branches alternate to sub-verticillate, 6–8 cm long. Spikelets ovate-lanceolate, 2–3 mm long, crowded. Lower glumes broadly ovate, 1.5–2 × 1–1.3 mm, acute at apex, cuneate at base, broadly hyaline at margins, membranous, puberulous, 3-nerved. Upper glumes broadly ovate, 2–2.5 × 1–1.5 mm, acute at apex, cuneate at base, broadly hyaline at margins, membranous, puberulous, 7–9-nerved. Lower florets empty. Upper florets bisexual. First lemmas ovate, 2–2.5 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, 7–9-nerved. Paleas oblong-lanceolate, 1.5–2 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, 2-nerved, 2-keeled. Second lemmas

ovate-lanceolate, 1.5–2 × 0.3–0.5 mm, acute at apex, cuneate at base, sub-coriaceous, shiny, glabrous, faintly 3-nerved. Paleas ovate-elliptic, 1.5–1.7 × 0.3–0.5 mm, acute at apex, cuneate at base, sub-coriaceous, shining, glabrous, faintly 2-nerved, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Sinai to Indo-China (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: May-December.

Specimen examined: Periyar Tiger Reserve, Karadikkavala, 20.08.1994, *Jomy Augustine* 13924 (CALI).

Notes: Commonly called'Blue panicum', *Panicum antidotale* is a good sand binder and fodder grass. It can be distinguished from other species by the broad hyaline margin of glumes (Sreekumar & Nair, 1991).

Panicum brevifolium L., Sp. Pl. 1: 59. 1753; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1783. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 324. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 263. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 584. 2004. *Panicum ovalifolium* Poir. in Lamarck, Encycl. Suppl. 4: 279. 1816; Hook.f., Fl. Brit. India 7: 44. 1896.

Annuals. Culms erect or geniculate; nodes glabrous. Leaves broadly ovate, 2–10 × 0.5–3 cm, acute-acuminate at apex, amplexicaul at base, glabrous or puberulous, green; sheaths 2–3.5 cm long, ciliate. Ligules membranous, ciliate. Panicles effuse, 5–15 cm long, branched; branches alternate or fascicled. Spikelets ovate-elliptic, slightly gibbous, 1.5–2 mm long. Lower glumes ovate-oblong, 1.5–2 × 0.3–0.5 mm, obtuse at apex, cuneate at base, hyaline at margins, membranous, sparsely pubescent, 5-nerved. Upper glumes ovate, 1.5–2 × 0.8–1 mm, acute at apex, cuneate at base, sparsely hairy, 5-nerved. Lower florets male. Upper florets bisexual. First lemmas ovate, 1.5–2 × 0.8–1 mm, acute at apex, cuneate at base, membranous, glabrous, 3-nerved. Paleas oblong, 1–1.5 × 0.3–0.5 mm, acute at apex, cuneate at base, glabrous, 2-nerved, 2-keeled, scabrid along the keel. Second lemmas ovate, 1–1.2 × 0.8–1 mm, acute at apex, cuneate at base, gibbous, sub-coriaceous, glabrous, faintly 5-nerved. Paleas elliptic, 1.2–1.5 × 0.3–0.5 mm, acute at apex, cuneate at base, sub-coriaceous, shining, glabrous, 2-nerved, 2-keeled. Stamens 3. Ovary elliptic; stigma plumose.

Distribution: Tropical Africa, W. Indian Ocean, Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Forest margins and waysides; *Fl. & Ft.*: March-December.

Specimen examined: Mlappara, 06.12.1993, *Jomy Augustine* 12611 (CALI).

Notes: The ovate-elliptic leaves and slightly gibbous spikelets distinguish this species. It varies in size and indumentum; the plant growing in the forest has robust habit and the rachis is covered with tubercled hairs, while those growing in plains are moderately sized and glabrous (Sreekumar & Nair, 1991).

Panicum gardneri Thwaites, Enum. Pl. Zeyl. 359. 1864; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1783. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 326. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 264. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 852. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 584. 2004. *Isachne gardneri* (Thwaites) Benth. & Hook.f. ex B.D.Jacks., Index Kew. 1: 1233. 1893; Hook.f., Fl. Brit. India 7: 26. 1896.

Perennials. Culms creeping or geniculate, slender, glabrous, rooting at lower nodes; nodes glabrous. Leaves ovate-lanceolate, 5–20 × 0.3–2.8 cm, acuminate at apex, rounded at base, pubescent, green; sheaths 3–6 cm long, densely ciliate along one margins. Ligules membranous, fimbriate. Panicles lax, 5–20 cm long, branched; branches 2–10 cm long, alternate or 2–3 at each node; rachis angular, pubescent or glabrous; pedicels slender, undulate, 0.5–8 cm long, dilated at apex, glabrous. Spikelets ovate-elliptic, 4–6 mm long, acute at apex, glabrous, green. Lower glumes ovate-lanceolate, 2.5–3 × 1–1.5 mm, acute at apex, cuneate at base, silvery hyaline at margins, glabrous, 3-nerved. Upper glumes ovate, 3.5–4 × 1.6–2 mm, acute at apex, cuneate at base, silvery hyaline at margins, glabrous, 5–7-nerved. Lower florets male. Upper florets bisexual. First lemmas ovate, 3.5–4 × 1.6–2 mm, acute at apex, cuneate at base, chartaceous, glabrous, 7-nerved. Paleas elliptic, 3–3.5 × 0.8–1 mm, obtuse at apex, obtuse at base, 2-nerved, 2-keeled, keel minutely winged, scaberulous. Stamens 2–3, anthers rudimentary. Second lemmas ovate, 2.9–3 × 1.2–1.5 mm, acute at apex, cuneate at base, coriaceous, shining, glabrous, faintly 5-nerved. Paleas ovate, *c.* 3 × 1 mm, acute at apex, cuneate at base, coriaceous, shining, glabrous, 2-nerved, 2-keeled. Lodicules 2. Stamens 3. Ovary elliptic; stigma plumose.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Semi evergreen forests and shola forests; *Fl. & Ft.*: July-January.

Specimens examined: Anamudi Shola National Park, 25.01.2018, *Dani Francis & Santhosh Nampy* 158264; Edathattu, Mankulam, 13.09.2018, *Dani Francis & Santhosh Nampy* 159482; Inchippara, Periyar Tiger Reserve, 06.12.1994, *Jomy Augustine* 13195 (CALI); Kulamavu, 14.12.1982, *C.N. Mohanan* 76055; Umayamala, 22.11.1965, *B.V. Shetty* 26621 (MH).

Notes: *Panicum gardneri* is distinguished by its larger spikelets and silvery hyaline margined glumes. Its leaves and spikelts resemble those of *Isachne walkeri* (Sreekmar & Nair, 1991).

Panicum humidorum Buch.-Ham. Ex Hook.f., Fl. Brit. India 7: 53. 1896; Bor, Grasses Burma, Ceylon, India & Pakistan 326. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 265. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 584. 2004.

Perennials. Culms erect, or creeping, glabrous; nodes glabrous. Leaves lanceolate, 3–15 × 0.3–1 cm, acuminate at apex, cuneate at base, with tubercled hairs, green; sheaths 3–5 cm long, ciliate. Ligules membranous, narrow. Panicles effuse, 5–35 cm long, branched; branches 2–15 cm long, alternate; rachis angular, scabrid; pedicels angular, slender, 1–5 mm long, scabrid. Spikelets ovate, 1–1.5 mm long, acute at apex, puberulous, green. Lower glumes ovate-lanceolate, 1–1.2 × 0.5–0.6 mm, caudate at apex, cuneate at base, glabrous, 3-nerved. Upper glumes ovate, 1.1–1.5 × 0.6–1 mm, acute at apex, cuneate at base, puberulous, 5-nerved. Lower florets barren, epaleate. Upper florets bisexual. First lemmas ovate, 1.2–1.5 × 0.8–1 mm, acute at apex, cuneate at base, chartaceous, glabrous, 5-nerved. Paleas absent. Second lemmas elliptic, 1–1.2 × 0.5–0.7 mm, acute at apex, cuneate at base, glabrous, nerves faint, shining. Paleas elliptic, 0.7–1 × 0.5–0.7 mm, acute at apex, cuneate at base, coriaceous, glabrous, 2-nerved, 2-keeled. Lodicules 2, obovate. Stamens 3. Ovary oblong; stigma 2, plumose.

Distribution: Nepal to W. Malesia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-March.

Specimen examined: Kalvary Mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154368 (CALI).

Panicum notatum Retz., Observ. Bot. 4: 18. 1786; Bor, Grasses Burma, Ceylon, India & Pakistan 701. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 267. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 585. 2004. *Panicum montanum* Roxb., Fl. Ind. 1: 313. 1820; Hook.f., Fl. Brit. India 7: 53. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1783. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 329. 1960.

Perennials. Culms erect or trailing; nodes glabrous. Leaves lanceolate, 5–20 × 1–3 cm, acuminate at apex, cordate at base, with a few tubercled hairs along margin, green; sheaths 3–6 cm long, sparsely ciliate along one margins. Ligules thin, membranous, fimbriate with a few long hairs behind. Panicles lax, 10–35 cm long, branched, spreading; branches 5–25 cm long, verticillate in lower nodes, alternate or opposite towards apex; rachis angular, scaberulous; pedicels straight, capillary, 5–10 mm long, dilated at apex, glabrous. Spikelets ovate-oblong, 2.5–3 mm long, acute at apex, sparsely hairy, green tinched with purple. Lower glumes ovate-lanceolate, 2–2.2 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, with a few hairs along margin, 5-nerved. Upper glumes ovate, 2–2.5 × 1–1.2 mm, acute at apex, cuneate at base, sparsely hairy along margin, 5-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas ovate, 2.3–2.5 × 1–1.2 mm, acute at apex, cuneate at base, chartaceous, glabrous, 5-nerved. Second lemmas ovate, *c.* 2 × 1.5 mm, acute at apex, cuneate at base, sub-coriaceous, shining, glabrous, faintly 5-nerved. Paleas ovate, *c.* 2 × 1 mm, acute at apex, cuneate at base, sub-coriaceous, shining, glabrous, 2-nerved, 2-keeled. Lodicules 2. Stamens 3. Ovary elliptic; stigma plumose.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Moist deciduous forests; *Fl. & Ft.*: July-March.

Specimens examined: Meenmutty, 02.10.1983, *C.N. Mohanan* 79918; Panamkutty, 19.12.1982, *C.N. Mohanan* 76185; Thekkady, 17.11.1975, *K. Vivekananthan* 46701; Valara R.F., 24.11.1982, *R. Rajan* 74966 (MH).

Notes: This species is characterized by the trailing habit, lanceolate leaves, lax panicles and epaleate lower florets (Sreekumar & Nair, 1991).

Panicum sumatrense Roth in Roemer & Schultes, Syst. Veg. ed. 15[bis]. 2: 434. 1817; Bor, Grasses Burma, Ceylon, India & Pakistan 701. 1960; Sreek. & V.J.Nair,

Fl. Kerala-Grasses 272. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 585. 2004. *Panicum miliare auct.* Hook.f., Fl. Brit. India 7: 46. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1782. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 329. 1960 *non* Lam., 1791. **Fig. 30H**

Annuals. Culms erect, glabrous; nodes glabrous. Leaves linear-lanceolate, 15–60 × 0.5–1.5 cm, tapering at apex, rounded at base, ciliate, glabrous or sparsely hairy, green; sheaths 5–10 cm long, ciliate along the margins, mouth bearded. Ligules truncate, *c.* 1 mm long, thin, sparsely ciliate at apex. Panicles contracted, 5–35 cm long, densely branched; branches 3–12 cm long, alternate or thyrsiform, densely spiculate; rachis angular, scabrid; pedicels angular, slender, 1–5 mm long, dilated at apex, scabrid. Spikelets ovate-oblong, 2.5–3.5 × 1–1.2 mm, acute at apex, glabrous, green. Lower glumes broadly ovate-orbicular, 1–1.2 × 1–1.5 mm, acute at apex, clasping at base, glabrous, faintly 3–5-nerved. Upper glumes ovate-lanceolate, 2.5–3 × 1.2–1.5 mm, obtuse at apex, cuneate at base, glabrous, 9–13-nerved. Lower florets male or barren. Upper florets bisexual. First lemmas ovate-lanceolate, 2.3–2.5 × 1–1.2 mm, obtuse at apex, cuneate at base, chartaceous, glabrous, 9–11-nerved. Paleas elliptic, 2–2.5 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous, 2-nerved, 2-keeled, hyaline. Stamens 3. Second lemmas ovate-oblong, 2–2.1 × 1–1.2 mm, acute at apex, cuneate at base, glabrous, faintly 7–9-nerved, sub-coriaceous, shining. Paleas elliptic, 1.8–2 × 0.7–1 mm, acute at apex, cuneate at base, sub-coriaceous, glabrous, inflexed at margins. Lodicules 2, obovate. Stamens 3. Ovary ovate, 0.4–0.5 mm long; stigma plumose.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Forest margins and road sides; *Fl. & Ft.*: July-March.

Specimens examined: Erattayar dam, 28.09.1981, *C.N. Mohanan* 72196 (MH); Idukki Wildlife Sanctuary, 05.08.2017, *Dani Francis & Santhosh Nampy* 154182; Thannikkudy, Periyar Tiger Reserve, 16.03.1995, *Jomy Augustine* 14843 (CALI).

Notes: *Panicum sumatrense* is known as 'Little millet' and considered as cultivated form of *Panicum.* It can be differentiated by the much contracted panicles, persistent spikelets, broader leaves and taller culms (Sreekumar & Nair, 1991).

Paspalum L.,

Syst. Nat. ed. 10. 2: 855. 1759.

Key to the species

1. Spikelets with a ciliate fringe from the margin of the upper glume…….. 2

1. Spikelets without a ciliate fringe, rarely fimbriate with tubercled hairy but then the leaves oblong-elliptic ……. 3

2. Racemes usually 2; spikelets 1.2–2 mm long; pedicels without an appendage at base ……. *P. conjugatum*

2. Racemes 3–8; spikelets 2–4 mm long; pedicels with a rudimentary scale like appendage at base ……. *P. dilatatum*

3. Spikelets orbicular-obovate ..... *P. scrobiculatum*

3. Spikelets ovate-elliptic ..... *P. distichum*

Paspalum conjugatum P.J.Bergius, Acta Helv. Phys.-Math. 7: 129. 1772; Hook.f., Fl. Brit. India 7: 11. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1772. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 336. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 285. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 586. 2004.

Perennials. Culms 25–90 cm high, creeping or stoloniferous, rooting at nodes; nodes glabrous. Leaves lanceolate, 2–20 × 0.3–1.5 cm, acuminate at apex, rounded at base, ciliate, sparsely hairy on both surfaces; sheaths 2–10 cm long, keeled, ciliate along one margin. Ligules narrow, membranous. Racemes 2, conjugate, 5–15 cm long; rachis triquetrous, scabrous along the margin. Spikelets broadly elliptic-obovate, 1.2–2 × 1.2–1.5 mm, obtuse-acute at apex, obtuse at base; pedicels 0.8–1 mm long, scabrous. Lower glumes absent. Upper glumes ovate-orbicular, 1.2–1.5 × 1–1.2 mm, obtuse at apex, cuneate at base, membranous, ciliate along margins, 2-nerved. Lower florets barren. Upper florets bisexual. First lemmas ovate-orbicular, 1.2–1.4 × 1–1.2 mm, obtuse at apex, cuneate at base, membranous, glabrous, 2-nerved. Second lemmas ovate, 1–1.2 × 1 mm, acute at apex, cuneate at base, crustaceous, 2-keeled, glabrous. Paleas ovate, 1–1.1 × 0.8–1 mm, crustaceous, inflexed, acute at apex, cuneate at base, glabrous. Lodicules 2,

cuneate, 0.5 × 0.3 mm, glabrous. Stamens 3. Ovary oblong, 0.3 × 0.2 mm, glabrous; stigma plumose.

Distribution: Tropical and Subtropical America (POWO, 2023); *Habitat*: Open lands; *Fl. & Ft.*: Throughout the year.

Specimens examined: Anamudishola National Park, 04.04.2017, *Dani Francis & Santhosh Nampy* 186733 (CALI); Kulamavu, 05.06.1982, *C.N. Mohanan* 74197 (MH); Thekkady, 04.08.1994, *Jomy Augustine* 13834 (CALI); Vandiperiyar, 23.06.1968, *D.B. Deb* 30193 (MH).

Notes: *Paspalum conjugatum* is a vigorous, creeping perennial grass with long stolons and dense culms. It is distinguished by its conjugate racemes, which remain together during the opening stage, leaving the middle portion open. It is widely used as a forage and lawn grass.

Paspalum dilatatum Poir. in JLamarck, Encycl. 5: 35. 1804; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1772. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 338. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 285. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 853. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 586. 2004.

Perennials. Culms 30–70 cm high, erect, tufted or geniculate; nodes glabrous. Leaves lanceolate, 5–25 × 0.5–1 cm, acuminate at apex, rounded at base, glabrous, green; sheaths 2–8 cm long, slightly keeled. Ligules ovate, membranous. Racemes 3–8, alternate, 1–8 cm long, villous at nodes; rachis triquetrous, scabrous along the margin. Spikelets broadly ovate, 2–4 mm long, acute at apex, obtuse at base; pedicels 0.5–1 mm long, with a rudimentary scale like spikelet at base. Lower glumes absent. Upper glumes broadly ovate, 2–4 × 1.5–2 mm, acute at apex, cuneate at base, chartaceous, ciliate, softly hairy, 7-nerved. Lower florets barren. Upper florets bisexual. First lemmas broadly ovate, 2–4 × 1.5–2 mm, acute at apex, cuneate at base, chartaceous, ciliate, softly hairy, 7-nerved. Second lemmas orbicular, 2–2.5 × 1.5–2 mm, acute at apex, cuneate at base, crustaceous, faintly 5–7-nerved, glabrous. Paleas orbicular, 2–2.5 × 1.5–2 mm, acute at apex, cuneate at base, crustaceous, inflexed and auriculate at base, glabrous, 2-nerved, 2-keeled. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose.

Distribution: SE. and S. Brazil to S. South America (POWO, 2023); *Habitat*: Weed in tea estates; *Fl. & Ft.*: June-August.

Specimens examined: Old Devikulam, 14.06.1963, *K.M. Sebastine* 16473; Vaguvarai estate, 29.08.1980, *P.V. Sreekumar* 68424 (MH).

Paspalum distichum L., Syst. Nat. ed. 10. 2: 855. 1759; Hook.f., Fl. Brit. India 7: 12. 1896. Bor, Grasses Burma, Ceylon, India & Pakistan 338. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 286. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 586. 2004. *Paspalum paspalodes* (Michx.) Scribn., Mem. Torrey Bot. Club 5: 29. 1894; K.M.Matthew, Illustr. Fl. Palni Hills 854. 1996.

Annuals or Perennials. Culms 15–90 cm high, creeping, stoloniferous, rooting at nodes; nodes glabrous. Leaves linear-lanceolate, 2–20 × 0.3–0.5 cm, acuminate at apex, sub-rounded at base, with a few cilia at margins, hairy adaxially, glabrous abaxially; sheaths 1.5–5 cm long, keeled, with tubercled hairs along margin. Ligules narrow, membranous, *c*. 2 mm long. Racemes 2 or rarely 3, 1.5–8 cm long; rachis triquetrous, scabrous along the margin. Spikelets ovate-elliptic, 2.1–3.5 × 1–1.3 mm, acute at apex, obtuse at base, softly hairy; pedicels 0.3–0.5 mm long, scabrous. Lower glumes absent. Upper glumes broadly ovate, 2.1–3.5 × 1–1.5 mm, acute at apex, cuneate at base, membranous, chartaceous, softly hairy, 5-nerved. Lower florets barren, epaleate. Upper florets bisexual. First lemmas ovate, 2.1–3.5 × 1–1.5 mm, acute at apex, cuneate at base, membranous, glabrous, 5-nerved. Second lemmas ovate-oblong, 2–2.5 × 1–1.5 mm, acute at apex, cuneate at base, crustaceous, 2-keeled, glabrous, with a few hairs at apex. Paleas ovate-oblong, 2–2.5 × 1–1.5 mm, crustaceous, inflexed, acute at apex, cuneate at base, glabrous, 2-keeled. Lodicules 2, cuneate, *c*. 0.5 × 0.3 mm, glabrous. Stamens 3, 0.5–1.2 mm long; anthers yellow. Ovary oblong, *c*. 0.4 × 0.2 mm, glabrous; stigma plumose.

Distribution: U.S.A. to Tropical and Subtropical America (POWO, 2023); *Habitat*: Banks of streams and paddy fields; *Fl. & Ft.*: April-December.

Specimens examined: Dam site, Periyar Tiger Reserve, 03.11.1993, *Jomy Augustine* 12569; Erattayar, 03.04.2018, *Dani Francis & Santhosh Nampy* 158414 (CALI);

Munnar, 30.05.1944, *K.C. Jacob* 20493; Vaguvarai, 23.08.1980, *P.V. Sreekumar* 67775 (MH).

Paspalum scrobiculatum L., Mant. Pl. 1: 29. 1767; Hook.f., Fl. Brit. India 7: 10. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1772. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 340. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 287. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 586. 2004. **Fig. 30B**

Annuals or Perennials. Culms densely tufted, 10–70 cm high, erect or creeping, rooting at lower nodes; nodes glabrous. Leaves linear-lanceolate, 2–30 × 0.3–1 cm, acute or acuminate at apex, rounded at base, scabrous at margins, glabrous; Sheaths 1.5–10 cm long, slightly keeled, glabrous. Ligules narrow, membranous, fimbriate or not. Racemes usullay 2, rarely 3–5, 3–15 cm long; rachis flat, scabrous along margin. Spikelets orbicular-obovate, 2–2.5 × 1.2–1.5 mm, obtuse base and at apex, glabrous; pedicels 0.5–0.8 mm long, scabrous. Lower glumes absent. Upper glumes ovate-orbicular, 2–2.5 × 2–2.2 mm, obtuse at apex, cuneate at base, membranous, glabrous, 3–5-nerved. Lower florets barren. Upper florets bisexual. First lemmas ovate-orbicular, 2–2.2 × 1.5–2 mm, obtuse at apex, cuneate at base, membranous, glabrous, 3-nerved. Second lemmas ovate, 1.5–2 × *c*. 1 mm, obtuse-su-brounded at apex, sub-rounded at base, crustaceous, glabrous, faintly 3–7-nerved. Paleas ovate-oblong, 1.5–1.8 × 1–1.2 mm, crustaceous, inflexed, obtuse at apex, cuneate at base, glabrous. Lodicules 2, cuneate, *c*. 0.5 × 0.3 mm, glabrous. Stamens 3. Ovary oblong,glabrous; stigma plumose.

Distribution: Tropical and Subtropical Old World to N. and E. Australia (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: Throughout the year.

Specimens examined: Near Devikulam lake, 15.04.1960, *K. Subramanyam* 10245; Idukki-Kattappana, 25.09.1981, *C.N. Mohanan* 72046; Kulamavu, 05.06.1982, *C.N. Mohanan* 74193; Munnar, 31.05.1944, *K.C. Jacob* 20499 (MH); Nelliparakandam, Periyar Tiger Reserve, *Jomy Augustine* 12055; Painav, 05.08.2017, *Dani Francis & Santhosh Nampy* 154191; Panchalimedu, 13.09.2019, *Dani Francis & Santhosh Nampy* 170287; Vellakkayam, 04.04.2018, *Dani Francis & Santhosh Nampy* 176555 (CALI).

Pseudechinolaena Stapf

in Oliver *et al.* (eds.), Fl. Trop. Afr. 9: 494. 1919.

Pseudechinolaena polystachya (Kunth) Stapf in Oliver *et al.* (eds.), Fl. Trop. Afr. 9: 495. 1919; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1766. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 352. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 293. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 588. 2004. *Echinolaena polystachya* Kunth in H.B.K., Nov. Gen. Sp. 1: 119. 1816. Panicum *uncinatum* Raddi, Agrostogr. Bras. 41. 1823; Hook.f., Fl. Brit. Ind. 7: 58. 1896.

Annuals or Perennials. Culms creeping or decumbent, rooting at lower nodes; nodes glabrous or sparsely hairy. Leaves elliptic-lanceolate, 1–5 × 0.3–1 cm, acute or acuminate at apex, cuneate at base, sparsely villous; sheaths 0.5–5 cm long, pubescent. Ligules truncate, membranous. Panicles 5–15 cm long; racemes 4–8, each 1–5 cm long; rachis triquetrous, scabrellate. Spikelets elliptic-lanceolate, 3–5 × 1–2 mm, slightly gibbous; pedicels 0.5–8 mm long, slender. Lower glumes ovate-lanceolate, 3–5 × 1.5–2.5 mm, acuminate at apex, cuneate at base, glabrous-puberulous, 3–5-nerved. Upper glumes ovate-lanceolate, boat shaped, 3–5 × 1.5–2 mm, acuminate at apex, cuneate at base, rows of transparent hooked bristles of glands between nerves, 7-nerved. Lower florets barren or male. Upper florets bisexual. First lemmas ovate, 3–4 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, faintly 5–7-nerved. Paleas lanceolate-linear, 3–3.6 × 0.5–1 mm, obtuse at apex, cuneate at base, glabrous, faintly 2-nerved, 2-keeled. Second lemmas ovate-lanceolate, 2–3 × 1.5–2 mm, obtuse at apex, cuneate at base, crustaceous, glabrous, faintly 3–5-nerved. Paleas ovate-lanceolate, 2–3 × 1–1.5 mm, obtuse at apex, cuneate at base, crustaceous, glabrous, faintly 2-nerved. Lodicules 2, cuneate. Stamens 3. Ovary elliptic; stigma plumose.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Forest margins; *Fl. & Ft.*: Throughout the year.

Specimens examined: Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 168860; Choondal, Mathikettan Shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 151525 (CALI); Kuttikkanam-Peermade, 27.11.1967, *K. Vivekananthan* 29386; Meenmutty, 27.09.1981, *C.N. Mohanan & B. Ramanujan*

72103; Pachakkanam, 13.11.1975, *K. Vivekananthan* 46660 (MH); Thekkady, 20.05.1994, *Jomy Augustine* 13626 (CALI).

Notes: This species is a true forest grass, characterized by its glandular spikelets, bristly glumes and stilt roots at the nodes (Sreekumar & Nair, 1991).

Pseudoraphis Griff. ex Pilg.,

Notizbl. Bot. Gart. Berlin-Dahlem 10: 210. 1928.

Pseudoraphis spinescens (R.Br.) Vickery, Proc. Roy. Soc. Queensland 62: 69. 1952; Bor, Grasses Burma, Ceylon, India & Pakistan 353. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 296. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 589. 2004. *Panicum spinescens* R.Br., Prodr. Fl. Nov. Holland. 193. 1810. *Chamaeraphis spinescens* (R.Br.) Poir. in Lamarck, Encycl., Suppl. 2: 189. 1811; Hook.f., Fl. Brit. India 7: 62. 1896.

Annuals or perennials, aquatic or marshy herbs. Culms prostrate or decumbent, softly villous. Leaves linear-lanceolate, 2–8 × 0.1–0.5 cm, acuminate at apex, shallowly cordate at base, glabrous or with tubercled hairs, green; sheaths 2.5–6 cm long, strongly keeled, pubescent. Ligules truncate, membranous. Panicles 3–12 cm long; branches produced in to bristles; bristles solitary, triquetrous, scabrid. Spikelets narrowly lanceolate, 4–8 mm long. Lower glumes ovate, 0.5–1 × 0.5–1 mm, obtuse at apex, cuneate at base, membranous, glabrous, faintly 3-nerved. Upper glumes lanceolate, 4–8 × 1–1.5 mm, acuminate at apex, cuneate at base, scabrid or glabrous, 11–13-nerved. Lower florets male. Upper florets female or bisexual. First lemmas lanceolate, 4–6 × 1–1.5 mm, acuminate at apex, cuneate at base, sparsely hairy, 9–11-nerved. Paleas lanceolate, 2–4 × 0.5–1 mm, obtuse at apex, cuneate at base, delicate, hyaline, glabrous, 2-nerved, 2-keeled. Stamens 3. Second lemmas oblong, 1.5–3 × 0.5–1 mm, obtuse at apex, cuneate at base, glabrous, shining, faintly 3-nerved. Paleas oblong, 1–2 × 0.5–1 mm, obtuse at apex, cuneate at base, hyaline, glabrous, nerveless. Stamens rudimentary or absent. Ovary oblong; stigma plumose.

Distribution: Tropical Asia to Australia (POWO, 2023); *Habitat*: Paddy fields; *Fl. & Ft.*: August-December.

Specimens examined: Thekkady, 11.12.1996, *Jomy Augustine* 16974 (CALI); *Ibid.*, 17.11.1975, *K. Vivekananthan* 46698 (MH).

Sacciolepis Nash

in Britton, Man. Fl. N. States 89. 1901.

Key to the species

1. Spikelets 3–5 mm long; panicles interrupted ..... *S. interrupta*

1. Spikelets 2–3 mm long; panicles not interrupted ..... *S. indica*

Sacciolepis indica (L.) Chase, Proc. Boil. Soc. Washington 21: 8. 1908; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1787. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 357. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 298. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 590. 2004. *Aira indica* L., Sp. Pl. 1: 63. 1753. *Panicum indicum* L., Mant. Pl. 2: 184. 1771, *nom. illeg.*; Hook.f., Fl. Brit. India 7: 41. 1896. **Fig. 30D**

Annuals. Culms tufted, erect or ascending; nodes glabrous. Leaves lanceolate-linear, 2–20 × 0.1–0.5 cm, acute at apex, rounded at base, pubescent, green; sheaths 1.5–6 cm long, slightly keeled. Ligules truncate, membranous, fimbriate at apex. Panicles spiciform, 0.5–8 cm long. Spikelets ovate-elliptic, 2–3 mm long, acute at apex, slightly gibbous. Lower glumes ovate, 0.5–1.5 × 0.2–0.6 mm, acute at apex, cuneate at base, glabrous, 3–5 nerved. Upper glumes ovate-lanceolate, 1.5–3 × 0.5–1 mm, acute at apex, cuneate at base, glabrous, 5–11-nerved. Lower florets male or barren. Upper florets bisexual. First lemmas ovate-lanceolate, 1–3 × 0.5–1 mm, acute at apex, cuneate at base, glabrous, 5–11-nerved. Paleas a minute scale or absent. Second lemmas oblong, 0.5–1 × 0.2–0.5 mm, acute at apex, cuneate at base, coriaceous, glabrous, shining. Paleas oblong, 0.5–1 × 0.2–0.5 mm, acute at apex, cuneate at base, inflexed at margins, coriaceous, shining, glabrous. Stamens 3. Ovary ovate; stigma plumose.

Distribution: Tropical and Subtropical Old World to N. and E. Australia (POWO, 2023); *Habitat*: Wetlands and Marshy areas; *Fl. & Ft.*: March-January.

Specimens examined: Brandippara, Periyar Tiger Reserve, 26.03.1995, *Jomy Augustine* 14907; Lakkam waterfalls, 24.01.2017, *Dani Francis & Santhosh Nampy* 158204; Meenuliyanpara, 29.11.2019, *Dani Francis & Santhosh Nampy* 164625 (CALI).

Notes: This species shows wide variations in shape and size of leaves and spikelets, number of nerves and hairiness of glumes and lemmas (Sreekumar & Nair, 1991).

Sacciolepis interrupta (Willd.) Stapf Oliver *et al.* (eds.), Fl. Trop. Afr. 9: 757. 1920; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1787. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 358. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 299. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 862. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 590. 2004. *Panicum interruptum* Willd., Sp. Pl. ed., 4. 1: 341. 1797; Hook.f., Fl. Brit. Ind. 7: 40. 1896.

Annuals or perennials. Culms creeping or geniculate, spongy, floating below; nodes glabrous. Leaves elliptic-lanceolate, 5–30 × 0.3–1.2 cm, acuminate at apex, rounded at base, glabrous, green; sheaths 3–7 cm long, glabrous. Ligules ovate, membranous. Panicles spiciform, interrupted, 5–30 cm long. Spikelets ovate-lanceolate, 3–5 mm long, acute at apex, glabrous. Lower glumes ovate-oblong, 1–1.5 × 0.5–1 mm, obtuse at apex, sub-truncate at base, hyaline at margins, glabrous, 3–5-nerved. Upper glumes ovate-lanceolate, 3–5 × 1–2 mm, acute at apex, cuneate at base, glabrous, 7–9-nerved. Lower florets male or barren. Upper florets bisexual. First lemmas ovate-lanceolate, 3–5 × 1–2 mm, acute at apex, cuneate at base, glabrous, 7–9-nerved. Paleas oblong, 1–2.5 × 0.5–0.6 mm, obtuse at apex, cuneate at base, delicate, hyaline. Second lemmas ovate-oblong, 2–3 × 1–1.5 mm, acute at apex, cuneate at base, sub-coriaceous, glabrous, faintly 5-nerved. Paleas oblong-elliptic, 2–3 × 0.8–1 mm, obtuse at apex, cuneate at base, sub-coriaceous, hyaline, glabrous, 2-keeled. Stamens 3. Ovary ovate; stigma plumose.

Distribution: Guinea-Bissau, Chad, Tanzania to Botswana, China (Yunnan) to Tropical Asia (POWO, 2023); *Habitat*: Wetlands and marshy areas; *Fl. & Ft.*: Throughout the year.

Specimens examined: Kattappana, 16.03.2018, *Dani Francis & Santhosh Nampy* 158375; Kodikulam, 08.02.2021, *Dani Francis & Santhosh Nampy* 188920, 188931 (CALI); Okrai, Thekkady, 29.09.1972, *B.D. Sharma* 42346 (MH); Sivaloda, Periyar Tiger Reserve, 21.10.1993, *Jomy Augustine* 12510 (CALI).

Notes: It is a tropical weed, also used as a fodder. It differs from other species by having robust, spongy, floating culms and larger spikelets.

Setaria P.Beauv.,

Ess. Agrostogr. 51. 1812, *nom. cons.*

Key to the species

1. Leaves flat, not folded; inflorescence contracted, narrow ……. 2

1. Leaves plicately folded, at least towards base; inflorescence lax, widely spreading ……. 6

2. Paleas smooth ……. 3

2. Paleas rugose ……. 4

3. Leaves blunt at apex; spikes 3–10, each distant by 2–4 times of their length; bristles absent ……. *S. flavida*

3. Leaves acuminate at apex; spikes solitary; bristles present …… *S. parviflora*

4. Second lemmas acute at apex; bristles persistent …… *S. verticillata*

4. Second lemmas beaked at apex; bristles caducous …… 5

5. Inflorescence a cylindric, false spike …… *S. pumila*

5. Inflorescence a narrow, lobed panicle …… *S. intermedia*

6. Leaves plicately folded from base to apex; panicles lax …… *S. palmifolia*

6. Leaves plicately folded only at base; panicles contracted …… *S. barbata*

Setaria barbata (Lam.) Kunth, Révis. Gramin. 1: 47. 1829; Bor, Grasses Burma, Ceylon, India & Pakistan 360. 1960; Sreek. & V.J.Nair, Fl. Kerala Grasses 303. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 591. 2004. *Panicum barbatum* Lam., Tabl. Encycl. 1: 171. 1791.

Annuals. Culms creeping, rooting at lower nodes; nodes sparsely hairy. Leaves elliptic-lanceolate, 5–20 × 0.3–2 cm, acuminate at apex, rounded at base, plicate towards base, with tubercled hairs, green; sheaths 3–6 cm long, keeled, with tubercled hairs, villous towards mouth. Ligules a row of hairs. Panicles contracted, 2–12 cm long; bristles angular, 1–10 mm long, scabrid. Spikelets elliptic-lanceolate, 1.5–3 mm long, glabrous. Lower glumes ovate, 0.5–1 × 0.5–1 mm, obtuse at apex, cuneate at base, glabrous, 3-nerved. Upper glumes ovate-oblong,

1.5–2 × 1–1.3 mm, obtuse or sub-rounded at apex, cuneate at base, glabrous, 5–7-nerved. Lower florets male. Upper florets bisexual. First lemmas elliptic-lanceolate, 1.5–3 × 0.5–1 mm, acute at apex, cuneate at base, glabrous, 7-nerved. Paleas elliptic, 1.5–2.5 × 0.5–1 mm, acute at apex, cuneate at base, hyaline, glabrous, 2-nerved, 2-keeled. Second lemmas elliptic-lanceolate, 1.5–2.5 × 1–1.5 mm, acute at apex, cuneate at base, crustaceous, rugose, faintly 5–7-nerved. Paleas elliptic, 1.5–2 × 1–1.5 mm, obtuse at apex, cuneate at base, crustaceous, rugose, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Way sides and stream banks; *Fl. & Ft.*: August-March.

Specimen examined: Poonkavanam, Periyar Tiger Reserve, 09.08.1993, *Jomy Augustine* 12392 (CALI).

Setaria flavida (Retz.) Veldkamp, Blumea 39: 376. 1994. *Panicum flavidum* Retz., Observ. Bot. 4: 15. 1786; Hook.f., Fl. Brit. India 7: 28. 1896. *Paspalidium flavidum* (Retz.) A.Camus in P.H.Lecomte *et al.*, Fl. Indo-Chine 7: 419. 1922; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1774. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 333. 1960; Sreek. & V.J. Nair, Fl. Kerala Grasses 278. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 585. 2004.

Annuals or perennials. Culms tufted, erect; nodes glabrous. Leaves linear-oblong, 3–30 × 0.3–0.6 cm, blunt at apex, rounded at base, glabrous, scaberulous along margin, green; sheaths 2–6 cm long, compressed, keeled. Ligules annular. Inflorescence spiciform, 5–30 cm long. Spikes 3–10, alternate, 0.5–2 cm long, each distant by 2–4 times of their length; rachis narrowly winged. Spikelets ovate, 1–3 mm long, gibbous, glabrous. Lower glumes ovate, 0.5–1 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, 3-nerved. Upper glumes ovate, 2–3 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, 3–9-nerved. Lower florets barren. Upper florets bisexual. First lemmas ovate, 2–3 × 1.5–2 mm, obtuse at apex, cuneate at base, chartaceous, glabrous, 5-nerved. Paleas ovate-elliptic, 1.5–2 × 0.8–1 mm, obtuse at apex, cuneate at base, hyaline, glabrous, 2-nerved, 2-keeled. Second lemmas elliptic, 1.5–2 × 0.8–1 mm, obtuse at apex, cuneate at base, crustaceous, granular, faintly 5–7-nerved. Paleas elliptic, 1–2 × 0.5–1 mm, obtuse at apex,

obtuse at base, sub-coriaceous, glabrous, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: W. Indian Ocean, Arabian Peninsula to Tropical Asia and E. Australia (POWO, 2023); *Habitat*: Paddy fields and marshy areas; *Fl. & Ft.*: July-December.

Specimens examined: Kokkara, Periyar Tiger Reserve, 05.08.1993, *Jomy Augustine* 12199; Ramakalmedu, 07.09.2017, *Dani Francis & Santhosh Nampy* 152948 (CALI).

Notes: *Setaria flavida* is a variable species, with some specimens cespitose, with mostly basal leaves, and others with decumbent culms and leaves evenly distributed along the culms. The leaf shape varies greatly from filiform with involute margins to linear and flat, the size of the inflorescences and spikelets is also variable (Morrone *et al.*, 2014).

Setaria intermedia Roem. & Schult., Syst. Veg. ed. 15 bis 2: 489. 1817; Hook.f., Fl. Brit. India 7: 79. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1789. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 306. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 591. 2004. *Setaria tomentosa* (Roxb.) Kunth, Revis. Gramin. 1: 47. 1829; Bor, Grasses Burma, Ceylon, India & Pakistan 365. 1960.

Annuals. Culms erect or decumbent, rooting at lower nodes; nodes glabrous. Leaves linear-lanceolate, 3–25 × 0.3–1 cm, acuminate at apex, rounded at base, pubescent; sheaths 3–8 cm long, keeled, with sparse tubercled hairs, ciliate. Ligules a row of hairs. Panicles spiciform, narrow, lobed, interrupted, 3–20 cm long; bristles angular, 1–8 mm long, antrorsely barbed. Spikelets broadly elliptic-ovate, 1–2 × 1–1.5 mm, glabrous. Lower glumes ovate, 0.5–1 × 0.5–1 mm, acute at apex, sub-truncate at base, glabrous, 3-nerved. Upper glumes ovate, 1–1.5 × 1–1.5 mm, acute at apex, sub-truncate at base, glabrous, 5–7-nerved. Lower florets barren or male, with rudimentary stamens. Upper florets bisexual. First lemmas ovate, 1.5–2 × 1–1.5 mm, apiculate at apex, cuneate at base, glabrous, 5–7-nerved. Paleas ovate-orbicular, 1–2 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous, 2-nerved, 2-keeled. Second lemmas boat shaped, 1–2 × 1–1.5 mm, beaked at apex, cuneate at base, crustaceous, transversely rugose, faintly 5-nerved. Paleas broadly

elliptic, *c.* 1.5 × 1 mm, obtuse at apex, cuneate at base, crustaceous, rugose, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Eritrea to Tanzania, Arabian Peninsula, Indian Subcontinent to China and Indo-China (POWO, 2023); *Habitat*: Stream banks and waste lands; *Fl. & Ft.*: September-December.

Specimens examined: Anchuruli, 07.09.2017, *Dani Francis & Santhosh Nampy* 152907; way to Karimutty, 29.12.2017, *Dani Francis & Santhosh Nampy* 158037; Uppupara, 09.09.1994, *Jomy Augustine* 14145 (CALI).

Notes: This species is similar to *S. verticillata* in its similar habit and nature of panicles, but can be differentiated by the antrorsely barbed bristles of the involucre (Sreekumar & Nair, 1991).

Setaria palmifolia (J.Koenig) Stapf, J. Linn. Soc. Bot. 42: 186. 1914; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1789. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 363. 1960; Sreek. & V.J.Nair, Fl. Kerala Grasses 307. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 591. 2004. *Panicum palmifolium* J.Koenig, Naturforscher 23: 208. 1788. *Setaria paniculifera* (Steud.) E.Fourn. ex Hemsl., Biol. Cent.-Amer. Bot. 3: 505. 1885; K.M.Matthew, Illustr. Fl. Palni Hills 864. 1996.

Perennials. Culms densely tufted, erect; nodes glabrous or sparsely hairy. Leaves elliptic-lanceolate, 15–50 × 2–8 cm, acuminate at apex, rounded at base, plicate from base to apex, glabrous or puberulous; sheaths 10–20 cm long, with tubercled hairs. Ligules a row of hairs. Panicles lax, 15–50 cm long; bristles angular, 3–10 mm long, scabrid. Spikelets broadly elliptic-lanceolate, 3–4 × 1–1.5 mm, glabrous. Lower glumes ovate, 1–1.5 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous, 3–5-nerved. Upper glumes elliptic-ovate, 2–2.5 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, 5–7-nerved. Lower florets barren. Upper florets bisexual. First lemmas ovate-lanceolate, 3–4 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, 5-nerved. Paleas absent or a triangular scale, 0.5 mm long, obtuse at apex, hyaline, glabrous. Second lemmas ovate-lanceolate, 2.5–3 × 1–1.3 mm, obtuse at apex, cuneate at base, rugose, faintly 5-nerved. Paleas elliptic, 2–3 × 1–1.5 mm, obtuse at apex, cuneate at base, rugose, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Tropical and Subtropical Asia to E. Australia (POWO, 2023); *Habitat*: Forest margins and stream banks; *Fl. & Ft.*: July-January.

Specimens examined: Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154366; Mangaladevi hills, Periyar Tiger Reserve, 15.07.2017, *Dani Francis & Santhosh Nampy* 154106; Mlappara, 18.07.1994, *Jomy Augustine* 13903; Pachakkanam, Periyar Tiger Reserve, 20.12.1996, *Jomy Augustine* 17043; Pethotti, Mathikettan Shola National Park, 06.01.2017, *Dani Francis & Santhosh Nampy* 151589 (CALI).

Notes: It is a robust plant with plicate leaves and lax open panicles (Morrone *et al.*, 2014).

Setaria parviflora (Poir.) Kerguelen, Lejeunia 120: 161. 1987. *Cenchrus parviflorus* Poir. in J.Lamarck *et al.*, Encycl. 6: 52. 1804. *Pennisetum polystachion* (L.) Schult., Syt. Veg. Mant. 2: 146. 1824; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1792. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 346. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 291. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 856. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 587. 2004.

Annuals or perennials. Culms erect, densely tufted; nodes glabrous. Leaves linear-lanceolate, 5–35 × 0.2–1.5 cm, acuminate at apex, rounded at base, glabrous or pubescent, green; sheaths 8–18 cm long, keeled, sparsely hairy. Ligules membranous, fimbriate. Panicles spiciform, 8–20 cm long; spikes solitary; rachis angular, winged. Involucre enclosing one sessile spikelet; bristles 2–10 cm long, barbellate, at least the inner ones plumose in the lower half. Spikelets lanceolate, 3–4 mm long, sessile. Lower glumes ovate, 0.5–1 × 0.2–0.3 mm, obtuse at apex, cuneate at base, glabrous. Upper glumes ovate-lanceolate, 3–3.5 × 1–1.5 mm, acuminate at apex, cuneate at base, glabrous, 5–7-nerved. Lower florets male or empty, epaleate. Upper florets bisexual. First lemmas ovate-lanceolate, 3–3.5 × 1–1.5 mm, acute-obtuse at apex, cuneate at base, glabrous, 5–7-nerved. Paleas narrowly ovate-lanceolate, 2.5–3 × 0.3–0.4 mm, obtuse at apex, cuneate at base, glabrous, 0–2-nerved, 2-keeled. Second lemmas ovate-lanceolate, 2–3 × 0.8–1 mm, acute-obtuse at apex, cuneate at base, faintly 3–5-nerved. Paleas ovate, *c.* 2 × 1 mm,

obtuse at apex, cuneate at base, glabrous, 2-nerved, slightly 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: New World (POWO, 2023); *Habitat*: Way sides and grasslands; *Fl. & Ft.*: September-May.

Specimens examined: Irumbupalam, 28.12.2017, *Dani Francis & Santhosh Nampy* 156554; *Ibid*., 28.12.2017, *Dani Francis & Santhosh Nampy* 156555; Puthussery, Periyar Tiger Reserve, 27.12.1996, *Jomy Augustine* 17068 (CALI).

Setaria pumila (Poir.) Roem. & Schult., Syst. Veg. ed. 15 bis 2: 891. 1817; Sreek. & V.J.Nair, Fl. Kerala-Grasses 309. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 592. 2004. *Panicum pumilum* Poir. in J.Lamarck, Encycl. Suppl. 4: 273. 1816. *Setaria pallide-fusca* (Schumach.) Stapf & C.E.Hubb., Bull. Misc. Inform. Kew 1930: 259. 1930; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1789. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 363. 1960.

Annuals. Culms tufted, creeping or erect; nodes glabrous or sparsely hairy. Leaves linear-lanceolate, 5–30 × 0.2–1 cm, acuminate at apex, rounded at base, glabrous or puberulous; sheaths 2–5 cm long, keeled, glabrous or puberulous. Ligules ovate, membranous, thin. Panicles spiciform, cylindric, 1–15 cm long; bristles numerous, 1–5 mm long, scabrid. Spikelets ovate-sub-globose, 1.5–2.5 × 1–1.5 mm, slightly gibbous, glabrous. Lower glumes ovate, 1–2 × 1–1.5 mm, acute at apex, sub-truncate at base, glabrous, faintly 3–5-nerved. Upper glumes ovate, 1–2 × 1–1.5 mm, acute at apex, sub-truncate at base, glabrous, 5-nerved. Lower florets male or barren. Upper florets bisexual. First lemmas ovate-elliptic, 1.5–2.5 × 1–2 mm, acute at apex, cuneate at base, glabrous, 5–7-nerved. Paleas elliptic, 1.5–2 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, delicate, 2-nerved, 2-keeled. Stamens 3. Second lemmas boat shaped, 2–2.5 × 1–1.5 mm, acute at apex, cuneate at base, crustaceous, slightly keeled, beaked, rugose, faintly 5-nerved. Paleas ovate-elliptic, 1.5–2 × 0.8–1 mm, acute at apex, cuneate at base, crustaceous, rugose, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Old World (POWO, 2023); *Habitat*: Grasslands and forest margins; *Fl. & Ft.*: May-December.

Specimens examined: Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154350, 154358, 170317; Mangaladevi, 20.07.1993, *Jomy Augustine* 12349; Mathikettan Shola National Park, 11.12.2016, *Dani Francis & Santhosh Nampy* 151367; *Ibid*., Sivanpara, 23.08.2014, *Syam Radh S.* 143537; *Ibid*., Survikal Para, 17.07.2015, *Syam Radh S.* 145067 (CALI).

Setaria verticillata (L.) P.Beauv., Ess. Agrostogr. 51. 1812; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1789. 1934; Hook.f., Fl. Brit. India 7: 80. 1896; Bor, Grasses Burma, Ceylon, India & Pakistan 365. 1960; K.M.Matthew, Illustr. Fl. Palni Hills 866. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 592. 2004. *Panicum verticillatum* L., Sp. Pl., ed. 2. 1: 82. 1762.

Annuals or short-lived perennials. Culms tufted, more or less furrowed at one side; nodes glabrous, brown. Leaves linear-lanceolate, 4–35 × 0.5–3 cm, acuminate at apex, rounded at base, scabrous or with sparse tubercled hairs, green; sheaths 3–15 cm long, keeled, sparsely villous, ciliate. Ligules membranous, fimbriate at apex. Panicles spiciform, cylindrical, 2–20 cm long; rachis scabrid. Spikelets ovate-elliptic, 1.5–2.5 mm long, glabrous; bristles persistent, one per spikelet, 4–7 mm long, retrorsely barbellate. Lower glumes ovate, 0.5–1 × 0.8–1 mm, acute at apex, sub-truncate at base, hyaline, glabrous, 1–3-nerved. Upper glumes ovate-lanceolate, 1–2 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, 5–7-nerved. Lower florets barren. Upper florets bisexual. First lemmas elliptic-lanceolate, 1–2 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, 5-nerved. Paleas oblong, 0.5–1 × 0.4–0.5 mm, acute at apex, cuneate at base, hyaline, glabrous, not keeled. Second lemmas ovate-lanceolate, 1–2 × 0.8–1 mm, acute at apex, cuneate at base, sub-coriaceous, transversely rugulose, faintly 3–5-nerved. Paleas elliptic, 1–1.8 × 0.8–1 mm, acute at apex, cuneate at base, sub-coriaceous, transversely rugulose, faintly 2-nerved. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Wet areas of way sides, waste places; *Fl. & Ft.*: June-April.

Specimen examined: Way to Karimutty, 29.12.2017, *Dani Francis & Santhosh Nampy* 158055 (CALI).

Notes: *Setaria verticillata* is distinguished by its retrorsely barbellate bristles of inflorescence.

Trachys Pers.,

Syn. Pl. 1: 85. 1805.

Trachys muricata (L.) Pers. ex Trin., Mem. Acad. Imp. Sci. Saint-Petersbourg, ser. 6, Sci. Math. Seconde Pt. Sci. Nat. 3(2): 189. 1834; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1813. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 369. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 315. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 594. 2004. *Cenchrus muricatus* L., Mant. Pl. 2: 302. 1771. *Trachys mucronata* Pers., Syn. Pl. 1: 85. 1805; Hook.f., Fl. Brit. India 7: 96. 1896.

Annuals. Culms tufted, creeping, rooting at nodes; nodes hairy. Leaves elliptic-lanceolate, 2–6 × 0.3–0.7 cm, acuminate at apex, rounded at base, undulate on one margin, hispid; sheaths 1.5–3 cm long, with tubercled hairs. Ligules ovate, membranous. Racemes 1–3, 1–5 cm long. Spikelets groups of 1–6, mixed with scale like glumes, clustered on a broad, flat rachis, ovate, 5–6 mm long, glabrous; rachis disarticulating. Lower glumes lanceolate, 2–3 × 0.2–0.5 mm, acute at apex, chartaceous, glabrous, 1-nerved. Upper glumes lanceolate, 2–4 × 0.4–0.5 mm, acute at apex, chartaceous, glabrous, 1–3-nerved. Lower florets barren, epaleate. Upper florets bisexual. First lemmas broadly elliptic, 5–6 × 2–3 mm, acuminate at apex, chartaceous, glabrous, 11-many nerved. Second lemmas lanceolate, 3–4.5 × 1–2 mm, acute at apex, coriaceous, hyaline, glabrous, faintly 3–5-nerved. Paleas elliptic-lanceolate, 3–5 × 1–2 mm, acute at apex, coriaceous, hyaline, glabrous, 2-nerved. Stamens 3. Ovary oblong; stigma *c.* 2 mm long.

Distribution: India, Sri Lanka and Myanmar (POWO, 2023); *Habitat*: Banks of streams; *Fl. & Ft.*: July-December.

Specimens examined: Kanthallur, 10.12.2019, *Dani Francis & Santhosh Nampy* 176152; Mangaladevi, 20.07.1993, *Jomy Augustine* 12349 (CALI).

Urochloa P.Beauv.,

Ess. Agrostogr. 52. 1812.

Key to the species

1. Rachis flat, narrowly winged ..... *U. panicoides*

1. Rachis flat or angular, not winged 2

2. Culms often erect; lower glumes not clasping the spikelet 3

2. Culms creeping or decumbent; lower glumes clasping the spikelet 4

3. Nodes hairy; spikelets 2.5–3.5 mm long ..... *U. mutica*

3. Nodes glabrous; spikelets 4.5–5.5 mm long ..... *U. eminii*

4. Spikelets 1–2 mm long ..... *U. reptans*

4. Spikelets 2–4 mm long 5

5. Rachis flat; spikelets secund, solitary ..... *U. distachyos*

5. Rachis triquetrous; spikelets not secund, paired ..... *U. ramosa*

Urochloa distachyos (L.) T.Q.Nguyen, Novosti Sist. Vyssh. Rast. 3: 13. 1966. *Panicum distachyon* L., Mant. Pl. 183. 1767. *Brachiaria miliiformis* (J.Presl) Chase, Contr. U.S. Natl. Herb. 22: 35. 1920; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1769. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 283. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 220. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 556. 2004.

Annuals or perennials. Culms creeping, rooting at lower nodes; nodes glabrous. Leaves linear-lanceolate, 3–20 × 0.3–1.5 cm, acuminate at apex, shallowly cordate at base, scabrous at margins, glabrous, green; sheaths 1–5 cm long, glabrous or tubercled hairy, ciliate. Ligules fimbriate or a row of hairs. Racemes 3–8, alternate, 2–8 cm long; rachis flat, scabrous along margins. Spikelets elliptic, 3.5–4 mm long, secund, solitary. Lower glumes obvate, 1.5–2 × 1.5–2 mm, obtuse at apex, clasping at base, glabrous, 9–11-nerved. Upper glumes ovate, 3–4 × 1.5–2 mm, acute at apex, cuneate at base, glabrous, 7–9-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas ovate, 3–3.5 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, 5–7-nerved. Second lemmas elliptic, 2.5–3.5 × 1–1.5 mm, acute at apex, cuneate at base, crustaceous, rugulose, faintly 3–5-nerved. Paleas elliptic, 2–3 × 1–1.5 mm, acute at apex, cuneate at base, crustaceous, 2-keeled, 2-nerved. Lodicules 2. Stamens 3. Ovary elliptic; stigma plumose.

Distribution: S. Arabian Peninsula to W. Pacific (POWO, 2023); *Habitat*: Waste lands and river banks; *Fl. & Ft.*: Throughout the year.

Specimens examined: Kokkara, Periyar Tiger Reserve, 07.07.1993, *Jomy Augustine* 12053; Kulamavu, 24.09.1981, *C.N. Mohanan & B. Ramanujan* 71964 (MH); Thekkady, 12.09.1993, *Jomy Augustine* 12389 (CALI).

Urochloa eminii (Mez) Davidse, Monogr. Syst. Bot. Missouri Bot. Gard. 45: 1258. 1993. *Panicum eminii* Mez., Bot. Jahrb. Syst. 34: 135. 1904. *Brachiaria decumbens* Stapf. in Oliver *et al.* (eds.), Fl. Trop. Afr. 9: 528. 1919; Bor, Grasses Burma, Ceylon, India & Pakistan 281. 1960; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 556. 2004.

Perennial herbs. Culms tufted, 20–100 cm high, erect-geniculate, rhizomatous, rooting from nodes; nodes glabrous. Leaves lanceolate, 3–25 × 0.2–1 cm, acute at apex, sub-rounded at base, pilose, scabrous and undulate at margin, green. Sheaths keeled, 3–10 cm long, pilose. Ligules a row of hairs, *c.* 0.8–1 mm long. Racemes 2–6, 2–10 cm long, often terminated by rudimentary spikelet; peduncles pilose below the inflorescence; rachis broadly ribbon like, 2–2.5 mm wide, densely pilose along the margins; pedicels 0.4–1 mm long, puberulous. Spikelets ellipsoid, solitary, 4.5–5.5 mm long, hairy. Lower glumes widely ovate, 2.8–3 × 2.5–3 mm, acute at apex, amplexicaul at base, 9–11 nerved, glabrous. Upper glumes ovate-elliptic, 4–5.5 × 2–3.5 mm, acuminate at apex, cuneate at base, 5–7-nerved, distally pilose. Lower florets male. Upper florets bisexual. First lemmas ovate-elliptic, 4–5 × 2–3.5 mm, acuminate at apex, cuneate at base, 5–7-nerved, distally pilose. Paleas elliptic, 3.5–3.9 × 2–2.2 mm, slightly emarginate at apex, cuneate at base, glabrous, hyaline, 2-keeled, 2-nerved. Second lemmas ovate, 3–4 × 1.3–2 mm, apiculate or mucronate at apex, *c.* 0.1 mm long, cuneate at base, glabrous, crustaceous, finely longitudinally punctate striate, 2nerved. Paleas elliptic, 3–3.8 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, 2-keeled, faintly 2-nerved, crustaceous. Lodicules 2, cuneate, 0.8–1 mm long, membranous, hyaline, truncate at apex. Stamens 3, 2.5–3 mm long; anthers yellow. Ovary ovate; style 2, 2.5 mm long; stigma plumose.

Distribution: Ivory coast to Kenya and Zambia (POWO, 2023); *Habitat*: Open lands and grass lands; *Fl. & Ft.*: September-March.

Specimens examined: Anakkara, 17.03.2017, *Dani Francis & Santhosh Nampy* 158397; Kalvary mount, 06.09.2017, *Dani Francis & Santhosh Nampy* 154349; Kattadikadavu, 07.12.2018, *Dani Francis & Santhosh Nampy* 167826; *Ibid.*,

12.10.2019, *Dani Francis & Santhosh Nampy* 170337; Mlappara, Periyar Tiger Reserve, 16.10.1993, *Jomy Augustine* 12578 (CALI).

Notes: It is an introduced species often grown as a fodder grass. It is a new report for the study area.

Urochloa mutica (Forssk.) T.Q.Nguyen, Novosti Sist. Vyssh. Rast. 3: 13. 1966. *Panicum muticum* Forssk., Fl. Aegypt.-Arab. 20. 1775; Hook.f., Fl. Brit. India 7: 34. 1896. *Brachiaria mutica* (Forssk.) Stapf in Oliver *et al.* (eds.), Fl. Trop. Afr. 9: 526. 1919; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1769. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 284. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 221. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 556. 2004.

Perennials. Culms tufted, erect, puberulous; nodes hairy. Leaves linear-lanceolate, 5–30 × 0.3–2 cm, acuminate at apex, shallowly cordate at base, glabrous-puberulous, green, scabrous at margins. Sheaths 7–12 cm long, densely tubercled hairy. Ligules membranous, thin, fimbriate. Racemes pseudopaniculate, 10–20, alternate, 2–8 cm long; rachis flat, ribbon like, scabrous along margins. Spikelets elliptic, 2.5–3.5 mm long, crowded, arranged in two rows, pubescent; pedicels 0.5–2 mm long, with a few white bristles. Lower glumes ovate, 0.8–1 × 0.3–0.5 mm, obtuse at apex, cuneate at base, glabrous, faintly 1–3-nerved. Upper glumes broadly ovate, 3–3.5 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, 5-nerved. Lower florets male. Upper florets bisexual. First lemmas ovate, 3–3.5 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, 5-nerved. Paleas elliptic, 2.5–3 × 1–1.5 mm, obtuse at apex, obtuse at base, glabrous, delicate, hyaline, 2-keeled, 2-nerved. Stamens 3. Second lemmas ovate, 2–2.5 × 0.8–1 mm, rounded and slightly mucronate at apex, cuneate at base, crustaceous, rugulose, faintly 3-nerved. Paleas ovate-elliptic, 2–2.4 × 0.8–1 mm, rounded at apex, cuneate at base, crustaceous, 2-nerved, 2-keeled. Lodicules 2, obovate, denticulate at apex. Stamens 3. Ovary ovate, *c*. 0.3 × 0.2 mm; style 1 mm long; stigma plumose.

Distribution: Sahara to Angola, N. Africa to Syria, SW. Arabian Peninsula (POWO, 2023); *Habitat*: Waste lands and paddy fields; *Fl. & Ft.*: November-March.

Specimen examined: Neriamangalam, 26.12.2017, *Dani Francis & Santhosh Nampy* 156387 (CALI).

Urochloa panicoides P.Beauv., Ess. Agrostogr. 52. 1812; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1775. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 372. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 316. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 595. 2004. *Panicum javanicum* Poir. in J. Lamarck *et al.*, Encycl. Suppl. 4: 274. 1816; Hook.f., Fl. Brit. India 7: 35. 1896.

Annuals. Culms tufted, erect or creeping, rooting at the lower nodes; nodes sparsely hairy. Leaves ovate-lanceolate, 2–8 × 0.3–1 cm, acuminate at apex, cordate at base, margin undulate on one margin, glabrous or hairy, green; sheaths 3–6 cm long, keeled, tubercled hairy. Ligules a row of hairs. Panicle 5–14 cm long; racemes 3–5, alternate, 1–4 cm long; rachis flat, narrowly winged, bearing solitary or paired spikelts. Spikelets elliptic, 3–4 × 1.5–2 mm, pubescent; pedicels 0.5–2 mm long, with a few white glassy bristles. Lower glumes ovate, 1–1.5 × 1–1.5 mm, acute at apex, cuneate at base, pubescent, 3–5-nerved. Upper glumes broadly ovate, 3–4 × 1.5–2.5 mm, acute at apex, cuneate at base, pubescent, 7–9-nerved. Lower florets male. Upper florets bisexual. First lemmas broadly ovate, 3–4 × 1.5–2 mm, acute at apex, cuneate at base, chartaceous, pubescent, 5–7-nerved. Paleas ovate-elliptic, 3–3.5 × 1.5–2 mm, obtuse at base and apex, delicate, hyaline, glabrous, 2-nerved, 2-keeled. Stamens 3. Second lemmas ovate, 2–3 × 1.5–2 mm, mucronate at apex, cuneate at base, crustaceous, transversely rugose, faintly 5-nerved. Paleas ovate, 2–2.5 × 1–1.5 mm, obtuse at apex, cuneate at base, crustaceous, rugose, faintly 2-nerved, 2-keeled. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Egypt to S. Africa and Indo-China (POWO, 2023); *Habitat*: Waste lands and paddy fields; *Fl. & Ft.*: July-December.

Specimen examined: Thekkady, 08.09.1993, *Jomy Augustine* 12556 (CALI).

Urochloa ramosa (L.) T.Q.Nguyen, Novosti Sist. Vyssh. Rast. 3: 13. 1966. *Panicum ramosum* L., Mant. Pl. 1: 29. 1767; Hook.f., Fl. Brit. India 7: 36. 1896. *Brachiaria ramosa* (L.) Stapf in Oliver *et al.* (eds.), Fl. Trop. Afr. 9: 542. 1919; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1770. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 284. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 223. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 556. 2004.

Annuals or perennials. Culms creeping or decumbent, 15–80 cm long; nodes glabrous or softly hairy. Leaves lanceolate, 2–15 × 0.5–2 cm, acuminate at apex, shallowly cordate at base, tubercled hairy, green, scabrous at margins. Sheaths 5–10 cm long, slightly keeled, glabrous, ciliate along margins. Ligules a row of hairs. Panicles 5–20 cm long, lax; racemes 3–6, alternate, 2–4.5 cm long; rachis triquetrous, scabrous along margins. Spikelets ovate-elliptic, 2.5–3.1 × 1–2 mm, paired, glabrous; pedicels 0.8–1 mm long, sparsely hairy. Lower glumes broadly ovate, *c*. 1.5 × 2 mm, obtuse at apex, clasping the spikelet, glabrous, 7–9-nerved. Upper glumes broadly ovate-elliptic, 2.5–3 × 1.5–2 mm, acute at apex, cuneate at base, glabrous, 7-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas broadly ovate, 2.5–3 × 1.5–2 mm, obtuse at apex, cuneate at base, glabrous, 5-nerved. Paleas oblong-lanceolate, *c*. 2 × 0.5 mm, obtuse at base and apex, glabrous, delicate, hyaline, 2-keeled, 2-nerved. Second lemmas broadly ovate-elliptic, 2–2.5 × 1.5–2 mm, slightly mucronate at apex, cuneate at base, crustaceous, rugose, faintly 5–7-nerved. Paleas ovate, 2–2.2 × *c*. 1 mm, obtuse at apex, cuneate at base, crustaceous, muriculate, 2-keeled. Ligules 2, cuneate, *c*. 0.3 × 0.2 mm. Stamens 3, 1–1.5 mm long, yellow. Ovary ovate, *c*. 0.3 × 0.2 mm; style *c*. 1 mm long; stigma plumose.

Distribution: Africa to Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Paddy fields; *Fl. & Ft.*: January-September.

Specimens examined: Thannikkudy, 07.01.1994, *Jomy Augustine* 13078; Ramakkalmedu, 07.09.2017, *Dani Francis & Santhosh Nampy* 152941; *Ibid.*, 07.09.2017, *Dani Francis & Santhosh Nampy* 152943 (CALI).

Urochloa reptans (L.) Stapf. in Oliver *et al.* (eds.), Fl. Trop. Afr. 9: 601. 1920; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1775. 1934. *Panicum reptans* L., Syst. Nat. ed. 10. 2: 870. 1759. *Brachiaria reptans* (L.) C.A.Gardner & C.E.Hubb., Hooker's Icon. Pl. 34: t. 3363. 1938; Bor, Grasses Burma, Ceylon, India & Pakistan 285. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 224. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 557. 2004.

Annuals. Culms creeping, rooting at nodes; nodes glabrous or sparsely hairy. Leaves lanceolate, 2–6 × 0.2–1 cm, acuminate at apex, shallowly cordate at base, glabrous or pubescent, green; sheaths 5–10 cm long, glabrous or sparsely hairy,

ciliate. Ligules a row of hairs. Panicles 3–6 cm long; racemes 3–6, alternate, 1–5 cm long. Spikelets elliptic, 1–2 mm long, glabrous; pedicels 0.5–2 mm long, with long bristles. Lower glumes broadly ovate, 0.5–1 × *c*. 0.2 mm, obtuse at apex, truncate at base, glabrous, faintly 1–3-nerved. Upper glumes ovate, 1.5–2 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, 5-nerved. Lower florets empty. Upper florets bisexual. First lemmas broadly ovate, 1.5–2 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, 7-nerved. Paleas ovate-lanceolate, 1.5–2 × 0.5–1 mm, obtuse at apex, obtuse at base, delicate, hyaline, glabrous, 2-nerved, 2-keeled. Second lemmas ovate, 1–1.5 × 0.8–1 mm, mucronate at apex, cuneate at base, crustaceous, rugulose. Paleas ovate, 1–1.5 × 0.8–1 mm, obtuse at apex, cuneate at base, crustaceous, rugulose, 2-nerved, 2-keeled. Lodicules 2. Stamens 3. Pistil rudimentary.

Distribution: Arabian Peninsula and Afghanistan to Pacific (POWO, 2023); *Habitat*: Wetlands; *Fl. & Ft.*: August-September.

Specimen examined: Munnar, 22.08.1980, *P.V. Sreekumar* 67764 (MH).

Tribe Isachneae Benth,

J. Linn. Soc. Bot. 19: 30. 1881.

Key to the genera

1. Glumes longer or sub-equal to spikelets, deciduous ..... *Isachne*

1. Glumes shorter than the spikelets, persistent ..... *Coelachne*

Coelachne R.Br.,

Prodr. Fl. Nov. Holland. 187. 1810.

This genus has 12 species worldwide, four of which have been reported from India. According to POWO (2023), *C. ghatica* Naik is an accepted name, but Ved Prakash and Kulkarni (1979) synonymized it under *C. minuta* Bor.

Key to the species

1. Panicles contracted; florets glabrous at base ..... *C. simpliciuscula*

1. Panicles lax; florets densely hairy at base ..... *C. perpusilla*

Coelachne perpusilla (Nees ex Steud.) Thwaites, Enum. Pl. Zeyl. 373. 1864; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1804. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 576. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 414. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 800. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 560. 2004. *Panicum perpusillum* Nees ex Steud., Syn. Pl. Glumac. 1: 96. 1854. *Coelachne pulchella* var. *perpusilla* (Nees. ex Steud.) Hook.f., Fl. Brit. India 7: 271. 1896. *Coelachne pulchella* var. *gracillima* Hook.f., Fl. Brit. India 7: 271. 1896.

Annuals or perennials. Culms erect or geniculate, densely tufted, glabrous; nodes glabrous or hairy. Leaves linear-lanceolate, 0.5–2 × 0.1–0.3 cm, acute at apex, rounded at base, tubercled hairy, green; sheaths 0.5–1 cm long, tubercled hairy. Ligules a row of hairs. Panicles 1–6 cm long, lax, with spreading branches. Spikelets obovate, 2.5–4 mm long, green. Lower florets male, bearded. Upper florets bisexual, bearded. Lower glumes ovate-elliptic, 1.2–1.5 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous, purplish green, 3-nerved. Upper glumes ovate-oblong, 1.5–2 × 1–1.2 mm, obtuse at apex, cuneate at base, glabrous or puberulous, chartaceous, 4-nerved. First lemmas ovate-lanceolate, 2–3 × 1–1.2 mm, obtuse at apex, cuneate at base, glabrous or puberulous, 3-nerved. Paleas elliptic, 1.5–2 × 0.8–1 mm, obtuse at apex, cuneate at base, delicate, 2-nerved, 2-keeled. Second lemmas ovate-elliptic, 1–1.6 × 0.5–0.6 mm, coriaceous, obtuse at base and apex, sparsely scabrellate, 3–5-nerved. Paleas oblong-elliptic, boat shaped, 1–1.3 × 0.4–0.5 mm, obtuse at apex, cuneate at base, coriaceous, 0–2-nerved, 2-keeled, keels scabrellate. Lodicules membranous, hyaline. Stamens 3. Ovary ovate; stigma plumose. Caryopsis oblong-elliptic, flat, brown.

Distribution: S. India, Sri Lanka and Indo-China to Philippines (POWO, 2023); *Habitat*: Moist grasslands; *Fl. & Ft.*: July-December.

Specimen examined: Pettimudi, near Subranshed, 30.12.2019, *Dani Francis & Santhosh Nampy* 170043 (CALI).

Notes: This species can be differentiated from other species by its lax panicles with spreading branches (Sreekumar & Nair, 1991).

Coelachne simpliciuscula (Wight & Arn. ex Steud.) Munro ex Benth., J. Linn. Soc. Bot. 19: 93. 1881; Bor, Grasses Burma, Ceylon, India & Pakistan 576. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 415. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 560. 2004. *Panicum simpliciusculum* Wight & Arn. ex Steud., Syn. Pl. Glumac. 1: 96. 1854. *Coelachne pulchella* var. *simpliciuscula* (Wight & Arn. ex Steud.) Hook.f., Fl. Brit. India 7: 271. 1896. *Coelachne pulchella* var. *gardneri* Hook.f., Fl. Brit. India 7: 271. 1896. *Coelachne pulchella* var. *spicata* Hook.f., Fl. Brit. India 7: 271. 1896.

Annuals. Culms tufted, slender, glabrous; nodes hairy. Leaves oblong-lanceolate, 0.5–3 × 0.1–0.3 cm, acute-acuminate at apex, rounded at base, glabrous, green; sheaths 0.5–1 cm long, glabrous-puberulous. Ligules a rim of hairs. Panicles spiciform, 3–8 cm long, contracted, interrupted. Spikelets ovate-oblong, 1.5–2.5 mm long, green. Lower florets bisexual, glabrous at base. Upper florets male, glabrous at base. Lower glumes ovate-oblong, 0.5–1 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous, green, 3-nerved. Upper glumes oblong, 1–1.5 × 1–1.2 mm, obtuse at apex, cuneate at base, glabrous, 5-nerved. First lemmas ovate-lanceolate, 1.5–2.5 × 1–1.2 mm, obtuse at apex, cuneate at base, glabrous, 3–5-nerved. Paleas elliptic, 1.5–2 × 0.8–1 mm, obtuse at apex, cuneate at base, delicate, 2-nerved, 2-keeled. Second lemmas ovate-oblong, 1–2 × 0.5–0.6 mm, obtuse at apex, obtuse at base, 0–3 nerved, ciliate along the nerves. Paleas ovate-elliptic, 1–2 × 0.4–0.5 mm, obtuse at apex, cuneate at base, 2 nerved, 2 keeled, ciliate along the keels. Lodicules membranous, *c.* 0.3 mm long, hyaline. Stamens 3, *c.* 0.7 mm long. Ovary elliptic, *c.* 0.4 mm long; stigma plumose. Caryopsis ovate-lanceolate, greenish brown.

Distribution: Madagascar and S. China to Tropical Asia (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: December-March.

Specimens examined: Kumarikulam, Periyar Tiger Reserve, 05.03.2021, *Dani Francis & Santhosh Nampy* 186607 (CALI); Meenmutty, 20.02.1983, *C.N. Mohanan* 76236 (MH); Pettimudi, 30.12.2019, *Dani Francis & Santhosh Nampy* 176100; Swamikkayam, 03.01.1994, *Jomy Augustine* 13110 (CALI).

Notes: The narrowly contracted, spiciform panicles and broader leaves distinguish this species.

Isachne R.Br.,

Prodr. Fl. Nov. Holland. 196. 1810.

Key to the species

1. Inflorescence a raceme; plants dwarf ..... *I. fischeri*

1. Inflorescence a panicle; plants taller 2

2. Spikelets 3.5 mm long 3

2. Spikelets 1.5–3.5 mm long 4

3. Panicles few flowered; pedicels with glandular bands ..... *I. walkeri*

3. Panicles many flowered; pedicels without glandular bands ..... *I. bourneorum*

4. Glumes caudate or acuminate at apex, setose with tubercled hairs ..... *I. setosa*

4. Glumes not acuminate-caudate at apex, sparsely hairy or glabrous 5

5. Florets equal; glumes longer than florets ..... *I. kunthiana*

5. Florets unequal; glumes equal to or shorter than florets ..... *I. globosa*

Isachne bourneorum C.E.C.Fisch., Bull. Misc. Inform. Kew 1932: 324. 1932, in Gamble, Fl. Madras 3: 1796. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 579. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 417. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 838. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 575. 2004.

Perennials. Culms tufted, erect, branched; nodes sparsely hairy or glabrous. Leaves ovate-elliptic, 1–5 × 0.2–1.2 cm, acuminate at apex, rounded at base, glabrous or sparsely hairy, green; sheaths 1–2 cm long, tubercled hairy. Ligules a row of hairs. Panicles 2–10 cm long, congested, many flowered. Spikelets ovate-lanceolate, 3–4 mm long; pedicels without glandular bands. Lower glumes ovate-lanceolate, 3–4 × 0.8–1 mm, acuminate at apex, cuneate at base, sparsely tubercled hairy, 7–9-nerved. Upper glumes ovate-lanceolate, 3.5–4 × 1–1.5 mm, acuminate at apex, cuneate at base, sparsely tubercled hairy, 5–7-nerved. First lemmas ovate-lanceolate, 2–2.5 × 1–1.5 mm, acute or obtuse at apex, cuneate at base, glabrous, faintly 5-nerved. Paleas ovate-elliptic, 2–2.5 × 1–1.5 mm, obtuse at apex, cuneate at base, delicate, glabrous, 2-nerved, 2-keeled. Stamens 3. Second lemmas broadly ovate, 1–1.5 × 0.8–1 mm, obtuse at apex, cuneate at base, coriaceous, pubescent, nerves not clear.

