

DIVERSITY OF GAMOPETALAE IN IDUKKI DISTRICT, KERALA

*Thesis submitted to the University of Calicut in partial
fulfillment of the requirements for the award of the Degree of*

Doctor of Philosophy in Botany

By

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CERTIFICATE

This is to certify that the thesis entitled “Diversity of Gamopetalae in Idukki district, Kerala” is an authentic record of research work carried out by Ms. Divya K. Venugopal under my supervision in fulfillment of the requirement for the degree of Doctor of Philosophy, in Botany of university of Calicut. The result embodied in this thesis has not been included in any other thesis submitted previously for the award of any degree or diploma of any other university or institution. Also certified that the content of the thesis has been checked using anti-plagiarism data base and no unacceptable similarity was found through the software check.

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This is to certify that the adjudicators of the PhD thesis of **Ms. Divya K. Venugopal**, titled **"Diversity of Gamopetalae in Idukki District, Kerala"** have given some directions for corrections or suggestions for change in their reports. The thesis has been modified as recommended by the adjudicators and the content of the thesis in both hard copy and soft copy are one and same.

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Declaration

I hereby declare that the thesis entitled “Diversity of Gamopetalae in Idukki district, Kerala”, submitted to the University of Calicut, for the award of the degree of Doctor of Philosophy in Botany, is a bona fide record of the original research work done by me under the supervision and guidance of Dr. Vimala Jose, Assistant Professor, Research and Post graduate Department of Botany, St. Thomas’ College (Autonomous), Thrissur and it has not been submitted earlier either in part or full for the award of any degree or diploma to any candidate of any university.

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*Dedicated to my
Achan & Amma*

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Abstract

Abstract

The present study deals with the floristic documentation of gamopetalous members present in Idukki district, Kerala. The study area Idukki, second largest district in Kerala is a part of Southern Western Ghats and is enriched with various habitats. The study follows the system of classification proposed by Bentham and Hooker. Gamopetalae members coming under 32 families have been studied and documented.

Materials for the present study were collected through extensive field trips in different parts of Idukki during 2017-2021 by undertaking 60 field trips and spending more than 300 days in the field, in various seasons. Specimens of 672 species were collected for scientific study and preparation of herbarium. Out of 672 plants collected, 481 specimens could be placed in wild category and remaining 191 under ornamental/ cultivated/ medicinal plants. Systematic treatment consists of keys for the identification of families. The 32 families are dealt separately with family and genera, along with keys for the identification of genera and species. Taxonomic description is followed by distribution, habitat, etymology and specimen examined. The descriptions were prepared on the basis of details from live specimens and herbarium specimens from CALI, MH, KFRI and virtual herbaria. The images of some collected plants (wild and cultivated) were merged into various photoplates.

During the study period, 2 species were discovered new to science (*Asyneuma cupulare* – Campanulaceae and *Parasopubia raghavendrae* – Orobanchaceae) and typifications of two plants were done (*Iochroma arborescens*– neotypification and *Asyneuma fulgens* - lectotypification) and one invasive plant was discovered (*Iochroma arborescens* – Solanaceae) and one plant was reinstated (*Fagraea coromandelina* - Loganiaceae). The floristic surveys are of prime importance in any taxonomic study since it will throw light into the geographical distribution so that strategies for conservation and sustainable utilization of plant resources could be formulated. This work is an attempt to document all the gamopetalous members of Idukki district.

സംഗ്രഹം

കേരളത്തിലെ ഇടുക്കി ജില്ലയിലെ സംയുക്ത ദളീയ സസ്യങ്ങളെക്കുറിച്ചുള്ളതാണ് ഈ പഠനം. തെക്കൻ പശ്ചിമഘട്ടത്തിന്റെ ഭാഗമായ കേരളത്തിലെ ഏറ്റവും വലിയ രണ്ടാമത്തെ ജില്ലയായ ഇടുക്കി, വിവിധ ആവാസവ്യവസ്ഥകളാൽ സമ്പുഷ്ടമാണ് ബെന്തം- ഇക്കർ വർഗ്ഗീകരണ സമ്പ്രദായമാണ് ഈ പഠനത്തിൽ അവലംബിച്ചിരിക്കുന്നത്. ഈ പഠനത്തിൽ 32 സസ്യകുടുംബങ്ങൾക്ക് കീഴിൽ വരുന്ന സംയുക്ത ദളീയ (ഗാമോപെറ്റലേ) അംഗങ്ങളെ പഠിക്കുകയും രേഖപ്പെടുത്തുകയും ചെയ്യുന്നു

ഈ പഠനത്തിനായി 2017 മുതൽ 2021 വരെ സസ്യ ശേഖരണത്തിനായി പല സീസണുകളിൽ മുന്നൂറിലധികം ദിവസങ്ങളിൽ അറുപതോളം വിപുലമായ ഫീൽഡ് ട്രിപ്പുകൾ നടത്തേണ്ടി വന്നു. ശേഖരിച്ച 672 സസ്യങ്ങളിൽ 481 എണ്ണം തനത് ഇനത്തിലും ബാക്കി 191 അലങ്കാര/ശൃംഗി/ഔഷധ സസ്യവിഭാഗങ്ങളുടെ കീഴിലുമാണ് വർഗ്ഗീകരണ സൂചികകൾ വിവിധ സസ്യകുടുംബങ്ങളെ തിരിച്ചറിയുന്നതിനായി ഉൾക്കൊള്ളിച്ചിരിക്കുന്നു. ഓരോ സസ്യകുടുംബത്തെക്കുറിച്ചുള്ള ലഘു വിവരണവും ഓരോ സ്പീഷീസുകളുടെയും ജീനസുകളുടെയും വർഗ്ഗീകരണ സൂചികയും ഇതോടൊപ്പം നൽകിയിരിക്കുന്നു. ടാക്സോണോമി വിവരണങ്ങൾ തയ്യാറാക്കുന്നതിനായി സസ്യങ്ങളുടെ വിതരണം, വളരുന്ന ചുറ്റുപാട്, പദാർപ്പത്തിൽ സസ്യങ്ങളുടെ വിവിധ ഭാഗങ്ങൾ എന്നിവ കണ്ടെത്തുകയും പരിശോധിക്കുകയും ചെയ്തു. CALI, MH, KFRI, മറ്റ് വിദഗ്ദ്ധർ ഹെർബറിയങ്ങൾ എന്നിവ ഇതിനായി സന്ദർശിച്ചു കണ്ടെത്തിയ ചില സസ്യങ്ങളുടെ ചിത്രങ്ങൾ ഇതോടൊപ്പം ഉള്ളടക്കം ചേർത്തിട്ടുണ്ട്.

ഈ കാലയളവിൽ രണ്ട് പുതിയ സസ്യ ഇനങ്ങളെ കണ്ടെത്തി (കമ്പാനുലേസിയ കുടുംബത്തിലെ അസിനൂമ ക്യൂപ്പലാറെ എന്ന സസ്യവും ഒറോബങ്കസിയ കുടുംബത്തിലെ പാരാസോപ്പുബിയ രാഘവേന്ദ്ര എന്ന സസ്യവും). ഇതോടൊപ്പം രണ്ട് ഇനങ്ങളുടെ ടൈപ്പിഫിക്കേഷനും (അയോക്ത്രോമ അർബോറൈസെൻസ് - നിയോടൈപ്പിഫിക്കേഷൻ, അസൈനൂമ ഫുൾജെൻസ് - ലെക്ടോടൈപ്പിഫിക്കേഷൻ) നടത്തി അവയിലൊന്ന് പുതിയ ഒരിനം അധിനിവേശ സസ്യമാണ് (അയോക്ത്രോമ അർബോറൈസെൻസ്-സൊളനേസിയ). കൂടാതെ നിലവിൽ മറ്റൊരു സസ്യത്തിന്റെ സിനോണിം (പര്യായം) ആയ (ഫാഗ്രിയ കൊറോമാണ്ടലിന - ലോഗാനിയേസിയ) സസ്യത്തെ പ്രത്യേക സ്പീഷീസ് ആയി കണക്കാക്കുകയും ചെയ്തു.

ടാക്സോണമിക് പഠനത്തിൽ ക്ലോറിസ്റ്റിക് സർവേകൾക്ക് പ്രത്യേക പ്രാധാന്യമുണ്ട്, കാരണം ഇത് ഭൂമിശാസ്ത്രപരമായ ജൈവവൈവിധ്യത്തിന്റെ വിതരണം എപ്രകാരമാണ് എന്ന അറിവിലേക്ക് വെളിച്ചം വീശും, അങ്ങനെ സസ്യവിഭവങ്ങളുടെ സംരക്ഷണത്തിന് സുസ്ഥിരമായ ഉപയോഗത്തിനുമുള്ള നയങ്ങൾ രൂപപ്പെടുത്താൻ സാധിക്കും. ഇടുക്കി ജില്ലയിലെ സൗഷ്ഠികളായ എല്ലാ ഗാമോപെറ്റലസ് സസ്യങ്ങളെയും രേഖപ്പെടുത്താനുള്ള ശ്രമമാണ് ഈ പഠനം.

Keywords

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Bentham & Hooker's system of classification

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Plant description

New species

Typification & nomenclatural notes

Reinstatement of species

Introduction

Introduction

Plants play pivotal role in maintaining the ecological balance. Not only human, almost all live forms in the earth directly or indirectly depends on the plants for their existence and survival. Thus plants are in fact the major backbone of our ecosystem if we consider their prime role in the supply of oxygen to the living world. Humans are distinct from all other species because of our thirst for exploring nature. Primitive man started the phenomenon of classifying plants in order to sort the edible plants from poisonous plants. As the outcome of civilizations, man began to domesticate wild plants to meet his basic needs such as food, medicine, clothing and shelter. *Pharaohs* of ancient Egypt started the organized plant exploration since 2000 BC for illustrating them on their temple walls. The intense of exploration increased on the account of the search for sea route for collection of spices from East. Thus during the end of 15th century, many plants were brought to Europe from various parts of the world and were documented. Floristic works created awareness among the people because the data revealed the distribution of each species and also pointed towards the need for conservation and propagation of plants. Thus in our country, Flora of British India by Hooker (1875-1897) paved the way for initiating the conservation of plants throughout India. Inception of applied branches of science resulted in the gradual elimination of basic plant science from the main stream. The inevitable consequence of urbanization and industrialization is the disintegration of forest areas and extinction of endemic plants. The adverse effects of negligence of the science of plant systematics resulted in shifting the balance of nature and hence in the present scenario, the field of taxonomy is regaining its lost prestige. As the result of the Earth Summit at Rio de Janeiro in 1992, the biodiversity conservation gained wide popularity. Botanists are still exploring every nook and corner of the biosphere to provide a proper taxonomic documentation of plants. Many plants are vanishing from the earth in a very fast pace and a species once lost is lost forever. Biodiversity loss is beyond any calculation, especially in tropical forests. Tropical forest ecosystems are mainly distributed in developing countries and population explosion along with industrialization and urbanization, leads to the destruction of natural ecosystems. It is high time to deeply focus on sustainable utilisation of natural resources ensuring their conservation.

According to Gadgil, (1996 a) documentation and conservation of biodiversity is inevitable since the components of biodiversity are not restricted to some protected areas such as national parks and biosphere reserves. Due to increased anthropogenic activities, unexplored treasure of biodiversity is getting severely devastated. Endemism is one of the major components of biodiversity which can be easily identifiable (Punekar & Kumaran, 2005). Western Ghats is the treasure house of endemic species. Ministry of Environment & Forests (MOEF) of Govt. of India established Western Ghats Ecology Expert Panel in 2010 in order to address the issues and to formulate the protocols for planning conservation strategies.

Forests are usually described as lungs of nature, as their function undoubtedly reveals their role in balancing between living and non living components of ecosystem. Since forests carry two third of all plants and animals living on the land, it is considered as the most diverse part of terrestrial ecosystem. Tropical forests are also known as ‘cradle of evolution’; because of exceptional species diversity. When compared with Eastern Ghats; Western Ghats are more diverse and hosts more endemic species. Southern regions of Western Ghats are topographically more diverse with many complex hilly areas and tropical forests followed by Central and Northern region of Western Ghats. Western Ghats is recently declared as World heritage site by UNESCO (Lewis, 2012).

India is one among the twelve biodiversity rich nations and ranks second position preceding Brazil in floristic species richness. According to Hooker (1875-1897), India is the country in Eastern hemisphere with most varied flora. The presence of floristic diversity along the ancestral stocks of flowering plants made Takhtajan to entitle this nation as the ‘cradle of flowering plants’. Biodiversity along with its ecosystem is effectively conserved since time immemorial by various tribal communities. The serious attempts made by Government of India during 1970 – 1990 to raise many wildlife sanctuaries and national parks in the nation was a great leap towards the protection of biodiversity. According to conservation international 2005 (<https://www.conservation.org/priorities/biodiversity-hotspots>), there are almost 35 biodiversity hotspots and their number is still increasing. Biodiversity hotspots are areas with high number of endemic species but facing loss of habitat. Out of 35 global biodiversity hotspots, four are running through India (Indo-Burma, Western Ghats,

Sundaland and Himalaya), and they deserve special significance in the conservation aspect (<https://www.thehindu.com/children/wild-wonderlands/article34686553.ece>). Western Ghats and Eastern Himalayas are two major hotspots in Indian sub continent and among these Western Ghats (*Sahyadri*) is geographically vast and diverse. Ecologically fragile areas of Western Ghats are being disturbed by plantations and various developmental activities, and hence facing frequent natural calamities and biodiversity loss. Forest areas coming under the Southern Western Ghats is the most diverse region among Peninsular India with high degree of species richness and endemism. Environmental factors are continuously changing in this region due to anthropogenic activities leading to the decline in the plant diversity (Tilman, 2000). Unpredictable changes in environmental factors along with natural calamities bring about sudden and huge decline in biodiversity. This emphasizes the need for documentation of plants in the unexplored areas of Southern Western Ghats so as to design conservation strategies.

Floristic documentation necessitates the proper identification of species, their distribution and abundance. It is very important to have basic ideas about the local vegetation in order to predict future impact on vegetation and ecosystem caused by climatic change.

The Flora of a region documents all plants in a particular area. Flora helps to identify rare, threatened & endangered taxa. The term ‘flora’ was used since 1898, for phytogeographical studies of plants. Flora usually contains scientific name, common name, citation, references, habit, description, ecology, flowering and fruiting season etc. Floristic studies have major role for planning and implementing forest conservation projects and also in the indirect assessment of speciation, endemism, isolation and evolution.

Biodiversity documentation of an unexplored representative area of Southern Western Ghats (Idukki district) has been attempted in this study. The documentation of gamopetalous members of Angiosperms distributed in Idukki district of Kerala, India has been undertaken. Since floristic studies of 12 districts of Kerala have been completed (<https://www.eflorakerala.com/floristic.php>), survey and documentation of Idukki district has yet to be done. Floristic analysis of some minor areas within the district has been already published (Sebastine & Vivekananthan, 1967; Shetty &

Vivekanathan, 1968, 1969, 1970, 1971, 1972, 1973, 1975, 1991; Vivekanathan 1978, 1981; Mohanan *et al.*, 1984; Pandurangan *et al.*, 1985; Balasubramanyan *et al.*, 1989; Pandurangan & Nair, 1993; Sasidharan 1999; Augustine 2000; Biju 2004); data about entire district is missing. Idukki district is geographically rich with various kinds of forests including tropical rainforests with huge number of endemic species.

The study area Idukki, second largest district in Kerala is a part of Southern Western Ghats. Many areas are remote with mountainous terrain. Tribal communities belonging to different ethnic groups reside in the district and helps to conserve the traditional knowledge and use of natural resources. Ecological parameters such as rainfall, temperature, soil conditions and altitudinal variations host various plants in the district. Idukki is enriched with 4 national parks, 4 wildlife sanctuaries and 14 peaks (including Anamudi, the highest peak in south India). More than half of the district is covered by forests and rugged mountains. The district is also abundant with various types of flora and fauna. The diverse ecosystems present in the study area are: shola forests, grasslands, transition forests, evergreen forests, semi evergreen forests, shrub lands, deciduous forests, plantations, etc. The district is also remarkable for many endemic vertebrates such as Nilgiri Langur, Sstipe – necked mongoose, Indian porcupine, Nilgiri marten, small clawed otter, ruddy mongoose, dusky palm squirrel, albino gaur, Indian star tortoise and white tiger.

The appearance of a number of invasive plants in this area is a potent threat to the endemic flora. Eventhough the forest areas of Idukki is enriched with timber trees, endemic medicinal plants and ecologically important plants; there is a gradual depletion in diversity and many species have been placed to a threatened status. The causative factors for biodiversity loss include deforestation, soil erosion, pesticide residues in plantations and unscientific construction works. The entire area of Idukki district is 4612.23 sq km (Anonymous, 2023); the total forest area is getting depleted as the result of unimaginable growth of tea plantations. Many private business group and land mafias are illegally utilizing forest land for tea plantations. Tourism is another business in the high range areas of Idukki. Many resorts are getting established in different parts of the district mainly near forest areas and waterfalls. Over exploitation of nature in the name of tourism results in pollution, deforestation and poaching of animals. Natural calamities such as flood, heavy rainfall and

landslides that occurred continuously during 2017 – 2019 also wiped out considerable part of flora and fauna from the district.

The floristic study of Idukki district presented here is in accordance with the classification proposed by Bentham and Hooker. The floristic documentation of plants belonging to 32 gamopetalous families from Rubiaceae to Plantaginaceae has been ventured in this study. Gamopetalous members mainly comprises of herbs, shrubs, climbers and trees. Among the gamopetalae members, the families: Asteraceae, Lamiaceae, Rubiaceae and Acanthaceae; have more medicinally useful plants. Gamopetalae also includes plants under cultivation, ornamental plants, invasive weeds and timber yielding trees. The floristic surveys are of prime importance in any taxonomic study since it will throw light into the geographical distribution so that strategies for conservation and sustainable utilization of plant resources could be formulated. This work is an attempt to document all gamopetalous members of Idukki district.

Objectives

Objectives

- To assess the diversity of Gamopetalae in Idukki district.
- To prepare herbarium specimens for future reference.
- To identify all the collected specimens with floras and protologues.
- To prepare photoplates of RET plants collected from the area.

Review of Literature

Review of literature

The urge for exploring nature by human beings started from the beginning of earliest civilizations. Indian works such as *Vrikshayurvedha* of Parasara, *Charaka samhita* and *Susruta samhita* explains the importance of plants and their uses to mankind. Britons were the pioneer contributors to the floristic literatures of India and Portuguese travellers successfully carried out modern scientific explorations in India.

Robert Wight (1840) was the front-runner among the explorers with 28 publications and his most important publication is *Illustrations of Indian Botany*. Wight along with Arnott published *Prodromus Florae Peninsulae Indiae Orientalis* in 1834. The other important contributions during the 19th century are *Flora Indica* (1820-1824) and *Hortus Bengalensis* (1814) by Roxburgh. The two important works by R.H. Beddome - *The flora sylvatica for southern India* (1869-1874) and *Icones Plantarum Indiae Orientalis* (1868-1874), with illustrations in 6 volumes has taken 15 years for completion. *Flora of Nilgiris* (1876, 1880); *Flora of Tinnevely* (1877) are the other important contributions by R. H. Beddome. *Coloquis dos simple*, written by Garcia de Orta in 1563, is the earliest botanical treatise on the flowering plants of Western Ghats to be published and is regarded as the first catalogue of Indian medicinal plants. *Hortus Malabaricus* (1678-1693), the earliest printed work on the flora of Asia and Tropics is considered as a renowned work in Latin language by Dutch Governor of Malabar, Van Rheedee. It covers taxonomy and medicinal uses of plants in Western Ghats region especially from Goa to Kanyakumari. This is a voluminous work done over a period of 30 years in 12 volumes of 200 pages each with 794 copper plates. Manilal, the eminent scientist and retired professor from the Department of Botany, University of Calicut translated the world famous *Hortus Malabaricus* into English and Malayalam in 2003 and 2008 respectively. Hooker published *Flora of British India* during 1875-1897 in 7 volumes.

Britons divided India into two: Presidencies and Provenances, hence the regional floras were named after Presidencies and Provenances. Peninsular India was once under Madras and Bombay presidencies. Cooke (1901-1908) published *Flora of presidency of Bombay* in 3 volumes after 30 years of work and thereafter Gamble ((1915-1936) contributed *Flora of presidency of Madras*.

Floristic works from South India

Forest trees of Travancore by Bourdillon (1908) is considered as the first floristic work which describes about 582 trees of Travancore region. Rama Rao (1914) published *Flowering plants of Travancore* which comprises data from southern districts of Kerala as well as Tirunelveli and Kanyakumari districts of Tamil Nadu. Lushington (1915) published *Vernacular list of trees, shrubs and woody climbers of Madras Presidency*. After 6 years, Fischer (1921) contributed to *A survey of flora of Anaimalai hills Coimbatore district, Madras Presidency*. Later Fyson (1932) documented the floristic diversity of *South Indian hill stations*. Aiyar (1932) published *The Shola of Palghat division: a study in the ecology and silviculture of the tropical rain forests of Western Ghats. A preliminary survey of forests of India & Burma* was done by Champion (1936). Burkill (1965) discussed the contributions of various workers, in *Chapters on the history of Botany in India*. Meher-Homji (1967-1969) documented *Phytogeography of south Indian hill stations and some observations in the succession of vegetations around Kodaikanal*. Later, Manilal (1980) discussed about *Implication of Hortus Malabaricus with the Botany and History of Peninsular India*. Rao & Razi (1981) together contributed to the work *A synoptic flora of Mysore district*.

The flora of presidency of Madras is considered as the number one regional flora. After the publication of the *Flora of presidency of Madras*; Botanical Survey of India (BSI), southern circle headquartered at Coimbatore, took the initiative to explore south India which resulted in the discovery of several novelties. Karthikeyan & Kumar (1983) and Nair & Daniel (1986) listed such novelties in South Indian floristics. District floras were also studied by BSI, in order to revise the *Flora of India*. Some universities also took part in that initiative and this is going on since past three decades. Manilal & Raveendrakumar, (1998) listed 625 new taxa from Kerala which were not documented in the *Flora of Presidency of Madras*. Botanical Survey of India (BSI) published numerous regional and local floras as an effort to provide a complete floristic documentation of India. In *Flora of Tamil Nadu – Carnatic* K.M. Matthew (1981 a & b 1983), provides a detailed description about deciduous floristic elements. Later *Flora of Tamil Nadu, India* (Nair & Henry, 1983; Henry *et al.*, 1987 & 1989), *Flora of Karnataka* (Sharma, 1984) came into reality as a result of efforts to

document novel taxa. Some volumes of *Flora of India* were published by Sharma *et al.*, (1993 a, 1993 b, 1993 c) and Hajra *et al.* (1995).

Some revisionary studies were conducted by various workers such as *Revision of the genus Psychotria* (Deb & Gangopadhyay, 1989); *Observation in the aquatic angiosperms of Malabar exclusively north Kerala* (Joseph, 1991); *Bladderworts of India* (Janarthanam & Henry, 1992); *Revision of the genus Pavetta* (Rout & Deb, 1999); *Monograph on Indian Leucas* (Singh, 2001); *The Indian Verbenaceae, a taxonomic revisionary studies* (Rajendran & Daniel, 2002); *Taxonomic revision of Hedyotis in Indian subcontinent* (Dutta & Deb, 2004); *Morphologic and taxonomic studies of the genus Leucas R.Br. (Lamiaceae) in southern Peninsular India* (Sunojkumar, 2005); *Strobilanthes in Peninsular India* (Venu *et al.*, 2006); *Taxonomic studies on Gentianaceae Juss. in south India* (Shahina, 2014); *Taxonomic studies on the family Linderniaceae in south India* (Prasad, 2015); *Taxonomic studies on family Gesneriaceae Rich. & Juss. in South India supplemented with molecular data* (Janeesha, 2017); *A study on systematic and phylogenetic relationships of Asian Leucas (Lamiaceae: Lamioideae) based on molecular methods* (Vimal, 2017) and *Taxonomic revision and molecular phylogeny of the genus Plectranthus L' Hér. (Lamiaceae) in India* (Smitha, 2018).

Other than revisionary works, some workers studied about rare and endemic plants such as *Rare and threatened flowering plants of south India* (Henry *et al.*, 1978); *The Indian plant red data book* (Jain & Sastry, 1984); *Discovery of some rare and interesting Asclepiads from Kerala* (Sasidharan & Swarupanandan, 1994); *Camp on strict endemics of Agasthyamala Hills* (Gopalan & Henry, 2000); *IUCN red list of threatened species* (IUCN, 2010 & 2012) and *Strict endemics of Kerala with special reference to its ethnobotany* (Shaju, 2010).

Additional to the above mentioned works, some checklists were published including *Addition to flora of Kerala since Gamble 1935* (Manilal & Raveendrakumar, 1998); *Flowering plants of Kerala* (Sasidharan, 2013) and *Flowering plants of Western Ghats* (Nayar *et al.*, 2014).

Floristic works from Kerala

The state of Kerala is rich in diverse habitats and plant diversity. It is very essential to document the floristic richness of various districts of Kerala in order to implement the conservation measures and for the sustainable utilisation of natural resources. Floristic studies were initiated in Kerala from 1980s onwards. Vivekanathan (1981) marked the beginning of floristic studies of Kerala by documenting the floristic wealth of second largest district, Idukki. Manilal & Sivarajan (1982) published the *Flora of Calicut* and listed 983 species in 566 genera and 132 families. After two years, Mohanan (1984) studied floristic diversity of Quilon district. *Flora of Cannanore* was published by Ramachandran & Nair (1988) and reported 1132 species in 658 genera. Manilal (1988) documented *Flora of Silent valley Tropical rain forests of India* and listed 966 flowering plants in 559 genera and 234 families. Vajaravelu and Babu (1990) documented floristic richness of two districts of Kerala, *Palghat* and *Malappuram*. *Flora of Palghat* describes 1355 species in 737 genera and 196 families and *Flora of Malappuram* listed 813 angiosperms belonging to 511 genera under 122 families. *Flora of Thiruvananthapuram* by Mohanan & Henry (1994) describes 1336 species in 251 genera and 195 families. Subramaniyan (1995) studied *Flora of Thenmala division*. Sasidharan (1996) published the *Flowering plants of Thrissur forest* and Sasidharan & Sivarajan (1996) published *Flowering plants of Thrissur district* which includes the description of 1225 species in 703 genera and 129 families. Sivarajan & Philip Mathew (1997) documented *Floristic diversity of Nilambur* which includes 1132 species in 665 genera. Swarupananthan *et al.*, (1998) studied about the shola forest of Kerala. Sasidharan (1999) documented *Floristic diversity of Shenduruny wildlife sanctuary* and Pradeep (2000) studied *Floristic diversity of Vellarimala*. Mohanan & Sivadasan (2002) published *Flora of Agasthyamala hills* describing 1117 plants in 585 genera. In 2005, Anilkumar *et al.*, documented floristic richness of Pathanamthitta district with 1249 species in 658 genera and 148 families. *Angiosperm flora of Kerala* (Volume 1) - a publication by BSI was done by Nayar *et al.*, (2006). Floristic documentation of Wayanad and Alappuzha were done by Ratheesh Narayanan; Sunil & Sivadasan respectively (2009). *Flora of Alappuzha district* reported 1111 angiosperms in 617 genera and *Flora of Wayanad* documented 2034 species belonging to 903 genera under 171 families. *Riparian flora of the Chalakkudy river basin and its ecological significance* was studied by Amitabachan (2010).

Floristic and ecological studies on Madayipara Lateritic plateau of northern Kerala and *Flora of Achankovil forest* were published by Pramod (2015) and Mathew (2013). *Phytosociology and plant diversity of Attapady forest* was documented by Anil kumar (2015).

Studies on the *Flora of Kasargod division, Cannanore district* (Ansary, 1985); *Flora of Kottayam district* (Antony, 1989); *Flora of Malappuram district excluding Nilambur forest* (Babu, 1990); *Flora of Shenduruny wildlife sanctuary* (Sasidharan, 1997); *Flora of Chinnar wildlife sanctuary* (Sasidharan, 1999); *Flora of Periyar Tiger Reserve* (Jomy Augustine, 2000) and *Flora of Parambikulam wildlife sanctuary* (Sujanapal, 2005) were documented in detail by various research workers as the part of their PhD programme.

Floristic studies from Idukki district

Beddome (1883) initiated botanical collection from Idukki by exploring Peerumedu and adjacent Anamudi. Rama Rao (1914) cited various places of Idukki in his floristic work. Barnes (1939) studied the family Geraniaceae of high ranges; the study about forest types of Idukki were done by Iyppu (1955) and Chandrasekharan (1962). A brief account on the flora of Anamudi and Devikolam was published respectively by Sebastine & Vivekananthan (1967) and Shetty & Vivekananthan (1971). In 1978, Vivekananthan studied the floristic wealth of Periyar Tiger Reserve and listed 12 rare and threatened plants. Several new taxa were discovered from the district by various researchers such as Shetty & Vivekananthan (1968, 1969, 1970, 1971, 1972, 1973, 1975 & 1991), Sharma *et al.*, (1974), Nayar (1974), Nagendran *et al.*, (1975), Sreekumar *et al.*, (1983 a, 1983 b), Nair & Sreekumar (1985), Pandurangan & Nair (1993 & 1995), Pandurangan *et al.*, (1985) and Prabhukumar *et al.*, (2013 & 2020). Mohanan *et al.* (1984) reported some rare and interesting plants from the vicinity of Idukki hydroelectric project. As the part of ecological studies in the Pooyamkutty hydroelectric project area, Balasubramanyan *et al.* (1989) listed out some rare and interesting plants. Several protected areas were also considered for floristic documentation and ecological studies by various workers (Shetty & Vivekananthan, 1968, 1969, 1970, 1973 & 1975; Sasidharan, 1996 & 2000; Augustine, 2000; Kishore, 2003; Biju, 2004). Gopalan and Nayar (1973 and 1986) studied about the problems associated with the encroachment and displacement of tribal peoples in the

Cardamom hill reserve from 1958-1970. Sivanandan *et al.*, (1986) studied the impacts of encroachment in floristic wealth of Cardamom hill reserve. The new species and varieties discovered from the study area included: *Leucas vestita* var. *devicolamensis* (Shetty & Vivekananthan, 1968); *Hedyotis santapauui* (Shetty & Vivekananthan, 1969); *Vernonia anaimudica* (Shetty & Vivekananthan, 1970); *Pogostemon travancoricus* var. *devicolamensis* (Shetty & Vivekananthan, 1973); *Gentiana sasidharanii* (Prabhukumar *et al.*, 2020). The results of our research have also led to the recent discovery of two new species to science: *Asyneuma cupulare* (Venugopal *et al.*, 2021) and *Parasopubia raghavendrae* (Venugopal *et al.*, 2021).

Materials and methods

Materials and methods

The methodology for the present study was primarily based on survey of plants and documentation of Flora of Idukki district. In the present work, only gamopetalous plants were surveyed and studied.

Field exploration

Intensive floristic collections were carried out in every season throughout the study area during the period from 2017 – 2021. Altitude of each place was recorded with the help of Global Positioning System (GPS). At least two field trips were conducted per month. Frequent field trips were conducted to the areas of maximum diversity. The time for visiting each area depends on the climatic factors & the topography of the habitat. Dry deciduous forests and scrub jungles were inspected during October – December. The peaks could be climbed only during summer season. After the collection trips of first two years, we made a new strategy for exploration by evaluating specimens collected from previous trips. Almost all accessible areas were explored during the first 3 years. Upon entering in to the 4th year, we planned our trips so as to collect the unattained specimens and missing fruits or flowering twigs.

Meteorological study

The abiotic factors such as climate, soil type, weather, average annual rainfall, average annual temperature, etc. determines the floristic diversity of an area. The meteorological data of the study area were also accessed from various literatures and online sources such as from Indian Meteorological Department, Soil Survey of India, etc.

Plant collection

The flowering or fruiting twigs were taken from plants by using secateurs and the subterranean organs were collected by using digger. About 2-3 specimens of each plant were collected. Herbaceous plants were collected as a whole; all other plants were collected as flowering/fruiting twig. During every field trip we focused to reduce the number of duplicates.

Photographs of habitat and plants were taken using Canon EOS 77 Digital camera. Primary morphological data such as flower colour, odour, etc. which are fugacious were noted in the field book. Colour of vegetative parts were also noted from the field itself. In case of parasitic plants, details of host plants were also recorded. Details of plants growing in home gardens, under cultivation and invasive / introduced plants were also included in the study.

Specimens were collected in air tightened polypropylene bag, tied with rubber band from the field and later preserved in diluted formaldehyde for further laboratory study and for voucher specimen preparation. Very delicate plants such as those of parasites were preserved separately on tissue / blotting paper to maintain their structure. In the absence of generative stages, rhizome / subterranean organs were collected and grown in the botanical garden of the University of Calicut and details were recorded during blooming stage. Flowering and fruiting twigs were preserved in diluted formalin / alcohol for microscopic studies. Various literatures were accessed to ascertain phytogeography and endemism.

Plant description

The photographs of floral parts were taken with a Stemi 508 stereomicroscope attached to an Axiocam 105 color camera (Zeiss, Germany). Details such as habit, habitat, ecology, nature of stems, leaves, inflorescence, flowers, fruits and seeds were noted. Shape, size, colour, pubescence of vegetative and reproductive parts were also recorded. The scientific terms that defines the shape, pubescence of parts, etc. were confirmed with the help of Plant Systematics (Simpson, 2006) and Botanical Latin (Stearn, 1998). Phenology and geographical distribution of each species were also noted.

Plant identification

The specimens were identified with the help of literatures such as Flora of British India (Hooker, 1885), Flora of Presidency of Madras (Gamble, 1921), Flora of Chinnar Wild life sanctuary (Sasidharan, 1999), Flora of Periyar Tiger reserve (Sasidharan, 1998) and relevant revisions, published papers, unpublished thesis, etc. The collected specimens were also compared with the specimens deposited at University of Calicut Herbarium (CALI), Kerala Forest Research Institute (KFRI)

Herbarium and Madras Herbarium (MH) by previous researchers. Some virtual herbaria were also consulted by accessing Index Herbariorum. For updating the present names of each species, IPNI(<http://ipni.org/ipni/plantnamesearchpage.do>), POWO(www.plantsoftheworldonline.org) and World Checklist (<http://apps.kew.org/wcsp/home.do>) were also consulted.

Photo plates

Photographs of habit and floral parts were merged into a photo plate with the help of Adobe Photoshop version CS 7.0. Images of seed micro morphology of selected specimens were captured by Gemini 300 Scanning Electron Microscope (Zeiss, Germany) and included in the photo plate. All photoplates were accompanied by legends to define each floral part with measurements.

Herbarium preparation and systematic arrangement

The voucher specimens were prepared by following Bridson & Forman (1991). The specimens were pressed in between folded sheets of old newspapers & made wet by sprinkling diluted formaldehyde. Field number was also given for each specimen. Each bundle with medium size thickness was sealed in a plastic transparent cover by cello tape after removing air content. The specimens preserved in this manner could last up to almost one week without any damage. Damp newspapers in which the plant specimens were pressed were replaced with dry newspapers daily until the specimen turns completely dry. Each specimen was later dried in herbarium drying cabinet (50 degree Celsius for 24-48 hours) for removing the water content; later they were mounted on standard sized handmade herbarium mount boards using synthetic gum. Herbarium sheets were scientifically labeled on the lower right hand corner. The prepared herbarium sheets were arranged in white coloured species folders and in grey coloured genus folders and deposited at CALI according to the system of classification proposed by Bentham and Hooker. Type specimens of new taxa were deposited at CALI by labeling red coloured type sheet tag.

Herbarium preservation

The specimens were poisoned by brushing each specimen in saturated solution of Mercuric chloride in Ethyl alcohol (6 % Ethanolic solution of Mercuric chloride). Naphthalene balls tied in a muslin cloth bag also prevents infestation of herbarium sheets kept in Pigeon hole. Fumigation was done twice a year using volatile poisonous liquids like Methyl bromide, Carbon disulphide or Carbon tetrachloride and Para dichlorobenzene.

Conservation assessment

Conservation status of each species was confirmed with the help of assessment made by IUCN Petitions and Standard Committee. These data will be of use for undertaking conservation measures of threatened taxa in future.

Key preparation

Most important and diagnostic characters were used for the key preparation. Dichotomous bracketed key was prepared for the identification of family, genera and species.

Typification and nomenclatural notes

Designation of type sheets were done in certain cases in those plants which lacks type specimen and requires reinstatement. Detailed analyses of protologue were done and with the help of Taxonomic Literature, herbarium sheets collected by the original author were accessed. Typification and nomenclatural notes were also provided. A nomenclatural type is that element to which the name of a taxon is permanently attached. Holotype and lectotype were designated to some plant specimens as part of study. Holotype is a particular specimen or illustration designated by author in original publication. Lectotype is a specimen selected from original material cited by author when no holotype exists. Reinstatement is the process of uplifting a particular plant specimen as separate species which was already considered as synonym of another species. In order to solve taxonomic and nomenclatural problems; experts with in the country and abroad were also consulted.

Area of Study

Area of Study

The district Idukki came into existence on January 26, 1972 by adjoining Devikulam, Peerumede and Udumbanchola taluks from Kottayam district and Thodupuzha taluk from Ernakulam district of Kerala. Total geographical area is approximately 4612.23 sq km (Anonymous, 2023). It lies between 9° 15' and 10° 2' latitude and between 76° 37' and 77° 25' longitude. Idukki district is positioned in southern central part of Kerala. The district is bordered by Ernakulam in the northwest and west, Kottayam district in the west and Pathanamthitta district in the south. Northern and eastern boundaries of Idukki district are shared by Tamil Nadu. The high ranges of Idukki is remarkable for the plantation and export of the 'King of spices' (Black pepper) and 'Queen of spices' (Cardamom). Hence the district is also known as spice garden of Kerala. *Anamudi* and *Meesapulimala*, the two highest peaks of South India are in this district.

Etymology

The name of the district is derived from the malayalam word '*Idukku*' meaning narrow gorge.

Dam

Idukki dam, considered as the Asia's largest arch dam is constructed across Periyar River. The river is flowing through the gorge formed between two huge rocks named *Kuravanmala* and *Kurathimala* and is completed in 1974. Even though the district gives noticeable contribution to Kerala and Tamil Nadu by providing renewable energy by exploiting water, wind and solar powers, the land area has inadequacy of transportation facilities due to the topographic limitations.

Administration

The district is peculiar in having 2 revenue divisions which are headquartered at *Idukki* and *Devikulam*. The five taluks present in the district are *Devikulam*, *Udumbanchola*, *Thodupuzha*, *Peerumede* and *Idukki*. For the purpose of convenience in administration, the district is again subdivided into 64 revenue villages, 51 grama panchayats and 8 community development blocks. The district consists of one municipal town, *Thodupuzha* and collectorate is located at *Painavu*.

Energy production

The Idukki dam is famous for its largest hydroelectric project and provides more than 60% of the total power requirement of Kerala. Ramakalmedu is one of the windiest area and tourist villages near Ramakalmedu hosts many private wind farms. Thus district has a major role in the energy production of Kerala.

Rivers and water falls

Out of 3 rivers, two (Periyar and Achankovil Aar) are flowing through west and the rest (Pambar) is flowing through east. The largest river, Periyar originates in the south eastern border of the district and drains along 80% of the district. *Mulla Aar*, *Panni Aar*, *Puyankutti Aar* and *Muthirapuzha Aar* are the tributaries of Periyar River. *Kaliyar Aar* and *Thodupuzha Aar* are the tributaries of Muvattupuzha River which originates from the *Thodupuzha* and *Nagarampara* reserve forests. *Pamba Aar* and *Ten Aar* are tributaries of *Amaravathi* River which drains the north-eastern part of the district. *Azhutha* River, tributary of *Pamba* River drains small area in the southern part of district. Major irrigation projects are absent in the district.

Cheeyappara and *Thommankuthu* are major waterfalls of *Idukki* district.

Land

The district comprises of midland region, Plateau and high ranges. More than 50% of Idukki is covered by forest. Almost 45% of the area is used for cultivation of perennial crops. Cardamom, Tea, Rubber, Coffee and Black pepper are the major cash crops cultivated in the district and among these Black pepper has the least area under cropping (approx. 25%). Some of the largest tea plantations in the world are in this district. Majority of crops are dependent on rain. Though major portion of the district is topographically unsuitable for paddy cultivation, 3000 hectares of land is under rice cultivation.

Demography

According to annual vital statistical report of 2018, population of Idukki is 1,093,156. Population density is 251 inhabitants/sq km. When compared to other districts of Kerala, lowest population density is reported in Idukki with more urban population.

National parks and Wildlife sanctuaries

The four national parks meant for *insitu* conservation in the district of Idukki are – Eravikulam, Pambadum shola, Mathikettan shola and Anamudi shola.

Idukki district also harbours four wildlife sanctuaries –Idukki, Chinnar, Kurinjimala and Periyar wildlife sanctuaries.

Threatened and endemic species protected in this district are: Nilgiri Tahr, Grizzled giant squirrel, Nilgiri wood-pigeon, Elephant, Gaur, Sambar and *Strobilanthes kunthiana*, Nilgiri Langur, Stripe-necked mongoose, Indian porcupine, Nilgiri marten, Small clawed otter, Ruddy mongoose, Dusky palm squirrel, Albino gaur, Indian star tortoise and White tiger.

Rainfall and Climate

An average rainfall of about 3677 mm is reported in *Marayoor, Kanthaloor, Chinnar* and areas north east of *Anamudi* receives annual rainfall less than 1000 mm. On the other hand, *Peerumedu* and *Neriyamangalam* receives an annual rainfall of around 5000 mm. Intensity of rainfall increases from eastern to western regions of the district; it is because eastern region of district lies in the rain shadow region of Western Ghats. Among the total annual rainfall, 60% is received during South West monsoon. Due to topography of the district, chances for drought are extremely rare here. Heavy rainfall, flood and landslides that occurred during 2018 and 2019 severely affected vegetation of the district. *Munnar* and *Pettimudi* were severely affected by landslides.

Meteorological parameters

Climatic conditions of midland, plateau and hill ranges are highly varied.

a) Temperature

Average monthly minimum temperature ranges from 14.0 to 18.6 degree celsius and maximum temperature from 25.1 to 31.5 degree celsius.

b) Relative humidity

Relative humidity is maximum during the day time (85.0 to 98.45%) and minimum during evening hours (40.8 to 87.3%).

c) Evaporation

Evaporation is reported in maximum during summer months (March – May). It usually ranges from 1.11 to 5.0 mm/day.

d) Sunshine hours

Pleasant sunshine hours are obtained during the months of December to May, with maximum sunshine during February. Average value of sunshine is 1.8 to 9.5 hrs/day. Minimum sunshine hours are recorded during south west monsoon due to the presence of cloudy sky.

e) Wind

Average wind speed ranges from 3.90 to 7.95 km/hour. Wind speed is high during the month of March to July and during November to January (District survey report, 2016).

Major soil and rock types

Four major types of soil identified from the district are forest loams, lateritic soils, brown hydromorphic soils and alluvial soils.

- About 60% of the district is covered by forest and these regions consist of forest loams formed as the result of weathering of rocks. Surface layer of forest loam is rich in organic matter. Due to heavy leaching, forest loam is acidic, high in nitrogen and dark reddish brown to black in colour with loamy to silt loam texture.
- Lateritic soils are mainly seen in *Elamdesam* and *Thodupuzha* taluks which are derived from laterites. This type of soil is very low in plant nutrients and organic matter and is usually well drained. Due to less availability of nitrogen and phosphorous, fertility of soil is very poor.
- Brown hydromorphic soils are usually seen in undulating terrain of valley regions. As the name indicates, this soil is brown in colour and formed as the

result of sedimentation of materials from adjoining hill slopes. Surface texture varies from sandy loam to clay.

- Alluvial soils are fertile soils usually seen along river banks as narrow strips. Their surface texture ranges from sandy loam to clay. Commonly seen along the banks of Thodupuzha River.
- Types of rocks identified from the district are charnockite, hornblende gneiss and granite mass (District survey report, 2016).

Geomorphology

The district comprises of midland region, plateau and high ranges. Except *Thodupuzha* block and western part of *Elamdesam* block, major part of the district is in the hill ranges of Western Ghats. The hill ranges can be again divided in to high ranges, foot hills and plateau regions.

- The places in the north eastern part of the district belong to high ranges with mountains of altitude more than 1500 m msl. Anamudi, the highest peak in South India belongs to high range. This region also consists of many steep falls.
- Foot hills are narrow strip of land formed at the point where midland regions adjoins plateau regions. Elevation ranges between 80 to 500m msl and the slope is usually very steep.
- Major portion of the district belongs to the last category, plateau. The land mass is usually moderately slope (> 30%) and elevation is less than 1500 m msl with many deep cut streams.

Tourist spots

Munnar, Vagamon, Ramakkalmedu, Thekkady and Marayur are the major tourist spots in the district.

Tribal communities

In Kerala, among all districts, Idukki hosts second position in tribal population. Majority of tribal communities resides in *Munnar*, *Marayur*, *Mankulam*, *Adimali* and *Udumbannur*. Almost 33 tribal settlements are reported in the district including

Venmani, Moothampadi, Poovanthikudi, Vellallu, Kizhakkemattukkatta, Mullaringad, Kannambadi, Nadukani, Memanikkudi, Koovakandam and Kurukkanad. Approximately 55,815 tribal people reside in the district. Most of the tribal communities inhabit the mountains of Western Ghats and forests which border Tamil Nadu and Karnataka, so that there exist intermingling of language, custom & rituals. The tribals of Idukki comprises of *Malaipandaram, Malappulayan, Malayarayan, Urali, Muthuvan, Paliyas* and *Mannan*.

- *Hill pulayas* resides in *Kummithankuzhi, Thattikad, Nachivayal, Malakkad* and *Chavakkalam* areas of *Chinnar* and *Marayoor* villages. There are 3 subgroups to this community: *Kurumbapulaya, Karavazhipulaya* and *Pambupulaya*. Their main resource is land.
- *Mala arayans* usually resides in *Peerumedu, Devikolam* and *Thodupuzha*. Usually this community earn their livelihood by shifting cultivation, hunting and food gathering.
- Another tribal community ethnic to Idukki district is *Muthuvan*. It is believed that they usually carry children and belongings on their back; hence they got the name. They are usually agriculturalists, hunters and rubber tappers.
- *Uraly* is another tribal community employed as soldiers. Land is the main resource of *Uraly* and they have the right to cultivate in forest land. Women of this community are experts in making fine reed mats, winnowing fan and baskets, etc.
- *Mannan* resides throughout Idukki. They are basically agriculturalists and their traditional occupation is laundry.
- *Malaipandaram* or *Malampandaram*, have knowledge about herbs and their medicinal properties. They usually collect medicinal herbs from forests and still utilize the natural resources to cure chronic diseases. They earn livelihood from hunting and gathering.
- *Paliyas* usually collect forest products and earn their living by selling them (Bijumon & Jose, 2015).

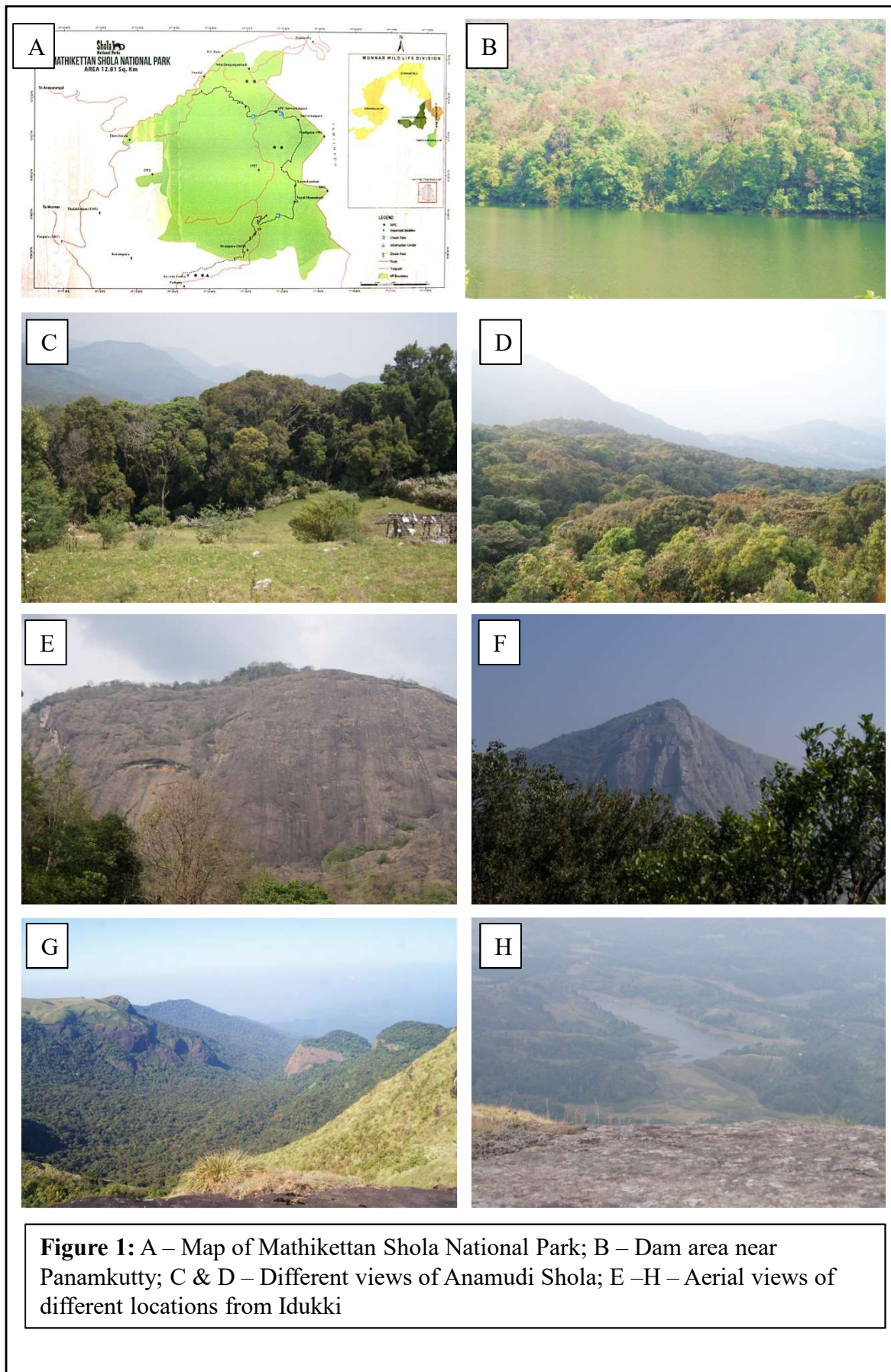




Figure 2: A & B – Stream flowing through Mankulam forest; C – Stream on the way to Santhanpara; D – Mathikettan Shola National Park; E – Anayirangal Dam; F – Lakkam water falls; G & H – Views from Chinnar

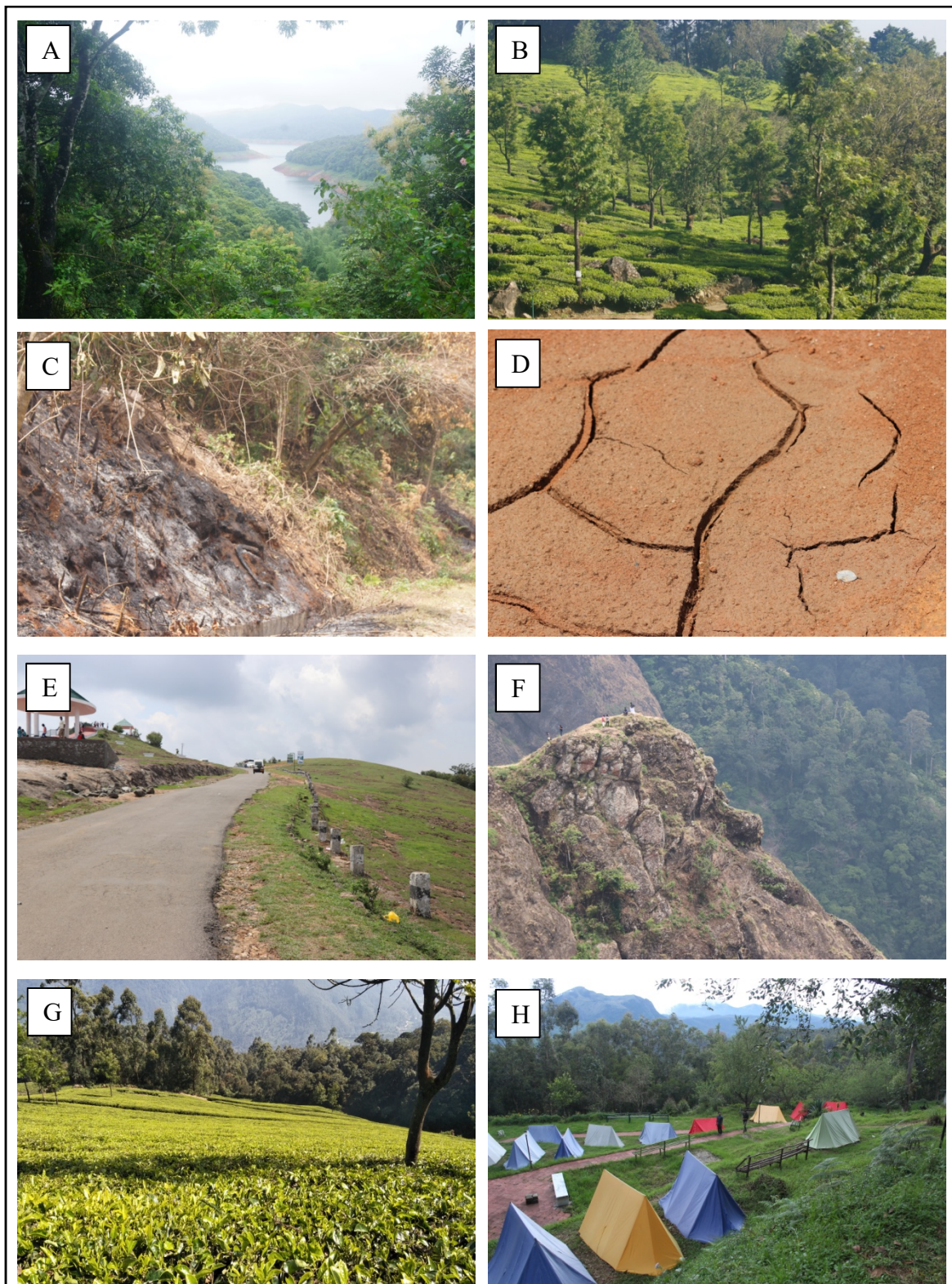


Figure 3: Reasons for decline in vegetation in Idukki; A – Dam catchment area; B & G– Tea plantations; C – Forest fire; D – Drought during summer; E & F – Tourism in Parunthumpara; H – Tourism in Meesapulimala



Figure 4: A – Way to Anamudi Peak; B – Meesapulimala 8 th plot; C – Cheeyapara water falls; D – Meesapulimala; E & F – Dam area; G – Way to Anamudi peak; H – Tributary of Periyar river

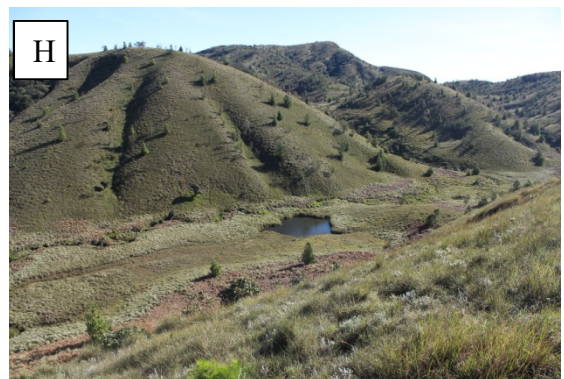
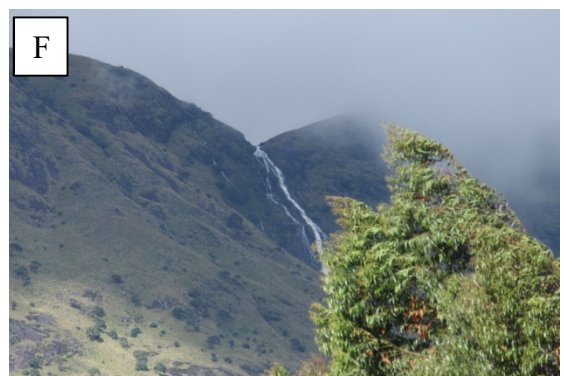


Figure 5: A – Old tunnel in Erattayar; B-H – Views from Meesapulimala



Figure 6: A – Meesapulimala; B – View from Kanthalloor; C – Forest area at Kadalaar; D – Tribal house at Pettimudi; E-H – Views from Anamudi Peak

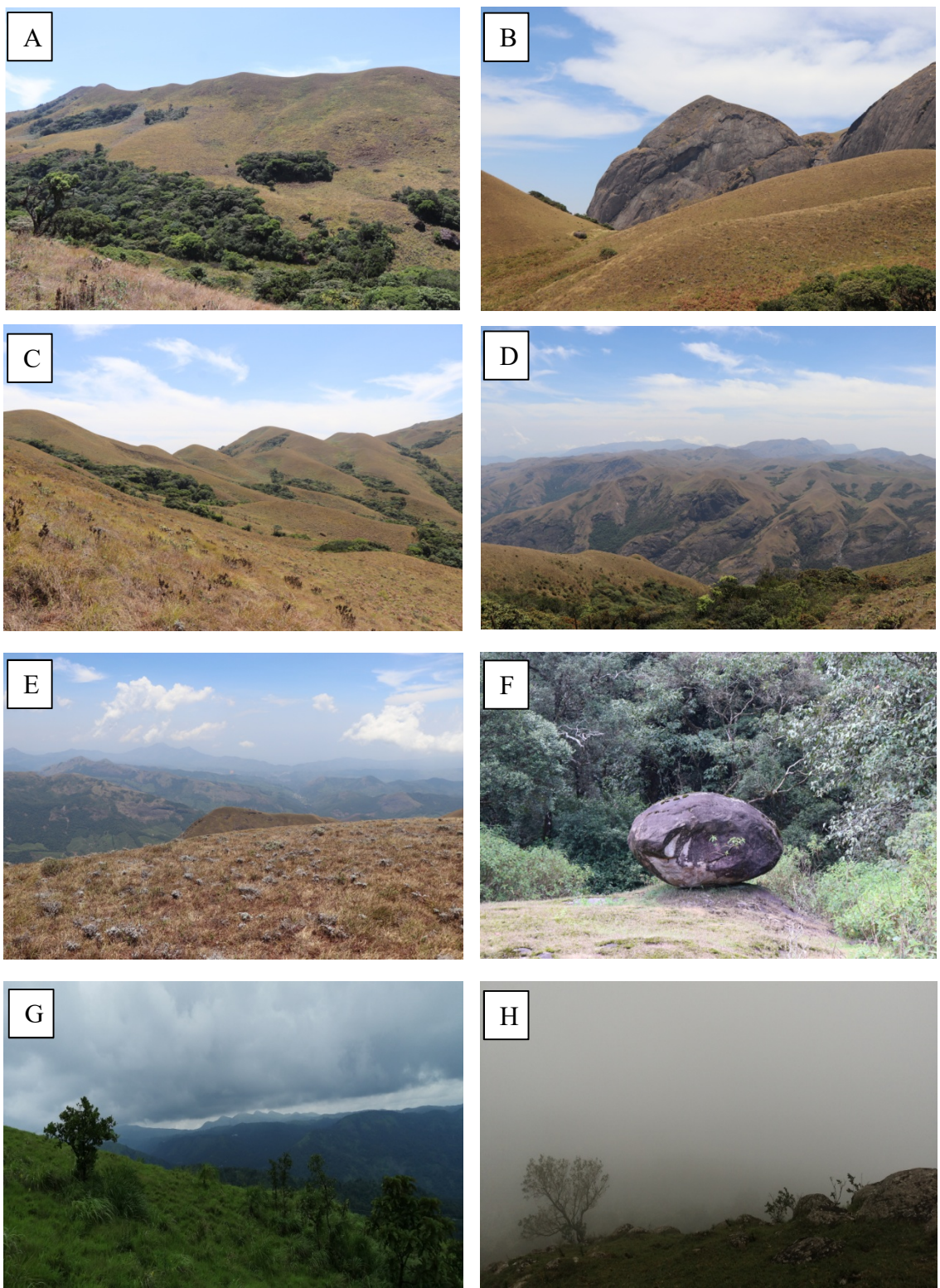


Figure 7: A-E – Views from Meesapulimala and Anamudi peaks; F – Mankulam; G&H – Views from Vaguvarai

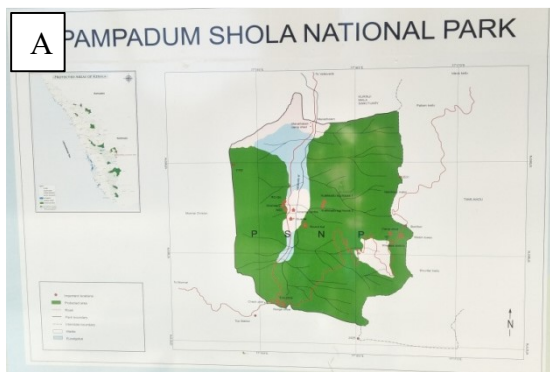


Figure 8: A – Map of Pambadum Shola: B – Meesapulimala

Area of study



Figure 9: Map of Kerala State



Figure 10: Idukki District

Results

Results

Results are arranged in the following pattern. Dichotomous bracketed keys for the 32 gamopetalous families recorded from the study area has been prepared for the easy identification of families. The description of the families are arranged in chronological order of Bentham & Hooker's system of classification which is followed by key to genera and key to species. Each species is described in detail with respect to its morphology, distribution and habitat. References from important floras with respect to each species is given. Details of live and herbarium specimens examined for the identification is also presented. Lastly photo plates of some of the collected plants has also been arranged.

Family key

1a. Flowers in capitulum	<i>Asteraceae</i>
1b. Flowers not in capitulum.....	2
2a. Flowers sessile	<i>Valerianaceae</i>
2b. Flowers not sessile	3
3a. Stipules present	<i>Rubiaceae</i>
3b. Stipules absent	4
4a. Plants parasites	5
4b. Plants not parasites.....	6
5a. Leaves absent; stamens 4	<i>Orobanchaceae</i>
5b. Leaves present; stamens 2.....	<i>Lentibulariaceae</i>
6a. Leaves glandular	7
6b. Leaves not glandular	8
7a. Corolla tube absent.....	<i>Myrsinaceae</i>
7b. Corolla tube present	9
8a. Stigma entire	10
8b. Stigma lobed	11
9a. Style single	12
9b. Style not single.....	13
10a. Corolla deciduous.....	<i>Vacciniaceae</i>
10b. Corolla not deciduous	14

11a. Herbs with milky latex	<i>Campanulaceae</i>
11b. Herbs without milky latex.....	15
12a. Glands present at the base of flower stalk.....	<i>Pedaliaceae</i>
12b. Glands absent.....	<i>Bignoniaceae</i>
13a. Heterostyly present.....	<i>Primulaceae</i>
13b. Heterostyly absent.....	16
14a. Stamens numerous	17
14b. Stamens 4 or 5.....	18
15a. Plant aromatic; gynobasic style present	<i>Lamiaceae</i>
15b. Plant not aromatic; gynobasic style absent	19
16a. Style 2; anthers versatile	<i>Hydrophyllaceae</i>
16b. Style 5; anthers not versatile	<i>Plumbaginaceae</i>
17a. Fruit capsule.....	20
17b. Fruit berry.	21
18a. Gynostegium present.....	<i>Apocynaceae</i>
18b. Gynostegium absent.....	22
19a.Bracts petaloid enclosing flower	<i>Acanthaceae</i>
19b.Bracts not petaloid	23
20a. Capsule with persistent calyx.....	<i>Symplocaceae</i>
20b. Capsule without persistent calyx	<i>Ericaceae</i>
21a. Plants produce white latex	<i>Sapotaceae</i>
21b. Plants do not produce white latex	<i>Ebenaceae</i>
22a. Corolla lobes regular	24
22b. Corolla lobes bilipped.....	25
23a. Seeds 1 or 2	<i>Oleaceae</i>
23b. Seeds more than 2	<i>Verbenaceae</i>
24a. Plants with rhizome.....	<i>Gentianaceae</i>
24b. Plants without rhizome	26
25a. Nectariferous glands present between ovary and petals	<i>Gesneriaceae</i>
25b. Nectariferous glands absent	<i>Scrophulariaceae</i>
26a. Follicles & milky sap present.....	<i>Asclepiadaceae</i>
26b. Follicles & milky sap absent.....	27
27a. Seeds winged.....	<i>Loganiaceae</i>

27b. Seeds not winged	28
28a. Stamens 4	29
28b. Stamens 5	30
29a. Stem present; leaves with reticulate venation	<i>Salvadoraceae</i>
29b. Stem absent; leaves with parallel venation	<i>Plantaginaceae</i>
30a. Nectariferous disk present at the base of filaments.....	<i>Boraginaceae</i>
30b. Nectariferous disk absent	31
31a. Flowers with involucre of bracts; seeds 2–4.....	<i>Convolvulaceae</i>
31b. Flowers without involucre of bracts; seeds numerous	<i>Solanaceae</i>

RUBIACEAE Juss.

Gen. Pl. [Jussieu] 196. 1789. *nom. cons.*

Herbs, shrubs or trees; non-laticiferous (Delta Intkey, 2023). Stem may be spiny. Leaves simple, opposite or whorled, entire, stipulate. Inflorescence panicle or cyme. Flowers regular, bisexual. Pollination entomophilous (Delta Intkey, 2023). Calyx tubular; lobes 4 or 5. Corolla tubular, hairy; lobes 4 or 5. Stamens as many as corolla lobes, inserted; anthers dorsifixed. Style simple. Stigma in various shapes. Fruit berry, capsule or drupe.

According to POWO 2022, Rubiaceae consists of 609 accepted genera worldwide.

Key to Genera

1a. Plant exstipulate	<i>Galium</i>
1b. Plant stipulate.....	2
2a. Stem spiny.....	3
2b. Stem not spiny.....	4
3a. Flowers solitary.....	<i>Catunaregam</i>
3b. Flowers not solitary.....	5
4a. Flowers solitary.....	6
4b. Flowers not solitary.....	7
5a. Stamen inserted	<i>Benkara</i>
5b. Stamen exserted	8
6a. Leaves opposite-superposed; filaments present.....	<i>Dentella</i>
6b. Leaves opposite-decussate; filaments absent.....	<i>Gardenia</i>
7a. Flowers in raceme	<i>Neurocalyx</i>
7b. Flowers in cyme.....	9
8a. Fruit drupe.....	<i>Canthium</i>
8b. Fruit capsule.....	<i>Rubia</i>
9a. Filaments present	10
9b. Filaments absent.....	11
10a. Fruit berry.....	12
10b. Fruit capsule.....	13
11a. Flowers sessile	14
11b. Flowers not sessile	15
12a. Stamens 4	16
12b. Stamens 5	17

13a. Stamens 4	18
13b. Stamens 5	19
14a. Fruit berry.....	<i>Chassalia</i>
14b. Fruit capsule.....	20
15a. Fruit berry.....	<i>Mycetia</i>
15b. Fruit capsule.....	<i>Psydrax</i>
16a. Style entire	21
16b. Style bifid.....	<i>Ixora</i>
17a. Plants tree.....	22
17b. Plants shrub.....	23
18a. Roots arises from nodes	<i>Anotis</i>
18b. Roots absent from nodes.....	24
19a. Flowers sessile	25
19b. Flowers not sessile	<i>Ophiorrhiza</i>
20a. Leaves glabrous; corolla white.....	<i>Lasianthus</i>
20b. Leaves pubescent; corolla pink.....	<i>Neanotis</i>
21a. Flowers sessile	<i>Saprosma</i>
21b. Flowers not sessile	<i>Pavetta</i>
22a. Leaves opposite-superposed; cymes axillary	<i>Aidia</i>
22b. Leaves opposite-decussate; cymes terminal	<i>Mitragyna</i>
23a. Calyx lobe transformed into coloured leaf.....	<i>Mussaenda</i>
23b. Calyx lobe not transformed into coloured leaf	<i>Psychotria</i>
24a. Stem terete.....	<i>Argostemma</i>
24b. Stem quadrangular	<i>Spermacoce</i>
25a. Stigma bilobed	<i>Hedyotis</i>
25b. Stigma entire	26
26a. Plant tree; corolla purple	<i>Neonauclea</i>
26b. Plant herb; corolla white	<i>Richardia</i>

***Aidia* Lour.**

Fl. Cochinch.: 143.1790.

Aidia gardneri (Thwaites) Tirveng., Bull. Mus. Natl. Hist. Nat., Sér. 3, Bot. 35: 11.1978; Sasidh., Fl. Periyar Tiger Reserve 168. 1998. *Randia gardneri* (Thwaites)

Benth. & Hook.f., Gen. Pl. 2: 88.1873; Hook.f., Fl. Brit. India 3: 11. 1882; Gamble, Fl. Madras 2: 617. 1921.

Tree. Stem terete, woody, warty. Leaves simple, opposite, elliptic, 2–6 × 1.5–3 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Stipules triangular, pubescent, green. Flowers in axillary cymes. Peduncle terete, 3–5 cm long, greenish brown, pubescent. Pedicel terete, 8–10 mm long, green, pubescent. Calyx tube short, green, pubescent; lobes 5, minute, apex acute, green, pubescent. Corolla tube 2–3 cm long, white, pubescent; lobes 5, 1 cm long, apex obtuse, white, pubescent. Stamens 5, inserted; filaments slender, white, pubescent; anthers bilobed, linear, 2–3 mm long, white, glabrous. Style slender, white, pubescent. Stigma bifid, minute, white, glabrous. Berry globose, 5–7 mm long, purple, glabrous.

Distribution: Tropical Africa, Tropical & Subtropical Asia to West Pacific (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January–July

Specimen examined: India, Kerala, Idukki, Mankulam, 16/06/2018, Divya K. Venugopal 151366 (CALI).

Anotis DC.

Prodr. 4: 431.1830.

Anotis leschenaultiana (Wight & Arn.) Benth. & Hook.f., Fl. Brit. India 3: 72.1880; Gamble, Fl. Madras 2: 604. 1921.

Herb. Stem terete, brownish green, pubescent, roots arises from nodes. Leaves simple, opposite, ovate, 8–10 × 2–3 cm, apex acute, base round, margins entire, green, white tomentose, petiolate. Stipules ovate, green, villous. Flowers in axillary and terminal cymes. Peduncle terete, 2–6 cm long, green, villous. Pedicel terete, 5–8 mm long, green, villous. Calyx tube minute, green, pubescent; lobes 4, minute, apex acute, green, pubescent. Corolla tube pink, pubescent; lobes 4, 2–5 mm long, apex acute, pink, pubescent. Stamens 4, at the mouth of corolla tube; filaments short, white, glabrous; anthers bilobed, linear, minute, white, glabrous. Style filiform, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule globose, green, pubescent.

Distribution: South West India, Jawa (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: October–December

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 11/10/2018, Divya K. Venugopal 158473 (CALI).

***Argostemma* Wall.**

W. Roxburgh, Fl. Ind. 2: 324.1824.

Argostemma courtallense Arn., Ann. Nat. Hist. 3: 22.1839; Hook.f., Fl. Brit. India 3: 42. 1882; Gamble, Fl. Madras 2: 590. 1921; Sasidh., Fl. Periyar Tiger Reserve 168. 1998.

Figure 11 H.

Herb. Stem terete, green, pubescent. Leaves simple, opposite, orbicular, 6–8 × 3–4 cm, apex acute, base round, margins entire, green, pubescent, petiolate. Stipules ovate, 3–5 mm long, green, pubescent. Flowers in terminal cymes. Peduncle terete, 3–6 cm long, green, pubescent. Pedicel terete, 6–8 mm long, green, pubescent. Calyx tube minute, green, pubescent; lobes 4, apex acute, green, pubescent. Corolla tube white, glabrous; lobes 4, 3–4 mm long, apex acute, white, glabrous. Stamens 4, inserted; filaments slender, 5–7 mm long, white, glabrous; anthers bilobed, lanceolate, 4–5 mm long, yellow, glabrous. Style slender, 4–6 mm long, white, glabrous. Stigma capitate, minute, white, glabrous. Capsule ellipsoid, green, glabrous.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: July–November

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 17/11/1993, Jomy Augustine 16267 (CALI); Way to Ayyappan Temple, Devikulam, 02/09/1977, N.C. Nair 50798 (MH); Mankulam, 13/07/2017, Divya K. Venugopal 152857 (CALI).

***Benkara* Adans.**

Fam. Pl. 2: 85.1763.

Benkara malabarica (Lam.) Tirveng., Taxon 32: 440.1983; Hook.f., Fl. Brit. India 3: 111. 1882; Gamble, Fl. Madras 2: 616. 1921; Sasidh., Fl. Chinnar WLS 145. 1999.

Shrub. Stem terete, green, spiny. Leaves simple, opposite, obovate, 3–6 × 1.25–3 cm, apex obtuse, base cuneate, margins entire, green, glabrous, petiolate. Stipules ovate, green, glabrous. Flowers in axillary cymes. Peduncle terete, 3–5 cm long, green, glabrous. Pedicel terete, 4–6 mm long, green, glabrous. Bracts minute, free, green, glabrous. Bracteoles numerous, minute, green, glabrous. Calyx tube 3–4 mm long,

green, glabrous; lobes 5, minute, apex acute, green, glabrous. Corolla tube 4–7 mm long, white, pubescent; lobes 5, apex acute, white, pubescent. Stamens 5, exserted; filaments slender, white, glabrous; anthers bilobed, linear, 2 mm long, white, glabrous. Style slender, white, glabrous. Stigma entire, minute, white, glabrous. Berries globose, c. 1 cm long, green, glabrous.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: November–June

Specimens examined: India, Kerala, Idukki, Marayur, 28/11/1979, *Nambiar 1044* (KFRI); Chinnar, 22/02/2017, *Divya K. Venugopal 152857* (CALI).

***Canthium* Lam.**

Encycl. 1: 602.1783.

Key to species

1a. Filaments absent; stigma capitate..... *C. coromandelicum*

1b. Filaments present; stigma acute *C. rheedei*

Canthium coromandelicum (Burm.f.) Alston, H. Trimen, Handb. Fl. Ceylon 6(Suppl.): 152.1931; Sasidh., Fl. Chinnar WLS 146. 1999. *Canthium parviflorum* Lam., Encycl. 1: 602.1785; Hook.f., Fl. Brit. India 3: 136. 1882; Sasidh., Fl. Periyar Tiger Reserve 170. 1998. *Plectronia parviflora* (Lam.) Bedd., Fl. Sylv. S. India: cxxxiv-5 (1874), *nom. illeg.*; Gamble, Fl. Madras 2: 625. 1921.

Shrub. Stem terete, green, spiny. Leaves simple, opposite, ovate, 5–7 × 3–4 cm, apex acute, base round, margins entire, green, glandular, petiolate. Stipules connate, green, pubescent. Flowers in axillary cymes, sessile. Peduncle terete, green, glabrous. Calyx tube short, green, glabrous; lobes 4, 2–4 mm long, apex acute, green, pubescent. Corolla tube 4–5 mm long, white, pubescent; lobes 4, apex acute, white, pubescent. Stamens 4, inserted; filaments absent; anthers bilobed, lanceolate, 3–4 mm long, white, glabrous. Style stout, white, glabrous. Stigma capitate, large, white, glabrous. Drupe subglobose, 1–2 cm long, green, glabrous.

Distribution: South India, Sri Lanka, Bangladesh (POWO, 2022)

Habitat: Deciduous forests

Flowering and fruiting: January–June

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 06/02/1997, *Jomy Augustine 17199* (CALI); Chinnar, 05/04/2018, *Divya K. Venugopal 154117* (CALI).

Canthium rheedei DC., Prodr. 4: 474.1830; Hook.f., Fl. Brit. India 3: 134. 1882; Sasidh., Fl. Periyar Tiger Reserve 170. 1998. *Plectronia rheedei* (DC.) Bedd., Fl. Sylv. S. India: cxxxiv-5.1874; Gamble, Fl. Madras 2: 625. 1921.

Shrub. Stem terete, green, spiny. Leaves simple, opposite, ovate, 2–5 × 1.5–3 cm, apex acute, base round, margins entire, green, glandular, petiolate. Stipules filiform, green, glabrous. Flowers in axillary cymes. Peduncle terete, c. 1 cm long, green, glabrous. Pedicel terete, minute, green, glabrous. Calyx tube short, green, glabrous; lobes 4, minute, apex slightly acute, green, pubescent. Corolla tube 3–5 mm long, white, pubescent; lobes 4, 3–4 mm long, apex acute, white, pubescent. Stamens 4, inserted; filaments slender, 2–3 mm long, white, glabrous; anthers bilobed, lanceolate, c. 2 mm long, white, glabrous. Style stout, white, glabrous. Stigma acute, white, glabrous. Drupe subglobose, c. 1 cm long, green, glabrous.

Distribution: West & South India, Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: March-June

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 22/04/2016, *S. Syam Radh 149111* (CALI); On the way to Chinnar, 18/05/1999, *M. Shamina 78925* (CALI); Periyar Tiger Reserve, 25/04/1995, *Jomy Augustine 15014* (CALI); Mankulam, 13/05/2018, *Divya K. Venugopal 152857* (CALI).

***Catunaregam* Wolf**

Gen. Pl.: 75.1776.

Key to species

1a. Flowers terminal; stamens inserted; berry obovoid *C. spinosa*

1b. Flowers axillary; stamens exserted; berry globose *C. torulosa*

Catunaregam spinosa (Thunb.) Tirveng., Bull. Mus. Natl. Hist. Nat., Sér. 3, Bot. 35: 13.1978; Sasidh., Fl. Periyar Tiger Reserve 170. 1998. *Randia spinosa* (K.Schum.) Loes., Verh. Bot. Vereins Prov. Brandenburg 65: 109 (1923), *nom. illeg.*, Hook.f., Fl. Brit. India 3: 110. 1882. *Randia dumetorum* (Retz.) Poir., J.B.A.M.de Lamarck, Encycl., Suppl. 2: 829.1812; Gamble, Fl. Madras 2: 616. 1921.

Tree. Stem terete, green, spiny. Leaves simple, opposite, obovate, 2–4 × 1.5–2 cm, apex obtuse, base cuneate, margins entire, green, pubescent, petiolate. Stipules ovate, green, glabrous. Flowers solitary, terminal. Pedicel terete, minute, green, glabrous. Calyx tube short, green, pubescent; lobes 5, minute, apex acute, green, pubescent.

Corolla tube 5–7 mm long, white, pubescent; lobes 5, 8–10 mm long, apex obtuse, white, pubescent. Stamens 5, inserted; filaments absent; anthers bilobed, elliptic, c. 3 mm long, brown, glabrous. Style stout, 9 mm long, white, glabrous. Stigma fusiform, white, glabrous. Berry obovoid, 3–4 cm long, green, glabrous.

Distribution: Pakistan to South China and West Malesia (POWO, 2022)

Habitat: Deciduous forests

Flowering and fruiting: March–December

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 03/06/1994, Jomy Augustine 13803 (KFRI); Chinnar, 27/04/1995, K.K. Sajeev 15574 (KFRI); *ibid.*, 10/03/2018, Divya K. Venugopal 151352 (CALI).

Catunaregam torulosa (Dennst.) Deb & M.Gangop., Nelumbo 54: 267. 2012; Sasidh., Fl. Periyar Tiger Reserve 170. 1998. *Randia brandisii* Gamble, Fl. Madras: 616.1921, *nom. illeg.*

Tree, spiny. Leaves simple, opposite, obovate, 5–6 × 1.5–3 cm, apex obtuse, base cuneate, margins entire, green, pubescent, petiolate. Stipules ovate, green, glabrous. Flowers solitary, axillary. Pedicel terete, minute, green, glabrous. Calyx tube short, green, pubescent; lobes 5, minute, apex acute, green, pubescent. Corolla tube 4–5 mm long, white, pubescent; lobes 5, 6–8 mm long, apex obtuse, white, pubescent. Stamens 5, exserted; filaments absent; anthers bilobed, linear, 3 mm long, brown, glabrous. Style stout, 7 mm long, white, pubescent. Stigma entire, white, glabrous. Berry globose, 3–5 cm long, green, ribbed, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: April–December

Specimen examined: India, Kerala, Idukki, Chinnar, 07/08/2017, Divya K. Venugopal 151320 (CALI).

Chassalia Comm. ex Poir.

J.B.A.M.de Lamarck, Encycl., Suppl. 2: 450.1812.

Chassalia curviflora (Wall.) Thwaites, Enum. Pl. Zeyl.: 150.1859; Sasidh., Fl. Periyar Tiger Reserve 171. 1998; Sasidh., Fl. Chinnar WLS 147. 1999.

Figure 11 G.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite, lanceolate, 12–15 × 3–5 cm, apex slightly acuminate, base cuneate, margins entire, green, glabrous, petiolate.

Stipules connate, green, glabrous. Flowers in terminal cymes, sessile. Peduncle terete, 3–4 cm long, green, glabrous. Calyx tube green, pubescent; lobes 5, minute, apex acute, green, pubescent. Corolla tube 6–7 mm long, purple, pubescent; lobes 5, 2–3 mm long, apex acute, yellow, pubescent. Stamens 5, inserted; filaments absent; anthers bilobed, linear, c. 3 mm long, white, glabrous. Style slender, 4–5 mm long, white, glabrous. Stigma bifid, minute, white, glabrous. Berry globose, 4–5 mm long, purple, glabrous.

Distribution: Indian Subcontinent to South China and West & Central Malesia (POWO, 2022)

Habitat: Degraded forests

Flowering and fruiting: March–October

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 08/05/2015, *S. Syam Radh* 137958 (CALI); Periyar Tiger Reserve, 18/08/1993, *Jomy Augustine* 12220 (CALI); Kuttampuzha, 03/10/1990, *P. Bharghavan* 920930 (MH); Chinnar, 25/04/2017, *Divya K. Venugopal* 151359 (CALI).

***Dentella* J.R.Forst. & G.Forst.**

Char. Gen. Pl.: 25.1776.

***Dentella repens* (L.) J.R.Forst. & G.Forst.**, Char. Gen. Pl.: 26.1776; Hook.f., Fl. Brit. India 3: 42. 1882; Gamble, Fl. Madras 2: 590. 1921; Sasidh., Fl. Periyar Tiger Reserve 171. 1998.

Herb. Stem terete, green, pubescent. Leaves simple, opposite, obovate, 4–6 × 1.5–2.5 cm, apex acute, base cuneate, margins dentate, green, glabrous, sessile. Stipules connate, minute, green, glabrous. Flowers solitary, axillary, sessile. Calyx tube short, green, pubescent; lobes 5, c. 1 mm long, apex acute, green, pubescent. Corolla tube 2–3 mm long, white, pubescent; lobes 5, c. 2 mm long, apex acute, white, pubescent. Stamens 5, inserted; filaments slender, c. 2 mm long, white, glabrous; anthers bilobed, linear, c. 1 mm long, white, glabrous. Style filiform, 2–3 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Drupe globose, 3–4 mm long, green, pubescent.

Distribution: Tropical & Subtropical Asia to West Pacific (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: February–May

Specimen examined: India, Kerala, Idukki, Thoppramkudi, 14/03/2018, Divya K. Venugopal 164627 (CALI).

***Galium* L.**

Sp. Pl.: 105.1753.

Galium asperifolium Wall., W.Roxburgh, Fl. Ind. 1: 381.1820; Gamble, Fl. Madras 2: 656. 1921; Sasidh., Fl. Chinnar WLS 148. 1999. *Galium mollugo* L., Sp. Pl.: 107.1753; Hook.f., Fl. Brit. India 3: 207. 1882.

Twiner. Stem quadrangular, green, pubescent. Leaves simple, whorled, oblong, 5–10 × 1–1.5 cm, apex acute, base cuneate, margins slightly dentate, green, pubescent, sessile, exstipulate. Flowers axillary, solitary. Pedicel quadrangular, 4–5 mm long, green, pubescent. Calyx tube green, glabrous; lobes 4, minute, apex acute, green, glabrous. Corolla tube 3–4 mm long, greenish yellow, glabrous; lobes 4, minute, apex acute, greenish yellow, glabrous. Stamens 5, exserted; filaments absent; anthers bilobed, linear, white, glabrous. Style stout, short, white, glabrous. Stigma large, capitate, white, glabrous. Drupe globose, green, glabrous.

Distribution: Afghanistan to South China and Sri Lanka, Sumatera (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: March–November

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 16/07/2015, S. Syam Radh 145036 (CALI); Munnar, 27/11/1979, Nambiar 875 (KFRI); Anamudi shola, 20/04/2017, Divya K. Venugopal 158256 (CALI).

***Gardenia* J.Ellis**

Philos. Trans. 51(2): 935.1761. *nom. cons.*

Gardenia gummifera L.f., Suppl. Pl.: 164.1782; Hook.f., Fl. Brit. India 3: 116. 1882; Gamble, Fl. Madras 2: 618. 1921; Sasidh., Fl. Chinnar WLS 148. 1999.

Tree. Stem terete, woody, puberulent, spines absent. Leaves simple, opposite-decussate, obovate, 4–6 × 2.5–3 cm, apex obtuse, base round, margins entire, green, glabrous, sessile. Stipules ovate, minute, green, glabrous. Flowers axillary, solitary. Pedicel terete, 3–5 mm long, green, glabrous. Calyx tube 4–6 mm long, green, pubescent; lobes 5, 1–2 mm long, apex acute, green, pubescent. Corolla tube 3–3.5 cm long, white, glabrous; lobes 5, 2–3 cm long, apex obtuse, yellowish white, glabrous. Stamens 5, inserted; filaments absent; anthers bilobed, linear, 3–5 mm long,

white, glabrous. Style stout, thick, 1–2 cm long, white, glabrous. Stigma club shaped, white, glabrous. Berry ellipsoid, 3–4 cm long, green, glabrous.

Distribution: India (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: December-May

Specimens examined: India, Kerala, Idukki, Chinnar, 17/03/1995, K.K. Sajeev 15507 (KFRI); *ibid.*, 11/03/2018, Divya K. Venugopal 151699 (CALI).

***Gynochthodes* Blume**

Bijdr. Fl. Ned. Ind.: 993.1826. *nom. cons.*

***Gynochthodes umbellata* (L.) Razafim. & B.Bremer**, *Adansonia*, sér. 3, 33: 296. 2011. *Morinda umbellata* L., *Sp. Pl.*: 176.1753; Hook.f., *Fl. Brit. India* 3: 157. 1882; Gamble, *Fl. Madras* 2: 652. 1921; Sasidh., *Fl. Periyar Tiger Reserve* 180. 1998; Sasidh., *Fl. Chinnar WLS* 153. 1999.

Climbing shrub. Stem quadrangular, green, glabrous. Leaves simple, opposite, elliptic, 8–10 × 2–3 cm, apex acuminate, base cuneate, margins entire, green, pubescent, petiolate. Stipules ovate, green, glabrous. Flowers in axillary or terminal umbellate. Peduncle quadrangular, 2–4 cm long, green, glabrous. Pedicel quadrangular, minute, green, glabrous. Calyx tube 3–5 mm long, green, glabrous; lobes 4, minute, apex acute, green, glabrous. Corolla tube 3–4 mm long, white, pubescent; lobes 4, 3–5 mm long, apex obtuse, white, pubescent. Stamens 5, exserted; filaments short, white, glabrous; anthers bilobed, oblong, c. 2 mm long, white, glabrous. Style slender, white, glabrous. Stigma bilobed, minute, white, glabrous. Berry pyriform, 7–10 mm long, orange, glabrous.

Distribution: Tropical & Subtropical Asia to West Pacific (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: January-August

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 02/08/1993, Jomy Augustine 12095 (CALI); Kanthallur, 29/01/2018, Divya K. Venugopal 158178 (CALI).

***Hedyotis* L.**

Sp. Pl.: 101.1753.

Key to species

- 1a. Stem terete..... 2
- 1b. Stem quadrangular 3
- 2a. Stem glabrous; corolla white..... *H. affinis*
- 2b. Stem pubescent; corolla pink *H. articularis*
- 3a. Leaves glabrous..... 4
- 3b. Leaves pubescent 5
- 4a. Leaves ovate; corolla pink *H. bourdillonii*
- 4b. Leaves linear; corolla white *H. neesiana*
- 5a. Roots arises from nodes *H. diffusa*
- 5b. Roots absent..... 6
- 6a. Leaves opposite; calyx lobes glabrous *H. fruticosa*
- 6b. Leaves rosette; calyx lobes pubescent *H. wightii*

Hedyotis affinis Roem. & Schult., Syst. Veg., ed. 15 bis 3: 194.1818; Sasidh., Fl. Periyar Tiger Reserve 173. 1998. *Oldenlandia dichotoma* (Cav.) Willd. ex Cham. & Schltl., Linnaea 4: 155.1829, *nom. illeg.*; Hook.f., Fl. Brit. India 3: 67. 1882; Gamble, Fl. Madras 2: 601. 1921.

Herb. Stem terete, green, glabrous. Leaves simple, opposite, linear, 15–20 × 1.5–2 cm, apex acute, base cuneate, margins entire, green, glabrous, sessile. Stipules ovate, minute, green, glabrous. Flowers in terminal cyme, sessile. Peduncle terete, 1–2 cm long, green, glabrous. Calyx tube short, green, pubescent; lobes 5, c. 1 mm long, apex acute, green, pubescent. Corolla tube 2–3 mm long, white, pubescent; lobes 5, c. 1 mm long, apex acute, white, pubescent. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers bilobed, linear, minute, white, glabrous. Style filiform, c. 1 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule obovoid, 2–3 mm long, green, pubescent.

Distribution: Africa, India to Malaya (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: June–October

Specimen examined: India, Kerala, Idukki, Mankulam, 12/07/2017, Divya K. Venugopal 168834 (CALI).

Hedyotis articularis R.Br. ex Wight & Arn., Prodr. Fl. Ind. Orient. 1: 407. 1834. *Hedyotis auricularia* L., Sp. Pl.: 101.1753; Hook.f., Fl. Brit. India 3: 58. 1882; Sasidh., Fl. Periyar Tiger Reserve 173. 1998. *Oldenlandia auricularia* (L.) K.Schum., H.G.A.Engler & K.A.E.Prantl, Nat. Pflanzenfam. 4(4): 25.1891; Gamble, Fl. Madras 2: 597. 1921.

Figure 11 E.

Shrub. Stem terete, brownish green, sparsely pubescent. Leaves simple, opposite, lanceolate, 15–20 × 1.5–2 cm, apex acute, base round, margins entire, green, tomentose, subsessile. Stipules ovate, minute, green, glabrous. Flowers in terminal cyme, sessile. Peduncle terete, green, pubescent. Calyx tube short, green, pubescent; lobes 5, c. 2 mm long, apex acute, green, pubescent. Corolla tube c. 1 mm long, pink, pubescent; lobes 5, minute, apex acute, pink, pubescent. Stamens 5, inserted; filaments slender, >1 mm long, white, glabrous; anthers bilobed, linear, minute, white, glabrous. Style filiform, c. 1 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule obovoid, 2–3 mm long, green, pubescent.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: August–February

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 13/08/1993, Jomy Augustine 16281 (CALI); Mankulam, 14/11/2018, Divya K. Venugopal 168979 (CALI).

Hedyotis bourdillonii (Gamble) R.S.Rao & Hemadri ex N.C.Nair, V.J.Nair & R.Ansari, Bull. Bot. Surv. India 22: 205.1980. Publ.1982; Sasidh., Fl. Periyar Tiger Reserve 174. 1998. *Oldenlandia bourdillonii* Gamble, Bull. Misc. Inform. Kew 1919: 404.1919; Gamble, Fl. Madras 2: 598. 1921.

Shrub. Stem quadrangular, green, pubescent. Leaves simple, opposite, ovate, 2–5 × 1.5–2 cm, apex acute, base cuneate, margins entire, green, pubescent, petiolate. Stipules ovate, green, pubescent. Flowers in terminal cyme, sessile. Peduncle quadrangular, 3–5 cm long, pinkish white, pubescent. Calyx tube short, green, pubescent; lobes 5, c.1 mm long, apex acute, green, pubescent. Corolla tube 3–5 mm long, pink, pubescent; lobes 5, 2–3 mm long, apex obtuse, pink, pubescent. Stamens 5, inserted; filaments absent; anthers bilobed, linear, minute, white, glabrous. Style filiform, 4–5 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule obovoid, green, pubescent.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: October-February

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 23/12/2018, Divya K. Venugopal 168940 (CALI).

Hedyotis neesiana Arn., Nova Acta Acad. Caes. Leop.-Carol. German. Nat. Cur. 18: 341.1836. *Hedyotis nitida* Wight & Arn., Prodr. Fl. Ind. Orient. 1: 412 (1834), *nom. illeg.*; Hook.f., Fl. Brit. India 3: 61. 1882; Sasidh., Fl. Periyar Tiger Reserve 174. 1998. *Oldenlandia nitida* (Kurz) Gamble, Fl. Madras: 597.1921.

Figure 11 D.

Herb. Stem quadrangular, green, pubescent. Leaves simple, opposite, linear, 2–5 × 1.5–2 cm, apex acute, base round, margins entire, green, pubescent, petiolate. Stipules ovate, 3–5 mm long, green, pubescent. Flowers in axillary cyme, sessile. Peduncle quadrangular, 3–4 mm long, green, pubescent. Calyx tube short, green, pubescent; lobes 5, 3–5 mm long, apex acute, green, pubescent. Corolla tube 3–5 mm long, white, pubescent; lobes 5, 2–3 mm long, apex acute, white, pubescent. Stamens 5, inserted; filaments absent; anthers bilobed, linear, c.1 mm long, white, glabrous. Style filiform. Stigma bilobed. Capsule ovoid, glabrous.

Distribution: India to West Malesia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: August-January

Specimens examined: India, Kerala, Idukki, Narkkanam, 18/08/1977, K. Vivekananthan 49693 (MH); Kallar, 07/09/2018, Divya K. Venugopal 169370 (CALI).

Hedyotis fruticosa L., Sp. Pl.: 101.1753. *Oldenlandia fruticosa* (L.) Kuntze, Revis. Gen. Pl. 1: 292.1891; Hook.f., Fl. Brit. India 3: 49. 1882; Gamble, Fl. Madras 2: 597. 1921.

Herb. Stem quadrangular, green, glabrous. Leaves simple, opposite, linear, 1–3 × 0.25–0.5 cm, apex acute, base round, margins entire, green, glabrous, petiolate. Stipules sheathy, green, glabrous. Flowers in axillary and terminal corymbs, sessile. Peduncle quadrangular, 3–5 cm long, green, glabrous. Calyx tube short and broad, green, pubescent; lobes 5, c. 2 mm long, apex acute, green, pubescent, persistent. Corolla tube minute, white, pubescent; lobes 5, 2–3 mm long, apex acute, white, pubescent. Stamens 5, inserted; filaments slender, white, glabrous; anthers bilobed,

elliptic, c. 2 mm long, white, glabrous. Style linear, 2–3 mm long, white, glabrous. Stigma bilobed, c. 2 mm long, white, glabrous. Capsule globose, green, glabrous.

Distribution: South India, Sri Lanka, Myanmar (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: June–October

Specimen examined: India, Kerala, Idukki, Kuttikanam, 27/09/2018, Divya K. Venugopal 159324 (CALI).

Hedyotis diffusa Willd., Sp. Pl., ed. 4, 1: 566.1798. *Oldenlandia diffusa* (Willd.) Roxb., Hort. Bengal.: 11.1814; Hook.f., Fl. Brit. India 3: 65. 1882; Gamble, Fl. Madras 2: 601. 1921. *Hedyotis brachypoda* (DC.) Sivar. & Biju, Taxon 39: 672.1990; Sasidh., Fl. Periyar Tiger Reserve 174. 1998.

Herb. Stem quadrangular, green, pubescent, roots arises from nodes. Leaves simple, opposite, linear, $1-3 \times 0.25-0.5$ cm, apex acute, base cuneate, margins entire, green, glabrous, sessile. Stipules pectinate, c. 3 mm long, green, glabrous. Flowers in axillary cyme, lax, sessile. Peduncle quadrangular, 3–4 mm long, green, glabrous. Calyx tube short and broad, green, glabrous; lobes 5, 3–4 mm long, apex acute, green, glabrous, persistent. Corolla tube minute, white, pubescent; lobes 5, 3–6 mm long, apex acute, white, pubescent. Stamens 5, inserted; filaments slender, white, glabrous; anthers bilobed, elliptic, c. 2 mm long, white, glabrous. Style linear, exserted, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule ovoid, 6–8 mm long, green, glabrous.

Distribution: Tropical & Subtropical Asia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: January–September

Specimen examined: India, Kerala, Idukki, Kumily, 07/05/2017, Divya K. Venugopal 159466 (CALI).

Hedyotis wightii (Hook.f.) K.K.N.Nair, J. Bombay Nat. Hist. Soc. 79: 453. 1982 publ. 1983. *Oldenlandia umbellata* L., Sp. Pl.: 119.1753; Hook.f., Fl. Brit. India 3: 66. 1882; Gamble, Fl. Madras 2: 601. 1921. *Hedyotis umbellata* (L.) Lam., Tabl. Encycl. 1: 272 (1792), *nom. illeg.*; Sasidh., Fl. Chinnar WLS 150. 1999.

Herb. Stem quadrangular, green, glabrous. Leaves simple, rosette, linear, $1-3 \times 0.25-0.5$ cm, apex acute, base cuneate, margins entire, green, pubescent, sessile. Stipules pectinate, 2–3 mm long, green, glabrous. Flowers in axillary and terminal umbel, sessile. Peduncle quadrangular, 2–4 cm long, green, glabrous. Calyx tube short and

broad, c. 2 mm long, green, pubescent; lobes 5, 1 mm long, apex acute, green, pubescent. Corolla tube minute, white, pubescent; lobes 5, 2–3 mm long, apex acute, white, pubescent. Stamens 5, inserted; filaments slender, 2–3 mm long, white, glabrous; anthers bilobed, elliptic, c. 2 mm long, white, glabrous. Style linear, exserted, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule globose, 2–3 mm long, green, glabrous.

Distribution: Hainan to Tropical Asia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: May–September

Specimens examined: India, Kerala, Idukki, Chinnar, 18/05/1999, *K.V. Thushar 79320* (CALI); Eravikulam, 21/06/2017, *Divya K. Venugopal 152078* (CALI).

Ixora L.

Sp. Pl.: 110.1753.

Key to species

- 1a. Leaves glabrous..... 2
- 1b. Leaves pubescent *I. nigricans*
- 2a. Leaves sessile *I. pavetta*
- 2b. Leaves petiolate 3
- 3a. Calyx lobes glabrous 4
- 3b. Calyx lobes pubescent..... *I. elongata*
- 4a. Plant tree; corolla lobes glabrous *I. brachiata*
- 4b. Plant shrub; corolla lobes pubescent..... *I. johnsonii*

Ixora brachiata Roxb., Fl. Ind. 1: 381.1820; Hook.f., Fl. Brit. India 3: 142. 1882; Gamble, Fl. Madras 2: 631. 1921; Sasidh., Fl. Periyar Tiger Reserve 176. 1998.

Figure 12 A.

Tree. Stem terete, green, glabrous. Leaves simple, opposite-decussate, elliptic, 10–15 × 3–6 cm, apex obtuse, base cuneate, margins entire, green, glabrous, petiolate. Stipules ovate, 2–4 mm long, green, glabrous. Flowers in terminal cyme, sessile. Peduncle terete, long, reddish green, glabrous. Calyx tube short, green, glabrous; lobes 4, 2–3 mm long, apex acute, green, glabrous. Corolla tube 4–6 mm long, white, glabrous; lobes 4, apex acute, white, glabrous. Stamens 4, inserted; filaments slender, 3–4 mm long, white, glabrous; anthers bilobed, sagittate, 2–3 mm long, white,

glabrous. Style filiform, bifid, white, glabrous. Stigma bilobed, minute, white, glabrous. Berry globose, 3–5 mm long, red, glabrous.

Distribution: Bangladesh, India (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: January-December

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 06/12/1993, *Jomy Augustine* 12759 (CALI); Pooyamkutty, 16/12/1988, *P. Bharghavan* 89950 (MH); Mankulam, 18/02/2018, *Divya K. Venugopal* 152822 (CALI).

Ixora elongata B.Heyne ex G.Don, Gen. Hist. 3: 571.1834; Hook.f., Fl. Brit. India 3: 141. 1882; Gamble, Fl. Madras 2: 630. 1921; Sasidh., Fl. Periyar Tiger Reserve 176. 1998.

Figure 12 B.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite-decussate, elliptic, 12–15 × 3–5 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Stipules ovate, 2–4 mm long, green, glabrous. Flowers in terminal cyme, sessile. Peduncle terete, 4–6 cm long, green, glabrous. Calyx tube short, green, pubescent; lobes 4, 2–4 mm long, apex acute, green, pubescent. Corolla tube 6–9 mm long, white, pubescent; lobes 4, 3–4 mm long, apex acute, white, pubescent. Stamens 4, inserted; filaments slender, 2–3 mm long, white, glabrous; anthers bilobed, sagittate, 2–3 mm long, white, glabrous. Style filiform, bifid, white, glabrous. Stigma bilobed, minute, white, glabrous. Berry globose, 4–6 mm long, red, glabrous.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: September-January

Specimens examined: India, Kerala, Idukki, Meenmutty, 24/09/1984, *C.N. Mohanan* 80160 (MH); Anamudi shola, 18/11/2018, *Divya K. Venugopal* 167855 (CALI).

Ixora johnsonii Hook.f., Fl. Brit. India 3: 139.1880; Gamble, Fl. Madras 2: 630. 1921; Sasidh., Fl. Periyar Tiger Reserve 177. 1998.

Figure 12 C.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite, elliptic, 12–15 × 3–5 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Stipules ovate, 3–4 mm long, green, glabrous. Flowers in terminal cyme, dense, sessile. Peduncle terete, 3–4 cm long, green, glabrous. Calyx tube short, green, glabrous; lobes 4, 4–5 mm long, apex acute, green, glabrous. Corolla tube white, pubescent;

lobes 4, 3–5 mm long, apex acute, white, pubescent. Stamens 4, inserted; filaments slender, 2–3 mm long, white, glabrous; anthers bilobed, sagittate, 2 mm long, white, glabrous. Style filiform, bifid, white, glabrous. Stigma bilobed, minute, white, glabrous. Berry globose, 4–5 mm long, green, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January–November

Specimen examined: India, Kerala, Idukki, Anamudi shola, 19/11/2018, Divya K. Venugopal 167860 (CALI).

Ixora nigricans R.Br. ex Wight & Arn., Prodr. Fl. Ind. 1: 428.1834; Hook.f., Fl. Brit. India 3: 148. 1882; Gamble, Fl. Madras 2: 631. 1921; Sasidh., Fl. Periyar Tiger Reserve 177. 1998.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite, lanceolate, 10–12 × 3–4 cm, apex attenuate, base cuneate, margins entire, green, black when dry, pubescent on abaxial surface, petiolate. Stipules ovate, 3–5 mm long, green, glabrous. Flowers in terminal cyme. Peduncle terete, 4–5 cm long, green, glabrous. Pedicel terete, c. 5 mm long, green, glabrous. Calyx tube minute, green, glabrous; lobes 4, 2 mm long, apex acute, green, glabrous. Corolla tube 7–9 mm long, white, pubescent; lobes 4, 3–4 mm long, apex acute, white, pubescent. Stamens 4, inserted; filaments slender, 3–5 mm long, white, glabrous; anthers bilobed, sagittate, c. 2 mm long, white, glabrous. Style filiform, bifid, 6–9 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Berry biglobose, green, glabrous.

Distribution: India to South Malesia (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: October–July

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 22/04/2016, S. Syam Radh 149101 (CALI); Periyar Tiger Reserve, 18/01/1994, Jomy Augustine 13125 (CALI); Pooyamkutty, 10/07/1988, P. Bharghavan 87444 (MH); Mankulam, 22/10/2019, Divya K. Venugopal 167845 (CALI).

Ixora pavetta Andrews, Bot. Repos. 2: t. 78.1799; Sasidh., Fl. Chinnar WLS 151. 1999. *Ixora parviflora* Vahl, Symb. Bot. 3: 11 (1794), *nom. illeg.*; Hook.f., Fl. Brit. India 3: 142. 1882; Gamble, Fl. Madras 2: 631. 1921.

Tree. Leaves simple, opposite-decussate, elliptic, 5–10 × 3–6 cm, apex obtuse, base round, margins entire, green, glabrous, sessile. Stipules ovate, 4–5 mm long, green,

glabrous. Flowers in terminal panicles. Peduncle terete, 2–6 cm long, green, glabrous. Pedicel terete, 2–5 mm long, green, glabrous. Calyx tube minute, green, glabrous; lobes 4, minute, apex acute, green, glabrous. Corolla tube 4–5 mm long, white, glabrous; lobes 4, 3–4 mm long, apex acute, white, glabrous. Stamens 4, inserted; filaments slender, 3–4 mm long, white, glabrous; anthers bilobed, sagittate, 2–3 mm long, white, glabrous. Style linear, bifid, exserted, white, glabrous. Stigma bilobed, minute, white, glabrous. Berry globose, 4–7 mm long, black, glabrous.

Distribution: Bangladesh, India, Sri Lanka, Nicobar Islands (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: January–March

Specimens examined: India, Kerala, Idukki, Chinnar, 12/02/1995, K.K. Sajeew 11931 (KFRI); *ibid.*, 16/02/2017, Divya K. Venugopal 159463 (CALI).

***Lasianthus* Jack**

Trans. Linn. Soc. London 14: 125.1823, *nom. cons.*

Key to species

1a. Stem glabrous; leaves elliptic..... *L. acuminatus*

1b. Stem pubescent; leaves oblong *L. parvifolius*

Lasianthus acuminatus Wight, Calcutta J. Nat. Hist. 6: 511.1846; Hook.f., Fl. Brit. India 3: 185. 1882; Gamble, Fl. Madras 2: 647. 1921; Sasidh., Fl. Periyar Tiger Reserve 178. 1998.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite, elliptic, 6–8 × 3–4 cm, apex acuminate, base round, margins entire, green, glabrous, petiolate. Stipules ovate, 3–4 mm long, green, glabrous. Flowers in terminal cyme, sessile. Peduncle terete, 3–7 mm long, green, glabrous. Calyx tube 2–5 mm long, green, pubescent; lobes 4, minute, apex acute, green, pubescent. Corolla tube 3–5 mm long, white, pubescent; lobes 4, 2–4 mm long, apex obtuse, white, pubescent. Stamens 4, inserted; filaments absent; anthers bilobed, sagittate, c. 1 mm long, white, glabrous. Style filiform, 2–3 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule globose, 3–6 mm long, black, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: May–December

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 29/12/2014, *S. Syam Radh* 137888 (CALI); Periyar Tiger Reserve, 14/08/1994, *Jomy Augustine* 14054 (CALI); Vattavada, 28/07/1982, *Nambiar & Sasidharan* 1853 (KFRI); Mankulam, 16/10/2018, *Divya K. Venugopal* 167820 (CALI).

Lasianthus parvifolius Wight, Calcutta J. Nat. Hist. 6: 512.1846; Hook.f., Fl. Brit. India 3: 186. 1882; Gamble, Fl. Madras 2: 647. 1921; Sasidh., Fl. Periyar Tiger Reserve 179. 1998.

Shrub. Stem terete, green, pubescent. Leaves simple, opposite, obovate, 7–9 × 3–6 cm, apex slightly acuminate, base round, margins entire, green, glabrous, petiolate. Stipules oblong, 3–5 mm long, green, glabrous. Flowers in terminal cyme, sessile. Peduncle terete, 3–7 mm long, green, glabrous. Calyx tube 2–3 mm long, green, sparsely pubescent; lobes 4, minute, apex acute, green, sparsely pubescent. Corolla tube 6–7 mm long, white, pubescent; lobes 4, 3–5 mm long, apex obtuse, white, pubescent. Stamens 4, inserted; filaments absent; anthers bilobed, sagittate, c. 2 mm long, white, glabrous. Style filiform, 2–3 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule globose, 4–7 mm long, green, glabrous.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: October-May

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 08/05/2015, *S. Syam Radh* 137961 (CALI); Periyar Tiger Reserve, 12/05/1994, *Jomy Augustine* 13707 (CALI); Mankulam, 17/10/2018, *Divya K. Venugopal* 167835 (CALI).

***Mitragyna* Korth.**

Observ. Naocl. Indic.: 19.1839, *nom. cons.*

Mitragyna parvifolia (Roxb.) Korth., Observ. Naocl. Ind. 19. 1839; Gamble, Fl. Madras 2: 585. 1921; Sasidh., Fl. Periyar Tiger Reserve 179. 1998; Sasidh., Fl. Chinnar WLS 152. 1999. *Stephegyne parvifolia* (Roxb.) Korth., Verh. Nat. Gesch. Ned. Bezitt., Bot.: 161.1842; Hook.f., Fl. Brit. India 3: 25. 1882.

Tree. Leaves simple, opposite-decussate, ovate, 5–12 × 6–8 cm, apex obtuse, base round, margins entire, green, glabrous, petiolate. Stipules oblong, 5–8 mm long, green, glabrous. Flowers in terminal cymes. Peduncle terete, 2–4 cm long, green, glabrous. Pedicel terete, c. 5 mm long, green, glabrous. Calyx tube 3–4 mm long,

green, glabrous; lobes 5, minute, apex acute, green, glabrous. Corolla tube 4–6 mm long, cream, pubescent; lobes 5, 3–6 mm long, apex acute, cream, pubescent. Stamens 5, exserted; filaments short, white, glabrous; anthers bilobed, oblong, c. 2 mm long, white, glabrous. Style filiform, 4–6 mm long, white, glabrous. Stigma mitriform, white, glabrous. Berry globose, 3–5 mm long, black, glabrous.

Distribution: Indian Subcontinent to Indo-China (POWO, 2022)

Habitat: Deciduous forests

Flowering and fruiting: January–September

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 06/01/1994, *Jomy Augustine 13101* (CALI); Chinnar, 18/06/2017, *Divya K. Venugopal 159108* (CALI).

***Mussaenda* Burm. ex L.**

Sp. Pl.: 177.1753.

Mussaenda tomentosa Wall. ex G.Don, Gen. Hist. 3: 491.1834; Hook.f., Fl. Brit. India 3: 88. 1882; Gamble, Fl. Madras 2: 610. 1921; Sasidh., Fl. Periyar Tiger Reserve 180. 1998; Sasidh., Fl. Chinnar WLS 153. 1999.

Figure 12 E.

Shrub. Stem terete, brownish green, pubescent. Leaves simple, opposite, elliptic, 8–10 × 2–3 cm, apex acute, base cuneate, margins entire, green, white tomentose, petiolate. Stipules ovate, 3–7 mm long, green, glabrous. Flowers in terminal cymes. Peduncle terete, 3–5 cm long, green, glabrous. Pedicel terete, 2–5 mm long, green, glabrous. Calyx tube 4–7 mm long, green, glabrous; lobes 5, one lobe usually transformed into coloured leaf. Corolla tube 1.6–2 cm long, white, pubescent; lobes 5, white, pubescent. Stamens 5, at the mouth of corolla tube; filaments short, white, glabrous; anthers bilobed, linear, white, glabrous. Style filiform, 1–1.2 cm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Berry globose, 5–8 mm long, green, pubescent.

Distribution: India (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: October–January

Specimens examined: India, Kerala, Idukki, Devikulam, 12/12/1970, *P. P. Raveendranathan 23* (CALI); Mankulam, 23/11/2019, *Divya K. Venugopal 170347* (CALI).

***Mycetia* Reinw.**

Syll. Pl. Nov. 2: 9.1825.

Mycetia acuminata (Wight) Kuntze, Revis. Gen. Pl. 1: 289.1891; Gamble, Fl. Madras 2: 612. 1921; Sasidh., Fl. Periyar Tiger Reserve 181. 1998. *Adenosacme lawii* Hook.f., Fl. Brit. India 3: 96.1880, *nom. illeg.*; Hook.f., Fl. Brit. India 3: 96. 1882.

Figure 11 C..

Shrub. Stem terete, green, pubescent. Leaves simple, opposite, obovate, 7–9 × 3–6 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Stipules oblong, large, green, glabrous. Flowers in axillary cyme. Peduncle terete, 2–5 cm long, green, glabrous. Pedicel terete, 8–10 mm long, green, glabrous. Calyx tube 4–6 mm long, green, sparsely pubescent; lobes 4, minute, apex acute, green, sparsely pubescent. Corolla tube minute, yellow, pubescent; lobes 4, apex acute, yellow, pubescent. Stamens 4, inserted; filaments absent; anthers bilobed, linear, c. 2 mm long, yellow, glabrous. Style cylindric, white, glabrous. Stigma bilobed, c. 2 mm long, white, glabrous. Berry globose, 5–7 mm long, white, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: June–January

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 10/01/1994, *Jomy Augustine 13159* (CALI); Kulamavu, 23/09/1984, *C.N. Mohanan 80143* (MH); Mankulam, 24/11/2019, *Divya K. Venugopal 170358* (CALI).

***Neanotis* W.H.Lewis**

Ann. Missouri Bot. Gard. 53: 34.1966.

Neanotis decipiens (Hook.f.) W.H.Lewis, Ann. Missouri Bot. Gard. 53: 37. 1966; Sasidh., Fl. Periyar Tiger Reserve 181. 1998. *Anotis decipiens* Hook.f., Fl. Brit. India 3: 72.1880; Gamble, Fl. Madras 2: 604. 1921.

Herb. Stem terete, green, glabrous, roots arises from nodes. Leaves simple, opposite, ovate, 7–9 × 3–6 cm, apex acute, base round, margins entire, green, pubescent, petiolate. Stipules oblong, large, green, glabrous. Flowers in terminal cyme, sessile. Peduncle terete, 3–5 cm long, green, pubescent. Calyx tube 1–2 mm long, green, sparsely pubescent; lobes 4, minute, apex acute, green, sparsely pubescent. Corolla tube 3–6 mm long, pink, pubescent; lobes 4, 2–4 mm long, apex acute, pink, pubescent. Stamens 4, inserted; filaments absent; anthers bilobed, linear, c. 1 mm

long, white, glabrous. Style cylindric, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule subglobose, green, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: September-December

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 12/09/1996, *Jomy Augustine 16801* (CALI); Uppupara, 26/09/1972, *B.D. Sharma 41691* (MH); Pambadum shola, 24/11/2018, *Divya K. Venugopal 161980* (CALI).

Neonauclea Merr.

J. Washington Acad. Sci. 5: 538.1915.

Neonauclea purpurea (Roxb.) Merr., Interpr. Herb. Amboin.: 483.1917; Gamble, Fl. Madras 2: 584. 1921; Sasidh., Fl. Periyar Tiger Reserve 182. 1998. *Nauclea purpurea* Roxb., Pl. Coromandel 1: 41.1796; Hook.f., Fl. Brit. India 3: 26. 1882.

Tree. Leaves simple, opposite-decussate, elliptic, 10–15 × 3–5 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Stipules oblong, large, green, glabrous. Flowers in axillary or terminal cyme, sessile. Peduncle terete, 3–5 cm long, green, glabrous. Calyx tube green, pubescent; lobes 5, 3–6 mm long, apex acute, green, pubescent. Corolla tube 5–8 mm long, purple, glabrous; lobes 5, 4–9 mm long, apex obtuse, purple, glabrous. Stamens 5, inserted; filaments slender, 6–9 mm long, white, glabrous; anthers bilobed, oblong, c. 3 mm long, white, glabrous. Style cylindric, 1–1.3 cm long, white, glabrous. Stigma globose, minute, white, glabrous. Capsule obovoid, 4–6 mm long, purple, pubescent.

Distribution: India, Indo-China (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: November-April

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 06/12/1993, *Jomy Augustine 12737* (CALI); Pambadum shola, 25/11/2018, *Divya K. Venugopal 161989* (CALI).

Neurocalyx Hook.

Hooker's Icon. Pl. 4: t. 174.1837.

Neurocalyx calycinus (R.Br. ex Benn.) B.L.Rob., Proc. Amer. Acad. Arts 45: 402.1910; Sasidh., Fl. Periyar Tiger Reserve 182. 1998. *Neurocalyx wightii* Arn.,

Ann. Nat. Hist. 3: 22.1839; Hook.f., Fl. Brit. India 3: 47. 1882; Gamble, Fl. Madras 2: 591. 1921.

Figure 11 B.

Herb. Stem terete, green, woody, pubescent. Leaves simple, whorled, oblanceolate, 10–20 × 4–6 cm, apex acute, base cuneate, margins entire, green, pubescent, petiolate. Stipules obovate, large, green, glabrous. Flowers in terminal raceme. Peduncle terete, 2–6 cm long, greenish white, pubescent. Pedicel terete, 3–5 mm long, greenish white, glabrous. Calyx tube 2–5 mm long, green, glabrous; lobes 5, 3–6 mm long, apex acute, green, glabrous. Corolla tube absent; lobes 5, 5–6 mm long, apex acute, pink, pubescent. Stamens 5, inserted; filaments short, white, glabrous; anthers bilobed, linear, c. 3 mm long, yellow, glabrous. Style filiform, 3–6 mm long, white, glabrous. Stigma capitate, minute, white, glabrous. Capsule globose, green, glabrous, fleshy.

Distribution: South India, South West Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: May–October

Specimens examined: India, Kerala, Idukki, Mankulam, 22/06/1976, C.E. Ridsale 223 (MH); Pambadum shola, 20/10/2018, Divya K. Venugopal 159466 (CALI).

***Ophiorrhiza* L.**

Sp. Pl.: 150.1753.

Key to species

1a. Roots arises from nodes 2

1b. Roots absent..... *O. rugosa*

2a. Stipules lanceolate; calyx lobes pubescent *O. eriantha*

2b. Stipules subulate; calyx lobes glabrous *O. mungos*

Ophiorrhiza eriantha Wight, Icon. Pl. Ind. Orient. 3: t. 1067.1846; Hook.f., Fl. Brit. India 3: 81. 1882; Gamble, Fl. Madras 2: 608. 1921; Sasidh., Fl. Chinnar WLS 154. 1999.

Shrub. Stem terete, brownish green, pubescent, roots arises from nodes. Leaves simple, opposite, elliptic, 10–12 × 3–5 cm, apex acute, base cuneate, margins entire, green, white tomentose, petiolate. Stipules lanceolate, 5–7 mm long, green, glabrous. Flowers in axillary and terminal cymes. Peduncle terete, 2–3 cm long, green, glabrous. Pedicel terete, 3–4 mm long, green, glabrous. Calyx tube minute, green, pubescent; lobes 5, 3–4 mm long, apex acute, green, pubescent. Corolla tube 8 mm–

1.2 cm long, white, pubescent; lobes 5, 4–6 mm long, apex acute, white, pubescent. Stamens 5, inserted; filaments slender, 4–5 mm long, white, glabrous; anthers bilobed, linear, c. 2 mm long, white, glabrous. Style filiform, 6 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule globose, green, ciliate.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: August–October

Specimens examined: India, Kerala, Idukki, Pachakanam, 22/09/1972, B.D. Sharma 40827 (MH); Anamudi shola, 17/08/2019, Divya K. Venugopal 168859 (CALI).

Ophiorrhiza rugosa Wall., W.Roxburgh, Fl. Ind. 2: 546.1824; Sasidh., Fl. Periyar Tiger Reserve 183. 1998. *Ophiorrhiza harrisiana* B.Heyne ex Hook.f., Fl. Brit. India 3: 78.1880, *nom. superfl.*; Gamble, Fl. Madras 2: 607. 1921.

Herb. Stem terete, green, pubescent. Leaves simple, opposite, ovate, 10–20 × 4–6 cm, apex acute to acuminate, base cuneate, margins entire, green, pubescent on abaxial surface, petiolate. Stipules triangular, green, glabrous. Flowers in terminal cyme. Peduncle terete, 2–4 cm long, green, glabrous. Pedicel terete, 2–5 mm long, green, glabrous. Calyx tube 1–2 mm long, green, glabrous; lobes 5, minute, apex acute, green, glabrous. Corolla tube 3–6 mm long, white, pubescent; lobes 5, minute, apex acute, white, pubescent. Stamens 5, inserted; filaments slender, 3–4 mm long, white, glabrous; anthers bilobed, linear, c. 2 mm long, white, glabrous. Style filiform, 3–4 mm long, white, glabrous. Stigma bilobed, c. 2 mm long, white, glabrous. Capsule obconic, 2–5 mm long, green, glabrous.

Distribution: Indian Subcontinent to China (Yunnan) and Peninsula Malaysia (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: June–October

Specimen examined: India, Kerala, Idukki, Mankulam, 15/06/2018, Divya K. Venugopal 151357 (CALI).

Ophiorrhiza mungos L., Sp. Pl.: 150.1753; Hook.f., Fl. Brit. India 3: 77. 1882; Gamble, Fl. Madras 2: 607. 1921; Sasidh., Fl. Periyar Tiger Reserve 183. 1998.

Figure 12 D.

Herb. Stem terete, green, pubescent, roots arises from nodes. Leaves simple, opposite, elliptic, 7–12 × 3–4 cm, apex slightly acuminate, base round, margins entire, green, pubescent on abaxial surface, petiolate. Stipules subulate, 3–6 mm long, green,

glabrous. Flowers in terminal cyme, dense. Peduncle terete, 2–3 cm long, green, glabrous. Pedicel terete, 1–3 mm long, green, glabrous. Calyx tube 1–2 mm long, green, glabrous; lobes 5, minute, apex acute, green, glabrous. Corolla tube 3–5 mm long, white, glabrous; lobes 5, 2–4 mm long, apex acute, white with pink shades, pubescent. Stamens 5, inserted; filaments slender, 2–3 mm long, white, glabrous; anthers bilobed, linear, c. 2 mm long, white, glabrous. Style filiform, 4–6 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule globose, 2–5 mm long, green, glabrous.

Distribution: India to West Malesia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: July–December

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 06/07/1993, Jomy Augustine 12010 (CALI); Narakkathode, 18/12/1988, P. Bharghavan 89984 (MH); Kallar, 22/08/2018, Divya K. Venugopal 159108 (CALI).

Pavetta L.

Sp. Pl.: 110.1753.

Key to species

- 1a. Stem pubescent; corolla yellow *P. siphonantha*
- 1b. Stem glabrous; corolla white 2
- 2a. Stipules ovate; stigma bilobed *P. monticola*
- 2b. Stipules lanceolate; stigma clavate *P. travancorica*

Pavetta siphonantha Dalzell, Hooker's J. Bot. Kew Gard. Misc. 2: 133.1850; Gamble, Fl. Madras 2: 633. 1921; Sasidh., Fl. Periyar Tiger Reserve 185. 1998. *Pavetta hispidula* Prodr. Fl. Ind. Orient. 1: 431.1834; Hook.f., Fl. Brit. India 3: 151. 1882.

Shrub. Stem terete, green, pubescent. Leaves simple, opposite, oblanceolate, 7–12 × 3–4 cm, apex acute, base cuneate, margins entire, green, pubescent on abaxial surface, petiolate. Stipules subulate, 3–7 mm long, green, glabrous. Flowers in terminal cyme. Peduncle terete, 1–2 cm long, green, glabrous. Pedicel terete, 2–5 mm long, green, glabrous. Calyx tube 2–4 mm long, green, pubescent; lobes 4, minute, apex acute, green, pubescent. Corolla tube 6–8 mm long, yellow, glabrous; lobes 4, 3–6 mm long, apex acute, yellow, glabrous. Stamens 4, inserted; filaments slender, 4–6 mm long, white, glabrous; anthers bilobed, linear, c. 3 mm long, white, glabrous. Style filiform,

entire, 1.5–1.8 cm long, white, glabrous, exserted. Stigma bilobed, minute, white, glabrous. Berry globose, green, glabrous.

Distribution: West India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: March-January

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 12/05/1994, Jomy Augustine 13739 (CALI); Munnar, 20/12/2003, C. Murugan 117647 (MH); Mankulam, 15/06/2018, Divya K. Venugopal 151357 (CALI).

Pavetta monticola Hiern, D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 3: 170. 1877. *Ixora monticola* Gamble, Bull. Misc. Inform. Kew 1920: 246.1920, *nom. illeg.*; Gamble, Fl. Madras 2: 631. 1921; Sasidh., Fl. Periyar Tiger Reserve 177. 1998.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite, oblanceolate, 5–7 × 2–3 cm, apex acute, base round, margins entire, green, pubescent on abaxial surface, petiolate. Stipules ovate, 3–5 mm long, green, glabrous. Flowers in terminal cyme, sessile. Peduncle terete, 2–3 cm long, green, glabrous. Calyx tube short, green, glabrous; lobes 4, 1–2 mm long, apex acute, green, glabrous. Corolla tube 5–8 mm long, white, pubescent; lobes 4, 2–3 mm long, apex acute, white, pubescent. Stamens 4, inserted; filaments slender, 3–4 mm long, white, glabrous; anthers bilobed, sagittate, 2 mm long, white, glabrous. Style filiform, entire, 5–7 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Berry biglobose, 4–6 mm long, green, glabrous.

Distribution: southern Western Ghats

Habitat: Evergreen forests

Flowering and fruiting: March-May

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 14/05/1994, Jomy Augustine 13791 (CALI); Mankulam, 14/03/2017, Divya K. Venugopal 151369 (CALI).

Pavetta travancorica Bremek., Repert. Spec. Nov. Regni Veg. 37: 81.1934; Gamble, Fl. Madras 2: 633. 1921. *Pavetta laeta* Bremek., Repert. Spec. Nov. Regni Veg. 37: 82.1934; Sasidh., Fl. Chinnar WLS 154. 1999; Hook.f., Fl. Brit. India 3: 150. 1882.

Shrub. Stem terete, brownish green, glabrous. Leaves simple, opposite, ovate, 6–10 × 3–4 cm, apex acute-acuminate, base cuneate, margins entire, green, glabrous, petiolate. Stipules lanceolate, 4–6 mm long, green, glabrous. Flowers in axillary cymes. Peduncle terete, 2–5 cm long, green, glabrous. Pedicel terete, 3–4 mm long,

green, glabrous. Calyx tube 1–2 mm long, green, pubescent; lobes 4, minute, apex acute, green, pubescent. Corolla tube 7–9 mm long, white, pubescent; lobes 4, 3–4 mm long, apex acute, white, pubescent. Stamens 4, exserted; filaments slender, 4–6 mm long, white, glabrous; anthers bilobed, linear, 2 mm long, white, glabrous. Style filiform, entire, 6 mm long, white, glabrous. Stigma clavate, minute, white, glabrous. Berry globose, 6–8 mm long, green, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February–December

Specimens examined: India, Kerala, Idukki, Eravikulam, 18/05/1999, *K. Lisha* 78617 (CALI); Puliyanmala, 14/12/1982, *C.N. Mohanan* 76138 (MH); Mankulam, 15/03/2017, *Divya K. Venugopal* 151375 (CALI).

***Psychotria* L.**

Syst. Nat. ed. 10, 2: 929.1759, *nom. cons.*

Key to species

- 1a. Stem pubescent..... *P. anamallayana*
- 1b. Stem glabrous..... 2
- 2a. Corolla lobes green *P. nigra*
- 2b. Corolla lobes white 3
- 3a. Leaves obovate..... 4
- 3b. Leaves elliptic *P. flavida*
- 4a. Flowers sessile *P. nudiflora*
- 4b. Flowers not sessile *P. nilgiriensis* var. *nilgiriensis*

Psychotria anamallayana Bedd., Icon. Pl. Ind. Or.: 57 .1873; Hook.f., Fl. Brit. India 3: 171. 1882; Gamble, Fl. Madras 2: 641. 1921; Sasidh., Fl. Periyar Tiger Reserve 185. 1998.

Shrub. Stem terete, green, pubescent. Leaves simple, opposite, oblanceolate, 15–20 × 5–6 cm, apex obtuse, base cuneate, margins entire, green, glabrous, petiolate. Stipules lanceolate, 2–3 cm long, green, glabrous. Flowers in terminal cyme, sessile. Peduncle terete, 2–4 cm long, green, glabrous. Calyx tube 2–3 mm long, green, pubescent; lobes 5, minute, apex acute, green, pubescent. Corolla tube minute, white, glabrous; lobes 5, 3–4 mm long, apex acute, white, glabrous. Stamens 5, inserted; filaments slender, 2–3 mm long, white, glabrous; anthers bilobed, linear, c. 2 mm long, white,

glabrous. Style short, white, glabrous. Stigma bilobed, minute, white, glabrous. Berry globose, 7–9 mm long, green, glabrous.

Distribution: South India

Habitat: Evergreen forests

Flowering and fruiting: March–August

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 23/08/2014, *S. Syam Radh 143515* (CALI); Peerumedu, *s.d.*, *Bourdillone 86284* (MH); Mankulam, 20/04/2018, *Divya K. Venugopal 167841* (CALI).

Psychotria flavida Talbot, Syst. List Trees Bombay: 113.1894; Gamble, Fl. Madras 2: 641. 1921; Sasidh., Fl. Periyar Tiger Reserve 186. 1998.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite, elliptic, 10–15 × 4–6 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Stipules ovate, 5–6 mm long, green, glabrous. Flowers in terminal cyme. Calyx tubular; lobes 5, minute, green, pubescent. Corolla tube minute, white, pubescent; lobes 5, 3–4 mm long, apex acute, white, pubescent. Stamens 5, inserted; filaments slender, minute, white, glabrous; anthers bilobed, linear, 2 mm long, white, glabrous. Style short, white, glabrous. Stigma bilobed, minute, white, glabrous. Berry globose, 3–4 mm long, green, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: March–June

Specimens examined: India, Kerala, Idukki, Eravikulam, 18/05/1999, *P. Prashy 79415* (CALI); Thekkady, 12/03/1973, *B.D. Sharma 43831* (MH); Anamudi shola, 14/05/2018, *Divya K. Venugopal 159185* (CALI).

Psychotria nigra (Gaertn.) Alston, H. Trimen, Handb. Fl. Ceylon 6(Suppl.): 152.1931; Sasidh., Fl. Periyar Tiger Reserve 187. 1998. *Psychotria thwaitesii* Hook.f., Fl. Brit. India 3: 162.1880; Gamble, Fl. Madras 2: 640. 1921.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite, obovate, 15–20 × 6–8 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Stipules ovate, 4–7 mm long, green, pubescent. Flowers in terminal cyme, dense. Peduncle terete, 1–3 cm long, green, glabrous. Pedicel terete, c. 1 mm long, green, glabrous. Calyx tube 2 mm long, green, pubescent; lobes 5, minute, apex acute, green, pubescent. Corolla tube minute, white, pubescent; lobes 5, 2 mm long, apex obtuse, white, pubescent. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous;

anthers bilobed, linear, 1 mm long, white, glabrous. Style short, white, glabrous. Stigma bilobed, minute, white, glabrous. Berry subglobose, 4–6 mm long, green, glabrous.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: March–October

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 08/05/2015, *S. Syam Radh* 137968 (CALI); Vandiperiyar, 04/06/2003, *C. Murugan* 116019 (MH); Edapalayam, 25/09/1972, *B.D. Sharma* 41657 (MH); Anamudi shola, 15/05/2018, *Divya K. Venugopal* 159196 (CALI).

Psychotria nudiflora Wight & Arn., Prodr. Fl. Ind. Orient. 1: 434.1834; Hook.f., Fl. Brit. India 3: 175. 1882; Gamble, Fl. Madras 2: 641. 1921; Sasidh., Fl. Periyar Tiger Reserve 187. 1998.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite, obovate, 12–14 × 3–4 cm, apex slightly acuminate, base cuneate, margins entire, green, glabrous, petiolate. Stipules ovate, 5–7 mm long, green, glabrous. Flowers in terminal cyme, sessile. Peduncle terete, 3–5 cm long, green, glabrous. Calyx tube 1 mm long, green, pubescent; lobes 5, minute, apex acute, green, pubescent. Corolla tube minute, white, glabrous; lobes 5, 3–5 mm long, apex acute, white, glabrous. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers bilobed, linear, 1 mm long, white, glabrous. Style short, white, glabrous. Stigma bilobed, minute, white, glabrous. Berry globose, green, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: November–December

Specimens examined: India, Kerala, Idukki, Meenmutty, 20/12/1983, *C.N. Mohanan* 76281 (MH); Mankulam, 27/11/2019, *Divya K. Venugopal* 164812 (CALI).

Psychotria nilgiriensis Deb & M.G.Gangop., Taxon 31: 546.1982; Sasidh., Fl. Periyar Tiger Reserve 187. 1998. *Psychotria congesta* (Wight & Arn.) Hook.f., Fl. Brit. India 3: 162.1880, *nom. illeg.*; Gamble, Fl. Madras 2: 640. 1921.

Shrub. Stem terete, brownish green, glabrous. Leaves simple, opposite, obovate, 10–14 × 6–8 cm, apex obtuse, base cuneate, margins entire, green, glabrous, petiolate. Stipules ovate, 4–6 mm long, green, glandular. Flowers in terminal cyme. Peduncle terete, 3–5 cm long, green, glabrous. Pedicel terete, 2–3 mm long, green, glabrous.

Calyx tube 3 mm long, green, glabrous; lobes 5, minute, apex acute, green, glabrous. Corolla tube 3–4 mm long, white, pubescent; lobes 5, 2–4 mm long, apex acute, white, pubescent. Stamens 5, inserted; filaments slender, 2–3 mm long, white, glabrous; anthers bilobed, linear, 1 mm long, white, glabrous. Style short, white, glabrous. Stigma bifid, minute, white, glabrous. Berry globose, 6–9 mm long, green, glabrous.

Distribution: South India (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: April–December

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 09/05/2015, *S. Syam Radh* 145007 (CALI); Periyar Tiger Reserve, 09/04/1994, *Jomy Augustine* 13588 (CALI); Munnar, 20/12/2003, *C. Murugan* 117645 (MH); Anakkara, 14/07/2017, *Divya K. Venugopal* 159160 (CALI).

***Psydrax* Gaertn.**

Fruct. Sem. Pl. 1: 125.1788.

***Psydrax dicoccos* Gaertn.**, Fruct. Sem. Pl. 1: 125.1788. *Canthium didymum* C.F.Gaertn., Suppl. Carp.: 94.1806; Hook.f., Fl. Brit. India 3: 132. 1882. *Plectronia didyma* (C.F.Gaertn.) Kurz, Forest Fl. Burma 2: 35.1877, *nom. illeg.*; Gamble, Fl. Madras 2: 624. 1921. *Canthium dicoccum* (Gaertn.) Merr., Philipp. J. Sci. 35(1): 8. 1928; Sasidh., Fl. Periyar Tiger Reserve 169. 1998; Sasidh., Fl. Chinnar WLS 146. 1999.

Tree. Stem terete, woody, warty. Leaves simple, opposite, ovate, 8–10 × 4–5 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Stipules deciduous, ovate, green, glabrous. Flowers in axillary cymes. Bracts minute, green, glabrous, free. Bracteoles numerous. Calyx tube 3–4 mm long, green, glabrous; lobes 5, minute, apex acute, green, glabrous. Corolla tube 2–3 mm long, white, pubescent; lobes 5, 3–4 mm long, apex obtuse, white, pubescent. Stamens 5, exserted; filaments absent; anthers bilobed, linear, 2 mm long, white, glabrous. Style stout, 6–8 mm long, white, pubescent. Stigma entire, large, white, glabrous. Capsule sub globose, 6–8 mm long green, glabrous.

Distribution: South China to Tropical Asia (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: March–October

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 09/05/2015, *S. Syam Radh* 137995 (CALI); Chinnar, 10/06/2010, *Anoop P.B.* 128 (CALI); Eravikulam, 24/04/2012, *K.D. Prathapan* 270 (CALI); Munnar to Bodi Road, 26/03/1980, *C. Ramamurthy* 66520 (MH); Periyar Tiger Reserve, 03/05/1995, *Jomy Augustine* 15227 (KFRI); Mankulam, 17/05/2019, *Divya K. Venugopal* 164675 (CALI).

***Richardia* L.**

Sp. Pl.: 330.1753.

***Richardia scabra* L.**, Sp. Pl.: 330.1753; Sasidh., Fl. Periyar Tiger Reserve 188. 1998; Sasidh., Fl. Chinnar WLS 156. 1999.

Figure 11 A.

Herb. Stem terete, green, pubescent. Leaves simple, opposite, ovate, 10–14 × 6–8 cm, apex acute, base round, margins entire, green, glabrous, fleshy, sessile. Stipules ovate, 2–3 mm long, green, ciliate. Flowers in terminal cymes, sessile. Peduncle terete, green, glabrous. Calyx tube 1–2 mm long, green, ciliate; lobes 5, minute, apex acute, green, ciliate. Corolla tube 2 mm long, white, pubescent; lobes 5, 2–3 mm long, apex acute, white, pubescent. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers bilobed, linear, c. 1 mm long, white, glabrous. Style short, white, glabrous. Stigma capitate, minute, white, glabrous. Capsule globose, green, pubescent.

Distribution: Pantropical

Habitat: In the plains

Flowering and fruiting: March–August

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 20/04/2017, *S. Syam Radh* 167314 (CALI); Periyar Tiger Reserve, 10/08/1993, *Jomy Augustine* 12174 (CALI); Kallar, 19/04/2019, *Divya K. Venugopal* 164835 (CALI).

***Rubia* L.**

Sp. Pl.: 109.1753.

***Rubia cordifolia* L.**, Syst. Nat. ed. 12: 229.1767; Hook.f., Fl. Brit. India 3: 202. 1882; Gamble, Fl. Madras 2: 655. 1921; Sasidh., Fl. Periyar Tiger Reserve 188. 1998; Sasidh., Fl. Chinnar WLS 156. 1999.

Climber. Stem quadrangular, green, spiny. Leaves simple, whorled, ovate, 3–5 × 2–2.5 cm, apex acuminate, base cordate, margins serrate, green, glabrous, petiolate. Stipules ovate, 3–4 mm long, green, ciliate. Flowers in axillary and terminal cymes. Peduncle quadrangular, 3–5 cm long, green, glabrous. Pedicel quadrangular, 2–6 mm long, green, glabrous. Calyx tube 3–4 mm long, green, glabrous; lobes absent. Corolla tube 2–4 mm long, white, pubescent; lobes 4, 2–3 mm long, apex acute, white, pubescent. Stamens 6, inserted; filaments short, white, glabrous; anthers bilobed, globose, 1 mm long, white, glabrous. Style bifid, white, glabrous. Stigma capitate, white, glabrous. Capsule globose, 4–6 mm long, green, pubescent.

Distribution: Greece, Sudan to South Africa, Asia (POWO, 2022)

Habitat: Deciduous forests

Flowering and fruiting: March–December

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 23/11/2014, S. Syam Radh 137856 (CALI); Thekkady, 10/08/1988, S. Santha 3682 (CALI); Devikulam, 31/03/1978, Nambiar 00321 (KFRI); Chinnar, 22/11/2018, Divya K. Venugopal 164693 (CALI).

***Saprosma* Blume**

Bijdr. Fl. Ned. Ind.: 956.1826.

Saprosma foetens (Wight) K.Schum., H.G.A.Engler & K.A.E.Prantl, Nat. Pflanzenfam. 4(4): 122.1891; Sasidh., Fl. Periyar Tiger Reserve 188. 1998; Sasidh., Fl. Chinnar WLS 156. 1999. *Saprosma ceylanicum* (Gard.) Bedd., For. Man. Bot. 134/5. 1872; Hook.f., Fl. Brit. India 3: 193. 1882; Gamble, Fl. Madras 2: 649. 1921.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite, elliptic, 4–6 × 2–3 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Stipules ovate, 4–5 mm long, green, glabrous. Flowers in axillary cyme, sessile. Peduncle terete, 2–3 cm long, green, glabrous. Calyx tube 3–4 mm long, green, pubescent; lobes 4, 1–2 mm long, apex acute, green, pubescent. Corolla tube minute, purple, pubescent; lobes 4, 4–6 mm long, apex obtuse, purple, pubescent. Stamens 4, inserted; filaments short, white, glabrous; anthers bilobed, linear, 2 mm long, white, glabrous. Style short, entire, white, glabrous. Stigma bilobed, minute, white, glabrous. Berry globose, green, glabrous.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January-December

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 30/07/2016, *S. Syam Radh 149193* (CALI); Periyar Tiger Reserve, 14/08/1994, *Jomy Augustine 14064* (CALI); Cardamom hills, 18/06/1976, *C.E. Ridsale 175* (MH); Mankulam, 15/06/2018, *Divya K. Venugopal 151358* (CALI).

***Spermacoce* L.**

Sp. Pl.: 102.1753.

Key to species

- 1a. Stem glabrous..... *S. pusilla*
- 1b. Stem pubescent 2
- 2a. Stamen exserted; capsule globose..... *S. articularis*
- 2b. Stamen inserted; capsule ellipsoid..... *S. latifolia*

Spermacoce articularis L.f., Suppl. Pl.: 119.1782; Sasidh., Fl. Periyar Tiger Reserve 189. 1998; Sasidh., Fl. Chinnar WLS 157. 1999. *Spermacoce hispida* L., Sp. Pl.: 102.1753; Hook.f., Fl. Brit. India 3: 200. 1882.

Herb. Stem quadrangular, green, pubescent. Leaves simple, opposite, elliptic, 1.5–3 × 0.5–1 cm, apex acute, base round, margins entire, green, pubescent, sessile. Stipules ovate, 3–5 mm long, green, pubescent. Flowers in axillary and terminal cymes, sessile. Peduncle quadrangular, 2–4 mm long, green, glabrous. Calyx tube 2–3 mm long, green, pubescent; lobes 4, c. 1 mm long, apex acute, green, pubescent. Corolla tube 2–3 mm long, pinkish white, pubescent; lobes 4, 2 mm long, apex acute, pinkish white, pubescent. Stamens 4, exserted; filaments slender, 1–2 mm long, white, glabrous; anthers bilobed, globose, 1 mm long, white, glabrous. Style bifid, 2–3 mm long, white, glabrous. Stigma capitate, minute, white, glabrous. Capsule globose, 3–6 mm long, green, pubescent.

Distribution: Tropical & Subtropical Asia to North Australia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: October-December

Specimen examined: India, Kerala, Idukki, Thoppramkudi, 14/10/2019, *Divya K. Venugopal 164879* (CALI).

Spermacoce latifolia Aubl., Hist. Pl. Guiane: 55.1775; Sasidh., Fl. Periyar Tiger Reserve 189. 1998; Sasidh., Fl. Chinnar WLS 157. 1999.

Herb. Stem quadrangular, green, pubescent. Leaves simple, opposite, ovate, 2–6 × 1.5–3 cm, apex acute, base round, margins entire, green, pubescent, subsessile. Stipules sheathy, 2–3 mm long, green, pubescent. Flowers in axillary cymes. Peduncle quadrangular, 3–4 mm long, green, glabrous. Pedicel quadrangular, minute, green, glabrous. Calyx tube 2 mm long, green, pubescent; lobes 4, not equal, 1–2 mm long, apex acute, green, pubescent. Corolla tube 2–3 mm long, white, pubescent; lobes 4, 1–2 mm long, apex obtuse, white, pubescent. Stamens 4, in the mouth of corolla tube; filaments slender, 1–2 mm long, white, glabrous; anthers bilobed, globose, minute, white, glabrous. Style bifid, 2–3 mm long, white, glabrous. Stigma capitate, > 1 mm long, white, glabrous. Capsule ellipsoid, 2–4 mm long, green, pubescent.

Distribution: Pantropical

Habitat: In the plains

Flowering and fruiting: July–December

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 16/09/1996, *Jomy Augustine 16814* (CALI); Narakathode, 18/12/1988, *P. Bharghavan 89997* (MH); Thodupuzha, 28/07/2019, *Divya K. Venugopal 170352* (CALI).

Spermacoce pusilla Wall., W.Roxburgh, Fl. Ind. 1: 379.1820; Sasidh., Fl. Periyar Tiger Reserve 189. 1998.

Herb. Stem quadrangular, green, glabrous. Leaves simple, opposite, lanceolate, 3–5 × 0.5–0.8 cm, apex acuminate, base round, margins entire, green, sparsely pubescent, sessile. Stipules ovate, 5–6 mm long, green, glabrous. Flowers in axillary cyme, dense. Peduncle quadrangular, green, glabrous. Pedicel quadrangular, minute, green, glabrous. Calyx tube 2–3 mm long, green, glabrous; lobes 4, minute, apex acuminate, green, glabrous. Corolla tube minute, white, glabrous; lobes 4, 2–3 mm long, apex acute, white, glabrous. Stamens 4, in the mouth of corolla tube; filaments slender, 2 mm long, white, glabrous; anthers bilobed, globose, 1 mm long, white, glabrous. Style bifid, white, glabrous. Stigma capitate, 1 mm long, white, glabrous. Capsule ovoid, 2–4 mm long, green, glabrous.

Distribution: South China to Tropical Asia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: June–January

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 21/11/2014, *S. Syam Radh 137958* (CALI); Periyar Tiger Reserve, 14/01/1994, *Jomy*

Augustine 13188 (CALI); *Anakkara, 28/08/2019, Divya K. Venugopal 170347* (CALI).

VALERIANACEAE Batsch

Tab. Affin. Regni Veg. 227.1802, *nom. cons.*

[According to POWO, 2022 Valerianaceae is synonym of Caprifoliaceae]

Annual or perennial herbs, rarely some shrubs; bears essential oils. Valerianic acid in roots provides a strong odour when plant gets dry. Leaves opposite, pinnate, exstipulate, usually united at the basal portion by stipule like structure thus shows a clasping base. Inflorescence - cymose. Flowers sessile. Pollination entomophilous (Delta Intkey, 2023). Calyx lobes very minute in flower, but enlarged in fruits. Corolla tube long, with spur at the base. Stamens inserted in upper part of corolla tube. Fruit cypsela, dry, indehiscent, with persistent calyx teeth. Seeds solitary, pendulous.

According to POWO, 2022; family consists of 33 accepted genera and the genus *Valeriana* consists of 424 accepted species.

Valeriana L.

Sp. Pl.: 31. 1753.

Key to species

- 1a. Stamens 4; corolla lobes 4..... *V. hookeriana*
- 1b. Stamens 3; corolla lobes 5 2
- 2a. Leaf margin serrate; calyx lobes 10 *V. hardwickei*
- 2b. Leaf margin entire; calyx lobes 5..... *V. leschenaultii*

Valeriana hardwickei Wall., W.Roxburgh, Fl. Ind. 1: 166. 1820. *Valeriana hardwickii* wall. var. *arnottiana* Hook.f., Fl. Brit. India 3: 213. 1882. *Valeriana arnottiana* Wight, Icon. Pl. Ind. Orient. 3: t. 1045 (1845); Gamble, Fl. Madras 2: 657. 1921.

Figure 13 B.

Annual erect herb, up to 60 cm high. Stem quadrangular, hollow, green, glabrous. Leaves cauline, decussate, pinnate, leaflets 4–9, ovate, 4–6 × 3–4 cm, apex acuminate, base cuneate, margin serrate, green, glabrous. Petiole terete, 2–3 × 0.4–0.5 cm, green, glabrous. Flowers 20–25, in axillary and terminal cyme, 14–16 × 0.4–0.6 cm, glabrous. Peduncle quadrangular, 12–15 × 0.5–0.6 cm, green, glabrous. Pedicel

quadrangular, 5×3 mm, green, glabrous. Bracts ovate, $8-10 \times 2-3$ mm, apex acute, green, glabrous. Calyx tube minute, 2×1 mm, green, glabrous; lobes 10, ovate, 1×1 mm, apex acute, green, glabrous. Corolla tube funnel shaped, 2×2 mm, white, glabrous; lobes 5, broadly ovate, 5×2 mm, white, glabrous. Stamens 3; filaments slender, 2×1 mm, white, glabrous; anthers bilobed, oblong, 1×1 mm, white, glabrous. Style 2×1 mm, white, glabrous. Stigma very minute, sub capitate, white, glabrous. Fruits achene, oblong, 4×1 mm, green, glabrous. Seeds very few in number, minute.

Distribution: North Pakistan to South China and West Malesia (POWO, 2022)

Habitat: Shola forests and grasslands

Flowering and fruiting: May-November

Specimens examined: India, Kerala, Idukki, Meesapulimala, 21/11/2018, Divya K. Venugopal 157320 (CALI); Mannavan shola, 27/11/1979, Nambiar 1014 (KFRI).

Valeriana hookeriana Wight & Arn., Prodr. 444.1834; Hook.f., Fl. Brit. India 3: 214. 1882; Gamble, Fl. Madras 2: 657. 1921.

Annual erect herb, up to 50 cm high. Stem quadrangular, hollow, green, glabrous. Leaves opposite, radical, pinnate, leaflets 6–10, elliptic-lanceolate, $1-3 \times 0.5-2$ cm, apex acute, base cuneate, margin dentate, green, glabrous. Petiole quadrangular, $10-12 \times 0.2-0.3$ cm, green, glabrous. Flowers 15–20, in terminal cymes, 3–5 cm long. Peduncle quadrangular, 20×0.2 cm, green, glabrous. Pedicel quadrangular, 1×1 mm, green, glabrous. Calyx tube 1×1 mm, green, glabrous; lobes 4, triangular, very minute, apex acute, green, glabrous. Corolla tube 2×1 mm, violet, glabrous; lobes 4, ovate, 1×1 mm, violet, glabrous. Stamens 4; filaments 1×1 mm, white, glabrous; anthers bilobed, oblong, 1×1 mm, white, glabrous. Style 3×1 mm, white, glabrous. Stigma very minute, white, glabrous. Fruits achene, oblong, 3×1 mm, green. Seeds 1 or 2, minute.

Distribution: southern Western Ghats

Habitat: Shola forests and grasslands

Flowering and fruiting: February-April

Specimens examined: India, Kerala, Idukki, Way to Meesapulimala, 06/04/2019, Divya K. Venugopal 159150 (CALI); Kanthallur, 30/03/1978, Nambiar 274 (KFRI).

Valeriana leschenaultii DC., Prodr. 4: 640. 1830; Hook.f., Fl. Brit. India 3: 214. 1882; Gamble, Fl. Madras 2: 657. 1921.

Annual erect herb, up to 1 m high. Stem quadrangular, with 1 or 2 branches, hollow, purplish green, glabrous. Leaves simple, opposite, dimorphic: lower leaves ovoid, 12 × 15 cm, apex acute, base cordate, margin entire, green, pubescent. Petiole quadrangular, 5–10 × 0.3–0.5 cm, green, glabrous; upper leaves smaller, oblanceolate, 6 × 4 cm, apex acute, base cordate, margin entire, green, pubescent. Petiole quadrangular, 2–4 × 0.3–0.5 cm, green, glabrous. Flowers numerous, in axillary and terminal cymes, minute, about 5 mm long. Peduncle quadrangular, 10 × 0.2 cm, green, glabrous. Pedicel quadrangular, 1 × 1 mm, green, glabrous. Calyx tube 1 × 1 mm, green, glabrous; lobes 5, minute, apex acute, green, glabrous. Corolla tube funnel-shaped, 2 × 1 mm, pink, glabrous; lobes 5, obtuse, 1 × 1 mm, spreading, pink, glabrous. Stamens 3; filaments 2 × 2 mm, white, glabrous; anthers bilobed, oblong, 2 × 2 mm, white, glabrous. Style 4 × 1 mm, white, glabrous. Stigma very minute, white, glabrous. Fruits achene, oblong, 4 × 1 mm, green, glabrous. Seeds 1 or 2, minute.

Distribution: South West India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: September–December

Specimen examined: India, Kerala, Idukki, Panchalimedu, 13/09/2019, Divya K. Venugopal 167820 (CALI).

ASTERACEAE Bercht. & J.Presl

Prir. Rostlin 254.1820., *nom. cons.*

Herbs or shrubs, rarely trees; laticiferous or non-laticiferous, without coloured juice (Delta Intkey, 2023). Leaves simple or compound, alternate or opposite, exstipulate. Flowers in head inflorescence covered by involucre bracts with disc and ray florets. Calyx tubular; lobes represented by pappus hairs. Corolla of two forms; tubular and ligulate. Disc floret – bisexual; Ray floret – unisexual. Stamens 4–5, inserted; filaments free, slender; anthers connate. Style slender, bifid. Fruit dry indehiscent achene.

According to POWO 2022, Asteraceae consists of 1688 accepted genera worldwide.

Key to Genera

- 1a. Flowers homogamous 2
- 1b. Flowers heterogamous 3
- 2a. Flowers in axillary/terminal heads 4
- 2b. Flowers in cyme/raceme 5

3a. Flowers sessile	6
3b. Flowers pedicellate	7
4a. Flowers axillary.....	<i>Mikania</i>
4b. Flowers terminal	8
5a. Flowers in cyme	9
5b. Flowers in raceme	10
6a. Flowers tetramerous; corolla purple.....	<i>Centipeda</i>
6b. Flowers pentamerous; corolla yellow	<i>Acanthospermum</i>
7a. Flowers solitary	11
7b. Flowers not solitary.....	12
8a. Bracts uniseriate	13
8b. Bracts bi/multiseriate	14
9a. Stamens inserted.....	15
9b. Stamens exerted.....	<i>Elephantopus</i>
10a. Bracts uniseriate	<i>Crassocephalum</i>
10b. Bracts bi/triseriate	16
11a. Bracts triseriate; disc floret yellow, ray floret white.....	<i>Tridax</i>
11b. Bracts biseriate; disc and ray floret yellow	<i>Wedelia</i>
12a. Flowers in capitulum	17
12b. Flowers in raceme/cyme	18
13a. Flowers yellowish orange; anthers sagittate	<i>Gynura</i>
13b. Flowers pink; anthers connate	<i>Emilia</i>
14a. Bracts multiseriate.....	<i>Anaphalis</i>
14b. Bracts biseriate.....	19
15a. Leaves alternate; achenes glandular	<i>Vernonia</i>
15b. Leaves opposite; achenes glabrous	<i>Chromolaena</i>
16a. Bracts biseriate	<i>Ageratum</i>
16b. Bracts triseriate	<i>Sonchus</i>
17a. Stem quadrangular	<i>Bidens</i>
17b. Stem terete	20
18a. Flowers in cyme	<i>Galinsoga</i>
18b. Flowers in raceme	21
19a. Stamens inserted.....	22
19b. Stamens exerted.....	<i>Youngia</i>

20a. Leaves sessile	23
20b. Leaves petiolate.	24
21a. Leaves opposite.....	25
21b. Leaves alternate	26
22a. Flowers white	27
22b. Flowers yellow.....	<i>Acmella</i>
23a. Stamens 4	<i>Eclipta</i>
23b. Stamens 5	<i>Grangea</i>
24a. Achenes spiny	<i>Synedrella</i>
24b. Achenes not spiny	28
25a. Leaves pinnatifid.....	<i>Parthenium</i>
25b. Leaves simple.....	29
26a. Leaves margin entire	30
26b. Leaves margin dentate	31
27a. Leaves opposite.....	<i>Adenostemma</i>
27b. Leaves alternate	<i>Blainvillea</i>
28a. Bracts homogamous.....	<i>Helichrysum</i>
28b. Bracts heterogamous.....	<i>Xanthium</i>
29a. Flowers white	<i>Ageratina</i>
29b. Flowers yellow.....	<i>Senecio</i>
30a. Achenes glabrous	<i>Artemisia</i>
30b. Achenes pubescent.....	<i>Gnomophalium</i>
31a. Stem glabrous.....	<i>Blumea</i>
31b. Stem pubescent	32
32a. Stem winged; flowers pink.....	<i>Laggera</i>
32b. Stem not winged; flowers yellow	<i>Eschenbachia</i>

Acanthospermum Schrank

Pl. Rar. Hort. Monac.: t. 53.1820.

Acanthospermum hispidum DC., Prodr. 5: 522.1836; Sasidh., Fl. Chinnar WLS 160. 1999; Gamble, Fl. Madras 2: 704. 1921; Sasidh., Fl. Periyar Tiger Reserve 192. 1998. Herb. Stem terete, green, puberulent. Leaves simple, opposite, ovate, 2–5 × 1–2 cm, apex acute, base cuneate, margins serrate, green, pubescent, petiolate. Flowers in axillary capitulum, sessile. Peduncle terete, green, pubescent. Bracts uniseriate, 3–5

mm long, apex acute, green, pubescent. Calyx represented by pappus hairs. Flowers heterogamous. Flowers in innermost row bisexual, corolla tube 1 mm long, yellow, glabrous; lobes 5, 1–2 mm long, apex acute, yellow, glabrous. Female flowers in outer layer, ligulate; lobes 3, apex acute, yellow, glabrous. Stamens 5, inserted; filaments free, slender, 2 mm long, white, glabrous; anthers connate, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes obovate, 3–5 mm long, green, spiny.

Distribution: Pantropical

Habitat: Degraded forest areas

Flowering and fruiting: January-May

Specimen examined: India, Kerala, Idukki, Chinnar, 13/03/2018, Divya K. Venugopal 154168 (CALI).

***Acmella* Rich. ex Pers.**

Syn. Pl. 2: 472.1807.

Acmella paniculata (Wall. ex DC.) R.K.Jansen, Syst. Bot. Monogr. 8: 67.1985. *Spilanthes paniculata* Wall. ex DC., Prodr. 5: 625 (1836); Sasidh., Fl. Periyar Tiger Reserve 209. 1998; Sasidh., Fl. Chinnar WLS 171. 1999. *Spilanthes acmella* var. *paniculata* (Wall. ex DC.) C.B.Clarke, Compos. Ind.: 139 (1876); Hook. f., Fl. Brit. India 3: 307. 1882.

Herb. Stem terete, green, sparsely pubescent. Leaves simple, opposite, ovate, 3–5 × 1–2 cm, apex acute, base round, margins crenate, green, pubescent, petiolate. Flowers in solitary capitulum. Peduncle terete, 5–8 cm long, green, glabrous. Bracts biseriate, oblong, 2–4 mm long, glabrous. Flowers homogamous. Calyx represented by pappus hairs. Corolla tube 2–3 mm long, yellow, glabrous; lobes 5, > 1 mm long, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 1 mm long, white, glabrous; anthers bilobed, linear, minute, black, glabrous. Style slender, bifid, 2 mm long, white, glabrous. Achenes obovoid, ribbed, 1–2 mm long, brown, glandular.

Distribution: China (Guangdong, Guangxi, Yunnan), Taiwan, Laccadives to Queensland (POWO, 2022)

Habitat: Shola forest margins

Flowering and fruiting: June-January

Specimens examined: India, Kerala, Idukki, 13 km from Munnar towards Marayur, 22/01/2005, *K. Deepa 110910* (CALI); Peerumedu, 20/11/1988, *N.B. Sreedevi 1011* (CALI); Mankulam, 15/06/2018, *Divya K. Venugopal 151360* (CALI).

Adenostemma J.R.Forst. & G.Forst.

Char. Gen. Pl., ed. 2: [89].1776.

Adenostemma macrophyllum DC., Prodr. 5: 113. 1836; Sasidh., Fl. Periyar Tiger Reserve 192. 1998.

Herb. Stem terete, green, glandular. Leaves simple, opposite, ovate, 3–6 × 1–2.5 cm, apex acute, base round, margins dentate, green, pubescent, petiolate. Flowers in terminal head. Peduncle terete, 3–6 cm long, green, glandular. Bracts biseriate, numerous, 2–4 mm long, apex obtuse, green, glabrous. Calyx represented by pappus hairs. Flowers homogamous. Corolla tube minute, white, pubescent; lobes 5, 2–3 mm long, apex acute, white, pubescent. Stamens 5, inserted; filaments slender, white, glabrous; anthers truncate with glandular tip, > 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes truncate, angled, brown, 3–4 mm long, glabrous.

Distribution: India

Habitat: Evergreen forests

Flowering and fruiting: June–October

Specimen examined: India, Kerala, Idukki, Mankulam, 15/06/2018, *Divya K. Venugopal 151354* (CALI).

Ageratina Spach

Hist. Nat. Vég. 10: 286. 1841.

Ageratina adenophora (Spreng.) R.M.King & H.Rob., Phytologia 19: 211 .1970; Sasidh., Fl. Periyar Tiger Reserve 193. 1998; Sasidh., Fl. Chinnar WLS 161. 1999.

Figure 13 D.

Shrub. Stem terete, purplish green, glandular hairy. Leaves simple, opposite, ovate, 6–8 × 2–4 cm, apex acute, base cuneate, margins serrate, green, pubescent, petiolate. Flowers in terminal corymbose panicle. Peduncle terete, 1–4 cm long, green, glabrous. Bracts triseriate, lanceolate, 2–3 mm long, apex acute, green, glabrous. Calyx represented by pappus hairs. Flowers heterogamous. Female flowers in inner whorls and male flowers in outer whorls. Corolla tube minute, white, pubescent; lobes

5, apex acute, white, pubescent. Stamens 5, inserted; filaments free, slender, white, glabrous; anthers connate, > 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes ellipsoid, 2–3 mm long, brown, smooth.

Distribution: New World (POWO, 2022)

Habitat: Degraded forest patches

Flowering and fruiting: February-June

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 17/02/2017, *S. Syam Radh* 167330 (CALI); Kanthallur, 25/02/2003, *M.B. Reena* 89075 (CALI); Chinnar, 13/03/2018, *Divya K. Venugopal* 154170 (CALI).

Ageratum L.

Sp. Pl.: 839.1753.

Key to species

1a. Stem purplish green; bracts elliptic..... *A. conyzoides*

1b. Stem green; bracts linear..... *A. houstonianum*

Ageratum conyzoides L., Sp. Pl.: 839.1753; Hook.f., Fl. Brit. India 3: 243. 1882; Gamble, Fl. Madras 2: 677. 1921; Sasidh., Fl. Periyar Tiger Reserve 193. 1998; Sasidh., Fl. Chinnar WLS 161. 1999.

Herb. Stem terete, purplish green, pubescent. Leaves simple, opposite, ovate, 5–8 × 3–4 cm, apex acute, base round, margins serrate, green, pubescent, petiolate. Flowers in terminal corymbose panicle. Peduncle terete, 2–5 cm long, green, pubescent. Bracts biserial, elliptic, 2–3 mm long, apex acute, green, glabrous. Flowers homogamous. Calyx represented by pappus hairs. Corolla tube c. 1 mm long, white, glabrous; lobes 5, 2 mm long, apex acute, white, glabrous. Stamens 5, inserted; filaments slender, white, glabrous; anthers connate, > 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes linear, angled, 2–3 mm long, green, pubescent.

Distribution: Pantropical

Habitat: Waste lands

Flowering and fruiting: August-January

Specimens examined: India, Kerala, Idukki, Way to Kanthallur, 08/01/2004, *B. K. Kavitha* 96713 (CALI); Kumily, 20/09/2018, *Divya K. Venugopal* 151388 (CALI).

Ageratum houstonianum Mill., Gard. Dict. ed. 8: n.º 2.1768; Gamble, Fl. Madras 2: 677. 1921; Sasidh., Fl. Chinnar WLS 161. 1999; Matthew, K.M., Illustrations on the flora of Palni hills 411. 1996.

Herb. Stem terete, branched, green, pubescent. Leaves simple, opposite, ovate, 5–7 × 3–4 cm, apex acute, base round, margins serrate, green, pubescent, petiolate. Flowers in terminal corymbs. Peduncle terete, 2–5 cm long, green, pubescent. Bracts biseriate, linear, 2–5 mm long, apex acute, green, glabrous. Flowers homogamous. Calyx represented by pappus hairs. Corolla tube minute, white, glabrous; lobes 5, 2–3 mm long, apex acute, white, glabrous. Stamens 5, inserted; filaments slender, white, glabrous; anthers connate, > 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes linear, angled, 1–2 mm long, green, pubescent.

Distribution: Pantropical

Habitat: Waste lands

Flowering and fruiting: February–December

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 17/02/2017, *S. Syam Radh* 167329 (CALI); Munnar, 30/12/1986, *Ramesan C.* 42334 (CALI); Kumily, 14/04/2017, *Divya K. Venugopal* 158402 (CALI).

Anaphalis DC.

Prodr. 6: 271.1838.

Key to species

- 1a. Bracts 1 ribbed 2
- 1b. Bracts not 1 ribbed 3
- 2a. Bracts white 4
- 2b. Bracts not white 5
- 3a. Leaves 3 ribbed *A. elliptica*
- 3b. Leaves 5 ribbed *A. travancorica*
- 4a. Ray & Disc florets present *A. bournei*
- 4b. Disc florets only present 6
- 5a. Bract yellow/yellowish white 7
- 5b. Bract pink/pinkish white 8
- 6a. Leaves base amplexicaul; achene oblong *A. lawii*
- 6b. Leaves base extending downwards; achene angled *A. leptophylla*
- 7a. Leaves cordate, apex acute *A. aristata*

- 7b. Leaves lanceolate, apex acuminate *A. meeboldii*
 8a. Disc & Ray florets present *A. subdecurrens*
 8b. Disc florets only present 9
 9a. Leaves base extend downwards *A. wightii*
 9b. Leaves base cuneate *A. marcescens*

Anaphalis aristata (DC.) DC., Prodr. 6: 274. 1838; Hook.f., Fl. Brit. India 3: 285. 1882; Gamble, Fl. Madras 2: 696. 1921; Sasidh., Fl. Periyar Tiger Reserve 193. 1998.

Herb. Stem terete, green, woolly tomentose. Leaves simple, opposite, 1-ribbed, cordate, 2–4 × 0.3–0.5 cm, apex acute, base cordate, margins entire, green, greyish woolly tomentose on abaxial surface, sessile. Flowers in terminal heads. Bracts multiseriate, oblanceolate, 3–4 mm long, yellow, woolly tomentose. Calyx represented by pappus hairs. Corolla tube minute, yellow, glabrous; lobes 5, 2–3 mm long, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, white, glabrous; anthers connate, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, cylindrical, 2–3 mm long, brown, papillose.

Distribution: West & South India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: July-May

Specimen examined: India, Kerala, Idukki, Meesapulimala, 08/05/2019, Divya K. Venugopal 158111 (CALI).

Anaphalis bournei Fyson, Bull. Misc. Inform. Kew 1914: 209.1914; Gamble, Fl. Madras 2: 697. 1921.

Figure 13 F.

Herb. Stem terete, branched, green, woolly tomentose. Leaves simple, opposite, 1-ribbed, linear, clustered at base, 1–1.2 × 0.3–0.4 cm, apex acute, base attenuate, margins entire, green, woolly tomentose, sessile. Flowers in terminal heads. Bracts multiseriate, ovate, 2–3 mm long, apex acute, white, woolly tomentose. Calyx represented by pappus hairs. Ray floret white. Disc floret brown - corolla tube 2–3 mm long, brown, glabrous; lobes 5, apex acute, brown, glabrous. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers connate, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, 3–4 angled, scaly.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: May-December

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 21/11/2014, *S. Syam Radh 143579* (CALI); Eravikulam, 29/11/1979, *Nambiar 1126* (KFRI); Dhanas Valley hill slopes, 16/10/1989, *P. Bharghavan 90961* (MH); Meesapulimala, 08/05/2019, *Divya K. Venugopal 158111* (CALI).

Anaphalis elliptica DC., Prodr. 6: 274.1838; Gamble, Fl. Madras 2: 695. 1921.
Anaphalis oblonga DC., Prodr. 6: 274.1838.

Figure 13 H.

Herb. Stem terete, green, white woolly tomentose. Leaves simple, opposite, 3-ribbed, elliptic, 2–4 × 0.5–0.7 cm, apex obtuse, base obtuse, margins entire, green, white woolly tomentose, sessile. Flowers in terminal heads. Bracts multiseriate, ovate-linear, apex acute, white woolly tomentose. Calyx represented by pappus hairs. Ray floret lobed, 1–2 mm long, pink, glabrous. Disc floret - corolla tube 2–3 mm long, pink, glabrous; lobes 5, apex acute, pink, glabrous. Stamens 5, inserted; filaments slender, 1 mm long, white, glabrous; anthers connate, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, oblong, white hairy.

Distribution: South West India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: April-January

Specimens examined: India, Kerala, Idukki, Way to Marayur, 07/01/2004, *V. Mini 97205* (CALI); Dhanas Valley-Upper Vaguvarai, 17/10/1989, *P. Bharghavan 90983* (MH); Meesapulimala, 08/05/2019, *Divya K. Venugopal 158111* (CALI).

Anaphalis leptophylla DC., Prodr. 6: 273.1838; Hook. f., Fl. Brit. India 3: 285. 1882; Gamble, Fl. Madras 2: 696. 1921.

Herb. Stem terete, profusely branched from base, green, woolly tomentose. Leaves simple, opposite, 1-ribbed, linear, 1–3 × 0.3–0.4 cm, apex acute, base extending downwards, margins entire, green, woolly tomentose, sessile. Flowers in terminal heads. Bracts multiseriate, oblanceolate, 2–3 mm long, apex acute, white woolly tomentose. Calyx represented by pappus hairs. Disc floret yellow coloured. Corolla tube 3–4 mm long, yellow, glabrous; lobes 5, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 1 mm long, white, glabrous; anthers connate, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, angled, papillose.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: May-October

Specimen examined: India, Kerala, Idukki, Meesapulimala, 08/05/2019, Divya K. Venugopal 158111 (CALI).

Anaphalis marcescens (Wight) C.B. Clarke, J.D. Hooker, Fl. Brit. India 3: 286. 1881; Gamble, Fl. Madras 2: 696. 1921.

Herb. Stem terete, branched, green, woolly tomentose. Leaves simple, opposite, 1-ribbed, linear, 1–4 × 0.2–0.3 cm, apex acute, base cuneate, margins entire, green, woolly tomentose on abaxial surface and glabrous on adaxial surface, sessile. Flowers in terminal heads. Bracts multiseriate, obovate, 1–3 mm long, apex acute, pink, woolly tomentose. Calyx represented by pappus hairs. Only disc florets present. Corolla tube 2–3 mm long, white, glabrous; lobes 5, apex acute, white, glabrous. Stamens 5, inserted; filaments slender, minute, white, glabrous; anthers connate, minute, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, pubescent.

Distribution: South West India, Sri Lanka, Indo-China (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: March-June

Specimens examined: India, Kerala, Idukki, Near Mannavan Shola, 30/03/1978, Nambiar 288 (KFRI); Meesapulimala, 08/05/2019, Divya K. Venugopal 158111 (CALI).

Anaphalis meeboldii W.W. Sm., Rec. Bot. Surv. India 4: 284 (1911); Gamble, Fl. Madras 2: 696. 1921.

Figure 13 G.

Herb. Stem terete, branched, green, woolly tomentose. Leaves simple, opposite, 1-ribbed, compactly arranged, lanceolate, 1–2 × 0.2–0.3 cm, apex acuminate, base cuneate, margins entire, green, woolly tomentose, sessile. Flowers in terminal heads. Bracts multiseriate, oblong, 2–4 mm long, apex acute, yellowish white, white woolly tomentose. Calyx represented by pappus hairs. Disc floret yellow coloured. Corolla tube 2–3 mm long, yellow, glabrous; lobes 5, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 1 mm long, white, glabrous; anthers connate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, elongate, angled, papillose.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: November-May

Specimens examined: India, Kerala, Idukki, Munnar, 08/01/1989, *Ushakumari V.N.* 4987 (CALI); Western Slopes-Eravikulam, 04/12/1987, *P. Bharghavan* 82325 (MH); Meesapulimala, 08/05/2019, *Divya K. Venugopal* 158111 (CALI).

Anaphalis wightiana DC., Prodr. 6: 273.1838; Hook.f., Fl. Brit. India 3: 286. 1882; Gamble, Fl. Madras 2: 696. 1921.

Figure 14 E.

Herb. Stem terete, branched, green, woolly tomentose. Leaves simple, opposite, 1-ribbed, linear, 1–5 × 0.3–0.4 cm, apex acute, base extend downwards, margins entire, green, woolly tomentose on abaxial surface, sessile. Flowers in terminal heads. Bracts multiseriate, oblong, 2–4 mm long, apex acute, pink, glabrous. Calyx represented by pappus hairs. Only disc florets present. Corolla tube 2–4 mm long, yellow, glabrous; lobes 5, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 1 mm long, white, glabrous; anthers connate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, papillose.

Distribution: South West India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: January-June

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 17/02/2017, *S. Syam Radh* 191194 (CALI); Meesapulimala, 08/05/2019, *Divya K. Venugopal* 158111 (CALI).

Anaphalis lawii Gamble, Fl. Madras: 696.1921; Hook.f., Fl. Brit. India 3: 283. 1882; Sasidh., Fl. Periyar Tiger Reserve 193. 1998; Sasidh., Fl. Chinnar WLS 162. 1999.

Herb. Stem terete, branched, white woolly tomentose. Leaves simple, opposite, 1-ribbed, linear-oblong, 4–6 × 0.4–0.6 cm, apex acute, base amplexicaul, margins entire, green, white woolly tomentose, sessile. Flowers in terminal heads. Peduncle terete, 2–3 cm long, green, glabrous. Bracts ovate, 2–3 mm long, white, pubescent. Calyx represented by pappus hairs. Only disc floret present. Corolla tube minute, white, glabrous; lobes 5, 2–3 mm long, apex acute, white, glabrous. Stamens 5, inserted; filaments slender, minute, white, glabrous; anthers connate, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes oblong, small, brown, pubescent, scaly.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: September-March.

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 25/05/1994, *Jomy Augustine 13905* (CALI); Meesapulimala, 10/02/2018, *Divya K. Venugopal 167752* (CALI).

Anaphalis subdecurrens Gamble, Fl. Madras: 695.1921; Hook.f., Fl. Brit. India 3: 283. 1882; Sasidh., Fl. Periyar Tiger Reserve 194. 1998.

Figure 14 H.

Herb. Stem terete, branched, green, woolly tomentose. Leaves simple, opposite, 1-ribbed, linear, 4–6 × 0.4–0.6 cm, apex acute, margins entire, green, white woolly tomentose, sessile. Flowers in terminal heads, pink, sessile. Peduncle terete, 2–6 cm long, greenish white, woolly tomentose. Bracts elliptic, 2–3 mm long, pinkish white, pubescent. Calyx represented by pappus hairs. Disc floret - corolla tube minute, yellow, glabrous; lobes 5, 2–4 mm long, apex acute, yellow, glabrous. Ray floret lobed, pink, glabrous. Stamens 5, inserted; filaments slender, white, glabrous; anthers connate, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, oblong, brown, papillose.

Distribution: India, Sri Lanka (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: July-March

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 17/02/2017, *S. Syam Radh 167328* (CALI); Way to Mannavan Shola, 08/01/2004, *L.R. Sajeena 96433* (CALI); Way to Kanthallur, 30/03/1978, *Nambiar 256* (KFRI); Elaveezhapoonchira, 21/09/2018, *Divya K. Venugopal 152109* (CALI).

Anaphalis travancorica W.W.Sm., Rec. Bot. Surv. India 4: 284.1911; Gamble, Fl. Madras 2: 695. 1921; Sasidh., Fl. Chinnar WLS 162. 1999.

Herb. Stem terete, erect, white woolly tomentose. Leaves simple, opposite, 5-ribbed, oblong, 4–6 × 0.4–0.6 cm, apex acute, base flat, margins entire, green, white woolly tomentose, sessile. Flowers in terminal heads, white with yellow in centre, large. Peduncle terete, 2–4 cm long, green, woolly tomentose. Bracts ovate, 2–3 mm long, white, pubescent. Calyx represented by pappus hairs. Bisexual flowers in centre; female flowers in outer layer, corolla tube minute, yellow, glabrous; lobes 5, 2 mm long, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, white, glabrous; anthers connate, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes oblong, small, minutely scaly, brown, papillose, scaly.

Distribution: South West India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: September-March

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 30/12/2014, *S. Syam Radh* 137939 (CALI); Munnar, 12/02/2001, *T. Sujitha* 739305 (CALI); Near Mannavan Shola, 30/03/1978, *Nambiar* 287 (KFRI); Subsidiary Turner's Valley, 13/12/1987, *P. Bharghavan* 87307 (MH); Elaveezhapoonchira, 21/09/2018, *Divya K. Venugopal* 152125 (CALI).

***Artemisia* L.**

Sp. Pl.: 845.1753.

Key to species

1a. Stem glabrous; phyllotaxy uniform..... *A. parviflora*

1b. Stem pubescent; phyllotaxy not uniform *A. nilagirica*

Artemisia nilagirica (C.B.Clarke) Pamp., Nuovo Giorn. Bot. Ital., n.s., 33: 452 .1926; Sasidh., Fl. Periyar Tiger Reserve 194. 1998. *Artemisia vulgaris* L., Sp. Pl.: 848.1753; Hook.f., Fl. Brit. India 3: 325. 1882; Gamble, Fl. Madras 2: 713. 1921.

Shrub. Stem terete, green, pubescent. Leaves pinnatisect in the lower portion and simple towards upper part, alternate, oblong, 4–5 × 1.5–2.5 cm, apex acute, base cuneate, margins entire, green, pubescent, sessile. Flowers in axillary and terminal raceme. Peduncle terete, 2–5 cm long, green, pubescent. Pedicel terete, c. 1 mm long, green, pubescent. Bracts multilayered, ovate, 2–3 mm long, green, pubescent. Calyx represented by pappus hairs. Flowers heterogamous – female flowers in outer layer and bisexual flowers in inner layer. Corolla tube 1 mm long, white, glabrous; lobes 3 (in female flowers) and lobes 5 (in bisexual flowers), 2–3 mm long, apex acute, white, glabrous. Stamens 5, inserted; filaments slender, 1–2 mm long, white, glabrous; anthers connate, c. 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes oblong, 1–3 mm long, green, glabrous.

Distribution: Indian Subcontinent to China (South West Sichuan) and North Myanmar (POWO, 2022)

Habitat: Forest margins

Flowering and fruiting: February-December

Specimens examined: India, Kerala, Idukki, Kanthalloor, 25/02/2003, *Reesha* 89465 (CALI); Periyar Tiger Reserve, 15/07/2018, *Divya K. Venugopal* 154339 (CALI).

Artemisia parviflora Roxb. ex D.Don, Prodr. Fl. Nepal.: 181.1825; Hook.f., Fl. Brit. India 3: 322. 1882; Gamble, Fl. Madras 2: 713. 1921; Sasidh., Fl. Periyar Tiger Reserve 194. 1998.

Herb. Stem terete, green, glabrous. Leaves simple, alternate, oblong, 4–5 × 1.5–2.5 cm, apex acute, base cuneate, margins entire, green, glabrous, sessile. Flowers in axillary and terminal racemes. Peduncle terete, 5–7 cm long, green, glabrous. Pedicel terete, 1 cm long, green, glabrous. Bracts multilayered, ovate, 2–3 mm long, green, glabrous. Calyx represented by pappus hairs. Flowers heterogamous – female flowers in outer layer and bisexual flowers in inner layer. Corolla tube 1 mm long, pale yellow, glabrous; lobes 3 (in female flowers) and lobes 5 (in bisexual flowers), 2–4 mm long, apex acute, pale yellow, glabrous. Stamens 5, inserted; filaments slender, 1 mm long, white, glabrous; anthers connate, c. 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes oblong, 1–2 mm long, yellowish brown, glabrous.

Distribution: Pakistan to China and Myanmar (POWO, 2022)

Habitat: Forest margins

Flowering and fruiting: May–December

Specimens examined: India, Kerala, Idukki, Devikulam, 12/12/2020, Raveendranathan P. P. 22 (CALI); Periyar Tiger Reserve, 15/07/2018, Divya K. Venugopal 154340 (CALI).

***Bidens* L.**

Sp. Pl.: 831.1753, *nom. cons.*

Bidens pilosa L., Sp. Pl.: 832.1753; Hook.f., Fl. Brit. India 3: 309. 1882; Gamble, Fl. Madras 2: 709. 1921; Sasidh., Fl. Chinnar WLS 162. 1999.

Figure 15 H.

Herb. Stem quadrangular, green, glabrous. Leaves pinnately lobed, opposite, ovate, 10–14 × 2–4 cm, apex acute, base cuneate, margins serrate, green, pubescent, petiolate. Flowers in axillary and terminal capitulum. Peduncle quadrangular, 2–5 cm long, green, glabrous. Bracts biseriate, linear, 2–5 mm long, apex acute, green, glabrous. Calyx represented by pappus hairs. Disc florets – corolla tube c. 3 mm long, yellow, glabrous; lobes 5, minute, apex acute, yellow, glabrous; ray florets – ligulate, 4–6 mm long, slightly lobed, white, glabrous. Stamens 5, inserted; filaments

slender, 2 mm long, yellow, glabrous; anthers connate, minute, brown, glabrous. Style slender, bifid, yellow, glabrous. Achenes linear, 2–3 mm long, green, spiny.

Distribution: Pantropical

Habitat: Wastelands

Flowering and fruiting: January-October

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 23/08/2014, *S. Syam Radh 143511* (CALI); Way to Mannavan Shola, 08/01/2004, *B.K. Kavitha 96752* (CALI); Way to Mannavan Shola, 08/01/2004, *Jayatha Jayapalan 96649* (CALI); Kallar, 11/03/2019, *Divya K. Venugopal 167770* (CALI).

***Blainvillea* Cass.**

G.-F.Cuvier, Dict. Sci. Nat. ed. 2. 29: 493.1823.

***Blainvillea acmella* (L.) Philipson**, Blumea 6: 350.1950; Sasidh., Fl. Chinnar WLS 162. 1999. *Blainvillea latifolia* (L.f.) DC., R.Wight, Contr. Bot. India: 17.1834; Hook.f., Fl. Brit. India 3: 305. 1882. *Blainvillea rhomboidea* Cass., G.-F.Cuvier, Dict. Sci. Nat. ed. 2. 29: 493.1823; Gamble, Fl. Madras 2: 706. 1921.

Herb. Stem terete, branching, green, pubescent. Leaves simple, alternate, ovate, 4–8 × 2–4 cm, apex acuminate, base round, margins serrate, green, pubescent, petiolate. Flowers in solitary capitulum. Peduncle terete, 4–9 mm long, green, pubescent. Bracts biseriate, linear, 3–5 mm long, apex acute, green, glabrous. Calyx represented by pappus hairs. Disc florets – bisexual, corolla tube 3–4 mm long, white, glabrous; lobes 5, > 1 mm long, apex acute, white, glabrous. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers connate, minute, black, glabrous. Style slender, bifid, c. 4 mm long, white, glabrous. Achenes truncate, 2–4 mm long, black, glabrous.

Distribution: Tropical & Subtropical Asia to Queensland (Torres Strait Islands) (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: January-December

Specimens examined: India, Kerala, Idukki, Chinnar, 14/02/2001, *K.A. Deepa 73766* (CALI); Kallar, 13/03/2019, *Divya K. Venugopal 167780* (CALI).

***Blumea* DC.**

Arch. Bot. (Paris) 2: 514.1833, *nom. cons.*

Key to species

- 1a. Stem aromatic..... *B. lacera*
- 1b. Stem not aromatic 2
- 2a. Leaves petiolate..... *B. hieracifolia*
- 2b. Leaves sessile..... 3
- 3a. Stem red 4
- 3b. Stem green 5
- 4a. Flowers in racemes, not sessile *B. eriantha*
- 4b. Flowers in cymes, sessile..... *B. belangeriana*
- 5a. Flowers in racemes, yellow 6
- 5b. Flowers in cyme, purple..... *B. axillaris*
- 6a. Leaves glabrous, apex obtuse..... *B. oxydonta*
- 6b. Leaves sparsely glandular, apex acute *B. membranacea*

***Blumea eriantha* DC.**, R. Wight, Contr. Bot. India: 15.1834; Hook.f., Fl. Brit. India 3: 266. 1882; Gamble, Fl. Madras 2: 686. 1921; Sasidh., Fl. Periyar Tiger Reserve 196. 1998.

Erect herb. Stem terete, red, not aromatic, densely pubescent. Leaves simple, alternate, obovate, 6–8 × 2–3 cm, apex acute, base round, margins dentate, green, glabrous, sessile. Flowers in axillary and terminal racemes. Peduncle terete, 1–2 cm long, green, glabrous. Bracts in many layers, lanceolate, 3–5 mm long, brown, glabrous. Flowers heterogamous. Calyx represented by pappus hairs. Female flowers minutely lobed, ligulate, 2–3 mm long, yellow, glabrous. Bisexual flowers – corolla tube 2 mm long, yellow, pubescent; lobes 5, 3–4 mm long, apex acute, yellow, pubescent. Stamens 5, inserted; filaments slender, white, glabrous; anthers sagittate, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, ribbed, pubescent.

Distribution: Indian Subcontinent (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: November–April

Specimens examined: India, Kerala, Idukki, Thekkady, 12/11/1985, *Ramesan C. 42206* (CALI); Anakkara, 14/03/2019, *Divya K. Venugopal 167880* (CALI).

Blumea belangeriana DC., Prodr. 5: 444.1836; Hook.f., Fl. Brit. India 3: 266. 1882; Gamble, Fl. Madras 2: 686. 1921; Sasidh., Fl. Periyar Tiger Reserve 195. 1998.

Erect herb. Stem terete, red, not aromatic, densely pubescent. Leaves simple, alternate, obovate, 3–6 × 2–3 cm, apex obtuse, base cuneate, margins dentate, green, white tomentose on abaxial surface, sessile. Flowers in axillary and terminal cymes, sessile. Bracts in many layers, lanceolate, 3–5 mm long, green, pubescent. Flowers heterogamous. Calyx represented by pappus hairs. Female flowers minutely lobed, ligulate, 4–5 mm long, yellow, glabrous. Bisexual flowers – corolla tube 3–6 mm long, yellow, glabrous; lobes 5, minute, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 3 mm long, white, glabrous; anthers sagittate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes terete, small, ribbed, glabrous.

Distribution: South India, Assam (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: November–April

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 22/12/2017, S. Syam Radh 167327 (CALI); Anakkara, 14/03/2019, Divya K. Venugopal 167880 (CALI).

Blumea axillaris (Lam.) DC., Prodr. 5: 434.1836; Sasidh., Fl. Periyar Tiger Reserve 197. 1998. *Blumea wightiana* DC., R.Wight, Contr. Bot. India: 14.1834; Hook. f., Fl. Brit. India 3: 261. 1882; Gamble, Fl. Madras 2: 686. 1921.

Herb. Stem terete, green, not aromatic, densely pubescent. Leaves simple, alternate, obovate, 3–5 × 2–3 cm, apex obtuse, base round, margins serrate, green, glandular, sessile. Flowers in axillary and terminal cymes. Peduncle terete, 1–3 cm long, green, pubescent. Bracts in many layers, linear, 3–4 mm long, green, pubescent. Flowers heterogamous. Calyx represented by pappus hairs. Female flowers minutely lobed, ligulate, 3–4 mm long, purple, glandular. Bisexual flowers – corolla tube 3–5 mm long, purple, pubescent; lobes 5, minute, apex acute, purple, pubescent. Stamens 5, inserted; filaments slender, 3 mm long, white, glabrous; anthers sagittate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes ellipsoid, small, ribbed, pubescent.

Distribution: Tropical & Subtropical Old World (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: November–June

Specimen examined: India, Kerala, Idukki, Anakkara, 14/03/2019, Divya K. Venugopal 167880 (CALI).

Blumea oxydonta DC., R. Wight, Contr. Bot. India: 15.1834; Hook. f., Fl. Brit. India 3: 266. 1882; Gamble, Fl. Madras 2: 686. 1921; Sasidh., Fl. Periyar Tiger Reserve 197. 1998.

Prostrate herb. Stem terete, green, not aromatic, pubescent. Leaves simple, alternate, obovate, 6–8 × 2–3 cm, apex obtuse, base round, margins dentate, green, glabrous, sessile. Flowers in axillary and terminal racemes. Peduncle terete, 2–5 cm long, green, pubescent. Bracts in many layers, lanceolate, 3–4 mm long, green, tomentose. Flowers heterogamous. Calyx represented by pappus hairs. Female flowers ligulate, 3–4 mm long, yellow, glandular. Bisexual flowers – corolla tube 4–5 mm long, yellow, pubescent; lobes 5, minute, apex acute, yellow, pubescent. Stamens 5, inserted; filaments slender, 3 mm long, white, glabrous; anthers sagittate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes 2–3 mm long, 4 angled, ribbed, pubescent.

Distribution: Indian Subcontinent to China (Yunnan) and Indo-China (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: September-May

Specimens examined: India, Kerala, Idukki, Adimali-Munnar route, 19/01/1987, Dr. K. Ramamurthy 84691 (MH); Anakkara, 14/03/2019, Divya K. Venugopal 167880 (CALI).

Blumea hieraciifolia (Spreng.) DC., R. Wight, Contr. Bot. India: 15.1834; Gamble, Fl. Madras 2: 687. 1921; Sasidh., Fl. Periyar Tiger Reserve 196. 1998. *Blumea sericans* Hook.f., Fl. Brit. India 3: 263. 1882.

Figure 15 G.

Herb. Stem terete, green, branched, not aromatic, densely pubescent. Leaves rosette towards base and alternate towards upper part, elliptic, 6–12 × 3–4 cm, apex acute, base cuneate, margins dentate, green, white tomentose, petiolate. Flowers axillary and terminal racemes. Peduncle terete, 4–7 cm long, green, pubescent. Bracts in many layers, linear, 4–6 mm long, green, pubescent. Flowers heterogamous. Calyx represented by pappus hairs. Female flowers minutely lobed, ligulate, 3–5 mm long, yellow, glabrous. Bisexual flowers – corolla tube 3–6 mm long, yellow, glandular; lobes 5, minute, apex acute, yellow, glandular. Stamens 5, inserted; filaments slender, 4 mm long, white, glabrous; anthers sagittate, 3 mm long, white, glabrous. Style

slender, bifid, white, glabrous. Achenes small, oblong, 1–2 mm long, brown, ribbed, glabrous.

Distribution: Tropical & Subtropical Asia to Caroline Islands (POWO, 2022)

Habitat: Deciduous forests

Flowering and fruiting: January–December

Specimen examined: India, Kerala, Idukki, Chinnar, 12/09/2017, Divya K. Venugopal 158256 (CALI).

Blumea membranacea DC., Prodr. 5: 440.1836; Hook.f., Fl. Brit. India 3: 266. 1882; Gamble, Fl. Madras 2: 686. 1921.

Herb. Stem terete, green, not aromatic, pubescent. Leaves simple, alternate, obovate, 6–8 × 2–3 cm, apex acute, base cuneate, margins dentate, green, sparsely glandular hairy, sessile. Flowers in terminal racemes. Peduncle terete, 3–6 cm long, green, pubescent. Bracts in many layers, linear, 3–5 mm long, green, pubescent. Flowers heterogamous. Calyx represented by pappus hairs. Female flowers minutely lobed, ligulate, 3–5 mm long, yellow, glabrous. Bisexual flowers – corolla tube 3–6 mm long, yellow, glabrous; lobes 5, minute, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 3 mm long, white, glabrous; anthers sagittate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, ribbed, green, pubescent.

Distribution: Pakistan to South China and Borneo (POWO, 2022)

Habitat: Deciduous forests

Flowering and fruiting: August–June

Specimens examined: India, Kerala, Idukki, Way to Parriavu, 18/02/1984, A.G. Pandurangan 78025 (MH); Chinnar, 13/09/2017, Divya K. Venugopal 158263 (CALI).

Blumea lacera (Burm.f.) DC., R.Wight, Contr. Bot. India: 14.1834; Sasidh., Fl. Periyar Tiger Reserve 196. 1998; Sasidh., Fl. Chinnar WLS 163. 1999; Hook.f., Fl. Brit. India 3: 263. 1882; Gamble, Fl. Madras 2: 687. 1921.

Herb. Stem, terete, green, pubescent, aromatic. Leaves simple, alternate, elliptic, 8–10 × 4–5 cm, apex acute, base cuneate, margins dentate, green, glabrous, petiolate. Flowers axillary and terminal raceme. Peduncle terete, 0.7–1 cm long, green, pubescent. Bracts in many layers, narrow, size, apex, green, pubescent. Flowers heterogamous. Calyx represented by pappus hairs. Female flowers minutely lobed, ligulate, 3–5 mm long, yellow, glabrous. Bisexual flowers – corolla tube 3–6 mm

long, yellow, glabrous; lobes 5, minute, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers connate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, subtetragonus, green, glabrous.

Distribution: Tropical & Subtropical Asia to South West Pacific (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: January-December

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 04/03/1997, Jomy Augustine 17717 (CALI); Meenmutty, 14/12/1982, C.N. Mohanan 73224 (MH); Anakulam, 10/09/2019, Divya K. Venugopal 167875 (CALI).

***Centipeda* Lour.**

Fl. Cochinch. 2: 492.1790.

***Centipeda minima* (L.) A.Braun & Asch., Index Seminum (B, Berolinensis) 1867(App. 1): 6.1867; Sasidh., Fl. Periyar Tiger Reserve 197. 1998. *Centipeda orbicularis* Lour., Fl. Cochinch. 2: 493.1790; Hook.f., Fl. Brit. India 3: 317. 1882; Gamble, Fl. Madras 2: 678. 1921.**

Figure 14 G.

Herb. Stem terete, green, pubescent. Leaves simple, alternate, obovate, 1–2 × 0.5–0.7 cm, apex obtuse, base cuneate, margins dentate, green, glabrous, petiolate. Flowers in axillary head, sessile. Bracts biseriate, lanceolate, 1 mm long, apex acute, green, pubescent. Flowers heterogamous. Female flowers in outermost layers and bisexual flowers in the centre. Female flowers – corolla tube 3–4 mm long, purple, glabrous; lobes 4, minute, apex acute, purple, glabrous; bisexual flowers – corolla tube 4–6 mm long, purple, glabrous; lobes 4, minute, apex acute, purple, glabrous. Stamens 4, inserted; filaments slender, 2 mm long, white, glabrous; anthers connate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, obovate, angled, 1 mm long, brown, puberulent.

Distribution: Russian Far East to Tropical Asia and South Pacific (POWO, 2022)

Habitat: Paddy fields

Flowering and fruiting: February-April

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 08/04/1995, Jomy Augustine 15062 (CALI); Thodupuzha, 18/03/2019, Divya K. Venugopal 167853 (CALI).

***Chromolaena* DC.**

Prodr. 5: 133.1836.

Chromolaena odorata (L.) R.M.King & H.Rob., Phytologia 20: 204.1970; Sasidh., Fl. Periyar Tiger Reserve 198. 1998; Sasidh., Fl. Chinnar WLS 163. 1999. *Eupatorium odoratum* L., Syst. Nat. ed. 10. 2: 1205.1759; Hook.f., Fl. Brit. India 3: 244. 1882.

Shrub. Stem terete, green, glandular. Leaves simple, opposite, ovate, 8–10 × 5–7 cm, apex acute, base cuneate, margins serrate, green, pubescent, petiolate. Flowers in terminal cymes. Peduncle terete, 1–4 cm long, green, glabrous. Bracts triseriate, ovate, 5–6 mm long, green, glabrous. Flowers homogamous. Calyx represented by pappus hairs. Corolla tube 3–4 mm long, white, pubescent; lobes 5, minute, apex acute, white, pubescent. Stamens 5, inserted; filaments slender, 1 mm long, white, glabrous; anthers connate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes linear, angular, 3–4 mm long, black, glabrous.

Distribution: Pantropical (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: November-June

Specimen examined: India, Kerala, Idukki, Kattappana, 17/03/2019, Divya K. Venugopal 170067 (CALI).

***Crassocephalum* Moench**

Methodus: 516.1794.

Crassocephalum crepidioides (Benth.) S.Moore, J. Bot. 50: 211.1912; Sasidh., Fl. Periyar Tiger Reserve 199. 1998; Sasidh., Fl. Chinnar WLS 164. 1999.

Figure 14 C.

Herb. Stem terete, green, glabrous. Leaves simple at upper part and pinnatifid in the lower part, opposite, 8–12 × 3–6 cm, apex acute, base cuneate, margins dentate, green, pubescent, petiolate. Flowers in terminal racemes. Peduncle terete, 1–3 cm long, green, glabrous. Bracts uniseriate, lanceolate, 4–6 mm long, green, glabrous. Calyx represented by pappus hairs. Flowers bisexual – corolla tube 4–6 mm long, yellow, glabrous; lobes 5, minute, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers connate, 1 mm long, white, glabrous. Style slender, bifid, 4–5 mm long, white, glabrous. Achenes 3–4 mm long, brown, glabrous.

Distribution: Pantropical (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: August-January

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 22/11/2017, *S. Syam Radh* 167326 (CALI); Way to Kanthalloor, 23/01/2005, *P. Sheeja* 111029 (CALI); Cheruthoni, 19/08/2017, *Divya K. Venugopal* 164642 (CALI).

***Eschenbachia* Moench**

Methodus: 573.1794.

Key to species

1a. Leaves obovate; achenes glabrous *E. japonica*

1b. Leaves linear; achenes puberulent *E. stricta*

Eschenbachia japonica (Thunb.) J.Kost., Blumea 7: 290.1952. *Conyza japonica* (Thunb.) DC., Prodr. 5: 382.1836; Hook.f., Fl. Brit. India 3: 258. 1882; Gamble, Fl. Madras 2: 683. 1921; Sasidh., Fl. Periyar Tiger Reserve 198. 1998.

Herb. Stem terete, green, pubescent. Leaves simple, alternate, obovate, 2–6 × 1.5–3 cm, apex obtuse, base cuneate, margins serrate, green, pubescent, petiolate. Flowers in terminal panicle, dense. Peduncle terete, 2–5 cm long, green, pubescent. Bracts biseriate, narrow, 2–3 mm long, green, glabrous. Flowers heterogamous, small. Calyx represented by pappus hairs. Female flowers in outermost layers and bisexual flowers in the centre. Female flowers – corolla short, yellow, filiform; bisexual flowers – corolla tube minute, yellow, glabrous; lobes 5, 2–3 mm long, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers connate, minute, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, oblong, 1–2 mm long, green, glabrous.

Distribution: Afghanistan to Japan & Philippines (POWO, 2022)

Habitat: Deciduous forests

Flowering and fruiting: April-June

Specimens examined: India, Kerala, Idukki, Kulamavu, 23/09/1981, *C.N. Mohanan & B. Ramanujam* 71922 (MH); Chinnar, 07/04/2018, *Divya K. Venugopal* 164555 (CALI).

Eschenbachia stricta (Willd.) Raizada, Indian Forester 85: 679 (1959). *Conyza stricta* Willd., Sp. Pl. ed. 4. 3: 1922; Hook.f., Fl. Brit. India 3: 258. 1882; Gamble, Fl.

Madras 2: 683. 1921; Sasidh., Fl. Periyar Tiger Reserve 199. 1998; Sasidh., Fl. Chinnar WLS 164. 1999.

Herb. Stem terete, green, pubescent. Leaves simple, alternate, linear, 2–4 × 1–1.5 cm, apex obtuse, base cuneate, margins serrate, green, pubescent, petiolate. Flowers in terminal panicle, dense. Peduncle terete, 2–4 cm long, green, pubescent. Bracts biseriate, narrow, 3–6 mm long, green, pubescent. Flowers heterogamous, small. Calyx represented by pappus hairs. Female flowers in outermost layers and bisexual flowers in the centre. Female flowers – corolla short, yellow, filiform; bisexual flowers – corolla tube 3 mm long, yellow, glabrous; lobes 5, minute, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 1 mm long, white, glabrous; anthers connate, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, green, puberulent.

Distribution: Sahara & Sahel to South Jordan and Arabian Peninsula, Himalaya to China and North Indo-China (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: June–November

Specimens examined: India, Kerala, Idukki, Vagamon, 15/11/2014, P.K. Dilna 136650 (CALI); Bhimanodu-Upper Vaguvarai, 12/06/1987, P. Bharghavan 87355 (MH); Ramakalmedu, 06/09/2018, Divya K. Venugopal 164879 (CALI).

Eclipta L.

Mant.Pl. 2: 157, 286.1771, *nom. cons.*

Eclipta prostrata (L.) L., Mant. Pl. 2: 286.1771; Sasidh., Fl. Periyar Tiger Reserve 200. 1998; Sasidh., Fl. Chinnar WLS 165. 1999. *Eclipta alba* (L.) Hassk., Pl. Jav. Rar.: 528.1848; Hook.f., Fl. Brit. India 3: 304. 1882; Gamble, Fl. Madras 2: 705. 1921.

Herb. Stem terete, green, pubescent. Leaves simple, opposite, elliptic, 2–4 × 0.5–1.5 cm, apex acute, base cuneate, margins entire, green, pubescent, sessile. Flowers in axillary and terminal head. Peduncle terete, 2–6 mm long, green, pubescent. Bracts biseriate, 3–5 mm long, green, pubescent. Calyx represented by pappus hairs. Flowers heterogamous – disc and ray florets. Disc florets – bisexual, campanulate, 3 mm long, white, glabrous; ray florets – female flowers, 4 mm long, white, glabrous. Stamens 4, exserted; filaments slender, 2 mm long, white, glabrous; anthers connate, 2 mm long,

white, glabrous. Style slender, bifid, white, glabrous. Achenes oblong, brown, pubescent.

Distribution: Pantropical (POWO, 2022)

Habitat: Moist areas

Flowering and fruiting: January-December

Specimens examined: India, Kerala, Idukki, Kulamavu dam site, 17/04/1986, Ramesan C. 42250 (CALI); Kanthallur, 03/05/2018, Divya K. Venugopal 164569 (CALI).

***Elephantopus* L.**

Sp. Pl.: 814.1753.

***Elephantopus scaber* L.**, Sp. Pl.: 814.1753; Hook.f., Fl. Brit. India 3: 242. 1882; Gamble, Fl. Madras 2: 676. 1921; Sasidh., Fl. Periyar Tiger Reserve 200. 1998.

Herb. Stem terete, green, pubescent. Leaves simple, rosette, obovate, 8–12 × 3–5 cm, apex obtuse, base cuneate, margins dentate, green, glabrous, petiolate. Flowers in terminal cymes. Peduncle terete, 2–7 cm long, green, pubescent. Bracts biseriate, oblong, 4–6 mm long, green, pubescent. Calyx represented by pappus hairs. Flowers homogamous, sessile. Corolla tube 4–6 mm long, purple, glabrous; lobes 5, 3–5 mm long, apex acute, purple, glabrous. Stamens 5, exserted; filaments slender, 3 mm long, white, glabrous; anthers sagittate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes ribbed, 4–5 mm long, green, pubescent.

Distribution: Tropical & Subtropical Old World (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: October-January

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 22/11/2017, S. Syam Radh 167324 (CALI); Periyar Tiger Reserve, 16/11/1993, Jomy Augustine 12524 (CALI); Thekkadi, 17/11/1975, K. Vivekananthan 46702 (MH); Chinnar, 17/10/2018, Divya K. Venugopal 170045 (CALI).

***Emilia* Cass.**

Bull. Sci. Soc. Philom. Paris 1817: 68.1817.

Key to species

1a. Stem purplish green; leaves sessile, margin entire..... *E. scabra*

1b. Stem green; leaves petiolate, margin serrate..... *E. sonchifolia*

Emilia scabra DC., R. Wight, Contr. Bot. India: 24.1834; Hook.f., Fl. Brit. India 3: 336. 1882; Gamble, Fl. Madras 2: 716. 1921; Sasidh., Fl. Periyar Tiger Reserve 200. 1998; Sasidh., Fl. Chinnar WLS 165. 1999.

Herb. Stem terete, purplish green, pubescent. Leaves simple, opposite, cauline, oblong, $2-4 \times 1-1.5$ cm, apex acute, base auricled, margins entire, green, pubescent, sessile. Flowers in terminal capitulum. Peduncle terete, 3–7 cm long, green, pubescent. Bracts uniseriate, oblong, 5–6 mm long, green, glabrous. Calyx represented by pappus hairs. Flowers homogamous. Corolla tube 5–6 mm long, pink, glabrous; lobes 5, 2 mm long, apex acute, pink, glabrous. Stamens 5, inserted; filaments slender, 4 mm long, white, glabrous; anthers connate, 3 mm long, orange, glabrous. Style slender, bifid, white, glabrous. Achenes 3–4 mm long, green, pubescent.

Distribution: Indian Subcontinent, Vietnam (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: September–December

Specimens examined: India, Kerala, Idukki, Munnar, 30/12/1986, *Ramesan C. 42304* (CALI); Calvary Mount, 17/10/2019, *Divya K. Venugopal 170204* (CALI).

Emilia sonchifolia (L.) DC., R. Wight, Contr. Bot. India: 24.1834; Hook.f., Fl. Brit. India 3: 336. 1882; Gamble, Fl. Madras 2: 716. 1921; Sasidh., Fl. Periyar Tiger Reserve 200. 1998; Sasidh., Fl. Chinnar WLS 165. 1999.

Herb. Stem terete, green, branched, pubescent. Leaves simple, radical and cauline, obovate, $2-8 \times 1-3$ cm, apex acute, base auricled, margins serrate, green, pubescent, petiolate. Flowers in axillary and terminal corymb. Peduncle terete, 4–6 cm long, green, pubescent. Bracts uniseriate, oblong, 4–7 mm long, green, glabrous. Calyx represented by pappus hairs. Flowers homogamous – only disc florets, bisexual. Corolla tube 3–4 mm long, pink, glabrous; lobes 5, minute, apex acute, pink, glabrous. Stamens 5, inserted; filaments slender, 3 mm long, white, glabrous; anthers connate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes ribbed, 1–3 mm long, green, pubescent.

Distribution: Tropical & Subtropical Old World (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: February–December

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 23/08/2014, *S. Syam Radh 143544* (CALI); Munnar, 12/02/2001, *B. Nazeedha 73609*

(CALI); Idukki, 12/09/1986, *Ramesan C. 42262* (CALI); Munnar, 27/11/1979, *Nambiar 876* (KFRI); Kallar, 25/09/2018, *Divya K. Venugopal 164895* (CALI).

***Galinsoga* Ruiz & Pav.**

Fl. Peruv. Prodr.: 110.1794.

Galinsoga parviflora Cav., Icon. 3: 41.1795; Hook.f., Fl. Brit. India 3: 311. 1882; Gamble, Fl. Madras 2: 711. 1921; Sasidh., Fl. Periyar Tiger Reserve 201. 1998; Sasidh., Fl. Chinnar WLS 166. 1999.

Herb. Stem terete, green, pubescent, branched. Leaves simple, opposite, ovate, 3–6 × 1.5–2 cm, apex acute, base cuneate, margins serrate, green, pubescent, sessile. Flowers in axillary and terminal cymes. Peduncle terete, 1–5 cm long, green, pubescent. Bracts biseriate, ovate, 3–4 mm long, green, glabrous. Flowers heterogamous – disc and ray florets. Calyx represented by pappus hairs. Disc florets – bisexual, corolla tube 2 mm long, yellow, glabrous; lobes 5, minute, apex acute, yellow, glabrous. Ray florets – ligulate, lobes 3, 2–3 mm long, apex acute, white, glabrous. Stamens 5, inserted; filaments slender, 2 mm long, yellow, glabrous; anthers connate, 1 mm long, yellow, glabrous. Style slender, bifid, white, glabrous. Achenes obovoid, 2–3 mm long, black, pubescent.

Distribution: Pantropical (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: December–August

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 23/08/2014, *S. Syam Radh 143509* (CALI); Pallivasal, 02/05/1984, *Ramesan C. 32728* (CALI); Chinnar, 13/02/2019, *Divya K. Venugopal 170063* (CALI).

***Gnomophalium* Greuter**

Willdenowia 33: 242. 2003.

Gnomophalium pulvinatum (Delile) Greuter, Willdenowia 33: 242.2003. *Gnaphalium pulvinatum* Delile, Descr. Egypte, Hist. Nat. 2(Mém.): 266.1813; Hook.f., Fl. Brit. India 3: 289. 1882; Gamble, Fl. Madras 2: 698. 1921.

Prostrate herb. Stem terete, green, woolly tomentose. Leaves simple, alternate, obovate, 1–2 × 0.2–0.5 cm, apex obtuse, base cuneate, margins entire, green, woolly tomentose, sessile. Flowers in terminal round spikes. Peduncle terete, 3–6 cm long, green, woolly tomentose. Bracts numerous, ovoid-lanceolate, 3–4 mm long, green,

pubescent. Flowers heterogamous – outer female flowers and inner bisexual flowers. Calyx represented by pappus hairs. Female flowers ligulate, filiform. Bisexual flowers – corolla tube 2 mm long, yellowish white, glabrous; lobes 5, minute, apex acute, yellowish white, glabrous. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers sagittate, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, oblong, 2–3 mm long, black, pubescent.

Distribution: Egypt to Arabian Peninsula, Indian Subcontinent to South East Tibet (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: January–November

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 12/01/1995, Jomy Augustine 14573 (CALI); Chinnar, 13/02/2019, Divya K. Venugopal 170065 (CALI).

***Grangea* Adans.**

Fam. Pl. 2: 121.1763.

***Grangea maderaspatana* (L.) Poir., J.B.A.M.de Lamarck, Encyc., Suppl. 2: 825.1812; Hook.f., Fl. Brit. India 3: 247. 1882; Gamble, Fl. Madras 2: 680. 1921; Sasidh., Fl. Periyar Tiger Reserve 202. 1998.**

Herb. Stem terete, green, pubescent. Leaves pinnatifid, alternate, oblanceolate, 2–4 × 1.5–2.5 cm, apex obtuse, base auricled, margins dentate, green, glabrous, sessile. Flowers in axillary, solitary head. Peduncle terete, 2–5 cm long, green, pubescent. Bracts biseriate, oblong, 2–4 mm long, green, pubescent. Flowers heterogamous – outer female flowers and inner bisexual flowers. Calyx represented by pappus hairs. Corolla tube 2 mm long, yellow, glabrous; lobes 5, minute, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 1 mm long, white, glabrous; anthers sagittate, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes obovate, small, black, pubescent.

Distribution: Tropical & Subtropical Old World (POWO, 2022)

Habitat: River banks

Flowering and fruiting: March–August

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 03/06/1995, Jomy Augustine 13620 (CALI); Kaliyar, 08/03/2021, Divya K. Venugopal 172054 (CALI).

***Gynura* Cass.**

G.-F.Cuvier, Dict. Sci. Nat., ed. 2. 34: 391.1825.

Key to species

1a. Stem terete, pubescent; leaves margin serrate..... *G. travancorica*

1b. Stem quadrangular, glabrous; leaves margin entire *G. nitida*

Gynura nitida DC., R. Wight, Contr. Bot. India: 24.1834; Hook.f., Fl. Brit. India 3: 333. 1882; Gamble, Fl. Madras 2: 714. 1921; Sasidh., Fl. Periyar Tiger Reserve 202. 1998.

Figure 15 F.

Herb. Stem quadrangular, green, glabrous. Leaves cauline, oblanceolate, 8–10 × 2–3 cm, apex acute, base auricled, margins entire, green, pubescent, sessile. Flowers in terminal corymb. Peduncle quadrangular, 2–6 cm long, green, glabrous. Bracts uniseriate, lanceolate, 5–8 mm long, green, glabrous. Flowers homogamous – only disc florets. Calyx represented by pappus hairs. Corolla tube 5–7 mm long, yellowish orange, glandular; lobes 5, minute, apex acute, yellowish orange, glandular. Stamens 5, inserted; filaments slender, 3 mm long, white, glabrous; anthers sagittate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes narrow, ribbed, ellipsoid, 3–4 mm long, black, pubescent.

Distribution: West & South India, Indo-China (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: January–October

Specimens examined: India, Kerala, Idukki, Way to Marayur, 09/01/2004, *M. Amritha* 96953 (CALI); Periyar Tiger Reserve, 04/09/1994, *Jomy Augustine* 14130 (CALI); Parunthupara, 11/04/2019, *Divya K. Venugopal* 170238 (CALI).

Gynura travancorica W.W.Sm., Rec. Bot. Surv. India 6: 29.1914; Gamble, Fl. Madras 2: 714. 1921; Sasidh., Fl. Periyar Tiger Reserve 203. 1998.

Figure 15 E.

Herb. Stem terete, green, pubescent. Leaves simple, alternate, elliptic, 8–10 × 2–3 cm, apex acute, base cuneate, margins serrate, green, pubescent, sessile. Flowers in terminal corymb. Peduncle terete, 2–6 cm long, green, pubescent. Bracts uniseriate, ovate, 6–9 mm long, green, glabrous. Flowers homogamous – only disc florets. Calyx represented by pappus hairs. Corolla tube 8–10 mm long, yellow, glabrous; lobes 5, minute, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 3 mm

long, white, glabrous; anthers sagittate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes narrow, ribbed, ovoid, black, pubescent.

Distribution: West & South India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: February-December

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 12/12/1993, Jomy Augustine 12780 (CALI); Parunthupara, 11/04/2019, Divya K. Venugopal 170249 (CALI).

***Helichrysum* Mill.**

Gard. Dict. Abr., ed. 4.: 462. 1754.

Helichrysum buddlejoides DC., R. Wight, Contr. Bot. India: 20. 1834; Sasidh., Fl. Periyar Tiger Reserve 203. 1998; Sasidh., Fl. Chinnar WLS 167. 1999; Hook.f., Fl. Brit. India 3: 290. 1882; Gamble, Fl. Madras 2: 699. 1921.

Figure 15 C.

Shrub. Stem terete, green, woolly tomentose. Leaves simple, alternate, lanceolate, 5–10 × 1.5–2 cm, apex acute, base amplexicaul, margins entire, green, white woolly tomentose on abaxial surface, sessile. Bracts in many layers, oblanceolate, 2–3 mm long, yellow, glabrous. Flowers in axillary and terminal heads. Peduncle terete, 2–5 cm long, green, woolly tomentose. Calyx represented by pappus hairs. Flowers heterogamous. Female flowers in outer layer – ligulate, filiform, yellow, glabrous. Bisexual flowers – corolla tube 3 mm long, yellow, glabrous; lobes 5, minute, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers sagittate, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes small, angled, black, pubescent.

Distribution: India, Sri Lanka (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October-March

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 08/12/1994, Jomy Augustine 14349 (CALI); Poosanampara Grassy Slopes, 19/10/1989, P. Bharghavan 91824 (MH); Calvary Mount, 15/11/2018, Divya K. Venugopal 164882 (CALI).

***Laggera* Sch.Bip. ex Benth.**

G.Bentham & J.D.Hooker, Gen. Pl. 2: 290.1873.

Laggera alata (D.Don) Sch.Bip. ex Oliv., Trans. Linn. Soc. London 29: 94. 1873; Hook.f., Fl. Brit. India 3: 271. 1882; Gamble, Fl. Madras 2: 689. 1921. *Blumea alata* (D.Don) DC., Prodr. 5: 448.1836; Sasidh., Fl. Periyar Tiger Reserve 195. 1998. Herb. Stem, terete, green, winged, densely pubescent. Leaves simple, alternate, obovate, 6–8 × 2–3 cm, apex obtuse, margins dentate, green, glabrous, sessile, decurrent on stem at base. Flowers in axillary and terminal racemes. Bracts in many layers, oblong, 5–7 mm long, green, glabrous. Flowers heterogamous. Peduncle terete, 2–4 cm long, green, pubescent. Calyx represented by pappus hairs. Female flowers minutely lobed, ligulate. Bisexual flowers – corolla tube 5–6 mm long, pink, glabrous; lobes 5, minute, apex acute, pink, glabrous. Stamens 5, inserted; filaments slender, 3 mm long, white, glabrous; anthers sagittate, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes oblong, small, black, ribbed, pubescent.

Distribution: Tropical & Subtropical Old World (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: September-April

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 24/02/2016, *S. Syam Radh 145130* (CALI); Rajamala, 25/09/1984, *Ramesan c. 38774* (CALI); Meenmutty, 14/02/1982, *C.N. Mohanan 73233* (MH); Anakulam, 10/03/2019, *Divya K. Venugopal 164581* (CALI).

***Mikania* Willd.**

Sp. Pl. ed. 4. 3: 1481, 1742.1803, *nom. cons.*

Mikania cordata (Burm.f.) B.L.Rob., Contr. Gray Herb. 104: 65.1934; Sasidh., Fl. Periyar Tiger Reserve 205. 1998; Sasidh., Fl. Chinnar WLS 168. 1999. *Mikania scandens* (L.) Willd., Sp. Pl. ed. 4. 3: 1743; Hook.f., Fl. Brit. India 3: 144. 1882.

Figure 17 B.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite, ovate, 8–10 × 6–7 cm, apex acute, base cordate, margins serrate, green, glabrous, petiolate. Flowers in axillary corymbs. Bracts biseriate, ovate, minute, green, pubescent. Flowers bisexual. Peduncle terete, 2–6 cm long, green, glabrous. Calyx represented by pappus hairs. Corolla tube 3 mm long, white, glandular; lobes 5, minute, apex acute, white, glandular. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers

linear, 1 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes oblong, 2 mm long, black, glabrous.

Distribution: Tropical Old World (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: January-May

Specimens examined: India, Kerala, Idukki, Way to Marayur, 09/01/2004, *Mini 97624* (CALI); Kattappana, 16/04/2018, *Divya K. Venugopal 170057* (CALI).

***Parthenium* L.**

Sp. Pl.: 988.1753.

***Parthenium hysterophorus* L.**, Sp. Pl.: 988.1753; Sasidh., Fl. Chinnar WLS 169. 1999. Figure 16 F.

Herb. Stem terete, green, pubescent, branched. Leaves pinnatisect, opposite, lanceolate, 6–10 × 0.5–1.5 cm, apex acute, base decurrent, margins entire, green, pubescent, petiolate. Flowers in terminal panicles. Bracts biseriate, ovate, 2–3 mm long, green, ciliate. Peduncle terete, 2–4 cm long, green, glabrous. Calyx represented by pappus hairs. Flowers heterogamous; outer ray florets female and inner disc florets male. Female flowers – ligulate, lobes 5, shortly lobed, white, glabrous. Male flowers – corolla tube 3–4 mm long, white, glabrous; lobes 5, minute, apex acute, white, glabrous. Stamens 5, inserted; filaments slender, 3 mm long, white, glabrous; anthers linear, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes oblong, 1–2 mm long, black, glabrous.

Distribution: Pantropical

Habitat: In the plains

Flowering and fruiting: June-April

Specimens examined: India, Kerala, Idukki, Way to Kanthalloor, 23/01/2005, *P. I. Jattisha 110224* (CALI); Kattappana, 17/04/2018, *Divya K. Venugopal 170065* (CALI).

***Senecio* L.**

Sp. Pl.: 866.1753.

Key to species

- 1a. Leaves & bracts glabrous *S. scandens*
- 1b. Leaves & bracts pubescent..... *S. corymbosa*

Senecio corymbosus Wall. ex DC., R. Wight, Contr. Bot. India: 22:1834; Hook.f., Fl. Brit. India 3: 351. 1882; Gamble, Fl. Madras 2: 723. 1921.

Shrub. Stem terete, climbing, green, woolly tomentose. Leaves simple, opposite, ovate, 5–18 × 3–4 cm, apex acute, base cordate, margins dentate, green, tomentose on abaxial surface, petiolate. Flowers in axillary and terminal panicles, woolly. Peduncle terete, 3–5 cm long, green, woolly tomentose. Bracts biseriate, oblong, 3–5 mm long, green, woolly. Calyx represented by pappus hairs. Flowers heterogamous; outer ray florets female and inner disc florets bisexual. Female flowers – ligulate, lobes 5, shortly lobed, yellow. Bisexual flowers – corolla tube 4–5 mm long, yellow, pubescent; lobes 5, minute, apex acute, yellow, pubescent. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers linear, 3 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes ribbed, 2–3 mm long, black, glabrous, with pappus hairs.

Distribution: Pantropical

Habitat: In the plains

Flowering and fruiting: December–April

Specimens examined: India, Kerala, Idukki, Way to Mannavan Shola, 23/01/2005, *P. Sheeja* 111050 (CALI); Devikulam, 31/03/1978, *Nambiar* 320 (KFRI); Way to Mangaladevi temple, 16/02/1981, *N.C. Nair* 70226 (MH); Kattappana, 18/04/2018, *Divya K. Venugopal* 170068 (CALI).

Senecio scandens Buch.-Ham. ex D.Don, Prodr. Fl. Nepal.: 178.1825; Hook.f., Fl. Brit. India 3: 352. 1882; Sasidh., Fl. Periyar Tiger Reserve 208. 1998; Sasidh., Fl. Chinnar WLS 169. 1999. *Senecio intermedius* Wight, Icon. Pl. Ind. Orient. 3(4): 12.1846; Gamble, Fl. Madras 2: 724. 1921.

Shrub. Stem terete, climbing, green, glabrous, dichotomously branched. Leaves simple, opposite, ovate, 6–10 × 0.5–1.5 cm, apex acute, base cuneate, margins dentate, green, glabrous, petiolate. Flowers in axillary and terminal panicles. Bracts biseriate, lanceolate, 3–5 mm long, green, glabrous. Peduncle terete, 3–6 cm long, green, glabrous. Calyx represented by pappus hairs. Flowers heterogamous; outer ray florets female and inner disc florets bisexual. Female flowers – ligulate, lobes 5, 5–7 mm long, shortly lobed, yellow. Bisexual flowers – corolla tube 4 mm long, yellow, pubescent; lobes 5, minute, apex acute, yellow, pubescent. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers linear, 2 mm long, white,

glabrous. Style slender, bifid, white, glabrous. Achenes ribbed, 3–4 mm long, black, glabrous, without pappus hairs.

Distribution: China to Indo-China and Central Malesia (POWO, 2022)

Habitat: Shola forest margins

Flowering and fruiting: December-July

Specimens examined: India, Kerala, Idukki, Way to Marayur, 24/02/2003, *K.V. Radhika* 88602 (CALI); 18 km from Munnar towards Marayur, 24/02/2003, *Tomson Mani* 90802 (CALI); Mankulam, 15/06/2018, *Divya K. Venugopal* 151357 (CALI).

***Sonchus* L.**

Sp. Pl.: 793.1753.

Key to species

1a. Stem fleshy; leaves compound..... *S. oleraceus*

1b. Stem not fleshy; leaves simple..... *S. wightianus*

***Sonchus oleraceus* L.**, Sp. Pl.: 794.1753; Hook.f., Fl. Brit. India 3: 414. 1882; Gamble, Fl. Madras 2: 732. 1921; Sasidh., Fl. Periyar Tiger Reserve 208. 1998; Sasidh., Fl. Chinnar WLS 170. 1999.

Herb. Stem terete, fleshy, green, glandular. Leaves compound, pinnatifid, alternate, 12–16 × 4–6 cm, apex acute, base amplexicaul, margins serrate, green, glabrous, sessile. Flowers in terminal panicles. Bracts triseriate, oblong, 6–9 mm long, green, glabrous. Peduncle terete, 3–7 cm long, green, glabrous. Calyx represented by pappus hairs. Flowers homogamous. Corolla tube 7–10 mm long, yellow, glabrous; lobes 5, 8–10 mm long, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 3 mm long, white, glabrous; anthers sagittate, 4 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes obovoid, 2–3 mm long, black, ribbed, glabrous.

Distribution: Pantropical (POWO, 2022)

Habitat: Shola forest margins

Flowering and fruiting: March-December

Specimens examined: India, Kerala, Idukki, Pallivasal, 20/10/1984, *Ramesan C.* 38742 (CALI); Periyar Tiger Reserve, 06/09/1993, *Jomy Augustine* 12394 (CALI); Periyar Tiger Reserve, 21/05/2018, *Divya K. Venugopal* 152546 (CALI).

Sonchus wightianus DC., Prodr. 7: 187.1838; Sasidh., Fl. Periyar Tiger Reserve 208. 1998; Sasidh., Fl. Chinnar WLS 170. 1999. *Sonchus arvensis* L., Sp. Pl.: 793.1753; Hook.f., Fl. Brit. India 3: 414. 1882; Gamble, Fl. Madras 2: 732. 1921.

Figure 16 E.

Herb. Stem terete, not fleshy, green, sparsely pubescent. Leaves simple, opposite, 10–15 × 3–5 cm, apex obtuse, base cuneate, margins serrate, green, glabrous, sessile. Flowers in terminal panicles. Bracts triseriate, oblong, 8–10 mm long, green, pubescent. Peduncle terete, 4–10 cm long, green, pubescent. Calyx represented by pappus hairs. Flowers homogamous. Corolla tube 9–10 mm long, yellow, glabrous; lobes 5, 4–5 mm long, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 5–6 mm long, white, glabrous; anthers sagittate, 4 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes obovoid, 3–4 mm long, black, glabrous, ribbed.

Distribution: Afghanistan to China and West Malesia (POWO, 2022)

Habitat: Shola forest margins

Flowering and fruiting: January–December

Specimens examined: India, Kerala, Idukki, Vallakadavu Reserve Forest, 19/03/1973, B.D. Sharma 43934 (MH); Periyar Tiger Reserve, 21/05/2018, Divya K. Venugopal 152548 (CALI).

Synedrella Gaertn.

Fruct. Sem. Pl. 2: 456.1791, *nom. cons.*

Synedrella nodiflora (L.) Gaertn., Fruct. Sem. Pl. 2: 456. 1791; Hook.f., Fl. Brit. India 3: 308. 1882; Gamble, Fl. Madras 2: 708. 1921; Sasidh., Fl. Periyar Tiger Reserve 209. 1998; Sasidh., Fl. Chinnar WLS 171. 1999.

Figure 16 B.

Herb. Stem terete, green, pubescent, branched. Leaves simple, opposite, ovate, 6–8 × 2–4 cm, apex acute, base cuneate, margins serrate, green, pubescent on abaxial surface, petiolate. Flowers in solitary capitulum. Peduncle terete, 1–2 cm long, green, pubescent. Bracts biseriate, ovate, 3–4 mm long, green, glabrous. Flowers heterogamous. Calyx represented by pappus hairs. Ray florets in outer layer, female, 2–3 mm long, lobed, yellow, glabrous. Disc florets in inner layer, bisexual, corolla tube 2–3 mm long, yellow, glabrous; lobes 5, minute, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 2–3 mm long, yellow, glabrous; anthers linear,

1 mm long, yellow, glabrous. Style slender, bifid, yellow, glabrous. Achenes dimorphic, spiny, 2–3 mm long, black, glabrous.

Distribution: Pantropical (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: January–December

Specimen examined: India, Kerala, Idukki, Thodupuzha, 13/11/2017, Divya K. Venugopal 151248 (CALI).

***Tridax* L.**

Sp. Pl.: 900. 1753.

Tridax procumbens L., Sp. Pl.: 900.1753; Hook.f., Fl. Brit. India 3: 311. 1882; Gamble, Fl. Madras 2: 711. 1921; Sasidh., Fl. Periyar Tiger Reserve 210. 1998; Sasidh., Fl. Chinnar WLS 172. 1999.

Figure 17 C.

Herb. Stem terete, green, pubescent. Leaves simple, opposite, ovate, 2–3 × 1–1.5 cm, apex acute, base cuneate, margins dentate, green, pubescent, petiolate. Flowers terminal, solitary. Peduncle terete, 2–8 cm long, green, pubescent. Bracts triseriate, lanceolate, 2–3 mm long, green, pubescent. Calyx represented by pappus hairs. Flowers heterogamous. Disc florets – bisexual, corolla tube 3–4 mm long, yellow, glabrous; lobes 5, apex acute, yellow, glabrous. Ray florets – female, ligulate, 3–4 mm long, minutely lobed, white, glabrous. Stamens 5, inserted; filaments slender, 2 mm long, yellow, glabrous; anthers linear, 3 mm long, yellow, glabrous. Style slender, bifid, yellow, glabrous. Achenes obovoid, 2–3 mm long, black, pubescent.

Distribution: Pantropical (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: January–December

Specimen examined: India, Kerala, Idukki, Thodupuzha, 13/11/2017, Divya K. Venugopal 151261 (CALI).

***Vernonia* Schreb.**

Gen. Pl., ed. 8[a] 2: 541.1791.

Key to species

- 1a. Stem glabrous..... 2
- 1b. Stem pubescent 3

- 2a. Leaves margin entire; flowers lilac *V. travancorica*
 2b. Leaves margin not entire; flowers pink 4
 3a. Leaves sessile *V. salviifolia*
 3b. Leaves petiolate 5
 4a. Leaves apex acute; achenes ovoid, glabrous *V. peninsularis*
 4b. Leaves apex obtuse; achenes obovoid, pubescent *V. cinerea*
 5a. Stem branched; leaves margin entire *V. arborea*
 5b. Stem unbranched; leaves margin dentate *V. indica*

Vernonia arborea Buch.-Ham., Trans. Linn. Soc. London 14: 218. 1824; Sasidh., Fl. Periyar Tiger Reserve 211. 1998; Hook.f., Fl. Brit. India 3: 239. 1882. *Vernonia monosis* Benth. ex C.B. Clarke, Compos. Ind.: 24 1876; Gamble, Fl. Madras 2: 672. 1921.

Tree. Stem terete, green, branched, pubescent. Leaves simple, alternate, obovate, 12–30 × 5–8 cm, apex acuminate, base cuneate, margins entire, green, pubescent on abaxial surface, petiolate. Flowers in terminal panicles. Peduncle terete, 2–6 cm long, green, pubescent. Bracts biseriate, ovate, 3–4 mm long, green, pubescent. Calyx represented by pappus hairs. Flowers homogamous. Corolla tube 4–6 mm long, pink, glabrous; lobes 5, pink, glabrous. Stamens 5, inserted; filaments slender, white, glabrous; anthers connate, 2–4 mm long, white, glabrous. Style slender, bifid, 7–8 mm long, white, glabrous. Achenes obovoid, 2–3 mm long, black, 10 ribbed, pubescent.

Distribution: China (South East Yunnan, Guangxi) to Tropical Asia (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: September–April

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 20/03/2017, *S. Syam Radh 167318* (CALI); Rajamala, 17/02/1998, *Susmitha 6110* (CALI); Mankulam, 07/09/2018, *Divya K. Venugopal 156318* (CALI).

Vernonia cinerea (L.) Less., Linnaea 4: 291. 1829; Hook.f., Fl. Brit. India 3: 233. 1882; Gamble, Fl. Madras 2: 676. 1921; Sasidh., Fl. Periyar Tiger Reserve 211. 1998; Sasidh., Fl. Chinnar WLS 173. 1999.

Herb. Stem terete, green, pubescent. Leaves simple, alternate, ovate-elliptic, 2–6 × 1–3 cm, apex obtuse, base cuneate, margins dentate, green, glabrous, petiolate. Flowers in terminal corymbs. Peduncle terete, 1–5 cm long, green, pubescent. Bracts biseriate, oblong, 3–4 mm long, green, pubescent. Calyx represented by pappus hairs. Flowers homogamous. Corolla tube 3–5 mm long, pink, glabrous; lobes 5, apex acute, pink,

glabrous. Stamens 5, inserted; filaments slender, 1 mm long, white, glabrous; anthers linear, 2 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes obovoid, 1–2 mm long, black, pubescent.

Distribution: Tropical & Subtropical Old World to Pacific (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: January–October

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 08/09/1996, *Jomy Augustine 16964* (CALI); Kumily, 10/05/2019, *Divya K. Venugopal 167785* (CALI).

Vernonia indica Wall. ex C.B. Clarke, Comps. Ind.: 16. 1876; Hook.f., Fl. Brit. India 3: 238. 1882; Gamble, Fl. Madras 2: 674. 1921; Sasidh., Fl. Periyar Tiger Reserve 212. 1998.

Shrub. Stem terete, green, woolly tomentose, unbranched. Leaves simple, alternate, elliptic, 8–10 × 3–4 cm, apex acute, base cuneate, margins dentate, green, white on abaxial surface, pubescent on abaxial surface, petiolate. Flowers in terminal corymbs. Peduncle terete, 1–4 cm long, green, woolly tomentose. Bracts biseriate, oblong, 3–5 mm long, green, woolly tomentose. Calyx represented by pappus hairs. Flowers homogamous. Corolla tube 4–6 mm long, pink, glabrous; lobes 5, minute, apex acute, pink, glabrous. Stamens 5, inserted; filaments slender, 2 mm long, white, glabrous; anthers linear, 3 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes ovoid, 2–3 mm long, black, 10 ribbed, glandular.

Distribution: India to Myanmar (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: September–December

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 21/11/2014, *S. Syam Radh 143578* (CALI); Periyar Tiger Reserve, 16/08/1994, *Jomy Augustine 14076* (CALI); Kulamavu, 24/09/1981, *C.N. Mohanan & B. Ramanujam 71933* (MH); Elaveezhapoonchira, 14/10/2018, *Divya K. Venugopal 172547* (CALI).

Vernonia peninsularis C.B. Clarke ex Hook.f., Fl. Brit. India 3: 233. 1881; Gamble, Fl. Madras 2: 674. 1921; Sasidh., Fl. Periyar Tiger Reserve 212. 1998.

Herb. Stem terete, green, branched, pubescent. Leaves simple, alternate, elliptic, 6–10 × 3–4 cm, apex acute, base round, margins serrate, green, white on abaxial surface, glabrous, petiolate. Flowers in terminal corymbs. Peduncle terete, 1–5 cm long, green, pubescent. Bracts multiseriate, linear, 4–8 mm long, green, pubescent. Calyx represented by pappus hairs. Flowers homogamous. Corolla tube 6–8 mm long, pink,

glabrous; lobes 5, apex acute, pink, glabrous. Stamens 5, inserted; filaments slender, 3 mm long, white, glabrous; anthers linear, 3 mm long, white, glabrous. Style slender, bifid, white, glabrous. Achenes ovoid, 4–7 mm long, black, ribbed, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October–February

Specimen examined: India, Kerala, Idukki, Elaveezhapoonchira, 14/10/2018, *Divya K. Venugopal* 172547 (CALI).

Vernonia salviifolia Wight, Icon. Pl. Ind. Orient.: t. 1079.1846; Hook. f., Fl. Brit. India 3: 237. 1882; Gamble, Fl. Madras 2: 675. 1921; Sasidh., Fl. Periyar Tiger Reserve 214. 1998.

Shrub. Stem terete, green, white woolly tomentose. Leaves simple, alternate, clustered at top, lanceolate, 8–10 × 3–4 cm, apex acute, base cuneate, margins crenate, green, white woolly on abaxial surface, sessile. Flowers in terminal corymbs, dense. Peduncle terete, 1–4 cm long, green, woolly tomentose. Bracts multiseriate, ovate, 3–6 mm long, green, woolly. Calyx represented by pappus hairs. Flowers homogamous. Corolla tube 5–7 mm long, lilac, glabrous; lobes 5, apex acute, lilac, glabrous. Stamens 5, inserted; filaments slender, 3 mm long, white, glabrous; anthers linear, 4 mm long, white, glabrous. Style slender, bifid, white, pubescent. Achenes tetraginous, 3–4 mm long, black, ribbed, glabrous.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: March–October

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 15/03/1997, *Jomy Augustine* 17789 (CALI); Elaveezhapoonchira, 14/10/2018, *Divya K. Venugopal* 172547 (CALI).

Vernonia travancorica Hook.f., Fl. Brit. India 3: 240. 1881; Gamble, Fl. Madras 2: 673. 1921; Sasidh., Fl. Periyar Tiger Reserve 214. 1998.

Figure 15 A.

Tree. Leaves simple, alternate, obovate, 8–10 × 3–4 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Flowers in terminal corymbs. Peduncle terete, green, glabrous. Bracts biseriate, oblong, 5–7 mm long, green, glabrous. Calyx represented by pappus hairs. Flowers homogamous. Corolla tube 7–9 mm long, lilac, glabrous; lobes 5, apex acute, lilac, glabrous. Stamens 5, inserted; filaments slender, 3

mm long, white, glabrous; anthers linear, 3 mm long, white, glabrous. Style slender, bifid, white, pubescent. Achenes ovoid, black, 10 ribbed, glandular.

Distribution: South West & South India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: February-September

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 07/02/1994, Jomy Augustine 13307 (CALI); Elaveezhapoonchira, 18/03/2017, Divya K. Venugopal 170242 (CALI).

***Wedelia* Jacq.**

Enum. Syst. Pl.: 8, 28.1760.

Wedelia urticifolia (Blume) DC., R. Wight, Contr. Bot. India: 18. 1834; Hook.f., Fl. Brit. India 3: 306. 1882; Gamble, Fl. Madras 2: 707. 1921; Sasidh., Fl. Periyar Tiger Reserve 215. 1998.

Herb. Stem terete, green, pubescent. Leaves simple, opposite, ovate, 8–10 × 3–4 cm, apex acute, base cuneate, margins serrate, green, pubescent, petiolate. Flowers terminal, solitary. Peduncle terete, 2–5 cm long, green, pubescent. Bracts biseriate, oblong, 5–7 mm long, green, pubescent. Calyx represented by pappus hairs. Flowers heterogamous. Ray florets in outer layer – female flowers, 3 lobed, yellow, glabrous. Disc florets in inner layer – bisexual, corolla tube 6–8 mm long, yellow, glabrous; lobes 5, minute, apex acute, yellow, glabrous. Stamens 5, inserted; filaments slender, 4 mm long, yellow, glabrous; anthers linear, 3 mm long, yellow, glabrous. Style slender, bifid, 5 mm long, yellow, glabrous. Achenes oblanceolate, black, angled.

Distribution: Tropical and Subtropical Asia (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: January-December

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 17/07/2015, S. Syam Radh 145061 (CALI); Kulamavu, 03/06/1982, C.N. Mohanan 74162 (MH); Meesapulimala, 17/04/2018, Divya K. Venugopal 167422 (CALI).

***Xanthium* L.**

Sp. Pl.: 987.1753.

Xanthium strumarium L., Sp. Pl.: 987.1753; Hook.f., Fl. Brit. India 3: 303. 1882; Gamble, Fl. Madras 2: 703. 1921. *Xanthium indicum* J.Koenig ex Roxb., Fl. Ind. ed.

1832. 3: 601.1832; Sasidh., Fl. Periyar Tiger Reserve 215. 1998; Sasidh., Fl. Chinnar WLS 174. 1999.

Herb. Stem terete, green, pubescent. Leaves simple, alternate, broadly ovate, 8–12 × 6–9 cm, apex acute, base cordate, margins serrate, green, pubescent, petiolate. Flowers in axillary head. Peduncle terete, green, pubescent. Bracts heterogamous; united in female flowers (as horny projection) and free in bisexual flowers. Calyx represented by pappus hairs. Flowers heterogamous. Female flowers in lower axils and bisexual flowers in upper axils. Female flowers – corolla absent; bisexual flowers – corolla tube greenish yellow, glabrous; lobes 5, greenish yellow, glabrous. Stamens 5, inserted; filaments slender, 3 mm long, yellow, glabrous; anthers linear, 2 mm long, yellow, glabrous. Style slender, bifid, exserted, yellow, glabrous. Achenes 2 in each head.

Distribution: South Central & South Europe to China and Indo-China, Taiwan, North West Africa (POWO, 2022)

Habitat: Deciduous forests

Flowering and fruiting: March–November.

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 11/11/1993, Jomy Augustine 12511 (CALI); Way to Panamkutti, 07/10/1983, A.G. Pandurangan 79281 (MH); Chinnar, 21/05/2018, Divya K. Venugopal 164555 (CALI).

***Youngia* Cass.**

Ann. Sci. Nat. (Paris) 23: 88.1831.

***Youngia japonica* (L.) DC.**, Prodr. 7: 194.1838; Sasidh., Fl. Periyar Tiger Reserve 215. 1998; Sasidh., Fl. Chinnar WLS 175. 1999. *Crepis japonica* (L.) Benth., Fl. Hongk.: 194.1861; Hook.f., Fl. Brit. India 3: 395. 1882; Gamble, Fl. Madras 2: 730. 1921.

Herb. Stem terete, green, glabrous. Leaves simple, alternate, basal and cauline, 8–10 × 5–6 cm, apex obtuse, base narrow, margins serrate, green, glabrous, petiolate. Flowers in terminal heads. Peduncle terete, 1–6 cm long, green, glabrous. Bracts biseriate, linear, 3–4 mm long, green, glabrous. Flowers homogamous – bisexual, small. Calyx represented by pappus hairs. Corolla tube 4–6 mm long, yellow, glandular; lobes 5, apex acute, yellow, glandular. Stamens 5, exserted; filaments slender, 3–4 mm long, yellow, glabrous; anthers sagittate, 3 mm long, yellow, glabrous. Style slender, bifid,

yellow, glabrous, exserted. Achenes small, oblong, 2–3 mm long, brown, ribbed, pubescent.

Distribution: Tropical & Subtropical Asia (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: July-May

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 30/12/2014, *S. Syam Radh 137928* (CALI); Periyar Tiger Reserve, 08/12/1994, *Jomy Augustine 14343* (CALI); Mankulam, 10/08/2018, *Divya K. Venugopal 161289* (CALI).

CAMPANULACEAE Juss

Gen. Pl. 163. 1789, *nom. cons.*

Herbs or shrubs, often with milky juice. Herbs mostly perennial (Delta Intkey, 2023). Leaves alternate or opposite, exstipulate; cystoliths commonly present. Inflorescence axillary or terminal racemes. Flowers usually large and predominantly blue. Pollination entomophilous (Delta Intkey, 2023). Calyx tube adnate to the ovary; usually persistent. Corolla tubular, lobes as many as those of the calyx. Stamens 4–6, alternating with the corolla lobes, inserted; anthers free or united in a tube. Style simple, sticky or hairy. Stigma capitate or many lobed. Fruit capsule or berry. Seeds numerous, small.

According to POWO, 2022, family consists of 84 accepted genera and 2319 species worldwide. This family is also known as bell flower family and are cosmopolitan. Members of Campanulaceae usually exhibit different mechanisms of secondary pollen presentation (POWO, 2022).

Key to genera

- 1a. Corolla bilipped..... *Lobelia*
- 1b. Corolla not bilipped 2
- 2a. Capsule dehisce loculicidally *Wahlenbergia*
- 2b. Capsule dehisce through apex, base or median valves 3
- 3a. Corolla tube present, lobes pubescent..... *Campanula*
- 3b. Corolla tube absent, lobes glabrous *Asyneuma*

Asyneuma Griseb. & Schenk
Arch. Naturgesch. 18(1): 335. 1852.

Key to species

- 1a. Stem 4-angular; flowers in cymes; capsule cupular, dehisce
by median valves..... *A. cupulare*
- 1b. Stem terete; flowers in racemes; capsule obovoid-conical,
dehisce by apical pores *A. fulgens*

Asyneuma cupulare K.V.Divya & Nampy, Nordic J. Bot. 39(1)-e02889: 2. 2021.

Figure 17 H.

Perennial herb, up to 10 cm high. Stem 4-angular, branched, green, puberulent. Leaves simple, alternate, oblanceolate, 3–5 × 1–1.5 cm, apex acute, base cuneate, margins dentate, green, puberulent, petiolate. Flowers in terminal cymes, 2–3 flowered. Pedicel 3 cm long, green, puberulent. Calyx tubular, 4–4.3 × 5–5.1 mm, green, glabrous; lobes 5, 6–6.1 mm long, much shorter than corolla lobes, green, glabrous. Corolla tube absent; lobes 5, not bilipped, rotate, 0.8–1 cm long, pale pink, glabrous. Stamens 5, inserted; filaments 3–3.2 mm long, cream coloured, glabrous; anther bilobed, oblong, cream coloured, glabrous. Style slender, 4–4.2 × 0.8–1 mm, hairy at tip. Stigma trilobed, 1 mm long, purple, glabrous. Capsule cupular, 5–5.3 mm long, green, dehisce by median valves. Seeds numerous, obovoid, straw coloured.

Distribution: Meesapulimala

Habitat: Grasslands

Flowering and fruiting: October–December

Specimen examined: India, Kerala, Idukki, Meesapulimala, 14/10/2019, Divya K. Venugopal 170375 (CALI).

Asyneuma fulgens (Wall.) Briq., Candollea 4: 334. 1931; Sasidh., Fl. Periyar Tiger Reserve 216. 1998. *Campanula fulgens* Wall., W.Roxburgh, Fl. Ind. 2: 99.1824; Hook.f., Fl. Brit. India 3: 442. 1882; Gamble, Fl. Madras 2: 740. 1921.

Perennial herb, up to 70 cm high. Stem terete, green, glabrous. Leaves simple, alternate, ovate, 3–5 × 2–2.5 cm, apex acute, base cuneate, margins serrate, green, glabrous, petiolate. Flowers in elongated branched racemes. Pedicel sub-sessile, green, puberulent. Calyx tubular, 3.5–4 × 4.8–5 mm; lobes 5–10 mm long, equal to corolla lobes, green, glabrous. Corolla tube absent; lobes 5, not bilipped, campanulate, 0.6–1 cm long, blue, glabrous. Stamens 5, inserted; filaments 3–3.2 mm long, cream coloured, densely ciliate margin; anther bilobed, oblong, cream coloured, glabrous.

Style slender, 4–4.2 × 0.8–1 mm, cylindric, glabrous. Stigma trilobed, 1 mm long, purple, pubescent. Capsule obovoid-conical, dehisce by apical pores, green, glabrous. Seeds numerous, obovoid.

Distribution: South Tibet to Indian sub continent and China (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: July–December

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 18/08/1996, *Jomy Augustine 16219* (CALI).

***Campanula* L.**

Sp. Pl. 1: 164. 1753.

Campanula alphonsii Wall. ex A.DC., A.P.de Candolle, Prodr. 7: 473. 1839; Hook.f., Fl. Brit. India 3: 440. 1882; Gamble, Fl. Madras 2: 740. 1921.

Figure 17 G.

Perennial herb, spreading. Stem terete, green, villous. Leaves simple, alternate, obovate, 0.5–1 × 0.2–0.4 cm, apex obtuse, base cuneate, margins serrate, green, villous, sub sessile. Flowers solitary, terminal. Pedicel terete, 0.8–1 × 0.1–0.2 cm, green, pubescent. Calyx tube absent; lobes-5, deeply lobed, 2–3 × 1–2 mm, green, villous. Corolla tubular, 8 × 3 mm, blue, pubescent; lobes 5, not bilipped, campanulate, 1 × 0.3 cm, blue, pubescent. Stamens 5, inserted; filaments dilated at base, 2.8–3 mm long, cream coloured, glabrous; anther bilobed, cream, glabrous. Style cylindric, 3.5–4 × 0.8–1 mm, glabrous. Stigma trilobed. Capsule obovoid, 4–5 mm long, green, dehisce by valves at the base. Seeds numerous, minute.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October–March

Specimens examined: India, Kerala, Idukki, Anamudi peak, 11/12/2019, *Divya K. Venugopal 164560* (CALI); Eravikulam, 29/11/1979, *Nambiar 1104* (KFRI).

***Lobelia* Plum. ex L.**

Sp. Pl. 2: 929. 1753.

Key to species

- 1a. Stem terete..... 2
- 1b. Stem 3-angular..... 3

- 2a. Corolla lavender; capsule globose *L. leschenaultiana*
 2b. Corolla white; capsule cupular..... *L. nicotianifolia*
 3a. Roots arises from lower nodes; stigma lobed 4
 3b. Roots absent from lower nodes; stigma capitate..... *L. heyneana*
 4a. Flowers in raceme; corolla & capsule glabrous *L. alsinoides*
 4b. Flowers solitary; corolla & capsule pubescent *L. zeylanica*

Lobelia alsinoides Lam., Encycl. 3: 588. 1792; Sasidh., Fl. Periyar Tiger Reserve 216. 1998. *Lobelia trigona* Roxb., Fl. Ind. 2: 11.1824; Hook.f., Fl. Brit. India 3: 423. 1882; Gamble, Fl. Madras 2: 736. 1921.

Annual herb. Stem 3-angled, winged, roots arises from lower nodes, green, glabrous. Leaves simple, alternate, ovate, 1–1.5 × 0.5–1 cm, apex obtuse, base cordate, margins dentate, green, glabrous, sub sessile. Flowers in terminal racemes; flowers lax, small. Pedicel slender, 2–3 × 0.1 cm, green, sparsely pubescent. Bracts linear, green, pubescent. Calyx tubular, 2 × 2 mm, green, glabrous; lobes 5, lanceolate, 3–5 × 2 mm, green, glabrous. Corolla tubular, 3–4 × 2–3 mm, lilac, glabrous; lobes 5, bilipped (3+2), 0.8–1 × 0.4–0.5 cm, upper lips ovate and lower lips linear, lilac, glabrous. Stamens 5, inserted; filaments slender, 4–5 × 2 mm, lilac, glabrous; anthers fused, white, hairy. Style slender, 6–8 × 2 mm, lilac, glabrous. Stigma minute, lobed. Capsule globose with persistent calyx, green, glabrous. Seeds minute, numerous, brown.

Distribution: Hainan to Tropical Asia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: August-January

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 06/08/1994, Jomy Augustine 14295 (CALI); *ibid.*, 08/01/1994, Jomy Augustine 13010 (CALI).

Lobelia heyneana Schult., J.J.Roemer & J.A.Schultes, Syst. Veg., ed. 15 [bis] 5: 50. 1819; Sasidh., Fl. Periyar Tiger Reserve 216. 1998. *Lobelia trialata* Buch.-Ham., Prodr. Fl. Nepal. 157.1825; Hook. f., Fl. Brit. India 3: 425. 1882, incl. var. *lamifolia*; Gamble, Fl. Madras 2: 736. 1921.