Paleas boardly ovate, 1–1.3 × 0.8–1 mm, obtuse at apex, cuneate at base, hyaline, pubescent dorsally, 2-nerved. Stamens 3. Ovary oblong; stigma plumose.

Distribution: SW. India (POWO, 2023); *Habitat*: Marshy grasslands; *Fl. & Ft.*: July-January.

Specimens examined: Chokkampetty, Periyar Tiger Reserve, 02.01.1995, *Jomy Augustine* 14488; Kalvarimala, Periyar Tiger Reserve, 17.08.1994, *Jomy Augustine* 13901; way to Meesapulimala, Rhodomansion, 21.11.2018, *Dani Francis & Santhosh Nampy* 167777 (CALI); Umayamala, 10.08.1967, *B.V. Shetty* 28357; *Ibid.*, 22.11.1965, *B.V. Shetty* 26611 (MH).

Notes: This species resembles *I. setosa* but is distinguished by smaller spikelets and slender leaves and culms. It is also related to *I. kunthiana*, but differs by having unequal florets with differently textured lemmas and paleas (Sreekumar & Nair, 1991).

Isachne fischeri Bor, Kew Bull. 4: 69. 1949, Grasses Burma, Ceylon, India & Pakistan 580. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 419. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 575. 2004. *Isachne kunthiana* var. *nana* C.E.C.Fisch. in Gamble, Fl. Madras 3: 1796. 1934.

Annuals. Culms erect, 3–9 cm long; nodes hairy. Leaves lanceolate-elliptic, 5–10 × 1–6 mm, acute at apex, cuneate at base, hirsute, green; sheaths 5–12 mm long, sparsely tubercled hairy. Ligules a row of hairs. Inflorescence racemose, 1–1.5 cm long, lax, few flowered. Spikelets obovoid, 2–3 × 1–2 mm, acuminate at apex, tubercled hairy, greenish purple. Lower glumes ovate-lanceolate, 2–3 × 1–1.8 mm, acuminate at apex, cuneate at base, tubercled hairy, purplish green, 5-nerved. Upper glumes ovate-lanceolate, 2–3 × 1–1.5 mm, acuminate at apex, cuneate at base, tubercled hairy, chartaceous, 5–7-nerved. Lower florets male. Upper florets bisexual. First lemmas ovate-lanceolate, 2–2.5 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, faintly 3–5-nerved. Paleas oblong, 2–2.5 × 0.5–1.5 mm, obtuse at apex, cuneate at base, delicate, 2-nerved. Second lemmas ovate-elliptic, 1–2 × 0.6–1 mm, coriaceous, obtuse at apex, obtuse at base, softly hairy. Paleas elliptic, 1–1.5 × 0.8–1 mm, obtuse at apex, cuneate at base, coriaceous, softly hairy. Stamens 3. Ovary ovate; stigma plumose. Caryopsis elliptic.

Distribution: SW. India (POWO, 2023); *Habitat*: Marshy grasslands; *Fl. & Ft.*: September-January.

Specimens examined: Anamudi peak, 19.11.1965, *B.V. Shetty* 26533 (MH); *Ibid*., 11.12.2019, *Dani Francis & Santhosh Nampy* 164571; 8th plot, Meesapulimala, 20.11.2018, *Dani Francis & Santhosh Nampy* 167733; *Ibid.*, 15.09.2019, *Dani Francis & Santhosh Nampy* 170380; Perattakkalam, Mathikettan Shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 176157 (CALI).

Notes: This species is characterized by the small size of the plant.

Isachne globosa (Thunb.) Kuntze, Revis. Gen. Pl. 2: 778. 1891; Bor, Grasses Burma, Ceylon, India & Pakistan 580. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 421. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 575. 2004. *Milium globosum* Thunb., Fl. Jap. 49. 1784. *Isachne austrails* R.Br., Prodr. Fl. Nov. Holland 196.1810; Hook.f., Fl. Brit. India 7: 24. 1896.

Annuals or perennials. Culms erect or creeping, glabrous; nodes glabrous or hairy. Leaves ovate-lanceolate, 1–10 × 0.3–1 cm, acute at apex, rounded at base, scaberulous, green; sheaths 2–5 cm long, ciliate. Ligules a row of hairs. Panicles 1–18 cm long, compact or effuse. Spikelets globose, 1.5–3 mm long, obtuse at apex, puberulous, greenish purple. Lower glumes ovate-oblong, 1.5–2 × 0.8–1 mm, obtuse at apex, cuneate at base, puberulous, purplish green, 7-nerved. Upper glumes ovate-oblong, 2–3 × 1–1.2 mm, obtuse at apex, cuneate at base, puberulous, chartaceous, 7-nerved. Lower florets male, 2–3 mm long. Upper florets bisexual. First lemmas elliptic, 2–3 × 1–1.5 mm, obtuse at apex, cuneate at base, puberulous, 5–7-nerved. Paleas oblong-elliptic, 2–2.5 × 0.8–1 mm, obtuse at apex, cuneate at base, delicate, 2-nerved, 2-keeled. Second lemmas ovate-elliptic, 1.5–2 × 0.7–1 mm, coriaceous, obtuse at apex, obtuse at base, softly hairy dorsally. Paleas elliptic, 1–1.5 × 0.8–1 mm, obtuse at apex, cuneate at base, coriaceous, softly hairy. Stamens 3. Ovary ovate; stigma plumose.

Distribution: Oman, Tropical and Subtropical Asia to W. Pacific (POWO, 2023); *Habitat*: Marshy areas and paddy fields; *Fl. & Ft.*: Throughout the year.

Specimens examined: Brook's peak, 21.12.1996, *Jomy Augustine* 13142; Kattappana, 12.02.2019, *Dani Francis & Santhosh Nampy* 176156; *Ibid*., field near

Govt. College, 16.03.2018, *Dani Francis & Santhosh Nampy* 158383 (CALI); Peermade-Pambanar, 24.05.1965, *K. Vivekananthan* 24316 (MH); Thommankuth, 10.12.2016, *Dani Francis & Santhosh Nampy* 151428 (CALI).

Isachne kunthiana (Wight & Arn. ex Steud.) Miq., Fl. Ned. Ind. 3: 460. 1857. Hook.f., Fl. Brit. India 7: 21. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1796. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 581. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 422. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 575. 2004. *Panicum kunthianum* Wight & Arn. ex Steud., Syn. Pl. Glumac. 1: 96. 1854. *Isachne kunthana* var. *latifolia* Hook.f., Fl. Brit. India 7: 22. 1896; K.M.Matthew, Illustr. Fl. Palni Hills 840, 841. 1996.

Perennials. Culms erect or geniculate, ciliate; nodes villous. Leaves ovate-lanceolate, 2–8 × 0.4–1.5 cm, acute at apex, rounded at base, tubercled hairy, green; sheaths 1.3–5 cm long, tubercled hairy, ciliate. Ligules a row of hairs. Panicles 2–10 cm long, lax. Spikelets elliptic-obovate, 2–3.5 mm long, hairy, green. Lower glumes ovate-lanceolate, 2–3 × 1–1.1 mm, acuminate at apex, cuneate at base, chartaceous, setose towards apex, 7-nerved. Upper glumes ovate-lanceolate, 2–3.5 × 1–1.5 mm, acuminate-caudate at apex, cuneate at base, setose towards apex, 7-nerved. Lower and upper florets bisexual, similar. First lemmas ovate-oblong, 2.5–3 × 0.5–1 mm, obtuse at apex, cuneate at base, glabrous, chartaceous, 5-nerved. Paleas oblong-elliptic, 2–2.5 × 0.8–1 mm, obtuse at apex, cuneate at base, chartaceous, 2-nerved. Second lemmas ovate-oblong, 2.5–3 × 0.5–1 mm, obtuse at apex, cuneate at base, glabrous, chartaceous, 5-nerved. Paleas oblong-elliptic, 2–2.5 × 0.8–1 mm, obtuse at apex, cuneate at base, chartaceous, 2-nerved. Lodicule cuneate, truncate at apex. Stamens 3. Ovary ovate, 0.3 mm long; stigma plumose. Caryopsis oblong, *c.* 1 × 0.5 mm, brown.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: May-January.

Specimens examined: Anamudi Shola National Park, 25.01.2018, *Dani Francis & Santhosh Nampy* 158278; Kottamala, Periyar Tiger Reserve, 21.05.1995, *Jomy Augustine* 15356; Meesapulimala, Rhodomansion, 21.11.2018, *Dani Francis & Santhosh Nampy* 167777; Pius Nagar, 22.06.2018, *Dani Francis & Santhosh Nampy* 159373 (CALI).

Notes: This species is easily distinguished by its equal sized florets.

Isachne setosa C.E.C.Fisch., Bull. Misc. Inform. Kew 1932: 247. 1932, in Gamble, Fl. Madras 3: 1797. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 582. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 425. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 576. 2004.

Annuals. Culms erect or geniculate, slender, glabrous; nodes hairy. Leaves ovate-elliptic, 0.5–5 × 0.2–1.1 cm, acute at apex, rounded or cordate at base, hairy, green; sheaths 0.3–3 cm long, tubercled hairy. Ligules a row of hairs. Panicles 0.5–6 cm long, lax. Spikelets elliptic-obovate, 2–3 mm long, obtuse at apex, puberulous, green Lower glumes ovate-lanceolate, 2–3 × 1–1.5 mm, acuminate-caudate at apex, cuneate at base, setose with tubercled hairs, faintly 5-nerved. Upper glumes ovate-lanceolate, 2–3 × 1–2 mm, acuminate-caudate at apex, cuneate at base, setose with tubercled hairs, faintly 5-nerved. Lower florets male. Upper florets bisexual. First lemmas ovate-oblong, 2–2.5 × 0.5–1 mm, obtuse at apex, cuneate at base, glabrous, 4–5-nerved. Paleas oblong-elliptic, 1–2 × 0.8–1 mm, obtuse at apex, cuneate at base, delicate, 2-nerved. Stamens 1.5 mm long. Second lemmas orbicular, 0.5–1.5 × 0.9–1 mm, coriaceous, obtuse at base and apex, softly hairy. Paleas orbicular, 0.5–1 × 0.8–1 mm, obtuse at apex, cuneate at base, coriaceous, softly hairy. Stamens 3. Ovary ovate, 0.3 mm long; stigma plumose.

Distribution: SW. and S. India (POWO, 2023); *Habitat*: Moist rocky crevices; *Fl. & Ft.*: September-December.

Specimens examined: Edathattu, Mankulam, 13.09.2018, *Dani Francis & Santhosh Nampy* 159472; *Ibid*., 13.09.2019, *Dani Francis & Santhosh Nampy* 159491 (CALI); Kalvary mount, 24.12.1983, *C.N. Mohanan* 66474 (MH); Kattadikadavu, 07.10.2019, *Dani Francis & Santhosh Nampy* 170331; Kozhiyalakkudi, Anakkulam, 18.09.2017, *Dani Francis & Santhosh Nampy* 161986; Neriamangalam, 11.09.2018, *Dani Francis & Santhosh Nampy* 159457; Vakavanam, 14.09.2019, *Dani Francis & Santhosh Nampy* 170293; Varayattumudi, Periyar Tiger Reserve, 16.09.1993, *Jomy Augustine* 14390 (CALI).

Isachne walkeri (Arn. ex Steud.) Wight & Arn. ex Thwaites, Enum. Pl. Zeyl. 361. 1864; Hook.f., Fl. Brit. India 7: 26. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1797.

1934; Bor, Grasses Burma, Ceylon, India & Pakistan 582. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 426. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 576. 2004.

Perennials. Culms erect or creeping; nodes glabrous. Leaves linear-lanceolate, 5–20 × 0.5–2 cm, acuminate at apex, rounded at base, scaberulous, green; sheaths 2–5 cm long, keeled towards apex, ciliate along one margin. Ligules a tuft of hairs. Panicles lax, 5–30 cm long. Spikelets obovate, 3.5–4.5 mm long; pedicels with glandular bands. Lower glumes ovate-lanceolate, 3–4 × 1–2 mm, acute at apex, cuneate at base, sparsely pubescent, veins not clear. Upper glumes ovate-lanceolate, 3–4.5 × 1–2 mm, acute at apex, cuneate at base, sparsely pubescent, veins not clear. Florets 2, bisexual. First lemmas oblong-lanceolate, 3–4.5 × 1–2 mm, acute at apex, cuneate at base, chartaceous, sparsely pubescent, 9–11-nerved. Paleas elliptic, 3–3.5 × 1–1.5 mm, acute at apex, cuneate at base, delicate, hyaline, 2-nerved, 2-keeled. Second lemmas ovate, 3–3.5 × 0.8–1 mm, acute at apex, cuneate at base, coriaceous, sparsely hairy, nerves not clear. Paleas orbicular, 3–3.5 × 0.8–1 mm, acute at apex, cuneate at base, sparsely pubescent, 2-keeled, 2-nerved. Stamens 3. Ovary oblong; stigma plumose.

Distribution: SW., S. India and Sri Lanka (POWO, 2023); *Habitat*: Forest margins; *Fl. & Ft.*: August-March.

Specimens examined: Koyimanchola, 10.02.2021, *Dani Francis & Santhosh Nampy* 188771 (CALI); Lockhert gap, 23.01.1964, *K.M. Sebastine* 18425 (MH); Pambadum Shola, 20.12.2018, *Dani Francis & Santhosh Nampy* 167854; Thannikkudy, Periyar Tiger Reserve, 06.01.1994, *Jomy Augustine* 13086 (CALI).

Tribe Arundinelleae Stapf,

Fl. Cap. 7(2): 314. 1898.

Key to the genera

1. Spikelets with one florets ……..…….. *Garnotia*

1. Spikelets with 2-many florets ……..…….. 2

2. Panicles contracted, capitate, densely arranged ..... *Jansenella*

2. Panicles lax, not capitate, loosely arranged ..... *Arundinella*

Arundinella Raddi,

Agrostogr. Bras. 36. 1823.

Key to the species

1. Spikelets 1–2 mm long; culms slender; panicles effuse ……. *A. pumila*

1. Spikelets more than 2 mm long; culms stout; panicles not effuse ……. 2

2. Second lemmas with 2 setae on either side of the awn at the tip ……. 3

2. Second lemmas without setae, awned or not ……4

3. Spikelets elliptic-lanceolate, glabrous …….. *A. setosa*

3. Spikelets lanceolate, densely tubercle based hairy …….. *A. mesophylla*

4. Culms, leaves and spikelets densely tubercled hairy; panicles narrow spiciform… ……. 5

4. Culms, leaves and spikelets glabrous or sparsely hairy; panicles often lax, not spiciform …….. 6

5. Panicles loosely spiculate; lower glumes longer than the first lemma ….. *A. ciliata*

5. Panicles densely spiculate; lower glumes as long as the first lemma … *A. vaginata*

6. Panicles often contracted; leaves bluish green turning yellow when dry …….. ……. *A. purpurea*

6. Panicles often very effuse; leaves green …….. 7

7. Spikelets distinctly awned; base of the second lemmas bearded …….. 8

7. Spikelets unawned; base of the second lemmas glabrous …….. *A. leptochloa*

8. Annuals; ligules truncate, fimbriate …….. *A. pradeepiana*

8. Perennials; ligules ovate, membranous …….. *A. nepalensis*

Arundinella ciliata Nees ex Miq., Verh. Eerste Kl. Kon. Ned. Inst. Wetensch. Amsterdam ser. 3. 4: 30. 1851; Bor, Grasses Burma, Ceylon, India & Pakistan 421. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 335. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 553. 2004. *Arundinella holcoides auct*. C.E.C.Fisch. in Gamble, Fl. Madras 3: 1801.

1934 *non* Trin., 1836. *Arundinella agrostoides aut*. Hook.f., Fl. Brit. India 7: 71. 1896 *non* Trin., 1836.

Annuals. Culms erect, tufted, densely tubercled hairy; nodes hairy. Leaves elliptic-lanceolate, 2–12 × 0.2–1 cm, acute-acuminate at apex, sub-cordate at base, densely tubercled hairy; sheaths 2–8 cm long, with dense tubercled hairs. Ligules a fimbriate membrane or a row of hairs. Panicles loosely spiculate. Spikelets elliptic-lanceolate, 2–4 mm long, densely tubercled hairy. Lower glumes lanceolate-oblong, 3–3.5 × *c.* 1 mm, acuminate at apex, cuneate at base, densely tubercled hairy, 5-nerved. Upper glumes lanceolate-oblong, 3–4 × *c.* 1 mm, acuminate at apex, tubercled hairy, 5–7-nerved. Lower florets male or rarely bisexual. Upper florets bisexual. First lemmas ovate, 2–2.5 × 0.8–1 mm, obtuse at apex, cuneate at base, delicate, glabrous, 3-nerved. Paleas elliptic-ovate, 1–1.5 × 0.5–0.6 mm, obtuse at apex, cuneate at base, delicate, glabrous, faintly 2-nerved, 2–keeled. Second lemmas elliptic, 1–1.5 × 0.5–1 mm, awned at apex, sub-coriaceous, granular; awns 4–8 mm long. Paleas elliptic, 0.9–1 × *c.* 0.5 mm, obtuse at apex, sub-coriaceous, granular or stiff hairy. Lodicules 2. Stamens 3. Ovary ovate; stigma plumose.

Distribution: Central and S. India and W. Indo-China (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: October-April.

Specimens examined: Choondal, Mathikettan Shola National Park, 21.11.2014, *Syam Radh S.* 143567 (CALI); way to Eravikulam, 14.10.1989, *P. Bhargavan* 90944; Kalvary mount, 24.12.1983, *A.G. Pandurangan* 66475; Kuttikkanam, Peermade, 27.11.1967, *K. Vivekananthan* 29391 (MH); Meesapulimala, 20.11.2018, *Dani Francis & Santhosh Nampy* 167728; Mesthirikettu, Lakkam, lower Vaguvarai, 30.12.2017, *Dani Francis & Santhosh Nampy* 158058; *Ibid*., 30.12.2017, *Dani Francis & Santhosh Nampy* 158059; Methaganam, Periyar Tiger Reserve, 08.04.1994, *Jomy Augustine* 13641 (CALI); Painavu-Kulamavu, 07.11.1981, *V.S. Raju* 71201; Peermade, 02.12.1941, *K.C. Jacob* 20217 (MH).

Notes: This species is characterized by its narrowly contracted, spiciform panicles and dense tubercled hairs along the culms and leaves. It shows similarity with *A. tuberculata* Munro ex Lisboa where the spikelets are larger and the upper lemmas possess two setae on either side of the awn (Sreekumar & Nair, 1991).

Arundinella leptochloa (Nees ex Steud.) Hook.f., Fl. Brit. India 7: 76. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1802. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 423. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 336. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 553. 2004. *Panicum leptochloa* Nees ex Steud., Syn. Pl. Glumac. 1: 62. 1853.

Perennials. Culms erect, tufted; nodes glabrous. Leaves lanceolate, 5–30 × 0.5–2 cm, acuminate at apex, rounded at base, tubercled hairy or glabrous; sheaths 2–10 cm long, tubercled hairy or glabrous. Ligules ovate, thin, membranous. Panicle lax, 5–20 cm long. Spikelets elliptic-lanceolate, 2–4 mm long, unawned. Lower glumes ovate, 1.5–3 × 1–1.5 mm, acute at apex, cuneate at base, scaberulous on nerves, 3-nerved. Upper glumes ovate-lanceolate, 2–3 × 1–1.5 mm, acuminate at apex, cuneate at base, puberulous, 5-nerved. Lower florets male. Upper florets bisexual. First lemmas ovate, 2–2.5 × 1–1.5 mm, obtuse at apex, cuneate at base, chartaceous, glabrous, 5-nerved. Paleas elliptic, 1.5–2 × 0.5–1 mm, obtuse at apex, cuneate at base, delicate, glabrous, faintly 2-nerved, 2–keeled. Second lemmas elliptic, 1–1.5 × 0.5–1 mm, aristate at apex, cuneate at base, muricate, glabrous at base. Paleas lanceolate, 0.9–1 × *c.* 0.5 mm, obtuse at apex, delicate, granular. Lodicules 2. Stamens 3. Ovary ovate; stigma plumose.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands and degraded forests; *Fl. & Ft.*: Throughout the year.

Specimen examined: Uppupara, 06.09.1993, *Jomy Augustine* 12391 (CALI).

Notes: It is a highly variable species, and can be distinguished from other species by its robust culms and leaves, larger panicles and spikelets and the glabrous base of upper lemmas.

Arundinella mesophylla Nees ex Steud., Syn. Pl. Glumac. 1: 115. 1854; Hook.f., Fl. Brit. India 7: 69. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1801. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 423. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 337. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 553. 2004. **Fig. 29E**

Perennials. Culms erect or creeping; nodes glabrous. Leaves linear-lanceolate, 5–15 × 0.1–1.5 cm, acute to acuminate at apex, cordate at base, tubercled hairy, pale yellowish green; sheaths 3–6 cm long, tubercled hairy, ciliate. Ligules

membranous, fimbriate. Panicles congested or spreading, 3–15 cm long. Spikelet lanceolate, 4–8 mm long, densely tubercled hairy, purplish. Lower glumes lanceolate, 4–6 × 0.9–1.5 mm, caudate-acuminate at apex, cuneate at base, tubercled hairy, 3-nerved. Upper glumes lanceolate, 4–7 × 1–1.5 mm, caudate-acuminate at apex, cuneate at base, tubercled hairy, 5-nerved. Lower florets male. Upper florets bisexual. First lemmas ovate-lanceolate, 2–3.5 × 1–1.5 mm, acute at apex, cuneate at base, hyaline, glabrous, 3–5-nerved. Paleas linear-lanceolate, 2–3 × 0.5–1 mm, obtuse at apex, cuneate at base, glabrous, 2-nerved, 2-keeled. Stamens 3. Second lemmas elliptic, 2–3 × 0.5–0.8 mm, awned at apex, hairy at base, sub-coriaceous, muricate, 3–5-nerved; awn 5–8 mm long, geniculate with 2 setae on either side, 1.5–2 mm long. Paleas oblong-lanceolate, 1.5–2 × 0.5–1 mm, obtuse at apex, delicate, hyaline, glabrous, 2-nerved, 2-keeled. Stamen 3. Ovary ovate; stigma plumose.

Distribution: India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: June-January.

Specimens examined: Alampetty, CWS, 12.01.1995, *N. Sasidharan & K.K. Sajeev* 11782; Chengamperu, Chinnar Wildlife Sanctuary, 08.01.1995, *N. Sasidharan & K.K. Sajeev* 11719 (KFRI); Chinnar, 27.01.2018, *Dani Francis & Santhosh Nampy* 158344; Choondal, Mathikettan Shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 151524; Eravikulam, 29.09.2017, *Dani Francis & Santhosh Nampy* 156307; on the way to Eravikulam from Munnar, 23.01.2018, *Dani Francis & Santhosh Nampy* 158136; Kudimala, Lakkamkudi, 09.12.2019, *Dani Francis & Santhosh Nampy* 170006; Kumarikulam, 28.01.1994, *Jomy Augustine* 13020 (CALI); Meenmutty, 28.12.1983, *A.G. Pandurangan* 62561; *Ibid.*, 04.10.1983, *C.N. Mohanan* 79975 (MH); Panchalimedu, 13.09.2019, *Dani Francis & Santhosh Nampy* 170284 (CALI); Peermade, 02.12.1941, *K.C. Jacob* 20220 (MH); Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164888 (CALI); Top station, 05.06.1944, *K.C. Jacob* 20524 (MH).

Arundinella nepalensis Trin., Gram. Panic. 62. 1826; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1801. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 423. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 341. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 553. 2004. *Arundinella brasiliensis auct*. Hook.f., Fl. Brit. India 7: 73. 1896 *non* Raddi, 1823.

Perennials. Culms erect, tufted, pilose; nodes glabrous. Leaves lanceolate, 5–20 × 0.3–1 cm, acute or acuminate at apex, rounded at base, tubercled hairy; sheaths 5–10 cm long, tubercled hairy. Ligules ovate, membranous. Panicles 15–40 cm long, densely spiculate, pubescent below; rachis triquetrous, scabrous; pedicels 1–3 mm long. Spikelets elliptic, 3–4 mm long, hairy. Lower glumes ovate, 3–3.5 × 1.5–2 mm, acuminate at apex, cuneate at base, chartaceous, scabrid along nerves, 3-nerved. Upper glumes ovate-lanceolate, 3.5–4 × 1.5–2 mm, acuminate at apex, cuneate at base, glabrous, 5-nerved. Lower florets male. Upper florets bisexual. First lemmas oblong, 3–3.5 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, 3–5-nerved. Paleas oblong-elliptic, 2–2.5 × 0.5–1 mm, obtuse at apex, cuneate at base, delicate, hyaline, 2-nerved, 2-keeled, ciliate along keels. Stamens 3. Second lemmas oblong, 1–1.5 × 0.8–1 mm, sub-coriaceous, awned, softly hairy at base, faintly 3-nerved; awn 4–6 mm long. Paleas oblong-elliptic, 1–1.5 × 0.5 mm, obtuse at apex, cuneate at base, sub-coriaceous with a few warts like growth dorsally. Stamens 3. Ovary oblong, *c.* 0.5 mm long; stigma plumose.

Distribution: Africa, S. Arabian Peninsula, Indian Subcontinent to Indo-China and N. & E. Australia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-January.

Specimen examined: Choondal, Mathikettan Shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 151522 (CALI).

Notes: This species is closely allied to *A. leptochloa* and can be distinguished by its puberulous culms below the inflorescence, distinctly awned spikelets and the upper lemmas bearded at base (Sreekumar & Nair, 1991).

Arundinella pradeepiana Sunil & Naveen Kum., Webbia 69(2): 249. 2014.

Annuals. Culms erect, tufted; nodes hairy. Leaves linear-lanceolate, 10–30 × 0.8–2 cm, acuminate at apex, rounded at base, pubescent, pale yellowish green; sheaths 10–12 cm long, tubercled hairy, ciliate. Ligules truncate, fimbriate. Panicles effuse, 30–50 cm long. Spikelet ovate-lanceolate, 4–4.5 × 1–1.5 mm long, glabrous, greenish yellow. Lower glumes ovate-lanceolate, 2.5–3 × 1–1.3 mm, caudate-acuminate at apex, cuneate at base, glabrous, 3–5-nerved. Upper glumes ovate-lanceolate, 3.5–4.5 × 1–1.5 mm, caudate-acuminate at apex, cuneate at base, glabrous, 5-nerved. Lower florets male. Upper florets bisexual. First lemmas

ovate-lanceolate, 2.5–3 × 1.2–1.4 mm, acute-obtuse at apex, cuneate at base, hyaline, glabrous, 5-nerved. Paleas ovate-lanceolate, 2–2.2 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous, 2-nerved, 2-keeled. Second lemmas elliptic-lanceolate, 1.5–2 × 1–1.5 mm, retuse or emarginate and awned at apex, hairy at base, sub-coriaceous, granulate, 3–5-nerved; awn 5–6.5 mm long, geniculate. Paleas oblong-lanceolate, 1.4–1.6 × 0.8–1 mm, obtuse at apex, sub-coriaceous, hyaline, glabrous, 2-nerved, 2-keeled. Stamen 3. Ovary sub-globose; stigma plumose.

Distribution: India (Kerala) (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: October-February.

Specimens examined: Irumbupalam, 28.12.2017, *Dani Francis & Santhosh Nampy* 156559; Kattadikadavu, 07.12.2018, *Dani Francis & Santhosh Nampy* 167819; Neriyamangalam, Mamalakandam, near Yakobaya church, 27.12.2017, *Dani Francis & Santhosh Nampy* 156539 (CALI).

Notes: This species is morphologically allied to *A. metzii* Hochst. ex Miq. in its annual habit, long-bearded second lemmas and unequal glumes, but differs from it in having tubercled hairy nodes, leaves and sheaths, profusely branched primary inflorescence branches, large sized, glabrous and caudate-acuminate lower and upper glumes, deep brown second lemmas with long and geniculate awns (Sunil & Kumar, 2014).

Arundinella pumila (Hochst. ex A.Rich.) Steud., Syn. Pl. Glumac. 1: 114. 1854; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1801. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 423. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 342. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 553. 2004. *Acratherum pumilum* Hochst. ex A.Rich., Tent. Fl. Abyss. 2: 414. 1850. *Arundinella tenella* Nees ex Steud., Syn. Pl. Glumac. 1: 115. 1854; Hook.f., Fl. Brit. India 7: 71. 1896.

Annuals. Culms slender, tufted; nodes glabrous or sparsely hairy. Leaves elliptic-lanceolate, 2–20 × 0.3–1.5 cm, acuminate at apex, rounded at base, glabrous or tubercled hairy, green; sheaths 1.5–5 cm long, glabrous or hairy. Ligules truncate or lacerate, membranous. Panicles effuse, 5–25 cm long, effuse. Spikelets elliptic, 1–2 mm long, hairy. Lower glumes ovate, 1–1.5 × 0.4–0.5 mm, acute-acuminate at

apex, cuneate at base, glabrous or hairy, 3-nerved. Upper glumes ovate-lanceolate, 1.5–2 × 0.5–1 mm, acuminate at apex, cuneate at base, pubescent, 5-nerved. Lower florets male or barren. Upper florets bisexual. First lemmas ovate-lanceolate, 1–1.5 × 0.5–1 mm, acute at apex, cuneate at base, delicate, glabrous, 3–5-nerved. Paleas elliptic, 0.9–1 × 0.4–0.5 mm, obtuse at apex, hyaline, glabrous, 2-nerved. Second lemmas elliptic, *c.* 1 × 0.5 mm, awned at apex, sub-coriaceous, softly hairy; awns 2–4 mm long. Paleas oblong, 0.8–1 × 0.3–0.4 mm, obtuse at apex, delicate, softly hairy, 2-nerved, 2-keeled. Stamens 3. Ovary ovate; stigma plumose.

Distribution: W. Tropical Africa to Ethiopia, S. Arabian Peninsula and Tropical Asia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-January.

Specimens examined: Kannimala, saw mill near bridge, 24.01.2018, *Dani Francis & Santhosh Nampy* 158153; Lakkam waterfalls, 24.01.2017, *Dani Francis & Santhosh Nampy* 158202; Pachakkanam, 02.11.1993, *Jomy Augustine* 12718 (CALI); Uppupara, Periyar Tiger Reserve, 17.11.1993, *N. Sasidharan & K.K. Sajeev* 12718 (KFRI).

Notes: This species is characterized by very slender culms and leaves and smaller spikelets.

Arundinella purpurea Hochst. ex Steud., Syn. Pl. Glumac. 1: 115. 1854; Bor, Grasses Burma, Ceylon, India & Pakistan 424. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 343. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 554. 2004. *Arundinella fuscata auct*. Hook.f., Fl. Brit. India 7: 74. 1896. C.E.C.Fisch. in Gamble, Fl. Madras 3: 1802. 1934 *non* Nees ex Buese, 1854.

Perennials. Culms erect or decumbent, densely tufted; nodes glabrous. Leaves lanceolate, 3–25 × 0.2–1.5 cm, acuminate to acute at apex, rounded at base, tubercled hairy, bluish green turns yellow when dry; sheaths 1.5–8 cm long, tubercled hairy. Ligules thin, membranous. Panicles 3–15 cm long, dense flowered, contracted. Spikelets lanceolate, 3–5 mm long, pubescent. Lower glumes ovate-lanceolate, 3–4 × 1–2 mm, acuminate or aristate at apex, cuneate at base, chartaceous, scabrous along veins, 3-nerved. Upper glumes ovate-lanceolate, 4–5 × 1.8–2 mm, acuminate at apex, cuneate at base, chartaceous, scabrous along nerves, 5-nerved. Lower florets male. Upper florets bisexual. First lemmas ovate-

lanceolate, 3–4 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, 3–5-nerved. Paleas elliptic, 2–3 × 0.5–1 mm, obtuse at apex, cuneate at base, glabrous, 2-nerved, slightly 2-keeled. Second lemmas elliptic-oblong, 1.5–2 × 0.5–1 mm, awned and notched at apex, cuneate at base, sub-coriaceous, scabrous; awns 3–6 mm long, scabrellate. Paleas oblong, 1–1.5 × 0.5 mm, obtuse at apex, hyaline, scabrous dorsally, 2-nerved, 2-keeled.

Distribution: W. Himalaya to India and Myanmar (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: October-January.

Specimens examined: Anamudi peak, 2600 m, 11.12.2019, *Dani Francis & Santhosh Nampy* 164548; on the way to Eravikulam, 2000 m, 23.01.2018, *Dani Francis & Santhosh Nampy* 158123; Meesapulimala, 2200 m, 21.11.2018, *Dani Francis & Santhosh Nampy* 167788; *Ibid*., 8th plot, 1350 m, 20.11.2018, *Dani Francis & Santhosh Nampy* 167744 (CALI); Ponnambalamedu, Periyar Tiger Reserve, 09.12.1995, *K.P. Rajesh & Jomy Augustine* 16997 (KFRI).

Notes: *Arundinella purpurea* differs from other species by its peculiar bluish green leaves turning yellowish green when dry, probably due to accumulation of aluminum (Sreekumar & Nair, 1991).

Arundinella setosa Trin., Gram. Panic. 63. 1826; Hook.f., Fl. Brit. India 7: 70. 1896. C.E.C.Fisch. in Gamble, Fl. Madras 3: 1801. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 424. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 344. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 786. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 554. 2004. **Fig. 29D**

Annuals or perennials. Culms erect or creeping, tufted; nodes glabrous. Leaves linear-lanceolate, 2–20 × 0.1–0.5 cm, acuminate at apex, rounded at base, glabrous or pubescent, green; sheaths 1.5–6 cm long, tubercled hairy. Ligules thin, fimbriate, membranous. Panicles lax, 3–25 cm long. Spikelets elliptic-lanceolate, 4–5.5 mm long, glabrous. Lower glumes lanceolate, 3–4 × 0.8–1 mm, acuminate at apex, cuneate at base, chartaceous, 3-nerved. Upper glumes ovate-lanceolate, 4–5 × 1–1.5 mm, acuminate at apex, cuneate at base, chartaceous, 5-nerved. Lower florets male or barren. Upper florets bisexual. First lemmas elliptic, 3–3.5 × 1–1.5 mm, obtuse at apex, cuneate at base, glabrous, 5-nerved. Paleas elliptic-lanceolate,

2.5–3 × 0.5–1 mm, obtuse at apex, cuneate at base, glabrous, 2-nerved, slightly 2-keeled. Second lemmas elliptic-oblong, 2–2.5 × 0.8–1 mm, awned at apex, glabrous at base, sub-coriaceous, granular, 3-nerved; awn 6–8 mm long, straight with 2 setae on either side, 0.5–1.5 mm long. Paleas oblong, 1.5–2 × 0.8–1 mm, obtuse at apex, delicate, granular, 2-nerved, 2-keeled. Stamens 3. Ovary ovate; stigma plumose.

Distribution: Tropical and Subtropical Asia to N. Australia. (POWO, 2023); *Habitat*: Forests and grasslands; *Fl. & Ft.*: May-December.

Specimen examined: Pachakkanam, 08.12.1996, *Jomy Augustine* 17051 (CALI).

Arundinella vaginata Bor, J. Indian Bot. Soc. 27. 66. 1948, Grasses Burma, Ceylon, India & Pakistan 425. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 345. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 554. 2004. *Arundinella villosa* sensu C.E.C.Fisch. in Gamble, Fl. Madras 3: 1801. 1934 *non* Arn. ex Steud., 1854. *Arundinella villosa* var. *heynei* Hook.f., Fl. Brit. India 7: 73. 1896.

Perennials. Culms erect, densely tufted, villous; nodes hairy. Leaves linear-lanceolate, 10–50 × 0.3–0.5 cm, acuminate at apex, rounded at base, densely villous, green; sheaths 8–17 cm long, densely tubercled hairy. Ligules membranous, fimbriate. Panicle contracted, densely spiculate, 8–20 cm long, interrupted. Spikelets lanceolate, 5–8 mm long, densely villous. Lower glumes lanceolate, 4–5 × 1–2 mm, acuminate at apex, sub-truncate at base, densely hairy, 3–5-nerved. Upper glumes ovate-lanceolate, 5–8 × 1.5–2 mm, acuminate at apex, sub-truncate at base, densely hairy, 5-nerved. Lower florets male. Upper florets bisexual. First lemmas lanceolate, 4–5 × 1.5–2 mm, acuminate at apex, cuneate at base, glabrous, 5-nerved. Paleas elliptic-lanceolate, 3–4 × 0.5–1 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous, 2-nerved, 2-keeled. Stamens 3. Second lemmas ovate-elliptic, 3–4 × 1–1.5 mm, awned at apex, cuneate at base, sub-coriaceous, scaberulous dorsally, faintly 5-nerved; awn 3–6 mm long. Paleas oblong-lanceolate, 3–4 × 0.5–1 mm, obtuse at apex, cuneate at base, hyaline, glabrous. Lodicules 2. Stamens 3. Ovary elliptic; stigma plumose.

Distribution: India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-December.

Specimens examined: Anamudi western slopes, 19.11.1965, *B.V. Shetty* 26539; Eravikulam National Park, 27.08.1980, *P.V. Sreekumar* 67800; *Ibid.*, 25.08.1980, *P.V. Sreekumar* 67782, 67787 (MH); Meesapulimala, 21.11.2018, *Dani Francis & Santhosh Nampy* 167767 (CALI).

Notes: This species is found in high altitude grasslands and can be distinguished by its dense tubercled hairy sheath and interrupted, spiciform panicles.

Garnotia Brongn.,

Voy. Monde, Phan. 132. 1832.

Key to the species

1. Spikelets awnless; leaves oblanceolate ..... *G. exaristata*

1. Spikelets awned; leaves not oblanceolate 2

2. Leaves broadly lanceolate ..... *G. arundinacea*

2. Leaves narrowly linear 3

3. Perennials; panicles lax ..... *G. elata*

3. Annuals; panicles contracted 4

4. Lower glumes longer than upper glumes, aristate ..... *G. tenella*

4. Lower glumes shorter than upper glumes, acute ..... *G. courtallensis*

Garnotia arundinacea Hook.f., Fl. Brit. India 7: 243. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1812. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 567. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 409. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 572. 2004.

Perennials. Culms erect or trailing; nodes hairy. Leaves broadly lanceolate, 5–20 × 1–3.5 cm, acuminate, rounded at base, ciliate, glabrous, green; sheaths 5–10 cm long, keeled, hairy at mouth. Ligules truncate, membranous. Panicles lax, 10–30 cm long. Spikelets lanceolate, 2.5–4 mm long, disarticulating from the tip of pedicel. Lower glumes ovate-lanceolate, 2–3 × 0.8–1 mm, acuminate and short bristly at apex, cuneate at base, chartaceous, glabrous, 3-nerved. Upper glumes elliptic-lanceolate, 2.5–4 × 1–1.5 mm, acuminate and short bristly at apex, cuneate at base, glabrous, 3-nerved. Lemmas elliptic-lanceolate, 2.5–4 × 1–1.5 mm,

acuminate and short bristly at apex, cuneate at base, glabrous, 3-nerved, awned; awn 5–12 mm long. Paleas lanceolate, 2–2.5 × 0.4–0.6 mm, acute at apex, cuneate at base, membranous, hyaline, faintly 2-nerved, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: SW. India (POWO, 2023); *Habitat*: Forest margins; *Fl. & Ft.*: October-February.

Specimens examined: Chenthamara, Periyar Tiger Reserve, 06.01.1997, *Jomy Augustine* 17095; 2 km before Munnar, 23.01.2018, *Dani Francis & Santhosh Nampy* 158113 (CALI).

Garnotia courtallensis (Arn. & Nees) Thwaites, Enum. Pl. Zeyl. 363. 1864; Hook.f., Fl. Brit. India 7: 244. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1812. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 567. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 409. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 572. 2004. *Miquelia courtallensis* Arn. & Nees in C.G.D.Nees von Esenbeck, Gramineae 47. 1841.

Annuals. Culms erect, creeping; nodes hairy. Leaves lanceolate, 2–8 × 0.2–1 cm, acute to acuminate at apex, rounded at base, glabrous or hispid, rigid, green; sheaths 2–5 cm long, slightly keeled, glabrous or ciliate at margin. Ligules membranous, hairy at apex. Panicles lax, 6–15 cm long. Spikelets lanceolate, 2.5–3.5 mm long, awned or awnless, tufted hairy at base; pedicels 3–5 mm long, glabrous or puberulous. Lower glumes lanceolate, 2–3 × 0.5–1 mm, acute at apex, cuneate at base, chartaceous, glabrous, 3-nerved, scabrous along nerves. Upper glumes lanceolate, 2.5–3.5 × 0.5–1 mm, acuminate or shortly aristate at apex, cuneate at base, chartaceous, 3-nerved, scabrous along nerves. Lemmas ovate-lanceolate, 2–3.5 × 0.6–1 mm, awned at apex, cuneate at base, hyaline, glabrous, nerveless; awns 2–6 mm long. Paleas oblong, *c.* 2 × 0.5 mm, obtuse at apex, cuneate at base, delicate, hyaline, ciliate, glabrous, 2-nerved, slightly 2-keeled. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Wetlands; *Fl. & Ft.*: November-December.

Specimen examined: Vellimala, 27.12.1993, *Jomy Augustine* 12990 (CALI).

Garnotia elata (Arn. ex Miq.) Janowsky, Repert. Spec. Nov. Regni Veg. 17: 86. 1921; Bor, Grasses Burma, Ceylon, India & Pakistan 567. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 410. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 834. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 572. 2004. *Berghausia elata* Arn. ex Miq., Nieuwe Verh. Eerste Kl. Kon. Ned. Inst. Wetensch. Amsterdam, ser. 3. 4: 44. 1851. *Granotia tenuiglumis* Stapf ex Hook.f., Fl. Brit. India 7: 242. 1896. *Granotia scoparia* Stapf. ex Hook.f., Fl. Brit. India 7: 242. 1896, *nom. illeg.*; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1812. 1934.

Perennials. Culms tufted, robust; nodes glabrous. Leaves lanceolate, 5–80 × 0.2–0.8 cm, acute-acuminate at apex, rounded at base, sparsely hairy, green; sheaths 10–25 cm long, keeled, ciliate. Ligules membranous, dense ciliate hairy at apex. Panicles lax, 20–40 cm long, with many 10–20 cm long racemes at nodes. Spikelets lanceolate, 3–6 mm long, callus hairy; pedicels 1.5–4 mm long, glabrous. Lower glumes lanceolate, 3–6 × 0.4–0.6 mm, acuminate and aristate at apex, cuneate at base, chartaceous, glabrous, 3-nerved, serrulate on nerves; arista 0.5–0.7 mm long, barbellate. Upper glumes lanceolate, 2.5–4.5 × 0.4–0.6 mm, acuminate at apex, cuneate at base, chartaceous, glabrous, 3-nerved, scabrous along nerves. Lemmas ovate-lanceolate, 2–3.5 × 0.4–0.6 mm, acuminate and shortly 2-lobed at apex, cuneate at base, chartaceous, awned, glabrous, 3-nerved; awn 3–5 mm long. Paleas lanceolate, 1.5–2.5 × 0.3–0.5 mm, acute at apex, cuneate at base, membranous, hyaline, 2-nerved, nerves ciliate towards apex. Lodicules 2. Stamens 3. Ovary obovate; stigma plumose.

Distribution: S. India, Andaman and Nicobar Islands (POWO, 2023); *Habitat*: Rocky hill slopes; *Fl. & Ft.*: September-December.

Specimens examined: Above Cheeyappara waterfalls, near river, 27.12.2017, *Dani Francis & Santhosh Nampy* 156503; Elaveezhapoonchira, 08.09.2017, *Dani Francis & Santhosh Nampy* 152998 (CALI).

Garnotia exaristata Gould, Kew Bull. 27: 558. 1972; Sreek. & V.J.Nair, Fl. Kerala-Grasses 410. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 572. 2004.

Perennials. Culms erect, tufted; nodes glabrous or ssparsely hairy. Leaves oblanceolate, 8–40 × 0.5–2 cm, narrowly acute at base and apex, villous, rigid,

green; sheaths terete, 5–15 cm long, sparsely villous towards apex. Ligules ovate-truncate, fimbriate. Panicles congested, 8–40 cm long. Spikelets lanceolate, 4–6 mm long, basally tufted hairy, unawned; pedicels 1–10 mm long, glabrous or puberulous. Lower glumes lanceolate, 4–5 × 0.8–1 mm, acuminate at apex, cuneate at base, chartaceous, glabrous, 3-nerved, scabrous along nerves. Upper glumes lanceolate, 4–5 × 0.8–1 mm, acuminate or aristate at apex, sub-truncate at base, chartaceous, 3–5-nerved, scabrous along nerves. Lemmas oblong-lanceolate, 4–5 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, faintly 3–5-nerved. Paleas lanceolate, 3–4 × 0.5–1 mm, acute at apex, cuneate at base, delicate, ciliate, 2-nerved, 2-keeled. Lodicules 2, obovate, glabrous. Stamens 3. Ovary oblong; stigma 2, plumose.

Distribution: S. India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: June-December.

Specimens examined: Meesapulimala, 21.11.2018, *Dani Francis & Santhosh Nampy* 167766; Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164896 (CALI); *Ibid.*, 21.11.1965, *B.V. Shetty* 26605; Umayamala, 06.08.1967, *B.V. Shetty* 28328 (MH); Vallakkadavu, 08.06.1995, *Jomy Augustine* 15428 (CALI).

Garnotia tenella (Arn. ex Miq.) Janowski, Repert. Spec. Nov. Regni Veg. 17: 86. 1921; Sreek. & V.J.Nair, Fl. Kerala-Grasses 413. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 573. 2004. *Berghausia tenella* Arn. ex Miq., Nieuwe Verh. Eerste Kl. Kon. Ned. Inst. Wetensch. Amsterdam, ser. 3. 4: 46. 1851. *Garnotia stricta* var. *breviaristata* Stapf ex Hook.f., Fl. Brit. India 7: 243. 1896. **Fig. 30E**

Annuals. Culms erect, tufted; nodes densely hairy. Leaves elliptic-lanceolate, 4–20 × 0.3–1.5 cm, acuminate at apex, rounded at base, pubescent, green; sheaths 5–10 cm long, slightly keeled, hairy or glabrous, ciliate. Ligules membranous, fimbriate. Panicles lax or congested, 7–30 cm long. Spikelets lanceolate, 2–5 mm long, awned or aristate; pedicels 0.5–2 mm long, scabrid. Lower glumes lanceolate, 2–5 × 1–1.5 mm, aristate at apex, cuneate at base, chartaceous, scabrous, 3-nerved. Upper glumes lanceolate, 1.5–3 × 1–1.5 mm, aristate at apex, cuneate at base, chartaceous, 3-nerved, scabrous along nerves. Lemmas lanceolate, 1.5–3.5 × 0.4–0.6 mm, awned at apex, cuneate at base, scabrous, 3-nerved; awn 5–15 mm long.

Paleas elliptic-lanceolate, 1.5–3.5 × 0.3–0.5 mm, acute at apex, cuneate at base, delicate, ciliate, 2-nerved, 2-keeled. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Oman, Indian Subcontinent to China and SW. Malesia (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: May-December.

Specimens examined: Adimali, Oonnukal, 14.12.2014, *Dani Francis & Santhosh Nampy* 137580; Meenuliyanpara, 29.11.2019, *Dani Francis & Santhosh Nampy* 164622 (CALI); Peermade, 25.11.1967, *K. Vivekananthan* 29387; *Ibid.*, 03.12.1941, *K.C. Jacob* 20238 (MH); Vallakkadavu, Periyar Tiger Reserve, 10.11.1993, *Jomy Augustine* 12653 (CALI); Valara R.F., 24.11.1982, *K. Ramamurthy* 74986 (MH).

Jansenella Bor,

Kew Bull. 10: 6. 1955.

Jansenella griffithiana (Mull.Hal.) Bor, Kew Bull. 10: 98. 1955, Grasses Burma, Ceylon, India & Pakistan 426. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 348. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 580. 2004. *Danthoniopsis griffithiana* Mull.Hal., Bot. Zeitung 14: 347. 1856. *Arundinella avenacea* Munro ex Thwaites, Enum. Pl. Zeyl. 362. 1864; Hook.f., Fl. Brit. India 7: 69. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1801. 1934. **Fig. 31E**

Annuals. Culms erect or creeping; nodes glabrous. Leaves elliptic-lanceolate, 0.3–8 × 0.1–1 cm, acuminate at apex, amplexicaul at base, glabrous or hairy, tubercled hairy towards base, green. Ligules ovate, membranous, thin. Panicles capitate, 1–8 cm long, densely compact. Spikelets elliptic-lanceolate, 5–7 mm long, hairy. Lower glumes lanceolate, 4–5 × 0.8–1 mm, acuminate at apex, cuneate at base, chartaceous, tubercled hairy, 3-nerved. Upper glumes oblong-lanceolate, 5–7 × 0.8–1 mm, caudate at apex, cuneate at base, glabrous or scaberulous, 3–5-nerved. Lower florets male. Upper florets bisexual. First lemmas lanceolate, 4–5 × 1–2 mm, acuminate at apex, cuneate at base, glabrous, 5-nerved; Paleas elliptic-linear, 2–3 × 0.8–1 mm, notched at apex, cuneate at base, delicate, glabrous, 2-nerved, 2-keeled. Stamens 3. Second lemmas oblanceolate-elliptic, 3–4 × 0.8–1 mm, notched, 2-aristate and awned at apex, tufted hairy at base of each side; awn geniculate, 6–10 cm long. Paleas oblanceolate, 2–3 × 0.3–0.5 mm, notched at apex, cuneate at base, hairy dorsally, 2-nerved, 2-keeled. Stamens 3. Ovary ovate; stigma plumose.

Distribution: W. India, Sri Lanka and Assam to Myanmar (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: October-January.

Specimens examined: Kalvary mount, 14.12.1982, *C.N. Mohanan* 76109 (MH); Kudimala-lakkamkudi, 09.12.2019, *Dani Francis & Santhosh Nampy* 164694; Kumarikulam, 10.01.1994, *Jomy Augustine* 13074; Meesapulimala, 8th plot, 20.11.2018, *Dani Francis & Santhosh Nampy* 167732; Palkulamedu, 01.12.2019, *Dani Francis & Santhosh Nampy* 164665; Pothadi, Marayur, 26.01.2018, *Dani Francis & Santhosh Nampy* 158308 (CALI).

Tribe Andropogoneae Dumort,

Observ. Gramin. Belg. 84. 1824.

Key to the genera

1. Spikelets unisexual, male and female spikelets in separate inflorescence or in different positions of the same inflorescence …….. 2

1. Spikelets bisexual or with male or barren and bisexual spikelets mixed in the same inflorescence …….. 3

2. Female spikelets enclosed in a modified sheath forming bead like involucre; panicles not interrupted …… *Coix*

2. Female spikelets not enclosed in an involucre; panicles interrupted ……
…… *Polytoca*

3. Spikelets solitary, usually sessile …….. *Dimeria*

3. Spikelets paired or rarely in threes, both sessile and pedicelled spikelets present or rarely pedicelled spikelets reduced …… 4

4. Inflorescence true or false panicles …… 5

4. Inflorescence solitary, digitate or sub-digitate racemes …….. 16

5. Panicles of racemes interrupted by spathes …… 6

5. Panicles not interrupted by spathes …… 9

6. Aromatic grasses; racemes paired …… *Cymbopogon*

6. Grassess not aromatic; racemes fascicled …….. 7

7. Basal joints of racemes bulbous; spikelets in threes, one sessile and the other two pedicelled; terminal spikelets reduced to a broad, glume like pedicel …….. *Apluda*

7. Basal joints of racemes not bulbous; spikelets not as above …….. 8

8. Racemes with 2 pairs of sessile involucral spikelets at base; awnless spikelets either sessile or pedicelled …….. *Themeda*

8. Racemes without 2 pairs of sessile involucral spikelets at base; awnless spikelets always pedicelled …….. *Pseudanthistiria*

9. Panicles densely silky villous …….. 10

9. Panicles not silky villous …….. 12

10. Spikelets awned; leaves petiolate; lower glumes truncate and toothed at apex, with 5–9 prominent nerves …….. *Spodiopogon*

10. Spikelets awnless; leaves not distinctly petiolate; lower glumes acute or acuminate at apex, with 2–5 faint nerves …….. 11

11. Panicles contracted, spiciform; both the spikelets in a pair pedicelled ……..
…….. *Imperata*

11. Panicles effuse, not spiciform; one of the spikelets in a pair sessile, the other pedicelled …….. *Saccharum*

12. Joints and pedicels with a translucent median line; second lemmas of the sessile spikelets reduced to hyaline base of the awn …….. 13

12. Joints and pedicels without a translucent median line; second lemmas of the sessile spikelets well developed, often bifid and awned in the sinus …….. 14

13. Branches and branchlets of panicles capillary; glumes never pitted; decumbent or trailing grasses …….. *Capillipedium*

13. Branches and branchlets of panicles not capillary; glumes pitted or not; erect grasses …….. *Bothriochloa*

14. Spikelets in threes, one sessile, other two pedicelled; glumes usually aristate, rarely without arista …….. *Chrysopogon*

14. Spikelets paired; glumes never aristate …….. 15

15. Spikelets few paired, dorsally compressed; panicles *c.* 40 cm or more long ... ……. *Sorghum*

15. Spikelets many paired, not dorsally compressed; panicles *c.* 15 cm long ……. ……. *Pseudosorghum*

16. Racemes solitary ……. 17

16. Racemes 2-many ……..... 23

17. Joints and pedicels fused; second lemmas of sessile spikelets awnless ……. 18

17. Joints and pedicels not fused; second lemmas of sessile spikelets awned ….. 20

18. Lower glumes of sessile spikelets cartilaginous, pitted ……..... *Hackelochloa*

18. Lower glumes of sessile spikelets not cartilaginous, not pitted ……..…… 19

19. Culms not supported by stilt roots; lower glumes of sessile spikelets either winged or awned or both, often ridged, perforate or muricate ……..… *Glyphochloa*

19. Culms supported by stilt roots; lower glumes of the sessile spikelets neither winged nor awned, coriaceous, granular, glabrous ……..…….. *Rottboellia*

20. Upper glumes awned; joints, pedicels and callus long bearded; racemes fragile ……..... *Pogonatherum*

20. Upper glumes unawned; joints, pedicels and not long bearded; racemes not fragile ……... 21

21. Racemes terete, callus pungent; pedicelled spikelets twisted around the sessile spikelets ……..... *Heteropogon*

21. Racemes not terete, callus not pungent; pedicelled spikelets not twisted ….. 22

22. Internodes and pedicels with a translucent median line …….. *Euclasta*

22. Internodes and pedicels without a translucent median line ……... *Dichanthium*

23. Lower glumes of sessile spikelets truncate or emarginate at apex; pedicelled spikelets reduced usually represented by vestigial pedicels ……..... *Apocopis*

23. Lower glumes of sessile spikelets acute or acuminate; pedicelled spikelets not as above ……..... 24

24. Lower glumes of sessile spikelets with a dorsal groove …….. *Microstegium*

24. Lower glumes of sessile spikelets without a dorsal groove ……..... 25

25. Second lemmas of the sessile spikelets awned from the back, often just above the base ……..…. *Arthraxon*

25. Second lemmas of the sessile spikelets awned from the sinus, often from the middle …… 26

26. Pedicelled spikelets reduced to a small aristate glumes; joints and pedicels toothed; racemes solitary ……..….. *Schizachryum*

26. Pedicelled spikelets well developed; joints and pedicels not toothed; racemes binate, digitate or corymbose ……..…… 27

27. Spikelets of each pair similar, bisexual ……..…….. 28

27. Spikelets of each pair dissimilar, sessile with male or female; pedicelled usually male, rarely bisexual ……..…….. 29

28. Joints and pedicels brownish-golden yellow hairy …….. *Eulalia*

28. Joints and pedicels white hairy ……..…… *Pseudopogonatherum*

29. Lower glumes of the sessile spikelets always smooth and chartaceous; joints and pedicels solid ……..…….. *Andropogon*

29. Lower glumes of the sessile spikelets usually coriaceous with several nodules and wrinkles, rarely smooth and chartaceous, but then racemes binate; joints and pedicels hollow …….. *Ischaemum*

Andropogon L.,

Sp. Pl. 2: 1045. 1753, *nom. cons.*

Key to the species

1. Keels of lower glume of sessile spikelet winged in upper half; joints of racemes with denticulate apex; callus slightly hairy ……..…….. *A. lividus*

1. Keels of lower glume of sessile spikelet not winged; joints of racemes not denticulate at apex; callus densely hairy ……..…. *A. polyptychos*

Andropogon lividus Thwaites, Enum. Pl. Zeyl. 367. 1864; Hook.f., Fl. Brit. India 7: 209. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1753. 1934; Bor, Grasses Burma,

Ceylon, India & Pakistan 91. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 29. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 780. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 550. 2004.

Perennials. Culms tufted, stout; nodes glabrous. Leaves linear-lanceolate, 5–25 × 0.2–0.6 cm, acuminate at apex, rounded at base, glabrous, green; sheaths 3–10 cm long, keeled, sparsely hairy. Ligules membranous. Racemes 1–3, digitate or sub-digitate, purple; joints 2.5–3 mm long, articulate, denticulate at apex, ciliate. Sessile spikelets elliptic-lanceolate, 6–8 mm long; callus sparsely hairy. Lower glumes elliptic-lanceolate, 6–7 × 1–1.2 mm, 2-toothed at apex, flat with a shallow depression near the base, sub-coriaceous, pubescent, 3–5-nerved, 2-keeled; keels winged in upper half. Upper glumes lanceolate, 6–7 × 1.5–2 mm, acuminate at apex, cuneate at base, sub-coriaceous, margin ciliate towards apex, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas lanceolate, 6–7 × 0.3–0.5 mm, acute at apex, cuneate at base, delicate, hyaline, ciliate towards apex, 3–7-nerved. Second lemmas oblong, 4–5 × 0.5–0.7 mm, notched and awned at apex, cuneate at base, delicate, glabrous, lobes acute, ciliate; awn 10–15 mm long. Paleas oblong, 0.5–1 × 0.4–0.5 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelet elliptic-lanceolate, 6–9 mm long; pedicels linear, 2.5–3 mm long, ciliate. Lower glumes elliptic-lanceolate, 7–9 × 1.5–2 mm, 2-toothed at apex, cuneate at base, sub-coriaceous, margin minutely winged, scabrous, 13–15-nerved. Upper glumes lanceolate, 6–7 × 1.5–2 mm, acuminate at apex, cuneate at base, sub-coriaceous, margin ciliate towards apex, 3-nerved. Lower florets empty, epaleate. Upper florets male. First lemmas lanceolate, 6–7 × 0.3–0.5 mm, acute at apex, cuneate at base, delicate, hyaline, ciliate towards apex, 3–7-nerved. Second lemmas oblong, 3.5–4 × 0.5–1 mm, notched at apex, cuneate at base, delicate, hyaline, glabrous, 3-nerved; awn reduced to a mucro. Paleas minute or absent. Stamens 3.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-February.

Specimens examined: Anamudi slopes, 04.02.1970, *B.V. Shetty* 33412; Eravikulam, 23.08.1980, *P.V. Sreekumar* 67770 (MH); Meesapulimala, 15.10.2019, *Dani Francis*

& Santhosh Nampy 170393 (CALI); Umayamala, 20.11.1965, *B.V. Shetty* 26561, 26568 (MH).

Notes: This species can be distinguished by its purplish racemes with easily breaking joints.

Andropogon polyptychos Steud., Syn. Pl. Glumac. 1(4-5): 380. 1854; Hook.f., Fl. Brit. India 7: 198. 1896; Bor, Grasses Burma, Ceylon, India & Pakistan 91. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 30. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 550. 2004. *Dichanthium polyptychum* (Steud.) A.Camus, Bull. Mus. Natl. Hist. Nat. 27: 550. 1921; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1741. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 135. 1960.

Perennials. Culms densely tufted, stout; nodes hairy. Leaves linear-lanceolate, 5–40 × 0.2–0.6 cm, acuminate at apex, rounded at base, densely tubercled hairy, green; sheaths 3–12 cm long, keeled, sparsely villous. Ligules ovate, membranous. Racemes 2–5, digitate or sub-digitate, alternate, hairy at axils, 2–8 cm long; joints 3–4 mm long, ciliate. Sessile spikelets oblong-lanceolate, 5–7 mm long, callus densely hairy. Lower glumes lanceolate, 5–6 × 1.5–1.7 mm, acute at apex, cuneate at base, chartaceous, villous, 9-nerved, keels not winged. Upper glumes ovate-lanceolate, 5–6 × 1–1.5 mm, acute at apex, cuneate at base, chartaceous, margin ciliate towards apex, puberulous, 3–5-nerved. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas lanceolate, 5.5–6 × 0.8–1 mm, acute at apex, cuneate at base, delicate, hyaline, margin ciliate towards apex, glabrous, 1-nerved. Second lemmas oblong, 2–3 × 0.3–0.4 mm, notched and awned at apex, cuneate at base, delicate, glabrous; awn 12–15 mm long. Paleas minute or absent. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelet oblong-lanceolate, 5–7 mm long, unawned; pedicels linear, 2–3.5 mm long, ciliate. Lower glumes oblong, 5–7 × 1.5–1.8 mm, acute at apex, cuneate at base, chartaceous, hispid, 13–15-nerved. Upper glumes lanceolate, 5–5.5 × 1–1.5 mm, acute at apex, cuneate at base, ciliate, pubescent, 5-nerved. Lower florets empty, epaleate. Upper florets male, epaleate. First lemma lanceolate, 5.5–6 × 0.8–1 mm, acute at apex, cuneate at base, delicate, hyaline, margin ciliate towards apex, glabrous, 1-nerved. Second lemmas oblong, 4–5 × 0.5–0.6 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous, faintly 3-nerved. Paleas minute or absent. Stamens 3.

Distribution: S. India, Sri Lanka and Indo-China (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-February.

Specimens examined: Anamudi slopes, 19.11.1965, *B.V. Shetty* 26536; Eravikulam National Park, 23.08.1980, *P.V. Sreekumar* 67769; *Ibid*., 25.08.1980, *P.V. Sreekumar* 67789; *Ibid*., 26.08.1980, *P.V. Sreekumar* 67794; *Ibid*., 27.08.1980, *P.V. Sreekumar* 67799 (MH); Pettimudi, near subran shed, 30.12.2019, *Dani Francis & Santhosh Nampy* 170059 (CALI); Umayamala slopes, 03.02.1970, *B.V. Shetty* 33408 (MH).

Apluda L.,

Sp. Pl. 1: 82. 1753.

Apluda mutica L., Sp. Pl. 82. 1753; C.E.C.Ficsh. in Gamble, Fl. Madras 3: 1750. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 93. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 32. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 550. 2004. *Apluda varia* Hack., in Engler & Prantl, Nat. Pflanzenfam. 2(2): 26. 1887, *nom. superfl.*; Hook.f., Fl. Brit. India 7: 150. 1896.

Apluda arisata L., Cent. Pl. 2: 7. 1756; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1750. 1934.

Annuals or perennials. Culms creeping or erect; nodes glabrous. Leaves elliptic-lanceolate, 3–30 × 0.3–1.2 cm, acuminate at apex, attenuate at base, glabrous or pubescent. Ligules membranous. False panicle 5–40 cm long, lax, interrupted; racemes solitary from a peduncled spatheole; joints bulbous. Spatheole broadly elliptic, 3–15 × 1–4 mm, acuminate at apex, cuneate at base, glabrous. Spikelets 3, one sessile and 2-pedicelled, terminal spikelets reduced to broad, glume like pedicel. Sessile spikelets 3–8 mm long, awned. Lower glumes lanceolate, 3–8 × 1–2 mm, shortly bifid at apex, truncate at base, margin narrowly winged towards in the upper half, puberulous, 9–15-nerved. Upper glumes ovate-boat shaped, 3–6 × 1–3 mm, beaked at apex, truncate at base, glabrous, faintly 5–11-nerved, keeled, keel ciliolate or glabrous. Lower florets male. Upper florets bisexual. First lemmas oblong-lanceolate, 2.5–5 × 0.5–1 mm, acute at apex, cuneate at base, delicate, glabrous, faintly 3–5-nerved. Paleas oblong-lanceolate, 2.5–5 × 0.5–1 mm, acute at apex, cuneate at base, delicate, glabrous, 2-keeled, 2-nerved. Lodicules 2. Stamens

3. Second lemmas as long as the sessile spikelet, ovate-lanceolate, 3–5 × 0.8–1 mm, notched and awned at apex, cuneate at base, glabrous or puberulous, 3-nerved; awn 5–15 mm long. Paleas ovate, 1.5–2.5 × 0.5–1 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous, 0–2-nerved, 2–keeled. Stamens 3. Ovary oblong; stigma plumose. Sterile pedicelled spikelet lanceolate, 3–8 × 0.5–1.5 mm, shortly bifid at apex, cuneate at base, glabrous or pubescent, 5–7-nerved. Pedicelled spikelet oblong-lanceolate, 3–6 mm long; pedicels flat, 2–5 mm long, ciliolate. Lower glumess ovate-lanceolate, 3–6 × 1–1.5 mm, acute at apex, cuneate at base, scaberulous, 11–13-nerved. Upper glumes ovate-lanceolate, 3–6 × 1–3 mm, beaked at apex, truncate at base, glabrous, faintly 5–11-nerved, keeled, keel ciliolate or glabrous. Lower florets barren or male. Upper florets male or bisexual. First lemmas oblong-lanceolate, 3–5 × 0.8–1 mm, acute at apex, cuneate at base, delicate, glabrous, faintly 3–5-nerved. Paleas 2.5–5 × 0.5–1 mm, acute at apex, cuneate at base, delicate, glabrous, 2-keeled, 2-nerved. Second lemmas 3.5–4.5 × 1–1.2 mm, acuminate at apex, sub-truncate at base, glabrous, 1-nerved. Paleas similar to sessile spikelet.

Distribution: Mascarenes, Socotra, Asia to W. Pacific (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-February.

Specimens examined: Cheruthoni, 16.02.1982, *C.N. Mohanan* 73312 (MH); Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 188826; way to Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 175955; way to Kanketty, Mankulam, 29.12.2017, *Dani Francis & Santhosh Nampy* 158010, 158013 (CALI); Kattappana, 25.09.1981, *C.N. Mohanan* 72047; Pullupara, Kuttikkanam, 22.01.1965, *K. Vivekananthan* 22971; Pullupara-Peruvanthanam, 24.01.1967, *K. Vivekananthan* 29348 (MH); Thannikkudy, 06.01.1994, *Jomy Augustine* 13072; (CALI).

Notes: It is a highly polymorphic species with creeping and rooting culms as well as tall, stout perennial forms with erect and tufted culms.

Apocopis Nees,

Proc. Linn. Soc. London 1: 93. 1841.

Apocopis mangalorensis (Hochst. ex Steud.) Henrard, Blumea 4: 523. 1941; Bor, Grasses Burma, Ceylon, India & Pakistan 96. 1960; Sreek. & V.J.Nair, Fl. Kerala-

Grasses 33. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 551. 2004. *Amblyachyrum mangalorense* Hochst. ex Steud., Syn. Pl. Glumac. 1: 413. 1854.

Annuals. Culms erect or decumbent; nodes glabrous. Leaves lanceolate, 1–5 × 0.2–0.5 cm, acuminate at apex, cuneate at base, tubercled hairy, green; sheaths 0.5–3 cm long, keeled, tubercled hairy towards upper portion. Ligules ovate, membranous. Racemes solitary or paired, 0.5–4 cm long. Sessile spikelets oblanceolate, 3–4 mm long, awned, basally hairy. Lower glumes obovate, 3–3.5 × 1.8–2 mm, truncate or emarginate at apex, sub-truncate at base, sparsely pubescent along margins, 7-nerved. Upper glumes oblong-lanceolate, 3.5–4 × 1–1.5 mm, bifid and ciliolate at apex, sub-truncate at base, glabrous, 3-nerved, keeled. Lower florets male or barren. Upper florets bisexual. First lemmas ovate-oblong, 3.5–4 × 1.5–2 mm, truncate and fimbriate at apex, sub-truncate at base, delicate, glabrous, veins not clear. Paleas lanceolate, 3.5–4 × 0.8–1 mm, obtuse at apex, cuneate at base, delicate, glabrous, faintly 2-nerved. Second lemmas linear, 3.5–4 × 0.4–0.6 mm, slightly notched and awned at apex, sub-truncate at base, glabrous, 3-nerved; awns 10–15 mm long. Paleas ovate, 1.5–2 × 0.8–1 mm, fimbriate at apex, cuneate at base, delicate, glabrous, faintly 2-nerved. Stamens 2. Ovary oblong; stigma plumose. Pedicelled spikelets reduced, usually represented by vestigial pedicels.

Distribution: India, Sri Lanka and Myanmar (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-December.

Specimen examined: Mangaladevi hills, 16.09.1994, *Jomy Augustine* 14203 (CALI).

Arthraxon P.Beauv.,

Ess. Agrostogr. 111. 1812.

Key to the species

1. Pedicelled spikelets developed ……..…….. 2

1. Pedicelled spikelets not developed ……..…….. 3

2. Spikelets 1.5–3 mm long; glumes aristate; stamens 2 ……..... *A. lancifolius*

2. Spikelets 5–6 mm long; glumes not aristate; stamens 3 ……. *A. lanceolatus*

3. Pedicelled spikelets reduced to glabrous points; stamens 2 …….. *A. hispidus*

3. Pedicelled spikelets reduced to linear pedicels, 2–3 mm long; stamens 3……*A. nudus*

Arthraxon hispidus (Thunb.) Makino, Bot. Mag. (Tokyo) 26: 214. 1912; C.E.C.Ficsh. in Gamble, Fl. Madras 3: 1728. 1934; K.M.Matthew, Illustr. Fl. Palni Hills 784. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 551. 2004. *Phalaris hispida* Thunb. in Murray (ed.), Syst. Veg. ed. 14. 104. 1784. *Arthraxon ciliaris* P.Beauv., Ess. Agrostogr 111. 1812; Hook.f., Fl. Brit. India 7: 145. 1896. *Arthraxon quartinianus* (A.Rich.) Nash in N.L.Britton & al. (eds.), N. Amer. Fl. 17: 99. 1912; C.E.C.Ficsh. in Gamble, Fl. Madras 3: 1728. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 102. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 41. 1991.

Annuals. Culms creeping or geniculate, glabrous; nodes hairy. Leaves ovate-lanceolate, 1–6 × 0.2–1 cm, acuminate at apex, rounded at base, margin ciliate towards base, green; sheaths tubercled hairy. Ligules ovate, membranous, fimbriate. Racemes 3–8, digitate, 1–3 cm long; joints linear, ventrally grooved, ciliate. Sessile spikelets lanceolate, 3–3.5 mm long, callus sparsely hairy. Lower glumes ovate-lanceolate, 3–3.5 × 0.8–1 mm, acuminate at apex, cuneate at base, entire, 7-nerved. Upper glumes boat–shaped, 3–3.5 × 0.8–1 mm, acute at apex, cuneate at base, chartaceous, puberulous, 3–5-nerved. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas lanceolate, 1–2 × 0.4–0.5 mm, obtuse at apex, cuneate at base, delicate, hyaline, glabrous, faintly 1–3 nerved. Second lemmas lanceolate, 1.5–2 × 0.4–0.5 mm, deeply notched, awned, delicate, hyaline; awn 5–10 mm long. Stamens 2. Ovary oblong; stigma plumose. Pedicelled spikelets reduced to glabrous points.

Distribution: Tropical Africa, W. Indian Ocean and Asia to E. Australia (POWO, 2023); *Habitat*: Road sides, hill slopes and barren fields; *Fl. & Ft.*: June-January.

Specimens examined: Munnar, 12.11.1980, *P.V. Sreekumar* 68433; *Ibid.*, 01.06.1944, *K.C. Jacob* 2055; Peermade, 02.12.1941, *K.C. Jacob* 20229; *Ibid.*, 03.12.1941, *K.C. Jacob* 20240 (MH).

Notes: It is closely allied to *A. nudus* but can be differentiated by the two stamens, slender racemes and villous joints and pedicels (Sreekumar & Nair, 1991).

Arthraxon lanceolatus (Roxb.) Hochst., Flora 39: 188. 1856; Hook.f., Fl. Brit. India 7: 143. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1728. 1934; Bor, Grasses Burma,

Ceylon, India & Pakistan 100. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 36. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 785. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 551. 2004. *Andropogon lanceolatus* Roxb., Fl. Ind. 1: 262. 1820.

Annuals or perennials. Culms geniculate, glabrous; nodes glabrous. Leaves lanceolate, 1–6 × 0.2–1.2 cm, acuminate at apex, rounded at base, margin ciliate towards base, green. Ligules membranous, thin. Racemes 2–5, digitate, 1.5–5.5 cm long; joints densely ciliate. Sessile spikelets lanceolate, 5–6 mm long, callus hairy. Lower glumes lanceolate, 4.5–5.5 × 0.8–1 mm, acute at apex, cuneate at base, spinulose at margin, 7-nerved. Upper glumes boat–shaped, 4–5 × 1.3–1.5 mm, acute at apex, cuneate at base, chartaceous, retrorsely ciliate, 3-nerved, nerves scabrid Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas linear-oblong, 2–3 × 0.4–0.5 mm, obtuse at apex, cuneate at base, delicate, hyaline, glabrous, faintly 2–3 nerved. Second lemmas lanceolate, 3–4 × 0.8–1 mm, deeply notched, awned, delicate, hyaline; awn 10–12 mm long. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets lanceolate, 4–5 mm long. Lower glumes elliptic-lanceolate, 4–5 × 0.8–1 mm, acute at apex, cuneate at base, scabrid towards apex, 6–7 nerved. Upper glumes elliptic-lanceolate, 4–4.5 × 0.8–1 mm, acute at apex, infolded at margins, retrorsely ciliate, faintly 3–5-nerved. Second lemmas elliptic-lanceolate, 2.8–3 × 0.8–1 mm, obtuse at apex, delicate, glabrous, faintly 3-nerved; epaleate. Stamens 3.

Distribution: Eritrea to S. Africa, SW. Arabian Peninsula, Pakistan to China and Lesser Sunda Islands (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-January.

Specimen examined: Nyamakkad, 8th mile, 24.01.2018, *Dani Francis & Santhosh Nampy* 158191 (CALI).

Arthraxon lancifolius (Trin.) Hochst., Flora 39: 188. 1856; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1729. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 100. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 38. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 552. 2004. *Andropogon lancifolius* Trin., Mem. Acad. Imp. Sci. St.-Petersbourg ser. 6. Sci. Math. 2: 271. 1832. *Arthraxon microphyllus sensu* Hook.f., Fl. Brit. India 7: 147. 1896 *non* Hochst., 1856.

Annuals. Culms creeping, geniculate, glabrous; nodes hairy. Leaves lanceolate, 0.6–6 × 0.2–1.5 cm, acuminate at apex, rounded at base, pubescent or glabrous, green.

Ligules a row of hairs. Racemes 3–8, digitate, 0.5–2.8 cm long; joints densely villous. Sessile spikelets lanceolate, 1.5–3 mm long. Lower glumes lanceolate, 2–3 × 0.8–1 mm, bifid and shortly aristate at apex, cuneate at base, glabrous, faintly 5-nerved. Upper glumes lanceolate, 2–2.5 × 0.8–1 mm, aristate at apex, cuneate at base, chartaceous, glabrous, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas oblong, 0.5–1 × 0.3–0.5 mm, obtuse at apex, cuneate at base, delicate, hyaline, glabrous, faintly 2–3-nerved. Second lemmas lanceolate, 0.8–1 × 0.3–0.5 mm, deeply notched and awned at apex, cuneate at base, delicate, hyaline, glabrous; awn 6–8 mm long. Stamens 2. Ovary oblong; stigma plumose. Pedicelled spikelets lanceolate, 1.5–2 mm long, empty. Lower glumes ovate-lanceolate, 1–1.6 × 0.6–0.7 mm, acuminate at apex, cuneate at base, glabrous, 3–5-nerved. Upper glumes ovate-lanceolate, 1–1.5 × 0.4–0.5 mm, acute at apex, cuneate at base, glabrous, membranous, nerves not clear.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: October-January.

Specimens examined: Kulamavu, 15.12.1982, *C.N. Mohanan* 76072; Peermade, 02.12.1941, *K.C. Jacob* 20224 (MH); Vallakadavu, 06.12.1993, *Jomy Augustine* 12723 (CALI).

Notes: This grass is similar to *A. hispidus* in habit and habitat, but can be distinguished by its well-developed pedicelled spikelets.

Arthraxon nudus (Steud.) Hochst., Flora 39: 188. 1856; Bor, Grasses Burma, Ceylon, India & Pakistan 101. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 39. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 552. 2004.

Annuals. Culms creeping and geniculate; nodes hairy. Leaves ovate-lanceolate, 1–5 × 0.5–1.5 cm, acuminate at apex, cordate at base, ciliate, glabrous, green; sheaths 2–4 cm long, ciliate. Ligules thin, membranous, fimbriate. Racemes digitate or sub-digitate, 2–5 cm long. Sessile spikelets lanceolate, 4–5 mm long; callus sparsely hairy. Lower glumes lanceolate, 3.5–4 × 0.8–1 mm, acute at apex, cuneate at base, scabrous along nerves, 9-nerved. Upper glumes boat shaped, 4–5 × 0.8–1 mm, acute at apex, cuneate at base, scabrid along margins, slightly keeled, faintly 2-nerved. Lower florets empty. Upper florets bisexual. First lemmas linear, 2.5–3 × 0.3–0.5 mm, acute at apex, cuneate at base, delicate, glabrous, 1-nerved. Second lemmas

oblong, 2–3 × 0.5 mm, deeply notched and awned at apex, cuneate at base, delicate, glabrous; awn 10–12 mm long. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets reduced to linear pedicels, 2–3 mm long, villous.

Distribution: Oman, Pakistan to S. Central China and Peninsula Malaysia (POWO, 2023); *Habitat*: Moist deciduous forests; *Fl. & Ft.*: September-February.

Specimen examined: Koruthode, 06.09.1997, *Jomy Augustine* 17855 (CALI).

Bothriochloa Kuntze,

Revis. Gen. Pl. 2: 762. 1891.

Key to the species

1. Lower glumes of sessile spikelets hairy with a deep circular pit above …… …….. *B. pertusa*

1. Lower glumes of sessile spikelets glabrous with or without shallow pits ..... …….. *B. insculpta*

Bothriochloa insculpta (Hocht. ex A.Rich.) A.Camus, Ann. Soc. Linn. Lyon, n.s. 76: 165. 1931; Bor, Grasses Burma, Ceylon, India & Pakistan 107. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 51. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 790. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 555. 2004. *Andropogon insculptus* Hochst. ex A.Rich., Tent. Fl. Abyss. 2: 458. 1850. *Andropogon pertusus* var. *insculptus* (Hochst. ex A. Rich.) Hack. in A.DC. & C.DC., Monogr. Phan. 6: 482. 1889; Hook.f., Fl. Brit. India 7: 174. 1896. *Amphilophis insculpta* (Hochst. ex A. Rich.) Stapf, in Oliver *et al.* (eds.), Fl. Trop. Afr. 9: 176. 1917; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1732. 1934.

Perennials. Culms tufted, erect or geniculate; nodes hairy. Leaves linear-lanceolate, 5–25 × 0.2–0.5 cm, acuminate at apex, rounded at base, glabrous or pubescent, green; sheaths 3–6 cm long, keeled. Ligules ovate, membranous, fimbriate at apex. Racemes digitate, 2–6 cm long. Sessile spikelets oblong, 3–4 mm long, callus hairy. Lower glumes oblong, 3–4 × 0.8–1 mm, acute at apex, cuneate at base, scabrous along margins, glabrous, faintly 0–11-nerved, pitted or not, shallow depression all along, keeled. Upper glumes oblong-lanceolate, 3.5–4 × 0.8–1 mm, acute at apex, cuneate at base, margin villous in the upper half, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas ovate-oblong, 3–3.5 × 0.8–1 mm, acute at apex, cuneate at base, delicate, margin ciliolate

towards apex, nerveless. Second lemmas reduced to hyaline base of awn, stipitate, awned at apex; awn 11–15 mm long. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets elliptic, 3–5 mm long; pedicels linear, 1.5–2 mm long, ciliate. Lower glumes ovate-oblong, 3.5–4 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, faintly 11–15-nerved, 1–4 pitted, keeled. Upper glumes and lower florets similar to sessile spikelet. Upper florets male, epaleate. Second lemmas linear, 3–4 × 0.6–1 mm, acute at apex, cuneate at base, delicate, glabrous.

Distribution: Sicilia, S. Greece, Africa, Arabian Peninsula and Indian Subcontinent (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-May.

Specimens examined: Munnar, 30.05.1944, *K.C. Jacob* 20489 (MH); Thekkady, 08.01.1996, *Jomy Augustine* 14048 (CALI).

Bothriochloa pertusa (L.) A.Camus, Ann. Soc. Linn. Lyon n.s. 76: 164. 1931; Bor, Grasses Burma, Ceylon, India & Pakistan 109. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 54. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 555. 2004. *Holcus pertusus* L., Mant. Pl. 2: 301. 1771. *Andropogon pertusus* (L.) Willd., Sp. Pl. 4: 922. 1806; Hook.f., Fl. Brit. India 7: 173. 1896. *Amphilophis pertusa* (L.) Stapf, Agric. News (Barbados) 15: 179. 1916; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1731. 1934.

Perennials, stoloniferous. Culms erect or creeping; nodes hairy. Leaves usually crowded at base, linear-lanceolate, 3–12 × 0.3–0.5 cm, acuminate at apex, rounded at base, glabrous or pubescent; sheaths 2–5 cm long, keeled, glabrous or sparsely tubercled hairy. Ligules membranous, fimbriate at apex. Racemes digitate or sub-digitate, 2–6 cm long, villous. Sessile spikelets elliptic-lanceolate, 3–4 mm long, pilose hairy up to half. Lower glumes elliptic-lanceolate, 3–4 × 0.6–1 mm, acute at apex, cuneate at base, pilose in lower half, 2-keeled, 7–11-nerved, prominently one pitted above the middle. Upper glumes boat shaped, 3–4 × 0.6–1 mm, acuminate at apex, cuneate at base, puberulous, keeled, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas ovate-lanceolate, 2.5–3 × 0.8–1 mm, acute-acuminate at apex, cuneate at base, puberulous, faintly 3–5-nerved. Second lemmas stipitate, oblong, reduced to hyaline base of awn, 1–2 × 0.3–0.5 mm, awned at apex, cuneate at base, glabrous; awn 14–18 mm long. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets elliptic, 3–4 mm long; pedicels 2–2.5 mm long, villous. Lower glumes elliptic, 3–4 × 0.5–1 mm, acute

at apex, cuneate at base, sparsely hairy, 11–13-nerved, keeled. Upper glumes lanceolate, 3–4 × 0.5–1 mm, acute at apex, cuneate at base, sparsely hairy, 3–5-nerved. Lower florets similar to sessile spikelet. Upper florets male or barren, epaleate. First lemmas ovate-lanceolate, 2.5–3 × 1 mm, obtuse at apex, cuneate at base, pubescent, nerveless. Second lemmas lanceolate, 3–3.5 × 0.5–1 mm, acute at apex, cuneate at base, glabrous, nerveless.

Distribution: W. Indian Ocean, Tropical and Subtropical Asia to W. Pacific (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-February.

Specimen examined: Thekkady, 06.01.1994, *Jomy Augustine* 14574 (CALI).

Notes: This species can be easily identified by its hairy racemes and lower glumes with 1–2 peculiar deep circular pit.

Capillipedium Stapf,

Oliver *et al.* (eds.), Fl. Trop. Afr. 9: 169. 1917.

Capillipedium assimile (Steud.) A.Camus in H.Lecomte, Fl. Indo-Chine 7: 314. 1922; Bor, Grasses Burma, Ceylon, India & Pakistan 110. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 55. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 557. 2004. *Andropogon assimilis* Steud., Syn. Pl. Glumac. 1: 397. 1854; Hook.f., Fl. Brit. India 7: 179. 1896. *Capillipedium glaucopsis* (W.Watson) Stapf, in Hooker's Icon. Pl. 31: t. 3085. 1922; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1730. 1934.

Annuals or perennials. Culms decumbent or straggling; nodes villous or glabrous. Leaves elliptic-lanceolate, 3–15 × 0.2–0.5 cm, acuminate at apex, rounded at base, glabrous, green; sheaths slightly keeled, glabrous. Ligules ovate, membranous. Panicles open or contracted, 5–15 cm long, branches and branchlets capillary; joints ciliate. Sessile spikelets ovate-oblong, 2.5–4 mm, glabrous or pubescent, callus hairy. Lower glumes ovate, 3–4 × 1–1.5 mm, acute at apex, cuneate at base, glabrous or pubescent, margins pectinately pubescent towards apex, 7-nerved. Upper glumes boat shaped, 2.8–3 × 0.8–1 mm, acute at apex, cuneate at base, chartaceous, glabrous or pubescent, 2-keeled. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas obovate, 1–1.5 × 0.5–0.7 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous. Second lemmas oblong, 1–2 mm long, delicate, awned, awn 10–15 mm long. Stamens 3. Ovary oblong.

Pedicelled spikelets elliptic-lanceolate, 2.5–4 mm long, unawned; pedicels 1.5–2.5 mm long. Lower glumes oblong-lanceolate, 2.8–3 × 0.8–1 mm, acute at apex, cuneate at base, long ciliate or glabrous at margins. Upper glumes lanceolate, 2.8–3 × 0.8–1 mm, acute at apex, cuneate at base, ciliate towards apex of margin. Lower florets similar to sessile spikelet. Upper florets male or empty. First lemmas ovate-oblong, 2–3 × *c*. 1 mm, delicate, hyaline.

Distribution: Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Waste lands; *Fl. & Ft.*: May-January.

Specimens examined: Meenmutty, 28.12.1983, *A.G. Pandurangan* 62565; Munnar, 30.05.1944, *K.C. Jacob* 20496 (MH).

Chrysopogon Trin.,

Fund. Agrost. 187. 1820, *nom. cons.*

Key to the species

1. Lower glume of the pedicelled spikelet awned …….. *C. asper*

1. Lower glume of the pedicelled spikelet unawned …….. 2

2. Sessile spikelets aristate; culms creeping or ascending; pedicels glabrous …….. …….. *C. aciculatus*

2. Sessile spikelets awned; culms erect; pedicels villous …….. 3

3. Pedicelled spikelets 5–6 mm long; ligules a tuft of hairs …….. *C. hackelii*

3. Pedicelled spikelets 10–15 mm long; ligules fimbriate, membranous …….. …….. *C. nodulibarbis*

Chrysopogon aciculatus (Retz.) Trin., Fund. Agrost. 188. 1820; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1738. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 115. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 59. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 559. 2004. *Andropogon aciculatus* Retz., Observ. Bot. 5: 22. 1789; Hook.f., Fl. Brit. India 7: 188. 1896.

Perennials. Culms creeping, ascending; nodes glabrous. Leaves ovate-lanceolate, 1.5–6 × 0.2–0.4 cm, acute or blunt at apex, sub-rounded at base, serrulate, glabrous, green; sheaths 0.5–2 cm long, slightly keeled, glabrous. Ligules annular,

thin, membranous. Panicles 5–8 cm long, open or contracted. Sessile spikelets lanceolate, 3–4 mm long, aristate, callus hairy. Lower glumes lanceolate, 3–4 × 0.8–1 mm, bifid at apex, cuneate at base, 3-nerved, keeled, scabrous along the keels. Upper glumes lanceolate, 3–4 × 0.8–1 mm, acuminate at apex, cuneate at base, puberulous, 3-nerved, keeled, scabrous along the keels. Lower florets empty, epaleate. Upper florets bisexual, paleate. First lemmas obovate, 2.5–3 × 0.8–1 mm, acute at apex, cuneate at base, delicate, glabrous, 2-nerved, 2-keeled. Second lemmas ovate-lanceolate, 2.5–3 × 0.8–1 mm, aristate at apex, cuneate at base, delicate, glabrous, 1–3-nerved; arista 2–5 mm long. Paleas oblong, 1.5–2 × 0.5–0.6 mm, obtuse at apex, cuneate at base, delicate, glabrous, nerveless. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets linear-lanceolate, 4–5 mm long, unawned; pedicels 2.5–3 mm long, glabrous. Lower glumes lanceolate, 4–5 × 0.8–1 mm, acuminate at apex, cuneate at base, glabrous, scaberulous along margin, 5-nerved. Upper glumes lanceolate, 4–5 × 0.8–1 mm, acuminate at apex, cuneate at base, glabrous, scabrous along margin, 3-nerved. Lower florets empty, epaleate. Upper florets male. First lemmas lanceolate, 3–4 × 0.5–1 mm, acute at apex, cuneate at base, delicate, glabrous, faintly 3–5-nerved. Second lemmas lanceolate, 2.5–3 × 0.5–1 mm, acute at apex, cuneate at base, delicate, ciliate, glabrous, faintly 3-nerved. Paleas similar to sessile spikelet. Stamens 3.

Distribution: Indian Ocean, Tropical and Subtropical Asia to Pacific (POWO, 2023); *Habitat*: Forests; *Fl. & Ft.*: May-October.

Specimen examined: Manakkavala, Periyar Tiger Reserve, 16.05.1997, *Jomy Augustine* 17815 (CALI).

Notes: This species is distinguished by its creeping and decumbent habit, as well as its disarticulating, acicular spikelets with extremely sharp callus that frequently attach to the skin and hair of animals (Sreekumar & Nair, 1991).

Chrysopogon asper B.Heyne ex Blatt. & McCann, Sci. Monogr. Imp. Council Agric. Res. India 5: 68. 1935; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1738. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 116. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 61. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 797. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 559. 2004. *Andropogon asper* B.Heyne ex Hook.f., Fl. Brit. India 7: 189. 1896, *nom*. *illeg*.

Perennials. Culms erect; nodes glabrous. Leaves linear-lanceolate, 10–35 × 0.5–1.5 cm, acute at apex, rounded at base, serrulate, glabrous, green; sheaths 0.5–2 cm long, keeled, glabrous. Ligules thin, membranous, fimbriate. Panicles lax, 10–20 cm long. Sessile spikelets oblong, 5–6 mm long, awned, callus sharply acute, chocolate-brown hairy. Lower glumes linear-oblong, 5–6 × 0.8–1 mm, emarginate at apex, cuneate at base, glabrous, faintly 3–5-nerved. Upper glumes ovate-oblong,5–6 × 0.8–1 mm, emarginate and awned at apex, cuneate at base, delicate, hyaline, glabrous, awn 12–15 mm long. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas linear-oblong, 3–5 × 0.8–1 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous, margin sparsely ciliate, 2-nerved. Second lemmas oblong, 3–4 × 0.8–1 mm, awned at apex, cuneate at base, delicate, hyaline, glabrous; awn 6–7 cm long. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets linear-lanceolate, 10–12 mm long, awned; pedicels flat, 3–4 mm long, ciliate. Lower glumes lanceolate, 10–12 × 1.5–2 mm, acuminate at apex, cuneate at base, chartaceous, glabrous, 7-nerved, keel sparsely ciliate; awns 12–15mm long. Upper glumes lanceolate, 10–12 × 1.5–2 mm, acute at apex, cuneate at base, chartaceous, glabrous, sparsely ciliate along margin, 3-nerved. Lower florets empty, epaleate. Upper florets male, epaleate. First lemmas oblong-lanceolate, 8–10 × 1–1.5 mm, acute at apex, cuneate at base, delicate, hyaline, sparsely ciliate at margins, 2-nerved. Second lemmas linear-oblong, 5–6 × 0.8–1 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous, 1-nerved. Stamens 3.

Distribution: S. India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-December.

Specimens examined: Peermade, 02.12.1941, *K.C. Jacob* 20226; *Ibid.*, 03.12.1941, *K.C. Jacob* 20234; *Ibid.*, 25.11.1967, *K. Vivekananthan* 29364 (MH).

Notes: The distichous leaves and unawned upper glumes of pedicelled spikelets distinguish this grass from *C. orientalis* (Desv.) A.Camus (Sreekumar & Nair, 1991).

Chrysopogon hackelii (Hook.f.) C.E.C.Fisch. in Gamble, Fl. Madras 3: 1739. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 117. 1960; Sreek. & V.J.Nair, Fl.

Kerala-Grasses 62. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 559. 2004. *Andropogon hackelii* Hook.f., Fl. Brit. India 7: 194. 1896. **Fig. 31A**

Perennials. Culms erect; nodes hairy or glabrous. Leaves linear-lanceolate, 10–35 × 0.5–1 cm, acuminate at apex, rounded at base, scaberulous, green; sheaths 8–15 cm long, hairy, keeled. Ligules a tuft of hairs. Panicles 5–25 cm long, open; racemes whorled at nodes. Sessile spikelets oblong, 5–6 mm long, awned, with a tuft of brown hair basally. Lower glumes oblong-lanceolate, 5–6 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, 5–7-nerved. Upper glumes oblong-lanceolate, 5–6 × 1–1.5 mm, acuminate at apex, cuneate at base, scabrellate, 3-nerved, awned; awns 3–7 mm long. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas linear-lanceolate, 4–5 × 0.8–1 mm, acute at apex, cuneate at base, delicate, ciliate, glabrous, faintly 3-nerved. Second lemmas lanceolate, 4–5 × 0.8–1 mm, awned at apex, cuneate at base, delicate, glabrous, 3-nerved; awn 18–25 mm long. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets lanceolate, 5–6 mm long, unawned; pedicels 1.5–2 mm long, densely ciliate, brown. Lower glumes ovate-lanceolate, 5–6 × 1.5–2 mm, acuminate at apex, cuneate at base, puberulous, 7-nerved. Upper glumes ovate-lanceolate, 5–6 × 1.5–2 mm, acuminate at apex, cuneate at base, sparsely ciliate, 3-nerved. Lower florets empty, paleate or epaleate. Upper florets male, epaleate. First lemmas lanceolate, 4–5 × 0.8–1 mm, acute at apex, cuneate at base, ciliate, delicate, 2-nerved. Paleas oblong, 1.5–2 × 0.2–0.3 mm, obtuse at apex, cuneate at base, glabrous, nerveless. Second lemmas oblong, 3–4 × 0.3–0.5 mm, obtuse at apex, cuneate at base, sparsely ciliate, delicate 3-nerved. Stamens 3.

Distribution: S. India (POWO, 2023); *Habitat*: Forest margins; *Fl. & Ft.*: February-December.

Specimens examined: Above Cheeyappara waterfalls, 27.12.2017, *Dani Francis & Santhosh Nampy* 156502; Irumbupalam, 28.12.2017, *Dani Francis & Santhosh Nampy* 156561 (CALI); Kulamavu, 04.06.1982, *C.N. Mohanan* 74173; Lockhert gap, 10.10.1963, *K.M. Sebastine* 17509 (MH); Meenuliyanpara, 29.11.2019, *Dani Francis & Santhosh Nampy* 164616 (CALI); Peermade, 02.12.1941, *K.C. Jacob* 20230 (MH); Thannikkudy, Periyar Tiger Reserve, 18.10.1996, *Jomy Augustine* 12465 (CALI).

Notes: This species is often confused with *C. nodulibarbis* in the presence of keeled leaf sheaths, but can be distinguished by its smaller pedicelled spikelets and considerably shorter pedicels which covered with long chocolate brown hairs along the margin (Sreekumar & Nair, 1991).

Chrysopogon nodulibarbis (Hochst. ex Steud.) Henrard, Blumea 4: 534. 1941; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 559. 2004. *Andropogon nodulibarbis* Hochst. ex Steud., Syn. Pl. Glumac. 1: 396. 1854. *Chrysopogon zeylanicus* (Steud.) Thwaites, Enum. Pl. Zeyl. 366. 1864; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1739. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 119. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 65. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 799. 1996. *Andropogon zeylanicus* Steud., Syn. Pl. Glumac. 1: 397. 1854; Hook.f., Fl. Brit. India 7: 192. 1896.

Perennials. Culms tufted, erect; nodes glabrous. Leaves narrowly linear, 8–45 × 0.4–0.6 cm, acuminate at apex, cordate at base, tubercled hairy, green; sheaths 5–15 cm long, keeled, ciliolate. Ligules membranous, fimbriate. Panicles 5–25 cm long, open; racemes whorled or sub-whorled. Sessile spikelets oblong-lanceolate, 6–8 mm long, awned. Lower glumes lanceolate-oblong, 5–6.5 × 0.8–1 mm, obtuse at apex, cuneate at base, scabrous, glabrous, 5–7-nerved, keeled, scabrellate along keels. Upper glumes oblong-lanceolate, 5–6 × 1–2 mm, aristate at apex, cuneate at base, ciliate, puberulous, 3–5-nerved, arista 0.8–1 mm long. Lower florets empty, epaleate. Upper florets bisexual. First lemmas elliptic-lanceolate, 5–5.5 × 0.8–1 mm, acute-acuminate at apex, cuneate at base, ciliate, glabrous, faintly 5-nerved, 2-keeled. Second lemmas oblong, 3–6 × 0.4–0.6 mm, awned at apex, cuneate at base, glabrous, faintly 3-nerved; awns 14–20 mm long, barbellate. Paleas reduced, scale like, lanceolate, 0.8–1 mm long, hyaline, glabrous. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets oblong-lanceolate, 10–15 mm long, unawned; pedicels 4–6 mm long, brownish hairy along margin. Lower glumes ovate-lanceolate, 10–12 × 1–2 mm, acuminate at apex, cuneate at base, pubescent, 5–7-nerved, aristate, arista 0.5–1 mm long. Upper glumes lanceolate, 8–13 × 0.8–1 mm, acuminate at apex, cuneate at base, pubescent, 3–5-nerved. Lower florets empty, epaleate. Upper florets male, epaleate. First lemmas lanceolate, 6–10 × 0.8–1 mm, acuminate at apex, cuneate at base, ciliate, hyaline, glabrous, faintly 3–5-nerved.

Second lemmas elliptic-lanceolate, 6–9 × 0.6–0.8 mm, acute at apex, cuneate at base, hyaline, ciliate above middle, nerveless. Stamens 3.

Distribution: Indian Subcontinent to Indo-China (POWO, 2023); *Habitat*: Forest margins; *Fl. & Ft.*: July-May.

Specimens examined: Anamudi slopes, 19.11.1965, *B.V. Shetty* 26535 (MH); Eravikulam, 02.05.2017, *Dani Francis & Santhosh Nampy* 152117 (CALI); *Ibid.*, 24.08.1980, *P.V. Sreekumar* 67779; *Ibid.*, 25.08.1980, *P.V. Sreekumar* 67788 (MH); *Ibid.*, 02.10.1979, *s. coll. s.n.* (KFRI); Mangaladevi, 07.07.1993, *Jomy Augustine* 12035; Mesthirikettu, 30.12.2017, *Dani Francis & Santhosh Nampy* 158066 (CALI); Munnar, 31.05.1944, *K.C. Jacob* 20501 (MH).

Coix L.,

Sp. Pl. 2: 972. 1753.

Coix lacryma–Jobi L., Sp. Pl. 2: 972. 1753; Hook.f. Fl. Brit. India 7: 100. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1705. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 264. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 207. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 560. 2004.

Annuals. Culms densely tufted; nodes glabrous. Leaves linear-lanceolate, 8–45 × 1–3 cm, acuminate at apex, cordate at base, glabrous, green; sheaths 3–7 cm long, glabrous. Ligules ovate, membranous, thin. Inflorescence of peduncled false spikes, 5–25 cm long. Male spikelets 2 or 3, lanceolate, 5–12 × 2–4 mm, glabrous. Lower glumes ovate-elliptic, 5–12 × 2–4 mm, acute at apex, cuneate at base, chartaceous, glabrous, many nerved, keel slightly winged. Upper glumes elliptic-lanceolate, 5–10 × 2–3 mm, acute at apex, cuneate at base, chartaceous, glabrous, 7–9-nerved. Lower florets male. Upper florets male or barren. First lemmas elliptic-lanceolate, 5–9 × 2–3 mm, acuminate at apex, cuneate at base, delicate, glabrous, faintly 5–7-nerved. Paleas elliptic-lanceolate, 5–9 × 1–2 mm, obtuse at apex, cuneate at base, delicate, glabrous, 2-nerved, 2-keeled. Stamens 3. Second lemmas elliptic-lanceolate, 5–7 × 1–2 mm, acute at apex, cuneate at base, delicate, glabrous, 5-nerved. Paleas elliptic-lanceolate, 4–7 × 1–1.5 mm, acute at apex, cuneate at base, glabrous, 2-nerved. Stamens 3. Female spikelets globose-ovoid, 5–15 mm long, shining, enclosed in a modified sheath forming bead like involucre. Lower glumes ovate-oblong, 6–8 × 1–

2 mm, acute at apex, cuneate at base, glabrous. Upper glumes ovate, 6–8 × 1–2 mm, acute at apex, cuneate at base, glabrous. Lower florets female or barren. Upper florets female. Lemmas ovate-oblong, 6–14 × 1–3 mm, acute at apex, cuneate at base, glabrous. Paleas ovate-oblong, 5–11 × 1–2 mm, obtuse at apex, cuneate at base, delicate, glabrous.

Distribution: Indian Subcontinent to Taiwan and Peninsula Malaysia (POWO, 2023); *Habitat*: Marshy areas; *Fl. & Ft.*: July-March.

Specimens examined: Way to Mannavan Shola, 08.01.2004, *B.K. Kavitha* 96738; *Ibid*., 08.01.2004, *K. Sereena* 96872; *Ibid*., 08.01.2004, *N. Sairabhanu* 97037; way to Marayur, 08.01.2004, *P. Regy* 96339; Munnar, 13.12.1970, *P. Rugmini* 995; *Ibid*., 13.12.1970, *M. Sivadasan* 641; Thannikkudy, 10.11.1994, *Jomy Augustine* 14226 (CALI).

Notes: It is commonly called 'Job's tears', and shows a wide variation in the habit, wings of glumes and in colour and texture of fruits (Sreekumar & Nair, 1991).

Cymbopogon Spreng.,

Pl. Min. Cogn. Pug. 2: 14. 1815.

Key to the species

1. Pedicels of the lowest pedicelled spikelets in the sessile raceme swollen; panicles contracted …….. *C. caesius*

1. Pedicels of the lowest pedicelled spikelets in the sessile raceme not swollen; panicles lax with numerous flexuous branches …….. *C. flexuosus*

Cymbopogon caesius (Hook. & Arn.) Stapf, Bull. Misc. Inform. Kew 1906: 341. 1906; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1757. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 125. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 69. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 560. 2004. *Andropogon caesius* Hook. & Arn., Bot. Beechey Voy 244. 1838. *Andropogon schoenanthus* var. *gracillimus* Hook.f., Fl. Brit. India 7: 205. 1896.

Perennials. Culms erect; nodes glabrous. Leaves linear-lanceolate, 8–30 × 0.3–0.7 cm, acuminate at apex, rounded at base, glabrous, green; sheaths 3–7 cm long, glabrous. Ligules ovate, membranous, fimbriate. Panicles narrow, contracted, 12–

40 cm long, spathaceous. Racemes 2, one sessile and one pedicelled, 1–1.5 cm long; joints 1.5–2 mm long, densely villous, abscission cupuliform. Sessile spikelets linear-oblong, 3–4.5 mm long, callus hairy. Lower glumes oblong, 3–4.5 × 0.8–1 mm, acute and slightly notched at apex, cuneate at base, glabrous, faintly 3–5-nerved, keeled, with a narrow slit at the lower half. Upper glumes elliptic-lanceolate, 3–4 × 0.8–1 mm, acuminate at apex, cuneate at base, ciliate, glabrous, 3-nerved, keeled. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas oblong-elliptic, 3–3.5 ×0.4–0.5 mm, acute at apex, cuneate at base, ciliate, hyaline, delicate, 2-nerved. Second lemmas lanceolate, 1.5–3 × 0.3–0.4 mm, awned at apex, cuneate at base, glabrous, nerveless, reduced to a hyaline base of awn; awns 13–15 mm long. Stamens 3. Ovary ovate-oblong; stigma plumose. Pedicelled spikelets elliptic, 3–4 × 0.8–1 mm, glabrous, unawned; pedicels 1–2 mm long, densely long villous, swollen. Lower glumes elliptic, 3–4 × 1–1.5 mm, acuminate at apex, cuneate at base, glabrous, 11–13-nerved, keeled. Upper glumes elliptic-lanceolate, 3–4 × 0.8–1 mm, acuminate at apex, cuneate at base, glabrous, 3-nerved. Lower florets male. Upper florets wanting. First lemmas lanceolate, 3–4 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, faintly 2–3-nerved; Paleas lanceolate, *c.* 1 × 0.5 mm, sometimes absent. Second lemmas lanceolate, 3–3.5 × 0.4–0.5 mm, acuminate at apex, cuneate at base, delicate, glabrous, nerveless. Stamens 3.

Distribution: Tropical and S. Africa, W. Indian Ocean, Arabian Peninsula to Indian Subcontinent (POWO, 2023); *Habitat*: Forest margins; *Fl. & Ft.*: August-January.

Specimen examined: Swamikkayam, Periyar Tiger Reserve, 03.01.1994, *Jomy Augustine* 14515 (CALI).

Cymbopogon flexuosus (Nees ex Steud.) Will.Watson, Bot. Himalayan Distr. N. W. Prov. 392. 1882; C,E.C.Fisch. in Gamble, Fl. Madras 3: 1756. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 127. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 71. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 803. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 561. 2004. *Andropogon flexuosus* Nees ex Steud., Syn. Pl. Glumac. 1: 388. 1854. *Andropogon nardus* subsp. *flexuosus* (Nees ex Steud.) Hack. in A.DC. & C.DC., Monogr. Phan. 6: 603. 1889; Hook.f., Fl. Brit. India 7: 207. 1896. **Fig. 29C**

Perennials. Culms erect, tufted; nodes glabrous. Leaves linear-lanceolate, 12–60 × 1–2 cm, acuminate at apex, rounded at base, scabrous at margins, glabrous, green; sheaths 12–16 cm long, keeled towards apex, glabrous or sparsely hairy. Ligules ovate, membranous. Panicles lax, 12–60 cm long, with numerous flexuous branches, spathaceous. Racemes 2, one sessile and one pedicelled, 1–1.5 cm long; joints 1.8–2 mm long, densely villous. Sessile spikelets elliptic-lanceolate, 4–5 mm long, awned. Lower glumes elliptic-lanceolate, 3.5–4 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, faintly 5–7-nerved, keeled, keel winged. Upper glumes ovate-lanceolate, ciliate, 3–4 × 0.8–1 mm, acute at apex, cuneate at base, ciliate, glabrous, 3-nerved, keeled. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas lanceolate, 3–3.5 × 0.8–1 mm, acute at apex, cuneate at base, delicate, glabrous, nerveless. Second lemmas oblong-lanceolate, 1.8–2 × 0.3–0.4 mm, deeply notched and awned at apex, cuneate at base, reduced to hyaline base of awn, glabrous, nerveless; awns 7–12 mm long. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets lanceolate, 3–4 mm long, unawned; pedicels *c.* 2 mm long, densely villous, abscission cupuliform. Lower glumes ovate-lanceolate, 3–3.5 × 0.8–1 mm, acuminate at apex, cuneate at base, ciliate, puberulous, 9–11-nerved. Upper glumes elliptic-lanceolate, 2.8–3 × 0.8–1 mm, acuminate at apex, cuneate at base, ciliate, puberulous, 3-nerved. Lower florets male. Upper florets wanting. First lemmas elliptic-lanceolate, *c.* 3 × 1 mm, acute at apex, cuneate at base, delicate, hyaline, ciliate, puberulous, nerveless. Second lemmas oblong-lanceolate, *c.* 1 × 0.2 mm, reduced, membranous, hyaline, nerveless. Stamens 3.

Distribution: Indian Subcontinent to Indo-China (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: June-January.

Specimens examined: Above Cheeyappara waterfalls, 27.12.2017, *Dani Francis & Santhosh Nampy* 156501; Choondal, Mathikettan Shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 151635 (CALI); Kuttikkanam, Peermade, 27.11.1967, *K. Vivekananthan* 29387; Lockhert gap, 10.10.1963, *K.M. Sebastine* 17508 (MH); Mangaladevi hills, 12.10.2017, *Dani Francis & Santhosh Nampy* 156378; Meenuliyanpara, 29.11.2019, *Dani Francis & Santhosh Nampy* 164626

(CALI); Munnar, 12.11.1980, *P.V. Sreekumar* 68429 (MH); Vallakkadavu, 15.11.1993, *Jomy Augustine* 12728 (CALI).

Notes: This species is characterized by its reddish culms, narrowly winged lower glumes of sessile spikelets with 2–3 shallow wrinkles and 3 nerves on the dorsal side (Sreekumar & Nair, 1991)

Dichanthium Willemet,

Ann. Bot. 18: 11. 1796.

Dichanthium foulkesii (Hook.f.) S.K.Jain & Deshp., Bull. Bot. Surv. India 20: 134. 1979; Sreek. & V.J.Nair, Fl. Kerala-Grasses 77. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 563. 2004. *Andropogon foulkesii* Hook.f., Fl. Brit. India 7: 174. 1896. *Amphilophis foulkesii* (Hook.f.) C.E.C.Fisch. in Gamble, Fl. Madras 3: 1732. 1934. *Bothriochloa foulkesii* (Hook.f.) Henrard, Blumea 3: 457. 1940; Bor, Grasses Burma, Ceylon, India & Pakistan 107. 1960; K.M.Matthew, Illustr. Fl. Palni Hills 789. 1996.

Perennials. Culms erect or geniculate; nodes glabrous. Leaves linear, 10–20 × 0.2–0.5 cm, acuminate at apex, rounded at base, glabrous or puberulous, green; sheaths 5–12 cm long, slightly keeled, mouth villous. Ligules membranous, fimbriate. Racemes 3–6, digitate or sub-digitate, hairy at axils, 3–8 cm long; joints linear, 2.5–3 mm long, ciliate. Sessile spikelets oblong-lanceolate, 4–5 mm long, callus sparsely hairy. Lower glumes lanceolate, 4–5 × 1–1.5 mm, acute at apex, cuneate at base, flat or with a shallow depression towards base, puberulous, faintly 7-nerved. Upper glumes oblong-lanceolate, 4–5 × 1–1.5 mm, acute-acuminate at apex, cuneate at base, puberulous, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas oblong-lanceolate, 3.5–4 × 0.8–1 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous, faintly 3–5-nerved. Second lemmas stipitate, reduced to hyaline base of awn, 2–3 mm long; awn 15–25 mm long. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelet elliptic-lanceolate, 5–6 mm long, unawned. pedicels linear, 2–3 mm long, ciliate along the margin. Lower glumes elliptic-lanceolate, 5–5.5 × 1–1.5 mm, acute at apex, cuneate at base, ciliate towards apex, 7-9-nerved. Upper glumes lanceolate, *c.* 5 × 1 mm, acute at apex, cuneate at base, ciliate, faintly 3-nerved. Lower florets empty, epaleate. Upper florets male. First lemmas oblong-

lanceolate, 3.5–4 × 0.8–1 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous, faintly 3–5-nerved. Second lemmas lanceolate, 3–4 × 1–1.2 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous. Stamens 3.

Distribution: Indian Subcontinent and Nicobar Islands (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-February.

Specimens examined: Mlappara, 08.07.1993, *Jomy Augustine* 12088 (CALI); Rajamala, 02.02.1970, *B.V. Shetty* 31794 (MH).

Notes: The genus *Bothrichloa* shows affinity with the genus *Dichantium*, but the pitted glumes and translucent joints and pedicels distinguishes *Bothriochloa* from *Dichanthium*. *B. foulkesii* can be distinguished by having groove, that is not translucent along the upper surface of the pedicel (Sreekumar & Nair, 1991).

Dimeria R.Br.,

Prodr. Fl. Nov. Holland. 204. 1810.

Key to the species

1. Racemes solitary ……..…….. 2

1. Racemes 2–3 ……..……. 3

2. Spikelets 2–3 mm long; callus hairs *c.* 0.5 mm long ……. *D. fischeri*

2. Spikelets 5–6 mm long; callus hairs 1–1.5 mm long ……. *D. borii*

3. Rachis triquetrous; keels of upper glumes prominently winged ….. *D. idukkiensis*

3. Rachis flat; keels of upper glumes narrowly winged ……..... 4

4. Spikelets 2.5–3 mm long …… *D. deccanensis*

4. Spikelets 3.5–4 mm long …… *D. kanjirapallilana*

Dimeria borii Sreek., V.J.Nair & N.C.Nair, J. Econ. Taxon. Bot. 3: 657. 1982; Sreek. & V.J.Nair, Fl. Kerala-Grasses 83. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 565. 2004. **Fig. 30A**

Annuals. Culms tufted, erect; nodes glabrous. Leaves lanceolate, 2–6 × 0.2–0.4 cm, acuminate at apex, rounded at base, villous with tubercled hairy, green; sheaths 1–4 cm long, slightly keeled, glabrous or villous. Ligules ovate, membranous.

Racemes solitary, 2–4 cm long; rachis flattened, *c.* 1 mm wide, sparsely ciliate. Spikelets obovate, 5–6 mm long, callus cuneate, golden yellow hairs, 1–1.5 mm long; pedicels c. 0.5 mm long; joints concave. Lower glumes lanceolate, 3.5–4 × 0.7–1 mm, acuminate at apex, cuneate at base, coriaceous, broadly winged, wings shortly ciliate, 1-nerved. Upper glumes elliptic-lanceolate, 5–5.5 × 1–1.5 mm, acuminate at apex, cuneate at base, coriaceous, broadly winged, wing *c.* 0.5 mm wide, corky at base, papery towards apex, shortly ciliate, 1-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas oblanceolate, 3–3.5 × 0.5–0.8 mm, acute at apex, cuneate at base, delicate, hyaline, ciliate, faintly 1-nerved. Second lemmas ovate, 3–3.5 × 0.7–1 mm, 2-lobed and awned at apex, delicate, glabrous, 1-nerved; awns 12–15 mm long, geniculate. Stamens 2. Ovary elliptic; stigma plumose.

Distribution: SW. and S. India (POWO, 2023); *Habitat*: Moist hill slopes, rocky grasslands; *Fl. & Ft.*: October-December.

Specimens examined: Meenuliyanpara, 29.11.2019, *Dani Francis & Santhosh Nampy* 164634; Padikkappu, 28.12.2017, *Dani Francis & Santhosh Nampy* 156577 (CALI).

Dimeria deccanensis Bor, Kew Bull. 7(4): 578. 1953; Bor, Grasses Burma, Ceylon, India & Pakistan 140. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 89. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 566. 2004.

Annuals. Culms tufted, geniculate or erect; nodes hairy or glabrous. Leaves linear-lanceolate, 2–6 × 0.2–0.4 cm, acuminate at apex, rounded at base, tubercled hairy, green; sheaths 1–3 cm long, slightly keeled, glabrous or villous. Ligules truncate, membranous, fimbriate. Racemes 2, 2–5 cm long; rachis flat, *c.* 0.7 mm wide, narrowly winged, scabrid. Spikelets oblanceolate, 2.5–3 mm long, callus hairy, *c.* 0.5 mm long; pedicels *c.* 0.3 mm long. Lower glumes linear-lanceolate, 2.5–3 × 0.1–0.2 mm, acuminate at apex, cuneate at base, coriaceous, 1-nerved, keeled, keel ciliate. Upper glumes lanceolate, 2.5–3 × 0.3–0.5 mm, acuminate at apex, cuneate at base, coriaceous, 1-nerved, keeled; keel narrowly winged, ciliate. Lower florets empty, epaleate. Upper florets bisexual. First lemmas oblanceolate, 1–1.5 × 0.1–0.2 mm, acute at apex, cuneate at base, delicate, hyaline, ciliate towards apex, faintly 1-nerved. Second lemmas ovate, 1.5–2 × 0.8–1 mm, notched and awned at

apex, delicate, glabrous, 1-nerved; awn 8–10 mm long. Stamens 2. Ovary oblong; stigma plumose.

Distribution: S. India (POWO, 2023); *Habitat*: Moist hill slopes and rocky grasslands; *Fl. & Ft.*: October-February.

Specimen examined: Koyimanchola, 10.02.2021, *Dani Francis & Santhosh Nampy* 188714 (CALI).

Dimeria fischeri Bor, Kew Bull. 7: 564. 1952; Bor, Grasses Burma, Ceylon, India & Pakistan 140. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 89. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 566. 2004.

Annuals. Culms slender, geniculate; nodes sparsely hairy. Leaves linear-lanceolate, 0.5–3 × 0.05–0.1 cm, acuminate at apex, rounded at base, sparsely tubercled hairy, green; sheaths 1–2 cm long, slightly keeled, tubercled hairy. Ligules ovate, membranous. Racemes solitary, 0.5–4 cm long; rachis flat, 0.7–1 mm wide, scabrous. Spikelets oblong-lanceolate, 2–3 mm long, callus hairy, *c.* 0.5 mm long. Lower glumes linear-lanceolate, 1.5–2 × 0.1–0.2 mm, acuminate at apex, cuneate at base, chartaceous, sparsely ciliate. Upper glumes oblong-lanceolate, 1.5–2 × 0.3–0.5 mm, acute at apex, cuneate at base, coriaceous, broadly winged, corky at base, papery towards apex, ciliate, 1-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas oblanceolate, 1–1.5 × 0.1–0.2 mm, acute at apex, cuneate at base, delicate, hyaline, ciliolate, 1-nerved. Second lemmas ovate, 1.5–2 × 0.4–0.5 mm, notched and awned at apex, delicate, hyaline, glabrous, 1-nerved; awns 8–10 mm long, geniculate. Stamens 2. Ovary elliptic; stigma plumose.

Distribution: S. India (POWO, 2023); *Habitat*: Open and rocky grasslands; *Fl. & Ft.*: October-December.

Specimen examined: Meenuliyanpara, 29.10.2020, *Dani Francis & Santhosh Nampy* 170091 (CALI).

Dimeria idukkiensis Ravi & Anil Kumar, Rheedea 2: 104. 1992; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 566. 2004.

Annuals. Culms slender, glabrous; nodes hairy. Leaves linear-lanceolate, 4–5 × 0.3–0.5 mm, acuminate at apex, slightly rounded at base, tubercled hairy on

margins and veins, green; sheaths *c.* 6.5 cm long, prominently keeled on the back towards apex. Ligules transversely oblong, membranous, fimbriate at the truncate apex. Racemes 2, sometimes 1, slightly divergent; rachis triquetrous, winged, keeled and zig-zag on the front; pedicels 5–7 mm long. Spikelets elliptic-oblong, 4.5–5.5 mm long, awned; callus hairy. Lower glumes linear-elliptic, 3–3.5 × 0.4–0.5 mm, acute and shortly curved at apex, cuneate at base, scaberulous along back and sides, especially towards apex and base, ciliate on the keel in the lower half, sometimes shortly towards the margins below middle, keeled; keel narrowly winged in the upper two thirds. Upper glumes elliptic-oblong, 4–5.2 × 0.5–0.7 mm, acute to shortly acuminate at apex, cuneate at base, keeled, prominently winged in the upper 1/2 to 2/5 of the keel with long ciliate hairs along the back from above or below the middle except the tip, sparsely ciliate in the middle towards the margins. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas oblanceolate, 2–2.5 × 0.8–1 mm, acute at apex, cuneate at base, sparsely ciliate on the margins towards upper half. Second lemmas elliptic-lanceolate, 2-cleft at apex, awned; awn *c.* 12 mm long. Stamens 2. Ovary *c.* 0.5 mm long; stigma plumose.

Distribution: SW. India (POWO, 2023); *Habitat*: Open and rocky grasslands; *Fl. & Ft.*: October-December.

Specimen examined: Kuttikkanam, Peermade, 19.10.1991, *Anil Kumar N.* 3190 (MH).

Notes: *Dimeria idukkiensis* is related to *D. orissae* Bor and *D. kanjirapallilana* Jacob, but differs by its ciliate rachis. It is also distinguished by bearded culm nodes, a prominently hairy sheath, non-scabrid blades with long tubercled hairs on the margins and veins, longer spikelets, lower glumes ciliate in the lower half of the keel, and upper glumes prominently winged in the upper half of the keel with long hairs along the back. It is distinguished from *D. kanjirapallilana* by its ciliate rachis, non-divaricate racemes, and larger spikelets (Ravi & Anil Kumar, 1992).

Dimeria kanjirapallilana Jacob, J. Bombay Nat. Hist. Soc. 47: 48. 1947; Sreek. & V.J.Nair, Fl. Kerala-Grasses 91. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 566. 2004.

Annuals. Culms tufted, erect or geniculate; nodes sparsely hairy or glabrous. Leaves linear- lanceolate, 3–10 × 0.2–0.4 cm, acuminate at apex, rounded at base, sparsely ciliate with tubercled hairs, green; sheaths 2–3 cm long, keeled, glabrous. Ligules ovate, membranous. Racemes 2, divaricate, 2–7 cm long; rachis flat, 0.5–0.7 mm wide, zig zag, sparsely ciliate and narrowly winged at margins. Spikelets sessile, lanceolate, 3.5–4 mm long, callus cuneate, golden yellow hairy. Lower glumes linear-lanceolate, 3–3.5 × 0.2–0.3 mm, acuminate at apex, cuneate at base, chartaceous, scabrid. Upper glumes lanceolate, 3.5–4 × 0.3–0.5 mm, acuminate at apex, cuneate at base, chartaceous, narrowly winged towards apex, keels ciliate. Lower florets empty, epaleate. Upper florets bisexual. First lemmas oblong, 1.5–2 × 0.4–0.5 mm, obtuse at apex, cuneate at base, delicate, hyaline, ciliate towards apex, 1-nerved. Second lemmas ovate, 2–2.5 × 0.4–0.5 mm, notched and awned at apex, cuneate at base, delicate, hyaline, glabrous, 1-nerved; awn 8–12 mm long, geniculate. Stamens 2. Ovary oblong; stigma plumose.

Distribution: S. India (POWO, 2023); *Habitat*: Rocky grasslands; *Fl. & Ft.*: October-December.

Specimens examined: Kattadikadavu, 07.12.2018, *Dani Francis & Santhosh Nampy* 167820; Meenuliyanpara, 26.10.2020, *Dani Francis & Santhosh Nampy* 170098; *Ibid*., 29.11.2019, *Dani Francis & Santhosh Nampy* 164623 (CALI).

Euclasta Franch.,

Bull. Soc. Hist. Nat. Autun 8: 335. 1895.

Euclasta oligantha (Hochst. ex Steud.) M.R.Almeida, Fl. Maharashtra 6A: 147. 2014. *Andropogon oliganthus* Hochst. ex Steud., Syn. Pl. Glumac. 1: 368. 1854; Hook.f., Fl. Brit. India 7: 201. 1896. *Dichanthium oliganthum* (Hochst. ex Steud.) Cope, Kew Bull. 35(3): 703. 1980; Sreek. & V.J.Nair, Fl. Kerala-Grasses 79. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 812, 813. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 563. 2004. *Indochloa oligantha* (Hochst. ex Steud.) Bor, Kew Bull. 9: 79. 1954; Bor, Grasses Burma, Ceylon, India & Pakistan 171. 1960.

Annuals. Culms erect or decumbent; nodes glabrous. Leaves lanceolate, 4–10 × 0.2–0.5 cm, acuminate at apex, rounded at base, undulate on one margin, densely villous, green; sheaths 2–6 cm long, slightly keeled, ciliate; internodes with a

translucent median line. Ligules ovate, membranous. Racemes solitary, rarely 2, 2–7 cm long, hairy at base; joints linear, 2–2.5 mm long, densely villous along margins. Sessile spikelets oblong-lanceolate, 3–5 mm long, callus hairy. Lower glumes oblong, 3–4 × 0.8–1 mm, obtuse at apex, cuneate at base, puberulous, faintly 5-nerved. Upper glumes lanceolate, 3–4 × 1.5–2 mm, obtuse at apex, cuneate at base, ciliate towards apex, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas oblong-lanceolate, 2–3 × 0.8–1 mm, acute at apex, cuneate at base, delicate, hyaline, ciliate, faintly 3-nerved. Second lemmas stipitate, reduced to hyaline base of awn, 1–2 mm long; awn 20–40 mm long. Stamens 2. Ovary oblong; stigma plumose. Pedicelled spikelet ovate-oblong, 5–6 mm long, unawned; pedicels linear, 2–3 mm long, with a translucent median line, densely villous along margin. Lower glumes ovate-oblong, 5–6 × 1.5–2 mm, acute at apex, cuneate at base, ciliate towards apex, 11–13-nerved. Upper glumes oblong, 3–4 × 0.8–1 mm, obtuse at apex, cuneate at base, delicate, ciliate, faintly 3-nerved. Florets absent.

Distribution: S. India and Myanmar (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-January.

Specimens examined: Anamudi slopes, 19.11.1965, *B.V. Shetty* 26532, 26543 (MH); Anamudi Shola National Park, 25.01.2018, *Dani Francis & Santhosh Nampy* 158280; Brooks peak, 21.12.1996, *Jomy Augustine* 17027; way to honeymoon cottage, Meesapulimala, 20.11.2018, *Dani Francis & Santhosh Nampy* 167741; Mesthirikettu, 30.12.2017, *Dani Francis & Santhosh Nampy* 158091 (CALI); Peermade, 03.12.1941, *K.C. Jacob* 20239 (MH); Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164887; Rhodomansion, Meesapulimala, 21.11.2018, *Dani Francis & Santhosh Nampy* 167784 (CALI).

Eulalia Kunth,

Revis. Gramin. 1: 160. 1829.

Eulalia phaeothrix (Hack.) Kuntze, Revis. Gen. Pl. 2: 775. 1891; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1715. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 156. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 102. 1991; K.M.Matthew, Illustr. Fl.

Palni Hills 829. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 572. 2004. *Pollinia phaeothrix* Hack. in A.DC & C.DC, Monogr. Phan. 6: 168. 1889; Hook.f., Fl. Brit. India 7: 112. 1896.

Perennials. Culms tufted; nodes glabrous. Leaves linear-lanceolate, 5–30 × 0.3–0.6 cm, acuminate at apex, rounded at base, densely hairy adaxially, green; sheaths 6–10 cm long, chocolate brown woolly. Ligules a dense tuft of white hairs. Racemes 3–8, digitate or sub-digitate, 3–15 cm long, golden yellow-brownish; joints turbinate, 2.5–3 mm long, densely brownish-golden yellow hairy. Sessile spikelets elliptic-lanceolate, 3.5–5 mm long, densely villous with golden yellow or brownish hairs; callus hairy. Lower glumes oblong-lanceolate, 3.5–5 × 0.8–1 mm, acute at apex, cuneate at base, chartaceous, densely villous, 2–4-nerved. Upper glumes lanceolate, 4–4.5 × 1.5–2 mm, acute at apex, cuneate at base, ciliate towards apex, 1–3-nerved, keeled dorsally. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas oblong-lanceolate, 3.5–4 × 0.5–1 mm, acute at apex, cuneate at base, hyaline, ciliate along margin, faintly 2-nerved. Second lemmas oblong-lanceolate, 2.5–3 × 0.8–1 mm long, notched and awned at apex, cuneate at base, glabrous, faintly 1–3-nerved; awns 12–15 mm long. Stamens 3. Ovary elliptic; stigma plumose. Pedicelled spikelet elliptic, 4–4.5 mm long, awned or not, densely villous; pedicels turbinate, 2–3 mm long, densely ciliate. Lower glumes elliptic, 4–4.5 × 1–1.5 mm, acute at apex, cuneate at base, densely villous, 2–4-nerved. Upper glumes lanceolate, 4–4.5 × 1.5–2 mm, acute at apex, cuneate at base, ciliate towards apex, 1–3-nerved, keeled dorsally. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas oblong-lanceolate, 3.5–4 × 0.5–1 mm, acute at apex, cuneate at base, hyaline, ciliate along margin, faintly 2-nerved. Second lemmas oblong-lanceolate, 2.5–3 × 0.8–1 mm long, notched and awned at apex, cuneate at base, glabrous, faintly 1–3-nerved.

Distribution: India, Sri Lanka and S. Central China to Indo-China (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: August-January.

Specimens examined: Choondal, 04.01.2017, *Dani Francis & Santhosh Nampy* 151504 (CALI); Eravikulam, 03.11.1979, *s.coll, s.n.* (KFRI).

Glyphochloa Clayton,

Kew Bull. 35(4): 814. 1981.

Glyphochloa forficulata (C.E.C.Fisch.) Clayton, Kew Bull. 35(4): 815. 1981; Sreek. & V.J.Nair, Fl. Kerala-Grasses 109. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 573. 2004. *Manisuris forficulata* C.E.C.Fisch., Bull. Misc. Inform. Kew 1933: 355. 1933; Bor, Grasses Burma, Ceylon, India & Pakistan 192. 1960.

Annuals. Culms tufted, erect; nodes glabrous or sparsely hairy. Leaves linear-lanceolate, 2–10 × 0.2–0.4 cm, acute at apex, rounded at base, glabrous or densely tubercled hairy, green; sheaths 1–5 cm long, keeled, tubercled hairy. Ligules ovate, membranous. Racemes spicate, 1–5 cm long; joints clavate, 1–2 mm long. Sessile spikelets ovate-oblong, 4–6 mm long, callus sparsely hairy. Lower glumes ovate-oblong, 4–8 × 1–3 mm, upper half broadly winged on both sides, 4–5 transverse ridged, 2-cleft, 2-awned, lower half coriaceous with tubercles and marginal hooks; wings 2–4 mm wide; awns 3–5 mm long, scabrid. Upper glumes oblong, 2–3 × 0.5–1 mm, acute at apex, cuneate at base, chartaceous, glabrous, 3-nerved. Lower florets empty. Upper florets bisexual. First lemmas oblong-lanceolate, 2–3 × 1–1.5 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous, faintly 2–3-nerved. Paleas elliptic, 2–3 × 0.4–0.5 mm, obtuse at apex, cuneate at base, delicate, glabrous, faintly 2-nerved. Second lemmas elliptic-ovate, 2–3 × 0.5–1 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous, faintly 2–3-nerved. Paleas elliptic-lanceolate, 1–2 × 0.4–0.5 mm, obtuse at apex, cuneate at base, delicate, glabrous, 2-nerved. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelet oblong-lanceolate, 4–6 mm long, awned; pedicels fused with rachis, 1–3 mm long, ciliate at apex. Lower glumes oblong-lanceolate, 4–6 × 1–2 mm, acuminate and awned at apex, cuneate at base, chartaceous, 5–7-nerved, winged on one side; wing 2–5 mm long; awn 2–4 mm long, scabrid. Upper glumes lanceolate, 4–6 × 0.5–1 mm, acuminate at apex, cuneate at base, delicate, glabrous, faintly 1-nerved, winged, wing keeled. Florets male or empty.

Distribution: India (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-December.

Specimen examined: Parunthanpara, 15.10.2015, *Thoiba K.* 146617 (CALI).

Notes: This species shows variations in the ornamentation and awns of the lower glumes, usually lower glumes have 4–5 annular, transverse ridges, but sometimes the glumes are smooth and glabrous (Sreekumar & Nair, 1991).

Hackelochloa Kuntze,

Revis. Gen. Pl. 2: 776. 1891.

Hackelochloa granularis (L.) Kuntze, Revis. Gen. Pl. 2: 776. 1891; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1758. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 159. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 111. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 573. 2004. *Cenchrus granularis* L., Mant. Pl. 2: 575. 1771. *Manisuris granularis* (L.) L.f., Amoen. Acad., Schreb. 40. 1790; Hook.f., Fl. Brit. India 7: 159. 1896.

Annuals. Culms erect; nodes densely villous. Leaves linear-lanceolate, 5–20 × 0.2–1.5 cm, obtuse or blunt at apex, rounded at base, tubercled hairy, green; sheaths 2–6 cm long, keeled, tubercled hairy. Ligules ovate, membranous. Racemes solitary or aggregated into a spatheate false panicle. Joints and pedicels fused, *c.* 1.5 mm long, swollen and cupuliform at apex. Sessile spikelets globose, 1–2 mm long, awnless. Lower glumes hemispherical, 1–2 × 1–1.5 mm, rounded at apex, rounded at base, crustaceous, glabrous, 7–9-nerved, cartilaginous, pitted. Upper glumes ovate-oblong, 1–1.5 × 0.8–1 mm, sub-rounded at base and apex, glabrous, adhering below the cavity of joint, faintly 3-nerved. Lower florets empty, epaleate. Upper florets bisexual. First lemmas broadly ovate, 1–1.5 × 0.8–1 mm, obtuse at apex, cuneate at base, delicate, hyaline, glabrous, nerveless; Paleas absent. Second lemmas ovate, 0.5–1 × 0.4–0.6 mm, obtuse at apex, cuneate at base, delicate, hyaline, glabrous, nerveless. PPaleas ovate-lanceolate, 0.5–0.8 × 0.4–0.5 mm, obtuse at apex, cuneate at base, delicate, hyaline, glabrous, nerveless. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets broadly ovate, 1.5–2.5 mm long; pedicels 1–1.5 mm long, fused with rachis. Lower glumes broadly ovate, 1.5–2.5 × 0.8–1 mm, acute at apex, cuneate at base, 5–7-nerved, keeled, keel winged on one side, scabrous. Upper glumes boat shaped, 2–2.5 × 0.6–0.8 mm, acute at apex, cuneate at base, 5–7-nerved, strongly keeled; keel scaberulous, winged. Lower florets empty. Upper florets male or empty. First lemmas broadly ovate, 1.5–2 × 0.8–1 mm, obtuse at apex, cuneate at base, delicate, hyaline, glabrous,

nerveless. Second lemmas ovate-lanceolate, 1–1.5 × 0.8–1 mm, obtuse at apex, cuneate at base, delicate, hyaline, glabrous, nerveless. Paleas ovate-lanceolate, 1–1.5 × 0.8–1 mm, obtuse at apex, cuneate at base, delicate, hyaline, glabrous, nerveless. Stamens 3.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: July-February.

Specimen examined: Mangaladevi, Periyar Tiger Reserve, 07.08.1993, *Jomy Augustine* 12173 (CALI).

Heteropogon Pers.,

Syn. Pl. 2: 533. 1807.

Heteropogon contortus (L.) P.Beauv. ex Roem. & Schult., Syst. Veg. ed., 15. 2: 836. 1817; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1743. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 163. 1960; K.M.Matthew, Illustr. Fl. Palni Hills 836. 1996; Sreek. & V.J.Nair, Fl. Kerala-Grasses 112. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 574. 2004. *Andropogon contortus* L., Sp. Pl. 2: 1045. 1753; Hook.f., Fl. Brit. India 7: 199. 1896. **Fig. 30G**

Perennials. Culms tufted, erect or geniculate; nodes glabrous. Leaves linear-lanceolate, 2–20 × 0.2–0.5 cm, acute or blunt at apex, rounded at base, glabrous, green; sheaths 1–5 cm long, keeled, sparsely long hairy towards mouth. Ligules truncate, membranous, fimbriate. Racemes solitary, terete, 2–6 cm long with lower homogamous spikelet pairs and upper heterogamous; callus pungent. Homogamous sessile spikelets linear-lanceolate, 5–8 cm long, awnless. Lower glumes linear-lanceolate, 5–8 × 0.8–1 mm, acute at apex, cuneate at base, chartaceous, densely tubercled hairy or glabrous, many nerved. Upper glumes elliptic-lanceolate, 5–7 × 0.8–1 mm, acute at apex, cuneate at base, ciliate, 3-nerved. Lower florets empty, epaleate. Upper florets male, epaleate. First lemmas lanceolate, 4–8 × 1–1.5 mm, obtuse at apex, cuneate at base, ciliate, delicate, hyaline, glabrous, 3-nerved. Second lemmas linear-lanceolate, 4–6 × 0.8–1 mm, obtuse at apex, cuneate at base, ciliate, delicate, hyaline, glabrous, 1–3-nerved. Stamens 3. Homogamous pedicelled spikelets elliptic-lanceolate, 5–8 mm long; pedicels 1–2 mm long, glabrous. Lower glumes oblong-lanceolate, 5–8 × 1.5–2

mm, acute at apex, cuneate at base, chartaceous, winged on margins, tubercled hairy, many nerved. Upper glumes elliptic-lanceolate, 5–7 × 0.8–1 mm, acute at apex, cuneate at base, chartaceous, ciliate, 3-nerved; florets and parts similar to sessile spikelet. Heterogamous sessile spikelets linear-lanceolate, 5–8 mm long, awned; callus chocolate brown hairy. Lower glumes oblong, 5–8 × 1–1.5 mm, rounded at apex, sub-truncate at base, coriaceous, pubescent, 9–11-nerved. Upper glumes linear, 5–6 × 0.5–0.8 mm, sub-acute at apex, cuneate at base, coriaceous, sparsely pubescent, 3-nerved. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas oblong, 1–3 × 0.5–1 mm, acute at apex, cuneate at base, hyaline, ciliate towards apex, faintly 1-nerved. Second lemmas oblanceolate, 2–3 × 0.8–1 mm, reduced to hyaline base of awn, awned at apex, cuneate at base, delicate, hyaline, glabrous, 1-nerved; awns 3–10 cm long. Stamens 3. Ovary oblong; stigma plumose. Heterogamous pedicelled spikelets linear, 6–8 mm long; pedicels 2–3 mm long, hairy, twisted around the sessile spikelet. Glumes not broadly winged; florets and parts similar to homogamous pedicelled spikelet.

Distribution: Tropics and Sub-tropics to S. Central Europe (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: Throughout the year.

Specimens examined: Chinnar, 09.02.2021, *Dani Francis & Santhosh Nampy* 188860; Choondal, Mathikettan Shola National Park, 04.01.2017, *Dani Francis & Santhosh Nampy* 151536; near Lakkamkudi, Eravikulam National Park, 06.02.2018, *Drisya V.* 157833; Mangaladevi hills, Periyar Tiger Reserve, 12.10.2017, *Dani Francis & Santhosh Nampy* 156378 (CALI); way to Mangaladevi temple, 10.10.1976, *K. Vivekananthan* 48651; Meenmutty, 28.12.1983, *A.G. Pandurangan* 62562 (MH); Parunthanpara, 16.10.2015, *Drisya V.* 144249 (CALI).

Imperata Cirillo,

Pl. Rar. Neapol 2: 26. 1792.

Imperata cylindrica (L.) Raeusch., Nomencl. Bot. Pl. Illustr. ed., 3. 10. 1797; Sreek. & V.J.Nair, Fl. Kerala-Grasses 114. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 574. 2004. *Lagurus cylindricus* L., Syst. Nat. ed., 10. 2: 878. 1759. *Imperata cylindrica* var. *major* (Nees) C.E.Hubb., Grassess Mauritius 96. 1940; Bor, Grasses Burma, Ceylon, India & Pakistan 170. 1960. *Imperata cylindrica* var. *koenigii* (Retz.) Benth.

ex Pilg., Fragm. Fl. Philipp. 1: 137. 1904; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1707. 1934. *Imperata arundincea* Cirillo, Pl. Rar. Neapol. 2: 26. 1792; Hook.f., Fl. Brit. India 7: 106. 1896. **Fig. 30F**

Perennials. Culms tufted, erect, robust; nodes woolly hairy. Leaves linear, 40–100 × 1–5 cm, acuminate at apex, rounded at base, puberulous, green; sheaths 15–25 cm long, villous at mouth, ciliate. Ligules ovate, membranous. Panicles contracted, spiciform, 15–50 cm long, densely silky villous; peduncle sparsely hairy or glabrous; joints turbinate, 1.5–3 mm long, dilated at apex, densely long villous; pedicels turbinate, 0.5–1 mm long, dilated at apex, densely villous. Spikelets similar, paired, pedicelled, lanceolate, 2.5–3 mm long, cream; callus densely long villous. Lower glumes lanceolate, 2.5–3 × 0.8–1 mm, acuminate at apex, cuneate at base, sub-coriaceous, densely villous, 3–5-nerved, 2-keeled. Upper glumes lanceolate, 2.5–3 × 0.8–1 mm, acuminate at apex, cuneate at base, chartaceous, villous, 5-nerved, keeled. Lower florets empty. Upper florets bisexual. First lemmas linear, 2–2.5 × 0.8–1 mm, acute at apex, cuneate at base, ciliolate, hyaline, 1-nerved. Second lemmas linear, 2–2.5 × 0.1 mm, obtuse at apex, cuneate at base, hyaline, glabrous, 1-nerved. Paleas absent or minute. Stamens 3. Ovary oblong; stigma plumose.

Distribution: Medit. to Africa and Afghanistan (POWO, 2023); *Habitat*: Along banks of river; *Fl. & Ft.*: Throughout the year.

Specimen examined: Edamalakkudy, 15.03.2019, *Dani Francis & Santhosh Nampy* 158125 (CALI).

Notes: It is a rapidly spreading species in low-altitude grasslands. The rhizomes are extremely aggressive, making it difficult to uproot and eradicate the grass. This grass is ideal for thatching and the paper industry (Sreekumar & Nair, 1991).

Ischaemum L.,

Sp. Pl. 1049. 1753.

Key to the species

1. Racemes 3–10, paniculate ..... *I. Polystachyum*

1. Racemes usually paired, rarely solitary or 3, digitate or sub-digitate …….…….. 2

2. Margins of the lower glume of sessile spikelet expanded in the lower half 3

2. Margins of the lower glume of sessile spikelet narrowly and evenly inflexed from base to apex ..... *I. Commutatum*

3. Lower glumes of sessile spikelet broadly or narrowly winged towards apex .... *I. ciliare*

3. Lower glumes of sessile spikelet not winged towards apex ..... *I. timorense*

Ischaemum ciliare Retz., Observe. Bot. 6: 36. 1791; Hook.f., Fl. Brit. India 7: 133. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1721. 1934. *Ischaemum indicum sensu* Bor, Grasses Burma, Ceylon, India & Pakistan 180. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 137. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 577. 2004, *non* (Houtt.) Merr., 1938

Annuals. Culms creeping, rooting at nodes; nodes glabrous or sparsely hairy. Leaves lanceolate, 1–7 × 0.2–0.5 cm, acute at apex, rounded at base, glabrous or densely villous; sheaths 2–5 cm long, keeled. Ligules ovate, membranous. Racemes 2, 1–5 cm long; joints turbinate, 1.5–2 mm long, densely villous. Sessile spikelets ovate, 4–5 mm long, awned; callus sparsely hairy. Lower glumes oblong, 4–5 × 1–1.5 mm, notched and acuminate at apex, sub-truncate at base, sub-coriaceous, pubescent, faintly 7–9-nerved, broadly winged towards apex, wings ear shaped, long ciliate. Upper glumes boat shaped, 4–5 × 1.5–2 mm, aristate at apex, sub-truncate at base, 3–5-nerved, keeled dorsally, minutely winged, ciliate. Lower florets male. Upper florets bisexual. First lemmas ovate-lanceolate, 3.5–4 × 1–1.5 mm, acuminate at apex, cuneate at base, chartaceous, ciliate, 3-nerved. Paleas elliptic-lanceolate, 3–3.5 × 0.5–1 mm, acute at apex, cuneate at base, 2-nerved, 2-keeled. Stamens 3. Second lemmas oblong, 3.5–4 × 1.5–2 mm, notched and awned at apex, cuneate at base, delicate, hyaline, faintly 3-nerved; awn 8–12 mm long. PPaleas oblong, 3–3.5 × 0.8–1 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous, 2-nerved, 2-keeled. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets ovate, 4–4.5 mm long, awned; pedicels linear, 1.5–2 mm long, densely villous. Lower glumes ovate-lanceolate, 3.5–4 × 1–1.5 mm, acuminate at apex, sub-truncate at base, 9–11-nerved, winged on margins, wing densely villous towards apex. Upper glumes and florets similar to sessile spikelets.

Distribution: Indian Subcontinent to S. China and W. Malesia (POWO, 2023); *Habitat*: Grasslands and waste lands; *Fl. & Ft.*: January-December.

Specimens examined: Anamudi peak, 11.12.2019, *Dani Francis & Santhosh Nampy* 164566; Anamudi Shola National Park, 25.01.2018, *Dani Francis & Santhosh Nampy* 158276; Kodikulam, 08.02.2021, *Dani Francis & Santhosh Nampy* 188932; *Ibid*., 08.02.2021, *Dani Francis & Santhosh Nampy* 188939; Mangaladevi, Periyar Tiger Reserve, *s.d., Jomy Augustine* 14075; way to 8th plot, Meesapulimala, 20.11.2018, *Dani Francis & Santhosh Nampy* 167743; way to Meesapulimala, 20.11.2018, *Dani Francis & Santhosh Nampy* 167775 (CALI).

Notes: This species can be easily identified by its slender creeping culms and broad auriculate wings of the lower glumes with distinctly nerved upper portion. It also shows variation in indumentum of leaves and sheaths and width of glumes wing (Sreekumar & Nair, 1991).

Ischaemum commutatum Hack. in A.DC & C.DC, Monogr. Phan. 6: 209. 1889; Hook.f., Fl. Brit. India 7: 131. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1722. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 178. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 129. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 576. 2004.

Perennials. Culms stoloniferous, creeping or erect; nodes glabrous. Leaves elliptic-lanceolate, 4–13 × 0.5–1.5 cm, acuminate at apex, upper ones cordate at base, lower one slightly petioled, densely villous; sheaths 3–7 cm long, slightly keeled. Ligules ovate, membranous. Racemes 2, 3–5 cm long; joints linear-turbinate, 3–4 mm long, densely ciliate. Sessile spikelets oblong, 5–6 mm long, awned; callus hairy or glabrous. Lower glumes oblong, 5–6 × 1.5–2 mm, acute at apex, sub-truncate at base, crustaceous, hairy or glabrous, 11–13-nerved, margins narrowly and evenly inflexed from base to apex. Upper glumes ovate-lanceolate, 5–6 × 1.5–2 mm, acuminate at apex, sub-truncate at base, coriaceous, ciliate towards apex, faintly 3-nerved. Lower florets male. Upper florets bisexual. First lemmas oblong-lanceolate, 5–5.5 × 1–1.5 mm, acuminate at apex, cuneate at base, delicate, hyaline, ciliate towards apex, faintly 3–5-nerved. Paleas oblong-lanceolate, 4.5–5 × 0.8–1 mm, acute at apex, cuneate at base, delicate, hyaline, 2-nerved, 2-keeled. Stamens 3. Second lemmas oblong, 4–4.5 × 1.5–2 mm, notched and awned at apex, cuneate at base, delicate, hyaline, ciliolate; awn 10–15 mm long. Paleas oblong, 3.5–4 × 0.8–

1 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous, 2-nerved, 2-keeled. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets ovate, 4.5–5 mm long, awnless; pedicels linear, 3–4 mm long, densely ciliate along angles. Lower glumes ovate, 4–4.5 × 1.8–2 mm, acute at apex, sub-truncate at base, glabrous or hairy, 11–13-nerved, broadly winged on margins, wing scabrid. Upper glumes ovate-lanceolate, 4–4.5 1–1.5 mm, acuminate at apex, sub-truncate at base, glabrous or hairy, 3-nerved, keeled dorsally. Florets male. Lemmas and paleas similar to sessile spikelet. Second lemmas awnless.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Forests, grasslands and wetlands; *Fl. & Ft.*: April-December.

Specimens examined: Eravikulam National Park, *s.d., P.V. Sreekumar* 68420 (MH); Kalvarithode, 21.04.1994, *Jomy Augustine* 13630; Meesapulimala, way to 8th plot, 20.11.2018, *Dani Francis & Santhosh Nampy* 167742; Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164868; *Ibid*., near Subranshed, 30.12.2019, *Dani Francis & Santhosh Nampy* 170045 (CALI).

Notes: This species can be distinguished from other related species by its flat lower glumes of sessile spikelets, longer pedicels and joints, broadly winged lower glumes of sessile spikelets and distinctly petioled leaves (Sreekumar & Nair, 1991).

Ischaemum polystachyum J.Presl, Reliq. Haenk. 1: 328. 1830. *Ischaemum nilagiricum* Hack., Oesterr. Bot. Z. 51: 150. 1901; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1722. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 183. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 153. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 842. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 578. 2004. *Ischaemum hirtum* Hack. in A.DC & C.DC, Monogr. Phan. 6: 228. 1889.

Perennials. Culms tufted, erect; nodes glabrous. Leaves lanceolate, 5–18 × 0.5–1.5 cm, acuminate at apex, rounded at base, sparsely hairy; sheaths 3–7 cm long, keeled, pubescent. Ligules ovate, membranous, fimbriate. Racemes paniculate, 3–10, 2–8 cm long; joints linear-turbinate, 3–5 mm long, teeth like projections at apex, angles densely ciliate. Sessile spikelets elliptic-lanceolate, 5–6 mm long, awned; callus densely hairy. Lower glumes ovate-lanceolate, 4–5 × 1.5–2 mm,

notched at apex, sub-truncate at base, chartaceous, densely villous, 11–13-nerved. Upper glumes ovate-lanceolate, 5–6 × 1.5–2 mm, acuminate at apex, sub-truncate at base, pubescent, 5–7-nerved, keeled, ciliate towards apex. Lower florets male. Upper florets bisexual. First lemmas elliptic-lanceolate, 5–5.5 × 0.8–1 mm, acuminate at apex, cuneate at base, delicate, 3-nerved. Paleas elliptic-lanceolate, 4.5–5 × 0.8–1 mm, acute at apex, cuneate at base, delicate, hyaline, 2-nerved, 2-keeled. Stamens 3. Second lemmas oblong, 4–4.5 × 1.5–2 mm, notched and awned at apex, cuneate at base, delicate, hyaline, ciliate along the margin; awn 6–12 mm long. Paleas lanceolate, 4–5 × 0.5–1 mm, acute at apex, cuneate at base, delicate, hyaline, warty dots towards apex, 2-nerved, 2-keeled. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets elliptic-lanceolate, 5–6 mm long, awned; pedicels turbinate, 2–3 mm long, densely ciliate. Lower glumes ovate-lanceolate, 5–6 × 1.5–2 mm, acuminate at apex, sub-truncate at base, densely villous, 13–15-nerved. Upper glumes and florets similar to sessile spikelet.

Distribution: Tropical and Subtropical Old World (POWO, 2023); *Habitat*: Grasslands and wet areas; *Fl. & Ft.*: October-April.

Specimens examined: Chinnar, 27.01.2018, *Dani Francis & Santhosh Nampy* 158354; Mankulam, Hanging bridge, Tiger caves, 04.12.2018, *Dani Francis & Santhosh Nampy* 168858; Thannikkudy, Periyar Tiger Reserve, 08.01.1994, *Jomy Augustine* 13056; Vallakkadavu, 16.10.1994, *Jomy Augustine* 14213 (CALI).

Notes: This species is commonly found near water bodies and characterized by numerous paniculate racemes.

Ischaemum timorense Kunth, Révis. Gramin. 1: 369. 1830; Hook.f., Fl. Brit. India 7: 136. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1722. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 185. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 164. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 842. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 579. 2004.

Perennials. Culms tufted, creeping, stoloniferous, rooting at nodes; nodes hairy. Leaves linear-lanceolate, 2–10 × 0.2–0.7 cm, acuminate at apex, rounded at base, densely hairy; sheaths 1.5–4 cm long, keeled, pubescent. Ligules ovate, membranous. Racemes solitary or paired, 1–4 cm long; joints turbinate, 2–3 mm

long, long ciliate along one angle. Sessile spikelets ovate-lanceolate, 3–4 mm long, awned; callus cuneate, hairy. Lower glumes ovate-lanceolate, 3–4 × 1.5–2 mm, cuspidate at apex, sub-truncate at base, chartaceous, pilose towards apex, 7–9-nerved. Upper glumes ovate-lanceolate, 3–4 × 0.8–1 mm, slightly bifid and aristate at apex, sub-truncate at base, pubescent, 3-nerved; arista 2–3 mm long. Lower florets male. Upper florets bisexual. First lemmas oblong-lanceolate, 2.5–3 × 0.8–1 mm, acute at apex, cuneate at base, delicate, 3-nerved. Paleas lanceolate, 2.5–3 × 0.5–1 mm, acute at apex, cuneate at base, delicate, hyaline, 2-nerved, 2-keeled. Stamens 3. Second lemmas oblong, 2.5–3 × 0.8–1 mm, notched and awned at apex, cuneate at base, delicate, hyaline, glabrous, 3-nerved; awns 10–15 mm long. Paleas oblong-lanceolate, 2–2.5 × 0.5–1 mm, acute at apex, cuneate at base, delicate, hyaline, 2-nerved, 2-keeled. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets oblong-lanceolate, 3–4 mm long, awned; pedicels turbinate, 1.5–2 mm long, ciliate. Lower glumes ovate-lanceolate, 3–4 × 1–1.5 mm, acuminate and shortly aristate at apex, sub-truncate at base, pubescent towards upper half, 5–7-nerved. Upper glumes and florets similar to sessile spikelet.