Annual herb. Stem 3-angled, winged, green, glabrous. Leaves simple, alternate, obovate, 2–3 × 1.3–1.5 cm, apex obtuse, base round, margins dentate, green, glabrous, sub sessile. Flowers in terminal racemes. Pedicel slender, 1–1.5 × 0.15–0.3 cm, green, glabrous. Bracts linear, green, glabrous. Calyx tubular, 4–5 × 2 mm, green, glabrous; lobes 5, lanceolate, 3–4 × 1–1.5 mm, green, glabrous. Corolla tubular, 5–6 ×

2–3 mm, lilac, glabrous; lobes bilipped (3+2), 4–5 × 2–3 mm, upper lips ovate and lower lips linear, lilac, glabrous. Stamens 5; filaments slender, 4–5 × 2–2.5 mm, cream coloured, glabrous; anthers fused, black, hairy. Style 7–8 × 2 mm, cream coloured, glabrous. Stigma minute, capitate, hairy. Capsule globose with persistent calyx, green, glabrous. Seeds minute, numerous, brown.

Distribution: Eritrea to Zambia, South Arabian Peninsula, China (Yunnan) to Tropical Asia (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: September–November

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 20/09/1994, *Jomy Augustine 14260* (CALI); Eravikulam, 26/03/1980, *s.n. 110* (KFRI).

Lobelia zeylanica L., Sp. Pl.: 932. 1753; Sasidh., Fl. Periyar Tiger Reserve 217. 1998.

Lobelia affinis Wall. ex G.Don, Gen. Hist. 3: 709.1834; Hook. f., Fl. Brit. India 3: 424. 1882.

Annual herb. Stem 3-angled, green, sparsely pubescent, winged, roots arises from lower nodes. Leaves simple, alternate, ovate, 1.5–1.8 × 1–1.2 cm, apex acute, base truncate, margins dentate, green, pubescent, petiolate. Flowers axillary, solitary. Pedicel slender, 1.5–2 × 0.2 cm, green, sparsely pubescent. Bracts linear, green. Calyx tubular, 3–4 × 2 mm, green, pubescent; lobes 5, oblong, 3–4 × 1 mm, green, pubescent. Corolla tubular, 4–5 × 2–3 mm, lilac, sparsely pubescent; lobes bilipped (3+2), 5–6 × 1–2 mm, upper lips ovate and lower lips linear, lilac, pubescent. Stamens 5; filaments slender, 4–5 × 1.5–2 mm, cream coloured, glabrous; anthers fused, white, hairy. Style slender, 5 × 2 mm, pale lilac, glabrous. Stigma minute, lobed. Capsule globose with persistent calyx, green, densely pubescent. Seeds minute, numerous, brown.

Distribution: Tropical & Subtropical Asia (POWO, 2022)

Habitat: Marshy places

Flowering and fruiting: January–December

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 10/05/1994, *Jomy Augustine 14492* (CALI).

Lobelia leschenaultiana (C.Presl) Skottsb., Acta Horti Gothob. 4: 4 (1928); Sasidh., Fl. Periyar Tiger Reserve 217. 1998. *Lobelia excelsa* Bonpl., Descr. Pl. Malmaison: 112.1816; Hook.f., Fl. Brit. India 3: 427. 1882; Gamble, Fl. Madras 2: 737. 1921.

Annual erect herb. Stem terete, green, unbranched, glabrous. Leaves simple, alternate, elliptic, 15–20 × 3–5 cm, apex acute, base cuneate, margins dentate, green, densely pubescent on abaxial surface, petiolate. Flowers in terminal racemes, elongated, cylindrical. Flowers densely packed, large. Pedicel green, pubescent. Bracts linear, 2–2.5 cm long, green, pubescent. Calyx tubular, 3 × 3 mm, green, pubescent; lobes 5, linear, 8–10 × 2–2.5 mm, green, pubescent. Corolla tubular, lavender, pubescent; lobes 5, bilipped, linear, 15–20 × 5–7 mm, lavender coloured flower with white tinch, pubescent. Stamens 5; filaments slender, 2 × 0.2 cm, glabrous; anthers fused, purple, hairy at tip but glabrous on back. Style slender, 2 × 0.2 cm, cream, pubescent. Stigma minute, lobed, cream. Capsule globose with persistent calyx, green. Seeds minute, numerous, brown.

Distribution: South West India & Sri Lanka (POWO, 2022)

Habitat: Grasslands and shola forests

Flowering and fruiting: January–December

Specimen examined: India, Kerala, Idukki, Pambadum shola, 21/12/2018, Divya K. Venugopal 167881 (CALI).

Lobelia nicotianifolia Roth, J.J.Roemer & J.A.Schultes, Syst. Veg., ed. 15 [bis] 5: 47. 1819; Hook.f., Fl. Brit. India 3: 427. 1882; Gamble, Fl. Madras 2: 736. 1921; Sasidh., Fl. Periyar Tiger Reserve 217. 1998; Sasidh., Fl. Chinnar WLS 176. 1999.

Figure 17 D.

Annual erect, tall shrub. Stem terete, green, branched, glabrous. Leaves simple, alternate, elliptic, 15–20 × 3–4 cm, apex acuminate, base attenuate, margins dentate, green, glabrous, petiolate. Flowers in axillary and terminal racemes. Flowers densely packed. Pedicel terete, 1–1.2 × 0.8–1 cm, green, slightly pubescent. Bracts linear, green, pubescent. Calyx tubular, 3 × 3 mm, green, pubescent; lobes 5, linear, 1 × 0.2 cm, green, slightly pubescent. Corolla tubular, white, glabrous; lobes 5, bilipped, linear, 2–2.5 × 1 cm, white, glabrous. Stamen 5, fused; filaments slender, 2 × 0.2 cm, glabrous; anthers fused, 5 × 2 mm, purple, hairy. Style slender, 1.6–1.9 × 0.1–0.13 cm, cream coloured, glabrous. Stigma minute, lobed. Capsule cupular with persistent calyx, green. Seeds minute, numerous, brown.

Distribution: India to South China and Peninsular Malaysia (POWO, 2022)

Habitat: Grasslands and shola forests

Flowering and fruiting: October-March

Specimens examined: India, Kerala, Idukki, Devikulam, 07/02/2017, Divya K. Venugopal 151652 (CALI); Between Eravikulam & Munnar, 23/01/2018, Divya K. Venugopal 158133 (CALI); Wagamon, 15/11/2014, Thasnim P.M. 142755 (CALI).

Wahlenbergia Schrad. ex Roth

Nov. Pl. Sp.: 399. 1821.

Key to species

- 1a. Tuber present; corolla lobes bell shaped..... *W. marginata*
- 1b. Tuber absent; corolla lobes deeply divided 2
- 2a. Leaves sessile; flowers solitary; anthers oblong;
stigma 3-lobed..... *W. erecta*
- 2b. Leaves petiolate; flowers in cyme; anthers
sagittate; stigma 2-lobed *W. hookeri*

Wahlenbergia erecta (Roth ex Schult.) Tuyn, Fl. Males. 6: 113. 1960; Sasidh., Fl. Chinnar WLS 175. 1999. *Cephalostigma schimperi* Hochst. ex A. Rich., Tent. Fl. Abyss. 2: 2. 1850; Hook. f., Fl. Brit. India 3: 428. 1882; Gamble, Fl. Madras 2: 738. 1921.

Figure 17 F.

Annual erect herb, hirsute. Stem terete, green, pilose. Leaves simple, alternate, ovate, 1–1.5 × 0.3–0.4 cm, apex acute, base cuneate, margins crenate, green, pubescent, sessile. Flowers solitary, axillary and terminal. Calyx tubular, 1 × 1 mm, green, pubescent; lobes 5, lanceolate, 2 × 1 mm, green, pubescent, persistent. Corolla tube absent; lobes 5, linear, deeply divided, 3–3.5 × 1–1.5 mm, pale purple colour, glabrous. Stamens 5, free, inserted; filaments slender, 2–2.5 × 1 mm, glabrous; anthers bilobed, oblong, white. Style cylindric, 2–2.5 mm long, white, glabrous. Stigma tri-lobed, white. Capsule globose, 3–4 × 3–3.5 mm, green, hirsute with persistent calyx teeth, dehisce loculicidally. Seeds numerous, minute.

Distribution: Nigeria, Eritrea to South tropical Africa, India to Bangladesh, Sumatera (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: March-December

Specimen examined: India, Kerala, Idukki, Kudimala-Lakkamkudi, 09/12/2019, Divya K. Venugopal 164700 (CALI).

Wahlenbergia marginata (Thunb.) A.DC., Monogr. Campan.: 143. 1830; Sasidh., Fl. Chinnar WLS 175. 1999. *Wahlenbergia gracilis* (G.Forst.) A.DC., Monogr. Campan.: 142. 1830; Hook.f., Fl. Brit. India 3: 429. 1882.

Figure 17 E.

Perennial herb. Roots with elongate tuber. Stem terete, green, glabrous. Leaves simple, alternate, usually at the base of stem, linear, $1.5-2 \times 0.1-0.2$ cm, apex acute, base cuneate, margins entire, green, pubescent, sessile. Flowers solitary, axillary. Pedicel elongated, $3-4 \times 0.1$ cm, green, glabrous. Calyx tubular, $2-3 \times 1-2$ mm, green, sparsely pubescent; lobes 5, lanceolate, $3-4 \times 1-2$ mm, green, pubescent, persistent. Corolla tube 3×2 mm, lilac, glabrous; lobes 5, not bilipped, bell shaped, $5-8 \times 3-4$ mm, lilac, ciliate along margins. Stamens 5, free, inserted; filaments slender, $2-2.5 \times 1$ mm, glabrous; anthers bilobed, oblong, white. Style cylindric, $2-3 \times 1$ mm, white, glabrous. Stigma 3-lobed, 2×2 mm, white. Capsule obconical, 3×4 mm, green, with persistent calyx lobes, dehisce loculicidally. Seeds numerous, minute.

Distribution: Tropical & Subtropical Asia (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: December-May

Specimens examined: India, Kerala, Idukki, Way to Meesapulimala, 06/05/2019, Divya K. Venugopal 159149 (CALI); Mathikettan shola National Park, 04/01/2017, Divya K. Venugopal 151476 (CALI); Upper vaguvarai, 16/10/1989, P. Bhargavan 90960 (KFRI); Eravikulam, 29/11/1979, Nambiar 1109 (KFRI).

Wahlenbergia hookeri (C.B.Clarke) Tuyn, Fl. Males. 6: 114. 1960; Sasidh., Fl. Periyar Tiger Reserve 217. 1998. *Cephalostigma hookeri* C.B.Clarke, J.D.Hooker, Fl. Brit. India 3: 429. 1881; Gamble, Fl. Madras 2: 738. 1921.

Annual erect slender herb, up to 20 cm high. Stem terete, dichotomously branched, green, villous. Leaves simple, alternate, lance-ovate, $1-2 \times 0.5-1$ cm, apex obtuse, base round, margins dentate, green, pubescent, shortly petiolate. Flowers in cymes, axillary and terminal. Pedicel slender, 3–4 mm long, green, sparsely villous. Calyx tube obconical, c. 1×1 mm, green, pubescent; lobes 5, triangular, 1×0.5 mm, green, pubescent. Corolla tube absent; lobes 5, not bilipped, linear, 2–3 mm long, divided up to base, pale violet, glabrous. Stamens 5, free; filaments broaden at base, $2-3 \times 1$ mm,

pale violet, glabrous; anthers bilobed, sagittate, white. Style slender, 2×1 mm, white, glabrous. Sigma bi-lobed, white. Capsule subglobose, 3×4 mm, ribbed, green with persistent calyx, dehisce loculicidally. Seeds minute, ellipsoid, numerous.

Distribution: Cameroon to West Ethiopia and Tanzania, India to China (South Yunnan), East Jawa (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: June-January

Specimen examined: India, Kerala, Idukki, Mathikettan shola National Park, 04/01/2017, Divya K. Venugopal 151520 (CALI).

VACCINIACEAE_DC. ex Perleb

Vers. Arzneikr. Pfl. 228 .1818, *nom. cons.*

Climbers, shrubs or small trees. Leaves alternate or falsely whorled, entire or serrate, exstipulate. Flowers in racemes or solitary, axillary. Calyx tube ovoid, lobes 5, usually persistent. Corolla tubular, lobes 5, deciduous. Stamens 10, free; anthers opening by apical pores. Style cylindric. Stigma simple. Fruit berry, indehiscent. Seeds many, small, compressed.

Genus *Vaccinium* is cosmopolitan and consists of 446 accepted species (POWO, 2022).

Vaccinium L.

Sp. Pl. 1: 349. 1753.

[According to POWO, 2022 *Vaccinium* is placed under family Ericaceae]

Key to species

- 1a. Leaves ovate; calyx tube ovoid; corolla pink..... *V. symplocifolium*
- 1b. Leaves lanceolate; calyx tube globose; corolla white..... *V. neilgherrense*

Vaccinium symplocifolium (D.Don ex G.Don) Alston, H. Trimen, Handb. Fl. Ceylon 6(Suppl.): 176. 1931. *Vaccinium leschenaultii* Wight, Icon. Pl. Ind. Orient.4: t. 1188. 1848; Hook.f., Fl. Brit. India 3: 455. 1882; Gamble, Fl. Madras 2: 742. 1921; Sasidh., Fl. Periyar Tiger Reserve 219. 1998.

Figure 18 A.

Tree, up to 6 m high, bark greyish-brown, branchlets slender. Stem terete, brown, rough. Leaves simple, alternate, exstipulate, ovate, $2.5\text{--}6.5 \times 1\text{--}3$ cm, apex acute,

base attenuate, margin serrate, green, glabrous, coriaceous. Petiole $2-5 \times 1.8-2$ mm, slender, green, sparsely pubescent. Flowers in axillary and terminal racemose. Peduncle terete, $4.5-5 \text{ cm} \times 0.2-0.22$ mm, green, pubescent. Pedicel terete, 3×1 mm, green, glabrous. Bracts cauducous, $2-2.5 \times 1-1.2$ mm, apex acute, green, glabrous. Calyx tube ovoid, 2×2 mm, green, glabrous; lobes 5, acuminate, 1×1 mm, green, ciliate. Corolla tube $6-8 \times 3-4$ mm, pink, glabrous; lobes 5, triangular, 1×1 mm, apex acute, pink, glabrous. Stamens 10, free; filaments 5×1 mm, white, pubescent; anthers bilobed, 2×1 mm, white, glabrous. Style 6×1 mm, white, glabrous. Stigma minutely 5 lobed, white, glabrous. Fruit berry, globose, $7-8 \times 5-6$ mm, smooth, red, glabrous. Seeds minute, numerous, compressed, hyaline.

Distribution: South West India, Sri Lanka (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: December-April.

Specimens examined: India, Kerala, Idukki, Pettimudi, 30/12/2019, Divya K. Venugopal 170044 (CALI); Marayur, 24/02/2003, Smitha 89105 (CALI); Mattupetty, 13/01/1989, Ciji Scaria 7546 (CALI); Kanthallur, 30/03/1978, Nambiar 00284 (KFRI).

Vaccinium neilgherrense Wight, Calcutta J. Nat. Hist. 8:173. 1847; Hook.f., Fl. Brit. India 3: 454. 1882; Gamble, Fl. Madras 2: 741. 1921; Sasidh., Fl. Chinnar WLS 176. 1999; Sasidh., Fl. Periyar Tiger Reserve 219. 1998.

Large shrub, up to 60 cm high, branchlets drooping. Stem terete, purple-brown, rough. Leaves simple, alternate, exstipulate, lanceolate, $6-8 \times 1-1.5$ cm, apex acuminate, base obtuse, margin serrate, green, glabrous. Petiole terete, $1-2 \times 1-1.5$ mm, green, glabrous. Flowers in lax, axillary racemes. Peduncle terete, $5-5.3 \times 2-2.5$ mm, purplish green, sparsely pubescent. Pedicel terete, 6×1 mm, purplish green, glabrous. Bracts caducous, ovate, $2-2.4 \times 1-1.2$ mm, green, hairy along margin. Calyx tube globose, 1×1 mm, green, glabrous; lobes 5, ovate, 1×1 mm, green, ciliate. Corolla tube $6-7 \times 4-5$ mm, white, glabrous; lobes 5, ovate, 1×1 mm, spreading, white, glabrous. Stamens 10, free; filaments 2×1 mm, greenish white, tomentose; anthers bilobed, 1×1 mm, white, glabrous. Style cylindric, 2×1 mm, white, glabrous. Stigma 5 lobed, minute, white, glabrous. Berry globose, 8×1 mm, purplish green, sparsely pubescent. Seeds numerous, minute, hyaline.

Distribution: South West India (POWO, 2022)

Habitat: Evergreen & Shola forests

Flowering and fruiting: February–April

Specimens examined: India, Kerala, Idukki, Pettimudi, 19/03/2019, Divya K. Venugopal 159105 (CALI); Anamudi Shola, 05/04/2017, Divya K. Venugopal 152097 (CALI); Periyar Tiger Reserve, 04/12/1993, Jomy Augustine 12710 (CALI); Rajamalai, 09/01/1989, Beena T. Cherian 2661 (CALI); Mathikettan shola National Park, 22/11/2014, S. Syam Radh 137852 (CALI); *ibid.*, 16/07/2015, S. Syam Radh 145038 (CALI); *ibid.*, 04/11/2015, S. Syam Radh 145073 (CALI); Vallakadavu, 11/03/1973, B.D. Sharma 43801 (MH).

ERICACEAE Durande

Notions Élé. Bot. 270. 1782

Trees or shrubs, usually ornamental; bears essential oils (in *Gaultheria* spp.) (Delta Intkey, 2023). Leaves alternate or whorled, entire or serrate; non-sheathing, exstipulate, gland dotted (in *Gaultheria*) (Delta Intkey, 2023). Inflorescence varies from single flower to raceme or umbel. Flowers cyclic. Calyx 5–6 lobed. Corolla campanulate or with free petals. Stamens 10; filaments free; anthers oblong. Style cylindric; stigma simple or shortly lobed. Fruit capsular with numerous seeds.

Mostly members grow in acidic habitat and usually depend on fungal mycorrhizal association for successful growth (Heywood *et al.*, 1978). According to POWO, 2022; family consists of 124 accepted genera, of which the genera *Gaultheria* and *Rhododendron* consists of 151 and 1073 accepted species respectively.

Key to genera

1a. Leaves gland dotted, aromatic; flowers white; capsule

blue.....*Gaultheria*

1b. Leaves not gland dotted, not aromatic; flowers red; capsule

brown*Rhododendron*

Gaultheria Kalm ex L.

Sp. Pl.: 395. 1753.

Gaultheria fragrantissima Wall., Asiat. Res. 13: 397. 1820; Hook.f., Fl. Brit. India 3: 457. 1882; Gamble, Fl. Madras 2: 743. 1921; Sasidh., Fl. Chinnar WLS 176. 1999.

Perennial shrub, up to 60 cm high. Stem terete, green, glabrous. Leaves simple, alternate, elliptic, 7–8 × 2–4 cm, apex acute, base obtuse, margins serrate, thick coriaceous, green, reddish gland dotted, aromatic. Flowers white, 10–12, in racemes,

glabrous. Peduncle terete, 4×1 cm, white, sparsely pubescent. Pedicel terete, 3×1 mm, white, sparsely pubescent. Calyx lobes 5, triangular, 4×1 mm, green, margins hairy. Corolla tube 5×1 mm, white, glabrous; lobes 5, round, 1×1 mm, reflexed, white, glabrous. Stamens 10, inserted; filaments slender, 4×1 mm, white, glabrous; anthers bilobed, 1×1 mm, white, spurred at apex. Style cylindric, 4×1 mm, white, glabrous. Stigma sub-capitate, 1×1 mm, white, glabrous. Capsule cupular, 8×6 mm, blue with red stalk, glabrous. Seeds numerous, angled, minute, hyaline, glabrous.

Distribution: Indian subcontinent to China and Peninsula Malaysia (POWO, 2022)

Habitat: Shola forests and grasslands

Flowering and fruiting: April-May

Specimens examined: India, Kerala, Idukki, Kattadikadavu, 08/04/2018, Divya K. Venugopal 154351 (CALI); Devikolam, 16/06/1963, K.M. Sebastine 16516 (MH); Munnar, 31/03/1978, Nambiar 322 (KFRI).

***Rhododendron* L.**

Sp. Pl.: 392. 1753.

Rhododendron nilagiricum Zenker, Ann. Sci. Nat., Bot. ser. 2, 6: 150. 1836; Hook.f., Fl. Brit. India 3: 466. 1882; Gamble, Fl. Madras 2: 743. 1921.

Figure 18 B.

Tree, up to 1 m high. Stem terete, brown, rough; branchlets stout. Leaves simple, alternate, clustered towards the tip, exstipulate, elliptic, $6-8 \times 3-5$ cm, apex obtuse, base nearly cuneate, margins entire, dark green on adaxial surface, golden yellow on abaxial surface, glabrous. Petiole terete, 10–15 mm long, green, tomentose. Flowers red, dense, in terminal capitate racemes. Peduncle terete, 2×1 cm, green, pubescent. Pedicel terete, 5×2 mm, green, pubescent. Bracts lance-ovate, broad, 4×1 cm, golden yellow, cauducous, pubescent. Bracteoles linear, 2×0.5 cm, golden yellow, pubescent. Calyx tube green, pubescent; lobes 5, lance-ovate, 5×2 mm, apex acute, green, pubescent. Corolla tube 3×1.5 cm, crimson red, glabrous; lobes 5, widely ovate, 1×1.5 cm, dark crimson, glabrous. Stamens 10, free; filaments slender, $7-15 \times 1$ mm, pale red, glabrous; anthers oblong, 3×1 mm, slightly spurred at base, yellowish white, glabrous. Style slender, 2×0.1 cm, pale red, glabrous. Stigma capitate, 1×2 mm, yellowish white, glabrous. Capsule oblong, 3×1 cm, brown, woody. Seeds numerous, ellipsoid.

Distribution: southern Western Ghats

Habitat: Shola forests

Flowering and fruiting: December-June

Specimens examined: India, Kerala, Idukki, Anamudi Shola, 05/04/2017, Divya K. Venugopal 152094 (CALI); *ibid.*, 25/01/2018, Divya K. Venugopal 158270 (CALI); Choondal, 04/01/2017, Divya K. Venugopal 151462 (CALI); Mesthirikettu, 30/12/2017, Divya K. Venugopal 158069 (CALI); Periyar Tiger Reserve, 31/05/1995, Jomy Augustine 15368 (KFRI).

PLUMBAGINACEAE Juss.

Gen. Pl. [Jussieu] 92. 1789, *nom. cons.*

Annual or perennial herbs, shrubs or climbers, most of them are cultivated as ornamentals. Leaves alternate or in basal rosette, glandular, radical, exstipulate. Flowers bisexual in terminal scapes or racemose; bracts often scarious on the margins, usually sheathing the flower. Pollination entomophilous (Delta Intkey, 2023). Calyx and corolla tubular. Calyx persistent. Stamens 5; anthers oblong. Styles 5. Stigma sub capitate. Fruits capsule. Seeds cylindric, pendulous.

According to POWO, 2022; family consists of 22 accepted genera and the genus *Plumbago* consists of 23 accepted species.

Plumbago Tourn. ex L.

Sp. Pl.: 151.1753.

Plumbago zeylanica L., Sp. Pl. 151. 1753; Hook.f., Fl. Brit. India 3: 480. 1882; Gamble, Fl. Madras 2: 744. 1921.

Figure 18 C.

Erect shrub, 40–50 cm high, glabrous. Stem terete, branched with striations, green, glabrous. Leaves alternate, ovate, 5–6 × 2–3 cm, apex acute, base attenuate, margins entire, glaucous on abaxial surface, green, glabrous. Petiole 5 × 1 mm, green, glabrous. Flowers in elongate, axillary and terminal racemes, white. Peduncle terete, 10–12 × 0.4–0.5 cm, green, glabrous. Pedicel terete, 1 × 1 mm, glabrous. Bracts scarious, ovate, 2 × 2 mm, apex acute, green, glabrous; bracteoles 2, ovate, 4 × 2 mm, green, glabrous. Calyx persistent; tube 6 – 8 × 3–4 mm, green, densely covered with stalked glands; lobes 5, 1 × 1 mm, apex acute, green, glandular hairs. Corolla tube 1–1.5 × 0.2 cm, white, glabrous; lobes 5, obovate, 1 × 1 cm, apex acuminate, white, glabrous. Stamens 5; filaments 1.5–2 × 0.2 cm, hyaline, glabrous; anthers bilobed,

oblong, 2×2 mm, inserted, blue, glabrous. Styles 5, 1×0.1 cm, white, glabrous. Stigma 5 lobed, sub capitate, very minute, white, glabrous. Capsule oblong, 8×5 mm, greenish brown, glabrous. Seed solitary, cylindric, 1×1 mm, white.

Distribution: Tropics & subtropics (POWO, 2022)

Habitat: Deciduous forests, also in plains

Flowering and fruiting: August-January

Specimens examined: India, Kerala, Idukki, Way to Karimuttu, 29/12/2017, Divya K. Venugopal 158023 (CALI); Painavu, 07/08/2017, Divya K. Venugopal 154321 (CALI); Marayur, 28/11/1979, Nambiar 1062 (KFRI).

PRIMULACEAE Batsch ex Borkh.

Syn. Univ. Anal. Gen. Pl. 2: 395.1794, *nom. cons.*

Perennial herbs, rooting at nodes and usually ornamental. Leaves opposite, alternate or whorled, entire, exstipulate. Stem and leaves bear glandular hairs. Flowers usually borne on leafless scapes. Flowers solitary or racemose, axillary, on an elongated scape, heterostylous. Pollination entomophilous (Delta Intkey, 2023). Calyx often leafy and persistent. Corolla usually rotate, campanulate or funnel shaped. Fruit capsule with persistent calyx. Primulaceae is also known as primrose family. Members of this family consist of haplostemonous flowers (equal number of petals and stamens). Heterostyly and dimorphic pollen grains are characteristics of some species.

According to POWO, 2022; Primulaceae consists of 56 accepted genera and genus *Lysimachia* have 262 accepted species.

Key to genera

- 1a. Leaves alternate towards upper portion, opposite below;
corolla lobes campanulate..... *Anagallis*
- 1b. Leaves opposite throughout the plant; corolla lobes not
campanulate *Lysimachia*

***Anagallis* L.**

Sp. Pl. 1: 148. 1753.

Anagallis pumila Sw., Prodr. [O. P. Swartz] 40.1788; Gamble, Fl. Madras 2: 747. 1921; Sasidh., Fl. Periyar Tiger Reserve 221. 1998. *Centunculus tenellus* Duby, A.P.de Candolle, Prodr. 8: 72 (1844); Hook.f., Fl. Brit. India 3: 506. 1882.

Annual herb, up to 5–7 cm high, glabrous. Stem quadrangular, green, glabrous. Leaves simple, sessile, alternate towards upper portion, opposite below, obovate, 6–8 × 3–4 mm, apex acute, base obtuse, margins entire, green, glabrous. Flowers axillary, solitary, white. Pedicel terete, 7–8 × 1–1.8 mm, green, glabrous. Calyx lobes 5, deeply divided, lanceolate, 4–5 × 1–2 mm, green, glabrous. Corolla tube 2–2.2 × 1.8–2 mm, white, glabrous; lobes 5, campanulate, obovate, 2–2.3 × 1–1.2 mm, apex round, white, glabrous. Stamens 5, free; filaments 2–2.2 × 1–1.3 mm, white, glabrous; anthers bilobed, oblong, 0.8–1 × 1–1.1 mm, yellow, glabrous. Style terete, 1 × 1 mm, white, glabrous. Stigma sub-capitate, 0.4–0.5 mm long, white, pubescent. Capsule globose, 3 × 3 mm, green, glabrous. Seeds numerous, minute, peltate, hyaline, glabrous.

Distribution: Tropics and Sub tropics (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: July–December

Specimens examined: India, Kerala, Idukki, Meesapulimala, 18/11/2018, Divya K. Venugopal 158250 (CALI); Periyar Tiger Reserve, 22/09/1996, Jomy Augustine 16844 (CALI).

Lysimachia L.

Sp. Pl. 1: 146. 1753.

Key to species

- 1a. Stem quadrangular, glabrous; leaves lanceolate; flowers pink, in racemes *L. leschenaultii*
- 1b. Stem terete, villous; leaves ovate; flowers yellow; not in racemes *L. procumbens*

Lysimachia leschenaultii Duby, Prodr. [A. P. De Candolle] 8: 61. 1844; Hook.f., Fl. Brit. India 3: 501. 1882.

Annual herb, up to 30–40 cm high, glabrous. Stem quadrangular, green, glabrous. Leaves simple, opposite, lanceolate, 3–4 × 0.5 cm, apex acute, base cuneate, margins slightly serrulate, green, glabrous. Petiole quadrangular, 5–8 × 2 mm, green, glabrous. Flowers dense, in terminal racemes, pink, glabrous. Peduncle quadrangular, 5–6 × 0.5 cm, green, glabrous. Pedicel terete, 2 × 1 mm, greenish pink, glabrous. Bracts subulate, 2 × 1 mm, green, glabrous. Calyx lobes 5, deeply divided, lanceolate, 3 × 1 mm, apex acute, green, glabrous. Corolla tube almost absent; lobes 5, obovate, 3–4 × 1–1.2 mm, pink, glabrous. Stamens 5, exserted, free; filaments terete, slender, 6 × 1

mm, pink, glabrous; anthers bilobed, oblong, 1×1 mm, black, glabrous. Style filiform, 5×1 mm, persistent, pink, glabrous. Stigma obtuse, 1×1 mm, pink, glabrous. Capsule globose, 4×3 mm, pinkish brown, glabrous. Seeds elliptic, 1×1 mm, numerous, minute, hyaline, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: December-March

Specimens examined: India, Kerala, Idukki, Umayamala, 13/03/2019, Divya K. Venugopal 159454 (CALI); Eravikulam, 03/05/1980, s.n. 121 (KFRI).

Lysimachia procumbens Baudo, Ann. Sci. Nat., Bot. sér. 2, 20:348 .1843; Sasidh., Fl. Periyar Tiger Reserve 221. 1998. *Lysimachia deltoidea* Wight, Ill. Ind. Bot. 2: 137. 1847; Hook.f., Fl. Brit. India 3: 505. 1882; Gamble, Fl. Madras 2: 746. 1921.

Perennial herb, up to 30 cm high, villous. Stem terete, green, villous. Leaves simple, opposite, ovate, $2-4 \times 1.5-1.8$ cm, apex obtuse, base round to cordate, margins entire, green, tomentose. Petiole terete, $3-5 \times 1.7-2$ mm, green, tomentose. Flowers axillary, solitary, yellow. Pedicel terete, $0.9-1 \times 0.2$ cm, green, tomentose. Calyx tube $1-1.5 \times 2-2.2$ mm, green, tomentose; lobes 5, lanceolate, $6-8 \times 1-1.4$ mm, apex acute, green, tomentose. Corolla tube absent; lobes 5, deeply lobed, obovate, $6-7 \times 5-5.3$ mm, yellow, glabrous. Stamens 5, free; filaments terete, 2×1 mm, pale yellow, glabrous; anthers bilobed, oblong, 2×1 mm, yellow, glabrous. Style filiform, 3×1 mm, pale yellow, glabrous. Stigma flat, minute, pale yellow, glabrous. Capsule globose, $5-6 \times 1-1.5$ mm, green, glabrous. Seeds elliptic, numerous, minute, hyaline, glabrous.

Distribution: India, Sri Lanka, Himalaya

Habitat: Grasslands

Flowering and fruiting: September-May

Specimens examined: India, Kerala, Idukki, Way to Meesapulimala, 06/05/2019, Divya K. Venugopal 159148 (CALI); Periyar Tiger Reserve, 08/03/1995, Jomy Augustine & K.P. Rajesh 15371 (CALI); Eravikulam, 29/11/1979, Nambiar 1111 (KFRI).

MYRSINACEAE R.Br.

Prodr. Fl. Nov. Holland. 532. 1810.

Plant includes shrubs to small trees and distribution is pantropical. Mesophytic. Leaves simple, alternate, leathery, gland dotted, exstipulate. Flowers small, regular,

usually in fascicles. Calyx 4–6 lobed, persistent, usually glandular. Corolla tube minute or absent; lobes 4–6, usually glandular. Stamens as many as corolla lobes; filaments short if present; anthers oblong. Style filiform; stigma simple or lobed. Fruit small, berry or drupe, globose, indehiscent. Seeds globose, 1 to many. Usually members of this family are of little economic importance.

Key to genera

- 1a. Stamen inserted 2
- 1b. Stamen exerted *Ardisia*
- 2a. Stigma lobed..... 3
- 2b. Stigma not lobed 4
- 3a. Leaf margin serrate; flowers in racemes; filaments short;
seeds numerous *Maesa*
- 3b. Leaf margin entire; flowers in fascicles; filaments absent;
seed single..... *Myrsine*
- 4a. Woody climbers; berries not drooping..... *Embelia*
- 4b. Trees; berries drooping *Antistrophe*

Antistrophe A.DC.

Ann. Sci. Nat., Bot. sér. 2, 16: 84. 1841.

Antistrophe serratifolia (Bedd.) Hook.f., G.Bentham & J.D.Hooker, Gen. Pl. 2: 647 (1876); Fl. Brit. India 3: 532. 1882; Gamble, Fl. Madras 2: 756. 1921.

Tree. Stem terete, smooth, brownish green, glabrous. Leaves simple, alternate, narrowly elliptic, 10–15 × 3–4 cm, apex acuminate, base acuminate, margins serrate, green, glabrous, petiolate. Flowers axillary, cymose. Pedicel terete, 0.8 – 0.1 cm long, purplish green, glabrous. Calyx tube absent; lobes 5, deeply divided, 2 × 1 mm, green, ciliate. Corolla tube absent; lobes 5, deeply divided, 2–2.5 × 1.3–1.5 mm, pink, gland dotted. Stamens 5, inserted; filaments short, c. 1 mm long, creamy, glabrous; anthers acute, bilobed, less than 1 mm long, creamy, glabrous. Style slender, filiform, 3–4 × 1–1.5 mm, creamy, glabrous. Stigma punctiform, unlobed, creamy, glabrous. Berries drooping, globose, with persistent calyx, red when ripe, 4–5 × 4–5 mm, glabrous. Seed single.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: April–October

Specimen examined: India, Kerala, Idukki, Mankulam, 13/09/2018, Divya K. Venugopal 159480 (CALI).

***Ardisia* Sw.**

Prodr. Veg. Ind. Occ.: 48. 1788, *nom. cons.*

Key to species

- 1a. Flowers in cymes..... 2
- 1b. Flowers in racemes 3
- 2a. Leaves rhombic; filaments absent; berries with persistent style..... *A. rhomboidea*
- 2b. Leaves ovate-elliptic; filaments present; berries without persistent style 4
- 3a. Corolla tube present; flowers pink; styles elongate *A. stonei*
- 3b. Corolla tube absent; flowers white; styles minute *A. pauciflora*
- 4a. Leaves elliptic; berries with persistent calyx 5
- 4b. Leaves ovate; berries without persistent calyx *A. sonchifolia*
- 5a. Leaves margin entire; calyx & corolla lobes not black punctuate; berries purplish red *A. solanacea*
- 5b. Leaves margin serrate; calyx & corolla lobes black punctuate; berries black *A. blatteri*

Ardisia blatteri Gamble, Bull. Misc. Inform. Kew 1921: 121.1921; Gamble, Fl. Madras 2: 755. 1921; Sasidh., Fl. Periyar Tiger Reserve 222. 1998.

Shrub. Stem terete, smooth, greenish brown, glabrous. Leaves simple, alternate, elliptic, 9–18 × 3–4 cm, apex acuminate, base cuneate, margins serrate, green, glabrous, petiolate. Flowers in axillary cyme, small. Pedicel terete, slender, 6–8 × 1–2 mm, green, glabrous. Calyx tube absent; lobes 5, ovate, 1 × 1 mm, green, rough surface, black punctate. Corolla tube absent; lobes 5, deeply divided, 3–4 × 2 mm, pink, glabrous, black punctate. Stamens 5, exserted; filaments minute, cream, glabrous; anthers bilobed, apiculate, white. Style slender, 3–4 × 1 mm, white, glabrous. Stigma pointed, minute, white. Berries globose, 5–6 mm long, black, with persistent calyx, glabrous. Seed single.

Distribution: India (Kerala, Tamil Nadu) (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: October–February

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 10/12/1998, *Jomy Augustine 12904* (CALI); *ibid.*, 09/12/1993, *Jomy Augustine 11014* (KFRI).

Ardisia pauciflora B.Heyne ex Roxb., Fl. Ind. 2: 279. 1824; Hook.f., Fl. Brit. India 3: 529. 1882; Gamble, Fl. Madras 2: 755. 1921; Sasidh., Fl. Periyar Tiger Reserve 222. 1998; Sasidh., Fl. Chinnar WLS 177. 1999.

Figure 14 F.

Small tree. Stem terete, smooth, brownish green, glabrous. Leaves simple, alternate, elliptic, 10–12 × 3–5 cm, apex and base acuminate, gland dotted, nerves not clear, margins entire, green, glabrous, petiolate. Flowers in axillary racemes. Pedicel terete, 5–6 × 1–1.5 mm, green, glabrous. Calyx tube absent; lobes 5, 3–5 × 1–1.5 mm, green, pubescent. Corolla tube absent; lobes 5, 2–4 × 1–1.5 mm, white, glabrous. Stamens 5, exserted; filaments short, 1 × 1 mm, creamy, glabrous; anthers bilobed, sagittate, yellow. Style minute, white, glabrous. Stigma pointed, minute, white. Berries globose, 4–5 mm long, reddish-black, glabrous. Seed single.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: September–November

Specimens examined: India, Kerala, Idukki, Chinnar, 10/09/1998, *K.K. Sajeev 17450* (CALI); Between Idukki and Kulamavu, 08/11/1981, *B. Ramanujam 72424* (MH); Periyar Tiger Reserve, 21/08/1993, *Jomy Augustine 12313* (KFRI).

Ardisia rhomboidea Wight, Icon. Pl. Ind. Orient. 4: t. 1213. 1848; Hook.f., Fl. Brit. India 3: 529. 1882; Gamble, Fl. Madras 2: 755. 1921; Sasidh., Fl. Periyar Tiger Reserve 222. 1998.

Shrub. Stem terete, rough, green, glabrous. Leaves simple, alternate, rhombic, 2–4 × 1–2 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary cymes. Pedicel terete, 3 × 1 mm, green, sparsely puberulent. Calyx tube absent; lobes 5, triangular, 1 × 1 mm, green, glabrous. Corolla tube absent; lobes 5, 3–4 × 1–2 mm, creamy, glabrous. Stamens 5, exserted; filaments absent; anthers bilobed, sagittate, yellow. Style 2.5 mm long, persistent, white, glabrous. Stigma minute, pointed, white. Berries globose, 4 × 4 mm, red, with persistent style, glabrous. Seed single.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: September–December

Specimens examined: India, Kerala, Idukki, Pettimudi, 30/12/2019, Divya K. Venugopal 170055 (CALI); Eravikulam, 18/10/1988, P. Bhargavan 91801 (MH); *ibid.*, 29/11/1979, Nambiar 1115 (KFRI).

Ardisia solanacea Roxb., Pl. Coromandel 1: 27.1795; Gamble, Fl. Madras 2: 756. 1921. *Ardisia humilis* Vahl, Symb. Bot. 3: 40.1794; Hook.f., Fl. Brit. India 3: 529. 1882.

Shrub-tree. Stem terete, smooth, green, glabrous. Leaves simple, alternate, elliptic, 9–18 × 3–4 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal cyme. Pedicel terete, 0.6–1 × 0.1–0.2 cm, pink, puberulent. Calyx tube absent; lobes 5, ovate, 2 × 2 mm, green, ciliate. Corolla tube absent; lobes 5, deeply divided, 4–5 × 2 mm, bright pink, glabrous. Stamens 5, exserted; filaments minute, cream, glabrous; anthers bilobed, sagittate, yellow. Style slender, elongate, 4–5 × 1 mm, white, glabrous. Stigma pointed, minute, white. Berries globose, 5–6 mm long, purplish red, with persistent calyx, glabrous. Seed single, globose.

Distribution: India subcontinent to China and Peninsula Malaysia (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: March–August

Specimen examined: India, Kerala, Idukki, Mankulam, 04/12/2018, Divya K. Venugopal 168840 (CALI).

Ardisia sonchifolia Mez, H.G.A. Engler (ed.), Pflanzenr., IV, 236: 116.1902; Hook.f., Fl. Brit. India 3: 525. 1882; Gamble, Fl. Madras 2: 754. 1921.

Shrub. Stem terete, rough, green, glabrous. Leaves simple, alternate, ovate, 5–10 × 2–4 cm, apex acute, base cuneate, margins entire, green, glabrous, subsessile. Flowers in axillary cymes with branched pubescent peduncle. Pedicel terete, 1 × 0.1 cm, green, puberulent. Calyx tube absent; lobes 5, ovate, 3–4 × 1 mm, green, pubescent. Corolla tube absent; lobes 5, 4–5 × 1–2 mm, pale pink, glabrous. Stamens 5, subsessile, exserted; anthers bilobed, acute, yellow. Style elongated, 3 mm long, exserted, creamy, glabrous. Stigma pointed, minute, creamy. Berries globose, 5–6 mm long, pink, glabrous. Seed single.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: March–May

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 10/04/1994, *Jomy Augustine* 13563 (CALI); *ibid.*, 06/03/1996, *Jomy Augustine* 17792 (KFRI).

Ardisia stonei Sasidh. & Sivar., *Rheedea* 4: 116.1994; Sasidh., Fl. Periyar Tiger Reserve 222. 1998.

Subshrub. Stem terete, greenish brown, rusty tomentose. Leaves simple, alternate, elliptic, 9–18 × 3–4 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Flowers solitary or in axillary pendulous raceme. Pedicel terete, 0.6–1 × 0.1–0.2 cm, pink, puberulent. Calyx tube absent; lobes 5, ovate, 2 × 2 mm, green, tomentose. Corolla tube very short; lobes 5, deeply divided, 4–5 × 2 mm, pink, pubescent. Stamens 5, exserted; filaments minute, cream, glabrous; anthers bilobed, sagittate, yellow. Style slender, elongate, 5–6 × 1 mm, white, glabrous. Stigma punctiform, entire, white. Berries globose, 5–6 mm long, red, with persistent calyx, glabrous. Seed single, globose.

Distribution: South West India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January–December

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 07/12/1998, *Jomy Augustine* 17825 (CALI).

***Embelia* Burm.f.**

Fl. Indica: 62.1768, *nom. cons.*

Key to species

- 1a. Leaves elliptic; style present 2
- 1b. Leaves ovate; style absent..... *E. ribes*
- 2a. Flowers pentamerous; calyx tube absent..... *E. adnata*
- 2b. Flowers tetramerous; calyx tube present..... *E. tsjeriam-cottam*

Embelia adnata Bedd. ex C.B.Clarke, J.D.Hooker, Fl. Brit. India 3: 514.1882; Gamble, Fl. Madras 2: 752. 1921; Sasidh., Fl. Periyar Tiger Reserve 225. 1998.

Figure 18 D.

Woody climber. Stem terete, rough, reddish, branched, glabrous. Leaves simple, alternate, elliptic, 2–8 × 2–4 cm, apex obtuse, base round, glandular pit absent, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal panicles. Pedicel terete, minute, 1 × 1 mm, glabrous. Calyx tube absent; lobes 5, ovate, 1 × 1 mm, green, pubescent. Corolla tube absent; lobes 5, minute, 2 × 2 mm, greenish-

white, pubescent. Stamens 5, inserted; filaments minute, less than 1 mm long, creamy, glabrous; anthers bilobed, elliptic, creamy. Style conical, 1 × 1 mm, creamy, glabrous. Stigma capitate, creamy. Berries globose, 5–6 mm long, purple, glabrous. Seed single.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February–August

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 28/02/1995, Jomy Augustine 15208 (CALI).

Embelia ribes Burm.f., Fl. Indica: 62.1768; Hook.f., Fl. Brit. India 3: 513. 1882; Gamble, Fl. Madras 2: 752. 1921; Sasidh., Fl. Periyar Tiger Reserve 225. 1998; Sasidh., Fl. Chinnar WLS 178. 1999.

Woody climber. Stem angular, branched, greenish white, rusty tomentose. Leaves simple, alternate, ovate, 3–7 × 2–3 cm, apex acuminate, base round, glandular pit present, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal racemes. Pedicel terete, 1 × 1 mm, greenish white, sparsely pubescent. Calyx tube absent; lobes 5, minute, less than 1 mm long, green, pubescent. Corolla tube absent; lobes 5, minute, 1 × 1 mm, greenish white, pubescent. Stamens 5, inserted; filaments minute, 1 × 1 mm, creamy, glabrous; anthers bilobed, elliptic, creamy. Style absent. Stigma capitate, persistent, creamy. Berries globose, 3–4 mm long, red, glabrous. Seed single.

Distribution: India to South China and West & Central Malaysia (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February–August

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 04/03/1994, Jomy Augustine 13441 (CALI); *ibid.*, 16/05/1995, Jomy Augustine & K.P. Rajesh 15291 (CALI); Devicolam, 24/03/1980, C. E. Ridsale 670 (CALI); Kadalar, 31/03/1978, Nambiar 00294 (KFRI); Devikolam, 24/03/1980, K. Ramamurthy 66338 (MH).

Embelia tsjeriam-cottam (Roem. & Schult.) A.DC., Trans. Linn. Soc. London 17: 131. 1834; Gamble, Fl. Madras 2: 753. 1921. *Embelia robusta* Roxb., Fl. Ind. 2: 287. 1824; Hook.f., Fl. Brit. India 3: 515. 1882

Woody climber. Stem terete, branched, green, glabrous. Leaves simple, alternate, elliptic, 6–8 × 3–4 cm, apex and base acuminate, gland dotted, margins entire, green, glabrous, petiolate. Flowers in axillary racemes. Pedicel terete, 2–3 × 1 mm, green, glabrous. Calyx tube minute; lobes 4, 1–1.5 × 1 mm, green, glabrous. Corolla tube

absent; lobes 4, minute, $2-2.5 \times 1.5-2$ mm, greenish white, pubescent. Stamens 4, inserted; filaments minute, 2×1 mm, creamy, glabrous; anthers bilobed, elliptic, white. Style terete, short, 2×1 mm, creamy, glabrous, persistent. Stigma capitate, persistent, creamy. Berries globose with persistent style, 4–5 mm long, red, glabrous. Seed single.

Distribution: India Subcontinent to South Central China and Indo-China. (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: January-April

Specimen examined: India, Kerala, Idukki, Chinnar, 04/02/1998, K.K. Sajeew 15997 (CALI).

***Maesa* Forssk.**

Fl. Aegypt.-Arab. 66. 1775.

Maesa indica (Roxb.) Sweet, Hort. Brit. 2: 268. 1826; Sasidh., Fl. Periyar Tiger Reserve 225. 1998; Sasidh., Fl. Chinnar WLS 178. 1999. *Maesa dubia* (Wall.) A.DC., Trans. Linn. Soc. London 17: 134.1834; Hook.f., Fl. Brit. India 3: 510. 1882; Gamble, Fl. Madras 2: 749. 1921.

Figure 18 E.

Shrub. Stem terete, rough, green, glabrous. Leaves simple, alternate, ovate to oblong, $6-10 \times 3-5$ cm, apex acute, base obtuse, margins serrate, green, glabrous, petiolate. Flowers in axillary and terminal racemes. Pedicel terete, green, 1–2 mm long, sparsely pubescent. Calyx tube minute, green, sparsely pubescent; lobes 5, less than 1 mm long, green, sparsely pubescent. Corolla tube minute, white, glabrous; lobes 5, 2×1 mm, campanulate, broadly ovate, white, glabrous. Stamens 5, inserted; filaments short, c. 1 mm long, white, glabrous; anthers bilobed, oblong, white. Style short, less than 1 mm long, white, glabrous. Stigma lobed, white. Berries globose with persistent calyx, 4×4 mm, white, glabrous. Seeds numerous, small, angular.

Distribution: China (South Yunnan) to Tropical Asia (POWO, 2022)

Habitat: Moist deciduous and shola forests

Flowering and fruiting: September-May

Specimens examined: India, Kerala, Idukki, Calvary Mount, 06/09/2017, Divya K. Venugopal 154364 (CALI); Vakavanam, 14/09/2019, Divya K. Venugopal 170315 (CALI); Periyar Tiger Reserve, 16/10/1993, Jomy Augustine & K.P. Rajesh 12525

(CALI); 13 km away from Munnar to Marayoor, 22/01/2004, *Jattisha P. I. 110214* (CALI); Rajamala to Chinnar road, 18/02/1998, Lincy *Antony T. 60505* (CALI); Chinnar, 03/10/1996, *K.K. Sajeev 17447* (KFRI); Periyar Tiger Reserve, 06/03/1996, *Jomy Augustine 17792* (KFRI); Vattavada, 29/03/1978, *Nambiar 00238* (KFRI).

Myrsine L.

Sp. Pl.: 196. 1753.

Key to species

- 1a. Flowers sessile; filaments present..... *M. capitellata*
- 1b. Flowers pedicellate; filaments absent 2
- 2a. Leaves clustered at tip; branchlets hairy in juvenile stage 3
- 2b. Leaves not clustered; branchlets glabrous *M. daphnoides*
- 3a. Leaf venations not obscure; corolla lobes pale brown;
style absent..... *M. thwaitesii*
- 3b. Leaf venation obscure; corolla lobes creamy;
style present *M. wightiana*

Myrsine capitellata Wall., W.Roxburgh, Fl. Ind. 2: 295.1824; Hook. f., Fl. Brit. India 3: 512. 1882. *Rapanea capitellata* (Wall.) Mez, H.G.A.Engler (ed.), Pflanzenr., IV, 236: 356.1902; Gamble, Fl. Madras 2: 750. 1921; Sasidh., Fl. Periyar Tiger Reserve 226. 1998.

Tree. Stem terete, branched, brownish green, rough. Leaves simple, alternate below and opposite above, elliptic, 6–10 × 2–4 cm, apex acute, base cuneate, margins entire, green, glabrous, minutely petiolate. Flowers in axillary umbellate fascicles, sessile. Calyx lobes 5, 1–2 × 1 mm, green, ciliate, persistent, with resinous glands. Corolla lobes 5, 3–4 × 2–2.5 mm, creamy, hairy, with resinous glands. Stamens 5, inserted; filaments minute, 1 × 1 mm, white, glabrous; anthers bilobed, cordate, creamy. Style minute, white, glabrous. Stigma trilobed, creamy. Berries globose, 4–5 mm long, brown, glabrous. Seed single.

Distribution: Himalaya to Peninsula Malaysia (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: March-May

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 16/03/1998, *Jomy Augustine 17804* (CALI); Eravikulam, 04/12/1987, *P. Bhargavan 87333* (MH).

Myrsine daphnoides (Mez) Ricketson & Pipoly, Novon 22: 470. 2013. *Rapanea daphnoides* Mez, H.G.A.Engler (ed.), Pflanzenr., IV, 236: 357.1902; Gamble, Fl. Madras 2: 751. 1921; Sasidh., Fl. Periyar Tiger Reserve 226. 1998.

Shrub. Stem terete, rough, brownish green, branchlets glabrous. Leaves simple, alternate, lance-ovate, 4–5 × 1–1.5 cm, apex obtuse, base cuneate, margins entire, venation not clear, green, glabrous, petiolate. Flowers in fascicles. Pedicel terete, 2 × 1 mm, brown, glabrous. Calyx lobes 5, ovate, 1 × 1 mm, persistent, green, ciliate. Corolla lobes 5, 3 × 2 mm, pale pink, papillate. Stamens 5, inserted; filaments absent; anthers bilobed, ovate, creamy, glabrous. Style short, creamy, glabrous. Stigma lobed, creamy, glabrous. Berries globose densely covered with glands, 4 × 4 mm, brown, glabrous. Seed single.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February-May

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 06/03/1995, Jomy Augustine 15347 (CALI).

Myrsine thwaitesii (Mez) Wadhwa, M.D.Daddanayake & al. (eds.), Revis. Handb. Fl. Ceylon 13: 159.1999. *Rapanea thwaitesii* Mez, H.G.A.Engler (ed.), Pflanzenr., IV, 236: 357.1902; Gamble, Fl. Madras 2: 751. 1921.

Figure 18 F.

Tree. Stem terete, branched, brownish green, branchlets hairy in juvenile stage. Leaves simple, clustered on terminal portion, lanceolate, 7–9 × 1.5–1.8 cm, apex acute, base attenuate, margins entire, green, glabrous, petiolate, venation not obscure. Flowers in axillary umbellate fascicles. Pedicel terete, 4–5 × 1–2 mm, green, glabrous. Calyx lobes 5, 2 × 1 mm, green, ciliate, persistent. Corolla lobes 5, 3 × 2 mm, pale brown, hairy. Stamens 5, inserted; filaments absent; anthers bilobed, cordate, creamy. Style absent. Stigma 2–5 lobed, creamy. Berries globose, 4–5 mm long, purple, glabrous. Seed single.

Distribution: South India, Sri Lanka, Andaman Islands (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: January-April

Specimen examined: India, Kerala, Idukki, Mathikettan shola National Park, 06/03/2018, Divya K. Venugopal 163450 (CALI).

Myrsine wightiana Wall. ex A.DC., Trans. Linn. Soc. London 17: 106 (1834).
Rapanea wightiana (Wall. ex A.DC.) Mez, H.G.A.Engler (ed.), Pflanzenr., IV, 236: 360.1902; Gamble, Fl. Madras 2: 751. 1921; Sasidh., Fl. Periyar Tiger Reserve 226. 1998.

Tree. Stem terete, branched, brownish green, branchlets hairy in juvenile stage. Leaves simple, alternate, clustered towards tip, oblanceolate, 8–10 × 2–3 cm, apex obtuse, base attenuate, margins entire, green, glabrous, venation obscure, petiolate. Flowers in axillary fascicles. Pedicel terete, short, 1–2 × 1 mm, green, glabrous. Calyx tube 1–1.5 × 1 mm, green, ciliate; lobes 5, 2 × 1 mm, green, ciliate, persistent. Corolla lobes 5, 3 × 2 mm, creamy, glandular hairy. Stamens 5, inserted; filaments absent; anthers bilobed, ovate, creamy. Style minute, creamy, glabrous. Stigma slightly bilobed, creamy. Berries globose, 4–5 mm long, purple, glabrous. Seed single.

Distribution: South India, Assam, Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February-May

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 20/02/1996, Jomy Augustine 18483 (CALI).

SAPOTACEAE Juss.

Gen. Pl. [Jussieu] 151.1789, *nom. cons.*

Trees or shrubs; produces white latex, rusty tomentose; mesophytic (Delta Intkey, 2023). Leaves simple, alternate, margins entire, spirally arranged, usually exstipulate, persistent and leathery. Flowers axillary, borne in fascicles; cream or white. Calyx lobes 4–8, free. Corolla tube short; lobes as many as calyx lobes, usually in one whorl, united at the base. Stamens inserted or exserted, 1–3 seriate; filaments short, anthers oblong; staminodes when present alternate with stamens. Style linear. Stigma pointed. Berry ellipsoid-globose, usually rusty-tomentose, indehiscent. Seeds 1–8. Some members (eg. *Palaquium*) can produce latex with commercial value and some others are cultivated due to their fruit value.

Family consists of 62 accepted genera worldwide (POWO, 2022).

Key to genera

- 1a. Staminodes present..... 2
- 1b. Staminodes absent..... 3
- 2a. Stamens 6 4

2b. Stamens 8.....	<i>Mimusops</i>
3a. Calyx lobes uniseriate	<i>Donella</i>
3b. Calyx lobes biseriate	5
4a. Corolla lobes 6; anthers ovate	<i>Xantolis</i>
4b. Corolla lobes 18; anthers lanceolate	<i>Manilkara</i>
5a. Stamens inserted.....	6
5b. Stamens exerted.....	<i>Palaquium</i>
6a. Corolla lobes 4; stamens 8	<i>Isonandra</i>
6b. Corolla lobes 8–12; stamens 16	<i>Madhuca</i>

***Donella* Pierre ex Baill.**

Hist. Pl. 11: 294 .1891.

Donella lanceolata (Blume) Aubrév., Fl. Camb., Laos & Vietn. Fasc. 3: 64.1963. *Chrysophyllum roxburghii* G. Don, Gen. Hist. 4: 33.1837; Hook.f., Fl. Brit. India 3: 535. 1882; Gamble, Fl. Madras 2: 758. 1921; Sasidh., Fl. Periyar Tiger Reserve 226. 1998.

Tree. Stem terete, not thorny, green, glabrous; branchlets slender, rusty. Leaves simple, alternate, ovate, 8–10 × 2–3 cm, apex acuminate, base cuneate, margins entire, green, glabrous when old, petiolate. Flowers in axillary fascicles. Pedicel terete, 2–5 mm long, green, pubescent. Calyx lobes 5, uniseriate, obtuse, 1.5–2 × 1.3–1.5 mm, green, glabrous. Corolla lobes 5, campanulate, apex acute, 3–4 × 1–2 mm, white, ciliate along margin. Stamens 5, inserted; staminodes absent; filaments short, 1 mm long, cream, pubescent; anthers bilobed, ovate, 1mm long, pale yellow, glabrous. Style conical, 1–1.5 mm long, cream, glabrous. Stigma blunt. Berries globose, 4–5 cm long, yellowish-green, glabrous.

Distribution: North & East Madagascar, Tropical & Subtropical Asia to North Queensland (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: May–September

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 25/05/1994, Jomy Augustine 13735 (CALI); Thekkady, 16/03/1973, B.D. Sharma 43902 (MH); Periyar Tiger Reserve, 11/08/1993, Jomy Augustine 12216 (KFRI).

***Isonandra* Wight**

Icon. Pl. Ind. Orient. 2: 4.1840.

Key to species

- 1a. Leaves whorled; anthers black hairy at tip..... *I. perrottetiana*
- 1b. Leaves not whorled; anthers glabrous..... 2
- 2a. Leaves alternate; flowers subsessile; berries orange..... *I. lanceolata*
- 2b. Leaves opposite; flowers sessile; berries green *I. stocksii*

Isonandra lanceolata Wight, Icon. Pl. Ind. Orient.: t. 359.1840; Hook.f., Fl. Brit. India 3: 539. 1882; Gamble, Fl. Madras 2: 761. 1921; Sasidh., Fl. Periyar Tiger Reserve 227. 1998.

Tree. Stem terete, not thorny, rough, woody; branchlets slender. Leaves simple, alternate, elliptic, 6–15 × 1.5–4.5 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary fascicles, subsessile. Calyx lobes 4, biseriate, ovate, 3 × 1 mm, green, glabrous. Corolla lobes 4, deeply divided, ovate, 3 × 1 mm, pinkish white, glabrous. Stamens 8, inserted; subequal, uniseriate; staminodes absent; filaments erect, 1 mm long, cream, glabrous; anthers bilobed, sagittate, 1.5 mm long, cream, glabrous. Style linear, 3 mm long, cream, glabrous, exserted. Stigma pointed, cream. Berry oblong, 2 cm long, orange, glabrous. Seed single.

Distribution: South India, Sri Lanka, Borneo (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: August–October

Specimens examined: India, Kerala, Idukki, Puliya, 28/03/1980, C.E. Ridsale 749 (CALI); Kulamavu, 25/04/1984, C.N. Mohanan 81608 (MH); Anamudi shola, 19/04/1996, K. Kishore kumar 17332 (KFRI).

Isonandra perrottetiana A.DC., A. P. de Candolle, Prodr.8: 188.1844; Hook.f., Fl. Brit. India 3: 539. 1882; Gamble, Fl. Madras 2: 761. 1921; Sasidh., Fl. Periyar Tiger Reserve 227. 1998.

Tree. Stem terete, not thorny, rough, woody; branchlets slender. Leaves simple, whorled, lance-ovate–elliptic, 4–9 × 2–4 cm, apex acute, base obtuse, margins entire, green, glabrous, petiolate. Flowers axillary fascicles, subsessile. Calyx lobes 4, biseriate, ovate, 3–4 × 1 mm, green–pale brown, ciliate. Corolla lobes 4, deeply divided, obovate, 5–6 × 3–4 mm, cream–dull yellow, ciliate. Stamens 8, subequal, uniseriate, inserted; staminodes absent; filaments erect, 1–1.2 mm long, cream, glabrous; anthers bilobed, oblong, black hairy at tip. Style linear, 1 cm long, cream,

glabrous, exserted. Stigma pointed, cream, glabrous. Berry oblong, 1–1.5 cm long, pale brown, glabrous. Seed single.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: March–April

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 24/04/2017, Divya K. Venugopal 151525 (CALI); *ibid.*, 26/12/1993, Jomy Augustine 12906 (CALI); *ibid.*, 01/01/1994, Jomy Augustine 13000 (CALI); *ibid.*, 02/11/1993, Jomy Augustine 12709 (CALI); Devicolam, 25/03/1980, C.E. Ridsale 707 (CALI); Munnar – Kumali road, 26/03/1980, K. Ramamurthy 66397 (MH); Chinnar, 19/04/1996, K.K. Sajeev 17333 (KFRI).

Isonandra stocksii C.B.Clarke, J.D.Hooker, Fl. Brit. India 3: 539.1882; Gamble, Fl. Madras 2: 761. 1921; Sasidh., Fl. Periyar Tiger Reserve 227. 1998.

Tree. Stem terete, not thorny, rough, brown; branchlets stout, glabrous. Leaves simple, opposite, widely elliptic, 7–9 × 4–6 cm, apex and base obtuse, margins entire, green, glabrous, petiolate. Flowers in axillary fascicles, sessile. Calyx lobes 4, biseriata, ovate, 1–2 × 2 mm, green, ciliate. Corolla lobes 4, deeply divided, oblong, 3–5 × 2 mm, dull yellow, ciliate. Stamens 8, subequal, uniseriate, inserted; staminodes absent; filaments erect, 1–1.5 mm long, white, glabrous; anthers bilobed, oblong, apiculate, yellow, glabrous. Style linear, 9–10 mm long, white, glabrous, exserted. Stigma pointed. Berry oblong, 1–1.2 cm long, green, glabrous. Seed single.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January–March

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 07/01/1994, Jomy Augustine 13144 (CALI); *ibid.*, 15/06/1994, Jomy Augustine 13961 (CALI).

Madhuca Buch.-Ham. ex J.F.Gmel.

Syst. Nat., ed. 13[bis]: 799.1791.

Key to species

- 1a. Corolla lobes 12, reddish green; filaments absent; style glabrous; berries ovoid; seeds 2..... *M. longifolia*
1b. Corolla lobes 8, yellowish pink; filaments short; style pubescent; berries ellipsoid; seed 1 *M. neriifolia*

Madhuca longifolia (L.) J.F.Macbr., Contr. Gray Herb., n.s., 53: 17.1918. *Bassia longifolia* J.Koenig ex L., Mant. Pl. 2(App.): 563.1771; Hook.f., Fl. Brit. India 3: 544. 1882; Gamble, Fl. Madras 2: 763. 1921.

Tree. Stem terete, rough with prominent leaf scars, brown. Leaves simple, elliptic, 6–12 × 2–4 cm, apex obtuse, base cuneate, margins entire, clustered at the apex of branchlets, green, glabrous, petiolate. Flowers at the tip of branchlets. Peduncle absent. Pedicel terete, 2–4 cm long, brown, glabrous. Calyx lobes 4, biseriate, ovate, 5–6 × 3–4 mm, green, tomentose. Corolla lobes 12, oblong, 6–8 × 3–4 mm, reddish green, glabrous. Stamens 16, triseriate, inserted; staminodes absent; filaments absent; anther bilobed, apiculate, cream, hairy. Style exserted, 1.8–2 cm long, cream, glabrous. Stigma obtuse, cream. Berries ovoid, 2–3 cm long, greenish, rusty tomentose. Seeds 2.

Distribution: Nepal, India, Sri Lanka, Bangladesh (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: December-May

Specimens examined: India, Kerala, Idukki, Mankulam, 04/12/2018, Divya K. Venugopal 168848 (CALI); Kannampara - Pooyamkutty, 16/12/1988, P. Bhargavan 89967 (MH); Chinnar, 17/03/1995, K.K. Sajeev 15505 (KFRI).

Madhuca neriifolia (Moon) H.J.Lam, Bull. Jard. Bot. Buitenzorg, ser. 3, 7: 183.1925; Sasidh., Fl. Periyar Tiger Reserve 227. 1998. *Bassia malabarica* Bedd., Fl. Sylv. S. India: cix .1872; Hook.f., Fl. Brit. India 3: 544. 1882; Gamble, Fl. Madras 2: 763. 1921.

Tree. Stem terete, not thorny, rough, brown; branchlets slender. Leaves simple, opposite, elliptic, 7–10 × 2–3 cm, apex round, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal cyme. Pedicel terete, 1–2 cm long, green, sparsely tomentose. Calyx lobes 4, biseriate, ovate, 4–5 × 3–4 mm, green, ciliate. Corolla lobes 8, campanulate, 0.7–1.5 × 0.3–0.5 cm, yellowish pink, pubescent. Stamens 16, inserted; staminodes absent; filaments short, 1 × 1 mm, cream, densely hairy; anthers bilobed, lanceolate, cream, glabrous. Style elongated, 1.8–2 cm long, exserted, white, pubescent. Stigma minute, pointed, white. Berries ellipsoid, 2–4 cm long, beaked, green, glabrous. Seed single.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January-May

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 22/04/1994, *Jomy Augustine* 13658 (CALI); Panamkutti, 22/02/1983, *C.N. Mohanan* 77932 (MH).

***Mimusops* L.**

Sp. Pl.: 349.1753.

***Mimusops elengi* L.**, Sp. Pl.: 349.1753; Hook.f., Fl. Brit. India 3: 548. 1882; Gamble, Fl. Madras 2: 765. 1921; Sasidh., Fl. Periyar Tiger Reserve 228. 1998; Sasidh., Fl. Chinnar WLS 180. 1999.

Tree. Stem terete, smooth; branchlets rusty tomentose, brownish green. Leaves simple, alternate, ovate-elliptic, 9–11 × 4–5 cm, apex and base obtuse, margins entire, green, glabrous, petiolate. Flowers in axillary fascicles. Pedicel terete, 0.8–1 × 0.1–0.2 cm, brownish green, tomentose. Calyx lobes 8, biseriate, lanceolate, 3–4 × 2 mm, brown, tomentose. Corolla lobes 24, triseriate, apex acute, white, glabrous except margins. Stamens 8, inserted; staminodes present, lanceolate, pubescent; filaments short, 1 × 1 mm, cream, hairy; anthers bilobed, lanceolate, yellow. Style slender with tapering tip, 3–4 mm long, cream, glabrous. Stigma minutely fimbriate, cream. Berries ovoid, 2–3 cm long, yellow, glabrous. Seed single.

Distribution: South India to Vanuatu (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: December-May

Specimens examined: India, Kerala, Idukki, Mankulam, 18/07/2018, *Divya K. Venugopal* 168728 (CALI); Periyar Tiger Reserve, 06/01/1994, *Jomy Augustine* 13011 (CALI); Chinnar, 13/05/1995, *K.K. Sajeev* 15682 (KFRI).

***Manilkara* Adans.**

Fam. Pl. 2: 166.1763, *nom. cons.*

Key to species

- 1a. Leaves elliptic; staminodes 1 mm long; berries ellipsoid,
reddish yellow *M. hexandra*
- 1b. Leaves oblong; staminodes 4 mm long; berries globose,
green *M. roxburghiana*

Manilkara hexandra (Roxb.) Dubard, Ann. Mus. Colon. Marseille sér. 3, 3: 9. 1915; Sasidh., Fl. Chinnar WLS 179. 1999. *Mimusops hexandra* Roxb., Pl. Coromandel 1: 16. 1795; Hook.f., Fl. Brit. India 3: 549. 1882; Gamble, Fl. Madras 2: 766. 1921.

Tree. Stem terete, brown, rough, warty, exudates latex. Leaves simple, alternate, elliptic, 7–9 × 4–5 cm, apex obtuse, base cuneate, margins entire, clustered at the tip of branchlets, green, glabrous, petiolate. Flowers in axillary fascicles, small. Pedicel terete, 5–8 mm long, green, glabrous. Calyx lobes 6, biseriate, ovate, green, tomentose. Corolla lobes 18, triseriate, apex obtuse, 2–3 × 1–1.5 mm, white, glabrous. Stamens 6, inserted; staminodes c.1 mm long, glabrous; filaments short, 1 mm long, cream, glabrous; anthers bilobed, lanceolate, cream. Style subulate, 3 mm long, cream, glabrous. Stigma simple, pointed. Berries ellipsoid, 1 cm long, reddish yellow, rusty tomentose. Seed single.

Distribution: India to China and Peninsula Malaysia (POWO, 2022)

Habitat: Near streams

Flowering and fruiting: December–August

Specimens examined: India, Kerala, Idukki, Cheeyappara waterfalls, 27/12/2017, Divya K. Venugopal 156509 (CALI); Chinnar, 09/05/1996, K.K. Sajeev 17404 (KFRI).

Manilkara roxburghiana (Wight) Dubard, Ann. Mus. Colon. Marseille sér. 3, 3: 10. 1915; Sasidh., Fl. Chinnar WLS 179. 1999. *Mimusops roxburghiana* Wight, Icon. Pl. Ind. Orient.: t. 1588.1850; Hook.f., Fl. Brit. India 3: 548. 1882; Gamble, Fl. Madras 2: 766. 1921.

Tree. Stem terete, brown, rough. Leaves simple, alternate, oblong, 4–6 × 3–4 cm, apex obtuse, base round, margins entire, clustered at the tip of branches, green, glabrous, petiolate. Flowers in axillary and terminal cyme, 2–5. Pedicel terete, 1.5–2 cm long, green, glabrous. Calyx lobes 6, biseriate, ovate, 6 × 3 mm, green, hairy. Corolla lobes 18, triseriate, apex obtuse, 8–10 × 2–3 mm, white, glabrous. Stamens 6, inserted; staminodes 4 mm long, pubescent; filaments short, 1 mm long, cream, glabrous; anthers bilobed, lanceolate, cream. Style subulate, 2 mm long, cream, glabrous. Stigma simple, pointed. Berries globose, 1.5–2 cm long, green, glabrous. Seeds more than 1.

Distribution: South India (POWO, 2022)

Habitat: Near streams

Flowering and fruiting: December–March

Specimens examined: India, Kerala, Idukki, Chinnar, 09/02/2021, Divya K. Venugopal 170060 (CALI); Chinnar, 30/01/1996, K.K. Sajeev 15945 (KFRI).

***Palaquium* Blanco**

Fl. Filip.: 403.1837.

Key to species

- 1a. Stem glabrous; leaves not spiral at apex; berries ellipsoid, green..... *P. ellipticum*
- 1b. Stem pubescent; leaves spiral at apex; berries obovoid, brown *P. ravii*

Palaquium ellipticum (Dalzell) Baill., *Traité Bot. Méd. Phan.*: 1500. 1884; Sasidh., Fl. Periyar Tiger Reserve 228. 1998; Gamble, Fl. Madras 2: 766. 1921. *Dichopsis elliptica* (Dalzell) Bedd., Indian Forester 3: 24.1877; Hook.f., Fl. Brit. India 3: 542. 1882.

Tree. Stem terete, slender, exudates latex, brownish green, glabrous. Leaves simple, alternate, elliptic, 5–9 × 3–4 cm, apex acuminate, base cuneate, margins entire, green, sparsely pubescent on abaxial surface, petiolate. Flowers in axillary fascicles. Pedicel terete, 2–4 mm long, brownish green, pubescent. Calyx lobes 6, biseriate, ovate–lanceolate, 4–5 × 2–3 mm, brown, pubescent. Corolla lobes 6, campanulate, ovate, 5–7 × 2–3 mm, white, glabrous. Stamens 12–15, exserted; staminodes absent; filaments minute, cream, pubescent; anthers bilobed, lanceolate, white. Style exserted, 1.5 cm long, cream, glabrous. Stigma minute, pointed, cream. Berries ellipsoid, 2–3 cm long, green, glabrous. Seed single.

Distribution: West & South West India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February–July

Specimens examined: India, Kerala, Idukki, Puliya, Munnar–Alwaye Road, 28/03/1980, C.E. Ridsale 743 (CALI); Periyar Tiger Reserve, 15/06/1995, Jomy Augustine 12926 (CALI); Adimali Forest Range, 28/03/1980, K. Ramamurthy 66551 (MH).

Palaquium ravii Sasidh. & Vink, *Blumea* 35: 385.1991; Sasidh., Fl. Periyar Tiger Reserve 228. 1998.

Tree. Stem terete, exudates latex, greyish brown, pubescent. Leaves simple, alternate and spiral at apex, elliptic, 8–10 × 3–4 cm, apex obtuse, base cuneate, margins entire,

green, sparsely pubescent, petiolate. Flowers in axillary fascicles. Pedicel terete, 5–7 mm long, greyish brown, pubescent. Calyx lobes 6, biseriate, ovate–oblong, 4–5 × 2–3 mm, brown, pubescent. Corolla lobes 6, campanulate, obovate, 4–5 × 1.5–2 mm, cream, glabrous. Stamens 12, biseriate, exserted; staminodes absent; filaments minute, 2 mm long, cream, pubescent; anthers bilobed, lanceolate, white. Style exserted, 8 mm long, cream, glabrous. Stigma minute, pointed, cream. Berries obovoid, 2–3 cm long, brown, glabrous. Seed single.

Distribution: India (Kerala) (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: April–February

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 20/03/1994, Jomy Augustine 13616 (CALI).

Xantolis Raf.

Sylva Tellur.: 35.1838.

Xantolis tomentosa (Roxb.) Raf., Sylva Tellur.: 35.1838; Sasidh., Fl. Periyar Tiger Reserve 228. 1998. *Sideroxylon tomentosum* Roxb., Pl. Coromandel 1: 28. 1795; Hook.f., Fl. Brit. India 3: 538. 1882; Gamble, Fl. Madras 2: 759. 1921.

Tree. Stem terete, slender; old branches thorny. Leaves simple, alternate, ovate, 6–7 × 5–6 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axil of fallen leaves, fascicles. Pedicel terete, 3–5 mm long, brownish green, tomentose. Calyx lobes 6, biseriate, ovate, 4–5 × 2–3 mm, brown, pubescent. Corolla lobes 6, campanulate, 8–10 × 2–3 mm, white, pubescent. Stamens 6, exserted; staminodes present, lanceolate, pubescent at base; filaments linear, minute, cream, pubescent at base; anthers bilobed, ovate, white. Style exserted, cylindric, 7 mm long, cream, glabrous. Stigma minute, pointed, cream. Berries ovoid, 1.5–3 cm long, pink with persistent calyx lobes, rusty tomentose. Seeds numerous.

Distribution: India, Sri Lanka, Indo-China (POWO, 2022)

Habitat: Near streams

Flowering and fruiting: December–March

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 12/01/2017, Divya K. Venugopal 176444 (CALI); *ibid.*, 06/11/1993, Jomy Augustine 12788 (CALI); *ibid.*, 28/12/1993, Jomy Augustine 12928 (CALI); *ibid.*, 16/05/1995, Jomy Augustine 15275 (CALI); Devicolam, 23/03/1980, C.E. Ridsale 720 (CALI); Munnar Bodi road,

26/03/1980, *K. Ramamurthy 66516* (MH); Chinnar, 06/12/1993, *N. Sasidharan 12788* (KFRI).

EBENACEAE Gürke

Nat. Pflanzenfam. [Engler & Prantl] 4(1): 153.1892, *nom. cons.*

Trees or shrubs. Mesophytic (Delta Intkey, 2023). Leaves alternate, entire, usually coriaceous, exstipulate. Flowers usually unisexual, in axillary cyme or solitary, bracteate. Calyx lobes 4–5, often accrescent. Corolla tubular; lobes 3–7, contorted. Stamens epipetalous, as many as corolla lobes, usually in two whorls; anthers narrow. Style 2–8, fused at the base. Berry globose or ellipsoid. Seeds numerous, oblong, pendulous.

According to POWO 2022, family consists of 3 accepted genera and genus *Diospyros* consists of 737 accepted species worldwide.

Diospyros L.

Sp. Pl.: 1057. 1753.

Key to species

- 1a. Branchlets glabrous..... 2
- 1b. Branchlets pubescent 3
- 2a. Flowers sessile *D. ovalifolia*
- 2b. Flowers pedicellate 4
- 3a. Calyx tube present..... 5
- 3b. Calyx tube absent..... 6
- 4a. Flowers in axillary cymes *D. bourdillonii*
- 4b. Flowers solitary..... *D. ferrea*
- 5a. Corolla lobes greenish yellow; stamens 16..... *D. montana*
- 5b. Corolla lobes white; stamens 24 *D. sylvatica*
- 6a. Calyx lobes 5..... *D. paniculata*
- 6b. Calyx lobes 4..... 7
- 7a. Stamens 12 *D. pruriens*
- 7b. Stamens 16..... 8
- 8a. Leaves widely obovate; peduncle tomentose..... *D. ghatensis*
- 8b. Leaves elliptic; peduncle glabrous..... *D. nilagirica*

Diospyros ovalifolia Wight, Icon. Pl. Ind. Orient. 4: t. 1227. 1848; Hook.f., Fl. Brit. India 3: 559. 1882; Gamble, Fl. Madras 2: 777. 1921; Sasidh., Fl. Periyar Tiger Reserve 231. 1998; Sasidh., Fl. Chinnar WLS 181. 1999.

Tree. Stem terete, rough; branchlets glabrous. Leaves simple, alternate, obovate, 6–8 × 2–4 cm, apex obtuse, base cuneate, margins entire, green, glabrous, glaucous beneath, petiolate. Flowers cauliflorous, dioecious, sessile, bracteate. Calyx tube absent; lobes 4, 3 × 1 mm, apex acute, green, pubescent. Corolla tube 4 × 2 mm, fleshy, cream, glabrous; lobes 5, 3 × 2 mm, apex round, creamy white, glabrous. Male flowers: stamens 20; filament 1 × 1 mm, cream, glabrous; anther bilobed, elliptic, minute, cream, glabrous. Female flowers: style 2–8, minute, cream, glabrous. Stigma 4 lobed, cream, glabrous. Berry not seen.

Distribution: India, Sri Lanka, Bangladesh (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: April–September

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 06/05/1994, Jomy Augustine 13738 (CALI); Mankulam, 11/04/2018, Divya K. Venugopal 157742 (CALI).

Diospyros paniculata Dalzell, Hooker's J. Bot. Kew Gard. Misc. 4: 109. 1852; Hook.f., Fl. Brit. India 3: 570. 1882; Gamble, Fl. Madras 2: 775. 1921; Sasidh., Fl. Periyar Tiger Reserve 231. 1998.

Tree. Stem terete, pubescent; branchlets pubescent. Leaves simple, alternate, ovate-elliptic, 10–12 × 3–4 cm, apex slightly acute, base cuneate, margins reflexed near base, green, glabrous, petiolate. Flowers in axillary raceme (male flowers); solitary, axillary (female flowers), bracteate. Pedicel terete, 1–2 cm long, green, pubescent. Calyx tube absent; lobes 5, deeply divided, 6–8 × 3–4 mm, apex acute, green, pubescent. Corolla tube 5–7 mm long, cream, pubescent; lobes 5, 5–6 × 2–3 mm, apex obtuse, creamy white, pubescent. Male flowers: stamens 20, triseriate; filaments 1 × 1 mm, cream, glabrous; anther bilobed, linear, minute, cream, glabrous. Female flowers: style minute, cream, glabrous. Stigma 4, cream, glabrous. Berry obovoid, 4–5 × 2–3 cm, yellowish green, pubescent.

Distribution: India, Bangladesh (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February–August

Specimens examined: India, Kerala, Idukki, Pambadum Shola, 18/02/2019, *Divya K. Venugopal* 176457 (CALI); Koomanpara, 22/03/1983, *Philip Mathew* 33785 (CALI); Periyar Tiger Reserve, 04/08/1993, *Jomy Augustine* 12221 (CALI); Painavu, 25/05/1982, C.N. Mohanan 74011 (MH).

Diospyros sylvatica Roxb., Pl. Coromandel 1: 38. 1795; Hook.f., Fl. Brit. India 3: 559. 1882; Gamble, Fl. Madras 2: 773. 1921; Sasidh., Fl. Periyar Tiger Reserve 232. 1998.

Tree. Stem terete; bark smooth; branchlets pubescent. Leaves simple, alternate, ovate, 5–7 × 1–2 cm, apex acute to acuminate, base cuneate, margins entire, green, membranous, tomentose, petiolate. Flowers in axillary racemes (male flowers); solitary (female flowers), bracteate. Pedicel terete, 2–3 mm long, green, pubescent. Calyx tube 2 mm long, green, pubescent; lobes 4, 3 mm long, apex acute, green, pubescent. Corolla tube absent; lobes 4, campanulate, 5 mm long, apex obtuse, white, tomentose. Male flowers: stamens 24; filaments 1 × 1 mm, pale green, glabrous below, pubescent at apex; anther bilobed, elliptic, minute, pale yellow, glabrous. Female flowers: style 4, free, 1–2 mm long, pale green, glabrous. Stigma bilobed, minute, pale green, glabrous. Berry globose, 1 × 1 cm, green, glabrous.

Distribution: India, Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: May–November

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 02/05/1995, *Jomy Augustine & K.P. Rajesh* 15171 (CALI); *ibid.*, 15/05/1995, *Jomy Augustine* 15235 (CALI); Thanpumala, 13/11/1982, *Philip Mathew* 33635 (CALI); Kattapana, 12/06/1983, *A.G. Pandurangan* 79204 (MH).

Diospyros pruriens Dalzell, Hooker's J. Bot. Kew Gard. Misc. 4: 110.1852; Hook.f., Fl. Brit. India 3: 553. 1882; Gamble, Fl. Madras 2: 774. 1921; Sasidh., Fl. Periyar Tiger Reserve 232. 1998.

Tree. Stem terete, tomentose; branchlets densely tomentose. Leaves simple, alternate, ovate, 7–12 × 2–3 cm, apex acute, base round, margins entire, green, pubescent along margin and mid veins, petiolate. Flowers in axillary cymes (male flowers); axillary, solitary (female flowers), bracteate. Peduncle terete, green, tomentose. Pedicel terete, 2–3 mm long, green, tomentose. Calyx tube absent; lobes 4, deeply divided, 5 mm long, apex acute, green, pubescent. Corolla tube 8 mm long, yellowish white, tomentose; lobes 4, 4–6 mm long, apex obtuse, yellowish white, tomentose. Male

flowers: stamens 12; filaments 1×1 mm, cream, glabrous; anther bilobed, elliptic, 1×1 mm, cream, glabrous. Female flowers: style 2, minute, cream, pubescent at base. Stigma bilobed, minute, cream, glabrous. Berry ovoid, 2–3 cm long, yellow, tomentose.

Distribution: India (POWO, 2022)

Habitat: Shola margins

Flowering and fruiting: February-July

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 09/06/2018, Divya K. Venugopal 163246 (CALI); Karuvarakundu, 16/06/1982, Philip Mathew 33369 (CALI); Periyar Tiger Reserve, 25/03/1994, Jomy Augustine 13490 (KFRI).

Diospyros ghatensis B.R. Ramesh & D. De Franceschi, *Blumea* 38: 131.1993; Sasidh., *Fl. Periyar Tiger Reserve* 230. 1998.

Tree. Stem terete, smooth, glabrous; young branchlets tomentose. Leaves simple, alternate, widely obovate, $4-10 \times 4-5$ cm, apex acute-acuminate, base attenuate, margins entire, green, glabrous, petiolate. Flowers in axillary cymes, pubescent, bracteate. Peduncle terete, 2–2.5 cm long, brown tomentose. Pedicel absent. Calyx tube almost absent; lobes 4, 3 mm long, apex acute, pale brown, tomentose. Corolla tube 6 mm long, creamy white, tomentose; lobes 4, 3 mm long, apex acute, creamy white, sparsely pubescent. Male flowers: stamens 16; filaments 1×1 mm, pale yellow, pubescent at connectives; anther bilobed, elliptic, 1×1 mm, pale yellow, glabrous. Female flowers not seen.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: March-December

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 08/04/1995, Jomy Augustine 15095 (CALI); *ibid.*, 19/04/2017, Divya K. Venugopal 163742 (CALI).

Diospyros nilagirica Bedd., *Icon. Pl. Ind. Or.*: 27. 1871; Hook.f., *Fl. Brit. India* 3: 566. 1882; Gamble, *Fl. Madras* 2: 775. 1921; Sasidh., *Fl. Periyar Tiger Reserve* 231. 1998.

Tree. Stem terete, smooth, glabrous; young branchlets tomentose. Leaves simple, alternate, elliptic, $6-14 \times 2-5$ cm, apex acute, base attenuate, margins recurved, green, sparsely pubescent along margins, petiolate. Flowers in axillary cymes (male flowers); axillary, solitary (female flowers), bracteate. Peduncle terete, 5–6 mm long,

brown, glabrous. Pedicel absent. Calyx tube absent; lobes 4, deeply divided, 3–5 mm long, apex obtuse, green, tomentose. Corolla tube 4–6 mm long, pinkish white, tomentose; lobes 4, 3–4 mm long, apex obtuse, reflexed, white, glabrous on inner surface. Male flowers: stamens 16; filaments 1×1 mm, cream, pubescent; anther bilobed, lanceolate, 1×1 mm, cream, glabrous. Female flowers: style 4, cream, glabrous. Stigma dilated, minute, cream, glabrous. Berry globose, 2–3 cm long, green, with persistent calyx, glabrous.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January–October

Specimens examined: India, Kerala, Idukki, Karuvarakundu, 27/02/2018, Philip Mathew 33822 (CALI); Upper vaguvarai, 13/10/1989, P. Bhargavan 90907 (MH).

Diospyros bourdillonii Brandis, Indian Trees: 435. 1906; Gamble, Fl. Madras 2: 777. 1921; Sasidh., Fl. Periyar Tiger Reserve 229. 1998.

Tree. Stem terete, smooth; trunk buttressed; branchlets glabrous. Leaves simple, alternate, elliptic, $8\text{--}14 \times 4\text{--}6$ cm, apex acuminate, base round, margins entire, green, glabrous, petiolate. Flowers in axillary cymes, bracteate. Peduncle terete, 1–1.5 cm long, green, glabrous. Pedicel terete, 2–4 mm long, green, glabrous. Calyx tube absent; lobes 5, 3–4 mm long, apex acute, green, brown tomentose. Corolla tube 5–7 mm long, white, pubescent; lobes 5, 3–4 mm long, apex obtuse, white, pubescent. Male flowers: stamens 20, inserted, biseriate; filaments 1×1 mm, cream, glabrous; anther bilobed, elliptic, 1×1 mm, cream, glabrous. Female flowers not seen.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February–December

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 07/03/1994, Jomy Augustine 13461 (CALI); Painavu, 28/04/1984, C.N. Mohanan 81653 (MH); Kallar, 01/12/2018, Divya K. Venugopal 171158 (CALI).

Diospyros montana Roxb., Pl. Coromandel 1: 37. 1795; Hook.f., Fl. Brit. India 3: 555. 1882; Gamble, Fl. Madras 2: 776. 1921; Sasidh., Fl. Periyar Tiger Reserve 231. 1998.

Tree. Stem terete, brown; branchlets tomentose, thorny. Leaves simple, alternate, oblong, $6\text{--}8 \times 2\text{--}4$ cm, apex obtuse, base cordate, green, pubescent, petiolate. Flowers in axillary racemes (male flowers), bracteate. Peduncle terete, 3–4 mm long, green,

pubescent. Pedicel terete, 1 mm long, green, pubescent. Calyx tube 1–2 mm long, green, glabrous; lobes 4, 4–5 mm long, apex sub acute, green, margins ciliate. Corolla tube 4–5 × 2–3 mm, greenish yellow, glabrous; lobes 4, 3–5 × 2–3 mm, apex sub acute, greenish yellow, glabrous. Male flowers: stamens 16; filaments 1–2 mm long, hyaline, glabrous; anther bilobed, lanceolate, 3–4 mm long, yellow, glabrous. Female flowers not seen.

Distribution: Tropical Asia (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: February–December

Specimens examined: India, Kerala, Idukki, Near Thaniikudi, 08/02/1981, *M.C. Nair* 70139 (MH); Marayur, 23/11/1979, *Nambiar* 1072 (KFRI).

Diospyros ferrea (Willd.) Bakh., Gard. Bull. Straits Settle. 7: 162. 1933; Sasidh., Fl. Periyar Tiger Reserve 230. 1998.

Tree. Stem terete, woody, rough; branchlets glabrous. Leaves simple, alternate, obovate, apex obtuse, base cuneate, margins entire, glabrous, petiolate. Flowers solitary, axillary (female flowers), bracteate. Pedicel terete, 3–4 mm long, green, glabrous. Calyx cupular, lobes 3, minutely lobed, 1–3 mm long, apex obtuse, green, glabrous. Corolla tube 4–6 × 3 mm, yellowish white, glabrous; lobes 3, 1–2 mm long, apex obtuse, yellowish white, glabrous, reflexed. Male flowers not seen. Female flowers: style bifid, 3–4 × 1 mm, pale yellow, glabrous. Stigma capitate, minute, pale yellow, glabrous. Berry globose, 4–5 mm long, orange-red when ripe, glabrous.

Distribution: Tropical Africa to South West Pacific (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: January–June

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 06/05/1994, *Jomy Augustine* 13768 (CALI); *ibid.*, 23/05/2018, *Divya K. Venugopal* 153124 (CALI).

SYMPLOCACEAE Desf.

Mém. Mus. Hist. Nat. 6: 9.1820, *nom. cons.*

Trees or shrubs. Leaves simple, alternate, sessile or shortly petioled, exstipulate. Flowers in axillary and terminal spike or solitary. Pollination entomophilous (Delta Intkey, 2023). Calyx campanulate, lobes 4–5, persistent. Corolla lobes 5. Stamens adnate to petals; usually in many layers as multiple of 5; filaments filiform; anthers short. Style filiform. Stigma capitate or shortly lobed. Fruit capsule with persistent

calyx. Seeds 1 or 3, oblong. Members are usually tropical to subtropical evergreen trees and commonly known as sweetleaf.

According to POWO, 2022, family is monotypic and the genus consists of 402 accepted species worldwide.

***Symplocos* Jacq.**

Enum. Syst. Pl. :5. 1760.

Key to species

- 1a. Corolla lobes white 2
- 1b. Corolla lobes pink.....*S. macrophylla* subsp. *rosea*
- 2a. Stem glabrous..... 3
- 2b. Stem pubescent 4
- 3a. Drupe oblong..... 5
- 3b. Drupe not oblong 6
- 4a. Flowers solitary *S. monantha*
- 4b. Flowers in raceme 7
- 5a. Leaves obovate, margins entire; drupe green..... *S. obtusa*
- 5b. Leaves elliptic, margins serrate; drupe yellowish green..... *S. racemosa*
- 6a. Drupe ampulliform, purplish green; pedicel absent..... *S. cochinchinensis*
- 6b. Drupe ovoid-elliptic, blue; pedicel present..... *S. wynadense*
- 7a. Drupe glabrous 8
- 7b. Drupe villous..... 9
- 8a. Leaves elliptic 10
- 8b. Leaves not elliptic 11
- 9a. Pedicel absent; drupe green..... *S. macrophylla*
- 9b. Pedicel present; drupe white*S. pulchra* subsp. *villosa*
- 10a. Leaves margin dentate; drupe yellow *S. foliosa*
- 10b. Leaves margin serrate; drupe red..... *S. nicolsonii*
- 11a. Leaves oblong, margin minutely serrate; drupe
yellow.....*S. macrophylla* subsp. *microphylla*
- 11b. Leaves obovate, margin dentate; drupe blue.....*S. macrophylla* subsp. *rosea*

Symplocos cochinchinensis (Lour.) S.Moore, J. Bot. 52: 148.1914; Sasidh., Fl. Periyar Tiger Reserve 233. 1998; Sasidh., Fl. Chinnar WLS 183. 1999. *Symplocos spicata* Roxb., Fl. Ind. ed. 1832, 2: 541.1832; Hook.f., Fl. Brit. India 3: 573. 1882; Gamble, Fl. Madras 2: 782. 1921.

Small tree. Stem terete; branchlets terete, brown, glabrous. Leaves simple, alternate, ovate-elliptic, 5–11 × 2.5–5 cm, apex acuminate, base cuneate, margins serrate, yellow when dry, glabrous, petiolate. Flowers in axillary spike, branched. Peduncle terete, 3–4 cm long, brown, tomentose. Pedicel absent. Calyx lobes 5, 1 × 1 mm, apex round, green, pubescent. Corolla lobes 5, deeply divided, 3 × 2 mm, apex round, white, glabrous. Stamens numerous, free, inserted; filaments filiform, 2–3 mm long, white, glabrous; anthers bilobed, elliptic, minute, > 1 mm, yellow, glabrous. Style slender, 3 mm long, cream, glabrous. Stigma capitate, > 1 mm long, white, glabrous. Drupe ampulliform, 6–8 mm long, purplish green, glabrous. Seed single.

Distribution: Tropical & Subtropical Asia (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: January-May

Specimens examined: India, Kerala, Idukki, Anamudi shola, 03/04/2017, Divya K. Venugopal 152065 (CALI); Periyar Tiger Reserve, 03/09/1994, Jomy Augustine 14085 (CALI); Kanthalloor, 25/02/2003, Shylaja N. 88326 (CALI); Idukki – Kattapana, 08/11/1981, B. Ramanujam 72418 (MH); Chinnar, 28/08/1995, K.K. Sajeev 15784 (KFRI).

Symplocos foliosa Wight, Icon. Pl. Ind. Orient. 4: t. 1234.1848; Hook.f., Fl. Brit. India 3: 582. 1882; Gamble, Fl. Madras 2: 783. 1921; Sasidh., Fl. Periyar Tiger Reserve 233. 1998.

Tree. Stem terete, woody; branchlets terete, brown, tomentose. Leaves simple, alternate, elliptic, 9–14 × 3.5–4.5 cm, apex acuminate, base cuneate, margins dentate, green, tomentose on abaxial surface, petiolate. Flowers in axillary raceme, tomentose. Peduncle terete, 2–3 cm long, brown, woolly tomentose. Pedicel terete, minute, 1 mm long, brown, glabrous. Calyx lobes 5, 1 × 1 mm, apex obtuse, green, glabrous. Corolla lobes 5, deeply divided, 2 × 1 mm, apex obovate, white, glabrous. Stamens numerous, free, inserted; filaments filiform, 0.5 mm long, cream, glabrous; anthers bilobed, elliptic, short, yellow, glabrous. Style slender, 1 mm long, cream, glabrous. Stigma capitate, 1 mm long, yellow, glabrous. Drupe cylindric, 7–8 mm long, yellow, glabrous. Seeds 1–3.

Distribution: South West India (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: November-January

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 25/11/1993, *Jomy Augustine* 12720 (CALI); *ibid.*, 19/01/1994, *Jomy Augustine* 13103 (KFRI).

Symplocos macrophylla Wall. ex DC., Prodr. 8: 257.1844. *Symplocos gardneriana* Wight, Icon. Pl. Ind. Orient. 4: t. 1231.1848; Hook.f., Fl. Brit. India 3: 578. 1882; Gamble, Fl. Madras 2: 782. 1921.

Shrub-small tree. Stem terete, rough; branchlets terete, brown, densely tomentose. Leaves simple, alternate, elliptic, 10–13 × 4–5.5 cm, apex acuminate, base obtuse, margins serrate, petiolate (tomentose), yellow when dry, tomentose. Flowers in axillary raceme, sessile. Peduncle terete, 3–4 cm long, brown, woolly tomentose. Calyx lobes 5, 3 × 2 mm, apex acute, green, densely hairy. Corolla lobes 5, deeply divided, 2–3 × 1–1.5 mm, apex obtuse, white, slightly hairy along margins. Stamen numerous, free, inserted; filaments filiform, 2 mm long, white, glabrous; anthers bilobed, elliptic, > 1 mm long, yellow, glabrous. Style filiform, 3 mm long, white, glabrous. Stigma capitate, minute, yellow, glabrous. Drupe oblong, 5–10 mm long, green, villous. Seed single.

Distribution: Indian Subcontinent to Indo-China (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: November-January

Specimens examined: India, Kerala, Idukki, Kulamavu, 22/01/2019, *Divya K. Venugopal* 168907 (CALI); Periyar Tiger Reserve, 26/12/1993, *Jomy Augustine* 12998 (CALI); Eravikulam, 13/04/1996. *K. Kishore Kumar* 17652 (KFRI).

Symplocos macrophylla* subsp. *microphylla (Wight) Noot., Leiden Bot. Ser. 1: 229.1975; Sasidh., Fl. Periyar Tiger Reserve 233. 1998. *Symplocos microphylla* Wight, Icon. Pl. Ind. Orient. 4: t. 1232. 1848; Hook.f., Fl. Brit. India 3: 581. 1882; Gamble, Fl. Madras 2: 748. 1921.

Small tree. Stem terete, woody; branchlets terete, brown, tomentose. Leaves simple, alternate, oblong, 3–6 × 1.5–3 cm, apex obtuse, base cuneate, margins minutely serrate, green, glabrous except midvein, petiolate. Flowers in axillary spike, sessile. Peduncle quadrangular, 1.5–3 cm long, brownish green, pubescent. Calyx lobes 5, > 1 mm long, apex acute, green, pubescent. Corolla lobes 5, deeply divided, 2–3 × 1–1.5 mm, apex round, white, glabrous. Stamen numerous, free, inserted; filaments filiform,

up to 1 mm long, white, glabrous; anthers bilobed, elliptic, minute, > 1 mm long, yellow, glabrous. Style filiform, 1 mm long, white, glabrous. Stigma capitate, minute, >1 mm long, yellow, glabrous. Drupe oblong, 3–6 mm long, yellow, glabrous. Seed single.

Distribution: South India, Myanmar (POWO, 2022)

Habitat: Shola margins

Flowering and fruiting: February-May

Specimens examined: India, Kerala, Idukki, Way to Anamudi peak, 26/04/2019, Divya K. Venugopal 159131 (CALI); Periyar Tiger Reserve, 15/04/1994, Jomy Augustine 13589 (CALI).

Symplocos macrophylla* subsp. *rosea (Bedd.) Noot., Leiden Bot. Ser. 1: 229.1975; Sasidh., Fl. Periyar Tiger Reserve 233. 1998. *Symplocos rosea* Bedd., Madras J. Lit. Sci., ser. 3, 1: 51 (1864); Hook.f., Fl. Brit. India 3: 583. 1882; Gamble, Fl. Madras 2: 783. 1921.

Shrub. Stem terete, brownish green; branchlets terete, brownish green, tomentose. Leaves simple, alternate, obovate, 12–15 × 3–6 cm, apex caudate, base cuneate, margins dentate, green, yellow when dry, glabrous, petiolate. Flowers in axillary and terminal raceme, hispid. Peduncle terete, 3–3.5 × 0.1–0.15 cm, brown, tomentose. Pedicel terete, minute, 1 mm long, brown, tomentose. Calyx lobes 5, triangular, minute, > 1 mm long, apex acute, green, pubescent. Corolla lobes 5, deeply divided, 2–3 mm long, apex obtuse, pink, glabrous. Stamens numerous, free, inserted, multiseriate; filaments filiform, upto 1 mm long, white, glabrous; anthers bilobed, elliptic, > 1mm long, yellow, glabrous. Style filiform, 1 mm long, white, glabrous. Stigma capitate, minute, > 1 mm long, yellow, glabrous. Drupe cylindrical, 5–10 mm long, blue, glabrous, calyx lobes at apex. Seeds 1–2.

Distribution: South West India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February-April

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 25/02/1994, Jomy Augustine 13399 (CALI); Meenmutty – Kulamavu, 24/01/1983, A.G. Pandurangan 76615 (MH).

Symplocos monantha Wight, Icon. Pl. Ind. Orient. 4: t. 1236.1848; Hook.f., Fl. Brit. India 3: 581. 1882; Gamble, Fl. Madras 2: 784. 1921; Sasidh., Fl. Periyar Tiger Reserve 235. 1998.

Shrub. Stem terete, branched; branches terete, brownish green, tomentose. Leaves simple, alternate, ovate-elliptic, $2.5-4 \times 1-1.5$ cm, apex acute, base cuneate, margins serrate, green, glabrous, petiolate. Flowers axillary, solitary, sessile. Calyx lobes 5, 1×1 mm, apex obtuse, green, ciliate along margins. Corolla lobes 5, 2×1 mm, apex round, white, glabrous. Stamens numerous, not free, inserted; filaments filiform, 1–1.5 mm long, white, glabrous; anthers bilobed, elliptic, minute, yellow, glabrous. Style 1.5 mm long, white, glabrous. Stigma capitate, minute, yellow. Drupe ovoid, 8–10 mm long, white, glabrous. Seeds 1–2.

Distribution: South West India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: November-January

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 16/08/1994, Jomy Augustine 13993 (CALI).

Symplocos nicolsonii R.Jagadeesan, A.Gangaprasad, S.P.Mathew, E.S.S. Kumar & J.Stephan, Annals of Plant Sciences 5.7: 1389. 2016.

Small tree. Stem terete, branched, brown, pubescent. Leaves simple, alternate, elliptic, $2-5 \times 1-3.5$ cm, apex cuspidate, base cuneate, margins serrate, green, pubescent, petiolate. Flowers in axillary and terminal spikes. Peduncle quadrangular, 2–5 cm long, brown, tomentose. Pedicel absent. Calyx lobes 5, 1×1 mm, apex obtuse, purple, pubescent. Corolla lobes 5, deeply divided, 2×2 mm, apex round, white, glabrous. Stamens numerous, free, inserted; filaments filiform, 1–1.5 mm long, cream, glabrous; anthers bilobed, elliptic, >1 mm long, yellow, glabrous. Style about 1 mm long, filiform, cream, glabrous. Stigma capitate, >1 mm long, yellow, glabrous. Drupe ellipsoid with persistent calyx, 1–1.5 cm long, red, glabrous. Seed 1.

Distribution: Known only from Idukki district, Kerala

Habitat: Shola margins

Flowering and fruiting: December-May

Specimens examined: India, Kerala, Idukki, Rajappara, 10/02/2017, Divya K. Venugopal 151682 (CALI); Mathikettan shola National Park, 12/04/2017, S. Syam Radh 149200 (CALI).

Symplocos obtusa Wall. ex G.Don, Gen. Hist. 4: 3. 1837; Gamble, Fl. Madras 2: 783. 1921. *Symplocos laeta* Thwaites, Enum. Pl. Zeyl.: 184. 1860; Hook.f., Fl. Brit. India 3: 583. 1882. *Symplocos obtusa* var. *pedicellata* (C.B.Clarke) Noot., Leiden Bot. Ser. 1: 244. 1975; Sasidh., Fl. Periyar Tiger Reserve 235. 1998.

Tree. Stem terete, woody; branchlets terete, brown, glabrous. Leaves simple, alternate, obovate, 5–10 × 4–6 cm, apex obtuse, base cuneate, margins entire, petiolate, green, glabrous. Flowers in axillary raceme, glabrous. Peduncle terete, 2–3 cm long, glabrous. Pedicel terete, minute, 1 mm long, green, glabrous. Calyx lobes 5, apex obtuse, 1 × 1 mm, green, glabrous. Corolla lobes 5, deeply divided, apex obovate, 2 × 1 mm, white, glabrous. Stamens numerous, free, multiseriate, inserted; filaments filiform, upto 2 mm long, white, glabrous; anthers bilobed, elliptic, short, cream-yellow, glabrous. Style slender, 2 mm long, white, glabrous. Stigma capitate, >1 mm long, yellow, glabrous. Drupe oblong, 6–8 mm long, green, glabrous. Seeds 1–2.

Distribution: South West India, Sri Lanka (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: November-January

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 15/01/1994, Jomy Augustine 13773 (CALI).

Symplocos pulchra* ssp. *villosa (Brand) Noot., Leiden Bot. Ser. 1: 268. 1975; Sasidh., Fl. Periyar Tiger Reserve 235. 1998. *Symplocos villosa* Brand, H.G.A.Engler (ed.), Pflanzenr., IV, 242: 63. 1901; Gamble, Fl. Madras 2: 784. 1921.

Shrub. Stem terete, woody; branchlets terete, brown, densely tomentose. Leaves simple, alternate, elliptic, 8–16 × 3–6 cm, apex acuminate, base round, margins serrate, petiolate, green, tomentose. Flowers in axillary raceme, tomentose. Peduncle terete, minute, pubescent. Pedicel terete, minute, 1–1.5 mm long, green, glabrous. Calyx lobes 5, apex acute, 1 × 1 mm, green, pubescent. Corolla lobes 5, deeply divided, apex obovate, 2 × 1 mm, white, glabrous. Stamens numerous, free, multiseriate, inserted; filaments filiform, 1–1.5 mm long, white, glabrous; anthers bilobed, elliptic, short, yellow, glabrous. Style slender, 1.5 mm long, white, glabrous. Stigma capitate, >1 mm long, yellow, glabrous. Drupe oblong, 6–8 mm long, white, pubescent. Seeds 1–2.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February-April

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 17/03/1994, *Jomy Augustine* 13580 (CALI); Pambadum shola, 21/12/2018, *Divya K. Venugopal* 167892 (CALI).

Symplocos racemosa Roxb., Fl. Ind., 2: 539.1832; Hook.f., Fl. Brit. India 3: 576. 1882; Sasidh., Fl. Periyar Tiger Reserve 235. 1998. *Symplocos beddomei* C.B. Clarke, J.D. Hooker, Fl. Brit. India 3: 582.1882; Gamble, Fl. Madras 2: 783. 1921.

Figure 18 G.

Small tree. Stem terete, branched, brown, glabrous. Leaves simple, alternate, elliptic, 8–12 × 2.5–4.5 cm, apex acute, base cuneate, margins serrate, green, glabrous, petiolate. Flowers in axillary and terminal spikes, sessile. Peduncle terete, 2–5 cm long, green, pubescent. Calyx lobes 5, 1–2 mm long, apex acute, green, pubescent. Corolla lobes 5, deeply divided, 2–3 mm long, apex obtuse, white, glabrous. Stamens numerous, inserted; filaments unequal, 3–5 mm long, white, glabrous; anthers bilobed, elliptic, > 1 mm long, yellow, glabrous. Style about 2 mm long, filiform, white, glabrous. Stigma capitate, > 1 mm long, yellow, glabrous. Drupe oblong, 0.5–1.2 cm long, yellowish green, glabrous, calyx lobes at apex. Seeds 1 or 2.

Distribution: Nepal to South China and Indo-China (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: June–December

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 06/01/2017, *Divya K. Venugopal* 151606 (CALI); Periyar Tiger Reserve, 16/05/1994, *Jomy Augustine* 13754 (CALI); Mathikettan Shola National Park, 17/07/2015, *S. Syam Radh* 145047 (CALI).

Symplocos wynadense (Kuntze) Noot., Leiden Bot. Ser. 1: 293. 1975; Sasidh., Fl. Periyar Tiger Reserve 236. 1998. *Symplocos acuminata* Bedd., Fl. Sylv. S. India: cl. 1872; Hook.f., Fl. Brit. India 3: 583. 1882; Gamble, Fl. Madras 2: 783. 1921.

Tree. Stem terete, woody; branchlets terete, brownish green, glabrous. Leaves simple, alternate, elliptic, 9–14 × 3.5–4.5 cm, apex acuminate, base cuneate, margins serrate, petiolate, green, glabrous. Flowers in axillary spike, tomentose. Peduncle terete, 3–5 cm long, densely tomentose. Pedicel terete, 4 mm long, green, glabrous. Calyx lobes 5, apex obtuse, 1 × 1 mm, green, pubescent. Corolla lobes 5, deeply divided, 2 × 1 mm, apex obovate, white, glabrous. Stamens numerous, free, inserted; filaments filiform, 1.5–2 mm long, white, glabrous; anthers bilobed, elliptic, short, yellow,

glabrous. Style slender, 4 mm long, cream, pubescent. Stigma capitate, > 1 mm long, yellow, glabrous. Drupe ovoid-elliptic, 1–1.3 cm long, blue, glabrous. Seeds 2–3.

Distribution: South West India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: August–December.

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 05/06/1994, Jomy Augustine 12222 (CALI).

OLEACEAE Hoffmanns. & Link

Fl. Portug. [Hoffmannsegg] 1: 62.1809, *nom. cons.*

Shrubs or trees, unarmed, non-laticiferous, non-succulent (Delta Intkey, 2023). Mesophytic. Leaves simple, trifoliate or pinnate, opposite, exstipulate. Flowers regular in dichasial cyme; terminal or axillary, bracteate. Calyx lobes 4, green, campanulate. Corolla tube short or long; lobes 4–9. Stamens 2, inserted; filaments short. Style long. Stigma simple or bilobed. Fruit capsule or berry or drupe. Seeds 1 or 2. Family consists of species with economic and horticultural importance.

According to POWO, 2022, there are 29 accepted genera worldwide.

Key to genera

- 1a. Calyx tubular..... 2
- 1b. Calyx not tubular..... 3
- 2a. Stem terete..... 4
- 2b. Stem quadrangular *Myxopyrum*
- 3a. Corolla tubular *Olea*
- 3b. Corolla not tubular *Chionanthus*
- 4a. Stigma bilobed; fruit berry *Jasminum*
- 4b. Stigma subclavate; fruit drupe *Ligustrum*

Chionanthus D.Royen

Sp. Pl. 1: 8.1753.

Key to species

- 1a. Branchlets & calyx lobes glabrous..... *C. ramiflorus*
- 1b. Branchlets & calyx lobes pubescent 2
- 2a. Filaments absent; stigma bifid *C. mala-elengi*
- 2b. Filaments present; stigma not lobed *C. zeylanicus*

Chionanthus zeylanicus L., Sp. Pl.: 8.1753; Hook.f., Fl. Brit. India 3: 608. 1882; Gamble, Fl. Madras 2: 794. 1921; Sasidh., Fl. Periyar Tiger Reserve 237. 1998.

Tree. Stem terete, smooth; branchlets brown, sparsely pubescent. Leaves simple, opposite, obovate, $3-5 \times 1-2$ cm, apex obtuse, base cuneate, margins entire, recurved, green, glabrous, petiolate. Flowers in axillary panicle. Peduncle terete, $1-3 \times 0.1$ cm, brown, glabrous. Pedicel terete, $1-2 \times 1$ mm, brown, glabrous. Bracts cauducous, green, glabrous. Calyx tube absent; lobes 5, minute, triangular, 1×1 mm, apex slightly acute, green, glabrous. Corolla tube absent; lobes 5, linear, 3×1 mm, cream, glabrous. Stamens 2, inserted; filaments short, c. 1 mm long, cream, glabrous; anthers bilobed, lanceolate-oblong, 1×1 mm, cream, glabrous. Style short, >1 mm long, cream, glabrous. Stigma with blunt end, minute, cream, glabrous. Drupe obovoid, 5–6 mm long, green, glabrous.

Distribution: India & Sri Lanka (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: January-September

Specimens examined: India, Kerala, Idukki, Shenbagavalli, 23/02/1982, C. N. Mohanan 73476 (MH); Periyar Tiger Reserve, 15/04/1994, Jomy Augustine 13663 (CALI).

Chionanthus ramiflorus Roxb., Fl. Ind. 1: 106 (1820); Hook.f., Fl. Brit. India 3: 610. 1882; Gamble, Fl. Madras 2: 795. 1921; Sasidh., Fl. Periyar Tiger Reserve 236. 1998; Sasidh., Fl. Chinnar WLS 184. 1999.

Tree. Stem terete, smooth; branchlets brown, glabrous. Leaves simple, opposite, ovate-elliptic, $5-10 \times 2-4$ cm, apex cuspidate, base obtuse-cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal panicle. Peduncle terete, $2-6 \times 0.1-0.2$ cm, brown, glabrous. Pedicel terete, $2-3 \times$ c. 1 mm, brown, glabrous. Bracts small, green, glabrous. Calyx tube absent; lobes 4, 1×1 mm, apex, obtuse-round, green, glabrous. Corolla tube absent; lobes 4, elliptic, $3-4 \times 1$ mm, dull white, glabrous. Stamens 2, inserted; filaments short, > 1 mm long, white, glabrous; anthers bilobed, lanceolate-elliptic, 1×1 mm, white, glabrous. Style short, > 1 mm long, white, glabrous. Stigma minute with blunt end, white, glabrous. Drupe oblong, 1–3 cm long, black, glabrous.

Distribution: Tropical & Subtropical Asia to North Queensland (POWO, 2022)

Habitat: Evergreen & Shola forests

Flowering and fruiting: January-June

Specimens examined: India, Kerala, Idukki, Periakanal estate, 27/03/1980, K. Ramamurthy 66540 (MH); Periyar Tiger Reserve, 21/03/1997, Jomy Augustine 17762 (CALI); Chinnar, 18/04/1996, K. K. Sajeev 17298 (KFRI); Pambala dam, 08/03/2017, Divya K. Venugopal 152017 (CALI).

Chionanthus mala-elengi (Dennst.) P.S.Green, Bull. Bot. Surv. India 26: 124 (1984 publ. 1985); Hook.f., Fl. Brit. India 3: 607. 1882; Gamble, Fl. Madras 2: 794. 1921; Sasidh., Fl. Periyar Tiger Reserve 236. 1998; Sasidh., Fl. Chinnar WLS 183. 1999.

Tree. Stem terete, smooth; branchlets brownish white, thinly tomentose. Leaves simple, opposite, elliptic, 4–10 × 2–4 cm, apex cuspidate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary cyme, sessile. Peduncle terete, 1–3 × 0.1–0.2 cm, green, glabrous. Pedicel terete, minute c. 1 mm long, green, pubescent. Calyx tube absent; lobes 5, 1 × 1 mm, apex obtuse, green, pubescent. Corolla lobes 5, 3–4 × 1–1.5 mm, apex obtuse, white, glabrous. Stamens 2, inserted; filaments absent; anthers bilobed, lanceolate, 1 × 1 mm, yellow, glabrous. Style short, c. 1 mm long, white, glabrous. Stigma bifid, minute, white, glabrous. Drupe ovate-ellipsoid, 1–1.5 × 0.3–0.5 cm, pinkish brown, glabrous, ridged.

Distribution: Indian Subcontinent to Indo-China and Sumatera (POWO, 2022)

Habitat: Evergreen & semi evergreen forests

Flowering and fruiting: January-June

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 28/04/1995, Jomy Augustine 15167 (CALI); *ibid.*, 06/03/1994, Jomy Augustine 13424 (CALI); Chinnar, 16/03/1995, K. K. Sajeev 11988 (KFRI).

***Jasminum* L.**

Sp. Pl. [Linnaeus] 1: 7. 1753.

Key to species

- 1a. Plants climber..... 2
- 1b. Plants erect herbs/shrubs..... 3
- 2a. Stem glabrous..... 4
- 2b. Stem pubescent/tomentose..... 5
- 3a. Bracts subulate; calyx lobes glabrous *J. cordifolium*
- 3b. Bracts ovate; calyx lobes sparsely pubescent *J. cuspidatum*
- 4a. Bracts pubescent; corolla lobes with pinkish outer surface *J. flexile*
- 4b. Bracts glabrous; corolla lobes without pinkish outer surface . *J. calophyllum*

5a. Leaves simple.....	6
5b. Leaves compound	<i>J. brevilobum</i>
6a. Leaves glabrous.....	7
6b. Leaves pubescent	8
7a. Corolla lobes yellow	<i>J. angustifolium</i>
7b. Corolla lobes white	<i>J. trichotomum</i>
8a. Calyx lobes 5.....	9
8b. Calyx lobes 7.....	<i>J. rottlerianum</i>
9a. Leaves apex cuspidate.....	<i>J. scandens</i>
9b. Leaves apex acute	10
10a. Flowers in terminal cyme; berry ellipsoid	<i>J. arborescens</i>
11a. Flowers in terminal cyme; berry ovoid	<i>J. multiflorum</i>

Jasminum angustifolium* var. *sessiliflorum (Vahl) P.S.Green Kew Bull. 40: 227.1985; Hook.f., Fl. Brit. India 3: 597. 1882; Gamble, Fl. Madras 2: 790. 1921; Sasidh., Fl. Periyar Tiger Reserve 237. 1998.

Climber. Stem terete, green, smooth, tomentose. Leaves simple, opposite, lance-ovate, 2–5 × 1–2 cm, apex acute, base round, margins entire, green, glabrous. Flowers in axillary cyme. Peduncle terete, 1 × 0.2 cm, green, tomentose. Pedicel terete, 1 × 0.2 cm, green, glabrous. Bracts absent. Calyx tubular, 2 × 2 mm, green, glabrous; lobes 6, linear, 5–6 × c. 1 mm, green, glabrous. Corolla tubular, 10 × 2 mm, yellowish green, glabrous; lobes 8, 8–10 × 3–4 mm, obtuse, yellow, glabrous. Stamens 2, inserted; filaments short, 1 mm long, white, glabrous; anthers bilobed, oblong, 1–2 mm long, yellow, glabrous. Style filiform, 3–5 mm long, pale green, glabrous. Stigma bifid, 1–2 mm long, pale green, glabrous. Berry ovoid, 1 × 0.5–1 cm, black, glabrous.

Distribution: India, Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: August–November

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 02/05/1994, Divya K. Venugopal 13770 (CALI).

Jasminum multiflorum (Burm.f.), Bot. Repos. 8: t. 496.1807; Hook.f., Fl. Brit. India 3: 597. 1882; Gamble, Fl. Madras 2: 790. 1921; Sasidh., Fl. Periyar Tiger Reserve 239. 1998.

Climber. Stem terete, green, pubescent. Leaves simple, opposite, widely ovate, 5–6 × 3–4 cm, apex acute, base round, margins entire, green, pubescent, petiolate. Flowers

in axillary cyme; dense. Peduncle terete, $2-3 \times 1$ mm, green, pubescent. Pedicel terete, 1×1 mm, green, pubescent. Bracts leafy, $1-1.2 \times 0.3-0.4$ cm, green, pubescent. Calyx tubular, 2×1 mm, green, pubescent; lobes 5, linear, 5×1 mm, green, villous. Corolla tubular, $2-2.5 \times 0.2$ cm, white, glabrous; lobes 6-8, ovate, 6×2 mm, white, glabrous. Stamens 2, inserted; filaments short, 1 mm long, white, glabrous; anthers bilobed, oblong, 4×1 mm, yellow, glabrous. Style filiform, 1 cm $\times$ > 0.1 cm, pale green, glabrous. Stigma bilobed, 1×1 mm, pale green, glabrous. Berry ovoid, c. 1 cm long, purple, glabrous.

Distribution: Indian Subcontinent to Indo-China (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January-April

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 02/05/1994, Jomy Augustine 13715 (CALI); Periyar Tiger Reserve, 06/05/1995, Jomy Augustine 15292 (CALI); Painavu, 04/04/2018, Divya K. Venugopal 158465 (CALI).

Jasminum cordifolium Hook.f., Fl. Brit. India 4: 596. 1882; Gamble, Fl. Madras 2: 790. 1921; Sasidh., Fl. Periyar Tiger Reserve 238. 1998.

Erect herb. Stem terete, green, glabrous. Leaves simple, opposite, widely ovate, $5-6 \times 4-5$ cm, apex acuminate, base round, margins entire, green, veins pink coloured, glabrous, petiolate. Flowers in axillary and terminal cyme. Peduncle terete, $3-4 \times 0.1-0.2$ cm, green, glabrous. Pedicel terete, $7-8 \times 1-2$ mm, green, glabrous. Bracts subulate, green, glabrous. Calyx tubular, 2×1 mm, green, glabrous; lobes 5, linear, $4 \times$ c. 1 mm, green, glabrous. Corolla tubular, 8-10 mm long, white, glabrous; lobes 5, oblong, 6×3 mm, white, glabrous. Stamens 2, inserted; filaments short, 1 mm long, white, glabrous; anthers bilobed, oblong, 3×1 mm, yellow, glabrous. Style filiform, c. 1 cm long, pale green, glabrous. Stigma bilobed, 1×1 mm, pale green, glabrous. Berry globose-ovoid, 1×1 cm, green, glabrous.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January-June

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 16/07/1993, Jomy Augustine 12096 (CALI).

Jasminum rottlerianum Wall. ex DC., Prodr. [A. P. de Candolle] 8: 305 (1844); Hook.f., Fl. Brit. India 3: 593. 1882; Gamble, Fl. Madras 2: 789. 1921.

Climber. Stem terete, green, pubescent. Leaves simple, opposite, elliptic, 8–9 × 3–4 cm, apex cuspidate, base round, margins entire, green, pubescent, petiolate. Flowers in axillary cyme. Peduncle terete, 3–5 × 0.1–0.2 cm, green, pubescent. Pedicel absent. Bracts lanceolate, 1–1.5 × 0.3–0.5 cm, greenish white, pubescent. Calyx tubular, 5 × 2 mm, green, pubescent; lobes 7, linear, 3 × 1 mm, green, pubescent. Corolla tubular, 6–8 mm long, white, glabrous; lobes 7, oblong, 5 × 2 mm, white, glabrous. Stamens 2, inserted; filaments terete, short, 1 mm long, white, glabrous; anthers bilobed, oblong, 2 × 1 mm, yellow, glabrous. Style filiform, c. 1 cm long, pale green, glabrous. Stigma bilobed, 1 × 1 mm, pale green, glabrous. Berry sub globose, c. 1 cm long, purple, glabrous.

Distribution: India to South Central China and Indo-China (POWO, 2022)

Habitat: Evergreen & Shola forests

Flowering and fruiting: January-June

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 22/03/1997, Jomy Augustine 17794 (CALI).

Jasminum flexile Vahl, Symb. Bot. 3: 1 (1794); Hook.f., Fl. Brit. India 4: 601. 1882; Gamble, Fl. Madras 2: 791. 1921; Sasidh., Fl. Periyar Tiger Reserve 238. 1998. *Jasminum azoricum* L., Sp. Pl.: 7.1753; Sasidh., Fl. Chinnar WLS 185. 1999.

Figure 18 H.

Climber. Stem terete, smooth, glabrous. Leaves trifoliate, opposite, widely ovate-lanceolate, 3–5 × 3–4 cm, apex acute-acuminate, base round, margins entire, green, glabrous, petiolate. Flowers in axillary cyme, lax. Peduncle terete, 3.5–7 × 0.1–0.2 cm, green, glabrous. Pedicel terete, 3–5 × 1–1.5 mm, green, glabrous. Bracts linear, minute, 1–2 × 1 mm, green, pubescent. Calyx tubular, 2–5 × 1–3 mm, green, glabrous; lobes 5, minute, 2 × 1 mm, green, glabrous. Corolla tubular, 1–3 × 0.1–0.2 cm, white, glabrous; lobes 5–6, elliptic, 7 mm–1.5 × 0.3–0.4 cm, white with pinkish outer surface, glabrous. Stamens 2, inserted; filaments short, 3 × 1 mm, white, glabrous; anthers bilobed, oblong, 5–6 × 2 mm, yellow, glabrous. Style filiform, 6–8 × >1 mm, pale green, glabrous. Stigma bilobed, c. 1 mm long, pale green, glabrous. Berry obovoid, 8 mm long, black, glabrous.

Distribution: Indian Subcontinent to China (POWO, 2022)

Habitat: Evergreen & semi evergreen forests

Flowering and fruiting: September-December

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 16/01/1994, *Jomy Augustine 13135* (CALI); Idukki to Kattappana route, 08/11/1981, *B. Ramanujam 72421* (MH); Wayside near Valara waterfalls, 27/12/2017, *Divya K. Venugopal 156393* (CALI); Karimutty waterfalls, 29/12/2017, *Divya K. Venugopal 156394* (CALI).

Jasminum cuspidatum Rottler, Neue Schriften Ges. Naturf. Freunde Berlin 4: 192.1803; Sasidh., Fl. Periyar Tiger Reserve 238. 1998; Sasidh., Fl. Chinnar WLS 185. 1999. *Jasminum rigidum* Zenker, Pl. Ind.: 5 (1835); Hook.f., Fl. Brit. India 3: 598. 1882; Gamble, Fl. Madras 2: 790. 1921.

Erect shrub. Stem terete, green, glabrous. Leaves simple, opposite, ovate, 7–8 × 5–6 cm, apex acute, base round, margins entire, green, glabrous. Flowers in axillary cyme. Peduncle terete, 5–6 mm long, green, glabrous. Pedicel terete, 2–3 mm long, green, glabrous. Bracts ovate, 1–2 mm long, green, glabrous. Calyx tubular, 2–3 mm long, green, glabrous; lobes 5, narrow, linear, 5–6 mm long, green, sparsely pubescent. Corolla tubular, 2–3 cm long, white, glabrous; lobes 7, lanceolate, 1.5–1.8 cm long, apex acute, white, glabrous. Stamens 2, inserted; filaments short, c. 2 mm long, white, glabrous; anthers bilobed, oblong, 2–3 mm long, yellow, glabrous. Style filiform, 5–7 × 1 mm, pale green, glabrous. Stigma bilobed, >1 mm long, pale green, glabrous. Berry ovoid, 5–6 mm long, green, glabrous.