Distribution: Tropical and Subtropical Asia to W. Pacific (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-December.

Specimens examined: Above Cheeyappara waterfalls, near river, 27.12.2017, *Dani Francis & Santhosh Nampy* 156504; Kattadikadavu, 12.10.2019, *Dani Francis & Santhosh Nampy* 170362; Meenuliyanpara, 12.12.2016, *Dani Francis & Santhosh Nampy* 151414; *Ibid*., 29.11.2019, *Dani Francis & Santhosh Nampy* 164613 (CALI); Peermade, 02.12.1941, *K.C. Jacob* 20225 (MH).

Notes: This species can be differentiated from the allied species by its long, creeping and stoloniferous culms.

Microstegium Nees,

Intr. Nat. Syst. Bot., ed. 2. 447. 1836.

Microstegium fasciculatum (L.) Henrard, Blumea 3: 453. 1940. *Andrpogon fasciculatus* L., Sp. Pl. 2: 1047. 1753. *Microstegium ciliatum* (Trin.) A.Camus in H.Lecomte *et al.*, Fl. Indo-Chine 7: 259. 1922; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1716. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 193. 1960; Sreek. &

V.J.Nair, Fl. Kerala-Grasses 172. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 847. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 581. 2004. *Pollinia ciliata* Trin., Mem. Acad. Imp. Sci. St.-Petersbourg ser. 6. Sci. Math. 2: 306. 1832; Hook.f., Fl. Brit. India 7: 116. 1896.

Perennials. Culms tufted, creeping, rooting at lower nodes; nodes glabrous. Leaves elliptic-lanceolate, 3–15 × 0.2–1 cm, acuminate at apex, attenuate at base, scabrous along margin, puberulous or glabrous, green; sheaths 3–5 cm long, glabrous, sometimes puberulous. Ligules obscure. Racemes 3–15, sub-digitate, 2–10 cm long, flexuous; joints linear-clavate, densely ciliate. Sessile spikelets oblong-lanceolate, 4–5 mm long, awned, callus hairy. Lower glumes lanceolate, 4–5 × 0.6–1 mm, notched at apex, cuneate at base, dorsally grooved, 2–5-nerved, 2-keeled, keels sparsely ciliate. Upper glumes lanceolate, 3–4 × 0.3–0.5 mm, awned at apex, cuneate at base, infolded at margin, pubescent, 3-nerved, strongly keeled, keels scabrous; awns 1–2 mm long. Lower florets absent. Upper florets bisexual, epaleate. Lemmas ovate-lanceolate, 0.5–1 × 0.3–0.5 mm, reduced to hyaline base of awn, awned at apex, hyaline, glabrous, nerveless; awn 5–15 mm long. Paleas ovate, *c.* 0.5 × 0.2 mm, acute at apex, cuneate at base, hyaline, delicate, glabrous. Stamens 3; Ovary oblong; stigma plumose. Pedicelled spikelets lanceolate, 4–5 mm long; pedicels 2–3 mm long, ciliate. Lower glumes lanceolate, 4–5 × 0.6–1 mm, notched at apex, cuneate at base, dorsally flat, 2–5-nerved, 2-keeled, keels serrulate. Upper glumes lanceolate, 3–4 × 0.3–0.5 mm, awned at apex, cuneate at base, pubescent, 3-nerved, strongly keeled, keels scabrous; awn 1–2 mm long. Florets similar to sessile spikelets.

Distribution: Uganda to Malawi, Tropical and Subtropical Asia (POWO, 2023); *Habitat*: Moist deciduous forests and grasslands; *Fl. & Ft.*: March-August.

Specimen examined: Mlappara, 28.07.1993, *Jomy Augustine* 12150 (CALI).

Pogonatherum P.Beauv.,

Ess. Agrostogr. 56. 1812.

Pogonatherum crinitum (Thunb.) Kunth, Enum. Pl. 1: 478. 1833; Hook.f., Fl. Brit. India 7: 141. 1896; Bor, Grasses Burma, Ceylon, India & Pakistan 200. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 176. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 588. 2004. *Andropogon crinitus* Thunb. in J.A.Murray (ed.), Syst. Veg. ed. 14. 903. 1784.

Perennials. Culms densely tufted with root stock; nodes sparsely hairy or glabrous. Leaves lanceolate, 1–7 × 0.1–0.5 cm, acuminate at apex, narrowed at base, pubescent; sheaths 1.5–3 cm long, slightly keeled, villous towards mouth along one margin. Ligules thin, membranous, fimbriate. Racemes solitary, 1–4 cm long, fragile; joints long bearded. Sessile spikelets lanceolate, 1.5–2 mm long, awned; callus long bearded. Lower glumes oblong, 1–1.5 × 0.3–0.5 mm, truncate and ciliate at apex, sub-truncate at base, slightly 2-keeled, 2-nerved. Upper glumes boat shaped, 1.5–2 × 0.5–1 mm, awned at apex, cuneate at base, ciliate, 3-nerved; awn 15–25 mm long. Lower florets empty, epaleate. Upper florets bisexual. First lemmas ovate-oblong, *c.* 1 × 0.5 mm, obtuse at apex, cuneate at base, hyaline, glabrous, 1-nerved. Second lemmas oblong, 1–1.5 × *c.* 0.5 mm, notched and awned at apex, cuneate at base, delicate, hyaline, glabrous, 1-nerved; awn 20–30 cm long. Paleas oblong, *c.* 1 × 0.5 mm, rounded at apex, sub-truncate at base, hyaline, glabrous, 2-nerved, 2-keeled. Stamen 1. Ovary elliptic; stigma plumose. Pedicelled spikelets as similar to sessile spikelets; pedicels long bearded. Callus hairs 1.5–4 mm long.

Distribution: Madagascar, Tropical and Subtropical Asia to Marianas (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: November-May.

Specimens examined: Attathode, 03.11.1993, *Jomy Augustine* 12743 (CALI); near Kappakkanam, 27.05.1982, *C.N. Mohanan* 74051; Munnar, 30.05.1944, *K.C. Jacob* 20498 (MH); way to Panamkutty, 09.03.2017, *Dani Francis & Santhosh Nampy* 152063 (CALI).

Notes: It is closely allied to *P. paniceum* (Lam.) Hack., but differs by its smaller spikelets, empty lower florets, solitary stamen of the upper florets and long callus hairs and awns (Sreekumar & Nair, 1991).

Polytoca R.Br.,

in Bennett, Pl. Jav. Rar. 20. 1838.

Polytoca gigantea (J.Koenig) Mabb., Mabberley's Pl.-Book. ed. 4: 1102. 2017. *Coix gigantea* J.Koenig, Naturforscher 23: 211. 1788. Hook.f., Fl. Brit. India 7: 118. 1896. *Chionachne koenigii* (Spreng.) Thwaites, Enum. Pl. Zeyl. 357. 1864; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1706. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan

262. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 205. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 558. 2004. *Polytoca barbata* (Roxb.) Stapf in Hook.f., Fl. Brit. India 7: 102. 1896.

Perennials. Culms densely tufted, erect or decumbent; nodes densely hairy. Leaves linear-lanceolate, 10–55 × 0.5–1.5 cm, acuminate at apex, rounded at base, tubercled hairy, green; sheaths 5–11 cm long, tubercled hairy, ciliate towards mouth. Ligules membranous, fimbriate. Panicles branched with clusters of racemes, 10–25 cm long, interrupted, subtended by leafy spathes, racemes subtended by spatheoles; spathes leafy, oblanceolate, 2–2.5 × 0.5–1 cm, aristate at apex, cuneate at base, ciliate; spatheoles obovate, 1–1.5 × 0.5–1 cm, coriaceous, aristate at apex, sub-truncate at base, glabrous. Racemes 2 or 3 per spatheole, each 2–4 cm long, male or male above with a solitary female spikelet at base. Male spikelets elliptic, solitary or paired, 6–10 × 2–4 mm. Lower glumes ovate-lanceolate, 5–10 × 2–2.5 mm, acute-acuminate at apex, cuneate at base, winged at margins, glabrous or ciliate, 10–13-nerved. Upper glumes elliptic-lanceolate, 5–8 × 1.5–2 mm, acuminate at apex, cuneate at base, chartaceous, 7-nerved, not keeled, glabrous-ciliate. First lemmas elliptic-lanceolate, 5–10 × 1.5–3 mm, acute at apex, cuneate at base, chartaceous, glabrous, 7–9-nerved. Paleas lanceolate, 5–8 × 1–1.5 mm, acute at apex, cuneate at base, 2-keeled, 2-nerved. Second lemmas lanceolate, 5–8 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, 1–3-nerved. Paleas lanceolate, 5–8 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous, 2-nerved. Lodicules 2. Stamens 3. Female spikelets ovate-oblong, 4–6 × 2–3 mm, slightly bifid at apex, sub-truncate at base, glabrous. Ovary ovate; stigma plumose.

Distribution: Indian Subcontinent to W. Malaysia (POWO, 2023); *Habitat*: River banks; *Fl. & Ft.*: July-October.

Specimen examined: Mullakkudy, 02.08.1994, *Jomy Augustine* 13851 (CALI).

Notes: This species is similar to *P. semiteres* Benth. ex Hook.f., but differs in its solitary female involucre and broader leaves. Grazing animals avoid this plant because of its irritating hairs on the leaves and sheaths (Jannink & Veldkamp, 2002).

Pseudanthistiria (Hack.) Hook.f.,

Fl. Brit. India 7: 219. 1896.

Pseudanthistiria umbellata (Hack.) Hook.f., Fl. Brit. India 7: 220. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1749. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 204. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 181. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 588. 2004; Drisya & Pradeep, Rheedea 31(4): 235–247. 2021. *Andropogon umbellatus* Hack. in A.DC & C.DC, Monogr. Phan. 6: 401. 1889.

Annuals. Culms creeping or decumbent, rooting at lower nodes, purple; nodes glabrous. Leaves elliptic-lanceolate, 1–10 × 0.3–0.6 cm, acuminate at apex, rounded at base, glabrous, green; sheaths slightly keeled. Ligules truncate, membranous. Panicles loose, 10–40 cm long. Sessile spikelets 2 in a raceme, oblong, 3–4 mm long, awned, callus white shaggy hairy. Lower glumes elliptic-oblong, 3–4 × *c*. 1 mm, truncate at apex, cuneate at base, glabrous, 5–7-nerved. Upper glumes elliptic-lanceolate, 3–4 × 0.3–0.5 mm, acute at apex, cuneate at base, chartaceous, glabrous, 3-nerved, dorsally keeled. Lower florets wanting. Upper florets bisexual. Second lemmas oblanceolate, 2–3 mm long, reduced by a hyaline base of awn, 1-nerved; awn 15–30 mm long. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets 3 in a raceme, narrowly elliptic-lanceolate, 4–6 mm long, awnless; pedicels 1–2 mm long, hairy. Lower glumes elliptic-lanceolate, 4–5 × *c*. 1 mm, acute at apex, cuneate at base, chartaceous, softly hairy or glabrous, 11-nerved. Upper glumes elliptic, 4–5 × 0.8–1 mm, acute at apex, cuneate at base, chartaceous, glabrous, 3-nerved. Upper florets male. Stamens 3.

Distribution: S. India, Sri Lanka and S. Myanmar to Thailand (POWO, 2023); *Habitat*: Open grasslands, margins of forests; *Fl. & Ft.*: November-March.

Specimens examined: Peermade, 03.12.1941, *K.C. Jacob* 20241; *Ibid*., Pullupara, 24.11.1967, *K. Vivekananthan* 29335 (MH).

Notes: This species can be easily distinguished by its slender, creeping habit and short elliptic-lanceolate leaves.

Pseudopogonatherum A.Camus,

Ann. Soc. Linn. Lyon, n.s. 68: 204. 1921.

Pseudopogonatherum trispicatum (Schult.) Ohwi, Bull. Tokyo Sci. Mus. 18: 3. 1947. *Andropogon trispicatus* Schult., Mant. 2: 452. 1824. *Eulalia trispicata* (Schult.) Henrard, Blumea 3: 453. 1940; Bor, Grasses Burma, Ceylon, India & Pakistan 157. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 104. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 830. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 572. 2004. *Eulalia tristachya* Kuntze, Revis. Gen. Pl. 2: 776. 1891, *nom. superfl.*; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1715. 1934. *Pollinia argentea* (Brongn.) Trin., Bull. Sci. Acad. Sci. Saint-Petersbourg 1: 71. 1836; Hook.f., Fl. Brit. India 7: 111. 1896.

Perennials. Culms tufted; nodes hairy. Leaves linear-lanceolate, 5–35 × 0.3–0.8 cm, acuminate at apex, rounded at base, glabrous or sparsely hairy. Ligules membranous, with a tuft of long hairs. Racemes 3–15, digitate or sub-digitate, 5–20 cm long; rachis 1.5–2 mm long, densely villous; joints white hairy. Sessile spikelets elliptic-lanceolate, 3–4 mm long, awned. Lower glumes elliptic, 3–4 × 0.8–1 mm, acute at apex, cuneate at base, chartaceous, densely villous, 2-nerved, 2-keeled. Upper glumes elliptic, 3–4 × 0.8–1 mm, acute at apex, cuneate at base, ciliate, 1–3-nerved. Lower florets empty. Upper florets bisexual. First lemmas elliptic-lanceolate, 2.5–3 × 0.8–1 mm, acute at apex, cuneate at base, brown hairy along margin, nerveless. Second lemmas oblong, 2–2.5 × 0.8–1 mm, awned at apex, cuneate at base, hyaline, glabrous; awn 10–12 mm long. Stamens 3. Ovary elliptic; stigma plumose. Pedicelled spikelets elliptic-lanceolate, 3–3.5 mm long, awned or not; pedicels 1.5–2 mm long, densely villous, white. Glumes and florets similar to sessile spikelets.

Distribution: China to Tropical Asia and Queensland (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-May.

Specimens examined: Kattadikkadavu, 07.12.2018, *Dani Francis & Santhosh Nampy* 167824; Mangaladevi, 21.09.1993, *Jomy Augustine* 12457; Pettimudi, 29.12.2019, *Dani Francis & Santhosh Nampy* 164890 (CALI).

Pseudosorghum A.Camus,

Bull. Mus. Natl. Hist. Nat. 26: 662. 1920.

Pseudosorghum fasciculare (Roxb.) A.Camus, Bull. Mus. Natl. Hist. Nat. 26: 662. 1920; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1734. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 205. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 182. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 589. 2004. *Andropogon fascicularis* Roxb., Fl. Ind. 1: 269. 1820; Hook.f., Fl. Brit. India 7: 177. 1896.

Perennials. Culms erect or geniculate; nodes sparsely hairy or glabrous. Leaves linear-lanceolate, 10–30 × 0.5–0.8 cm, acuminate at apex, rounded at base, sparsely pubescent, green; sheaths 7–12 cm long, keeled, tubercled hairy towards apex, densely villous at margins. Ligules ovate, membranous. Panicles open, *c.* 15 cm long; joints dorsally rounded, ventrally flattened, densely bristly. Sessile spikelets lanceolate, 5–6 mm long; callus densely villous. Lower glumes elliptic-lanceolate, 4.5–5 × 1.5–2 mm, acute at apex, cuneate at base, pubescent, faintly 9–11-nerved, keeled. Upper glumes lanceolate, *c.* 5 × 1.5 mm, sub-acute at apex, cuneate at base, glabrous, faintly 7-nerved, slightly keeled dorsally. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas elliptic-lanceolate, 4–5 × 0.8–1 mm, acute at apex, cuneate at base, ciliate, delicate, 3–5-nerved. Second lemmas oblong-lanceolate, 3–4 × 0.8–1 mm, notched at apex, cuneate at base, delicate, glabrous; awns 15–25 mm long. Stamens 3. Ovary ovate; stigma plumose. Pedicelled spikelets linear-lanceolate, 4–5 mm long; pedicels 3–4 mm long, hairy. Lower glumes elliptic-oblong, 4–5 × 1–1.5 mm, sub-acute at apex, cuneate at base, puberulous, 11–13-nerved, keeled towards apex. Upper glumes lanceolate, 4–5 × 0.8–1 mm, acute at apex, cuneate at base, minutely ciliate, 7–9-nerved. Lower florets empty, epaleate. Upper florets male or empty, paleate. First lemmas lanceolate, 4–4.5 × 0.5–1 mm, acuminate at apex, cuneate at base, membranous, hyaline, glabrous, 2-nerved. Second lemmas ovate-lanceolate, 2–3 × 0.5–1 mm, acute at apex, cuneate at base, membranous, glabrous, 2 or 3-nerved. Paleas oblong, 0.5–1 × 0.3–0.5 mm, obtuse at apex, cuneate at base, membranous, glabrous, nerveless.

Distribution: Indian Subcontinent to S. Central China and Philippines (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-December.

Specimen examined: Mangaladevi, 28.11.1993, *Jomy Augustine* 12671 (CALI).

Rottboellia L.f.,

Suppl. Pl. 13. 1782, *nom. cons.*

Rottboellia cochinchinensis (Lour.) Clayton, Kew Bull. 35: 817. 1981; Sreek. & V.J.Nair, Fl. Kerala-Grasses 183. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 589. 2004. *Stegosia cochinchinensis* Lour., Fl. Cochinch. 51. 1790. *Rottboellia exaltata* L.f., Suppl. Pl. 114. 1782, *nom. illeg.*; Hook.f., Fl. Brit. India 7: 156. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1759. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 206. 1960.

Annuals. Culms tufted, with stilt roots at base; nodes glabrous. Leaves linear-lanceolate, 5–60 × 0.5–2 cm, acuminate at apex, rounded at base, sparsely tubercled hairy, green; sheaths 3–8 cm long, tubercled hairy. Ligules ovate, membranous. Spikes terete, 3–10 cm long, terminating in a tail of reduced spikelets; joints hollow, crustaceous, abscission oblique. Sessile spikelets ovate, 3–4 mm long, sunken in cavities of joints, callus annular. Lower glumes broadly ovate, 3–5 × 2–2.5 mm, acute-obtuse at apex, sub-truncate at base, coriaceous, granulate, faintly 13–15-nerved. Upper glumes boat shaped, 3–5 × 2–4 mm, muticous at apex, sub-truncate at base, coriaceous, 11–13-nerved, keeled, keel narrowly winged towards apex. Lower florets male or empty. Upper florets bisexual. First lemmas ovate-lanceolate, 3–5 × 1–1.5 mm, muticous at apex, cuneate at base, sub-coriaceous, glabrous, faintly 0–3-nerved. Paleas ovate-lanceolate, 3–4 × 1.5–2 mm, obtuse at apex, cuneate at base, delicate, hyaline, glabrous, nerveless. Stamens 3. Second lemmas boat shaped, 3–4 × 2–3 mm, acute at apex, cuneate at base, delicate, hyaline, glabrous, faintly 3-nerved. Paleas ovate-lanceolate, 3–4 × 1.5–2 mm, acute at apex, cuneate at base, membranous, hyaline, glabrous, faintly 0–2-nerved. Ovary oblong; stigma plumose. Pedicelled spikelets ovate-lanceolate, 3–5 mm long; pedicels clavate, 4–5 mm long, glabrous. Lower glumes elliptic-oblong, 3–5 × 1–1.5 mm, acute at apex, sub-truncate at base, chartaceous, glabrous, 13–15-nerved. Upper glumes boat shaped, 3–4 × 0.8–1 mm, acute at apex, sub-truncate at base, chartaceous, glabrous, 7-nerved. Lower florets male or empty. Upper florets often with reduced stamens. First lemmas ovate-lanceolate, 3–4 × 0.8–1 mm, acute at apex, cuneate at base, membranous, hyaline, glabrous, faintly 3-nerved. Paleas oblong, 1–3 × 0.5–1 mm, obtuse at apex, cuneate

at base, membranous, hyaline, glabrous, faintly 2-nerved. Second lemmas obovate-lanceolate, 1–3 × 0.5–1 mm, obtuse at apex, cuneate at base, hyaline, glabrous, nerveless. Paleas oblong, 1–3 × 0.5–1 mm, obtuse at apex, cuneate at base, hyaline, glabrous, faintly 0–2-nerved. Stamens 3.

Distribution: Tropical and Subtropical Old World to N. and NE. Australia (POWO, 2023); *Habitat*: Forests, grasslands and waste lands; *Fl. & Ft.*: August-March.

Specimens examined: Koruthode, 30.01.1995, *Jomy Augustine* 14741 (CALI); Painavu, 16.12.1982, *C.N. Mohanan* 76160; Thannikkudy, Periyar Tiger Reserve, 02.10.1972, *B.D. Sharma* 42385 (MH).

Notes: This grass has stilt roots that allow it to survive in semi-aquatic environments. It is considered as a troublesome weed (Correia, 2016).

Saccharum L.,

Sp. Pl. 1: 54. 1753.

Saccharum spontaneum L., Mant. Pl. 2: 183. 1771; Hook.f., Fl. Brit. India 7: 118. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1709. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 214. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 185. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 590. 2004. **Fig. 31G**

Perennials. Culms densely tufted, erect, rhizomatous; nodes glabrous or sparsely hairy. Leaves linear-lanceolate, 30–150 × 0.5–1.5 cm, acuminate at apex, rounded at base, puberulous, green; sheaths 15–25 cm long, elongate white hairs at mouth. Ligules ovate, membranous. Panicles effuse, 15–30 cm long, densely silky villous; peduncle soft hairy below; joints turbinate, 1.5–3 mm long, dilated at apex, densely long villous. Spikelets similar, paired one sessile and other pedicelled, similar, lanceolate, 3–4 mm long, brown; callus densely long villous. Lower glumes ovate-lanceolate, 3–4 × 0.8–1 mm, acuminate at apex, cuneate at base, sub-coriaceous below, delicate above, ciliate, glabrous, 2–3-nerved, slightly 2-keeled. Upper glumes ovate-lanceolate, 3–4 × 1–1.5 mm, acuminate at apex, cuneate at base, ciliate, chartaceous, 1-nerved, dorsally keeled. Lower florets empty. Upper florets bisexual. First lemmas ovate, 2–2.5 × 0.8–1 mm, acute at apex, cuneate at base,

ciliate, delicate, hyaline, 2–3-nerved. Second lemmas narrowly linear-lanceolate, 2–2.5 × *c*. 0.1 mm, obtuse at apex, cuneate at base, hyaline, glabrous. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets similar to sessile spikelets; pedicels turbinate, 0.5–1 mm long, dilated at apex, densely villous.

Distribution: Sicilia, Africa, Asia to N. and NE. Australia (POWO, 2023); *Habitat*: River banks; *Fl. & Ft.*: Throughout the year.

Specimens examined: Kaliyar, 07.02.2021, *Dani Francis & Santhosh Nampy* 173388; Neriamangalam, 26.12.2017, *Dani Francis & Santhosh Nampy* 156382 (CALI).

Notes: *Saccharum spontaneum* is well-known for its ability to colonise wastelands and marginal lands. The ecological significance of this species in terms of high biomass productivity and a strong root system suggests that it is a promising tall grass for restoring disturbed soils and colonising wastelands. In some countries, it is considered a weed or an invasive grass (Pandey *et al.*, 2015).

Schizachyrium Nees,

Fl. Bras. Enum. Pl. 2: 331. 1829.

Schizachyrium brevifolium (Sw.) Nees ex Buse in Miquel, Pl. Jungh. 19. 1854; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1752. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 215. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 186. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 590. 2004. *Andropogon brevifolius* Sw., Prodr. Veg. Ind. Occ. 26. 1788; Hook.f., Fl. Brit. Ind. 7: 165. 1896.

Annuals. Culms erect or geniculate; nodes glabrous. Leaves oblong-lanceolate, 1–4 × 0.2–0.7 cm, obtuse or blunt at apex, rounded at base, scabrid, green; sheaths 2–3 cm long, keeled, keel scabrid. Ligules membranous, thin, fimbriate. Racemes solitary, 1–4 cm long; joints linear-clavate, 1–3 mm long, 2-toothed at apex. Sessile spikelets lanceolate, 2–4 mm long, awned; callus sparsely hairy. Lower glumes lanceolate, 2–3.5 × 0.3–0.5 mm, shortly bifid at apex, cuneate at base, scabrous, faintly 3–5-nerved. Upper glumes boat shaped, 2–4 × 0.5–1 mm, acute at apex, cuneate at base, pubescent, 1-nerved, dorsally keeled. Lower florets empty, epaleate. Upper florets bisexual. First lemmas oblong-lanceolate, 1.5–2 × 0.3–0.5

mm, acute at apex, cuneate at base, hyaline, 2-nerved, 2-keeled. Second lemmas oblong, 1.5–2.5 × 0.3–0.4 mm, notched and awned at apex, cuneate at base, glabrous; awn 6–12 mm long. Paleas absent or obscure. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets reduced to aristate glumes; pedicels linear, 2–3 mm long, toothed, glabrous. Glumes ovate-lanceolate, 0.5–1 mm long, acute at apex, cuneate at base, scabrid; arista 2–3 mm long.

Distribution: Tropics and Subtropics (POWO, 2023); *Habitat*: Hill slopes and open grasslands; *Fl. & Ft.*: November-December.

Specimen examined: Mangaladevi, 06.12.1996, *Jomy Augustine* 16976 (CALI).

Sorghum Moench,

Methodus 207. 1794, *nom. cons.*

Key to the species

1. Nodes densely hairy ..... *S. nitidum*

1. Nodes glabrous ..... *S. halepense*

Sorghum halepense (L.) Pers., Syn. Pl. 1: 101. 1805; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1735. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 222. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 191. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 592. 2004. *Holcus halepensis* L., Sp. Pl. 2: 1047. 1753. *Andropogon halepensis* (L.) Brot., Fl. Lusit. 1: 89. 1804; Hook.f., Fl. Brit. India 7: 182. 1896. **Fig. 31F**

Perennials. Culms erect, stout; nodes glabrous. Leaves linear-lanceolate, 20–50 × 0.5–3.5 cm, acuminate at apex, rounded at base, glabrous, green; sheaths 10–20 cm long, puberulous. Ligules membranous, fimbriate. Panicles lax, *c.* 45 cm long. Sessile spikelets elliptic, 4–5 mm long, awned, cream yellow, purple or brown; callus densely hairy. Lower glumes elliptic, 4–5 × 1.5–2 mm, acute and 3-toothed at apex, cuneate at base, coriaceous, densely hairy, faintly 5–7-nerved. Upper glumes elliptic-lanceolate, 4–5 × 1.5–2 mm, acute at apex, cuneate at base, coriaceous, pubescent, faintly 3–5-nerved, keeled towards apex, sparsely hairy. Lower florets empty, epaleate. Upper florets bisexual, epaleate or minute. First lemmas ovate-elliptic, 3.5–4 × 1–1.5 mm, acuminate at apex, cuneate at base,

ciliate, hyaline, faintly 3-nerved. Second lemmas ovate, 2–3 × 0.8–1 mm, notched and awned at apex, cuneate at base, hyaline, glabrous, faintly 3-nerved; awn 8–15 mm long. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets lanceolate, 5–6 mm long, awnless, glabrous, purple or brown; pedicels 3–4 mm long, densely villous. Lower glumes elliptic-lanceolate, 5–6 × 1.5–2 mm, acute at apex, cuneate at base, chartaceous, glabrous, 7–9-nerved. Upper glumes elliptic-lanceolate, 4.5–5 × 1–1.5 mm, acute at apex, cuneate at base, ciliate, chartaceous, glabrous, 5-nerved. Florets male, epaleate. First lemmas ovate-elliptic, 3.5–4 × 1–1.5 mm, acuminate at apex, cuneate at base, ciliate, hyaline, faintly 3-nerved. Second lemmas elliptic, 3.5–4 × 1–1.5 mm, obtuse at apex, cuneate at base, hyaline, glabrous, nerveless. Paleas linear-lanceolate, 2–2.5 × 0.3–0.5 mm, obtuse at apex, cuneate at base, ciliate, hyaline. Stamens 3.

Distribution: Macaronesia to Central Asia and Indo-China (POWO, 2023); *Habitat*: Way sides and banks of streams; *Fl. & Ft.*: October-June.

Specimen examined: Kanthallur way side, 24.06.2018, *Dani Francis & Santhosh Nampy* 159380 (CALI).

Notes: *Sorghum halepense*, also known as 'Johnsongrass,' is an invasive species as well as one of the ten most noxious and destructive global annual weeds. Its native range encompasses western Asia, the Mediterranean, and North Africa. However, widespread distributions have recently been introduced as a result of crop seed and forage cultivation, increasing the risk of invasion and endangering agriculture, economic development, and human health (Yang *et al.*, 2023).

Sorghum nitidum (Vahl) Pers., Syn. Pl. 1: 101. 1805; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1735. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 245. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 192. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 870. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 592. 2004. *Holcus nitidus* Vahl, Symb. Bot. 2: 102. 1791. *Andropogon serratus* Thunb. in Murray (ed.), Syst. Veg., ed. 14. 903. 1784; Hook.f., Fl. Brit. India 7: 185. 1896.

Perennials. Culms erect, slender; nodes densely hairy. Leaves linear-lanceolate, 10–50 × 0.5–1 cm, acuminate at apex, rounded at base, tubercled hairy, green; sheaths 8–15 cm long, keeled, densely tubercled hairy. Ligules membranous, fimbriate. Panicles lax, *c.* 40 cm long. Sessile spikelets elliptic, 3–4 mm long, awned, purple or brown; callus densely hairy. Lower glumes ovate, 3–3.5 × 1–1.5 mm, acute at apex, cuneate at base, coriaceous, densely hairy, faintly 5–7-nerved. Upper glumes elliptic-lanceolate, 3–3.5 × 1–1.5 mm, acute at apex, cuneate at base, coriaceous, pubescent, 5–7-nerved. Lower florets empty, epaleate. Upper florets bisexual, epaleate or minute. First lemmas ovate-lanceolate, 2.5–3 × 0.8–1 mm, acuminate at apex, cuneate at base, ciliate, hyaline, faintly 3-nerved. Second lemmas ovate-lanceolate, 2.5–3 × 0.8–1 mm, muticous or awned at apex, cuneate at base, hyaline, glabrous, 1-nerved; awn 8–12 mm long. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets lanceolate, 3–4 mm long, awnless, softly hairy; pedicels 2.5–3 mm long, rufous brown hairy. Lower glumes ovate, 3–3.5 × 1–1.5 mm, acute at apex, cuneate at base, coriaceous, densely hairy, faintly 5–7-nerved. Upper glumes elliptic-lanceolate, 3–3.5 × 1–1.5 mm, acute at apex, cuneate at base, coriaceous, pubescent, 5–7-nerved. Lower florets empty, epaleate. Upper florets male, epaleate or minute. First lemmas ovate-lanceolate, 2.5–3 × 0.8–1 mm, acute at apex, cuneate at base, ciliate, hyaline, faintly 3-nerved. Second lemmas ovate-lanceolate, 2.5–3 × 0.8–1 mm, muticous or awned at apex, cuneate at base, hyaline, glabrous, 1-nerved. Stamens 3.

Distribution: Tropical and Subtropical Asia to NW. Pacific (POWO, 2023); *Habitat*: Moist deciduous forests and grasslands; *Fl. & Ft.*: September-December.

Specimens examined: Kumarikulam, 28.12.1993, *Jomy Augustine* 13025 (CALI); Okrai, Thekkady, 29.09.1972, *B.D. Sharma* 42357 (MH).

Notes: This species can be easily identified by its densely bearded nodes, almost similar spikelets which are black when mature, narrower leaves and loose pyramidal panicles. Awned and awnless spikelets are seen even in the same panicle (Sreekumar & Nair, 1991).

Spodiopogon Trin.,

Fund. Agrost. 192, t. 17. 1820.

Spodiopogon rhizophorus (Steud.) Pilg. in Engler & Prantl, Nat. Pflanzenfam., ed. 2. 14e: 119. 1940; Bor, Grasses Burma, Ceylon, India & Pakistan 246. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 193. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 593. 2004. *Andropogon rhizophorus* Steud., Syn. Pl. Glumac. 1: 381. 1854. *Spodiopogon albidus* Wall., Numer. List: n.° 8821. 1829, *nom*. *nud*.; Hook.f., Fl. Brit. India 7: 108. 1896; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1710. 1934.

Annuals or perennials. Culms erect with stilt roots at basal nodes; nodes glabrous. Leaves elliptic-lanceolate, 5–25 × 0.5–3 cm, acuminate at apex, narrowed or tapering at base, flaccid; petioles 1–5 cm long, softly hairy; sheaths 2–6 cm long, ciliate along margins. Ligules ovate, membranous. Panicles congested, 5–15 cm long, densely silky villous. Sessile spikelets elliptic-lanceolate, 5–8 mm long, awned. Lower glumes ovate-lanceolate, 5–6.5 × 1–2 mm, truncate and toothed at apex, sub-truncate at base, densely or sparsely villous, 5–9-nerved. Upper glumes ovate-lanceolate, 5–6 × 1.5–2 mm, acuminate or aristate at apex, cuneate at base, villous, 7–11-nerved, keeled. Lower florets male. Upper florets bisexual. First lemmas lanceolate, 5–7 × 0.8–1 mm, acute at apex, cuneate at base, glabrous, delicate, 3-nerved. Paleas lanceolate, 4–6 × 0.8–1 mm, obtuse at apex, cuneate at base, glabrous, 2-nerved, 2-keeled. Second lemmas oblong, 4–5 × 0.5–1 mm, notched and awned at apex, cuneate at base, delicate, glabrous, 1-nerved, keeled; awns 10–12 mm long; lobes acuminate. Paleas ovate, 2.5–3 × 1.5–2 mm, acute at apex, faintly toothed at apex, cuneate at base, glabrous. Stamens 3. Ovary elliptic-lanceolate; stigma plumose. Pedicelled spikelets lanceolate, 5–6 mm long, awned; pedicels flat, 3–4 mm long, densely ciliate along margin. Glumes and florets similar to sessile spikelet.

Distribution: India (POWO, 2023); *Habitat*: River banks and road sides; *Fl. & Ft.*: October-March.

Specimen examined: Kaliyar river, 07.12.2018, *Dani Francis & Santhosh Nampy* 167814 (CALI).

Notes: This species is characterized by its broadly elliptic, flaccid leaves and silky woolly panicles (Sreekumar & Nair, 1991).

Themeda Forrsk.,

Fl. Aegypt.-Arab. 178. 1775.

Key to the species

1. Lower glume of sessile awned spikelet with a longitudinal slit like groove on the dorsal side; sessile spikelet 2 in a raceme ..... *T. tremula*

1. Lower glume of sessile awned spikelet without a longitudinal slit like groove on the dorsal side; sessile spikelet solitary in a raceme 2

2. Callus hairs of sessile spikelet rufous brown hairy 3

2. Callus hairs of sessile spikelet white hairy ..... *T. cymbaria*

3. Keels of the lower glume of the involucral spikelets broadly winged ……..
……. *T. triandra*

3. Keels of the lower glume of the involucral spikelets not winged ……..……
……..... *T. sabarimalayana*

Themeda cymbaria Hack. in A.DC & C.DC, Monogr. Phan. 6: 668. 1889; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1746. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 251. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 196. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 875. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 594. 2004.

Perennials. Culms densely tufted; nodes glabrous. Leaves linear-lanceolate, 20–90 × 0.5–1 cm, acuminate at apex, narrowed and tapering at base, glabrous or pubescent; sheaths keeled, villous towards apex. Ligules membranous, fimbriate. Panicles lax, drooping, 15–60 cm long, densely spiculate. Involucral spikelets 2 pairs in a raceme, elliptic-lanceolate, 5–6 mm long. Lower glumes elliptic-lanceolate, 5–6 × 0.8–1 mm, acute at apex, sub-truncate at base, chartaceous, glabrous, 7–9-nerved. Upper glumes elliptic-lanceolate, 4–5 × 0.8–1 mm, acute at apex, truncate at base, ciliate at margin towards apex, 3-nerved. Lower florets

empty, epaleate. Upper florets male, epaleate. First lemmas elliptic, 3–4 × 0.8–1 mm, acuminate at apex, sub-truncate at base, hyaline, glabrous, faintly 3–5-nerved. Second lemmas linear-lanceolate, 2.8–3 × 0.2–0.3 mm, acute at apex, cuneate at base, hyaline, glabrous. Stamens 3. Sessile spikelets solitary in a raceme, lanceolate, 4–5 mm long, awned; callus white hairy. Lower glumes lanceolate, 4–4.5 × 0.8–1 mm, 2-toothed at apex, sub-truncate at base, puberulous or glabrous, faintly 5–7-nerved. Upper glumes lanceolate, 4–5 × 0.8–1 mm, mucronate at apex, sub-truncate at apex, glabrous or puberulous, 3–5-nerved, 2-keeled. Lower florets empty, epaleate. Upper florets bisexual. First lemmas oblong, 3–3.5 × 0.8–1 mm, acute at apex, cuneate at base, hyaline, glabrous, faintly 2-nerved. Second lemmas stipitate, oblong, reduced to hyaline base of awn, *c.* 2 mm long, awned, glabrous, 1-nerved; awn 14–18 mm long. Paleas elliptic-lanceolate, 0.8–1 × *c*. 0.2 mm, acute at apex, cuneate at base, hyaline, glabrous. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets 2 or 3 in a raceme, lanceolate, 4–5 mm long; pedicels 2–3 mm long, sparsely hairy. Glumes and florets similar to involucral spikelets.

Distribution: India and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: September-February.

Specimens examined: Kudimala, near Lakkam kudi, 06.02.2018, *Drisya V.* 157825 (CALI); Okrai, Thekkady, 29.09.1972, *B.D. Sharma* 42355 (MH); Mangaladevi hills, 12.10.2017, *Dani Francis & Santhosh Nampy* 156378; Mathikettan Shola National Park, 11.12.2016, *Dani Francis & Santhosh Nampy* 151337; micro, near Painav, 23.01.2019, *Dani Francis & Santhosh Nampy* 168919 (CALI); Peermade, 02.12.1941, *K.C. Jacob* 20222 (MH); Thannikkudy, 29.12.1993, *Jomy Augustine* 13057; near Thookupalam, Lakkam, 06.02.2018, *Drisya V.* 157827 (CALI).

Themeda sabarimalayana Sreek. & V.J.Nair, Bull. Bot. Surv. India 29: 127. 1989; Sreek. & V.J.Nair, Fl. Kerala-Grasses 198. 1991; K.M.Matthew, Illustr. Fl. Palni Hills 876. 1996; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 594. 2004.

Perennials. Culms densely tufted, erect; nodes glabrous. Leaves linear-lanceolate, 15–35 × 0.5–1 cm, acuminate at apex, rounded at base, glabrous; sheaths keeled, glabrous. Ligules ovate, membranous. Panicles lax, drooping, 25–60 cm long, densely spiculate. Involucral spikelets 2 pairs in a raceme, elliptic-lanceolate, 4–6 mm long. Lower glumes elliptic-lanceolate, 4–6 × 0.8–1 mm, acuminate at apex, sub-truncate at base, chartaceous, sparsely hairy towards apex, 9–13-nerved, keeled, not winged. Upper glumes lanceolate, 4–6 × 0.8–1 mm, acuminate at apex, truncate at base, hyaline at margins, ciliate towards apex, 3–5-nerved. Lower florets empty, epaleate. Upper florets male, etc. First lemmas elliptic-lanceolate, 3–5 × 0.5–1 mm, acute at apex, sub-truncate at base, hyaline, glabrous, ciliolate towards apex, faintly 3–5-nerved. Second lemmas linear-lanceolate, 1.8–2 × 0.2–0.3 mm, acute at apex, cuneate at base, hyaline, glabrous. Stamens 3. Sessile spikelets solitary, oblong-lanceolate, 5–6 mm long, awned; callus rufous-brown hairy. Lower glumes lanceolate, 5–6 × 0.8–1 mm, truncate and dentate at apex, sub-truncate at base, coriaceous, puberulous, 9–11-nerved. Upper glumes oblong-lanceolate, 5–5.5 × 0.8–1 mm, acute at apex, sub-truncate at apex, glabrous, 3–5-nerved, 2-keeled. Lower florets empty, epaleate. Upper florets bisexual. First lemmas elliptic-lanceolate, 3–4 × 0.5–1 mm, acute at apex, cuneate at base, hyaline, glabrous, faintly 3–5-nerved. Second lemmas stipitate, oblong, reduced to hyaline base of awn, 1–2 mm long, glabrous, 1-nerved; awns 15–25 mm long. Paleas elliptic, 0.3–0.5 × 0.3 mm, acute at apex, cuneate at base, hyaline, glabrous. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets 3 or 4 in a raceme, lanceolate, 4–6 mm long; pedicels 1–2 mm long, sparsely hairy. Glumes and florets similar to sessile spikelets.

Distribution: SW. India (POWO, 2023); *Habitat*: Forest margins and hill slopes; *Fl. & Ft.*: November-January.

Specimens examined: Way to Eravikulam, 23.01.2018, *Dani Francis & Santhosh Nampy* 158125; Irumbupalam, 28.12.2017, *Dani Francis & Santhosh Nampy* 156560 (CALI).

Themeda tremula (Nees ex Steud.) Hack. in A.DC & C.DC, Monogr. Phan. 6: 667. 1889; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1746. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 254. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 198. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 594. 2004. *Anthistiria tremula* Nees ex Steud., Syn. Pl. Glumac. 1: 401.1854; Hook.f., Fl. Brit. India 7: 214. 1896.

Annuals or perennials. Culms tufted, erect or geniculate; nodes glabrous. Leaves linear-lanceolate, 5–35 × 0.3–1 cm, acuminate at apex, rounded at base, sparsely hairy or glabrous; sheaths keeled, glabrous. Ligules membranous, fimbriate. Panicles loose or rarely congested, 5–40 cm long. Involucral spikelets 2 pairs in a raceme, sessile, elliptic-lanceolate, 6–8 mm long. Lower glumes elliptic-lanceolate, 6–8 × 1.5–2 mm, acuminate at apex, sub-truncate at base, chartaceous, long tubercled hairy, many nerved, 2-keeled. Upper glumes elliptic-lanceolate, 6–7 × 1–1.5 mm, acuminate at apex, truncate at base, chartaceous, tubercled hairy, 3-nerved. Lower florets empty, epaleate. Upper florets male. First lemmas elliptic-lanceolate, 4–7 × 0.8–1 mm, acute at apex, sub-truncate at base, hyaline, ciliate, 3-nerved. Second lemmas linear-lanceolate, 3–4.5 × 0.2–0.3 mm, slightly bifid at apex, cuneate at base, hyaline, glabrous, 1-nerved. Paleas elliptic, 0.8–1 × 0.3–0.5 mm, acute at apex, cuneate at base, hyaline, glabrous. Lodicules 2. Stamens 3. Sessile spikelets 2 in a raceme, oblong-lanceolate, 3–4 mm long, awned; callus rufous-brown hairy. Lower glumes ovate-lanceolate, 3–4 × 1–2 mm, truncate at apex, sub-truncate at base, coriaceous, densely hairy with a deep slit like groove in the middle. Upper glumes oblong, 3–4 × 0.8–1 mm, acute at apex, sub-truncate at base, pubescent, 2-keeled. Lower florets empty, epaleate. Upper florets bisexual. First lemmas elliptic-lanceolate, 2–3 × 0.8–1 mm, acute at apex, cuneate at base, hyaline, glabrous, 1-nerved. Second lemmas stipitate, oblong, reduced to hyaline base of awn, 2–3 mm long, awned, glabrous, 1-nerved; awn 15–25 mm long. Paleas elliptic-lanceolate, 0.8–1 × 0.3 mm, acute at apex, cuneate at base, hyaline, glabrous. Lodicules 2. Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets 3 in a raceme, elliptic-lanceolate, 5–8 mm long, awnless; pedicels 1–2 mm long, brown hairy. Lower glumes elliptic-lanceolate, 5–6 × 0.8–1 mm, acute at apex,

sub-truncate at base, tubercled hairy, 9–11-nerved. Upper glumes and florets similar to involucral spikelets.

Distribution: India to Bangladesh and Sri Lanka (POWO, 2023); *Habitat*: Grasslands; *Fl. & Ft.*: Throughout the year.

Specimens examined: Eravikulam, 29.09.2017, *Dani Francis & Santhosh Nampy* 156308; Kattadikadavu, 07.12.2018, *Dani Francis & Santhosh Nampy* 167825 (CALI); Meenmutty, 12.12.1982, *C.N. Mohanan* 76016 (MH); Meesapulimala, 21.11.2018, *Dani Francis & Santhosh Nampy* 167760; micro, Painav, 22.01.2019, *Dani Francis & Santhosh Nampy* 168923 (CALI); *Ibid*., 08.11.1981, *V.S. Raju* 71216 (MH); Vallakkadavu, 12.12.1993, *Jomy Augustine* 12768 (CALI).

Notes: The habit, habitat, and indumentum of this species vary greatly. Slender annuals with creeping and geniculate culms and robust perennials with tufted, erect culms were found (Sreekumar & Nair, 1991).

Themeda triandra Forrsk., Fl. Aegypt.-Arab. 178. 1775; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1746. 1934; Bor, Grasses Burma, Ceylon, India & Pakistan 254. 1960; Sreek. & V.J.Nair, Fl. Kerala-Grasses 202. 1991; Sasidh., Biodiv. Doc. Kerala-Fl. Pl. 594. 2004. *Anthistiria imberbis* Retz., Observ. Bot. 3: 11. 1783; Hook.f., Fl. Brit. India 7: 211. 1896.

Perennials. Culms densely tufted, erect; nodes glabrous. Leaves linear-lanceolate, 5–40 × 0.3–1 cm, acute at apex, rounded at base, tubercled hairy; sheaths keeled, tubercled hairy. Ligules membranous, fimbriate. Panicles narrow, lax or congested flabelliform clusters of spikelets, 5–60 cm long. Involucral spikelets 2 pairs in a raceme, elliptic-lanceolate, 6–12 mm long. Lower glumes elliptic-lanceolate, 6–12 × 2–3 mm, acuminate at apex, sub-truncate at base, chartaceous, densely tubercled hairy, 9–11-nerved, 2-keeled, keels broadly winged. Upper glumes elliptic-lanceolate, 6–12 × 1–2 mm, acuminate at apex, truncate at base, chartaceous, margins ciliate towards apex, pubescent, 3-nerved. Lower florets empty, epaleate. Upper florets male, epaleate. First lemmas elliptic-lanceolate, 6–10 × 1–2 mm, acute at apex, sub-truncate at base, hyaline, ciliate, 1-nerved. Second lemmas

elliptic, 0.5–1 mm long, acute at apex, cuneate at base, hyaline, glabrous, 1-nerved. Lodicules 2. Stamens 3. Sessile spikelets solitary, oblanceolate, 6–10 mm long, awned; callus rufous-brown hairy. Lower glumes oblong-lanceolate, 6–10 × 1–2 mm, acute at apex, truncate at base, coriaceous, glabrous or pubescent, faintly 7–9-nerved. Upper glumes linear-oblong, 6–8 × 1–1.5 mm, acute at apex, sub-truncate at base, sparsely hairy, 3–5-nerved, 2-keeled. Lower florets empty, epaleate. Upper florets bisexual, epaleate. First lemmas elliptic, 4–5 × 1–2 mm, acute at apex, cuneate at base, hyaline, glabrous, 1-nerved. Second lemmas stipitate, oblong, reduced to hyaline base of awn, 2–3 mm long, awned, glabrous, 1-nerved; awn 15–50 mm long; Stamens 3. Ovary oblong; stigma plumose. Pedicelled spikelets 2 in a raceme, elliptic-lanceolate, 6–10 mm long, awnless; pedicels 2–3 mm long, hairy. Lower glumes elliptic-lanceolate, 6–10 × 1–2 mm, acute at apex, sub-truncate at base, glabrous or sparsely hairy, 11–13-nerved. Upper glumes and florets similar to involucral spikelets.

Distribution: Africa, Tropical and Subtropical Asia to Australia (POWO, 2023); *Habitat*: Forests and grasslands; *Fl. & Ft.*: June-February.

Specimens examined: Devikulam, 02.06.1944, *K.C. Jacob* 20573; Eravikulam National Park, 26.08.1980, *P.V. Sreekumar* 67792 (MH); Karimutty, 1st bridge, 09.02.2021, *Dani Francis & Santhosh Nampy* 188775; Kumarikulam, 28.12.1993, *Jomy Augustine* 13055 (CALI); Peermade, 03.12.1941, *K.C. Jacob* 20235 (MH); Pius Nagar, 22.06.2018, *Dani Francis & Santhosh Nampy* 159330; Ramakkalmedu, 07.09.2017, *Dani Francis & Santhosh Nampy* 152927 (CALI); Thannikkudy, 01.10.1972, *B.D. Sharma* 42373 (MH).

Fig. 29. A. *Eragrostis atrovirens* (Desf.) Trin. ex Steud.; **B.** *Eragrostis amabilis* (L.) Wight & Arn.; **C.** *Cymbopogon flexuosus* (Nees ex Steud.) Will.Watson; **D.** *Arundinella setosa* Trin.; **E.** *Arundinella mesophylla* Nees ex Steud.; **F.** *Eragrostiella bifaria* var. *bifaria* (Vahl) Bor; **G.** *Cyrtococcum patens* (L.) A.Camus; **H.** *Briza minor* L.

Fig. 30. A. *Dimeria borii* Sreek., V.J.Nair & N.C.Nair; **B.** *Paspalum scrobiculatum* L.; **C.** *Dactyloctenium aegyptium* (L.) Willd.; **D.** *Sacciolepis indica* (L.) Chase; **E.** *Garnotia tenella* (Arn. ex Miq.) Janowski; **F.** *Imperata cylindrica* (L.) Raeusch.; **G.** *Heteropogon contortus* (L.) P.Beauv.; **H.** *Panicum sumatrense* Roth.

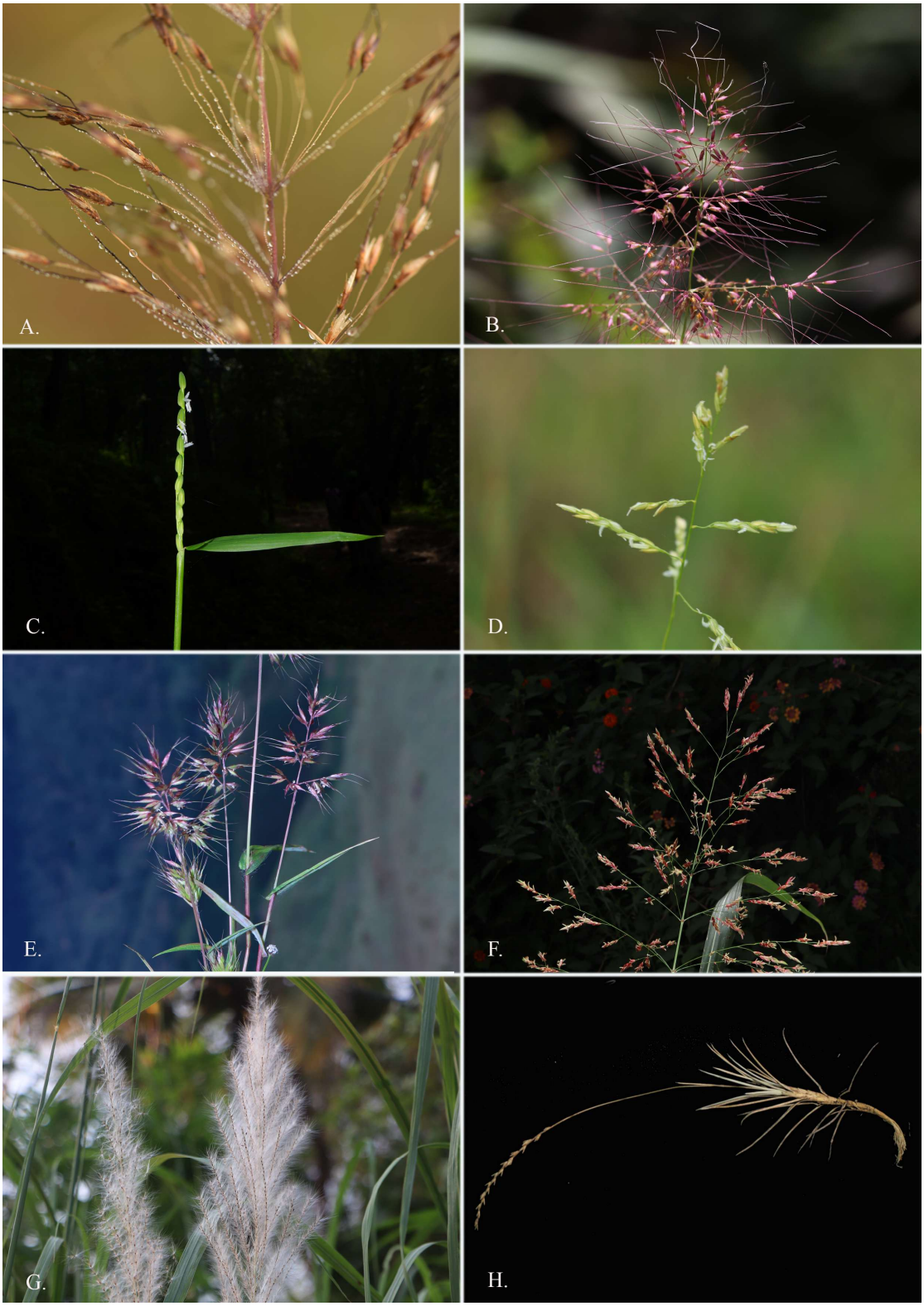


Fig. 31. A. *Chrysopogon hackelii* (Hook.f.) C.E.C.Fisch.; **B.** *Melinis minutiflora* P.Beauv.; **C.** *Oryza rufipogon* Griff.; **D.** *Poa annua* L.; **E.** *Jansenella griffithiana* (Mull.Hal.) Bor; **F.** *Sorghum halepense* (L.) Pers.; **G.** *Saccharum spontaneum* L.; **H.** *Tripogon pungens* C.E.C.Fisch.

DISCUSSION

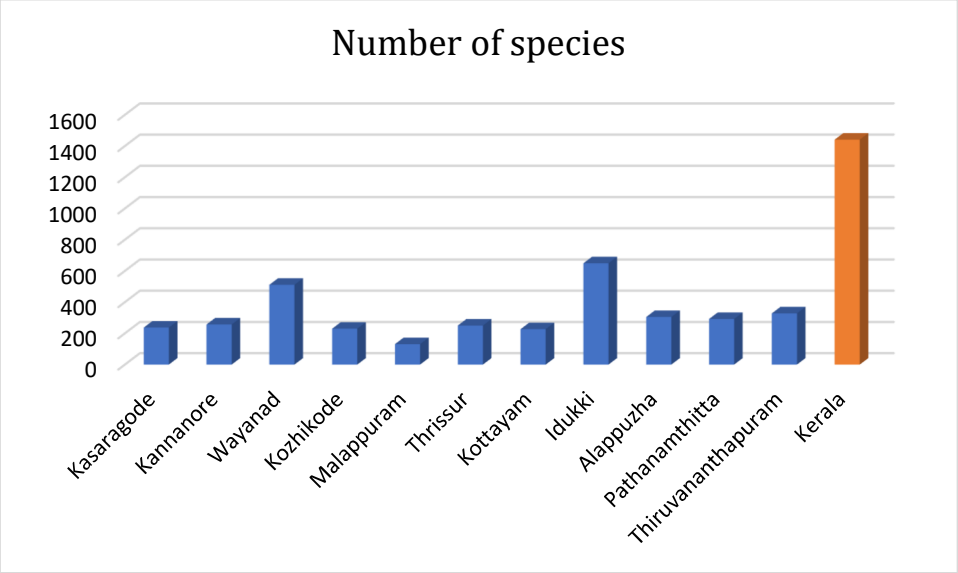
DISCUSSION

The Idukki district is the largest district in Kerala covering an area of 4612 km^2, with five National Parks and three Wildlife Sanctuaries. It supports diverse types of vegetation, comprising evergreen forests, semi-evergreen forests, moist deciduous forests, dry deciduous forests, shola forests, grasslands, and forest plantations. Majority of the area are covered by forests and other vegetation with less population density, indicating a rich diversity of plants. During the present study, 652 taxa in 248 genera under 28 families were collected for scientific study, which includes 641 species, 6 subspecies, and 5 variety. Around 1000 herbarium sheets were prepared and deposited in CALI herbarium. The study documented the diversity of monocotyledons in the region and provided dichotomous keys for families, genera and species. Each taxon was identified, detailed description was provided for each taxon along with world distribution, habitat, flowering and fruiting. Notes are provided for most species which helps in easy identification. Out of 652 monocotyledons taxa, 592 occur wild and 58 are cultivated variously and used as ornamentals, vegetables, fruits and medicines. Idukki has the largest number of monocotyledonous taxa comparing to the other districts. According to Sasidharan (2023), 1441 species of monocots are found in Kerala. The present investigation recorded 45% of the state's monocotyledon diversity. When evaluating the other district floras, the largest number of taxa (652) occur in Idukki district, followed by Wayanad (511), Thiruvananthapuram (328) and Alappuzha (305).

Table 1. Comparison of number of monocotyledons taxa with other districts and state flora

Sl. No.	District	Number of species
1.	Kasaragode	237
2.	Kannur??	257
3.	Wayanad	511
4.	Kozhikode	230
5.	Malappuram	131
6.	Thrissur	250

7.	Kottayam	227
8.	Idukki	652
9.	Alappuzha	305
10.	Pathanamthitta	292
11.	Thiruvananthapuram	328
12.	**Kerala**	**1441**



Graph 5. Comparison of number of monocotyledons taxa with other districts and state flora

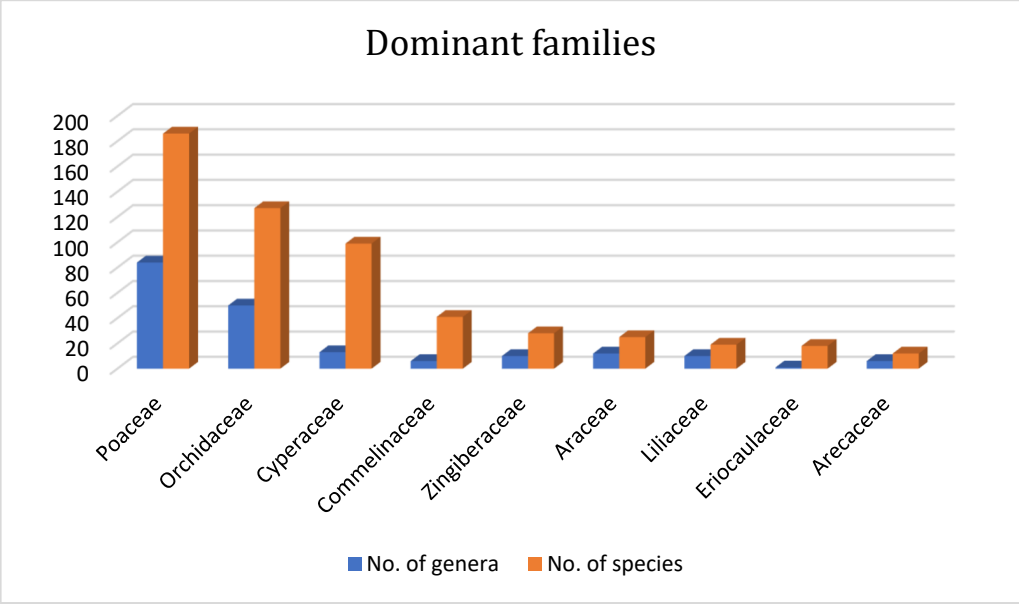
Table 2. Relative abundance of dominant families in Idukki, Wayanad and Kerala

Family	**Idukki**		**Wayanad**		**Kerala**	
	Genera	**Species**	**Genera**	**Species**	**Genera**	**Species**
Poaceae	84	186	65	163	126	415
Orchidaceae	50	127	68	165	81	277
Cyperaceae	13	99	12	38	19	212
Commelinaceae	6	41	7	17	10	66
Zingiberaceae	10	28	8	18	13	75
Araceae	12	25	14	21	20	95
Liliaceae	10	19	6	9	12	34
Eriocaulaceae	1	18	1	9	1	49
Arecaceae	6	12	5	10	25	53

Poaceae is the largest family with 186 species in 84 genera, followed by Orchidaceae representing 127 species in 50 genera and Cyperaceae with 99 species in 13 genera. The other dominant families include, Commelinaceae having 41species in 6 genera, Zingiberaceae with 28 species in 10 genera, Araceae with 25 species in 12 genera, Liliaceae with 19 species in 10 genera, Eriocaulaceae with 18 species in a single genus, and Arecaceae with 12 species in 6 genera. Among the 592 wild taxa of this district, 412 belong to Poaceae, Cyperaceae and Orchidaceae, representing, 69% of the monocotyledonous diversity.

Table 3. Major families with number of genera and species in Idukki

Sl. No.	Family	No. of genera	No. of species
1	Poaceae	84	186
2	Orchidaceae	50	127
3	Cyperaceae	13	99
4	Commelinaceae	6	41
5	Zingiberaceae	10	28
6	Araceae	12	25
7	Liliaceae	10	19
8	Eriocaulaceae	1	18
9	Arecaceae	6	12



Graph 6. Major families with number of genera and species in Idukki

Hydrocharitaceae

The family includes aquatic species growing primarily in water bodies and marshy lands with a cosmopolitan distribution. Three genera and four species are found in the study area. *Vallisneria* and *Hydrilla* are considered as noxious weeds. *Blyxa aubertii*, *Hydrilla verticillata* and *Vallisneria spiralis* are treated as Least Concern (IUCN, 2023). No species are endemic.

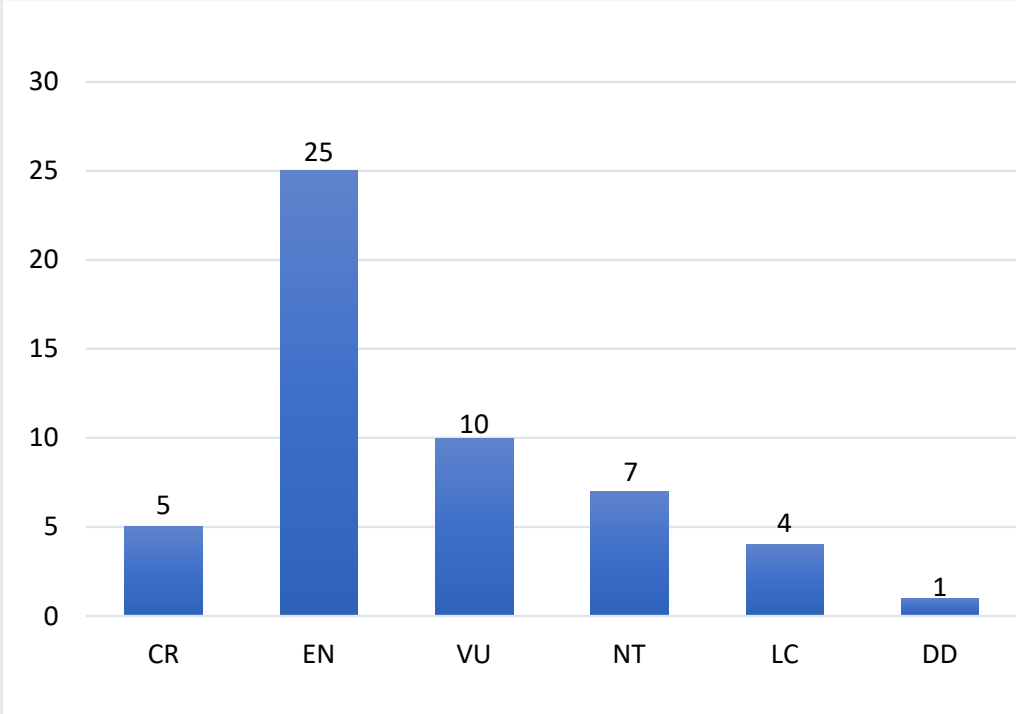
Burmanniaceae

This family consists of myco-heterotrophic and autotrophic species that are mostly found in open wet grasslands and on dripping rocks. Despite the fact that there are three genera in India (POWO, 2023), only one genus, with four species, has been reported from the study area. *Burmannia munnarensis* is newly described from the study area and is characterized by narrow wing of the perianth lobes. *Burmannia indica* is rediscovered from Meenuliyanpara after a lapse of 110 years. *Burmannia munnarensis* and *B. indica* were assessed as Critically Endangered, while *B. pusilla* and *B. coelestis* as Least Concern. *Burmannia munnarensis* and *B. indica* are endemic to the study area.

Orchidaceae

It is one of the world's largest family, with a cosmopolitan distribution. The orchids are extremely vulnerable to habitat destruction thus it acts as excellent indicators of environmental degradation. Orchidaceae is the second largest family in the study area, with 50 genera and 127 species, 74 of which are epiphytic, and 52 are terrestrial. *Dendrobium kallarense* is lithophytic whereas *Aphyllorchis montana* and *Epipogium roseum* are saprophytic. Among the 50 genera *Dendrobium* (15) stands first followed by *Habenaria* (13), *Bulbophyllum* (11) and *Oberonia* (10). Among the 127 species, 109 are listed in the CITES Appendix II.

The threat status of 52 species were assessedin which four are Least Concern and one is Data Deficient., *Brachycorythis splendida*, *Bulbophyllum stocksii*, *B. elegantulum*, *Habenaria periyarensis* and *Oberonia chandrasekharanii* are Critically Endangered while 25 are Endangered, 10 are Vulnerable and 7 are Near Threatened.



Graph 7. Status of orchids in Idukki district

The family contains a significant number of endemics. Forty seven species are endemic, with eight species endemic to India, 19 species to South India, 17 species to SW. India, two species to Kerala, such as *Dendrobium kallarense* and *Bulbophyllum bonaccordense*. *Habenaria periyarensis* is endemic to the study area. This high endemism and threat status emphasize the importance of conserving the taxa in this family. Genera with largest number of endemic species were analyzed (Table 4). Among them, *Bulbophyllum* has the highest proportion of endemic taxa (72%), followed by *Habenaria* (69%), *Dendrobium* (60%), and *Oberonia* (40%).

Table 4. Genera with highest number of species and percentage of endemism

Sl. No.	Genus	No. of species	Endemics	% of Endemism
1	*Dendrobium* Sw.	15	9	60%
2	*Habenaria* Willd.	13	9	69%
3	*Bulbophyllum* Thouars	11	8	72%
4	*Oberonia* Lindl.	10	4	40%

Nineteen species of orchids are found to be Indo-Sri Lankan, which includes *Acanthophippium bicolor*, *Aerides ringens*, *Coelogyne breviscapa, Cottonia peduncularis, Dendrobium nutantiflorum*, *Dendrobium wightii*, *Gastrochilus acaulis*, *Habenaria roxburghii*, *Liparis walkerae, Luisia tenuifolia*, *Malaxis densiflora*, *Oberonia thwaitesii, Oberonia wightiana, Papilionanthe cylindrica*, *Peristylus spiralis*, *Porpax braccata*, *Sirhookera lanceolata*and *Sirhookera latifolia*.

Zingiberaceae

Majority of the species in 'ginger family' are ornamental/ spice or medicinal plants. Ten genera and 28 species are collected from the study area. The diversity of Zingiberaceae in this district is high when compared to other district floras. Among the 28 species, the status of 10 species were assessed and others were not evaluated. *Curcuma coriacea* is Endangered, while *Alpinia nigra*, *Globba marantina*, *G. sessiliflora*, *Meistera masticatorium*and *Zingiber nimmonii* belong to Least Concern. Six species are endemic, in which *Boesenbergia tiliifolia* is endemic to India, *C. zanthorrhiza*, *Meistera cannicarpa*, *Meistera ghatica* and *Zingiber neesanum* are endemic to SW. India while *Curcuma coriacea* is endemic to the study area. Three species *viz*. *Alpinia abundiflora*, *Meistera acuminata* and *M. masticatorium* are Indo-Sri Lankan species. *Zingiber nimmonii* and *Hedychium venustum* are found only in India and Myanmar. *Hedychium flavescens* is an introduced species.

The family is economically important: *Alpinia purpurata*, *Costus elegans* and *Etlingera elatior* have high ornamental value. *Curcuma longa*, *C. angustifolia*, *Elettaria cardamomum*, *Kaempferia galanga* and *Zingiber officinale* are edible as well as medicinal. *Curcuma aeruginosa*, *Curcuma amada*, *Curcuma aromatica* and *Hedychium coronarium* have medicinal properties.

Marantaceae

It is a pantropical family of large leaved herbs. Three species are collected from the study area. *Stachyphrynium spicatum* is assessed as Least Concern, while the others are not evaluated. None of them are endemic. *Indianthus virgatus* is found only in India and Sri Lanka, while *Stachyphrynium spicatum* and *Phrynium pubinerve* in Asian countries.

Cannaceae

It is a monotypic family with the lone species, *Canna indica*. It is an introduced species, native to tropical and subtropical America, that was brought for its ornamental value.

Musaceae

The family includes wild seeded species as well as seedless cultivars, native to the tropics of Africa and Asia. Two species are collected from the study area. Both the species, *Ensete superbum* and *Musa kattuvazhana* are Near Threatened. *Ensete superbum* is endemic to South India while *M. kattuvazhana* is found in Asia. The medicinal properties of *Ensete superbum* are well known.

Haemodoraceae

This family contains three species in two genera from the study area, with *Peliosanthes neilghiriensis* and *P. courtallensis* being reinstated. These names were considered as synonyms of *P. teta* subsp. *humilis*. These two species have only been reported from South India, making them endemic to that region.

Amaryllidaceae

It is a cosmopolitan family with important horticultural and ornamental species. Four species are reported from the study area, and are not evaluated by IUCN. *Curculigo trichocarpa* is only distributed in India and Sri Lanka while *Hypoxis aurea* is found only in tropical and subtropical Asia. The study area includes eight ornamental species.

Dioscoreaceae

It is one of the earliest angiosperm family originated in Southeast Asia. They are usually vines and are found in a variety of habitats, mainly in tropical forests. Members of this family are primarily used as staple foods and medicines. Single genus is represented in the study area with eight species. Only *Dioscorea wallichii* is assessed as Least Concern, others are not evaluated. *D. bulbifera* is regarded as a noxious weed while *D. alata* and *D. bulbifera* are used as medicines. *Dioscorea alata* and *D. esculenta* are edible species.

Liliaceae

This family is dispersed in northern Hemisphere, and the species are valuable commercially, pharmaceutically and ethnobotanically. The study resulted 10 genera and 19 species from the study area. *Chlorophytum tuberosum* and *Gloriosa superba* is assessed as Least Concern, others are not evaluated. Seven species are endemic, in which *Dracaena roxburghiana* and *Smilax wightii* are endemic to India, while *Chlorophytum nimmonii* and *Drimia nagarjunae* are endemic to S. India, *C. malabaricum* and *C. indicum* are endemic to SW. India and *C. sharmae* is endemic to the study area. *Asparagus racemosus* and *A. gonoclados* are only found in India and Sri Lanka. *Lilium wallichianum* var. *neilgherrense* is only distributed in India and Nepal.

According to different classification (Hutchinson (1959; APG IV, 2016), this family is divided in to five different families such as Liliaceae, Colchicaceae, Smilacaceae, Asphodelaceae and Asparagaceae.

Aloe vera, *Asparagus densiflorus*, *A. setaceus*, *Cordyline fruticosa*, *Allium cepa*, *A. sativum*, *Gloriosa superba* etc. are economically important plants, variously used as ornamentals, food and medicines.

Pontederiaceae

It is a heterostylous, aquatic monocot family, represented by a two species from the study area. These species are invasive in rice fields and other water bodies. They are assessed as Least Concern and is widely distributed. *Pontederia crassipes* is an introduced species native to S. tropical America.

Xyridaceae

This family has a cosmopolitan distribution. Two species are collected from the study area. Both of these species have a wider distribution and are assessed as Least Concern.

Commelinaceae

The family is distributed throughout the Old and New Worlds. They are ecologically diverse and can be found from sea level to higher elevations, primarily in humid and mesic habitats. They are grown for ornamental purposes, medicinal

purposes, and fodder. The study area yielded six genera and 41 species: *Murdannia* (14) is the largest genus, followed by *Cyanotis* (12) and *Commelina* Pl (11). The status of the 12 species were assessed under LC category, it indicates that the group is less threatened. Eight species are endemic, in which *Cyanotis tuberosa* is endemic to India, *M. dimorpha*, *M. lanuginosa* and *M. pauciflora* are endemic to S. India, *Cyanotis vivipara* endemic to SW. India, *M. fadeniana* endemic to Kerala and *Commelina clavatoides* and *Murdannia satheeshiana* are endemic to the study area. Eight species are solely present in India and Sri Lanka, such as *Commelina indehiscens* , *Cyanotis adscendens*, *C. fasciculata*, *C. obtusa*, *C. pilosa* , *C. villosa*, *Murdannia esculenta* and *M. zeylanica*.

Juncaceae

This family has a cosmopolitan distribution represented by three species from the study area. The species mostly prefers marshy areas. *Juncus bufonius* is assessed as LC and others are not evaluated.

Arecaceae

The family is distributed in tropics and subtropics. They rank second only to grasses in terms of economic importance. Six genera and 12 species are collected from the study area. Among them, *Arenga wightii* and *Bentinckia condapanna* are Vulnerable, *Caryota urens* assessed as Least Concern and *Corypha umbraculifera* as Data Deficient. Seven species are endemic, in which *Bentinckia condapanna* and *Calamus brandisii* are endemic to India, *Calamus hookerianus* to S. India, *Arenga wightii*, *C. gamblei*, *C. rheedei*, and *C. vattayila* to SW. India. The species such as *C. pseudotenuis*, *C. thwaitesii*, *Caryota urens*, and *Corypha umbraculifera* are found only in India and Sri Lanka.

The economically important plants include *Areca catechu*, *Areca triandra*, *Cyrtostachys renda*, *Cocos nucifera* and *Elaeis guineensis*.

Pandanaceae

This family represents palm like trees with long, narrow, rigid, spirally arranged, pineapple like leaves and prop roots. They are economically significant and used as food, flavors, fibres and ornamentals. Only a single species, *Pandanus unipapillatus* is collected from the study area. This species is endemic to S. India.

Typhaceae

This family comprises aquatic or marshy perennial monoecious herbs. *Typha angustifolia* is the sole species collected from the study area. This species is a gregarious weed with a wide distribution, and is assessed as Least Concern.

Araceae

This family is distributed in New World tropics, Old World tropics and northern temperate regions. Twelve genera and 25 species are collected from the study area. *Cryptocoryne consobrina* is a Near Threatened species, *Arisaema jacquemontii*, *Colocasia esculenta*, *Lagenandra ovata* and *Pistia stratiotes* are assessed as Least Concern, while others are not evaluated. Twelve species are endemic, in which *Arisaema madhuanum*, *A. sarracenioides*, *Pothos keralensis* and *Theriophonum infaustum* are endemic to India; *Cryptocoryne consobrina*, *Lagenandra meeboldii*, *Pothos armatus* and *P. thomsonianus* Schtt are endemic to SW. India; *Arisaema attenuatum* and *A. peltatum* are endemic to Kerala while *Ariopsis idukkiana* and *Arisaema psittacus* are endemic to the study area. *Ariopsis idukkiana* is a new discovery from the study area.

The ornamental species include *Aglaonema commutatum*, *Alocasia macrorrhiza*, *Caladium bicolor*, *Epipremnum pinnatum* While *Amorphophallus paeoniifolius* and *Colocasia esculenta* are edible species.

Alismataceae

The family includes aquatic or semi-aquatic herbs with a cosmopolitan distribution. *Limnocharis flava* is the only species collected from the study area. It is an invasive species native to tropical and sub-tropical America introduced mainly for ornamental purpose, but grew into an obnoxious weed.

Potamogetonaceae

The family comprises submerged water plants with creeping rootstock. *Potamogeton octandrus* is only collected from the study area. It is assessed as Least Concern and is widely distributed.

Najadaceae

It is a cosmopolitan monogeneric family. The members are submerged aquatic herbs. *Najas indica* alone is collected from the study area. The species is considered as Least Concern. According to the recent studies (Haynes & Holm-Nielsen, 2001) this family is merged with Hydrocharitaceae.

Eriocaulaceae

The 'Pipewort family' includes marshy or aquatic scapigerous herbs and, found in tropical and warm temperate regions. *Eriocaulon* is the sole representative of the family in India. There are 18 species collected. *Eriocaulon vamanae* is a new species discovered from the study area. The therat status of 15 species is assessed. *E. vamanae* is Critically Endangered, *E. pectinatum* and *E. tuberiferum* are Vulnerable and 10 species are Least Concern. 10 species are endemic, in which *E. parviflorum* is endemic to India, *E. pectinatum* and *E. nairii* to S. India, *E. eurypeplon*, *E. rhodae*, and *E. tuberiferum* to SW. India, *E. vasudevanii* to Kerala and *E. biappendiculatum*, *E. pandeyana* and *E. vamanae* to the study area.

Cyperaceae

It is the third largest family in the study area and includes perennial or annual herbs with a global distribution. Thirteen genera and 99 species are collected from the study area. Dominating genera in the study area includes *Cyperus* with 43 species, followed by *Fimbristylis* with 21 species. Out of the 99 species, 61 are assessed as Least Concern indicating that they are less threatened. Only five species are endemic, in which *Fimbristylis kingii*, *F. narayanii*, *F. uliginosa*, and *Scleria swamyi* are endemic to S. India, while *Cyperus raynalianus* to SW. India, and *Fimbristylis monticola* and *Scleria multilacunosa* to India and Sri Lank. Less endemism indicates a wide distribution of the members of this family. *Cyperus sphacelatus* is an introduced species.

Poaceae

Poaceae are the fifth largest family in the world with a global distribution, ranking first in economic and ecological importance. It holds the first position in India and in the study area. Eighty-four genera and 186 species are collected from the study area. The major genera include *Eragrostis* (14), *Digitaria* (10), *Arundinella* (9),

Tripogon (8) and *Setaria* (7). 36 species are assessed by IUCN Red List of Threatened plants and the remaining 150 species are not evaluated. *Kuruna floribunda* and *K. walkeriana* are Critically Endangered while *Anthoxanthum borii* is Near Threatened, the remaining 32 species are assessed as Least Concern. When compared to the abundance of species, the threat status in this family is very less. Thirty species are endemic, with 10 endemic to India, 12 endemic to S. India, six to SW. India, one each to Kerala and the study area. There are 15 species found only in India and Sri Lanka while one to India and Myanmar. The low percentage of endemism indicates a wider distribution.

Table 5. Distribution of endemic species in the family Poaceae

Geographical area	Species
India	*Anthoxanthum borii*, *Arundinella mesophylla*, *A. vaginata*, *Garnotia elata*, *Glyphochloa forficulata*, *Pseudoxytenanthera bourdillonii*, *Schizostachyum beddomei*, *Spodiopogon rhizophorus*, *Zenkeria elegans*, *Zenkeria sebastinei*
S. India	*Chrysopogon asper*, *C. hackelii*, *Dimeria borii*, *D. deccanensis*, *D. fischeri*, *D. kanjirapallilana*, *Isachne setosa*, *Kuruna wightiana*, *Ochlandra travancorica*, *Tripogon narayanae*, *T. pungens*, *T. sivarajanii*
SW. India	*Dimeria idukkiensis*, *Eragrostis collinensis*, *Garnotia arundinacea*, *Isachne bourneorum*, *I. fischeri*, *Themeda sabarimalayana*
Kerala	*Arundinella pradeepiana*
Idukki	*Tripogon munnarensis*
India & Sri Lanka	*Andropogon lividus*, *Arundinella leptochloa*, *Cyrtococcum deccanense*, *Eragrostiella bifaria* var. *secunda*, *Eragrostis maderaspatana*, *Garnotia courtallensis*, *G. exaristata*, *Isachne kunthiana*, *I. walkeri*, *Ischaemum commutatum*, *Kuruna floribunda*, *K. walkeriana*, *Panicum gardneri*, *Themeda cymbaria*, *Tripogon zeylanicus*
India & Myanmar	*Euclasta oligantha*

This family contains the majority of the exotic species, which are primarily introduced as forage grasses. Thirteen species including *Axonopus compressus*, *Briza minor*, *Festuca bromoides*, *Imperata cylindrica*, *Megathyrsus maximus*, *Melinis minutiflora*, *Melinis repens*, *Paspalum conjugatum*, *P. dilatatum*, *P. distichum*, *Sporobolus indicus*, *Urochloa eminii* and *U. mutica* are found to be introduced. Many of these species exhibit weedy characteristics.

Eleusine coracana, *Oryza sativa*, *Saccharum officianarum*, *Sorghum bicolor*, and *Zea mays* are used as food while *Cymbopogon citratus*, *Cynodon dactylon* have medicinal uses. *Setaria viridis* is used as ornamental.

Dominant genera and number of endemic species

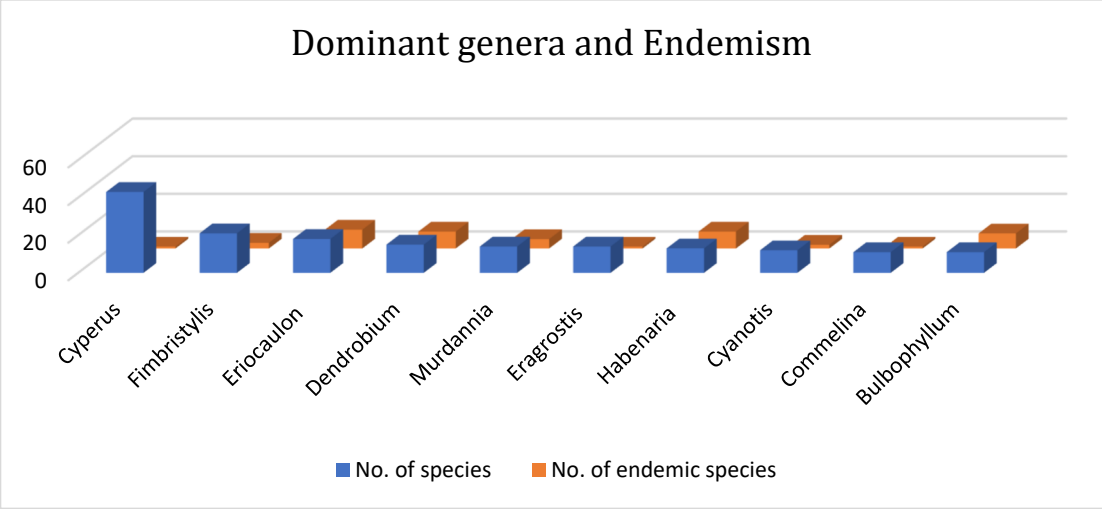
Out of the 217 genera, 10 genera have more than 10 species each (Table 6), which include *Cyperus* (43), *Fimbristylis* (21), *Eriocaulon* (18), *Dendrobium* (15), *Murdannia* (14), *Eragrostis* (14), *Habenaria* (13), *Cyanotis* (12), *Commelina* (11) and *Bulbophyllum* (11) while 128 genera are represented by one species each.

Cyperus is the largest genus in the study area, with a single species *C. raynalianus*, endemic to SW. India. Thirty-one of the 43 species are assessed as least concern. Despite being the largest genus, *Cyperus* is less threatened and has a wider distribution. *Fimbristylis* with 21 species is the second largest genus, and has only three endemic species, *F. kingii*, *F. narayanii*, and *F. uliginosa* and all belong to LC category. *Eriocaulon*, the third largest genus with 18 species, has the maximum number of endemics ie, 10, followed by *Dendrobium* (15) with nine endemic species.

Table 6. Genera with more than 10 species and number of endemic species

Sl. No.	Genera	No. of species	No. of endemic species
1	*Cyperus*	43	1
2	*Fimbristylis*	21	3
3	*Eriocaulon*	18	10
4	*Dendrobium*	15	9
5	*Murdannia*	14	5

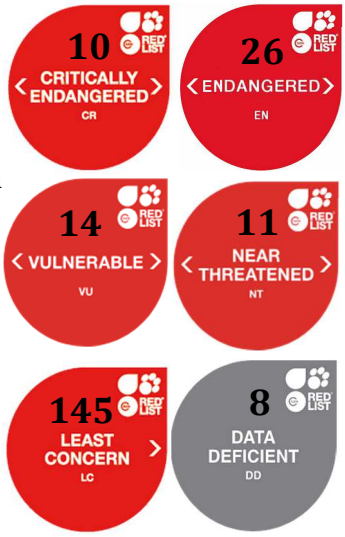
6	*Eragrostis*	14	1
7	*Habenaria*	13	9
8	*Cyanotis*	12	2
9	*Commelina*	11	1
10	*Bulbophyllum*	11	8



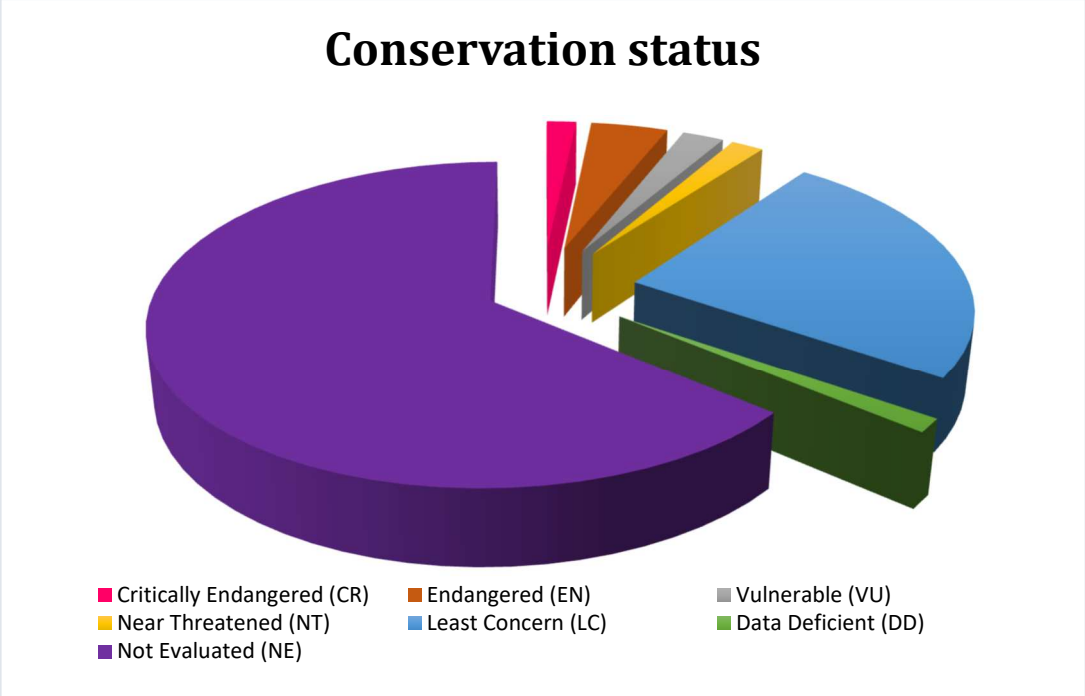
Graph 8. Genera with more than 10 species and number of endemic species

IUCN status

Among the 592 wild taxa, the threat assessment of 214 taxa has been done while the remaining 378 species were Not Evaluated. Ten species were assessed as Critically Endangered (CR), 26 as Endangered (EN), 14 as Vulnerable (VU), 11 as Near Threatened (NT), 145 as Least Concern (LC), and 8 as Data Deficient (DD). The Critically Endangered species includes *Burmannia indica*, *B. munnarensis* (Burmanniaceae), *Brachycorythis splendida*, *Bulbophyllum elegantulum*, *B. stocksii*, *Habenaria periyarensis*, *Oberonia chandrasekharanii* (Orchidaceae), *Eriocaulon vamanae* (Eriocaulaceae), *Kuruna floribunda* and *K. waikeriana* (Poaceae). The species in the Endangered (EN) category include *Aerides maculosa*, *Anoectochilus elatus*, *Bulbophyllum fimbriatum*, *B. fuscopurpureum*, *B. mysorense*, *B. tremulum*, *Coelogyne mossiae*, *C. nervosa*, *Dendrobium anamalayanum*, *D.*



heyneanum, *D. microbulbon*, *D. nanum*, *Diplocentrum congestum*, *Disperis neilgherrensis*, *Habenaria barnesii*, *H. cephalotes*, *H. elliptica*, *H. longicornu*, *H. perrottetiana*, *Oberonia anamalayana*, *O. proudlockii*, *Pinalia mysorensis*, *Porpax nana*, *Schoenorchis jerdoniana*, *Smithsonia viridiflora* (Orchidaceae), *Curcuma coriacea* (Zingiberaceae). The Vulnerable (VU) species are *Bulbophyllum bonaccordense*, *B. sterile*, *Cylindrolobus pseudoclavicaulis*, *Dendrobium barbatulum*, *D. nodosum*, *D. ovatum*, *D. wightii*, *Oberonia sebastiana*, *Robiquetia josephiana*, *Taprobanea spathulata* (Orchidaceae), *Arenga wightii*, *Bentinckia condapanna* (Arecaceae), *Eriocaulon pectinatum*, and *Eriocaulon tuberiferum* (Eriocaulaceae). The Near Threatened (NT) species are *Dendrobium aqueum*, *Habenaria heyneana*, *H. longicorniculata*, *H. rariflora*, *Oberonia brunoniana*, *Pinalia polystachya*, *Porpax filiformis* (Orchidaceae), *Ensete superbum*, *Musa kattuvazhana* (Musaceae), *Cryptocoryne consobrina* (Araceae), *Anthoxanthum borii* (Poaceae). The majority of the threatened species are from the Orchidaceae family (47, suggesting that orchids are extremely vulnerable to environmental changes followed by Poaceae (3), Eriocaulaceae (3), Musaceae (2) and Arecaceae (2) (Table 7). Most of the species in Cyperaceae, Poaceae, and Commelinaceae belong to the Least Concern (LC) category, ie., they are widespread and abundant.

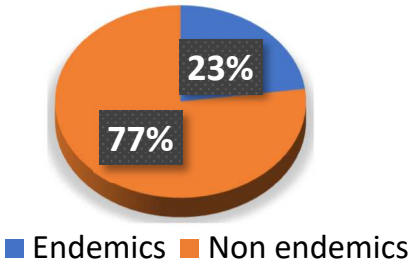


Graph 9. Conservation status of monocotyledons in Idukki district

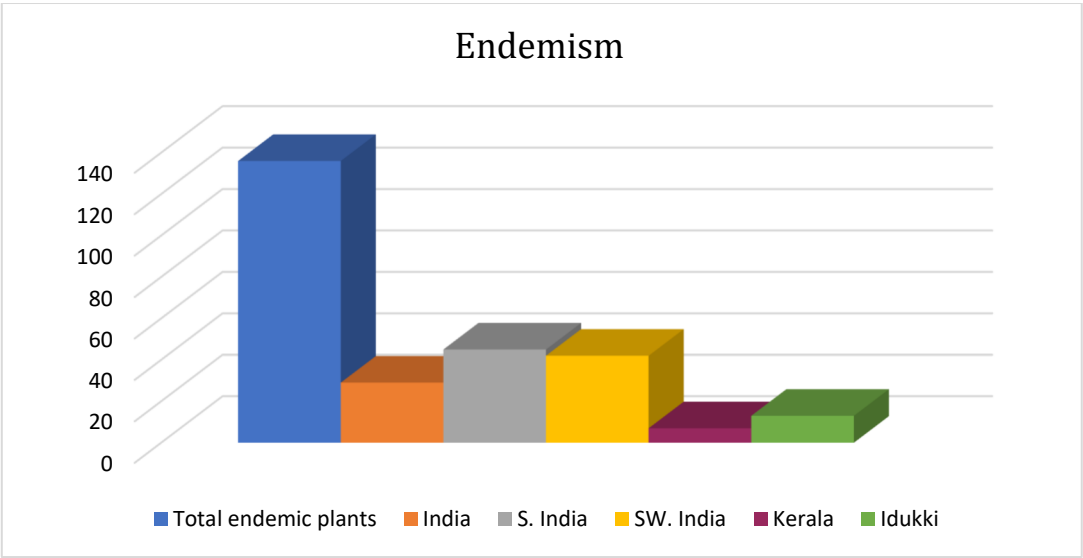
Table 7. Families with number of threatened plants

CR	EN	VU	NT
Orchidaceae (5)	Orchidaceae (25)	Orchidaceae (10)	Orchidaceae (7)
Burmanniaceae (2)	Zingiberaceae (1)	Arecaceae (2)	Musaceae (2)
Poaceae (2)		Eriocaulaceae (2)	Araceae (1)
Eriocaulaceae (1)			Poaceae (1)

Endemism



Endemism refers to any taxonomic unit or taxon that is restricted to a specific geographical area. India is a tropical country with a high degree of endemic plant taxa, and the study area harbours 138 endemic species with 23 % endemism. Out of the 138 endemic species, 29 are endemic to India, 47 to S. India, 42 to SW. India, and 7 to Kerala and 13 species such as *Burmannia indica*, *B. munnarensis*, *Habenaria periyarensis*, *Curcuma coriacea*, *Chlorophytum sharmae*, *Commelina clavatoides*, *Murdannia satheeshiana*, *Ariopsis idukkiana*, *Arisaema psittacus*, *Eriocaulon biappendiculatum*, *E. vamanae*, *E. pandeyana* and *Tripogon munnarensis* are endemic to the study area. Fifty-five species are distributed only in India and Sri Lanka while three species in India and Myanmar and one species in India and Nepal.

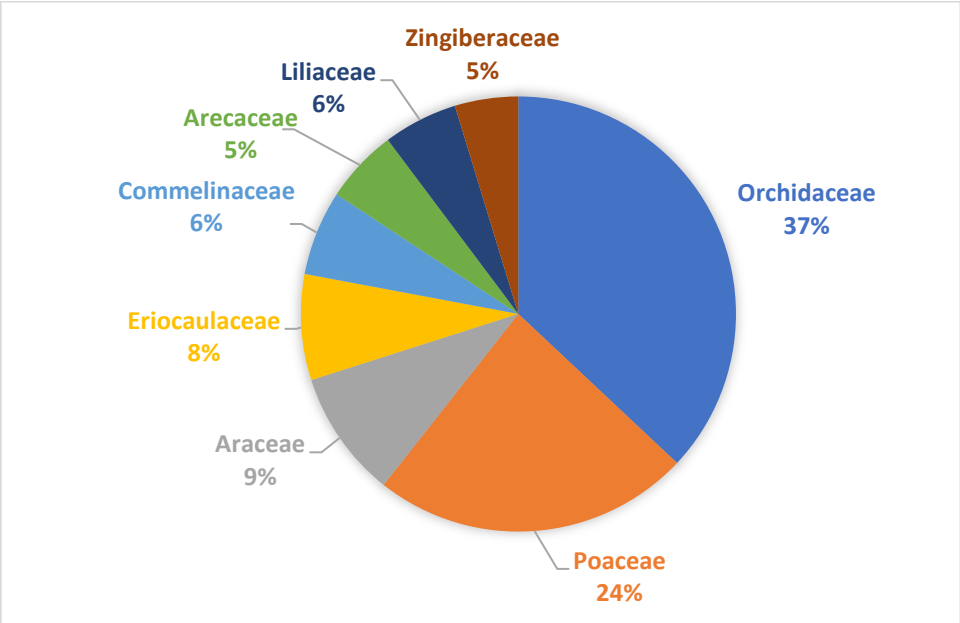


Graph 10. Endemism in monocotyledons of Idukki district

Comparing the relative abundance of endemic species in different families, Orchidaceae constitutes a high percentage of endemism (37%) followed by Poaceae (24%), Araceae (9%), Eriocaulaceae (8%), Commelinaceae and Liliaceae (6%), Arecaceae and Zingiberaceae (5% each). When the distribution patterns of different families are examined, the species-rich families, Cyperaceae, Commelinaceae and Zingiberaceae exhibit wider distribution with less endemism.

Table 8. Relative abundance of endemic species in families

Sl. No.	Family	No. of endemic species	Percentage
1	Orchidaceae	47	37%
2	Poaceae	30	24%
3	Araceae	12	9 %
4	Eriocaulaceae	10	8 %
5	Commelinaceae	8	6 %
6	Liliaceae	7	6 %
7	Arecaceae	7	5%
8	Zingiberaceae	6	5%



Graph 11. Relative abundance of endemic species in families

New taxa described from Idukki district

During the study three new species were discovered such as *Eriocaulon vamanae*, *Burmannia munnarensis* and *Ariopsis idukkiana.*

1. *Eriocaulon vamanae* was described from Meesapulimala. It resembles *Eriocaulon nepalense* var. *luzulifolium*, but differs in the shape of its involucral bracts and receptacle, the fusion of the sepals in male flowers, the shape and indumentum of the sepals in female flowers, the size and indumentum of the petals in female flowers, and the seed coat appendages. This species is so far known only from the type locality, and is assessed as 'Critically Endangered' according to the IUCN Red List Categories and Criteria.

2. *Burmannia munnarensis* is described from Munnar on the way to Rajamala. It is morphologically most similar to *B. indica* but can be easily distinguished by its narrow flower wings, involute margin of the perianth lobes, shorter perianth tube and shape of inflorescence. This species is known only from two localities and is provisionally categorized as Critically Endangered (CR).

3. *Ariopsis idukkiana sp. nov.* is discovered from Anakulam of the district. It is closely allied to *A. peltata*, but can be easily distinguished by its acute apex of the spathe, ovate dome shaped apex of the male spadices and slightly angled fruits. Moreover, in *A. idukkiana* petiole is attached at or near the leaf base, whereas in *A. peltata* younger leaves have attachment just above the leaf base and mature leaves show peltate nature. This species known from the type locality and the species is provisionally categorized as Data Deficient (DD) based on the IUCN Categories and Criteria.

Rediscovery and new distributional records

1. *Burmannia indica* was rediscovered from the study area after a lapse of 110 years. It was first described by F.P. Jonker in 1938 in his monograph of Burmanniaceae based on the homogenous collection of A. Meebold in 1909 from Peermade (now in Idukki district of Kerala). Hazra (1988) in *Fascicles of Flora of India* and Sasidharan (2011) in his *Flowering plants of Kerala* mentioned the occurrence of this species based on Meebold's collection and stated that it is endemic to Kerala. There was no subsequent collection of this species anywhere from South India after the original collection by Meebold in 1909 (Hooker, 1888; Gamble, 1928; Matthew, 1983). Thus, it's report forms a rediscovery after 110

years and proves its existence in the area. The new locality Meenuliyanpara also belongs to the same district but is separated by approximately 270 km from the type locality.

Cyperus raynalianus, *C. diaphanus*, *C. intactus*, *C. albescens*, *Scleria multilacunosa.*, *Festuca bromoides*, *Tripogon pungens* are new records to Kerala. *Eriocaulon rhodae* and *Urochloa eminii* are new reports to the study area.

Reinstatement

Peliosanthes neilgherriensis and *P. courtallensis* were reinstated. Wight (1853) described these two species from South India and were recognized as distinct species by Hooker (1894) and Gamble (1928). However, Jessop (1976) in his revision of *Peliosanthes*, recognized only a single species, *P. teta* with two sub-species, *P. teta* subsp. *teta* and *P. teta* subsp. *humilis*. The South Indian species were treated under the synonymy of *P. teta* subsp. *humilis*. During our study we have collected specimens of this genus from different areas of Idukki district. Critical examination revealed that these specimens are quite distinct and belong to *P. courtallensis* and *P. neilgherrensis*, which however, has long been treated as synonyms of *P. teta* subsp. *humilis*.

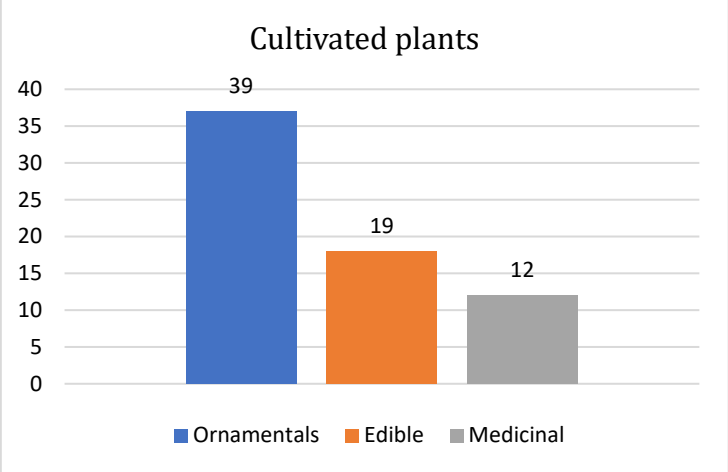
Invasive and exotic species

During the study, 26 introduced exotic species from eight families are collected. The majority of them are introduced for ornamental and fodder purposes, but most of them become aggressive colonizers and threaten the habitat of the native species. The exotic species include *Hedychium flavescens*, *Canna indica*, *Hippeastrum reginae*, *Hymenocallis littoralis*, *Zephyranthes minuta*, *Limnocharis flava*, *Alocasia macrorrhizos*, *Caladium bicolor*, *Aristea ecklonii*, *Crocosmia* × *crocosmiiflora*, *Eleutherine bulbosa*, *Cyperus sphacelatus*, *Axonopus compressus*, *Briza minor*, *Festuca bromoides*, *Urochloa eminii*, *Urochloa mutica*, *Imperata cylindrica*, *Megathyrsus maximus*, *Melinis minutiflora*, *Melinis repens*, *Paspalum conjugatum*, *P. dilatatum*, *P. distihum*, *Sporobolus indicus*, *Pontederia crassipes*. Poaceae (12) constitutes the majority of introduced species, which are primarily used as forage grasses followed by Amaryllidaceae and Iridaceae. The three species in the family Iridaceae, *Aristea ecklonii*, *Crocosmia* × *crocosmiiflora* and *Eleutherine bulbosa* were introduced mainly as ornamentals, but they are naturalized in high elevation grasslands.

Some native plants, including *Potamogeton octandrus*, *Typha angustifolia*, *Vallisneria spiralis*, *Pontederia vaginalis*, *Hydrilla verticillata*, *Cyperus mindorensis*, *Cyperus dubius*, *Dactyloctenium aegyptium* and *Eragrostis unioloides* are obnoxious weeds in paddy fields, water bodies, and agricultural lands.

Cultivated plants

Among the 652 taxa collected, 58 taxa are found to be cultivated variously and used as ornamentals, food and medicines: 39 as ornamentals, 19 as edible, and 12 as medicinal. The list of cultivated species is given in the table 9.



Graph 12. Cultivated plants

Table 9. Cultivated plants variously used as ornamentals, edible and medicines

Ornamental species		
Sl. No.	**Name**	**Family**
1.	*Agave salmiana* var. *ferox* (K.Koch) Gentry	Liliaceae
2.	*Aglaonema commutatum* Schott	Araceae
3.	*Alocasia macrorrhiza* (L.) G. Don	Araceae
4.	*Aloe vera* (L.) Burm.f.	Liliaceae
5.	*Alpinia purpurata* (Vieill.) K.Schum.	Zingiberaceae
6.	*Areca catechu* L.	Arecaceae
7.	*Areca triandra* Roxb. ex Buch.-Ham.	Arecaceae
8.	*Aristea ecklonii* Baker	Iridaceae
9.	*Asparagus densiflorus* (Kunth) Jessop	Liliaceae

10.	*Asparagus setaceus* (Kunth) Jessop	Liliaceae
11.	*Billbergia pyramidalis* (Sims) Lindl.	Bromeliaceae
12.	*Caladium bicolor* (Aiton) Vent.	Araceae
13.	*Callisia repens* (Jacq.) L.	Commelinaceae
14.	*Cordyline fruticosa* (L.) A.Chev.	Lilaceae
15.	*Costus elegans* Veitch ex J.Dix	Zingiberaceae
16.	*Crinum amabile* Donn ex Ker Gawl.	Amaryllidaceae
17.	*Crinum latifolium* L.	Amaryllidaeae
18.	Crinum moorei Hook.f.	Amaryllidaceae
19.	*Crocosmia* × *crocosmiflora* (Lemoine) N.E.Br.	Iridaceae
20.	*Cyrtostachys renda* Blume	Arecaceae
21.	*Eleutherine bulbosa* (Mill.) Urb.	Iridaceae
22.	*Epipremnum pinnatum* (L.) Engl.	Araceae
23.	Etlingera elatior (Jack) R.M.Sm.	Zingiberaceae
24.	*Heliconia marginata* (Griggs) Pittier	Musaceae
25.	*Heliconia rostrata* Ruiz & Pav.	Musaceae
26.	*Hippeastrum puniceum* (Lam.) Voss	Amaryllidaceae
27.	*Hymenocallis littoralis* (Jacq.) Salisb.	Amaryllidaceae
28.	*Iris domestica* (L.) Goldblatt & Mabb.	Iridaceae
29.	*Maranta arundinacea* L.	Marantaceae
30.	*Pontederia crassipes* Mart.	Pontederiaceae
31.	*Scadoxus multiflorus* (Martyn) Raf.	Amaryllidaceae
32.	*Setaria viridis* (L.) P.Beauv.	Poaceae
33.	*Spathoglottis plicata* Blume	Orchidaceae
34.	*Tacca chantrieri* André	Taccaceae
35.	*Tradescantia pallida* (Rose) D.R.Hunt	Commelinaceae

36.	*Tradescantia spathacea* Sw.	Commelinaceae
37.	*Tradescantia zebrina* Bosse	Commelinaceae
38.	*Zephyranthes candida* Herb.	Amaryllidaceae
39.	*Zephyranthes minuta* (Kunth) D.Dietr.	Amaryllidaceae

Edible species		
Sl. No.	**Name**	**Family**
1.	*Allium cepa* L.	Liliaceae
2.	*Allium sativum* L.	Liliaceae
3.	*Amorphophallus paeoniifolius* (Dennst.) Nicolson	Araceae
4.	*Ananas comosus* (L.) Merr.	Bromeliaceae
5.	*Cocos nucifera* L.	Arecaceae
6.	*Colocasia esculenta* (L.) Schott	Araceae
7.	*Curcuma longa* L.	Zingiberaceae
8.	*Dioscorea alata* L.	Dioscoreaceae
9.	*Dioscorea esculenta* (Lour.) Burkill	Dioscoreaceae
10.	*Elaeis guineensis* Jacq.	Arecaceae
11.	*Elettaria cardamomum* (L.) Maton	Zingiberaceae
12.	*Eleusine coracana* (L.) Gaertn.	Poaceae
13.	*Kaempferia galanga* L.	Zingiberaceae
14.	*Musa paradisiaca* L.	Musaceae
15.	*Oryza sativa* L.	Poaceae
16.	*Saccharum officianarum* L.	Poaceae
17.	*Sorghum bicolor* (L.) Moench	Poaceae
18.	*Zea mays* L.	Poaceae
19.	*Zingiber officinale* Roscoe	Zingiberaceae

Medicinal species		
Sl. No.	**Name**	**Family**
1	*Cymbopogon citratus* (DC.) Stapf	Poaceae
2	*Curcuma aeruginosa* Roxb.	Zingiberaceae
3	*Curcuma amada* Roxb.	Zingiberaceae
4	*Curcuma aromatica* Salisb.	Zingiberaceae
5	*Cynodon dactylon* (L.) Pers.	Poaceae
6	*Cyperus mindorensis* (Steud.) Huygh	Cyperaceae
7	*Dioscorea alata* L.	Dioscoreaceae
8	*Dioscorea bulbifera* L.	Dioscoreaceae
9	*Eleutherine bulbosa* (Mill.) Urb.	Iridaceae
10	*Ensete superbum* (Roxb.) Cheesman	Musaceae
11	*Gloriosa superba* L.	Liliaceae
12	*Hedychium coronarium* J.Koenig	Zingiberaceae

Threats to the diversity of the district

Idukki is a biodiversity rich district located in the southern Western Ghats, and it is well-known for its abundance of flora. However, threats to this native flora included habitat degradation, climate change, pollutions, agricultural intensification, invasive species and ornamental and medicinal use.

1. Habitat degradation

It is caused by natural calamities and anthropogenic activities.

1a. Natural calamities

i. Flood and Landslides

In 2018 and 2019 the district was challenged with extensive natural disasters, such as floods, landslides, etc. It was the worst disaster after 1924. The district was severely affected due to its terrain. A large number of dams have been opened and

the diversity of the district distorted severely. More than 500 landslides reported on revenue land and 1000 landslides in the forest areas (Kanungo *et al.*, 2020). Several square kilometres of forests were submerged under water. This repeated landslides and heavy flood caused depletion of surface soil and lead to the loss of soil nutrients, also the young soil was exposed with less water holding capacity. Thereby the high land and midland deprived of topsoil and subsoil. This has resulted in the uproot of trees especially in the forest areas and they became lifeless. The landslides, debris flow, and sedimentation were the main reasons for these losses. In flooded areas, the accumulation of water in the root zone and the lack of oxygen induced severe stress to the roots generating toxic compounds in the rhizosphere, which killed many plants. Due to the overflow of water and other sediments which will be stuck in the leaves of plants will cause the reduction of photosynthesis. The erosion of surface soils from the sloppy terrains also resulted in the dislocating of plants from their growing environment. Further, many flora were also eradicated by the secondary fungal infections which developed subsequently (Impact assessment, Kerala state Biodiversity Board, 2019).

Unusual flowering and fruiting of trees have been reported throughout the Idukki district. Early flowering and fruiting or non-seasonal flowering and fruiting will have a major impact on the ecological cycle. In some areas, the flowering process was delayed due to heavy rains. Besides, the flowering was not consistent due to adverse weather conditions. Many plants were washed out with water to the new localities (Impact assessment, Kerala state Biodiversity Board, 2018). It takes a longer time to restore the ecosystem stability.

Another major disaster that occurred in the district in 2020 was the Pettimudi landslide. There are tea plantations in the area, which borders the Eravikulam National Park. It is a lushly vegetated area. This worst disaster has had a negative impact on the diversity of this area.

ii. Drought

Following the flood, the district experienced a severe drought. This abrupt change in climatic conditions influenced plant diversity and altered physiological mechanisms. Seasonal variations in plant flowering and fruiting were observed.

iii. Snow fall

It was resulted from the flooding that occurred in 2018 and 2019. During December and January, the district, particularly high-altitude regions such as Munnar and Meesapulimala, experienced heavy snowfall. The temperature dropped to -4°C. This may result in the collapse of vegetation, particularly in the grasslands and forest margins.

iv. Forest fires

Fire is one of the significant threats that continuously occured in this area. Either it happens naturally during the summer season due to wind forces, or it results from the anthropogenic activities. This had a detrimental effect on the area's abundant vegetation.

1b. Anthropogenic activities

While natural disasters are a contributing factor to the loss of biodiversity, anthropogenic activities may also trigger natural disasters of a more severe nature. The district's biodiversity is being seriously impacted by a number of issues, such as quarrying, grazing pressures, plantation encroachment, illegal tourism, and road widening. It is one of the major tourist destinations in Kerala, the development of tourism actively and passively affects the floral and faunal diversity through the construction activities and putting severe pressure on fragile ecosystem, road widening, pollution, etc.

2. Pollution

Another major threat to diversity is air, water, and plastic pollution brought on by increased tourism, which will put a lot of strain on the diversity of plants and animals. Additionally, the use of pesticides in agricultural fields, particularly endosulfan, DDT, and organophosphorous pesticides, will have an impact on the fertility of the soil and the native vegetation. Numerous plants were gathered from the adjacent side of the tea estate, and the cardomum plantations displayed differences in their floral parts, indicating alterations in their metabolism brought on by the heavy use of pesticides.

3. Invasive species

Numerous species exhibit invasive traits, spreading swiftly and eradicating other species in their path. Many plants become invasive and harm natural vegetation and agricultural fields. Examples of these include *Limnocharis flava*, *Pontederia vaginalis*, *Typha angustifolia*, *Axonopus compressus*, *Melinis minutiflora*, *Pontederia crassipes*, *Potamogeton octandrus*, *Vallisneria spiralis* and *Hydrilla verticillata*.

4. Ornamental and Medicinal use

There are ornamental, medicinal, and commercially valuable species in the families Orchidaceae, Zingiberaceae, Araceae, and Dioscoriaceae, among others. These species are therefore heavily exploited for these purposes.

Recommendations

a. Enumeration of floristic richness through various research and inventories, including protected and non-protected areas, with special attention to the endemic and threatened plants.

b. Improve *ex-situ* and *in-situ* conservation strategies for threatened plant group in all areas.

c. Limiting destructive activities such as mining, plantation, tourism, constructions and fires and provide awareness to the public and policy makers about the importance of vegetation.

d. Implement rules for ecofriendly tourism activities and reduce pollution, destruction of plant diversity, etc.

e. Implement measures to manage invasive species.

Fig. 32. A. & B. Munnar landslides; **C. & E.** Cheruthoni after flood; **D.** Forest fire Marayur; **F.** Adimali; **G.** Cheruthoni dam during flood (Photos from District Information Centre).

Fig. 33. A-B. Lockhert gap earlier view; **C.** Lockhert gap after road widening; **D. & E.** Puliyanmala; **F.** Pollution at Parunthanpara (Photos from District Information Centre).

SUMMARY AND CONCLUSION

Summary and Conclusion

The floristic study of monocotyledons of Idukki district envisaged exploration and documentation of monocot plant diversity of Idukki district. The thesis is organised into introductory part, systematic part, discussion and summary. In the introductory part features of the study area, review of earlier work, methodology, were given. The systematic part taxonomically enumerates the taxa encountered from the study area.

Idukki is the largest district of Kerala, with five national parks and three wildlife sanctuaries. The vegetation comprises evergreen forests, semi-evergreen forests, moist deciduous forests, dry deciduous forests, shola forests, grasslands, and forest plantations. Majority of the area of the district are covered with forests and other vegetation with less population density, which indicates the rich diversity of plants.

The thesis is the result of the intensive exploratory studies carried out during the period 2016-2022. A total of 652 specimens of monocotyledons belonging to 248 genera in 28 families were reported from the study area. In which 592 were wild plants and 58 were cultivated plants. The cultivated plants were listed in table. The plants were classified according to Bentham and Hooker's system (1862-1883). Keys have been provided for families, genera, species and intraspecific taxa. Illustrations for new species and photo plates for habitats, and different species were provided. 45% of the state's monocotyledon diversity is occurring in this district. When evaluating the other district floras, the largest number of taxa, ie., 652 occur in Idukki district. The family Poaceae with 186 species in 84 genera is the largest family followed by Orchidaceae with 127 species in 50 genera. Cyperaceae are the third largest family represented in the district with 99 species in 13 genera.

Sl. No.	Families	Total no. of taxa	No. of genera	species	Ssp.	Var.	Wild	Cultivated	Endemism	Threat assessed
1.	Hydrocharitaceae	4	3	4	-	-	4	-	-	3
2.	Burmanniaceae	4	1	4	-	-	4	-	2	2

3.	Orchidaceae	128	51	128	-	-	127	1	47	52
4.	Zingiberaceae	37	13	37	-	-	28	9	6	10
5.	Marantaceae	4	4	4	-	-	3	1	-	1
6.	Cannaceae	1	1	1	-	-	-	1	-	-
7.	Musaceae	5	3	5	-	-	2	3	1	2
8.	Haemodoraceae	3	2	3	-	-	3	-	2	-
9.	Amaryllidaceae	11	7	11	-	-	2	9	-	-
10.	Dioscoreaceae	9	1	9	-	-	8	1	-	1
11.	Liliaceae	25	13	24		1	19	6	7	2
12.	Pontederiaceae	2	1	2	-	-	1	1	-	1
13.	Xyridaceae	2	1	2	-	-	2	-	-	2
14.	Commelinaceae	45	8	45	-	-	41	4	8	12
15.	Juncaceae	3	1	2	1	-	3	-	-	1
16.	Arecaceae	17	10	16	-	1	12	5	7	4
17.	Pandanaceae	1	1	1	-	-	1	-	1	-
18.	Typhaceae	1	1	1	-	-	1	-	-	1
19.	Araceae	31	17	31	-	-	25	6	12	5
20.	Alismataceae	1	1	1			1			
21.	Potamogetonaceae	1	1	1	-	-	1	-	-	1
22.	Najadaceae	1	1	1	-	-	1	-	-	1
23.	Eriocaulaceae	18	1	18	-	-	18	-	10	15
24.	Cyperacae	99	13	95	4	-	99	-	5	61
25.	Poaceae	192	85	188	1	3	186	6	30	36
26.	Iridaceae	4	4	4	-	-	-	4	-	-
27.	Bromeliaceae	2	2	2	-	-	-	2	-	-
28.	Taccaceae	1	1	1	-	-	-	1	-	-
		652	248	641	6	5	592	58	138	213

Out of the 248 genera, *Cyperus* (43) is the largest genus followed by *Fimbristylis* (21), *Eriocaulon* (18), and *Dendrobium* (15).

The pristine forests in Idukki are the treasure-house of unique flora, and the present floristic exploration in this biodiversity region resulted in the discovery of three new taxa, *viz*. *Eriocaulon vamanae*, *Burmannia munnarensis* and *Ariopsis idukkiana*. *Burmannia indica* is rediscovered from Meenuliyanpara after a lapse of 110 years. *Cyperus raynalianus*, *C. diaphanus*., *C. intactus*, *C. albescens*, *Scleria multilacunosa*, *S. swamyi*, *Festuca bromoides* and *Tripogon pungens* are new records to Kerala while *Eriocaulon rhodae* and *Urochloa eminii* are new reports to the study area. *Peliosanthes courtallensis* and *P. neilgherriensis* are reinstated.

The study reports a total of 138 endemic taxa forming nearly 23% of the total species. Out of the 138 endemic species, 29 species are endemic to India, 47 to South India, 42 to South West India, and 7 to Kerala and 13 exclusively to the study area. Fifty-five species are distributed only in India and Sri Lanka. Three species are restricted to India and Myanmar and one species in India and Nepal.

Among the 592 wild taxa, the threat assessment of 213 taxa has been done while the remaining 379 species were Not Evaluated (Table 2). Ten species were assessed as Critically Endangered (CR), 26 as Endangered (EN), 14 as Vulnerable (VU), 11 as Near Threatened (NT), 145 as Least Concern (LC), and eight as Data Deficient (DD).

Table 2. No. of species in Red List Category

Sl. No.	Red List Category	No. of species
1	Critically Endangered (CR)	10
2	Endangered (EN)	26
3	Vulnerable (VU)	14
4	Near Threatened (NT)	11
5	Least Concern (LC)	145
6	Data Deficient (DD)	8
7	Not Evaluated (NE)	379

During the study, 26 introduced exotic species from eight families were collected. The majority of them are introduced for ornamental and fodder purposes, but

most of them become aggressive colonizers and threaten the habitat of the native species.

Idukki is a biodiversity rich district located in the southern Western Ghats, and is well-known for its abundance of flora. However, threats to this native flora included habitat degradation, climate change, pollutions, agricultural intensification, invasive species and ornamental and medicinal use. All these facts indicate the immediate need of implementing proper conservation measures to maintain the species diversity which is our national heritage, and to save the valuable genetic resources for judicious and sustainable utilization for the future generation.

RECOMMENDATIONS & FUTURE PERSPECTIVES

Recommendations

- The district faced severe natural calamities, and many of the floristic elements of the district were lost. There is a need to find them and propagate, and conserve these plant species, via., *Ex situ* and *In situ* conservation methods.
- It is a major tourist destination in Kerala, illegal tourism activities, mining and construction damages the diversity of the district, so there should be new governing policies for conservation.
- Collaboration with researchers, government agencies, and non-governmental organizations will help to understand various aspects of the nature of the district. It will aid in taking various protection measures.
- Conduct public awareness programmes, which will help the general public to understand the diversity of the district and the challenges faced by the biodiversity of the district.

Future perspectives

- Population studies in different areas will help to know the abundance of species and the extent of the threat.
- After natural calamities like floods and landslides, the climatic conditions of the district drastically changed. A study of climate change and the effect of these changes on the plant diversity of the district is needed.
- A thorough study of the invasive species and its source, its effect on native flora, and effective control can be studied.

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APPENDIX

Appendix I

List of plants included in Red List category and Endemism

Sl no.	Name	CR	EN	VU	NT	LC	DD	NE	Distribution
1.	*Blyxa aubertii*					✓			
2.	*Blyxa echinosperma*							✓	
3.	*Hydrilla verticillata*					✓			
4.	*Vallisneria spiralis*					✓			
5.	*Burmannia coelestis*					✓			
6.	*Burmannia indica*	✓							India (Kerala)
7.	*Burmannia munnarensis*	✓							
8.	*Burmannia pusilla*					✓			
9.	*Acanthophippium bicolor*								S. & E. India, Sri Lanka
10.	*Aerides maculosa*		✓						India
11.	*Aerides ringens*							✓	India, Sri Lanka
12.	*Anoectochilus elatus*		✓						S. India
13.	*Aphyllorchis montana*							✓	
14.	*Arundina graminifolia*							✓	
15.	*Brachycorythis iantha*							✓	S. India
16.	*Brachycorythis splendida*	✓							SW. India
17.	*Bulbophyllum bonaccordense*			✓					SW. India, Kerala
18.	*Bulbophyllum elegantulum*	✓							S. India
19.	*Bulbophyllum fimbriatum*		✓						SW. India
20.	*Bulbophyllum fischeri*							✓	
21.	*Bulbophyllum fuscopurpureum*		✓						India
22.	*Bulbophyllum kaitiense*							✓	India
23.	*Bulbophyllum mysorense*		✓						India
24.	*Bulbophyllum sterile*			✓					
25.	*Bulbophyllum stocksii*	✓							S. India
26.	*Bulbophyllum tremulum*		✓						SW. India
27.	*Bulbophyllum xylophyllum*							✓	
28.	*Calanthe masuca*							✓	
29.	*Calanthe triplicata*							✓	
30.	*Cheirostylis flabellata*							✓	
31.	*Cleisostoma tenuifolium*							✓	
32.	*Coelogyne breviscapa*							✓	S. India, Sri Lanka
33.	*Coelogyne imbricata*							✓	
34.	*Coelogyne mossiae*		✓						S. India
35.	*Coelogyne nervosa*		✓						
36.	*Cottonia peduncularis*							✓	India, Sri Lanka
37.	*Crepidium acuminatum*							✓	
38.	*Crepidium resupinatum*							✓	
39.	*Cylindrolobus pauciflorus*					✓			S. India
40.	*Cylindrolobus pseudoclavicaulis*			✓					SW. India
41.	*Cymbidium aloifolium*							✓	
42.	*Dendrobium anamalayanum*		✓						S. India
43.	*Dendrobium aqueum*				✓				S. India
44.	*Dendrobium barbatulum*			✓					SW. India
45.	*Dendrobium herbaceum*							✓	
46.	*Dendrobium heterocarpum*							✓	
47.	*Dendrobium heyneanum*		✓						S. India
48.	*Dendrobium kallarense*						✓		India (Kerala)

49.	*Dendrobium macraei*							✓	
50.	*Dendrobium macrostachyum*							✓	
51.	*Dendrobium microbulbon*		✓						S. India
52.	*Dendrobium nanum*		✓						S. India
53.	*Dendrobium nodosum*			✓					S. India
54.	*Dendrobium nutantiflorum*							✓	S. India, Sri Lanka
55.	*Dendrobium ovatum*			✓					SW. India
56.	*Dendrobium salaccense*							✓	
57.	*Dendrobium wightii*			✓					S. India, Sri Lanka
58.	*Diplocentrum congestum*		✓						SW. India
59.	*Diplocentrum recurvum*							✓	
60.	*Disperis neilgherrensis*		✓						
61.	*Epipogium roseum*							✓	
62.	*Eulophia epidendraea*							✓	
63.	*Eulophia graminea*							✓	
64.	*Eulophia nuda*							✓	
65.	*Eulophia picta*							✓	
66.	*Gastrochilus acaulis*							✓	India, Sri Lanka
67.	*Goodyera procera*							✓	
68.	*Habenaria barnesii*		✓						SW. India
69.	*Habenaria brachyphylla*							✓	India
70.	*Habenaria cephalotes*		✓						S. India
71.	*Habenaria crinifera*							✓	
72.	*Habenaria elliptica*		✓						SW. India
73.	*Habenaria furcifera*							✓	
74.	*Habenaria heyneana*				✓				SW. India
75.	*Habenaria longicorniculata*				✓				India, Sri Lanka
76.	*Habenaria longicornu*		✓						SW. India
77.	*Habenaria periyarensis*	✓							SW. India (Kerala)
78.	*Habenaria perrottetiana*		✓						SW. India
79.	*Habenaria rariflora*				✓				SW. India
80.	*Habenaria roxburghii*							✓	India, Sri Lanka
81.	*Liparis elliptica*							✓	
82.	*Liparis odorata*							✓	
83.	*Liparis viridiflora*							✓	
84.	*Liparis walkerae*							✓	SW. India, Sri Lanka
85.	*Liparis wightiana*							✓	
86.	*Luisia tenuifolia*							✓	SW. India, Sri Lanka
87.	*Luisia zeylanica*							✓	
88.	*Malaxis densiflora*							✓	SW. India, Sri Lanka
89.	*Nervilia simplex*							✓	
90.	*Nervilia plicata*							✓	
91.	*Oberonia anamalayana*		✓						S. India
92.	*Oberonia bicornis*							✓	
93.	*Oberonia brachystachys*							✓	
94.	*Oberonia brunoniana*				✓				
95.	*Oberonia chandrasekharanii*	✓							SW. India
96.	*Oberonia ensiformis*							✓	
97.	*Oberonia proudlockii*		✓						S. & NE. India
98.	*Oberonia sebastiana*			✓					S. India
99.	*Oberonia thwaitesii*							✓	India, Sri Lanka
100.	*Oberonia wightiana*							✓	India, Sri Lanka
101.	*Pachystoma pubescens*							✓	

102.	*Papilionanthe cylindrica*							✓	India, Sri Lanka
103.	*Pecteilis gigantea*							✓	
104.	*Peristylus aristatus*							✓	
105.	*Peristylus densus*							✓	
106.	*Peristylus goodyeroides*							✓	
107.	*Peristylus richardianus*							✓	
108.	*Peristylus spiralis*							✓	SW. India, Sri Lanka
109.	*Pinalia mysorensis*		✓						S. India
110.	*Pinalia polystachya*				✓				S. India
111.	*Podochilus malabaricus*							✓	
112.	*Polystachya concreta*							✓	
113.	*Porpax braccata*							✓	S. India, Sri Lanka, E. Himalaya
114.	*Porpax filiformis*				✓				SW. India
115.	*Porpax jerdoniana*							✓	S. India, N. Andaman Island
116.	*Porpax nana*		✓						S. India
117.	*Porpax reticosa*							✓	Uttarakand, S. India
118.	*Rhynchostylis retusa*							✓	
119.	*Robiquetia josephiana*			✓					SW. India (Kerala)
120.	*Satyrium nepalense*							✓	
121.	*Schoenorchis jerdoniana*		✓						S. India
122.	*Schoenorchis smeeana*							✓	SW. India
123.	*Sirhookera lanceolata*					✓			SW. India, Sri Lanka
124.	*Sirhookera latifolia*							✓	SW. India, Sri Lanka
125.	*Smithsonia viridiflora*		✓						SW. India
126.	*Spiranthes sinensis*					✓			
127.	*Tainia bicornis*							✓	
128.	*Taprobanea spathulata*			✓					S. India, Sri Lanka
129.	*Thelasis pygmaea*							✓	
130.	*Trichoglottis tenera*							✓	S. India, Sri Lanka
131.	*Tropidia angulosa*							✓	
132.	*Vanda tessellata*					✓			
133.	*Vanda testacea*							✓	
134.	*Zeuxine gracilis*							✓	
135.	*Zeuxine longilabris*							✓	
136.	*Alpinia abundiflora*							✓	S. India, Sri Lanka
137.	*Alpinia calcarata*							✓	
138.	*Alpinia fax*							✓	
139.	*Alpinia galanga*							✓	
140.	*Alpinia malaccensis*						✓		
141.	*Alpinia nigra*					✓			
142.	*Amomum hypoleucum*							✓	
143.	*Boesenbergia tiliifolia*							✓	SW. India, Assam
144.	*Costus pictus*							✓	
145.	*Curcuma aromatica*							✓	
146.	*Curcuma coriacea*		✓						SW. India
147.	*Curcuma montana*							✓	
148.	*Curcuma neilgherrensis*							✓	
149.	*Curcuma zanthorrhiza*						✓		SW. India
150.	*Globba marantina*					✓			

151.	*Globba sessiliflora*					✓			
152.	*Hedychium coronarium*						✓		
153.	*Hedychium flavescens*							✓	Introduced india
154.	*Hedychium spicatum*							✓	
155.	*Hedychium venustum*							✓	S. India, Myanmar
156.	*Hellenia speciosa*							✓	
157.	*Meistera acuminata*							✓	SW. India, Sri Lanka
158.	*Meistera cannicarpa*							✓	SW. India
159.	*Meistera ghatica*							✓	SW. India
160.	*Meistera masticatorium*					✓			SW. India, Sri Lanka
161.	*Zingiber neesanum*							✓	W. India
162.	*Zingiber nimmonii*					✓			S. India, Myanmar
163.	*Zingiber zerumbet*						✓		
164.	*Indianthus virgatus*							✓	S. India, Sri Lanka, Andaman
165.	*Phrynium pubinerve*							✓	
166.	*Stachyphrynium spicatum*					✓			
167.	*Canna indica*							✓	Introduced india
168.	*Ensete superbum*				✓				S. India
169.	*Musa kattuvazhana*				✓				
170.	*Ophiopogon intermedius*							✓	
171.	*Peliosanthes teta subsp. humilis*							✓	
172.	*Hippeastrum reginae*							✓	Introduced
173.	*Curculigo orchioides*							✓	
174.	*Curculigo trichocarpa*							✓	India, Sri Lanka
175.	*Hypoxis aurea*							✓	
176.	*Dioscorea alata*							✓	
177.	*Dioscorea bulbifera*							✓	
178.	*Dioscorea esculenta*							✓	
179.	*Dioscorea oppositifolia*							✓	
180.	*Dioscorea pentaphylla*							✓	
181.	*Dioscorea spicata*							✓	
182.	*Dioscorea tomentosa*							✓	
183.	*Dioscorea wallichii*					✓			
184.	*Asparagus racemosus*							✓	
185.	*Asparagus gonoclados*							✓	S. India, Sri Lanka
186.	*Chlorophytum heynei*							✓	S. India, Sri Lanka
187.	*Chlorophytum indicum*							✓	SW. Indica
188.	*Chlorophytum laxum*							✓	
189.	*Chlorophytum malabaricum*							✓	SW. India
190.	*Chlorophytum nimmonii*							✓	S. India
191.	*Chlorophytum sharmae*							✓	India (Kerala)
192.	*Chlorophytum tuberosum*					✓			
193.	*Dianella ensifolia*							✓	
194.	*Disporum cantoniense*							✓	
195.	*Dracaena roxburghiana*							✓	W. & S. India
196.	*Drimia nagarjunae*							✓	S. India
197.	*Gloriosa superba*					✓			
198.	*Iphigenia indica*							✓	
199.	*Lilium wallichianum* var. *neilgherrense*							✓	Central Nepal & S. India
200.	*Smilax zeylanica*							✓	
201.	*Smilax wightii*							✓	C. & E. Himalaya, S. India
202.	*Smilax prolifera*							✓	

203.	*Pontederia vaginalis*					✓			
204.	*Xyris capensis*					✓			
205.	*Xyris indica*					✓			
206.	*Commelina benghalensis*					✓			
207.	*Commelina clavata*					✓			India (Kerala)
208.	*Commelina clavatoides*							✓	
209.	*Commelina diffusa*					✓			
210.	*Commelina ensifolia*							✓	S. India, Sri Lanka
211.	*Commelina indehiscens*							✓	
212.	*Commelina undulata*							✓	
213.	*Commelina longifolia*							✓	
214.	*Commelina maculata*							✓	
215.	*Commelina paludosa*							✓	
216.	*Commelina suffruticosa*							✓	India, Sri Lanka
217.	*Cyanotis adscendens*							✓	
218.	*Cyanotis arachnoidea*							✓	
219.	*Cyanotis axillaris*					✓			
220.	*Cyanotis burmanniana*							✓	
221.	*Cyanotis cristata*					✓			India, Sri Lanka
222.	*Cyanotis fasciculata*					✓			S. India, Sri Lanka
223.	*Cyanotis obtusa*							✓	SW. India, Sri Lanka
224.	*Cyanotis pilosa*							✓	
225.	*Cyanotis racemosa*							✓	India
226.	*Cyanotis tuberosa*							✓	SW. India, Sri Lanka
227.	*Cyanotis villosa*							✓	SW. India
228.	*Cyanotis vivipara*							✓	
229.	*Dictyospermum montanum*							✓	
230.	*Dictyospermum ovalifolium*							✓	
231.	*Floscopa scandens*					✓			S. India
232.	*Murdannia dimorpha*							✓	India, Sri Lanka
233.	*Murdannia esculenta*					✓			India (KL)
234.	*Murdannia fadeniana*							✓	
235.	*Murdannia gigantea*							✓	
236.	*Murdannia japonica*							✓	S. India
237.	*Murdannia lanuginosa*							✓	
238.	*Murdannia loriformis*							✓	
239.	*Murdannia nudiflora*							✓	S. India
240.	*Murdannia pauciflora*					✓			SW. India
241.	*Murdannia satheeshiana*							✓	
242.	*Murdannia semiteres*					✓			
243.	*Murdannia simplex*					✓			
244.	*Murdannia spirata*					✓			S. India, Sri Lanka
245.	*Murdannia zeylanica*							✓	
246.	*Rhopalephora scaberrima*							✓	
247.	*Juncus bufonius*					✓			
248.	*Juncus effusus*							✓	
249.	*Juncus prismatocarpus*							✓	SW. India
250.	*Arenga wightii*			✓					SW. India, S. India
251.	*Bentinckia condapanna*			✓					SW. & S. India
252.	*Calamus brandisii*							✓	SW. India
253.	*Calamus gamblei*							✓	S. India
254.	*Calamus hookerianus*							✓	SW. India, Sri Lanka
255.	*Calamus pseudotenuis*							✓	SW. India

256.	*Calamus rheedei*							✓	SW. India, Sri Lanka
257.	*Calamus thwaitesii*							✓	SW. India
258.	*Calamus vattayila*							✓	SW. & S. India, Sri Lanka
259.	*Caryota urens*					✓			SW. India, Sri Lanka
260.	*Corypha umbraculifera*						✓		
261.	*Phoenix loureiroi* var. *pedunculata*							✓	S. India
262.	*Pandanus unipapillatus*							✓	
263.	*Typha angustifolia*					✓			Laccadive Islands, SW. India
264.	*Anaphyllum wightii*							✓	Kl
265.	*Ariopsis idukkiana*							✓	India (KL)
266.	*Arisaema attenuatum*							✓	SW. India, Sri Lanka
267.	*Arisaema barnesii*							✓	
268.	*Arisaema jacquemontii*					✓			
269.	*Arisaema leschenaultii*							✓	India
270.	*Arisaema madhuanum*							✓	India (KL)
271.	*Arisaema peltatum*							✓	S. India (KL, ID)
272.	*Arisaema psittacus*							✓	India
273.	*Arisaema sarracenioides*							✓	
274.	*Arisaema tortuosum*							✓	
275.	*Colocasia esculenta*					✓			SW. India
276.	*Cryptocoryne consobrina*				✓				
277.	*Cryptocoryne retrospiralis*					✓			SW. India
278.	*Lagenandra meeboldii*							✓	
279.	*Lagenandra ovata*					✓			
280.	*Pistia stratiotes*					✓			SW. India
281.	*Pothos armatus*							✓	India
282.	*Pothos keralensis*							✓	
283.	*Pothos scandens*							✓	SW. India
284.	*Pothos thomsonianus*							✓	
285.	*Rhaphidophora pertusa*							✓	
286.	*Remusatia vivipara*							✓	W. & S. India
287.	*Theriophonum infaustum*							✓	
288.	*Typhonium trilobatum*							✓	Introduced
289.	*Limnocharis flava*							✓	
290.	*Potamogeton octandrus*					✓			
291.	*Najas indica*					✓			India (KL)
292.	*Eriocaulon biappendiculatum*							✓	
293.	*Eriocaulon brownianum*					✓			SW. India
294.	*Eriocaulon eurypeplon*					✓			S. India
295.	*Eriocaulon nairii*							✓	
296.	*Eriocaulon nepalense*					✓			
297.	*Eriocaulon odoratum*					✓			India (KL)
298.	*Eriocaulon pandeyana*						✓		C. & W. India
299.	*Eriocaulon parviflorum*					✓			S. India (W. Ghats)
300.	*Eriocaulon pectinatum*			✓					
301.	*Eriocaulon quinquangulare*							✓	SW. India
302.	*Eriocaulon rhodae*					✓			
303.	*Eriocaulon sexangulare*							✓	
304.	*Eriocaulon thwaitesii*					✓			
305.	*Eriocaulon truncatum*					✓			W. India

306.	*Eriocaulon tuberiferum*			✓					India (KL, ID)
307.	*Eriocaulon vamanae*	✓							India (KL)
308.	*Eriocaulon vasudevanii*							✓	
309.	*Eriocaulon xeranthemum*					✓			
310.	*Abildgaardia ovata*							✓	
311.	*Bulbostylis barbata*							✓	
312.	*Bulbostylis barbata* Subsp. *Pulchella*							✓	
313.	*Bulbostylis densa*					✓			
314.	*Carex baccans*					✓			
315.	*Carex condensata*							✓	
316.	*Carex cruciata*							✓	
317.	*Carex filicina*					✓			
318.	*Carex lenta*							✓	
319.	*Carex ligulata*							✓	
320.	*Carex lindleyana*					✓			
321.	*Carex longicruris*							✓	
322.	*Carex maculata*					✓			
323.	*Carex myosurus*					✓			
324.	*Carex phacota*					✓			
325.	*Carex speciosa*							✓	
326.	*Cyperus albescens*							✓	
327.	*Cyperus brevifolius*					✓			
328.	*Cyperus clarkei*					✓			
329.	*Cyperus compressus*					✓			
330.	*Cyperus corymbosus*					✓			
331.	*Cyperus cuspidatus*							✓	
332.	*Cyperus cyperoides*					✓			
333.	*Cyperus diaphanus*							✓	
334.	*Cyperus difformis*					✓			
335.	*Cyperus diffusus*					✓			
336.	*Cyperus digitatus*					✓			
337.	*Cyperus distans*					✓			
338.	*Cyperus dubius*					✓			
339.	*Cyperus exaltatus*					✓			
340.	*Cyperus flavidus*					✓			
341.	*Cyperus haspan*					✓			
342.	*Cyperus intactus*					✓			
343.	*Cyperus iria*					✓			
344.	*Cyperus javanicus*							✓	
345.	*Cyperus maderaspatanus*					✓			
346.	*Cyperus melanospermus*							✓	
347.	*Cyperus metzii*							✓	
348.	*Cyperus mindorensis*							✓	
349.	*Cyperus mollipes*					✓			
350.	*Cyperus neochinensis*							✓	
351.	*Cyperus nutans*					✓			
352.	*Cyperus pangorei*					✓			
353.	*Cyperus paniceus*					✓			
354.	*Cyperus pilosus*					✓			
355.	*Cyperus polystachyos*					✓			
356.	*Cyperus procerus*					✓			
357.	*Cyperus pumilus*					✓			SW. India
358.	*Cyperus raynalianus*							✓	
359.	*Cyperus richardii*							✓	
360.	*Cyperus rotundus*					✓			
361.	*Cyperus sanguinolentus*					✓			

362.	*Cyperus sesquiflorus* subsp. *cylindricus*							✓	Introduced in India
363.	*Cyperus sphacelatus*							✓	
364.	*Cyperus squarrosus*					✓			
365.	*Cyperus substramineus*							✓	
366.	*Cyperus tenuiculmis*					✓			
367.	*Cyperus tenuispica*					✓			
368.	*Cyperus zollingeri*					✓			
369.	*Diplacrum caricinum*					✓			
370.	*Eleocharis congesta*					✓			
371.	*Eleocharis dulcis*					✓			
372.	*Eleocharis retroflexa* subsp. *Chaetaria*							✓	
373.	*Eleocharis tetraquetra*							✓	
374.	*Fimbristylis aestivalis*							✓	
375.	*Fimbristylis aphylla*					✓			
376.	*Fimbristylis argentea*					✓			
377.	*Fimbristylis bisumbellata*					✓			
378.	*Fimbristylis cinnamometorum*					✓			
379.	*Fimbristylis complanata*					✓			
380.	*Fimbristylis dichotoma*					✓			
381.	*Fimbristylis dichotoma* Subsp. *Podocarpa*							✓	
382.	*Fimbristylis dipsacea*					✓			
383.	*Fimbristylis eragrostis*							✓	
384.	*Fimbristylis falcata*							✓	S. India
385.	*Fimbristylis kingii*					✓			
386.	*Fimbristylis littoralis*					✓			S. India, Sri Lanka
387.	*Fimbristylis monticola*							✓	S. India
388.	*Fimbristylis narayanii*							✓	
389.	*Fimbristylis quinquangularis*					✓			
390.	*Fimbristylis salbundia*					✓			
391.	*Fimbristylis squarrosa*					✓			
392.	*Fimbristylis tenera*							✓	S. India
393.	*Fimbristylis uliginosa*							✓	
394.	*Fimbristylis velata*							✓	
395.	*Fuirena umbellata*					✓			
396.	*Hypolytrum nemorum*							✓	
397.	*Isolepis fluitans*					✓			
398.	*Rhynchospora corymbosa*					✓			
399.	*Rhynchospora rugosa*					✓			
400.	*Schoenoplectiella juncoides*							✓	
401.	*Schoenoplectiella mucronata*					✓			
402.	*Scleria levis*							✓	
403.	*Scleria lithosperma*					✓			S. India, Sri Lanka
404.	*Scleria multilacunosa*							✓	
405.	*Scleria parvula*					✓			
406.	*Scleria pergracilis*					✓			S. India
407.	*Scleria swamyi*							✓	
408.	*Scleria terrestris*					✓			
409.	*Agrostis pilosula*							✓	
410.	*Alloteropsis cimicina*							✓	India, Sri Lanka
411.	*Andropogon lividus*							✓	
412.	*Andropogon polyptychos*							✓	India
413.	*Anthoxanthum borii*				✓				
414.	*Apluda mutica*							✓	
415.	*Apocopis mangalorensis*							✓	

416.	*Aristida adscensionis*							✓	
417.	*Arthraxon hispidus*							✓	
418.	*Arthraxon lanceolatus*							✓	
419.	*Arthraxon lancifolius*							✓	
420.	*Arthraxon nudus*							✓	
421.	*Arundinella ciliata*							✓	India, Sri Lanka
422.	*Arundinella leptochloa*					✓			India
423.	*Arundinella mesophylla*							✓	
424.	*Arundinella nepalensis*					✓			India (KL)
425.	*Arundinella pradeepiana*							✓	
426.	*Arundinella pumila*							✓	
427.	*Arundinella purpurea*							✓	
428.	*Arundinella setosa*							✓	India
429.	*Arundinella vaginata*							✓	Introduced
430.	*Axonopus compressus*					✓			
431.	*Bambusa bambos*							✓	
432.	*Bothriochloa insculpta*							✓	
433.	*Bothriochloa pertusa*							✓	Introduced
434.	*Briza minor*							✓	
435.	*Capillipedium assimile*							✓	
436.	*Cenchrus hohenackeri*					✓			
437.	*Centotheca lappacea*							✓	
438.	*Chloris barbata*							✓	
439.	*Chrysopogon aciculatus*							✓	S. India
440.	*Chrysopogon asper*							✓	S. India
441.	*Chrysopogon hackelii*							✓	
442.	*Chrysopogon nodulibarbis*							✓	
443.	*Coelachne perpusilla*					✓			
444.	*Coelachne simpliciuscula*							✓	
445.	*Coix lacryma–Jobi*							✓	
446.	*Cymbopogon caesius*							✓	
447.	*Cymbopogon flexuosus*							✓	
448.	*Cynodon dactylon*							✓	S. India, Sri Lanka
449.	*Cyrtococcum deccanense*							✓	
450.	*Cyrtococcum longipes*							✓	
451.	*Cyrtococcum oxyphyllum*							✓	
452.	*Cyrtococcum patens*							✓	
453.	*Cyrtococcum trigonum*							✓	
454.	*Dactyloctenium aegyptium*							✓	
455.	*Dichanthium foulkesii*							✓	
456.	*Digitaria bicornis*							✓	
457.	*Digitaria ciliaris*							✓	
458.	*Digitaria didactyla*							✓	
459.	*Digitaria griffithii*							✓	
460.	*Digitaria longiflora*							✓	
461.	*Digitaria radicosa*							✓	
462.	*Digitaria setigera*							✓	
463.	*Digitaria ternata*							✓	
464.	*Digitaria violascens*							✓	
465.	*Digitaria wallichiana*							✓	SW. & S. India
466.	*Dimeria borii*							✓	S. India
467.	*Dimeria deccanensis*							✓	S. India
468.	*Dimeria fischeri*							✓	SW. India
469.	*Dimeria idukkiensis*							✓	S. India
470.	*Dimeria kanjirapallilana*							✓	
471.	*Echinochloa colonum*					✓			

472.	*Echinochloa colonum subsp. edulis*							✓	
473.	*Echinochloa crus-galli*					✓			
474.	*Echinochloa stagnina*					✓			
475.	*Eleusine indic*a					✓			
476.	*Enteropogon monostachyos*							✓	
477.	*Eragrostiella bifaria* var. bifaria							✓	S. India, Sri Lanka
478.	*Eragrostiella bifaria* var. secunda							✓	
479.	*Eragrostis amabilis*							✓	
480.	*Eragrostis atrovirens*								
481.	*Eragrostis cilianensis*					✓			SW. India
482.	*Eragrostis collinensis*							✓	
483.	*Eragrostis gangetica*							✓	India, Sri Lanka
484.	*Eragrostis maderaspatana*					✓			
485.	*Eragrostis minor*							✓	
486.	*Eragrostis nigra*							✓	
487.	*Eragrostis nutans*							✓	
488.	*Eragrostis paniciformis*							✓	
489.	*Eragrostis pilosa*							✓	
490.	*Eragrostis tenuifolia*							✓	
491.	*Eragrostis unioloides*					✓			
492.	*Eragrostis viscosa*							✓	S. India, Myanmar
493.	*Euclasta oligantha*							✓	
494.	*Eulalia phaeothrix*							✓	Introduced
495.	*Festuca bromoides*							✓	SW. India
496.	*Garnotia arundinacea*							✓	S. India, Sri Lanka
497.	*Garnotia courtallensis*					✓			S. India, ANdaman
498.	*Garnotia elata*							✓	S. India, Sri Lanka
499.	*Garnotia exaristata*							✓	
500.	*Garnotia tenella*							✓	India
501.	*Glyphochloa forficulata*							✓	
502.	*Hackelochloa granularis*							✓	
503.	*Heteropogon contortus*							✓	
504.	*Ichnanthus pallens* var. *major*							✓	Introduced
505.	*Imperata cylindrica*							✓	SW. India
506.	*Isachne bourneorum*							✓	SW. India
507.	*Isachne fischeri*							✓	
508.	*Isachne globosa*					✓			India, Sri Lanka
509.	*Isachne kunthiana*							✓	SW. & S. India
510.	*Isachne setosa*							✓	SW. & S. India, Sri Lanka
511.	*Isachne walkeri*							✓	
512.	*Ischaemum ciliare*							✓	India, Sri Lanka
513.	*Ischaemum commutatum*							✓	
514.	*Ischaemum polystachyum*					✓			
515.	*Ischaemum timorense*							✓	
516.	*Jansenella griffithiana*							✓	India (Kerala), Sri Lanka
517.	*Kuruna floribunda*	✓							S. India, Sri Lanka
518.	*Kuruna walkeriana*	✓							S. India
519.	*Kuruna wightiana*						✓		
520.	*Leersia hexandra*					✓			
521.	*Louisiella paludosa*							✓	Introduced
522.	*Megathyrsus maximus*							✓	Introduced
523.	*Melinis minutiflora*							✓	Introduced

524.	*Melinis repens*							✓	
525.	*Microstegium fasciculatum*							✓	S. India
526.	*Ochlandra travancorica*							✓	
527.	*Oplismenus compositus*					✓			
528.	*Oplismenus undulatifolius*							✓	
529.	*Oropetium thomaeum*							✓	
530.	*Oryza rufipogon*					✓			
531.	*Ottochloa nodosa*							✓	
532.	*Panicum antidotale*							✓	
533.	*Panicum brevifolium*							✓	India, Sri Lanka
534.	*Panicum gardneri*							✓	
535.	*Panicum humidorum*							✓	
536.	*Panicum notatum*							✓	
537.	*Panicum sumatrense*					✓			Introduced
538.	*Paspalum conjugatum*					✓			Introduced
539.	*Paspalum dilatatum*							✓	Introduced
540.	*Paspalum distichum*					✓			
541.	*Paspalum scrobiculatum*					✓			
542.	*Perotis indica*							✓	
543.	*Poa annua*					✓			
544.	*Pogonatherum crinitum*							✓	
545.	*Polytoca gigantea*							✓	
546.	*Pseudanthistiria umbellata*							✓	
547.	*Pseudechinolaena polystachya*							✓	
548.	*Pseudopogonatherum trispicatum*							✓	
549.	*Pseudoraphis spinescens*							✓	
550.	*Pseudosorghum fasciculare*							✓	India
551.	*Pseudoxytenanthera bourdillonii*							✓	
552.	*Pseudoxytenanthera monadelpha*							✓	
553.	*Rottboellia cochinchinensis*							✓	
554.	*Saccharum spontaneum*					✓			
555.	*Sacciolepis indica*					✓			
556.	*Sacciolepis interrupta*							✓	
557.	*Schizachyrium brevifolium*					✓			India
558.	*Schizostachyum beddomei*							✓	
559.	*Setaria barbata*							✓	
560.	*Setaria flavida*							✓	
561.	*Setaria intermedia*							✓	
562.	*Setaria palmifolia*							✓	
563.	*Setaria parviflora*					✓			
564.	*Setaria pumila*							✓	
565.	*Setaria verticillata*							✓	
566.	*Sorghum halepense*							✓	
567.	*Sorghum nitidum*							✓	India
568.	*Spodiopogon rhizophorus*							✓	Introduced
569.	*Sporobolus indicus*					✓			
570.	*Sporobolus pilifer*							✓	
571.	*Streptogyna crinita*							✓	India, Sri Lanka
572.	*Themeda cymbaria*							✓	SW. India
573.	*Themeda sabarimalayana*							✓	
574.	*Themeda tremula*							✓	
575.	*Themeda triandra*							✓	
576.	*Trachys muricata*							✓	
577.	*Trigonochloa uniflora*							✓	
578.	*Tripogon bromoides*							✓	

579.	*Tripogon filiformis*							✓	
580.	*Tripogon munnarensis*							✓	
581.	*Tripogon narayanae*							✓	S. India
582.	*Tripogon pungens*							✓	
583.	*Tripogon sivarajanii*							✓	
584.	*Tripogon velliangiriensis*							✓	S. India, Sri Lanka
585.	*Tripogon zeylanicus*							✓	
586.	*Trisetopsis virescens*							✓	
587.	*Urochloa distachyos*							✓	Introduced
588.	*Urochloa eminii*							✓	Introduced
589.	*Urochloa mutica*					✓			
590.	*Urochloa panicoides*					✓			
591.	*Urochloa ramosa*					✓			
592.	*Urochloa reptans*					✓			India
593.	*Zenkeria elegans*							✓	India
594.	*Zenkeria sebastinei*							✓	

Appendix II

Weather data of the district

Table 1: Monthly average rain falls in mm from 2016–2020 (https://www.world weatheronline.com/lang/en-in/idukki-weather-history/kerala/in.aspx)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	1.54	5.37	7.6	59.34	79.5	40.28	24.77	22.27	16.24	113.51	27. 16	18.53
2017	20.85	1.43	117.95	55.72	86.22	42.26	15.85	43.48	78.79	83. 18	103.97	30.92
2018	6.86	15.06	54.28	87.82	153.78	45.74	25.93	87.97	70.2	138.06	85.62	19.62
2019	14	24.7	13.5	56.7	103.9	55.3	235.9	373.3	219.6	584.6	327	172.9
2020	19.7	12.4	79.9	106.3	253.5	282.7	188.4	266.9	225.6			

Table 2: Monthly Average humidity and cloud in % from 2016–2020

(https://www.worldweatheronline.com/lang/en-in/idukki-weather history/ kerala/ in.aspx)

Average Humidity and Cloud (%)	year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Humidity	2016	67	60	58	63	67	69	69	68	69	72	73	74
Cloud		16	11	8	23	25	32	35	16	17	30	22	20
Humidity	2017	71	58	67	62	67	69	64	69	70	71	76	74
Cloud		23	5	16	8	19	29	21	30	31	31	34	21
Humidity	2018	64	56	56	64	68	68	69	70	64	70	76	74
Cloud		18	10	15	24	25	28	32	29	20	28	24	24
Humidity	2019	64	63	53	56	62	71	76	81	79	84	86	87
Cloud		18	29	13	28	53	51	52	67	61	65	67	69
Humidity	2020	77	71	66	62	73	77	78	79	80			
Cloud		37	35	31	39	54	54	55	57	67			

Table 3: Average monthly temperature in ^{0}c from 2016–2020

(https://www.worldweatheronline.com/lang/en-in/idukki-weather-history/kerala/in.aspx)

Year	Temp in ^{0}c	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	Max	29	31	34	34	31	29	30	30	30	29	29	28
	Min	18	19	21	23	24	23	22	22	22	21	19	18
	Average temp	23	24	27	28	27	25	25	26	25	25	23	22
2017	Max	28	31	31	34	32	30	31	30	30	30	28	28
	Min	17	16	20	22	23	23	23	23	23	22	21	19
	Average temp	22	23	25	28	27	26	26	26	26	26	24	23
2018	Max	29	32	32	33	32	30	29	29	31	30	28	28
	Min	18	19	21	23	24	23	23	22	22	22	21	20
	Average temp	23	25	26	27	27	26	25	25	26	25	24	23
2019	Max	30	32	35	36	36	31	29	27	28	28	28	26
	Min	17	19	21	23	24	20	17	17	18	21	20	18
	Average temp	25	27	30	32	31	27	26	24	25	25	25	23
2020	Max	28	30	32	35	33	29	29	29	29			
	Min	17	17	20	21	21	18	18	17	20			
	Average temp	24	25	28	30	29	26	26	25	26			

Table 4: Monthly Average wind speed in km/h from 2016–2020

(https://www.worldweatheronline.com/lang/en-in/idukki-weather-history/kerala/in.aspx)

Year	2016	2017	2018	2019	2020
Max. wind	8.37	6.49	7.14	10.62	11.96
Average wind	8.37	6.49	6.08	8.68	8.6

Appendix III

Orchids in CITES Appendix II (De, 2022)

1. *Aerides maculosa*
2. *Aerides ringens*
3. *Anoectochilus elatus*
4. *Aphyllorchis montana*
5. *Arundina graminifolia*
6. *Brachycorythis iantha*
7. *Brachycorythis splendida*
8. *Bulbophyllum elegantulum*
9. *Bulbophyllum fimbriatum*
10. *Bulbophyllum fuscopurpureum*
11. *Bulbophyllum mysorense*
12. *Bulbophyllum sterile*
13. *Bulbophyllum sterile*
14. *Bulbophyllum xylophyllum*
15. *Bulbophyllum fischeri*
16. *Calanthe triplicate*
17. *Cheirostylis flabellata*
18. *Cleisostoma tenuifolium*
19. *Coelogyne breviscapa*
20. *Coelogyne nervosa*
21. *Cottonia peduncularis*
22. *Cymbidium aloifolium*
23. *Dendrobium anamalayanum*
24. *Dendrobium aqueum*
25. *Dendrobium barbatulum*
26. *Dendrobium herbaceum*
27. *Dendrobium heterocarpum*
28. *Dendrobium heyneanum*
29. *Dendrobium macrostachyum*
30. *Dendrobium nanum*
31. *Dendrobium nutantiflorum*
32. *Dendrobium ovatum*
33. *Dendrobium salaccense*
34. *Dendrobium wightii*
35. *Diplocentrum congestum*
36. *Diplocentrum recurvum*
37. *Disperis neilgherrensis*
38. *Epipogium roseum*
39. *Porpax braccata*
40. *Pinalia mysorensis*
41. *Pinalia polystachya*
42. *Cylindrolobus pauciflorus*
43. *Porpax reticosa*
44. *Eulophia epidendraea*
45. *Eulophia graminea*
46. *Dendrobium nodosum*
47. *Gastrochilus acaulis*
48. *Eulophia picta*
49. *Goodyera procera*
50. *Habenaria barnesii*
51. *Habenaria cephalotes*
52. *Habenaria crinifera*
53. *Habenaria elliptica*
54. *Habenaria furcifera*
55. *Habenaria heyneana*
56. *Habenaria longicorniculata*
57. *Habenaria longicornu*
58. *Habenaria periyarensis*
59. *Habenaria roxburghii*
60. *Liparis elliptica*
61. *Liparis viridiflora*
62. *Liparis wightiana*
63. *Liparis walkeriae*
64. *Luisia zeylanica*
65. *Crepidium acuminatum*
66. *Nervilia plicata*
67. *Nervilia simplex*
68. *Oberonia anamalayana*
69. *Oberonia bicornis*
70. *Oberonia brachystachys*
71. *Oberonia brunoniana*
72. *Oberonia chandrasekharanii*
73. *Oberonia ensiformis*
74. *Oberonia proudlockii*
75. *Oberonia Sebastiana*
76. *Oberonia thwaitesii*
77. *Oberonia wightiana*
78. *Pachystoma pubescens*
79. *Papilionanthe cylindrica*
80. *Pecteilis gigantea*
81. *Peristylus aristatus*
82. *Peristylus densus*
83. *Peristylus goodyeroides*
84. *Peristylus richardianus*
85. *Peristylus spiralis*
86. *Coelogyne imbricata*
87. *Podochilus malabaricus*
88. *Polystachya concreta*
89. *Porpax jerdoniana*
90. *Porpax reticulata*
91. *Rhynchostylis retusa*

92. *Robiquetia josephiana*
93. *Satyrium nepalense*
94. *Schoenorchis jerdoniana*
95. *Sirhookera lanceolata*
96. *Sirhookera latifolia*
97. *Smithsonia viridiflora*
98. *Spiranthes sinensis*
99. *Tainia bicornis*
100. *Taprobanea spathulate*
101. *Thelasis pygmaea*
102. *Bulbophyllum bonaccordense*
103. *Bulbophyllum stocksii*
104. *Trichoglottis tenera*
105. *Tropidia angulosa*
106. *Vanda tessellata*
107. *Vanda Testacea*
108. *Zeuxine gracilis*
109. *Zeuxine longilabris*

Appendix IV

Papers published in peer reviewed journal

1. **Dani Francis**, Vishnu Mohan, Divya K. Venugopal & Santhosh Nampy. *Burmannia munnarensis* (Burmanniaceae) a new species and rediscovery of *B. indica* after 110 years from southern Western Ghats, Kerala, India. *Phytotaxa* 507(1): 105–112. https://doi.org/10.11646/phytotaxa.507.1.6
2. **D. Francis**, V. Mohan, D.K. Venugopal & S. Nampy 2020. A new species of *Eriocaulon* (Eriocaulaceae) from the southern Western Ghats of Kerala, India. *Edinburgh Journal of Botany* 77(2): 281–290. https://doi.org/ 10.1017/ S0960428620000013
3. Vishnu Mohan, **Dani Francis**, Santhosh Nampy & Divya K. Venugopal 2021. *Impatiens raktakesara* (Balsaminaceae), a new species from the southern Western Ghats, India. *Brittonia* 73(3): 316–322. https://doi.org/10.1007/ s12228- 021-09676-7
4. Divya K. Venugopal, Santhosh Nampy, A.K. Pradeep, **Dani Francis**, Vishnu Mohan & Syam Radh S. A new species of *Parasopubia* (Orobanchaceae) from southern Western Ghats, India. *Anales del Jardin Botanico de Madrid* 78(1): e106. https://doi.org/10.3989/ajbm.2585
5. Divya K. Venugopal, Santhosh Nampy, Vishnu Mohan and **Dani Francis** 2021. *Asyneuma cupulare*, a new species of Campanulaceae from southern Western Ghats, India and lectotypification of *Campanula fulgens* (*Asyneuma fulgens*). *Nordic Journal of Botany* e02889: 1–7. http://dx.doi.org/10.1111/njb.02889
6. Mohan Vishnu, Divya K. Venugopal, **Dani Francis**, Santhosh Nampy 2020. Two new scapigerous species of Impatiens (Balsaminaceae) from southern Western Ghats, India. *Taiwania* 65(2): 187–194. http://dx.doi.org/ 10.6165/tai.2020.65.187
7. Santhosh Nampy, Divya K. Venugopal, **Dani Francis** & Vishnu Mohan 2019. New record of *Iochroma arborescens* (Solanaceae) for India, a potential invasive plant from America with notes on its typification. *Rheedea* 29(3): 222–226. http://dx.doi.org/10.22244/rheedea.2019.29.3.06
8. Divya K Venugopal, **Dani Francis**, Vishnu Mohan & Santhosh Nampy 2018. Notes on taxonomic Identity and typification of *Fagraea coromandelina* (Gentianaceae). *Phytotaxa* 360 (3): 292-295. http://dx.doi.org/ 10.11646/ phytotaxa.360.3.10

Appendix V

Papers presented in conferences

Dani Francis & Santhosh Nampy. Unravelling the diversity of Orchids in Idukki district, Kerala: their potential threats and recommendations for conservation. 32nd Annual Conference of Indian Association for Angiosperm Taxonomy. Department of Botany, Karnataka University's Karnataka Science College, Dharward. 14–16 October 2022.