Distribution: South India to Myanmar (POWO, 2022)

Habitat: Evergreen & Shola forests

Flowering and fruiting: January-March

Specimen examined: India, Kerala, Idukki, Erattayar, 22/01/2018, *Divya K. Venugopal 159207* (CALI).

Jasminum trichotomum B.Heyne ex Roth, Nov. Pl. Sp.: 6.1821; Hook.f., Fl. Brit. India 3: 599. 1882; Gamble, Fl. Madras 2: 790. 1921; Sasidh., Fl. Chinnar WLS 185. 1999.

Climber. Stem terete, green, slightly tomentose. Leaves simple, opposite, ovate, 3–10 × 1–3 cm, apex acute, base round, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal cyme. Peduncle terete, 2–10 × 0.1–0.3 cm, green, glabrous. Pedicel terete, 5–7 × c. 1 mm, green, glabrous. Bracts minute, green, glabrous. Calyx tubular, 1–2 × 1 mm, green, glabrous; lobes 5, minute, > 1 mm long, green, glabrous. Corolla tubular, 6–8 × 2–3 mm, white, glabrous; lobes 5, narrow, linear, 0.8 –1 × 0.1

cm, white, glabrous. Stamens 2, inserted; filaments short, c. 2 mm long, white, glabrous; anthers bilobed, oblong, 3–4 mm long, yellow, glabrous. Style filiform, 6–8 × 1 mm, pale green, glabrous. Stigma bilobed, >1 mm long, pale green, glabrous. Berry not seen.

Distribution: South India (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: April–July

Specimens examined: India, Kerala, Idukki, Chinnar, 19/05/1999, *Shamina M. 78990* (CALI); Mankulam, 05/12/2018, *Divya K. Venugopal 176331* (CALI).

Jasminum arborescens Roxb., Fl. Ind. 1: 94.1820; Hook. f., Fl. Brit. India 3: 594. 1882; Gamble, Fl. Madras 2: 789.1921.

Climber. Stem terete, green, pubescent. Leaves simple, opposite, ovate, 5–9 × 2.5–4.5 cm, apex acute, base obtuse-round, margins entire, green, pubescent, petiolate. Flowers in terminal cyme. Peduncle terete, 0.7–2 × 0.1–0.2 cm, green, tomentose. Pedicel terete, 1 × 1 mm, green, tomentose. Bracts leafy, 0.8–1 × 0.1–0.2 cm, green, tomentose. Calyx tubular, 2–3 × 1 mm, green, pubescent; lobes 5, linear, 4 × 1 mm, green, tomentose. Corolla tubular, c. 0.8–1 cm long, white, glabrous; lobes 9, narrow, linear, 3–4 mm long, apex acute, white, glabrous. Stamens 2, inserted; filaments short, c. 3 mm long, white, glabrous; anthers bilobed, oblong, 2–4 mm long, yellow, glabrous. Style filiform, 6–8 × 1 mm, pale green, glabrous. Stigma bilobed, >1 mm long, pale green, glabrous. Berry ellipsoid, 1–2 cm long, black, glabrous.

Distribution: Andaman Island, Cambodia, East Himalaya, India, Myanmar, Nepal, Nicobar Island, West Himalaya (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: April–June

Specimen examined: India, Kerala, Idukki, Painavu, 04/04/2018, *Divya K. Venugopal 176332* (CALI).

Jasminum brevilobum DC., Prodr. 8: 307. 1844; Hook. f., Fl. Brit. India 3: 600. 1882; Gamble, Fl. Madras 2: 791.1921.

Climber. Stem terete, green, tomentose. Leaves trifoliate, opposite, ovate, 1.5–4 × 0.5–1 cm, apex acute, base obtuse, margins entire, green, tomentose, petiolate. Flowers in axillary and terminal cyme. Peduncle terete, 0.7–2 × 0.1–0.2 cm, green, tomentose. Pedicel terete, 1 × 1 mm, green, tomentose. Bracts leafy, 1 × 0.2 cm, apex acuminate, green, tomentose. Calyx tubular, 3 × 1 mm, green, tomentose; lobes 5,

ovate, 3×1 mm, green, tomentose. Corolla tubular, $3-4 \times 0.2-0.3$ cm, white, glabrous; lobes 5, ovate, $1 \times 0.1-0.2$ cm, white, glabrous. Stamens 2, inserted; filaments short, c. 2 mm long, white, glabrous; anthers bilobed, oblong, 2–3 mm long, yellow, glabrous. Style filiform, 5×1 mm, pale green, glabrous. Stigma bilobed, >1 mm long, pale green, glabrous. Berry globose, 1 cm long, black, glabrous.

Distribution: India, Vietnam (POWO, 2022)

Habitat: Shola margin forests

Flowering and fruiting: October-January

Specimen examined: India, Kerala, Idukki, Mankulam, 15/10/2019, Divya K. Venugopal 176325 (CALI).

Jasminum calophyllum Wall. ex G.Don, Gen. Hist. 4: 63.1837; Hook. f., Fl. Brit. India 3: 602. 1882; Gamble, Fl. Madras 2:791.1921; Sasidh., Fl. Periyar Tiger Reserve 238. 1998.

Climber. Stem terete, green, glabrous. Leaves trifoliate, opposite, widely ovate, $2.5-4 \times 3-3.5$ cm, apex acute, base obtuse, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal cyme. Peduncle terete, $3-4 \times 0.1-0.2$ cm, green, glabrous. Pedicel terete, $1-2 \times 1$ mm, green, glabrous. Bracts linear, 1×1 mm, green, glabrous. Calyx tubular, $2-3 \times 1$ mm, green, glabrous; lobes 5, minutely lobed, green, glabrous. Corolla tubular, $1.5-2 \times 0.1-0.2$ cm, white, glabrous; lobes 5, $4-6 \times 1-2$ mm, apex obtuse, white, glabrous. Stamens 2, inserted; filaments short, c. 2 mm long, white, glabrous; anthers bilobed, oblong, 2–4 mm long, yellow, glabrous. Style filiform, 6×1 mm, pale green, glabrous. Stigma bilobed, >1 mm long, pale green, glabrous. Berry not seen.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January-December

Specimen examined: India, Kerala, Idukki, on the way to Chinnar, 09/02/2021, Divya K. Venugopal 175942 (CALI).

Jasminum scandens (Retz.) Vahl, Symb. Bot. 3: 2.1794; Gamble, Fl. Madras 2:786.1921.

Climber. Stem terete, green, pubescent. Leaves simple, opposite, ovate, $4-7.5 \times 2-4$ cm, apex cuspidate, base obtuse, margins entire, green, pubescent, petiolate. Flowers in axillary and terminal cyme, dense. Peduncle terete, $1-5 \times 0.1-0.2$ cm, green, pubescent. Pedicel terete, 1×1 mm, green, pubescent. Bracts leafy, $1-1.5 \times 0.3-0.5$

cm, green, pubescent. Calyx tubular, 2–3 × 2 mm, green, pubescent; lobes 5, linear, curved, 4–5 × 1 mm, green, pubescent. Corolla tubular, 1.5–2 × 0.1–0.2 cm, white, glabrous; lobes 5, oblong, 5–7 × 2–3 mm, apex acute-obtuse, white, glabrous. Stamens 2, inserted; filaments short, c. 3 mm long, white, glabrous; anthers bilobed, oblong, 2–3 mm long, yellow, glabrous. Style filiform, 5 × 1 mm, pale green, glabrous. Stigma bilobed, >1 mm long, pale green, glabrous. Berry not seen.

Distribution: Assam, Bangladesh, Cambodia, East Himalaya, India, Myanmar, Thailand (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: January-June

Specimen examined: India, Kerala, Idukki, Anayirangal dam, 05/01/2017, Divya K. Venugopal 151539 (CALI).

***Ligustrum* L.**

Sp. Pl. 1: 7.1753.

Key to species

1a. Leaves ovate; calyx tube absent; drupe ellipsoid *L. robustum* subsp. *perrottetii*

1b. Leaves elliptic; calyx tube present; drupe obovoid *L. robustum* subsp. *walkerii*

Ligustrum robustum* subsp. *perrottetii (A.DC.) de Juana, *Bouteloua* 24: 152.2016; Hook.f., *Fl. Brit. India* 3: 615. 1882; Gamble, *Fl. Madras* 2: 798 1921; Sasidh., *Fl. Periyar Tiger Reserve* 239. 1998; Sasidh., *Fl. Chinnar WLS* 186. 1999.

Large shrub. Stem terete, brown, smooth. Leaves simple, opposite, ovate, 3–5 × 1–2 cm, apex acute, base obtuse, margins entire, green, glabrous, petiolate. Flowers in axillary panicle, dense. Peduncle terete, 2–3 × 0.1–0.2 cm, green glabrous. Pedicel terete, 1 × 1 mm, green, glabrous. Bracts narrow, 1 × 1 mm, apex acute, green, glabrous. Calyx tube absent; lobes 5, minute, c. 1 mm long, green, glabrous. Corolla tubular, 4–5 × 1 mm, white, glabrous; lobes 5, 1 × 1 mm, apex slightly acute, white, glabrous. Stamens 2, exserted; filaments short, c. 2 mm long, white, glabrous; anthers bilobed, oblong, yellowish brown, glabrous. Style slender, white, glabrous. Stigma subclavate, minute, white, glabrous. Drupe ellipsoid, 5–6 mm long, green, glabrous.

Distribution: Laccadive Islands, South India, Andaman Islands (POWO, 2022)

Habitat: Evergreen & semi evergreen forests

Flowering and fruiting: January-July

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 06/06/1995, *Jomy Augustine 15403* (CALI); *ibid.*, 24/07/1993, *Jomy Augustine 12106* (KFRI); Vaguvarai, 27/06/2018, *Divya K. Venugopal 154377* (CALI).

Ligustrum robustum* subsp. *walkeri (Decne.) P.S.Green, Hook.f., Fl. Brit. India 3: 615. 1882; Gamble, Fl. Madras 2: 797. 1921; Sasidh., Fl. Periyar Tiger Reserve 239. 1998.

Tree. Stem terete, brown, glabrous. Leaves simple, opposite, elliptic, 3–6 × 1–2 cm, apex acute-cuspidate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal raceme. Peduncle terete, 2–3 × 0.1–0.2 cm, green, glabrous. Pedicel terete, 3–5 × 1–2 mm, green, glabrous. Bracts leafy, 1 mm long, apex acute, green, glabrous. Calyx tube 1 × 2 mm, green, glabrous; lobes 4, minute, 1 × 1 mm, apex acute, green, glabrous. Corolla tube minute, white, glabrous; lobes 4, 5 × 2 mm, apex obtuse, white, glabrous. Stamens 2, inserted; filaments short, c. 1 mm long, white, glabrous; anthers bilobed, oblong, yellowish brown, glabrous. Style slender, c. 1 mm long, white, glabrous. Stigma subclavate, minute, white, glabrous. Drupe obovoid, 0.5 – 1 × 0.2 – 0.5 cm, green, glabrous.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: Evergreen & semi evergreen forests

Flowering and fruiting: March-June

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 07/07/1993, *Jomy Augustine 12030* (CALI); *ibid.*, 19/08/1993, *Jomy Augustine 12297* (KFRI); Way between Kulamavu and Idukki, 23/09/1981, *C. N. Mohanan 71901* (MH); Devikulam, 07/02/2017, *Divya K. Venugopal 151656* (CALI); Peerumedu 27/04/2018, *Divya K. Venugopal 159209* (CALI); Mankulam, 16/09/2018, *Divya K. Venugopal 161939* (CALI).

***Myxopyrum* Blume**

Bijdr. Fl. Ned. Ind. 13: 683.1826.

Myxopyrum smilacifolium (Wall.) Blume, Mus. Bot. 1: 320.1851; Hook.f., Fl. Brit. India 4: 380. 1885; Gamble, Fl. Madras 2: 996. 1921; Sasidh., Fl. Periyar Tiger Reserve 239. 1998.

Climber. Stem terete, green, glabrous. Leaves simple, opposite, elliptic, 11–14 × 4–5 cm, apex acute, base obtuse, margins serrate, green, glabrous. Flowers in axillary panicle, sessile. Peduncle terete, 1–2 × 0.1–0.2 cm, green, glabrous. Calyx tube absent; lobes 4, 1 × 1 mm, deeply divided, green, glabrous. Corolla tube absent; lobes

4, oblanceolate, minute, dull white-yellow, glabrous. Stamens 2, inserted; filaments short, white, glabrous; anthers bilobed, ovate, c. 1 mm long, yellow, glabrous. Style minute, c. 1 mm long, white, glabrous. Stigma bilobed, white, glabrous. Berry sub globose, 1–2 × 1–2 cm, black, glabrous-pubescent.

Distribution: Nepal to South China and Indo-China. (POWO, 2022)

Habitat: Evergreen & Semi evergreen forests

Flowering and fruiting: January-September

Specimens examined: India, Kerala, Idukki, Meenmutty, 19/02/1983, C. N. Mohanan 76241 (MH); Periyar Tiger Reserve, 16/03/1994, Jomy Augustine 13468 (CALI); *ibid.*, 12/08/1993, Jomy Augustine 12242 (KFRI); Way to Panamkutty, 10/03/2017, Divya K. Venugopal 152058 (CALI).

***Olea* L.**

Sp. Pl. 1: 8.1753.

Key to species

- 1a. Flowers in axillary panicle; filaments absent; drupe blue.....*O. dioica*
- 1b. Flowers in terminal panicle; filaments present; drupe black2
- 2a. Leaves elliptic; corolla tube absent..... *O. paniculata*
- 2b. Leaves ovate-lance ovate; corolla tube present*O. polygama*

Olea dioica Roxb., Fl. Ind. 1: 105.1820; Hook.f., Fl. Brit. India 3: 612. 1882; Gamble, Fl. Madras 2: 796. 1921; Sasidh., Fl. Periyar Tiger Reserve 240. 1998; Sasidh., Fl. Chinnar WLS 186. 1999.

Tree. Stem terete; branchlets reddish, warty. Leaves simple, opposite, ovate-oblong, 4–10 × 3–5 cm, apex acute, base round, margins slightly serrate, green, glabrous, petiolate. Flowers in axillary panicle. Peduncle terete, 2–4 × 2–3 mm, green, glabrous. Pedicel terete, 1–2 × 1–1.5 mm, green, glabrous. Calyx tube absent; lobes 4, campanulate, 1 × 1 mm, apex obtuse, minutely lobed, green, tomentose. Corolla tubular, c. 2 mm long, white, pubescent; lobes 4, c. 1 mm long, apex obtuse, white, pubescent. Stamens 2, inserted; filaments absent; anthers bilobed, oblong, 1 × 1 mm, yellow, glabrous. Style short, 1 × 1 mm, pale green, glabrous. Stigma capitate, 1 mm long, pale green, glabrous. Drupe ellipsoid-obovate, 3–5 × 4–5 mm, blue, glabrous.

Distribution: India to Myanmar (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: December-May

Specimens examined: India, Kerala, Idukki, Chinnar, 16/11/1995, K. K. Sajeev 15894 (KFRI); Kulamavu, 15/12/1982, C. N. Mohanan 76076 (MH); Vallakadavu, 11/03/1973, B. D. Sharma 43821 (MH); Mathikettan shola National Park, 22/11/2014, Divya K. Venugopal 137834 (CALI); Way to Anamudi base camp, 10/12/2019, Divya K. Venugopal 170039 (CALI).

Olea paniculata R. Br., Prodr. Fl. Nov. Holland.: 528.1810. *Olea glandulifera* Wall. ex G. Don, Gen. Hist. 4: 49.1837; Hook.f., Fl. Brit. India 3: 612. 1882; Gamble, Fl. Madras 2: 796. 1921; Sasidh., Fl. Periyar Tiger Reserve 240. 1998.

Tree. Stem terete, smooth, brown, glabrous. Leaves simple, opposite, elliptic, 8–10 × 2–3 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal panicle. Peduncle terete, 4–7 × 0.1–0.2 cm, green, tomentose. Pedicel terete, 1 × 1 mm, green, tomentose. Calyx tubular, 1–2 × 1 mm, green, glabrous; lobes 4, minute, apex slightly acute, green, gland dotted. Corolla tube absent; lobes 4, deeply divided, 3–4 × 1–2 mm, apex obtuse, cream, glabrous. Stamens 2, inserted; filaments short, 2 × 1 mm, white, glabrous; anthers bilobed, oblong, 2 × 1 mm, yellow, glabrous. Style short, 2 × 1 mm, pale green, glabrous. Stigma capitate, 1 mm long, pale green, glabrous. Drupe ovoid, 2–3 × 2 mm, black, glabrous.

Distribution: Indian Subcontinent to China and South West Pacific (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: May–August

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 17/02/1997, Divya K. Venugopal 17936 (CALI); Way to Anamudi peak, 26/04/2019, Divya K. Venugopal 159130 (CALI).

Olea polygama Wight, Icon. Pl. Ind. Orient. 4: t. 1239.1848; Hook.f., Fl. Brit. India 3: 613. 1882; Gamble, Fl. Madras 2: 796. 1921.

Tree. Stem terete, smooth, brown, glabrous. Leaves simple, opposite, ovate-lance ovate, 4–6 × 1.5–2 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Flowers in terminal panicle. Peduncle terete, 6–12 × 0.1 cm, green, tomentose. Pedicel terete, 2 × 1 mm, green, tomentose. Calyx tubular, 1 × 1 mm, green, glabrous; lobes 4, minute, green, glabrous. Corolla tubular, 1 × 1 mm, whitish cream, glabrous; lobes 4, deeply divided, 2 × 1 mm, apex slightly acute, whitish cream, glabrous. Stamens 2, inserted; filaments short, 2 × 1 mm, white, glabrous; anthers bilobed, oblong, 1 × 1 mm, yellow, glabrous. Style short, 1 × 1 mm, pale

green, glabrous. Stigma capitate, minute, pale green, glabrous. Drupe ovoid, black, glabrous.

Distribution: India, Sri Lanka (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: July-October

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 14/05/1994, Jomy Augustine 13722 (KFRI); *ibid.*, 15/07/2017, Divya K. Venugopal 152876 (CALI).

SALVADORACEAE Lindl.

Nat. Syst. Bot. 2: 269.1836, *nom. cons.*

Trees or shrubs, glabrous, unarmed or spinous. Leaves opposite, entire, exstipulate. Flowers minute, bisexual or unisexual, regular, usually in racemes. Calyx free, campanulate or ovoid, 3-5 lobed. Corolla shortly campanulate or the petals free, 4 lobed. Stamens 4, on the corolla tube or hypogynous, anthers ovate. Style short, stigma bifid or sub entire. Fruit berry or drupe, usually 1 seeded, indehiscent (Delta Intkey, 2023). Seeds erect, globose. Usually members are shrubs or small trees adapted to arid conditions.

According to POWO, 2022; family consists of 3 accepted genera of which the genus *Azima* consists of 3 accepted species.

Azima Lam.

Encycl. 1: 343. 1783.

Azima tetracantha Lam., Encycl. 1: 343. 1783; Hook.f., Fl. Brit. India 3: 620. 1882; Gamble, Fl. Madras 2: 800. 1921; Sasidh., Fl. Chinnar WLS 186. 1999.

Annual shrub, up to 30 cm high. Stem quadrangular, green, pubescent with axillary spines. Leaves simple, opposite, ovate, 2–3 × 1–2 cm, apex acute, base obtuse, margins entire, coriaceous, green, glabrous. Petiole quadrangular, 4–5 × 2–3 mm, green, glabrous. Flowers in axillary racemes, dense, sessile. Peduncle quadrangular, 3–4 × 1 cm, green, glabrous. Calyx tube 1 × 1 mm, green, pubescent; lobes 4, ovate, 1–1.2 × 1 mm, apex acute, green, pubescent. Corolla tube 2 × 2 mm, cream, glabrous; lobes 4, oblong, 2 × 1 mm, apex obtuse, cream, glabrous. Stamens 4; filaments slender, 1 × 1 mm, free, white, glabrous; anthers bilobed, 1 × 1 mm, white, glabrous. Style 2, 3 × 1 mm, white, glabrous. Stigma globose, c. 1 × 1 mm, white, glabrous.

Berry ovoid, 4 × 3 mm, white, glabrous. Seed 1, globose, 2 × 1 mm, hyaline, glabrous.

Distribution: Tropical & South Africa, West Indian Ocean, Indian sub continent to Myanmar (POWO, 2022)

Habitat: Dry deciduous forests and in homesteads

Flowering and fruiting: August-September

Specimens examined: India, Kerala, Idukki, Chinnar, 08/09/2018, Divya K. Venugopal 154388 (CALI); Lower camp to Kumily, 26/12/1974, K. Vivekananthan 45702 (MH).

APOCYNACEAE Juss.

Gen. Pl. [Jussieu] 143. 1789. *nom. cons.*

Habits perennial; laticiferous (Delta Intkey, 2023). Leaves simple, opposite or whorled, margins entire, exstipulate, persistent. Flowers in axillary umbelliform cymes; cyclic. Unisexual flowers absent. Calyx lobes 5, partly fused. Corolla tubular, with hairs; lobes 5. Stamens 5, inserted, epipetalous; filaments short or absent; anthers 2 celled, non-versatile, fused with gynoeceium to form gynostegium. Style 2, short. Fruits of 2 follicles.

According to Delta Intkey, 2023, Apocynaceae consists of 164 genera and 1500 species.

Key to genera

- 1a. Staminal filaments absent *Aganosma*
- 1b. Staminal filaments present 2
- 2a. Plants climber 3
- 2b. Plants not climber 4
- 3a. Stem spiny *Carissa*
- 3b. Stem not spiny 5
- 4a. Leaves whorled 6
- 4b. Leaves opposite 7
- 5a. Leaves glabrous 8
- 5b. Leaves pubescent 9
- 6a. Stigma unlobed *Alstonia*
- 6b. Stigma bilobed 10
- 7a. Leaves elliptic *Wrightia*

- 7b. Leaves broadly ovate *Holarrhena*
 8a. Leaves opposite-decussate *Anodendron*
 8b. Leaves opposite-distichous 11
 9a. Calyx & corolla glabrous *Chonemorpha*
 9b. Calyx & corolla villous *Ichnocarpus*
 10a. Calyx not glandular *Rauvolfia*
 10b. Calyx glandular *Tabernaemontana*
 11a. Stem glabrous *Chilocarpus*
 11b. Stem pubescent 12
 12a. Corolla white; flowers in terminal cyme *Kametia*
 12b. Corolla greenish yellow; flowers in axillary cyme *Parsonsia*

***Aganosma* (Blume) G.Don**

Gen. Hist. 4: 77.1837.

Aganosma cymosa (Roxb.) G.Don, Gen. Hist. 4: 77.1837; Hook.f., Fl. Brit. India 3: 663. 1882; Gamble, Fl. Madras 2: 819. 1921; Sasidh., Fl. Periyar Tiger Reserve 241. 1998; Sasidh., Fl. Chinnar WLS 187. 1999.

Climbing Shrub. Stem terete, exudates latex, green, pubescent. Leaves simple, opposite, elliptic, 6–8 × 2.5–5 cm, apex acute, base round, margins entire, green, glabrous, petiolate. Flowers in terminal cymes, dense. Peduncle terete, 2–3 cm long, green, pubescent. Pedicel terete, 2–3 mm long, green, pubescent. Calyx tube absent; lobes 5, linear, divided up to base, 5–6 × 2–3 mm, glandular, green, tomentose. Corolla salver shaped, tube 5–6 mm long; lobes 5, 3–4 mm long, apex acuminate, pale yellow, pubescent. Stamens 5, inserted; filaments absent; anthers bilobed, sagittate, 2 mm long, glabrous. Style filiform, 3–4 mm long, white, glabrous. Stigma sub clavate, 1 mm long, white, glabrous. Fruits of 2 follicular mericarps, 10–15 cm long, oblong, brown, tomentose.

Distribution: Assam and India to Indo-China (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: April–October

Specimens examined: India, Kerala, Idukki, Ammachikottaram, 28/04/2018, Divya K. Venugopal 159246 (CALI); Kulamavu to Ayyappan covil, 26/05/1982, C. N. Mohanan 74032 (MH); Periyar Tiger Reserve, 25/06/1995, Jomy Augustine 15430 (CALI).

Alstonia R. Br.

Asclepiadeae: 64.1810. *nom. cons.*

Key to species

1a. Plants shrubs; flowers in axillary cymes; corolla white.....*A. venenata*

1b. Plants trees; flowers in terminal cymes; corolla greenish white.....*A. scholaris*

Alstonia venenata R. Br., Asclepiadeae: 64.1810; Hook.f., Fl. Brit. India 3: 642. 1882; Gamble, Fl. Madras 2: 810. 1921; Sasidh., Fl. Periyar Tiger Reserve 241. 1998; Sasidh., Fl. Chinnar WLS 187. 1999.

Shrub. Stem terete, exudates latex, green, glabrous. Leaves simple, whorled, lanceolate, 8–12 × 1–3 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary cymes. Peduncle terete, 1–2 cm long, green, glabrous. Pedicel terete, 3–5 mm long, green, glabrous. Calyx tube minute, green, glabrous; lobes 5, minute, apex acute, green, ciliate. Corolla tube 1 cm long, white, glabrous; lobes 5, 8–10 × 2–3 mm, apex acute, white, glabrous. Stamens 5, included; filaments slender, 5–6 mm long, white, hirsute; anthers bilobed, 1 × 1 mm, apex acute, yellow, glabrous. Style filiform, 5–7 mm long, white, glabrous. Stigma cylindric, 1 mm long, white, glabrous. Fruits of 2 slender mericarps, 5–10 cm long, green, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Semi evergreen forests and in plains

Flowering and fruiting: July–December

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 15/07/2017, Divya K. Venugopal 154122 (CALI); Kurisumala - Painavu, 06/08/2017, Divya K. Venugopal 154199 (CALI); Chinnar, 28/11/1929, Nambiar 1090 (KFRI).

Alstonia scholaris (L.) R.Br., Asclepiadeae:64.1810; Hook.f., Fl. Brit. India 3: 642. 1882; Gamble, Fl. Madras 2: 810. 1921; Sasidh., Fl. Periyar Tiger Reserve 241. 1998. Tree. Stem terete, exudates latex, brown, rough surface. Leaves simple, whorled, obovate, 4–15 × 3–6 cm, apex obtuse, base cuneate, margins entire, green, glabrous, petiolate. Flowers in terminal cymes. Peduncle terete, 3–4 cm long, green, glabrous. Pedicel terete, minute, green, glabrous. Calyx tube minute, green, glabrous; lobes 5, minute, apex obtuse, green, ciliate. Corolla tube short, greenish white, glabrous; lobes 5, 3–6 × 2–3 mm, apex obtuse, greenish white, glabrous. Stamens 5, included; filaments slender, 3–4 mm long, white, hirsute; anthers bilobed, 1 × 1 mm, apex acute, yellow, glabrous. Style filiform, minute, white, glabrous. Stigma cylindric, 1

mm long, white, glabrous. Fruits of 2 slender mericarps, 20–30 cm long, green, glabrous.

Distribution: Tropical & Subtropical Asia to North Australia (POWO, 2022)

Habitat: In plains

Flowering and fruiting: June–December

Specimen examined: India, Kerala, Idukki, Valara Reserve Forest, 24/11/1982, K. Ramamurthy 74982 (MH).

***Anodendron* A.DC**

A.P.de Candolle, Prodr. 8: 443.1844.

Anodendron parviflorum (Roxb.) I.M.Turner, Webbia 71: 227.2016. *Anodendron paniculatum* A.DC., A.P.de Candolle, Prodr. 8:444, 480.1844; Hook.f., Fl. Brit. India 3: 668. 1882; Gamble, Fl. Madras 2: 820. 1921. *Anodendron manubriatum* (Wall. ex Steud.) Merr., Philipp. J. Sci., C 7: 333.1912; Sasidh., Fl. Periyar Tiger Reserve 242. 1998; Sasidh., Fl. Chinnar WLS 187. 1999.

Climber. Stem terete, exudates latex, brown, glabrous. Leaves simple, opposite-decussate, oblong, 10–15 × 4–6 cm, apex acute, base round, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal cymes. Peduncle terete, 2–3 cm long, green, glabrous. Pedicel terete, 2–3 mm long, green, glabrous. Calyx tube 1 mm long, green; lobes 5, minute, 1 mm long, apex acute-obtuse, green, glandular. Corolla tube 1–2 mm long, pale yellow, glabrous; lobes 5, 3–4 mm long, apex obtuse, pale yellow, pubescent. Stamens 5, included; filaments minute, white, glabrous; anthers bilobed, sagittate, 1 × 1 mm, yellow, glabrous. Style minute, white, glabrous. Stigma conical, minute, white, glabrous. Fruits of 2 slender mericarps, 10–15 cm long, green, glabrous.

Distribution: Tropical Asia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: February–November

Specimen examined: India, Kerala, Idukki, Meenmutty Dam Area, 25/02/1983, C. N. Mohanan 77978 (MH).

***Carissa* L.**

Mant. Pl. 1: 7.1767. *nom. cons.*

Carissa spinarum L., Mant. Pl. 2: 559.1771; Hook.f., Fl. Brit. India 3: 631. 1882; Gamble, Fl. Madras 2: 805. 1921. *Carissa inermis* Vahl, Symb. Bot. 3: 43.1794.

Climber. Stem terete, green, spiny, branched. Leaves simple, opposite, ovate, 4–6 × 2–4 cm, apex acuminate, base obtuse, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal cymes. Peduncle terete, 0.5–1 cm long, green, glabrous. Pedicel terete, 3–4 mm long, green, glabrous. Calyx tube 2 mm long, green, glabrous; lobes 5, linear, 2 mm long, apex acute, reddish, glabrous. Corolla tube 2 cm long, white, glabrous; lobes 5, oblong, 5–7 mm long, apex acute, white, glabrous. Stamens 5, inserted; filaments slender, 2 × 1 mm, white, glabrous; anthers bilobed, lanceolate, 2 × 1 mm, yellow, glabrous. Style filiform, 0.9–1 cm long, white, glabrous. Stigma minutely bilobed, 1–2 mm long, white, pubescent. Berry globose, 9–10 cm long, green, glabrous.

Distribution: Africa to Indo-China, Australia to New Caledonia (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: April–September

Specimens examined: India, Kerala, Idukki, Kulamavu to Ayyappan covil, 26/05/1982, C. N. Mohanan 74205 (MH); Periyar Tiger Reserve, 16/05/1995, Jomy Augustine 15048 (CALI).

***Chilocarpus* Blume**

Catalogus: 22. 1823.

Chilocarpus denudatus Blume, Bijdr. Fl. Ned. Ind.:1025.1826; Sasidh., Fl. Periyar Tiger Reserve 242. 1998. *Chilocarpus atroviridis* (G.Don) Blume, Mus. Bot.1:153.1850; Hook.f., Fl. Brit. India 3: 626. 1882; Gamble, Fl. Madras 2: 802. 1921.

Climber. Stem terete, green, glabrous. Leaves simple, opposite, ovate-elliptic, apex caudate, base cuneate, 9–12 × 3–4 cm, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal cymes. Peduncle terete, 1–2 cm long, greenish yellow, glabrous. Pedicel terete, 1–2 mm long, greenish yellow, glabrous. Calyx tube minute, green, glabrous; lobes 5, 1 × 1 mm, apex acute, green, glabrous. Corolla tube 2 mm long, white, glabrous; lobes 5, 1 × 1 mm, apex obtuse, white, glabrous. Stamens 5, inserted; filaments short, > 1 mm long, white, glabrous; anthers bilobed, elliptic, 1 × 1 mm, yellow, glabrous. Style filiform, 1 mm long, white, glabrous. Stigma sub clavate, minute, white, glabrous. Fruits of 2 follicular mericarps, 5–6 cm long, green, glabrous.

Distribution: South West India to New Guinea (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February-October.

Specimens examined: India, Kerala, Idukki, Erattayar, 23/03/2017, Divya K. Venugopal 176012 (CALI); Puliya, 28/03/1980, C. E. Ridsale 757 (CALI); Periyar Tiger Reserve, 28/02/1997, Jomy Augustine 17730 (CALI).

***Chonemorpha* G.Don**

Gen. Hist. 4: 76.1837.

Chonemorpha fragrans (Moon) Alston, Ann. Roy. Bot. Gard. (Peradeniya) 11: 203.1929. *Chonemorpha macrophylla* G.Don, Gen. Hist. 4: 76.1837; Hook.f., Fl. Brit. India 3: 661. 1882; Gamble, Fl. Madras 2: 818. 1921. *Chonemorpha grandiflora* G.Don, Gen. Hist. 4: 76.1837; Sasidh., Fl. Periyar Tiger Reserve 242. 1998.

Climber. Stem terete, green, hispid. Leaves simple, opposite, elliptic, apex caudate, base round, 15–20 × 10–12 cm, margins entire, green, pubescent, petiolate. Flowers in terminal cymes. Peduncle terete, 7–10 × 0.3–0.5 cm, green, tomentose. Pedicel terete, 1 × 0.2 cm, green, tomentose. Calyx tube 0.9–1 × 0.4–0.5 cm, apex acute, green with purple tinge, glabrous; lobes 5, 5 × 3 mm, apex acute, green with purple tinge, glabrous. Corolla tube 2 × 0.5 cm, white, glabrous; lobes 5, 2.5–3 × 0.5–0.7 cm, apex obtuse, white with yellow at centre, glabrous. Stamens 5, inserted; filaments short, 2 mm long, white, glabrous; anthers bilobed, sagittate, 1 mm long, yellow, glabrous. Style filiform, 8 mm long, white, glabrous. Stigma sub clavate, minute, white, glabrous. Fruits of 2 follicular mericarps, 10–15 cm long, green, glabrous.

Distribution: Himalaya to West & Central Malesia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: February-October

Specimens examined: India, Kerala, Idukki, Panamkutti, 03/05/1984, C. N. Mohanan 81743 (MH); Periyar Tiger Reserve, 25/06/1995, Jomy Augustine 15459 (CALI).

***Kamettia* Kostel.**

Allg. Med.-Pharm. Fl. 3: 1062.1834.

Kamettia caryophyllata (Roxb.) Nicolson & Suresh, Taxon 35: 354. 1986. *Ellertonia rheedei* Wight, Icon. Pl. Ind. Orient. 4: t. 1295. 1848, *nom. Illeg.*; Hook.f., Fl. Brit. India 3: 641. 1882; Gamble, Fl. Madras 2: 811. 1921; Sasidh., Fl. Periyar Tiger Reserve 243. 1998.

Climber. Stem terete, pink-green, hispid. Leaves simple, opposite-distichous, elliptic, 6–9 × 2.5–3 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in terminal cymes. Peduncle terete, 3–5 × 0.1–0.2 cm, green, glabrous. Pedicel terete, 3–4 × 1 mm, green, glabrous. Calyx tube terete, 2 × 1 mm, deep pink, glabrous; lobes 5, linear, 2 × >1 mm, apex acute, deep pink, glabrous. Corolla tube 1–1.5 × 0.2–0.3 cm, white, glabrous; lobes 5, 4–5 × 1 mm, apex acute, white, glabrous. Stamens 5, inserted; filaments short, 1 × 1 mm, white, glabrous; anthers bilobed, sagittate, 2 × 1 mm, yellow, glabrous. Style minute, 1 × 1 mm, white, glabrous. Stigma globose, minute, yellow, glabrous. Fruits of 2 follicular mericarps, linear, 7–9 cm long, green, glabrous.

Distribution: West & South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February–October

Specimens examined: India, Kerala, Idukki, Erattayar, 23/03/2017, Divya K. Venugopal 159263 (CALI); Periyar Tiger Reserve, 28/07/1993, Jomy Augustine 12255 (CALI).

***Holarrhena* R.Br.**

Asclepiadeae: 51.1810.

Holarrhena pubescens Wall. ex G.Don, Gen. Hist. 4: 78.1837; Sasidh., Fl. Periyar Tiger Reserve 243. 1998. *Holarrhena antidysenterica* Wall., Numer. List: n.º 1672.1829, *nom. nud.*; Hook.f., Fl. Brit. India 3: 644. 1882; Gamble, Fl. Madras 2: 811. 1921.

Tree. Stem brown, rough. Leaves simple, opposite, broadly ovate, 8–12 × 3–8 cm, apex acute, base round, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal cymes. Peduncle terete, 2–3 cm long, green, glabrous. Pedicel terete, 5–7 mm long, green, glabrous. Calyx tube 2 mm long, green, glabrous; lobes 5, 1 × 1 mm, apex acute, green, ciliate. Corolla tube 1 cm long, greenish white, glabrous; lobes 5, oblong, 1 cm long, apex obtuse, white, glabrous. Stamens 5, inserted; filaments slender, 1 mm long, white, glabrous; anthers bilobed, sagittate, minute, yellow, glabrous. Style short, white, glabrous. Stigma bifid, minute, white, glabrous. Fruits of 2 follicular mericarps, 10–15 cm long, green, glabrous.

Distribution: Kenya to South Africa, Indian Subcontinent to Indo-China (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: February-December

Specimens examined: India, Kerala, Idukki, Kannadippara, 08/02/2018, Divya K. Venugopal 159262 (CALI); Irumbupalam, 28/12/2017, Divya K. Venugopal 156558 (CALI); Vazhathoppe, 18/02/1982, C. N. Mohanan 73383 (MH).

***Ichnocarpus* R.Br.**

Asclepiadeae: 50.1810. *nom. cons.*

***Ichnocarpus frutescens* (L.) W.T.Aiton**, Hortus Kew. 2: 69.1811; Hook.f., Fl. Brit. India 3: 669. 1882; Gamble, Fl. Madras 2: 820. 1921; Sasidh., Fl. Periyar Tiger Reserve 243. 1998.

Climber. Stem terete, greenish brown, tomentose. Leaves simple, opposite, ovate, 3–6 × 1–2 cm, apex acute, base round, margins entire, green, pubescent on abaxial surface, petiolate. Flowers in axillary and terminal cymes. Peduncle terete, 3–4 cm long, greenish brown, sparsely tomentose. Pedicel terete, 3–4 mm long, greenish brown, sparsely tomentose. Calyx tube minute, green, glandular; lobes 5, > 1 mm long, apex acute, green, glandular. Corolla tube 2–3 mm long, white, pubescent; lobes 5, 7–8 mm long, apex acuminate, white, villous. Stamens 5, inserted; filaments minute, white, glabrous; anthers bilobed, sagittate, 1 × 1 mm, yellow, glabrous. Style minute, white, glabrous. Stigma columnar, 1 × 1 mm, white, glabrous. Fruit of 2 follicular mericarps, 5–10 cm long, green, puberulent.

Distribution: Tropical & Subtropical Asia to North Australia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: July-February

Specimen examined: India, Kerala, Idukki, Tholnada, 02/10/1990, P. Bharghavan 92071 (MH).

***Parsonsia* R. Br.**

Asclepiadeae: 53.1810, *nom.cons.*

***Parsonsia alboflavescens* (Dennst.) Mabb.**, Taxon 26:532. 1977; Sasidh., Fl. Periyar Tiger Reserve 244. 1998. *Parsonsia spiralis* Wall. ex G. Don, Gen. Hist. 4: 80: 1837; Hook.f., Fl. Brit. India 3: 650.1882; Gamble, Fl. Madras 2: 814. 1921.

Climber. Stem terete, green, sparsely pubescent. Leaves simple, opposite-distichous, ovate, 6–8 × 3–4 cm, apex acuminate, base round, margins entire, green, glabrous, petiolate. Flowers in axillary cymes. Peduncle terete, 4–5 cm long, green, sparsely pubescent. Pedicel terete, 3–4 mm long, green, sparsely pubescent. Calyx tube 2 mm long, green, glabrous; lobes 5, 1 × 1 mm, apex acute, green, glabrous. Corolla tube 3 × 2 mm, greenish yellow, glabrous except mouth; lobes 5, 5 × 1 mm, apex acute, greenish yellow, glabrous. Stamens 5, inserted; filaments 3 mm long, white, glabrous; anthers bilobed, sagittate, 1 mm long, yellow, glabrous. Style minute, white, glabrous. Stigma columnar, 1 mm long, white, glabrous. Fruit of 2 follicular mericarps, 8–10 cm long, green, glabrous.

Distribution: Tropical & Subtropical Asia to North Australia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: June–February

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 25/06/1995, Jomy Augustine 15450 (CALI).

Rauvolfia Plum. ex L.

Sp. Pl.: 208.1753.

Key to species

1a. Calyx lobes green; corolla lobes apex acute *R. micrantha*

1b. Calyx lobes red; corolla lobes apex obtuse..... 2

2a. Leaves lanceolate; corolla lobes whitish red; drupe ovoid *R. serpentina*

2b. Leaves oblanceolate; corolla lobes white; drupe oblong *R. verticillata*

Rauvolfia micrantha Hook.f., Fl. Brit. India 3: 633.1882; Gamble, Fl. Madras 2: 808. 1921; Sasidh., Fl. Periyar Tiger Reserve 244. 1998.

Shrub. Stem terete, green, glabrous. Leaves simple, whorled, elliptic, 6–10 × 2–4 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary cymes, lax. Peduncle terete, 3–5 cm long, green, glabrous. Pedicel terete, minute, green, glabrous. Calyx tube minute, green, glabrous, not glandular; lobes 5, very minute, apex acute, green, glabrous, not glandular. Corolla tube 4–5 mm long, whitish red, glabrous; lobes 5, 2–3 mm long, apex acute, whitish red, glabrous. Stamens 5, inserted; filaments short, white, glabrous; anthers bilobed, 1 mm long, yellow, glabrous. Style filiform, 3–4 mm long, white, glabrous. Stigma bilobed,

minute, white, glabrous. Fruits of 2 distinct drupes, ovoid, 5–6 mm long, green; black when ripe, glabrous.

Distribution: South West India, Indo-China (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: February-July

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 25/06/1995, Jomy Augustine 15451 (CALI).

Rauvolfia serpentina (L.) Benth. ex Kurz, Forest Fl. Burma 2: 171. 1877; Hook.f., Fl. Brit. India 3: 632.1882; Gamble, Fl. Madras 2: 807. 1921; Sasidh., Fl. Periyar Tiger Reserve 244. 1998.

Shrub. Stem terete, green, glabrous. Leaves simple, whorled, lanceolate, 6–10 × 2–4 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal cymes, closely arranged. Peduncle terete, 4–5 cm long, green, glabrous. Pedicel terete, 1 mm long, red, glabrous. Calyx tube > 1 mm long, red, glabrous, not glandular; lobes 5, minute, apex acute, red, glabrous, not glandular. Corolla tube 1–1.5 cm long, whitish red, glabrous; lobes 5, 3–4 mm long, apex obtuse, whitish red, glabrous. Stamens 5, inserted; filaments short, white, glabrous; anthers bilobed, minute, > 1 mm long, yellow, glabrous. Style filiform, 2–3 mm long, white, glabrous. Stigma bilobed, > 1 mm long, pale yellow, glabrous. Fruits of 2 distinct drupes, ovoid, 4 mm long, purplish-black when ripe, glabrous.

Distribution: Indian Subcontinent to South Central China and West Malesia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: February-May

Specimens examined: India, Kerala, Idukki, Pambla dam, 08/03/2017, Divya K. Venugopal 152013 (CALI); Periyar Tiger Reserve, 18/02/1994, Jomy Augustine 13416 (CALI).

Rauvolfia verticillata (Lour.) Baill., Hist. Pl. 13: 170 .1895; Sasidh., Fl. Periyar Tiger Reserve 244. 1998. *Rauvolfia densiflora* (Wall.) Benth. ex Hook.f., Fl. Brit. India 3: 633.1882; Gamble, Fl. Madras 2: 808. 1921.

Figure 19 E.

Shrub. Stem terete, green, glabrous. Leaves simple, whorled, oblanceolate, 6–10 × 2–4 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary or terminal cymes, lax. Peduncle terete, 3–5 cm long, green,

glabrous. Pedicel terete, 0.7–1 cm long, green, glabrous. Calyx tube 1 mm long, green, glabrous, not glandular; lobes 5, 1 mm long, apex acuminate, red, glabrous, not glandular. Corolla tube 4 mm long, white, glabrous; lobes 5, 5 mm long, apex obtuse, white, glabrous. Stamens 5, inserted; filaments short, minute, white, glabrous; anthers bilobed, >1 mm long, yellow, glabrous. Style filiform, 3 mm long, white, glabrous. Stigma bilobed, >1 mm long, white, glabrous. Fruits of 2 distinct drupes, oblong, c. 1 cm long, black, glabrous.

Distribution: India to Taiwan and West & Central Malesia (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: February-May

Specimens examined: India, Kerala, Idukki, Anamudi Shola, 04/04/2017, Divya K. Venugopal 152091 (CALI); *ibid.*, 04/04/2017, Divya K. Venugopal 157443 (CALI); Mathikettan Shola National Park, 22/04/2016, S. Syam Radh 149113 (CALI).

***Tabernaemontana* Plum. ex L.**

Sp. Pl.: 210.1753.

Key to species

1a. Flowers in terminal cymes; corolla tube white; drupe orange *T. gamblei*

1b. Flowers in axillary and terminal cymes; corolla tube
greenish white; drupe yellow *T. alternifolia*

Tabernaemontana gamblei Subr. & A.N.Henry, Bull. Bot. Surv. India 12: 5. 1970 publ.1972; Sasidh., Fl. Periyar Tiger Reserve 245. 1998. *Ervatamia caudata* Gamble, Bull. Misc. Inform. Kew 1921: 310.1921; Gamble, Fl. Madras 2: 813. 1921.

Shrub. Stem terete, green, glabrous. Leaves simple, whorled, elliptic, 6–10 × 2–4 cm, apex acuminate, base round-cuneate, margins entire, green, glabrous, petiolate. Flowers in terminal cymes. Peduncle terete, 2–3 cm long, green, glabrous. Pedicel terete, 4–5 mm long, green, glabrous. Calyx tube 1 mm long, green, glandular; lobes 5, > 1 mm long, apex obtuse, green, glandular. Corolla tube 1–1.2 cm long, white, glabrous; lobes 5, 0.8–1 cm long, apex obtuse, white, glabrous. Stamens 5, inserted; filaments short, white, glabrous; anthers bilobed, minute, yellow, glabrous. Style filiform, 5 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Fruits of 2 distinct drupes, 2–3 cm long, orange, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February-December

Specimens examined: India, Kerala, Idukki, Painavu, 04/04/2018, Divya K. Venugopal 158445 (CALI); Mankulam, 04/12/2018, Divya K. Venugopal 168844 (CALI); Periyar Tiger Reserve, 13/07/1993, Jomy Augustine 12138 (CALI).

Tabernaemontana alternifolia L., Sp. Pl.: 211.1753. *Tabernaemontana heyneana* Wall., Edwards's Bot. Reg. 15: t. 1273.1829; Hook.f., Fl. Brit. India 3: 646.1882; Sasidh., Fl. Periyar Tiger Reserve 245. 1998. *Ervatamia heyneana* (Wall.) T.Cooke, Fl. Bombay 2: 134.1904; Gamble, Fl. Madras 2: 813. 1921.

Shrub. Stem terete, green, glabrous. Leaves simple, whorled, elliptic, 6–10 × 2–4 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal cymes. Peduncle terete, 3–5 cm long, green, glabrous. Pedicel terete, 4–6 mm long, green, glabrous. Calyx tube, >1 mm long, green, glandular; lobes 5, 1 mm long, apex obtuse, green, glandular. Corolla tube 1.8–2 cm long, greenish white, glabrous; lobes 5, 1 cm long, apex obtuse, white, glabrous. Stamens 5, inserted; filaments 5 mm long, white, glabrous; anthers bilobed, sagittate, c. 1 mm long, yellow, glabrous. Style filiform, 1.5 cm long, white, glabrous. Stigma bilobed, minute, > 1 mm long, white, glabrous. Fruits of 2 distinct drupes, 3–4 cm long, yellow, glabrous.

Distribution: West & South India (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: February-December

Specimens examined: India, Kerala, Idukki, Mankulam, 04/12/2018, Divya K. Venugopal 168843 (CALI); Kulamavu, 23/09/1981, C. N. Mohanan 71930 (MH).

***Wrightia* R.Br.**

Prodr. Fl. Nov. Holland.: 467.1810.

Key to species

- 1a. Leaves pubescent; corolla orange-yellow; fruit brown
with white tubercles *W. arborea*
- 1b. Leaves glabrous; corolla white; fruit green *W. tinctoria*

Wrightia arborea (Dennst.) Mabb., Taxon 26: 533.1977; Sasidh., Fl. Periyar Tiger Reserve 245. 1998. *Wrightia tomentosa* Roem. & Schult., Syst. Veg. ed.15[bis]. 4:414. 1819; Hook.f., Fl. Brit. India 3: 653. 1882; Gamble, Fl. Madras 2: 816. 1921.

Tree. Leaves simple, opposite, elliptic, 5–12 × 2–4 cm, apex acuminate, base cuneate-round, margins entire, green, pubescent, petiolate. Flowers in terminal cymes. Peduncle terete, 3–4 cm long, green, glabrous. Pedicel terete, 3–7 mm long, green, glabrous. Calyx tube 5–6 mm long, green, ciliate; lobes 5, 2–3 mm long, apex acute, green, ciliate. Corolla tube short, orange-yellow, glabrous; lobes 5, 1.5–2 cm long, apex obtuse, orange-yellow, glabrous; with 1 series of corona, corona scales oblong, orange-yellow, glabrous. Stamens 5, inserted; filaments short, white, pubescent at base; anthers bilobed, sagittate, 5 mm long, yellow, glabrous. Style filiform, 4 mm long, white, glabrous. Stigma ovoid, minute, white, glabrous. Fruits of 2 follicular mericarps, 8–15 cm long, brown with white tubercles.

Distribution: Indian Subcontinent to South China and Peninsula Malaysia (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: November-February

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National park, 06/01/2017, Divya K. Venugopal 151607 (CALI); Way to Pazhampilichal, 26/12/1988, P. Bhargavan 90098 (MH).

Wrightia tinctoria (Roxb.) R.Br., Asclepiadeae: 59.1810; Hook.f., Fl. Brit. India 3: 653. 1882; Gamble, Fl. Madras 2: 815. 1921; Sasidh., Fl. Periyar Tiger Reserve 245. 1998; Sasidh., Fl. Chinnar WLS 189. 1999.

Tree. Leaves simple, opposite, elliptic, 10–12 × 2–4 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in terminal cymes. Peduncle terete, 2–3 cm long, green, glabrous. Pedicel terete, 1–2 mm long, green, glabrous. Calyx tube minute, green, glandular; lobes 5, 1–2 mm long, apex obtuse, green, glandular. Corolla tube short, white, glabrous; lobes 5, 1–1.5 cm long, apex obtuse, white, pubescent at base; with 1 series of corona, corona scales fimbriate, white, glabrous. Stamens 5, inserted; filaments short, dilated, white, pubescent at base; anthers bilobed, sagittate, 3 mm long, yellow, glabrous. Style filiform, 5 mm long, white, glabrous. Stigma ovoid, minute, white, glabrous. Fruits of 2 follicular mericarps, 10–20 cm long, green, glabrous.

Distribution: India to Myanmar (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: January-September

Specimen examined: India, Kerala, Idukki, Karimanal, 09/03/2017, Divya K. Venugopal 152034 (CALI).

ASCLEPIADACEAE Borkh.

Bot. Wörterb 1: 31.1797, *nom. cons.*

Herbs or shrubs, usually with milky sap. Leaves simple, opposite or whorled, entire, exstipulate. Flowers regular, cyclic, pentamerous. Pollination entomophilous (Delta Intkey, 2023). Calyx lobes 5, green, glandular scales. Corolla tubular, usually hairy; lobes 5. Corona, structure derived from androecium is typical character of Asclepiadaceae family. Stamens 5, inserted; filaments minute or absent; anthers bilobed. Style 2, minute. Fruits with 2 follicles, non-fleshy.

According to Delta Intkey, 2023, Asclepiadaceae consists of 250 genera and 2000 species.

Key to Genera

- 1a. Stem quadrangular *Pergularia*
- 1b. Stem terete 2
- 2a. Plant climber 3
- 2b. Plant not climber 4
- 3a. Corona uniseriate 5
- 3b. Corona biseriate 6
- 4a. Stem & leaves glabrous..... *Asclepias*
- 4b. Stem & leaves woolly tomentose..... *Calotropis*
- 5a. Corolla tube present 7
- 5b. Corolla tube absent 8
- 6a. Corolla tube present *Ceropegia*
- 6b. Corolla tube absent *Cynanchum*
- 7a. Flowers in raceme *Cryptolepis*
- 7b. Flowers in cyme..... 9
- 8a. Style 1..... 10
- 8b. Style 2 *Hemidesmus*
- 9a. Stem glabrous..... 11

- 9b. Stem tomentose *Gymnema*
 10a. Stem green; corolla lobes not campanulate *Vincetoxicum*
 10b. Stem brownish green; corolla lobes campanulate *Hoya*
 11a. Leaves linear, base cuneate; corolla pale yellow *Secamone*
 11b. Leaves ovate, base cordate; corolla green *Wattakaka*

Asclepias L.

Sp. Pl.: 215.1753.

Asclepias curassavica L., Sp. Pl.: 215.1753; Hook.f., Fl. Brit. India 4: 18. 1885; Gamble, Fl. Madras 2: 833. 1921.

Figure 20 B.

Herb. Stem terete, green, glabrous. Leaves simple, opposite, lanceolate, 5–8 × 3–4 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary or terminal cymes. Peduncle terete, 3–7 cm long, green, glabrous. Pedicel terete, 1–1.4 cm long, green, glabrous. Calyx lobes 5, 2 mm long, deeply lobed, apex acute, green, glabrous. Corolla lobes 5, 1 cm long, apex obtuse, orange-red, glabrous. Corona lobes 5, yellow, glabrous. Stamens 5, inserted; filaments connate, yellow, glabrous; anthers bilobed, yellow, glabrous. Style 2, slender, connate above, glabrous. Fruits of 2 follicular mericarps, green, hairy.

Distribution: Mexico to Tropical America, now introduced in tropics (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: February–November

Specimens examined: India, Kerala, Idukki, Kulamavu, 10/07/2017, Divya K. Venugopal 152314 (CALI); Anamudi Shola, 08/01/2017, Divya K. Venugopal 151557 (CALI); Mathikettan Shola National Park, 12/03/2017, S. Syam Radh 167343 (CALI); Periyar Tiger Reserve, 10/05/1995, K. P. Rajesh 15200 (KFRI); Kanthalloor, s.d., C. K. Smitha 89142 (CALI); Periyar Tiger Reserve, 06/05/1995, Jomy Augustine 15200 (CALI).

***Calotropis* R.Br.**

Asclepiadeae: 28.1810.

***Calotropis gigantea* (L.) W.T.Aiton**, Hortus Kew. 2: 78.1811; Hook.f., Fl. Brit. India 4: 17. 1885; Gamble, Fl. Madras 2: 832. 1921; Sasidh., Fl. Periyar Tiger Reserve 247. 1998; Sasidh., Fl. Chinnar WLS 190. 1999.

Figure 19 D.

Shrub. Stem terete, green, woolly. Leaves simple, opposite, ovate, 8–15 × 6–8 cm, apex acute, base cordate, margins entire, green, woolly tomentose, petiolate. Flowers in umbellate cymes. Peduncle terete, 5–7 cm long, green, glabrous. Pedicel terete, 1.5–2 cm long, green, glabrous. Calyx lobes 5, 3 mm long, apex acute, green, glandular hairy. Corolla tube minute, pale violet, glabrous; lobes 5, 1 cm long, campanulate, pale violet, glabrous. Corona lobes 5, fleshy, narrow, lobed at apex, violet, pubescent. Stamens 5, inserted; anthers bilobed, short. Style slender. Fruits of 2 follicular mericarps, ovoid, 3–4 cm long, green.

Distribution: South China to Tropical Asia (POWO, 2022)

Habitat: Barren lands

Flowering and fruiting: January-December

Specimen examined: India, Kerala, Idukki, Way to Moolamattom, 18/02/1982, C. N. Mohanan 73341 (MH).

***Ceropegia* L.**

Sp. Pl.: 211.1753.

Key to species

- 1a. Stem glabrous..... 2
- 1b. Stem pubescent 3
- 2a. Flowers in axillary cymes 4
- 2b. Flowers in axillary racemes *C. intermedia*
- 3a. Stem purplish green; corolla lobes deep purple, distally coiled. *C. beddomei*
- 3b. Stem green; corolla lobes greenish white, connate at tip..... *C. ciliata*
- 4a. Leaves glabrous..... 5
- 4b. Leaves pubescent *C. hirsuta*
- 5a. Corolla lobes green, glabrous..... *C. ensifolia*
- 5b. Corolla lobes yellowish green with purple tip, pubescent *C. candelabrum*

Ceropegia ensifolia Bedd., Madras J. Lit. Sci., ser. 3, 1: 52.1864; Hook.f., Fl. Brit. India 4: 75. 1885; Gamble, Fl. Madras 2: 859. 1921; Sasidh., Fl. Periyar Tiger Reserve 248. 1998.

Figure 19 F.

Twiner. Stem terete, green, glabrous. Leaves simple, opposite, linear, $8-10 \times 0.2-0.4$ cm, apex acute-acuminate, base round, margins entire, green, glabrous, petiolate. Flowers in axillary cymes. Peduncle terete, 1.5–2 cm long, green, hispid. Pedicel terete, 5 mm long, green, hispid. Calyx lobes 5, 2–3 mm long, apex acute, green, glabrous. Corolla tube slightly inflated at base, 1.5–2 cm long, greenish white, glabrous; lobes 5, connate at tip, green, glabrous. Corona biseriate, arising from staminal column. Staminal column short, inserted; anthers short, erect. Style conical at apex.

Distribution: South India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: August–March.

Specimens examined: India, Kerala, Idukki, Peerumedu, 08/10/2017, Divya K. Venugopal 152961 (CALI); Vakavanam, 13/09/2019, Divya K. Venugopal 170296 (CALI); Kulamavu, 03/10/1983, C. N. Mohanan 79958 (MH); Periyar Tiger Reserve, 12/02/1997, Jomy Augustine 17949 (CALI).

Ceropegia intermedia Wight, Icon. Pl. Ind. Orient. 4: t. 1263.1848; Hook.f., Fl. Brit. India 4: 71. 1885; Gamble, Fl. Madras 2: 858. 1921; Sasidh., Fl. Periyar Tiger Reserve 248. 1998.

Twiner. Stem terete, green, glabrous. Leaves simple, opposite, lanceolate, $8-10 \times 0.8-2.5$ cm, apex acute-acuminate, base round, margins entire, green, glabrous, petiolate. Flowers in axillary racemes. Peduncle terete, 2–3 cm long, purplish green, glabrous. Pedicel terete, 0.8–1 cm long, purplish green, glabrous. Calyx lobes 5, 4–5 mm long, apex acute, green, glabrous. Corolla tube dilated at base and then narrowly cylindric, 1.5–2.5 cm long, purplish white, pubescent; lobes 5, 4–8 mm long, connate at tip, purplish white, curved, pubescent. Corona biseriate, arising from staminal column. Staminal column short, inserted; anthers short, erect. Style conical at apex.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: January-June

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 18/02/1994, *Jomy Augustine 14363* (CALI).

Ceropegia hirsuta Wight & Arn., Contr. Bot. India: 30. 1834; Hook.f., Fl. Brit. India 4: 72. 1885; Gamble, Fl. Madras 2: 859. 1921; Sasidh., Fl. Periyar Tiger Reserve 248. 1998.

Twiner. Stem terete, greenish purple, glabrous. Leaves simple, opposite, ovate-lanceolate, 6–12 × 3–5 cm, apex acute-acuminate, base cordate, margins entire, green, pubescent on abaxial surface, petiolate. Flowers in axillary cymes. Peduncle terete, 1–4 cm long, purplish green, hirsute. Pedicel terete, 5–8 mm long, purplish green, glabrous. Calyx lobes 5, 5–7 mm long, apex acute, green, glabrous. Corolla tube dilated at base and then narrowly cylindric, 2–4 cm long, pale green with purple spots, glabrous; lobes 5, 1.3–2 cm long, connate at tip, purple, pubescent. Corona biseriate, arising from staminal column. Staminal column short, inserted; anthers short, erect. Style conical at apex.

Distribution: India, Thailand (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: June-December

Specimens examined: India, Kerala, Idukki, Peerumedu, 08/10/2017, *Divya K. Venugopal 151347* (CALI); Kulamavu to Meenmutty, *s.d.*, *C. N. Mohanan 76008* (MH).

Ceropegia beddomei Hook.f., Fl. Brit. India 4: 75. 1883; Gamble, Fl. Madras 2: 859. 1921; Sasidh., Fl. Periyar Tiger Reserve 247. 1998.

Twiner. Stem terete, purplish green, hispid. Leaves simple, opposite, linear-lanceolate, 8–15 × 0.6–0.8 cm, apex acute, base cuneate, margins entire, green, pubescent, petiolate. Flowers in axillary cymes. Peduncle terete, 2–5 cm long, purplish green, puberulent. Pedicel terete, 1 cm long, purplish green, puberulent. Calyx lobes 5, 6–8 mm long, apex acute, green, glabrous. Corolla tube abruptly dilated at base and funnel shaped above, 3 cm long, purple; lobes 5, 3.2–3.8 cm long, distally coiled, deep purple, curved, pubescent. Corona biseriate, arising from staminal column. Staminal column short, inserted; anthers short, erect. Style conical at apex.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: June-December

Specimens examined: India, Kerala, Idukki, Painavu, 06/08/2017, Divya K. Venugopal 154312 (CALI); Calvary Mount, 05/10/1983, A. G. Pandurangan 79260 (MH); Periyar Tiger Reserve, 08/08/1996, Jomy Augustine 16251 (CALI).

Ceropegia candelabrum L., Sp. Pl.: 211. 1753; Hook.f., Fl. Brit. India 4: 70. 1885; Gamble, Fl. Madras 2: 857. 1921; Sasidh., Fl. Periyar Tiger Reserve 248. 1998; Sasidh., Fl. Chinnar WLS 192. 1999.

Twiner. Stem terete, green, glabrous. Leaves simple, opposite, ovate, 8–10 × 0.8–2.5 cm, apex acuminate, base round, margins entire, green, glabrous, petiolate. Flowers in axillary cymes. Peduncle terete, 1–3 cm long, green, glabrous. Pedicel terete, 5–8 mm long, green, glabrous. Calyx lobes 5, 2–3 mm long, apex acute, green with purple tinge at apex, glabrous. Corolla tube abruptly dilated at base and cylindric towards upper portion, 1.5–1.8 cm long, grey colour in base and purple towards top, pubescent; lobes 5, 3–4 mm long, connate at tip, yellowish green with purple at tip, pubescent at apex. Corona biseriate, arising from staminal column. Staminal column short, inserted; anthers short. Style conical at apex.

Distribution: India, Sri Lanka (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: June-December

Specimens examined: India, Kerala, Idukki, Meenmutty, 02/10/1983, C. N. Mohanan 79904 (MH); Periyar Tiger Reserve, 05/10/1996, Jomy Augustine 16869 (CALI).

Ceropegia ciliata Wight, Icon. Pl. Ind. Orient. 4: t. 1262. 1848; Hook.f., Fl. Brit. India 4: 72. 1885; Gamble, Fl. Madras 2: 858. 1921.

Twiner. Stem terete, green, hirsute. Leaves simple, opposite, ovate-lanceolate, 5–7 × 0.5–2 cm, apex acute-attenuate, base round, margins entire, green, pubescent, petiolate. Flowers in axillary cymes. Peduncle terete, 4–7 cm long, brownish green, hispid. Pedicel terete, 1.3–1.5 cm long, brownish green, hispid. Calyx lobes 5, 4 mm long, apex acute, green, hispid. Corolla tube abruptly dilated at base and cylindric at top, 1–1.6 cm long, deep purple at lower part and whitish green towards top, glabrous; lobes 5, 5–8 mm long, linear, connate at tip, greenish white, glabrous. Corona biseriate, arising from staminal column. Staminal column short, inserted; anthers short, erect. Style conical at apex.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: June–October

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 13/08/2018, *S. Syam Radh 149198* (CALI).

***Cryptolepis* R.Br.**

Asclepiadeae: 58.1810.

***Cryptolepis buchananii* R.Br. ex Roem. & Schult., Syst. Veg., ed. 15 [bis] 4: 409.1819, *nom. cons.*; Hook.f., Fl. Brit. India 4: 5. 1885; Gamble, Fl. Madras 2: 826. 1921.**

Climber. Stem terete, green, glabrous. Leaves simple, opposite, elliptic, 10–12 × 3–5 cm, apex acute-obtuse, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary or terminal racemes, in lax. Calyx lobes 5, deeply lobed, 2–3 mm long, green, ciliate. Corolla tube short, greenish yellow, glabrous; lobes 5, linear, 4–7 mm long, apex acute-obtuse, greenish yellow, glabrous. Corona uniseriate, lobes 5, clavate, inserted. Stamens 5, inserted; filaments minute, pale yellow, glabrous; anthers short, connivent, yellow, glabrous. Style distinct, 1 mm long, pale yellow, glabrous. Stigma conical, minute, pale yellow, glabrous. Fruits 2 follicular mericarps, 7–11 cm long, green, glabrous.

Distribution: Indian Subcontinent to South China and Indo-China (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: June–February

Specimens examined: India, Kerala, Idukki, Anchuruli, 07/09/2017, *Divya K. Venugopal 152919* (CALI); Chinnar, 28/11/1979, *Nambiar 1089* (KFRI); Meenmutty - Kulamavu, 10/06/1983, *A. G. Pandurangan 76685* (MH).

***Gymnema* R.Br.**

Prodr. Fl. Nov. Holland.: 461.1810.

Key to species

- 1a. Stem green; leaves margin minutely dentate; corolla lobes greenish white..... *G. sylvestre*
- 1b. Stem yellowish brown; leaves margin entire; corolla lobes yellow..... *G. decaisneanum*

Gymnema sylvestre (Retz.) R.Br. ex Sm., A. Rees, Cycl. 17: n. 4. 1811; Hook.f., Fl. Brit. India 4: 29. 1885; Gamble, Fl. Madras 2: 839. 1921; Sasidh., Fl. Periyar Tiger Reserve 250. 1998; Sasidh., Fl. Chinnar WLS 196. 1999.

Twiner. Stem terete, green, tomentose. Leaves simple, opposite, ovate, 8–12 × 5–7 cm, apex acute, base round, margins minutely dentate, green, tomentose, petiolate. Flowers in axillary cymes, many flowered, small. Peduncle terete, 0.7–1 cm long, green, hispid. Pedicel terete, 5–7 mm long, green, hispid. Calyx lobes 5, 2–3 mm long, apex acute, green, ciliate. Corolla tube 2 mm long, greenish white, glabrous; lobes 5, 2–3 mm long, apex acute, greenish white, glabrous. Corona uniseriate, ridges long, apical process small. Stamens 5, staminal column arises from the base of corolla; anthers erect, connivent. Styles free up to the tip, conical, exserted. Fruits of follicular mericarps, 5–8 cm long, green, glabrous.

Distribution: Tropical & Subtropical old world (POWO, 2022)

Habitat: In the Plains

Flowering and fruiting: September–February

Specimen examined: India, Kerala, Idukki, Chinnar, 17/11/1994, N. Sasidharan 11610 (KFRI).

Gymnema decaisneanum Wight, Icon. Pl. Ind. Orient. 4:t. 1271. 1848. *Gymnema hirsutum* Wight & Arn., Contr. Bot. India: 44. 1834, *nom. illeg.*; Hook.f., Fl. Brit. India 4: 29. 1885; Gamble, Fl. Madras 2: 839. 1921.

Twiner. Stem terete, yellowish brown, pubescent. Leaves simple, opposite, ovate, 4–7 × 3–4 cm, apex slightly acuminate, base cordate, margins entire, green, tomentose, petiolate. Flowers in axillary cymes, many flowered, small. Peduncle terete, 4–6 mm long, green, pubescent. Pedicel terete, 3–4 mm long, green, pubescent. Calyx lobes 5, 1 mm long, apex acute, green, ciliate. Corolla tube 1 mm long, yellow, glabrous; lobes 5, 2–3 mm long, apex acute, yellow, glabrous. Corona uniseriate, ridges short, apical process large. Stamens 5, staminal column arises from the base of corolla; anthers erect, connivent. Styles free up to the tip, conical, exserted. Fruits of follicular mericarps, 4–7 cm long, green, glabrous.

Distribution: India to Myanmar (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: June–February

Specimen examined: India, Kerala, Idukki, Meenmutty – Kulamavu, 09/06/1983, A. G. Pandurangan 76672 (MH).

***Hemidesmus* R.Br.**

Asclepiadeae: 45.1810.

***Hemidesmus indicus* (L.) R.Br.**, W.T.Aiton, Hortus Kew., ed. 2, 2: 75.1811; Hook.f., Fl. Brit. India 4: 5. 1885; Gamble, Fl. Madras 2: 825. 1921; Sasidh., Fl. Periyar Tiger Reserve 250. 1998.

Twiner. Stem terete, brown, glabrous. Leaves simple, opposite, elliptic, 4–6 × 1–2 cm, apex acute, base round, margins entire, green, glabrous, petiolate. Flowers in axillary cymes. Peduncle terete, 5–8 mm long, greenish brown, glabrous. Pedicel terete, minute, > 1 mm long, greenish brown, glabrous. Calyx lobes 5, 1–3 mm long, apex acute, green, ciliate. Corolla lobes 5, deeply lobed, 3–4 mm long, apex acute, yellow, fleshy, glabrous. Corona of 5 scales, thick. Stamens 5, inserted; filaments connate at base; anthers minute, joined at apex. Styles 2, distinct, apex lobed.

Distribution: South India (POWO, 2022)

Habitat: Dry deciduous forests & in the plains

Flowering and fruiting: September–February

Specimens examined: India, Kerala, Idukki, Chinnar, 14/11/2017, Divya K. Venugopal 173483 (CALI); Kallar, 09/09/2018, Divya K. Venugopal 170351 (CALI); Painavu, 11/12/2019, Divya K. Venugopal 170023 (CALI); Periyar Tiger Reserve, 16/11/1993, Jomy Augustine 12716 (CALI).

***Cynanchum* L.**

Sp. Pl.: 212. 1753.

***Cynanchum annularium* (Roxb.) Liede & Khanum**, Taxon 65: 477. 2016. *Holostemma ada-kodien* Schult., J. J. Roemer & J.A. Schultes, Syst. Veg. ed. 15 [bis]. 6:95.1820; Sasidh., Fl. Periyar Tiger Reserve 250. 1998. *Holostemma rheedei* Wall., Pl. Asiat. Rar. 2:51.1831, *nom superfl.*; Hook.f., Fl. Brit. India 4: 21. 1885.

Twiner. Stem terete, greenish brown, glabrous. Leaves simple, opposite, ovate, 4–6 × 1–2 cm, apex acute, base cordate, margins entire, green, glabrous, petiolate. Flowers in axillary cymes. Peduncle terete, 2–3 cm long, green, glabrous. Pedicel terete, 1–1.5 cm long, green, glabrous. Calyx lobes 5, 3–4 mm long, apex acute, green, glabrous. Corolla lobes 5, 3–5 mm long, apex acute, pale purple, fleshy, glabrous. Corona biseriate, yellow. Stamens 5, inserted; filaments connate at base; anthers large, yellow. Style slender, apex oblong, winged.

Distribution: Indian Subcontinent to South China (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: September-February.

Specimen examined: India, Kerala, Idukki, Way to Karimutty, 29/12/2017, Divya K. Venugopal 158014 (CALI).

***Hoya* R.Br.**

Prodr. Fl. Nov. Holland.: 459.1810.

Key to species

1a. Leaves petiolate; flowers in axillary cymes; corona deep purple2

1b. Leaves sessile; flowers axillary solitary; corona pink.....*H. retusa*

2a. Leaves linear, apex obtuse, brownish green; corolla white*H. pauciflora*

2b. Leaves elliptic, apex acuminate; green; corolla cream*H. wightii*

Hoya wightii Hook.f., Fl.Brit. India 4:59.1883; Gamble, Fl. Madras 2: 849. 1921; Sasidh., Fl. Periyar Tiger Reserve 251. 1998.

Climber. Stem terete, slender, brownish green, glabrous. Leaves simple, opposite, elliptic, 5–7 × 2–3 cm, apex acuminate, base cuneate, margins entire, green, glabrous, fleshy, petiolate. Flowers in axillary cymes, dense. Peduncle terete, 0.7–1 cm long, greenish brown, glabrous. Pedicel terete, 2–2.6 cm long, greenish brown, glabrous. Calyx lobes 5, 2–3 mm long, deeply divided, apex acute, green, glandular scales. Corolla lobes 5, campanulate, 1.7–2 cm long, apex acute, cream, fleshy, glabrous. Corona lobes 5, apex sub globose, deep purple. Staminal column short, arises from the base of corolla; anthers connivent. Style solitary, apex 5 angled.

Distribution: West & South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January-August

Specimens examined: India, Kerala, idukki, Pambadum shola, 15/01/2018, Divya K. Venugopal 156901 (CALI); Mathikettan Shola National Park, 09/05/2015, S. Syam Radh 137985 (CALI); Painavu – Kulamavu, 20/08/1981, K. Vivekananthan 71121 (MH); Periyar Tiger Reserve, 15/04/1995, Jomy Augustine 15011 (CALI).

Hoya pauciflora Wight, Icon. Pl. Ind. Orient. 4:t.1356.1848; Hook.f., Fl. Brit. India 4: 56. 1885; Gamble, Fl. Madras 2: 849. 1921; Sasidh., Fl. Periyar Tiger Reserve 251. 1998.

Climber. Stem terete, slender, brownish green, glabrous. Leaves simple, clustered at tip, linear, narrow, $5-7 \times 0.2-0.4$ cm, apex obtuse, base round, margins entire, brownish green, glabrous, petiolate. Flowers in axillary cymes, few. Pedicel terete, 1–2 cm long, brownish green, glabrous. Calyx lobes 5, minute, apex acute, green, with glandular scales. Corolla lobes 5, campanulate, 1–1.6 cm long, apex acute, white, fleshy, glabrous. Corona lobes 5, deep purple, apex round. Staminal column short, arises from the base of corolla; anthers connivent. Style solitary, apex 5 angled.

Distribution: South West India & Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: September-February

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 22/11/2017, *S. Syam Radh* 167344 (CALI); Periyar Tiger Reserve, 09/10/1976, *K. Vivekananthan* 48628 (MH).

Hoya retusa Dalzell, Hooker's J. Bot. Kew Gard. Misc. 4: 294.1852; Hook.f., Fl. Brit. India 4: 56. 1885; Gamble, Fl. Madras 2: 849. 1921; Sasidh., Fl. Periyar Tiger Reserve 251. 1998.

Climber. Stem terete, slender, brownish green, glabrous. Leaves simple, narrow, clustered at tip, linear, $5-7 \times 0.2-0.4$ cm, apex retuse, base cuneate, margins entire, green, glabrous, subsessile. Flowers axillary, solitary. Pedicel terete, 0.8–1 cm long, brownish green, glabrous. Calyx lobes 5, minute, apex obtuse, green, with glandular scales. Corolla lobes 5, campanulate, 0.8–1 cm long, apex acute, white, fleshy, glabrous. Corona lobes 5, pink, acutely spurred. Staminal column short, arises from the base of corolla; anthers connivent. Style solitary, apex 5 angled.

Distribution: East Himalaya, West India (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: July-February.

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 11/12/2016, *Divya K. Venugopal* 151375 (CALI); Periyar Tiger Reserve, 17/07/1993, *Jomy Augustine* 12211 (CALI).

***Pergularia* L.**

Mant. Pl.: 8.1767.

Pergularia daemia (Forssk.) Chiov., Res. Sci. Somalia Ital. 1: 115.1916; Sasidh., Fl. Periyar Tiger Reserve 251. 1998; Sasidh., Fl. Chinnar WLS 197. 1999. *Pergularia extensa* (Jacq.) N. E. Br., W. H. Harvey & auct. suc. (eds.), Fl. Cap. 4(1): 758; Gamble, Fl. Madras 2: 837. 1921.

Twiner. Stem quadrangular, green, pubescent. Leaves simple, opposite, broadly ovate, 8–10 × 6–8 cm, apex acuminate, base cordate, margins entire, green, pubescent, petiolate. Flowers in axillary branched cymes. Peduncle quadrangular, 8–11 cm long, purplish green, pubescent. Pedicel quadrangular, 2–3 cm long, purplish green, pubescent. Calyx lobes 5, 1–2 mm long, apex acute, green, pubescent. Corolla tube 3–4 mm long, purplish green, pubescent; lobes 5, campanulate, 4–6 mm long, apex acute, greenish white, pubescent. Corona biseriate, cream. Stamens 5, inserted; filaments connate in a column; anthers bilobed. Styles 2, slender.

Distribution: Tropical & South Africa, Sinai to Arabian Peninsula, Iran to West Indo-China. (POWO, 2022)

Habitat: Dry deciduous forests and in plains

Flowering and fruiting: April–February

Specimens examined: India, Kerala, Idukki, Erattayar, 05/10/2019, Divya K. Venugopal 151307 (CALI); Marayur, 28/11/1979, Nambiar 1059 (KFRI); Lower camp to Kumily, 26/12/1974, K. Vivekananthan 45703 (MH); Periyar Tiger Reserve, 28/05/1995, Jomy Augustine 15314 (CALI).

***Secamone* R. Br.**

Prodr. Fl. Nov. Holland.: 464.1810.

***Secamone emetica* (Retz.) R.Br. ex Sm., A.Rees, Cycl. 32: n.º 2.1815; Hook.f., Fl. Brit. India 4: 13. 1885; Gamble, Fl. Madras 2: 829. 1921; Sasidh., Fl. Chinnar WLS 198. 1999.**

Climber. Stem terete, green, glabrous. Leaves simple, opposite, linear, 2–4 × 1–2 cm, apex acute, base cuneate, margins entire, green, pubescent on abaxial surface, subsessile. Flowers in axillary cymes. Peduncle terete, 5–8 mm long, green, glabrous. Pedicel terete, 1–3 mm long, green, glabrous. Calyx lobes 5, 3–4 mm long, apex acute, green, ciliate. Corolla tube 2 mm long, pale yellow, glabrous; lobes 5, 2–3 mm

long, apex acute, pale yellow, glabrous. Corona scales 5. Stamens 5, inserted; filaments minute; anthers connivent. Style dilated.

Distribution: India & Sri Lanka (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: August-February

Specimens examined: India, Kerala, Idukki, Chinnar, 15/10/2018, Divya K. Venugopal 151513 (CALI); *ibid.*, 30/07/1982, Nambiar 1886 (KFRI).

***Vincetoxicum* Wolf**

Gen. Pl.: 130.1776.

Key to species

- 1a. Stem glabrous..... 2
- 1b. Stem pubescent 3
- 2a. Corolla lobes apex acute, purplish brown,
pubescent..... *V. flexuosum* var. *tenuis*
- 2b. Corolla lobes apex obtuse, purple, glabrous *V. capparidifolium*
- 3a. Leaves apex acuminate; flowers in umbellate racemes *V. hirsutum*
- 3b. Leaves apex obtuse; flowers in umbellate cymes *V. rotundifolium*

Vincetoxicum hirsutum (Wall.) Kuntze, Revis. Gen. Pl. 2: 424. 1891. *Tylophora mollissima* Wall. ex Wight, Contr. Bot. India: 49 .1834; Hook.f., Fl. Brit. India 4: 48. 1885; Gamble, Fl. Madras 2: 843. 1921; Sasidh., Fl. Periyar Tiger Reserve 254. 1998; Sasidh., Fl. Chinnar WLS 199. 1999.

Climbing herb. Stem terete, creeping, green, pubescent. Leaves simple, opposite, broadly ovate, 4–6 × 3–5 cm, apex acuminate, base round, margins entire, green, pubescent, petiolate. Flowers in umbellate racemes. Peduncle terete, 3–6 cm long, green, pubescent. Pedicel terete, 5–8 mm long, green, pubescent. Calyx lobes 5, 1 mm long, apex acute, green, glandular. Corolla lobes 5, deeply lobed, minute, apex obtuse, cream, pubescent. Corona processes 5, globose, fleshy. Staminal column arises from base of corolla; anthers erect, small. Style solitary, apex lobed, inserted, glabrous.

Distribution: Indian sub continent to Taiwan and Peninsula Malaysia (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: May-September

Specimens examined: India, Kerala, Idukki, Devikulam, 27/07/1982, Nambiar 1822 (KFRI); Periyar Tiger Reserve, 18/05/1995, Jomy Augustine 15267 (CALI).

Vincetoxicum flexuosum var. *tenuis* (Blume) Schneidt, Meve & Liede, Phytotaxa 369:144.2018. *Tylophora tenuis* Blume, Bijdr. Fl. Ned. Ind.: 1062.1826; Hook.f., Fl. Brit. India 4: 42. 1885; Gamble, Fl. Madras 2: 843. 1921.

Climbing herb. Stem terete, creeping, green, glabrous. Leaves simple, opposite, oblong, 4–6 × 2–2.5 cm, apex acute, base round, margins entire, green, glabrous, petiolate. Flowers in umbellate cymes, lax. Peduncle terete, 3–5 cm long, purplish green, glabrous. Pedicel terete, 5–6 mm long, purplish green, glabrous. Calyx lobes 5, 3–4 mm long, apex acute, green, glabrous. Corolla lobes 5, 4–6 mm long, apex acute, purplish brown, pubescent. Corona processes 5, sub globose, glabrous, fleshy. Staminal column arises from base of corolla; anthers erect, small, glabrous. Style solitary, apex lobed, inserted, glabrous.

Distribution: Tropical & Subtropical Asia to Caroline Islands (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: July–December

Specimen examined: India, Kerala, Idukki, Thekkady, 14/07/2017, Divya K. Venugopal 152835 (CALI).

Vincetoxicum rotundifolium (Buch.-Ham. ex Wight) Kuntze, Revis. Gen. Pl. 2: 425.1891. *Tylophora rotundifolia* Buch.-Ham. ex Wight, Contr. Bot. India: 50.1834; Hook.f., Fl. Brit. India 4: 43. 1885; Gamble, Fl. Madras 2: 843. 1921; Sasidh., Fl. Periyar Tiger Reserve 254. 1998.

Climbing herb. Stem terete, creeping, green, pubescent. Leaves simple, opposite, broadly ovate, 4–6 × 3–5 cm, apex obtuse, base cordate, margins entire, green, pubescent, petiolate. Flowers in umbellate cymes, dense. Peduncle terete, 2–4 cm long, green, pubescent. Pedicel terete, 3–6 mm long, green, pubescent. Calyx lobes 5, 1–2 mm long, apex acute, green, hirsute. Corolla lobes 5, minute, apex obtuse, cream, pubescent. Corona processes 5, sub globose, fleshy. Staminal column arises from base of corolla; anthers erect, small, glabrous. Style solitary, apex lobed, inserted, glabrous.

Distribution: Indian sub continent to China (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February–May

Specimen examined: India, Kerala, Idukki, Meenmutty, 25/02/1983, C. N. Mohanan 77998 (MH).

Vincetoxicum capparidifolium (Wight & Arn.) Kuntze, Revis. Gen. Pl. 2: 424.1891. *Tylophora capparidifolia* Wight & Arn., R.Wight, Contr. Bot. India: 51.1834;

Hook.f., Fl. Brit. India 4: 41. 1885; Gamble, Fl. Madras 2: 843. 1921; Sasidh., Fl. Periyar Tiger Reserve 253. 1998; Sasidh., Fl. Chinnar WLS 199. 1999.

Figure 19 C.

Twiner. Stem terete, green, glabrous. Leaves simple, opposite, elliptic, 4–6 × 2–4 cm, apex acute, base round, margins entire, green, glabrous, petiolate. Flowers in axillary umbel, short. Peduncle terete, 3–5 cm long, purplish green, glabrous. Pedicel terete, 7–9 mm long, purplish green, glabrous. Calyx lobes 5, lanceolate, 1–2 mm long, apex acute, purplish green, glabrous. Corolla lobes 5, deeply lobed, 3–5 mm long, apex obtuse, purple, glabrous. Corona 5, sub globose, brown, glabrous. Staminal column arising from base of corolla; anthers small, erect. Style solitary, lobed at apex, inserted, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: September-February

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 04/01/2017, Divya K. Venugopal 151450 (CALI); *ibid.*, 23/11/2014, S. Syam Radh 137861 (CALI).

***Wattakaka* Hassk.**

Flora 40: 99.1857.

Wattakaka volubilis (L.f.) Stapf, Bot. Mag. 148: t. 8976.1923; Sasidh., Fl. Chinnar WLS 199. 1999. *Marsdenia volubilis* (L.F.) T.Cooke, Fl. Bombay 2: 166. 1904; Gamble, Fl. Madras 2: 846. 1921.

Figure 19 B.

Twiner. Stem terete, green, glabrous. Leaves simple, opposite, ovate, 8–12 × 5–6 cm, apex acuminate, base cordate, margins entire, green, glabrous, petiolate. Flowers in axillary umbel, dense. Peduncle terete, 2–4 cm long, green, glabrous. Pedicel terete, 0.5–1 cm long, green, glabrous. Calyx lobes 5, 2 mm long, apex acute, green, glandular. Corolla tube 2–3 mm long, green, glabrous; lobes 5, 4 mm long, apex acute, green, glabrous. Corona in single row, corona processes 5, round, adnate at the base of staminal column. Staminal column arises from the base of corolla tube; anthers erect. Style short with conical apex.

Distribution: North East Pakistan to South China and West Malesia (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: February-June

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 22/04/2016, S. Syam Radh 145195 (CALI).

LOGANIACEAE R.Br. ex Mart.

Nov. Gen. Sp. Pl. (Martius) 2(2): 133. 1827, *nom. cons.*

Trees, shrubs and climbers. Leaves opposite, pinnately nerved, exstipulate. Inflorescence cymose, terminal or axillary. Calyx 4-5-lobed, minute. Corolla tubular, 4-5-lobed. Stamens 4-5-lobed, inserted or exserted. Style simple. Stigma capitate or bifid. Fruit a septicidal capsule or indehiscent berry. Seeds various, often winged. Usually members of Loganiaceae are deadly poisonous due to the presence of alkaloids and glycosides in bark and seeds but they are commercially useful for timber and ornamental purposes.

Family consists of 20 genera and 700 species worldwide (POWO, 2022).

Key to genera

- 1a. Leaves tomentose; flowers in raceme *Buddleja*
- 1b. Leaves glabrous; flowers in cyme..... 2
- 2a. Leaves succulent; bracts absent *Fagraea*
- 2b. Leaves coriaceous; bracts present..... 3
- 3a. Flowers drooping; corolla not tubular..... *Gardneria*
- 3b. Flowers erect; corolla tubular *Strychnos*

Buddleja Houst. ex L.

Sp. Pl.: 112. 1753.

Buddleja asiatica Lour., Fl. Cochinch.: 72.1790; Hook.f., Fl. Brit. India 4: 82. 1885; Gamble, Fl. Madras 2: 865. 1921; Sasidh., Fl. Periyar Tiger Reserve 256. 1998; Sasidh., Fl. Chinnar WLS 201. 1999.

Shrub. Stem terete, green, puberulent. Leaves simple, opposite, lanceolate, 0.4–0.8 × 0.5–1 cm, apex acute, base cuneate, margins entire, green, white tomentose on abaxial surface, petiolate. Flowers in terminal racemes. Pedicel terete, up to 1 mm long, green, puberulent. Bracts leafy, 2–3 mm long, green, puberulent. Calyx lobes 4, ovate, 2–3 × 1 mm, green, pubescent. Corolla tube 3–4 × 1–2 mm, white, pubescent; lobes 4, rounded, 2 × 1 mm, white, pubescent. Stamens 4, inserted, sessile; anthers bilobed,

oblong, white. Style 3–4 × 1 mm, white, glabrous. Stigma small, bilobed, white, glabrous. Capsule globose, 2–4 mm long, green, pubescent, with persistent calyx. Seeds numerous.

Distribution: Central & South China to Tropical Asia and Marianas (POWO, 2022)

Habitat: Degraded forest patches

Flowering and fruiting: October–April

Specimens examined: India, Kerala, Idukki, Munnar, 13/12/1970, *Rugmini P. 1008* (CALI); Chinnar, 18/10/1995, *K.K. Sajeev 15831* (CALI); Periyar Tiger Reserve, 26/08/1993, *Jomy Augustine 12498* (CALI); Kakki dam, 10/10/1983, *C.N. Mohanan 80106* (MH).

***Fagraea* Thunb.**

Kongl. Vetensk. Acad. Nya Handl. 3:125. 1782.

Key to species

1a. Leaves petiolate; corolla abruptly tapering towards base;

stamen about the length of corolla *F. ceilanica*

1b. Leaves sessile; corolla gradually tapering towards base;

stamen exserted *F. coromandelina*

Fagraea ceilanica Thunb., Kongl. Vetensk. Acad. Nya Handl. 3:132. 1782; Hook.f., Fl. Brit. India 4: 83. 1885; Gamble, Fl. Madras 2: 865. 1921; Sasidh., Fl. Periyar Tiger Reserve 254. 1998; Sasidh., Fl. Chinnar WLS 201. 1999.

Figure 20 C.

Large shrub. Sometimes epiphytic. Leaves simple, opposite, widely obovate, 10–15 × 5–8 cm, margins entire, apex round, base cuneate, succulent, petiolate, green, glabrous. Flowers in axillary cymes. Pedicel terete, 1–1.5 × 0.2–0.3 cm, green, glabrous. Bracts absent. Calyx deeply 5-lobed, 5 × 5 mm, round, green, glabrous, persistent. Corolla tubular, conical, 2–3 × 1–1.5 cm, yellowish-white, glabrous, abruptly tapering towards base; lobes 5, 4–5 × 1–1.2 cm, apex round, yellowish-white, glabrous. Stamens 5, about the length of corolla; filaments slender at base, 2–3 cm × 0.1–0.15 cm, cream coloured, glabrous; anthers bilobed, elliptic, white. Style slender, 4–4.3 × 0.1 cm, cream coloured, glabrous, inserted. Stigma capitate, green, glabrous. Berries ovate, 2–4 × 1.5–3 cm, green, glabrous. Seeds numerous.

Distribution: Tropical and sub tropical Asia (POWO, 2022)

Habitat: Evergreen and shola forests

Flowering and fruiting: March-November

Specimens examined: India, Kerala, Idukki, Mankulam, 08/06/2017, Divya K. Venugopal 151670 (CALI); Chinnar, 22/07/1995, K.K. Sajeev 17417 (CALI); Periyar Tiger Reserve, 07/06/1995, Jomy Augustine 15475 (CALI).

Fagraea coromandelina Wight, Icon. Pl. Ind. Orient. 4. t. 1316. 1848; Hook.f., Fl. Brit. India 4: 83. 1885.

Figure 20 D.

Tree or shrub, often lithophytic or epiphytic. Leaves simple, opposite, obovate, 10–12 × 4–6 cm, apex obtuse to round, base cuneate, margins entire, succulent, sessile, green, glabrous. Flowers in terminal cymes, 3-flowered. Bracts absent. Calyx deeply 5-lobed, c. 1 × 1 cm, oblong, green, glabrous, persistent. Corolla tubular, 2–3 × 1–1.5 cm, cream coloured, glabrous, gradually tapering towards base; lobes 5, c. 5.6 × 2 cm, widely obovate, cream coloured, glabrous. Stamens 5, exserted; filaments thickened at base, c. 4 cm long, cream coloured, glabrous; anthers bilobed, oblong, white. Style slender, 4.5–5 × 0.1 cm, white, glabrous, exserted. Stigma capitate, green, glabrous. Berries round, 4–5 × 3–4 cm, green, glabrous. Seeds numerous.

Distribution: South West India (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: March-December

Specimens examined: India, Kerala, Idukki, Mathikettan shola National Park, 20/09/2017, Divya K. Venugopal 154133 (CALI); Periyar Tiger Reserve, 15/07/2017, Divya K. Venugopal 154122 (CALI).

Gardneria Wall.

W. Roxburgh, Fl. Ind. 1: 400. 1820.

Gardneria ovata Wall., W. Roxburgh, Fl. Ind. 1: 400. 1820; Hook.f., Fl. Brit. India 4: 93. 1885; Gamble, Fl. Madras 2: 869. 1921; Sasidh., Fl. Periyar Tiger Reserve 255. 1998.

Climber. Leaves simple, opposite, elliptic, 8–10 × 4–5 cm, apex acuminate, base cuneate, margins entire, green, glabrous, coriaceous, petiolate. Flowers in axillary cyme, 3–4 flowered. Bracts leafy, 2–3 × 1 mm, green, glabrous. Calyx lobes 4, round, 2–3 × 1.5–2 mm, green, pilose at margins. Corolla tube absent; lobes 4, 4–5 × 3–3.5 mm, greenish yellow, drooping, glabrous. Stamens 4, inserted; filaments minute,

hyaline, glabrous; anthers bilobed, elliptic, yellow. Style slender, minute, white, glabrous. Stigma pointed, white, glabrous. Berries globose, 4–5 mm long, blue, glabrous. Seeds 2.

Distribution: Assam to China & South India to West Java (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: February-May

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 22/05/1995, Jomy Augustine 15282 (CALI); *ibid.*, 28/12/1993, Jomy Augustine 12903 (CALI).

***Strychnos* L.**

Sp. Pl. 1: 189. 1753.

Key to species

- 1a. Tendrils present..... 2
- 1b. Tendrils absent..... 3
- 2a. Stem terete; flowers pedicellate; stamens inserted..... *S. minor*
- 2b. Stem obscurely tertragonal; flowers sessile;
stamens exerted *S. vanprukii*
- 3a. Flowers tetramerous; inflorescence terminal cyme;
berries orange..... *S. nux-vomica*
- 3b. Flowers pentamerous; inflorescence axillary cyme;
berries green..... *S. potatorum*

Strychnos minor Dennst., Schlüssel Hortus Malab. 33. 1818; Gamble, Fl. Madras 2: 867. 1921; Sasidh., Fl. Periyar Tiger Reserve 256. 1998. *Strychnos colubrina* L., Sp. Pl.: 189. 1753; Hook.f., Fl. Brit. India 4: 87. 1885.

Climbing shrub. Tendrils present, bifid. Stem terete, lenticellate, green, glabrous. Leaves simple, opposite, ovate, 6–9 × 3–4 cm, apex acute, base round, margins entire, green, glabrous, coriaceous, petiolate. Flowers in axillary cymes, erect, short. Pedicel terete, 3–4 × 1 mm, green, puberulent. Bracts leafy, 2–3 × 1–1.5 mm, green, glabrous. Calyx lobes 5, ovate, 1 × 1 mm, green, sparsely pubescent. Corolla tube 5–10 × 2 mm, greenish yellow, glabrous; lobes 5, tubes and lobes are equal in length, very minute, rounded, 2 × 1 mm, greenish yellow, glabrous. Stamens 5, inserted; filaments short, pale green, glabrous; anthers bilobed, oblong, brown. Style slender, 3–4 mm long, pale green, hirsute. Stigma capitate, white. Berries globose, 5–7 cm long, green, glabrous. Seeds 1–2.

Distribution: Tropical Asia to Santa Cruz Island (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: March-July

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 06/04/1994, *Jomy Augustine* 13560 (CALI); *ibid.*, 06/01/1995, *Jomy Augustine* 14765 (CALI); *ibid.*, 29/11/1993, *Jomy Augustine* 12739 (CALI); *ibid.*, 27/12/1997, *Jomy Augustine* 17078 (CALI); Triveny, 10/10/1972, *B.D. Sharma* 42466 (MH).

Strychnos nux-vomica L., Sp. Pl.: 189. 1753; Hook.f., Fl. Brit. India 4: 90. 1885; Gamble, Fl. Madras 2: 868. 1921; Sasidh., Fl. Periyar Tiger Reserve 256. 1998; Sasidh., Fl. Chinnar WLS 201. 1999.

Tree. Tendrils absent. Stem terete, brownish green, glabrous. Leaves simple, opposite, elliptic-orbicular, 8–12 × 6–8 cm, apex round, base obtuse, margins entire, green, glabrous, coriaceous, petiolate. Flowers in terminal cymes, erect. Pedicel terete, 2–3 mm long, green, puberulent. Bracts leafy, 2–3 mm long, green, puberulent. Calyx lobes 4, ovate, 1 × 1 mm, green, tomentose. Corolla tube 4–5 × 1–1.5 mm, greenish yellow, glabrous, tubes much longer than lobes; lobes 4, rounded, minute, 2 × 1 mm, greenish white, glabrous. Stamens 4, inserted, sessile; anthers bilobed, oblong, yellow. Style 6 × 1 mm, white, glabrous. Stigma small, capitate, white, glabrous. Berries globose, 5–6 cm long, orange, glabrous. Seeds 3–4.

Distribution: India to North Peninsula Malaysia (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: March-December

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 08/03/1994, *Jomy Augustine* 13487 (CALI); Chinnar, 25/05/1996, *K.K. Sajeev* 15802 (CALI).

Strychnos potatorum L.f., Suppl. Pl.: 148.1782; Hook.f., Fl. Brit. India 4: 90. 1885; Gamble, Fl. Madras 2: 868. 1921; Sasidh., Fl. Chinnar WLS 201. 1999.

Tree. Tendrils absent. Stem terete, brownish green, rough. Leaves simple, opposite, ovate, 3–8 × 1–4.5 cm, apex acute, base obtuse, margins entire, green, glabrous, coriaceous, petiolate. Flowers in axillary cymes, erect. Pedicel terete, 1.5–2 mm long, green, puberulent. Bracts leafy, 1–2 mm long, green, glabrous. Calyx tube 1 mm long, green, sparsely pubescent; lobes 5, ovate, very minute green, sparsely pubescent. Corolla tube minute, up to 2 mm long, white, sparsely pubescent; lobes 5, elliptic, 2 × 1 mm, white, pubescent. Stamens 5, inserted; filaments minute, white, glabrous; anthers bilobed, oblong, white. Style 3 × 1 mm, white, glabrous. Stigma small,

slightly bilobed, white, glabrous. Berries globose, 5–7 cm long, green, glabrous. Seeds 3–4.

Distribution: Rwanda to Limpopo, Madagascar, India to Myanmar, Sri Lanka (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: January–May

Specimens examined: India, Kerala, Idukki, Kallar, 07/01/1987, *Laxmana K. 3664* (CALI); Chinnar, 14/02/1995, *K.K. Sajeev 15613* (KFRI); *ibid.*, 30/07/1982, *Nambiar 1887* (KFRI).

Strychnos vanprukii Craib., Bull. Misc. Inform. Kew 1911: 421.1911; Sasidh., Fl. Periyar Tiger Reserve 256. 1998. *Strychnos aenea* A.W. Hill, Bull. Misc. Inform. Kew 1917: 138 (1917); Gamble, Fl. Madras 2: 867. 1921.

Climber. Tendrils present, bifid. Stem obscurely tetragonal, green, glabrous. Leaves simple, opposite, oblong-elliptic, 8–12 × 4–6 cm, apex acuminate, base cuneate, margins entire, green, glabrous, coriaceous, petiolate. Flowers in axillary cymes, erect, sessile. Pedicel terete, 2 mm long, green, puberulent. Bracts leafy, 1–2 mm long, green, puberulent. Calyx lobes 5, apex acute, 1 × 1 mm, green, ciliate. Corolla tube short, 1.5–2 mm long, yellow, glabrous, lobes longer than tube; lobes 5, oblong, 2.5–3 × 1.5–1.8 mm, yellow, glabrous outside, hairy below. Stamens 5, exserted; filaments 1.25 mm long, white, glabrous; anthers bilobed, oblong, yellow. Style 2 × 1 mm, white, glabrous. Stigma small, capitate, glabrous. Berries globose, 4–5 cm long, green, glabrous. Seeds 3–4.

Distribution: Assam to Peninsula Malaysia, Borneo (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: April

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 12/04/1993, *Jomy Augustine 15069* (CALI).

GENTIANACEAE Juss.

Gen. Pl. [Jussieu] 141.1789. *nom. cons.*

Annual and perennial herbs, usually rhizomatous; non-laticiferous (Delta Intkey, 2023). Leaves opposite, rarely alternate, exstipulate. Flowers usually in terminal cymes. Pollination entomophilous (Delta Intkey, 2023). Calyx 4–7 lobed. Corolla tube funnel shaped or rotate; lobes 4–7. Stamens as many as the corolla lobes, inserted in

the corolla tube or at its mouth; filaments sometimes dilated at the base; anthers dehiscing longitudinally, sometimes by apical pores. Disk annular with glands or none. Style simple. Stigma entire or 2-lobed. Fruit membranous capsule, septicidally 2-valved, rarely berry. Seeds many, minute, sometimes winged.

The family includes 102 genera and approximately 1750 species (Struwe, 2018). Members are distributed almost in all parts of the world except in Antarctica, but usually seen in temperate and high altitudinal regions. Members of this family show phytochemical properties and are widely used in traditional medicines (Jensen & Schripsema, 2002).

Key to genera

- 1a. Stigma not lobed2
- 1b. Stigma bilobed3
- 2a. Calyx lobes ovate; anthers yellow.....*Exacum*
- 2b. Calyx lobes lanceolate; anthers white.....*Hoppea*
- 3a. Corolla lobes with glandular nectarines.....*Swertia*
- 3b. Corolla lobes without glandular nectarines.....4
- 4a. Stamens 45
- 4b. Stamens 5*Gentiana*
- 5a. Stamens equal.....*Halenia*
- 5b. Stamens unequal (1 large & 3 small).....*Canscora*

Exacum L.

Sp. Pl. 1: 112. 1753.

Key to species

- 1a. Leaves petiolate..... *E. petiolare*
- 1b. Leaves sessile..... 2
- 2a. Calyx winged 3
- 2b. Calyx wingless..... 4
- 3a. Corolla lobes apex cuspidate..... 5
- 3b. Corolla lobes apex acute 6
- 4a. Stamens 4; filaments pale green; capsule globose *E. sessile*
- 4b. Stamens 5; filaments pale yellow; capsule ovate..... *E. lawii*
- 5a. Stem terete; filaments yellow; anthers sagittate..... *E. anamallayanum*
- 5b. Stem quadrangular; filaments pale green; anthers linear *E. wightianum*

- 6a. Flowers tetramerous *E. tetragonum*
 6b. Flowers pentamerous 7
 7a. Anthers sagittate; capsule oblong; seeds round *E. atropurpureum*
 7b. Anthers bottle shaped; capsule ovate; seeds tetrahedral *E. courtallense*

Exacum anamallayanum Bedd., Icon.Pl. Ind. Or. 1:33. 1870; Hook.f., Fl. Brit. India 4: 97. 1885; Gamble, Fl. Madras 2: 874. 1921; Shahina P.M., Taxonomic studies on Gentianaceae Juss. in South India 37. 2014.

Annual herb, up to 80 cm tall, glabrous. Stem terete, woody, green, glabrous. Leaves simple, opposite-decussate, ovate, 4–8 × 2–4 cm, apex acute, base amplexicaul, margins entire, green, glabrous, sessile. Flowers 1–4, in axillary or terminal cyme. Peduncle terete, 6 × 0.2 cm, green, glabrous. Pedicel terete, 1–3 × 0.1 cm, green, glabrous. Bracts ovate, 0.5–1.5 × 0.4–1 cm, green, glabrous. Calyx dorsally winged, wings: 6 × 1 mm, green, glabrous; lobes 5, ovate, 6–12 × 2–4 mm, apex acute, green, glabrous. Corolla tube 6 × 1 mm, white, glabrous; lobes 5, elliptic, 2–4 × 0.6–2 cm, apex cuspidate, violet, yellow at throat. Stamens 5; filaments 1.4–3.2 × 1 mm, yellow, glabrous; anthers bilobed, sagittate, 5–10 × 1 mm, orange yellow, glabrous, dehiscence through apical pores. Style terete, 0.7–2.8 × 0.1 cm, greenish white, glabrous. Stigma simple, minutely bilobed, 0.1 × 0.1 cm, apex round, green, glabrous. Capsule oblong, 1–2 × 0.5 cm, brown, glabrous. Seeds tetrahedral, 0.2 × 0.1 mm, numerous, brown, glabrous.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: March-July

Specimens examined: India, Kerala, Idukki, Anamudi shola, 20/05/2018, Divya K. Venugopal 176421 (CALI); Munnar Silent Valley, 02/05/2013, P. M. Shahina 4985 (CALI).

Exacum atropurpureum Bedd., Icon.Pl. Ind. Or. 1: 24. 1869; Hook.f., Fl. Brit. India 4: 97. 1885; Gamble, Fl. Madras 2: 874. 1921.

Annual herb, up to 65 cm tall, glabrous. Stem terete and woody at mature stage, green, glabrous. Leaves simple, opposite-decussate, elliptic, 3–10 × 2–3 cm, apex acuminate, base round, margins entire, green, glabrous, sessile. Flowers 1–5, in axillary or terminal cymes. Peduncle terete, 5 × 0.2 cm, green, glabrous. Pedicel terete, 1–3 × 0.1 cm, green, glabrous. Bracts ovate, 1–1.5 × 0.3–0.6 cm, green, glabrous. Calyx prominently winged, persistent, wings: 10 × 2 mm, green, glabrous;

lobes 5, ovate, 10–15 × 2–4 mm, apex acuminate, green, glabrous. Corolla tube 4–6 × 2 mm, pale blue, glabrous; lobes 5, oblong, 1.6–3.8 × 0.6–1.4 cm, apex acute, violet, yellow at throat, glabrous. Stamens 5; filaments 1.5–2.0 × 1 mm, pale yellow, glabrous; anthers bilobed, sagittate, 5–10 × 1 mm, orange yellow, glabrous, dehiscence through apical pores. Style 0.5–1.2 × 0.1 cm, greenish white, glabrous. Stigma simple, minutely bilobed, round, 1 × 1 mm, black, glabrous. Capsule oblong, 1–2.8 × 0.5 cm, brown, glabrous. Seeds round, 0.4 × 0.1 mm, numerous, brown, glabrous.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: January–December

Specimens examined: India, Kerala, Idukki, Mankulam, 16/09/2018, Divya K. Venugopal 161931 (CALI); Periyar Tiger Reserve, 11/04/1994, Jomy Augustine 13584 (CALI).

Exacum courtallense Arn., Ann. Sci. Nat., Bot. Ser. 2, 11: 175. 1839; Hook.f., Fl. Brit. India 4: 97. 1885; Gamble, Fl. Madras 2: 873. 1921; Shahina P.M., Taxonomic studies on Gentianaceae Juss. in South India 47. 2014.

Annual herb, up to 65 cm high, glabrous. Stem terete and woody, pale green, glabrous. Leaves simple, opposite-decussate, oblong, 2–8 × 1–4 cm, apex acuminate, base cuneate, margins entire, green, glabrous, sessile. Flowers 1–5, in axillary or terminal cyme. Peduncle terete, 3 × 0.2 cm, green, glabrous. Pedicel terete, 1–4 × 0.1 cm, green, glabrous. Bracts lanceolate, 1–3.5 × 0.5–1.2 cm, green, glabrous. Calyx winged, persistent, wings: 10 × 0.1 cm, green, glabrous; lobes 5, ovate, 10–15 × 2–3 mm, apex acuminate, green, glabrous. Corolla tube 4 × 2 mm, blue, glabrous; lobes 5, obovate, 1.6–3.8 × 0.6–1.4 cm, apex acute, blue with white colour at the throat, glabrous. Stamens 5; filaments 1.3–3 × 1 mm, pale yellow, glabrous; anthers bilobed, bottle shaped, 4–6 × 2 mm, yellow, glabrous, dehiscence through apical pores. Style terete, curved, 6–8 × 1 mm, greenish white, glabrous. Stigma simple, minutely bilobed, 1 × 1 mm, apex round, yellow, glabrous. Capsule ovate, 1–1.5 × 0.5 cm, brown, glabrous. Seeds tetrahedral, 0.4 × 0.2 mm, numerous, brown, glabrous.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: September–April

Specimens examined: India, Kerala, Idukki, Anamudi shola, 25/01/2018, Divya K. Venugopal 158289 (CALI); Mesthirikettu, 30/12/2017, Divya K. Venugopal 158067 (CALI); Kulamavu, 07/06/1984, N. Mohanan 82012 (MH).

Exacum lawii C.B. Clarke in Hook.f., Fl. Brit. India 4:98.1883; Gamble, Fl. Madras 2: 874. 1921.

Figure 20 F.

Annual herb, up to 30 cm high, glabrous. Stem quadrangular, pale green, glabrous. Leaves simple, opposite-decussate, ovate, 0.5–1 × 0.8–1.2 cm, apex acute, base cuneate, margins entire, green, glabrous, sessile. Flowers lax, in axillary or terminal cyme. Pedicel quadrangular, 8 × 1 mm, green, glabrous. Bracts ovate, 0.2–0.5 × 0.2–0.4 cm, green, glabrous. Calyx wingless, persistent; lobes 4, broadly ovate, 1.8–3.5 × 2–4 mm, apex acuminate, green, glabrous. Corolla tube 1 × 1 mm, white, glabrous; lobes 4, broadly obovate, 0.3–1.3 × 0.2–0.7 cm, apex acute, blue, glabrous. Stamens 5; filaments 2 × 1 mm, pale yellow, glabrous; anthers bilobed, rectangular, 1 × 1 mm, yellow, glabrous, dehiscence through apical pores. Style 2–3 × 1 mm, bluish white, glabrous. Stigma simple, minutely bilobed, 1 × 1 mm, apex capitate, black, glabrous. Capsule ovate, 1 × 0.5 cm, brown, glabrous. Seeds tetrahedral, 0.3 × 0.2 mm, numerous, brown, glabrous.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October–December

Specimens examined: India, Kerala, Idukki, Munnar silent valley, 16/10/2019, Divya K. Venugopal 164588 (CALI); Anamalai, 10/10/1901, C. A. Barber 3729 (MH).

Exacum petiolare Griseb. in A. DC., Prodr. 9:46.1845; Hook.f., Fl. Brit. India 4: 97. 1885; Gamble, Fl. Madras 2: 874. 1921.

Annual herb, up to 50 cm high, glabrous. Stem quadrangular, winged, green, glabrous. Leaves simple, opposite-decussate, broadly ovate, 2–6 × 0.8–3 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Petiole quadrangular, 3–4 × 0.5 cm, green, glabrous. Flowers 1–5, in axillary or terminal cyme. Peduncle quadrangular, 2 × 0.2 cm, green, glabrous. Pedicel quadrangular, 1 × 0.1 cm, green, glabrous. Bracts ovate, 1.5–3 × 0.7–1.5 cm, glabrous, green. Calyx winged, persistent; wings 4 × 2 mm, cordate; lobes 4, ovate, 3–5 × 2.1–3.6 mm, apex acuminate, green, glabrous. Corolla tube 2 × 1 mm, pale green, glabrous; lobes 4, broadly obovate, 0.3–1.3 × 0.2–0.7 cm, apex acute, pale blue with pale green at throat, glabrous. Stamens 4;

filaments 1.5×1 mm, pale green, glabrous; anthers bilobed, linear, 2×1 mm, yellow, glabrous, dehiscence through apical pores. Style 6×1 mm, white, deflexed, glabrous. Stigma simple, minutely bilobed, 2×1 mm, apex capitate, pale brown, glabrous. Capsule globose, 8×2 mm, brown, glabrous. Seeds tetrahedral, 0.4×0.2 mm, numerous, glabrous.

Distribution: India and Sri Lanka (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: July-December

Specimen examined: India, Kerala, Idukki, Kattadikadavu, 08/12/2018, Divya K. Venugopal 176420 (CALI).

Exacum sessile L., Sp. Pl.:112.1753; Hook.f., Fl. Brit. India 4: 98. 1885; Gamble, Fl. Madras 2: 874. 1921.

Annual herb, up to 40 cm high, glabrous. Stem quadrangular, winged, green, glabrous. Leaves simple, opposite-decussate, ovate, $0.6\text{--}1.5 \times 0.7\text{--}1.2$ cm, apex acute, base cordate, margins entire, green, glabrous, sessile. Flowers lax, in axillary or terminal cyme. Peduncle quadrangular, 2×0.2 cm, green, glabrous. Pedicel quadrangular, 2×0.1 cm, green, glabrous. Bracts ovate, $0.2\text{--}0.5 \times 0.4\text{--}0.5$ cm, green, glabrous. Calyx wingless, persistent; lobes 4, broadly ovate, $3\text{--}4 \times 2.5\text{--}3$ mm, apex acute, green, glabrous. Corolla tube 1.5×1 mm, white, glabrous; lobes 4, broadly obovate, $0.3\text{--}1.2 \times 0.2\text{--}0.5$ cm, apex acute, blue, glabrous. Stamens 4; filaments 1×1 mm, pale green, glabrous; anthers bilobed, rectangular, 2×1 mm, yellow, glabrous, dehiscence through apical pores. Style 4×1 mm, bluish white, glabrous. Stigma simple, minutely bilobed, 1×1 mm, apex capitate, brown, glabrous. Capsule globose, 6×3 mm, brown, glabrous. Seeds tetrahedral, 0.3×0.1 mm, numerous, reddish brown, glabrous.

Distribution: India and Sri Lanka (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October-December

Specimens examined: India, Kerala, Idukki, Kattadikadavu, 12/10/2019, Divya K. Venugopal 170358 (CALI); Dhanas valley, 17/10/1989, P. Bhargavan 90996 (MH); Kulamavu, 20/08/1977, K. Vivekananthan 50433 (MH); *ibid.*, 08/10/1982, C.N. Mohanan 7451 (MH); Painavu-Kulamavu, 21/08/1986, K. Vivekananthan & V. S. Raju 71740 (MH); Periyar Tiger Reserve, 16/09/1994, Jomy Augustine 14164 (CALI).

Exacum tetragonum Roxb., Fl. Ind. 1:413.1820; Hook.f., Fl. Brit. India 4: 95. 1885; Gamble, Fl. Madras 2: 873. 1921.

Annual herb, up to 100 cm high, glabrous. Stem quadrangular, winged, green, glabrous. Leaves simple, opposite-decussate, linear-lanceolate, 4–12 × 1.2–3 cm, apex acute, base cuneate, margins entire, green, glabrous, sessile. Flowers 1–6, in axillary or terminal cyme. Peduncle quadrangular, 4 × 0.2 cm, green, glabrous. Pedicel quadrangular, 1 × 0.1 cm, green, glabrous. Bracts ovate, 0.2–0.5 × 0.4–0.5 cm, green, glabrous. Calyx winged dorsally, persistent, wings: 2 × 1 mm; lobes 4, ovate, 2 × 1 mm, apex acute, green, glabrous. Corolla tube 1 × 0.2 cm, yellowish white, glabrous; lobes 4, obovate, 3–6 × 1.2–2 cm, apex acute, white coloured lobes with violet at apex, yellow at the throat portion, glabrous. Stamens 4; filaments 1 × 0.1 cm, pale green, glabrous; anthers bilobed, sagittate, curved, 1 × 0.1 cm, orange yellow, glabrous, dehiscence through apical pores. Style 2 × 0.1 cm, greenish white, glabrous. Stigma simple, minutely bilobed, 1 × 1 mm, apex round, pale brown, glabrous. Capsule ovate, 8 × 3 mm, brown, glabrous. Seeds tetrahedral, 0.2 × 0.1 mm, numerous, brown, glabrous.

Distribution: South China to Tropical Asia and North Australia (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: January–December

Specimens examined: India, Kerala, Idukki, Munnar, 23/01/2018, Divya K. Venugopal 158105 (CALI); Meenmutty, 04/10/1983, C. N. Mohanan 79974 (MH); Vallakadavu, 03/09/1972, B.D. Sharma 40841 (MH); Periyar Tiger Reserve, 08/01/1995, Jomy Augustine 14549 (CALI); Kanthaloor, 25/02/2003, Nishitha I.K. 90430 (CALI).

Exacum wightianum Arn., Ann. Sci. Nat., Bot., ser. 2, 11:176.1839; Hook.f., Fl. Brit. India 4: 97. 1885; Gamble, Fl. Madras 2: 873. 1921; Shahina P.M., Taxonomic studies on Gentianaceae Juss. in South India 98. 2014.

Figure 20 E.

Annual herb, up to 120 cm high, glabrous. Stem quadrangular, winged, woody, green, glabrous. Leaves simple, opposite-decussate, broadly ovate, 2–8 × 1–2.5 cm, apex acute, base attenuate, margins entire, green, glabrous, sessile. Flowers 1–3, in axillary or terminal cyme. Peduncle quadrangular, 5 × 0.2 cm, green, glabrous. Pedicel quadrangular, 2 × 0.1 cm, green, glabrous. Bracts ovate, 0.6–2 × 0.4–0.7 cm, green, glabrous. Calyx winged dorsally, persistent, wings: 4 × 2 mm; lobes 5, ovate, 6–12 × 2.5–5 mm, apex acuminate, green, glabrous. Corolla tube 5 × 2 mm, white, glabrous;

lobes 5, elliptic, $3-6 \times 1.2-2$ cm, apex cuspidate, blue, glabrous. Stamens 5; filaments 3×1 mm, pale green, glabrous; anthers bilobed, linear, erect, 6×2 mm, yellow, glabrous, dehiscence through apical pores. Style terete, 8×1 mm, greenish white, glabrous. Stigma simple, minutely bilobed, 1×1 mm, apex round, pale brown, glabrous. Capsule oblong, 8×4 mm, brown, glabrous. Seeds irregular, 0.3×0.1 mm, numerous, brown, glabrous.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: June-March

Specimens examined: India, Kerala, Idukki, Mathikettan shola National Park, 04/01/2017, Divya K. Venugopal 151448 (CALI); Kannadippara, 17/09/2018, Divya K. Venugopal 161946 (CALI); Silent valley, 22/11/2018, Divya K. Venugopal 168805 (CALI); Anamudi shola, 30/12/2017, Divya K. Venugopal 152076 (CALI); Idukki, 06/12/1987, P. Bharghavan 87353 (MH); *ibid.*, 14/10/1989, P. Raghavan 90940 (MH); Periyar Tiger Reserve, 08/12/1994, Jomy Augustine 14352 (CALI); Maattupetti, 19/11/2012, P. M. Shahina 4957 (CALI).

Canscora Lam.

Encycl. 1: 601.1785.

Key to species

- 1a. Calyx winged *C. perfoliata*
- 1b. Calyx not winged 2
- 2a. Leaves petiolate; corolla lobes orbicular; anthers linear *C. diffusa*
- 2b. Leaves sessile; corolla lobes obovate; anthers oblong *C. roxburghii*

Canscora diffusa (Vahl) R. Br. ex Roem.& Schult., Syst. Veg., ed. 15[bis]. 3: 301.1818; Hook.f., Fl. Brit. India 4: 103. 1885; Gamble, Fl. Madras 2: 878. 1921; Shahina P.M., Taxonomic studies on Gentianaceae Juss. in South India 119. 2014.

Figure 20 G.

Annual herb, up to 60 cm tall, glabrous. Stem quadrangular, winged, green, glabrous. Leaves simple, opposite-decussate, ovate, $1.2-5 \times 0.6-3.5$ cm, apex acute, base attenuate, margins entire, green, glabrous. Petiole quadrangular, $3-6 \times 1$ mm, green, glabrous. Flowers 4–25, in axillary or terminal cyme. Peduncle quadrangular, 2×0.2 cm, green, glabrous. Pedicel quadrangular, $6-15 \times 1$ mm, green, glabrous. Bracts broadly ovate, $0.5-7 \times 0.8-4$ mm, green, glabrous. Calyx not winged, persistent; lobes

4, linear, $3.5\text{--}5 \times 1\text{--}1.5$ mm, apex acuminate, green, glabrous. Corolla tube 6×2 mm, white, glabrous; lobes 4, orbicular, upper lobes 2×3 mm, lower lobes 4×1 mm, apex obtuse, pink, glabrous. Stamens 4 (1 large & 3 small), unequal; filaments of upper stamen 2×1 mm, filaments of lower stamens 1×1 mm, pale green, glabrous; anthers bilobed, linear, erect, 5×1 mm, orange (upper stamen), yellow-white (lower stamen), papillate. Style 3×1 mm, pinkish white, glabrous, exserted. Stigma simple, obovate, bilobed, 3×2 mm, pinkish white, glabrous. Capsule oblong, 8×2 mm, brown, glabrous. Seeds irregular, 0.3×0.1 mm, numerous, brown, glabrous.

Distribution: Tropical Africa to South West Pacific (POWO, 2022)

Habitat: Grasslands, river banks, road sides

Flowering and fruiting: June-March.

Specimens examined: India, Kerala, Idukki, Chinnar, 10/02/2021, Divya K. Venugopal 170411 (CALI); Thekkady, 21/05/2003, N. Venkata Subramanian s.n. (FRC); Periyar Tiger Reserve, 08/01/1995, Jomy Augustine & K.P. Rajesh 14548 (CALI); Munnar, 11/11/2011, P.M. Shahina 3327 (CALI).

Canscora perfoliata Lam., Encyc. 1:601.1785; Hook.f., Fl. Brit. India 4: 1094. 1885; Gamble, Fl. Madras 2: 879. 1921.

Annual herb, up to 75 cm high, glabrous. Stem quadrangular, winged, green, glabrous. Leaves simple, opposite-decussate, oblong, $1.5\text{--}6 \times 0.3\text{--}4.5$ cm, apex acute, base attenuate, margins entire, green, glabrous, sessile. Flowers 1–3, in axillary or terminal cyme. Pedicel quadrangular, winged, 5×1 mm, green, glabrous. Bracts sub orbicular, $4\text{--}15 \times 3\text{--}15$ mm, green, glabrous. Calyx winged, persistent; lobes 4, semi elliptic, $10\text{--}15 \times 4\text{--}6$ mm, apex acuminate, green, glabrous. Corolla tube $8\text{--}10 \times 2$ mm, white, glabrous; lobes 4, obovate, larger lobes $6\text{--}10 \times 4\text{--}8$ mm, smaller lobes $4\text{--}8 \times 1\text{--}4$ mm, apex obtuse, cream with brown striations, glabrous. Stamens 4 (1 large & 3 small), unequal; filaments of upper stamen 3×1 mm, filaments of lower stamens 2×1 mm, pale green, glabrous; anthers bilobed, oblong, erect, 5×1 mm, orange (upper stamen) yellow (lower stamen), papillate. Style 4×1 mm, white, glabrous, exserted. Stigma simple, obovate, bilobed, 1×1 mm, white, papillate. Capsule oblong, 6×2 mm, brown, glabrous. Seeds irregular, 0.4×0.2 mm, numerous, brown, glabrous.

Distribution: India (POWO, 2022)

Habitat: Grasslands, river banks, road sides

Flowering and fruiting: August-December.

Specimens examined: India, Kerala, Idukki, Kattadikadavu, 07/12/2018, Divya K. Venugopal 167806 (CALI); *ibid.*, 12/10/2019, Divya K. Venugopal 170352 (CALI); Anamalai hills, 26/12/1912, *s.coll.* 3215 (FRC); Thekkady, 21/05/2003, N. Venkata Subramanian *s.n.* (FRC); Periyar Tiger Reserve, 22/11/1993, Jomy Augustine 12747 (CALI); Neriamangalam, 30/11/1979, Nambiar 1129 (KFRI).

Canscora roxburghii Arn. ex Miq., Nieuwe Verh. Eerste Kl. Kon. Ned. Inst. Wetensch. Amsterdam, ser. 3, 5: 11. 1852; Hook.f., Fl. Brit. India 3: 105. 1882; Gamble, Fl. Madras 2: 879. 1921.

Figure 21 A.

Annual herb, up to 60 cm high, glabrous. Stem quadrangular, winged, green, glabrous. Leaves simple, opposite-decussate, elliptic, 1.5–4.5 × 0.3–1.5 cm, apex acute, base attenuate, margins entire, green, glabrous, sessile. Flowers 1–6, in axillary or terminal cyme. Pedicel quadrangular, 2 × 1 mm, not winged, green, glabrous. Bracts orbicular, 4–12 × 3–15 mm, green, glabrous. Calyx not winged, persistent; lobes 4, lanceolate, 4–8 × 2–5 mm, apex acute, green, glabrous. Corolla tube 6 × 2 mm, white with yellow throat, glabrous; lobes 4, obovate, larger lobes 3.5–5 × 2.5–3.5 mm, smaller lobes 2.5–3 × 1–2.8 mm, apex obtuse, pink, glabrous. Stamens 4 (1 large & 3 small), unequal; filaments of upper stamen 2 × 1 mm, filaments of lower stamen 1.5 × 1 mm, pale green, glabrous; anthers bilobed, oblong, erect, 5 × 1 mm, orange (upper stamen), yellow (lower stamen), papillate. Style 4 × 1 mm, exerted, white, glabrous. Stigma simple, obovate, bilobed, 1 × 1 mm, white, papillate. Capsule globose, 6 × 2 mm, brown, glabrous. Seeds cubical, 0.4 × 0.2 mm, numerous, brown, glabrous.