Dani Francis & Santhosh Nampy. Diversity of the genus Eriocaulon (Eriocaulaceae) in Idukki district, Kerala. XLII All India Botanical Conference of the Indian Botanical Society and National Symposium on 'Innovations and inventions in Plant Science research'. Department of Botany, University of Calicut. 6–8, November 2019.

Dani Francis & Santhosh Nampy. Two new species of *Eriocaulon* L. (Eriocaulaceae) from Idukki district, Kerala, India. National Seminar on Plant Sciences: Current Challenges & Perspectives. Department of Botany, University of Calicut. 28.02.2019 to 1–2 March 2019.

Dani Francis & Santhosh Nampy. A glimpse to the orchid diversity of Idukki district (Kerala) with special emphasis on its conservation. XLI All India Botanical Conference of the Indian Botanical Society & "Ecological Restoration, Carbon sequestration and Biotechnological Approaches for Biodiversity Conservation". School of studies in Botany, Jiwaji University, Gwalior. 25– 27 October 2018.

Dani Francis & Santhosh Nampy. Preliminary observations on the monocot flora of Idukki district, Kerala'. XXVII Annual Conference of Indian Association for Angiosperm Taxonomy & International Symposium on "Plant Systematics: Priorities and Challenges". 10–12 November 2017.

Poster presented in conference

Dani Francis & Santhosh Nampy. *Ariopsis idukkiana* (Araceae), a new species from Idukki district, Kerala with notes on the variations in *Ariopsis peltata*. XLV All India Botanical Conference of the Indian Botanical Society. Department of Botany, University of Lucknow. 11–13 November 2022.

Workshops attended during the period

GIAN (Global Initiative for Academic Networks) Molecular phylogeny workshop. Department of Botany, University of Calicut. 23–27 September 2019.

Workshop on Digital Photography. Department of Botany, University of Calicut. 21–23 March, 2018.

Work shop on Wildlife photography and conservation. Educational Multi Media Research Centre (EMMRC), University of Calicut. 17 November 2017.

Award received in conference

Best poster award in XLV All India Botanical Conference of the Indian Botanical Society. Department of Botany, University of Lucknow. 11–13 November 2022.

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A NEW SPECIES OF *ERIOCAULON* (ERIOCAULACEAE) FROM THE SOUTHERN WESTERN GHATS OF KERALA, INDIA

D. Francis, V. Mohan, D. K. Venugopal & S. Nampy

A new species of *Eriocaulon*, *E. vamanae*, is described from the southern Western Ghats of Kerala, India. It resembles *Eriocaulon nepalense* var. *luzulifolium* (Mart.) Praj. & J.Parn. but differs in the shape of its involucral bracts and receptacle, the fusion of the sepals in male flowers, the shape and indumentum of the sepals in female flowers, the size and indumentum of the petals in female flowers, and the seed coat appendages. *Eriocaulon vamanae* is so far known only from the type locality, Meesapulimala in Idukki District, Kerala, and is assessed as 'Critically Endangered' according to the IUCN's *Red List Categories and Criteria*.

Keywords. Critically Endangered, *Eriocaulon duthei*, *Eriocaulon nepalense* var. *luzulifolium*, *Eriocaulon thwaitesii*, grassland, Meesapulimala.

Introduction

Eriocaulon L., commonly known as pipeworts, is a genus of about 470 species (WCSP, 2019) in the Eriocaulaceae. The genus is widely distributed but with its centre of diversity in tropical regions (Stützel, 1998). Species of *Eriocaulon* live exclusively in damp or aquatic places (De Oliveira & Bove, 2011) and are mostly acaulescent herbs with a monoecious head inflorescence.

Regional infrageneric classifications of the genus based on morphological data have been provided by various authors: for Indian species by Fyson (1919, 1921, 1922) and Ansari & Balakrishnan (1994, 2009), for Chinese species by Ma (1991, 1997), and for East Asian species by Zhang (1999). In a recent molecular phylogenetic analysis using ptDNA and PHYC datasets by Larridon *et al.* (2019), the existing morphology-based infrageneric classification was reassessed, but the authors refrained from suggesting a new classification because of inadequate sampling. Ansari & Balakrishnan (2009) recognised twelve numbered sections (I–XII) based primarily on seed surface characters for the Indian species of *Eriocaulon*, but these are not supported by Larridon *et al.* (2019).

Ansari & Balakrishnan (2009) reported 80 species from India. Several new taxa were subsequently described from India, bringing the total number to 107 (Shimpale *et al.*, 2009; Shimpale & Yadav, 2010; Vivek *et al.*, 2010; Nampy *et al.*, 2011; Biju *et al.*, 2012; Swapna *et al.*, 2012; Sunil *et al.*, 2013; Rashmi & Krishnakumar, 2014; Sunil *et al.*, 2014; Manudev *et al.*, 2015; Sunil & Naveen Kumar, 2015; Anto & Reshma, 2017; Darshetkar *et al.*, 2017; Manudev *et al.*, 2017; Paithane *et al.*, 2017; Biju *et al.*, 2018; Khanna & Kumar, 2019).

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During floristic investigations in Idukki District, some interesting specimens of *Eriocaulon* were collected on the way to Meesapulimala (2640 m), the second highest peak in South India. A critical study using the available literature and specimens demonstrated that these are quite different from any of the known taxa, and they are described and illustrated here as *Eriocaulon vamanae*.

Materials and Methods

The material for the present study was collected during field trips in Idukki District, Kerala. Specimens were pickled in 4% formalin and 70% ethanol for laboratory study. The distribution and density of the species were observed by frequent field trips to the study area. Photographs were taken with a Stemi 508 stereomicroscope (Zeiss, Oberkochen, Germany) attached to an Axiocam 105 colour camera (Zeiss). Herbarium sheets were prepared by conventional methods (Bridson & Forman, 1991) and deposited in Calicut University Herbarium (CALI).

The identity of the species was confirmed with types or protologues and through consultation of online data sources (B, BM, CALI, E, K and MH). Detailed descriptions were prepared after proper diagnosis by examining the specimens. Seed micromorphology was studied with a scanning electron microscope (Zeiss Gemini SEM 300 Microscope).

Species Descriptions

Eriocaulon vamanae Dani & Nampy, **sp. nov.**

Eriocaulon vamanae is morphologically close to *Eriocaulon nepalense* var. *luzulifolium* (Mart.) Praj. & J.Parn. but differs in the shape of its involucral bracts (oblong versus broadly ovate) and receptacle (obovoid versus convex), nature of male sepals (free versus fused), shape and hairiness of female sepals (boat-shaped and glabrous versus linear to narrowly oblanceolate and hoary at apex), size and hairiness of female petals (1.1 mm long, barbate versus 1.5 mm long, hairy at apex) and number of seed coat appendages (1 or very rarely 2 versus 1–4). – Type: India, Kerala, Idukki District, Munnar, Meesapulimala, ± 2445 m, 10°05′22.7″ N, 77°11′27.1″ E, 21 xii 2018, *Dani Francis & Santhosh Nampy* 167894 (holo CALI!, iso CAL). **Figs 1–4.**

Acaulescent herbs, 1–3 cm tall. *Root stock* absent. *Leaves* green, linear, 0.9–2 × 0.1–0.2 cm, apex acute, broadening slightly towards base, margin entire, ciliate. *Sheath* 0.6–2 cm long, terete, ciliate; limb 6–9 × 2 mm, lanceolate, apex narrowly acute, ciliate. *Head* 2–3 mm across, hemispherical, black to straw-coloured. *Peduncles* many, 0.6–2.7 cm long, pubescent. *Receptacle* obovoid, 1 × 1 mm, pilose. *Involucral bracts* 2–2.1 × 1–2 mm, oblong, apex obtuse to subtruncate, base truncate, glabrous to sparsely hoary, blackish, margins entire. *Floral bracts* 2 × 0.8 mm, oblanceolate, apex acuminate, base cuneate, sparsely hoary towards apex, straw-coloured. *Male flowers*: stipe 0.2–0.3 mm, basally hairy. *Sepals* 3, free, obovate to oblanceolate, 1 × 0.8 mm, obtuse to acute at apex, cuneate at base, sparsely hoary towards apex, straw-coloured. *Stipe* of corolla 0.6 mm. *Petals* 3, equal,

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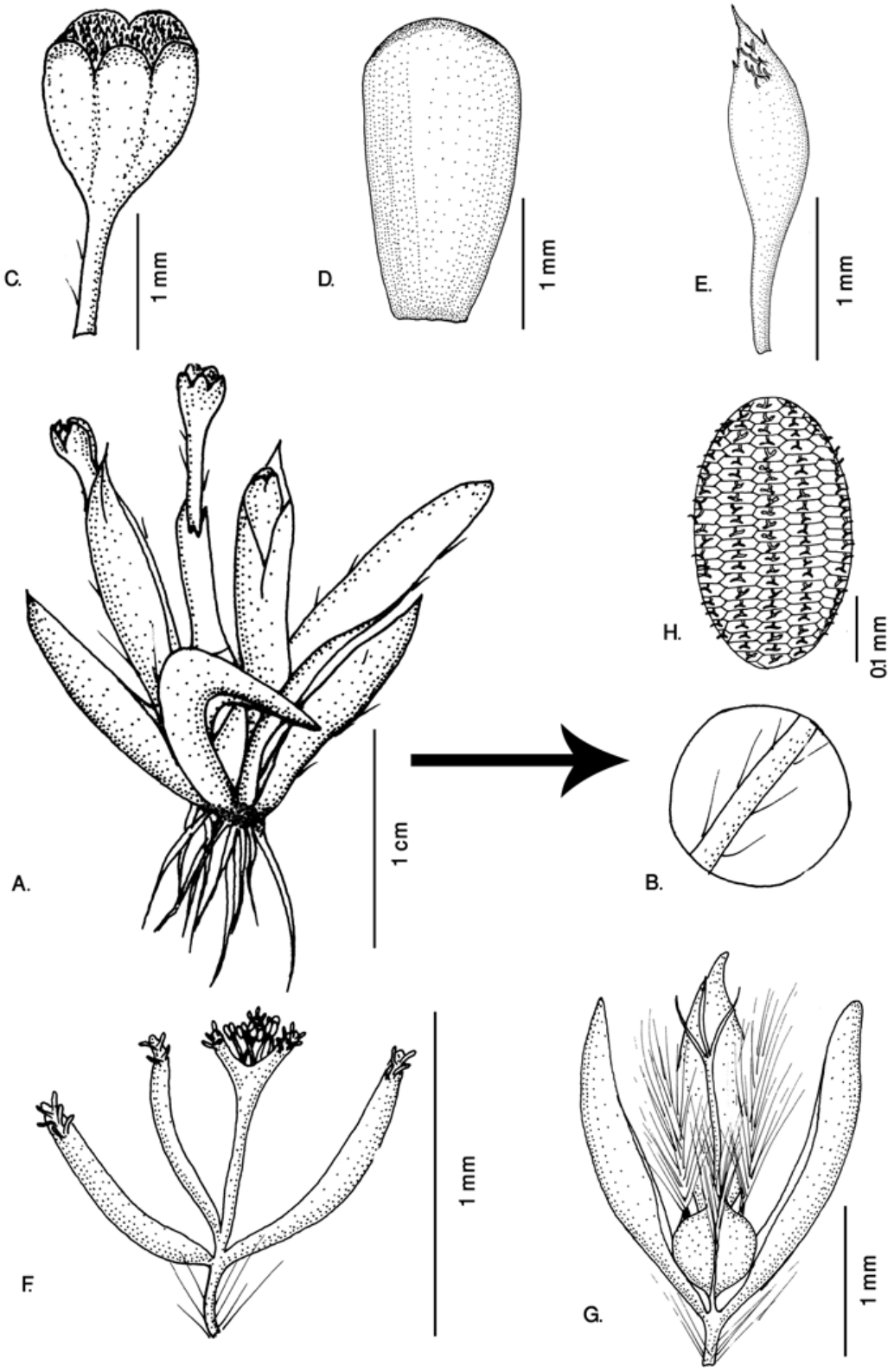

FIG. 1. *Eriocaulon vamanae* Dani & Nampy, sp. nov. A, Habit; B, hair pattern; C, head; D, involucral bract; E, floral bract; F, male flower; G, female flower; H, seed. Drawn by Dani Francis.

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FIG. 2. *Eriocaulon vamanae* Dani & Nampy, sp. nov. A, Habit; B, involucral bract; C, floral bract; D, male flower; E, male flower with sepals and petals spread out; F, female sepals; G, female petals; H, gynoecium with petals; I, seeds. A–I from *Dani Francis & Santhosh Nampy* 167894.

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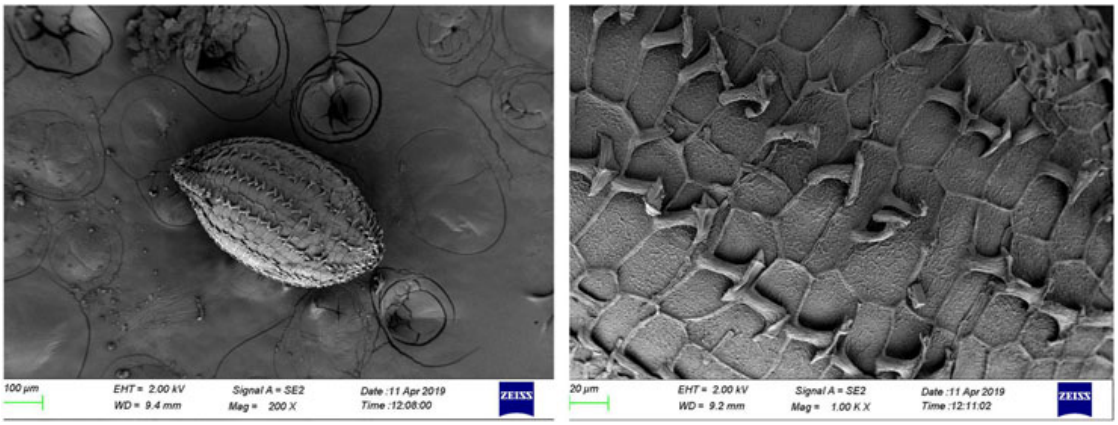

FIG. 3. Scanning electron micrograph showing seeds of *Eriocaulon vamanae* Dani & Nampy.

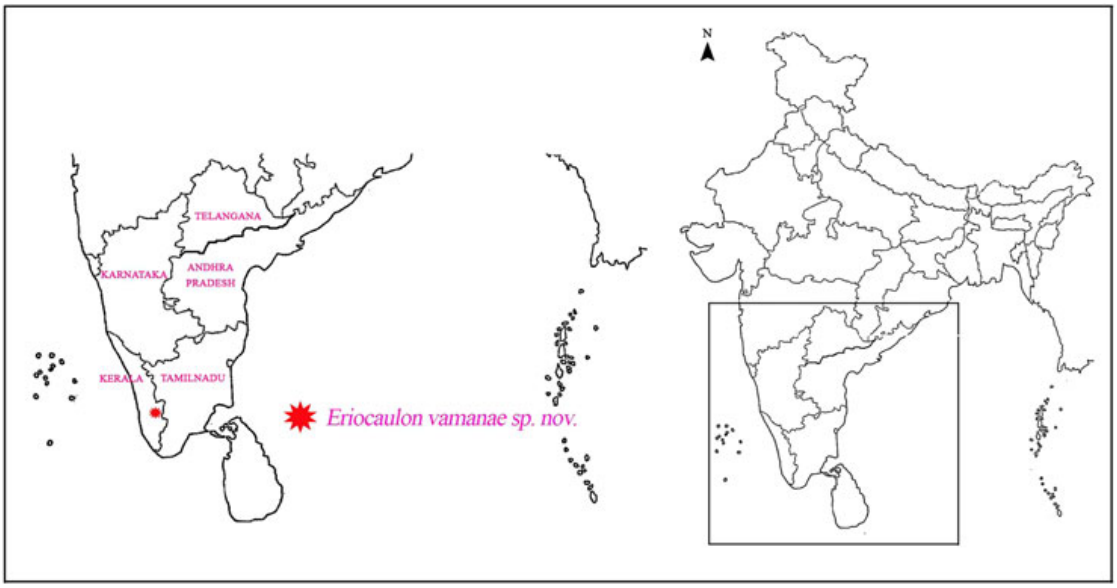

FIG. 4. Map showing the distribution of *Eriocaulon vamanae* Dani & Nampy.

0.2 mm, oblong, apex obtuse, hoary towards apex with a black gland, hyaline. *Stamens* 6; filaments 0.2 mm, white; anthers black. *Female flowers*: stipe 0.2 mm, basally hairy. *Sepals* 3, free, subequal, 1.6–2 mm, boat-shaped; lateral sepals conduplicate, apex obtuse to subacute, base cuneate, glabrous, blackish to straw-coloured. *Petals* 3, 1.1 mm, linear, narrow, barbate, eglandular, hyaline, not clawed, stipitate between sepals and petals. *Ovary* oblong, 0.4 × 0.4 mm; style 1.1 mm; stigma trifid. *Seeds* 0.4 × 0.3 mm, elliptic to oblong, seed coat cells transversely elongated, appendages solitary or very rarely two from the middle of each transverse radial wall, setiform, dilated at apex.

Distribution and habitat. Known only from the type locality, where it grows in wet meadows around mountain springs, along with species of *Utricularia* L. (Lentibulariaceae), *Apocopis*

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TABLE. Diagnostic morphological characters of *Eriocaulon vamanae* sp. nov., *E. nepalense* var. *luzulifolium* (Mart.) Praj. & J.Parn., *E. duthiei* Hook.f. and *E. thwaitesii* Körn.

Character	*Eriocaulon vamanae*	*Eriocaulon nepalense* var. *luzulifolium*	*Eriocaulon duthei*	*Eriocaulon thwaitesii*
Peduncles	0.6–2.7 cm, pubescent	Up to 3–22 cm, glabrous	2.5–12 cm, glabrous	Up to 18 cm, glabrous
Sheath	0.6–2 cm, ciliolate	1–7 cm, glabrous	Up to 3 cm, glabrous	Up to 6 cm, glabrous
Limb	Lanceolate	Ovate	Ovate	Ovate
Receptacle	Obovoid, pilose	Convex, villous	Ovoid to cylindric, glabrous	Convex, villous
Involucral bracts	Oblong	Broadly obovate	Oblong to lanceolate	Oblong
Floral bracts	Oblanceolate, sparsely hoary towards apex	Oblanceolate to oblong, hoary towards apex	Oblong to lanceolate, glabrous	Oblanceolate to cuneate, sparsely hoary towards apex
Male flower				
Sepals	3, free, 1 × 0.8 mm, obtuse to acute at apex, sparsely hoary towards apex	3, fused, 1.5–2 mm long, acute at apex, hoary towards apex	2, free, c.1 mm long, subacuminate at apex, glabrous	2 or with a minute protuberance in between the lobes, connate into a spathe, c.1 × 1.25 mm, obtuse, glabrous or sparsely hoary at apex
Petals	Hoary towards apex	Glabrous, or if unequal the longest petal hairy	Glabrous	Sparsely hoary towards apex
Female flower				
Sepals	3, 1.6–2 mm, boat-shaped, obtuse to subacute, glabrous	3, 2 mm, linear to narrowly oblanceolate, acute, densely hoary at apex	2, c.0.75 mm, linear to elliptic, acuminate, glabrous	3 (or 2), 1.75–2 mm, lateral sepals obovate to oblanceolate, conduplicate, sparsely hoary at apex
Petals	Linear, narrow, barbate, 1.1 mm	Linear, hairy at apex, 1.5 mm	Linear, glabrous, c.0.75 mm	Linear, barbate, c.0.75 mm
Seed coat appendages	1 or very rarely 2 from the middle of transverse radial walls	1–4 from the middle of transverse radial walls	1–3 from the middle of transverse radial walls	1 from the middle of transverse radial walls

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Nees (Poaceae), *Eriocaulon idukkianum* Manudev, Robi & Nampy and a few bryophytes (*Campylopus* sp.), at an elevation of ± 2445 m.

Phenology. Flowering and fruiting from November to January.

Additional specimens examined. INDIA. Kerala, Idukki District, on the way to the summit of Meesapulimala, ± 2445 m, 31 xii 2018, *Dani Francis & Vishnu Mohan* 167899 (CALI!).

Conservation status. The extent of occurrence of the species is estimated to be less than 100 km^2 and the area of occupancy less than 10 km^2. A single population consisting of 95 individuals was observed in the area. Because the type locality is a tourist destination, it is vulnerable to destruction. According to IUCN criteria (IUCN, 2012; IUCN Standards and Petitions Subcommittee, 2017), *Eriocaulon vamanae* is assigned to the category 'Critically Endangered'.

Eriocaulon vamanae is morphologically close to *E. nepalense* var. *luzulifolium* (Mart.) Praj. & J.Parn. but differs by the shape of the involucral bracts (oblong versus broadly ovate) and receptacle (obovoid versus convex), fusion of male sepals (free versus fused), shape and hairiness of female sepals (boat-shaped and glabrous versus linear to narrowly oblanceolate and hoary at apex), size and hairiness of female petals (1.1 mm, barbate, versus 1.5 mm, hairy at apex) and number of seed coat appendages (1 or very rarely 2 versus 1–4). *Eriocaulon vamanae* differs from *E. duthiei* Hook.f. by the length of the peduncle (0.6–2.7 cm versus 2.5–12 cm), nature of receptacles (obovoid and pilose versus ovoid to cylindric and glabrous), shape of floral bracts (oblanceolate versus oblong to lanceolate), number of male and female sepals (2 versus 3) and indumentum of the female petals (barbate versus glabrous). It differs from *Eriocaulon thwaitesii* Körn., a common species in the area, in the size of plants (1–3 cm tall versus c.18 cm), size of leaves (0.9–2 × 0.1–0.2 cm versus c.9 × 0.2 cm), shape of limb (lanceolate versus ovate), shape and hairiness of receptacle (obovoid and pilose versus convex and villous), fusion of male sepals (free versus fused) and nature of female sepals (not keeled versus keeled). The characters differentiating *Eriocaulon vamanae* from other species are listed in the Table.

Etymology. The epithet *vamanae* means 'dwarf' in Sanskrit and refers to the small size of the plant.

KEY TO SPECIES OF *ERIOCAULON* IN IDUKKI DISTRICT, KERALA

1a. Female petals 2.7–3.2 mm broad, distinctly clawed _____ *E. rhodae*
1b. Female petals 0.1–1 mm broad, not clawed _____ 2

2a. Plants without tubers. Anthers black _____ 3
2b. Plants with tuber. Anthers white _____ *E. idukkianum*

3a. Seed coat cells transversely or vertically elongated _____ 5
3b. Seed coat cells isodiametric _____ 4

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4a. Root stock absent, peduncles 5–17 _____ *E. biappendiculatum*
4b. Root stock present, peduncles 1–3 _____ *E. nairii*

5a. Seed coat appendages ribbon-like or rectangular _____ 6
5b. Seed coat appendages setiform _____7

6a. Sepals 2 in male flowers. Seed coat cells vertically elongated _____ *E. truncatum*
6b. Sepals 3 in male flowers. Seed coat cells laterally elongated _____ *E. quinquangulare*

7a. Male sepals free _____ 8
7b. Male sepals fused _____ 9

8a. Female sepals broadly keeled outside _____ *E. eurypeplon*
8b. Female sepals not keeled outside _____ **E. vamanae**

9a. Seed coat appendages with appendages arising from their angles ____ *E. vasudevanii*
9b. Seed coat cells with appendages arising from their transverse radial walls _____ 10

10a. Male petals unequal _____ *E. odoratum*
10b. Male petals equal or subequal _____ 11

11a. Seed coat appendages solitary from the transverse radial wall _____ 12
11b. Seed coat appendages 2 to many from the transverse radial wall _____ 13

12a. Leaves 9 × 0.2 cm, glabrous _____ *E. thwaitesii*
12b. Leaves 15–40 × 1.2 cm, pubescent _____ *E. brownianum*

13a. Seed coat appendages arranged in vertical rows on the surface of seeds *E. nepalense*
13b. Seed coat appendages arranged in transverse ring on the surface of seeds _____ 14

14a. Male sepals obtuse or acute at apex _____ *E. parviflorum*
14b. Male sepals truncate at apex _____ *E. xeranthemum*

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Burmannia munnarensis (Burmanniaceae) a new species and rediscovery of *B. indica* after 110 years from southern Western Ghats, Kerala, India

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Abstract

A new species of *Burmannia* (Burmanniaceae), endemic to the southern Western Ghats of Kerala, India is described as *Burmannia munnarensis* and illustrations are provided. The new species is morphologically most similar to *B. indica* but can be easily distinguished by its narrow flower wings, involute margin of the perianth lobes, shorter perianth tube and shape of inflorescence. *Burmannia indica*, known only from the type locality Peermade in Idukki district, Kerala, is rediscovered after a lapse of 110 years on another locality, Meenuliyanpara in the same district. Key to the Indian species of *Burmannia* is included and status of both taxa is provisionally assessed as per IUCN Red List Categories and Criteria.

Keywords: *Burmannia wallichii*, Critically Endangered, Meebold, Meenuliyanpara, Munnar

Introduction

The Burmanniaceae Blume (1827:1) are a fascinating family of achlorophyllous mycoheterotrophic and autotrophic green plants that occur predominantly in tropical and subtropical regions of the world and comprise eight genera (Merckx *et al.* 2006, 2009). All autotrophic members of the family are all part of the largest genus, *Burmannia* Linnaeus (1753: 1) (Merckx *et al.* 2006). Although they have retained functional photosynthesis, most of green-leaved members have a certain degree of vegetative reduction, suggesting a partial dependence on mycorrhizal fungi. All achlorophyllous Burmanniaceae share strong modifications that are related to their mycoheterotrophic lifestyle: reduction of stomata, reduction of root hairs, reduction of leaves, and relatively well-developed underground parts (Jonker 1938, Maas *et al*. 1986, Leake 1994, Maas-Van de Kamer 1998).

Burmannia consists of about 46 species worldwide (POWO 2020), of which eight occur in India (Jonker 1938). The genus is mainly distributed in the tropics and subtropics of the world, but some species extending into warm temperate regions (Ma *et al.* 2018). Jonker in his revision recognised 57 species in two sections: sect. *Foliosa* Jonker, with five species of comparatively large, robust autotrophs and sect. *Burmannia* (as "*Euburmannia*"), with 52 species including both autotrophs and (semi-) mycoheterotrophs. The chlorophyllous autotrophic species generally occur as sparse individuals in open and often wet habitats; the mycoheterotrophic species, however, occur almost exclusively on humus and decaying leaves (occasionally decaying wood) in the dense shade of wet tropical forests (Zhang & Saunders 1999).

Recent floristic investigations in the southern Western Ghats of Kerala revealed some interesting specimens of *Burmannia* with purple flowers and narrow perianth wings. Detailed study based on literature (Jonker 1938, Maas *et al*. 1986) and consultation of type specimens demonstrated that these are quite different from any of the known taxa, and hence described and illustrated here as *Burmannia munnarensis sp.nov. Burmannia indica* Jonker (1938: 161), is so far known only by the type collection by Meebold in 1909 from Peermade in the Idukki district. During our recent field work we have collected this species in Meenuliyanpara in the same district and the present collection represents a rediscovery of this species after 110 years.

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Materials and methods

The plant materials were collected during field trips in Idukki district, Kerala and preserved in 4% formalin and 70% ethanol for laboratory study. The distribution and abundance of the species were observed by frequent field trips to the study area. Photographs were taken with an Axiocam 105 colour camera attached to a Stemi 508 stereomicroscope (Zeiss, Oberkochen, Germany). Herbarium sheets were prepared following recommendation in Bridson and Forman (1991) and deposited in Calicut University Herbarium (CALI). The identity of the species was confirmed in comparison with the types, protologues of related species and herbarium specimens deposited at B, BM, CAL, CALI, E, K and MH (Thiers, continuously updated). Provisional conservation status assessments were based on IUCN Red List Categories and Criteria (2019).

Taxonomic treatment

Burmannia munnarensis Dani & Nampy *sp. nov.* **(Figs. 1, 4).**

The new taxon is morphologically close to *Burmannia indica* Jonker but differs by the narrow flower wings (0.3–0.5 mm vs. 1.5–6 mm), nature of the perianth lobes (involute vs. not involute), length of the perianth tube (5–8 mm vs. 10–13 mm) and inflorescence (rarely branched, 1–4 flowered vs. branched at the top, 1–8 flowered).

Type:—INDIA. Kerala: Idukki district, Munnar, way to Rajamala, ± 1355 m a.s.l., 10°08′00.2″ N, 77°03′22.5″ E, 18 November 2020; *Dani Francis, Vishnu Mohan & Santhosh Nampy 173331* (holo CALI, iso CAL).

Annual, erect, chlorophyllous herbs, 8–18 cm tall. Roots fibrous, short. Stems slender, seldom branched, green, glabrous. Radical leaves absent; cauline leaves appressed, scale like, linear-lanceolate, 2–3.5 mm long, cuneate at base, entire at margin, acute-acuminate at apex, greenish, glabrous, single veined. Bracts lanceolate, ca. 2.5 × 0.8–1 mm, obtuse at apex, green, glabrous. Inflorescence rarely branched, 1–4 flowered. Flowers bisexual, 10–15 × 2–5 mm, narrowly 3-winged, sessile or shortly stalked; stalk 1–5 mm long, glabrous. Perianth pale purple; perianth wings half elliptical, 8–11 × 0.3–0.5 mm, running from the base of the limb to the base of the ovary and decurrent along the pedicel, rounded at apex, glabrous; perianth tube cylindrical, 5–8 × 1–1.5 mm; outer perianth triangular, 1–1.5 × ca. 0.6 mm, acute at apex; margin single, involute, slightly thick, purple, glabrous; inner perianth erect, narrow, linear, 0.5–1 mm long, acute at apex, margin single, slightly involute, pale purple, glabrous. Stamens 3, sessile in the perianth throat, ca. 1 mm long, yellow; anthers 2, thecae lateral, connective with two curved, divergent, obtuse, apical crests, and an obtuse, basal spur. Gynoecium 9–15 mm long; ovary 3–7 mm long, obovoid, tricarpellary, syncarpous with axile placentation, glabrous; ovules many, green; style filiform, ca. 6 mm long, glabrous; stigma trifid, funnel shaped, sub-bilabiate, style with stigma 7–8 mm long. Capsules obovoid, 3–7 mm long, truncate at base, dehiscing in transverse slits, glabrous. Seeds numerous, obovate, 0.1–0.3 mm long, slightly curved; testa spirally twisted.

Distribution and Ecology:—Known only from two localities in Idukki district, where it grows as sparse individuals in open wet grasslands and on dripping rocks along with species of *Utricularia striatula* Sm. (1818: 37) (Lentibulariaceae) and *Jansenella griffithiana* (Mull.Hal. 1856:14) Bor (1955: 10) (Poaceae) at an elevation of ± 1355 m.

Flowering & fruiting:—Flowering from October to November. Fruiting from November to December.

Etymology:—The specific epithet refers to the type locality 'Munnar' of the new species.

Notes:—*Burmannia munnarensis* also shows some similarity with *Burmannia wallichi* Hooker f. (1888: 5) in having narrow perianth wings and overall appearance of flowers and lacking radical rosette leaves, but differs by its habit (chlorophyllous, autotrophic vs. achlorophyllous, mycohetrotrophic), flowers (10–15 mm vs. 6.5 mm long), bracts (ca. 2.5 × 0.8–1 vs. ca. 1.5 × ca. 0.5 mm), connectives (two crest at apex vs. without crest at apex), ovary (3–7 mm vs. 2.5 mm long) and perianth wings (8–11 × 0.3–0.5 vs. ca. 4.5 × ca. 0.5 mm).

Additional specimens examined:—INDIA. Kerala: Idukki district, Pettimudi, near Subran shed, ± 1897 m a.s.l., 10° 9' 39.76"N, 77° 0' 39.51'E, 29 December 2019, *Dani Francis & Santhosh Nampy 170099* (CALI!).

Provisional conservation status:—*Burmannia munnarensis* is known only from two localities with about 50 mature individuals in each population. The extent of occurrence (EOO) of the species is estimated to be less than 50 km^2 and the area of occupancy (AOO) less than 10 km^2. The type locality is located in a tourist destination, and vulnerable to flood. There is a chance of a reduction in the number of plants in the near future. Hence the species is provisionally categorized as Critically Endangered (CR) based on the criteria A3 + B1 + B2 (bii + iii) + C2 (ai) + D (IUCN 2019).

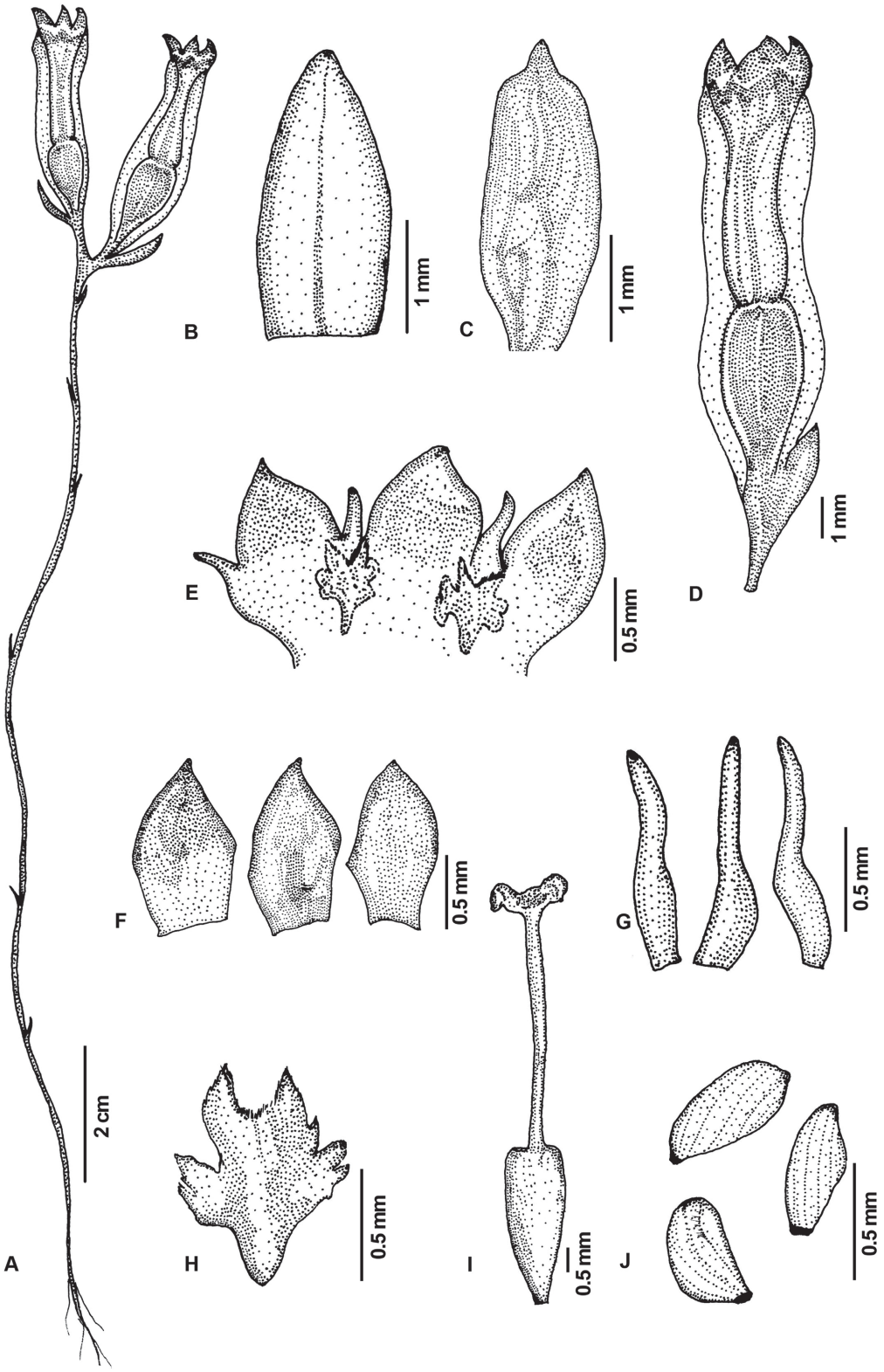

FIGURE 1. *Burmannia munnarensis* Dani & Nampy *sp. nov.*, A. Habit; B. Scale leaf; C. Bract; D. Single flower; E. Upper part of flower split open showing perianth lobes and stamens; F. Outer perianth lobes; G. Inner perianth lobes; H. Stamen, see the two lateral thecae, apical crests and basal spur; I. Gynoecium; J. Seeds. (Drawn by *Dani Francis* from *Dani Francis, Vishnu Mohan & Santhosh Nampy 173331*).

Burmannia indica Jonker (1938: 161) **(Figs. 2, 3, 4)**

Type:—INDIA. Kerala: Travancore, Peermade, December 1909, *Meebold, A. 12915* (B0296386, digital image!)

Annual, erect, chlorophyllous herbs, 15–35 cm tall. Roots fibrous, short. Stems slender, profusely branched, pale green-straw coloured, glabrous. Radical leaves absent; cauline leaves appressed, scale like, linear lanceolate, 1–3.5 mm long, cuneate at base, entire at margin, acute-acuminate at apex, greenish, glabrous; 3–5 veined. Bracts lanceolate, 2–4.2 × ca. 1.3 mm, acute at apex, green, glabrous. Inflorescence branched distally, 1–8 flowers on each branch. Flowers bisexual, 10–20 × ca. 5 mm, sessile or shortly stalked; stalk 1–7 mm long, glabrous. Perianth pale purple; perianth wings half elliptical, 10–16 × 1.5–6 mm, running from the base of the limb to the base of the ovary and decurrent along the pedicel, rounded or cordate at apex, glabrous; perianth tube cylindrical, 10–13 × 1–1.5 mm; outer perianth erect, triangular, 1–2 × 1.5–2 mm long, acute at apex, margin single, thick, swollen, purple, glabrous; inner perianth erect, thick, linear, 0.5–1 mm long, acute at apex, margin single, swollen, pale purple, glabrous, white. Stamens 3, sessile in the perianth throat, ca. 1 mm long, yellow; anthers 2, thecae lateral, connective with two curved, divergent, obtuse, apical crests, and an obtuse basal spur. Gynoecium 13–18 mm long; ovary ellipsoid or obovoid, 1–6 mm long, tricarpellary, syncarpous with axile placentation, glabrous; ovules many, green; style filiform, 8 mm long, glabrous; stigma trifid, funnel shaped, sub-bilabiate, style with stigma 5–12 mm long. Capsules obovoid, 1–6 mm long, truncate at base, dehiscing in transverse slits, glabrous. Seeds numerous, obovate, 0.1–0.3 mm long, slightly curved; testa spirally twisted.

Distribution and Ecology:—Endemic to southern Western Ghats of Kerala. The species is found in open and often wet rocky surfaces along with *Burmannia coelestis* D.Don (1825: 44) (Burmanniaceae), *Utricularia striatula* Sm. (1818: 37) (Lentibulariaceae), and *Tripogon bromoides* Roth (1817: 2) at an elevation of ± 1200 m.

Flowering & Fruiting:—Flowering from October to November. Fruiting from November to December.

Notes:—*Burmannia indica* was first described by F.P. Jonker in 1938 in his monograph of Burmanniaceae based on the homogenous collection of A. Meebold in 1909 from Peermade (now in Idukki district of Kerala). Hazra (1988) in *Fascicles of Flora of India* and Sasidharan (2011) in his *Flowering plants of Kerala* mentioned the occurrence of this species based on Meebold's collection and stated that it is endemic to Kerala. There was no subsequent collection of this species anywhere from south India after the original collection by Meebold in 1909 (Hooker 1888, Gamble 1928, Matthew, 1983). Thus, the present report forms a rediscovery after a lapse of 110 years and proves its existence in the area. The new locality Meenuliyanpara also belongs to the same district but is separated by approximately 270 km from the type locality. Jonker (1938) mentioned *B. indica* as a saprophytic species, which indicates the mycohetrotrophic nature of the species, but our collection is chlorophyllous and not mycohetrotrophic. It is likely that Jonker didn't see living material and his description is based solely on Meebold's specimens. Moreover, the open and often wet habitats of *B. indica* also indicates an autotrophic nature.

Additional specimens examined:—INDIA. Kerala: Idukki district, Meenuliyanpara, ± 1200 m a.s.l., 9° 99' 84" N, 76° 86' 49" E, 29 December 2019, *Dani Francis & Vishnu Mohan 164619* (CALI); *Ibid.*, 25 October 2020, *Santhosh Nampy 170085* (CALI).

Provisional conservation status:—*Burmannia indica* is known only from two localities, with only one of them extant. The number of mature individuals is about 30 in this population. The extent of occurrence (EOO) of the species is estimated to be less than 50 km^2 and the area of occupancy (AOO) less than 10 km^2. Since the only extant locality is a tourist destination, and a flood prone area, it is possible to infer a reduction in the past of the potential habitat of the species. For this reason, the species can be categorized as Critically Endangered (CR) based on criteria B1 + B2 (a + bii + iii) + C2 (ai) + D (IUCN 2019).

Key to the Indian species of *Burmannia*

1.	Mycoheterotrophic, achlorophyllous herbs	2
–	Non mycoheterotrophic, chlorophyllous herbs	4
2.	Rhizome tuberous; basal hanging connective spur absent	*B. championii*
–	Rhizome not tuberous; basal hanging connective spur present	3
3.	Perianth wings ca. 4.5 × ca. 0.5 mm, narrow, linear	*B. wallichii*
–	Perianth wings 5–10 × 2–3 mm, broad, half obovate-orbiculate	*B. candelabrum*
4.	Radical rosette of leaves absent	5
–	Radical rosette of leaves present (absent in *B. pusilla*)	7
5.	Stems unbranched; stem leaves thorn-like	*B. stricta*
–	Stems branched; stem leaves not thorn-like, linear	6

6. Wings 1.5–6 mm broad; margin of the perianth lobes swollen, not involute or revolute ..... *B. indica*
– Wings 0.3–0.5 mm broad; margin of the perianth lobes rather thin, involute ..... *B. munnarensis*
7. Margin of the perianth lobes double 8
– Margin of the perianth lobes single ..... *B. pusilla*
8. Robust herbs, up to 75 cm high, with well developed, radical rosette of leaves up to 15 × 1.3 cm ..... *B. disticha*
– Slender herbs, up to 30 cm high; reduced, radical rosette of leaves about ca. 1 × ca. 0.3 cm ..... *B. coelestis*

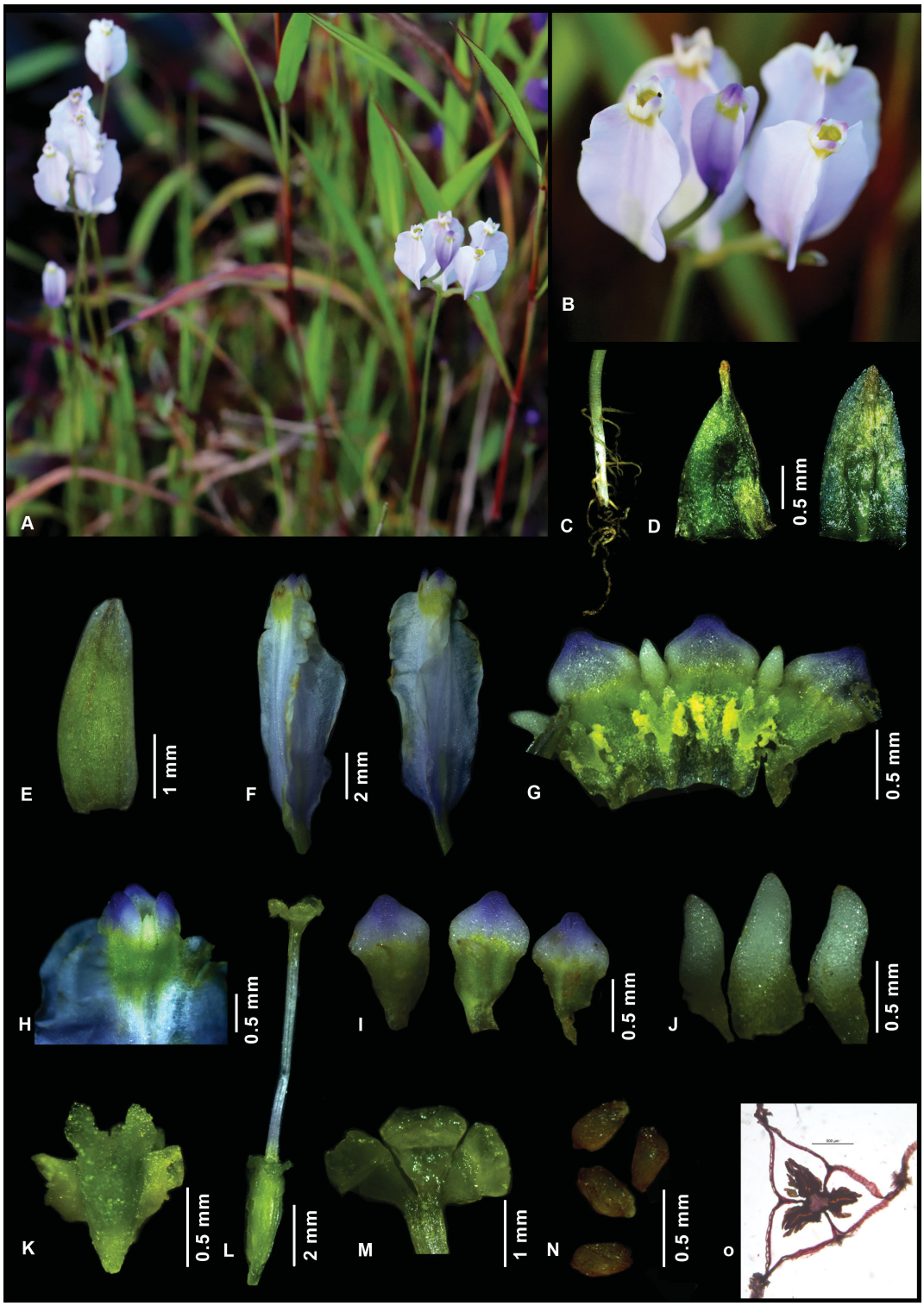

FIGURE 2. *Burmannia indica* Jonker, A. Habitat; B. Inflorescence; C. Basal part of the plant, see the absence of radical leaves; D. Scale-like leaves; E. Bract; F. Flowers; G. Upper part of flower split open showing perianth lobes and stamens; H. Upper part of flower showing closeup of perianth; I. Outer perianth lobes; J. Inner perianth lobes; K. Stamen, see the two lateral thecae, apical crests and basal spur; L. Gynoecium; M. Enlarged view of stigma; N. Seeds; O. Cross section of ovary. (A–M from *Santhosh Nampy 170085*; O from *Dani Francis & Vishnu Mohan 164619*).

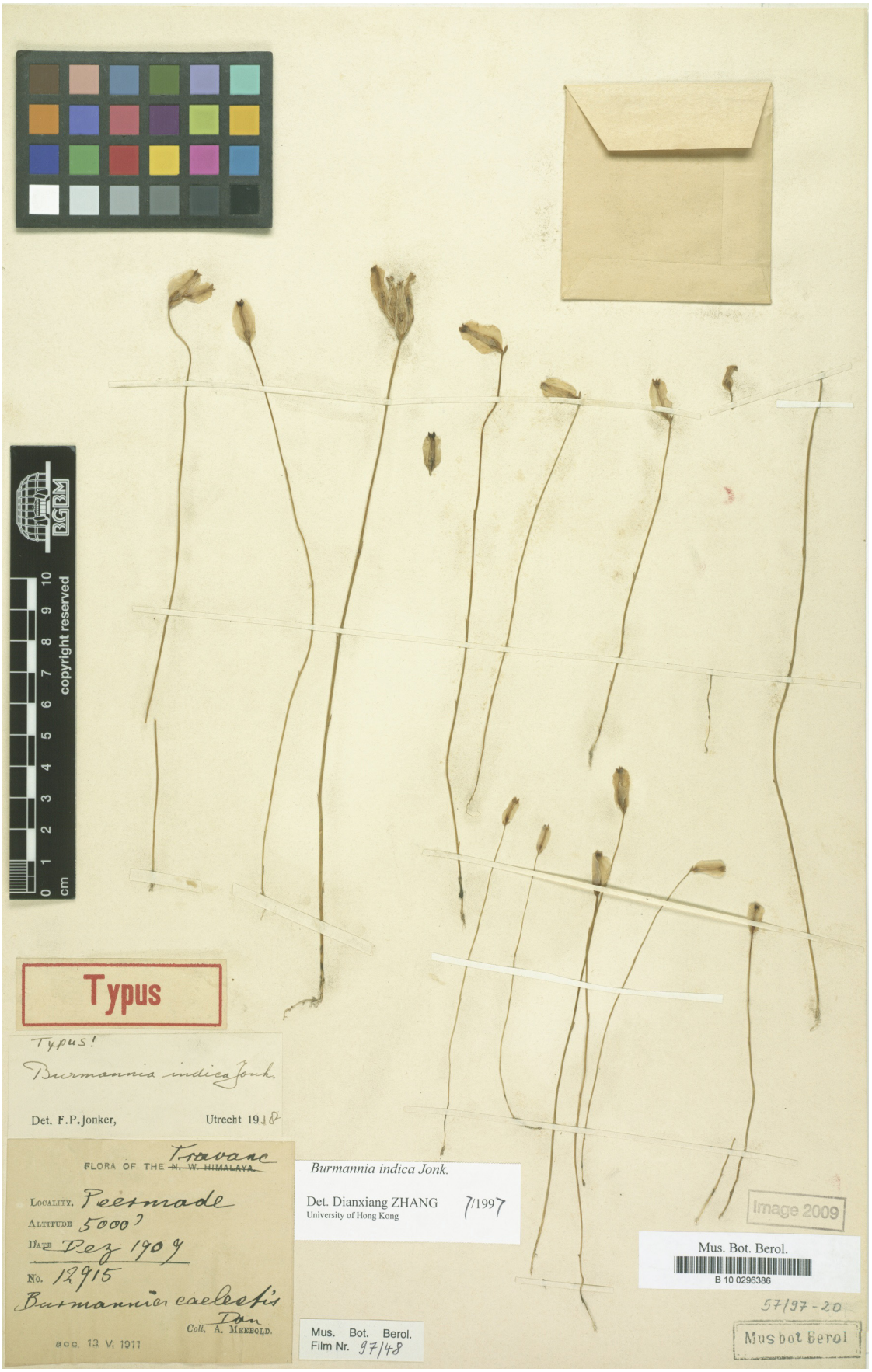

FIGURE 3. Type of *Burmannia indica* Jonker.

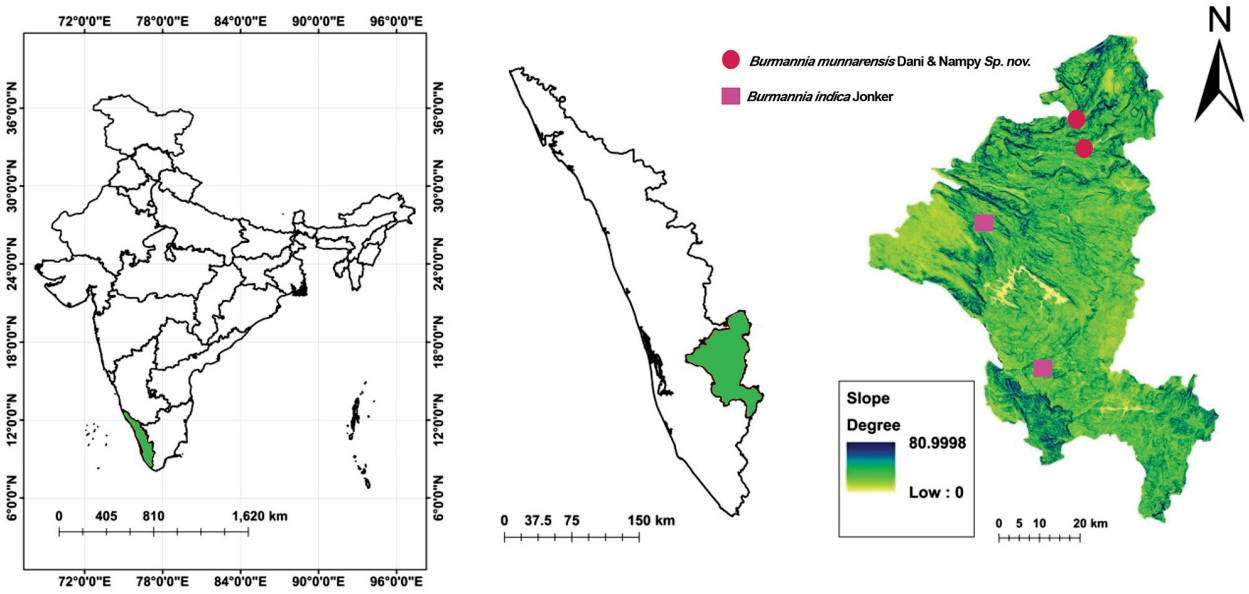

FIGURE 4. Map showing the distribution of *Burmannia munnarensis* Dani & Nampy and *B. indica* Jonker.

Acknowledgements

The authors are thankful to the Head, Department of Botany, University of Calicut, for facilities; officials of Kerala Forest Department for permission to undertake field trips to Idukki district and Dianxiang Zhang, Scientist, Chinese Academy of Sciences (CAS) for the confirmation of identity of *Burmannia indica*. The research is supported by Kerala State Council for Science, Technology and Environment, Thiruvananthapuram (126/2016/KSCSTE dated 26 May 2016).

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NORDIC JOURNAL OF
BOTANY

Research

Asyneuma cupulare, a new species of Campanulaceae from southern Western Ghats, India and lectotypification of *Campanula fulgens* (*Asyneuma fulgens*)

Divya K. Venugopal, Santhosh Nampy, Vishnu Mohan and Dani Francis

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Asyneuma cupulare (Campanulaceae) is described as a new species from the southern Western Ghats, India. The new species belongs to the section *Eupodanthum* and is morphologically close to *Asyneuma fulgens* in the same section, mainly for the absence of appendages on calyx, erect nature of capsules and calyx lobes after anthesis, presence of 3-lobed stigma and absence of agglutination in upper part of corolline lobes, but differs in having 4-angular puberulent stems, puberulent leaves, glabrous filaments and stigma, and cupular 6-ribbed capsules. Its description is given and diagnostic morphological characters of closely related species are compared and discussed. Information on habitat and conservation status is provided. The typification of *Asyneuma fulgens* is also discussed.

Keywords: *Asyneuma* sect. *Eupodanthum*, conservation assessment, Idukki, Meesapulimala

Introduction

Asyneuma Griseb. & Schenk, one among the 80 genera of Campanulaceae, consists of about 33 species in the world (Lammers 2007). Commonly called 'harebells', the genus is native to North Africa and Eurasia and is almost exclusively distributed from the Mediterranean to Caucasus and East Asia (Mabberley 2017). The genus is characterised by 1) corolla more or less rotate, with petals fused only at base; 2) calyx appendages lacking; 3) stigma 2–3(4)-partite and 4) capsules opening by median or subapical pores (Dambolt 1968).

Recent works based on molecular data indicated that *Asyneuma* is not monophyletic (Frajman and Schneeweiss 2009, Mansion et al. 2012, Jones et al. 2017, Chao and De-Yuan 2020). Dambolt (1968) divided the genus into three sections: *A.* sect. *Clinocarpium* (Boiss.) Rech.f. & Schiman-Czeika, *A.* sect. *Eupodanthum* Boiss. and *A.* sect. *Podanthum* Boiss. The section *Eupodanthum* is characterized by erect capsules with apical or medial dehiscence (Boissier 1875). *Asyneuma fulgens* (Wall.) Briq. and *A. thomsonii* (Hook. f.) Bornm. are species of this section present in India. Our literature study revealed that typification of *Asyneuma fulgens* is not done yet. Hence, a lectotype

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is designated below following Shenzhen Code (Turland et al. 2018).

A recent floristic survey in Meesapulimala, Idukki district in Kerala, the second highest peak in Western Ghats, resulted in the collection of a few specimens of *Asyneuma*. Detailed examination of the specimens and literature of the genus revealed that the morphological characters of the specimen do not fit any known species of *Asyneuma* and that they deserve the status of a new species, which we describe below as *Asyneuma cupulare* sp. nov. With this new taxon, there are three species in India.

Material and methods

Live specimens of the new taxon were collected from Idukki district and photographs of floral parts were taken with a camera attached to a stereomicroscope. Protologues of related species and other relevant literature (Clarke 1882, Gamble 1921, Dambolt 1968, Sasidharan 1998) were examined in detail for confirming the novelty of the species, and a detailed description was made. In order to designate a lectotype, the protologue of *A. fulgens* was examined and the following virtual herbaria were searched for locating the Wallich's specimens: K, E, BR, KFTA, M, GDC and PH (acronyms according to Thiers 2020 continuously updated). IPNI (<www.ipni.org>) was followed for the plant name authors.

Taxonomy

Asyneuma cupulare Divya & Nampy, sp. nov. (Fig. 1, 2)

Type: India, Kerala, Idukki District, Meesapulimala, ± 2640 m a.s.l., 14 Oct 2019, Divya K. Venugopal & Santhosh Nampy 170375 (holotype: CALI; isotype: CAL).

A species morphologically close to *Asyneuma fulgens* but differing by the nature of stems (4-angular versus terete), hairiness of stems and leaves (puberulent versus glabrous), hairiness of filaments and stigma (glabrous versus pubescent), shape of capsules (cupular versus obovoid-conical), number of ribs on capsules (10 versus 6) and way of capsule dehiscence (medial valves versus apical pores).

Etymology

The specific epithet 'cupulare' refers to the cup shaped nature of the capsules.

Description

Perennial herb, up to 10 cm tall. Subterranean organs not seen. Stems 4-angular, branched, puberulent, green. Leaves simple, alternate; petioles 4–5 mm long, puberulent; lamina oblanceolate, 3.0–5.0 × 1.0–1.5 cm, cuneate at base, acute at apex, dentate at margins, with both surfaces puberulent, pale green. Cymes terminal, erect, 2–3-flowered; flowers bisexual, actinomorphic, 1.0–2.0 × 1.0–1.5 cm; peduncles 4-angular, 3–4 cm long, puberulent, green; pedicels 3.0–3.2 cm long, puberulent, green. Bracts linear, leafy, 6.0–6.2 × 1.0–1.1 mm, puberulent, green; bracteoles 2, linear, leafy, 2.0–2.1 × 1.0–1.2 mm, glabrous, green. Calyx 5-lobed, cupular; tube 4.0–4.3 × 5.0–5.1 mm; lobes lanceolate, acute at apex, truncate at base, without appendages, 6.0–6.1 × 1.0–1.1 mm, glabrous, green. Corolla rotate, deeply 5-lobed, divided almost to the base; tube absent; lobes nearly elliptic, 0.8–1.0 cm long, glabrous, pale pink. Stamens 5, equal, inserted on the corolla; filaments dilated at base, 3.0–3.2 mm long, glabrous, cream coloured; anthers oblong, 2.9–3.0 × 1.0–1.2 mm, dithecous, basifixed, glabrous, cream coloured. Ovary inferior, 3-celled; ovules many in each cell; styles slender, 4.0–4.2 × 0.8–1.0 mm, hairy at the tip; stigma trilobed, lobes 1 mm long, glabrous, purple. Capsules cupular, erect, 5.0–5.3 mm long, prominently 10-ribed, puberulent along the ribs, dehiscense by medial valves. Seeds numerous, obovoid, smooth (without appendages), ca 1.0–1.2 × 0.5–1.0 mm, straw coloured.

Phenology

Flowering and fruiting in October–December.

Distribution and associated species

Extremely rare; presently known only from the type locality (Fig. 3). It occurs in wet and damp grasslands often associated with *Callitriche wightiana* Wall. ex Wight & Arn. (Plantaginaceae) and *Funaria* sp. (bryophytes), at an elevation of 2640 m a.s.l.

Conservation status

The new species is currently known only from a single population in Meesapulimala in Idukki district, with approximately 10 mature individuals in an area of 0.5 km^2. The locality being a tourist destination, there is the possibility of disturbances in the future due to human activities. Extensive field surveys in similar habitat are required to determine its exact IUCN status. Hence, the species shall be regarded as Data Deficient according to IUCN Guidelines (IUCN 2019).

Notes

Asyneuma cupulare is similar to the widespread and morphologically variable species *A. fulgens* in its erect and prominent calyx teeth without appendages, and the division of the corolline lobes to the base. But there are significant differences that allow them to be easily distinguished as outlined in the diagnosis and in the table below (Table 1) including flowering period (October–December versus June–July), nature of stem (4-angular versus terete), shape of capsules (cupular versus obovoid-conical), etc. *Asyneuma fulgens* produces numerous blue flowers on an elongated peduncle (10–15 cm) whereas in *A. cupulare*, the flowers are 2 or 3 (sometimes one) pale pink on short peduncles (3–4 cm).

Lectotypification of *Campanula fulgens* Wall.

Campanula fulgens Wall. in Roxb. (1824, p. 99).

Based on the same type: *Asyneuma fulgens* (Wall.) Briq. (1931, p. 334–335).

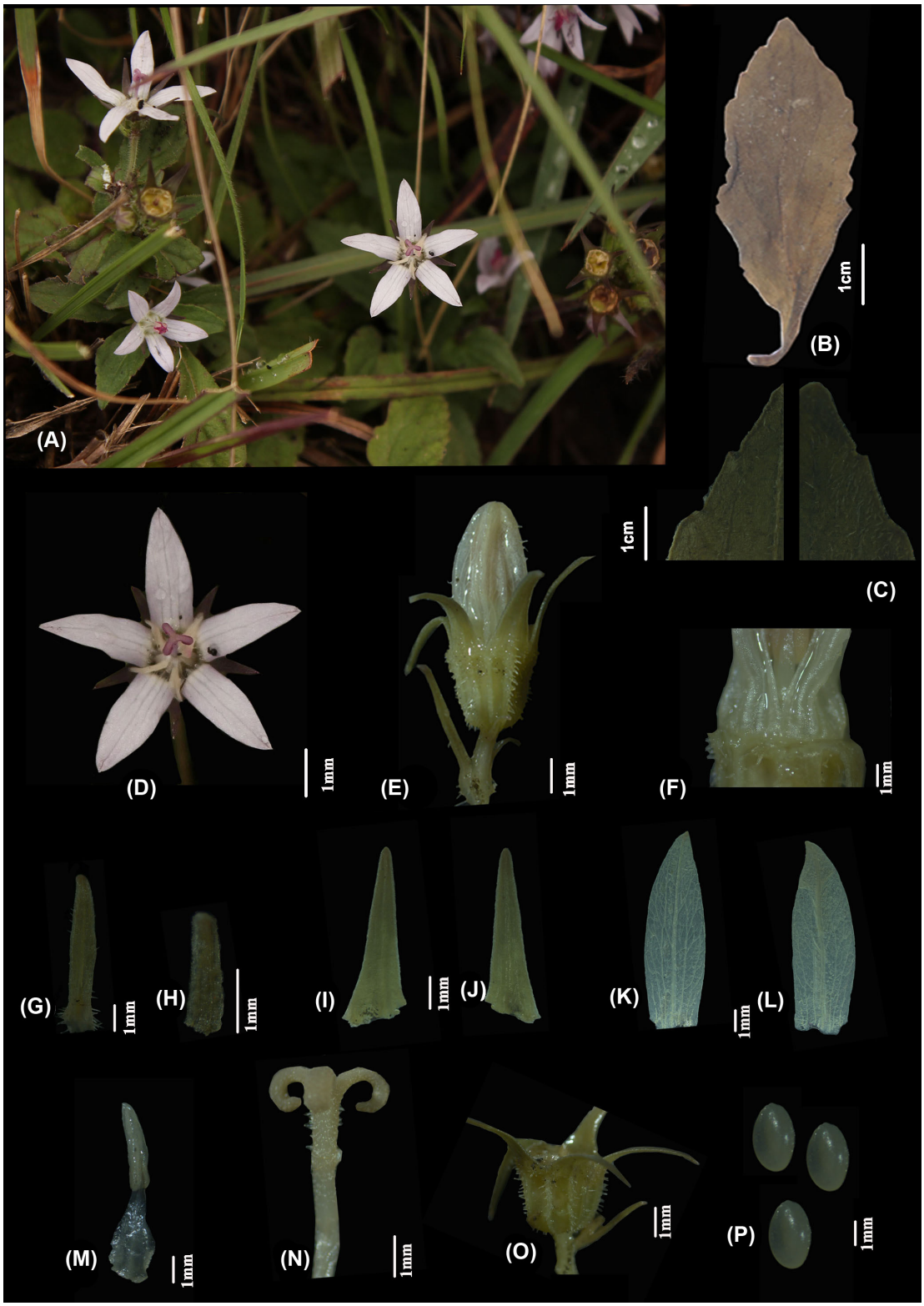

Figure 1. *Asyneuma cupulare* sp. nov. (A) habit, (B) leaf, (C) a portion of leaf showing pubescence, (D) flower, (E) flower bud, (F) corolla lobes split up to the base, (G) bract, (H) bracteole, (I) calyx lobe (adaxial view), (J) calyx lobe (abaxial view), (K) corolla (adaxial view), (L) corolla (abaxial view), (M) stamen, (N) style and stigma, (O) capsule, (P) seeds (all Divya K. Venugopal & Santhosh Nampy 170375, CALI). Photos by Vishnu Mohan.