Distribution: India & Sri Lanka (POWO, 2022)

Habitat: Grasslands, road sides

Flowering and fruiting: September-January

Specimens examined: India, Kerala, Idukki, Chinnar, 27/01/2018, Divya K. Venugopal 158335 (CALI); Anamalai hills, 03/02/1915, C.E.C. Fischer 3784 (FRC); Periyar Tiger Reserve, 17/08/1993, Jomy Augustine 12397 (CALI).

***Hoppea* Willd.**

Neue Schriften Ges. Naturf. Freunde Berlin 3: 434. 1801.

Hoppea fastigiata (Griseb.) C.B. Clarke in J.D. Hooker, Fl. Brit. India 4:100. 1885; Gamble, Fl. Madras 2: 877. 1921; Shahina P.M., Taxonomic studies on Gentianaceae Juss. in South India 173. 2014.

Annual herb, up to 20 cm high, glabrous. Stem quadrangular, winged, green, glabrous. Leaves simple, opposite, broadly ovate, 10–15 × 0.6–8 cm, apex obtuse, base truncate, margins entire, green, glabrous, sessile. Flowers dense, in cyme, terminal or axillary. Peduncle quadrangular, 2 × 0.3 cm, green, glabrous. Pedicel not winged, 2 × 1 mm, green, glabrous. Bracts linear, 2–4 × 0.5–1.5 mm, green, glabrous. Calyx not winged, persistent; calyx tube 3 × 1 mm, green, glabrous; lobes 4, lanceolate, 1.5–2 × 0.4–0.6 mm, apex acuminate, green, glabrous. Corolla tube 2 × 1 mm, white, glabrous; lobes 4, obovate, 1.5–2 × 0.5–0.8 mm, apex acuminate, white coloured, glabrous. Stamens 4 (1 large & 3 small), unequal; filaments of upper stamen 0.3 × 0.1 mm, filaments of lower stamens 0.25 × 0.1 mm, pale green, glabrous; anthers bilobed, elliptic, erect, larger anther 0.2 × 0.1 mm, smaller anther 0.15 × 0.1 mm, white, glabrous. Style 0.8 × 0.1 mm, green, glabrous. Stigma bilobed, 0.3 × 0.1 mm, apex subglobose, white, papillate. Capsule ellipsoid, 4 × 1 mm, brown, glabrous. Seeds subglobose, 0.3 × 0.1 mm, numerous, brownish black, glabrous.

Distribution: India & Sri Lanka (POWO, 2022)

Habitat: Grasslands, wet rocks, lateritic soils

Flowering and fruiting: July–March

Specimens examined: India, Kerala, Idukki, Lakkamkudi, 09/12/2019, Divya K. Venugopal 170004 (CALI); Chinnar, 03/10/1996, K.K. Sajeewan 17456 (KFRI).

***Gentiana* Tourn. ex L.**

Sp. Pl.: 227.1753.

Key to species

- 1a. Stem terete; corolla lobes apex acute; anthers papillate..... *G. pedicellata*
- 1b. Stem quadrangular; corolla lobes apex acuminate;
anthers glabrous *G. quadrifaria*

Gentiana pedicellata (D. Don) Griseb, Gen. Sp. Gent.: 273. 1838; Gamble, Fl. Madras 2: 876. 1921.

Annual herb, procumbent, up to 15 cm high, scabrous. Stem terete, winged, green, scabrous. Radical leaf sessile, elliptic, $0.5\text{--}1.5 \times 0.2\text{--}0.6$ cm, apex acute, base truncate, margins entire, green, glabrous; cauline leaf petiolate, elliptic, $0.5\text{--}1.2 \times 0.2\text{--}0.4$ cm, apex acute, base attenuate, margins entire, green, glabrous. Petiole terete, 1×0.1 cm, green, glabrous. Flowers 2–4, in axillary or terminal cyme. Pedicel terete, not winged, 1×0.2 cm, green, glabrous. Bracts linear, $5\text{--}8 \times 0.2\text{--}0.5$ mm, green, glabrous. Calyx persistent, green; calyx tube 5×2 mm, green, glabrous; lobes 5, lanceolate, $4\text{--}6 \times 0.5\text{--}1.8$ mm, apex acute, pale green with purple tinge, glabrous. Corolla tube 6×2 mm, blue, glabrous; lobes 5, ovate, $2.5\text{--}8 \times 1.5\text{--}3$ mm, apex acute, blue, glabrous. Stamens 5, equal; filaments 5 mm long, widened towards the base, white, glabrous; anthers bilobed, oblong, erect, 0.5×0.1 mm, yellow, papillate. Style 2×1 mm, white, glabrous. Stigma simple, bilobed, sub globose, 0.4×0.1 mm, greenish white, glabrous. Capsule 1×0.2 cm, obovate, brown, glabrous. Seeds oblong, 0.4×0.2 mm, numerous, brown, glabrous.

Distribution: North East Pakistan and China and North Indo-China (POWO, 2022)

Habitat: Grasslands, road sides, forests

Flowering and fruiting: January-December

Specimen examined: India, Kerala, Idukki, Silent valley, 21/11/2018, Divya K. Venugopal 167779 (CALI).

Gentiana quadrifaria Blume, Bijdr. Fl. Ned. 847.1826; Hook.f., Fl. Brit. India 4: 111. 1885; Gamble, Fl. Madras 2: 876. 1921; Shahina P.M., Taxonomic studies on Gentianaceae Juss. in South India 199. 2014.

Figure 25 C.

Annual herb, procumbent, up to 40 cm high. Stem quadrangular, green, glabrous. Radical leaves sessile, elliptic, $0.5\text{--}2 \times 0.2\text{--}0.8$ cm, apex acute, base truncate, margins entire, green, glabrous; cauline leaves petiolate, elliptic, $0.5\text{--}1.5 \times 0.2\text{--}0.6$ cm, apex acute, base attenuate, margins entire, green, glabrous. Petiole quadrangular, 3×0.2 cm, green, glabrous. Flowers 2–4, in axillary or terminal cyme. Pedicel quadrangular, not winged, 1×0.2 cm, green, glabrous. Bracts linear, $3\text{--}5 \times 0.3\text{--}0.4$ mm, purplish green, glabrous. Calyx persistent, calyx tube 5×2 mm, purplish green, glabrous; lobes 5, lanceolate, $0.4\text{--}0.8 \times 0.5\text{--}0.6$ mm, apex acute, pale green with purple tinge, glabrous. Corolla tube 6×2 mm, blue with white throat, glabrous; lobes 5, ovate, $3\text{--}5$

× 1.8–3 mm, apex acuminate, blue, glabrous. Stamens 5, equal; filaments widened towards the base, 4 mm long, white, glabrous; anthers bilobed, oblong, erect, 0.5 × 0.2 mm, yellow, glabrous. Style 1.5 × 1 mm, white, glabrous. Stigma simple, bilobed, apex sub globose, 0.4 × 0.2 mm, white, papillate. Capsule obovate, 5 × 2 cm, brown, glabrous. Seeds ovate, 0.6 × 0.2 mm, numerous, brown, glabrous.

Distribution: Jawa (POWO, 2022)

Habitat: Grasslands, road sides, forests

Flowering and fruiting: January–December

Specimens examined: India, Kerala, Idukki, Umayamala, 30/08/2019, Divya K. Venugopal 170278 (CALI); Munnar Silent Valley, 18/04/2013, P. M. Shahina 4996 (CALI); Kanthallur, 30/03/1978, Nambiar 262 (KFRI).

***Halenia* Borkh.**

Arch. Bot. (Leipzig) 1(1): 25.1796.

Halenia perrottetii Griseb., A. P. de Candolle, Prodr. 9:129.1845; Hook.f., Fl. Brit. India 4: 130. 1885; Gamble, Fl. Madras 2: 882. 1921; Shahina P.M., Taxonomic studies on Gentianaceae Juss. in South India 206. 2014.

Annual herb, procumbent, up to 35 cm high, glabrous. Stem quadrangular, green, glabrous. Radical leaves in rosette, cauline leaves opposite; elliptic, 1–5 × 4–5 cm, apex acute, base truncate, margins entire, green, glabrous. Petiole quadrangular, 1.5 × 1 mm, green, glabrous. Flowers 1–6, in axillary or terminal cyme. Pedicel quadrangular, not winged, 4 × 1 mm, green, glabrous. Bracts elliptic, 2–4 × 0.8–2 mm, green, glabrous. Calyx persistent, green; lobes 4, lanceolate, deeply lobed, 2–5 × 1.5–3 mm, apex acuminate, green, glabrous. Corolla tube 2 × 1 mm, white, glabrous; lobes 4, campanulate, 3–5 × 1.8–3 mm, apex acute, yellowish white with purple colour at edges, glabrous. Stamens 4, equal; filaments linear, 4 × 1 mm, white, glabrous; anthers bilobed, ovate, erect, 1 × 0.5 mm, yellow-white, glabrous. Style absent. Stigma simple, sub globose, bilobed, 0.4 × 0.1 mm, pale green with purple colour at edges, glabrous. Capsule obovate, 8 × 3 mm, brown, glabrous. Seeds sub globose, 1.4 × 1 mm, numerous, brown, glabrous.

Distribution: Assam, India (POWO, 2022)

Habitat: Grasslands, margins of shoals

Flowering and fruiting: August–January

Specimen examined: India, Kerala, Idukki, Munnar Silent Valley, 23/12/2012, P.M Shahina 4978 (CALI).

***Swertia* L.**

Sp. Pl. 1: 226.1753.

Key to species

- 1a. Corolla lobes have 1 gland each at its base..... 2
- 1b. Corolla lobes have 2 glands each at its base *S. minor*
- 2a. Corolla lobes ovate; seeds polyhedral..... *S. angustifolia*
- 2b. Corolla lobes obovate; seeds oval..... 3
- 3a. Corolla lobes white; anthers yellow *S. trichotoma*
- 3b. Corolla lobes lilac; anthers black..... *S. corymbosa*

Swertia angustifolia Buch-Ham. ex D. Don, Prodr. Fl. Nepal.127. 1825; Hook.f., Fl. Brit. India 4: 125. 1885; Gamble, Fl. Madras 2: 880. 1921.

Annual herb, up to 65 cm high, glabrous. Stem quadrangular, green, glabrous. Leaves simple, opposite, lanceolate, 4–8 × 1–2 cm, apex acute, base cuneate, margins entire, green, glabrous, sessile. Flowers numerous, in axillary or terminal cyme. Peduncle quadrangular, 2 × 0.2 cm, green, glabrous. Pedicel quadrangular, not winged, 5 × 2 mm, green, glabrous. Bracts linear, 0.4–0.6 × 2–4 mm, green, glabrous. Calyx persistent, green; lobes 4, lanceolate, deeply divided, 4–8 × 2–3.5 mm, apex acute, divided almost up to the base, green, glabrous. Corolla tube 1 × 1 mm, white, glabrous; lobes 4, ovate, 8–10 × 2–4 mm, apex acute, pale blue with purple dots, one gland at the base of each lobe, each gland is covered by fimbriae along margins. Stamens 4, equal; filaments linear, 4 × 1 mm, white, glabrous; anthers bilobed, oblong, erect, 1 × 1 mm, yellow, glabrous. Style 0.25 × 0.1 mm, yellow with minute purple striations, glabrous. Stigma simple, sub orbicular, bilobed, 0.4 × 0.2 mm, pale green with purple colour at edges, glabrous. Capsules oblong, 8 × 2 mm, brown, glabrous. Seeds polyhedral, 0.4 × 0.1 mm, numerous, pale brown, glabrous.

Distribution: Himalaya to South China and Indo-China (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: September–November

Specimens examined: India, Kerala, Idukki, Mathikettan shola National Park, 04/01/2017, Divya K. Venugopal 151475 (CALI); Way to Mangaladevi temple 09/10/1976, K. Vivekananthan 48633 (MH).

Swertia corymbosa (Griseb.) Fielding & Gardner, Sert. Pl. 4: 126. 1844; Gamble, Fl. Madras 2: 881. 1921; Shahina P.M., Taxonomic studies on Gentianaceae Juss. in South India 226. 2014.

Figure 21 B.

Annual herb, up to 65 cm high, glabrous. Stem quadrangular, green, glabrous. Leaves simple, opposite, elliptic, $1-5 \times 0.2-2$ cm, apex acute, base mucronate, margins entire, green, glabrous, sessile. Flowers numerous, in axillary or terminal cyme. Peduncle quadrangular, $2-3 \times 0.2$ cm, green, glabrous. Pedicel quadrangular, not winged, 4×1 mm, green, glabrous. Bracts elliptic, $2-6 \times 1.5-4$ mm, green, glabrous. Calyx persistent, green; lobes 4, divided almost up to the base, lanceolate, $2.5-3 \times 0.2-0.4$ mm, apex acuminate, green, glabrous. Corolla tube 1×1 mm, white, glabrous; lobes 4, obovate, $8-10 \times 2-4$ mm, apex acute, lilac, one gland at the base of each lobe, each gland is covered by fimbriae along margins, glabrous. Stamens 4, equal; filaments linear, 4×1 mm, white, glabrous; anthers bilobed, erect, oblong, 2×1 mm, black, papillate. Style 0.2×0.1 mm, yellow, glabrous. Stigma simple, bilobed, sub orbicular, 0.2×0.1 mm, yellow, glabrous. Capsule oblong, 8×2 mm, brown, glabrous. Seeds oval, 0.4×0.2 mm, numerous, pale brown, glabrous.

Distribution: India (POWO, 2022)

Habitat: Grasslands, open forests

Flowering and fruiting: July-March

Specimens examined: India, Kerala, Idukki, Meesapulimala, 14/10/2019, Divya K. Venugopal 170371 (CALI); Kulamav, 12/11/1982, C. N. Mohanan 74574 (MH); *ibid.*, 07/06/1984, C.N. Mohanan 82016 (MH); Vandanmedu-Kattapana, *s.d.*, C.N. Mohanan & B. Ramanujan 72075 (MH); Periyar Tiger Reserve, 22/08/1993, Jomy Augustine 12471 (CALI); Chinnar, 29/11/1979, Nambiar 1072 (KFRI).

Swertia minor (Griseb.) Knobl., Bot. Centrabl. 60:391. 1894; Hook.f., Fl. Brit. India 4: 120. 1885; Gamble, Fl. Madras 2: 880. 1921; Shahina P.M., Taxonomic studies on Gentianaceae Juss. in South India 238. 2014. *Lomatogonium minus* (Griseb.) Fernald, Rhodora 21:198. 1919.

Annual herb, up to 30 cm tall, glabrous. Stem quadrangular, green, glabrous. Leaves simple, opposite, ovate, $1-5 \times 0.2-2$ cm, apex acute, base mucronate, margins entire, green, glabrous, sessile. Flowers 1-5, in axillary or terminal cyme. Peduncle quadrangular, $3-4 \times 0.2$ cm, green, glabrous. Pedicel quadrangular, not winged, 2×0.1 cm, green, glabrous. Bracts ovate, $3-6 \times 1.5-3.5$ mm, green, glabrous. Calyx

persistent, green; lobes 4, divided almost up to the base, ovate, $4-6 \times 0.5-1.2$ mm, apex acute, green, glabrous. Corolla tube 0.3×0.1 mm, white, glabrous; lobes 4, ovate, $4-10 \times 1.2-2$ mm, apex acute, lilac, two glands at the base of each lobe, glabrous. Stamens 4, equal; filaments linear, 3×1 mm, white, glabrous; anthers bilobed, oblong, erect, 0.3×0.1 mm, black, glabrous. Style absent. Stigma simple, sub orbicular, bilobed, 0.6×0.2 mm, white, glabrous. Capsule oblong, 6×2 mm, brown, glabrous. Seeds ovoid, 0.3×0.1 mm, numerous, brown, glabrous.

Distribution: India (POWO, 2022)

Habitat: Grasslands, rock crevices

Flowering and fruiting: July-February

Specimens examined: India, Kerala, Idukki, Vagamon, 26/10/2020, Divya K. Venugopal 170094 (CALI); Dhanas Valley, 17/10/1989, P. Bhargavan 90996 (MH); Munnar Silent Valley, 16/12/2012, P.M. Shahina 4969 (CALI).

Swertia trichotoma Wight ex C. B. Clarke, J. D. Hooker, Fl. Brit. India 4: 126. 1883; Gamble, Fl. Madras 2: 881. 1921; Shahina P.M., Taxonomic studies on Gentianaceae Juss. in South India 249. 2014.

Annual herb, up to 70 cm high, glabrous. Stem quadrangular, green, glabrous. Leaves simple, elliptic, $4-5 \times 0.2-1.5$ cm, apex acute, base attenuate, margins entire, green, glabrous, sessile. Flowers 1-5, in axillary or terminal cyme. Peduncle quadrangular, $5-6 \times 0.2$ cm, green, glabrous. Pedicel quadrangular, not winged, $2-3 \times 0.1$ cm, green, glabrous. Bracts elliptic, $3-6 \times 2-5$ mm, green, glabrous. Calyx persistent, green; lobes 4, divided almost up to the base, lanceolate, $4-8 \times 2.5-4$ mm, apex acute, green, glabrous. Corolla tube 1×1 mm, white, glabrous; lobes 4, obovate, $8-10 \times 2.5-4$ mm, apex acute, white, one gland at the base of each lobe with fimbriae. Stamens 4, equal; filaments linear, 4×1 mm, white, glabrous; anthers bilobed, oblong, erect, 1×0.4 mm, yellow, glabrous. Style 0.3×0.1 mm, yellow with purple tinge, glabrous. Stigma simple, bilobed, orbicular, 0.4×0.2 mm, purple, glabrous. Capsule oblong, 5×1 mm, brown, glabrous. Seeds oval, 0.4×0.1 mm, numerous, yellowish brown, glabrous.

Distribution: India (POWO, 2022)

Habitat: Grasslands, open forests

Flowering and fruiting: July-February

Specimens examined: India, Kerala, Idukki, Mesthirikettu, 30/12/2017, Divya K. Venugopal 158080 (CALI); Munnar Silent Valley, 16/12/2012, A.J. Robi & K.M. Manudev 4973 (CALI).

HYDROPHYLLACEAE R.Br.

Bot. Reg. 3: ad t. 242 .1817. *nom. cons.*

[According to POWO, 2022: Hydrophyllaceae is synonym of Boraginaceae]

Annual herbs, rarely shrubs, non-laticiferous. Mesophytic (Delta Intkey, 2023). Leaves alternate, rarely opposite, hairy or glandular, exstipulate. Flowers in scorpioid cymes, spikes or racemes. Pollination entomophilous (Delta Intkey, 2023). Flowers regular, ebracteolate. Calyx 5 lobed, free. Corolla 5 lobed, rarely contorted. Stamens 5, inserted on the corolla tube; filaments filiform; anthers versatile, ovate-oblong or linear. Styles 1 or 2. Stigma capitate. Fruit globose bivalve capsule, non-fleshy. Seeds numerous, minute.

According to POWO, 2022; genus *Hydrolea* consists of 14 accepted species.

***Hydrolea* L.**

Sp. Pl. ed. 2: 328.1762.

[According to POWO, 2022 *Hydrolea* belongs to family Hydroleaceae]

***Hydrolea zeylanica* (L.) Vahl**, Symb. Bot. 2: 46 .1791; Hook.f., Fl. Brit. India 4: 133.1885; Gamble, Fl. Madras 2: 884. 1921; Sasidh., Fl. Chinnar WLS 203. 1999.

Annual herb, sub erect, usually rooting from nodes. Stem terete, green, pubescent. Leaves simple, sub sessile, alternate, elliptic-lanceolate, 4–6 × 1–1.5 cm, apex acute, base cuneate, margins entire, green, glabrous. Flowers 5–10, in racemose inflorescence. Peduncle terete, 2 × 1 cm, green, pubescent. Pedicel terete, 0.8 –1 cm long, green, pubescent. Calyx lobes 5, ovate – lanceolate, 4–5 × 1–2 mm, free, green, pubescent. Corolla lobes 5, almost splitting up to the base, ovate–obtuse, 5–6 × 3–4 mm, blue with white tinch, glabrous. Stamens 5, filaments 3 × 1 mm, dilated at the base, blue, glabrous; anthers bilobed, curved, 3 × 1 mm, white, papillose. Style 2; 4 × 1 mm, blue, glabrous. Stigma globose, 1 × 1 mm, blue, glabrous. Capsules ovoid, 3–4 × 1 mm, green, glabrous. Seeds numerous, minute, hyaline.

Distribution: Tropical and Subtropical Asia to North East Australia (POWO, 2022)

Habitat: Wet sandy areas near rivers and ponds

Flowering and fruiting: January-August

Specimens examined: India, Kerala, Idukki, Erattayar, 08/02/2021, Divya K. Venugopal 170232 (CALI); Chinnar, s.d., K.K. Sajeev 15973 (KFRI).

BORAGINACEAE Juss.

Gen. Pl. [Jussieu] 128.1789, *nom. cons.*

Family is represented by 156 accepted genera (POWO, 2022) and consists of herbs, shrubs or trees; annuals or perennials; usually hispid throughout and not aromatic. Leaves alternate or opposite; entire; exstipulate; cystoliths commonly present (Delta Intkey, 2023). Flowers usually in cyme rarely solitary and axillary. Pollination entomophilous (Delta Intkey, 2023). Calyx lobes 5, usually persistent in fruits. Corolla lobes 5–6, salver to bell shaped. Stamen 5, inserted; filaments have nectariferous disk at base; anthers oblong. Style simple or forked. Some members shows heterostyly. Stigma capitate or bilobed. Fruit drupe or nutlets. Seed erect. Boraginaceae is also known as borage family and some species shows colour changes in corolla during senescence due to change in cellular fluid pH (Berry, 2014).

Key to genera

- 1a. Plants trees 2
- 1b. Plants herbs/shrubs..... 3
- 2a. Drupe ovoid-ellipsoid; seed single..... *Cordia*
- 2b. Drupe globose; seeds more than one *Ehretia*
- 3a. Flowers in raceme *Cynoglossum*
- 3b. Flowers in cyme/solitary 4
- 4a. Style single 5
- 4b. Style 2 *Coldenia*
- 5a. Stigma lobed..... *Rotula*
- 5b. Stigma not lobed 6
- 6a. Drupe with 4 nutlets *Heliotropium*
- 6b. Drupe without nutlets..... 7
- 7a. Leaves petiolate; stamens free *Tournefortia*
- 7b. Leaves sessile; stamens united..... *Trichodesma*

***Cordia* L.**

Sp. Pl.: 191.1753, *nom. cons.*

Key to species

- 1a. Leaves opposite; stamens inserted *C. sinensis*
- 1b. Leaves alternate; stamens exerted 2
- 2a. Leaves margin entire; flowers not fragrant 3
- 2b. Leaves margin serrate; flowers fragrant *C. octandra*
- 3a. Corolla glabrous; stigma clavate *C. monoica*
- 3b. Corolla pubescent; stigma lobed *C. dichotoma*

Cordia sinensis Lam., Tabl. Encycl. 1: 423. 1792. *Cordia gharaf* Ehrenb. ex Asch., Sitzungsber. Ges. Naturf. Freunde Berlin: 46.1879; Sasidh., Fl. Chinnar WLS 204. 1999. *Cordia rothii* Roem. & Schult., Syst. Veg., ed. 15 bis 4: 798.1819; Hook.f., Fl. Brit. India 4: 138. 1885; Gamble, Fl. Madras 2: 888. 1921.

Tree. Stem terete, green, young branches tomentose. Leaves simple, opposite, oblanceolate, 5–7 × 2.5–5 cm, apex obtuse, base cuneate, margins entire, green, pubescent, petiolate. Flowers in axillary and terminal cymes. Peduncle terete, 2–4 cm long, green, sparsely pubescent. Pedicel terete, 3–4 mm long, green, sparsely pubescent. Calyx tube 3–4 × 1.5–2 mm long, green, tomentose; lobes 4, apex slightly acute, minutely lobed, green, tomentose. Corolla tube 2–4 × 1.5–2 mm, white, glabrous; lobes 4, 3–4 × 1.3–1.5 mm, apex round, white, glabrous. Stamens 4, inserted; filaments 2–3 mm long, white, pubescent at base; anthers bilobed, oblong, 2 × 1 mm, cream, glabrous. Style arms 4, slender, 4–5 mm long, white, glabrous. Stigma clavate, 2–2.5 mm long, white, glabrous. Drupe ovoid, 8–10 mm long, green-orange, glabrous. Seed single.

Distribution: Africa to Indian Subcontinent (POWO, 2022)

Habitat: Dry deciduous forest

Flowering and fruiting: November–April

Specimen examined: India, Kerala, Idukki, Chinnar, 21/11/2017, Divya K. Venugopal 16278 (CALI).

Cordia monoica Roxb., Pl. Coromandel 1: 43.1796; Hook.f., Fl. Brit. India 4: 137. 1885; Gamble, Fl. Madras 2: 888. 1921; Sasidh., Fl. Chinnar WLS 204. 1999.

Tree. Stem terete, brownish green, branchlets tomentose. Leaves simple, alternate, ovate, 5–8 × 4–6 cm, apex acute, base round, margins entire, green, tomentose on abaxial surface, petiolate. Flowers in terminal cymes; not fragrant. Peduncle terete, 3–

5 cm long, brownish green, pubescent. Pedicel terete, 2–3 mm long, green, pubescent. Calyx tube 5–6 × 2–2.5 mm, green, densely tomentose; lobes 5, apex acute, minutely lobed, green, pubescent. Corolla tube 4–8 × 1.5–2 mm, minute, white, glabrous; lobes 5, linear, 3–4 × 1.5–2 mm, apex round, white, glabrous. Stamens 5, exserted; filaments 4–5 mm long, slender, white, glabrous; anthers bilobed, oblong, minute, brown, glabrous. Style arms 4, slender, 4–5 mm long, white, glabrous. Stigma clavate, c. 1 mm long, white, glabrous. Drupe ovoid with mucronate tip, 10–15 mm long, yellow, pubescent. Seed single.

Distribution: Tropical & South Africa, South West Arabian Peninsula, India to Myanmar (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: September–November

Specimen examined: India, Kerala, Idukki, Chinnar, 08/10/2018, Divya K. Venugopal 171422 (CALI).

Cordia dichotoma G.Forst., Fl. Ins. Austr.: 18.1786. *Cordia wallichii* G. Don, Gen. Hist. 4: 379 (1837); Sasidh., Fl. Periyar Tiger Reserve 261. 1998; Gamble, Fl. Madras 2: 887. 1921. *Cordia obliqua* var. *wallichii* (G.Don) C.B.Clarke, J.D.Hooker, Fl. Brit. India 4: 137.1883.

Tree. Stem terete, brown, branchlets lenticellate. Leaves simple, alternate, broadly ovate, 8–12 × 6–9 cm, apex acute, base obtuse, margins entire, green, pubescent on abaxial surface, petiolate. Flowers in axillary and terminal cymes; not fragrant. Peduncle terete, 3–5 cm long, brownish green, tomentose. Pedicel terete, 2–3 mm long, greenish brown, tomentose. Calyx tube 4–5 × 1.5–2.5 mm, green, glabrous; lobes 5, 3–4 × 1.5–2 mm, apex acute, green, pubescent. Corolla tube 5–6 × 2–3 mm, creamy white, pubescent; lobes 5, 2–3 × 1–1.5 mm, apex acute, creamy white, pubescent. Stamens 5, exserted; filaments slender, 3–4 mm long, white, glabrous; anthers bilobed, oblong, 2 × 1 mm, brown, glabrous. Style arms 4, coiled, c. 1 cm long, white, pubescent. Stigma lobed, white, glabrous. Drupe ovoid, 2–2.5 cm long, yellow, rugose. Seed single.

Distribution: Indian Subcontinent to South West Pacific (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: April–December

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 22/04/1994, Jomy Augustine 13622 (CALI).

Cordia octandra A.DC., A. P. de Candolle, Prodr. 9:477.1845; Hook.f., Fl. Brit. India 4: 140. 1885; Gamble, Fl. Madras 2: 889. 1921; Sasidh., Fl. Periyar Tiger Reserve 260. 1998.

Tree. Stem terete, brownish green, hairy. Leaves simple, alternate, widely ovate, 6–9 × 4–6 cm, apex acuminate, base obtuse, margins serrate, green, nearly glabrous, petiolate. Flowers in terminal long peduncled cymes; flowers fragrant. Peduncle terete, slender, 6–8 × 0.1–0.15 cm, brownish green, tomentose. Pedicel terete, slender, 3–5 × 1 mm, brownish green, tomentose. Calyx tube cylindric, 3–5 × 3–4 mm, brown, densely woolly; lobes 4, minutely lobed, 2–3 × 2–3 mm, apex acute, green, pubescent. Corolla tube 5–6 mm long, white, glabrous; lobes 7, campanulate, 1–1.3 × 0.3–0.4 cm, apex round, creamy white, glabrous on outer surface, fragrant. Stamens 8, slightly exserted; filaments terete, 4–5 mm long, white, pubescent at base; anther bilobed, elliptic, 3 × 1 mm, brown, glabrous. Style absent. Stigma bilobed, 2 × 1 mm, creamy white, glabrous. Drupe ellipsoid, 2–3 cm long, green, glabrous. Seed single.

Distribution: India to Bangladesh (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: March–August

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 18/08/1993, Jomy Augustine 12383 (CALI); *ibid.*, 24/04/2017, Divya K. Venugopal 151277 (CALI).

***Cynoglossum* L.**

Sp. Pl.: 134.1753.

Cynoglossum zeylanicum (Sw. ex Lehm.) Thunb. ex Brand, Repert. Spec. Nov. Regni Veg. 13: 546.1915; Sasidh., Fl. Periyar Tiger Reserve 261. 1998; Sasidh., Fl. Chinnar WLS 205. 1999. *Cynoglossum furcatum* Wall., W.Roxburgh, Fl. Ind. 2: 6.1824; Hook.f., Fl. Brit. India 4: 155. 1885; Gamble, Fl. Madras 2: 900. 1921.

Herb. Stem terete, branched, green, pubescent. Leaves simple, alternate, lanceolate, 4–5 × 1–2 cm, apex acute, base cuneate, margins entire, green, pubescent on abaxial surface, petiolate. Flowers in racemes. Peduncle terete, 8–15 cm long, green, glabrous. Pedicel terete, 1–2 mm long, green, puberulent. Calyx tube 1–1.2 × 1 mm, green, puberulent; lobes 5, 1–1.5 × 1 mm, apex round, green, puberulent, persistent. Corolla tube 1.8–2 × 1.9–2 mm, bluish white, glabrous; lobes 5, campanulate, 3–4 mm long, apex round, bluish white, glabrous. Stamens 5, free, inserted; filaments absent; anthers bilobed, elliptic, 1 mm long, yellow, glabrous. Style single, minute,

c. 1 mm long, white, glabrous, gynobasic. Stigma capitate, minute, white, glabrous. Drupe of 4 nutlets, round, 2–3 mm long, yellowish green, with glochidiate hairs.

Distribution: Afghanistan to South Japan and Philippines (POWO, 2022)

Habitat: Semi evergreen forest

Flowering and fruiting: January-December

Specimens examined: India, Kerala, Idukki, Way to Marayur, 09/01/2004, Reji P. 96362 (CALI); Kanthaloor, Mannavan shola, 25/02/2003, Nishitha P. 90449 (CALI); Mathikettan Shola National Park, 23/08/2014, S. Syam Radh 143524 (CALI); *ibid.*, 11/12/2016, Divya K. Venugopal 151384 (CALI); Meesapulimala, 15/10/2019, Divya K. Venugopal 170387 (CALI); Vattavada, 29/03/1978, Nambiar 00221 (KFRI); Devikulam, 27/07/1982, Nambiar 1828 (KFRI).

***Ehretia* P. Browne**

Civ. Nat. Hist. Jamaica: 168.1756.

Key to species

- 1a. Leaves sessile; calyx tube absent *E. microphylla*
- 1b. Leaves petiolate; calyx tube present 2
- 2a. Leaves whorled *E. wightiana*
- 2b. Leaves alternate 3
- 3a. Flowers sessile; cymose *E. aspera*
- 3b. Flowers pedicellate; racemose *E. acuminata*

Ehretia microphylla Lam., Tabl. Encycl. 1:425.1792; Gamble, Fl. Madras 2: 891. 1921. *Carmona retusa* (Vahl) Masam, Trans. Nat. Hist. Soc. Formosa 30: 61.1940; Sasidh., Fl. Chinnar WLS 204. 1999. *Ehretia buxifolia* Roxb., Pl. Coromandel 1: 42.1796; Hook.f., Fl. Brit. India 4: 144. 1885.

Small tree. Stem terete, green-brown, branched, glabrous. Leaves simple, whorled, obovate, 2–4 × 1–2 cm, apex obtuse with many minute lobes, base cuneate, margins entire, green, pubescent, sessile. Flowers in axillary cymes, subsessile. Calyx tube absent; lobes 5, divided up to base, 3–4 mm long, apex acute, green, pubescent, persistent. Corolla tube minute, white, glabrous; lobes 5, 3–4 mm long, apex obtuse, white, glabrous. Stamens 5, exserted; filaments terete, minute, white, glabrous; anthers bilobed, ovate, >1 mm long, brown, glabrous. Style terete, elongate, slender, 4–5 mm long, white, glabrous. Stigma not lobed, minute, >1 mm long, white, glabrous. Drupe globose, 3–4 mm long, green, red when ripe, glabrous. Seeds 4.

Distribution: India to Nansei-shoto and Solomon Islands (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: March-June

Specimens examined: India, Kerala, Idukki, Chinnar, 16/03/2021, Divya K. Venugopal 181256 (CALI); *ibid.*, 18/03/2021, Divya K. Venugopal 181277 (CALI).

Ehretia aspera Willd, Phytographia 1: 4.1794. *Ehretia indica* (Dennst. ex Kostel.) M.R.Almeida & S.M.Almeida, J. Bombay Nat. Hist. Soc. 90: 424.1994; Sasidh., Fl. Periyar Tiger Reserve 261. 1998. *Ehretia canarensis* Miq. In Pl. Hohenack. No. 285; Gamble, Fl. Madras 2: 891. 1921. *Ehretia laevis* var. *canarensis* Miq. ex C.B.Clarke, J.D.Hooker, Fl. Brit. India 4: 142.1884. *Ehretia laevis* var. *pubescens* (Royle ex Benth.) C.B.Clarke, J.D.Hooker, Fl. Brit. India 4: 142.1884. *Ehretia pubescens* Royle ex Benth., J.F.Royle, Ill. Bot. Himal. Mts.: 306.1836; Gamble, Fl. Madras 2: 891. 1921; Sasidh., Fl. Chinnar WLS 206. 1999.

Tree. Stem terete, brownish green, branched, glabrous. Leaves simple, alternate, obovate, 9–10 × 3–4 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary cymes, sessile. Peduncle terete, 1–3 cm long, brownish green, tomentose. Calyx tube minute, green, glabrous; lobes 5, minutely lobed, c. 1 mm long, apex acute, green, glabrous. Corolla tube minute, c. 1 mm long, white, glabrous; lobes 5, 2–3 × 1–1.5 mm, apex round, white, glabrous. Stamens 5, exserted; filaments terete, 3 mm long, white, glabrous; anthers bilobed, oblong, minute, >1 mm long, white, glabrous. Style splitted into two, 2 mm long, white, glabrous. Stigma minute, white, glabrous. Drupe globose, 3–4 mm long, red, glabrous. Seeds 3–4, minute.

Distribution: Pakistan to Hainan and Peninsula Malaysia (POWO, 2022)

Habitat: Semi evergreen forest margins

Flowering and fruiting: April-September

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 16/08/1994, Jomy Augustine 13913 (CALI); *ibid.*, 24/04/2017, Divya K. Venugopal 151267 (CALI).

Ehretia acuminata R.Br. Prodr. Fl. Nov. Holland.: 497.1810. *Ehretia ovalifolia* Hassk., Cat. Hort. Bot. Bogor. Alt.: 137.1844; Sasidh., Fl. Chinnar WLS 205. 1999; Hook.f., Fl. Brit. India 4: 143. 1885; Gamble, Fl. Madras 2: 891. 1921.

Tree. Stem terete, branchlets lenticellate, brown. Leaves simple, alternate, oblong, 6–7 × 2–4 cm, apex obtuse, base cuneate, margins minutely dentate, green, pubescent

along nerves, petiolate. Flowers in axillary and terminal racemes. Peduncle terete, 6–10 cm long, green, glabrous. Pedicel terete, 1.5–3 mm long, green, glabrous. Calyx tube 0.5–1 mm long, green, pubescent; lobes 5, 1–1.2 × 1–1.1 mm, apex obtuse, green, pubescent. Corolla tube 2–3 × 1.2–1.5 mm, white, glabrous; lobes 5, 2–2.3 × 1.2–1.5 mm, apex obtuse, white, glabrous. Stamens 5, exserted; filaments terete, c. 4 mm long, slender, white, glabrous; anthers bilobed, oblong, >1 mm long, pale brown, glabrous. Style splitted into two, c. 2 mm long, white, glabrous. Stigma minute, white, glabrous. Drupe globose, 4–5 mm long, green-orange, glabrous. Seeds more than 1.

Distribution: Tropical & Subtropical Asia to East Australia (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: January-May

Specimen examined: India, Kerala, Idukki, Chinnar, 12/03/2021, Divya K. Venugopal 181300 (CALI).

Ehretia wightiana Wall. ex G.Don, Gen. Hist. 4: 388.1837; Hook.f., Fl. Brit. India 4: 143. 1885; Gamble, Fl. Madras 2: 891. 1921; Sasidh., Fl. Chinnar WLS 206. 1999.

Tree. Stem terete, branchlets white. Leaves simple, whorled, obovate, 3–4 × 1–3 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Flowers in terminal cymes, small. Peduncle terete, 2–4 cm long, green, glabrous. Pedicel terete, 2–3 mm long, green, glabrous. Calyx tube minute, c. 1 mm long, green, pubescent; lobes 5, 1–2 × 1–1.1 mm, apex obtuse, green, pubescent. Corolla tube 2–4 × 2 mm, white, glabrous; lobes 5, 3–4 mm long, apex round, white, glabrous. Stamens 5, exserted; filaments slender, 2 × 1 mm, white, glabrous; anthers bilobed, oblong, > 1 mm long, pale brown, glabrous. Style splitted into two, 1 mm long, white, glabrous. Stigma minute, white, glabrous. Drupe globose, 2–4 mm long, green, glabrous. Seeds more than 1.

Distribution: South West India (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: February-May

Specimen examined: India, Kerala, Idukki, Chinnar, 16/03/2021, Divya K. Venugopal 181293 (CALI).

Heliotropium Tourn. ex L.

Sp. Pl.: 130.1753.

Key to species

1a. Leaves ovate; flowers sessile; corolla lobes glabrous;

staminal filaments absent..... *H. indicum*

1b. Leaves lanceolate; flowers pedicellate; corolla lobes pubescent;

staminal filaments present..... *H. marifolium*

Heliotropium indicum L., Sp. Pl.: 139.1753; Hook.f., Fl. Brit. India 4: 152. 1885; Gamble, Fl. Madras 2: 896. 1921; Sasidh., Fl. Periyar Tiger Reserve 261. 1998.

Figure 21 D.

Herb. Stem terete, branched, green, pubescent. Leaves simple, opposite, ovate, 5–10 × 3–5 cm, apex obtuse, base cordate, margins minutely lobed, green, hispid, petiolate. Flowers in terminal scorpioid cymes, sessile. Peduncle terete, 10–13 cm long, green, tomentose. Calyx tube almost absent; lobes 5, linear, 1.5–2 × 1–1.2 mm, apex acute, green, hispid. Corolla tube 3–5 × 1.2–1.5 mm, white, glabrous; lobes 5, > 1 mm long, apex almost round with minute lobes, white, glabrous. Stamens 5, inserted; filaments absent; anthers bilobed, oblong, minute, > 1 mm long, pale yellow, glabrous. Style terete, single, 2–3 mm long, white, glabrous. Stigma conical, minute, apex obtuse, white, glabrous. Drupe ovoid, with 4 nutlets, 2–3 mm long, green, glabrous.

Distribution: Peru to Brazil and North Argentina (POWO, 2022)

Habitat: Paddy fields

Flowering and fruiting: August–October

Specimen examined: India, Kerala, Idukki, Kattappana, 15/09/2019, Divya K. Venugopal 171465 (CALI).

Heliotropium marifolium J.Koenig ex Retz., Observ. Bot. 2: 8. 1781; Hook.f., Fl. Brit. India 4: 152. 1885; Sasidh., Fl. Chinnar WLS 206. 1999. *Heliotropium scabrum* Retz., Observ. Bot. 2: 8.1781; Gamble, Fl. Madras 2: 897. 1921.

Herb, prostrate. Stem terete, branched, green, pubescent. Leaves simple, alternate, lanceolate, 3–7 × 2–4 mm, apex acute, base round, margins entire, green, pubescent on both surfaces, subsessile. Flowers in axillary and terminal cymes. Peduncle terete, 1–2 cm long, green, pubescent. Pedicel terete, 1–2 mm long, green, pubescent. Calyx tube almost absent; lobes 5, lanceolate, 2–2.5 × 1 mm, apex acute, green, pubescent. Corolla tube 3–4 × 1–1.5 mm, white, pubescent at throat; lobes 5, 1–2 × 1–1.5 mm, apex round, white, pubescent at throat. Stamens 5, free, inserted; filaments terete,

minute, >1 mm long, white, glabrous; anthers bilobed, connate, minute, >1 mm long, white, pubescent. Style single, terete, minute, >1 mm long, white, glabrous. Stigma conical, >1 mm long, white, glabrous. Drupe sub globose, 1.5–2 mm long, 4 nutlets, green, smooth.

Distribution: India to Hainan and Peninsula Malaysia, Jawa to Lesser Sunda Islands (Flores) (POWO, 2022)

Habitat: Dry and moist deciduous forests

Flowering and fruiting: March–September

Specimens examined: India, Kerala, Idukki, Chinnar, 09/03/2021, Divya K. Venugopal 181220 (CALI); *ibid.*, 19/05/1999, Thushar K.V. 79371 (CALI); *ibid.*, 19/05/1977, P. Prashy 79477 (CALI).

Tournefortia L.

Sp. Pl.: 140.1753.

Tournefortia montana Lour., Fl. Cochinch.: 122.1790. *Tournefortia heyneana* A.DC., A.P.de Candolle, Prodr. 9: 516.1845; Sasidh., Fl. Periyar Tiger Reserve 262. 1998; Hook.f., Fl. Brit. India 4: 145. 1885; Gamble, Fl. Madras 2: 893. 1921.

Scandent shrub. Stem terete, green, pubescent. Leaves simple, opposite, lance-ovate, 5–10 × 3–4 cm, apex acuminate, base round, margins entire, green, pubescent, petiolate. Flowers in terminal scorpioid cymes. Peduncle terete, slender, 3–5 cm long, green, pubescent. Pedicel terete, 1–2 mm long, green, pubescent. Calyx tube absent; lobes 5, c. 1 mm long, apex acute, persistent, green, pubescent. Corolla tube bottle shaped, 4 × 1 mm long, white, pubescent; lobes 5, minute, 1 × 1 mm long, apex acute, white, glabrous. Stamens 5, free, inserted; filaments absent; anthers bilobed, oblong, 2 × 1 mm, white, glabrous. Style short, single, c. 1 mm long, minutely bilobed, white, glabrous. Stigma capitate, > 1 mm long, white, glabrous. Drupe ovoid, 3–4 mm long, small, green, glabrous.

Distribution: East Himalaya to China (Yunnan) and Indo-China (POWO, 2022)

Habitat: Evergreen & Semi evergreen forests

Flowering and fruiting: April–August

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 21/04/1995, Jomy Augustine 15065 (CALI); Mankulam, 08/06/2017, Divya K. Venugopal 151481(CALI).

***Trichodesma* R. Br.**

Prodr. Fl. Nov. Holland.: 496.1810, *nom. cons.*

Key to species

- 1a. Calyx tube absent; corolla lobes pale blue;
filaments absent *T. zeylanicum*
- 1b. Calyx tube present; corolla lobes white with brown patches;
filaments present *T. indicum*

Trichodesma zeylanicum (Burm.f.) R.Br., Prodr. Fl. Nov. Holland.: 496.1810; Hook.f., Fl. Brit. India 4: 154. 1885; Gamble, Fl. Madras 2: 899. 1921; Sasidh., Fl. Periyar Tiger Reserve 262. 1998; Sasidh., Fl. Chinnar WLS 207. 1999.

Herb. Stem terete, strigose, green, pubescent. Leaves simple, opposite, lanceolate, 3–6 × 1–1.5 cm, apex acute, base cuneate, margins entire, green, pubescent, sessile. Flowers in axillary or terminal cymes. Peduncle terete, 2–4 cm long, green, tomentose. Pedicel terete, 1–2 cm long, green, pubescent. Calyx tube absent; lobes 5, 6–8 × 2.5–3 mm, deeply divided, apex acuminate, persistent, green, villous. Corolla tube cylindric, longer than lobes, 5–7 mm long, pale blue, glabrous; lobes 5, 3.5–4 × 3–3.2 mm, apex ovate, pale blue, glabrous. Stamens 5, inserted, united; filaments absent; anthers bilobed, lanceolate, pale yellow, villous. Style terete, single, slender, 5–6 mm long, white, glabrous. Stigma capitate, small, white, glabrous. Drupe ovoid, 3–4 mm long, rugose, green, glabrous.

Distribution: Ethiopia to South Africa, West Indian Ocean, South West Arabian Peninsula, Tropical Asia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: August–March

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 26/08/1993, Jomy Augustine 12403 (CALI); Kattappana, 23/02/2019, Divya K. Venugopal 162341(CALI).

Trichodesma indicum (L.) Sm., A.Rees, Cycl. 36: n.º 1.1817; Hook.f., Fl. Brit. India 4: 153. 1885; Gamble, Fl. Madras 2: 899. 1921; Sasidh., Fl. Chinnar WLS 207. 1999. Shrub. Stem terete, strigose, green, pubescent. Leaves simple, opposite, lanceolate, 1–4 × 0.2–0.4 cm, apex slightly obtuse, base auricled, margins entire, green, pubescent, sessile. Flowers solitary or in axillary cymes. Peduncle terete, green, tomentose. Pedicel terete, 0.5–1.5 cm long, green, tomentose. Calyx tube 4–5 × 7–8 mm, green, pubescent; lobes 5, 0.7–1 × 0.2–0.3 cm, apex acute, persistent, green, villous. Corolla

tube 4–6 × 2–3 mm, white, glabrous; lobes 5, 3–4 × 2–3 mm, apex acuminate, white with brown patches on the mouth, glabrous. Stamens 5, inserted, united; filaments terete, very minute, >1 mm long, white, glabrous; anthers bilobed, elongate, 7 × 1 mm, white, glabrous. Style terete, single, slender, 6–7 mm long, white, glabrous. Stigma minute, pointed, white, glabrous. Drupe ovoid, 3–5 mm long, rugose, green, glabrous.

Distribution: Afghanistan to Thailand, Philippines (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: February–December

Specimens examined: India, Kerala, Idukki, Chinnar, 14/02/2001, *Deepa K.A.* 73799 (CALI); Kanthaloor – Mannavan shola, 25/02/2003, *Nisha Kumari P.* 88858 (CALI); Way to Karimutty, 29/12/2017, *Divya K. Venugopal* 159400 (CALI).

***Coldenia* L.**

Sp. Pl.: 125.1753.

***Coldenia procumbens* L.**, Sp. Pl.: 125.1753; Hook.f., Fl. Brit. India 4: 144. 1885; Gamble, Fl. Madras 2: 892. 1921; Sasidh., Fl. Periyar Tiger Reserve 260. 1998.

Herb. Stem terete, prostrate, branched, green, white tomentose. Leaves simple, alternate, obovate and oblique, 1–3 × 0.5–1.5 cm, apex emarginate, base cuneate, margins dentate, green, pubescent, subsessile. Flowers in axillary cymes or solitary, sessile. Calyx tube absent; lobes 4, 1–2 mm long, deeply divided, apex acute, green, persistent, pubescent. Corolla tube 1–1.5 mm long, white, glabrous; lobes 4, 1–1.2 × 1–1.2 mm, apex obtuse, white, glabrous. Stamens 4, inserted; filaments terete, >1 mm long, white, glabrous; anthers bilobed, ovate, >1 mm long, pale brown, glabrous. Styles 2, slender, >1 mm long, white, glabrous. Stigma capitate, minute, white, glabrous. Drupe with 4 nutlets, 2–3 mm long, green, glabrous.

Distribution: Tropical & Subtropical Old World (POWO, 2022)

Habitat: Barren lands, lake shore

Flowering and fruiting: February–May

Specimen examined: India, Kerala, Idukki, Kanthallur, 25/02/2018, *Divya K. Venugopal* 174264 (CALI).

***Rotula* Lour.**

Fl. Cochinch.: 121.1790.

Rotula aquatica Lour., Fl. Cochinch.: 121.1790; Hook.f., Fl. Brit. India 4: 144. 1885; Gamble, Fl. Madras 2: 892. 1921; Sasidh., Fl. Periyar Tiger Reserve 260. 1998.

Figure 21 C.

Shrub. Stem terete, grey, glabrous. Leaves simple, alternate, oblong, 1–2 × 0.2–0.4 cm, apex obtuse, base round, margins entire, green, pubescent, petiolate. Flowers in axillary cymes or solitary. Pedicel terete, 1–2 mm long, green, pubescent. Calyx tube absent; lobes 5, 5–6 × 1–1.2 mm, deeply divided, apex acute, green, pubescent, persistent. Corolla tube 2–2.5 × 1.8–2.1 mm, pink, glabrous; lobes 5, 4–5 × 3–3.3 mm, apex obtuse, pink, glabrous. Stamens 5, inserted; filaments terete, 3 × 1 mm, pale pink, glabrous; anthers bilobed, elliptic, 1 × 1 mm, white, glabrous. Style single, terete, slender, 4 × 1 mm, pale pink, glabrous. Stigma small, bilobed, >1 mm long, pink, glabrous. Drupe subglobose, 3–4 mm long, red, glabrous.

Distribution: East Brazil, West Tropical Africa, Tropical & Subtropical Asia (POWO, 2022)

Habitat: Barren lands, lake shore

Flowering and fruiting: February-May

Specimen examined: India, Kerala, Idukki, Anakkulam, 15/02/2019, Divya K. Venugopal 168935 (CALI).

CONVOLVULACEAE Juss.

Gen. Pl. [Jussieu] 132 (1789), *nom. cons.*

Herbs or shrubs. Stem twiners or scrambling (Delta Intkey, 2023). Leaves alternate, exstipulate. Flowers in axillary cymes, rarely solitary; with involucre of bracts. Calyx lobes 5, free, persistent. Corolla funnel shaped; lobes 5, shortly lobed. Stamens 5, inserted; filaments slender; anthers linear, bilobed. Style filiform. Stigma capitate. Fruit berry or capsule. Seeds 2–4.

According to POWO 2022, there are 59 accepted genera worldwide.

Key to Genera

- 1a. Leaves absent *Cuscuta*
- 1b. Leaves present..... 2
- 2a. Leaves margin entire 3
- 2b. Leaves margin dentate *Xenostegia*

3a. Style absent	<i>Erycibe</i>
3b. Style present.....	4
4a. Style 1.....	5
4b. Style 2	<i>Evolvulus</i>
5a. Stamen exerted	<i>Merremia</i>
5b. Stamen inserted.....	6
6a. Stigma unlobed.....	<i>Ipomoea</i>
6b. Stigma bilobed	7
7a. Filaments glabrous	<i>Hewittia</i>
7b. Filaments pubescent.....	8
8a. Corolla salver shaped, white; stigma lobes linear	<i>Rivea</i>
8b. Corolla funnel shaped, pink; stigma lobes globose	<i>Argyreia</i>

***Argyreia* Lour.**

Fl. Cochinch.: 134.1790.

Key to species

1a. Leaves broadly ovate, apex acuminate.....	<i>A. hirsuta</i>
1b. Leaves obovate, apex acute.....	2
2a. Flowers in terminal cymes	<i>A. osyrensis</i>
2b. Flowers in axillary cymes	<i>A. argentea</i>

Argyreia hirsuta Wight & Arn., Madras J. Lit. Sci. 5: 18. 1837; Hook.f., Fl. Brit. India 4: 189. 1885; Gamble, Fl. Madras 2: 909. 1921; Sasidh., Fl. Periyar Tiger Reserve 263. 1998.

Figure 21 G.

Climbing shrub. Stem terete, unbranched, glabrous. Leaves simple, alternate, broadly ovate, 5–8 × 3–4 cm, apex acuminate, base cordate, margins entire, green, pubescent on abaxial surface, petiolate. Flowers in axillary cymes. Peduncle terete, 3–6 cm long, green, tomentose. Pedicel terete, 0.5–1 cm long, green, tomentose. Bract leafy, green, pubescent, persistent. Calyx lobes 5, 6–7 mm long, apex obtuse, green, sparsely pubescent, persistent. Corolla tube 3–3.5 cm long, pink, sparsely pubescent; lobes 5, funnel shaped, minutely lobed, apex obtuse, pink, glabrous. Stamens 5, inserted; filaments 2.8 cm long, pale lavender, hairy at base; anthers bilobed, oblong, 1 mm long, pale lavender, glabrous. Style filiform, 3.2 cm long, pale lavender, glabrous.

Stigma bilobed, lobes globose, minute, pale lavender, glabrous. Berry indehiscent, 1 cm long, ovoid, yellow, glabrous.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: July-October

Specimens examined: India, Kerala, Idukki, Kurisumala, 06/08/2017, Divya K. Venugopal 154192 (CALI); Mathikettan shola National park, 17/07/2015, S. Syam Radh 145051 (CALI).

Argyreia osyrensis (Roth) Choisy, A.P. de Candolle, Prodr. 9: 334. 1845. *Argyreia imbricata* (Roth) Santapau & Patel, Trans Bose Res. Inst. Calcutta 22: 40. 1958; Sasidh., Fl. Periyar Tiger Reserve 263. 1998. *Lettsomia aggregata* Roxb., Fl. Ind. 2: 76. 1824; Hook.f., Fl. Brit. India 4: 191. 1885; Gamble, Fl. Madras 2: 910. 1921.

Climbing shrub. Stem terete, unbranched, white tomentose. Leaves simple, alternate, obovate, 6–10 × 4–6 cm, apex acute, base cordate, margins entire, green, white tomentose on abaxial surface, petiolate. Flowers in terminal cymes. Peduncle terete, 4–6 cm long, green, white tomentose. Pedicel terete, minute, green, white tomentose. Bracts minute, green, white tomentose. Calyx lobes 5, 8 mm long, apex obtuse, green, white tomentose, persistent. Corolla tube 1 cm long, pink, white tomentose; lobes 5, funnel shaped, minutely lobed, 5–7 mm long, apex obtuse, pink, sparsely tomentose on outer surface. Stamens 5, inserted; filaments 1.2 cm long, pink, hairy at base; anthers bilobed, oblong, >1 mm long, pink, glabrous. Style filiform, 1 cm long, pink, glabrous. Stigma bilobed, lobes globose, 1 mm long, white, glabrous.

Distribution: South India to Hainan & North Sumatera (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: January-April

Specimen examined: India, Kerala, Idukki, Anayirangal dam, 05/01/2017, Divya K. Venugopal 151565 (CALI).

Argyreia argentea (Roxb.) Sweet, Hort. Brit., ed. 2: 373. 1830. *Argyreia sericea* St. – Lag., Ann. Soc. Bot. Lyon 7: 120. 1880, *nom. illeg.*; Hook. f., Fl. Brit. India 4: 188. 1885; Gamble, Fl. Madras 2: 908. 1921; Sasidh., Fl. Chinnar WLS 208. 1999.

Climbing shrub. Stem terete, unbranched, sparsely pubescent. Leaves simple, alternate, obovate, 5–8 × 3–4 cm, apex acute, base cordate, margins entire, green, pubescent on abaxial surface, petiolate. Flowers in axillary cymes. Peduncle terete, 6–7 cm long, green, pubescent. Pedicel terete, 0.6–1 cm long, green, pubescent. Bracts

leafy, 5–6 mm long, green, pubescent. Calyx lobes 5, 1 cm long, apex acute, green, pubescent, persistent. Corolla tube 3–5 cm long, pink, pubescent on outer surface; lobes 5, funnel shaped, minutely lobed, apex obtuse, pink, pubescent on outer surface. Stamens 5, not equal, inserted; filaments 2.8 cm long; 3 cm long, white, hairy at base; anthers bilobed, oblong, > 1 mm long, white, glabrous. Style filiform, 2.5 cm long, white, glabrous. Stigma bilobed, lobes globose, 1 mm long, white, glabrous.

Distribution: Nepal to Myanmar (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: April–July.

Specimen examined: India, Kerala, Idukki, Mankulam, 14/06/2018, Divya K. Venugopal 170213 (CALI).

***Cuscuta* L.**

Sp. Pl.: 124.1753.

Key to species

1a. Filaments white; style 2 *C. chinensis*

1b. Filaments pale yellow; style 1 *C. reflexa*

Cuscuta chinensis Lam., Encycl. 2: 229.1786; Hook.f., Fl. Brit. India 4: 227. 1885; Gamble, Fl. Madras 2: 931. 1921; Sasidh., Fl. Periyar Tiger Reserve 264. 1998; Sasidh., Fl. Chinnar WLS 210. 1999.

Figure 21 E.

Climber. Stem terete, yellow, glabrous. Leaves absent. Flowers in axillary fascicles, rarely solitary; sessile. Bracts absent. Calyx lobes 5, 2 mm long, apex acute, yellow, glabrous. Corolla lobes 5, 3 mm long, apex shortly acuminate, white, glabrous. Scales 5, minute, fimbriate. Stamens 5, inserted; filaments linear, 2 mm long, white, glabrous; anthers oblong, exserted, > 1 mm long, orange, glabrous. Styles 2, elongate, white, glabrous. Stigma capitate, minute, white, glabrous.

Distribution: West & North East Tropical Africa, Madagascar, Asia to North & East Australia, South West & South Central U.S.A. to Mexico (POWO, 2022)

Habitat: In plains

Flowering and fruiting: November–January.

Specimen examined: India, Kerala, Idukki, Kovilkadavu, 28/12/2017, Divya K. Venugopal 151568 (CALI).

Cuscuta reflexa Roxb., Pl. Coromandel 2: 3.1799; Hook.f., Fl. Brit. India 4: 225. 1885; Gamble, Fl. Madras 2: 931. 1921; Sasidh., Fl. Periyar Tiger Reserve 264. 1998; Sasidh., Fl. Chinnar WLS 210. 1999.

Climber. Stem terete, yellowish, glabrous. Leaves absent. Flowers in axillary racemes; sessile. Bracts absent. Calyx lobes 5, cupular, 1 mm long, apex acute, yellow, glabrous. Corolla lobes 5, 7 mm long, apex acute, creamish white, glabrous. Scales 5, minute, fimbriate. Stamens 5, inserted; filaments minute, pale yellow, glabrous; anthers oblong, exserted, >1 mm long, yellow, glabrous. Style 1, minute, pale yellow, glabrous. Stigmas 2, ovoid, minute, pale yellow, glabrous.

Distribution: Afghanistan to Indo-China, Jawa (POWO, 2022)

Habitat: In plains

Flowering and fruiting: November-February

Specimens examined: India, Kerala, Idukki, Near pambala dam, 22/10/2017, Divya K. Venugopal 188842 (CALI); Mathikettan Shola National Park, 29/12/2014, S. Syam Radh 137912 (CALI); Periyar Tiger Reserve, 10/12/1994, Jomy Augustine 14321 (CALI).

Erycibe Roxb.

Pl. Coromandel 2: 31.1802.

Erycibe paniculata Roxb., Pl. Coromandel 2: 31.1802; Hook.f., Fl. Brit. India 4: 180. 1885; Gamble, Fl. Madras 2: 930. 1921; Sasidh., Fl. Periyar Tiger Reserve 264. 1998. Climbing shrub. Stem terete, woody, tomentose. Leaves simple, alternate, elliptic, 3–8 × 2–4 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal cymes. Peduncle terete, 3–6 cm long, brown, tomentose. Pedicel terete, 4–7 mm long, brown, tomentose. Bracts small, lanceolate, brown, tomentose. Calyx tube 1 mm long, brown, tomentose; lobes 5, 2 mm long, apex obtuse, green, pubescent. Corolla tube 2 mm long, creamy white, glabrous; lobes 5, deeply lobed, 3 mm long, apex obtuse, creamy white, glabrous. Stamens 5, exserted; filaments short, white, glabrous; anthers bilobed, ovate, >1 mm long, white, glabrous. Style absent. Stigma sub globose, 2 mm long, white, glabrous.

Distribution: India, Sri Lanka, Assam to Bangladesh (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: December-April

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 29/12/1993, *Jomy Augustine 13014* (KFRI).

***Evolvulus* L.**

Sp. Pl. ed. 2: 391.1762.

***Evolvulus alsinoides* (L.) L.**, Sp. Pl. ed. 2: 392.1762; Hook.f., Fl. Brit. India 4: 220. 1885; Gamble, Fl. Madras 2: 922. 1921; Sasidh., Fl. Periyar Tiger Reserve 264. 1998; Sasidh., Fl. Chinnar WLS 210. 1999.

Herb. Stem terete, branched, green, villous. Leaves simple, opposite, oblong, 1–2 × 0.5–1 mm, apex sub acute, base round, margins entire, green, pubescent, petiolate. Flowers solitary. Pedicel terete, 4–6 mm long, terete, pubescent. Bract linear, 1 mm long, green, pubescent. Calyx lobes 5, 3 mm long, apex acuminate, green, pubescent. Corolla lobes 5, 1 cm long, apex obtuse, rotate, blue, glabrous. Stamens 5, exserted; filaments filiform, 4 mm long, white, glabrous; anthers oblong, exserted, 1 mm long, white, glabrous. Styles 2, bifid, 1 mm long, white, glabrous. Stigma minute, white, glabrous.

Distribution: Tropics & Subtropics (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: November–December

Specimens examined: India, Kerala, Idukki, Near pambla dam, 14/11/2018, *Divya K. Venugopal 188872* (CALI); Marayur, 28/11/1979, *Nambiar 1042* (KFRI); Thekkady, 10/11/1997, *Jomy Augustine 17907* (CALI).

***Hewittia* Wight & Arn.**

Madras J. Lit. Sci. 5:22. 1837, *nom. cons. prop.*

***Hewittia malabarica* (L.) Suresh, D.H.Nicolson, C.R.Suresh & K.S.Manilal**, Interpr. Van Rheede's Hort. Malab.: 88 (1988); Sasidh., Fl. Chinnar WLS 210. 1999; Sasidh., Fl. Periyar Tiger Reserve 266. 1998. *Hewittia bicolour* (Vahl) Wight & Arn., Madras J. Lit. Sci. 5: 22. 1837; Hook.f., Fl. Brit. India 4: 216. 1885; Gamble, Fl. Madras 2: 924. 1921.

Climber. Stem terete, green, pubescent. Leaves simple, alternate, broadly ovate, 6.5–8 × 7–8 cm, apex acute, base cordate, margins entire, angled, green, pubescent, petiolate. Flowers in axillary cymes. Bracts linear, green, pubescent. Peduncle terete, 3–4 cm long, green, glabrous. Pedicel terete, 5–8 mm long, green, glabrous. Calyx

lobes 5 (outer 3 large & 2 inner small), larger ones – ovate; smaller ones – lanceolate, 4–7 mm long, apex acute, unequal, green, pubescent. Corolla tube 2 cm long, cream, pubescent; lobes 5, campanulate, minutely lobed, apex obtuse, slightly acuminate at centre of each lobe, cream with purple at centre, pubescent. Stamens 5, inserted; filaments linear, 3 mm long, white, glabrous; anthers bilobed, reniform, > 1 mm long, white, glabrous. Style filiform, 5 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous.

Distribution: Tropical & Subtropical Old World (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: August-January

Specimens examined: India, Kerala, Idukki, Near Anayirangal dam, 21/11/2017, Divya K. Venugopal 173446 (CALI); Painavu, 07/08/2017, Divya K. Venugopal 154318 (CALI); Thekkady, 16/01/1997, Jomy Augustine 17188 (CALI).

Ipomoea L.

Sp. Pl.: 159.1753, *nom. cons.*

Key to species

- 1a. Stem prickly *I. alba*
- 1b. Stem not prickly 2
- 2a. Flowers in cymes 3
- 2b. Flowers solitary 4
- 3a. Flowers with pedicels 5
- 3b. Flowers without pedicels 6
- 4a. Leaves simple 7
- 4b. Leaves compound *I. cairica*
- 5a. Leaves glabrous *I. hederifolia*
- 5b. Leaves pubescent 8
- 6a. Stem brownish green; leaves compound *I. capitellata*
- 6b. Stem green; leaves simple *I. wightii*
- 7a. Leaves apex obtuse; corolla pink *I. barlerioides*
- 7b. Leaves apex acuminate; corolla yellow with purple at
centre *I. obscura*
- 8a. Leaves simple 9
- 8b. Leaves compound *I. nil*

- 9a. Corolla lobes tomentose..... *I. eriocarpa*
 9b. Corolla lobes glabrous 10
 10a. Calyx lobes apex obtuse..... *I. campanulata*
 10b. Calyx lobes apex acuminate..... *I. aitonii*

Ipomoea alba L., Sp. Pl.: 161. 1753; Sasidh., Fl. Periyar Tiger Reserve 266. 1998.
Ipomoea bona-nox L., Sp. Pl. ed. 2.: 228. 1762, *nom. superfl.*, Hook.f., Fl. Brit. India
 4: 197. 1885. *Calonyction bona-nox* (Spreng.) Bojer, Hortus Maurit.: 227 (1837),
nom. superfl.; Gamble, Fl. Madras 2: 920. 1921.

Climber. Stem terete, green, prickly. Leaves simple, alternate, ovate, 6–10 × 4–6 cm,
 apex acuminate, base cordate, margins entire, green, glabrous, petiolate. Flowers in
 axillary cymes. Peduncle terete, 4 cm long, green, glabrous. Pedicel terete, 4 mm
 long, green, glabrous. Bracts linear, green, glabrous, caducous. Calyx tube minute,
 green, glabrous; lobes 5, 6 mm long, apex acute, green, glabrous. Corolla tube 6–8 cm
 long, pale green, glabrous; lobes 5, campanulate, apex obtuse, white, glabrous.
 Stamens 5, unequal, inserted; filaments slender, 7 cm long; 6 cm long, white,
 glabrous; anthers reniform, 3 mm long, white, glabrous. Style slender, 7 cm long,
 white, glabrous. Stigma subglobose, 2 mm long, white, glabrous. Capsule sub
 globose, 7 mm long, brown, glabrous.

Distribution: Tropical and Sub tropical America (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: October–December

Specimen examined: India, Kerala, Idukki, Chinnar, 08/11/2018, Divya K. Venugopal
 157456 (CALI).

Ipomoea barlerioides (Choisy) Benth. ex C.B. Clarke, J.D. Hooker, Fl. Brit. India 4:
 201. 1885; Gamble, Fl. Madras 2: 915. 1921; Sasidh., Fl. Periyar Tiger Reserve 267.
 1998.

Climber. Stem terete, brownish green, pubescent. Leaves simple, alternate, ovate, 2–4
 × 1–2 cm, apex obtuse, base cordate, margins entire, green, pubescent, petiolate.
 Flowers solitary, axillary. Pedicel terete, 2–3 cm long, green, pubescent. Bracts
 lanceolate, green, pubescent. Calyx tube 3–5 mm long, green, pubescent; lobes 5,
 minute, apex acute, green, pubescent. Corolla tube 3 cm long, pink, pubescent; lobes
 5, 2 cm long, campanulate, apex obtuse, pink, pubescent. Stamens 5, inserted;
 filaments slender, 1.5 cm long, pale lilac, pubescent at base; anthers elliptic, 3 mm

long, lilac, glabrous. Style slender, 1.3 cm long, lilac, glabrous. Stigma capitate, minute, lilac, glabrous.

Distribution: Indian Subcontinent to Myanmar (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: May-December

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 10/06/1996, Jomy Augustine 16221 (CALI).

Ipomoea cairica (L.) Sweet, Hort. Brit.: 287. 1826; Gamble, Fl. Madras 2: 918. 1921; Sasidh., Fl. Periyar Tiger Reserve 267. 1998; Sasidh., Fl. Chinnar WLS 211. 1999. *Ipomoea palmata* Forssk., Fl. Aegypt. –Arab.: 43. 1775; Hook. f., Fl. Brit. India 4: 214. 1885.

Climber. Stem terete, green, glabrous. Leaves palmately compound, 5–7 lobed, alternate, elliptic, 2–6 × 3–7 cm, apex acute, margins entire, green, glabrous, petiolate. Flowers solitary. Pedicel terete, 1–1.5 cm long, green, glabrous. Calyx lobes 5, deeply lobed, 3–5 mm long, apex slightly acuminate, green, glabrous. Corolla tube 2–2.4 cm long, pink, glabrous; lobes 5, campanulate, 3–4 cm long, apex obtuse, pink, glabrous. Stamens 5, inserted; filaments slender, 2 cm long, pink, glabrous; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style slender, 2.2 cm long, pink, glabrous. Stigma globose, 2 mm long, white, glabrous.

Distribution: Tropical & South Africa, West Indian Ocean, Arabian Peninsula to Temperate East Asia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: February-June

Specimen examined: India, Kerala, Idukki, Kattapana, 16/03/2018, Divya K. Venugopal 158366 (CALI).

Ipomoea campanulata L., Sp. Pl.: 160. 1753; Gamble, Fl. Madras 2: 917. 1921; Sasidh., Fl. Periyar Tiger Reserve 267. 1998.

Climber. Stem terete, green, sparsely tomentose. Leaves simple, alternate, broadly ovate, 2–4 × 1–2 cm, apex acuminate, base cordate, margins entire, green, pubescent, petiolate. Flowers in axillary cymes. Peduncle terete, 4–5 cm long, green, sparsely tomentose. Pedicel terete, 2–2.6 cm long, green, sparsely tomentose. Bracts leafy, 6 mm long, green, pubescent. Calyx lobes 5, 1 cm long, apex obtuse, green, ciliate. Corolla tube 4 cm long, pale purple, glabrous; lobes 5, campanulate, 3 cm long, apex obtuse, pale purple with dark purple at centre, glabrous. Stamens 5, inserted; filaments

slender, 3 cm long, pale lilac, pubescent at base; anthers bilobed, elliptic, 3 mm long, white, glabrous. Style slender, 3.4 cm long, pale lilac, glabrous. Stigma globose, 2 mm long, white, glabrous.

Distribution: South Central China to Tropical Asia (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: October-December

Specimens examined: India, Kerala, Idukki, Neryamangalam to Adimali, 17/11/2020, Divya K. Venugopal 173305 (CALI); Periyar Tiger Reserve, 05/12/1994, Jomy Augustine 14292 (CALI).

Ipomoea capitellata Choisy, Mém. Soc. Phys. Genève 6: 457 (1833 publ. 1834)[Conv. Or.: 75]. *Ipomoea deccana* D.F. Austin, M.D. Dassanayake & al. (eds.), Revis. Handb. Fl. Ceylon 1: 324.1980; Sasidh., Fl. Periyar Tiger Reserve 267. 1998. *Ipomoea bracteata* Cav., Icon. 5:51. 1799; Hook.f., Fl. Brit. India 4: 203. 1885; Gamble, Fl. Madras 2: 918. 1921.

Climber. Stem terete, brownish green, tomentose. Leaves compound, 3-lobed, alternate, ovate, 3–5 × 2–4 cm, apex obtuse, margins entire, green, pubescent, petiolate. Flowers in axillary cymes, sessile. Peduncle terete, 3–3.6 cm long, brownish green, pubescent. Bract ovate, 1.5–1.9 cm long, green, pubescent. Calyx lobes 5, 4–5 mm long, apex acute, green, pubescent. Corolla tube 5–6 mm long, purple, glabrous; lobes 5, campanulate, 6–8 mm long, apex obtuse with acuminate at centre, purple, glabrous. Stamens 5, inserted; filaments slender, 5 mm long, pale purple, glabrous; anthers bilobed, elliptic, 1 mm long, white, glabrous. Style slender, 5–6 mm long, pale purple, glabrous. Stigma globose, 1–2 mm long, white, glabrous. Capsule globose, 4–6 mm long, green, glabrous.

Distribution: Indian subcontinent (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: October-December

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 15/11/1997, Jomy Augustine 16914 (CALI).

Ipomoea aitonii Lindl., Edwards's Bot. Reg. 21: t. 1794 (1836 publ. 1835). *Ipomoea pilosa* (Roxb.) Sweet, Hort. Brit.: 289 (1826), *nom. illeg.*; Hook. f., Fl. Brit. India 4: 213. 1885; Gamble, Fl. Madras 2: 917. 1921. *Ipomoea dichroa* Hochst. ex Choisy, A.P.de Candolle, Prodr. 9: 364.1845; Sasidh., Fl. Chinnar WLS 211. 1999.

Climber. Stem terete, brownish green, tomentose. Leaves simple, alternate, ovate, 2–4 × 1–2 cm, apex acuminate, base cordate, margins entire, green, white tomentose on abaxial surface, petiolate. Flowers in axillary cymes, lax. Peduncle terete, 3–5 cm long, brownish green, tomentose. Pedicel terete, 6–9 mm long, brownish green, tomentose. Bracts lanceolate, 5–7 mm long, green, tomentose. Calyx tube 4 mm long, green, tomentose; lobes 5, 6–7 mm long, apex acuminate, green, tomentose. Corolla tube 1–1.2 cm long, pink, glabrous; lobes 5, campanulate, 1.5 cm long, apex obtuse, pink, glabrous. Stamens 5, unequal, inserted; filaments slender, 6–7 mm long, lilac, glabrous; anthers bilobed, elliptic, 1 mm long, lilac, glabrous. Style slender, 7–9 mm long, lilac, glabrous. Stigma capitate, 1 mm long, lilac, glabrous.

Distribution: Africa, South Arabian Peninsula, Indian Subcontinent (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: October–December

Specimen examined: India, Kerala, Idukki, Chinnar, 08/11/2018, Divya K. Venugopal 157456 (CALI).

Ipomoea eriocarpa R. Br., Prodr. Fl. Nov. Holland.: 484.1810; Hook. f., Fl. Brit. India 4: 203. 1885; Sasidh., Fl. Periyar Tiger Reserve 267. 1998; Sasidh., Fl. Chinnar WLS 212. 1999. *Ipomoea hispida* (Vahl) Roem. & Schult., Syst. Veg. ed. 15[bis]. 4: 238 (1819), *nom. illeg.*; Gamble, Fl. Madras 2: 915. 1921.

Climber. Stem terete, green, tomentose. Leaves simple, alternate, ovate, 2–5 × 1.5–2 cm, apex acuminate, base cordate, margins entire, green, tomentose, petiolate. Flowers in axillary cymes. Peduncle terete, 3–4 mm long, green, tomentose. Pedicel terete, minute, green, tomentose. Bracts linear, minute, green, tomentose. Calyx lobes 5, 4–6 mm long, apex acuminate, green, tomentose. Corolla tube 5 mm long, pink, tomentose; lobes 5, campanulate, 3 mm long, apex obtuse, pink, tomentose. Stamens 5, inserted; filaments slender, 3 mm long, white, pubescent; anthers bilobed, elliptic, 1 mm long, white, glabrous. Style slender, 4 mm long, white, glabrous. Stigma capitate, c. 1 mm long, white, glabrous.

Distribution: Tropical & Subtropical Old World to North Australia (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: October–December

Specimen examined: India, Kerala, Idukki, Chinnar, 08/11/2018, Divya K. Venugopal 157456 (CALI).

Ipomoea hederifolia L., Syst. Nat. ed. 10. 2: 925.1759; Sasidh., Fl. Periyar Tiger Reserve 268. 1998; Sasidh., Fl. Chinnar WLS 212. 1999. *Quamoclit phoenicea* Wight ex Meisn., C.F.P.von Martius & auct. suc. (eds.), Fl. Bras. 7: 218.1869, pro syn.; Gamble, Fl. Madras 2: 919. 1923. *Ipomoea coccinea* Willd., Ges. Naturf. Freunde Berlin Neue Schriften 4: 197.1803, *nom. illeg.*, Hook. f., Fl. Brit. India 4: 199. 1885.

Climber. Stem terete, green, glabrous. Leaves simple, alternate, ovate, 3–7 × 2.5–6 cm, apex acuminate, base cordate, margins entire, green, glabrous, petiolate. Flowers in axillary cymes. Peduncle terete, 5–7 cm long, green, glabrous. Pedicel terete, 6–8 mm long, green, glabrous. Bracts linear, minute, green, glabrous. Calyx tube minute, green, glabrous; lobes 5, 2–3 mm long, apex acuminate, green, glabrous. Corolla tube 2.6–3 cm long, red, glabrous; lobes 5, campanulate, 2–2.3 cm long, apex obtuse, red, glabrous. Stamens 5, inserted; filaments slender, 4–4.3 cm long, pale orange, glabrous; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style slender, 4.6 cm long, pale orange, glabrous. Stigma globose, 1 mm long, white, glabrous. Capsule globose, 3–5 mm long, green, glabrous.

Distribution: Tropical & Subtropical America (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: October–December

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 29/10/2017, S. Syam Radh 153438 (CALI).

Ipomoea nil (L.) Roth, Catal. Bot. 1: 36. 1797; Sasidh., Fl. Periyar Tiger Reserve 268. 1998; Sasidh., Fl. Chinnar WLS 214. 1999. *Ipomoea hederacea* Anon, Hook. f., Fl. Brit. India 4: 199. 1885; Gamble, Fl. Madras 2: 917. 1921.

Climber. Stem terete, green, pubescent. Leaves compound, tri lobed, alternate, ovate, 6–10 × 5–8 cm, apex acuminate, base cordate, margins entire, green, sparsely pubescent, petiolate. Flowers in axillary cymes. Peduncle terete, 3–5 cm long, green, pubescent. Pedicel terete, 4–6 mm long, green, pubescent. Calyx tube minute, green, pubescent; lobes 5, linear, 1.4–1.6 cm long, apex acuminate, green, pubescent. Corolla tube 3–3.6 cm long, blue, glabrous; lobes 5, campanulate, 2–2.2 cm long, apex obtuse, blue with white throat, glabrous. Stamens 5, unequal, inserted; filaments slender, 1.8 cm long; 2 cm long, white, glabrous; anthers bilobed, elliptic, 1 mm long, white, glabrous. Style slender, 2 cm long, white, glabrous. Stigma capitate, minute, white, glabrous. Capsule sub globose, 0.7–1 cm long, green, glabrous.

Distribution: Tropical & Subtropical America (POWO, 2022)

Habitat: Deciduous forests

Flowering and fruiting: January-August

Specimens examined: India, Kerala, Idukki, Nymakkad, 24/01/2018, Divya K. Venugopal 158160 (CALI); Idukki Wildlife Sanctuary, 05/08/2017, Divya K. Venugopal 154179 (CALI).

Ipomoea obscura (L.) Ker Gawl., Bot. Reg. 3: t. 239. 1817; Hook. f., Fl. Brit. India 4: 207. 1885; Gamble, Fl. Madras 2: 916. 1921; Sasidh., Fl. Periyar Tiger Reserve 268. 1998; Sasidh., Fl. Chinnar WLS 214. 1999.

Climber. Stem terete, green, pubescent. Leaves simple, alternate, broadly ovate, 2–4 × 1–2 cm, apex acuminate, base cordate, margins entire, green, pubescent, petiolate. Flowers solitary, axillary. Pedicel terete, 1–1.6 cm long, green, puberulent. Bracts minute, green, pubescent. Calyx tube 3–5 mm long, green, pubescent; lobes 5, 4–6 mm long, apex acute, green, pubescent. Corolla tube 1.7–2 cm long, yellow, glabrous; lobes 5, 6–9 mm long, apex obtuse with acuminate at centre, yellow with purple at centre, glabrous. Stamens 5, inserted; filaments slender, 2 cm long, white, glabrous; anthers bilobed, elliptic, 1 mm long, white, glabrous. Style slender, 2.2 cm long, white, glabrous. Stigma capitate, minute, white, glabrous. Capsule sub globose, 6–7 mm long, green, glabrous.

Distribution: Tropical & Subtropical Old World (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: April-December

Specimens examined: India, Kerala, Idukki, Chinnar, 08/11/2018, Divya K. Venugopal 175916 (CALI); Painavu, 04/04/2018, Divya K. Venugopal 158466 (CALI); Periyar Tiger Reserve, 06/10/1993, Jomy Augustine 12571 (CALI).

Ipomoea wightii (Wall.) Choisy, Mém. Soc. Phys. Genève 6: 470 (1833 publ. 1834) [Conv. Or.: 88]; Hook. f., Fl. Brit. India 4: 203. 1885; Gamble, Fl. Madras 2: 917. 1921; Sasidh., Fl. Periyar Tiger Reserve 269. 1998.

Climber. Stem terete, green, pubescent. Leaves simple, alternate, minutely 3 lobed at apex, ovate, 4–8 × 3–7 cm, apex acuminate, base cordate, margins entire, green, white tomentose on abaxial surface, petiolate. Flowers in axillary cymes, sessile. Peduncle terete, 6–9 cm long, green, pubescent. Bracts lanceolate, 2–2.3 cm long, green, pubescent. Calyx tube minute, green, densely pubescent; lobes 5, 1.5–1.7 cm long, apex acuminate, green, densely pubescent. Corolla tube purple, 1–2 cm long,

glabrous; lobes 5, campanulate, 2–2.6 cm long, apex obtuse, purple, glabrous. Stamens 5, inserted; filaments slender, 1.3 cm long, pale lilac, glabrous; anthers bilobed, elliptic, 1 mm long, white, glabrous. Style slender, 1.6 cm long, lilac, glabrous. Stigma capitate, minute, lilac, glabrous.

Distribution: Ethiopia to South Africa, Madagascar, India to Bangladesh, Sri Lanka (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October–November

Specimen examined: India, Kerala, Idukki, Chinnar, 08/11/2018, Divya K. Venugopal 157456 (CALI).

***Merremia* Dennst. ex Endl.**

Gen. Pl., Suppl. 1: 1403.1841.

Merremia hederacea (Burm.f.) Hallier f., Bot. Jahrb. Syst. 18: 118. 1893; Sasidh., Fl. Periyar Tiger Reserve 269. 1998. *Ipomoea chryseides* Ker Gawl., Bot. Reg. 4: t. 270.1818; Hook.f., Fl. Brit. India 4: 206. 1885. *Merremia chryseides* (Ker Gawl.) Hallier f., Bot. Jahrb. Syst. 16: 552.1893; Gamble, Fl. Madras 2: 929. 1921.

Climber. Stem terete, purple, sparsely pubescent. Leaves palmately compound, alternate, trilobed, ovate, 2–5 × 1–3 cm, apex acute, base cordate, margins entire, green, sparsely pubescent, petiolate. Flowers in axillary cymes, dense. Peduncle terete, 3–4 cm long, green, pubescent. Pedicel terete, 1 cm long, green, pubescent. Calyx tube 1–2 mm long, green, glabrous; lobes 5, unequal, 3 mm long; 4 mm long, apex obtuse, green, glabrous. Corolla tube 6 mm long, yellow, glabrous; lobes campanulate, small, apex obtuse, margins slightly lobed, yellow, glabrous. Stamens 5, exserted; filaments filiform, 4–6 mm long, white, hairy at base; anthers bilobed, elliptic, > 1 mm long, white, glabrous. Style filiform, 5 mm long, white, glabrous. Stigma 2, globose, minute, white, glabrous.

Distribution: Tropical & Subtropical Old World to Pacific (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: September–February

Specimens examined: India, Kerala, Idukki, Kattadikadavu, 12/10/2019, Divya K. Venugopal 170363 (CALI); Periyar Tiger Reserve, 01/01/1970, Jomy Augustine 17074 (CALI).

***Rivea* Choisy**

Mém. Soc. Phys. Genève 6: 407.1833 publ. 1834.

Key to species

- 1a. Flowers in axillary cymes; corolla lobes pubescent..... *R. ornata*
1b. Flowers axillary, solitary; corolla lobes glabrous *R. hypocrateriformis*

Rivea ornata (Roxb.) Choisy, Mém. Soc. Phys. Genève 6: 409 (1833 publ. 1834); Hook.f., Fl. Brit. India 4: 183. 1885; Gamble, Fl. Madras 2: 903. 1921; Sasidh., Fl. Chinnar WLS 216. 1999.

Climber. Stem terete, green, white tomentose. Leaves simple, alternate, cordate, 4–5 × 3–4 cm, apex obtuse, shortly apiculate, base cordate, margins entire, green, white tomentose on abaxial surface, petiolate. Flowers in axillary cymes. Peduncle terete, 2 cm long, green, white tomentose. Pedicel terete, 5 mm long, green, white tomentose. Bracts leafy, green, tomentose. Calyx lobes 5, 1.5 cm long, apex acute, green, tomentose. Corolla tube 3 cm long, white, pubescent; lobes 5, salver shaped, campanulate, 4–5 cm long, apex obtuse, white, pubescent. Stamens 5, inserted; filaments slender, unequal, 5 mm long; 7 mm long, white, pubescent at base; anthers bilobed, oblong, 1 mm long, yellow, glabrous. Style filiform, 3 cm long, white, glabrous. Stigma bilobed, lobes linear, c. 1 mm long, white, glabrous. Berry globose, 1.8 cm long, yellow, glabrous.

Distribution: North India, Nepal to Indo-China (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: December–March

Specimen examined: India, Kerala, Idukki, Chinnar, 12/03/2021, Divya K. Venugopal 178844 (CALI).

Rivea hypocrateriformis (Desr.) Choisy, Mém. Soc. Phys. Genève 6: 408.1833 publ. 1834; Hook.f., Fl. Brit. India 4: 184. 1885; Gamble, Fl. Madras 2: 903. 1921.

Climber. Stem terete, green, white tomentose. Leaves simple, alternate, cordate, 4–5 × 3–4 cm, apex obtuse, base cordate, margins entire, green, tomentose on abaxial surface, petiolate. Flowers solitary, axillary. Pedicel terete, 3–5 cm long, green, tomentose. Bracts lanceolate, green, tomentose. Calyx lobes 5, 4–5 mm long, apex obtuse, green, tomentose. Corolla tube 4 cm long, white, glabrous; lobes 5, salver shaped, 3 cm long, apex obtuse, white, glabrous. Stamens 5, unequal, inserted; filaments 5 mm long; 7 mm long, white, pubescent; anthers bilobed, oblong, 2 mm

long, yellow, glabrous. Style filiform, 2 cm long, white, glabrous. Stigma bilobed, lobes linear, 2 mm long, white, glabrous. Berry globose, 2 cm long, yellow, glabrous.

Distribution: Indian Subcontinent (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: December-March

Specimen examined: India, Kerala, Idukki, Chinnar, 12/03/2021, Divya K. Venugopal 170289 (CALI).

***Xenostegia* D.F.Austin & Staples**

Brittonia 32: 533.1980 publ. 1981.

***Xenostegia tridentata* (L.) D.F.Austin & Staples**, Brittonia 32: 533.1980 publ. 1981.

Merremia tridentata (L.) Hallier f., Bot. Jahrb. Syst. 16: 552.1893; Gamble, Fl. Madras 2: 928. 1921; Sasidh., Fl. Periyar Tiger Reserve 270. 1998; Sasidh., Fl. Chinnar WLS 215. 1999. *Ipomoea tridentata* (L.) Roth, Arch. Bot. (Leipzig) 1(2): 38.1797; Hook.f., Fl. Brit. India 4: 205. 1885.

Herb. Stem terete, green, glabrous. Leaves alternate, linear, 2–5 × 0.5–1 cm, apex acute, base auricled, margins dentate, green, glabrous, sessile. Flowers solitary, axillary. Pedicel terete, 0.8–1 cm long, green, glabrous. Calyx lobes 5, 3–5 mm long, apex acuminate, green, glabrous. Corolla tube 1.8 cm long, cream, glabrous; lobes 5, campanulate, 1 cm long, apex obtuse slightly acuminate at centre, cream with purple at the centre, glabrous. Stamens 5, unequal, inserted; filaments filiform, 8 mm long; 1 cm long, white, villous at base; anthers bilobed, twisted, > 1 mm long, cream, glabrous. Style simple, 1.2 cm long, white, glabrous. Stigma bilobed, minute, pale yellow, glabrous. Capsule sub globose, 6 mm long, green, glabrous.

Distribution: Tropical & Subtropical Old World (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: March-January

Specimens examined: India, Kerala, Idukki, Neryamangalam, 17/12/2017, Divya K. Venugopal 164610 (CALI); Kaliyar, 30/11/2019, Divya K. Venugopal 164639 (CALI); Edamalakudi, 17/03/2019, Divya K. Venugopal 168983 (CALI).

SOLANACEAE Juss.

Gen. Pl. [Jussieu] 124 (1789), *nom. cons.*

Annual or perennial herbs, shrubs, erect or climbing habit; non-laticiferous. Members of this family produce fruits and vegetables of commercial importance. Some ornamental and poisonous plants also belong to this family. Leaves alternate, often in unequal pairs, exstipulate. Inflorescence cyme, flowers regular, hermaphrodite; bracts and bracteoles 0. Pollination entomophilous. Calyx lobes 5, usually persistent, often accrescent in fruit. Corolla funnel shaped or rotate; lobes usually 5. Stamens 5, on the corolla tube; anthers dehiscing by apical pores or by longitudinal slit. Style linear; stigma capitate or very shortly lobed. Fruit baccate or capsular, many seeded.

Solanaceae is one among the five families of the order Solanales and most plants are under cultivation. Even though the members are universal in occurrence, the majority of them are distributed in the tropics. Solanaceae includes 102 genera and nearly 2500 species worldwide (POWO, 2022), the majority of which are economically important as food, fodder, medicines and ornamentals. Many invasive plants belong to this family, and their allelopathic properties allow them to colonize in a short period of time. Some members of this family have the ability to produce alkaloids which have therapeutic or poisonous properties.

Key to genera

- 1a. Corolla large; fruits spiny..... *Datura*
- 1b. Corolla small; fruits not spiny..... 2
- 2a. Flowers cauliflorous..... *Iochroma*
- 2b. Flowers not cauliflorous. 3
- 3a. Berry covered by enlarged fruiting calyx..... *Physalis*
- 3b. Berry not covered by enlarged fruiting calyx 4
- 4a. Corolla tube prominent; stamens inserted..... *Cestrum*
- 4b. Corolla tube minute; stamens exserted *Solanum*

Cestrum L.

Sp. Pl. 1: 191. 1753.

Key to species

- 1a. Plants annual; pedicel present *C. aurantiacum*
- 1b. Plants perennial; pedicel absent 2
- 2a. Stamens 4; filaments pubescent; berries oblong *C. nocturnum*

2b. Stamens 5; filaments glabrous; berries elliptic *C. parqui*

Cestrum aurantiacum Lindl., Edwards's Bot. Reg. 30(Misc.): 71.1844; M.R. Almeida, Fl. Maharashtra 3b: 356.2001; K.M. Matthew, Bull. Bot. Surv. India 8: 163. 1967.

Figure 22 F.

Annual climber, up to 70 cm high. Stem terete, unarmed, pubescent, green. Leaves simple, alternate, ovate, 6–8 × 3–4 cm, apex acute, base obtuse, margins entire, green, glabrous. Petiole terete, 3–4 × 0.1–0.15 cm, green, glabrous. Flowers 2–8, in axillary and terminal cyme. Peduncle terete, 2–3 × 0.1–0.2 cm, green, slightly pubescent. Pedicel terete, 1 × 0.05–0.1 cm, green, glabrous. Calyx tube minute, green, pubescent; lobes 6, triangular, 1 × 0.2 cm, apex acute, green, pubescent. Corolla tube 2 × 0.05 cm, orange–yellow, glabrous; lobes 6, rotate, 2–3 × 3–4 mm, orange, glabrous. Stamens 5, inserted low on corolla tube; filaments 7 × c. 1 mm, pale green, glabrous; anthers bilobed, oblong, 1.5 × 1 mm, white, glabrous. Style 1–1.5 × 0.09–0.1 cm, orange, glabrous. Stigma capitate, green. Berries globose, 1 cm long, white, glabrous.

Distribution: Mexico to Venezuela; introduced to India (POWO, 2022)

Habitat: Introduced as garden plant, roadsides and scrub jungles

Flowering and fruiting: August–March

Specimen examined: India, Kerala, Idukki, Devikulam, 07/02/2017, Divya K. Venugopal 151644 (CALI).

Cestrum nocturnum L., Sp. Pl.: 191. 1753; Venkatappa & Pullaiah, J. Econ. Tax. Bot. 26: 122. 2002; K.M. Matthew, Bull. Bot. Surv. India 8: 163. 1967.

Perennial shrub to tree, up to 1 m tall. Stem terete, unarmed, glabrous, green. Leaves simple, alternate, lance-ovate, 5–10 × 3–5 cm, apex acute, base cuneate, margins entire, green, glabrous. Petiole terete, 0.5 × 0.1 cm, green, glabrous–slightly pubescent. Flowers numerous, in axillary and terminal cyme or raceme. Peduncle terete, 7–8 × 1–1.2 mm, green, glabrous. Pedicel absent. Calyx tube 2 × 3 mm, green, glabrous; lobes 4, triangular, very minute, c. 1 × 1 mm, apex acute, green, glabrous–pubescent. Corolla tube 2 × 0.1 cm, green, glabrous; lobes 4, 3–4 × 2–2.2 mm, ovate, yellowish green, glabrous. Stamens 4, inserted low on corolla tube; filaments 5 × c. 1 mm, pale green, pubescent; anthers bilobed, oblong, 1 × 1 mm, brown, glabrous. Style 1.5–2 × 0.09–0.1 cm, white, glabrous. Stigma capitate, 1 mm long, green. Berries oblong, 8–10 mm long, white, glabrous.

Distribution: Mexico to Venezuela, introduced to Tropics (POWO, 2022)

Habitat: Roadsides and scrub jungles

Flowering and fruiting: November-June

Specimen examined: India, Kerala, Idukki, Mathikettan shola National Park, 06/01/2017, Divya K. Venugopal 151591 (CALI).

Cestrum parqui (Lam.) L'Hér., Stirp. Nov. : 73. 1788; Willd., Enum. Pl.: 243. 1809.

Perennial shrub. Stem terete, unarmed, glabrous, green. Leaves simple, alternate, lanceolate, 8–12 × 3–5 cm, apex acute, base obtuse, margins entire, green, glabrous. Petiole terete, 1 × 0.1 cm, green, glabrous. Flowers numerous, axillary and terminal cymose or racemose, dense flowered. Peduncle terete, 6–8 × 1 mm, green, glabrous. Pedicel absent. Calyx tube 2 × 2 mm, green, glabrous; lobes 5, triangular, very minute, c. 1 × 1 mm, apex acute, green, glabrous. Corolla tube 2 × 0.2 cm, yellow, glabrous; lobes 5, 4–5 × 2–3 mm, yellowish, glabrous. Stamens 5, inserted low on corolla tube; filaments 5 × 1 mm, pale green, glabrous; anthers bilobed, oblong, 1 × 1 mm, brown, glabrous. Style 1.8–2 × 0.09–0.1 cm, white, glabrous. Stigma capitate, 1 mm long, green. Berries elliptic, 1 cm long, white, glabrous.

Distribution: Bolivia to Brazil and South America; introduced to India (POWO, 2022)

Habitat: Roadsides and scrub jungles

Flowering and fruiting: January-June

Specimen examined: India, Kerala, Idukki, Rajappara, 10/02/2017, Divya K. Venugopal 152001 (CALI).

***Datura* L.**

Sp. Pl. 1: 179. 1753.

Key to species

1a. Leaves pubescent, margins entire; flowers pentamerous..... *D. metel*

1b. Leaves glabrous, margins serrate; flowers not pentamerous.....*D. stramonium*

Datura metel L., Sp. Pl. 1: 179. 1753; Hook.f., Fl. Brit. India 4: 243. 1885; Gamble, Fl. Madras 2: 941. 1921; Sasidh., Fl. Periyar Tiger Reserve 271. 1998; Sasidh., Fl. Chinnar WLS 216. 1999.

Perennial herb or shrub, up to 60 cm high. Stem terete, unarmed, almost zigzag, green or purple, glabrous. Leaves simple, alternate, ovate, 9–10 × 4–5 cm, apex acute, base obtuse, margins entire, green, pubescent. Petiole terete, 3–4 cm × 0.1–0.125 cm, purplish green, pubescent. Flowers solitary, axillary. Pedicel terete, 1–2 × 0.15–0.2 cm, purplish green, slightly pubescent. Calyx tube 6 × 1.5 cm, green, puberulent;

lobes 5, triangular, 2×0.2 cm, apex acute, green, puberulent. Corolla tube 8×2 cm, white, glabrous; lobes 5, campanulate, $4-5 \times 2-3$ cm, apex acuminate, white with purple tinge, glabrous. Stamens 5, inserted; filaments $6 \times c. 1$ mm, white, pubescent towards base; anthers bilobed, oblong, 1×1 mm, white, glabrous. Style 1×0.2 cm, white, glabrous. Stigma capitate, 1 mm long, white. Capsule globose, 3 cm long, green, spiny.

Distribution: Texas to Colombia; introduced to India (POWO, 2022)

Habitat: Barren lands, deciduous forests

Flowering and fruiting: March-December

Specimen examined: India, Kerala, Idukki, Painavu, 04/04/2018, Divya K. Venugopal 158441 (CALI).

Datura stramonium L., Sp. Pl. 1: 179.1753; Hook.f., Fl. Brit. India 4: 242. 1885; Gamble, Fl. Madras 2: 941. 1921.

Perennial shrub, up to 80 cm high. Stem terete, unarmed, green, glabrous. Leaves simple, alternate, ovate, $10-12 \times 6-8$ cm, apex acute, base obtuse, margins serrate, green, glabrous. Petiole terete, $2-5 \times 0.1-0.2$ cm, green, slightly pubescent. Flowers single or paired, in axillary cyme. Pedicel terete, 1×0.2 cm, purplish green, glabrous. Calyx tube 5×1.5 cm, green, puberulent; lobes 6, triangular, 1×0.2 cm, apex acute, green, puberulent. Corolla tube 7×2 cm, white with purple striations, glabrous; lobes 6, campanulate, $3-4 \times 2-3$ cm, apex acuminate, white with purple tinge, glabrous. Stamens 5, inserted; filaments $8 \times c. 0.1$ cm, white, glabrous; anthers bilobed, oblong, 1×1 mm, white, glabrous. Style 1×0.2 cm, white, glabrous. Stigma capitate, 1 mm long, white. Capsule globose, 3 cm long, green, spiny.

Distribution: Texas to Central America, Caribbean; introduced to India (POWO, 2022)

Habitat: Barren lands

Flowering and fruiting: July-September

Specimen examined: India, Kerala, Idukki, Idukki Wild life Sanctuary, 05/08/2017, Divya K. Venugopal 154184 (CALI).

***Iochroma* Benth.**

Edwards's Bot. Reg. 31: ad t. 20.1845.

***Iochroma arborescens* (L.)J.M.H.Shaw, Plantsman 17: 200. 2018.**

Figure 21 B.

Unarmed shrub or small tree, up to 2 m tall, glabrous throughout. Stems terete, branched, greyish-white. Leaves simple, alternate, elliptic, 18–24 × 6–9 cm, apex acute, base acute to attenuate, margins entire, pale green, both surfaces glabrous. Petiole terete, 1–2 cm long, green, glabrous. Flowers numerous, in fascicle, cauliflorous. Flowers bisexual, actinomorphic, c. 2 × 1 cm. Pedicel c. 1 cm long. Calyx 5-lobed cupular; lobes c. 3 × 1 mm, apex acute, green, hairy outside. Corolla tube c. 4 × 1 mm, greenish white, glabrous; lobes 5, nearly elliptic, c. 8 × 1 mm, greenish-white with yellow tinge on inner surface, papillate along margins. Stamens 5, equal, exserted; filaments c. 5.1 mm long, epipetalous, cream coloured, glabrous; anthers dithecous, oblong, c. 2 × 2 mm, yellow coloured, glabrous. Style slender, c. 7 × 1 mm, cream, glabrous. Stigma capitate, green, glabrous. Berries globose, c. 5 mm long.

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

Flowering and fruiting: April-June

Specimen examined: India, Kerala, Idukki, Painavu, 04/04/2018, Divya K. Venugopal 158483 (CALI).

***Physalis* L.**

Sp. Pl. 1: 182. 1753.

Key to species

- 1a. Calyx lobes 5; anthers white with violet striations; stigma flat*P. angulata*
- 1b. Calyx lobes 4; anthers black; stigma bilobed*P. peruviana*

Physalis angulata L., Sp. Pl. 1: 183.1753; Hook.f., Fl. Brit. India 4: 238. 1885; Gamble, Fl. Madras 2: 939. 1921. *Physalis minima* L., Sp. Pl.: 183.1753; Sasidh., Fl. Chinnar WLS 217. 1999.

Annual erect herb, up to 40 cm high. Stem quadrangular green, pubescent. Leaves simple, alternate, widely ovate, 4–6 × 2–3 cm, apex narrowly acuminate, truncate at base, margins sinuate, green, pubescent. Petiole quadrangular, 3–4 cm long, green, pubescent. Flowers axillary solitary. Pedicel 0.8 –1 cm long, green, pubescent. Calyx campanulate, tube 3–4 × 4–5 mm, green, pubescent; lobes 5, ovoid, 4–6 × 4–5 mm, apex acute, green, pubescent, inflated in fruit. Corolla campanulate, shortly lobed, 10–12 mm across, pale yellow with purple at the centre, glabrous. Stamens 5; filaments 3–6 × c. 1 mm, yellow, pubescent at base only; anthers bilobed, oblong, 3–4 × 1.5–2 mm, white with violet striations, glabrous. Style 6–8 × c. 1mm, pale green, glabrous. Stigma flat, 1 × 1 mm, pale green, glabrous. Berry globose, 1 × 1 cm, yellow, pubescent covered by fruiting calyx.

Distribution: Tropical & Subtropical America; introduced to India (POWO, 2022)

Habitat: Degraded forest areas and barren lands

Flowering and fruiting: July-December

Specimen examined: India, Kerala, Idukki, Edamalakkudi, 17/03/2019, Divya K. Venugopal 168982 (CALI).

Physalis peruviana L., Sp. Pl., ed. 2. 2: 1670.1763; Hook.f., Fl. Brit. India 4: 238. 1885; Gamble, Fl. Madras 2: 939. 1921; Sasidh., Fl. Periyar Tiger Reserve 272. 1998; Sasidh., Fl. Chinnar WLS 217. 1999.

Annual erect herb, up to 40 cm high. Stem quadrangular, green, pubescent. Leaves simple, alternate, widely ovate, 4–6 × 3–4 cm, apex obtuse, obliquely at base, margins entire, green, pubescent. Petiole quadrangular, 2–3 cm long, green, pubescent. Flowers axillary, solitary. Pedicel quadrangular, 0.5 – 1 cm long, green, pubescent. Calyx campanulate, tube 3–4 × 4–5 mm; lobes 4, ovoid, 6–8 × 4–5 mm, apex acute, green, pubescent, accrescent in fruit. Corolla campanulate, tube hairy inside; lobes 5, minutely lobed, 12–15 mm across, apex acute, yellowish with deep brown centre, glabrous. Stamens 5; filaments 5–6 × c. 0.1 cm, black, glabrous; anthers bilobed, oblong, 3–4 × 0.5–1 mm, black, glabrous. Style 6–7 × c. 1 mm, pale green, glabrous. Stigma bilobed, 1 × 1 mm, pale green, glabrous. Berry globose, 5 × 5 mm, orange-yellow, glabrous, covered by fruiting calyx.

Distribution: Bolivia to West Brazil; introduced to India (POWO, 2022)

Habitat: Degraded forest areas and barren lands

Flowering and fruiting: February-May

Specimens examined: India, Kerala, Idukki, Munnar, 09/02/2017, Divya K. Venugopal 151677 (CALI); Chinnar, 18/02/1998, K.K. Sajeev 60148 (CALI); Devikulam, 31/03/1978, Nambiar 312 (KFRI).

***Solanum* L.**

Sp. Pl.: 184. 1753.

Key to species

- 1a. Leaves simple..... 2
- 1b. Leaves compound *S. seaforthianum*
- 2a. Flowers cyme 3
- 2b. Flowers raceme *S. brownii*
- 3a. Plants armed..... 4
- 3b. Plants unarmed..... 5
- 4a. Leaves margin entire *S. giganteum*
- 4b. Leaves margin sinuately lobed..... 6
- 5a. Corolla woolly..... *S. mauritianum*
- 5b. Corolla glabrous..... 7
- 6a. Calyx prickly..... 8
- 6b. Calyx not prickly..... *S. torvum*
- 7a. Flowers drooping; pedicel purplish white..... *S. diphyllum*
- 7b. Flowers erect; pedicel green 9
- 8a. Corolla lobes pubescent; berries yellow *S. aculeatissimum*
- 8b. Corolla lobes glabrous; berries red *S. capsicoides*
- 9a. Leaves lanceolate; stamens inserted..... *S. pseudo-capsicum*
- 9b. Leaves ovate; stamens exserted 10
- 10a. Stem quadrangular; style woolly tomentulose; berries red... *S. leave*
- 10b. Stem terete; style glabrous; berries purplish black *S. americanum*

Solanum aculeatissimum Jacq., Icon. Pl. Rar. 1: 5. 1781; Hook.f., Fl. Brit. India 4: 238. 1885; Gamble, Fl. Madras 2: 939. 1921.

Figure 23 A.

Perennial shrub, densely prickly, up to 75 cm tall. Stem terete, armed, pubescent, green. Leaves simple, sinuately lobed, alternate, ovate, 7–9 × 4–6 cm, apex acute, base obtuse, margins entire, green, pubescent, prickly. Petiole 4–5 cm × 0.1–0.2 cm,

green, prickled, pubescent. Flowers 2–3, in axillary cyme. Peduncle terete, 1×0.13 cm, green unarmed. Pedicel terete, $5\text{--}6 \times 1\text{--}2$ mm, green, unarmed. Calyx tube $1\text{--}3 \times 1\text{--}2$ mm, green, prickly, pubescent; lobes 5, ovate, $3\text{--}4 \times 1\text{--}2$ mm, apex acute, green, prickly, densely pubescent. Corolla tube 2×1 mm, yellowish–white with green at base, pubescent; lobes 5, lanceolate, 7×2 mm, yellowish-white, pubescent. Stamens 5, exserted; filaments 1×1 mm, pale green, glabrous; anthers bilobed, oblong, 5×2 mm, yellow, glabrous. Style 5×1 mm, pale green, glabrous. Stigma capitate, 1 mm long, pale green, glabrous. Berries globose, 2 cm long, yellow, glabrous.

Distribution: South East & South Brazil to South Central Paraguay; introduced to India (POWO, 2022)

Habitat: Waste lands

Flowering and fruiting: October–February

Specimen examined: India, Kerala, Idukki, Anayirangal dam, 05/01/2017, Divya K. Venugopal 151546 (CALI).

Solanum americanum Mill., Gard. Dict., ed. 8.: n.º 5. 1768; Sasidh., Fl. Periyar Tiger Reserve 272. 1998. *Solanum nigrum* L., Sp. Pl.: 186. 1753; Gamble, Fl. Madras 2: 936. 1921; Sasidh., Fl. Chinnar WLS 219. 1999.

Figure 22 C.

Annual herb, up to 50 cm tall. Stem terete, unarmed, glabrous, green. Leaves simple, ovate, 1.5–2.5 cm long, margins entire, apex acute, base cuneate, glabrous–slightly pubescent; petiole terete, $1\text{--}5 \times 0.1\text{--}0.2$ cm, glabrous, green. Flowers 3–4, in axillary or terminal cyme. Peduncle terete, $3\text{--}5 \times 0.1\text{--}0.12$ cm, green, glabrous. Pedicel terete, $4\text{--}5 \times 1\text{--}2$ mm, green, glabrous. Calyx tube cupular, 1×1 mm, green, glabrous; lobes 5, narrowly ovate, 0.5×1 mm, apex acute, green, glabrous; calyx not enlarged in fruit. Corolla lobes 5, deeply divided, ovate, $3\text{--}4 \times 1\text{--}2$ mm, white, glabrous. Stamens 5, exserted; filaments 1×1 mm, pale green, glabrous; anthers bilobed, oblong, 2×1 mm, yellow, glabrous. Style 2×1 mm, pale green, glabrous. Stigma capitate, c. 1 mm long, pale green, glabrous. Berries globose, 5 mm long, purplish black, glabrous.

Distribution: New World (POWO, 2022)

Habitat: In plains and degraded forests

Flowering and fruiting: March–November

Specimen examined: India, Kerala, Idukki, Kattappana, 06/08/2019, Divya K. Venugopal 170245 (CALI).

Solanum brownii Dunal, Hist. Nat. Solanum: 201 (1813); Hook.f., Fl. Brit. India 4: 234. 1885; Gamble, Fl. Madras 2: 938. 1921. *Solanum violaceum* R.Br., Prodr. Fl. Nov. Holland.: 445 (1810). *Solanum anguivi* Sasidh., Fl. Periyar Tiger Reserve 272. 1998; Sasidh., Fl. Chinnar WLS 218. 1999.

Perennial shrub, woody, up to 70 cm tall. Stem terete, armed, pubescent, green. Leaves simple, alternate, ovate, 5–6 × 3–4 cm, margins entire, wavy, apex acute, base obtuse, pubescent, prickles present on adaxial surface of leaves. Petiole terete, 0.8–1 × 0.1–0.12 cm, green, pubescent, prickled. Flowers numerous, in axillary and terminal raceme. Peduncle terete, 2–2.2 × 0.1–0.13 cm, green, pubescent, unarmed. Pedicel terete, 1–1.5 × 0.09–0.1 cm, green, pubescent, unarmed. Calyx tube 4–5 × 3–5 mm, green, tomentose; lobes 5, triangular, 1 × 0.5 cm, apex acute, green, tomentose. Corolla tube minute, blue, pubescent; lobes 5, rotate, 1–1.2 × 0.4–0.5 cm, apex acute, blue, pubescent. Stamens 5, exserted; filaments 1–1.2 × 0.8–1 mm, pale green, glabrous; anthers bilobed, oblong, 3 × 2 mm, yellow, glabrous. Style 5–6 × 0.8–1 mm, cream, glabrous. Stigma capitate, 0.1 mm long, green, glabrous. Berries globose, 8 mm long, orange-red, glabrous.

Distribution: South East Queensland to East Victoria; introduced to India (POWO, 2022)

Habitat: Evergreen and shola forests

Flowering and fruiting: November–January

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 12/12/1995, Jomy Augustine 15315 (CALI); Anamudi shola, 08/01/2004, Mini 97252 (CALI).

Solanum capsicoides All., Auct. Syn. Meth. Stirp. Hort. Regii Taur. 12.1773; Sasidh., Fl. Periyar Tiger Reserve 273. 1998.

Perennial shrub, woody, densely prickly, up to 40 cm tall. Stem terete, armed, glabrous, green. Leaves simple, sinuately lobed, alternate, ovate, up to 8–10 × 3–4 cm, margins wavy, serrate, apex acute, base cordate, pubescent, prickly. Petiole terete, 2 × 0.15 cm, prickled, green. Flowers 2–3, in axillary cyme. Peduncle terete, 1 × 0.13 cm, unarmed, green. Pedicel terete, 1–1.8 × 0.1 cm, unarmed, green. Calyx tube 2–3 × 1–2 mm, green, glabrous, prickly; lobes 5, triangular, 1 × 0.4 cm, apex acute, green, glabrous. Corolla tube 3 × 1 mm, white, pubescent; lobes 5, rotate, 1–1.2 × 0.3–0.5 cm, white, glabrous. Stamens 5, exserted; filaments 1 × 1 mm, glabrous; anthers bilobed, oblong, 5 × 2 mm, yellow colour with white at tip, glabrous. Style 5 × 1 mm,

pale green, glabrous. Stigma capitate, 1 mm long, pale green, glabrous. Berries globose, 3 mm long, red, glabrous.

Distribution: South Tropical America; introduced to India (POWO, 2022)

Habitat: Degraded forests and barren lands

Flowering and fruiting: September-January

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 12/12/1995, Jomy Augustine 15323 (CALI).

Solanum diphyllum L., Sp. Pl. : 184. 1753; M. Das & al., J. Econ. Tax. Bot. 21: 158, f. A - F. 1997; T.K. Paul & M.C. Biswas, Bull. Bot. Surv. India 37: 137, f. 1-4. 2000.

Figure 22 B.

Perennial shrub-small tree, up to 40 cm tall. Stem terete, glabrous, green-purple. Leaves simple, alternate, widely ovate, 7–12 × 1–6 cm, apex obtuse, base cuneate, margins entire, green, glabrous. Petiole terete, 1–6 × 1–1.2 mm, green, glabrous. Flowers many, drooping, in axillary cyme. Peduncle terete, 4–5 × 1–2 mm, green, glabrous. Pedicel terete, 4–7 × 1–2 mm, white, glabrous. Calyx tube 1 × 1 mm, purple, glabrous; lobes 5, ovate, 0.8–1 × 1–1.2 mm, apex acute, white, glabrous; calyx not enlarged in fruit. Corolla lobes 5, deeply divided, ovate, 2–4 × 1.5–2 mm, white, glabrous. Stamens 5, exserted; filaments 1 × 0.8 mm, cream, glabrous; anthers bilobed, oblong, 2 × 1 mm, yellow, glabrous. Style 4 × 1 mm, cream, glabrous. Stigma pointed, 1 mm long, cream, glabrous. Berries globose, 1 cm long, pink - orange, glabrous.

Distribution: Mexico to Central America; introduced to India (POWO, 2022)

Habitat: In plains and forest margins

Flowering and fruiting: January-June

Specimen examined: India, Kerala, Idukki, Kattappana, 16/03/2018, Divya K. Venugopal 158370 (CALI).

Solanum giganteum Jacq., Collectanea 4: 125. 1791; Hook.f., Fl. Brit. India 4: 233. 1885; Gamble, Fl. Madras 2: 937. 1921; Sasidh., Fl. Periyar Tiger Reserve 273. 1998. Perennial shrub, up to 3 m tall. Stem terete, woolly tomentulose, prickly, green. Leaves simple, ovate, 18–20 × 6–8 cm, apex narrowly acute, base cuneate, margins entire, green on adaxial surface and white on abaxial surface, woolly tomentulose beneath. Petiole terete, 3–5 × 0.2–0.4 cm, green, woolly tomentulose. Flowers numerous, in axillary or terminal cyme. Peduncle terete, 4–5 × 0.3–0.4 cm, green, woolly tomentulose. Pedicel terete, 3–4 × 1–1.2 mm, green, woolly tomentulose.

Calyx tube triangular, 3×2 mm, apex acute, green, woolly tomentulose; lobes 5, ovate, 4×2 mm, apex acute, green, woolly tomentulose; calyx not enlarged in fruit. Corolla tube 2×1 mm, blue; lobes 5, ovate, $4-5 \times 1-2$ mm, blue, woolly tomentulose. Stamens 5, exserted; filaments 1×1 mm, pale green, glabrous; anthers bilobed, oblong, 2×1 mm, yellow, glabrous. Style $3 \times c.1$ mm, cream, glabrous. Stigma capitate, 1 mm long, cream, glabrous. Berries globose, 7 mm long, red, glabrous.

Distribution: Tropical & South Africa; introduced to India (POWO, 2022)

Habitat: Semi evergreen, moist deciduous forests

Flowering and fruiting: June-March

Specimens examined: India, Kerala, Idukki, Kannimala, 24/01/2017, Divya K. Venugopal 158151 (CALI); Chinnar, 14/02/2001, Deepa K.V. 73742 (CALI).

Solanum laeve Dunal ex Poir., Encycl. [J. Lamarck & al.] Suppl.3. 751.1814; Hook.f., Fl. Brit. India 4: 231. 1885; Gamble, Fl. Madras 2: 936. 1921. *Lycianthes laevis* (Dunal) Bitter, Gatt. Lycianthes: 484. 1919.

Figure 22 A.

Annual herb-sub shrub, up to 60 cm high. Stem quadrangular, green, slightly pubescent. Leaves simple, alternate, elliptic, $15-20 \times 5-6$ cm, apex narrowly acute, base cuneate, margins entire, glabrous. Petiole terete, 3×0.1 cm, green, glabrous. Flowers 2-5, in axillary cymes. Pedicel terete, $6-8 \times 0.5-1$ mm, green, slightly pubescent. Calyx lobes 5, ovate, $3-4 \times 1-2$ mm, green, glabrous, persistent. Corolla tube – very minute; lobes 5, obovate, 1×1 cm, apex acute, white with purple shades, glabrous. Stamens 5, exserted; filaments 1×1 mm, pale green, glabrous; anthers bilobed, oblong, 2×1 mm, yellow, glabrous. Style $3 \times c. 1$ mm, lilac, woolly tomentulose. Stigma capitate, 1 mm long, yellow, glabrous. Berry globose, red, 1 cm across, glabrous, with saucer shaped calyx teeth.

Distribution: East Himalaya to China (Yunnan, Guangxi), Nansei-shoto, Taiwan (Lan Yü), West Malesia (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: December-May

Specimens examined: India, Kerala, Idukki, Mathikettan shola National Park, 06/01/2017, Divya K. Venugopal 151573 (CALI); Eravikulam, 18/05/1999, P. Prashy 79416 (CALI); Meenuliyanpara, 12/12/2016, Divya K. Venugopal 151418 (CALI).

Solanum mauritianum Scop., Delic. Fl. Faun. Insubr. 3: 16. 1788; R.R. Mill in Grierson & D.G. Long, Fl. Bhutan 2(3): 1050. 2001; A.P. Das, J. Econ. Tax. Bot. 26:35. 2002.

Perennial shrub, up to 2 m high. Stem quadrangular, unarmed, densely pubescent, green. Leaves simple, alternate, ovate, up to 15–20 × 6–12 cm, margins entire, apex acute, base cuneate, often oblique, margin, green, pubescent. Petiole quadrangular, 3–6 cm long, green, pubescent. Flowers in branched cyme, numerous. Peduncle terete, 2–10 × 0.2–0.4 cm, green, woolly tomentose. Pedicel terete, 2–3 × 1–2 mm, green, woolly tomentose. Calyx tube short, 2–3 × 1–2 mm, green, woolly; lobes 5, narrowly triangular, 2–3 × 1–2 mm, triangular, green, woolly. Corolla tube 2–4 × 1–2 mm, lilac, woolly; lobes 5, 4–5 × 2–3 mm, apex acute, lilac, woolly. Stamens 5, inserted low on corolla tube; filaments 2 × 1 mm, pale green, glabrous; anthers bilobed, oblong, 3 × 1 mm, yellow, glabrous, dehiscence by apical pores. Style 4–5 × 0.5–1 mm, cream, puberulent. Stigma capitate, green. Berries globose, 1–1.5 cm long, yellow, rusty, succulent.

Distribution: South East & South Brazil to Argentina; introduced to India (POWO, 2022)

Habitat: Shola forest margins, dry deciduous forests

Flowering and fruiting: December–June

Specimen examined: India, Kerala, Idukki, Devikulam, 07/02/2017, Divya K. Venugopal 151642 (CALI).

Solanum pseudocapsicum L., Sp. Pl.: 184. 1753; Matthew, Rec. Bot. Surv. India 20: 162. 1969.

Annual shrub, up to 80 cm high. Stem terete, unarmed, green, slightly pubescent. Leaves simple, alternate, lance-ovate, 8–10 × 1–2 cm, apex acute, base narrowly cuneate, margins wavy, entire, often oblique, green, glabrous. Petiole terete, 4–5 × 1–1.5 mm, green, glabrous. Flowers erect, 2–3, in axillary cyme. Peduncle terete, 2–3 × 1–2 mm, green, glabrous. Pedicel terete, 4–5 × 0.5–1 mm, green, glabrous. Calyx lobes 5, triangular, 5 × 1 mm, apex nearly acute, green, glabrous. Corolla lobes 5, rotate, 8–10 × 4–5 mm, white, glabrous. Stamens 5, inserted low on corolla tube; filaments c. 1 × 1 mm, pale green, glabrous; anthers bilobed, oblong, 3 × 1 mm, orange, glabrous. Style 4–5 × 0.8–1 mm, cream, glabrous. Stigma capitate, minute, green, glabrous. Berries globose, 1 cm long, red, glabrous.

Distribution: Native of South America, widely naturalised in the tropics and subtropics (POWO, 2022)

Habitat: Waste lands and road sides

Flowering and fruiting: October-June

Specimen examined: India, Kerala, Idukki, Devikulam, 02/05/2017, Divya K. Venugopal 152116 (CALI).

Solanum seaforthianum Andrews, Bot. Repos. 8: t. 504. 1808; Sasidh., Fl. Periyar Tiger Reserve 274. 1998; Sasidh., Fl. Chinnar WLS 219. 1999.

Figure 23 C.

Perennial shrub with climbing nature, up to 50 cm tall. Stem terete, armed, glabrous, green. Leaves compound, alternate, ovate, up to $3-4 \times 1-1.2$ cm, margins slightly serrate, apex acute, base cuneate, glabrous. Petiole terete, $3-6 \times 0.1-0.15$ cm, glabrous, green. Flowers numerous, in axillary cyme. Peduncle terete, $4-5 \times 0.1-0.2$ cm, terete, slightly prickled. Pedicel $1-1.5 \times 0.1-0.2$ cm, terete, glabrous. Calyx tube 3×2 mm, green, glabrous; lobes 5, triangular, $2 \times c. 1$ mm, apex acute, green, glabrous. Corolla lobes 5, $1-1.2 \times 0.4-0.5$ cm, lilac, sparsely pubescent. Stamens 5; filaments $1-2 \times 0.8-1$ mm, glabrous; anthers bilobed, 4×2 mm, oblong, yellow. Style $6-8 \times 0.9-1$ mm, glabrous. Stigma capitate, c. 1 mm long, green, glabrous. Berries globose, 3 cm long, yellow, glabrous.

Distribution: Florida to Caribbean, Mexico to Venezuela, Brazil; introduced to India (POWO, 2022)

Habitat: Degraded and moist deciduous forests

Flowering and fruiting: May-November

Specimen examined: India, Kerala, Idukki, Vellappara, 05/08/2017, Divya K. Venugopal 154131 (CALI).

Solanum torvum Sw., Prodr. Veg. Ind. Occ.: 47 (1788); Hook.f., Fl. Brit. India 4: 234. 1885; Gamble, Fl. Madras 2: 937. 1921; Sasidh., Fl. Periyar Tiger Reserve 275. 1998; Sasidh., Fl. Chinnar WLS 219. 1999.

Figure 23 B.

Perennial shrub, prickly, up to 70 cm tall. Stem terete, armed, densely pubescent, green. Leaves simple, sinuately lobed, alternate, widely ovate, $9-10 \times 5-6$ cm, apex acute, base truncate, margins entire, tomentulose, prickly on midrib. Petiole terete, $2-2.5 \times 0.1-0.2$ cm, green, tomentulose, prickled. Flowers numerous, in axillary cyme. Peduncle terete, $1-3 \times 0.1-0.2$ cm, green, pubescent, unarmed. Pedicel terete, $3-4 \times$

1–2 mm, green, pubescent, unarmed. Calyx tube 2–3 × 1–2 mm, green, pubescent; lobes 5, ovate, 1–2 × 1–2 mm, apex acute, green, pubescent; calyx not enlarged in fruit. Corolla tube 1 × 1 mm, white, glabrous; lobes 5, campanulate, 5–6 × 3–4 mm, ovate, white, pubescent on outer surface. Stamens 5, exserted; filaments 1 × 1 mm, yellow, glabrous; anthers bilobed, oblong, 4 × 2 mm, yellow, glabrous. Style 5 × 1 mm, cream, glabrous. Stigma capitate, 1 mm long, green, glabrous. Berries globose, 1 cm long, yellow, glabrous.

Distribution: Mexico to North South America, Caribbean, East Brazil; introduced to India (POWO, 2022)

Habitat: Degraded forests and also in plains

Flowering and fruiting: July–March

Specimens examined: India, Kerala, Idukki, Anayirangal dam, 15/01/2017, Divya K. Venugopal 151561 (CALI); Kanthallur, 25/02/2003, Reena M. B. 89069 (CALI).

SCROPHULARIACEAE Juss.

Gen. Pl. [Jussieu] 117.1789, *nom. cons*

Herbs or shrubs. Leaves simple, opposite, exstipulate, green, glabrous; non-laticiferous. Flowers irregular. Pollination entomophilous or ornithophilous (Delta Intkey, 2023). Calyx lobes 5, green, glabrous, persistent. Corolla bilipped, lobes 4–5. Stamens 4, didynamous; filaments slender; anthers various. Style 1, bilobed. Stigma capitate. Nectar secreting disc usually presents at the base of ovary. Capsule varies in shape. Seeds small, numerous. Many are poisonous; some have ornamental and medicinal values (Delta Intkey, 2023).

According to POWO 2022, family consists of 60 accepted genera worldwide.

Key to Genera

- 1a. Stem glabrous..... 2
- 1b. Stem pubescent 3
- 2a. Stamens 2 4
- 2b. Stamens 4..... 5
- 3a. Stem aromatic..... 6
- 3b. Stem not aromatic 7
- 4a. Leaves margin entire 8
- 4b. Leaves margin dentate/serrate..... *Bonnaya*
- 5a. Stigma entire 9

5b. Stigma bilobed	10
6a. Stem terete, rooting at nodes present	<i>Adenosma</i>
6b. Stem quadrangular, rooting at nodes absent	<i>Artanema</i>
7a. Calyx tube absent	11
7b. Calyx tube present.....	12
8a. Corolla lobes white-white with blue patches at centre; anther white.....	<i>Lindernia</i>
8b. Corolla lobes pink; anther yellow	<i>Dopatrium</i>
9a. Flowers solitary	13
9b. Flowers raceme.....	<i>Micrargeria</i>
10a. Calyx tube absent	<i>Torenia</i>
10b. Calyx tube present.....	<i>Mimulus</i>
11a. Herbs root parasitic	<i>Pedicularis</i>
11b. Herbs not parasitic	14
12a. Leaves petiolate.....	<i>Mazus</i>
12b. Leaves sessile.....	15
13a. Leaves petiolate.....	<i>Scoparia</i>
13b. Leaves sessile.....	16
14a. Stem quadrangular	<i>Centranthera</i>
14b. Stem terete	<i>Yamazakia</i>
15a. Flowers pedicellate.....	<i>Limnophila</i>
15b. Flowers sessile	<i>Buchnera</i>
16a. Leaves whorled; corolla bluish white	<i>Bacopa</i>
16b. Leaves opposite; corolla yellow.....	<i>Mecardonia</i>

Adenosma R. Br.

Prodr. Fl. Nov. Holland.: 442.1810.

Adenosma subrepens (Thwaites) Benth. ex Hook.f., Fl. Brit. India 4: 263.1885; Gamble, Fl. Madras 2: 949. 1921; Sasidh., Fl. Periyar Tiger Reserve 275. 1998.

Herb. Stem terete, green, villous, aromatic, rooting at nodes. Leaves simple, opposite, ovate, 3–5 × 1–2 cm, apex acute, base cuneate, margins serrate, green, pubescent, petiolate. Flowers solitary, axillary, sub sessile. Calyx lobes 5, deeply divided, 4–6 mm long, apex acute, green, pubescent. Corolla tube 4–5 mm long, blue, sparsely pubescent; lobes 5, bilipped, upper lip entire, lower lip 3 lobed, 3–5 mm long, blue,

sparsely pubescent. Stamens 4, didynamous, inserted; filaments filiform, 3 mm long; 2.4 mm long, pale blue, glabrous; anthers bilobed, elliptic, c. 1 mm long, white, glabrous. Style filiform on basal portion, dilated towards top, minute, pale blue, glabrous. Stigma entire, minute, blue, glabrous.

Distribution: Sri Lanka (POWO, 2022) & India

Habitat: Semi evergreen forests

Flowering and fruiting: January-November

Specimen examined: India, Kerala, Idukki, Eravikulam, 12/02/2017, Divya K. Venugopal 154319 (CALI).

Artanema D. Don

R. Sweet, Brit. Fl. Gard. 3: t. 234 (1829), *nom. cons.*

Artanema longifolium (L.) Vatke, Linnaea 43: 307.1882; Sasidh., Fl. Periyar Tiger Reserve 276. 1998. *Artanema sesamoides* (Vahl) Benth., Scroph. Ind.: 39.1835; Hook. f., Fl. Brit. India 4: 274. 1885; Gamble, Fl. Madras 2: 955. 1921.

Herb. Stem quadrangular, green, villous, aromatic. Leaves simple, opposite, elliptic, 6–15 × 4–7 cm, apex acuminate, base cuneate, margins serrate, green, glabrous, sessile. Flowers in racemes, sessile. Peduncle quadrangular, 5–8 cm long, green, glabrous. Calyx lobes 5, deeply divided, 4–9 mm long, apex acuminate, green, glabrous. Corolla tube 1.4–1.5 cm long, blue, pubescent; lobes 5, bilipped, upper lip entire, lower lip 3 lobed, 2–2.2 cm long, apex obtuse, blue, pubescent. Stamens 4, didynamous, inserted; filaments filiform, 7 mm long; 9 mm long, pale blue, glabrous; anthers bilobed, elliptic, c. 1 mm long, white, glabrous. Style filiform on basal portion, dilated towards top, 1 cm long, pale blue, glabrous. Stigma bilobed, minute, white, glabrous. Capsule globose, 5–7 mm long, green, glabrous.

Distribution: Sri Lanka (POWO, 2022) & India

Habitat: Moist deciduous forests

Flowering and fruiting: January-November

Specimens examined: India, Kerala, Idukki, Eravikulam, 12/02/2017, Divya K. Venugopal 152071 (CALI); Periyar Tiger Reserve, 10/11/1994, Jomy Augustine 14216 (CALI).

***Bacopa* Aubl.**

Hist. Pl. Guiane 1: 128.1775, *nom.cons.*

Bacopa monnieri (L.) Wettst., H.G.A.Engler & K.A.E.Prantl, Nat. Pflanzenfam. 4(3b): 77 .1891; Sasidh., Fl. Chinnar WLS 220. 1999. *Herpestis monniera* (L.) Kunth, F.W.H.von Humboldt, A.J.A.Bonpland & C.S.Kunth, Nov. Gen. Sp. 2: 366.1818; Hook.f., Fl. Brit. India 4: 272. 1885. *Moniera cuneifolia* Michx., Fl. Bor.-Amer. 2: 22.1803; Gamble, Fl. Madras 2: 953. 1921.

Herb. Stem terete, prostrate, green, glabrous, rooting at nodes. Leaves simple, whorled, oblong, 1–2 × 0.2–0.8 cm, apex obtuse, base cuneate, margins entire, green, glabrous, sessile. Flowers solitary, axillary. Pedicel terete, 1.4–2 cm long, green, glabrous. Calyx lobes 5, unequal, 3 mm long; 4 mm long, apex acute, green, glabrous. Corolla tube 4 mm long, bluish white, glabrous; lobes 5, sub equal, campanulate, 4–5 mm long, apex obtuse, bluish white, glabrous. Stamens 4, didynamous, inserted; filaments slender, 3 mm long; 4 mm long, white, glabrous; anther bilobed, elliptic, > 1 mm long, white, glabrous. Style linear, dilated at top, 5 mm long, pale green, glabrous. Stigma entire, 1 mm long, pale green, glabrous. Capsule ovoid, 3–5 mm long, green, enclosed by calyx.

Distribution: Tropics & Subtropics (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: May–December

Specimens examined: India, Kerala, Idukki, Chinnar, 28/11/1979, *Nambiar 1085* (KFRI); Chinnar, 18/05/1999, *P. Prashy 79436* (CALI).

***Bonnaya* Link & Otto**

Icon. Pl. Select.: 25.1820.

Key to species

- 1a. Stem terete; flowers solitary..... *B. antipoda*
- 1b. Stem quadrangular; flowers in racemes 2
- 2a. Stem green; corolla pale blue..... *B. ciliata*
- 2b. Stem purplish green; corolla pink *B. oppositifolia*

Bonnaya antipoda (L.) Druce, Rep. Bot. Exch. Club Soc. Brit. Isles 3: 415. 1913 publ. 1914. *Lindernia antipoda* (L.) Alston, H.Trimen, Handb. Fl. Ceylon 6(Suppl.): 214.1931; Sasidh., Fl. Periyar Tiger Reserve 278. 1998; Sasidh., Fl. Chinnar WLS

222. 1999. *Bonnaya veronicifolia* (Retz.) Spreng., Syst. Veg. ed. 16. 1: 41. 1824; Hook.f., Fl. Brit. India 4: 285. 1885.

Herb. Stem terete, green, glabrous, rooting at nodes. Leaves simple, opposite, oblong, 1–2 × 0.2–0.5 cm, apex obtuse, base cuneate, margins dentate, green, glabrous, sessile. Flowers solitary, axillary. Pedicel terete, 0.7–1 cm long, green, glabrous. Bracts leafy, green, glabrous. Calyx lobes 5, deeply divided, 4–5 mm long, apex obtuse, green, glabrous. Corolla tube 3–4 mm long, blue, glabrous; lobes 5, bilipped, 6–8 mm long, apex obtuse, blue, glabrous. Stamens 2, inserted; filaments slender, minute, pale blue, glabrous; anthers bilobed, elliptic, orange, glabrous. Staminodes present. Style slender, 3–6 mm long, pale blue, glabrous. Stigma bilobed, > 1 mm long, pale blue, glabrous. Capsule linear, 8 mm–1 cm long, green, glabrous.

Distribution: Tropical & Subtropical Asia to North Australia (POWO, 2022)

Habitat: Marshy areas

Flowering and fruiting: April–December

Specimen examined: India, Kerala, Idukki, Chinnar, 19/05/1999, P. Prashy 79460 (CALI).

Bonnaya ciliata (Colsm.) Spreng., Syst. Veg. ed. 16. 1: 41.1824. *Lindernia ciliata* (Colsm.) Pennell, Brittonia 2: 182.1936; Sasidh., Fl. Periyar Tiger Reserve 278. 1998. *Bonnaya brachiata* Link & Otto, Icon. Pl. Select. 2: 25.1821; Hook.f., Fl. Brit. India 4: 284. 1885. *Ilysanthes serrata* (Roxb.) Urb., Ber. Deutsch. Bot. Ges. 2: 436.1884; Gamble, Fl. Madras 2: 962. 1921.

Herb. Stem quadrangular, green, branched, glabrous. Leaves simple, opposite, oblong, 1–2 × 0.3–0.5 cm, apex obtuse, base round, margins closely serrate, green, glabrous, sessile. Flowers in terminal racemes, lax. Peduncle quadrangular, 2–5 cm long, green, glabrous. Pedicel quadrangular, 1–2 mm long, green, glabrous. Bracts linear, green, glabrous. Calyx lobes 5, deeply divided, 4–5 mm long, apex acuminate, green, glabrous. Corolla tube 4–6 mm long, pale blue, glabrous; lobes 5, bilipped, upper lip minutely lobed, lower lip 3 lobed, 3–6 mm long, apex obtuse, pale blue, glabrous. Stamens 2, inserted; filaments slender, 3–4 mm long, white, glabrous; anthers bilobed, elliptic, c. 1 mm long, white, glabrous. Staminodes present. Style slender, 5–6 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous.

Distribution: Tropical & Subtropical Asia to North Australia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: July–February

Specimen examined: India, Kerala, Idukki, Vakavanam, 14/09/2019, Divya K. Venugopal 170322 (CALI).

Bonnaya oppositifolia (Retz.) Spreng., Syst. Veg., ed. 16. 1: 41.1824; Hook.f., Fl. Brit. India 4: 286. 1885. *Lindernia oppositifolia* (Retz.) Mukerjee, J. Indian Bot. Soc. 24: 134.1945; Sasidh., Fl. Periyar Tiger Reserve 279. 1998. *Ilysanthes oppositifolia* (Retz.) Urb., Ber. Deutsch. Bot. Ges. 2: 435.1884; Gamble, Fl. Madras 2: 962. 1921.

Herb. Stem quadrangular, purplish green, branched, glabrous. Leaves simple, opposite, oblong, 3–5 × 0.3–0.5 cm, apex acute, base cuneate, margins distantly serrate, green, glabrous, sessile. Flowers in axillary or terminal racemes. Peduncle quadrangular, 3–4 cm long, green, glabrous. Pedicel quadrangular, 1–1.6 cm long, green, glabrous. Bracts linear, green, glabrous. Calyx lobes 5, deeply divided, 5–6 mm long, apex acute, green, glabrous. Corolla tube 4–6 mm long, pink, glabrous; lobes 5, bilipped, upper lip entire; lower lip 3 lobed, 5–9 mm long, apex obtuse, pink, glabrous. Stamens 2, inserted; filaments slender, 3–4 mm long, white, glabrous; anthers bilobed, elliptic, 1 mm long, white, glabrous. Staminodes present. Style slender, 6–8 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule linear, 1–1.5 cm long, brown, glabrous.

Distribution: Indian Subcontinent (POWO, 2022)

Habitat: Marshy areas

Flowering and fruiting: June–December

Specimens examined: India, Kerala, Idukki, Neriamangalam, 26/12/2017, Divya K. Venugopal 156385 (CALI); Periyar Tiger Reserve, 12/06/1995, Jomy Augustine 15421 (CALI).

***Buchnera* L.**

Sp. Pl.: 630.1753.

Buchnera hispida Buch.-Ham. ex D.Don, Prodr. Fl. Nepal.: 91.1825; Hook.f., Fl. Brit. India 4: 298. 1885; Gamble, Fl. Madras 2: 966. 1921; Sasidh., Fl. Periyar Tiger Reserve 276. 1998.

Herb. Stem terete, green, pubescent. Leaves simple, lower leaves opposite, upper leaves alternate, elliptic, 3–5 × 1–2 cm, apex obtuse, base cuneate, margins serrate, green, pubescent, sessile. Flowers in axillary and terminal spikes, sessile, lax. Peduncle terete, 5–8 cm long, green, pubescent. Bracts linear, minute, green, pubescent. Calyx tube 4–5 mm long, green, pubescent; lobes 5, minute, 10 ribbed,

apex acute, green, pubescent. Corolla tube 5–8 mm long, pale purple, pubescent; lobes 5, bilipped, almost equal, 3–4 mm long, apex obtuse, pale purple, pubescent. Stamens 4, didynamous, inserted; filaments minute, white, glabrous; anthers bilobed, sagittate, c. 1 mm long, white, glabrous. Style 4–7 mm long, white, glabrous. Stigma entire, minute, pale blue, glabrous. Capsule oblong, 3–6 mm long, green, glabrous.

Distribution: Africa, Arabian Peninsula, Indian Subcontinent (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: April-January

Specimens examined: India, Kerala, Idukki, Erattayar, 03/04/2018, Divya K. Venugopal 158418 (CALI); Periyar Tiger Reserve, 02/11/1993, Jomy Augustine 12692 (CALI).

***Centranthera* R.Br.**

Prodr. Fl. Nov. Holland.: 438.1810.

***Centranthera indica* (L.) Gamble, Fl. Madras: 971.1924; Hook.f., Fl. Brit. India 4: 191. 1885; Sasidh., Fl. Periyar Tiger Reserve 276. 1998.**

Herb. Stem quadrangular, green, pubescent. Leaves simple, lower leaves opposite, upper leaves alternate, oblong, 1–3 × 0.5–0.7 cm, apex acute, base round, margins entire, green, pubescent, sessile. Flowers solitary, axillary, sessile. Bracts linear, minute, green, pubescent. Calyx lobes 5, 4–11 mm long, apex acute, green, pubescent. Corolla tube 6–9 mm long, white, pubescent; lobes 5, equal, 2–4 mm long, apex obtuse, white, pubescent. Stamens 4, didynamous, inserted; filaments filiform, 4 mm long; 5 mm long, white, pubescent; anthers bilobed, elliptic, > 1 mm long, yellow, spurred at base. Style slender, 7–8 mm long, white, pubescent. Stigma obovate, minute, yellow, glabrous. Capsule ovoid, 5–8 mm long, brown, with persistent calyx lobes, glabrous.

Distribution: India to Bangladesh, Sri Lanka, Andaman Islands (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: September-December

Specimen examined: India, Kerala, Idukki, Meesapulimala, 04/09/2017, Divya K. Venugopal 151491 (CALI).

***Dopatrium* Buch.-Ham. ex Benth.**

Edwards's Bot. Reg. 21: t. 1770.4.1835.

***Dopatrium junceum* (Roxb.) Buch.-Ham. ex Benth.**, Edwards's Bot. Reg. 21: t. 1770.4.1835; Hook.f., Fl. Brit. India 4: 191. 1885; Gamble, Fl. Madras 2: 954. 1921; Sasidh., Fl. Periyar Tiger Reserve 276. 1998.

Herb. Stem quadrangular, green, glabrous. Leaves simple, opposite-decussate, ovate, 3–4 × 1–2 cm, apex acute, base cuneate, margins entire, green, glabrous, sessile. Flowers solitary, axillary, minute. Pedicel quadrangular, 5–9 mm long, green, glabrous. Bracts linear, minute, green, glabrous. Calyx lobes 5, 1–2 mm long, apex acute, green, glabrous. Corolla tube 4–5 mm long, pink, glabrous; lobes 5, bilipped, upper lip 2 lobed; lower lip 3 lobed, 2–3 mm long, apex obtuse, pink, glabrous. Stamens 2; filaments filiform, minute, white, glabrous; anthers bilobed, elliptic, minute, yellow, glabrous. Staminodes present. Style 3–4 mm long, white, glabrous. Stigma bilobed, linear, minute, white, glabrous.

Distribution: Tropical & South Africa to Central China and North Australia (POWO, 2022)

Habitat: Marshy areas

Flowering and fruiting: June–December

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 15/06/1995, Jomy Augustine 15441 (CALI).

***Limnophila* R.Br.**

Prodr. Fl. Nov. Holland.: 442.1810.

Key to species

1a. Stem terete; flowers in racemes *L. aromatica*

1b. Stem quadrangular; flowers solitary *L. chinensis*

***Limnophila aromatica* (Lam.) Merr.**, Interpr. Herb. Amboin.: 466.1917; Sasidh., Fl. Periyar Tiger Reserve 277. 1998. *Limnophila gratissima* Blume, Bijdr. Fl. Ned. Ind.: 749.1826; Hook.f., Fl. Brit. India 4: 191. 1885; Gamble, Fl. Madras 2: 951. 1921.

Herb. Stem terete, green, sparsely pubescent. Leaves simple, opposite-decussate, elliptic, 3–5 × 1–2 cm, apex acute, base truncate, margins serrate, green, glabrous, sessile. Flowers in axillary racemes. Bracts leafy, 2–3 mm long, green, glabrous. Pedicel terete, 6–9 mm long, green, pubescent. Calyx tube minute, green, pubescent; lobes 5, 3–6 mm long, apex acuminate, green, pubescent. Corolla tube 7–10 mm

long, pink, pubescent; lobes 5, bilipped, upper lip 2 lobed; lower lip 3 lobed, 3–6 mm long, apex obtuse, purple, pubescent. Stamens 4, didynamous, inserted; filaments slender, 5 mm long; 4 mm long, white, villous; anthers bilobed, elliptic, > 1 mm long, white, glabrous. Style slender, 6–9 mm long, white, villous. Stigma bilobed, minute, white, glabrous.

Distribution: Tropical & Subtropical Asia to North & North East Australia (POWO, 2022)

Habitat: Marshy areas

Flowering and fruiting: August–December

Specimens examined: India, Kerala, Idukki, Painavu road, 07/08/2017, Divya K. Venugopal 154322 (CALI); Periyar Tiger Reserve, 28/12/1996, Jomy Augustine 17071 (CALI).

Limnophila chinensis (Osbeck) Merr., Amer. J. Bot. 3: 581.1916 publ. 1917; Sasidh., Fl. Chinnar WLS 220. 1999. *Limnophila hirsuta* (B.Heyne ex Benth.) Benth., A.P.de Candolle, Prodr. 10: 388 .1846; Gamble, Fl. Madras 2: 951. 1921.

Herb. Stem quadrangular, green, pubescent. Leaves simple, opposite, ovate, 2–4 × 1–1.7 cm, apex acute, base truncate, margins serrate, green, pubescent, sessile. Flowers axillary, solitary. Pedicel quadrangular, 6–9 mm long, green, pubescent. Calyx tube 2–3 mm long, green, pubescent; lobes 5, 5–8 mm long, apex acuminate, green, pubescent. Corolla tube 4–5 mm long, purple, pubescent; lobes 5, bilipped, upper lip 2 lobed, lower lip 3 lobed, 2–3 mm long, apex obtuse, purple, pubescent. Stamens 4, didynamous, inserted; filaments slender, 2 mm long; 3 mm long, white, villous; anthers bilobed, elliptic, > 1 mm long, white, glabrous. Style slender, 4–5 mm long, white, pubescent. Stigma bilobed, minute, white, glabrous.

Distribution: Tropical & Subtropical Asia to North Australia (POWO, 2022)

Habitat: Marshy areas

Flowering and fruiting: May–December

Specimens examined: India, Kerala, Idukki, Meenuliyanpara, 12/12/2016, Divya K. Venugopal 151431 (CALI); Idukki Wildlife Sanctuary, 05/08/2017, Divya K. Venugopal 154181 (CALI); Chinnar, 18/05/1999, Satheesh George 79240 (CALI).

***Lindernia* All.**

Mélanges Philos. Math. Soc. Roy. Turin 3: 178.1766.

Key to species

- 1a. Stem rooting at lower nodes..... *L. rotundifolia*
- 1b. Stem not rooting at lower nodes 2
- 2a. Leaves opposite-decussate; corolla lobes white without patches;
capsule oblong *L. parviflora*
- 2b. Leaves opposite-superposed; corolla lobes white with
blue patches at centre; capsule ovoid..... *L. hyssopioides*

Lindernia parviflora (Roxb.) Haines, Bot. Bihar Orissa: 635.1922; Sasidh., Fl. Periyar Tiger Reserve 279. 1998; Sasidh., Fl. Chinnar WLS 223. 1999. *Ilysanthes parviflora* (Roxb.) Benth., A.P.de Candolle, Prodr. 10: 419.1846; Hook.f., Fl. Brit. India 4: 191. 1885; Gamble, Fl. Madras 2: 961. 1921.

Herb. Stem quadrangular, erect, green, glabrous. Leaves simple, opposite-decussate, oblong, 1–2 × 0.5–0.8 cm, apex acute, base round, margins entire, green, glabrous, sessile. Flowers in axillary, solitary. Pedicel terete, 0.8–1.2 cm long, green, glabrous. Bracts ovate, minute, green, glabrous. Calyx lobes 5, deeply divided, 2–5 mm long, apex acute, green, glabrous. Corolla tube 5–8 mm long, white, glabrous; lobes 5, bilobed, upper lip minutely 2 lobed; lower lip 3 lobed, 3–7 mm long, apex obtuse, white, glabrous. Stamens 2, inserted; filaments slender, 2–3 mm long, white, glabrous; anther bilobed, elliptic, c. 1 mm long, white, glabrous. Staminodes present. Style slender, 5–9 mm long, white, glabrous. Stigma bilobed, c. 1 mm long, white, glabrous. Capsule oblong, 4–5 mm long, green, glabrous.

Distribution: Africa, Indian Subcontinent to Indo-China (POWO, 2022)

Habitat: Marshy areas

Flowering and fruiting: June–December

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 12/06/1995, Jomy Augustine 15423 (CALI).

Lindernia hyssopioides (L.) Haines, Bot. Bihar Orissa: 635.1922; Sasidh., Fl. Periyar Tiger Reserve 279. 1998; Sasidh., Fl. Chinnar WLS 223. 1999. *Ilysanthes hyssopioides* (L.) Benth., A.P.de Candolle, Prodr. 10: 419.1846; Hook.f., Fl. Brit. India 4: 283. 1885; Gamble, Fl. Madras 2: 961. 1921.

Herb. Stem quadrangular, erect, green, glabrous. Leaves simple, opposite, lower leaves lanceolate; upper leaves linear, 1–2 × 0.5–0.8 cm, apex acute, base cuneate, margins entire, green, glabrous, sessile. Flowers axillary, solitary. Pedicel quadrangular, 1–4 cm long, green, glabrous. Calyx lobes 5, deeply divided, 2–4 mm long, apex acute, green, glabrous. Corolla tube 5–9 mm long, blue, glandular; lobes 5, bilobed, upper lip minutely 2 lobed; lower lip 3 lobed, 3–8 mm long, apex obtuse, white with blue patches at centre, glandular. Stamens 2, inserted; filaments slender, 2–3 mm long, white, glabrous; anthers bilobed, elliptic, c. 1 mm long, white, glabrous. Staminodes present. Style slender, 5–8 mm long, white, glabrous. Stigma bilobed, c. 1 mm long, white, glabrous. Capsule ovoid, 4–5 mm long, green, glabrous.

Distribution: Indian Subcontinent to China and Indo-China (POWO, 2022)

Habitat: Marshy areas

Flowering and fruiting: March-July

Specimen examined: India, Kerala, Idukki, Kattappana, 16/03/2018, Divya K. Venugopal 158372 (CALI).

Lindernia rotundifolia (L.) Alston, H. Trimen, Handb. Fl. Ceylon 6(Suppl.): 214.1931; Sasidh., Fl. Periyar Tiger Reserve 280. 1998; Sasidh., Fl. Chinnar WLS 223. 1999. *Ilysanthes rotundifolia* (L.) Benth., A.P. de Candolle, Prodr. 10: 420.1846; Hook. f., Fl. Brit. India 4: 254. 1885; Gamble, Fl. Madras 2: 962. 1921.

Herb. Stem quadrangular, green, glabrous, rooting at lower nodes. Leaves simple, opposite-decussate, ovate, 0.6–1.2 cm × 5–1 cm, apex obtuse, base round, margins entire, green, glabrous, sessile. Flowers axillary, solitary. Pedicel quadrangular, 3–5 mm long, green, glabrous. Calyx lobes 5, deeply divided, 2–3 mm long, apex acute, green, glabrous. Corolla tube 4–7 mm long, blue, glabrous; lobes 5, bilobed, upper lip minutely 2 lobed; lower lip 3 lobed, 3–8 mm long, apex obtuse, white with blue patches at centre, glabrous. Stamens 2, inserted; filaments slender, 2–3 mm long, white, glabrous; anthers bilobed, elliptic, c. 1 mm long, white, glabrous. Staminodes present. Style slender, 4–7 mm long, white, glabrous. Stigma bilobed, c. 1 mm long, white, glabrous. Capsule oblong, 3–4 mm long, green, glabrous.

Distribution: West Indian Ocean, Indian Subcontinent, Central & South Tropical America (POWO, 2022)

Habitat: Marshy areas

Flowering and fruiting: January-July

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 15/07/2017, Divya K. Venugopal 154114 (CALI); *ibid.*, 17/01/1995, Jomy Augustine 14580 (CALI).

***Mazus* Lour.**

Fl. Cochinch.: 385.1790.

Mazus pumilus (Burm.f.) Steenis, Nova Guinea, n.s., 9: 31.1958; Sasidh., Fl. Periyar Tiger Reserve 280. 1998; Sasidh., Fl. Chinnar WLS 223. *Mazus rugosus* Lour., Fl. Cochinch.: 385.1790; Hook.f., Fl. Brit. India 4: 259. 1885; Gamble, Fl. Madras 2: 947. 1921.

Herb. Stem terete, green, pubescent. Leaves simple, lower leaves opposite, upper leaves alternate, obovate, 4–5 × 1–2 cm, apex obtuse, base cuneate, margins serrate, green, glabrous, petiolate. Flowers in terminal racemes. Peduncle terete, 3–5 cm long, green, glabrous. Pedicel terete, c. 1 cm long, green, glabrous. Bracts minute, green, glabrous. Calyx tube 2 mm long, green, pubescent; lobes 5, 3–4 mm long, apex acute, green, pubescent. Corolla tube 2–3 mm long, blue, glabrous; lobes 5, bilipped, upper lip 2 lobed; lower lip 3 lobed, lower lip unequal, 4–6 mm long, apex obtuse, bluish white with yellow at centre, glabrous. Stamens 4, didynamous, inserted; filaments slender, 2 mm long; 3 mm long, white, glabrous; anthers bilobed, elliptic, white, glabrous. Style short, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule oblong, 2–4 mm long, green, enclosed by calyx, glabrous.

Distribution: Asia (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: August–December.

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 11/12/2016, Divya K. Venugopal 151389 (CALI).

***Mecardonia* Ruiz & Pav.**

Fl. Peruv. Prodr.: 95.1794.

Mecardonia procumbens (Mill.) Small, Fl. S.E. U.S.: 1065.1903; Sasidh., Fl. Periyar Tiger Reserve 281. 1998.

Herb. Stem quadrangular, green, glabrous. Leaves simple, opposite, ovate, 1–2 × 0.3–0.6 cm, apex acute, base round, margins serrate, green, glabrous, sessile. Flowers solitary, axillary. Pedicel quadrangular, 0.7–1 cm long, green, glabrous. Calyx lobes 5, deeply lobed, unequal, outer 3 lobes; inner 2 lobes, 5 mm long; 4 mm long, apex

acute, green, glabrous. Corolla tube 2–3 mm long, yellow, glabrous; lobes 5, bilipped, upper lip 2 lobed; lower lip 3 lobed, 5–7 mm long, apex obtuse, yellow, glabrous. Stamens 4, didynamous, inserted; filaments filiform, 1 mm long; 2 mm long, pale yellow, glabrous; anthers bilobed, elliptic, > 1 mm long, white, glabrous. Style slender, 3–4 mm long, pale yellow, glabrous. Stigma capitate, 1 mm long, pale yellow, glabrous. Capsule oblong, 5–6 mm long, enclosed by calyx, green, glabrous.

Distribution: Tropical & Subtropical America (POWO, 2022)

Habitat: Waste lands

Flowering and fruiting: January-June

Specimens examined: India, Kerala, Idukki, Anayirangal dam, 05/01/2017, Divya K. Venugopal 151553 (CALI); Periyar Tiger Reserve, 25/05/1995, Jomy Augustine 15289 (CALI).

***Micrargeria* Benth.**

A.P.de Candolle, Prodr. 10: 509. 1846.

Micrargeria wightii Benth., A.P.de Candolle, Prodr. 10: 509.1846; Hook.f., Fl. Brit. India 4: 303. 1885; Gamble, Fl. Madras 2: 970. 1921; Sasidh., Fl. Chinnar WLS 224. 1999.

Herb. Stem terete, branched, green, black when dry, glabrous. Leaves compound, opposite, linear, 2–4 × 0.5–1 cm, apex acute, base pointed, margins pinnatisect, green, pubescent, sessile. Flowers in terminal racemes, minute. Peduncle terete, 6–7 cm long, green, glabrous. Pedicel terete, c. 1–2 mm long, green, glabrous. Bracts minute, green, glabrous. Calyx tube 1–1.2 cm long, green, glabrous; lobes 5, 4–6 mm long, apex acuminate, green, glabrous. Corolla tube 2–4 mm long, pink, glabrous; lobes 5, 2–3 mm long, apex obtuse, pink, glabrous. Stamens 4, didynamous, inserted; filaments 2 mm long; 1 mm long, pale pink, glabrous; anthers bilobed, elliptic, > 1 mm long, white, glabrous. Style slender, 2–3 mm long, pale pink, glabrous. Stigma clavate, c. 1 mm long, white, glabrous. Capsule globose, 2–3 mm long, green, glabrous.

Distribution: Myanmar (POWO, 2022)

Habitat: Dry rocks

Flowering and fruiting: February-June

Specimen examined: India, Kerala, Idukki, Chinnar, 18/02/1998, K. Sinitha 61726 (CALI).

***Mimulus* L.**

Sp. Pl.: 634.1753.

Mimulus orbicularis Wall. ex Benth., Scroph. Ind.: 29.1835; Hook.f., Fl. Brit. India 4: 259. 1885; Gamble, Fl. Madras 2: 947. 1921; Sasidh., Fl. Periyar Tiger Reserve 281. 1998.

Herb. Stem terete, green, glabrous. Leaves simple, opposite, broadly ovate, 1.5–3 × 1–1.2 cm, apex obtuse, base round, margins serrate, green, glabrous, sessile. Flowers solitary, axillary. Pedicel terete, 5–8 mm long, green, glabrous. Calyx tube 3 mm long, green, glabrous; lobes 5, c. 1 mm long, apex acute, green, glabrous. Corolla tube 2–3 mm long, yellowish white, glabrous; lobes 5, bilipped, upper lip 2 lobed; lower lip 3 lobed, 4–9 mm long, apex obtuse, yellow, glabrous. Stamens 4, didynamous, included; filaments filiform, 2 mm long; 3 mm long, white, glabrous; anthers bilobed, elliptic, > 1 mm long, white, glabrous. Style slender, 3 mm long, white, glabrous. Stigma bilobed, 1 mm long, white, glabrous. Capsule ellipsoid, 3–5 mm long, green, glabrous.

Distribution: North East India to Indo-China (POWO, 2022)

Habitat: Marshy areas

Flowering and fruiting: August-February

Specimen examined: India, Kerala, Idukki, Chottuppara, 07/09/2017, Divya K. Venugopal 152984 (CALI).

***Pedicularis* L.**

Sp. Pl.: 607.1753.

Pedicularis zeylanica Benth., Scroph. Ind.: 54.1835; Hook.f., Fl. Brit. India 4: 317. 1885; Gamble, Fl. Madras 2: 972. 1921; Sasidh., Fl. Periyar Tiger Reserve 281. 1998.

Figure 23 D.

Root parasitic herb. Stem terete, green, pubescent. Leaves simple, alternate, oblong, 3–5 × 1.5–2 cm, apex obtuse, base cuneate, margins serrate, green, pubescent, sessile. Flowers in terminal racemes, dense, sessile. Peduncle terete, 5–7 cm long, green, glabrous. Bracts leafy, green, pubescent. Calyx lobes 5, deeply lobed, 0.8–1 cm long, apex obtuse, green, pubescent. Corolla tube 1.2–1.5 cm long, pink, glabrous; lobes 5, bilipped, upper lip hooded, lower lip 3 lobed, 1.8–2.3 cm long, apex obtuse, pink, glabrous. Stamens 4, didynamous; filaments slender, 7 mm long; 9 mm long, white, glabrous; anthers bilobed, elliptic, 1 mm long, yellow, glabrous. Style slender, 1.3 cm

long, white, glabrous. Stigma capitate, 2 mm long, white, glabrous. Capsule oblong, 6–9 mm long, green, labrous.

Distribution: South West India, Sri Lanka (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: July-December

Specimens examined: India, Kerala, Idukki, Calvary Mount, 08/09/2017, Divya K. Venugopal 154333 (CALI); Wayside Chinna Anamudi, 31/08/2019, Divya K. Venugopal 170262 (CALI); Rhodovalley, 22/11/2018, Divya K. Venugopal 168825 (CALI); Munnar, 29/07/1982, Nambiar 1861 (KFRI); Periyar Tiger Reserve, 07/07/1993, Jomy Augustine 12031 (CALI).

***Scoparia* L.**

Sp. Pl.: 116.1753.

***Scoparia dulcis* L.**, Sp. Pl.: 116.1753; Hook.f., Fl. Brit. India 4: 289. 1885; Gamble, Fl. Madras 2: 964. 1921; Sasidh., Fl. Periyar Tiger Reserve 281. 1998; Sasidh., Fl. Chinnar WLS 224. 1999.

Herb. Stem terete, branched, green, glabrous. Leaves simple, opposite-decussate, elliptic, 1–4 × 0.5–2 cm, apex acute, base cuneate, margins serrate, green, glabrous, petiolate. Flowers solitary, axillary. Pedicel terete, 3–5 mm long, green, glabrous. Calyx lobes 4, 2–4 mm long, apex obtuse, green, ciliate along margin. Corolla lobes 4, 3–7 mm long, apex obtuse, white, pubescent. Stamens 4, equal, exserted; filaments filiform, 3–4 mm long, white, glabrous; anthers bilobed, elliptic, > 1 mm long, white, glabrous. Style slender, 4–5 mm long, white, glabrous. Stigma capitate, > 1 mm long, white, glabrous. Capsule globose, 1–3 mm long, green, glabrous.

Distribution: Native to Tropical & Subtropical America & now Pantropical (POWO, 2022)

Habitat: Waste lands

Flowering and fruiting: January-May

Specimen examined: India, Kerala, Idukki, Kulamavu, 01/03/2017, Divya K. Venugopal 167780 (CALI).

***Torenia* L.**

Sp. Pl.: 619.1753.

Key to species

- 1a. Leaves sessile, glabrous *T. anagallis*
- 1b. Leaves petiolate, pubescent 2
- 2a. Stem rooting at nodes..... *T. crustacea*
- 2b. Stem not rooting at nodes 3
- 3a. Calyx lobes not winged, glabrous *T. bicolor*
- 3b. Calyx lobes winged, ciliate *T. courtallensis*

Torenia anagallis (Burm.f.) Wanner, W.R.Barker & Y.S.Liang, Austral. Syst. Bot.31:250.2018, *Lindernia anagallis* (Burm.f.) Pennell, J. Arnold Arbor. 24: 252. 1943; Sasidh., Fl. Periyar Tiger Reserve 278. 1998. *Vandellia pedunculata* Benth., Scroph. Ind.: 37.1835; Hook.f., Fl. Brit. India 4: 282. 1885; Gamble, Fl. Madras 2: 959. 1921.

Herb. Stem quadrangular, green, glabrous. Leaves simple, opposite-decussate, ovate, 1–3 × 0.8–1.5 cm, apex acute, base round, margins dentate, green, glabrous, sessile. Flowers solitary, axillary. Pedicel quadrangular, 0.8–1.2 cm long, green, glabrous. Calyx lobes 5, deeply divided, 2–7 mm long, apex acute, green, glabrous. Corolla tube 4–7 mm long, blue, glabrous; lobes 5, bilipped, upper lip entire; lower lip 3 lobed, 3–5 mm long, apex obtuse, bluish white, glabrous. Stamens 4, didynamous, inserted; filaments slender, 3 mm long; 2 mm long, white, glabrous; anthers bilobed, elliptic, c. 1 mm long, white, glabrous. Style slender, 5–8 mm long, white, glabrous. Stigma bilobed, c. 1 mm long, white, glabrous. Capsule linear, 1–1.3 cm long, green, glabrous.

Distribution: Tropical & Subtropical Asia to North Queensland (POWO, 2022)

Habitat: Marshy areas

Flowering and fruiting: September-December

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 27/11/1996, Jomy Augustine 16987 (CALI).

Torenia bicolor Dalzell, Hooker's J. Bot. Kew Gard. Misc. 3: 38.1851; Hook.f., Fl. Brit. India 4: 278. 1885; Gamble, Fl. Madras 2: 957. 1921; Sasidh., Fl. Periyar Tiger Reserve 283. 1998.

Herb. Stem quadrangular, green, glabrous. Leaves simple, opposite, ovate, $1-4 \times 0.8-2.5$ cm, apex acute, base cordate, margins serrate, green, sparsely pubescent, petiolate. Flowers solitary, axillary. Pedicel quadrangular, 1–2 cm long, green, glabrous. Calyx lobes 5, bilipped, not winged, 1–1.6 cm long, apex acute, green, glabrous. Corolla tube 1–1.5 cm long, yellow, glabrous; lobes 5, bilipped, upper lip entire; lower lip 3 lobed, 1–1.4 cm long, apex obtuse, deep purple, glabrous. Stamens 4, didynamous, inserted; filaments slender, 6 mm long; 5 mm long, pale purple, glabrous; anthers bilobed, elliptic, c. 1 mm long, white, glabrous. Style slender, 7–8 mm long, pale purple, glabrous. Stigma bilobed, c. 1 mm long, pale purple, glabrous. Capsule oblong, 1–1.6 cm long, covered by calyx, green, glabrous.

Distribution: West India (POWO, 2022)

Habitat: Marshy areas

Flowering and fruiting: June–October

Specimens examined: India, Kerala, Idukki, Painavu road, 07/08/2017, Divya K. Venugopal 154320 (CALI); Periyar Tiger Reserve, 22/06/1996, Jomy Augustine 16296 (CALI).

Torenia courtallensis Gamble, Fl. Madras: 956.1923; Sasidh., Fl. Periyar Tiger Reserve 283. 1998.

Herb. Stem quadrangular, green, glabrous. Leaves simple, opposite, ovate, $2-3 \times 1-1.5$ cm, apex acute, base round, margins serrate, green, sparsely pubescent, petiolate. Flowers solitary, axillary. Pedicel quadrangular, 3–5 cm long, green, pubescent. Calyx lobes 5, bilipped, 4–7 mm long, apex acute, winged, green, ciliate. Corolla tube 5–7 mm long, white, pubescent; lobes 5, bilipped, upper lip entire; lower lip 3 lobed, 6–9 mm long, apex obtuse, violet-blue, pubescent. Stamens 4, didynamous, inserted; filaments slender, 5 mm long; 6 mm long, white, glabrous; anthers bilobed, elliptic, c. 1 mm long, white, glabrous. Style slender, 5–6 mm long, white, glabrous. Stigma bilobed, 1 mm long, white, glabrous. Capsule ellipsoid, 5–8 mm long, covered by calyx, green, glabrous.

Distribution: South West India & Sri Lanka (POWO, 2022)

Habitat: Marshy areas

Flowering and fruiting: June–December

Specimens examined: India, Kerala, Idukki, Painavu road, 07/08/2017, Divya K. Venugopal 154319 (CALI); Mankulam, 11/06/2018, Divya K. Venugopal 159319

(CALI); Mathikettan Shola National Park, 30/07/2016, *S. Syam Radh 149194* (CALI); Munnar, 29/11/1979, *Nambiar 1105* (KFRI); Periyar Tiger Reserve, 08/12/1994, *Jomy Augustine 14367* (CALI).

Torenia crustacea (L.) Cham. & Schltdl., *Linnaea* 2: 570.1827. *Lindernia crustacea* (L.) F.Muell., *Syst. Census Austral. Pl.*: 97.1882; Sasidh., *Fl. Periyar Tiger Reserve* 279. 1998; Sasidh., *Fl. Chinnar WLS* 222. 1999. *Vandellia crustacea* (L.) Benth., *Scroph. Ind.*: 35 1835; Hook.f., *Fl. Brit. India* 4: 274. 1885; Gamble, *Fl. Madras* 2: 959. 1921.

Herb. Stem quadrangular, branched, rooting at nodes, green, glabrous. Leaves simple, opposite, ovate, 2–3 × 0.8–1.5 cm, apex acute, base round, margins serrate, green, sparsely pubescent, petiolate. Flowers axillary, 1–2, minute. Pedicel terete, 1–1.4 cm long, green, glabrous. Calyx lobes 5, 3–5 mm long, apex acute, green, pubescent. Corolla tube 3–5 mm long, blue, glabrous; lobes 5, bilipped, upper lip minutely 2 lobed; lower lip 3 lobed, 6–7 mm long, apex obtuse, bluish white, glabrous. Stamens 4, didynamous, inserted; filaments slender, 2 mm long; 3 mm long, white, glabrous, usually with a blotched appendage at base; anthers bilobed, elliptic, c. 1 mm long, white, glabrous. Style slender, 4–6 mm long, white, glabrous. Stigma bilobed, > 1 mm long, white, glabrous. Capsule ovoid, 4–5 mm long, green, glabrous.

Distribution: Tropics & Subtropics (POWO, 2022)

Habitat: Waste lands

Flowering and fruiting: April–September

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 09/05/2015, *S. Syam Radh 145006* (CALI); Periyar Tiger Reserve, 06/08/1996, *Jomy Augustine 16282* (CALI).

Yamazakia W.R.Barker, Y.S.Liang & Wannan

Austral. Syst. Bot. 31: 249.2018.

Key to species

1a. Leaves petiolate; flowers in racemes *Y. viscosa*

1b. Leaves sessile; flowers not in racemes *Y. pusilla*

Yamazakia viscosa (Hornem.) W.R.Barker, Y.S.Liang & Wannan, *Austral. Syst. Bot.* 31: 249.2018. *Lindernia viscosa* (Hornem.) Bold. *Zakfl. Java*: 165.1916; Sasidh., *Fl. Periyar Tiger Reserve* 280. 1998. *Vandellia hirsuta* Buch.-Ham. ex Benth., *Scroph. Ind.*: 36 .1835; Gamble, *Fl. Madras* 2: 959. 1921.

Herb. Stem terete, purplish green, tomentose. Leaves simple, opposite, ovate, 2–5 × 1–2.5 cm, apex obtuse, base round, margins serrate, green, pubescent, petiolate. Flowers in terminal racemes. Peduncle terete, 3–4 cm long, purplish green, glabrous. Pedicel terete, 4–6 mm long, purplish green, glabrous. Bracts lanceolate, minute, green, pubescent. Calyx lobes 5, deeply divided, 2–5 mm long, apex acute, green, pubescent. Corolla tube 2–4 mm long, white, glabrous; lobes 5, bilipped, upper lip entire, 2 mm long, brown, glabrous; lower lip 3 lobed, 3–4 mm long, apex obtuse, white with yellow at centre, glabrous. Stamens 4, didynamous, inserted; filaments slender, 2 mm long; 1 mm long, white, glabrous; anthers bilobed, elliptic, > 1 mm long, yellow, glabrous. Style slender, 3 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule globose, 2–4 mm long, green, pubescent.

Distribution: Tropical & Subtropical Asia to Caroline Islands (Palau) (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: February–August

Specimens examined: India, Kerala, Idukki, Kattappana, 16/03/2018, Divya K. Venugopal 158373 (CALI); Periyar Tiger Reserve, 15/08/1996, Jomy Augustine 16238 (CALI).

Yamazakia pusilla (Willd.) W.R.Barker, Y.S.Liang & Wannan, Austral. Syst. Bot. 31: 250.2018. *Lindernia caespitosa* (Blume) Panigrahi, Taxon 33: 320.1984; Sasidh., Fl. Chinnar WLS 222. 1999. *Vandellia scabra* Benth., Scroph. Ind.: 36.1835; Gamble, Fl. Madras 2: 959. 1921; Hook. f., Fl. Brit. India 4: 281. 1885.

Herb. Stem terete, green, tomentose, rooting at nodes. Leaves simple, opposite, ovate, 2–5 × 1–2.5 cm, apex acute, base round, margins serrate, green, pubescent, sessile. Flowers axillary, 1 or 2 per node. Pedicel terete, 1–1.8 cm long, green, glabrous. Calyx lobes 5, deeply divided, 2–4 mm long, apex acute, green, pubescent. Corolla tube 2–4 mm long, white, glabrous; lobes 5, bilipped, upper lip entire, 2 mm long, apex obtuse, brown, glabrous; lower lip 3 lobed, 3–4 mm long, apex obtuse, white with yellow at centre, glabrous. Stamens 4, didynamous, inserted; filaments slender, 2 mm long; 1 mm long, white, glabrous; anthers bilobed, elliptic, > 1 mm long, yellow, glabrous. Style slender, 3 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Capsule globose, 2–5 mm long, green, pubescent.

Distribution: Tropical & Subtropical Asia to North Australia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: February–October

Specimen examined: India, Kerala, Idukki, Anchuruli, 07/09/2017, Divya K. Venugopal 152909 (CALI).

OROBANCHACEAE Vent.

Tabl. Regn. Vég. 2: 292. 1799, *nom. cons.*

Annual root parasites, brown, white or reddish in colour. Mesophytic. Stem usually simple, slender or stout, often scaly. Leaves much reduced to scales or absent (Delta Intkey, 2023). Flowers solitary or in spikes or racemes. Pollination entomophilous (Delta Intkey, 2023). Calyx spathaceous. Corolla tube curved; bilipped, upper lip often arched and throat of lower lip with 2 villous folds. Stamens 4, didynamous, anthers spurred at the base. Fruit capsule, usually 1-celled. Seeds numerous. This family is also known as *broomrapes* and members are parasites on roots of other plants either as holoparasitic or hemiparasitic. The genus *Striga* is a root parasite that harm the cereal crops in Asian and African countries and thus they are also known as ‘witch weed’.

Orobanchaceae have cosmopolitan distribution and consists of about 99 genera (POWO, 2022).

Key to genera

- 1a. Scales absent on stem..... 2
- 1b. Scales present on stem 3
- 2a. Leaves absent *Aeginetia*
- 2b. Leaves present..... *Parasopubia*
- 3a. Flowers sessile 4
- 3b. Flowers pedunculate *Christisonia*
- 4a. Plants stout; leaves absent..... *Campbellia*
- 4b. Plants slender; leaves present..... *Striga*

Aeginetia L.

Sp. Pl. 2: 632. 1753.

Key to species

- 1a. Stem unbranched; corolla lobes dark purple without yellow throat;
sepals modified into a spathe *A. indica*
- 1b. Stem branched; corolla lobes dark purple with yellow throat;
sepals not modified into a spathe *A. acaulis*

Aeginetia indica L., Sp. Pl. 2: 632.1753; Hook.f., Fl. Brit. India 4: 320. 1885; Gamble, Fl. Madras 2: 974. 1921; Sasidh., Fl. Periyar Tiger Reserve 284. 1998.

Annual leafless herb, up to 20 cm high, pale brown with purple striations, glabrous, stout root stock. Stem erect, terete, 12–25 × 0.5 cm, numerous, unbranched, deep pink, glabrous. Flowers in solitary spike, pink. Pedicel terete, 15–20 × 0.2 cm, pale brown, glabrous. Calyx modified in to spathe, 4–6 × 1 cm, yellow with reddish spots, glabrous, persistent. Corolla tube 2 × 1 cm, purple, glabrous; lobes 5 (3 + 2), upper lip 3 lobed, lower lip 2 lobed, 1 × 0.5 cm, apex round, dark purple, glabrous. Stamens 4, didynamous; filaments 5 × 1 mm, white, glabrous; anthers bilobed, reniform, 1 × 1 mm, yellow, spurred. Style slender, 2 × 1 mm, white, glabrous. Stigma discoid, 1 × 1 mm, white, glabrous. Capsule oblong, 2 × 1 cm, glabrous. Seeds numerous, elliptic, minute, white, glabrous.

Distribution: Tropical and Sub tropical Asia (POWO, 2022)

Habitat: Semi-evergreen and moist deciduous forests

Flowering and fruiting: August–December

Specimens examined: India, Kerala, Idukki, Valara, 28/12/2017, Divya K. Venugopal 156584 (CALI); Periyar Tiger Reserve, 16/08/1996, Jomy Augustine 16254 (CALI).

Aeginetia acaulis (Roxb.) Walp., Repert. Bot. Syst. 3: 481 (1844). *Aeginetia pedunculata* Wall., Pl. Asiat. Rar. 3: 13 (1831); Hook.f., Fl. Brit. India 4: 320. 1885; Gamble, Fl. Madras 2: 974. 1921; Sasidh., Fl. Periyar Tiger Reserve 285. 1998.

Annual leafless herb, erect, up to 10 cm high, brown, glabrous. Stem erect, terete, 12–15 × 0.5 cm, branched, brownish yellow, glabrous. Flowers numerous. Pedicel terete, 1 × 0.5 cm, pale brown, glabrous. Calyx tubular; lobes ovate, 3 × 0.5 cm, apex acute, pale orange, glabrous. Corolla tube widening above, 3 × 0.8 cm, yellow-pink, glabrous; lobes 5, obtuse, 1 × 1 cm, apex round, dark purple with yellow colour at throat, glabrous. Stamens 4, didynamous; filaments slender, 2 × 1 mm, white, glabrous; anthers bilobed, reniform, 1 × 1 mm, yellow, fertile anther glabrous and sterile anther have horny projection. Style 2 × 1 mm, white, glabrous. Stigma peltate, 1 × 1 mm, white, glabrous. Capsule ovoid, 2 × 1 cm, brown, glabrous. Seeds numerous, minute, white, glabrous.

Distribution: China to Tropical Asia (POWO, 2022)

Habitat: Moist deciduous forests and grasslands

Flowering and fruiting: September–December

Specimens examined: India, Kerala, Idukki, Valara, 27/12/2017, Divya K. Venugopal 156516 (CALI); Periyar Tiger Reserve, 16/11/1997, Jomy Augustine 17952 (CALI).

***Campbellia* Wight**

Icon. Pl. Ind. Orient. 4: 5. 1850.

Campbellia cytinoides (Reut.) Wight, Icon. Pl. Ind. Orient. [Wight] iv. t. 1425; Gamble, Fl. Madras 2: 976. 1921. *Christisonia neilgherrica* Gardner, Calcutta J. Nat. Hist. 8: 157. 1848; Hook.f., Fl. Brit. India 4: 322. 1885; Sasidh., Fl. Periyar Tiger Reserve 284. 1998.

Annual leafless herb, stout, up to 8 cm high, yellow, glabrous. Scape terete, 6 × 1 cm, brown, glabrous, densely covered with thick scales; scales ovate, 10 × 8 mm, obtuse at apex, brown, glabrous. Flowers in terminal clusters, sessile. Bracts ovate, 10 × 4 mm, apex obtuse, pale brown, glabrous; bracteoles 2, ovate, 8 × 4 mm, apex acute, pale brown, glandular hairy. Calyx tube almost absent; lobes 5, round, 2 × 1 cm, apex rounded, yellow, pubescent. Corolla tube cylindric, broad, 3 × 1 cm, yellow, puberulent; lobes 5, (2 + 3) lobes, obovate, 1 × 1 cm, apex obtuse, yellow, glandular hairy. Stamens 4, didynamous; filaments slender, 4 cm × 1 mm & 3 cm × 1 mm, yellow, glandular hairy at base; anthers bilobed, 2 × 1 mm, white, spurred. Style slender, hooked at apex, 4 × 0.1 cm, yellow, pubescent. Stigma clavate, 1 × 1 mm, white, papillose. Capsule globose, 1 cm long. Seeds minute, numerous, glabrous.

Distribution: South India and Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: April-May

Specimen examined: India, Kerala, Idukki, Lakkam, 08/04/2018, Divya K. Venugopal 156362 (CALI).

***Christisonia* Gardner.**

Calcutta J. Nat. Hist. 8. 153. 1847.

Key to species

- 1a. Inflorescence racemose; pedicel 4–5 cm long 2
- 1b. Inflorescence cymose; pedicel 1–3mm long..... 3
- 2a. Flowers yellowish-white; stigma glabrous; capsules pyriform.... *C. indica*
- 2b. Flowers purplish-white; stigma glandular; capsules ovoid..... *C. tubulosa*
- 3a. Stem pubescent; corolla orange-yellow; capsules ovoid *C. bicolor*

3b. Stem glabrous; corolla yellow-white; capsules globose *C. calcarata*

Christisonia bicolor Gardner, Calcutta J. Nat. Hist. 8. 160. 1847; Hook.f., Fl. Brit. India 4: 322. 1885; Gamble, Fl. Madras 2: 976. 1921; Sasidh., Fl. Periyar Tiger Reserve 284. 1998.

Annual leafless herb, erect, up to 18 cm high, pubescent. Stem terete, 6–10 × 1 cm, brown, pubescent; scales few, ovate, 3 × 2 mm, apex acute, pubescent. Flowers in tuft, yellow. Peduncle terete, 1 × 0.5 cm, brick red, glabrous. Pedicel terete, 1 × 1 mm, brick red, tomentose. Bracteoles 2, lanceolate, 6 × 2 mm, apex acute, brick red, pubescent. Calyx tube broader, 2 × 0.4 cm, red, sparsely pubescent; lobes 5, triangular, 1.5 × 1 cm, apex acute, brick-red, glandular. Corolla tube narrow at base, widening above, 3 × 1 cm, orange, glandular hairy; lobes 5 (3 + 2), orbicular, 1 × 1 cm, apex round, yellow, glandular. Stamens 4, didynamous; filaments slender, 3 × 0.1 cm & 2.5 × 0.1 cm, yellow, puberulent; anthers bilobed, oblong, 3 × 1 mm, apex acuminate, white, spur-like. Style slender, 3 × 0.1 cm, white, glabrous. Stigma peltate, 1 × 1 mm, white, glabrous. Capsule ovoid, 1 × 1 cm, brown, puberulent. Seeds minute, numerous.

Distribution: South India and Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: July-August

Specimens examined: Periyar Tiger Reserve, 14/07/2018, Divya K. Venugopal 161855 (CALI); *ibid.*, 13/08/1996, Jomy Augustine 16223 (CALI).

Christisonia calcarata Wight, Icon. Pl. Ind. Orient. 4. t. 1426. 1849; Hook.f., Fl. Brit. India 4: 322. 1885; Sasidh., Fl. Periyar Tiger Reserve 284. 1998.

Annual leafless herb, erect, 8–10 cm high, glabrous. Stem terete, pale yellow, glabrous. Flowers numerous, in tuft. Peduncle terete, 2 × 0.5 cm, pale yellow, glabrous. Pedicel terete, 3 × 2 mm, pale yellow, glabrous. Bracts orbicular, 5 × 7 mm, apex obtuse, pale yellow, glabrous. Calyx tube 1 × 0.5 cm, pale yellow, glabrous; lobes 5, ovate, 1 mm long, apex acute, pale yellow, glabrous. Corolla tube 4 × 1 cm, yellow, glabrous; lobes 5, bilipped (3 + 2), 3 × 2 mm, apex round, white lobes with yellow on inner surface, glabrous. Stamens 4, didynamous; filaments slender, 2 × 0.1 cm & 1.5 × 0.1 cm, pale yellow, glabrous; anthers bilobed, oblong, 4 × 2 mm, white, spurred. Style slender, 3 × 0.1 cm, pale yellow, pubescent. Stigma peltate, 2 × 2 mm, pale yellow, pubescent. Capsule globose, 1 cm long, glabrous. Seeds minute, numerous, ovoid, glabrous.

Distribution: Pakistan to West India, Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: April-July

Specimen examined: India, Kerala, Idukki, Eravikulam National Park, 16/04/2017, Divya K. Venugopal 158725 (CALI).

Christisonia indica Anilkumar, J. Econ. Taxon. Bot. 30: 285. 2006.

Annual leafless herb, fleshy, erect, up to 25 cm high, glabrous. Stem terete, simple or branched, 15–18 cm long, tufted, glabrous; scales alternate, ovate, apex acute, glabrous. Flowers 3 to 4, in racemes. Pedicel terete, 4 cm long, glabrous. Bracts ovate - oblong, apex acute, pubescent. Calyx tube up to 2.5 cm long, partly enclosing corolla tube; lobes 5, free, ovate, c. 1 mm long, apex acute, glabrous. Corolla tube dilated at throat, 4.5 cm long; lobes 5, free, c. 2 cm long, apex rounded, usually yellowish white or pale rose, glabrous. Stamens 4; didynamous; filaments slender, 3.2 × 0.1 cm & 3 × 0.1 cm, glabrous; anthers bilobed, sickle shaped, 1 mm long, included, spurred. Style terete, 4 mm long, glabrous. Stigma bilobed, peltate, glabrous. Capsule pyriform, c. 1.4 × 1.8 cm, enclosed by persistent calyx, glabrous. Seeds numerous, glabrous.

Distribution: India (Kerala) (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: July-September

Specimen examined: India, Kerala, Idukki, Anamudi shola, 02/10/1995, R. Anilkumar 104824 (MH).

Christisonia tubulosa (Wight) Benth. ex Hook. f., Fl. Brit. India 4: 321. 1885; Gamble, Fl. Madras 2: 975. 1921; Sasidh., Fl. Periyar Tiger Reserve 284. 1998.

Figure 23 G.

Annual leafless herb, up to 20–30 cm high, cream-pale purple, glabrous. Stem terete, scaly, simple or branched, purple, glabrous; scales ovate-lanceolate, 2–3 mm long, apex acute, purple, glabrous. Flowers 2–3, in terminal racemes. Pedicel terete, 1–5 × 0.5 cm, purple, glabrous. Calyx tube 1–1.5 × 0.3 cm, white, glabrous; lobes 5, triangular, 5 × 4 mm, apex obtuse, white, glabrous. Corolla funnel-shaped, purple colour at tip; tube 4.5 × 0.5 cm, white, pubescent; lobes 5, orbicular, 2 × 2 cm, sub equal, spreading, apex obtuse, lower lip yellowish at throat, pubescent. Stamens 4, didynamous; filaments slender, 9 × 1 mm & 7 × 1 mm, white, glabrous; anthers bilobed, oblong, 4 × 2 mm, white, spurred. Style slender, 3 × 0.1 cm, white, glabrous.

Stigma peltate, 6×5 mm, white, glandular hairs. Capsule ovoid, 0.8–1.2 cm long, with persistent calyx, glabrous. Seeds many, minute, white, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Evergreen and Shola forests

Flowering and fruiting: July–September

Specimen examined: India, Kerala, Idukki, Aluva-Munnar Road, 14/09/2018, Divya K. Venugopal 161905 (CALI).

***Parasopubia* H.-P.Hofm. & Eb.Fisch.**

Bot. Jahrb. Syst. 125: 357.2004.

Key to species

1a. Filaments & style glabrous; capsules obovoid..... *P. delphiniifolia*

1b. Filaments & style puberulent; capsules oblong *P. raghavendrae*

***Parasopubia delphiniifolia* (L.) H.-P.Hofm. & Eb.Fisch., Bot. Jahrb. Syst. 125: 357. 2004. *Sopubia delphiniifolia* (L.) G. Don, Gen., Hist. 4: 560. 1837; Hook.f., Fl. Brit. India 4: 302. 1883; Gamble, Fl. Madras 2: 970. 1921; Sasidh., Fl. Periyar Tiger Reserve 282. 1998.**

Annual herb. Stem terete at base and quadrangular above, green, glabrous. Leaves opposite, lower leaves segmented, upper leaves entire, linear, $1-2 \times 0.5-1.5$ cm, margins entire, green, glabrous, sessile. Flowers solitary, axillary, pedicellate. Calyx tubular, 4 mm long, shorter than calyx lobes, green, glabrous; lobes 5, 7 mm long, lanceolate, campanulate, green, glabrous. Corolla tubular, $6.5-6.8 \times 1-1.5$ mm, pink; lobes 5, $3.3-3.6 \times 3.8-4.1$ mm, subequal, pink, glandular hairy. Stamens 4, didynamous, inserted; filaments slender, 2 longer (5 mm long), 2 shorter (4 mm long), pink, glabrous; anthers bilobed, equal, 2 mm long, stomium glabrous, opening from apex. Style slender, $7.8-8.2 \times 1-1.2$ mm, pale pink, glabrous. Stigma globose, glabrous. Capsules obovoid, 5–5.4 mm long, purplish green, enclosed in calyx tube, slightly pubescent. Seeds numerous, minute, obovate, brown.

Distribution: West India, Sri Lanka (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: September–December

Specimens examined: India, Kerala, Idukki, Ramakalmedu, 07/10/2018, Divya K. Venugopal 164620 (CALI); Periyar Tiger Reserve, 10/01/1995, Jomy Augustine

14505 (CALI); Kanthallur, 25/02/2003, *Reena M.B.* 89054 (CALI); Marayur, 28/11/1979, *Nambiar 1077* (KFRI).

Parasopubia raghavendrae K.V.Divya & Nampy, *Anales Jard. Bot. Madrid* 78(1, e106): 2, figs. 1-2 (2021).

Figure 23 H.

Annual herb. Stem terete at base and quadrangular above, densely branched, green, glabrous. Leaves opposite, lower leaves 5–7 segmented, upper leaves entire, linear, 2–5 × 0.5–1.5 cm, margins entire, sessile, green, glabrous. Flowers solitary axillary, pedicellate. Pedicel 1–1.5 cm long, tomentose, green. Calyx tubular, 4–4.5 mm long, longer than lobes, green, glabrous; lobes 5, linear, 3.5–3.8 × 1–1.1 mm, green, glabrous. Corolla tubular, 6.8–7 × 1–1.5 mm; lobes 5, 3–3.2 × 4–4.1 mm, sub equal, pink, glandular hairy. Stamens 4, didynamous, inserted; filaments slender, deep pink, 2 longer (6 mm long), 2 shorter (5 mm long), glandular hairy; anthers bilobed, unequal, stomium hairy, opening whole length. Style slender, 8–8.2 × 1–1.1 mm, pale pink, puberulent distally. Stigma globose, glabrous. Capsule oblong, 5–5.3 mm long, green, $\frac{3}{4}$ portion enclosed in calyx tube, glabrous. Seeds numerous, oblong, brown.

Distribution: Idukki (Kerala)

Habitat: Grasslands

Flowering and fruiting: December-January

Specimen examined: India, Kerala, Idukki, Mathikettan shola National Park, 11/12/2016, *Divya K. Venugopal 151405* (CALI).

Striga Lour.

Fl. Cochinch.: 22. 1790.

Key to species

1a. Herbs with root stock; flowers in terminal spike *S. gesnerioides*

1b. Herbs without root stock; flowers solitary, axillary..... 2

2a. Leaves linear; calyx lobes 15 ribbed; corolla lobes white *S. angustifolia*

2b. Leaves oblong; calyx lobes 10 ribbed; corolla lobes yellow *S. Asiatica*

Striga angustifolia (D.Don) C.J.Saldanha, *Bull. Bot. Surv. India* 5: 70 (1963); Sasidh., *Fl. Periyar Tiger Reserve* 282. 1998; Sasidh., *Fl. Chinnar WLS* 225. 1999. *Striga euphrasioides* (Vahl) Benth., *Compan. Bot. Mag.* 1: 364.1836; Hook.f., *Fl. Brit. India* 4: 299. 1885; Gamble, *Fl. Madras* 2: 968. 1921.

Annual parasitic herb. Stem quadrangular, scabrid, green, pubescent. Leaves simple, lower leaves opposite, upper one alternate, linear, $2-3 \times 1-1.5$ cm, apex acute, margins entire, green, ciliate along margins. Flowers solitary, axillary. Calyx tubular, $2-3 \times 1-1.1$ mm, green, pubescent; lobes 5, $2.5-3.1 \times 1-1.2$ mm, 15 ribbed, green, pubescent. Corolla tubular, $4-5 \times 2-3$ mm, white, glabrous; lobes 5, $6-8 \times 3-4$ mm, bilipped, white, minute, glabrous. Stamens 4, didynamous, inserted; filaments filiform, 2×1 mm & 3×1 mm, cream, glabrous; anthers unilobed, cream, glabrous. Style slender, 4×1 mm, cream, glabrous. Stigma entire, cream, glabrous. Capsule oblong, ribbed, green, glabrous. Seeds ovoid, numerous.

Distribution: South Tanzania to South Tropical Africa, South Arabian Peninsula, Indian Subcontinent to Indo-China, Hainan (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: September-December

Specimens examined: India, Kerala, Idukki, Calvary Mount, 08/09/2017, Divya

K. Venugopal 168904 (CALI); Marayur, 28/11/1979, Nambiar 1078 (KFRI).

Striga asiatica (L.) Kuntze, Revis. Gen. Pl. 2: 466. 1891; Sasidh., Fl. Periyar Tiger Reserve 282. 1998; Sasidh., Fl. Chinnar WLS 225. 1999. *Striga lutea* Lour., Fl. Cochinch.: 22. 1790; Hook.f., Fl. Brit. India 4: 299. 1885; Gamble, Fl. Madras 2: 968. 1921.

Figure 23 E.

Annual parasitic herb. Stem quadrangular, green, little branched, pubescent. Leaves simple, lower leaves opposite, upper one alternate, oblong, $3-5 \times 0.3-0.5$ cm, apex acute, margins entire, green, pubescent. Flowers solitary axillary. Calyx tubular, $3-4 \times 1-1.5$ mm, green, pubescent; lobes 5, 10 ribbed, $0.8-1 \text{ cm} \times 2-3$ mm, green, pubescent. Corolla tubular, $4-5 \times 2-3$ mm, yellow, glabrous; lobes 5, bilipped, $6-8 \times 3-4$ mm, yellow, glabrous. Stamens 4, didynamous, inserted; filaments filiform, 2×1 mm & 3×1 mm, cream, glabrous; anthers unilobed, cream, glabrous. Style slender, 4×1 mm, cream, glabrous. Stigma entire, cream, glabrous. Capsule oblong, green, glabrous. Seeds angular, numerous.

Distribution: Tropical & Subtropical Old World (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: July-September

Specimens examined: India, Kerala, Idukki, Meesapulimala, 16/08/2017, Divya K. Venugopal 170265 (CALI); Periyar Tiger Reserve, 16/08/1996, Jomy Augustine 16255 (CALI).

Striga gesnerioides (Willd.) Vatke, Oesterr. Bot. Z. 25: 11. 1875; Sasidh., Fl. Chinnar WLS 225. 1999. *Striga orobanchoides* (R.Br.) Benth., Compan. Bot. Mag. 1: 361. 1836, Hook. f., Fl. Brit. India 4: 299. 1885; Gamble, Fl. Madras 2: 967. 1924.

Annual parasitic herb with tuberous root stock. Stem quadrangular, erect, branched, green, glabrous, brown when dry. Leaves simple, lanceolate, reduced to scales, 3–5 × 0.3–0.5 cm, apex, margins entire, green, sessile. Flowers in terminal spikes. Calyx tubular, 4–5 × 1–2 mm, green, pubescent; lobes 5, 5 ribbed, 2–3 × 1–2 mm, green, pubescent. Corolla tubular, 9–10 × 1–2 mm, pink, pubescent; lobes 5, bilipped, 5–6 × 2–3 mm, pink, pubescent. Stamens 4, didynamous, inserted; filaments filiform, 2 × 1 mm & 3 × 1 mm, cream, glabrous; anthers unilobed, cream, glabrous. Style slender, 3–3.5 × 1–1.1 mm, cream, glabrous. Stigma entire, cream, glabrous. Capsule oblong, green, glabrous, with persistent style. Seeds oblong, numerous.

Distribution: Africa, Arabian Peninsula, Indian Subcontinent (POWO, 2022)

Habitat: Deciduous forests

Flowering and fruiting: August–December

Specimen examined: India, Kerala, Idukki, Chinnar, 12/10/1996, K.K. Sajeew 15839 (CALI).

LENTIBULARIACEAE Rich.

Fl. Paris. [Poiteau & Turpin] 1: 23 (ed. fol.), 26 (ed. qto.).1808.

Herbs, aquatic or in damp places, insectivorous. Leaves radical rosulate, or rudimentary, exstipulate. Flowers one to many in simple or branched scapes or racemes. Flowers bisexual. Pollination entomophilous (Delta Intkey, 2023). Bracts small. Calyx 2–5 lobed. Corolla 2-lipped, spurred; upper lip usually smaller, entire or emarginate, the lower usually much larger, 3–5 lobed. Stamens 2; filaments curved. Stigma sessile with two lobes. Capsule globose-ovoid, non-fleshy.

According to POWO, 2022, the family consists of 3 genera and genus *Utricularia* consists of 269 accepted species worldwide.

Utricularia L.

Sp. Pl.: 18. 1753.

Key to species

- 1a. Herbs terrestrial 2
- 1b. Herbs aquatic *U. caerulea*
- 2a. Pseudo petiole present; foliar organs with dichotomously branched veins *U. striatula*
- 2b. Pseudo petiole absent; foliar organs without dichotomously branched veins 3
- 3a. Foliar organs 1-nerved 4
- 3b. Foliar organs 3-nerved 5
- 4a. Bracts 1-nerved; corolla yellow 6
- 4b. Bracts 3-nerved; corolla violet with white streaks..... *U. polygaloides*
- 5a. Trap globose..... 7
- 5b. Trap subglobose 8
- 6a. Calyx lobe unequal; spur conical *U. scandens*
- 6b. Calyx lobe subequal; spur subulate..... *U. bifida*
- 7a. Foliar organs linear; spur apex obtuse *U. uliginosa*
- 7b. Foliar organs obovate; spur apex acute..... *U. lazulina*
- 8a. Bract ovate; corolla lower lip obovate *U. graminifolia*
- 8b. Bract semiorbicular; corolla lower lip suborbicular *U. praeterita*

Utricularia graminifolia Vahl., Enum. Pl. 1: 195. 1804; Hook.f., Fl. Brit. India 4: 331. 1885; Gamble, Fl. Madras 2: 981. 1921.

Figure 24 E.

Terrestrial herb; rhizoids numerous, up to 2 cm long, branched, glandular; stolons up to 10 cm long, profusely branched, glandular. Foliar organs linear to strap-shaped, 3-nerved, apex obtuse, base linear, green. Traps numerous, sub globose, 1–2 mm long, mouth basal. Flowers 1–9, in racemes. Scales ovate, 1–2 mm long, apex acuminate, green. Bracts ovate, 1 nerved, 1–3 mm long, green. Pedicel up to 8 cm long, green, glabrous. Calyx lobes 2, unequal, ovate, 2–5 cm long, apex acuminate, green. Corolla upper lip linear-oblong, longitudinally streaked, ciliate along lower margin, apex obtuse, blue; lower lip obovate, apex round, obscurely 3-lobed, hairy in throat; spur conical, apex acute. Stamens 2; filaments strap shaped, 1.5–2 mm long. Style short. Stigma bi-lipped. Capsules ovoid, 2–3 mm long, green.

Distribution: China South-Central, China Southeast, India, Myanmar, Sri Lanka, Thailand (POWO, 2022)

Habitat: Marshy grasslands

Flowering and fruiting: September-March

Specimens examined: India, Kerala, Idukki, Meenuliyanpara, 12/01/2021, Divya K. Venugopal 170125 (CALI); Eravikulam, 29/11/1979, Nambiar 1123 (KFRI).

Utricularia praeterita P.Taylor, K.M.Matthew, Fl. Tamilnadu Carnatic 3(1): 1120.1983; M.K. Janarth. & Henry, Bladderworts India 81. 1992.

Terrestrial herb; rhizoids glandular, up to 1 cm long, branched; stolons up to 2 cm long, minutely branched, glandular. Foliar organs spatulate, 3-nerved, apex round, base linear and pointed, green. Traps sub globose, up to 1 mm, mouth basal. Flowers 1–7, in racemes, glabrous. Scales lanceolate, up to 1 mm long, apex acute to obtuse, green. Bracts semi orbicular, 1 nerved, up to 2 mm long, green. Pedicel 3–5 mm long, green, glabrous. Calyx lobes 2, sub equal, ovate, 2–2.8 mm long, apex acuminate, green. Corolla upper lip oblong, apex truncate, violet; lower lip sub orbicular, apex round, violet, hairy in throat; spur conical, apex acute. Stamens 2; filaments strap shaped. Stigma bi-lipped. Capsules ovoid, 2–2.5 mm long, green.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: August-October

Specimens examined: India, Kerala, Idukki, Vakavanam, 14/09/2019, Divya K. Venugopal 170314 (CALI); Mathikettan shola National Park, 22/08/2018, Divya K. Venugopal 164673 (CALI).

Utricularia uliginosa Vahl, Enum. Pl. 1: 203.1804; Gamble, Fl. Madras 2:981. 1921. *Utricularia nayarii* M.K. Janarth. & Henry. Bull. Bot. Surv. India 28: 195. 1986; M.K. Janarth. & Henry, Bladderworts India 77. 1992; Sasidh., Fl. Periyar Tiger Reserve 286. 1998.

Figure 24 A & H.

Terrestrial herb; rhizoids glandular, up to 2 cm long, branched, papillose; stolons up to 3 cm long, sparsely branched. Foliar organs linear, 3-nerved, apex round, base linear, green. Traps globose, 1–2 mm long, mouth basal. Flowers 1–5, in racemes. Scales ovate, upto 1 mm long, apex acuminate, green. Pedicel 2–6 mm long, green, glabrous. Bracts ovate, 1 nerved, 1–2 mm long, green. Calyx lobes 2, unequal, broadly ovate, 2–4 mm long, apex acuminate, green. Corolla upper lip oblong, violet;

lower lip obovate, apex round, violet, hairy in throat; spur conical, apex obtuse. Stamens 2; filaments strap-shaped. Stigma bi-lipped. Capsules ovoid, 2–3 mm long, green.

Distribution: Tropical and Subtropical Asia to North West Pacific (POWO, 2022)

Habitat: Wet rocks in grasslands

Flowering and fruiting: July–April

Specimens examined: India, Kerala, Idukki, Edamalakudy, 19/03/2019, *Krishnapriya M.P. 188035* (CALI); Mathikettan shola National Park, 22/07/2017, *S. Syam Radh 153433* (CALI); *ibid.*, 10/08/2018, *Divya K. Venugopal 158241* (CALI).

Utricularia caerulea L., Sp. Pl.: 18. 1753; M.K. Janarth. & Henry, Bladderworts India 43. 1992; Sasidh., Fl. Periyar Tiger Reserve 285. 1998. *Utricularia roseo-purpurea* Stapf ex Gamble. Fl. Madras 2: 983. 1921; Hook.f., Fl. Brit. India 4: 333. 1885.

Figure 24 F.

Aquatic herb; rhizoids glandular, up to 2 cm long, rarely branched; stolons up to 2 cm long, filiform, branched. Foliar organs spatulate to obovate, 1-nerved, apex round, base linear, green. Traps globose, 1–2 mm long, mouth terminal. Flowers 1–7, in racemes. Scales elliptic, 2–4 mm long, apex acute, green. Pedicel 1–3 mm long, green, glabrous. Bracts elliptic, 1 nerved, 2–3 mm long, green. Calyx lobes 2, unequal, hooded, broadly ovate, 2–3 mm long, apex obtuse, green. Corolla upper lip linear, hairy at lower margin, pink, glabrous; lower lip sub orbicular, apex round, pink, glabrous; spur conical, apex obtuse. Stamens 2; filaments strap-shaped. Stigma bi-lipped. Capsules globose to sub globose, 2–3 mm long, green.

Distribution: North Madagascar, South Russian Far East to Tropical and Subtropical Asia, North and East Australia (POWO, 2022)

Habitat: Near water courses in evergreen forests

Flowering and fruiting: July–December

Specimens examined: India, Kerala, Idukki, Eravikulam National Park, 23/12/2019, *Krishnapriya M.P. 188056* (CALI); *ibid.*, 29/11/1979, *Nambiar 1124* (KFRI); *ibid.*, 10/08/2018, *Divya K. Venugopal 158315* (CALI); Pettimudi, 30/12/2019, *Krishnapriya M.P. 188057* (CALI); Mathikettan shola National Park, 22/07/2017, *S. Syam Radh 153431* (CALI).

Utricularia striatula Sm., A.Rees, Cycl. 37: n.º 17. 1818; Hook.f., Fl. Brit. India 4: 334. 1885; Gamble, Fl. Madras 2: 983. 1921; M.K. Janarth. & Henry, Bladderworts India 106. 1992; Sasidh., Fl. Periyar Tiger Reserve 286. 1998.

Figure 24 C.

Terrestrial herb; rhizoids up to 2 cm long, simple; stolons up to 9 cm long, simple, rarely branched, glandular. Foliar organs with pseudopetiole, obovate, veins dichotomously branched, apex obtuse, base linear, green. Traps globose, 1–2 cm long, mouth lateral. Flowers 8–10, in racemes, often zigzag. Scales elliptic, 1–3 mm long, apex acute, green. Pedicel 2–5 mm long, filiform, green. Bracts elliptic, 1 nerved, 1–2 mm long, green. Calyx lobes 2, unequal, obovate, 1–2 mm long, apex obtuse, green. Corolla upper lip semi orbicular, bi dentate, lilac, glabrous; lower lip 3 or 5-lobed, throat hairy, base flat, apex round, lilac often yellow blotched near base; spur conical, 1–4 mm long, apex acute. Stamens 2; filaments strap-shaped. Stigma bi-lipped. Capsules obliquely ovoid, 1–3 mm long, green.

Distribution: Tropical Africa, South Arabian Peninsula, Tropical and Subtropical Asia (POWO, 2022)

Habitat: On wet rocks in grasslands

Flowering and fruiting: September–March

Specimens examined: India, Kerala, Idukki, Vagamon, 29/10/2020, *Krishnapriya M.P. 164387* (CALI); Mathikettan shola National Park, 22/07/2017, *S. Syam Radh 153432* (CALI); *ibid.*, 08/09/2018, *Divya K. Venugopal 158141* (CALI).

Utricularia lazulina P.Taylor, Proc. Indian Acad. Sci., Pl. Sci. 93: 101. 1984; M.K. Janarth. & Henry, Bladderworts India 67. 1992.

Figure 24 G.

Terrestrial herb; rhizoids up to 8 mm long, branched; stolons up to 15 mm long, rarely branched, glandular. Foliar organs obovate, 3-nerved, apex round, base linear, green. Traps globose, 1–2 mm long, mouth basal. Flowers in racemes, erect. Scales ovate, 1–1.5 mm long, apex acute, green. Pedicel 2–5 mm long, erect, green. Bracts ovate, 1-nerved, 1–2 mm long, apex acute, green. Calyx lobes 2, unequal, ovate, 2–3 mm long, apex acute, green. Corolla bilipped; upper lip oblong, blue, glabrous; lower lip wedged, throat hairy, apex truncate, yellow; spur subulate, 3–5 mm long, apex acute. Stamens 2; filaments strap-shaped. Stigma bi-lipped. Capsules ovoid, 1–3 mm long, green.

Distribution: South West India (POWO, 2022)

Habitat: On wet rocks in grasslands

Flowering and fruiting: July-September

Specimens examined: India, Kerala, Idukki, Kaliyar, 07/12/2018, *Krishnapriya M.P. 1876* (CALI); Vagamon, 11/11/2018, *Divya K. Venugopal 158285* (CALI).

Utricularia scandens Benj., *Linnaea* 20: 309. 1847; M.K. Janarth. & Henry, *Bladderworts India* 97. 1992; Sasidh., *Fl. Periyar Tiger Reserve* 286. 1998; Sasidh., *Fl. Chinnar WLS* 226. 1999.

Figure 24 B.

Terrestrial herb; rhizoids up to 1 cm long, branched; stolons up to 2 cm long, filiform, branched. Foliar organs linear, 1-nerved, apex acute, base linear, green. Traps globose, 1–2 mm long, mouth basal. Flowers 2–7, in racemes, twining. Scales ovate, 1–1.5 mm long, apex acute, green. Pedicel 1–5 mm long, erect, green. Bracts ovate, 1-nerved, 1–2 mm long, green. Calyx lobes 2, unequal, ovate, 1–2 mm long, apex acute, green. Corolla bilipped; upper lip obovate, apex obtuse, yellow, glabrous; lower lip 3 or 5-lobed, obovate, throat hairy, apex round, yellow; spur conical, 1–4 mm long, apex acute. Stamens 2; filaments twisted. Stigma bi-lipped. Capsules ovoid, 1–3 mm long, green.

Distribution: Tropical and South Africa, Madagascar, Indian Subcontinent to China (POWO, 2022)

Habitat: Marshy places

Flowering and fruiting: September-January

Specimens examined: India, Kerala, Idukki, Hill view Park, 10/12/2019, *Krishnapriya M.P 164333*(CALI); Mankulam, 16/09/2018, *Divya K. Venugopal 164342* (CALI).

Utricularia polygaloides Edgew., *Proc. Linn. Soc. London* 1: 351.1847; M.K. Janarth. & Henry, *Bladderworts India* 79. 1992.

Terrestrial herb; rhizoids up to 3 cm long, branched, glandular; stolons up to 2 cm long, rarely branched, glandular. Foliar organs linear, 1-nerved, apex obtuse, base linear, green. Traps globose, 1–2 mm long, mouth basal. Flowers 6–8, in racemes. Scales ovate, 1–2 mm long, apex acute, green. Pedicel 2–3 mm long, green. Bracts ovate, 3-nerved, 1–3 mm long, green. Calyx lobes 2, unequal, ovate, 3–5 mm long, apex acute, green. Corolla bilipped, upper lip oblong, apex obtuse, violet with white streaks, glabrous; lower lip obovate, throat hairy, base gibbous, apex rounded, violet

with white streaks; spur conical, 1–2 mm long, apex acute. Stamens 2; filaments strap-shaped. Stigma bi-lipped. Capsules ovoid, 3–4 mm long, green.

Distribution: India, Sri Lanka (POWO, 2022)

Habitat: Rocky areas

Flowering and fruiting: October–February

Specimens examined: India, Kerala, Idukki, Munnar, 16/01/2018, Divya K. Venugopal 156578 (CALI); Kalvary Mount, 23/11/2019, Divya K. Venugopal 164559 (CALI).

Utricularia bifida L., Sp. Pl.: 18. 1753; Hook. f., Fl. Brit. India 4: 332. 1885; Gamble, Fl. Madras 2: 982.690.1921; M.K. Janarth. & Henry, Bladderworts India 37. 1992.

Terrestrial herb; rhizoids up to 10 mm long, branched; stolons up to 2 cm long, filiform, branched. Foliar organs linear, 1-nerved, apex round, base linear, green. Traps globose, 1–2 mm long, mouth basal. Flowers 5–8, in racemes. Scales ovate, 1–2 mm long, apex acute, green. Pedicel 2–3 mm long, green. Bracts ovate, 1-nerved, 1–3 mm long, green. Calyx lobes 2, subequal, ovate, 2–4 mm long, apex round, green. Corolla bilipped, upper lip oblong, apex round, yellow, glabrous; lower lip obovate, throat hairy, apex round, yellow; spur subulate, 2–4 mm long, apex acute. Stamens 2; filaments strap-shaped. Stigma bi-lipped. Capsules ovoid, 2–3 mm long, green.

Distribution: Tropical and Subtropical Asia to North West Pacific (POWO, 2022)

Habitat: Wet areas

Flowering and fruiting: May–September

Specimen examined: India, Kerala, Idukki, Pambadum shola National Park, 17/08/2019, Divya K. Venugopal 156889 (CALI).

GESNERIACEAE Rich. & Juss.

Essai Propr. Méd. Pl. ed. 2: 192. 1816 [4–11 Mai 1816] (1816) *nom. cons.*

Herbs, undershrubs or epiphytes. Leaves opposite or alternate, entire or toothed; not gland dotted; exstipulate. Flowers in racemes, cymes or solitary; bracts present; bracteoles usually small. Corolla tubular, more or less bilobed; lobes 5. Stamens usually didynamous. Nectariferous gland lies between ovary and petals. Style linear; stigma capitate or 2 lobed. Fruit capsule or berry. Seeds numerous, small.

Gesneriaceae consists of 152 genera and c. 3540 species in tropical and subtropical regions with a few members in temperate areas (Christenhusz & Byng, 2016). In India, the family consists of 23 genera with 87–98 species (Moller *et al.*, 2017). They are usually cultivated for ornamental purposes due to their showy flowers.

Key to genera

- 1a. Plants epiphytic *Aeschynanthus*
- 1b. Plants not epiphytic 2
- 2a. Plants annual 3
- 2b. Plants perennial 4
- 3a. Flowers in raceme 5
- 3b. Flowers in cyme *Epithema*
- 4a. Stem reduced; stamens 4 *Jerdonia*
- 4b. Stem absent; stamens 2 *Henckelia*
- 5a. Rooting at nodes present; calyx lobes densely tomentose;
corolla lobes white *Rhynchotechum*
- 5b. Rooting at nodes absent; calyx lobes glabrous;
corolla lobes blue with yellow at throat *Rhynchoglossum*

Rhynchotechum Blume

Bijdr. Fl. Ned. Ind.: 775.1826.

Rhynchotechum permolle (Nees) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 24: 39.1962; Hook.f., Fl. Brit. India 4: 372. 1885; Gamble, Fl. Madras 2: 992. 1921.

Figure 25 F.

Annual sub-shrub, usually unbranched. Stem terete, rooting at nodes, green, hairy at younger stage, glabrous at later stage. Leaves simple, alternate, narrowly obovate, 9–24 × 4–10 cm, apex acute, base attenuate, margin serrate, green, glabrous to white pubescent. Petiole terete, 0.7–2.8 × 0.2 cm, green, glabrous. Flowers 10–15, in axillary racemes. Peduncle terete, 0.8–2.4 × 0.1 cm, golden yellow, villous. Pedicel terete, 2.2–6.1 × 1 mm, golden yellow, villous. Bracts linear, 7–11 × 0.5–0.65 mm, golden yellow, villous. Calyx lobes 5, lanceolate, 5–6 × 0.88–1.2 mm, apex slightly acute, golden yellow, densely tomentose. Corolla tube 1 mm long, white, glabrous; lobes 5, upper bilipped, lobes 5–5.2 × 3.5–3.7 mm, apex obtuse, white, glabrous; lower three lobed, lobes 5.8–6.0 × 4.3–4.5 mm, apex obtuse, white, glabrous. Stamens 4; filaments slender, 1–1.5 × 1 mm, hyaline, glabrous; anthers bilobed, globose, 0.6–0.8 × 1 mm, inserted, yellow, slightly puberulent. Style 1.8–2.4 × 1 mm, hyaline, glabrous, persistent in fruit. Stigma apex truncate, yellow, glabrous. Capsule fleshy, ovoid, 4 × 3 mm, white, puberulent. Seeds minute, numerous.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: In shady and moist areas of forests

Flowering and fruiting: May-December

Specimens examined: India, Kerala, Idukki, Mankulam, 20/12/2019, Divya K. Venugopal 164801 (CALI); *ibid.*, 09/06/2018, Divya K. Venugopal 159289 (CALI); Adimali Reserve forest, 29/03/1980, K. Ramamurthy 66569 (MH); Kulamavu, 26/05/1982, C. N. Mohanan 74033 (MH); *ibid.*, 09/10/1982, C.N. Mohanan 74506 (MH); *ibid.*, 24/02/1984, A.G. Pandurangan 78074 (MH); Periyar Tiger Reserve, 16/11/1997, Jomy Augustine 17958 (CALI).

***Rhynchoglossum* Blume**

Bijdr. Fl. Ned. Ind.: 741.1826.

Rhynchoglossum notonianum (Wall.) B.L. Burtt, Notes Roy. Bot. Gard. Edinburgh 24: 170. 1962; Hook.f., Fl. Brit. India 4: 366. 1885; Gamble, Fl. Madras 2: 990. 1921.

Figure 25 B.

Annual fleshy herb. Stem terete, branched, purple, pubescent. Leaves simple, alternate, ovate, 10–25 × 5–10 cm, apex acuminate, base oblique, margins entire, exstipulate, adaxially gland dotted, green, abaxially pubescent, gland dotted. Petiole terete, 0.8–6 × 1.5 cm, green, pubescent. Flowers 8–15, in terminal racemes. Peduncle terete, 5–6 × 0.2 cm, green, pubescent. Pedicel terete, 2–6 × 1 mm, green, pubescent. Bracts linear, 1–4 × 1 mm, green, puberulent; bracteoles linear, 2–3 × 1 mm, green, puberulent. Calyx tube 5–8 × 3 mm, pale green, glabrous; lobes 5, obovate, 0.7–1 × 0.2 cm, apex acuminate, green, glabrous. Corolla tube 5–8 × 2 mm, white, glabrous; lobes 5, ovate, upper lip bifid, 2–4 × 2.5–4.5 mm, lower lip 2–3 × 1–2 cm, blue with yellow colour at the throat, glabrous. Stamens 4; filaments terete, 4–8 × 1 mm, green, glabrous; anthers bilobed, oblong, 1 × 0.5 mm, white, glabrous. Style terete, 10 × 0.5 mm, green, glabrous. Stigma capitate, 0.4 × 0.2 mm, green, papillate. Capsules ovoid, 1 × 0.56 cm, green, glabrous. Seeds ellipsoid, 0.4–0.6 mm, brown, glabrous.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: In shady and moist areas, near streams and waterfalls

Flowering and fruiting: July-November.

Specimens examined: India, Kerala, Idukki, Calvary Mount, 06/09/2017, Divya K. Venugopal 154385 (CALI); Way side Neriamangalam, 11/09/2018, Divya K. Venugopal 159442 (CALI); Devikulam-Kumali Road, 30/05/1964, K.N. Subramanian

1458 (FRC); Karimalai Stream Bed, 25/01/1910, *C.E.C. Fischer s.n.* (FRC); Kulamavu, 04/10/1983, *C.N. Mohanan 79992* (MH); Munnar, 28/07/1982, *Nambiar 1859* (KFRI).

***Epithema* Blume**

Bijdr. Fl. Ned. Ind.: 737. 1826.

Epithema ceylanicum Gardner, Calcutta J. Nat. Hist 6: 492. 1846; Wight, Icon. Pl. Ind. Orient. 4: 11. T. 1354. 1848; Bransgr. & D.J. Middleton, Gard. Bull. Singapore 67(1): 159. 2015.

Figure 25 D.

Annual succulent herb. Stem terete, 1–10 × 0.5–1 cm, green, sparsely pubescent. Leaves simple, opposite, ovate, 2–7 × 3–6 cm, apex acute, base obtuse, margins dentate, green, pubescent. Petiole terete, 0.8–1 × 0.2 cm, green, minutely pubescent. Flowers 1–4, in axillary cyme. Peduncle terete, 1–3 × 0.1 cm, purple, pubescent. Pedicel terete, 2–4 × 1 mm, green, pubescent. Bracts lanceolate, 2–10 × 2–10 mm, green, glabrous. Calyx tube 1–2 × 0.8–2 mm, green, sparsely to densely pubescent; lobes 5, lanceolate, 1–2 × 0.8–1 mm, green, pubescent outside, glabrous inside. Corolla tube 4–6 × 2 mm, white, glabrous; lobes 5, 2–3 × 1.5–2 mm, apex round, blue, pubescent. Stamens 2; filaments slender, 1.5–2 × 1 mm, hyaline, glabrous; anthers bilobed, oblong, 0.5–0.7 × 0.3–0.5 mm, hyaline, glabrous. Style slender, 2.35–3.0 × 1 mm, hyaline, pubescent. Stigma capitate, 0.7 × 0.4 mm, hyaline, papillate. Capsule cylindrical, 2.2–5 × 1.2–2.4 mm, green, pubescent. Seeds ovoid, 0.4–0.6 × 0.12–0.19 mm, brown, glabrous.

Distribution: India to Taiwan and Philippines (POWO, 2022)

Habitat: Found in humid rocky crevices and on fallen tree trunks

Flowering and fruiting: August–February

Specimens examined: India, Kerala, Idukki, Anchuruli, 07/09/2017, *Divya K. Venugopal 152951* (CALI); Anakkulam, 18/09/2018, *Divya K. Venugopal 161963* (CALI); Panamkutty, 07/10/1983, *A. G. Pandurangan 79276* (MH); Sabarimalai slope, 26/09/1972, *B. D. Sharma 42032* (MH); Periyar Tiger Reserve, 28/08/1993, *Jomy Augustine 12373* (CALI).

Aeschynanthus Jack

Trans. Linn. Soc. London 14: 42.1823.

Aeschynanthus perrottetii A.DC., A.P.de Candolle, Prodr. 9.261. 1845, Monogr. Phan.5(1):25.1883; Hook.f., Fl. Brit. India 4: 340. 1885; Gamble, Fl. Madras 2: 985. 1921.

Figure 25 H.

Epiphyte. Stem terete, pale brown, glabrous, profusely branched, swollen at nodes. Leaves simple, opposite, lanceolate, $3-10 \times 1-2$ cm, apex acuminate, base obtuse, margins entire, leathery, green, glabrous. Petiole terete, $3-10 \times 1$ mm, green, glabrous. Flowers solitary or 2-3, axillary. Pedicel terete, $10-14 \times 2$ mm, purplish, glabrous. Bracts linear, 1×1 mm, brown, glabrous. Calyx lobes 5, linear, $5-7 \times 2$ mm, apex acute, green, persistent. Corolla tube 4×0.2 cm, dark red on outer surface, cream colour on inner surface, glandular hairy; lobes 5, unequal, upper lobe-3 lobed, lower lobe-2 lobed, ovate, upper lobe 4×3 mm, lower lobe 7×5 mm, round at tip, lobes bright red on outer surface and cream colour with purple dots on inner surface, ciliate. Stamens 4, didynamous; filaments slender, shorter filaments 2×0.1 cm, larger filaments 3×0.1 cm, basal hyaline distal pink, glandular hairy; anthers bilobed, oblong, 2 mm long, pale pink with yellowish tinge, glabrous. Style slender, 1×0.2 cm, pale green, glabrous. Stigma capitate, 1×1 mm, pink, glabrous. Capsule linear, $10-20 \times 0.2$ cm, green, glabrous. Seeds ellipsoid, 0.5×0.2 mm, brown, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Grows as epiphyte

Flowering and fruiting: August-February

Specimens examined: India, Kerala, Idukki, Munnar-Rajamala Road side, 18/11/2020, Divya K. Venugopal 173333 (CALI); Bank of Dhanas Valley, Way to Muduvankudi, 13/01/1989, P. Bhargavan 9092 (MH); Chapathu, 30/09/1981, C. N. Mohanan & B. Ramanujam 72092 (MH); Devikulam, 22/11/1965, B. V. Shetty 26615 (MH); Periyar Tiger Reserve, 10/10/1993, Jomy Augustine 12540 (CALI); Mannavan shola, 27/11/1979, Nambiar 1025 (KFRI).

Jerdonia Wight

Icon. Pl. Ind. Orient. 4: t. 1352. 1848.

Jerdonia indica Wight, Icon. Pl. Ind. Orient. 4: t. 1352. 1848; Hook.f., Fl. Brit. India 4: 366. 1885; Gamble, Fl. Madras 2: 991. 1921.

Figure 25 G.

Perennial herb, root stock 3–10 cm long, with leaf scars. Stem reduced. Leaves simple, opposite-decussate in young stage, later becomes alternative, elliptic, 4–8 × 2–5 cm, apex acute, base cordate, margin entire, purplish green, pubescent. Petiole terete, 3–10 × 0.2 cm, purplish green, pubescent. Flower 2–5 per plant, axillary, erect, purple, pubescent. Pedicel terete, 8–10 × 0.2 cm, purple, pubescent. Bracts linear, 3–4 × 1 mm, apex acute, green, pubescent. Calyx lobes 5, deeply divided, lanceolate, 4–8 × 0.85–1 mm, apex acute, purplish green, hairy. Corolla tube funnel shaped, 1 × 0.3 cm, cream, inner hairy, swollen towards the anterior; lobes 5, bilipped, upper lobes 2, small lobes, 3 × 3 mm; lower lobes 3, large lobes, 5 × 3 mm, apex round, pale lilac with a pinch of orange colour, glabrous. Stamens 4, didynamous; smaller filament 6.5–7 × 1 mm, pale lilac, pubescent, larger filament 7–8 × 1 mm, pale lilac, pubescent; anthers bilobed, oblong, 1 × 1 mm, hyaline, hairy. Style linear, 1 × 1 mm, hyaline, glabrous. Stigma peltate, 1.2 × 1.1 mm, hyaline, glabrous. Capsule globose, 5–6 × 5–7 mm, brown, pubescent. Seeds ellipsoid, 0.6 × 0.4 mm, brown, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: In moist shady slopes and river banks

Flowering and fruiting: March–April and August–September

Specimens examined: India, Kerala, Idukki, Vakavanam, 07/09/2019, Divya K. Venugopal 189000 (CALI); Anamallai, 06/1882, Beddome s.n. (MH).

Henckelia Spreng.

Anleit. Kenntn. Gew., ed. 2. 2(1): 402. 1817, *nom. rej.*

Key to species

- 1a. Leaves opposite-decussate 2
- 1b. Leaves in whorls 3
- 2a. Calyx lobes ovate; bracts linear; anthers cream *H. meeboldii*
- 2b. Calyx lobes linear; bracts oblanceolate;
 anthers yellowish brown *H. ovalifolia*
- 3a. Leaves in whorls of 3 4

- 3b. Leaves in whorls of 4 5
- 4a. Leaves apex obtuse *H. lyrata*
- 4b. Leaves apex acute 6
- 5a. Leaves with woolly hairs; calyx lobes green;
 anthers yellowish brown *H. wightii*
- 5b. Leaves tomentose; calyx lobes reddish brown;
 anthers white *H. fischeri*
- 6a. Capsules linear, green *H. humboldtiana*
- 6b. Capsules cylindrical, reddish brown 7
- 7a. Leaves sessile; filaments yellow;
 anther pubescent at connective *H. macrostachya*
- 7b. Leaves petiolate; filaments pale green; anther glabrous 8
- 8a. Leaves elliptic, margins doubly serrate;
 calyx lobes oblong *H. innominata*
- 8b. Leaves ovate, margins crenate; calyx lobes lanceolate *H. incana*

Henckelia fischeri (Gamble) A. Weber & B.L. Burtt, Beitr. Biol. Pflanzen 70(2-3): 344 .1998; Gamble, Fl. Madras 2: 989. 1921.

Perennial herb, pubescent, roots adventitious. Stem-less. Leaves simple, 10–20, whorl of four, ovate, 6–20 × 5–12 cm, apex acute, base attenuate, margins crenate, green, tomentose. Petiole winged, 0.8–5 × 0.5 cm, green, pubescent. Flowers 15–20, in axillary cyme. Peduncle terete, 15–30 × 0.3 cm, green-brown, glandular hairy. Pedicel terete, 6–20 × 2 mm, green, glandular hairy. Bracts-2, lanceolate, 2–4 × 1 mm, green, tomentose. Calyx tube 1 × 1 mm, reddish brown, tomentose; lobes – 5, deeply divided, ovate, 3–6 × 1–2 mm, apex acute, reddish brown, pubescent. Corolla tube 7–10 × 6–8 mm, lilac with yellow colour at the throat, pubescent; lobes 5, widely ovate, 6.8–7.5 × 8.5–10 mm, apex round, pale lilac, pubescent. Stamens 2; filaments 4–5 × 1 mm, yellow, glabrous; anthers bilobed, reniform, 2–3 × 0.8–1.2 mm, white, glabrous. Style terete, 2–4 × 1 mm, green, glabrous towards apex, glandular hairy towards base. Stigma 0.6 × 1 mm, green, papillate. Capsule cylindrical, 15–30 × 2 mm, brown, glandular hairy. Seeds numerous, elliptic, 0.5–0.6 × 0.22–0.29 mm, brown, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: In moist shady slopes and rock crevices

Flowering and fruiting: May–December

Specimens examined: India, Kerala, Idukki, Chottuppara, 07/09/2017, Divya K. Venugopal 152988 (CALI); Near Idukki dam, 24/08/1981, V. S. Raju 71173 (MH); Periyar Tiger Reserve, 16/05/1995, Jomy Augustine 15309 (CALI).

Henckelia humboldtiana (Gardner) A. Weber & B.L. Burt, Beitr. Biol. Pflanzen 70: 346. 1998; Hook.f., Fl. Brit. India 4: 353. 1885; Gamble, Fl. Madras 2: 989. 1921.

Perennial herb, pubescent, roots adventitious. Stem-less. Leaves simple, 4–12, rarely whorl of three, ovate, 4–8 × 2–6 cm, apex acute, base attenuate, margins crenate, green, tomentose. Petiole minutely winged, 2–6 × 0.5 cm, green, pubescent. Flowers 5–10, in axillary cyme. Peduncle terete, 10–12 × 0.2 cm, green, glandular hairy. Pedicel terete, 5–10 × 2 mm, green, pubescent. Bract-2, linear, 4–5 × 1 mm, apex round, green, tomentose. Calyx lobes 5, deeply divided, linear, 3–6 × 1–2 mm, apex round, pale green, tomentose. Corolla tube 5–8 × 4–5 mm, lilac with yellow colour at the throat, pubescent; lobes 5, 3–4 × 3.5–5 mm, apex round, lilac, pubescent. Stamens 2; filaments 5 × 1 mm, pale green, slightly bearded; anthers bilobed, reniform, 1.3 × 0.8 mm, white, glabrous. Style terete, 3–4 × 1 mm, green, sparsely pubescent at base. Stigma 0.6 × 0.2 mm, green, papillate. Capsules linear, 10–20 × 3 mm, green, glandular hairy. Seeds elliptic, numerous, 0.3–0.5 × 0.1–0.2 mm, brown, glabrous.

Distribution: South India and Sri Lanka (POWO, 2022)

Habitat: In moist shady slopes and rock crevices

Flowering and fruiting: May–November

Specimen examined: India, Kerala, Idukki, Vakavanam, 14/09/2019, Divya K. Venugopal 170300 (CALI).

Henckelia incana (Vahl) Spreng., Syst. Veg., ed.16. 1: 38. 1824; Pallith., Fl. Sirumalai Hills 180. 2001; Noltie, Bot. Robert Wight 276. 2005.

Perennial herb, pubescent, roots adventitious. Stem-less. Leaves simple, 6–18, whorl of three, ovate, 5–10 × 3–9 cm, apex acute, base attenuate, margins crenate, green, tomentose. Petioles winged, 1–3 × 0.5 cm, green, pubescent. Flowers dense, 6–14, in axillary cyme. Peduncle terete, 6–20 × 0.2 cm, reddish brown, pubescent. Pedicel terete, 7–10 × 1 mm, reddish brown, glandular hairy. Bracts 2, ovate to lanceolate, 4–5 × 1 mm, reddish brown, tomentose. Calyx lobes 5, lanceolate, deeply divided, 3–5 × 1–1.3 mm, apex obtuse, reddish brown, tomentose. Corolla tube 6–7 × 5–7 mm, lilac with yellow colour at the throat, pubescent; lobes 5, 3.5–4.5 × 4.7–5.2 mm, apex round, lilac, pubescent. Stamens 2; filaments slender, 4–5 × 1 mm, pale green, glabrous; anthers bilobed, reniform, 1.5 × 0.7 mm, white, glabrous. Style terete, 3.2–

3.4 × 1 mm, green, glabrous above, pubescent below. Stigma 0.6 × 1 mm, green, papillate. Capsule cylindrical, 15–20 × 2 mm, reddish brown, pubescent. Seeds elliptic, numerous, 0.5–0.6 × 0.1–0.2 mm, brown, glabrous.

Distribution: South Central & South West India (POWO, 2022)

Habitat: In moist slopes and rock crevices

Flowering and fruiting: May–December

Specimens examined: India, Kerala, Idukki, Kattadikadavu, 07/12/2018, Divya K. Venugopal 167810 (CALI); Idukki dam, 24/08/1981, V.S. Raju 71172 (MH); Kattappana, 23/08/1977, K. Vivekananthan 50486 (MH); *ibid.*, 23/08/1981, V.S. Raju 71162 (MH); *ibid.*, 27/09/1981, C.N. Mohanan 72013 (MH); Kulamavu, 12/10/1982, C.N. Mohanan 74583 (MH); Munnar F.D. - Suryanelli, 19/10/1986, B. Gurudev Singh & K.R. Sasidharan 12427 (FRC); Way to Calvary Mount, 13/11/1981, V.S. Raju s.n. (MH).

Henckelia innominata (B.L.Burt) A. Weber & B.L.Burt, Beitr. Biol. Pflanzen 70: 347.1998; Hook.f., Fl. Brit. India 4: 353. 1885; Gamble, Fl. Madras 2: 989. 1921.

Perennial herb, pubescent, roots adventitious. Stem-less. Leaves simple, 6–15, whorl of three, elliptic, 7–10 × 4.5–7 cm, apex acute, base attenuate, margins doubly serrate, hispid, green. Petiole winged, 2–8 × 0.5 cm, green, pubescent. Flowers dense, 12–20, in axillary cyme. Peduncle terete, 16–20 × 0.2 cm, green, pubescent. Pedicel terete, 5–12 × 1 mm, green, pubescent. Bracts 2, 2–5 × 1 mm, linear, tomentose. Calyx lobes 5, deeply divided, oblong, 2–3 × 0.7–1 mm, apex obtuse, reddish brown towards base and green towards apex, hispid. Corolla tube 6.8–8 × 5–6 mm, lilac with yellow colour at the throat, pubescent; lobes 5, ovate, 4.5–5.5 × 5.2–5.8 mm, apex round, pale lilac, glabrous. Stamens 2; filaments slender, 3.5–4 × 1 mm, pale green, glabrous; anthers bilobed, reniform, 1.5 × 0.7 mm, white, glabrous. Style terete, 2.1–2.4 × 1 mm, green, glabrous above, pubescent below. Stigma 0.5 × 0.2 mm, green, papillate. Capsule cylindrical, 12–20 × 2 mm, reddish brown, tomentose. Seeds elliptic, numerous, 0.3–0.6 × 0.1–0.2 mm, brown, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: In moist slopes and rock crevices

Flowering and fruiting: March–December

Specimens examined: India, Kerala, Idukki, Chinnar, 18/03/2020, Divya K. Venugopal 188999 (CALI); *ibid.*, 19/01/1986, B. Gurudev Singh & K.R. Sasidharan 12428 (FRC).

Henckelia lyrata (Wight) A. Weber & B. L. Burt, Beitr. Biol. Pflanzen 70: 349. 1998; Gamble, Fl. Madras 2: 988. 1921.

Perennial herb, pubescent, roots adventitious. Stem-less. Leaves simple, 6–9, whorl of three, elliptic, 5–8 × 4.5–6.3 cm, apex obtuse, base lyrate, margins doubly serrate, green, hispid; petiole 5–12 × 0.5 cm, pubescent. Flowers 12–20, in axillary cyme, pubescent. Peduncle terete, 15–25 × 0.2 cm, green, pubescent. Pedicel terete, 5–20 × 1 mm, green, pubescent. Bracts 2, linear, 3–5 × 1.5 mm, green, tomentose. Calyx lobes 5, deeply divided, lanceolate, 2–10 × 0.7–4 mm, apex obtuse, green, pubescent. Corolla tube 7–10 × 5–8 mm, pale lilac with yellow colour at the throat, pubescent; lobes 5, ovate, 3–5 × 4–5.5 mm, apex obtuse, pale lilac, glabrous. Stamens 2; filaments 3.5–4.5 × 1 mm, pale green, glabrous; anthers bilobed, reniform, 1.5 × 0.5 mm, white, glabrous. Style terete, 3.1–3.6 × 1 mm, green, glabrous above, pubescent below. Stigma 0.2 × 0.4 mm, green, papillate. Capsule cylindrical, 12–35 × 2 mm, green, tomentose. Seeds elliptic, numerous, 0.3–0.6 × 0.1–0.2 mm, brown, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: On moist rocks

Flowering and fruiting: May–December

Specimen examined: India, Kerala, Idukki, Kallar, 20/12/2019, Divya K. Venugopal 188998 (CALI).

Henckelia macrostachya (E. Barnes) A. Weber & B. L. Burt, Beitr. Biol. Pflanzen 70: 349. 1998; Shaju et al., Taprobanica 5(2): 138. 2013; T. S. Nayar et al., Fl. Pl. Western Ghats 1: Dicots 528. 2014.

Figure 25 E.

Perennial herb, pubescent, roots adventitious. Stem-less. Leaves simple, 9–12, whorl of three, obovate, 15–30 × 7–12 cm, apex slightly acute, base attenuate, margins crenate, green, golden tomentose hairs on juvenile leaves and becomes lesser during older stage, sessile. Flowers 15–30, in axillary cyme, tomentose. Peduncle terete, 30–50 × 0.3 cm, golden brown, tomentose. Pedicel terete, 4–10 × 1 mm, green, pubescent. Bracts 2, elliptic, 1.5–5 × 2 mm, green, tomentose. Calyx lobes 5, deeply divided, ovate, 2–5 × 0.7–2 mm, apex obtuse, reddish brown, tomentose. Corolla tube 7–10 × 4.5–5.5 mm, pale lilac with yellow colour at the throat, pubescent; lobes 5, widely obovate, 5.5–6 × 7–8 mm, apex round, lilac, glabrous. Stamens 2; filaments slender, 4–5 × 1 mm, yellow, glabrous; anthers bilobed, reniform, 1.5 × 0.8 mm,

cream, pubescent at connective. Style terete, $2-3 \times 1$ mm, green, glabrous above, pubescent below. Stigma 0.6×0.2 mm, green, papillate. Capsules cylindrical, $12-30 \times 2$ mm, reddish brown, glandular hairy. Seeds elliptic, numerous, $0.4-0.6 \times 0.2-0.24$ mm, brown, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: In moist slopes and rock crevices

Flowering and fruiting: July-October

Specimens examined: India, Kerala, Idukki, Eravikulam, 08/04/2018, Divya K. Venugopal 188997 (CALI); Near Idukki dam, 24/08/1981, V.S. Raju 71173 (MH); Kerala Ottaparai Ridge, near Munnar, Travancore High Range, 17/09/1935, Barnes, E. 1266 (K000858197!).

Henckelia meeboldii (W.W.Sm. & Ramaswami) A.Weber & B. L.Burt, Beitr. Biol. Pflanzen 70: 349. 1998; Gamble, Fl. Madras 2: 989. 1921.

Perennial herb, pubescent, roots adventitious. Stem-less. Leaves simple, 8–13, opposite-decussate, ovate, $6-12 \times 5-10$ cm, apex acute, base attenuate, margins crenate, green, pubescent. Petiole winged, $5-10 \times 0.5$ cm, green, pubescent. Flowers 10–20, in axillary cyme, pubescent. Peduncle terete, $10-25 \times 0.2$ cm, reddish brown, glandular hairy. Pedicel terete, $4-10 \times 1$ mm, green, pubescent. Bracts 2, linear, $3-5 \times 1$ mm, pubescent. Calyx lobes 5, deeply divided, ovate, $3-5 \times 0.8-2$ mm, reddish brown, glandular hairy. Corolla tube $7-10 \times 3.8-4$ mm, dark lilac with yellow colour at the throat; lobes 5, ovate, $4-7 \times 5-6$ mm, lilac, glabrous. Stamens 2; filaments slender, $4-5 \times 1$ mm, green towards top and hyaline towards base, glabrous; anthers bilobed, reniform, 1.5×0.8 mm, cream, glabrous. Style terete, $4-5 \times 1$ mm, green, glabrous above, pubescent below. Stigma 0.4×0.2 mm, green, papillate. Capsules cylindrical, $14-35 \times 2$ mm, reddish brown, tomentose. Seeds elliptic, numerous, $0.3-0.4 \times 0.2-0.24$ mm, brown, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: In moist slopes

Flowering and fruiting: July-November

Specimens examined: India, Kerala, Idukki, Way side Neriambangalam to Adimali, 17/11/2020, Divya K. Venugopal 173310 (CALI); Periyar Tiger Reserve, 15/07/2017, Divya K. Venugopal 152900 (CALI); Upputhora, 30/09/1981, C.N. Mohanan 72086 (MH); Peermade Ghat, s.d., Meebold, A.K. 12851 (E00155177!).

Henckelia ovalifolia (Wight) A. Weber & B. L. Burt, Beitr. Biol. Pflanzen 70: 351. 1998; Hook.f., Fl. Brit. India 4: 354. 1884; Gamble, Fl. Madras 2: 988. 1921.

Perennial herb, pubescent, roots adventitious. Stem-less. Leaves simple, 8–20, opposite-decussate, broadly ovate, 4–12 × 2.5–7 cm, apex acute, base unequal, margins crenate, green, tomentose. Petiole terete, 5–14 × 0.2 cm, purple, pubescent. Flowers 5–10, in axillary cyme, pubescent. Peduncle terete, 8–20 × 0.3 cm, reddish brown, pubescent. Pedicel terete, 9–10 × 1 mm, green, pubescent. Bracts 2, oblanceolate, 5–7 × 2 mm, purplish green, white tomentose hairs. Calyx lobes 5, deeply divided, linear, 5–6 × 1–1.2 mm, apex obtuse, reddish brown, pubescent. Corolla tube 7–12 × 5–6 mm, purple and yellow blotch at the base of the tube, pubescent; lobes 5, widely ovate, 7–9 × 7–7.5 mm, apex round, lilac, glabrous. Stamens 2; filaments slender, 5.3–5.7 × 1 mm, green towards top and white towards base, hairy towards the apex; anthers bilobed, reniform, 1.6–1.9 × 0.7–0.8 mm, yellowish brown, glabrous. Style terete, 4–4.5 × 1 mm, green, glabrous above, pubescent below. Stigma 0.5 × 0.1 mm, green, papillate. Capsules linear, 14–35 × 2 mm, reddish brown, pubescent. Seeds elliptic, numerous, 0.4–0.5 × 0.21–0.24 mm, brown, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: In moist shady areas of dense evergreen forests and also on moist tree trunks

Flowering and fruiting: June–October

Specimens examined: India, Kerala, Idukki, Way to Painavu, 06/09/2017, Divya K. Venugopal 152994 (CALI); Kallar Reserve forest, 16/07/1989, s.col. 90687 (MH); Periyar Tiger Reserve, 25/09/1996, Jomy Augustine 16811 (CALI).

Henckelia wightii (C.B. Clarke) A. Weber & B. L. Burt, Beitr. Biol. Pflanzen 70: 359. 1998; Hook.f., Fl. Brit. India 4: 353. 1885; Gamble, Fl. Madras 2: 989. 1921.

Perennial herb, hairy, roots adventitious. Stem-less. Leaves simple, 12–20, usually whorl of 4, elliptic, 3.5–12 × 1.5–4 cm, apex obtuse, base attenuate, margins crenate, green with whitish dusty appearance, white woolly hairs, sessile-sub sessile appearance. Flowers 5–15, in axillary cyme, pubescent. Peduncle terete, 10–20 × 0.3 cm, greenish, glandular hairy. Pedicel terete, 9–20 × 2 mm, green, glandular hairy. Bracts 2; oblanceolate, 1.5–2 × 1 mm, greenish white, woolly. Calyx lobes 5, deeply divided, oblong, 2 × 2 mm, green, white woolly hairs. Corolla tube 7–12 × 5–6 mm, lilac with yellow blotch at the throat, pubescent; lobes 5, ovate, 7–9 × 5–6 mm, lilac, glabrous. Stamens 2; filaments 2 × 1 mm, hyaline, glabrous; anthers bilobed,

reniform, 1–1.5 × 1 mm, yellowish brown, glabrous. Style terete, 1–1.3 × 1 mm, green, glabrous. Stigma sub capitate, 0.6 × 0.2 mm, green, glabrous. Capsule linear, 11–17 × 2 mm, green, tomentose. Seeds elliptic, numerous, minute, brown, glabrous.

Distribution: South India (POWO, 2022)

Habitat: On moist rocks

Flowering and fruiting: July

Specimens examined: India, Kerala, Idukki, Kanthallur, 22/06/2018, Divya K. Venugopal 159337 (CALI); Karadippara-Munnar, 25/07/2013, Janeesha 134203 (CALI).

BIGNONIACEAE Juss.

Gen. Pl. [Jussieu] 137. 1789, *nom. cons.*

Trees, shrubs, or climbers. Leaves usually opposite, petiolated with glands at the base, exstipulate, non-sheathing, margin entire or dentate. Flowers in racemes or panicles, terminal, large and showy. Flowers cyclic. Pollination entomophilous, or ornithophilous, or chiropterophilous (Delta Intkey, 2023). Calyx campanulate; lobes 2–5. Corolla tubular; lobes 5, bilipped, subequal. Stamens 4, didynamous, inserted; anthers dehiscing longitudinally. It bears nectariferous disk; style long, glabrous; stigma bilobed. Fruit bi valved capsule. Seeds compressed, winged. Members are usually tropical but generally with cosmopolitan distribution. Most members are economically important and can be used as ornamental, timber & dye.

Bignoniaceae consists of 79 accepted genera (POWO, 2022) and 841 accepted species (WFO Plant list, 2022).

Key to genera

- 1a. Leaflets elliptic.....*Dolichandrone*
- 1b. Leaflets ovate..... 2
- 2a. Capsule wrinkled, cylindrical.....*Radermachera*
- 2b. Capsule smooth, flattened..... 3
- 3a. Leaves margin entire; corolla pinkish white*Pajanelia*
- 3b. Leaves margin serrate; corolla yellow with red striations*Stereospermum*

***Dolichandrone* (Fenzl) Seem.**

Ann. Mag. Nat. Hist. ser. 3, 10: 31.1862.

Dolichandrone arcuata (Wight) C.B.Clarke, J.D.Hooker, Fl. Brit. India 4: 380 (1884); Gamble, Fl. Madras 2: 996. 1921; Sasidh., Fl. Chinnar WLS 227. 1999.

Tree; bark brown. Leaves compound, imparipinnate, opposite, leaflets 5–7 × 3–4 cm, elliptic, apex obtuse, base oblique, margins entire, green, pubescent, petiolate. Flowers in terminal corymbs or panicles, few flowered. Peduncle terete, 3–4 × 0.1–0.2 cm, greenish brown, glabrous. Pedicel terete, 2–4 × 0.1–0.2 cm, greenish brown, glabrous. Calyx spathaceous, elliptic, 4–6 × 1–2 cm, recurved, apex acute, greenish yellow, pubescent. Corolla tube 3–5 cm long, yellowish white, glabrous; lobes 5, fringed, white, glabrous. Stamens 4, didynamous, included; filaments terete, slender, 4 × 1 mm; 6 × 1 mm, white, glabrous; anthers bilobed, elliptic, 1–2 mm long, glabrous. Style terete, 2 × 0.1 cm, white, glabrous. Stigma bilobed, 1–2 mm long, white, glabrous. Capsule bi valved, linear, curved, 10–20 cm long, white dotted, pubescent.

Distribution: India (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: August–October

Specimen examined: India, Idukki, Kerala, Chinnar, 07/10/2017, Divya K. Venugopal 151688 (CALI).

***Pajanelia* DC.**

Biblioth. Universelle Genève, n.s., 17: 130.1838.

Pajanelia longifolia (Willd.) K.Schum., H.G.A.Engler & K.A.E.Prantl, Nat. Pflanzenfam. 4(3b): 244.1895; Sasidh., Fl. Periyar Tiger Reserve 289. 1998.

Pajanelia rheedei Wight, Icon. Pl. Ind. Orient. [Wight] t. 1343; Hook.f., Fl. Brit. India 4: 384. 1885; Gamble, Fl. Madras 2: 1000. 1921.

Tree; bark pale grey. Stem with prominent leaf scars, branched. Leaves compound, imparipinnate, opposite, exstipulate; leaflets 18–20 × 10–12 cm, ovate, apex slightly acute, base obtuse, margin entire, glabrous, sub sessile. Flowers in terminal raceme. Peduncle terete, 3–5 cm long, green, glabrous. Pedicel terete, 1–2 cm long, green, glabrous. Calyx lobes 5, 3–5 cm long, campanulate, apex acute, green, tomentose. Corolla tubular, 5–8 × 1–1.5 cm, pinkish white, hispid; lobes 5, 1–2 × 1–2 cm, apex wedged, constricted above base, cream, hispid. Stamens 4, didynamous, free, fifth one

rudimentary; filaments terete, 7×1 mm; 5×1 mm, cream, glabrous; anthers bilobed, oblong, 3–4 mm long, cream, glabrous. Style terete, 6×0.2 cm, cream, glabrous. Stigma bilobed, wedge shaped, cream, glabrous. Capsule bivalved, flattened, 15–30 cm long, winged, brown, glabrous. Seeds papery, winged.

Distribution: Andaman Island, Bangladesh, Borneo, India, Malaya, Myanmar, Sri Lanka, Sumatera, Thailand (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: January-August

Specimens examined: India, Kerala, Idukki, Pambadumpara, 03/03/2011, *K.D. Prathapan* 76 (CALI); Periyar Tiger Reserve, 20/03/2018, *Divya K.Venugopal* 151725 (CALI).

***Radermachera* Zoll. & Moritzi**

Syst. Verz. (Zollinger) 53. 1854.

***Radermachera xylocarpa* (Roxb.) Roxb. ex K.Schum., H.G.A.Engler & K.A.E.Prantl, Nat. Pflanzenfam. 4(3b): 243.1895; Gamble, Fl. Madras 2: 999. 1921; Sasidh., Fl. Periyar Tiger Reserve 289. 1998; Sasidh., Fl. Chinnar WLS 228. 1999. *Stereospermum xylocarpum* (Roxb.) Benth. & Hook.f., Gen. Pl. 2: 1047.1876; Hook.f., Fl. Brit. India 4: 383. 1885.**

Tree; deciduous, bark grey. Leaves compound, imparipinnate, opposite, exstipulate; leaflets $6-8 \times 4-5$ cm, ovate, apex acute, base cuneate, margin entire, glabrous, petiolate. Flowers in terminal paniced cymes. Peduncle terete, $2-3 \times 0.1-0.2$ cm, green, glabrous. Pedicel terete, $1-1.5 \times 0.1-0.2$ cm, green, glabrous. Calyx tubular, $6-8 \times 2-3$ mm, green, glabrous; lobes 5, campanulate, 2–3 mm long, apex acute, green, glabrous. Corolla tubular, $3-4 \times 0.2-0.3$ cm, white, glabrous; lobes 5, bilobed, 1–2 cm long, apex obtuse, campanulate, white, glabrous. Stamens 4, didynamous, inserted; filaments 8×1 mm; 6×1 mm cream, glabrous; anthers bilobed, divaricate, 3–4 mm long, cream, glabrous. Style slender, 3×1 cm, cream, glabrous. Stigma wedge shaped, 2–3 mm long, cream, glabrous. Capsule bivalved, cylindrical, 20–35 cm long, woody, wingless, wrinkled.