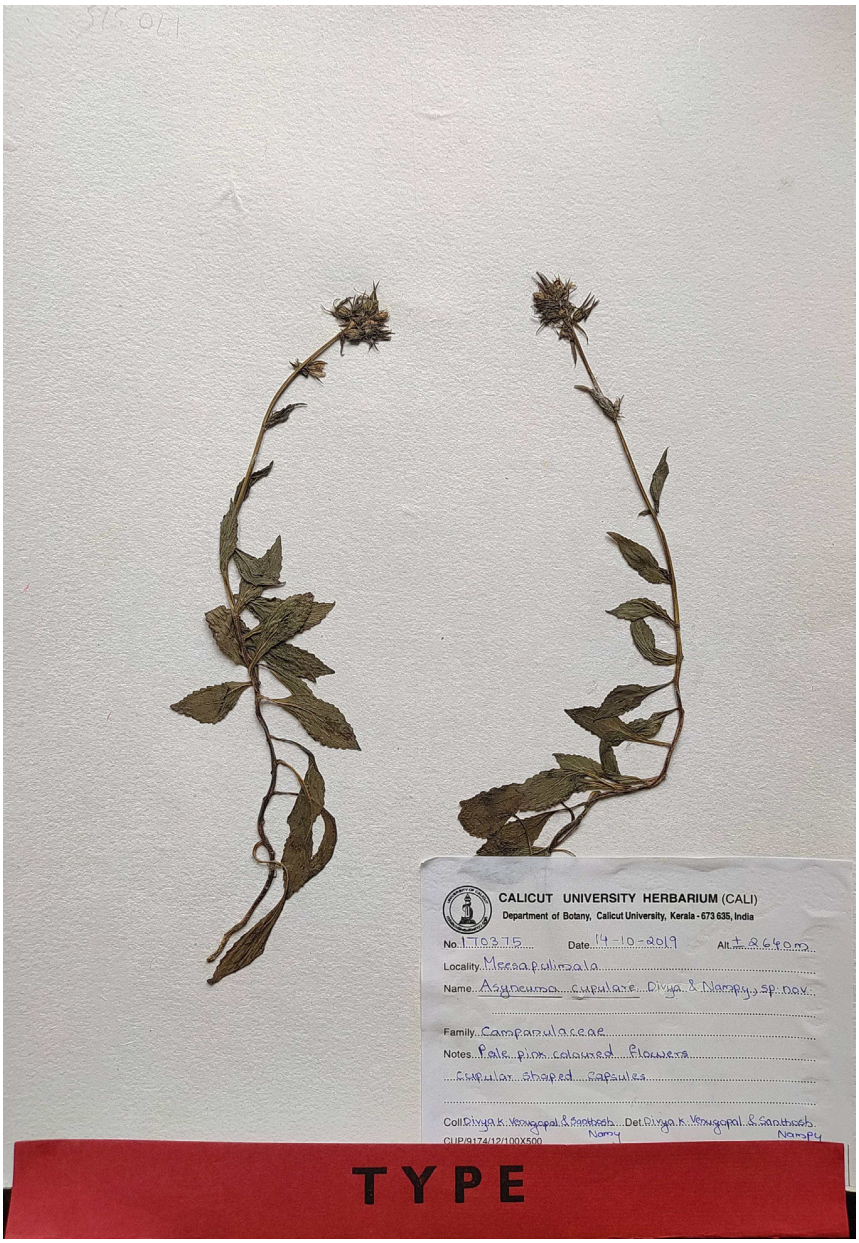

Figure 2. Holotype of *Asyneuma cupulare* sp. nov. deposited at CALI.

Type: Nepal, 1821, Nathaniel Wallich 1283 (lectotype K (barcode, K0001112638, <http://specimens.kew.org/herbarium/K0001112638>, designated here, digital image*) (Fig. 4).

Notes

Campanula fulgens was originally described by Wallich (1824) with the citation: 'I have found this species in the valley of Chitlong which is considerably higher than that of Nipal, and on mount Chanda-giri which separates the two. It has also been brought to me by a collecting party from the road to Gosnin-Thau'. When Briquet (1931) described *Asyneuma* Briq., he transferred this species to this genus as *Asyneuma fulgens* (Wall.) Briq. A detailed search in online databases of various herbaria revealed seven specimens collected by Wallich from Nepal: three at K (K0001112638, K000814285, K000814286), one each at E (E 00275106), BR (BR 696959), M (M0217898), GDC (G00321458) and PH (PH00000404). Among them, the sheets K000814286, BR696959, M0217898 and G00321458 were collected in 1821 while K000814285 in 1829 and the others E00275106 and PH (PH00000404) are without any year/date of collection. Hence the sheet at K (K0001112638) which agrees with the protologue is designated here as the lectotype following the Schenzen Code (Turland et al. 2018) and BR696959, M0217898 and G00321458 are consequently isolectotypes.

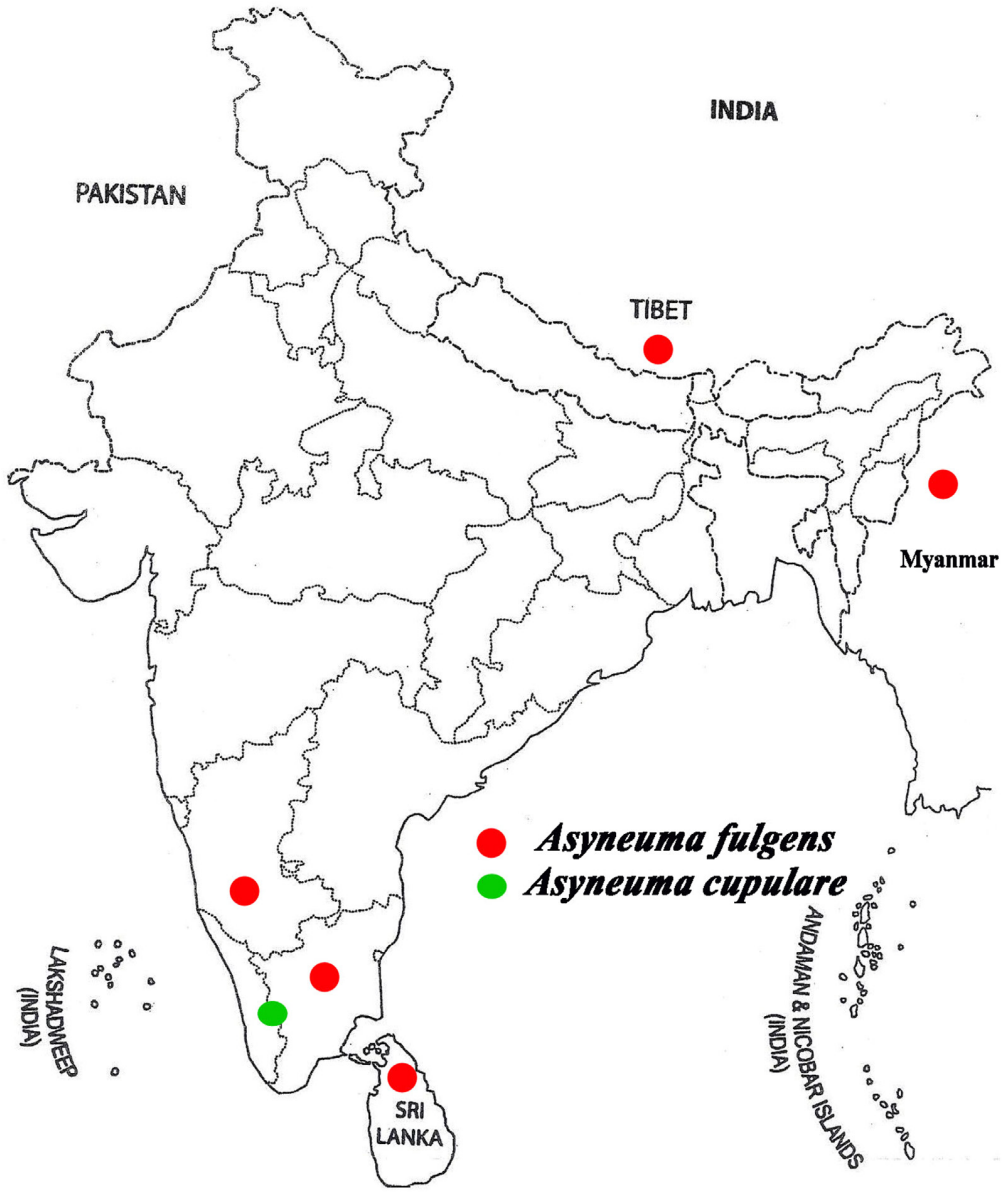

Figure 3. Distribution map of *Asyneuma cupulare* sp. nov. and *Asyneuma fulgens*.

Table 1. Diagnostic morphological features of *Asyneuma cupulare* and *A. fulgens*.

Characters	*A. cupulare* sp. nov.	*A. fulgens*
Hairiness of stems and leaves	Puberulent	Glabrous, sometimes sparsely hirsute below
Stem	4-angular	Terete
Venation	Nerves reticulate underneath	Nerves parallel oblique underneath
Racemes	Up to 5 cm long with usually 2-3 flowers, sometimes ending in a single flower	10–15 cm long with numerous flowers in an elongated peduncle
Pedicels	3 cm long	Sub-sessile
Calyx lobe	6.0–6.1 mm long, much shorter than corolla lobes	5–10 mm long, equal to the corolla lobes
Corolla	Pale pink	Blue
Filament	Glabrous	Margins densely ciliate
Stigma	Glabrous	Pubescent
Capsules	Erect, cupular; base rounded with 10 prominent ribs; dehisce by median valves.	Erect, obovoid-conical; base acute or acuminate, with 6 prominent ribs; dehisce by apical pores.

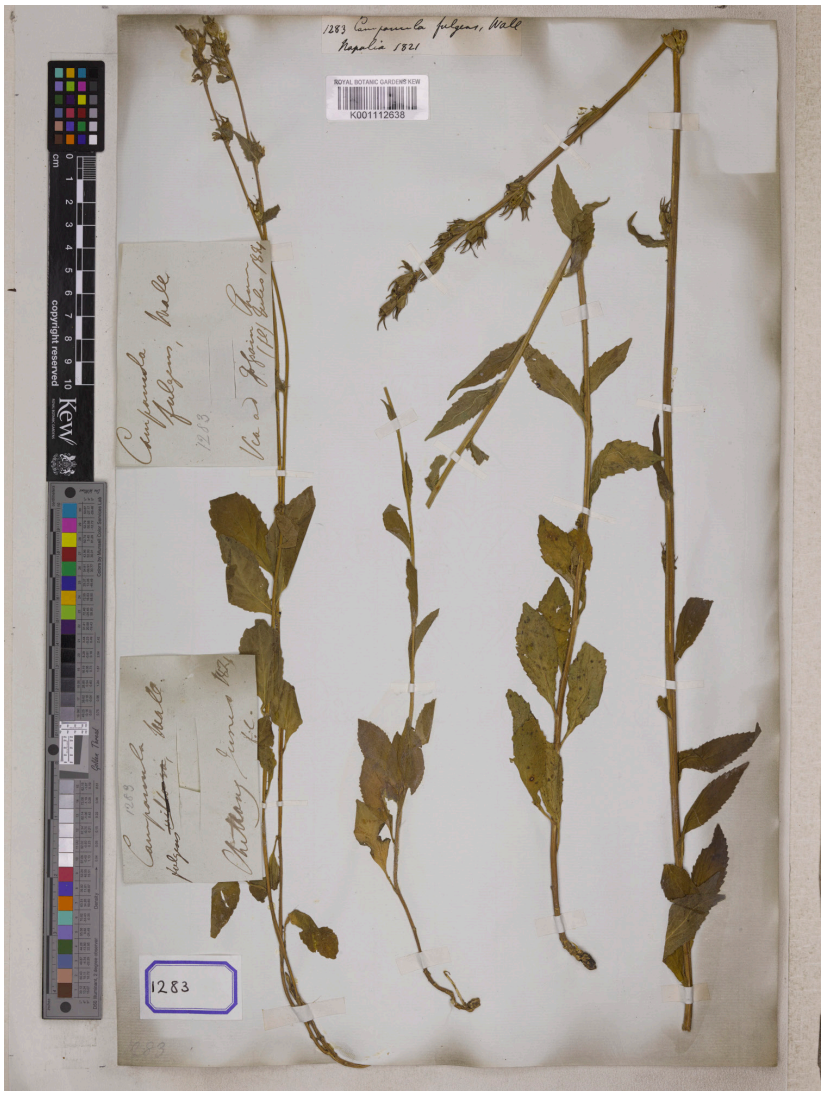

Figure 4. Lectotype of *Asyneuma fulgens* (Wall.) Briq. (K0001112638). (c) The board of trustees of Royal Botanic Gardens, Kew. Reproduced with permission.

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Taiwania 65(2): 187–194, **2020**
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Two new scapigerous species of *Impatiens* (Balsaminaceae) from southern Western Ghats, India

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(Manuscript received 7 August 2019; Accepted 10 March 2020; Online published 18 March 2020)

ABSTRACT: Two scapigerous species of *Impatiens* (Balsaminaceae): *I. nidholapathra* and *I. grandispora* from Idukki district in Kerala, India are here described. *Impatiens nidholapathra* is most similar to *I. tirunelvelica* from which it differs by its membranous and silky lanuginose leaves. *Impatiens grandispora* is related to *I. stolonifera* morphologically but differs mostly by the purplish white flowers with red patches of papillae near the centre and considerably larger pollen grains. They are known from a small, fragmented population from a low range of hills. Therefore, under the IUCN Red List Categories & Criteria, they are assessed as Critically Endangered. We provide here morphological descriptions, illustrations, colour photoplates, notes on their habitats, distribution, phenology and conservation status.

KEY WORDS: Idukki district, *Impatiens grandispora, I. nidholapathra, I. stolonifera, I. tirunelvelica*, India, new species.

INTRODUCTION

Impatiens L., a genus of the Balsaminaceae family, has over 1000 species in the world (Grey-Wilson, 1980). They are terrestrial or occasionally epiphytic, more or less succulent annual or perennial herbs with attractive and morphologically complex flowers and dehiscent fruits. The majority of *Impatiens* species are distributed in five hotspots: Southeast Asia and Southwestern China, eastern to central Himalayas, southern India, tropical Africa and Madagascar (Grey-Wilson, 1980). The Western Ghats is one of the centers of diversity for this genus (Bhaskar, 2012). There are currently 210 accepted species of *Impatiens* known from India, of which 110 species are reported from Western Ghats, including 30 scapigerous species with greater percentage of endemism. Based on morphological and molecular data Yu *et al.* (2016) divided the genus into two subgenera: subgen. *Clavicarpa* and subgen. *Impatiens*. The subgen. *Impatiens* is further divided into seven sections: Sect. *Semeiocardium*, Sect. *Impatiens*, Sect. *Tuberosae*, Sect. *Racemosae*, Sect. *Uniflorae*, Sect. *Scorpioidae* and Sect. *Fasciculatae*.

During field trips to the floristically rich Idukki district in Kerala (southern Western Ghats), as a part of documenting the angiosperm diversity, specimens of remarkable, apparently undescribed *Impatiens* taxa were collected and are described here as *I. nidholapathra* and *I. grandispora.* These novelties belong to the section *Uniflorae* in having 5-carpellate ovary, fusiform capsules conspicuously turgid at middle and flowers produced in racemes.

MATERIALS AND METHODS

Specimens of the new taxa were collected during field work in Idukki district. Collected materials were pressed and dried or preserved in 4% formalin and 70% ethanol. Photographs of habitat and habit were taken with a Canon 77D DSLR Camera. Colour plates were prepared using Zeiss Stemi 508 stereomicroscope attached with an Axiocam 105 color Camera. The description was prepared after examining all available specimens. Voucher specimens were deposited at CALI and K. The conservation status of these taxa were assessed using the standard IUCN Categories and Criteria (IUCN, 2012, 2017).

TAXONOMIC TREATMENT

Impatiens nidholapathra Vishnu & Nampy, ***sp. nov.***
Figs. 1A, 2 & 3

Type: INDIA, Kerala, Idukki district, 50th mile-Mankulam, 10°06′96.7″N; 076°58′80.7″E, ±1023 m, 14 Sep. 2018, *Vishnu Mohan & Santhosh Nampy 161903* (holotype, CALI; isotype, K).

Diagnosis*: I. nidholapathra* resembles *I. tirunelvelica*, but differs in its membranous silky lanuginose leaves, pale green veins, and pink corolla with a yellow centre surrounded by white papillae against fleshy glabrous leaves, brown veins, pink corolla uniformly white at centre in *I. tirunelveica*.

Tuberous acaulescent, lithophytic herbs, densely pubescent, 10–25 cm tall. Tubers oblate, 2–5 × 2–4 mm. Leaves radical, pendulous, membranous, elliptic to narrowly deltoid, 5–11 × 2–5.5 cm, serrate and spinose at margins, cordate but rarely cuneate or obliquely cordate at base, acute or rarely obtuse at apex, with a tuft of uniseriate trichomes on upper surface and silky lanuginose hairs on lower surface, nerves pale green below; petioles 1.5–6 cm long, glabrous. Flowers in

Fig. 1. A: Habitat of ***Impatiens nidholapathra*** Vishnu & Nampy. **B:** Habitat of ***Impatiens grandispora*** Nampy & Vishnu.

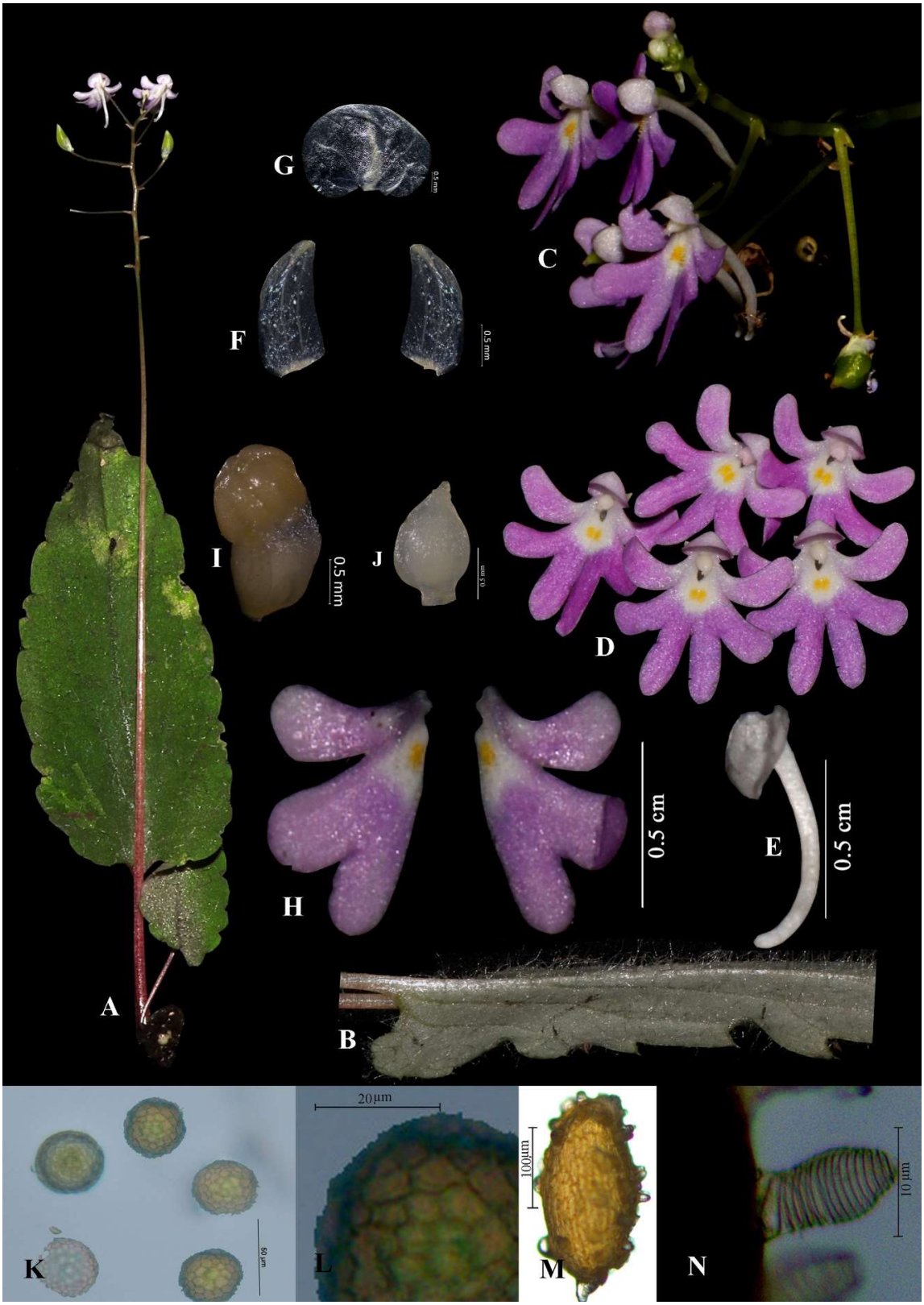

Fig. 2. ***Impatiens nidholapathra*** Vishnu & Nampy. **A:** Habit. **B:** Leaf abaxial side showing hairs. **C & D:** Inflorescence. **E:** Lower sepal with spur. **F:** Lateral sepals. **G:** Dorsal petal. **H:** Lateral united petals. **I:** Androecium. **J:** Ovary. **K:** Pollen grains showing reticulate exine. **L:** Pollengrain, a portion enlarged. **M**: Seed. **N**: Seed, part enlarged showing spirally coiled hairs.

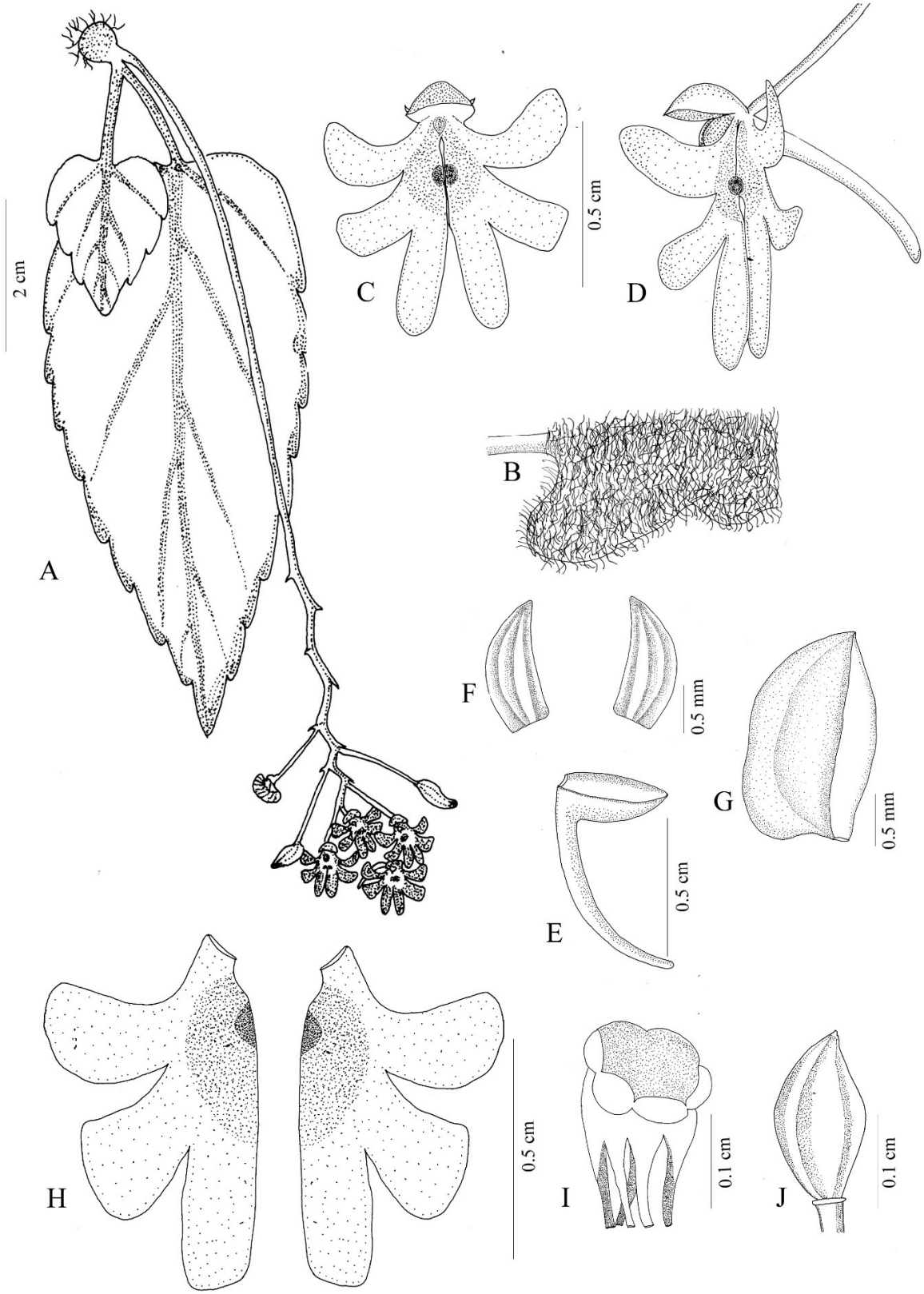

Fig. 3. **Impatiens *nidholapathra*** Vishnu & Nampy. **A:** Habit. **B:** Leaf abaxial side (a portion enlarged showing hairs). **C & D:** Flower (front and lateral views). **E:** Lower sepal with spur. **F:** Lateral sepals. **G:** Dorsal petal. **H:** Lateral united petals. **I:** Androecium. **J:** Ovary.

racemose scapes, scapes straight, 10–25 cm long; 4–12 flowered, pink. Pedicels glabrous, 0.8–1.5 cm long, erect, pale green. Bracts persistent, linear-lanceolate, 1–1.5 × 1 mm, pale green. Flowers 0.6–1 × 0.8–1.1 cm. Sepals free, pale green; lower sepal cymbiform, conical at apex, smooth at margins, white; spur 8–10 mm long, slightly incurved at base; lateral sepals elliptic, 1.7 × 0.7 mm, smooth at margins, rounded at base, acute at apex, glabrous. Petals pinkish, delicate; dorsal petal cordate, 2.7 × 3.3 cm, smooth at margins, rounded at base, acute at apex; lateral united petals 3-lobed, white papillae surrounds the yellow patch at base, 7 × 4.5 mm, smooth at margins, auricle absent. Stamens 5; filaments 2 × 3 mm; anthers united, ovate, 2 × 1 mm, extrose, longitudinally dehiscing; staminodes absent; pollen spheroidal, porate, golden yellow, *c.* 38±4 × 38±4 µm; exine reticulate. Ovary elliptic, 1 mm long, strigose; style 0; stigma sticky, capitate. Capsules 4 mm long, glabrous. Seeds numerous, golden brown, oval; testa reticulate with spirally coiled hairs.

Phenology: *Impatiens nidholapathra* produces flowers and fruits from August-October.

Distribution: Hitherto known only from the type locality.

Habitat: Grows on shady moist rocks in evergreen forests, in association with mosses (*Porella* L. and *Funaria* Hedw.), *Pilea microphylla* (L.) Liebm. (Urticaceae) and *Murdannia fadeniana* Nampy & Joby (Commelinaceae), at an elevation of 1023 msl.

Etymology: The epithet '*nidholapathra*' is derived from Sanskrit: 'nidholam' means pendulum and 'pathra' leaves, the whole referring to the pendulous nature of the leaves.

Notes: *Impatiens nidholapathra* is an integral component of evergreen forest found on shaded rocks and is highly sensitive to external conditions. They might be ruined by a small lack of moisture. The leaves are drooping and the flowers are pinkish with a 3-lobed lateral united petals. Even though it resembles *I. tirunelvelica* and *I. veerapazhasii,* it can be easily distinguished by its membranous and silky lanuginose leaves. Tubers on the rocks are covered with mosses and are non-stoloniferous but give rise to one or two leaves and a scape.

Specimen examined: India, Kerala, Idukki district, Kozhiyilakudi-Anakulam, 18 Sep. 2018, *Vishnu Mohan & Santhosh Nampy 161987* (CALI).

Conservation status: The authors came across three small populations from the Mankulam and Anakulam forests with no more than 30 individuals. The area of occupancy of each population is reduced to 3 m^2 with a distance of 14 km between two populations. Because of tourism and other anthropogenic activities, the type population may become extinct. The conservation status of the species is assessed as Endangered Category (IUCN, 2017).

Impatiens grandispora Nampy & Vishnu, ***sp. nov.***

Figs. 1B, 4 & 5

Diagnosis*: Impatiens grandispora* is close to *I. stolonifera* but differs by its pollen size (50 µm vs 25 µm), colour of papillae (red vs white), colour of bract (reddish brown vs pale green).

Type**:** INDIA, Kerala, Idukki district, Edathattu-Mankulam, 10°05′27.5″N; 076°57′29.0″E ±1395 m, 13 Sep. 2018, *Vishnu Mohan & Santhosh Nampy 159468* (holotype, CALI; isotype K).

Tuberous acaulescent, lithophytic, glabrous, herbs, 20–30 cm tall. Tubers oblate-prolate, 2–8 × 2–7 mm. Leaves radical, cordate to rounded, 6–8 × 4–6.5 cm, fleshy but leathery, serrate at margins, cordate at base, rounded or rarely mucronate at apex, with trichomes adaxially, glabrous abaxially, nerves pale green below; petioles 6–9 cm long, glabrous. Flowers in racemose scapes; scapes 20–30 cm long, reddish-brown; 4–16 flowered. Pedicels smooth, thin, erect, reddish-brown, 4–6 cm long; bract 1, persistent, ovate, 5–7 × 2 mm, acute at apex, smooth at margins, pale green-reddish brown. Flowers 2.5–3 × 1.8–2 cm. Sepals free, reddish-brown; lower sepal cymbiform, apex falcoid, 5–7 × 3–4 mm, smooth at margins, white, spurred; spur 3.8–4.3 cm long, base slightly incurved, white; lateral sepals obliquely triangular, 5–6 × 3.5–4 cm, smooth at margins, cordate at base, acute at apex, glabrous, reddish-brown. Petals purplish-white; dorsal petal cordate, 0.7–1 × 1.1–1.3 cm, smooth at margins, cordate at base, acute at apex; lateral united petals 3-lobed, 2.7 × 2 cm, smooth at margins, with a reddish patch of papillae at centre, auricle absent. Stamens 5; filaments papery, 5 × 8 mm; anthers oval, united, 5 × 2 mm, extrose, longitudinally dehiscing; pollen spheroidal, 50±8 µm diam., pantoporate with 2–4 pores, golden yellow; exine reticulate. Ovary elliptic, 4 × 1.5 mm; style 0; stigma sticky, capitate. Capsules 1.5 × 0.5 cm. Seeds numerous, golden brown, oval to elliptic with spirally coiled hairs.

Phenology: Flowering and fruiting occurs from August-October.

Distribution: Hitherto known only from the type locality.

Habitat: Grows on steep, exposed dripping rocks, in association with several grass species, at an elevation of 1425 msl.

Etymology: The epithet '*grandispora*' refers to the large pollen grains of the species.

Notes: The plants grow abundantly but are extremely sensitive to rain. They start to flowers only after receiving ample rains. But any rain during their period of flowering causes the plants to decline, eventually destroying the entire population. This sudden appearance and vanishing caused the tribal people to call them "Wonder Plant". With the beginning of next rainy season, the tubers will continue to give rise to new plants.

Fig. 4. ***Impatiens grandispora*** Nampy & Vishnu. **A:** Habit. **B:** Stolon. **C & D:** Flowers **E:** Lower sepal with spur. **F:** Lateral sepals. **G:** Dorsal petal. **H:** Lateral united petals. **I:** Androecium. **J:** Ovary. **K:** Pollen grains. **L**: Pollen grain, a portion enlarged showing reticulate exine. **M:** Seed. **N**: Seed, part enlarged showing spirally coiled hairs.

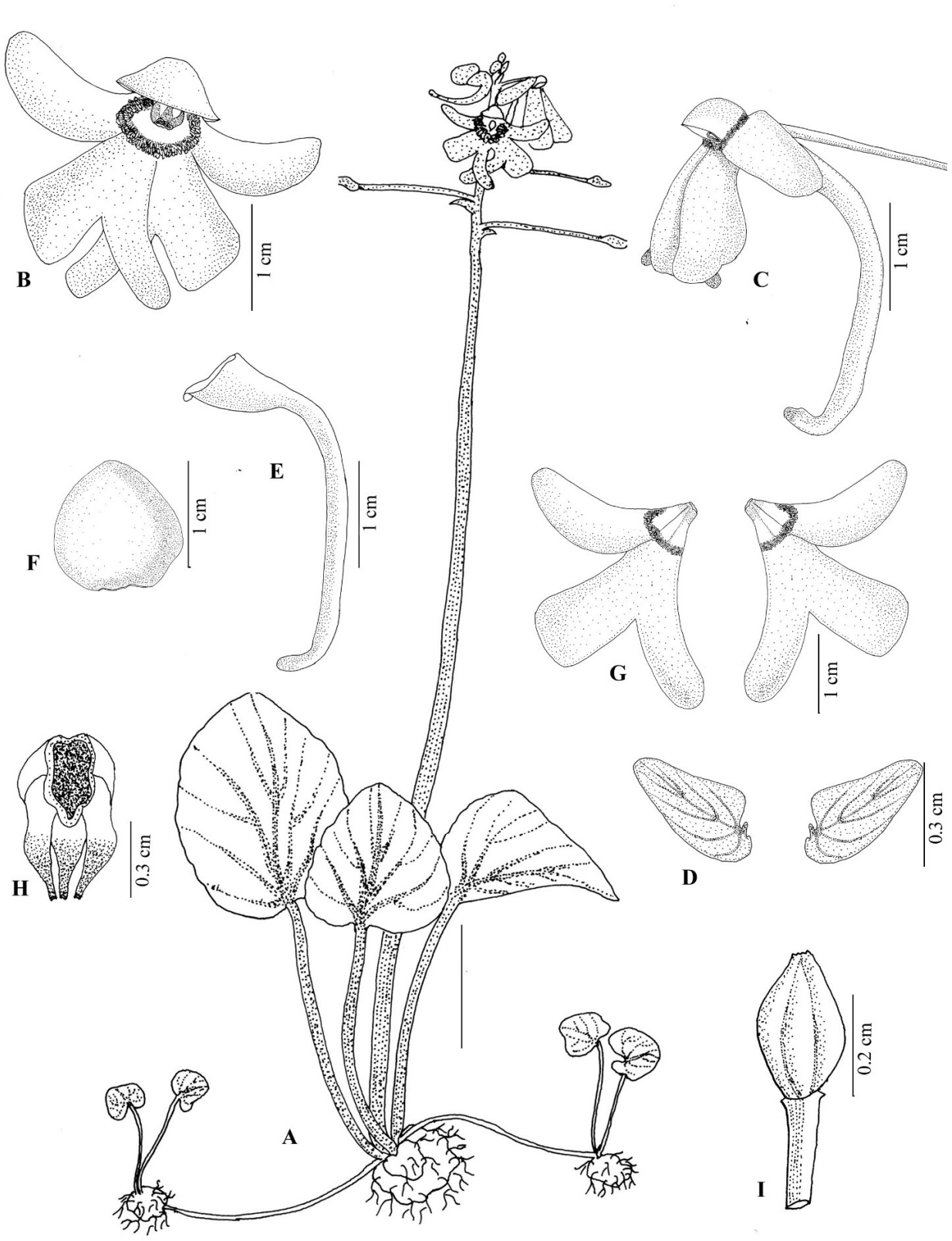

Fig. 5. **Impatiens *grandispora*** Nampy & Vishnu. **A:** Habit. **B & C:** Flower (front and lateral views). **D:** Lateral sepals. **E:** Lower sepal with spur. **F:** Dorsal petal. **G:** Lateral united petals. **H:** Androecium. **I:** Ovary.

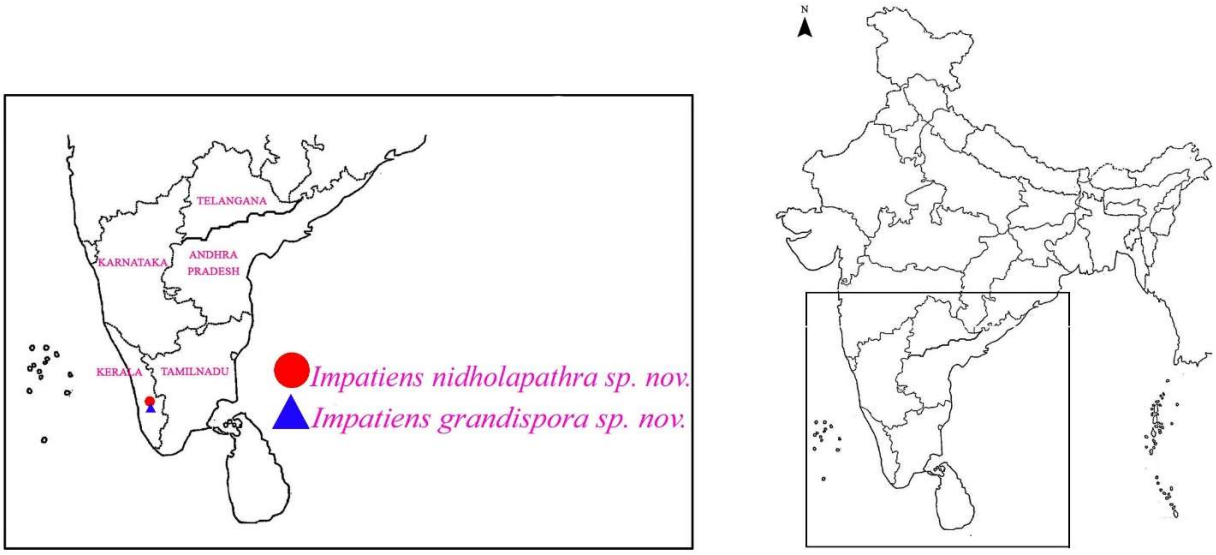

Fig. 6. Map showing distribution of ***Impatiens nidholapathra*** and ***I. grandispora***.

Although *I. grandispora* has similarities with *I. stolonifera*, there are many striking differences as well. While the latter's stolon is stout and exposed, that of the former is weak and unexposed. The former has purple white flowers with red patches of papillae near the centre, reddish brown pedicels, lateral united petals with inwardly bending basal lobes and larger pollen (50 µm) while the latter has white flowers with white papillae near the centre, pedicels pale green, lateral united petals with straight basal lobes and smaller pollen (25 µm).

Specimen examined: India, Kerala, Idukki district, Edathattu-Mankulam, 15 Oct. 2018, *Vishnu Mohan & Santhosh Nampy 167830* (CALI).

Conservation status: The current novelty is reported only from one location with 25–30 subpopulations. The extend of occurrence is 5 m^2. There are no perceived threats either to the populations or its habitat as it is reported from a protected area. Based on extend of occurrence, area of occupancy and number of individuals the species falls within the Critically Endangered Category (IUCN, 2017).

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The authors are thankful to the Head, Department of Botany, University of Calicut for facilities; Dr. K.N. Gandhi (Harward University) for confirming the gender of the specific epithet; Principal Chief Conservator of Forests (Wildlife) and Chief Wildlife Warden (Kerala), Divisional Forest Officer, Mankulam (Mr. Suhaib P.J.), Range Forest Officers of Mankulam Division (Mr. Anand R., Mr. Roy K.T.) and all other forest officers and watchers for their continuous assistance in frequent field explorations; Kerala State Council for Science, Technology and Environment, Thiruvananthapuram for financial assistance (126/2016/KSCSTE dated 26 May 2016).

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Impatiens raktakesara (Balsaminaceae), a new species from the southern Western Ghats, India

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Abstract: A new species, ***Impatiens raktakesara***, belonging to section *Scorpioidae* is described and illustrated from Idukki district of Kerala in the southern Western Ghats. It is morphologically similar to *Impatiens goughii*, but can easily be distinguished in having uniseriate moniliform trichomes on leaf upper surface, unlobed lower petals and 1–3(-5)-seeded capsules. *Impatiens raktakesara* is assessed here as Endangered based on the categories and criteria of the IUCN Red List.

Keywords: Anamudi hills, Eravikulam National Park, *Impatiens*, taxonomy.

The genus *Impatiens* L. (Balsaminaceae) comprises more than 1000 species distributed primarily in the mountainous areas of the Old World tropics and subtropics (Grey-Wilson, 1980; Fischer, 2004; Janssens et al., 2006). Southeast Asia, southern India and Sri Lanka, the eastern Himalayas, tropical Africa, and Madagascar are the hotspots for *Impatiens* species diversity, with numerous endemics in each area (Yuan et al., 2004; Janssens et al., 2006). More than 210 species of *Impatiens* are known from India, the majority of which are restricted to Himalayas or Western Ghats. Over half of the species in India occur in the Western Ghats, and nearly 103 species are endemic to the Western Ghats (Bhaskar, 2012). Based on morphological and molecular data, Yu et al. (2016) classified the genus into two subgenera: subgen. *Clavicarpa* Warb. and subgen. *Impatiens*. The subgen. *Impatiens* was further divided into seven sections: sect. *Semeiocardium* (Zoll.) S.X. Yu & Wei Wang, sect. *Impatiens*, sect. *Tuberosae* S.X. Yu & Wei Wang, sect. *Racemosae* Hook.f. & Thomson, sect. *Uniflorae* Hook.f. *&* *Thomson*, sect. *Scorpioidae* S.X. Yu & Wei Wang and sect. *Fasciculatae* X.S Yu & Wei Wang.

During fieldwork in the floristically rich Idukki district of Kerala in the southern Western Ghats, which was undertaken to better document the angiosperm diversity of the district, we found an unrecognized species of *Impatiens* resembling *I. goughii* Wight. After careful comparison of morphological characters in living and herbarium specimens, and after consulting the relevant literature, we found that the entity in question is consistently distinct from *I. goughii* and all other species of *Impatiens.* Hence, it is described herein as a new species belonging to sect. *Scorpioidae*.

Materials and methods

Specimens of the new taxon were collected during field work in Idukki district. Collected materials were dried or preserved in 4% formalin and 70% ethanol. Photographs of habitat and habit were taken with a 77D DSLR Camera (Canon, Japan). Photographic images of floral parts were taken with a Stemi 508 stereomicroscope (Zeiss, Germany) attached with an Axiocam 105 color camera. The terminology of morphological characters follows Grey-Wilson (1980), and the taxonomic description was prepared after examining all available specimens. Voucher specimens were deposited at CALI (acronyms after Thiers 2020). Conservation assessment was done using the IUCN Red List categories and criteria (IUCN, 2012; IUCN Standards and Petitions Committee, 2019). To assess the distinctiveness of the new species, the relevant literature was consulted (Grey-Wilson, 1980; Sasidharan, 2011; Bhaskar, 2012; Shajitha et al., 2016; Yu et al., 2016) and

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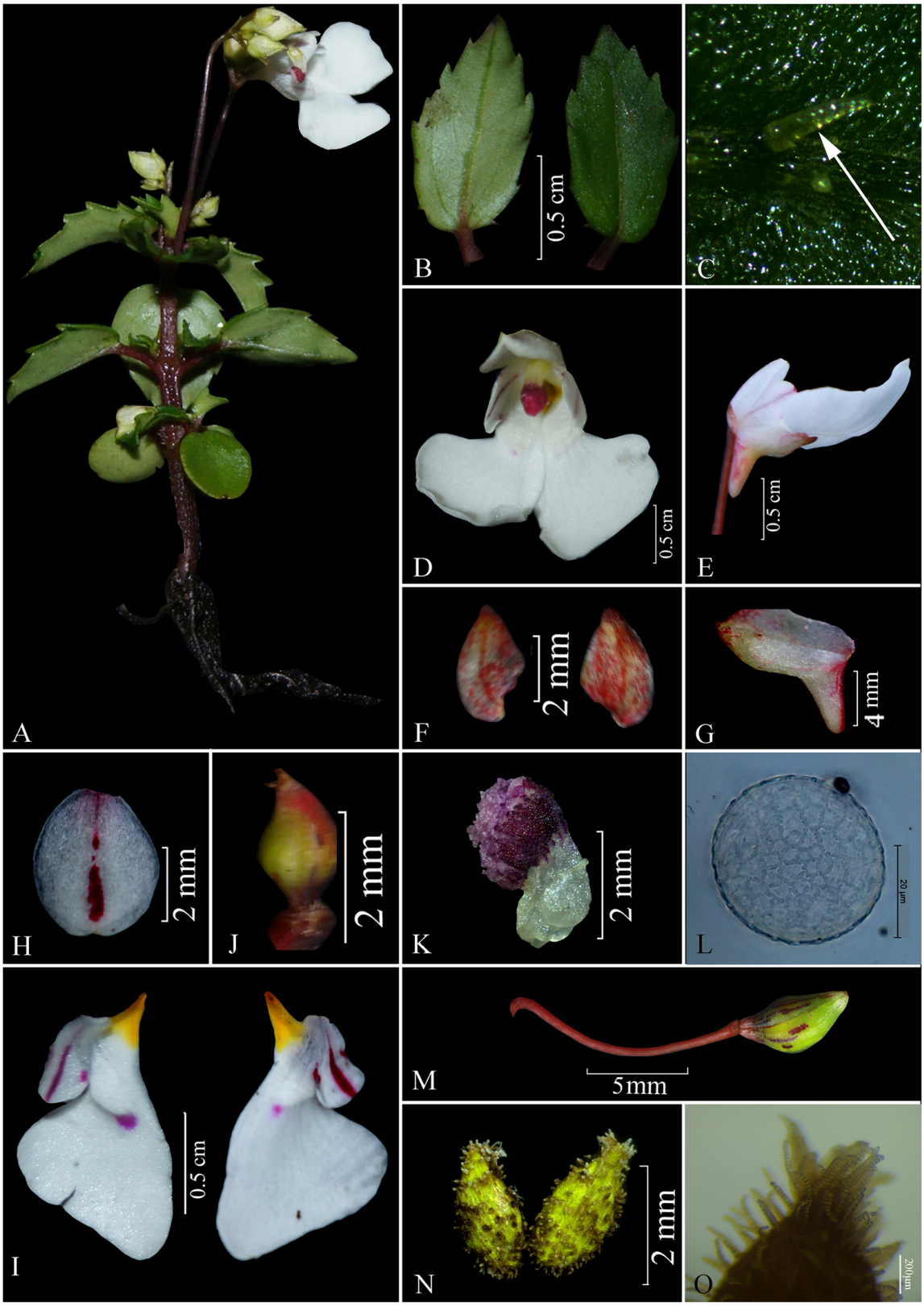

Fig. 1. *Impatiens raktakesara*. **A.** Habit. **B.** Leaf abaxial (left) and adaxial (right) surfaces. **C.** Detail of leaf adaxial surface showing trichome. **D.** Flower, frontal view. **E.** Flower, lateral view. **F.** Lateral sepals. **G.** Dorsal sepal with spur. **H.** Dorsal petal. **I.** Lateral united petals. **J.** Ovary. **K.** Connate stamens. **L.** Pollen grain. **M.** Mature fruit. **N.** Seeds. **O.** Detail of seed showing trichomes. (A–O from the holotype; photographed by Vishnu Mohan.)

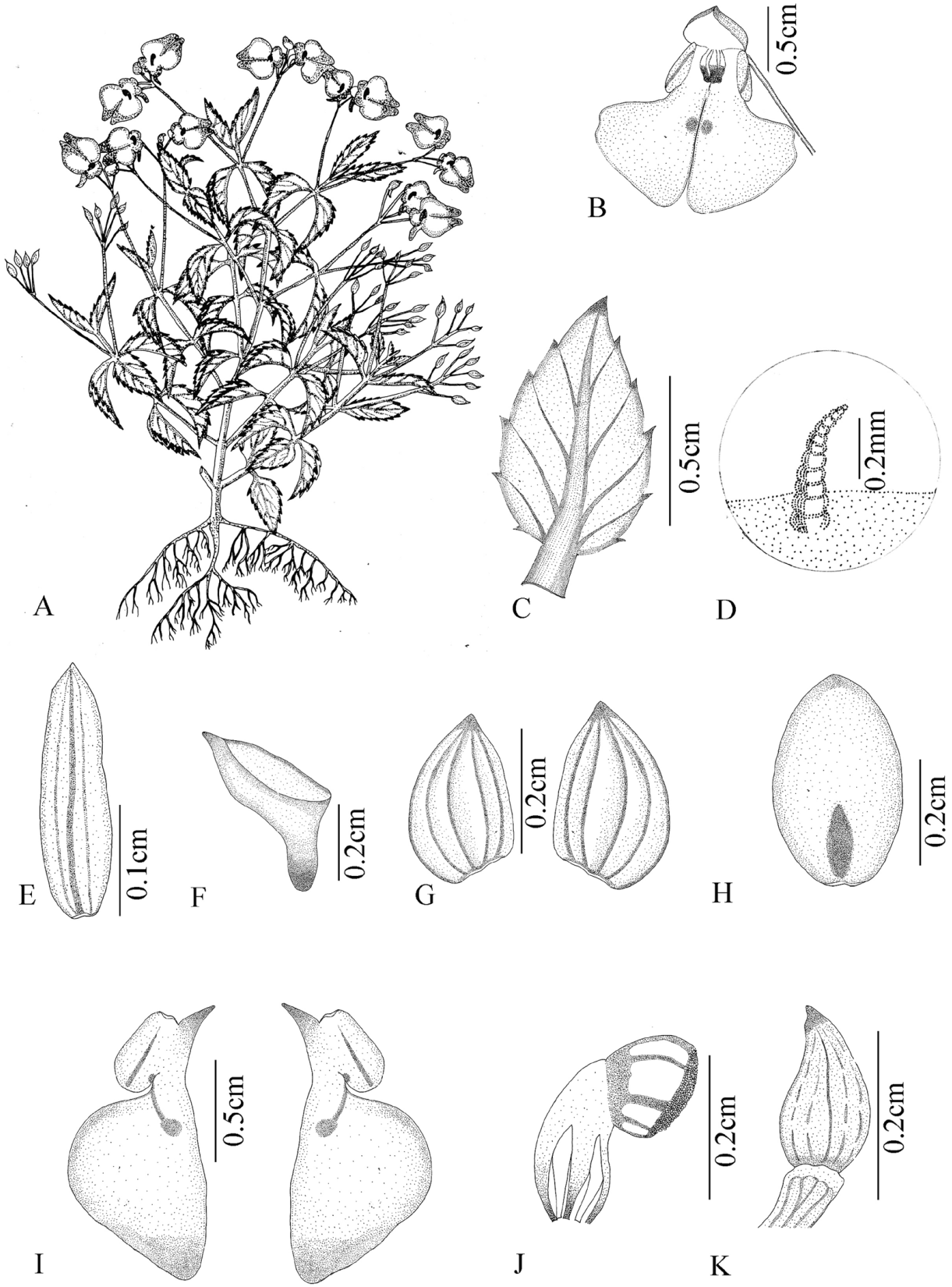

Fig. 2. *Impatiens raktakesara*. **A.** Habit. **B.** Flower, frontal view. **C.** Leaf, abaxial view. **D.** Leaf trichome. **E**. Bract. **F**. Dorsal sepal with spur. **G.** Lateral sepals. **H.** Dorsal petal. **I.** Lateral united petals. **J.** Connate stamens. **K.** Ovary. (A–K from the holotype; illustrated by Vishnu Mohan.)

Fig. 3. Habitat of *Impatiens raktakesara*. (Photographed by Vishnu Mohan.)

morphological comparisons were made with specimens of *I. goughii* and other similar species housed in the CALI herbarium and available as online images on GBIF (gbif.org) (Appendix 1).

Taxonomic treatment

Impatiens raktakesara Vishnu & Nampy., **sp. nov.**—Type: India, Kerala, Idukki District: Umiyamala peak, 10°10.3770'N,77°4.9870'E, ±2419 m, 30 Aug 2019, *Vishnu Mohan & Santhosh Nampy170254* (holotype: CALI; isotype: CAL). (Figs. 1 & 2.)

Diagnosis: *Impatiens raktakesara* is most similar to *I. goughii* (Fig. 5) but differs in having uniseriate moniliform trichomes on the upper leaf surface, unlobed lower petals, and 7–9 mm long, 1–3(-5)-seeded capsules.

Caulescent, lithophytic herbs, 4–40 cm tall. Stems simple or branched, purple, non-sticky, terete at base, grooved above, with scattered moniliform trichomes. Leaves simple, decussate; lamina 5–15 × 3–7 mm, ovate, serrate at margins, rounded at base, attenuate at apex, dark green above, pale green below, with scattered uniseriate moniliform trichomes on upper surface, glabrous below; petioles 1.5–2 mm long, grooved, glabrous. Inflorescences 4–6-flowered umbels, axillary from distal leaves; peduncles 2–5 cm long, sticky, dark brown; pedicels 0.4–0.6 cm long, erect, smooth, dark brown; bracts 2.2–2.4 mm long, linear, brown, persistent. Flowers 1.3–1.6 × 0.8–1.2 cm; sepals 3, free; lower sepal cymbiform, entire at margins, conical at apex, white with reddish patches; spur 4–5 mm long, straight, white with reddish patch on adaxial side; lateral sepals 3–3.3 × 2–2.2 mm, elliptic, entire at margins, acute at apex, oblique basally, glabrous, pale green to brownish red; petals white, delicate; dorsal petal 3.8–4.2 × 2.8–3.1 mm, widely elliptic to obovate, entire at margins, rounded at base and apex, white with a pink line at middle; lateral united petals 1.4–1.6 × 0.8–0.9 cm, entire at margins, with a pink spot between the upper and lower petals; upper petal white with 2 or 3 pink patches; auricle 2–2.5 mm long, yellow, extending into the spur; lower petal white, unlobed; stamens 5; filaments 1.8–2 mm long, united, white, papery; anthers 5–6 × 1.3–1.4 mm, united, oval, extrose, pink, longitudinally dehiscing; pollen 27–29 × 26–28 μm, white, spheroidal, with the exine reticulate; ovary 1.8–2 × 1 mm, elliptic, pale green to reddish; style 0; stigma sticky, crested. Capsules 7–9 × 2–4 mm, short-fusiform, subacute at apex, green with reddish patches, 1–3(-5) seeded. Seeds 2–3 × 1–2 mm, ovate, with the surface hairy throughout, the hairs spirally banded.

Distribution and habitat.—Known only from Idukki district in Kerala, where it grows on steep,

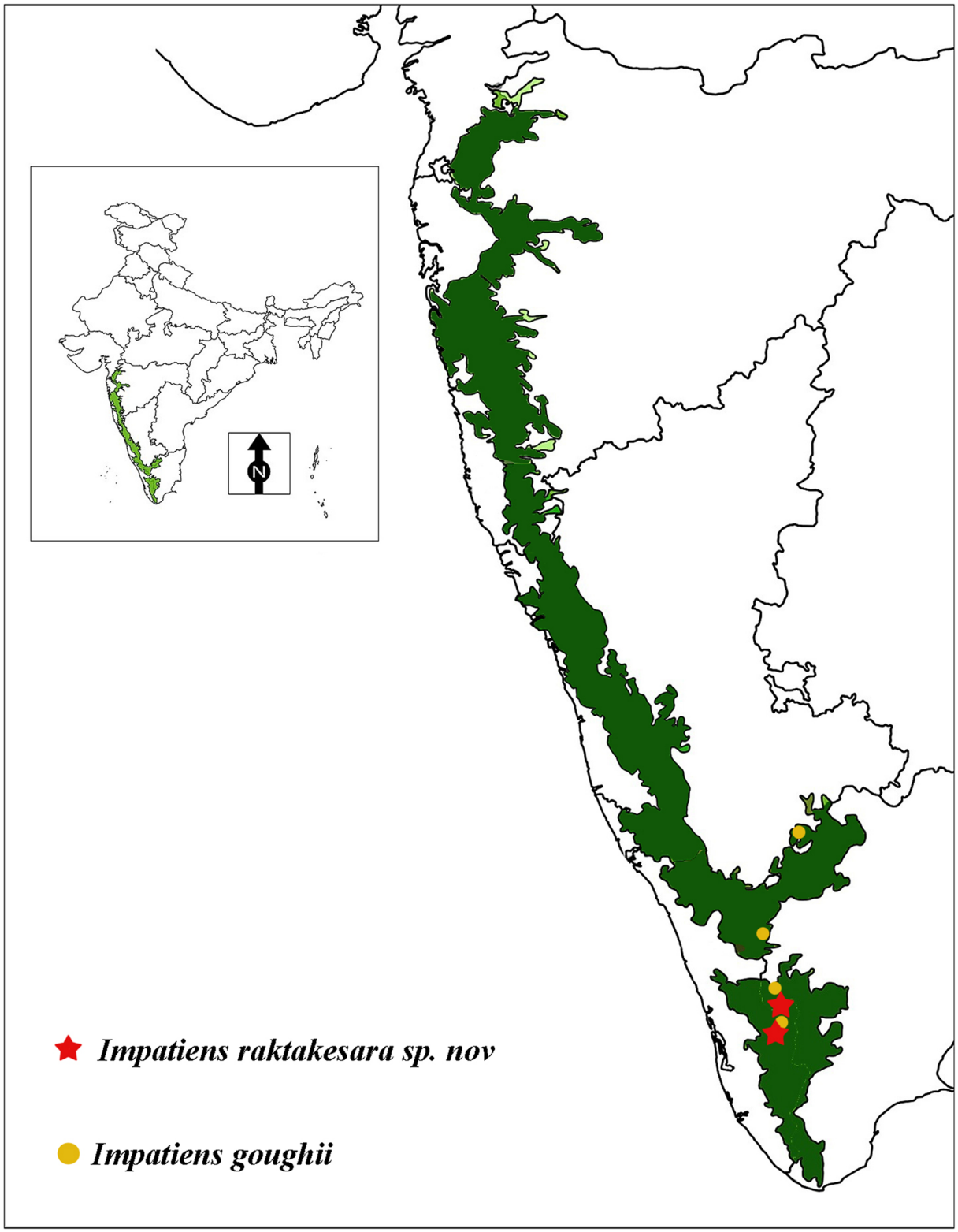

Fig. 4. Geographical distribution of *Impatiens raktakesara* and *I goughii*.

exposed, water dripping rocks, in association with *Utricularia nayarii* Janarth. & A.N. Henry (Lentibulariaceae), species of *Tripogon* Roth, *Isachne* R.Br. (both Poaceae) and *Funaria* Hedwig (moss), at elevations above 2000 msl. (Figs. 3 & 4).

FIG. 5. *Impatiens goughii*. (Photographed by Vishnu Mohan.)

Phenology.—Flowering and fruiting from August to December.

Etymology.—The specific epithet is derived from the Sanskrit words 'rakta', meaning red, and 'kesara', the word for stamens, the whole referring to the red colored stamens.

Conservation status.—The new species is known from four subpopulations in a protected area, each separated by a distance of 5 km. The estimated Extent of Occurrence (EOO) is 25 km^2 and the Area of Occupancy (AOO) is less than 10 km^2. The number of mature individuals is estimated to 120–180, when considering all the localities. Since these locations are inside a protected area, the likelihood of a decline due to anthropogenic activity is small. Nevertheless, we recommend that the species be categorized as Endangered [EN] based on criterion D: population size estimated to number less than 250 mature individuals (IUCN, 2012; IUCN Standards and Petitions Committee, 2019).

Additional specimens examined. INDIA. Kerala: Idukki district: Aanamudi, 10°10.0490"N, 77°3.5840"E, ±2658 m , 11 Dec 2019 *Vishnu Mohan & Santhosh Nampy 164675* (CALI); Subran shed, 30 Dec 2019, *Vishnu Mohan & Santhosh Nampy 164898* (CALI).

Notes.—*Impatiens raktakesara* is assigned to section *Scorpioidae* due to its decussate leaves, 2–4-flowered inflorescence, and short fusiform capsules. This lithophytic *Impatiens* grows up to 40 cm tall with flowers in axillary umbels. The stems are simple or branched and purple, but the most striking feature of the species is its red anthers. Within the

TABLE 1. MORPHOLOGICAL COMPARISON BETWEEN *IMPATIENS RAKTAKESARA* AND *I. GOUGHII*.

Characters	*I. raktakesara*	*I. goughii*
Plants	4–40 cm tall	15–25 cm tall
Leaves	5–15 × 3–7 mm; with uniseriate moniliform trichomes above, glabrous below	8–16 × 6–10 mm; glabrous above and below
Flowers	4–6 per umbel, 8–12 mm wide	4–8 per umbel, 4–6 mm wide
Lateral sepals	Elliptic	Subulate
Lateral united petals	White with a pink spot between the upper and lower petals, upper petal white with 2 or 3 pink patches; lower petals unlobed	Pink or rarely white with a pair of dark crimson eyes followed by white blotches at the mouth; lower petals lobed
Peduncle	2–5 cm long	2–8 cm long
Capsule	7–9 mm long	3–5 mm long
Seeds	1–3(-5) per capsule, 1.8–3 mm long, with spirally banded trichomes	12–15 per capsule, 1–1.5 mm long, with moniliform trichomes

section, the new species is most similar to *I. goughii* (Fig. 5), in having an umbellate inflorescence, a pink spot between the upper and lower petal, a boat-shaped lower sepal, and overlapping geographical distributions (Fig. 4). A morphological comparison between the two species expanding on the differences listed in the diagnosis is given in Table 1. The new species is also similar to *I. omissa* Hook.f. and *I. parvifolia* Bedd., in having umbellate inflorescence, a boat-shaped lower sepal, the spur of lip shorter than wings, and reticulate pollen, but it can be easily distinguished from both by the lower petals unlobed (vs. deeply lobed in *I. omissa* and *I. parvifolia*), seeds up to five in the capsule (vs. numerous in *I. omissa* and *I. parvifolia*) and the spur sparsely hairy (vs. glabrous).

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Appendix

Appendix 1. **Selected specimens examined of *Impatiens goughii*. INDIA. Kerala:** Idukki district: Devikolam, 8 Jul 1944, *James Sinclair 3670* (E digital image); Idukki, 29 Dec 1977, *K. U. Karmer & G. B. Nair 6531* (U digital image); Mathikettan shola National Park, 4 Jan 2017, *Vishnu Mohan & Santhosh Nampy 151490* (CALI); Neymakkad, 24 Jan 2018, *Vishnu Mohan & Santhosh Nampy 158187* (CALI); *Ibid*., 8th mile, 25 Jan 2018, *Vishnu Mohan & Santhosh Nampy 158220* (CALI); Meesapulimala, 8th plot, 15 Oct 2019, *Vishnu Mohan & Santhosh Nampy 170392* (CALI); Thrissur district: Sholayar, 18 Aug 1989, *N. Sasidharan 5461* (CALI); 19 Apr 2008, *K. H. Amithabachan 99056* (CALI); 30 June 2007, *K. H. Amithabachan 99091*(CALI). **Tamil Nadu:** Dindigul district: Shembaganur, 7 Feb 1986, *K. M. Matthew 44066* (L digital image).

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A new species of *Parasopubia* (Orobanchaceae) from the southern Western Ghats, India

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Abstract. *Parasopubia raghavendrae*, a new species of Orobanchaceae is described from the southern Western Ghats of Kerala. It resembles *P. delphinifolia* and *P. hofmannii* var. *hofmannii* by its habit, shape, colour and hairiness of corolla lobes but differs by length of calyx tube, hairiness of staminal filaments and stomium, and shape and ornamentation of seeds. *Parasopubia raghavendrae* is hitherto known only from the type locality Mathikettan Shola National Park in Idukki district, Kerala. Detailed description of the new species along with colour photographs and comparison with its closely similar species are given. We also assessed provisionally the conservation status of the new species as Critically Endangered (CR) according to IUCN Red List Categories and Criteria.

Keywords. Critically Endangered, Idukki, Mathikettan Shola National Park, Orobanchaceae, *Parasopubia raghavendrae*.

Resumen. *Parasopubia raghavendrae*, una nueva especie de Orobanchaceae se describe para el sur del Ghats occidental de Kerala. Se asemeja a *P. delphinifolia* y *P. hofmannii* var. *hofmannii* por su hábito, forma, color e indumento de los lóbulos de la corola, y difiere de ellas por la longitud del tubo del cáliz, indumento del filamento estaminal y del estomio, y la forma y ornamentación de las semillas. Hasta ahora, *P. raghavendrae* solo se conoce para la localidad tipo del Parque Nacional de Mathikettan Shola, en el distrito de Idukki, Kerala. Se proporciona la descripción detallada de la nueva especie junto con fotografías en color y una comparativa con las especies más similares. Así mismo, se evalúa provisionalmente el estado de conservación de la nueva especie con la categoría en Peligro Crítico (CR) de acuerdo a los Criterios de la Lista Roja de la UICN.

Palabras clave. En Peligro Crítico, Idukki, Parque Nacional de Mathikettan Shola, Orobanchaceae, *Parasopubia raghavendrae*.

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Title in Spanish: Una nueva especie de *Parasopubia* (Orobanchaceae) del sur de las Ghats occidentales, India.

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INTRODUCTION

Orobanchaceae, commonly called 'broomrapes', is the largest parasitic angiosperm family with morphologically diverse herbaceous plants (Young & al. 1999). Most of the species are facultative or obligate root parasites which may be photosynthetic (hemiparasites) or totally depend on host plants (holoparasites). *Parasopubia* H.-P.Hofm. & Eb.Fisch., a genus of Orobanchaceae recently segregated from *Sopubia* Ham. ex D.Don (Hofmann & Fischer 2004), is characterized by slightly zygomorphic flowers, corolla tube much longer than lobes and acuminate reduced thecae. The genus comprises four taxa, including the new species here described, distributed in South East Asia. *Parasopubia bonatii* H.-P.Hofm. & Eb.Fisch. is distributed in Cambodia, Laos, Vietnam, Thailand and China (Bonati 1927) while *P. delphinifolia* (L.) H.-P.Hofm. & Eb.Fisch., *P. hofmannii* Pradeep & Pramod var. *hofmannii* and *P. hofmannii* var. *albiflora* Pradeep & Pramod are found in India (Pradeep & Pramod 2013) (Fig. 1). Members of this genus are usually seen in grasslands, wet rocks, cultivated lands, marshy areas, lateritic hillocks and moist deciduous forests.

During our field work in Idukki district, Kerala, an interesting species of *Parasopubia* was collected from Mathikettan Shola National Park (MSNP). After careful comparison of *Parasopubia* specimens and consulting relevant literature, the authors found that it was quite distinct from other taxa in the genus and hence is described here as a new species.

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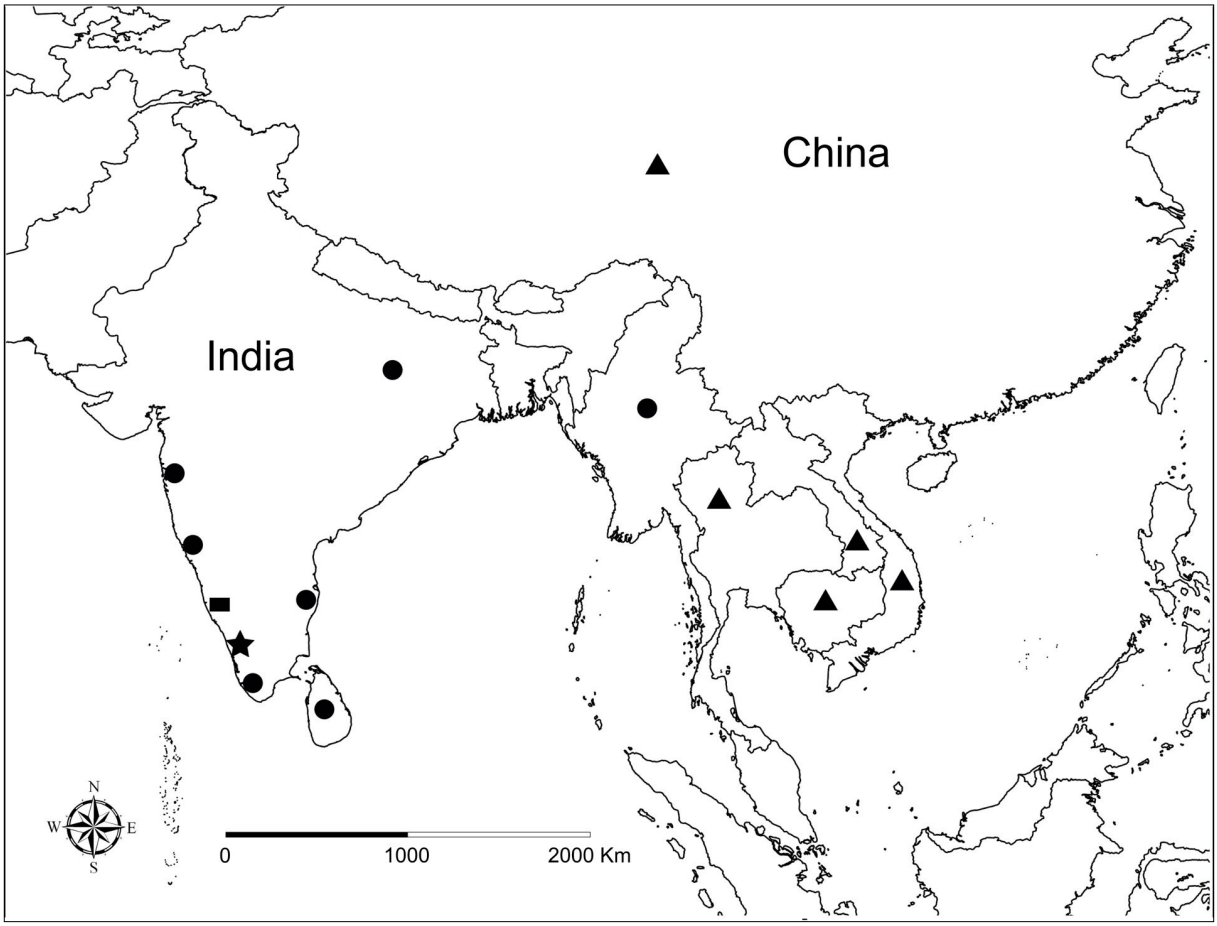

Fig. 1. Map showing the approximate location of the known herbarium records of *Parasopubia* species: *P. delphinifolia* (circle), *P. bonatii* (triangle), *P. hofmannii* (square), *P. raghavendrae* (star). Base map modified from version available at https://d-maps.com.

MATERIALS AND METHODS

Fresh specimens were collected from Mathikettan Shola National Park of Idukki district. Protologues and relevant literature (Bonati 1927; Hofmann & Fischer 2004; Pradeep & Pramod 2013) were examined for confirming the identity of the specimens and detailed descriptions were made. The following virtual herbaria were also searched for confirming the identity of the specimens: K, M and S (acronyms according to Thiers 2021, continuously updated). Herbarium sheets were prepared as per Bridson and Forman (1991). Conservation assessment was done using IUCN standards and petition committee criteria (IUCN 2019). The photographs of floral parts were taken with a Stemi 508 Stereomicroscope attached to an Axiocam 105 colour Camera (Zeiss, Germany). The ultra-morphological analysis of seeds was done using DM6 B Phase Contrast Microscope fitted with a DFC450 Camera (Leica, Switzerland) and Gemini 300 Scanning Electron Microscope (Zeiss, Germany).

RESULTS AND DISCUSSION

Taxonomic treatment

Parasopubia raghavendrae Divya & Nampy, sp. nov. Type: India, Kerala: Idukki district, Mathikettan Shola National Park (MSNP), Sivanpara, ± 1610 m, 11 Dec. 2016, D.K. Venugopal & S. Nampy 151405 (holotype: CALI!; isotypes: CALI!, CAL!). Fig. 2.

Diagnosis.—It is similar to *Parasopubia delphinifolia* and *P. hofmannii* var. *hofmannii* but can be easily distinguished by the calyx with tube exceeding lobes (4–4.5 mm against 3.5–3.8 mm long), the glandular hairy staminal filaments and stomium, the oblong capsules and seeds in contrast with the calyx tube less long than calyx lobes (2–2.5 mm against 4 mm long in *P. hofmannii* var. *hofmannii*; 4 mm against 7 mm long in *P. delphinifolia*), and glabrous staminal filaments and stomium. The capsules are elliptic and the seeds obovate in *P. delphinifolia* while obovoid and obovate, respectively in *P. hofmannii* var. *hofmannii*. The

Fig. 2. *Parasopubia raghavendrae* Divya & Nampy sp. nov.: **a**, habit; **b**, flowering twig with leaves; **c**, flower; **d**, didynamous stamens; **e**, glandular hairs on filaments; **f**, illustration of filament with glandular hairs; **g**, calyx tube and lobes; **h**, capsule; **i-j**, SEM images of seeds; **k**, phase contrast image of seed [from: MSNP 151405; photos: Divya K. Venugopal; scale: c = 1 cm; d = 1 mm; e = 1 mm; f = 2 mm; g = 1 mm; h = 5 mm; i =100 µm; j = 20 µm, k = 25 µm].

testa is uniformly ribbed and parallely reticulate with wide testa cells in *P. raghavendrae* while non-uniformly ribbed and obliquely reticulate in *P. hofmannii* var. *hofmannii* and *P. delphinifolia*. However, the testa cells are narrow in the former and wide in the latter.

Annual herbs up to 50 cm tall. Stems terete at base, 4-angular above, densely branched (branches 6–30), green. Leaves opposite, 2–5 cm long, sessile; lower leaves 5–7 segmented; segments linear-lanceolate to filiform; upper leaves entire; midrib prominent abaxially, strigose on

margins, green. Flowers axillary, solitary, bisexual, zygomorphic, 1–1.5 × 0.5–1 cm. Pedicels 1–1.5 cm long, tomentose, green; bracteoles 2, linear, 2–2.3 × 0.5–1 mm, glabrous, green. Calyx 5-lobed, persistent in fruit; tube 4–4.5 mm long, longer than lobes, glabrous; lobes linear, 3.5–3.8 × 1–1.1 mm, acute at apex, glabrous, green. Corolla campanulate, puberulent on outer surface, glabrous on inner surface, pink; tube 6.8–7 × 1–1.5 mm; lobes nearly sub-rotund, 3–3.2 × 4–4.1 mm. Stamens 4, unequal, inserted on corolla tube; filaments deep pink, 2 longer (6 mm long), 2 shorter (5 mm long), glandular hairy; anthers 2, pendent, thecae pale brown, one fertile and one sterile, unequal; fertile thecae 2 × 1 mm; sterile thecae 1 × 1 mm; stomium hairy, opening whole length. Ovary superior, 1 × 1 mm, ellipsoid, 2-celled, glabrous, green; ovules many in each cell; style slender, 8–8.2 × 1–1.1 mm, puberulent distally, pale pink; stigma globose, glabrous. Capsules oblong, erect, 5–5.3 mm long, glabrous; ¾ portion enclosed in calyx tube; fruiting calyx lobes erect. Seeds numerous, oblong, 0.57 mm long, brown; testa uniformly ribbed and parallely reticulate with wide testa cells.

Distribution and habitat.—The new species is hitherto known only from the type locality. It grows in wet humus-rich rock crevices at an elevation of c. 1610 m along with *Murdannia satheeshiana* Joby, Nisha & Unni, *Cyanotis* sp. (both Commelinaceae), *Eriocaulon* sp. (Eriocaulaceae), *Polycarpaea corymbosa* (L.) Lam. (Caryophyllaceae), etc.

Phenology.—Flowering and fruiting from early December to late January.

Etymology.—The new species is named in honour of Dr. R. Raghavendra Rao, for his contributions in Indian botany.

Provisional conservation status.—The new species is currently known only from the type locality in the Mathikettan Shola National Park. Two populations with approximately 15 mature individuals were observed in two successive years (2017–2019) and the populations were separated by a distance of around 300 m. There is no possible threat as the area falls under a National Park. On the basis of available data, this species is categorized provisionally as Critically Endangered (CR) (by considering area of occupancy < 10 km^2 [B_2]; number of mature individuals in each population ≤ 50 [C_2 a]; very small or restricted population with number of mature individuals < 50 [D]) as per IUCN Red List Categories and Criteria (IUCN, 2019).

Notes.—It is worth mentioning that *Parasopubia raghavendrae* shares the habit and hairiness of corolla lobes with other taxa of *Parasopubia* in India. *Parasopubia raghavendrae* is peculiar by its hairy staminal filaments and stomium, uniformly ribbed testa and parallely reticulate wide testa cells. It grows in wet, humus rich non-lateritic rocks, while *P. hofmannii* var. *hofmannii* grows in lateritic rocks and *P. delphinifolia* in almost all habitats (in grasslands, cultivated lands, marshes, lateritic rocks and non-lateritic rocks, etc.). The flowering period of the three taxa are: *P. delphinifolia* from August to February, *P. hofmannii* var. *hofmannii* from July to September while *P. raghavendrae* from December to January. A comparison of diagnostic characters between *P. delphinifolia*, *P. hofmanni* var. *hofmannii* and *P. raghavendrae* is given in Table 1.