Distribution: India (POWO, 2022)

Habitat: Dry and moist deciduous forests

Flowering and fruiting: January-May

Specimens examined: India, Kerala, Idukki, Nedumkandam, 07/03/2011, *K.D. Prathapan 123* (CALI); Attayar, 01/01/1970, *N. Mohanan 5560* (CALI); Chinnar, 10/02/2020, *Divya K. Venugopal 172565* (CALI).

***Stereospermum* Cham.**

Linnaea 7: 720.1833.

Stereospermum colais (Buch.-Ham. ex Dillwyn) Mabb., Taxon 27: 553.1979; Sasidh., Fl. Periyar Tiger Reserve 290. 1998; Sasidh., Fl. Chinnar WLS 228. 1999. *Stereospermum tetragonum* DC., Prodr. 9: 210.1845; Gamble, Fl. Madras 2: 998. 1921. *Stereospermum chelonoides* (L.f.) DC., Biblioth. Universelle Genève, n.s., 17: 125. 1838; Hook. f., Fl. Brit. India 4: 383. 1885.

Tree; bark rugose, greyish-brown. Leaves compound, imparipinnate, opposite, exstipulate; leaflets 8–12 × 4–5 cm, ovate, apex acuminate, base obtuse, margin serrate, green, glabrous on adaxial surface, pubescent on abaxial surface. Flowers in terminal panicle raceme, lax. Peduncle terete, 2–3 × 0.1–0.2 cm, green, glabrous. Pedicel terete, 0.8–1 × 0.1 cm, green, glabrous. Calyx tubular, 1–1.5 × 0.2–0.3 cm, green, glabrous; lobes 5, campanulate, 3–4 × 1–2 mm, apex obtuse-acute, green, glabrous. Corolla tubular, 1–1.5 × 0.5–0.6 cm, pale brown, pubescent; lobes 5, sub equal, 0.8–1 cm long, apex wrinkled, yellow with red striations, pubescent. Stamens 4, didynamous, included; filaments slender, 1.5 × 0.1 cm; 2 × 0.1 cm, cream, pubescent; anthers bilobed, oblong, 3–4 mm long, cream, glabrous. Style slender, 1.5–1.8 × 0.1 cm, pale green, glabrous. Stigma bilobed, elliptic, 1–3 mm long, green, glabrous. Capsule flattened, slender, tapering at ends, 15–35 cm long, purple coloured, glabrous.

Distribution: Indian subcontinent to South China and Sumatera (POWO, 2022)

Habitat: Moist deciduous forests and semi – evergreen forests

Flowering and fruiting: January–November

Specimens examined: India, Idukki, Kerala, Pambadumpara, 03/03/2011, *K.D. Prathapan 75* (CALI); Mankulam, 08/06/2018, *Divya K. Venugopal 156824* (CALI).

PEDALIACEAE R.Br.

Prodr. Fl. Nov. Holland. 519. 1810, *nom. cons.*

Annual or perennial herbs and shrubs. Leaves serrated with glandular hairs. Flowers solitary or rarely clustered, glandular at the base of flower stalk. Pollination

entomophilous (Delta Intkey, 2023). Calyx 4–5 lobed. Corolla tubular; lobes 5, bilipped. Stamens 4, didynamous. Style filiform. Stigma shortly 2-lobed. Capsules 2-celled. Seeds numerous, rarely 1 or 2.

According to POWO, 2022, the family consists of 11 accepted genera and the genus *Sesamum* consists of 31 species worldwide.

***Sesamum* L.**

Sp. Pl.: 634. 1753.

***Sesamum indicum* L.**, Sp. Pl.: 634. 1753, *nom. cons.*; Hook. f., Fl. Brit. India 4: 387. 1885; Gamble, Fl. Madras 2: 1002. 1921.

Annual herb. Stem quadrangular to terete, branched, green, pubescent. Leaves simple, opposite at base and alternate above, lanceolate, apex acute, base round, margin entire, 4–9 × 2–4 cm, green, pubescent, petiolate. Flowers solitary, axillary. Peduncle absent. Pedicel terete, 2–3 mm long, green, pubescent. Calyx lobes 5, lanceolate, 4–5 × 1–2 mm, green, pubescent, persistent. Corolla tube 2–3 cm long, white, pubescent; lobes unequal (3 + 2); upper lip - 2, 3–5 mm long, white; lower lip - 3, 6–8 mm long, white with pink shades and yellow colour at throat, pubescent. Stamens 4, didynamous; filaments slender, 5 mm long, white, glabrous; anther bilobed, oblong, 2 × 1 mm, yellow, glabrous. Style slender, 1 cm long, white, glabrous. Stigma bilobed, 1 × 1 mm, white, glabrous. Capsule oblong with beak at apex, 1.5–2 cm long, green, pubescent. Seeds ovate, 1–2 mm long, numerous, black, smooth.

Distribution: Indian Subcontinent (POWO, 2022)

Habitat: Barren lands

Flowering and fruiting: January–August

Specimens examined: India, Kerala, Idukki, Way to Eravikulam National Park, 13/02/2001, Rani K. Neetha 72540 (CALI); Painavu, 10/04/2017, Divya K. Venugopal 15480 (CALI).

ACANTHACEAE Juss.

Gen. Pl. [Jussieu] 102. 1789. *nom. cons.*

Herbs or shrubs. Leaves simple, opposite, margins entire, exstipulate. Cystoliths present on leaf lamina. Flowers irregular, in racemes or spikes, rarely solitary. Pollination entomophilous (Delta Intkey, 2023). Bracts petaloid enclosing the flower.

Calyx lobes 5. Corolla bilipped, lobes usually 5. Stamens 2 or 4, inserted; anthers bilobed. Style simple. Stigma bilobed. Fruit loculicidal capsule, non-fleshy.

According to POWO 2022, Acanthaceae consists of 207 accepted genera worldwide.

Key to Genera

1a. Stamens 2	2
1b. Stamens 4	3
2a. Calyx lobes 4	<i>Barleria</i>
2b. Calyx lobes 5	4
3a. Flowers sessile	5
3b. Flowers pedicellate	6
4a. Anthers bearded	<i>Andrographis</i>
4b. Anthers not bearded	7
5a. Style glabrous	<i>Lepidagathis</i>
5b. Style pubescent	<i>Ruellia</i>
6a. Stigma entire	<i>Thunbergia</i>
6b. Stigma bifid	8
7a. Stamens inserted	9
7b. Stamens exserted	<i>Ecbolium</i>
8a. Calyx lobes 4	<i>Blepharis</i>
8b. Calyx lobes 5	<i>Asystasia</i>
9a. Flowers sessile	<i>Nicotaba</i>
9b. Flowers pedicellate	10
10a. Stigma entire	<i>Gymnostachyum</i>
10b. Stigma bifid	11
11a. Stem terete	12
11b. Stem quadrangular	13
12a. Capsule glabrous	14
12b. Capsule pubescent	<i>Rungia</i>
13a. Filaments slender	<i>Dicliptera</i>
13b. Filaments dilated	<i>Rostellularia</i>
14a. Bracts glabrous	<i>Rhinacanthus</i>
14b. Bracts pubescent	<i>Strobilanthes</i>

Andrographis Wall. ex Nees

N.Wallich, Pl. Asiat. Rar. 3: 77.1832.

Key to species

- 1a. Stem terete..... *A. affinis*
- 1b. Stem quadrangular 2
- 2a. Corolla glabrous..... 3
- 2b. Corolla pubescent..... *A. neesiana*
- 3a. Capsule oblong..... *A. atropurpurea*
- 3b. Capsule linear..... *A. macrobotrys*

Andrographis atropurpurea (Dennst.) Alston, Taxon 26: 539.1977; Sasidh., Fl. Periyar Tiger Reserve 291. 1998. *Andrographis wightiana* Arn. ex Nees, A.P.de Candolle, Prodr. 11: 517.1847; Hook.f., Fl. Brit. India 4: 503. 1885; Gamble, Fl. Madras 2: 1048. 1921.

Figure 26 C.

Shrub. Stem quadrangular, slender, green, pubescent. Leaves simple, opposite, lanceolate, 8–10 × 3–4 cm, apex acuminate, base cordate, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal racemes. Peduncle quadrangular, 4–7 cm long, green, pubescent. Pedicel quadrangular, minute, green, pubescent. Bracts subulate, minute, green, pubescent. Calyx lobes 5, 3–6 mm long, apex acute, green, glandular. Corolla tube 1–1.2 cm long, pink, glabrous; lobes 5, bilipped, minute, pink with brown spots, glabrous. Stamens 2, inserted; filaments broad, 1 cm long, white, hirsute; anthers bilobed, elliptic, minute, purple, bearded at base. Style slender, 7–8 mm long, white, glabrous. Stigma shortly bifid, white, glabrous. Capsule oblong, 1.5–2 cm long, green, glandular.

Distribution: India (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: June–October

Specimen examined: India, Kerala, Idukki, Mankulam, 15/06/2018, Divya K. Venugopal 151352 (CALI).

Andrographis affinis Nees, N.Wallich, Pl. Asiat. Rar. 3: 116.1832; Hook.f., Fl. Brit. India 4: 504. 1885; Gamble, Fl. Madras 2: 1050. 1921.

Shrub. Stem terete, green, sparsely pubescent. Leaves simple, opposite, thick, elliptic, 4–5 × 2–3 cm, apex subacute, base round, margins entire, green, pubescent on adaxial surface, sessile. Flowers in axillary and terminal racemes. Peduncle terete, 3–6 cm

long, green, pubescent. Pedicel terete, 1–2 mm long, green, pubescent. Bracts lanceolate, minute, green, pubescent. Calyx lobes 5, 2–5 mm long, apex acute, green, glandular. Corolla tube 5–8 mm long, white, glandular; lobes 5, bilipped, 3–5 mm long, apex obtuse, white, glandular. Stamens 2, inserted; filaments broad, 4–5 mm long, white, pubescent; anthers bilobed, elliptic, 2–3 mm long, purple, bearded. Style slender, 4–5 mm long, white, pubescent. Stigma bifid, white, glabrous. Capsule oblong, 1–2 cm long, green, glandular.

Distribution: India (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: January-June

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 10/04/2017, Divya K. Venugopal 151657 (CALI).

Andrographis macrobotrys Nees, A.P.de Candolle, Prodr. 11: 516.1847; Hook.f., Fl. Brit. India 4: 503. 1885; Gamble, Fl. Madras 2: 1048. 1921; Sasidh., Fl. Periyar Tiger Reserve 292. 1998.

Shrub. Stem quadrangular, stout, green, glabrous. Leaves simple, opposite, oblong, 8–12 × 2–3 cm, apex acuminate, base round, margins entire, green, pubescent, petiolate. Flowers in axillary racemes. Peduncle terete, 3–8 cm long, green, pubescent. Pedicel terete, >1 mm long, green, pubescent. Bracts subulate, minute, green, pubescent. Calyx lobes 5, 2–4 mm long, apex acute, green, glandular. Corolla tube 1–1.2 cm long, pink, glabrous; lobes 5, bilipped, 8–10 mm long, pale pink with purple spots, glabrous. Stamens 2, inserted; filaments broad, 1 cm long, white, bulged at base, pubescent; anthers bilobed, elliptic, 2–3 mm long, purple, bearded at base. Style slender, 8–10 mm long, white, pubescent. Stigma bifid, white, pubescent. Capsule linear, 10–15 mm long, green, glandular.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: July-December

Specimens examined: India, Kerala, Idukki, Peerumedu, 10/12/1970, Sasikala M.S. 1121 (CALI); Eravikulam, 18/08/2017, Divya K. Venugopal 151396 (CALI).

Andrographis neesiana Wight, Icon. Pl. Ind. Orient. 4: t. 1561.1850; Hook.f., Fl. Brit. India 4: 504. 1885; Gamble, Fl. Madras 2: 1049. 1921; Sasidh., Fl. Periyar Tiger Reserve 292. 1998; Sasidh., Fl. Chinnar WLS 230. 1999.

Herb. Stem quadrangular, green, pubescent. Leaves simple, opposite, elliptic, 2–5 × 1–2 cm, apex acute, base cuneate, margins entire, green, glabrous, sessile. Flowers in terminal panicles, dense. Peduncle quadrangular, 2–5 cm long, green, pubescent. Pedicel quadrangular, 1–2 mm long, green, pubescent. Bracts subulate, minute, green, pubescent. Calyx lobes 5, linear, 4–7 mm long, apex acuminate, green, glandular. Corolla tube 8–9 mm long, brownish purple, pubescent; lobes 5, 2–4 mm long, apex obtuse, brownish purple, pubescent. Stamens 2, inserted; filaments broad, 5–6 mm long, white, bulged at base, pubescent; anthers bilobed, elliptic, 2–3 mm long, purple, bearded at base. Style 6–8 mm long, white, pubescent. Stigma bifid, white, pubescent. Capsule oblong, 8–10 mm long, green, pubescent.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: July–December

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 21/11/2014, *S. Syam Radh* 143582 (CALI); Munnar, 27/11/1979, *Nambiar* 899 (KFRI); Periyar Tiger Reserve, 07/07/1993, *Jomy Augustine* 12028 (CALI); Ramakalmedu, 17/11/2018, *Divya K. Venugopal* 152476 (CALI).

Asystasia Blume

Bijdr. Fl. Ned. Ind.: 796.1826.

Key to species

- 1a. Stem glabrous..... 2
- 1b. Stem pubescent *A. gangetica*
- 2a. Corolla lobes glabrous..... *A. travancorica*
- 2b. Corolla lobes pubescent 3
- 3a. Flowers subsessile, corolla tube purple; capsule pubescent.... *A. crispata*
- 3b. Flowers pedicellate, corolla tube white; capsule glabrous..... *A. chelonoides*

Asystasia chelonoides Nees, N.Wallich, Pl. Asiat. Rar. 3: 89.1832; Hook.f., Fl. Brit. India 4: 493. 1885; Gamble, Fl. Madras 2: 1063. 1921; Sasidh., Fl. Chinnar WLS 230. 1999.

Figure 27 H.

Herb. Stem quadrangular, green, glabrous. Leaves simple, opposite, elliptic, 8–10 × 2–4 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in terminal racemes. Peduncle terete, 3–6 cm long, green, glabrous. Pedicel terete, 8–9 mm long, green, glabrous. Bracts lanceolate, minute, green, pubescent. Calyx lobes 5, 3–5 mm long, apex acute, green, pubescent. Corolla tube 2–2.3 cm long, white, glabrous; lobes 5, 6–8 mm long, apex obtuse, white with purple shades, glabrous. Stamens 4, didynamous; filaments slender, 5–7 mm long, white, pubescent; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, 1–1.4 cm long, white, glabrous. Stigma bifid, white, glabrous. Capsule elliptic, 2–5 mm long, green, glabrous.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: Near streams

Flowering and fruiting: January–April

Specimen examined: India, Kerala, Idukki, Aranakkara, 26/02/2018, Divya K. Venugopal 156532 (CALI).

Asystasia crispata Benth., Linnaea 24: 647. 1851; Hook. f., Fl. Brit. India 4: 494. 1885; Gamble, Fl. Madras 2: 1063. 1921.

Figure 26 D.

Shrub. Stem quadrangular, green, glabrous. Leaves simple, opposite, elliptic, 4–8 × 2–3 cm, apex acuminate, base round, margins entire, green, glabrous, petiolate. Flowers in terminal racemes, subsessile. Peduncle terete, 4–7 cm long, green, glabrous. Bracts lanceolate, 1–3 cm long, green, pubescent. Calyx lobes 5, 4–6 mm long, apex acute, green, pubescent. Corolla tube 1–2 cm long, purple, sparsely pubescent; lobes 5, 1–1.5 cm long, apex obtuse, purple, glabrous. Stamens 4, didynamous; filaments slender, 6–8 mm long, white, glabrous; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, 1–2 cm long, white, glabrous. Stigma bifid, white, glabrous. Capsule elliptic, 1–3 cm long, green, pubescent.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January–August

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 23/08/2014, S. Syam Radh 143582 (CALI); Aranakkara, 26/02/2018, Divya K. Venugopal 156532 (CALI).

Asystasia gangetica (L.) T.Anderson, G.H.K.Thwaites, Enum. Pl. Zeyl.: 235. 1860; Hook.f., Fl. Brit. India 4: 493. 1885; Gamble, Fl. Madras 2: 1063. 1921; Sasidh., Fl. Periyar Tiger Reserve 293. 1998; Sasidh., Fl. Chinnar WLS 230. 1999.

Herb. Stem quadrangular, green-grey, puberulent. Leaves simple, opposite-decussate, ovate, 3–6 × 2–4 cm, apex acute, base cordate, margins entire, green, pubescent on abaxial surface, petiolate. Flowers in terminal racemes. Peduncle quadrangular, 3–10 cm long, green, puberulent. Pedicel quadrangular, minute, green, puberulent. Bracts ovate, minute, green, puberulent, opposite. Calyx tube absent; lobes 5, deeply divided, 5–9 mm long, apex acute, green, pubescent. Corolla tube 2–3 cm long, cream, glabrous; lobes 5, subequal, 2.5–2.8 cm long, apex obtuse, cream or yellow with blue patches, glabrous. Stamens 4, didynamous; filaments slender, 5–7 mm long, white, hairy; anthers bilobed, oblong, 3 mm long, white, glabrous. Style linear, 1.3–1.6 cm long, white, pubescent. Stigma bifid, white, glabrous. Capsule elliptic, 1–3 cm long, green, pubescent.

Distribution: Indian Subcontinent to North & East Australia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: September-January

Specimens examined: India, Kerala, Idukki, Way to Mannavan Shola, 08/01/2004, B.K. Kavitha 96733 (CALI); Chottupara, 18/10/2017, Divya K. Venugopal 158399 (CALI).

Asystasia travancorica Bedd., Icon. Pl. Ind. Or. 1: 39.1872; Hook.f., Fl. Brit. India 4: 494. 1885; Gamble, Fl. Madras 2: 1063. 1921; Sasidh., Fl. Periyar Tiger Reserve 293. 1998.

Herb. Stem quadrangular, green, glabrous. Leaves simple, opposite-decussate, linear, 8–12 × 1–2 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in terminal racemes. Peduncle quadrangular, 3–4 cm long, green, glabrous. Pedicel quadrangular, minute, green, glabrous. Bracts lanceolate, minute, green, glabrous, opposite. Calyx tube absent; lobes 5, deeply divided, 4–5 mm long, apex acute, green, glabrous. Corolla tube 10–12 mm long, violet, glabrous; lobes 5, subequal, 5–8 mm long, apex obtuse, violet, glabrous. Stamens 4, didynamous; filaments slender, 6–7 mm long, white, hairy; anthers bilobed, elliptic, 1 mm long, purple, glabrous. Style linear, 5–7 mm long, white, pubescent. Stigma bifid, white, glabrous. Capsule elliptic, 10–17 mm long, green, pubescent.

Distribution: India (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: October-March

Specimen examined: India, Kerala, Idukki, Mankulam, 14/11/2018, Divya K. Venugopal 158071 (CALI).

***Barleria* L.**

Sp. Pl.: 636.1753.

Key to species

- 1a. Stem spiny..... *B. prionitis*
- 1b. Stem not spiny..... 2
- 2a. Leaves & corolla lobes glabrous; capsule elliptic..... *B. involucrata*
- 2b. Leaves & corolla lobes pubescent; capsule obovoid *B. lawii*

Barleria involucrata Nees, N.Wallich, Pl. Asiat. Rar. 3: 92.1832; Hook.f., Fl. Brit. India 4: 485. 1885; Gamble, Fl. Madras 2: 1060. 1921.

Figure 27 G.

Shrub. Stem terete, green, not spiny, pubescent. Leaves simple, opposite, elliptic, 8–12 × 3–6 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal racemes, large. Peduncle terete, 2–6 cm long, green, pubescent. Pedicel terete, green, pubescent. Bracts linear, 2–2.3 cm long, green, glabrous. Calyx tube absent; lobes 4, deeply divided, ovate, 2–4 cm long, apex acute, green, pubescent. Corolla tube 1–1.6 cm long, purple, glabrous; lobes 5, subequal, 1.3–1.5 cm long, apex obtuse, pale blue, glabrous. Stamens 2, inserted; filaments slender, 7–9 mm long, white, glabrous; anthers bilobed, elliptic, 2–3 mm long, violet, glabrous. Style long, slender, 5–6 mm long, white, glabrous. Stigma bifid, white, glabrous. Capsule elliptic, 1–2 cm long, green, glabrous.

Distribution: South West India, Sri Lanka (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: October-May

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 17/02/2017, S. Syam Radh 151705 (CALI); Way to Eravikulam, 13/02/2001, V. Smitha 72769 (CALI); Kanthallur, 17/11/2018, Divya K. Venugopal 158245 (CALI).

Barleria lawii T.Anderson, J. Linn. Soc., Bot. 9: 492.1867; Hook.f., Fl. Brit. India 4: 486. 1885; Gamble, Fl. Madras 2: 1060. 1921.

Shrub. Stem terete, green, not spiny, pubescent. Leaves simple, opposite, lanceolate, 12–15 × 5–6 cm, apex acute, base round, margins entire, green, pubescent, petiolate. Flowers in axillary and terminal racemes. Peduncle terete, 2–4 cm long, green, pubescent. Pedicel terete, minute, green, pubescent. Bracts linear, 2–3 cm long, green, glandular. Calyx tube absent; lobes 4, deeply divided, 1–1.2 cm long, apex acute, green, glabrous. Corolla tube 3–5 cm long, violet, pubescent; lobes 4, 6–8 mm long, apex obtuse, violet, pubescent. Stamens 2, inserted; filaments slender, 1–1.6 cm long, white, glabrous; anthers bilobed, elliptic, 2–3 mm long, blue, glabrous. Style long, slender, 1–1.2 cm long, white, glabrous. Stigma bifid, white, glabrous. Capsule obovoid, 2–3 cm long, green, glabrous.

Distribution: West India (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: October-January

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 14/11/1993, *Jomy Augustine* 12590 (CALI); Mathikettan Shola National Park, 11/01/2017, *Divya K. Venugopal* 151477 (CALI).

Barleria prionitis L., Sp. Pl.: 636.1753; Hook.f., Fl. Brit. India 4: 482. 1885; Gamble, Fl. Madras 2: 1058. 1921; Sasidh., Fl. Chinnar WLS 232. 1999.

Shrub. Stem quadrangular, green, glabrous, spiny. Leaves simple, opposite-decussate, elliptic, 4–8 × 2–4 cm, apex acute, base cuneate, margins entire, green, pubescent on abaxial surface, petiolate. Flowers in axillary cyme, sessile. Peduncle quadrangular, 1–2 cm long, green, glabrous. Bracts oblong, 1–1.2 cm long, green, foliaceous. Calyx lobes 4, deeply divided, 1–1.3 cm long, apex acute, green, pubescent. Corolla tube 2–3 cm long, yellow, glabrous; lobes 5, subequal, 1.5–1.8 cm long, apex obtuse, yellow, glabrous. Stamens 2, inserted; filaments slender, 8–10 mm long, white, glabrous; anthers bilobed, elliptic, 2–3 mm long, yellow, glabrous. Style slender, 2–2.3 cm long, white, glabrous. Stigma bifid, white, glabrous. Capsule ovoid, 2–4 cm long, green, glabrous.

Distribution: North East Tropical Africa, Madagascar, Tropical & Subtropical Asia (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: August-February

Specimens examined: India, Kerala, Idukki, Rajamalai, 17/02/1998, *Soniya 61008* (CALI); Chinnar, 08/09/2018, *Divya K. Venugopal 151244* (CALI).

***Blepharis* Juss.**

Gen. Pl.: 103.1789.

***Blepharis maderaspatensis* (L.) B.Heyne ex Roth, Nov. Pl. Sp.: 320.1821; Hook.f., Fl. Brit. India 4: 478. 1885; Sasidh., Fl. Chinnar WLS 232. 1999. *Blepharis boerhaviifolia* Pers., Syn. Pl. 2: 180.1806, *nom. superfl.*; Gamble, Fl. Madras 2: 1013. 1921.**

Herb. Stem quadrangular, green, tomentose, spiny. Leaves simple, in a whorl of 4, 3–6 × 1–2 cm, obovate, apex acute, base round, margins serrate, green, pubescent, petiolate. Flowers in terminal spikes. Peduncle quadrangular, 1–2 cm long, green, tomentose. Pedicel quadrangular, minute, green, tomentose. Bracts obovate, 1–1.2 cm long, green, hairy along margin. Calyx lobes 4, unequal, 1–1.6 cm long, apex acute, green, glabrous. Corolla tube 4–6 mm long, white, glabrous; lobes 5, white with pink spots, glabrous. Stamens 4, didynamous; filaments thick, 4–5 mm long, white, glabrous; anthers bilobed, elliptic, 2 mm long, white, bearded. Style linear, 7–9 mm long, white, glabrous. Stigma bifid, white, glabrous. Capsule oblong, green, glabrous.

Distribution: Africa, Arabian Peninsula to Indo-China, Hainan (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: November–March

Specimens examined: India, Kerala, Idukki, Chinnar, 17/02/2001, *Rani K. Neetha 72550* (CALI); Kanthallur, 02/03/2022, *Nuflath P. 185357* (CALI); Kovilkadavu, 14/01/2018, *Divya K. Venugopal 159447* (CALI).

***Dicliptera* Juss.**

Ann. Mus. Hist. Nat. 9: 267.1807. *nom. cons.*

Key to species

- 1a. Stem glabrous; flowers pedicellate 2
- 1b. Stem pubescent; flowers sessile..... *D. cuneata*
- 2a. Leaves elliptic; bracts ovate *D. baphica*
- 2b. Leaves ovate; bracts linear..... *D. foetida*

Dicliptera baphica Nees, A.P.de Candolle, Prodr. 11: 490.1847. *Peristrophe montana* Nees, N.Wallich, Pl. Asiat. Rar. 3: 113.1832; Hook.f., Fl. Brit. India 4: 556. 1885; Gamble, Fl. Madras 2: 1084. 1921.

Herb. Stem quadrangular, green, glabrous. Leaves simple, opposite, elliptic, 12–15 × 3–5 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary and terminal cymes. Peduncle quadrangular, 2–3 cm long, green, glabrous. Pedicel quadrangular, minute, green, glabrous. Bracts ovate, 1.5–2 cm long, green, glabrous. Calyx lobes 5, 3–5 mm long, apex acute, green, glabrous. Corolla tube 2–3 cm long, pink, glabrous; lobes 5, bilipped, 10–12 mm long, apex obtuse, pink, glabrous. Stamens 2, inserted; filaments slender, 6–8 mm long, white, pubescent; anther bilobed, elliptic, 2 mm long, pink, glabrous. Style slender, filiform, 1 cm long, glabrous. Stigma bilobed, white, glabrous. Capsule ellipsoid, 8–10 mm long, green, pubescent.

Distribution: South India, Sri Lanka, Andaman Islands to Nicobar Islands, Hainan to Vietnam (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: September–April

Specimens examined: India, Kerala, Idukki, Chinnar, 14/02/2001, *K.A. Deepa* 73773 (CALI); Periyar Tiger Reserve, 21/09/1996, *Jomy Augustine* 16823 (CALI); Kumily, 24/04/2017, *Divya K. Venugopal* 167724 (CALI).

Dicliptera cuneata Nees, N.Wallich, Pl. Asiat. Rar. 3: 111.1832; Hook.f., Fl. Brit. India 4: 552. 1885; Gamble, Fl. Madras 2: 1073. 1921; Sasidh., Fl. Periyar Tiger Reserve 294. 1998; Sasidh., Fl. Chinnar WLS 233. 1999.

Herb. Stem quadrangular, green, pubescent. Leaves simple, opposite, elliptic, 5–8 × 3–4 cm, apex acuminate, base cuneate, margins entire, green, pubescent, petiolate. Flowers in terminal cymes, sessile. Peduncle quadrangular, 2–4 cm long, green, pubescent. Bracts linear, minute, green, glabrous. Calyx lobes 5, 4–6 mm long, apex acute, green, pubescent. Corolla tube 5–6 mm long, slender, pink, glabrous; lobes 5, bilipped, 3–4 mm long, apex obtuse, pink, glabrous. Stamens 2, inserted; filaments slender, 3–4 mm long, white, pubescent; anthers bilobed, 2 mm long, pink, glabrous. Style filiform, 5–7 mm long, white, glabrous. Stigma bilobed, pink, glabrous. Capsule clavate, green, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: November-January

Specimen examined: India, Kerala, Idukki, Mankulam, 12/11/2018, Divya K. Venugopal 151315 (CALI).

Dicliptera foetida (Forssk.) Blatt., Rec. Bot. Surv. India 8: 361.1921; Sasidh., Fl. Periyar Tiger Reserve 294. 1998. *Dicliptera zeylanica* Nees, A.P.de Candolle, Prodr. 11: 474.1847; Hook.f., Fl. Brit. India 4: 552. 1885; Gamble, Fl. Madras 2: 1073. 1921.

Shrub. Stem quadrangular, green, glabrous. Leaves simple, opposite, ovate, 5–7 × 2–3 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary cymes. Peduncle quadrangular, 2–4 cm long, green, glabrous. Pedicel quadrangular, 4–6 mm long, green, glabrous. Bracts linear, minute, green, glabrous. Calyx lobes 5, linear, 3–5 mm long, apex acute, green, glabrous. Corolla tube slender, 9–10 mm long, pink, glabrous; lobes 5, bilipped, apex obtuse, pink, glabrous. Stamens 2, inserted; filaments slender, 7–9 mm long, white, hairy; anthers bilobed, elliptic, 2–3 mm long, white, glabrous. Style filiform, 1 cm long, white, glabrous. Stigma bifid, white, glabrous. Capsule clavate, green, glabrous.

Distribution: Ethiopia, South West Arabian Peninsula, India, Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: June-January

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 22/12/1994, Jomy Augustine 14362 (CALI); Mankulam, 13/06/2018, Divya K. Venugopal 151320 (CALI).

***Ecbolium* Kurz**

J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 40: 75.1871.

Ecbolium ligustrinum (Vahl) Vollesen, Kew Bull. 44: 651.1989; Sasidh., Fl. Periyar Tiger Reserve 295. 1998. *Ecbolium linneanum* Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 40: 75.1871; Hook.f., Fl. Brit. India 4: 544. 1885; Gamble, Fl. Madras 2: 1074. 1921.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite, elliptic, 15–18 × 3–5 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in terminal spikes. Peduncle terete, 7–10 cm long, green, glabrous. Pedicel terete,

minute, green, glabrous. Bracts leafy, large, green, glabrous. Calyx lobes 5, 4–6 mm long, apex acute, green, pubescent. Corolla tube long & slender, bluish green, pubescent; lobes 5, bilipped, 1–1.2 cm long, apex obtuse, bluish green, pubescent. Stamens 2, exserted; filaments slender, white, glabrous; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style filiform, 1.2–1.5 cm long, white, glabrous. Stigma bifid, white, glabrous. Capsule clavate, 1.5–1.8 cm long, green, pubescent.

Distribution: Indian Subcontinent (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: December-May

Specimens examined: India, Kerala, Idukki, Chinnar, 19/05/1999, *Satheesh George* 79242 (CALI); Peerumedu, 20/12/2017, *Divya K. Venugopal* 154167 (CALI).

***Gymnostachyum* Nees**

N.Wallich, Pl. Asiat. Rar. 3: 76.1832.

Key to species

- 1a. Bracts linear; calyx lobes glabrous *G. latifolium*
- 1b. Bracts ovate; calyx lobes glandular *G. pubescens*

Gymnostachyum latifolium (Dalzell) T.Anderson, J. Linn. Soc., Bot. 9: 505. 1867; Hook.f., Fl. Brit. India 4: 509. 1885; Gamble, Fl. Madras 2: 1053. 1921; Sasidh., Fl. Periyar Tiger Reserve 296. 1998.

Herb. Stem quadrangular, green, glabrous. Leaves simple, opposite, elliptic, 8–10 × 4–6 cm, apex acuminate, base round, margins entire, green, glabrous, petiolate. Flowers in axillary cymes, subsessile. Peduncle quadrangular, 3–6 cm long, green, glabrous. Bracts linear, minute, green, glabrous. Calyx lobes 5, 4–6 mm long, apex acute, green, glabrous. Corolla tube slender, 6–9 mm long, greenish yellow, glabrous; lobes 5, bilipped, 6–7 mm long, apex obtuse, greenish yellow, glabrous. Stamens 2, inserted; filaments slender, 5–6 mm long, white, hairy; anthers bilobed, elliptic, 2 mm long, grey, glabrous. Style slender, white, glabrous. Stigma entire, minute, white, glabrous. Capsule linear, 2–2.3 cm long, green, glabrous.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: March-December

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 28/12/1993, *Jomy Augustine 12922* (CALI); Mankulam, 14/08/2017, *Divya K. Venugopal 152489* (CALI).

Gymnostachyum pubescens (Lam.) M.R.Almeida, Fl. Maharashtra 4A: 45. 2003. *Gymnostachyum canescens* (Nees) T.Anderson, J. Linn. Soc., Bot. 9: 505.1867; Hook.f., Fl. Brit. India 4: 509. 1885; Gamble, Fl. Madras 2: 1053. 1921; Sasidh., Fl. Periyar Tiger Reserve 295. 1998.

Shrub. Stem quadrangular, green, pubescent. Leaves simple, opposite, elliptic, 12–15 × 8–10 cm, apex acuminate, base cuneate, margins serrate, green, glabrous, petiolate. Flowers in axillary cymes. Peduncle quadrangular, 3–7 cm long, green, pubescent. Pedicel quadrangular, minute, green, pubescent. Bracts ovate, minute, green, pubescent. Calyx lobes 5, 3–6 mm long, apex acute, green, glandular. Corolla tube slender, 7–9 mm long, greenish white, glabrous; lobes 5, 4–6 mm long, apex obtuse, greenish white, glabrous. Stamens 2, inserted; filaments slender, 5–6 mm long, white, glabrous; anthers bilobed, elliptic, 2 mm long, grey, glabrous. Style slender, white, glabrous. Stigma entire, minute, white, glabrous. Capsule linear, 1–2 cm long, green, glabrous.

Distribution: West India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: August–December

Specimens examined: India, Kerala, Idukki, Adimali, 30/11/1979, *Nambiar 1127* (KFRI); Mankulam, 15/08/2017, *Divya K. Venugopal 152548* (CALI).

Lepidagathis Willd.

Sp. Pl., ed. 4, 3: 400.1800.

Lepidagathis incurva Buch.-Ham. ex D.Don, Prodr. Fl. Nepal.: 119.1825; Sasidh., Fl. Periyar Tiger Reserve 299. 1998. *Lepidagathis hyalina* Nees, N.Wallich, Pl. Asiat. Rar. 3: 95.1832; Hook.f., Fl. Brit. India 4: 521. 1885; Gamble, Fl. Madras 2: 1068. 1921.

Herb. Stem quadrangular, green, pubescent. Leaves simple, opposite, lanceolate, 5–8 × 2–3 cm, apex acute, base cuneate, margins entire, green, pubescent, petiolate. Flowers in axillary and terminal spikes, dense, sessile. Peduncle quadrangular, 2–6 cm long, green, pubescent. Bracts lanceolate, 3–5 mm long, green, ciliate. Calyx lobes 5, unequal, 3–6 mm long, apex acute, green, glandular. Corolla tube short, white,

glabrous; lobes 5, bilipped, 3–4 mm long, apex obtuse, white, glabrous. Stamens 4, didynamous; filaments short, white, pubescent; anthers bilobed, 2 mm long, white, glabrous. Style slender, curved, white, glabrous. Stigma capitate, white, glabrous. Capsule oblong, 3–5 mm long, green, pubescent.

Distribution: Tropical & Subtropical Asia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: January–December

Specimens examined: India, Kerala, Idukki, Devikulam, 10/12/1970, *M.K. Sreedharan Nambiar 169* (CALI); Munnar, 10/01/2018, *Divya K. Venugopal 154176* (CALI).

***Nicoteba* Lindau**

Bot. Jahrb. Syst. 18: 56.1893.

***Nicoteba betonica* (L.) Lindau**, Bot. Jahrb. Syst. 18: 56.1893. *Justicia betonica* L., Sp. Pl.: 15.1753; Hook.f., Fl. Brit. India 4: 525. 1885; Gamble, Fl. Madras 2: 1078. 1921; Sasidh., Fl. Periyar Tiger Reserve 297. 1998; Sasidh., Fl. Chinnar WLS 235. 1999.

Shrub. Stem quadrangular, green, glabrous. Leaves simple, opposite, ovate, 6–12 × 3–4 cm, apex acuminate, base cuneate, margins entire, green, glabrous, petiolate. Flowers in terminal spikes, sessile. Peduncle quadrangular, 3–8 cm long, green, glabrous. Bracts ovate, 2–4 cm long, white with green veins, glabrous. Calyx lobes 5, 3–6 cm long, apex acute, green, glabrous. Corolla tube 7–9 mm long, white, glabrous; lobes 5, bilipped, 5–7 mm long, apex obtuse, white, glabrous. Stamens 2, inserted; filaments dilated, 4–5 mm long, white, pubescent; anthers bilobed, elliptic, 2–3 mm long, yellow, glabrous. Style filiform, white, glabrous. Stigma bifid, white, glabrous. Capsule ovoid, green, pubescent, papery.

Distribution: Tropical & South Africa, Indian Subcontinent (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: November–January

Specimens examined: India, Kerala, Idukki, Way to Kanthallur, 23/01/2005, *P.I. Jattisha 110218* (CALI); Narakkampara, 17/11/2019, *Divya K. Venugopal 167718* (CALI).

***Rhinacanthus* Nees**

N.Wallich, Pl. Asiat. Rar. 3: 76.1832.

Rhinacanthus nasutus (L.) Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 39: 79. 1870; Sasidh., Fl. Periyar Tiger Reserve 301. 1998; Sasidh., Fl. Chinnar WLS 237. 1999. *Rhinacanthus communis* Nees, N.Wallich, Pl. Asiat. Rar. 3: 109.1832, *nom. superfl.*; Hook.f., Fl. Brit. India 4: 541. 1885; Gamble, Fl. Madras 2: 1083. 1921.

Shrub. Stem terete, green, pubescent. Leaves simple, opposite, ovate, 8–10 × 4–6 cm, apex acute, base cuneate, margins entire, green, pubescent, petiolate. Flowers in terminal cymes. Peduncle terete, 1–4 cm long, green, pubescent. Pedicel terete, minute, green, pubescent. Bracts linear, 1–2 mm long, green, glabrous. Calyx lobes 5, 4–6 mm long, apex acute, green, pubescent. Corolla tube long, 2–2.4 cm long, white, pubescent; lobes 5, bilipped, upper lip entire; lower lip 3 lobed, apex obtuse, white, pubescent. Stamens 2, inserted; filaments slender, 5–7 mm long, white, glabrous; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style filiform, white, glabrous. Stigma bifid, white, glabrous. Capsule clavate, 1–2 cm long, green, glabrous.

Distribution: Tropical Asia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: November–April

Specimens examined: India, Kerala, Idukki, Kumily, 21/11/1988, *Kadeejakutty U.* 439 (CALI); Periyar Tiger Reserve, 26/04/1994, *Jomy Augustine* 13634 (CALI); Medicinal Plant Conservation Area, 15/03/2018, *Divya K. Venugopal* 167848 (CALI).

***Rostellularia* Rchb.**

Handb. Nat. Pfl.-Syst.: 190.1837.

Key to species

- 1a. Stem glabrous, roots arises from basal nodes *R. mollissima*
- 1b. Stem pubescent, root absent..... 2
- 2a. Leaves ovate, petiolate; calyx lobes ciliate *R. procumbens*
- 2b. Leaves oblong, sessile; calyx lobes white tomentose *R. simplex*

Rostellularia mollissima (Nees) Nees, A.P.de Candolle, Prodr. 11. 373. 1847. *Justicia procumbens* var. *latispica* C.B.Clarke, J.D.Hooker, Fl. Brit. India 4: 539.1885. *Justicia latispica* (C.B.Clarke) Gamble, Fl. Madras: 1080.1924; Sasidh., Fl. Periyar Tiger Reserve 297. 1998; Sasidh., Fl. Chinnar WLS 235. 1999.

Herb. Stem quadrangular, branching, green, glabrous, roots arises from basal nodes. Leaves simple, opposite, elliptic, 4–6 × 1–2 cm, apex acute, base cuneate, margins entire, green, sparsely pubescent, petiolate. Flowers in axillary and terminal spikes. Peduncle quadrangular, 2–5 cm long, green, glabrous. Pedicel quadrangular, minute, green, glabrous. Bracts ovate, 3–5 mm long, green, ciliate. Calyx lobes 5, 3–4 mm long, apex acute, green, ciliate. Corolla tube 4–6 mm long, lilac, pubescent; lobes 5, bilipped, 4–5 mm long, apex obtuse, lilac with brown shades, pubescent. Stamens 2, inserted; filaments dilated, 3–4 mm long, white, glabrous; anthers bilobed, 2 mm long, white, glabrous. Style filiform, white, pubescent. Stigma bifid, lilac, glabrous. Capsule ovoid, 3–6 mm long, green, glabrous.

Distribution: Indian Subcontinent to China (South West Yunnan) and Myanmar (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: October–May

Specimens examined: India, Kerala, Idukki, Chinnar, 19/05/1999, *T. Resmi* 78372 (CALI); Periyar Tiger Reserve, 11/10/1993, *Jomy Augustine* 12605 (CALI); Mankulam, 10/11/2019, *Divya K. Venugopal* 168952 (CALI).

Rostellularia procumbens (L.) Nees, A.P.de Candolle, Prodr. 11: 371.1847. *Justicia procumbens* L., Sp. Pl.: 15.1753; Hook.f., Fl. Brit. India 4: 539. 1885; Gamble, Fl. Madras 2: 1080. 1921; Sasidh., Fl. Periyar Tiger Reserve 298. 1998; Sasidh., Fl. Chinnar WLS 236. 1999.

Herb. Stem quadrangular, branching, green, pubescent, roots absent from basal nodes. Leaves simple, opposite, ovate, 2–4 × 1–1.5 cm, apex acute, base cuneate, margins entire, green, pubescent on abaxial surface, petiolate. Flowers in terminal spike. Peduncle quadrangular, 2–3 cm long, green, pubescent. Pedicel quadrangular, minute, green, pubescent. Bracts lineolate, 3–5 mm long, green, pubescent. Calyx lobes 5, linear, 3–5 mm long, apex acute, green, ciliate. Corolla tube 2–3 mm long, lilac, pubescent; lobes 5, bilipped, upper lip entire; lower lip slightly 3 lobed, 2–5 mm long, apex obtuse, lilac with white shades, pubescent. Stamens 2; filaments dilated, 2 mm long, white, hairy at base; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style filiform, white, glabrous. Stigma bifid, white, glabrous. Capsule ovoid, 3–6 mm long, green, pubescent.

Distribution: Tropical & Subtropical Asia to Central China (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: August-March

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 04/11/2015, *S. Syam Radh* 145076 (CALI); Medicinal Plant Conservation Area, 15/03/2018, *Divya K. Venugopal* 167855 (CALI).

Rostellularia simplex Wight, Icon. Pl. Ind. Orient. 4: t. 1542.1850. *Justicia notha* C.B. Clarke, J.D. Hooker, Fl. Brit. India 4: 537.1885; Gamble, Fl. Madras 2: 1080. 1921; Sasidh., Fl. Periyar Tiger Reserve 298. 1998.

Herb. Stem quadrangular, green, pubescent, roots absent from basal nodes. Leaves simple, opposite, oblong, 3–5 × 0.8–1.2 cm, apex obtuse, base cuneate, margins entire, green, glabrous, sessile. Flowers in terminal spikes. Peduncle quadrangular, 1–3 cm long, green, pubescent. Pedicel quadrangular, minute, green, pubescent. Bracts elliptic, 3–7 mm long, green, ciliate. Calyx lobes 5, 5–7 mm long, apex acute, green, white tomentose. Corolla tube 2–4 mm long, lilac, pubescent; lobes 5, bilipped, upper lip entire; lower lip minutely 3 lobed, 2–5 mm long, apex obtuse, lilac, pubescent. Stamens 2, inserted; filaments dilated, 2–3 mm long, white, glabrous; anthers bilobed, elliptic, 2 mm long, white-pale brown, glabrous. Style filiform, 4–5 mm long, white, glabrous. Stigma bifid, white, glabrous. Capsule ovoid, 2–5 mm long, green, glabrous.

Distribution: India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: September-December

Specimen examined: India, Kerala, Idukki, Elaveezhapoonchira, 17/09/2019, *Divya K. Venugopal* 172536 (CALI).

Ruellia Plum. ex L.

Sp. Pl.: 634.1753.

Ruellia prostrata Poir, J.B.A.M. de Lamarck, Encycl. 6: 349.1804; Hook.f., Fl. Brit. India 4: 411. 1885; Gamble, Fl. Madras 2: 1017. 1921. *Dipteracanthus prostratus* (Poir.) Nees, N. Wallich, Pl. Asiat. Rar. 3: 81.1832; Sasidh., Fl. Periyar Tiger Reserve 294. 1998.

Herb. Stem quadrangular, prostrate, green, villous, rooting at lower nodes. Leaves simple, opposite, ovate, 4–6 × 2–3 cm, apex acute, base round, margins entire, green, glabrous, petiolate. Flowers solitary, axillary, sessile. Bracts absent. Calyx lobes 5, 5–9 mm long, apex acute, green, ciliate. Corolla tube 4–8 mm long, violet, glabrous; lobes 5, subequal, 4–6 mm long, apex obtuse, violet, glabrous. Stamens 4,

didynamous; filaments 4–5 mm long, white, glabrous; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, 5–6 mm long, white, pubescent. Stigma simple, white, glabrous. Capsule oblong, 1–2 cm long, green, pubescent.

Distribution: Central African Republic to Eritrea and S. Africa, Arabian Peninsula, Indian Subcontinent, Christmas Island to South West Pacific (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: November–April

Specimen examined: India, Kerala, Idukki, Medicinal Plant Conservation Area, 15/03/2018, Divya K. Venugopal 167862 (CALI).

***Rungia* Nees**

N. Wallich, Pl. Asiat. Rar. 3: 77.1832.

Key to species

- 1a. Leaves glabrous..... *R. pectinata*
- 1b. Leaves not glabrous 2
- 2a. Capsule oblong..... *R. apiculata*
- 2b. Capsule ovoid..... *R. latior*

Rungia apiculata Bedd., Icon. Pl. Ind. Or.: 60.1874; Hook.f., Fl. Brit. India 4: 548. 1885; Gamble, Fl. Madras 2: 1070. 1921; Sasidh., Fl. Periyar Tiger Reserve 300. 1998; Sasidh., Fl. Chinnar WLS 238. 1999.

Herb. Stem terete, green, pubescent. Leaves simple, opposite, ovate, 5–7 × 2–3 cm, apex acuminate, base round, margins entire, green, puberulent, petiolate. Flowers in axillary or terminal spikes, dense. Peduncle terete, 2–3 cm long green, pubescent. Pedicel terete, minute, green, pubescent. Bracts lanceolate, 4–7 mm long, green, pubescent. Calyx lobes 5, 4–6 mm long, apex acute, green, pubescent. Corolla lobes 5, bilipped, upper lip broad and emarginated; lower lip 3 lobed, 3–7 mm long, apex acute to obtuse, white, glabrous. Stamens 2, inserted; filaments slender, 3 mm long, white, glabrous; anther bilobed, elliptic, minute, white, glabrous. Style filiform, 4–5 mm long, white, glabrous. Stigma bifid, white, glabrous. Capsule oblong, 2–5 mm long, green, pubescent.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: June–January.

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 08/12/1996, *Jomy Augustine 17049* (CALI); *ibid.*, 18/12/1994, *Jomy Augustine 14392* (CALI); Mankulam, 13/06/2018, *Divya K. Venugopal 151325* (CALI).

Rungia latior Nees, *Compan. Bot. Mag.* 2: 313.1837; Hook.f., *Fl. Brit. India* 4: 547. 1885; Gamble, *Fl. Madras* 2: 1071. 1921; Sasidh., *Fl. Periyar Tiger Reserve* 301. 1998.

Herb. Stem terete, green, pubescent, roots arises from basal nodes. Leaves simple, opposite, ovate, 3–4 × 1.5–2 cm, apex acuminate, base cuneate, margins entire, green, pubescent, petiolate. Flowers in terminal spikes. Peduncle terete, 1–3 cm long, green, pubescent. Pedicel terete, minute, green, pubescent. Bracts obovate, 4–6 mm long, greenish white, ciliate. Calyx lobes 5, 3–5 mm long, apex acute, green, pubescent. Corolla lobes 5, bilipped, 5–8 mm long, apex obtuse, cream with lilac patches, glabrous. Stamens 2, inserted; filaments slender, 4–6 mm long, white, glabrous; anther bilobed, elliptic, 2–3 mm long, white, glabrous. Style filiform, 6–7 mm long, white, glabrous. Stigma bifid, white, glabrous. Capsule ovoid, 3–6 mm long, green, pubescent.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: December-May

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 30/12/2014, *S. Syam Radh 137927* (CALI); *ibid.*, 05/01/2017, *Divya K. Venugopal 151563* (CALI); Periyar Tiger Reserve, 16/04/1995, *Jomy Augustine 15032* (CALI).

Rungia pectinata (L.) Nees, *A.P.de Candolle, Prodr.* 11: 470.1847; Sasidh., *Fl. Periyar Tiger Reserve* 301. 1998. *Rungia parviflora* var. *pectinata* (L.) C.B.Clarke, *J.D.Hooker, Fl. Brit. India* 4: 550.1885, *nom. superfl.*; Gamble, *Fl. Madras* 2: 1071. 1921.

Herb. Stem terete, branched, green, pubescent. Leaves simple, opposite, ovate, 4–6 × 1–2.5 cm, apex obtuse, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary spikes, sessile. Peduncle terete, 2–4 cm long, green, pubescent. Bracts obovate, 2–4 mm long, green, ciliate. Calyx lobes 5, 2–4 mm long, apex acute, green, pubescent. Corolla lobes 5, bilipped, 3–5 mm long, apex obtuse, white, glabrous. Stamens 2, inserted; filaments slender, 2–3 mm long, white, glabrous; anther bilobed, elliptic, 2 mm long, white, glabrous. Style filiform, minute, white,

glabrous. Stigma bifid, white, glabrous. Capsule ovoid, 2–4 mm long, green, pubescent.

Distribution: South Arabian Peninsula, Tropical & Subtropical Asia (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: November-May

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 22/11/1996, Jomy Augustine 16934 (CALI); Pambadum shola, 23/12/2019, Divya K. Venugopal 166571 (CALI).

Strobilanthes Blume

Bijdr. Fl. Ned. Ind.: 781.1826.

Key to species

- 1a. Stem glabrous..... 2
- 1b. Stem not glabrous 3
- 2a. Leaves glabrous..... 4
- 2b. Leaves pubescent 5
- 3a. Calyx lobes glabrous *S. heyneana*
- 3b. Calyx lobes pubescent..... 6
- 4a. Corolla glabrous 7
- 4b. Corolla pubescent..... *S. kunthianus*
- 5a. Filaments glabrous *S. lurida*
- 5b. Filaments hairy..... *S. aurita*
- 6a. Stamens 2 8
- 6b. Stamens 4 *S. perrottetiana*
- 7a. Stem terete..... *S. gracilis*
- 7b. Stem quadrangular 9
- 8a. Leaves sessile *S. sessilis*
- 8b. Leaves petiolate 10
- 9a. Stamens 2 *S. consanguinea*
- 9b. Stamens 4..... *S. tristis*
- 10a. Flowers in cyme. *S. anceps*
- 10b. Flowers in spike *S. pulneyensis*

Strobilanthes anceps Nees, Compan. Bot. Mag. 2: 312.1837; Hook.f., Fl. Brit. India 4: 442. 1885; Gamble, Fl. Madras 2: 1038. 1921; Sasidh., Fl. Periyar Tiger Reserve 303. 1998; Venu in Daniel & Sanjappa (eds.), Fl. India ser. 4, *Strobilanthes* 57. 2006.

Shrub. Stem quadrangular, swollen above nodes, green, glandular. Leaves simple, opposite, elliptic, 8–10 × 4–6 cm, apex attenuate, base cuneate, margins entire, green, pubescent, petiolate. Flowers in axillary and terminal cymes, lax. Peduncle terete, 1–2 cm long, green, pubescent. Bracts orbicular, 6–8 mm long, green, ciliate. Calyx lobes 5, 4–6 mm long, apex acute, green, pubescent. Corolla tube long, 2–3 mm long, white, pubescent; lobes 5, bilipped, white, glabrous. Stamens 2, inserted; filaments slender, 2–5 mm long, white, pubescent; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, 1 cm long, white, glabrous. Stigma bifid, white, pubescent. Capsule ellipsoid, 1 cm long, green, glabrous.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: November–March

Specimen examined: India, Kerala, Idukki, Kumily, 09/12/2018, Divya K. Venugopal 161427 (CALI).

Strobilanthes aurita J.R.I.Wood, Kew Bull. 50: 12.1995; Venu in Daniel & Sanjappa (eds.), Fl. India ser. 4, *Strobilanthes* 64. 2006. *Strobilanthes caudatus* sensu Beed., Ic. t. 213. 1868–1874, non Anders. 1860; Hook.f., Fl. Brit. India 4: 441. 1885; Gamble, Fl. Madras 2: 1040. 1921.

Shrub. Stem terete, branched, green, glabrous. Leaves simple, opposite, lanceolate, 8–10 × 1.5–3 cm, apex acuminate, base cuneate, margins entire, green, pubescent, petiolate. Flowers in axillary spikes. Peduncle terete, 2–3 cm long, green, villous. Bracts linear, 2–2.5 cm long, green, glandular. Calyx lobes 5, 6–8 mm long, apex acute, green, pubescent. Corolla tube 3–4 mm long, blue, hairy on inner surface; lobes 5, 1.3–1.5 cm long, apex obtuse, blue with yellow dots on lower lobes, glabrous. Stamens 2, inserted; filaments slender, 3–4 mm long, white, hairy; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, 1 cm long, white, glabrous. Stigma bifid, white, glabrous. Capsule elliptic, 1.4–1.6 cm long, green, glabrous.

Distribution: India (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: October–December

Specimen examined: India, Kerala, Idukki, Kumily, 10/12/2018, Divya K. Venugopal 161438 (CALI).

Strobilanthes consanguinea (Nees) T. Anderson, G.H.K. Thwaites, Enum. Pl. Zeyl.: 226. 1860; Hook. f., Fl. Brit. India 4: 435. 1885; Gamble, Fl. Madras 2: 1036. 1921; Sasidh., Fl. Periyar Tiger Reserve 304. 1998; Venu in Daniel & Sanjappa (eds.), Fl. India ser. 4, *Strobilanthes* 86. 2006.

Shrub. Stem quadrangular, green, glabrous. Leaves simple, opposite, ovate, 7–13 × 5–7 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary spikes. Peduncle quadrangular, 5–7 cm long, green, glabrous. Bracts ovate, 5–7 mm long, green, pubescent. Calyx lobes 5, 5–7 mm long, apex acute, green, pubescent. Corolla tube 4–6 mm long, pale blue, glabrous outside; lobes 5, 1–1.2 cm long, apex obtuse, pale blue, glabrous. Stamens 2, inserted; filaments slender, 5–7 mm long, white, hairy at base; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, 1.6–1.9 cm long, white, glabrous. Stigma bifid, minute, white, glabrous. Capsule ellipsoid, 8–10 mm long, green, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: October–December

Specimens examined: India, Kerala, Idukki, Ramakalmedu, 15/11/2014, P.K. Dilna 136643 (CALI); Kumily, 10/12/2018, Divya K. Venugopal 161438 (CALI).

Strobilanthes gracilis Bedd., Madras J. Lit. Sci., ser. 3, 1: 55. 1864; Hook. f., Fl. Brit. India 4: 474. 1885; Gamble, Fl. Madras 2: 1043. 1921; Sasidh., Fl. Periyar Tiger Reserve 305. 1998; Venu in Daniel & Sanjappa (eds.), Fl. India ser. 4, *Strobilanthes* 103. 2006.

Figure 26 H.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite, lanceolate, 12–15 × 4–6 cm, apex acuminate, base cuneate, margins serrate, green, glabrous, petiolate. Flowers in axillary and terminal spikes. Peduncle terete, 5–16 cm long, green, glabrous. Bracts oblong, 3–4 cm long, green, glandular. Calyx lobes 5, linear, 7–9 mm long, apex acute, green, glabrous. Corolla tube 1–1.6 cm long, blue, glabrous; lobes 5, 6–8 mm long, apex obtuse, blue, glabrous. Stamens 4, inserted; filaments slender, 3–6 mm long, white, pubescent; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, 2–2.3 cm long, white, pubescent. Stigma bifid, minute, white, glabrous. Capsule ovoid, 1–1.2 cm long, green, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: December-June

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 22/04/2016, *S. Syam Radh 145196* (CALI); Periyar Tiger Reserve, 28/12/1994, *Jomy Augustine 14360* (CALI); Mankulam, 14/06/2018, *Divya K. Venugopal 151398* (CALI).

Strobilanthes heyneana Nees, N. Wallich., Pl. Asiat. Rar. 3: 85. 1832; Hook.f., Fl. Brit. India 4: 443. 1885; Gamble, Fl. Madras 2: 1041. 1921; Sasidh., Fl. Periyar Tiger Reserve 305. 1998; Venu in Daniel & Sanjappa (eds.), Fl. India ser. 4, *Strobilanthes* 109. 2006.

Shrub. Stem terete, green, pubescent. Leaves simple, opposite, elliptic, 5–10 × 4–6 cm, apex acuminate, base cuneate, margins crenate, green, glandular, petiolate. Flowers in axillary spikes. Peduncle terete, 2–4 cm long, green, pubescent. Bracts ovate, 2 cm long, pink, glandular. Calyx lobes 5, 4–6 mm long, apex acute, green, glabrous. Corolla tube 3–4 mm long, pale blue, pubescent; lobes 5, 1.8–2 cm long, apex obtuse, pale blue, pubescent. Stamens 4, inserted; filaments slender, 1–1.5 cm long, white, ciliate; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, long, white, glabrous. Stigma bifid, minute, white, glabrous. Capsule oblong, 1–1.5 cm long, green, glabrous.

Distribution: West & South India, Sri Lanka (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: October-January.

Specimens examined: India, kerala, Idukki, Mathikettan Shola National Park, *s.d.*, *S. Syam Radh 153426* (CALI); *ibid.*, 18/12/2016, *Divya K. Venugopal 151245* (CALI). Periyar Tiger Reserve, 26/11/1996, *Jomy Augustine 16912* (CALI).

Strobilanthes kunthiana (Nees) T.Anderson ex Benth., Fl. Hongk.: 262. 1861; Hook.f., Fl. Brit. India 4: 434. 1885; Gamble, Fl. Madras 2: 1036. 1921; Sasidh., Fl. Periyar Tiger Reserve 306. 1998; Venu in Daniel & Sanjappa (eds.), Fl. India ser. 4, *Strobilanthes* 129. 2006.

Figure 26 G.

Shrub. Stem terete, reddish, glabrous. Leaves simple, opposite, elliptic, 4–6 × 2–3 cm, apex acute, base cuneate, margins dentate, green, glabrous, petiolate. Flowers in axillary spikes, dense. Peduncle terete, 6–8 cm long, green, glabrous. Bracts elliptic,

1–1.2 cm long, green, tomentose. Calyx lobes 5, 1–1.2 cm long, apex acute, green, pubescent. Corolla tube 2 cm long, blue, pubescent; lobes 5, 3–5 mm long, apex obtuse, blue, pubescent. Stamens 2, inserted; filaments slender, 6–7 mm long, white, ciliate; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, 1.2–1.5 cm long, white, pubescent. Stigma bifid, minute, white, glabrous. Capsule oblong, 1–1.2 cm long, green, glabrous.

Distribution: Peninsular India

Habitat: Grasslands

Flowering and fruiting: July-January

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 17/07/2015, *S. Syam Radh* 145055 (CALI); Chinnar, 01/12/1995, *N. Sasidharan* 16754 (KFRI); Periyar Tiger Reserve 08/07/1993, *Jomy Augustine* 12040 (CALI); Eravikulam, 12/09/2017, *Divya K. Venugopal* 156433 (CALI).

Strobilanthes lurida Wight, Icon. Pl. Ind. Orient. 4: t. 1515. 1850; Hook.f., Fl. Brit. India 4: 450. 1885; Gamble, Fl. Madras 2: 1042. 1921; Sasidh., Fl. Periyar Tiger Reserve 306. 1998; Venu in Daniel & Sanjappa (eds.), Fl. India ser. 4, *Strobilanthes* 140. 2006.

Shrub. Stem terete, green, glabrous. Leaves simple, opposite, ovate, 15–20 × 8–10 cm, apex acuminate, base round, margins crenate, green, sparsely pubescent, petiolate. Flowers in axillary and terminal spikes. Peduncle terete, 2–4 cm long, green, glabrous. Bracts ovate, large, purplish-black, glandular. Calyx lobes 5, 1.8–2 cm long, apex acute, white, ciliate. Corolla tube minute, purple, glabrous; lobes 5, 2–3 cm long, apex obtuse, purple, glabrous. Stamens 4, exserted; filaments slender, 1.3–1.5 cm long, white, glabrous; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, 2.3–2.5 cm long, white, glabrous. Stigma bifid, minute, white, glabrous. Capsule ovate, 2 cm long, green, glabrous.

Distribution: southern Western Ghats

Habitat: Evergreen forests

Flowering and fruiting: November-May

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 28/11/2016, *S. Syam Radh* 153427 (CALI); Vattavada, 29/03/1978, *Nambiar* 00247 (KFRI); Periyar Tiger Reserve, 29/12/1993, *Jomy Augustine* 12956 (CALI); Mankulam, 13/01/2019, *Divya K. Venugopal* 167851 (CALI).

Strobilanthes perrottetiana Nees, A.P.de Candolle, Prodr. 11: 179.1847; Hook. f., Fl. Brit. India 4: 439. 1885; Gamble, Fl. Madras 2: 1039. 1921; Venu in Daniel & Sanjappa (eds.), Fl. India ser. 4, Strobilanthes 161. 2006.

Figure 27 B.

Shrub. Stem subterete, green, hairy. Leaves simple, opposite, elliptic, 5–8 × 3–4 cm, apex shortly acuminate, base cuneate, margins crenate, green, sparsely pubescent, petiolate. Flowers in axillary and terminal spikes. Peduncle subterete, 2–5 cm long, green, pubescent. Bracts ovate, 1.6–1.9 cm long, purple, hirsute. Calyx lobes 5, 7–9 mm long, apex acute, green, ciliate. Corolla tube 2–2.2 cm long, blue, glabrous outside; lobes 5, 4–7 mm long, apex obtuse, purple, glabrous. Stamens 4, inserted; filaments slender, 2–5 mm long, white, pubescent; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, 1 cm long, white, hairy at base. Stigma bifid, minute, white, glabrous. Capsule oblong, 1–1.4 cm long, green, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: May-January

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 29/11/2016, *S. Syam Radh* 153430 (CALI); Mankulam, 13/01/2019, *Divya K. Venugopal* 167851 (CALI).

Strobilanthes pulneyensis C.B.Clarke, J.D.Hooker, Fl. Brit. India 4: 438. 1884; Gamble, Fl. Madras 2: 1038. 1921; Sasidh., Fl. Periyar Tiger Reserve 307. 1998; Venu in Daniel & Sanjappa (eds.), Fl. India ser. 4, Strobilanthes 164. 2006.

Figure 26 B.

Shrub. Stem terete, green, pubescent. Leaves simple, opposite, ovate, 10–12 × 4–6 cm, apex acuminate, base round, margins crenate, green, pubescent, petiolate. Flowers in axillary spikes. Peduncle terete, 2–3 cm long, green, glabrous. Bracts suborbicular, 1–1.3 cm long, green, pubescent. Calyx lobes 5, 1 cm long, apex acute, white, ciliate. Corolla tube 1 cm long, purple, ciliate; lobes 5, 1–1.2 cm long, apex obtuse, purple, ciliate. Stamens 2, inserted; filaments slender, 3–8 mm long, white, ciliate; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, 1.5 cm long, white, sparsely pubescent. Stigma bifid, minute, white, glabrous. Capsule oblong, 1 cm long, green, glabrous.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: October-January

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 28/11/2016, *S. Syam Radh* 153428 (CALI); Mankulam, 14/01/2019, *Divya K. Venugopal* 167901 (CALI).

Strobilanthes sessilis Nees, N. Wallich, Pl. Asiat. Rar. 3: 85.1832; Hook.f., Fl. Brit. India 4: 452. 1885; Gamble, Fl. Madras 2: 1042. 1921; Sasidh., Fl. Periyar Tiger Reserve 307. 1998; Venu in Daniel & Sanjappa (eds.), Fl. India ser. 4, *Strobilanthes* 178. 2006.

Shrub. Stem terete, green, pubescent. Leaves simple, opposite, ovate, 2–6 × 1–2 cm, apex acute, base cordate, margins serrate, green, pubescent, sessile. Flowers in axillary and terminal spikes. Peduncle terete, 1–1.5 cm long, green, pubescent. Bracts ovate, c. 1 cm long, apex acute, green, pubescent. Calyx lobes 5, 6–8 mm long, apex acute, green, pubescent. Corolla tube 2–2.5 cm long, blue, pubescent; lobes 5, 6–8 mm long, apex obtuse, blue, pubescent. Stamens 2, inserted; filaments slender, 4–7 mm long, white, pubescent; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, 1.5–1.7 cm long, white, pubescent. Stigma bifid, minute, white, glabrous. Capsule linear, 1 cm long, green, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October-December

Specimen examined: India, Kerala, Idukki, Ramakalmedu, 17/11/2018, *Divya K. Venugopal* 152480 (CALI).

Strobilanthes tristis (Wight) T. Anderson, J. Linn. Soc., Bot. 9: 470.1867; Hook. f., Fl. Brit. India 4: 441. 1885; Gamble, Fl. Madras 2: 1040. 1921; Sasidh., Fl. Periyar Tiger Reserve 307. 1998; Venu in Daniel & Sanjappa (eds.), Fl. India ser. 4, *Strobilanthes* 182. 2006.

Shrub. Stem quadrangular, green, glabrous. Leaves simple, opposite, elliptic, 2–6 × 1–2 cm, apex acuminate, base cuneate, margins crenate, green, glabrous, petiolate. Flowers in axillary spikes. Peduncle terete, 8–10 mm long, green, glabrous. Bracts ovate, 1.8–2.2 cm long, green, glabrous. Calyx lobes 5, 2 cm long, apex acute, green, pubescent. Corolla tube 3–6 mm long, white, glabrous outside; lobes 5, apex obtuse, white, glabrous outside. Stamens 4, inserted; filaments slender, 3–8 mm long, white, pubescent; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style linear, white,

glabrous. Stigma bifid, minute, white, glabrous. Capsule ellipsoid, 1–1.3 cm long, green, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: November–July

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 28/07/2016, *S. Syam Radh 149169* (CALI); Periyar Tiger Reserve, 29/12/1994, *Jomy Augustine 14485* (CALI); Ramakalmedu, 17/11/2018, *Divya K. Venugopal 152480* (CALI).

***Thunbergia* Retz.**

Physiogr. Sölsk. Handl. 1: 163.1780.

Thunbergia fragrans Roxb., Pl. Coromandel 1: 47.1796; Hook.f., Fl. Brit. India 4: 390. 1885; Gamble, Fl. Madras 2: 1007. 1921; Sasidh., Fl. Periyar Tiger Reserve 308. 1998.

Figure 26 F.

Climber. Leaves simple, opposite, ovate, 6–10 × 3–5 cm, apex acute, base round, margins entire, green, glabrous, petiolate. Flowers axillary, solitary. Pedicel terete, 1–1.6 cm long, green, glabrous. Bracts leafy, ovate, green, glabrous. Calyx lobes 10 toothed, linear, apex acute, green, glabrous. Corolla tube 2.4–3 cm long, white, glabrous; lobes 5, 3–3.6 cm long, apex flat, white, glabrous. Stamens 4, didynamous, inserted; filaments 7–9 mm long, white, glandular; anthers bilobed, elliptic, 2–3 mm long, white, glabrous. Style slender, 2.6 cm long, white, glabrous. Stigma entire, minute, white, glabrous. Capsule globose with beak, 7–9 mm long, green, glabrous.

Distribution: Indian Subcontinent to South China and Indo-China, Philippines (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: September–February

Specimens examined: India, Kerala, Idukki, Kanthalloor, 25/02/2003, *M.B. Reena 89071* (CALI); Kumily, 11/12/2018, *Divya K. Venugopal 161450* (CALI).

VERBENACEAE J.St.-Hil.

Expos. Fam. Nat. 1: 245. 1805.

Herbs, shrubs or trees; bears essential oils. Leaves simple, opposite or whorled, exstipulate; petiolate to sessile. Cystoliths present. Flowers in racemes or cymes. Pollination entomophilous (Delta Intkey, 2023). Calyx lobes 4–5, green, persistent. Corolla tubular; lobes regular or bilipped, usually 4–5. Stamens 2 or 4, equal or didynamous, inserted; filaments free; anthers bilobed; alternate with corolla lobes. Style terminal. Stigma entire or bilobed. Drupe or capsule. Seeds numerous.

According to POWO 2022, family consists of 31 accepted genera worldwide.

Key to genera

- 1a. Stamens 2 *Stachytarpheta*
- 1b. Stamens 4 2
- 2a. Leaves whorled *Rothea*
- 2b. Leaves not whorled 3
- 3a. Stamens exerted 4
- 3b. Stamens inserted 5
- 4a. Leaves simple 6
- 4b. Leaves compound *Vitex*
- 5a. Stem terete 7
- 5b. Stem quadrangular 8
- 6a. Flowers sessile *Callicarpa*
- 6b. Flowers pedicellate *Volkameria*
- 7a. Flowers in racemose inflorescence 9
- 7b. Flowers in cymose inflorescence *Premna*
- 8a. Flowers in spike; stigma sub capitate *Lantana*
- 8b. Flowers in raceme; stigma pointed *Priva*
- 9a. Stem aromatic; leaves margin serrate; stigma sub capitate *Lippia*
- 9b. Stem not aromatic; leaves margin entire; stigma bilobed *Gmelina*

Callicarpa L.

Sp. Pl.: 111 .1753.

Callicarpa tomentosa (L.) L., J.A.Murray, Syst. Veg., ed. 13.: 153. 1774; Sasidh., Fl. Periyar Tiger Reserve 309. 1998; Rajendran & Daniel, Indian Verbenaceae 53. 2002. *Callicarpa lanata* L., Mant. Pl. 2: 331 (1771), *nom. illeg.*, Gamble, Fl. Madras 2:

1092. 1921. *Callicarpa arborea* Miq. ex C.B. Clarke, J.D. Hooker, Fl. Brit. India 4: 567. 1885, pro syn, Hook.f., Fl. Brit. India 4: 507. 1884.

Tree. Stem terete, brown, rough; branchlets terete, pubescent. Leaves simple, opposite, broadly ovate, 15–20 × 10–15 cm, apex acuminate, base round, margins entire, green, tomentose on abaxial surface, petiolate. Flowers in axillary cymes; sessile. Peduncle terete, 2–3 cm long, greenish brown, pubescent. Calyx tube minute (c. 2 mm long), green, tomentose; lobes 4, campanulate, minutely lobed, apex round, green, persistent. Corolla tube minute (c. 2 mm long), purple, glabrous; lobes 4, regular, 1 × 1 mm, apex obtuse, purple, glabrous. Stamens 4, unequal, exserted; filaments slender, 2 × 1 mm; 1.5 × 0.1 cm; white, glabrous; anthers bilobed, sagittate, 1 × 1 mm, yellow, glabrous. Style slender, 1 × 1 mm, white, glabrous. Stigma capitate, > 1 mm long, yellow, glabrous. Drupe globose, 4 × 4 mm, black, glabrous. Seeds 3–4.

Distribution: India, Sri Lanka (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: November–May

Specimens examined: India, Kerala, Idukki, Thekkady, 14/07/2017, Divya K. Venugopal 152855 (CALI); Thekkady, 02/04/1994, Jomy Augustine 13558 (CALI).

***Volkameria* L.**

Sp. Pl.: 637.1753.

***Volkameria inermis* L.**, Sp. Pl.: 637.1753. *Clerodendrum inerme* (L.) Gaertn., Fruct. Sem. Pl. 1: 27.1788; Hook.f., Fl. Brit. India 4: 589. 1885; Gamble, Fl. Madras 2: 1099. 1921; Rajendran & Daniel, Indian Verbenaceae 112. 2002.

Shrub. Stem terete, green-brownish green, glabrous. Leaves simple, opposite, elliptic, 4–5 × 2–3 cm, apex acute, base cuneate, margins entire, green, glabrous, petiolate. Flowers in axillary cymes. Peduncle terete, 2–3 cm long, green, glabrous. Pedicel terete, 5–6 mm long, green, glabrous. Calyx tube 4–5 mm long, green, glabrous; lobes 5, minutely lobed, apex acute, green, persistent. Corolla tube 3–4 cm long, white, glabrous; lobes 5, ovate, 5–6 × 2–3 mm, apex obtuse, white, glabrous. Stamens 4, didynamous, exserted; filaments filiform, 4.5 × 0.1 cm; 4 × 0.1 cm; purple, pubescent; anthers bilobed, ovate, 1 × 1 mm, yellow, glabrous. Style filiform, 4–5 cm long, white, glabrous. Stigma shortly bifid, minute, white, glabrous. Fruit not seen.

Distribution: Tropical & Subtropical Asia to West Pacific (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: August-December

Specimen examined: India, Kerala, Idukki, Painavu, 07/08/2017, Divya K. Venugopal 154324 (CALI).

***Gmelina* L.**

Sp. Pl.: 626.1753.

Key to species

1a. Trees; calyx lobes 5, glabrous; drupe ovoid, yellow.....*G. arborea*

1b. Shrubs; calyx lobes 4, tomentose; drupe globose, green.....*G. asiatica*

Gmelina arborea Roxb. ex Sm., A.Rees, Cycl. 16: n.º 4.1810; Hook.f., Fl. Brit. India 4: 581. 1885; Gamble, Fl. Madras 2: 1097. 1921; Sasidh., Fl. Periyar Tiger Reserve 310. 1998; Sasidh., Fl. Chinnar WLS 240. 1999; Rajendran & Daniel, Indian Verbenaceae 155. 2002.

Tree, unarmed. Branchlets stout, brownish grey, tomentose. Leaves simple, opposite, broadly ovate, 10–20 × 5–15 cm, apex acute, base round to cordate, margins entire, green, tomentose on abaxial surface, petiolate. Flowers in terminal racemes. Peduncle terete, 3–4 cm long, green, tomentose. Pedicel terete, 3–5 mm long, green, tomentose. Calyx tube 3–4 mm long, green, tomentose; lobes 5, campanulate, 1–2 mm long, apex acute, green, tomentose. Corolla tube stout, 2–3 cm long, brown-yellow, pubescent; lobes irregular (bilobed), 5–6 mm long, apex obtuse, brown-yellow, pubescent. Stamens 4, didynamous, inserted; filaments slender, 3 × 0.1 cm; 2.8 × 0.1 cm; yellow, pubescent; anthers bilobed, pendulous, 1 × 1 mm, yellow, glabrous. Style slender, 2–3 cm long, yellow, glabrous. Stigma bifid, minute, yellow, glabrous. Drupe ovoid, 2–4 × 1–1.5 cm, yellow, glabrous.

Distribution: Pakistan to China and North Indo-China (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: January-August

Specimens examined: India, Kerala, Idukki, Chinnar, 08/02/1995, K.K. Sajeew 11862 (KFRI); Chinnar, 19/05/1999, P. Prashy 79456 (CALI).

Gmelina asiatica L., Sp. Pl.: 626.1753; Hook.f., Fl. Brit. India 4: 582. 1885; Gamble, Fl. Madras 2: 1098. 1921; Sasidh., Fl. Chinnar WLS 240. 1999; Rajendran & Daniel, Indian Verbenaceae 161. 2002.

Shrub. Stem terete, brown, pubescent; branchlets spiny, brown, pubescent. Leaves simple, opposite, ovate, 3–5 × 1.5–3 cm, apex acute, base cuneate, margins entire, green, pubescent on abaxial surface, petiolate. Flowers in axillary or terminal racemes. Peduncle terete, 3–4 cm long, greenish brown, pubescent. Pedicel terete, 3–4 mm long, green, pubescent. Calyx tube 5–6 mm long, green, tomentose; lobes 4, 1 × 1 mm, minutely lobed, apex slightly acute, green, tomentose. Corolla tube 2 cm long, yellow, pubescent; lobes 4, 2.5 cm long, apex obtuse, yellow, pubescent. Stamens 4, didynamous, inserted; filaments slender, 1 × 0.1 cm; 1.4 × 0.1 cm; yellow, pubescent; anthers bilobed, oblong, 1 × 1 mm, yellow, glabrous. Style slender, 2–3 cm long, yellow, glabrous. Stigma minutely bilobed, yellow, glabrous. Drupe globose, 2–3 × 1–2 cm, green, glabrous.

Distribution: India to Indo-China (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: November–January

Specimens examined: India, Kerala, Idukki, Chinnar, 17/11/2018, Divya K. Venugopal 188827 (CALI); Chinnar, 06/01/1995, K.K. Sajeew 11658 (KFRI).

***Lantana* L.**

Sp. Pl.: 627.1753.

Lantana indica Roxb., Fl. Ind., ed. 1832. 3: 89.1832; Hook.f., Fl. Brit. India 4: 562. 1885; Gamble, Fl. Madras 2: 1087. 1921; Sasidh., Fl. Periyar Tiger Reserve 311. 1998; Sasidh., Fl. Chinnar WLS 241. 1999; Rajendran & Daniel, Indian Verbenaceae 185. 2002.

Figure 27 D.

Erect shrub. Stem quadrangular, green, densely tomentose, not prickly. Leaves simple, opposite, ovate, 6–8 × 4–5 cm, apex acute, base round, margins crenate, green, pubescent on abaxial surface, petiolate. Flowers in axillary, solitary spike, dense. Peduncle terete, 2–5 cm long, green, tomentose. Pedicel almost absent. Bracts lanceolate, 5 mm–1 cm, green, tomentose. Calyx lobes 4, 1 mm long, apex acute, green, pubescent. Corolla tube 5 × 1 mm, pink, pubescent; lobes 4, 2 × 1 mm, apex obtuse, pink, glabrous. Stamens 4, didynamous, inserted; filaments slender, 2 × 1 mm; 1 × 1 mm; white, glabrous; anthers bilobed, oblong, 1 mm long, yellow, glabrous. Style minute, white, glabrous. Stigma sub capitate, minute, white, glabrous.

Distribution: Afghanistan to Thailand (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: June-December

Specimens examined: India, Kerala, Idukki, Wayside Kanthallur, 24/06/2018, Divya K. Venugopal 159382 (CALI); Periyar Tiger Reserve, 06/12/1993, Jomy Augustine 12700 (CALI); Mathikettan Shola National Park, 29/12/2017, Syam Radh S. 153435 (CALI).

***Lippia* L.**

Sp. Pl.: 633.1753.

Lippia javanica (Burm.f.) Spreng., Syst. Veg., 2: 752.1825; Sasidh., Fl. Chinnar WLS 241. 1999; Rajendran & Daniel, Indian Verbenaceae 202. 2002. *Lippia geminata* Kunth, F.W.H.von Humboldt, A.J.A.Bonpland & C.S.Kunth, Nov. Gen. Sp. 2: 266.1818; Hook.f., Fl. Brit. India 4: 563. 1885; Gamble, Fl. Madras 2: 1088. 1921.

Herb. Stem terete, green, pubescent, aromatic. Leaves simple, opposite, ovate, 2–4 × 1–2 cm, apex acute, base obtuse, margins minutely serrate, green, pubescent, petiolate. Flowers in axillary spike, dense. Peduncle terete, green, pubescent. Calyx lobes bilobed, minute, green, pubescent. Corolla tube 4 mm long, yellowish white, pubescent; lobes 5, bilipped, 1 × 1 mm, apex obtuse, yellowish white, glabrous. Stamens 4, didynamous, inserted; filaments slender, 3 × 1 mm; 2 × 1 mm; white, glabrous; anthers bilobed, ovate, minute, yellow, glabrous. Style minute, white, glabrous. Stigma sub capitate, minute, white, glabrous.

Distribution: Ethiopia to South Africa; introduced to India (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: December-March

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 14/02/2018, Divya K. Venugopal 170226 (CALI); Chinnar, 22/01/2019, Divya K. Venugopal 170250 (CALI).

***Premna* L.**

Mant. Pl. 2: 154.1771.

Key to species

- 1a. Leaves ovate..... 2
- 1b. Leaves oblong/obovate 3
- 2a. Plants climbers 4
- 2b. Plants trees 5

- 3a. Leaves glabrous; petiolate..... *P. glaberrima*
 3b. Leaves tomentose; sessile *P. herbacea*
 4a. Calyx lobes 4, green..... *P. coriacea*
 4b. Calyx lobes 5, pink *P. paucinervis*
 5a. Leaves pubescent; corolla greenish white..... *P. tomentosa*
 5b. Leaves glabrous; corolla yellowish white..... *P. wightiana*

Premna coriacea C.B.Clarke, J.D.Hooker, Fl. Brit. India 5: 573.1888; Gamble, Fl. Madras 2: 1095. 1921; Sasidh., Fl. Periyar Tiger Reserve 311. 1998; Rajendran & Daniel, Indian Verbenaceae 226. 2002.

Climber. Stem terete, green, glabrous; branchlets lenticellate. Leaves simple, opposite, ovate, 12–15 × 8–10 cm, apex acuminate, base round, margins entire, green, coriaceous, glabrous, petiolate. Flowers in axillary and terminal cymes. Peduncle terete, 8–12 cm long, green, glabrous. Pedicel terete, 1 × 1 mm, green, glabrous. Calyx tube 1 mm long, green, pubescent; lobes 4, truncate, minute, green, pubescent, persistent. Corolla tube minute, cream coloured, pubescent; lobes 4, bilipped, minute, apex round, cream coloured, pubescent. Stamens 4, didynamous, inserted; filaments slender, 5 × 1 mm; 2 × 1 mm; white, glabrous; anther bilobed, ovate, > 1 mm long, yellow, glabrous. Style linear, 2 × 1 mm, white, glabrous. Stigma bifid, minute, white, glabrous. Drupe globose, 2 × 2 mm, black, glabrous.

Distribution: Indian Subcontinent to Indo-China (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: March-June

Specimen examined: India, Kerala, Idukki, Anamudi Shola, 08/04/2017, Divya K. Venugopal 152008 (CALI).

Premna glaberrima Wight, Icon. Pl. Ind. Orient.: t. 1484.1849; Hook.f., Fl. Brit. India 4: 577. 1885; Gamble, Fl. Madras 2: 1096. 1921; Sasidh., Fl. Periyar Tiger Reserve 311. 1998; Rajendran & Daniel, Indian Verbenaceae 240. 2002.

Shrub. Stem terete, greenish brown, glabrous; branchlets pubescent. Leaves simple, opposite, oblong, 12–14 × 4–5 cm, apex acuminate, base obtuse, margins entire, green, glabrous, petiolate. Flowers in terminal cymes. Peduncle terete, 4–10 cm long, green, sparsely pubescent. Pedicel terete, 1 × 1 mm, green, sparsely pubescent. Calyx tube 1 × 1 mm, green, minutely pubescent; lobes bilipped, minute, apex acute, green, pubescent. Corolla tube 3 mm long, cream coloured, pubescent; lobes 4, bilipped, 1 × 1 mm, apex obtuse, cream coloured, glabrous. Stamens 4, didynamous, inserted;

filaments slender, 4×1 mm; 2×1 mm; white, glabrous; anther bilobed, ovate, > 1 mm long, yellow, glabrous. Style linear, 2×1 mm, white, glabrous. Stigma bifid, minute, white, glabrous. Fruit not seen.

Distribution: India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: March-September

Specimen examined: India, Kerala, Idukki, Vaguvarai, 18/09/2018, Divya K. Venugopal 159484 (CALI).

Premna herbacea Roxb., Fl. Ind., ed. 1832, 3: 80.1832; Hook.f., Fl. Brit. India 4: 581. 1885; Gamble, Fl. Madras 2: 1097. 1921; Sasidh., Fl. Periyar Tiger Reserve 311. 1998; Rajendran & Daniel, Indian Verbenaceae 245. 2002.

Herb. Stem terete, green, glabrous; branchlets terete, slender, glabrous. Leaves simple, opposite, obovate, $4-5 \times 3-4$ cm, apex acute, base widely obtuse, margins serrate, green, tomentose on abaxial surface, sessile. Flowers in axillary and terminal cymes. Peduncle terete, 5 mm long, green, tomentose. Pedicel terete, 1–2 mm long, green, tomentose. Calyx tube 3–4 mm long, green, ciliate; lobes 5, bilipped, c. 2 mm long, apex acute, green, ciliate. Corolla tube 4 mm long, cream coloured, sparsely pubescent; lobes 4, bilipped, 2–3 mm long, apex round, cream coloured, glandular. Stamens 4, didynamous, inserted; filaments slender, 1×1 mm; 1.5×1 mm, white, glabrous; anthers bilobed, ovate, > 1 mm long, yellow, glabrous. Style slender, 3×1 mm, white, glabrous. Stigma minutely bilobed, > 1 mm long, white, glabrous. Fruit not seen.

Distribution: Hainan to Tropical Asia and North Australia (POWO, 2022)

Habitat: Near stream banks

Flowering and fruiting: June-December

Specimen examined: India, Kerala, Idukki, Meesapulimala, 18/10/2019, Divya K. Venugopal 151405 (CALI).

Premna paucinervis (C.B.Clarke) Gamble, Fl. Madras: 1095.1924; Sasidh., Fl. Periyar Tiger Reserve 312. 1998; Rajendran & Daniel, Indian Verbenaceae 267. 2002.
Premna purpurascens Thwaites, Enum. Pl. Zeyl.: 242.1861; Hook.f., Fl. Brit. India 4: 574. 1885.

Climber. Stem terete, brownish green, glabrous; branchlets terete, slender, minutely hispid. Leaves simple, opposite, ovate, $8-10 \times 4-6$ cm, apex acuminate, base obovate, margins entire, green, villous on abaxial surface, petiolate. Flowers in terminal cymes.

Peduncle terete, 3–4 cm long, green, sparsely pubescent. Pedicel terete, 3–5 mm long, green, sparsely pubescent. Calyx cupular, lobes 5, 1 mm long, apex acute, pink, pubescent. Corolla tube 3 mm long, pink, tomentose; lobes 4, bilipped, 2–3 mm long, apex obtuse, pink, densely tomentose. Stamens 4, didynamous, inserted; filaments slender, 1.5 × 1 mm; 1 × 1 mm, white, pubescent; anther bilobed, ovate, > 1 mm long, white, glabrous. Style slender, 3 mm long, white, glabrous. Stigma minutely bilobed, minute, white, glabrous. Fruit not seen.

Distribution: India (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: December-July

Specimens examined: India, Kerala, Idukki, Edamalakkudi, 18/03/2019, Divya K. Venugopal 152010 (CALI); Puliyar, 28/03/1980, C.E. Ridsale 765 (CALI).

Premna tomentosa Willd. Sp. Pl., ed. 4, 3: 314.1800; Hook.f., Fl. Brit. India 4: 578. 1885; Gamble, Fl. Madras 2: 1096. 1921; Sasidh., Fl. Chinnar WLS 243. 1999; Rajendran & Daniel, Indian Verbenaceae 289. 2002.

Tree. Stem terete, brownish green, tomentose; bark rough. Leaves simple, opposite, ovate, 6–8 × 4–5 cm, apex acuminate, base obtuse, margins entire, pubescent on adaxial surface, petiolate. Flowers in terminal cymes. Peduncle terete, 3–4 cm long, green, tomentose. Pedicel terete, 2–3 mm long, green, tomentose. Calyx tube 2 mm long, green, pubescent; lobes 4, bilipped, minute, apex acute, green, pubescent. Corolla tube 3–4 mm long, greenish white, pubescent; lobes 4, bilipped, 1 mm long, apex round, greenish white, pubescent. Stamens 4, didynamous, inserted; filaments slender, 2 × 1 mm; 1 × 1 mm, white, glabrous; anther bilobed, sagittate, > 1 mm long, yellow, glabrous. Style linear, 3 mm long, white, glabrous. Stigma minutely bilobed, minute, white, glabrous. Fruit not seen.

Distribution: China to Tropical Asia and North Queensland (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: January-June

Specimen examined: India, Kerala, Idukki, Chinnar, 20/01/2018, Divya K. Venugopal 158707 (CALI).

Premna wightiana Schauer, A. P. De Candolle, Prodr. 11:635. 1847; Hook.f., Fl. Brit. India 4: 578. 1885; Gamble, Fl. Madras 2: 1096. 1921; Sasidh., Fl. Chinnar WLS 243. 1999; Rajendran & Daniel, Indian Verbenaceae 291. 2002.

Tree. Stem terete, brownish green; bark rough. Leaves simple, opposite, ovate, 6–8 × 4–5 cm, apex acuminate, base obtuse, margins entire, glabrous, petiolate. Flowers in terminal cymes. Peduncle terete, 2–4 cm, green, pubescent. Pedicel terete, 2–3 mm, green, pubescent. Calyx tube 3 mm long, green, pubescent; lobes bilipped, 2 mm long, apex acute, green, pubescent. Corolla tube 2–3 mm long, yellowish white, pubescent; lobes 4, bilipped, 1 mm long, apex obtuse, yellowish white, pubescent. Stamens 4, didynamous, inserted; filaments slender, 2 × 1 mm; 1.5 × 1 mm, white, glabrous; anther bilobed, sagittate, > 1 mm long, yellow, glabrous. Style linear, 2 mm long, white, glabrous. Stigma bilobed, minute, white, glabrous. Fruit not seen.

Distribution: India (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: January-June

Specimen examined: India, Kerala, Idukki, Chinnar, 20/01/2018, Divya K. Venugopal 175941 (CALI).

***Priva* Adans.**

Fam. Pl. 2:505. 1763.

Priva cordifolia (L.f.) Druce, Rep. Bot. Soc. Exch. Club Brit. Isles 1916:641.1917; Sasidh., Fl. Chinnar WLS 243. 1999; Rajendran & Daniel, Indian Verbenaceae 298. 2002. *Priva leptostachya* Juss., Ann. Mus. Hist. Nat. 7:70.1806; Hook.f., Fl. Brit. India 4: 565. 1885; Gamble, Fl. Madras 2: 1091. 1921.

Herb. Stem quadrangular, green, pubescent. Leaves simple, opposite, ovate, 1–3 × 0.2–0.5 cm, apex acute, base truncate, margins serrate, pubescent, petiolate. Flowers in terminal racemes covered with hooked hairs. Peduncle quadrangular, 15 cm long, green, pubescent. Pedicel quadrangular, 1 mm long, green, pubescent. Calyx tube 3–4 mm long, green, pubescent; lobes 5, 1–2 mm long, apex acute, green, pubescent. Corolla tube 6–8 mm long, white, glabrous; lobes 5, 3–4 mm long, apex obtuse, white, glabrous. Stamens 4, didynamous, inserted; filaments slender, 3 × 1 mm; 2 × 1 mm, white, glabrous; anther bilobed, elliptic, 1 × 1 mm, yellow, glabrous. Style linear, 4 mm long, white, glabrous. Stigma pointed, minute, white, glabrous.

Distribution: South Arabian Peninsula, Indian Subcontinent to Myanmar (POWO, 2022)

Habitat: Dry deciduous forests

Flowering and fruiting: January-November

Specimens examined: India, Kerala, Idukki, Peerumedu, 27/04/2018, Divya K. Venugopal 154153 (CALI); Marayur, 28/11/1979, Nambiar 1057 (KFRI); Chinnar, 14/02/2001, K. Sonia 72674 (CALI).

***Rothea* Raf.**

Fl. Tellur. 4: 69. 1838.

***Rothea serrata* (L.) Steane & Mabb.,** Novon 8: 206.1998. *Clerodendrum serratum* (L.) Moon, Cat. Pl. Ceylon: 46 (1824); Hook.f., Fl. Brit. India 4: 592. 1885; Gamble, Fl. Madras 2: 1100. 1921; Sasidh., Fl. Periyar Tiger Reserve 310. 1998; Sasidh., Fl. Chinnar WLS 239. 1999; Rajendran & Daniel, Indian Verbenaceae 139. 2002.

Figure 28 F.

Shrub. Stem quadrangular, purple, glabrous; branchlets quadrangular. Leaves simple, whorled, elliptic, 15–30 × 10–15 cm, apex acuminate, base cuneate, margins serrate, green, pubescent on abaxial surface, petiolate. Flowers in terminal panicle. Peduncle quadrangular, 15–18 mm long, green, pubescent. Pedicel quadrangular, 3–4 mm long, green, pubescent. Calyx tube 5–6 mm long, green, tomentose; lobes 5, campanulate, minute, apex acute, green, ciliate, persistent. Corolla tube minute, blue, pubescent on inner surface; lobes irregular, 1 × 0.5 cm, apex obtuse, blue, pubescent. Stamens 4, didynamous, exserted; filaments filiform, 2 × 0.1 cm; 2.3 × 0.1 cm, pale blue, glabrous; anthers bilobed, oblong, 1 mm long, purple, glabrous. Style filiform, 2 cm long, pale blue, glabrous. Stigma bilobed, minute, pale blue, glabrous.

Distribution: Indian Subcontinent to South China and West Malesia (POWO, 2022)

Habitat: Shola margins

Flowering and fruiting: August-January

Specimen examined: India, Kerala, Idukki, Wayside Kanthallur, 24/02/2018, Divya K. Venugopal 159383 (CALI).

***Stachytarpheta* Vahl.**

Enum. Pl. Obs. 1: 205.1804.

***Stachytarpheta jamaicensis* (L.) Vahl,** Enum. Pl. Obs. 1: 206.1804; Sasidh., Fl. Periyar Tiger Reserve 312. 1998; Sasidh., Fl. Chinnar WLS 244. 1999; Rajendran & Daniel, Indian Verbenaceae 307. 2002. *Stachytarpheta indica* (L.) Vahl, Enum. Pl. Obs. 1: 206.1804; Gamble, Fl. Madras 2: 1090. 1921.

Figure 27 C.

Shrub. Stem quadrangular, green, glabrous. Leaves simple, opposite, ovate, 8–10 × 5–6 cm, apex obtuse, base cuneate, margins serrate, green, glabrous, petiolate. Flowers in terminal slender spikes. Peduncle quadrangular, 6–7 × 0.2–0.3 cm, green, glabrous. Pedicel minute, 2 × 1 mm, green, glabrous. Calyx lobes 5, 4–5 × 3–4 mm, apex acute, green, pubescent. Corolla tube 1–1.5 × 0.2–0.3 cm, blue, glabrous; lobes 5, 4–5 × 3–4 mm, apex obtuse, blue, glabrous. Stamens 2, inserted; filaments short, 1 × 1 mm, white, glabrous; anthers bilobed, elliptic, 2 × 1 mm, yellow, glabrous. Style filiform, 6 mm long, white, glabrous. Stigma capitate, minute, white, glabrous.

Distribution: South East United States of America to Tropical America (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: March–December.

Specimens examined: India, Kerala, Idukki, Peerumedu, 27/04/2018, Divya K. Venugopal 159201 (CALI); Kallar, 03/04/2018, Divya K. Venugopal 158424 (CALI); Way to Kanthalloor from Marayur, 23/01/2005, Farida Beegum 110725 (CALI); Mathikettan shola National Park, s.d., S. Syam Radh 153434 (CALI).

Vitex L.

Sp. Pl.: 638.1753.

Key to species

1a. Leaves opposite-superposed, leaflets 3; flowers in terminal
panicle; drupe globose, blue *V. altissima*

1b. Leaves opposite-decussate, leaflets 5; flowers in axillary cyme; drupe
ellipsoid, black *V. leucoxydon*

Vitex altissima L.f., Suppl. Pl.: 294.1782; Hook.f., Fl. Brit. India 4: 584. 1885; Gamble, Fl. Madras 2: 1102. 1921; Sasidh., Fl. Periyar Tiger Reserve 312. 1998; Sasidh., Fl. Chinnar WLS 245. 1999; Rajendran & Daniel, Indian Verbenaceae 344. 2002.

Tree. Stem terete, brown, sparsely pubescent; branchlets slender, sparsely pubescent. Leaves compound, opposite, leaflets 3, lance-ovate, 5–10 × 1.5–2.5 cm, apex acuminate, base cuneate, margins entire, green, pubescent on abaxial surface, sessile. Flowers in terminal panicles. Peduncle terete, 15–25 × 0.1–0.2 cm, greenish brown, tomentose. Pedicel almost sessile. Calyx tube 2 × 1 mm, green, tomentose; lobes 5,

minutely lobed, c. 1×1 mm, apex acute to obtuse, green, tomentose. Corolla tube 4 mm long, white, pubescent; lobes 5, bilipped, minute except lower lip, apex obtuse, white with blue tinge, glabrous. Stamens 4, didynamous, exserted; filaments 3×1 mm; 2×1 mm, pale blue, pubescent; anthers bilobed, elliptic, > 1 mm long, violet, glabrous. Style filiform, minute, pale blue, glabrous. Stigma bifid, minute, pale blue, glabrous. Drupe globose, 3–5 mm long, blue, glabrous.

Distribution: Tropical Asia (POWO, 2022)

Habitat: Semi evergreen forests

Flowering and fruiting: February–December

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 14/06/1995, Jomy Augustine 16228 (KFRI).

Vitex leucoxylon L.f., Suppl. Pl.: 293.1782; Hook.f., Fl. Brit. India 3: 587. 1882; Gamble, Fl. Madras 2: 1103. 1921; Sasidh., Fl. Periyar Tiger Reserve 314. 1998; Sasidh., Fl. Chinnar WLS 245. 1999; Rajendran & Daniel, Indian Verbenaceae 356. 2002.

Tree. Stem terete, greenish brown, sparsely tomentose; branchlets slender, sparsely tomentose. Leaves compound, opposite-decussate, leaflets 5, elliptic, $5\text{--}15 \times 2\text{--}4$ cm, apex acute, base cuneate, margins entire, green, pubescent on abaxial surface, petiolate. Flowers in axillary cymes. Peduncle terete, $5\text{--}8 \times 0.1\text{--}0.2$ cm, green, tomentose. Pedicel terete, 1×1 mm, green, tomentose. Calyx tube 2×3 mm, green, tomentose; lobes 5, > 1 mm long, apex acute, green, pubescent. Corolla tube 5 mm long, white, pubescent; lobes 5, bilipped, 5–8 mm long, apex slightly acute, white, glabrous. Stamens 4, didynamous, exserted; filaments thick, 3×1 mm; 2×1 mm, pale blue, tomentose; anthers bilobed, reniform, > 1 mm long, purple, glabrous. Style filiform, minute, pale blue, glabrous. Stigma bifid, minute, pale blue, glabrous. Drupe ellipsoid, 1–1.5 cm long, black, glabrous.

Distribution: Pakistan to Peninsula Malaysia (POWO, 2022)

Habitat: River banks

Flowering and fruiting: January–October

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 28/02/1994, Jomy Augustine 13411 (KFRI); Vallakadavu, 08/03/1994, Jomy Augustine 13421 (CALI).

LAMIACEAE Martinov.

Tekhno-Bot. Slovar 355. 1820. *nom. alt.*

Herbs and shrubs. Stem quadrangular, aromatic (bears essential oil), pubescent. Leaves simple, opposite or whorled, exstipulate. Flowers solitary or in axillary fascicles, bracteate. Pollination entomophilous or ornithophilous (Delta Intkey, 2023). Calyx tubular, bilipped, persistent. Corolla tubular, small, bilipped. Stamens 4, usually didynamous, inserted. Style slender, gynobasic. Stigma bilobed. Fruits dry or fleshy nutlets. Seeds small and erect. Many plants are sources of aromatic and essential oils and many are cultivated as ornamentals (Delta Intkey, 2023).

According to POWO 2022, Lamiaceae consists of 232 accepted genera worldwide.

Key to Genera

- 1a. Stamen equal *Pogostemon*
- 1b. Stamen didynamous 2
- 2a. Flowers in verticillaster *Leucas*
- 2b. Flowers other than in verticillaster 3
- 3a. Calyx lobes equal 4
- 3b. Calyx lobes bilipped 5
- 4a. Flowers in spike/raceme 6
- 4b. Flowers in cyme 7
- 5a. Corolla lobes 5 8
- 5b. Corolla lobes less than 5 9
- 6a. Flowers pedicellate, corolla blue *Mesosphaerum*
- 6b. Flowers sessile, corolla pink *Anisomeles*
- 7a. Leaves sessile; flowers lax, corolla pink *Micromeria*
- 7b. Leaves petiolate; flowers dense, corolla white *Hyptis*
- 8a. Style bifid 10
- 8b. Style not bifid *Orthosiphon*
- 9a. Flowers pedicellate, raceme; corolla lobes 3 *Teucrium*
- 9b. Flowers sessile, cyme; corolla lobes 4 *Gomphostemma*
- 10a. Flowers sessile *Coleus*
- 10b. Flowers pedicellate 11
- 11a. Flowers in cyme *Leonotis*
- 11b. Flowers in raceme 12

- 12a. Upper lip of corolla boat shaped; stamen exserted *Isodon*
 12b. Upper lip of corolla hooded; stamen inserted *Scutellaria*

***Anisomeles* R.Br.**

Prodr. Fl. Nov. Holland.: 503.1810. *nom. cons.*

***Anisomeles indica* (L.) Kuntze**, Revis. Gen. Pl. 2: 512.1891; Sasidh., Fl. Periyar Tiger Reserve 317. 1998; Sasidh., Fl. Chinnar WLS 246. 1999; Gamble, Fl. Madras 2: 1140. 1921. *Anisomeles ovata* W.T.Aiton, Hortus Kew. 3: 364 (1811), *nom. superfl.*; Hook.f., Fl. Brit. India 4: 672. 1885.

Figure 28 H.

Herb. Stem quadrangular, woody, branching, green, pubescent. Leaves simple, opposite, ovate, 3–6 × 2–4 cm, apex acute, base round, margins serrate, green, tomentose, petiolate. Flowers in axillary spikes, sessile. Bracts 2, linear, 3–4 mm long, green, ciliate. Calyx tube 3–5 mm long, green, ciliate; lobes 5, equal, 2–3 mm long, apex acute, green, ciliate. Corolla tube short, pink, glabrous; lobes 5, bilipped, 8–10 mm long, apex obtuse, pink, glabrous. Stamens 4, didynamous, exserted; filaments slender, 2–5 mm long, white, pubescent; anthers bilobed, elliptic, 1–2 mm long, white, glabrous. Style slender, bifid, 3–6 mm long, white, glabrous. Stigma lobed, white, glabrous. Nutlets reddish brown, dry.

Distribution: Tropical & Subtropical Asia (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: December-May

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 30/12/2014, *S. Syam Radh 137937* (CALI); Periyar Tiger Reserve, 12/08/1994, *Jomy Augustine 13933* (CALI); Painavu, 20/03/2017, *Divya K. Venugopal 151511* (CALI).

***Coleus* Lour.**

Fl. Cochinch.: 372.1790.

Key to species

- 1a. Stem glabrous..... *C. stobilifer*
 1b. Stem pubescent 2
 2a. Leaves margin entire 3
 2b. Leaves margin not entire..... 4
 3a. Leaves opposite..... *C. dysophylloides*

- 3b. Leaves whorled 5
- 4a. Leaves sessile; roots absent at stem lower nodes;
corolla blue..... *C. barbatus*
- 4b. Leaves petiolate; roots present at stem lower nodes;
corolla rose-purple *C. scaber*
- 5a. Leaves apex acute; corolla yellow *C. argenteus*
- 5b. Leaves apex obtuse; corolla blue *C. adenanthus*

Coleus adenanthus (Dalzell & A.Gibson) A.J.Paton, PhytoKeys 129: 13.2019. *Anisochilus verticillatus* Hook.f., Fl. Brit. India 4: 629.1885; Gamble, Fl. Madras 2: 1127. 1921; Sasidh., Fl. Periyar Tiger Reserve 316. 1998.

Shrub. Stem quadrangular, green, villous. Leaves simple, whorled, oblanceolate, 5–7 × 1–2 cm, apex obtuse, base cuneate, margins entire, green, pubescent, sessile. Flowers solitary or in terminal spikes. Peduncle quadrangular, 2–5 cm long, green, villous. Bracts lanceolate, 2–4 mm long, green, villous. Calyx tube 1–2 mm long, green, densely villous; lobes 5, bilipped, 2–3 mm long, apex acute, green, densely villous. Corolla tube 2–3 mm long, blue, villous; lobes 5, bilipped, 6–8 mm long, apex obtuse, blue, spreading, villous. Stamens 4, didynamous, exserted; filaments slender, 3–5 mm long, white, glabrous; anthers bilobed, elliptic, minute, purple, glabrous. Style bilobed, 4–6 mm long, white, glabrous. Stigma minute, white, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Deciduous forests

Flowering and fruiting: September–February

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 29/11/1996, Jomy Augustine 16924 (CALI); Chinnar, 12/10/2017, Divya K. Venugopal 154154 (CALI).

Coleus argenteus (Gamble) A.J.Paton, PhytoKeys 129: 20.2019. *Anisochilus argenteus* Gamble, Fl. Madras: 1127.1924; Hook.f., Fl. Brit. India 3: 663. 1882; Sasidh., Fl. Periyar Tiger Reserve 316. 1998.

Figure 28 E.

Herb. Stem nearly quadrangular, green, tomentose, fleshy. Leaves simple, whorled, oblanceolate, 1–2 × 1–1.2 cm, apex acute, base flat, margins entire, green, tomentose, sessile. Flowers in spikes. Peduncle quadrangular, 5–9 cm long, green, glabrous. Bracts ovate, 2–5 mm long, apex acute, caducous, white tomentose. Calyx tube 1–2 mm long, green, white tomentose; lobes 5, bilipped, 2–3 mm long, apex acute, green,

white tomentose. Corolla tube 1–2 mm long, yellow, glabrous; lobes 5, bilipped, 3–5 mm long, apex obtuse, yellow, glabrous. Stamens 4, didynamous, exserted; filaments slender, 2–4 mm long, white, glabrous; anthers bilobed, elliptic, minute, white, glabrous. Style bilobed, 3–6 mm long, white, glabrous. Stigma minute, white, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Rocky surfaces

Flowering and fruiting: August–February

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 04/01/2017, *S. Syam Radh 151451* (CALI); Periyar Tiger Reserve, 06/12/1994, *Jomy Augustine 14308* (CALI); Kanthallur, 03/08/2018, *Divya K. Venugopal 154188* (CALI).

Coleus barbatus (Andrews) Benth. ex G.Don, J.C.Loudon, Hort. Brit.: 483.1830; Hook.f., Fl. Brit. India 4: 625. 1885; Gamble, Fl. Madras 2: 1124. 1921; Sasidh., Fl. Periyar Tiger Reserve 317. 1998; Sasidh., Fl. Chinnar WLS 247. 1999.

Herb. Stem quadrangular, green, aromatic, fleshy, villous, roots absent at lower nodes. Leaves simple, opposite, broadly ovate, apex obtuse, base cuneate, 3–4 × 1–2 cm, margins crenate, green, hairy, not fleshy, sessile. Flowers in terminal cymes, sessile. Peduncle quadrangular, 8–13 cm long, greenish purple, pubescent. Bracts ovate, 2–4 mm long, apex acuminate, greenish purple, villous, caducous. Calyx tube 1–2 mm long, greenish purple, glabrous; lobes 5, bilipped, 2–5 mm long, apex acute, greenish purple, villous. Corolla tube 2–4 mm long, blue, villous; lobes 5, bilipped, 3–7 mm long, apex obtuse, blue, villous. Stamens 4, didynamous, exserted; filaments slender, 4–6 mm long, blue, glabrous; anthers bilobed, elliptic, minute, yellow, glabrous. Style slender, bifid, 3–5 mm long, blue, glabrous. Stigma minute, blue, glabrous.

Distribution: Eritrea to Tanzania, Arabian Peninsula, Indian Subcontinent to South Central China (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: July–November

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 06/11/1993, *Jomy Augustine 12472* (CALI); Kattadikadavu, 10/07/2020, *Divya K. Venugopal 168425* (CALI).

Coleus strobilifer (Roxb.) A.J.Paton, PhytoKeys 129: 100.2019. *Anisochilus carnosus* (L.f.) Wall. ex Benth., Edwards's Bot. Reg. 15: t. 1300.1830; Hook.f., Fl. Brit. India 4: 627. 1885; Gamble, Fl. Madras 2: 1126. 1921; Sasidh., Fl. Periyar Tiger Reserve 316. 1998; Sasidh., Fl. Chinnar WLS 246. 1999.

Herb. Stem quadrangular, branched, green, glabrous. Leaves simple, opposite, broadly ovate, 2–6 × 2–4 cm, apex obtuse, base cordate, margins crenate, green, pubescent, petiolate. Flowers in terminal spike. Peduncle oblong, 1–3 cm long, purple, glabrous. Bracts minute, apex acute, glabrous, caducous. Calyx tube 1–2 mm long, greenish purple, pubescent; lobes 5, bilipped, 2–5 mm long, apex acute, greenish purple, pubescent. Corolla tube 3–5 mm long, purple, glabrous, exserted; lobes 5, bilipped, 4–8 mm long, apex obtuse, purple, glabrous. Stamens 4, didynamous, exserted; filaments slender, connate, 2–5 mm long, white, glabrous; anthers bilobed, elliptic, 2 mm long, white, glabrous. Style slender, bifid at apex, white, glabrous.

Distribution: Indian Subcontinent to Indo-China (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October-June

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 06/12/1996, Jomy Augustine 16966 (CALI); *ibid.*, 12/01/2019, Divya K. Venugopal 168426 (CALI).

Coleus dysophylloides (Benth.) A.J.Paton, PhytoKeys 129:42.2019. *Anisochilus sericeus* Benth., A.P.de Candolle, Prodr. 12: 82. 1848; Hook.f., Fl. Brit. India 4: 629. 1885; Gamble, Fl. Madras 2: 1128. 1921; Sasidh., Fl. Periyar Tiger Reserve 316. 1998.

Shrub. Stem quadrangular, green, tomentose. Leaves simple, opposite, obovate, 2–4 × 0.6–0.8 cm, apex acute, base cuneate, margins entire, green, tomentose, sessile. Flowers in terminal spikes. Peduncle quadrangular, 2–5 cm long, green, tomentose. Bracts ovate, 1–3 mm long, apex acute, green, pubescent. Calyx tube 1–2 mm long, green, pubescent; lobes 5, bilipped, 2–4 mm long, apex acute, green, pubescent. Corolla tube 2–3 mm long, white, glabrous, exserted; lobes 5, bilipped, 3–5 mm long, apex obtuse, white, glabrous. Stamens 4, didynamous, exserted; filaments slender, 2–4 mm long, white, glabrous; anthers bilobed, elliptic, minute, white, glabrous. Style slender, bifid at apex, white, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October-June

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 12/11/2020, Divya K. Venugopal 168332 (CALI).

Coleus scaber (Benth.) A.J.Paton, PhytoKeys 129: 91.2019. *Anisochilus scaber* Benth., A.P.de Candolle, Prodr. 12: 81.1848; Hook.f., Fl. Brit. India 4: 629. 1885; Gamble, Fl. Madras 2: 1127. 1921.

Herb. Stem quadrangular, purplish green, pubescent, rooting at lower nodes. Leaves simple, opposite, oblong, 2–5 × 2–3 cm, apex obtuse, base round, margins crenate, green, tomentose, petiolate. Flowers in terminal spikes. Peduncle quadrangular, 1–5 cm long, purplish green, pubescent. Bracts minute, apex acute, purplish green, pubescent. Calyx tube 2–3 mm long, purplish green, puberulent; lobes 5, bilipped, 2–4 mm long, apex acute, purplish green, puberulent. Corolla tube 2–3 mm long, rose-purple, villous, exserted; lobes 5, bilipped, 3–6 mm long, apex obtuse, rose-purple, villous. Stamens 4, didynamous, exserted; filaments slender, 2–4 mm long, white, glabrous; anthers bilobed, elliptic, minute, white, glabrous. Style slender, bifid at apex, white, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October-June

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 10/02/2017, Divya K. Venugopal 167224 (CALI).

Gomphostemma Wall. ex Benth.

Edwards's Bot. Reg. 15: t. 1292.1830.

Gomphostemma eriocarpon Benth., N.Wallich, Pl. Asiat. Rar. 2: 12.1830; Hook.f., Fl. Brit. India 4: 698. 1885; Gamble, Fl. Madras 2: 1157. 1921; Sasidh., Fl. Periyar Tiger Reserve 318. 1998.

Herb. Stem terete, green, villous. Leaves simple, opposite-decussate, ovate, 4–10 × 3–4 cm, apex acute, base round, margins dentate, green, pubescent on abaxial surface, petiolate. Flowers in axillary cymes as whorls, sessile. Bracts 3–7 mm long, apex acute, purplish green, villous. Calyx tube 2–4 mm long, purplish green, villous; lobes 5, bilipped, 3–8 mm long, apex acuminate, purplish green, villous. Corolla tube 12–15 mm long, yellow, villous, exserted; lobes 4, bilipped, 4–6 mm long, apex obtuse, yellow, villous. Stamens 4, didynamous, exserted; filaments slender, 5–8 mm long,

white, puberulent; anthers bilobed, elliptic, minute, yellow, glabrous. Style slender, bifid at apex, 6–8 mm long, white, puberulent.

Distribution: South West & South India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October-June

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 22/07/1993, Jomy Augustine 12114 (CALI).

Hyptis Jacq.

Collectanea 1: 101.1787. *nom. cons.*

Hyptis capitata Jacq., Collectanea 1: 102.1787; Sasidh., Fl. Periyar Tiger Reserve 318. 1998.

Shrub. Stem quadrangular, green, pubescent. Leaves simple, opposite decussate, elliptic, 4–5 × 1–2 cm, apex acute, base cuneate, margins serrate, green, pubescent, petiolate. Flowers in axillary cyme, dense. Peduncle quadrangular, 2–6 cm long, green, pubescent. Calyx tube minute, green, glandular; lobes 5, equal, 4–7 mm long, apex acute, green, glandular. Corolla tube 2 mm long, white, glabrous; lobes 5, bilipped, 3–5 mm long, apex obtuse, white, glabrous. Stamens 4, didynamous; filaments slender, 2–3 mm long, white, pubescent; anthers bilobed, elliptic, minute, white, glabrous. Style slender, 2–3 mm long, white, pubescent. Stigma shortly bifid, white, glabrous.

Distribution: Florida, Mexico to Tropical America (POWO, 2022)

Habitat: Waste lands

Flowering and fruiting: August-February

Specimens examined: India, Kerala, Idukki, Kumily, 20/11/1988, V. P. Premalatha 3159 (CALI); Marayur, 29/01/2018, Divya K. Venugopal 154193 (CALI).

Isodon (Benth.) Schrad. ex Spach

Hist. Nat. Vég. 9:162. 1840.

Key to species

- 1a. Leaves opposite-superposed, petiolate; calyx red;
corolla white-lavender, woolly tomentose *I. japonicus*
- 1b. Leaves opposite decussate, sessile; calyx green;
corolla white, glandular *I. nilgherriensis*

Isodon japonicus (Burm.f.) H.Hara, Enum. Spermatophytarum Japon. 1: 206. 1948. *Plectranthus coetsa* Buch.-Ham. ex D.Don, Prodr. Fl. Nepal.: 117.1825; Hook.f., Fl. Brit. India 4: 619. 1885; Gamble, Fl. Madras 2: 1121. 1921. *Isodon coetsa* (Buch.-Ham. ex D.Don) Kudô, Mem. Fac. Sci. Taihoku Imp. Univ. 2: 131.1929; Sasidh., Fl. Periyar Tiger Reserve 322. 1998; Sasidh., Fl. Chinnar WLS 253. 1999.

Herb. Stem quadrangular, green, woolly tomentose. Leaves simple, opposite, 6–8 × 2–4 cm, apex acute, base round, margins serrate, green, white pubescent on abaxial surface, petiolate. Flowers in terminal racemes. Peduncle quadrangular, 10–20 cm long, greenish white, tomentose. Pedicel quadrangular, 1 cm long, greenish white, tomentose. Bracts ovate, minute, greenish white, tomentose. Calyx tube 1–2 mm long, red, glandular; lobes 5, bilipped, 2 mm long, apex acute, red, glandular. Corolla tube 2 mm long, white-lavender, woolly tomentose, exserted; lobes 5, upper lip boat shaped, 3–5 mm long, apex obtuse, white-lavender, woolly tomentose. Stamens 4, didynamous, exserted; filaments slender, 2–3 mm long, white, glabrous; anthers bilobed, elliptic, minute, white, glabrous. Style slender, bifid at apex, 3–4 mm long, white, glabrous.

Distribution: Russian Far East to Central China and Japan (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October-June

Specimens examined: India, Kerala, Idukki, Munnar, 27/11/1979, *Nambiar 881* (CALI); Way to Mannavan Shola, 08/01/2004, *A. Swapna Thomas 97444* (CALI); Munnar road, 07/12/2016, *Priyanka 191420* (CALI); Periyar Tiger Reserve, 15/04/1997, *Jomy Augustine 16890* (CALI).

Isodon nilgherricus (Benth.) H.Hara, J. Jap. Bot. 60: 236.1985. *Plectranthus nilgherricus* Benth., A.P.de Candolle, Prodr. 12: 57.1848; Hook. f., Fl. Brit. India 4: 619. 1885; Gamble, Fl. Madras 2: 1121. 1921; Sasidh., Fl. Periyar Tiger Reserve 322. 1998.

Shrub. Stem quadrangular, green, woolly tomentose. Leaves simple, opposite decussate, 4–10 × 3–6 cm, apex acute, base round, margins serrate, green, pubescent, sessile. Flowers in terminal racemes. Peduncle quadrangular, 10–20 cm long, green, pubescent. Pedicel quadrangular, 1 cm long, green, pubescent. Bracts ovate, 2–4 mm long, green, pubescent. Calyx tube 2 mm long, green, glandular; lobes 5, bilipped, 3–4 mm long, apex acute, green, glandular. Corolla tube 2–3 mm long, white, glandular, exserted; lobes 5, upper lip boat shaped, 3–8 mm long, apex obtuse, white, glandular.

Stamens 4, didynamous, exserted; filaments slender, 4–5 mm long, white, glabrous; anthers bilobed, elliptic, minute, white, glabrous. Style slender, bifid at apex, 4–5 mm long, white, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October-June

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 21/11/2014, *S. Syam Radh 143573* (CALI); Periyar Tiger Reserve, 07/01/1994, *Jomy Augustine 13105* (CALI); *ibid.*, 12/02/2017, *Divya K. Venugopal 154179* (CALI).

***Leonotis* (Pers.) R. Br.**

Prodr. Fl. Nov. Holland.: 504. 1810.

***Leonotis nepetifolia* (L.) R.Br.**, W.T.Aiton, Hortus Kew. 3: 409.1811; Hook. f., Fl. Brit. India 4: 691. 1885; Gamble, Fl. Madras 2: 1155. 1921; Sasidh., Fl. Chinnar WLS 248. 1999.

Herb. Stem quadrangular, green, glabrous. Leaves simple, opposite, ovate, 6–9 × 4–7 cm, apex acute, base truncate, margins crenate, green, pubescent, petiolate. Flowers in axillary and terminal cyme. Bracts linear, 1.4–2 cm long, green, pubescent. Calyx tube 8–10 mm long, green, glandular; lobes 5, bilipped, apex acute, green, glandular. Corolla tube 1 cm long, red, pubescent, exserted; lobes 5, bilipped, 1.5–2 cm long, apex obtuse, red, pubescent. Stamens 4, didynamous; filaments slender, 2–4 mm long, white, glabrous; anthers bilobed, elliptic, minute, white, glabrous. Style slender, bifid at apex, 1.6–1.8 cm long, white, glabrous.

Distribution: Africa, Indian Subcontinent (POWO, 2022)

Habitat: Deciduous forests

Flowering and fruiting: October-April

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 10/03/2018, *Divya K. Venugopal 154280* (CALI).

***Leucas* R. Br.**

Prodr. Fl. Nov. Holland.: 504.1810.

Key to species

- 1a. Leaves opposite-superposed..... 2
- 1b. Leaves opposite-decussate 3

- 2a. Leaves ovate-broadly ovate..... 4
- 2b. Leaves linear-oblong..... 5
- 3a. Stem green; leaves base round; flowers in terminal
verticillaster..... *L. biflora*
- 3b. Stem brownish green; leaves base attenuate; flowers in
axillary verticillaster *L. ciliata*
- 4a. Bract linear *L. chinensis*
- 4b. Bract lanceolate..... 6
- 5a. Leaves apex obtuse; flowers in terminal verticillaster *L. hirta*
- 5b. Leaves apex acute; flowers in axillary & terminal
verticillaster..... *L. aspera*
- 6a. Leaves apex acute *L. angularis*
- 6b. Leaves apex obtuse *L. pubescens*

Leucas angularis Benth., N.Wallich, Pl. Asiat. Rar. 1: 62.1830; Hook.f., Fl. Brit. India 4: 684. 1885; Gamble, Fl. Madras 2: 1151. 1921; Sasidh., Fl. Chinnar WLS 249. 1999.

Herb. Stem quadrangular, green, pubescent. Leaves simple, opposite, ovate, 2–5 × 1–1.5 cm, apex acute, base truncate, margins crenate, green, pubescent, petiolate. Flowers in axillary verticillaster. Bracts narrowly lanceolate, 2–3 mm long, green, ciliate. Calyx tube 5–7 mm long, green, pubescent; lobes 10, subequal, minute, apex acute, green, pubescent. Corolla tube 6–8 mm long, white, tomentose; lobes 5, bilipped, 3–4 mm long, apex obtuse, white, dense tomentose. Stamens 4, didynamous; filaments slender, 4–7 mm long, white, pubescent; anther bilobed, elliptic, 2 mm long, white, glabrous. Style slender, 5–7 mm long, white, glabrous.

Distribution: South India, Sri Lanka (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January-June

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 17/12/2016, Divya K. Venugopal 151254 (CALI).

Leucas aspera (Willd.) Link, Enum. Hort. Berol. Alt. 2: 113.1822; Hook.f., Fl. Brit. India 4: 690. 1885; Gamble, Fl. Madras 2: 1150. 1921; Sasidh., Fl. Chinnar WLS 249. 1999.

Herb. Stem quadrangular, green, pubescent. Leaves simple, opposite, linear, 3–6 × 1–2 cm, apex acute, base cuneate, margins serrate, green, pubescent, petiolate. Flowers in axillary and terminal verticillaster, dense. Bracts numerous, linear, 3–5 mm long, green, pubescent. Calyx tube 5–6 mm long, green, pubescent, glabrous in lower part only; lobes 10, minute, apex acute, green, pubescent. Corolla tube 5–7 mm long, white, pubescent; lobes 5, bilipped, 3–7 mm long, apex obtuse, white, pubescent. Stamens 4, didynamous; filaments slender, 3–5 mm long, white, pubescent; anther bilobed, elliptic, minute, white, glabrous. Style slender, 6–9 mm long, white, glabrous.

Distribution: Mauritius, Tropical & Subtropical Asia (POWO, 2022)

Habitat: Waste lands

Flowering and fruiting: August–February

Specimen examined: India, Kerala, Idukki, Kallar, 20/09/2017, Divya K. Venugopal 158065 (CALI).

Leucas hirta (B.Heyne ex Roth) Spreng., Syst. Veg., ed. 16. 2: 743.1825; Hook.f., Fl. Brit. India 4: 687. 1885; Gamble, Fl. Madras 2: 1153. 1921; Sasidh., Fl. Periyar Tiger Reserve 319. 1998; Sasidh., Fl. Chinnar WLS 250. 1999.

Herb. Stem quadrangular, green, pubescent. Leaves simple, opposite, narrow, oblong, 4–6 × 1–2 cm, apex obtuse, base cuneate, margins crenate, green, pubescent, petiolate. Flowers in terminal verticillaster. Bracts numerous, lanceolate, 5–8 mm long, apex acute, green, pubescent. Calyx tube 6–8 mm long, green, pubescent; lobes 10, 2–3 mm long, apex acute, green, pubescent. Corolla tube 4–6 mm long, white, pubescent; lobes 5, 3–6 mm long, apex obtuse, white, pubescent. Stamens 4, didynamous; filaments slender, 3–5 mm long, white, pubescent; anther bilobed, elliptic, minute, white, glabrous. Style slender, 5–6 mm long, white, glabrous.

Distribution: South India (POWO, 2022)

Habitat: Waste lands

Flowering and fruiting: August–February

Specimens examined: India, Kerala, Idukki, Devikulam, 30/11/2001, O.K. Premavally 1467 (CALI); Periyar Tiger Reserve, 12/12/1993, Jomy Augustine 12789 (CALI); Erattayar, 04/09/2018, Divya K. Venugopal 158119 (CALI).