Table 1. Diagnostic morphological characters of *Parasopubia raghavendrae* Divya & Nampy sp. nov. and comparison with morphologically similar species.

Character	***P. delphinifolia***	***P. hofmannii* var. *hofmannii***	***P. raghavendrae***
Calyx tube length	4 mm; shorter than calyx lobes	2–2.5 mm; shorter than calyx lobes	4–4.5 mm; longer than calyx lobes
Calyx lobes length, shape	7 mm, lanceolate	4 mm, linear	3.5–3.8 mm, linear
Staminal filaments indument and length	Glabrous Longer filaments 5 mm Shorter filaments 4 mm	Glabrous Longer filaments 5 mm Shorter filaments 3 mm	Glandular hairy Longer filaments 6 mm Shorter filaments 5 mm
Fertile and sterile thecae	Equal, 2 mm long	Equal, 1.5 mm long	Unequal Fertile thecae > 2 mm long Sterile thecae 1 mm long
Stomium	Glabrous Opening from apex	Glabrous Opening from base	Hairy Opening whole length
Fruiting calyx lobes	Erect	Divergent from capsule	Erect
Capsules	Elliptic Slightly pubescent Enclosed in calyx tube	Obovoid Glabrous ½ of the capsule enclosed in calyx tube	Oblong Glabrous ¾ of the capsule enclosed in calyx tube
Seeds	Obovate Non-uniformly ribbed with wide oblique reticulate cells	Obovate Non-uniformly ribbed with narrow oblique reticulate cells	Oblong Uniformly ribbed with wide parallel reticulate cells

Key to the species of genus Parasopubia *including the new species*

1. Plants stout; calyx lobes broadly triangular, without linear extension ..... ***P. bonatii***
– Plants slender; calyx lobes linear or lanceolate, with linear extension 2

2. Fruiting calyx lobes erect 3
– Fruiting calyx lobes divergent 4

3 Calyx with tube shorter than lobes; calyx lobes lanceolate; stomium opening from apex; capsules elliptic, slightly pubescent ..... ***P. delphinifolia***
– Calyx with tube longer than lobes; calyx lobes linear; stomium opening whole length; capsules oblong, glabrous ..... ***P. raghavendrae***

4. Corolla pale pink; plant parts often purplish; testa cells narrow ..... ***P. hofmannii*** var. ***hofmannii***
– Corolla white; plant parts without purplish tinge; testa cells wide ..... ***P. hofmannii*** var. ***albiflora***

Additional specimens examined.—Parasopubia delphinifolia. INDIA. **Kerala**: Malappuram district, Kozhippara, 21 Oct. 2009, A.K. Pradeep 90072 (CALI 152574); C U Campus, 22 Nov. 1989, Ushakumari V.N. 4878 (CALI 152663); ibid., 02 Sep. 1990, Solly George 3238 (CALI 152665). **Tamil Nadu**: Coimbatore district, Mount Stouert, 27 Oct. 1961, J. Joseph 13377 (MH 00125774, MH 00125773); Dharmapuri district, Dhoddikere, 22 Dec. 1990, T. Ravishankar 95524 (MH 00125763, MH 00125762). s.d., s.coll., s.n. (M 0188641 digital image); s.loc., 1 Jan. 1777, Johann G. Konig s.n. (S 09-26708 digital image); s.loc., 1831, N. Wallich 3890 (K 000999981 digital image).—*Parasopubia hofmanni* var. *hofmannii*. INDIA. **Kerala**: Kannur district, Madayippara, 27 Nov. 2011, Pramod CU 151405 (holotype CALI); ibid., 11 Sep. 2009, Pramod CU 123592 (CALI); ibid., 01 Aug. 2010, Pramod CU 126510 (CALI); ibid., 20 Aug. 2010, Pramod CU 126555 (CALI).

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Notes on taxonomic identity and typification of *Fagraea coromandelina* (Gentianaceae)

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The genus *Fagraea* Thunberg (1782: 132), belonging to the family Gentianaceae, is represented by 70 species in the world (Struwe *et al*. 2002). It is distributed in India, Sri Lanka, Sumatra, Malay Peninsula, Borneo, New Guinea, French Polynesia, China, Philippines and Australia. Clarke (1885) reported 5 species from the present political boundary of India, of which 2 species were recorded by Gamble (1921) from South India. The genus includes glabrous epiphytic trees or shrubs, with simple, opposite and coriaceous leaves, fragrant flowers and pulpy berries with a persistent calyx.

During a recent scientific survey, as a part of preparing the inventory of floristically rich Idukki district in Kerala (India), we came across a few interesting specimens of the genus from Mathikettan shola National Park and Periyar Tiger Reserve. Critical examination revealed that these specimens belong to *F. coromandelina* Wight (1848: t. 1316), which however, has long been treated as synonym of *F. obovata* Wallich (1824: 33) by Trimen (1895), Clarke (1885) and Gamble (1921) or *F. ceilanica* Thunberg (1782: 132) by Leenhouts (1962). Detailed studies in consultation with type and protologue revealed that the former is quite distinct and can be separated from the latter by the nature of leaves, shape of fruits and floral characters (see Table 1). Since no holotype was indicated at the time of original description, a lectotype is chosen among the original material traced.

TABLE 1. Comparison of diagnostic characters of *F. coromandelina*, *F. obovata* and *F. ceilanica.*

Characters	*F. coromandelina*	*F. obovata*	*F. ceilanica*
Petioles	Absent	1.2 cm long	1 cm long
Corolla tube	Gradually tapering towards base	Abruptly tapering towards base	Abruptly tapering towards base
Stamens	Exserted	About the length of corolla	About the length of corolla
Shape of filaments	Thickened at base	Slender at base	Slender at base
Berries	Round	Elliptic	Oval

Materials and methods

Live specimens were collected from Idukki district and detailed descriptions were made. Photographs were taken using Stereomicroscope (Leica EZ4HD). Protologues and relevant literatures were examined for confirming the identity and for typification. The following virtual herbaria were searched for locating Wight's original materials: A, ADB, B, BHU, BM, BR, C, CAL, CGE, DD, E, FH, FI, G, GH, GL(E), GOET, GZU, HAL, L, LE, M, MH, MO, NSW, NY, OXF, P, PH, S, TCD, W, Z (acronyms according to Thiers 2018). The morphological information on *Fagraea obovata* was taken from live individuals and that of *F. ceilanica* from literature (Trimen 1895, Leenhouts 1962) and protologue. In designating the lectotype, we follow the Shenzhen Code (Turland *et al*. 2018).

Results

Taxonomy

Fagraea coromandelina Wight (1848: t. 1316)

—*Fagraea obovata* sensu Gamble p.p. (1921: 865)

—*Fagraea obovata* sensu C.B. Clarke p.p. in Hooker (1885: 83)

Lectotype (designated here):—INDIA. Tamil Nadu: Courtallum, 1835, *Robert Wight 548* (E barcode E00173543 [digital photo!]).

 Accepted by Fabrizio Bartolucci: 14 May 2018; published: 17 Jul. 2018

Description:—Trees or shrubs, 1.5–2 m tall, often epiphytic or lithophytic. Stems branched, woody with prominent leaf scars, glabrous. Leaves simple, opposite, 10–12 × 4–6 cm, obovate, coriaceous, sessile, obtuse to rounded at apex, cuneate at base, entire at margins, both surfaces glabrous, fleshy; veins prominent only on adaxial surface; stipules absent. Cymes terminal, 3-flowered; peduncles 2–3 cm long, glabrous, green; bracts absent. Flowers bisexual, ca. 6 × 2 cm. Calyx deeply 5-lobed, ca. 1 × 1 cm; oblong, lobes thick, rounded at apex, imbricate, green, glabrous, persistent. Corolla 5-lobed, ca. 5.6 × 2 cm, widely obovate, twisted and slightly overlapping to the right in bud, cream coloured, glabrous, fleshy; apex rounded, reflexed; corolla tube ca. 1 cm wide from base. Stamens 5, equal, adnate to the corolla tube, exserted; filaments ca. 4 cm long, slender with a thickening at base, cream coloured; anthers oblong, ca. 0.5 × 0.3 cm, dithecous, dorsifixed, glabrous. Ovary 2-celled, oblong, ovules many; styles slender, ca. 4.9 × 0.1 cm, exserted; stigma capitate. Berries rounded, ca. 4.5 × 3.5 cm, green with persistent calyx; seeds nearly oblong-reniform, numerous, cells of seed coat isodiametric, hilum prominent at the base, brownish at maturity.

Distribution:—South India, endemic.

Ecology:—In shola forests, usually along banks of streams at an elevation about 1600m, epiphytic or lithophytic.

Flowering and fruiting:—March-December.

Nomenclatural notes:—Wight (1848) in the protologue, cited only the collection locality "Courtallum and Coonoor (Nilgiris)". We traced 5 specimens collected by Robert Wight: one at K collected from Nilgiris (barcode K000883562) and 4 at E collected from Courtallum (barcodes E00173543, E00173544, E00179254, E00179255). These specimens completely agree with the protologue, and can be safely considered as original material (Art. 9.3. of the ICN, Turland *et al.* 2018). The specimen kept at E (barcode E00173543), shows all the characters mentioned in the protologue, and is designated here as the lectotype for the name *Fagraea coromandelina*.

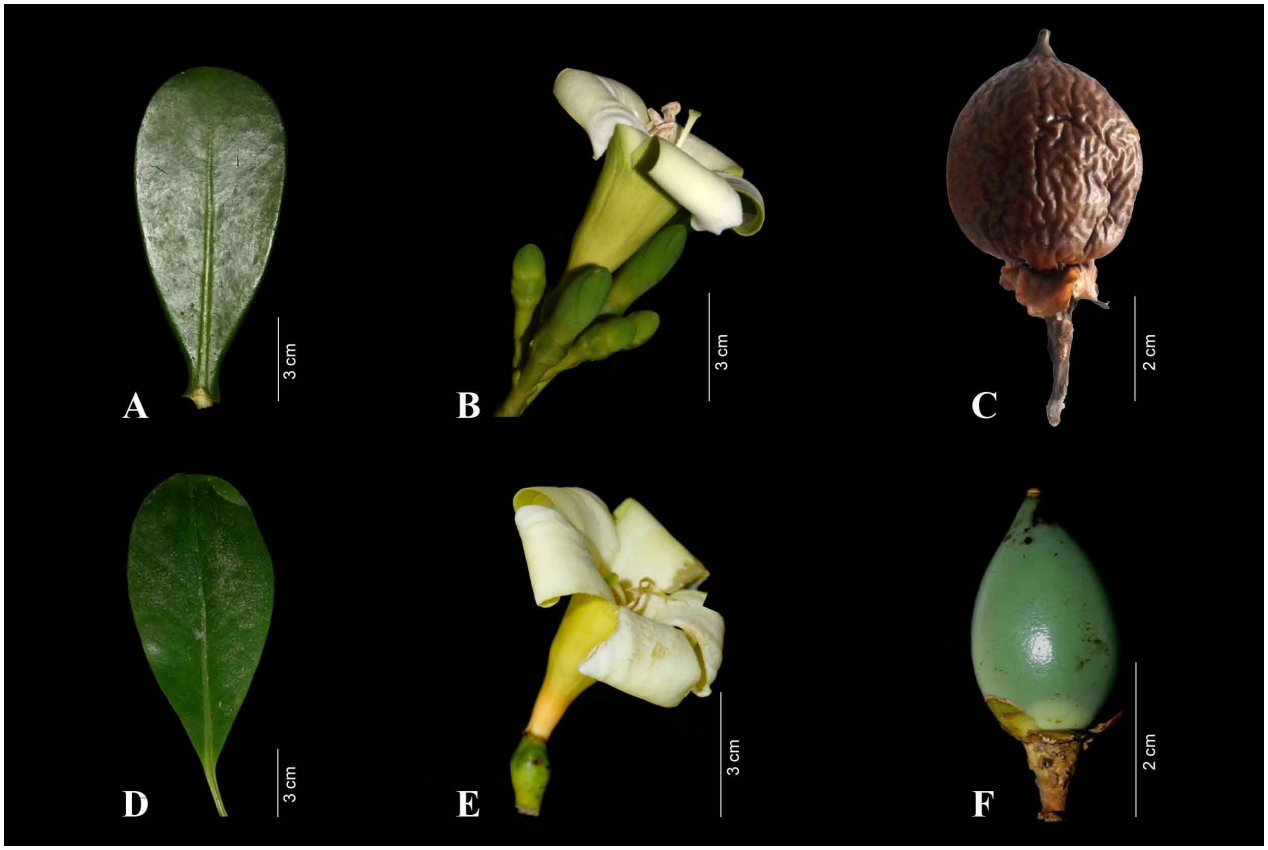

FIGURE 1. A-C. *Fagraea coromandelina* Wight, **D-F.** *Fagraea obovata* Wall. **A and D.** Leaves; **B and E.** Flowers; **C and F.** Fruits.

Taxonomic notes:—Wight (1848) described two species of *Fagraea* in his *Icones Planatarum Indiae Orientalis*: *F. coromandelina* Wight and *F. malabarica* Wight. The two species can be distinguished from each other by presence (vs absence) of petiole, round (vs elliptic) fruits, nature of corolla tube (wide vs slender) and presence or absence of thickening at the base of filaments. Wight considered *F. malabarica* as closely related to *F. ceilanica* Thunb. but *F. coromandelina* as a quite distinct species. Later, other authors treated *F. coromandelina* as a synonym of *F. obovata*

(Type: BANGLADESH. Silhet, *s.die*, *Desilva 1595.1* (K001113547 [digital photo!]) or *F. ceilanica* (Isolectotype designated by Wong & Sugumaran 2012: 75): SRI LANKA. *s.die*, *Thunberg S07-8227* (GOET [digital photo!]). Detailed analyses of the type material, protologue and live specimens revealed that *F. coromandelina* (Fig. 1) is quite distinct and can be separated from *F. obovata* or *F. ceilanica* (see Table 1) and it is reinstated here as a distinct species.

Additional specimens examined:—INDIA. Kerala: Idukki district, Mathikettan shola National park, Choondal, 20 September 2017, *Divya K. Venugopal* & *Santhosh Nampy 154133*; Changalakavalai, 29 December 2014, *Syam Radh* & *Santhosh Nampy 137913*; Onnamthodu, 08 May 2015, *Santhosh Nampy* & *Syam Radh 137971*; Periyar Tiger Reserve, Mangaladevi hills, 15 July 2017, *Santhosh Nampy* & *Divya K. Venugopal 154122* (CALI!). Tamil Nadu: Nilgiri district, Nilgiri hills, *s.die*, *s. coll. s.n.*(MH00257131!); *s.loc*., 16 March 1983, *s.coll. s.n.* (MH00257282!); *ibidem,*1835, *Wight s.n.* (K000883562!). Tirunelveli district, Courtallum, 1835, *Wight s.n.* (E00173543!, 00173544!); *ibidem,* 1830, *Wight s.n.* (E00179254!, 00179255!).

FIGURE 2. Lectotype of *Fagraea coromandelina* Wight (E00173543). @The board of trustees of Royal Botanical Garden, Edinburgh. Reproduced with permission.

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New record of *Iochroma arborescens* (Solanaceae) for India, a potential invasive plant from America with notes on its typification

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Abstract: *Iochroma arborescens* (L.)J.M.H.Shaw (Solanaceae), a potential invasive species from America, is authentically recorded for the first time in India. Perusal of relevant literature revealed that the name has yet to be typified. Details of the taxonomy, distribution and invasive nature of this species with notes on its typification are provided here.

Keywords: Allelopathy, Idukki district, *Iochroma*, Kerala, Maharashtra, Typification.

INTRODUCTION

While documenting the angiosperm diversity of the floristically rich Idukki district in Kerala, the authors collected some interesting specimens of the family Solanaceae. Detailed examination revealed its identity as *Iochroma arborescens* (L.) J.M.H. Shaw, a species so far not reported from India. The genus *Iochroma* Benth. includes nearly *c*. 26 species worldwide (Mabberley, 2017; but IPNI records 98 names under *Iochroma*), ranging from Mexico to Tropical America. *Iochroma arborescens* is an invasive weed distributed in American countries such as southern Mexico, central and South America (Shaw, 2018). The occurrence and distribution of this species in India is yet to be resolved, and this species has not been included in the list of invasive plants/ weeds in India. A perusal of relevant literature also revealed that the name is yet to be typified. The present paper discusses the taxonomy, distribution, invasive nature and typification of *Iochroma arborescens* in India.

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Taxonomic treatment

Iochroma arborescens (L.)J.M.H.Shaw, Plantsman 17(3): 200. 2018. *Atropa arborescens* L., Cent. Pl. II: 10. 1756. *Acnistus arborescens* (L.) Schltdl., Linnaea 7: 67. 1832. *Neotype* (designated here): Plumier, Pl. Amer. fasc. 2. t. 46. f. 1. 1756. **Figs. 1 & 2**

Unarmed shrubs or small trees, up to 2 m tall, glabrous throughout. Stems terete, branched, greyish-white. Leaves simple, alternate; petioles 1–2 cm long, glabrous; lamina elliptic, 18–24 × 6–9 cm, acute to attenuate at base, acute at apex, entire at margins, both surfaces glabrous, pale green. Inflorescence a many flowered fascicle, cauliflorous. Flowers bisexual, actinomorphic, *c*. 2 × 1 cm; pedicels *c*. 1 cm long. Calyx 5-lobed cupular; lobes *c*. 3 × 1 mm, hairy outside, acute at apex, green. Corolla 5-lobed; tube *c*. 4 × 1 mm; lobes *c*. 8 × 1 mm, nearly elliptic, greenish-white with yellow tinge on inner surface, papillate along margins. Stamens 5, equal, exserted; filaments *c*. 5.1 mm long, epipetalous, glabrous, cream coloured; anthers oblong, *c*. 2 × 2 mm, dithecous, dorsifixed, yellow coloured. Ovary 2-celled, ovoid, *c*. 2 × 1 mm; ovules many; styles slender, *c*. 7 × 1 mm; stigma capitate. Berries globose, *c*. 5 mm long.

Flowering & fruiting: April–June.

Distribution: South and central America (Brazil, Peru, Ecuador, Colombia, Venezuela, Costa Rica and Nicaragua), southern Mexico and now in India.

Habitat: Road side (damp areas); as fencing material at elevations around 1200 m.

Specimen examined: INDIA, **Kerala**, Idukki district, Painavu, 04.04.2018, *Divya K. Venugopal & Santhosh Nampy 158483* (CALI).

Figure 1. *Iochroma arborescens* (L.)J.M.H.Shaw: **a**. Habit; **b**. Flowering twig; **c**. Flower; **d**. Bud; **e**. Sepal; **f**. Flower opened; **g**. Corolla opened; **h**. Stamen; **i**. Carpel.

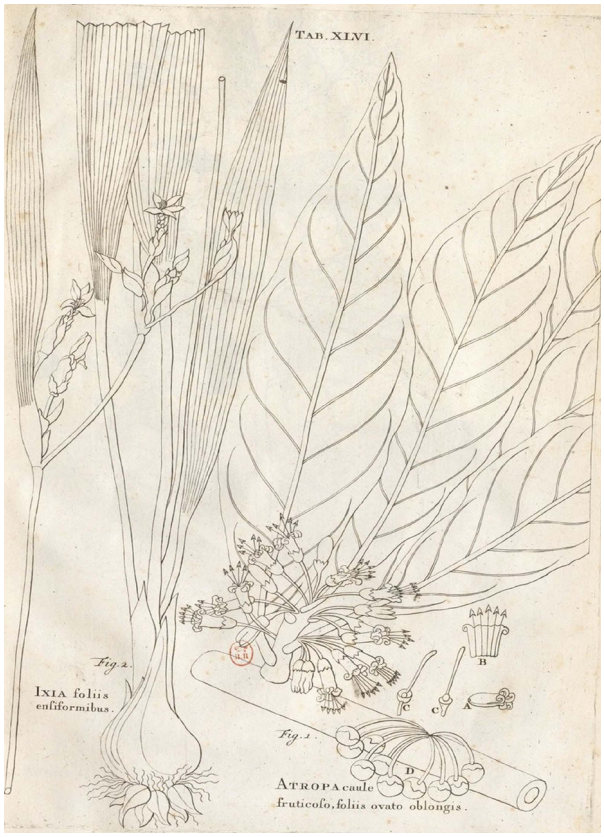

Fig. 2. Neotype of *Iochroma arborescens* (L.) J.M.H. Shaw (Plumier, Pl. Amer. fasc. 2. t. 46. f.1. 1756).

Notes: This species is usually found growing well in open sunny locations. It produces large number of cauliflorous flowers and fruits.

Typification

Iochroma arborescens was originally described as *Atropa arborescens* by Linnaeus (1756) in *Centuria II Plantarum* as "Atropa (arborescens) caule frutescens, pedunculis confortis, corollis limbo revolutis, foliis ovato-oblongis. Belladonna frutescens, flore albo, nicotianae foliis. Plum spec.1". The 'Plum spec. 1' refers to the species 1 in *Catalogus Plantarum Americanarum, Nova Plantarum Americanarum* of Plumier (1703), in which only the phrase-name (nomen specificum legitimum) cited by Linnaeus (1756) appears. Later, in Plumier's *Plantarum Americanarum*, in which Burman presented details of plants from Islands of Antilles once seen and drawn by Charles Plumier, included "*Bella Donna* frutescens, flore albo, Nicotianae foliis. *Plum. Cat. pl. Amer p. 1. Tourn. Inst. P.* 77." along with a description and illustration [fascicle 2, p. 34, t. 46, figure 1]. This set was seen by Linnaeus during his stay in Holland for the description of *Atropa arborescens* in *Centuria II plantarum* (Stafleu & Cowan, 1983). According to Jarvis (2007), the type of this name has not yet been designated as per Linnaean typfication databases. Although Howard (1989) attempted to typify the name in the *Flora of Lesser Antilles* by referring to *Plum. Spec. 1* as type, this is ineffective as he failed to indicate the illustration in *Plantarum Americanarum* (t.46. f.1). Moreover, Linnaeus also, did not refer to this illustration, and so as noted in the Linnaean typfication database no original material has been traced. Since no original material is present, the illustration t.46. f. 1 can be considered as a neotype (Art 40.3) as per *Shenzhen Code* (Turland *et al*., 2018).

Notes on invasive nature

The species is native to America and is commonly called Wild tobacco, Gallinero, Hollow heart etc. (Chimera, 2012). It is an edible non-crop plant, actively managed in home gardens as an ornamental plant and also for chicken fodder (berries), hedging and as a honey shrub in American countries (Eynden, 2004). It is a rapid growing plant propagated through seeds and stem cuttings and has some medicinal properties (Kupchan *et al.,* 1965, 1969; Barata *et al*., 1970).

How this plant got introduced in India is still a question unresolved. The name is not included in any of the Floras of India (Roxburgh, 1795; Clarke 1885; Gamble, 1921; *e-flora India*, 2014). It is also not included in *Invasive plants of India* (Reddy *et al*., 2008), *Invasive Alien Plant Species of Tamil Nadu* (Narasimhan *et al*. 2009), *Handbook on Weed identification* (Naidu, 2012) and *Weeds and weed management in India* (Rao & Chauhan, 2015). Even though this plant is reported as a cultivated species by Reema Kumari (2004, unpublished), based on a specimen collected from Pune, Maharashtra (*D.K. Kulkarni s.n.,* AHMA), it has not been reported in any of the subsequent floras (Sharma *et al*., 2000). Hence this is the first report of this species from India.

Chimera (2012) reported that, the plant is allelopathic in nature and has the ability to inhibit the growth of nearby plants and to colonize in a newly introduced area. In India, this species is planted as a fencing material and ornamental plant.

So there is a chance for this species to become massive in population in near future due to its rapid growth and allelopathic nature.

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Index

A
Abildgaardia eragrostis Nees 471
Abildgaardia ovata (Burm.f.) Kral **405**
Abildgaardia Vahl. **405**
Acanthophippium bicolor Lindl. **61**, 706
Acanthophippium Blume **61**
Acratherum pumilum Hochst. ex A.Rich. 626
Aerides cylindrica Lindl. 145
Aerides linearis Hook.f. 63
Aerides Lour. **52**
Aerides maculosa Lindl. **62**
Aerides ringens (Lindl.) C.E.C.Fisch. 63
Aerides testacea Lindl. 172
Agrostis indica L. 539
Agrostis L. **514**
Agrostis pilosula Trin. **514**
Aira indica L. 597
ALISMATACEAE Vent. 40, **370**, 710
Alloteropsis cimicina (L.) Stapf. **555**
Alloteropsis J.Presl **555**
Alpinia abundiflora Burtt & R.M.Sm. **183**, 211
Alpinia allughas (Retz.) Roscoe **188**
Alpinia calcarata Roscoe **184**
Alpinia galanga (L.) Willd. **186**
Alpinia malaccensis (Burm.f.) Roscoe **187**, 211
Alpinia neesana J.Graham 208
Alpinia nigra (Gaertn.) B.L.Burtt **188**
Alpinia nutans Roscoe var. *sericea* Baker 187
Alpinia Roxb. Mn **182**
***Alpinia* fax** Burtt & R.M.Sm. **185**
AMARYLLIDACEAE J.St.-Hil. **229**
Amblyachyrum mangalorense Hochst. ex Steud. 643
Amomum cannicarpum (Wight) Benth. ex Baker 205
Amomum floribundum (Thwaites) Trimen 183
Amomum ghaticum K.G.Bhat 206
Amomum involucratum (Thwaites) Trimen 185
Amomum masticatorium Thwaites 207
Amomum muricatum Bedd. 204
Amomum Roxb. **189**
Amomum zerumbet L. 210
Amomum hypoleucum Thwaites **189**
Amphilophis foulkesii (Hook.f.) C.E.C.Fisch. 659
Amphilophis pertusa (L.) Stapf 648
Anaphyllum Schott **344**
Anaphyllum wightii Schott **349**, 369
Andropogon aciculatus Retz. 650
Andropogon asper B.Heyne ex Hook.f. 651
Andropogon assimilis Steud. 649
Andropogon brevifolius Sw. 685
Andropogon caesius Hook. & Arn. 656
Andropogon contortus L. 669
Andropogon crinitus Thunb. 677
Andropogon fascicularis Roxb. 682
Andropogon flexuosus Nees ex Steud. 682
Andropogon foulkesii Hook.f. 659
Andropogon hackelii Hook.f. 653
Andropogon halepensis (L.) Brot. 686
Andropogon insculptus Hochst. ex A.Rich. 6647
Andropogon L. **638**
Andropogon lanceolatus Roxb. 645
Andropogon lancifolius Trin. 645
Andropogon lividus Thwaites **638**
Andropogon nardus subsp. *flexuosus* (Nees ex Steud.) Hack. 657
Andropogon nodulibarbis Hochst. ex Steud. 654
Andropogon oliganthus Hochst. ex Steud. 664
Andropogon pertusus (L.) Willd. 648
Andropogon polyptychos Steud. **640**
Andropogon rhizophorus Steud. 689
Andropogon schoenanthus var. *gracillimus* Hook.f. 656
Andropogon serratus Thunb. 687
Andropogon trispicatus Schult. 681
Andropogon umbellatus Hack. 680
Andropogon zeylanicus Steud. 654
Andrpogon fasciculatus L. 676

Aneilema dimorphum Dalzell 300
Aneilema esculentum Wall. ex C.B.Clarke 301
Aneilema giganteum (Vahl) R.Br. 304
Aneilema lanuginosum Wall. ex C.B.Clarke 306
Aneilema lineolatum (Blume) Kunth 305
Aneilema loriforme Hassk. 307
Aneilema nudiflorum (L.) Sweet 308
Aneilema ovalifolium (Wight) Bedd. 297
Aneilema pauciflorum Wight 309
Aneilema scaberrimum Kunth 316
Aneilema semiteres Dalzell 312
Aneilema sinicum Ker Gawl. 313
Aneilema spiratum (L.) Sweet 314
Aneilema zeylanicum C.B.Clarke 315
Anoectochilus Blume **64**
Anoectochilus elatior Lindl. 64
Anoectochilus elatus Lindl. **64**
Anthistiria imberbis Retz. 694
Anthistiria tremula Nees ex Steud. 693
Anthoxanthum borii S.K.Jain & Pal **515**
Anthoxanthum indicum L. 552
Anthoxanthum L. **515**
Aphyllorchis Blume **65**
Aphyllorchis montana Rchb.f. **65**
Apluda arisata L. 641
Apluda L. **641**
Apluda mutica L. **641**
Apluda varia Hack. 641
Apocopis mangalorensis (Hochst. ex Steud.) Henrard **642**
Apocopis Nees **642**
ARACEAE Juss. **341**
ARECACEAE Bercht. & J.Presl **325**
Arenga Labill. 3**27**
Arenga wightii Griff. **327**
Arethusa plicata Andrews 134
Arethusa simplex Thouars 134
Ariopsis idukkiana *sp. nov.* **345**, 347, 718
Ariopsis macrosperma N.V.Page, Ingalh. & Sardesai 346
Ariopsis Nimmo **345**
Ariopsis peltata Nimmo 346
Ariopsis protanthera (Engl. & K.Krause) N.E.Br. ex Govaerts & Frodin 346
Arisaema attenuatum E.Barnes & C.E.C.Fisch. **349**
Arisaema barnesii C.E.C.Fisch. **350**
Arisaema jacquemontii Blume **351**
Arisaema leschenaultii Blume **352**
Arisaema madhuanum Nampy & Manudev **354**
Arisaema Mart. **353**
Arisaema peltatum C.E.C.Fisch. **354**
Arisaema psittacus E.Barnes **355**
Arisaema sarracenioides E.Barnes & C.E.C.Fisch. **356**
Arisaema tortuosum (Wall.) Schott **357**
Arisaema tylophorum C.E.C.Fisch. 350, 354
Arisaema wightii Schott 351
Aristida adscensionis L. **520**
Aristida depressa Retz. 520
Aristida L. **520**
Arthraxon ciliaris P.Beauv. 644
Arthraxon hispidus (Thunb.) Makino **644**
Arthraxon lanceolatus (Roxb.) Hochst. **644**
Arthraxon lancifolius (Trin.) Hochst. **645**
Arthraxon nudus (Steud.) Hochst. **646**
Arthraxon P.Beauv. **643**
Arthraxon quartinianus (A.Rich.) Nash 644
Arum ovatum L. 361
Arundina bambusifolia Lindl. 66
Arundina Blume **66**
Arundina graminifolia (D.Don) Hochr. **66**
Arundinaria floribunda Thwaites 500
Arundinaria walkeriana Munro 501
Arundinaria wightiana Nees 503
Arundinella avenacea Munro ex Thwaites 634
Arundinella brasiliensis auct. Hook.f. 624
Arundinella ciliata Nees ex Miq. **621**
Arundinella fuscata auct. Hook.f. 627
Arundinella leptochloa (Nees ex Steud.) Hook.f. **623**, 712
Arundinella mesophylla Nees ex Steud. **623, 696**, 712
Arundinella metzii Hochst. ex Miq. 626
Arundinella nepalensis Trin. **624**
Arundinella pradeepiana Sunil & Naveen Kum. **625**, 712

Arundinella pumila (Hochst. ex A.Rich.) Steud. **626**
Arundinella purpurea Hochst. ex Steud. **627**, 628
Arundinella Raddi **621**
Arundinella setosa Trin. **628**, 696
Arundinella tenella Nees ex Steud. 626
Arundinella tuberculata Munro ex Lisboa 622
Arundinella vaginata Born **629**
Arundinella villosa var. *heynei* Hook.f. 629
Arundo bambos L. 699
Ascopholis gamblei C.E.C.Fisch. 644
Asparagus gonoclados Baker **245**
Asparagus L. **245**
Asparagus racemosus Willd. **246**
Axonopus cimicinus (L.) P.Beauv. 555
Axonopus compressus (Sw.) P.Beauv. **556**
Axonopus P.Beauv. **556**
B
Bambusa arundinacea (Retz.) Willd. 499
Bambusa bambos (L.) Voss **499**
Bambusa Schreb. **499**
Banksea speciosa J.Koenig 204
Beesha travancorica Bedd. 504
Belosynapsis vivipara (Dalzell) C.E.C.Fisch. 294
Bentinckia Berry ex Roxb**.** 327, **328**
Bentinckia condapanna Berry ex Roxb. **328**
Berghausia elata Arn. ex Miq. 632
Berghausia tenella Arn. ex Miq. 633
Bletia graminifolia D.Don 66
Bletia masuca D.Don 78
Blyxa aubertii Rich. **42**, 704
Blyxa ceylanica Hook.f. 42
Blyxa echinosperma (C.B.Clarke) Hook.f. **43**
Blyxa Thouars **42**
Boesenbergia Kuntze 182, **190**
Boesenbergia tiliifolia Kuntze **190**
Bothriochloa foulkesii (Hook.f.) Henrard 659
Bothriochloa insculpta (Hocht. ex A.Rich.) A.Camus **647**
Bothriochloa Kuntze **647**
Bothriochloa pertusa (L.) A.Camus **648**
Brachiaria decumbens Stapf. 608
Brachiaria miliiformis (J.Presl) Chase 607
Brachiaria mutica (Forssk.) Stapf 609
Brachiaria ramosa (L.) Stap 610
Brachiaria reptans (L.) C.A.Gardner & C.E.Hubb. 611
Brachycorythis iantha (Wight) Summerh. **67, 176**
Brachycorythis Lindl. **67**
Brachycorythis splendida Summerh. **68, 176**
Briza L. **512**
Briza minor L. **512, 696**
Bulbophyllum bonaccordense (C.S.Kumar) J.J.Verm. **70**, 705, 715
Bulbophyllum elegantulum (Rolfe) J.J.Sm. **70**, 714
Bulbophyllum fimbriatum (Lindl.) Rchb.f. **71**, 714
Bulbophyllum fischeri Seidenf. **71, 175**
***Bulbophyllum fuscopurpureum* 73**
Bulbophyllum kaitiense Rchb.f. **74**
Bulbophyllum mysorense (Rolfe) J.J.Sm. **75**
Bulbophyllum nilgherrense Wight 75
Bulbophyllum sterile (Lam.) Suresh **75**
Bulbophyllum stocksii (Benth. ex Hook.f.) J.J.Verm. **76**
Bulbophyllum Thouars **69**
Bulbophyllum tremulum Wight **77**
Bulbophyllum xylophyllum C.S.Parish & Rchb.f. **78**
Bulbostylis barbata (Rottb.) C.B.Clarke **406**
Bulbostylis barbata subsp. ***pulchella*** (Thwaites) T.Koyama **407**
Bulbostylis densa subsp. ***densa*** (Wall.) Hand.-Mazz. **408**
Bulbostylis Kunth **406**
Burmannia coelestis D.Don **48**
Burmannia indica Jonker **49, 51**
Burmannia L. **48**
Burmannia munnarensis Dani & Nampy **52, 53, 54**
Burmannia pusilla (Miers) Thwaites **55**
BURMANNIACEAE Blume **46**
C
Calamagrostis pilosula (Trin.) Hook.f. 514

Calamus brandisii Becc. in Hook.f. **329,** 709
Calamus gamblei Becc. **330**
Calamus hookerianus Becc. **331**
Calamus L. **329**
Calamus pseudotenuis Becc.n **331**
Calamus rheedei Griff. **332**
Calamus thwaitesii Becc. **333**
Calamus travancoricus Bedd. ex Hook.f. 332
Calamus vattayila Renuka 334
Calanthe masuca (D.Don) Lindl. **78,175**
Calanthe R.Br. **78**
Calanthe triplicata Ames **79,** 80
Calanthe veratrifolia R.Br. ex Ker Gawl. 79
Canna flaccida Salisb. 219
Canna indica L. **219**
Canna L. **219**
Canna orientalis Rosco 219
CANNACEAE Juss. **217**
Capillipedium assimile (Steud.) A.Camus in H.Lecomte 649
Capillipedium glaucopsis (W.Watson) Stapf 649
Capillipedium Stapf **649**
Carex baccans Nees in Wight **410**
Carex condensata Nees in Wight **411**
Carex cruciata Wahlenb. **412**
Carex filicina Nees in Wight **413**
Carex hebecarpa subsp. *ligulata* (Nees) T.Koyama 415
Carex L. **409**
Carex lenta D.Don **414**
Carex *leucantha* Arn. ex Boott 416
Carex ligulata Nees in Wight **414**
Carex lindleyana Nees in Wight **415**
Carex longicruris Nees in Wight **416**
Carex maculata Boott **417**
Carex myosurus Nees in Wight **418**
Carex nubigena D.Don 416
Carex ovata Burm.f. 406
Carex phacota Spreng. **419**
Carex speciosa Kunth **420**
Caryota L. **334**
Caryota urens L. **334**
Caulinia indica Willd. 375
Cenchrus granularis L. 668
Cenchrus hohenackeri (Hochst. ex Steud.) Morrone **557**
Cenchrus L. 557
Cenchrus lappaceus L. 518
Cenchrus muricatus L. 606
Cenchrus parviflorus Poir. 603
Centotheca Desv. **518**
Centotheca lappacea (L.) Desv. **518**
Chamaeraphis spinescens (R.Br.) Poir. 596
Cheirostylis Blume **80**
Cheirostylis flabellata Wight **80**
Chionachne koenigii (Spreng.) Thwaites 678
Chloris barbata Sw. **550**
Chloris Sw. **550**
Chlorophytum attenuatum Baker 249
Chlorophytum heyneanum Wall. ex Hook.f. 248
Chlorophytum heynei Baker **248**
Chlorophytum indicum (Willd.) Dress **249**
Chlorophytum Ker Gawl. **247**
Chlorophytum laxum R.Br. **249**
Chlorophytum malabaricum Baker **250**
Chlorophytum nimmonii Dalzell **251**
Chlorophytum sharmae Adsul **252**
Chlorophytum tuberosum Baker **253**
Chrysopogon aciculatus (Retz.) Trin. **650**
Chrysopogon asper B.Heyne ex Blatt. & McCann **651**
Chrysopogon hackelii (Hook.f.) C.E.C.Fisch. **652**
Chrysopogon nodulibarbis (Hochst. ex Steud.) Henrard **654**
Chrysopogon Trin. **650**
Chrysopogon zeylanicus (Steud.) Thwaites 654
Cirrhopetalum elegantulum Rolfe 70
Cirrhopetalum fimbriatum Lindl. 71
Cirrhopetalum gamblei Hook.f. 72
Cirrhopetalum mysorense Rolfe 75
Cleisostoma acaule Lindl. 113
Cleisostoma Blume **81**
Cleisostoma tenerum Hook.f. 169
Cleisostoma tenuifolium (L.) Garay **81**
Clinogyne virgata (Roxb.) Benth. & Hook.f. 213
Cnemidia angulosa Lindl. 170

Coelachne perpusilla (Nees ex Steud.) Thwaites **613**
Coelachne ghatica Naik 612
Coelachne pulchella var. *gardneri* Hook.f. 614
Coelachne pulchella var. *gracillima* Hook.f. 614
Coelachne pulchella var. *perpusilla* (Nees. ex Steud.) Hook.f. 613
Coelachne pulchella var. *simpliciuscula* (Wight & Arn. ex Steud.) Hook.f. 614
Coelachne pulchella var. *spicata* Hook.f. 614
Coelachne R.Br. **612**
Coelachne simpliciuscula (Wight & Arn. ex Steud.) Munro ex Benth. **614**
Coeloglossum densum Lindl. 148
Coelogyne breviscapa Lindl. **82**, 706
Coelogyne corrugata Wight 85
Coelogyne imbricata (Hook.) Rchb.f. **83, 176**
Coelogyne Lindl. **82**
Coelogyne mossiae Rolfe **84**
Coelogyne nervosa A.Rich. **85**
Coix L. **655**
Coix lacryma–jobi L. **655**
Colocasia antiquorum Schott 358
Colocasia esculenta (L.) Schott **358**
Colocasia Schott **358**
Commelina benghalensis L. **271**
Commelina clavata *C.B.Clarke* **272**
Commelina clavatoides Nampy & S.M.Joseph **274**
Commelina diffusa Burm.f. **275**
Commelina ensifolia R.Br. **276**
Commelina erecta L. 278
Commelina gigantea Vahl 303
Commelina indehiscens E.Barnes **277**
Commelina japonica Thunb. 305
Commelina kurzii C.B.Clarke 278
Commelina L. **271**
Commelina longifolia Lam. **279**
Commelina maculata Edgew. **280**
Commelina nudiflora L. 308
Commelina obliqua Buch.-Ham. ex D.Don 281
Commelina paludosa Blume **281**
Commelina scaberrima Blume 316
Commelina simplex Vahl 313
Commelina spirata L. 314
Commelina suffruticosa Blume **282**
Commelina undulata R.Br. **277**
COMMELINACEAE Mirb. **269**
Corypha L. **336**
Corypha umbraculifera L. **335**
Costus L. **191**
Costus pictus D.Don **191**
Costus speciosus (J.Koenig) Sm. 203
Cottonia macrostachya Wight 86
Cottonia peduncularis (Lindl.) Rchb.f. **86**
Cottonia Wight **86**
Crepidium acuminatum (D.Don) Szlach. **87**
Crepidium Blume **87**
Crepidium resupinatum (G.Forst.) Szlach. **88**
Cryptocoryne consobrina Schott **359**
Cryptocoryne Fisch. ex Wydler **359**
Cryptocoryne meeboldii Engl. 361
Cryptocoryne retrospiralis Kunth **360**
Cryptocoryne sivadasanii Bogner 360
Curculigo finlaysoniana (Baker) Wall. ex Hook.f. 233
Curculigo Gaertn. **232**
Curculigo orchioides Gaertn. **232**
Curculigo trichocarpa (Wight) Bennet & Raizada **233**
Curcuma aromatica Salisb. **192**
Curcuma coriacea Mangaly & M.Sabu **193**
Curcuma L. **192**
Curcuma neilgherrensis Wight **195**
Curcuma zanthorrhiza Roxb. **196**
Cyanotis adscendens Dalzell **284**
Cyanotis arachnoidea C.B.Clarke **284**
Cyanotis axillaris (L.) D.Don ex Sweet **285**
Cyanotis burmanniana Wight **286**
Cyanotis cristata (L.) D.Don **287**
Cyanotis D.Don **283**
Cyanotis fasciculata (B.Heyne ex Roth) Schult. & Schult.f. **288**
Cyanotis obtusa (Trimen) Trimen **289**
Cyanotis pilosa Schult & Schult.f. **290**
Cyanotis racemosa Heyne ex Hassk. **291**

Cyanotis tuberosa (Roxb.) Schult & Schult.f. **292**
Cyanotis villosa (Spreng.) Schult. & Schult.f. **293**
Cyanotis vivipara Dalzell **294**
Cylindrolobus Blume **89**
Cylindrolobus pauciflorus (Wight) Schuit. **89**
Cylindrolobus pseudoclavicaulis (Blatt.) Schuit. **90**
Cymbidium aloifolium (L.) Sw. **91**
Cymbidium Sw. **91**
Cymbopogon caesius (Hook. & Arn.) Stapf **656**
Cymbopogon flexuosus (Nees ex Steud.) Will.Watson **657**
Cymbopogon Spreng. **656**
Cynodon dactylon (L.) Pers. **551**
Cynodon Rich. **551**
Cynodon ternatus A.Rich. 570
Cynosurus aegyptius L. 522
Cynosurus indicus L. 523
Cynosurus monostachyos Vahl 551
CYPERACEAE Juss. **403**
Cyperus albescens (Steud.) Larridon & Govaerts 426
Cyperus brevifolius (Rottb.) Endl. ex Hassk. **427**
Cyperus clarkei T.Cooke **427**
Cyperus compressus L. **428**
Cyperus corymbosus Rottb. **429**
Cyperus cuspidatus Kunth **430**
Cyperus cyperoides (L.) Kuntze **431**
Cyperus diaphanus Schrad. ex Schult. **431**
Cyperus difformis L. **432**
Cyperus diffusus Vahl **433**
Cyperus digitatus Roxb. **434**
Cyperus distans L.f. **434**
Cyperus dubius Rottb. **435**
Cyperus exaltatus Retz. **436**
Cyperus flavidus Retz. **436**
Cyperus haspan L. **437**
Cyperus intactus Vahl **438**
Cyperus iria L. **439**
Cyperus javanicus Houtt. **440**
Cyperus L. **422**
Cyperus maderaspatanus Willd. **440**
Cyperus melanospermus (Nees) Valck.Sur. **441**
Cyperus metzii (Hochst. ex Steud.) Mattf. & Kuk. **441**
Cyperus mindorensis (Steud.) Huygh **443**
Cyperus mollipes K.Schum. **444**
Cyperus neochinensis (Tang & F.T.Wang) Bauters **445**
Cyperus nutans Vahl **445**
Cyperus pangorei Rottb. **446**
Cyperus paniceus (Rottb.) Boeckeler **447**
Cyperus pilosus Vahl **447**
Cyperus polystachyos Rottb. **448**
Cyperus procerus Rottb. **449**
Cyperus pumilus L. **449**
Cyperus raynalianus (Govind.) Bauters **450**
Cyperus richardii Steud. **451**
Cyperus rotundus L. **451**
Cyperus sanguinolentus Vahl **452**
Cyperus sesquiflorus* subsp. *cylindricus(Nees) T.Koyama **453**
Cyperus sphacelatus Rottb. **454**
Cyperus squarrosus L. **545**
Cyperus substramineus Kuk. **455**
Cyperus tenuiculmis Boeckelerm **456**
Cyperus tenuispica Steud. **457**
Cyperus zollingeri Steud. **458**
Cyrtococcum deccanense Bor **559**
Cyrtococcum longipes (Wight & Arn. ex Hook.f.) A.Camus **559**
Cyrtococcum oxyphyllum (Hochst. ex Steud.) Stapf **560**
Cyrtococcum patens (L.) A.Camus **561**
Cyrtococcum Stapf **558**
Cyrtococcum trigonum (Retz.) A.Camus **562**
D
Dactyloctenium aegyptium (L.) Willd. **522, 697**
Dactyloctenium Willd. **522**
Dendrobium anamalayanum Chandrab. **93, 178**
Dendrobium aqueum Lindl. **94**
Dendrobium barbatulum Lindl. **95**

Dendrobium braccatum Lindl. 155
Dendrobium haemoglossum Thwaites 103
Dendrobium herbaceum Lindl. **96**
Dendrobium heterocarpum Wall. ex Lindl. **97**
Dendrobium heyneanum Lindl. **97**
Dendrobium kallarense J.Mathew **98**
Dendrobium macraei Lindl. **99**
Dendrobium macrostachyum Lindl. **100**
Dendrobium microbulbon A.Rich. **100**
Dendrobium nanum Hook.f. **101**
Dendrobium nodosum Dalzell **102**
Dendrobium nutans Lindl. 103
Dendrobium nutantiflorum A.D.Hawkes & A.H.Heller **103**
Dendrobium ovatum Kraenzl. **103**
Dendrobium salaccense (Blume) Lindl. **104**
Dendrobium Sw. **92**
Dendrobium wightii A.D.Hawkes & A.H.Heller **105**
Dendrobium graminifolium Wight 105
Dianella ensifolia (L.) Redoute **254**
Dianella Lam. ex Juss. **254**
Dichanthium foulkesii (Hook.f.) S.K.Jain & Deshp. **659**
Dichanthium oliganthum (Hochst. ex Steud.) Cope 664
Dichanthium Willemet **659**
Dictyospermum montanum Wight **295**, **319**
Dictyospermum ovalifolium Wight **297**
Dictyospermum Wight **295**
Digitaria bicornis (Lam.) Roem. & Schult. **663**
Digitaria ciliaris (Retz.) Koeler **564**
Digitaria didactyla Willd. **565**
Digitaria griffithii (Hook.f.) Henrard **566**
Digitaria Haller **563**
Digitaria longiflora (Retz.) Pers. **567**
Digitaria marginata Link 564
Digitaria radicosa (J.Presl) Miq. **568**
Digitaria setigera Roth in Roemer & Schultes **569**
Digitaria ternata (A.Rich.) Stapf in Harvey **570**
Digitaria violascens Link **571**
Digitaria wallichiana (Wight & Arn. ex Steud.) Stapf **572**
Dimeria borii Sreek. **660**, **697**
Dimeria deccanensis Bor **661**
Dimeria fischeri Bor **662**
Dimeria idukkiensis Ravi & Anil Kumar **662**
Dimeria kanjirapallilana Jacob **663**
Dimeria R.Br. **660**
Dioscorea alata L. **236**
Dioscorea bulbifera L. **237**
Dioscorea esculenta (Lour.) Burkill **237**
Dioscorea L. **234**
Dioscorea oppositifolia L. **238**
Dioscorea pentaphylla L. **239**
Dioscorea spicata Roth
Dioscorea spinosa Roxb. ex Hook.f. 237
Dioscorea tomentosa Spreng. 241
Dioscorea wallichii Hook.f. **242**
DIOSCOREACEAE R.Br. **243**
Diplacrum caricinum R.Br. **458**
Diplacrum R.Br. **458**
Diplocentrum congestum Wight **106**
Diplocentrum Lindl. **105**
Diplocentrum recurvum Lindl. **106**
Disperis neilgherrensis Wight **107**
Disperis Sw. **107**
Disporum cantoniense (Lour.) Merr. **255**
Disporum Salisb. **255**
Dracaena roxburghiana (Schult.f.) Byng & Christenh. **256**
Dracaena Vand. **256**
Drimia Jacq. ex Willd. **256**
Drimia nagarjunae (Hemadri & Sawhni) An.Kumar **256**
E
Echinochloa colonum (L.) Link **573**
Echinochloa colonum subsp. ***edulis*** (Honda) Banfi & Galasso **574**
Echinochloa colonum var. *frumentacea* (Link) Ridl. 574
Echinochloa crus-galli (L.) P.Beauv. **574**
Echinochloa frumentacea Link 574
Echinochloa P.Beauv. **572**
Echinochloa stagnina (Retz.) P.Beauv. **475**

Eleocharis congesta D.Don **459**
Eleocharis dulcis (Burm.f.) Trin. ex. Hensch. **460**
Eleocharis R.Br. **459**
Eleocharis retroflexa subsp. ***chaetaria*** (Roem. & Schult.) T.Koyama **461**
Eleocharis tetraquetra Nees in Wight. **462**
Eleusine Gaertn. **523**
Eleusine indic**a** (L.) Gaertn. **523**
Ensete Bruce ex Horan. **222**
Ensete superbum (Roxb.) Cheesman **222**
Enteropogon monostachyos (Vahl) K.Schum. **551**
Enteropogon Nees *Aerides testacea* Lindl. **551**
Epipogium J.G.Gmel. ex Borkh. 108
Epipogium roseum Lindl. **108**
Eragrostiella bifaria var. ***bifaria*** (Vahl) Bor **524**
Eragrostiella bifaria var. ***secunda*** (Nees ex Steud.) Lazarides **525**
Eragrostiella Bor **524**
Eragrostis amabilis (L.) Wight & Arn. **527**
Eragrostis atrovirens (Desf.) Trin. ex Steud. **527**
Eragrostis cilianensis (All.) Vignolo ex Janch. **528**
Eragrostis collinensis Vivek, G.V.S.Murthy & V.J.Nair **529**
Eragrostis gangetica (Roxb.) Steud. **530**
Eragrostis maderaspatana Bor **531**
Eragrostis minor Host **531**
Eragrostis nigra Nees ex Steud. **532**
Eragrostis nutans (Retz.) Nees ex Steud. **533**
Eragrostis paniciformis (A.Braun) Steud. **534**
Eragrostis pilosa (L.) P.Beauv. **534**
Eragrostis tenuifolia (A.Rich.) Hochst. ex Steud. **535**
Eragrostis unioloides (Retz.) Nees ex Steud. **536**
Eragrostis viscosa (Retz.) Trin. **537**
Eragrostis Wolf. **526**
ERIOCAULACEAE Martinov **375**
Eriocaulon biappendiculatum Manudev **379**
Eriocaulon brownianum Mart. **380**
Eriocaulon eurypeplon Korn. **381**
Eriocaulon L. **376**
Eriocaulon nairii Chandrab. & V.Chandras. **382**
Eriocaulon nepalense J.D.Prescott ex Bong**.** 383
Eriocaulon odoratum Dalzell **384**
Eriocaulon pandeyana Nampy, Harishma & M.Vishnu **385**
Eriocaulon parviflorum (Fyson) R.Ansari & N.P.Balakr. **387**
Eriocaulon pectinatum Ruhland **388**
Eriocaulon quinquangulare L. **389**
Eriocaulon rhodae Fyson **390**
Eriocaulon sexangulare L. **391**
Eriocaulon thwaitesii Korn. **392**
Eriocaulon truncatum Buch.-Ham. ex Mart. **394**
Eriocaulon tuberiferum A.R.Kulk. & Desai **395**
Eriocaulon vamanae Dani & Nampy **396**
Eriocaulon vasudevanii R.Ansari & N.P.Balakr. **400**
Eriocaulon xeranthemum Mart. **401**
Euclasta Franch. **664**
Euclasta oligantha (Hochst. ex Steud.) M.R.Almeida **664**
Eulalia **Kunth 665**
Eulalia phaeothrix (Hack.) Kuntze **665**
Eulalia trispicata (Schult.) Henrard 664
Eulophia epidendraea (J.Koenig ex Retz.) C.E.C.Fisch. **109**
Eulophia graminea Lindl. **110**
Eulophia nuda Lindl. **111**
Eulophia picta (R.Br.) Ormerod **112**
Eulophia R.Br. **109**
F
Festuca bromoides L. **512**
Festuca L. **512**
Fimbristylis aestivalis (Retz.) Vahl **464**
Fimbristylis aphylla Steud. **456**
Fimbristylis argentea (Rottb.) Vahl **466**

Fimbristylis bisumbellata (Forssk.) Bubani **466**
Fimbristylis cinnamometorum (Vahl) Kunth **467**
Fimbristylis complanata (Retz.) Link. **468**
Fimbristylis dichotoma (L.) Vahl **469**
Fimbristylis dichotoma subsp. ***podocarpa*** (Nees) Koyama **470**
Fimbristylis dipsacea (Rottb.) C.B.Clarke in Hook.f. **470**
Fimbristylis eragrostis (Nees) Hance **471**
Fimbristylis falcata (Vahl) Kunth **472**
Fimbristylis kingii Gamble **473**
Fimbristylis littoralis Gaudich. **473**
Fimbristylis miliacea (L.) Vahl 474
Fimbristylis monticola Hochst. ex Steud. **474**
Fimbristylis narayanii C.E.C.Fisch. **475**
Fimbristylis quinquangularis (Vahl) Kunth **475**
Fimbristylis salbundia (Nees) Kunth **476**
Fimbristylis squarrosa Vahl **477**
Fimbristylis tenera Schult. **477**
Fimbristylis uliginosa Hochst. ex Steud. **478**
Fimbristylis Vahl **462**
Fimbristylis velata R.Br. **479**
Floscopa Lour. **298**
Floscopa scandens Lour.**298**
Fuirena Rottb. **480**
Fuirena umbellata Rottb. **480**
G
Garnotia arundinacea Hook.f. **630**
Garnotia Brongn. **630**
Garnotia courtallensis (Arn. & Nees) Thwaites **631**
Garnotia elata (Arn. ex Miq.) Janowsky **632**
Garnotia exaristata Gould **632**
Garnotia tenella (Arn. ex Miq.) Janowski **633**
Gastrochilus acaulis (Lindl.) Kuntze **113**
Gastrochilus D.Don **113**
Gastrochilus tiliifolius Baker 113
Globba L. **197**
Globba marantina L. **197**
Globba ophioglossa Wight 198
Globba sessiliflora Sims **198**
Gloriosa L. **257**
Gloriosa simplex L. 257
Gloriosa superba L. **257**
Glyphochloa Clayton **667**
Glyphochloa forficulata (C.E.C.Fisch.) Clayton **667**
Goodyera procera (Ker Gawl.) Hook. **114**
Goodyera R.Br. **114**
H
Habenaria barnesii Summerh. ex C.E.C.Fisch. **117**
Habenaria brachyphylla (Lindl.) Aitch. **117**
Habenaria cephalotes Lindl. **118**
Habenaria crinifera Lindl. **119**
Habenaria elliptica Wight **120**
Habenaria furcifera Lindl. **120**
Habenaria goodyeroides D.Don 149
Habenaria heyneana Lindl. **121**
Habenaria longicorniculata J.Graham **122**
Habenaria longicornu Lindl. **123**
Habenaria periyarensis Sasidh. **124**
Habenaria perrottetiana A.Rich. **124**
Habenaria platyphylla Spreng. 126
Habenaria rariflora A.Rich. **125**
Habenaria roxburghii Nicolson **126**
Habenaria Willd. **115**
Hackelochloa granularis (L.) Kuntze **668**
Hackelochloa Kuntze **668**
HAEMODORACEAE R.Br. **224**
Hedychium coronarium J.Koenig **199**
Hedychium flavescens Carey ex Roscoe **200**
Hedychium J.Koenig **199**
Hedychium spicatum Sm. **201**
Hedychium venustum Wight **202**
Hellenia Retz. **203**
Hellenia speciosa (J.Koenig) S.R.Dutta **203**
Heteropogon contortus (L.) P.Beauv. ex Roem. & Schult. **669**
Heteropogon Pers. **669**
Hippeastrum Herb. **231**
Hippeastrum reginae (L.) Herb. **231**
Hydrilla Rich. **44**
Hydrilla verticillata (L.f.) Royle **44**

HYDROCHARITACEAE Juss. **40**
Hypolytrum nemorum (Vahl) Spreng. **481**
Hypolytrum Pers. **481**
Hypoporum pergracile Nees 491
Hypoxis aurea Lour. **234**
Hypoxis L. **234**
I
Ichnanthus P.Beauv. **576**
Ichnanthus pallens var. ***major*** (Nees) Stieber **576**
Ichnanthus vicinus (F.M.Bailey) Merr. 576
Imperata arundincea Cirillo 670
Imperata Cirillo **670**
Imperata cylindrica (L.) Raeusch. **670**
Indianthus Suksathan & Borchs. **213**
Indianthus virgatus (Roxb.) Suksathan & Borchs. **213**
Indochloa oligantha (Hochst. ex Steud.) Bor 664
Iphigenia indica (L.) Kunth **258**
Iphigenia Kunth **258**
Isachne austrails R.Br. 617
Isachne bourneorum C.E.C.Fisch. **615**
Isachne fischeri Bor **616**
Isachne gardneri (Thwaites) Benth. & Hook.f. 587
Isachne globosa (Thunb.) Kuntze 617
Isachne kunthana var. *latifolia* Hook.f. 618
Isachne kunthiana (Wight & Arn. ex Steud.) Miq. **618**
Isachne R.Br. **615**
Isachne setosa C.E.C.Fisch. **619**
Isachne walkeri (Arn. ex Steud.) Wight & Arn. ex Thwaites **619**
Ischaemum ciliare Retz. 672
Ischaemum commutatum Hack. **673**
Ischaemum hirtum Hack. 674
Ischaemum L. **671**
Ischaemum nilagiricum Hack. 674
Ischaemum polystachyum J.Presl **674**
Ischaemum timorense Kunth **675**
Isolepis fluitans (L.) R.Br. **482**
Isolepis R.Br. **482**
J
Jansenella Bor **634**
Jansenella griffithiana (Mull.Hal.) Bor **634**
JUNCACEAE Juss. **320**
Juncus bufonius L. **320**
Juncus effusus L. **322**
Juncus L. **320**
Juncus prismatocarpus subsp ***leschenaultii*** (J.Gay ex Laharpe) Kirschner **323**
Juncus prismatocarpus R.Br. 324
K
Kuruna Attigala, Kaththr. & L.G.Clark **500**
Kuruna floribunda (Thwaites) Attigala, Kaththr. & L.G.Clark **500**
Kuruna walkeriana (Munro) Attigala, Kaththr. & L.G.Clark **501**
Kuruna wightiana (Nees) Attigala, Kaththr. & L.G.Clark **503**
L
Lagenandra Dalzell **361**
Lagenandra meeboldii (Engl.) C.E.C.Fisch. **361**
Lagenandra ovata (L.) Thwaites **361**
Lagurus cylindricus L. 670
Leersia hexandra Sw. **509**
Leersia Sw. **509**
LILIACEAE Juss. **243**
Lilium L. **259**
Lilium wallichianum var. ***neilgherrense*** (Wight) H.Hara **259**
Limnocharis Bonpl. **370**
Limnocharis flava (L.) Buchenau **370**
Liparis elliptica Wight **127**, 179
Liparis longipes Lindl. **129**
Liparis odorata Lindl. **128**
Liparis paradoxa Rchb.f. 128
Liparis Rich. **127**
Liparis viridiflora (Blume) Lindl. **129**
Liparis walkerae Graham **129**
Liparis wightiana Thwaites **130**
Louisiella C.E.Hubb. & J.Leonard **577**
Louisiella paludosa (Roxb.) Landge **577**
Luisia birchea Blume **131**
Luisia Gaudich. **131**
Luisia tenuifolia Blume **131**
Luisia zeylanica Lindl. **132**
M
Malaxis acuminata D.Don 87

Malaxis densiflora (A.Rich.) Kuntze **133**
Malaxis Sol. ex Sw. **133**
MARANTACEAE R.Br. **213**
Megathyrsus (Pilg.) B.K.Simon & S.W.L.Jacobs **578**
Megathyrsus maximus (Jacq.) B.K.Simon & S.W.L.Jacobs **578**
Meistera acuminata (Thwaites) Skornick. & M.F.Newman **204**
Meistera cannicarpa (Wight) Skornick. & M.F.Newman **205**
Meistera Giseke **204**
Meistera masticatorium (Thwaites) Skornick. & M.F.Newman **207**
Meistera ghatica (K.G.Bhat) Skornick. & M.F.Newman **206**
Melinis minutiflora P.Beauv. **579**
Melinis P.Beauv. **579**
Melinis repens (Willd.) Zizka **580**
Microstegium fasciculatum (L.) Henrard **676**
Microstegium Nees **676**
Murdannia dimorpha (Dalzell) G.Brückn. **300**
Murdannia esculenta (Wall. ex C.B.Clarke) R.S.Rao & Kammathy **301**
Murdannia fadeniana Nampy & Joby **302**
Murdannia gigantea (Vahl) G.Brückn. **303**
Murdannia japonica (Thunb.) Faden **305**
Murdannia lanuginosa G.Brückn. **306**
Murdannia loriformis (Hassk.) R.S.Rao & Kammathy **307**
Murdannia nudiflora (L.) Brenan **308**
Murdannia pauciflora (G.Brückn.) G.Brückn. **309**
Murdannia Royle **299**
Murdannia satheeshiana Joby **311**
Murdannia semiteres (Dalzell) Santapau **312**
Murdannia simplex (Vahl) Brenan **313**
Murdannia spirata (L.) G.Brückn. **314**
Murdannia zeylanica (C.B.Clarke) G.Brückn. **315**
Musa acuminata Colla 224
Musa kattuvazhana K.C.Jacob **223**
Musa L. **223**
Musa superba Roxb. 222
MUSACEAE Juss. **220**
Mycrostylis rheedei (Sw.) Lindl. 88
N
NAJADACEAE Juss. **374**
Najas falciculata A.Braun 375
Najas indica (Willd.) Cham. **375**
Najas L. **375**
Nervilia Comm. ex Gaudich. **134**
Nervilia plicata (Andrews) Schltr. **134**
Nervilia simplex (Thouars.) Schltr. **134**
O
Oberonia anamalayana J.Joseph **136**
Oberonia bicornis Lindl. **137**
Oberonia brachyphylla Blatt. & McCann 138
Oberonia brachystachys Lindl. **138**
Oberonia brunoniana Wight **138**
Oberonia chandrasekharanii V.J.Nair **139**
Oberonia ensiformis (Sm.) Lindl. **140**
Oberonia Lindl. **135**
Oberonia proudlockii King & Prantl. **141**
Oberonia sebastiana B.V.Shetty & Vivek. **141**
Oberonia thwaitesii Hook.f. **142**
Oberonia wightiana Lindl. **143**
Ochlandra Thwaites **504**
Ochlandra travancorica (Bedd.) Gamble **504**
Ophiopogon intermedius D.Don **226**
Ophiopogon Ker Gawl. **226**
Oplismenus compositus (L.) P.Beauv. **582**
Oplismenus P.Beauv. **582**
Oplismenus undulatifolius (Ard.) P.Beauv. **583**
ORCHIDACEAE Juss. **55**
Oropetium thomaeum (L.f.) Trin. **538**
Oropetium Trin. **538**
Oryza L. **510**
Oryza rufipogon Griff. **510**
Oryza *sativa* L. 511
Ottochloa Dandy **584**
Ottochloa nodosa (Kunth) Dandy **584**
P
Pachystoma Blume **144**
Pachystoma pubescens Blume **144**
PANDANACEAE R.Br. **337**

Pandanus Parkinson **338**
Pandanus unipapillatus Dennst. **338**
Panicum antidotale Retz. **585**
Panicum brevifolium L. **586**
Panicum gardneri Thwaites **587**
Panicum humidorum Buch.-Ham. Ex Hook.f. **588**
Panicum L. **585**
Panicum notatum Retz. **589**
Panicum ovalifolium Poir. 586
Panicum sumatrense Roth in Roemer & Schultes **589**
Papilionanthe cylindrica (Lindl.) Seidenf. **145**
Papilionanthe Schltr. **145**
Paspalum conjugatum P.J.Bergius **591**
Paspalum dilatatum Poir. **592**
Paspalum distichum L. **593**
Paspalum L. **591**
Paspalum scrobiculatum L. **594**
Pecteilis gigantea (Sm.) Raf. **146**
Pecteilis Raf. **146**
Peliosanthes Andrews **227**
Peliosanthes courtallensis Wight **227**
Peliosanthes neilgherriensis Wight **228**
Peristylus aristatus Lindl. **147**
Peristylus Blume **147**
Peristylus densus (Lindl.) Santapau & Kapadia **148**
Peristylus goodyeroides (D.Don) Lindl. **149**
Peristylus richardianus Wight **150**
Peristylus spiralis A.Rich. **151**
Perotis Aiton **552**
Perotis indica **(**L.) Kuntze **552**
Phoenix L. **336**
Phoenix loureiroi var. ***pedunculata*** (Griff.) Govaerts **336**
Phrynium pubinerve Blume **215**
Phrynium Willd. **215**
Pinalia Lindl. **151**
Pinalia mysorensis (Lindl.) Kuntze **151**
Pinalia polystachya (A.Rich.) Kuntze **152**
Pistia L. **362**
Pistia stratiotes L. **362**
Poa annua L. **513**
Poa L. **513**
POACEAE Barnhart **496**
Podochilus Blume **153**
Podochilus malabaricus Wight **153**
Pogonatherum crinitum (Thunb.) Kunth **677**
Pogonatherum P.Beauv. **677**
Polystachya concreta (Jacq.) Garay & H.R.Sweet **154**
Polystachya Hook. **154**
Polytoca gigantea (J.Koenig) Mabb. **678**
Pontederia L. **263**
Pontederia vaginalis Burm.f. **263**
PONTEDERIACEAE Kunth **263**
Porpax braccata (Lindl.) Schuit. **155**
Porpax filiformis (Wight) Schuit. **156**
Porpax jerdoniana (Wight) Rolfe **157**
Porpax Lindl. **155**
Porpax nana (A.Rich.) Schuit **157**
Porpax reticosa (Wight) Schuit. **158**
Potamogeton L. **372**
Potamogeton octandrus Poir. **372**
POTAMOGETONACEAE Bercht. & J.Presl **372**
Pothos armatus C.E.C.Fisch. **363**
Pothos keralensis Pandur. & V.J.Nair **364**
Pothos L. **363**
Pothos scandens L. **364**
Pothos thomsonianus Schott **365**
Pseudanthistiria (Hack.) Hook.f. **680**
Pseudanthistiria umbellata (Hack.) Hook.f. **680**
Pseudechinolaena polystachya (Kunth) Stapf **595**
Pseudechinolaena Stapf **595**
Pseudopogonatherum A.Camus **681**
Pseudopogonatherum trispicatum (Schult.) Ohwi **681**
Pseudoraphis Griff. ex Pilg. **596**
Pseudoraphis spinescens (R.Br.) Vickery **596**
Pseudosorghum A.Camus **682**
Pseudosorghum fasciculare (Roxb.) A.Camus **682**
Pseudoxytenanthera bourdillonii (Gamble) H.B.Naithani **505**

Pseudoxytenanthera monadelpha (Thwaites) Soderstr. & R.P.Ellis **506**
Pseudoxytenanthera Soderstr. & R.P.Ellis **505**
R
Raphidophora Hassk. **366**
Remusatia Schott **366**
Remusatia vivipara (Roxb.) Schott. **366**
Rhaphidophora pertusa (Roxb.) Schott **366**
Rhopalephora Hassk. **316**
Rhopalephora scaberrima (Blume) Faden **316**
Rhynchospora corymbosa (L.) Britton **483**
Rhynchospora glauca Vahl 484
Rhynchospora rugosa (Vahl) Gale **484**
Rhynchospora Vahl **483**
Rhynchostylis Blume **159**
Rhynchostylis retusa (L.) Blume **159**
Rikliella squarrosa (L.) J.Raynal 445
Robiquetia Gaudich **160**
Robiquetia josephiana Manilal & C.S.Kumar **160**
Rottboellia cochinchinensis (Lour.) **683**
Rottboellia L.f. **683**
S
Saccharum L. **684**
Saccharum spontaneum L. **684**
Sacciolepis indica (L.) Chase **597**
Sacciolepis interrupta (Willd.) Stapf **598**
Sacciolepis Nash **597**
Satyrium nepalense D.Don **161**
Satyrium Sw. **161**
Schizachyrium brevifolium (Sw.) Nees ex Buse in Miquel **685**
Schizachyrium Nees **685**
Schizostachyum beddomei (C.E.C.Fisch.) R.B.Majumdar **507**
Schizostachyum Nees **507**
Schoenoplectiella juncoides (Roxb.) Lye **485**
Schoenoplectiella Lye **485**
Schoenoplectiella mucronata (L.) J.Jung & H.K.Choi **486**
Schoenorchis jerdoniana (Wight) Garay **162**
Schoenorchis Reinw. ex Blume **162**
Schoenorchis smeeana (Rchb.f.) Jalal **163**
Scleria levis Retz. **488**
Scleria lithosperma (L.) Sw. **489**
Scleria multilacunosa T.Koyama **489**
Scleria P.J.Bergius **487**
Scleria parvula Steud. **490**
Scleria pergracilis (Nees) Kunth **491**
Scleria swamyi Govind. **492**
Scleria terrestris (L.) Fassett **493**
Setaria barbata (Lam.) Kunth **599**
Setaria flavida (Retz.) Veldkamp **600**
Setaria intermedia Roem. & Schult. **601**
Setaria P.Beauv. **599**
Setaria palmifolia (J.Koenig) Stapf **602**
Setaria parviflora (Poir.) Kerguelen **603**
Setaria pumila (Poir.) Roem. & Schult. **604**
Setaria verticillata (L.) P.Beauv. **605**
Sirhookera Kuntze **164**
Sirhookera lanceolata (Wight) Kuntze **164**
Sirhookera latifolia (Wight) Kuntze **165**
Smilax L. **260**
Smilax zeylanica L. **260**
Smilax wightii A.DC. **261**
Smithsonia C.J.Saldanha **165**
Smithsonia viridiflora (Dalzell) C.J.Saldanha **165**
Sorghum halepense (L.) Pers. **686**
Sorghum Moench **686**
Sorghum nitidum (Vahl) Pers. **687**
Spiranthes Rich. **166**
Spiranthes sinensis (Pers.) Ames **166**

Spodiopogon rhizophorus (Steud.) Pilg. **689**
Spodiopogon Trin. **689**
Sporobolus indicus (L.) R.Br. **539**
Sporobolus pilifer (Trin.) Kunth **540**
Sporobolus R.Br. **539**
Stachyphrynium K.Schum. **217**
Stachyphrynium spicatum (Roxb.) K.Schum. **217**
Streptogyna crinita P.Beauv. **508**
Streptogyna P.Beauv. **508**
T
Tainia bicornis Rchb.f. **167**
Tainia Blume **167**
Taprobanea Christenson **168**
Taprobanea spathulata (L.) Christenson **168**
Thelasis Blume **168**
Thelasis pygmaea (Griff.) Lindl. **168**
Themeda cymbaria Hack. **690**
Themeda Forrsk. **690**
Themeda sabarimalayana Sreek. & V.J.Nair **691**
Themeda tremula (Nees ex Steud.) Hack. **693**
Themeda triandra Forrsk. **694**
Theriophonum infaustum N.E.Br. **367**
Theriphonum Blume **367**
Trachys muricata (L.) Pers. ex Trin. **606**
Trachys Pers. **606**
Tribe Andropogoneae Dumort **635**
Tribe Aristideae C.E.Hubb. **520**
Tribe Arundineae Dumort **519**
Tribe Arundinelleae Stapf **620**
Tribe Aveneae Dumort **514**
Tribe Bambusae Kunth ex Dumort **499**
Tribe Centotheceae Ridl. **518**
Tribe Cynodonteae Dumort **549**
Tribe Eragrostideae Stapf **521**
Tribe Isachneae Benth **612**
Tribe Oryzeae Dumort **501**
Tribe Paniceae R.Br **553**
Tribe Poeae R.Br. **511**
Tribe Streptogyneae C.E.Hubb. ex C.E.Calderon & Soderstr. **508**
Trichoglottis Blume **169**
Trichoglottis tenera (Lindl.) Rchb.f. **169**
Trigonochloa P.M.Peterson & N.Snow **549**
Trigonochloa uniflora (Hochst. ex A.Rich.) P.M.Peterson & N.Snow **549**
Tripogon bromoides Roem. & Schult. **542**
Tripogon filiformis Nees ex Steud. **543**
Tripogon munnarensis Thoiba & Manudev **544**
Tripogon narayanae Sreek. **545**
Tripogon pungens C.E.C.Fisch. **546**
Tripogon Roem. & Schult. **541**
Tripogon sivarajanii Sunil **547**
Tripogon velliangiriensis Murug. & V.Balas. **548**
Tripogon zeylanicus Nees ex Steud. **549**
Trisetopsis Roser & A.Wolk **517**
Trisetopsis virescens (Nees ex Steud.) Roser & A.Wolk **517**
Tropidia angulosa (Lindl.) Blume **170**
Tropidia Lindl. **170**
Typha angustifolia L. **340**
Typha L. **340**
TYPHACEAE Juss. **338**
Typhonium Schott **368**
Typhonium trilobatum (L.) Schott **368**
U
Urochloa distachyos (L.) T.Q.Nguyen **607**
Urochloa eminii (Mez) Davidse **608**
Urochloa mutica (Forssk.) T.Q.Nguyen **609**
Urochloa P.Beauv. **607**
Urochloa panicoides P.Beauv. **610**
Urochloa ramosa (L.) T.Q.Nguyen **610**
Urochloa reptans (L.) Stapf. **611**
V

Vallisneria L. **45**
Vallisneria spiralis L. **45**
Vanda Jones ex R.Br. **171**
Vanda tessellata (Roxb.) Hook. ex G.Don **171**
Vanda testacea (Lindl.) Rchb.f. **172**
X
XYRIDACEAE C.Agardh **265**
Xyris capensis Thunb. **267**
Xyris Gronov. **267**
Xyris indica L. **268**
Z
Zenkeria elegans Trin. **519**
Zenkeria sebastinei A.N.Henry & Chandrab. **520**
Zenkeria Trin. **519**
Zeuxine gracilis (Breda) Blume **173**
Zeuxine Lindl. **173**
Zeuxine longilabris (Lindl.) Trimen **174**
Zingiber Mill. **208**
Zingiber neesanum (J.Graham) Ramamoorthy **208**
Zingiber nimmonii Dalzell **209**
Zingiber zerumbet (L.) Roscoe ex Sm. **210**
ZINGIBERACEAE Martinov **18**