Leucas biflora (Vahl) Sm., A.Rees, Cycl. 20: n.º 7.1812; Hook. f., Fl. Brit. India 4: 683. 1885; Gamble, Fl. Madras 2:1150. 1921; Sasidh., Fl. Periyar Tiger Reserve 319. 1998; Sasidh., Fl. Chinnar WLS 250. 1999.

Herb. Stem quadrangular, branched, green, pubescent. Leaves simple, opposite decussate, oblong, 2–4 × 1–2 cm, apex subacute, base round, margins crenate, green, pubescent, petiolate. Flowers in terminal verticillaster. Bracts ovate, 5–6 mm long, apex acute, green, pubescent. Calyx tube 6–8 mm long, green, pubescent; lobes 10, 8–10 mm long, apex acute, green, pubescent. Corolla tube 7–8 mm long, white, pubescent; lobes 5, bilipped, 5–7 mm long, apex obtuse, white, pubescent. Stamens 4, didynamous; filaments slender, 4–5 mm long, white, glabrous; anther bilobed, elliptic, minute, white, glabrous. Style slender, 5–7 mm long, white, glabrous.

Distribution: Indian Subcontinent to Indo-China (POWO, 2022)

Habitat: Waste lands

Flowering and fruiting: August-February

Specimens examined: India, Kerala, Idukki, Devikulam, 12/12/1970, M.K. Sreedharan Nambiar 200 (CALI); Erattayar, 04/09/2018, Divya K. Venugopal 158119 (CALI).

Leucas chinensis (Retz.) Sm., A.Rees, Cycl. 20: n.º 8.1812; Hook. f., Fl. Brit. India 4: 681. 1885; Gamble, Fl. Madras 2:1151.1921.

Herb. Stem quadrangular, branched, green, pubescent. Leaves simple, opposite, broadly ovate, 2–6 × 1–4 cm, apex obtuse, base truncate, margins crenate, green, pubescent, petiolate. Flowers in axillary verticillaster, lax. Bracts linear, 3–4 mm long, apex acute, green, pubescent. Calyx tube 1–1.3 cm long, green, pubescent; lobes 10, 5–7 mm long, apex acute, green, pubescent. Corolla tube 1–1.4 cm long, white, pubescent; lobes 5, bilipped, 7–10 mm long, apex obtuse, white, pubescent. Stamens 4, didynamous; filaments slender, 8–10 mm long, white, pubescent; anther bilobed, elliptic, minute, white, glabrous. Style slender, 1–1.2 cm long, white, glabrous.

Distribution: India, China to Hainan, South Japan to Philippines (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: October-February

Specimens examined: India, Kerala, Idukki, Way to Kanthallur, 22/01/1908, P. Deepa 107858 (CALI); Erattayar, 04/09/2018, Divya K. Venugopal 158119 (CALI).

Leucas ciliata Benth., N.Wallich, Pl. Asiat. Rar. 1: 61.1830; Hook. f., Fl. Brit. India 4: 687. 1885; Gamble, Fl. Madras 1153.1921; Sasidh., Fl. Periyar Tiger Reserve 319. 1998.

Figure 29 D.

Shrub. Stem quadrangular, brownish green, pubescent. Leaves simple, opposite decussate, oblong, 5–9 × 2–3 cm, apex acute, base attenuate, margins crenate, green, pubescent, petiolate. Flowers in axillary verticillaster. Bracts linear, 1–1.2 cm long, apex acute, green, pubescent. Calyx tube 8–10 mm long, green, pubescent; lobes 10, 4–6 mm long, apex acute, green, pubescent. Corolla tube 7–9 mm long, white, pubescent; lobes 5, 8–10 mm long, apex obtuse, white, pubescent. Stamens 4, didynamous; filaments slender, 4–6 mm long, white, pubescent; anther bilobed, elliptic, minute, white, glabrous. Style slender, 8–10 mm long, white, glabrous.

Distribution: Indian Subcontinent to South China (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: October-March

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 23/11/2014, *S. Syam Radh* 137855 (CALI); Way to Kanthallur, 30/03/1978, *Nambiar* 273 (KFRI); Way to Kanthallur, 22/01/2008, *M.P. Shyni* 107446 (CALI); Erattayar, 04/11/2018, *Divya K. Venugopal* 158119 (CALI).

Leucas pubescens Benth., Labiat. Gen. Spec.: 610.1834; Hook. f., Fl. Brit. India 4: 684. 1885; Gamble, Fl. Madras 2:1152.1921; Sasidh., Fl. Periyar Tiger Reserve 320. 1998.

Herb. Stem quadrangular, green, pubescent. Leaves simple, opposite, broadly ovate, 4–6 × 1–2 cm, apex obtuse, base truncate, margins crenate, green, pubescent, petiolate. Flowers in axillary verticillaster. Bracts lanceolate, 6–9 mm long, apex acuminate, green, pubescent. Calyx tube 7–9 mm long, green, pubescent; lobes 10, 3–4 mm long, apex acute, green, pubescent. Corolla tube 7–10 mm long, white, pubescent; lobes 5, 5–6 mm long, apex obtuse, white, pubescent. Stamens 4, didynamous; filaments slender, 5–6 mm long, white, glabrous; anther bilobed, elliptic, minute, white, glabrous. Style slender, 1 cm long, white, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: January-October

Specimens examined: India, Kerala, Idukki, Periyar Tiger Reserve, 25/05/1995, *Jomy Augustine 15398* (CALI); Erattayar, 04/09/2018, *Divya K. Venugopal 158119* (CALI).

***Mesosphaerum* P. Browne**

Civ. Nat. Hist. Jamaica: 257.1756.

Mesosphaerum suaveolens (L.) Kuntze, Revis. Gen. Pl. 2: 525.1891. *Hyptis suaveolens* (L.) Poit., Ann. Mus. Hist. Nat. 7: 472.1806; Hook.f., Fl. Brit. India 4: 630. 1885; Gamble, Fl. Madras 2: 1129. 1921; Sasidh., Fl. Periyar Tiger Reserve 319. 1998; Sasidh., Fl. Chinnar WLS 248. 1999.

Herb. Stem quadrangular, green, aromatic, pubescent. Leaves simple, opposite, ovate, 5–7 × 3–4 cm, apex acute, base cuneate, margins serrate, green, pubescent on abaxial surface, petiolate. Flowers in axillary racemes. Pedicel quadrangular, 3–4 mm long, green, pubescent. Calyx tube 6–8 mm long, green, glandular; lobes 5, equal, 4–5 mm long, apex acuminate, green, glandular. Corolla tube 8–10 mm long, blue, glabrous; lobes 5, bilipped, 4–5 mm long, apex obtuse, blue, glabrous. Stamens 4, didynamous; filaments slender, 5–6 mm long, white, pubescent; anthers bilobed, elliptic, minute, yellow, glabrous. Style slender, 6–8 mm long, white, glabrous. Stigma shortly bifid, white, glabrous.

Distribution: Pantropical (POWO, 2022)

Habitat: Waste lands

Flowering and fruiting: August–February

Specimen examined: India, Kerala, Idukki, Anakkara, 22/09/2017, *Divya K. Venugopal 151663* (CALI).

***Micromeria* Benth.**

Edwards's Bot. Reg. 15: t. 1282. 1829. *nom. cons.*

Micromeria imbricata (Forssk.) C.Chr., Dansk Bot. Ark. 4(3): 21.1922. *Micromeria biflora* (Buch.-Ham. Ex D. Don) Benth., Labiat. Gen. Spec. 378.1834; Hook.f., Fl. Brit. India 4:650.1885; Gamble, Fl. Madras 2:1138.1921.

Herb. Stem quadrangular, green, aromatic, pubescent. Leaves simple, opposite, ovate, 5–7 × 3–4 mm, apex acute, base cordate, margins entire, green, pubescent, sessile. Flowers in axillary cyme, lax. Pedicel quadrangular, 2–4 mm long, green, pubescent. Bract minute, apex acute, green, pubescent. Calyx tube 4–6 mm long, green,

pubescent; lobes 5, equal, 3–4 mm long, apex acuminate, green, pubescent. Corolla tube 6–8 mm long, pink, pubescent; lobes 5, bilipped, 5–7 mm long, apex obtuse, pink, pubescent. Stamens 4, didynamous; filaments slender, 5–6 mm long, white, pubescent; anthers bilobed, elliptic, minute, pink, glabrous. Style slender, 5–6 mm long, white, glabrous. Stigma shortly bifid, white, glabrous.

Distribution: African to Arabian Peninsula (POWO, 2022)

Habitat: Waste lands

Flowering and fruiting: August-February

Specimen examined: India, Kerala, Idukki, Anakkara, 22/09/2017, Divya K. Venugopal 151663 (CALI).

***Orthosiphon* Benth.**

Edwards's Bot. Reg. 15: t. 1300.1830.

Orthosiphon thymiflorus (Roth) Sleesen, Reinwardtia 5: 42.1959; Sasidh., Fl. Periyar Tiger Reserve 321. 1998; Sasidh., Fl. Chinnar WLS 252. 1999. *Orthosiphon glabratus* Benth., N.Wallich, Pl. Asiat. Rar. 2: 14.1830; Gamble, Fl. Madras 2: 1114. 1921.

Herb. Stem quadrangular, green, pubescent. Leaves simple, opposite, broadly ovate, 4–6 × 1–2 cm, apex acute, base round, margins serrate, green, glabrous, petiolate. Flowers in terminal racemes. Peduncle quadrangular, 6–15 cm long, green, pubescent. Pedicel quadrangular, 2–3 mm long, green, pubescent. Bracts minute, apex acute, green, pubescent. Calyx tube 4–6 mm long, green, pubescent; lobes 5, bilipped, 2–3 mm long, apex acute, green, pubescent. Corolla tube 7–9 mm long, white, glabrous; lobes 5, bilipped, 3–5 mm long, apex obtuse, white, glabrous. Stamens 4, didynamous; filaments slender, 4–6 mm long, white, glabrous; anthers bilobed, elliptic, minute, white, glabrous. Style slender, 6–8 mm long, white, glabrous. Stigma capitate, minute, white, glabrous.

Distribution: Africa, India to Indo-China, Central & East Jawa (POWO, 2022)

Habitat: In the plains

Flowering and fruiting: October-June

Specimens examined: India, Kerala, Idukki, Chinnar, 14/02/2001, M.V. Sheeba 73057 (CALI); Periyar Tiger Reserve, 15/05/1995, Jomy Augustine 15305 (CALI); Thoppramkudi, 07/03/2021, Divya K. Venugopal 178245 (CALI).

***Pogostemon* Desf.**

Mém. Mus. Hist. Nat. 2: 154.1815.

Key to species

1a. Calyx glabrous; corolla lobes pink, pubescent..... *P. benghalensis*

1b. Calyx pubescent; corolla lobes purplish white, glabrous..... *P. pubescens*

Pogostemon benghalensis (Burm.f.) Kuntze, Revis. Gen. Pl. 2: 529.1891; Sasidh., Fl. Periyar Tiger Reserve 323. 1998; Sasidh., Fl. Chinnar WLS 253. 1999. *Pogostemon plectranthoides* Desf., Mém. Mus. Hist. Nat. 2: t. 6, 155.1815; Hook.f., Fl. Brit. India 4: 632. 1885; Gamble, Fl. Madras 2: 1133. 1921.

Figure 28 C.

Shrub. Stem quadrangular, reddish brown, pubescent. Leaves simple, opposite, ovate, 10–12 × 3–4 cm, apex acute, base attenuate, margins serrate, green, puberulent, petiolate. Flowers in terminal racemes, sessile. Peduncle quadrangular, 9–13 cm long, brown, pubescent. Bracts ovate, minute, apex acute, green, pubescent. Calyx tube 4–6 mm long, green, glabrous; lobes 5, equal, 2–3 mm long, apex acute, green, glabrous. Corolla tube 5–6 mm long, white, pubescent, exserted; lobes 5, bilipped, 5–7 mm long, apex obtuse, pink, pubescent. Stamens 4, exserted, equal; filaments slender, 8–10 mm long, purple, hairy; anther bilobed, elliptic, minute, white, glabrous. Style slender, bifid, 7–8 mm long, pale purple, glabrous. Stigma bilobed, purple, glabrous.

Distribution: Pakistan to Indo-China (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: February-May

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 08/05/2015, *S. Syam Radh* 137965 (CALI); Periyar Tiger Reserve, 08/12/1997, *Divya K. Venugopal* 156732 (CALI).

Pogostemon pubescens Benth., A.P.de Candolle, Prodr. 12: 152.1848; Gamble, Fl. Madras 2: 1133. 1921; Sasidh., Fl. Chinnar WLS 254. 1999. *Pogostemon parviflorus* Benth., N.Wallich, Pl. Asiat. Rar. 1: 31.1830; Hook.f., Fl. Brit. India 4: 632. 1885.

Shrub. Stem quadrangular, purplish green, pubescent. Leaves simple, opposite, ovate, 6–9 × 3–4 cm, apex acute, base cuneate, margins serrate, green, pubescent, petiolate. Flowers in axillary and terminal panicle, dense, sessile. Peduncle quadrangular, 5–12 cm long, greenish purple, pubescent. Bracts ovate, 4–5 mm long, apex acute, greenish purple, pubescent. Calyx tube 3–5 mm long, green, pubescent; lobes 5, equal, 1–2 mm

long, apex acute, green, pubescent. Corolla tube 3–5 mm long, purplish white, glabrous, exserted; lobes 5, bilipped, 5–7 mm long, apex obtuse, purplish white, glabrous. Stamens 4, exserted, equal; filaments slender, 4–6 mm long, purple, hairy; anther bilobed, elliptic, minute, white, glabrous. Style slender, bifid, 5–7 mm long, purple, glabrous. Stigma bilobed, purple, glabrous.

Distribution: South India, West Indo-China (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: November–March

Specimens examined: India, Kerala, Idukki, Way to Eravikulam, 13/02/2001, V. Smitha 72757 (CALI); Periyar Tiger Reserve, 09/12/2018, Divya K. Venugopal 165499 (CALI).

***Scutellaria* L.**

Sp. Pl.: 598.1753.

Key to species

- 1a. Stem glabrous; leaves lanceolate *S. barbata*
- 1b. Stem pubescent; leaves ovate..... 2
- 2a. Bract glabrous; calyx purple; corolla tube pink *S. wightiana*
- 2b. Bract pubescent; calyx green; corolla tube pale blue..... *S. violacea*

Scutellaria violacea B.Heyne ex Benth., N.Wallich, Pl. Asiat. Rar. 1: 66. 1830; Hook.f., Fl. Brit. India 4: 668. 1885; Gamble, Fl. Madras 2: 1142. 1921; Sasidh., Fl. Periyar Tiger Reserve 325. 1998; Sasidh., Fl. Chinnar WLS 254. 1999.

Herb. Stem quadrangular, purplish green, pubescent. Leaves simple, opposite, ovate, 4–6 × 3–4 cm, apex acute, base cordate, margins serrate, green, pubescent, petiolate. Flowers in terminal raceme. Peduncle quadrangular, 8–10 cm long, purplish green, pubescent. Pedicel quadrangular, 3–5 mm long, purplish green, pubescent. Bracts ovate, minute, apex acute, purple, pubescent. Calyx tube minute, green, glabrous; lobes 5, bilipped, 4–6 mm long, apex obtuse, green, glabrous. Corolla tube 6–8 mm long, pale blue, glabrous; lobes 5, bilipped, upper lip hooded, 6–9 mm long, apex obtuse, pale blue, glabrous. Stamens 4, didynamous, inserted; filaments slender, 7–9 mm long, white, hairy; anther bilobed, elliptic, minute, white, glabrous. Style slender, bifid, 7–8 mm long, white, glabrous. Stigma bilobed, white, glabrous.

Distribution: Indian Subcontinent to South Central China and Indo-China (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: January-August

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 23/08/2014, *S. Syam Radh* 143545 (CALI); Munnar, 31/03/1978, *Nambiar* 300 (CALI); Mannavan Shola, 23/01/2005, *P. Sheeja* 111060 (CALI); Periyar Tiger Reserve, 22/07/1993, *Jomy Augustine* 12120 (CALI); *ibid.*, 14/05/2020, *Divya K. Venugopal* 175844 (CALI).

Scutellaria wightiana Benth., N.Wallich, Pl. Asiat. Rar. 1: 67.1830; Gamble, Fl. Madras 2: 1142. 1921; Sasidh., Fl. Periyar Tiger Reserve 326. 1998. *Scutellaria violacea* B.Heyne ex Benth., N.Wallich, Pl. Asiat. Rar. 1: 66.1830; Hook.f., Fl. Brit. India 4: 668. 1885.

Figure 29 G.

Herb. Stem quadrangular, purplish green, densely pubescent. Leaves simple, opposite, ovate, 6–8 × 3–4 cm, apex acute, base cordate, margins crenate, green on adaxial surface and purple on abaxial surface, pubescent, petiolate. Flowers in terminal racemes. Peduncle quadrangular, 8–10 cm long, purplish green, densely pubescent. Pedicel quadrangular, 4–6 mm long, purplish green, densely pubescent. Bracts ovate, minute, apex acute, purple, glabrous. Calyx tube 2–3 mm long, purple, glabrous; lobes 5, bilipped, 3–5 mm long, apex obtuse, purple, glabrous. Corolla tube 6–8 mm long, pink, glabrous; lobes 5, bilipped, upper lip hooded, 5–6 mm long, apex obtuse, pink, glabrous. Stamens 4, didynamous, inserted; filaments slender, 4–6 mm long, white, hairy; anther bilobed, elliptic, minute, white, glabrous. Style slender, bifid, 7–9 mm long, white, glabrous. Stigma bilobed, white, glabrous.

Distribution: South West India (POWO, 2022)

Habitat: Shola forests

Flowering and fruiting: May-December

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 11/06/2018, *Divya K. Venugopal* 151699 (CALI).

Scutellaria barbata D.Don, Prodr. Fl. Nepal.: 109.1825; Sasidh., Fl. Periyar Tiger Reserve 325. 1998. *Scutellaria rivularis* Wall. ex Benth., N.Wallich, Pl. Asiat. Rar. 1: 66.1829; Hook. f., Fl. Brit. India 4: 670. 1885; Gamble, Fl. Madras 2: 1142. 1921.

Herb. Stem quadrangular, green, glabrous. Leaves simple, opposite, lanceolate, 2–4 × 1–3 cm, apex acute, base cuneate, margins crenate, green, pubescent, petiolate. Flowers in terminal racemes. Peduncle quadrangular, 6–8 cm long, green, glabrous. Pedicel quadrangular, minute, green, glabrous. Bracts lanceolate, minute, apex acute,

green, glabrous. Calyx tube 2–4 mm long, green, pubescent; lobes 5, bilipped, 3–5 mm long, apex acute, green, pubescent. Corolla tube 3–4 mm long, blue, pubescent; lobes 5, bilipped, upper lip hooded, 5–8 mm long, apex acute, blue with white patches, pubescent. Stamens 4, didynamous, inserted; filaments slender, 2–3 mm long, white, glabrous; anther bilobed, elliptic, minute, white, glabrous. Style slender, bifid, 4–5 mm long, white, glabrous. Stigma bilobed, white, glabrous.

Distribution: Himalaya to Temperate East Asia (POWO, 2022)

Habitat: Evergreen forests

Flowering and fruiting: June–December

Specimen examined: India, Kerala, Idukki, Periyar Tiger Reserve, 11/06/2018, Divya K. Venugopal 151699 (CALI).

***Teucrium* L.**

Sp. Pl.: 562.1753.

Teucrium wightii Hook.f., Fl. Brit. India 4: 701.1885. *Teucrium tomentosum* Wight, Icon. Pl. Ind. Orient.: t. 1458.1849, *nom. illeg.*; Gamble, Fl. Madras 2: 1158. 1921. Sasidh., Fl. Periyar Tiger Reserve 326. 1998; Sasidh., Fl. Chinnar WLS 254. 1999.

Shrub. Stem quadrangular, green, tomentose. Leaves simple, opposite, ovate, 8–10 × 5–6 cm, apex acute, base round, margins crenate, green, pubescent, petiolate. Flowers in terminal racemes. Peduncle quadrangular, 2–6 cm long, green, tomentose. Pedicel quadrangular, 1–3 mm long, green, tomentose. Bracts lanceolate, minute, apex acute, green, pubescent. Calyx lobes 5, bilipped, 4–6 mm long, green, pubescent. Corolla tube 3–6 mm long, yellowish white, glabrous; lobes 3, 4–7 mm long, apex obtuse, yellowish white, glabrous. Stamens 4, didynamous; filaments slender, 3–4 mm long, white, glabrous; anthers reniform, bilobed, 2 mm long, white, glabrous. Style bilobed, 5–8 mm long, white, glabrous. Stigma minute, white, glabrous.

Distribution: South India, China to North Sumatera (POWO, 2022)

Habitat: Moist deciduous forests

Flowering and fruiting: July–December

Specimens examined: India, Kerala, Idukki, Mathikettan Shola National Park, 29/12/2014, S. Syam Radh 137893 (CALI); Periyar Tiger Reserve, 10/11/1994, Jomy Augustine 14218 (CALI); Mankulam, 15/08/2018, Divya K. Venugopal 164258 (CALI).

PLANTAGINACEAE Juss.

Gen. Pl. [Jussieu] 89.1789, *nom. cons.*

Annual to perennial scapigerous herbs or shrubs. Leaves entire or divided, alternate or opposite with a basal sheath, exstipulate, with parallel venation. Flowers small, wind pollinated, in axillary spikes, rarely solitary, tetramerous, regular. Anthers versatile, dehiscent inwards. Ovary superior. Style solitary and stigma simple. Fruit is a capsule, non-fleshy. Seeds black or brown, oblong, wings absent (in *Plantago*).

The family plantaginaceae is also known as speedwell family due to the presence of leaves which lie flat on the ground in some plants. According to POWO, 2022; family is highly heteromorphic group and have cosmopolitan distribution, mostly seen in temperate regions and are wind or insect pollinated. *Plantago lanceolata* is usually considered as a weed.

Family include 105 accepted genera and genus *Plantago* consists of 241 accepted species (POWO, 2022).

Plantago L.

Sp. Pl.: 112. 1753.

Key to species

1a. Leaves ovate; spike not cylindrical; capsules oblong, purple*P. erosa*

1b. Leaves linear–elliptic; spike cylindrical;

capsules narrowly ovoid, brown*P. lanceolata*

Plantago erosa Wall. in Roxb., Fl. Ind. 1: 423. 1820; Sasidh., Fl. Periyar Tiger Reserve 326. 1998; Sasidh., Fl. Chinnar WLS 255. 1999. *Plantago asiatica* L., Sp. Pl.: 113. 1753; Gamble, Fl. Madras 2: 1160. 1921. *Plantago major* L., Sp. Pl.: 112. 1753; Hook.f., Fl. Brit. India 3: 457. 1882.

Figure 29 F.

Annual herb, up to 50 cm high. Stem absent. Leaves radical, ovate, 7 × 5 cm, apex obtuse, base cuneate, margins entire, green, glabrous. Petiole winged, 5–6 cm long, sheathing at base, green, villous. Flowers in elongated axillary dense spikes, greenish, not cylindric. Peduncle 10 × 5 cm, green, glabrous. Bracts ovate, 4 × 1 mm, green, glabrous. Calyx tube 2.5 × 2 mm, lobes 4, ovate, minutely lobed, apex acute, green, glabrous. Corolla tube 1 × 2 mm, greenish white, glabrous; lobes salver-shaped, 2.5 × 2 mm, shortly lobed at apex, greenish white, glabrous. Stamens 4; filaments 4 × 0.1 cm, slender, white, glabrous; anthers bilobed, 2 × 1 mm, exserted, white, glabrous,

versatile. Style linear, 3×0.1 cm, white, glabrous. Stigma linear, 3×1 mm, white, glabrous. Capsule oblong, 6×3 mm, circumscissile, purple, glabrous.

Distribution: Indian subcontinent to China (POWO, 2022)

Habitat: Grasslands

Flowering and fruiting: April-June

Specimens examined: India, Kerala, Idukki, Mankulam, 10/06/2018, Divya K. Venugopal 159310 (CALI); Periyar Tiger Reserve, 31/12/1993, Jomy Augustine 12987 (CALI); Chinnar, 18/02/1998, Bindhu K.B. 62093 (CALI); Mathikettan shola National Park, 23/08/2014, S. Syam Radh 143529 (CALI); Vattavada, 29/03/1978, Nambiar 00251 (KFRI).

Plantago lanceolata L., Sp. Pl. 113. 1753; Hook.f., Fl. Brit. India 3: 457. 1882; Gamble, Fl. Madras 2: 1160.1921.

Perennial herb, up to 60 cm high. Stem absent. Leaves basal, linear – elliptic, $12\text{--}15 \times 4\text{--}5$ cm, apex acute, base cuneate, margins entire, green, glabrous. Petiole very slender, not winged, $4\text{--}8 \times 1\text{--}2$ cm, green, glabrous. Flowers dense, in elongated axillary spikes, white, cylindrical. Peduncle $10\text{--}50 \times 3\text{--}5$ cm, green, pubescent. Bracts ovate to elliptic, $3.5\text{--}5 \times 3\text{--}4$ mm, green, densely hirsute. Calyx tube minute, green, pubescent; lobes 4, broadly obovate, $2\text{--}3.5 \times 2\text{--}3$ mm, apex acute, abaxially hirsute, adaxially glabrous, margins with trichomes. Corolla tube $1\text{--}2 \times 2$ mm, white, glabrous; lobes ovate-lanceolate, $1.5\text{--}3 \times 1\text{--}2$ mm, apex shortly acuminate, white, glabrous. Stamens 4; filaments 2×0.1 cm, yellowish white, glabrous; anthers bilobed, ellipsoid, $2\text{--}3 \times 1\text{--}2$ mm, exserted, yellowish, glabrous. Style slender, 2×0.1 cm, white, glabrous. Stigma capitate, 1×1 mm, hyaline, glabrous. Capsule narrowly ovoid, $3\text{--}4 \times 2\text{--}3$ mm, brown, glabrous.

Distribution: Macaronesia, North Africa to Mauritania, Temperate Eurasia (POWO, 2022)

Habitat: Grasslands and roadsides in the high ranges

Flowering and fruiting: May-August

Specimen examined: India, Kerala, Idukki, Anakkara, 26/06/2017, Divya K. Venugopal 153116 (CALI).

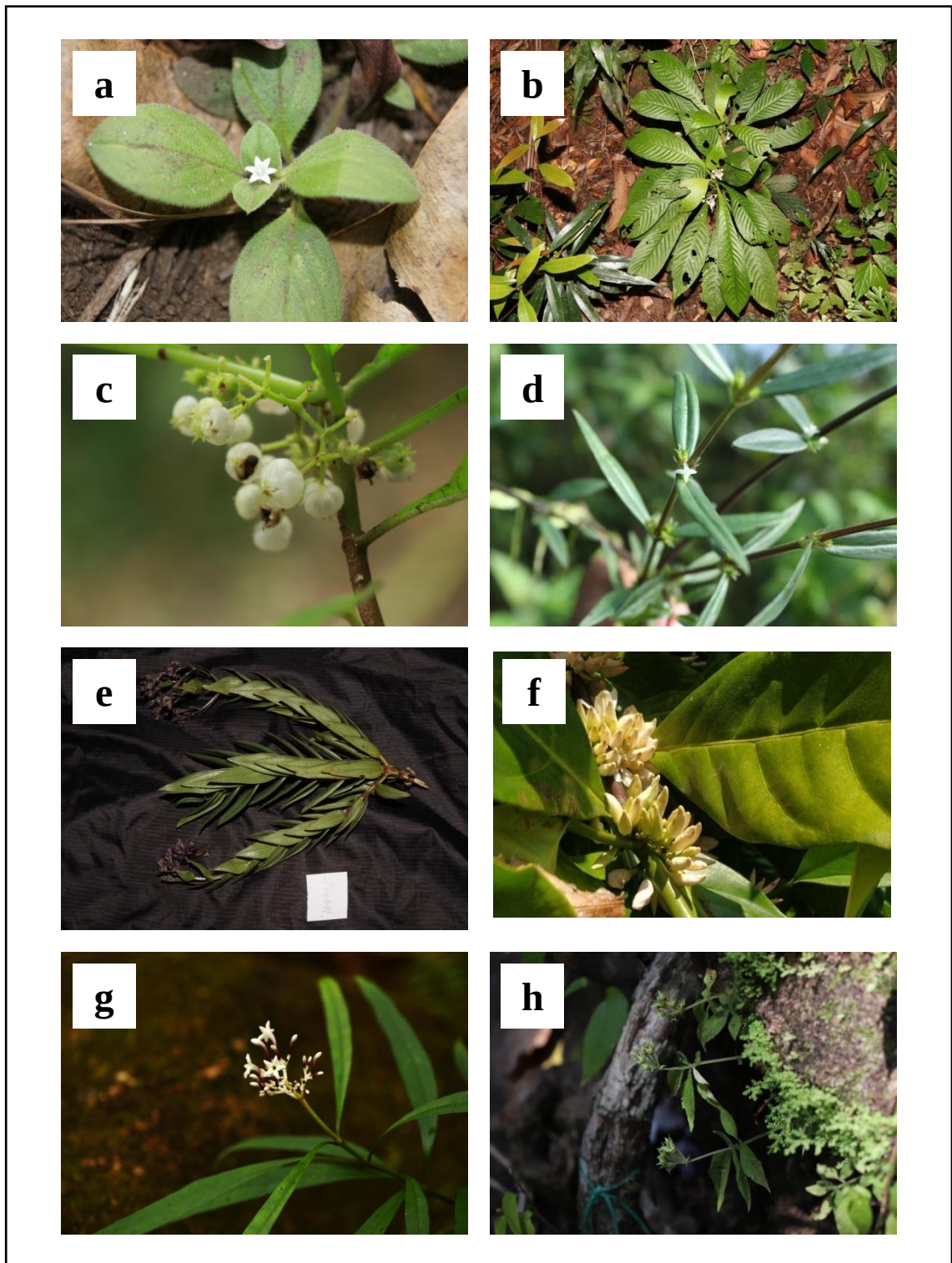


Figure 11: **a.** *Richardia scabra*; **b.** *Neurocalyx calycinus*; **c.** *Mycetia acuminata*; **d.** *Hedyotis neesiana*; **e.** *Hedyotis articularis*; **f.** *coffea arabica*; **g.** *Chassalia curviflora*; **h.** *Argostemma courtallense*

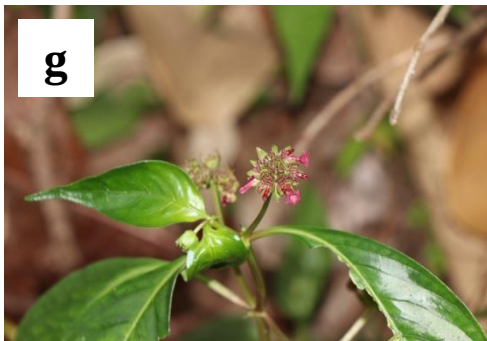


Figure 12: **a.** *Ixora brachiata*; **b.** *Ixora elongata*; **c.** *Ixora johnsonii*; **d.** *Ophiorrhiza mungos*; **e.** *Mussaenda tomentosa*; **f.** *Hamelia patens*; **g.** *Ophiorrhiza pectinata*; **h.** *Mitracarpus verticillatus*

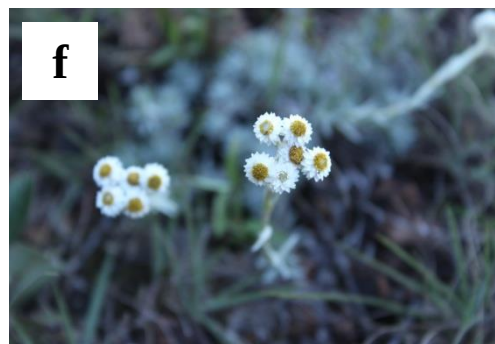


Figure 13: **a.** *Neolamarckia cadamba*; **b.** *Valeriana hardwickei*; **c.** *Adenoon indicum*; **d.** *Ageratina adenophora*; **e.** *Anaphalis neelgerryana*; **f.** *Anaphalis bournei*; **g.** *Anaphalis meeboldii*; **h.** *Anaphalis elliptica*

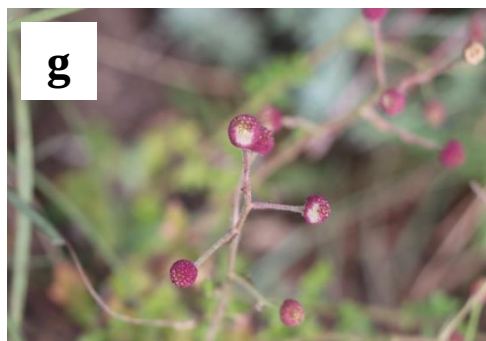
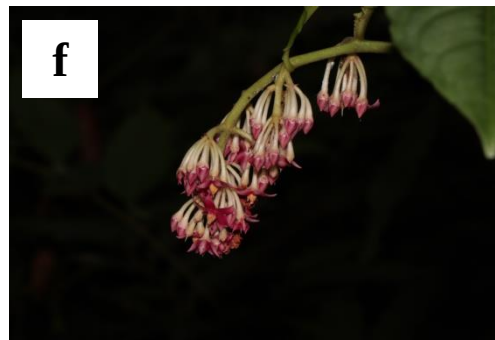


Figure 14: **a.** *Cissampelopsis corymbosa*; **b.** *Erigeron karvinskianus*; **c.** *Crassocephalum crepidioides*; **d.** *Emilia javanica*; **e.** *Anaphalis wightiana*; **f.** *Ardisia pauciflora*; **g.** *Centipeda minima*; **h.** *Anaphalis subdecurrens*



Figure 15: **a.** *Vernonia travancorica*; **b.** *Vernonia anamallica*; **c.** *Helichrysum buddlejoides*; **d.** *Helichrysum bracteatum*; **e.** *Gynura travancorica*; **f.** *Gynura nitida*; **g.** *Blumea hieraciifolia* var. *flexuosa*; **h.** *Bidens pilosa*

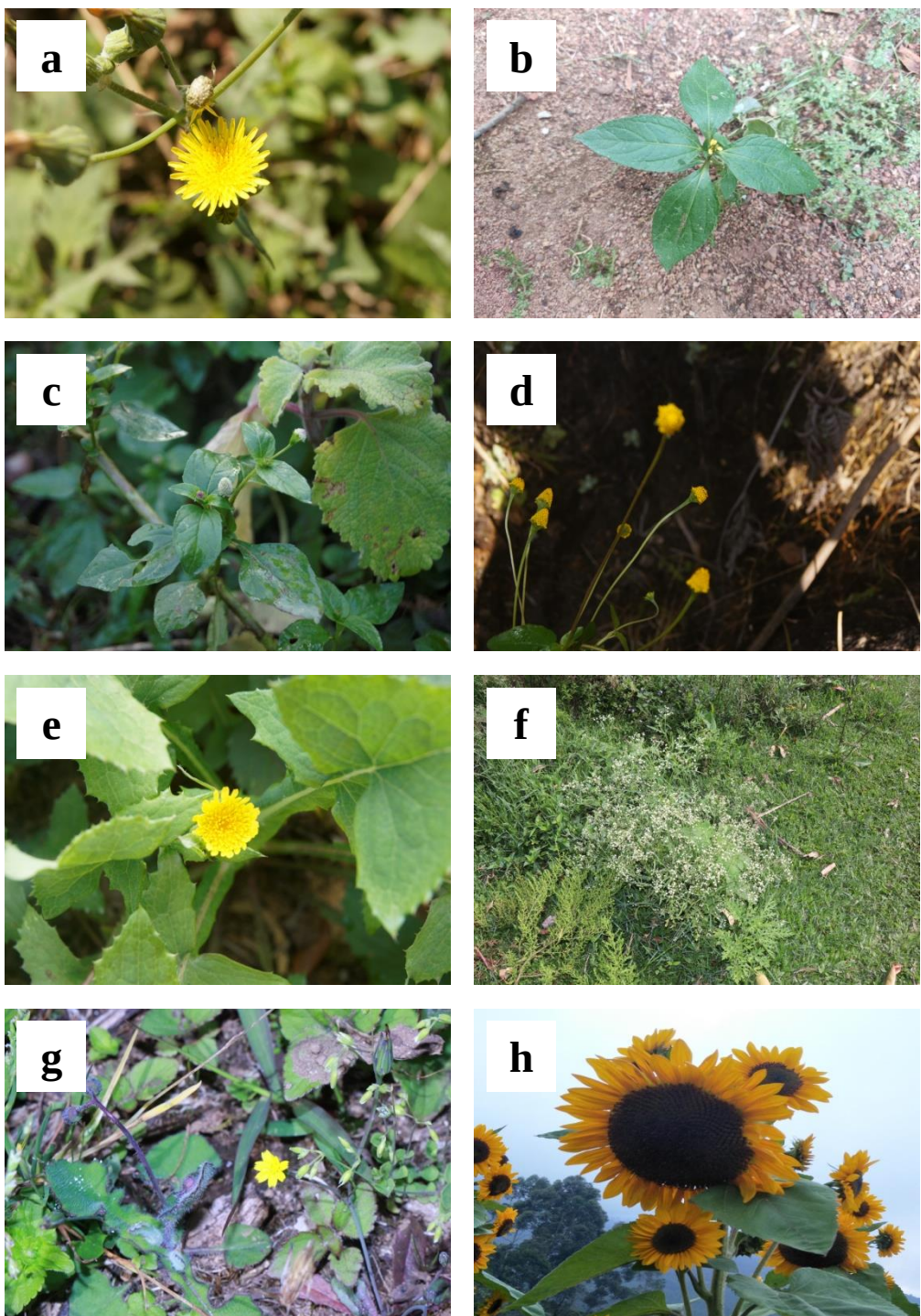


Figure 16: **a.** *Taraxacum officinale*; **b.** *Synedrella nodiflora*; **c.** *Spilanthes radicans*; **d.** *Spilanthes ciliata*; **e.** *Sonchus wightianus*; **f.** *Parthenium hysterophorus*; **g.** *Launaea acaulis*; **h.** *Helianthus annuus*

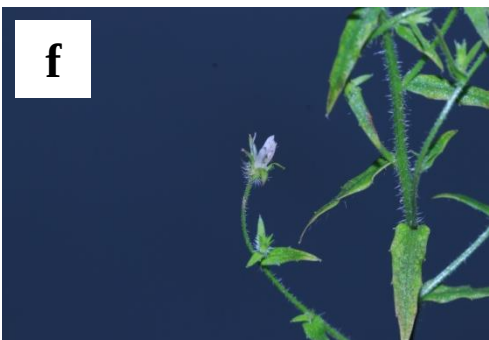


Figure 17: **a.** *Tithonia diversifolia*; **b.** *Mikania cordata*; **c.** *Tridax procumbens*; **d.** *Lobelia nicotianifolia*; **e.** *Wahlenbergia marginata*; **f.** *Wahlenbergia erecta*; **g.** *Campanula alphonсии*; **h.** *Asyneuma cupulare*

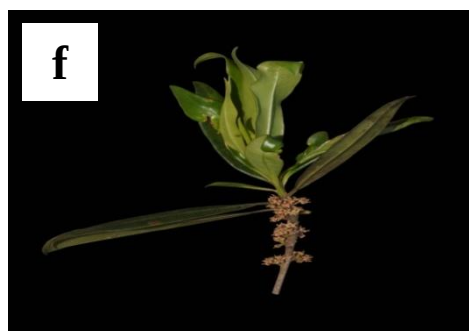
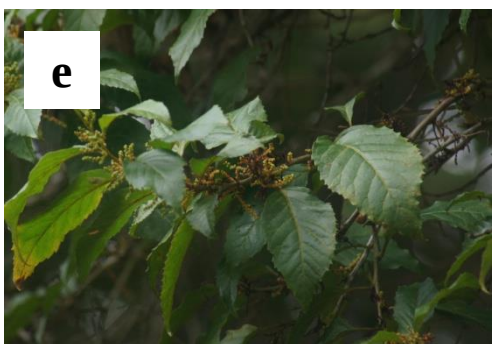
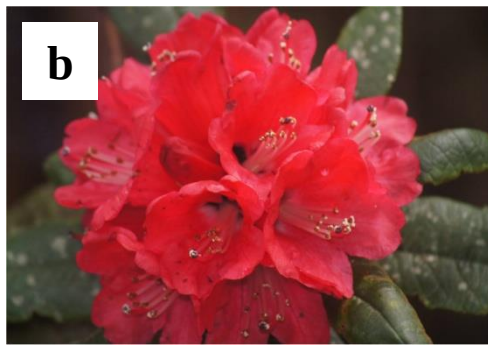


Figure 18: **a.** *Vaccinium symplocifolium*; **b.** *Rhododendron nilagiricum*; **c.** *Plumbago zeylanica*; **d.** *Embelia adnata*; **e.** *Maesa indica*; **f.** *Myrsine thwaitesii*; **g.** *Symplocos racemosa*; **h.** *Jasminum flexile*

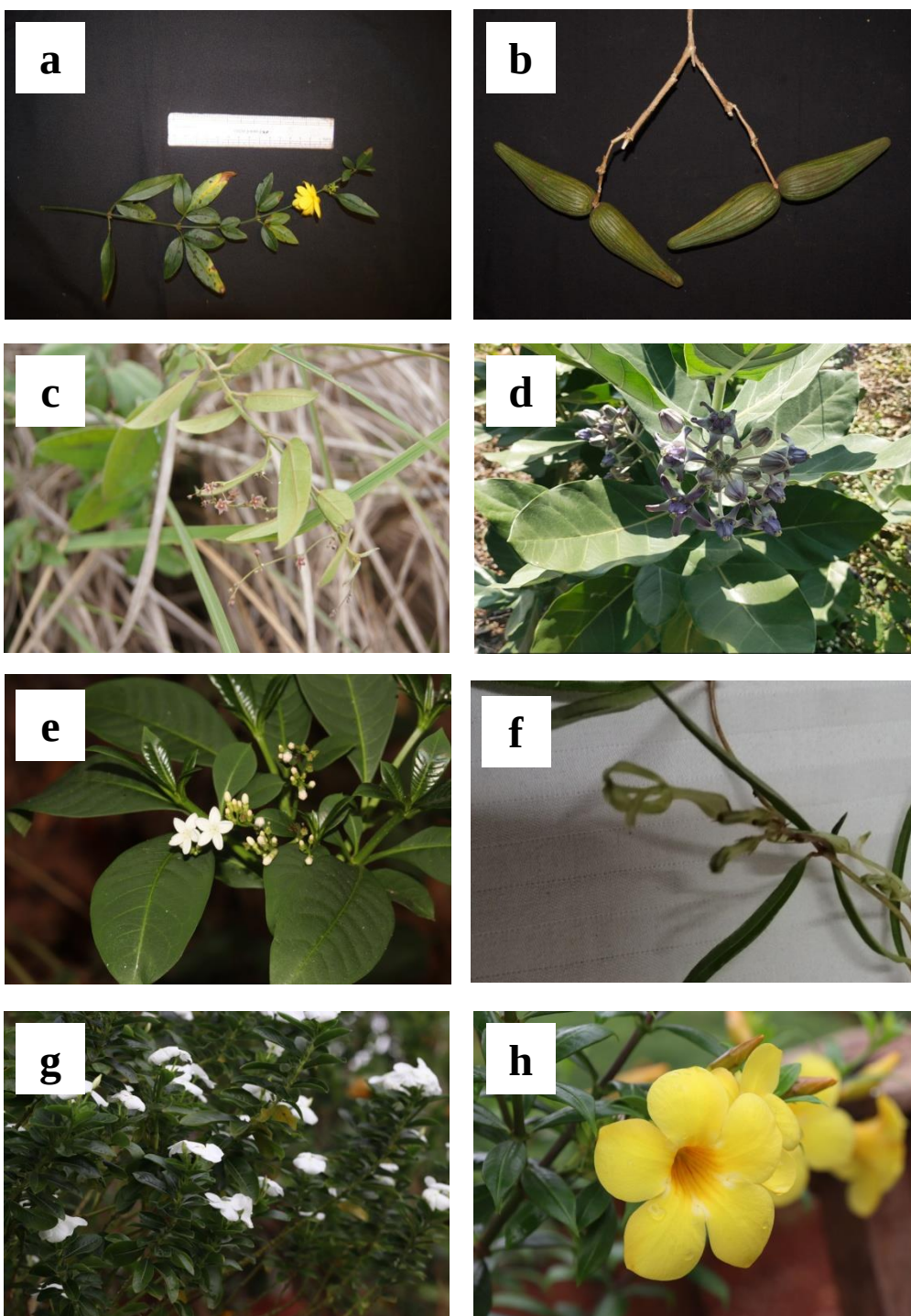


Figure 19: **a.** *Jasminum mesnyi*; **b.** *Wattakaka volubilis*; **c.** *Vincetoxicum capparidifolium*; **d.** *Calotropis gigantea*; **e.** *Rauwolfia verticillata*; **f.** *Ceropegia ensifolia*; **g.** *Catharanthus roseus*; **h.** *Allamanda cathartica*

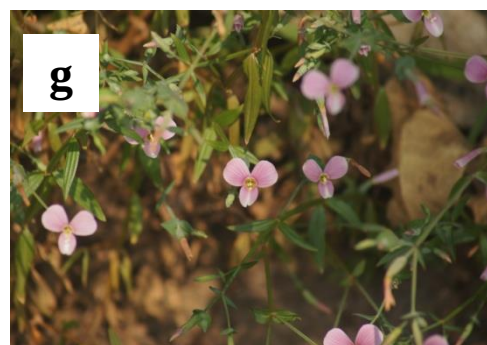
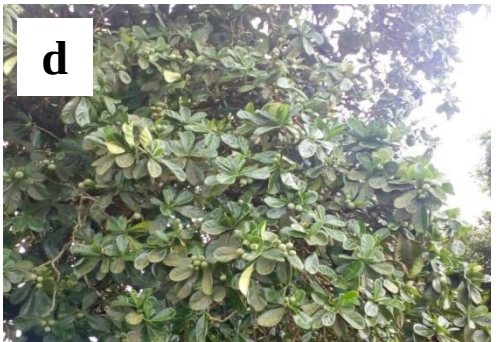


Figure 20: **a.** *Asclepias physocarpa*; **b.** *Asclepias curassavica*; **c.** *Fagraea ceilanica*; **d.** *Fagraea coromandelina*; **e.** *Exacum wightianum*; **f.** *Exacum lawii*; **g.** *Canscora diffusa*; **h.** *Swertia beddomei*

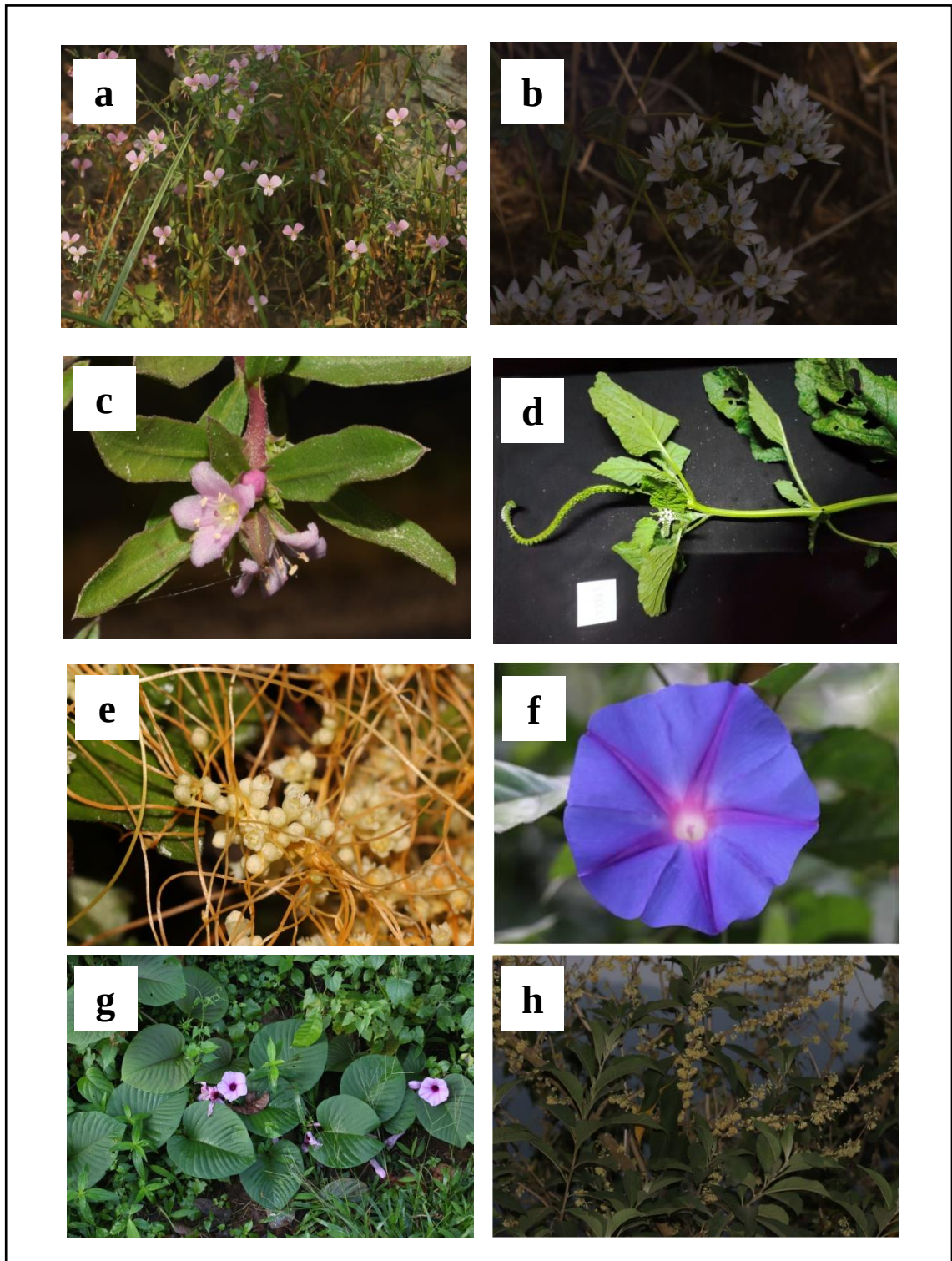


Figure 21: **a.** *Canscora roxburghii*; **b.** *Swertia corymbosa*; **c.** *Rotula aquatica*; **d.** *Heliotropium indicum*; **e.** *Cuscuta chinensis*; **f.** *Ipomoea indica*; **g.** *Argyreia hirsuta*; **h.** *Ioichroma arborescens*

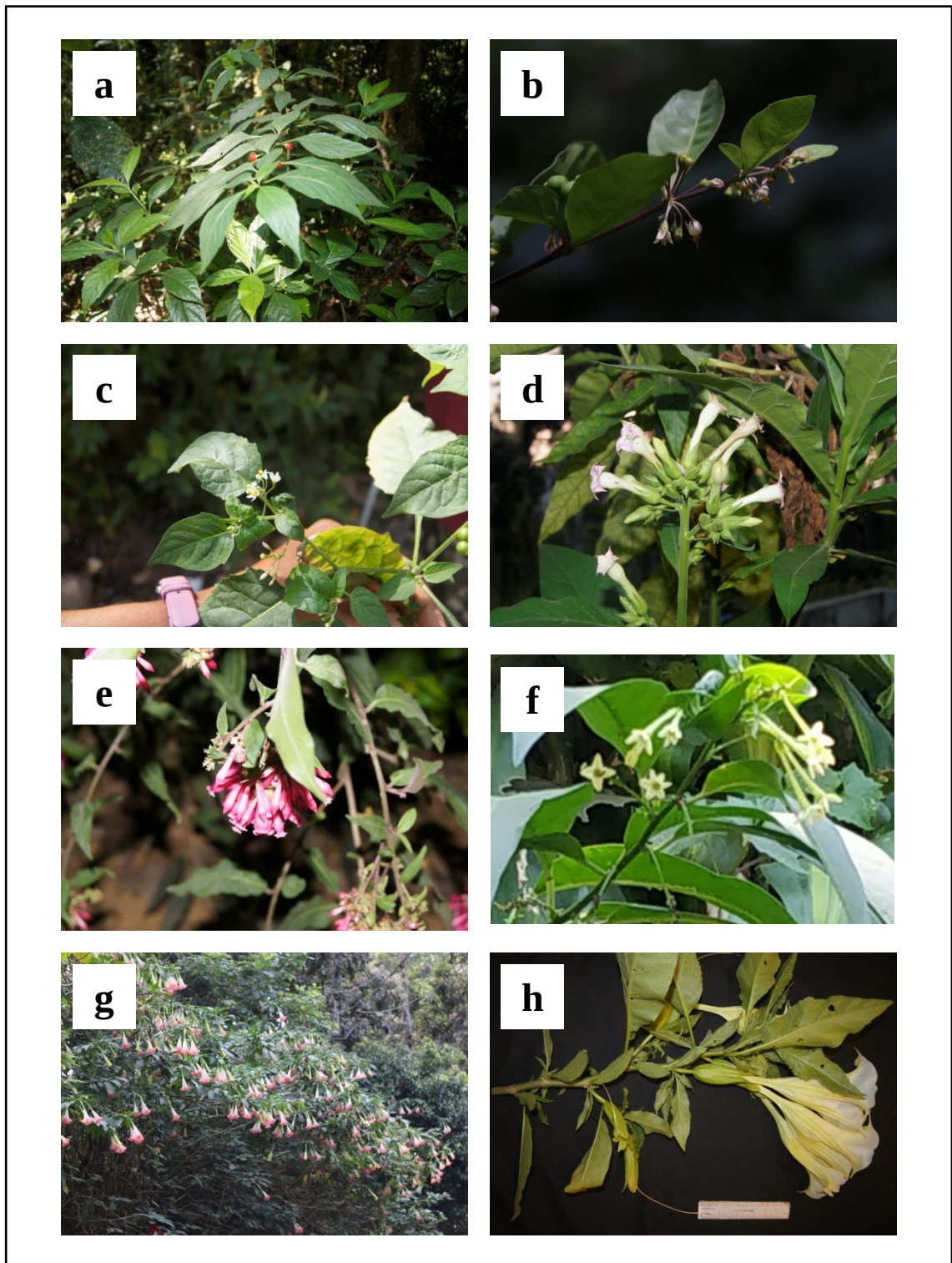


Figure 22: **a.** *Solanum laeve*; **b.** *Solanum diphyllum*; **c.** *Solanum americanum*; **d.** *Nicotiana tabacum*; **e.** *Cestrum elegans*; **f.** *Cestrum aurantiacum*; **g.** *Brugmansia suaveolens*; **h.** *Brugmansia arborea*

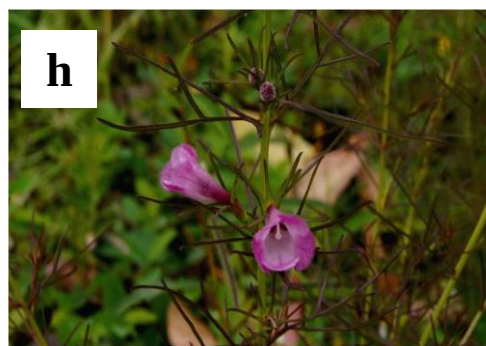
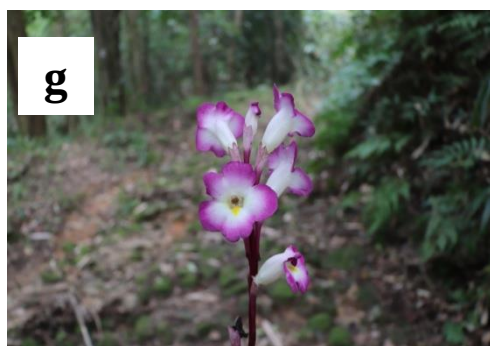
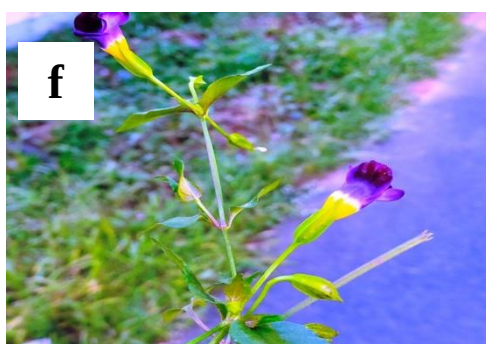
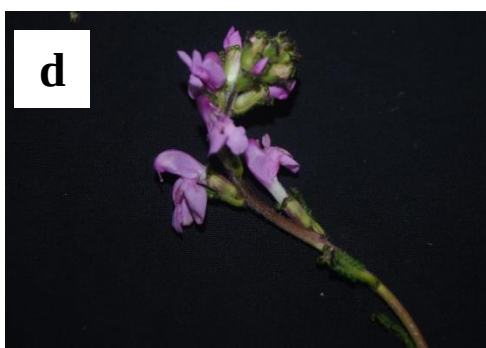
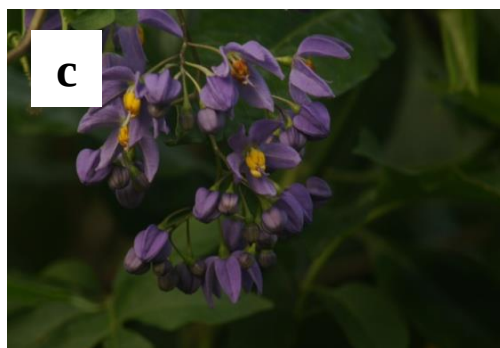
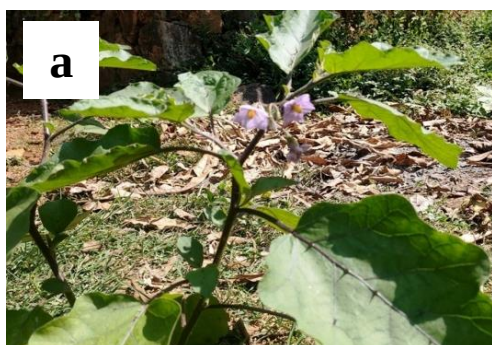


Figure 23: **a.** *Solanum aculeatissimum*; **b.** *Solanum torvum*; **c.** *Solanum seaforthianum*; **d.** *Pedicularis zeylanica*; **e.** *Striga asiatica*; **f.** *Torenia bicolor*; **g.** *Christisonia tubulosa*; **h.** *Parasopubia raghavendrae*

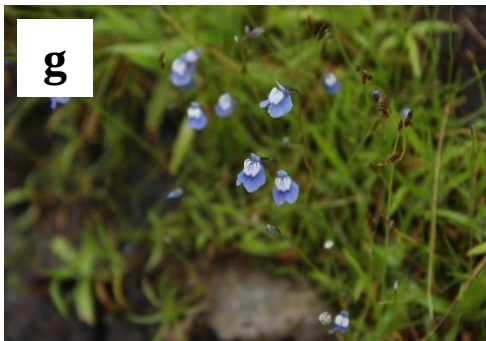
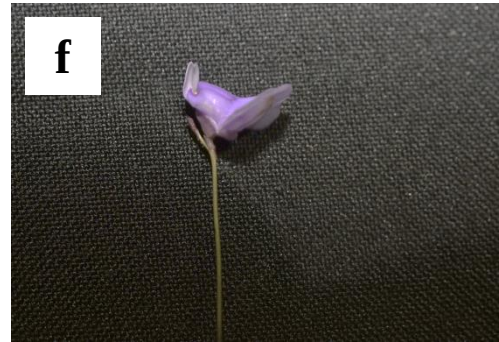
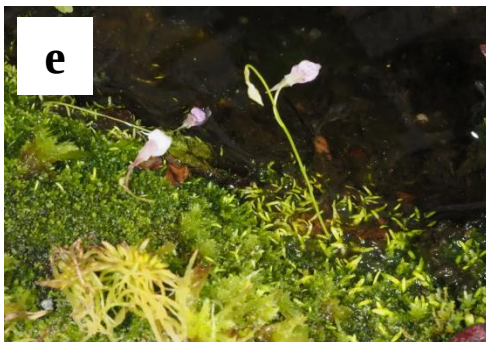
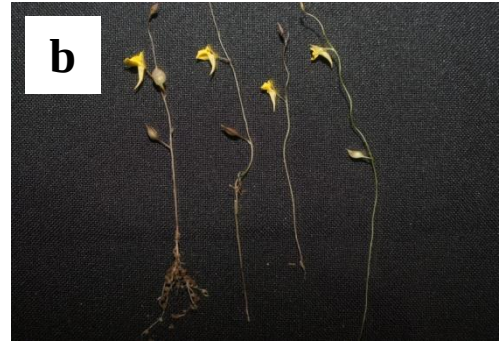
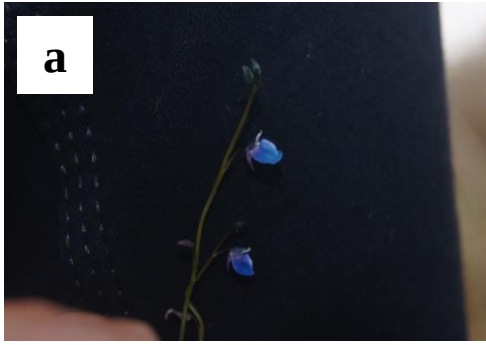


Figure 24: **a.** *Utricularia uliginosa*; **b.** *Utricularia scandens*; **c.** *Utricularia striatula*; **d.** *Utricularia reticulata*; **e.** *Utricularia graminifolia*; **f.** *Utricularia caerulea*; **g.** *Utricularia lazulina*; **h.** *Utricularia nayarii*

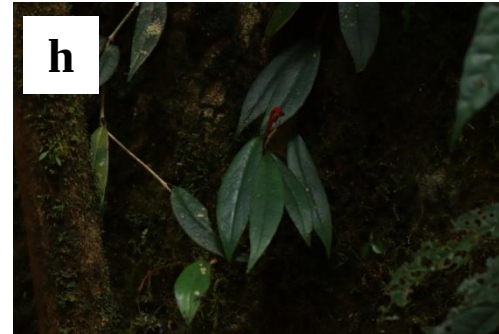
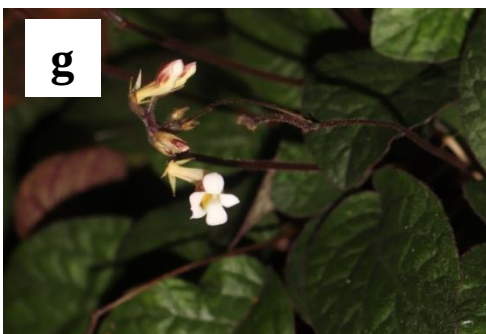


Figure 25: **a.** *Justicia japonica*; **b.** *Rhynchoglossum notonianum*; **c.** *Gentiana quadrifaria*; **d.** *Epithema ceylanicum*; **e.** *Henckelia macrostachya*; **f.** *Rhynchotechum permolle*; **g.** *Jerdonia indica*; **h.** *Aeschynanthus perrottetii*

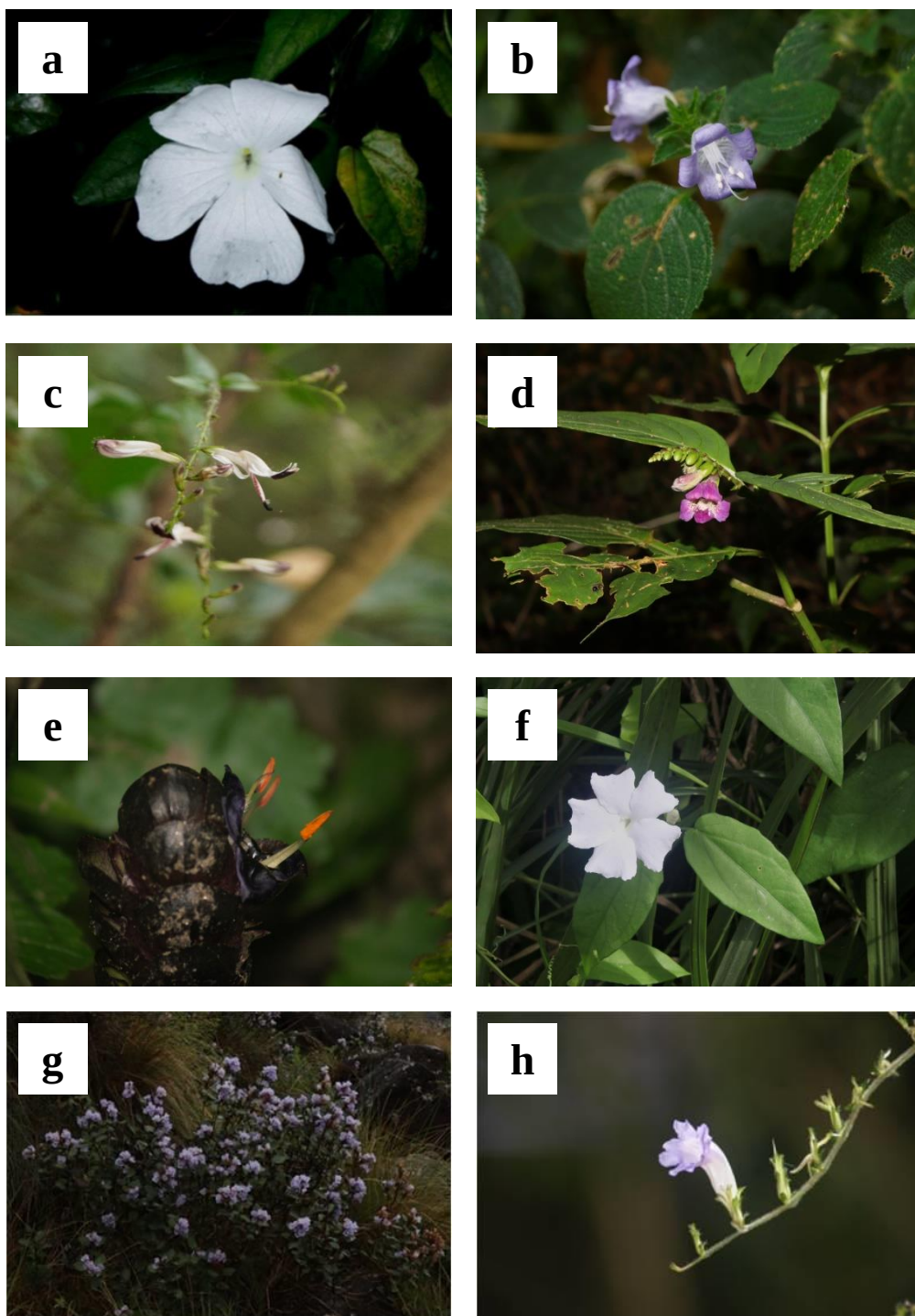


Figure 26: **a.** *Thunbergia tomentosa*; **b.** *Strobilanthes pulneyensis*; **c.** *Andrographis atropurpurea*; **d.** *Asystasia crispata*; **e.** *Strobilanthes lurida*; **f.** *Thunbergia fragrans*; **g.** *Strobilanthes kunthiana*; **h.** *Strobilanthes gracilis*

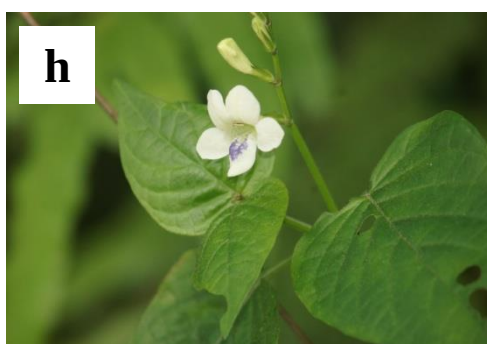
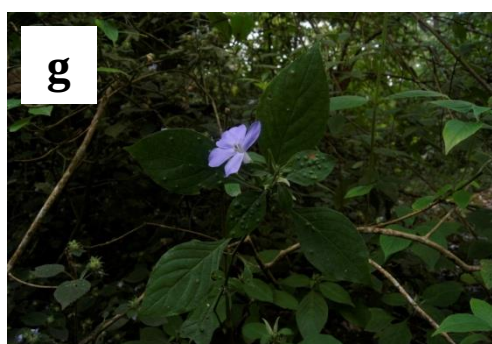
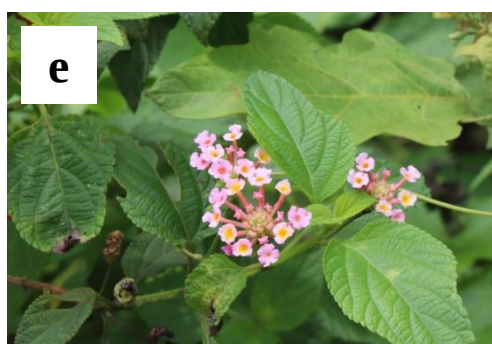
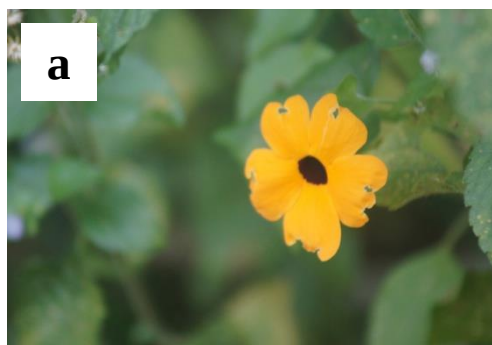


Figure 27: **a.** *Thunbergia alata*; **b.** *Strobilanthes perrottetiana*; **c.** *Stachytarpheta jamaicensis*; **d.** *Lantana indica*; **e.** *Lantana camara*; **f.** *Justicia adhatoda*; **g.** *Barleria involucrata*; **h.** *Asystasia chelonoides*

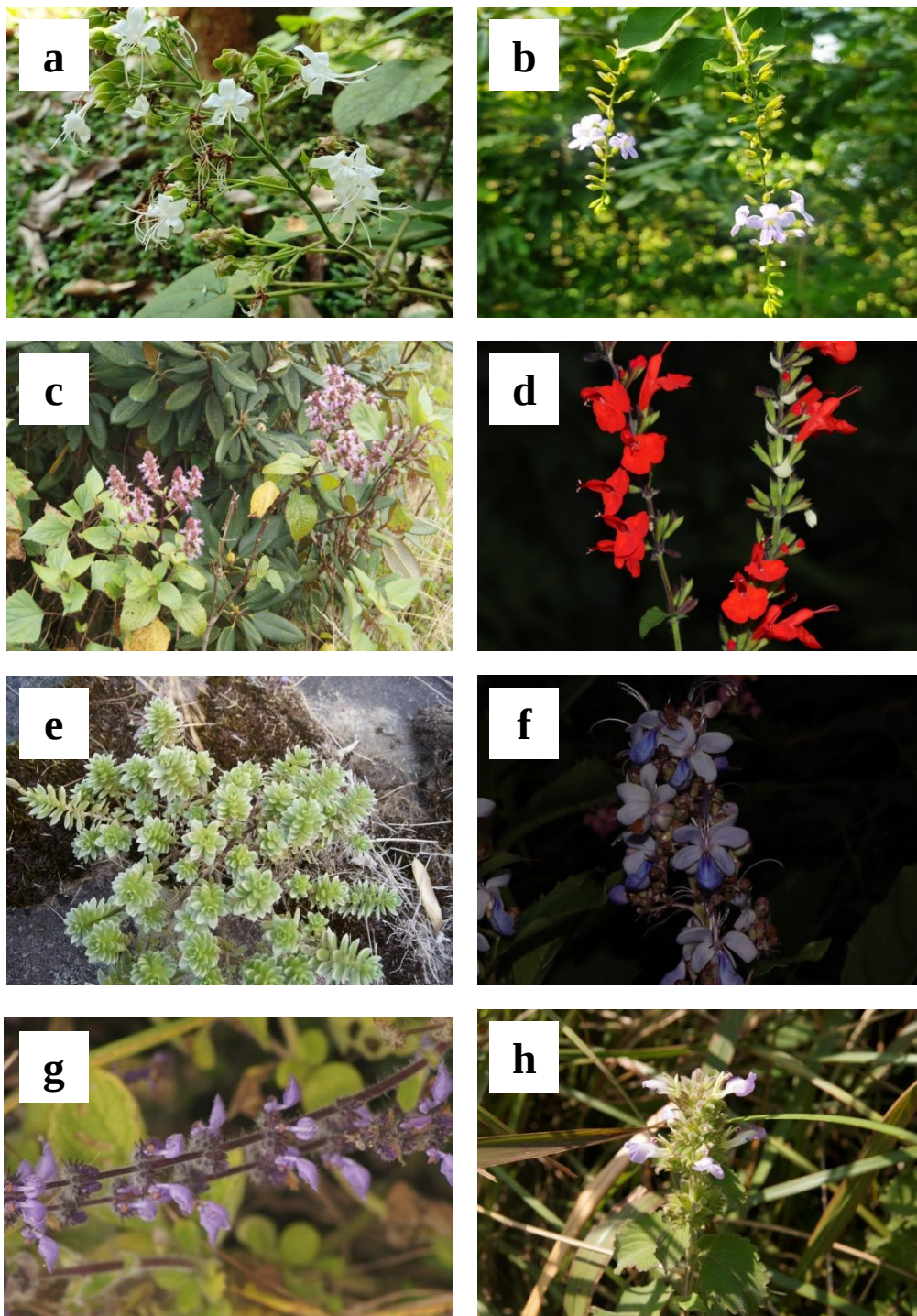


Figure 28: **a.** *Clerodendrum infortunatum*; **b.** *Duranta erecta*; **c.** *Pogostemon benghalensis*; **d.** *Salvia coccinea*; **e.** *Coleus argenteus*; **f.** *Rotheca serrata*; **g.** *Plectranthus barbatus*; **h.** *Anisomeles indica*

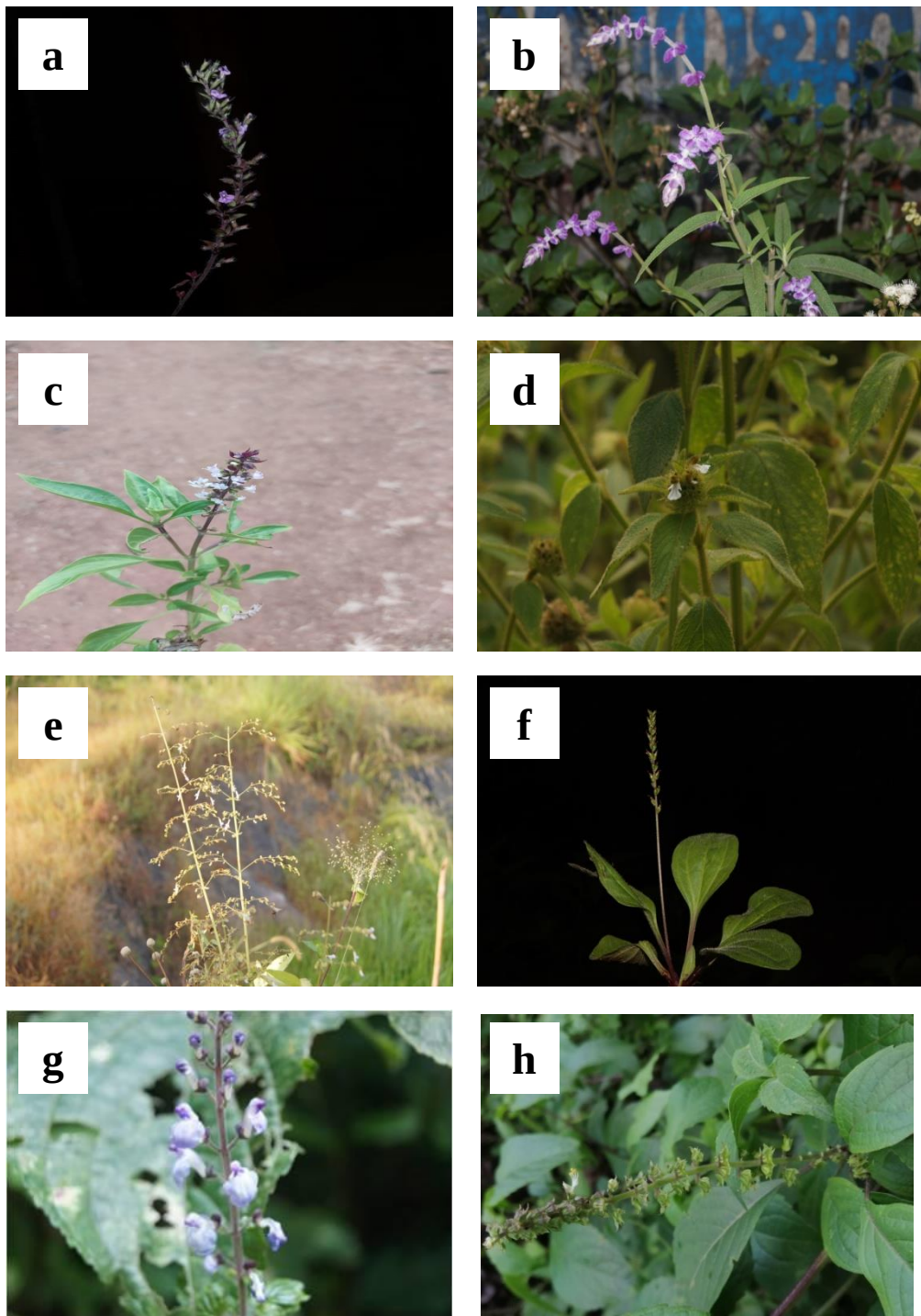


Figure 29: **a.** *Micromeria imbricata*; **b.** *Salvia leucantha*; **c.** *Ocimum sanctum*; **d.** *Leucas ciliata*; **e.** *Isodon lophanthoides*; **f.** *Plantago erosa*; **g.** *Scutellaria wightiana*; **h.** *Ocimum basilicum*

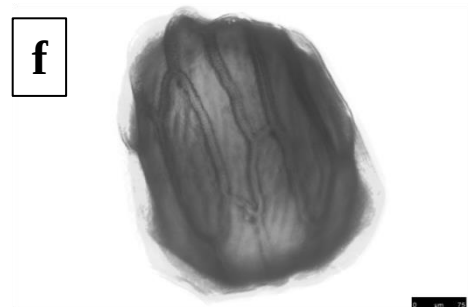
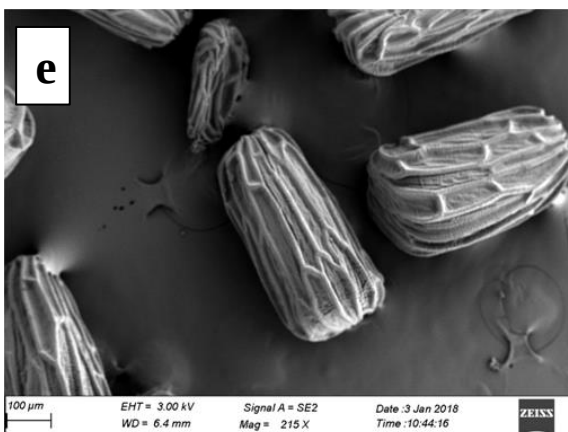
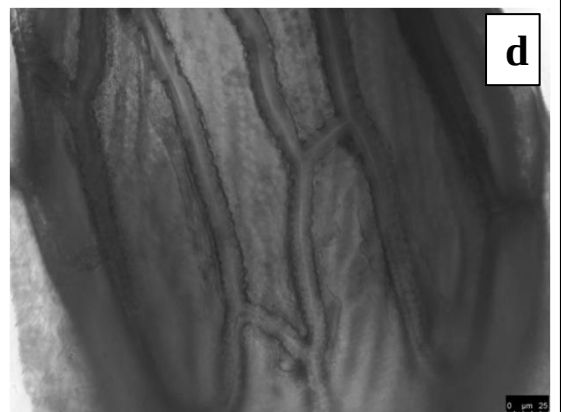
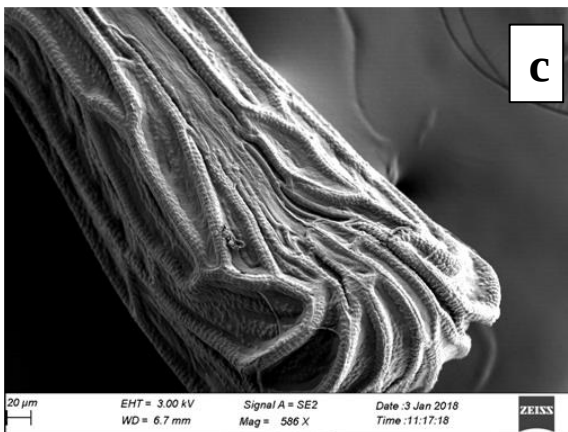
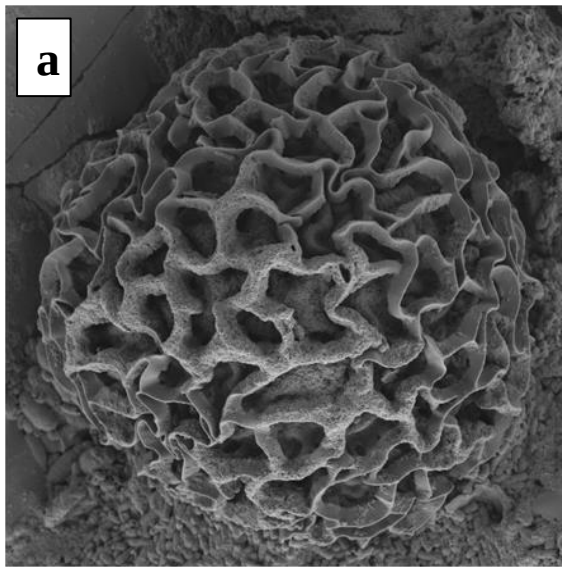
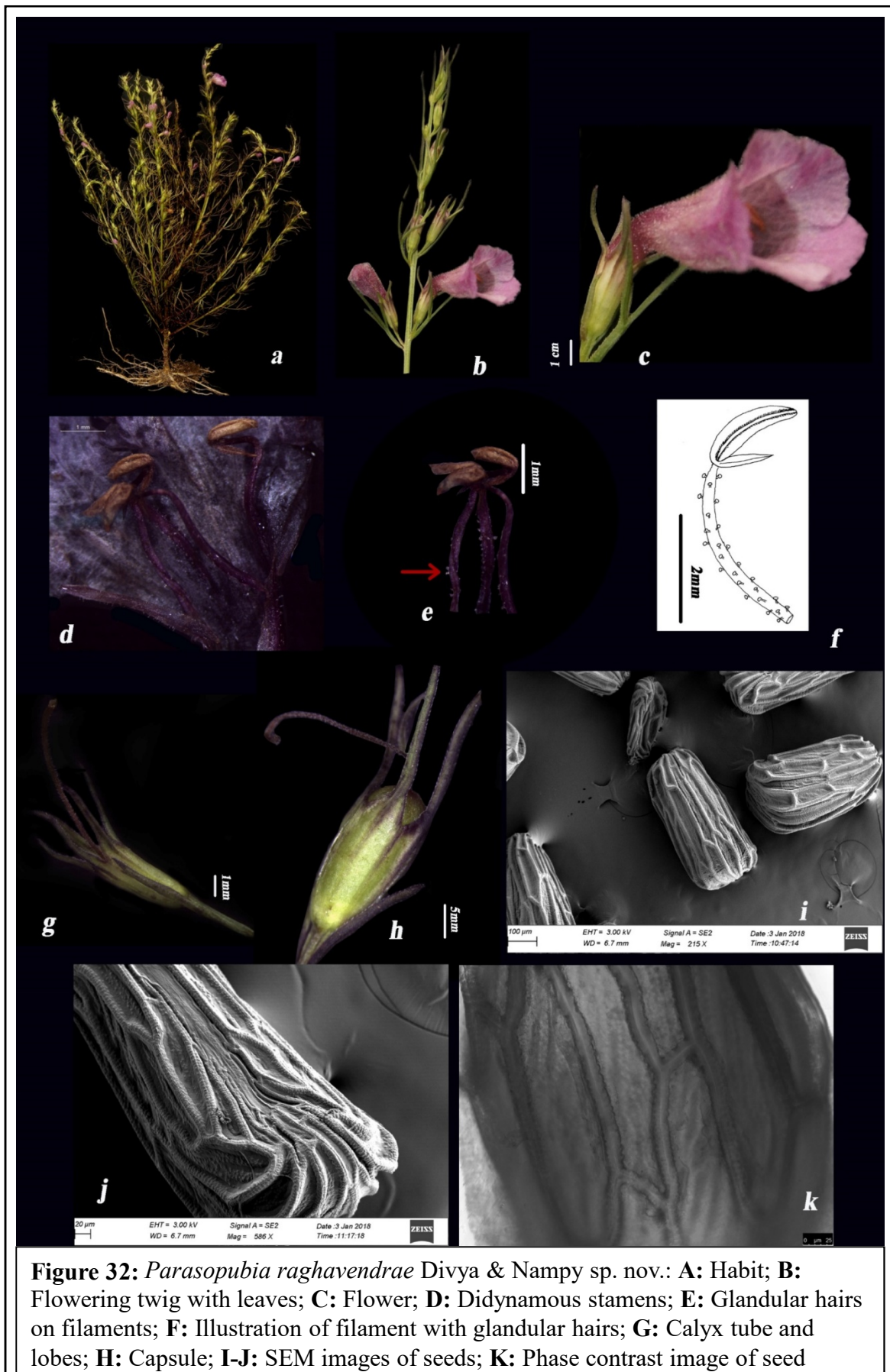


Plate 30: **a:** SEM Image of *Fagraea coromandelina* pollen; **b:** SEM Image of *Fagraea coromandelina* seed; **c & e:** SEM image of *Parasopubia raghavendrae* seed; **d & f:** Phase contrast image of *Parasopubia raghavendrae* seed



Figure 31: *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



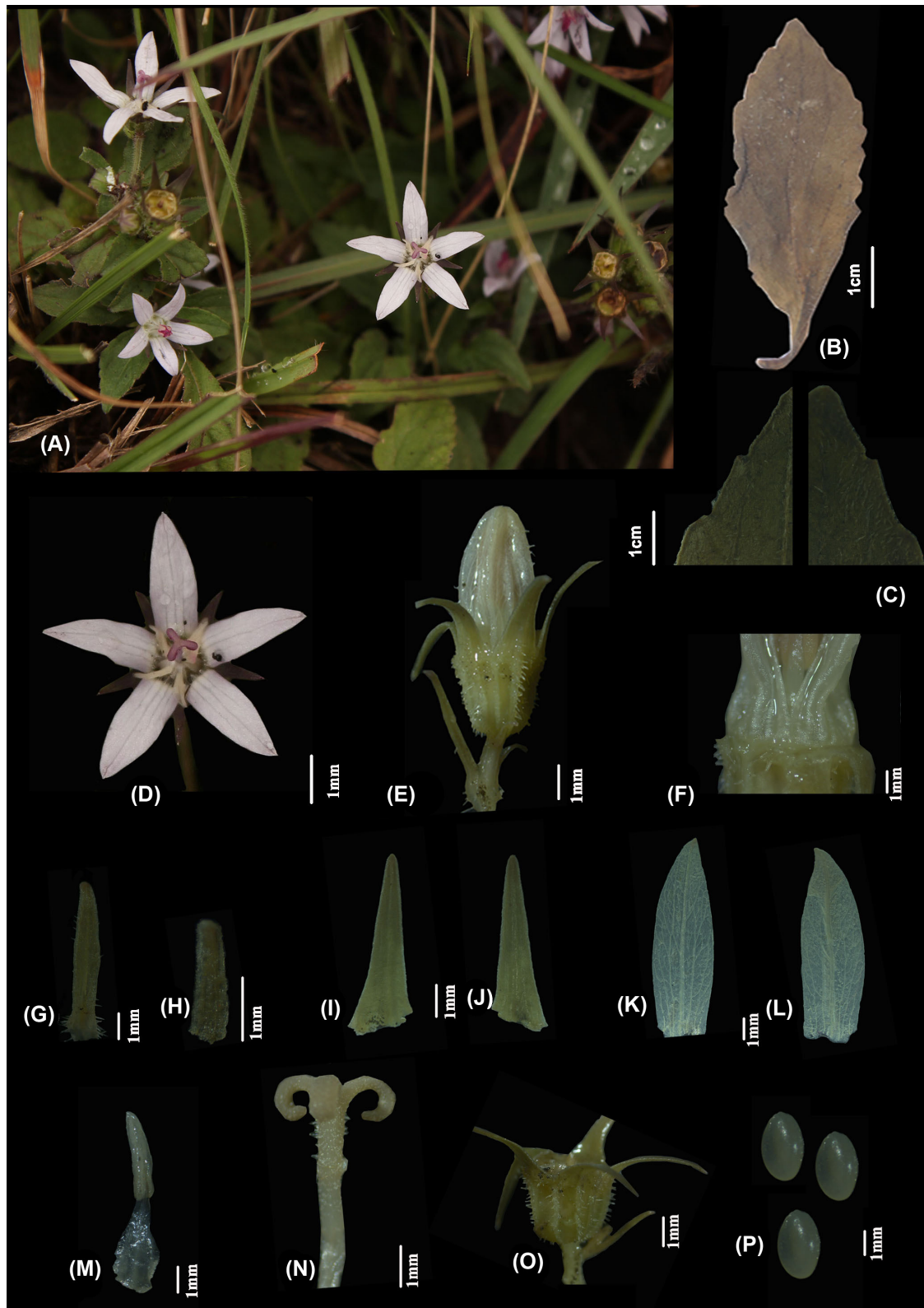


Figure 33: *Asyneuma cupulare* sp. nov. (A) Habit; (B) Leaf; (C) A portion of leaf showing pubescence; (D) Flower; (E) Flower bud; (F) Corolla lobes split up to the base; (G) Bract; (H) Bracteole; (I) Calyx lobe (adaxial view); (J) Calyx lobe (abaxial view); (K) Corolla (adaxial view); (L) Corolla (abaxial view); (M) Stamen; (N) Style and stigma; (O) Capsule; (P) Seeds

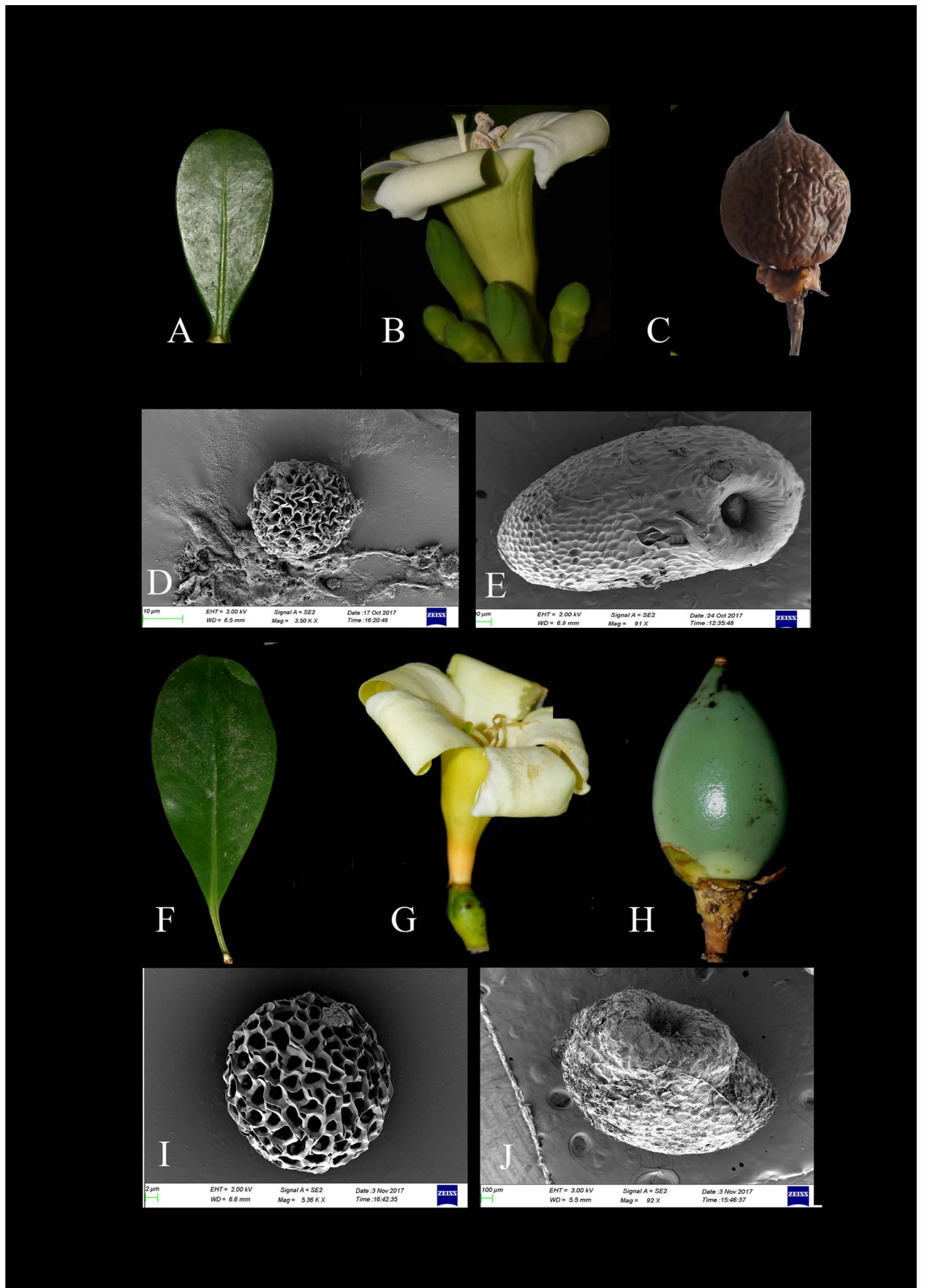


Figure 34: *Fagraea coromandelina*- A) Leaf; B) Flower; C) Fruit; D) SEM image of pollengrain; E) SEM image of seed; *Fagraea obovata* - F) Leaf; G) Flower; H) Fruit; I) SEM image of pollengrain; J) SEM image of seed

Discussion & Summary

Discussion and Summary

Field exploration and taxonomic treatment

Idukki was explored thoroughly during 2017-2021 by undertaking 60 field trips and spending more than 300 days in the field, in various seasons to collect and record gamopetalous members. Different regions of Idukki such as Mathikettan shola National Park, Mankulam, Periyar Tiger Reserve, Pambadum shola, Anamudi shola, Eravikulam, Meesapulimala, Chinnar etc were systematically and repeatedly explored for plant collection.

In the present study, the basic system of classification proposed by Bentham & Hooker has been followed. According to Bentham & Hooker's system of classification, Gamopetalae consists of 34 families starting with Rubiaceae and ends in Plantaginaceae (Table 1). Out of 34 families, plant specimens belonging to 32 families were collected from our study area. Plants belonging to the 2 families (Dipsacaceae & Goodeniaceae) were absent in the study area due to the unique topography of the study area. The recent system of classification in Taxonomy is APG system of classification. The position of some species and genera which are different in each of the classification has been tabulated (Table 2). In Bentham & Hooker system of classification, Apocynaceae and Asclepiadaceae are two separate families whereas in APG system these are included as a single family Apocynaceae. According to Endress and Bruyns (2000), Apocynaceae consist of five subfamilies (Rauvolfioideae, Apocynoideae, Periplocoideae, Secamonoideae and Asclepiadoideae). Genera such as *Ceropegia*, *Asclepias*, *Hoya*, *Vincetoxicum* and *Wattakaka* comes under Asclepiadaceae and *Rauvolfia* comes under Apocynaceae according to Bentham and Hooker's system of classification.

Specimens of 672 species coming under 355 genera were collected for scientific study, identified and herbarium has been prepared. Revised taxonomic keys for families, genera and species were prepared. Herbarium sheets were prepared and deposited in CALI according to Bentham and Hooker's system of classification.

Out of 672 species collected, 481 belonged to wild category and the remaining 191 species were under ornamental/cultivated/medicinal plants. Asteraceae family had maximum number of species (92) followed by Rubiaceae family (63 species). Figure 1 indicated 5 gamopetalous families with high species diversity distributed in Idukki district. Among the plants collected, 6 families with highest number of genera (Figure 2) and 6 genera with highest number of species were also recorded (Figure 3).

Different vegetation types and habits

Tropical evergreen forests, semi-evergreen forests, southern moist mixed deciduous forests, southern dry mixed deciduous forests, scrub jungles, southern montane wet temperate forests (sholas), southern montane wet grasslands (grasslands) are the dominant vegetation types of the study area (Sasidharan, 2000). The wild plants were classified into herbs, shrubs, trees and climbers and their number compared using pie chart (Table 3; Figure 4). A total of 215 herbs; 116 shrubs; 83 trees and 74 climbers were collected from the study area.

Endemic; ornamental and non-native species

The collected wild plants were also tabulated according to endemism (Table 4). Out of 481 wild plants collected; only 135 plants are native to India and southern Western Ghats and remaining belongs to non-native category. Among the collected wild plants, 163 plants belong to endemic category. Other than wild plants, cultivated plants presented in the study area were classified according to their purpose of farming such as ornamental, medicinal, fruits and vegetables etc. (Table 5).

Invasive plants from the study area comprised 20% of the collection. Some of them were accidentally introduced and others were introduced for ornamental purpose. These invasive plants expressed allelopathic effects to the wild plants in the vicinity which resulted in massive colonization of invasive weeds with in a very short span. *Parthenium* is one such example of colonized invasive plants accidentally introduced in the district.

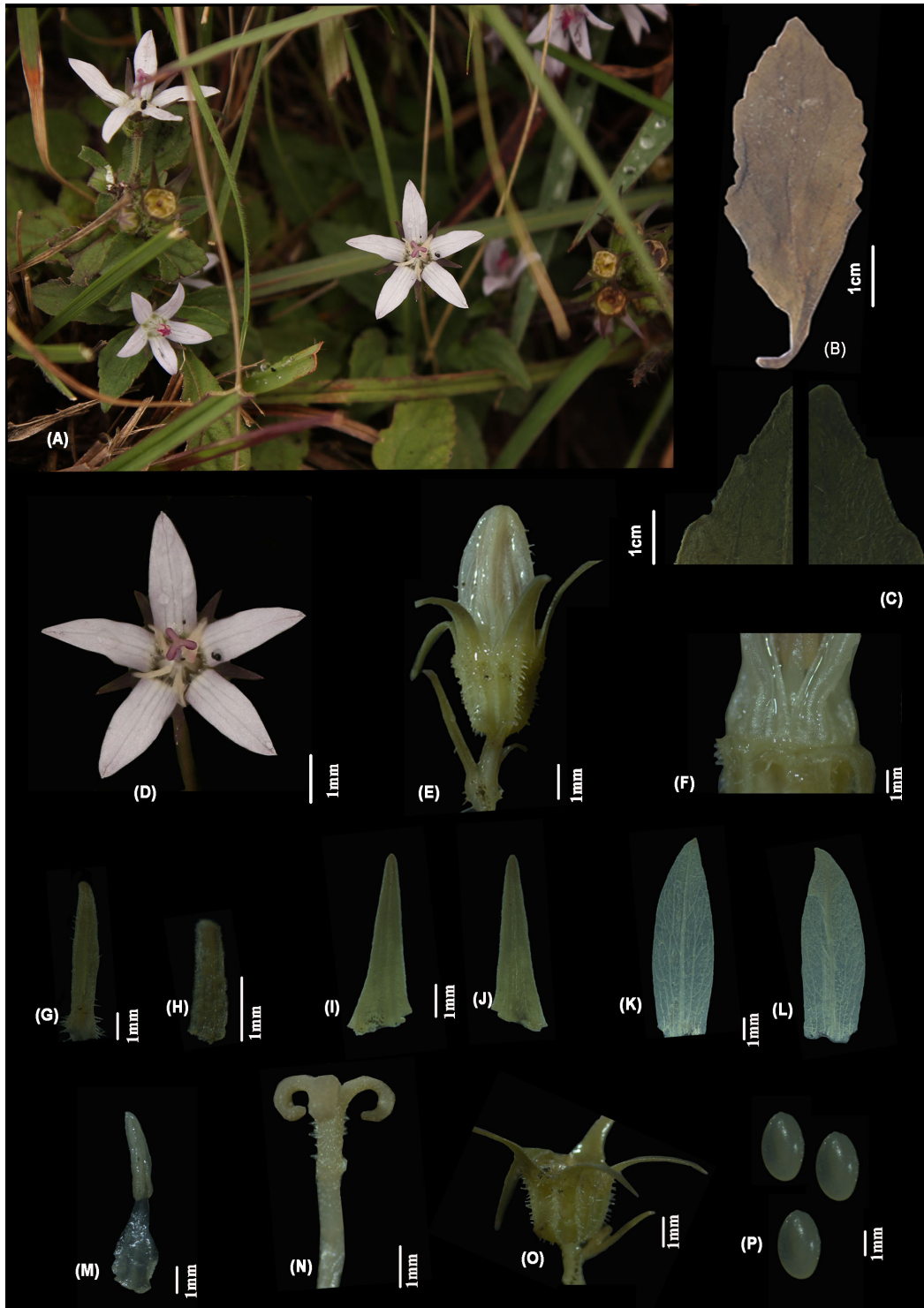
New species discovered

During the field explorations, 2 new species were discovered which were novel to science and typifications of two plants were done; one invasive plant was recorded and one plant reinstated.

➤ *Asyneuma cupulare* (Campanulaceae) has been described as a new species from the southern Western Ghats, India. This 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 (Figure 34). 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 km². The locality being a tourist destination, there is the possibility of disturbances in the future due to human activities. Hence, the species shall be regarded as Data Deficient according to IUCN Guidelines (IUCN, 2019). Lectotypification of *Asyneuma fulgens* was done (Venugopal *et al.*, 2021).

Phenology: Flowering and fruiting in October–December.

Distribution; habitat and associated species: Extremely rare; presently known only from the type locality. 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.



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

➤ *Parasopubia raghavendrae*, is another new species of Orobanchaceae 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 (Figure 33 E-K). *Parasopubia raghavendrae* is hitherto known only from the type locality Mathikettan Shola National Park in Idukki district, Kerala. We also assessed provisionally the conservation status of the new species as Critically Endangered (CR) according to IUCN Red List Categories and Criteria (Venugopal *et al.*, 2021).

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.



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.

Reinstatement & Typification

- *Asyneuma fulgens*; allied species of *Asyneuma cupulare* was lectotypified as the part of our study.
- *Iochroma arborescens* (L.) J.M.H.Shaw (Solanaceae), a potential invasive species from America, was authentically recorded for the first time in India (Figure 32). Perusal of relevant literature revealed that the name has yet to be typified and thus neotypified.
- Specimens of *Fagraea coromandelina* were collected from Mathikettan Shola National Park and Periyar Tiger Reserve. *F. coromandelina* Wight which however, has long been treated as synonym of *F. obovata* Wallich by Trimen (1895), Clarke (1885) and Gamble (1921) or *F. ceilanica* Thunberg 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 (Figure 35). Since no holotype was indicated at the time of original description, a lectotype was chosen among the original material traced.

Urbanization and natural calamities

The increasing urbanization and development of tourism in Idukki district have resulted in the identification and over exploitation of natural resources. This also brought about deforestation and emergence of vast tea plantations and resorts. The human encroachment into the closed territory of animals caused habitat disturbance too. Heavy flood and landslides of 2018 and 2019 devastated extensive area of Idukki and culminated in heavy loss of flora and fauna due to fragmentation of landscape. The drastic changes in climate during the last few years also generated in unpredictable changes in vegetation of Idukki district. All these led to a significant negative effect on the diversity and richness of species.

Most of the plant species which are reported here are capable of soil binding due to their intertwined roots which could play an important role in preventing landslides and soil erosion (Kanungo *et al.*, 2020). Water holding and flood tolerant species were also recorded from this study area. These include *Cordia*, *Coffee*, *Vinca*, *Ipomoea*,

Mesosphaerum, *Chromolaena*, *Calotropis*, *Lantana*, *Vallaris*, *Justicia*, *Acmella*, *Wahlenbergia*, *Cosmos* and *Eclipta* (Dey *et al.*, 2020).

The regular natural disasters like floods and landslides in Idukki district could be attributed to the excessive loading on the slopes by multistorey building construction and deforestation (Vanwesten & Sajinkumar, 2019; Premlet, 2019).

In this scenario, the floristic diversity data from this study has great significance in the management of natural disasters. The ecologically fragile mountain terrain with its natural endemic vegetation has to be conserved at any cost. Also, identification and reporting of spectacular endemic flora from Vaguvarai, Vakavanam, Pothadi, Mesthirikettu, Lakkamkudi, and Kadalaar areas which are not in the conservation /reserved forest list of the Government is worth mentioning. There is still scope to raise these areas to a protected status.

Table 1: Families reported under Gamopetalae according to Bentham &

Hooker's system of classification

Sl. No.	Families
1	Rubiaceae
2	Valerianaceae
3	Asteraceae
4	Campanulaceae
5	Vacciniaceae
6	Ericaceae
7	Plumbaginaceae
8	Primulaceae

9	Myrsinaceae
10	Sapotaceae
11	Ebenaceae
12	Symplocaceae
13	Oleaceae
14	Salvadoraceae
15	Apocynaceae
16	Asclepiadaceae
17	Loganiaceae
18	Gentianaceae
19	Hydrophyllaceae
20	Boraginaceae
21	Convolvulaceae
22	Solanaceae
23	Scrophulariaceae
24	Orobanchaceae
25	Lentibulariaceae
26	Gesneriaceae
27	Bignoniaceae
28	Pedaliaceae
29	Acanthaceae

30	Verbenaceae
31	Labiatae/Lamiaceae
32	Plantaginaceae

Table 2: Genera coming under different families according to APG & Bentham and Hooker system of classification

Sl. No.	Genera	Family according to APG	Family according to Bentham & Hooker
1	<i>Vaccinium</i>	Ericaceae	Vacciniaceae
2	<i>Embelia</i>	Primulaceae	Myrsinaceae
3	<i>Maesa</i>		
4	<i>Myrsine</i>		
5	<i>Ardisia</i>		
6	<i>Fagraea</i>	Gentianaceae	Loganiaceae
7	<i>Lindernia</i>	Linderniaceae	Scrophulariaceae
8	<i>Torenia</i>		
9	<i>Callicarpa</i>	Lamiaceae/Labiatae	Verbenaceae
10	<i>Clerodendron</i>		
11	<i>Rothea</i>		
12	<i>Pedicularis</i>	Orobanchaceae	Scrophulariaceae

Table 3: Classification of plants according to their habits, IUCN Status & Endemism

Sl.no	Name of plant	Family	H/S/T/C				IUCN Status	Endemism
1	<i>Aidia gardneri</i>	Rubiaceae			T		NE	
2	<i>Anotis leschenaultiana</i>		H				NE	
3	<i>Argostemma courtallense</i>		H				NE	E
4	<i>Benkara malabarica</i>			S			NE	
5	<i>Canthium coromandelicum</i>			S			NE	
6	<i>Canthium rheedei</i>			S			NE	E
7	<i>Catunaregam spinosa</i>				T		LC	
8	<i>Catunaregam torulosa</i>				T		NE	
9	<i>Chassalia curviflora</i>			S			NE	
10	<i>Dentella repens</i>		H				LC	
11	<i>Galium asperifolium</i>					C	NE	
12	<i>Gardenia gummifera</i>				T		LC	E
13	<i>Gynochthodes umbellata</i>					C	NE	
14	<i>Hedyotis affinis</i>		H				NE	
15	<i>Hedyotis articularis</i>			S			NE	E
16	<i>Hedyotis bourdillonii</i>			S			NE	E

17	<i>Hedyotis neesiana</i>		H				NE	
18	<i>Hedyotis fruticosa</i>		H				NE	
19	<i>Hedyotis diffusa</i>		H				LC	
20	<i>Hedyotis wightii</i>		H				NE	
21	<i>Ixora brachiata</i>				T		NE	E
22	<i>Ixora elongata</i>			S			NE	E
23	<i>Ixora johnsonii</i>			S			CR	E
24	<i>Ixora nigricans</i>			S			NE	
25	<i>Ixora pavetta</i>				T		NE	
26	<i>Lasianthus acuminatus</i>			S			NE	E
27	<i>Lasianthus parvifolius</i>			S			NE	E
28	<i>Mitragyna parvifolia</i>				T		NE	
29	<i>Mussaenda tomentosa</i>			S			NE	E
30	<i>Mycetia acuminata</i>			S			NE	E
31	<i>Neanotis decipiens</i>		H				NE	E
32	<i>Neonauclea purpurea</i>				T		NE	E
33	<i>Neurocalyx calycinus</i>		H				NE	
34	<i>Ophiorrhiza eriantha</i>			S			NE	E

35	<i>Ophiorrhiza rugosa</i>		H				NE	
36	<i>Ophiorrhiza mungos</i>		H				NE	
37	<i>Pavetta siphonantha</i>			S			NE	
38	<i>Pavetta monticola</i>			S			VU	E
39	<i>Pavetta travancorica</i>			S			NE	E
40	<i>Psychotria anamalayana</i>			S			NE	E
41	<i>Psychotria flavida</i>			S			NE	E
42	<i>Psychotria nigra</i>			S			NE	E
43	<i>Psychotria nudiflora</i>			S			NE	E
44	<i>Psychotria nilgiriensis</i>			S			EN	E
45	<i>Psydrax dicoccos</i>				T		VU	
46	<i>Richardia scabra</i>		H				NE	
47	<i>Rubia cordifolia</i>					C	NE	
48	<i>Saprosma foetens</i>			S			NE	E
49	<i>Spermacoce articularis</i>		H				NE	
50	<i>Spermacoce latifolia</i>		H				NE	
51	<i>Spermacoce pusilla</i>		H				NE	
52	<i>Valeriana hardwickei</i>		H				NE	

53	<i>Valeriana hookeriana</i>	Valerianaceae	H				NE	E
54	<i>Valeriana leschenaultii</i>		H				CR	E
55	<i>Acanthospermum hispidum</i>	Asteraceae	H				NE	
56	<i>Acmella paniculata</i>		H				NE	
57	<i>Adenostemma macrophylla</i>		H				NE	
58	<i>Ageratina adenophora</i>			S			NE	
59	<i>Ageratum conyzoides</i>		H				LC	
60	<i>Ageratum houstonianum</i>		H				NE	
61	<i>Anaphalis aristata</i>		H				NE	E
62	<i>Anaphalis bournei</i>		H				NE	E
63	<i>Anaphalis elliptica</i>		H				NE	E
64	<i>Anaphalis leptophylla</i>		H				VU	E
65	<i>Anaphalis marcescens</i>		H				NE	
66	<i>Anaphalis meeboldii</i>		H				NE	E
67	<i>Anaphalis wightiana</i>		H				VU	E
68	<i>Anaphalis lawii</i>		H				NE	E
69	<i>Anaphalis subdecurrens</i>		H				NE	
70	<i>Anaphalis travancorica</i>		H				NE	E

71	<i>Artemisia nilagirica</i>			S				NE	
72	<i>Artemisia parviflora</i>		H					NE	
73	<i>Bidens pilosa</i>		H					NE	
74	<i>Blainvillea acmella</i>		H					LC	
75	<i>Blumea eriantha</i>		H					NE	E
76	<i>Blumea belangeriana</i>		H					NE	
77	<i>Blumea axillaris</i>		H					NE	
78	<i>Blumea oxydonta</i>		H					NE	
79	<i>Blumea hieracifolia</i>		H					NE	
80	<i>Blumea membranacea</i>		H					NE	
81	<i>Blumea lacera</i>		H					LC	
82	<i>Centipeda minima</i>		H					NE	
83	<i>Chromolaena odorata</i>			S				NE	
84	<i>Crassocephalum crepidiodes</i>		H					NE	
85	<i>Eschenbachia japonica</i>		H					NE	
86	<i>Eschenbachia stricta</i>		H					NE	
87	<i>Eclipta prostrata</i>		H					LC	
88	<i>Elephantopus scaber</i>		H					NE	

89	<i>Emilia scabra</i>		H				NE	E
90	<i>Emilia sonchifolia</i>		H				NE	
91	<i>Galinsoga parviflora</i>		H				NE	
92	<i>Gnomophalium pulvinatum</i>		H				DD	
93	<i>Grangea maderaspatana</i>		H				LC	
94	<i>Gynura nitida</i>		H				NE	E
95	<i>Gynura travancorica</i>		H				NT	E
96	<i>Helichrysum buddlejoides</i>			S			NE	
97	<i>Laggera alata</i>		H				NE	
98	<i>Mikania cordata</i>			S			NE	
99	<i>Parthenium hysterophorus</i>		H				NE	
100	<i>Senecio corymbosus</i>			S			NE	
101	<i>Senecio scandens</i>			S			LC	
102	<i>Sonchus oleraceus</i>		H				NE	
103	<i>Sonchus wightianus</i>		H				NE	
104	<i>Synedrella nodiflora</i>		H				NE	
105	<i>Tridax procumbens</i>		H				NE	
106	<i>Vernonia arborea</i>				T		LC	

107	<i>Vernonia cinerea</i>		H				NE	
108	<i>Vernonia indica</i>			S			NE	E
109	<i>Vernonia peninsularis</i>		H				NE	E
110	<i>Vernonia salviifolia</i>			S			NE	E
111	<i>Vernonia travancorica</i>				T		NE	E
112	<i>Wedelia urticifolia</i>		H				NE	E
113	<i>Xanthium strumarium</i>		H				NE	
114	<i>Youngia japonica</i>		H				NE	
115	<i>Asyneuma cupulare</i>	Campanulaceae	H				NE	
116	<i>Asyneuma fulgens</i>		H				NE	
117	<i>Campanula alphonсии</i>		H				NE	E
118	<i>Lobelia alsinoides</i>		H				LC	
119	<i>Lobelia heyneana</i>		H				LC	
120	<i>Lobelia zeylanica</i>		H				LC	
121	<i>Lobelia leschenaultiana</i>		H				NE	
122	<i>Lobelia nicotianifolia</i>			S			NE	
123	<i>Wahlenbergia erecta</i>		H				NE	
124	<i>Wahlenbergia marginata</i>		H				NE	

125	<i>Wahlenbergia hookeri</i>		H				NE	E
126	<i>Vaccinium leschenaultii</i>	Vacciniaceae			T		NE	E
127	<i>Vaccinium neilgherrense</i>			S			NE	E
128	<i>Gaultheria fragrantissima</i>	Ericaceae		S			LC	
129	<i>Rhododendron nilagiricum</i>				T		NE	E
130	<i>Plumbago zeylanica</i>	Plumbaginaceae		S			NE	
131	<i>Anagallis pumila</i>	Primulaceae	H				NE	
132	<i>Lysimachia leschenaultii</i>		H				NE	E
133	<i>Lysimachia procumbens</i>		H				NE	
134	<i>Antistrophe serratifolia</i>	Myrsinaceae			T		NE	E
135	<i>Ardisia blatterii</i>			S			EN	E
136	<i>Ardisia pauciflora</i>				T		NE	
137	<i>Ardisia rhomboidea</i>			S			NE	E
138	<i>Ardisia solanacea</i>			S	T		NE	
139	<i>Ardisia sonchifolia</i>			S			EN	E
140	<i>Ardisia stonei</i>			S			NE	E
141	<i>Embelia adnata</i>					C	NE	E
142	<i>Embelia ribes</i>					C	NE	

143	<i>Embelia tsjeriam-cottam</i>					C	NE	
144	<i>Maesa indica</i>			S			LC	
145	<i>Myrsine capitellata</i>				T		NE	
146	<i>Myrsine daphnoides</i>			S			NE	E
147	<i>Myrsine thwaitesii</i>				T		NE	E
148	<i>Myrsine wightiana</i>				T		NE	
149	<i>Donella lanceolata</i>	Sapotaceae			T		LC	
150	<i>Isonandra lanceolata</i>				T		LC	
151	<i>Isonandra perrottetiana</i>				T		NE	E
152	<i>Isonandra stocksii</i>				T		EN	E
153	<i>Madhuca longifolia</i>				T		NE	
154	<i>Madhuca nerrifolia</i>				T		NE	
155	<i>Mimusops elengi</i>				T		LC	
156	<i>Manilkara hexandra</i>				T		NE	
157	<i>Manilkara roxburghiana</i>				T		NE	E
158	<i>Palaquium ellipticum</i>				T		EN	E
159	<i>Palaquium ravii</i>				T		EN	E
160	<i>Xantolis tomentosa</i>				T		NE	

161	<i>Diospyros ovalifolia</i>	Ebenaceae			T		NE	
162	<i>Diospyros paniculata</i>				T		VU	E
163	<i>Diospyros sylvatica</i>				T		NE	
164	<i>Diospyros pruriens</i>				T		NE	E
165	<i>Diospyros ghatensis</i>				T		NE	E
166	<i>Diospyros nilagirica</i>				T		NE	E
167	<i>Diospyros bourdillonii</i>				T		NE	E
168	<i>Diospyros montana</i>				T		NE	
169	<i>Diospyros ferrea</i>				T		NE	
170	<i>Symplocos cochinchinensis</i>	Symplocaceae			T		NE	
171	<i>Symplocos foliosa</i>				T		NE	E
172	<i>Symplocos macrophylla</i>			S	T		NE	E
173	<i>Symplocos macrophylla</i> subsp. <i>microphylla</i>				T		NE	E
174	<i>Symplocos macrophylla</i> subsp. <i>rosea</i>			S			NE	E
175	<i>Symplocos monantha</i>			S			NE	E
176	<i>Symplocos nicolsonii</i>				T		NE	
177	<i>Symplocos obtusa</i>				T		NE	
178	<i>Symplocos pulchra</i> subsp. <i>villosa</i>			S			NE	E

179	<i>Symplocos racemosa</i>				T		NE	
180	<i>Symplocos wynadense</i>				T		NE	E
181	<i>Chionanthus zeylanicus</i>	Oleaceae			T		NE	
182	<i>Chionanthus ramiflorus</i>				T		NE	
183	<i>Chionanthus mala-elengi</i>				T		NE	E
184	<i>Jasminum angustifolium</i> var. <i>sessiliflorum</i>					C	NE	
185	<i>Jasminum multiflorum</i>					C	NE	
186	<i>Jasminum cordifolium</i>		H				NE	E
187	<i>Jasminum rottlerianum</i>					C	NE	
188	<i>Jasminum flexile</i>					C	NE	
189	<i>Jasminum cuspidatum</i>			S			NE	
190	<i>Jasminum trichotomum</i>					C	NE	E
191	<i>Jasminum arborescens</i>					C	NE	
192	<i>Jasminum brevilobum</i>					C	NE	E
193	<i>Jasminum calophyllum</i>					C	NE	E
194	<i>Jasminum scandens</i>					C	NE	
195	<i>Ligustrum robustum</i> subsp. <i>perrottetii</i>			S			NE	E
196	<i>Ligustrum robustum</i> subsp. <i>walkeri</i>				T		NE	

197	<i>Myxopyrum smilacifolium</i>					C	NE	
198	<i>Olea dioica</i>				T		NE	E
199	<i>Olea paniculata</i>				T		NE	
200	<i>Olea polygama</i>				T		NE	E
201	<i>Azima tetracantha</i>	Salvadoraceae		S			LC	
202	<i>Aganosma cymosa</i>	Apocynaceae				C	NE	
203	<i>Alstonia venenata</i>			S			NE	E
204	<i>Alstonia scholaris</i>				T		LC	
205	<i>Anodendron parviflorum</i>					C	NE	
206	<i>Carissa spinarum</i>					C	LC	
207	<i>Chilocarpus denudatus</i>					C	NE	
208	<i>Chonemorpha fragrans</i>					C	NE	
209	<i>Kamettia caryophyllata</i>					C	NE	E
210	<i>Holarrhena pubescens</i>				T		LC	
211	<i>Ichnocarpus frutescens</i>					C	NE	
212	<i>Parsonsia alboflavescens</i>					C	NE	
213	<i>Rauvolfia micrantha</i>			S			NE	E
214	<i>Rauvolfia serpentina</i>			S			NE	

215	<i>Rauvolfia verticillata</i>			S			NE	
216	<i>Tabernaemontana gamblei</i>			S			CD	E
217	<i>Tabernaemontana alternifolia</i>			S			NE	E
218	<i>Wrightia arborea</i>				T		LC	
219	<i>Wrightia tinctoria</i>				T		LC	
220	<i>Asclepias curassavica</i>	Asclepiadaceae	H				NE	
221	<i>Calotropis gigantea</i>			S			NE	
222	<i>Ceropegia ensifolia</i>					C	NE	E
223	<i>Ceropegia intermedia</i>					C	NE	E
224	<i>Ceropegia hirsuta</i>					C	NE	E
225	<i>Ceropegia beddomei</i>					C	NE	E
226	<i>Ceropegia candelabrum</i>					C	NE	
227	<i>Ceropegia ciliata</i>					C	NE	E
228	<i>Cryptolepis buchnanii</i>					C	NE	
229	<i>Gymnema sylvestre</i>					C	NE	
230	<i>Gymnema decaisneanum</i>					C	NE	E
231	<i>Hemidesmus indicus</i>					C	NE	
232	<i>Cynanchum annularium</i>					C	NE	

233	<i>Hoya wightii</i>					C	NE	E
234	<i>Hoya pauciflora</i>					C	NE	
235	<i>Hoya retusa</i>					C	NE	E
236	<i>Pergularia daemia</i>					C	LC	
237	<i>Secamone emetica</i>					C	NE	
238	<i>Vincetoxicum hirsutum</i>					C	NE	E
239	<i>Vincetoxicum flexuosum</i> var. <i>tenuis</i>					C	NE	
240	<i>Vincetoxicum rotundifolium</i>					C	NE	E
241	<i>Vincetoxicum capparidifolium</i>					C	NE	E
242	<i>Wattakaka volubilis</i>					C	NE	
243	<i>Buddleja asiatica</i>	Loganiaceae		S			LC	
244	<i>Fagraea ceilanica</i>			S			NE	
245	<i>Fagraea coromandelina</i>			S	T		NE	
246	<i>Gardneria ovata</i>					C	NE	
247	<i>Strychnos minor</i>			S			NE	
248	<i>Strychnos nux-vomica</i>				T		NE	
249	<i>Strychnos potatorum</i>				T		NE	
250	<i>Strychnos vanprukii</i>					C	NE	E

251	<i>Exacum anamallayanum</i>	Gentianaceae	H				NE	E
252	<i>Exacum atropurpureum</i>		H				NE	E
253	<i>Exacum courtallense</i>		H				NE	E
254	<i>Exacum lawii</i>		H				NE	E
255	<i>Exacum petiolare</i>		H				NE	
256	<i>Exacum sessile</i>		H				NE	
257	<i>Exacum tetragonum</i>		H				LC	E
258	<i>Exacum wightianum</i>		H				NE	E
259	<i>Canscora diffusa</i>		H				NE	
260	<i>Canscora perfoliata</i>		H				NE	E
261	<i>Canscora roxburghii</i>		H				NE	
262	<i>Hoppea fastigiata</i>		H				LC	
263	<i>Gentiana pedicellata</i>		H				NE	
264	<i>Gentiana quadrifaria</i>		H				NE	
265	<i>Halenia perrottetii</i>		H				NE	
266	<i>Swertia angustifolia</i>		H				NE	
267	<i>Swertia corymbosa</i>		H				NE	E
268	<i>Swertia minor</i>		H				NE	E

269	<i>Swertia trichotoma</i>		H				NE	
270	<i>Hydrolea zeylanica</i>	Hydrophyllaceae	H				LC	
271	<i>Cordia sinensis</i>	Boraginaceae			T		LC	
272	<i>Cordia monoica</i>				T		LC	
273	<i>Cordia dichotoma</i>				T		LC	E
274	<i>Cordia octandra</i>				T		NE	E
275	<i>Cynoglossum zeylanicum</i>		H				NE	
276	<i>Ehretia microphylla</i>				T		NE	
277	<i>Ehretia aspera</i>				T		DD	E
278	<i>Ehretia acuminata</i>				T		LC	
279	<i>Ehretia wightiana</i>				T		NE	
280	<i>Heliotropium indicum</i>		H				NE	
281	<i>Heliotropium marifolium</i>		H				NE	
282	<i>Tournefortia montana</i>			S			NE	E
283	<i>Trichodesma zeylanicum</i>		H				NE	
284	<i>Trichodesma indicum</i>			S			NE	
285	<i>Coldenia procumbens</i>		H				LC	
286	<i>Rotula aquatica</i>			S			LC	

287	<i>Argyreia hirsuta</i>	Convolvulaceae				C	NE	
288	<i>Argyreia osyrensis</i>					C	NE	E
289	<i>Argyreia argentea</i>					C	NE	E
290	<i>Cuscuta chinensis</i>					C	NE	
291	<i>Cuscuta reflexa</i>					C	LC	
292	<i>Erycibe paniculata</i>					C	NE	
293	<i>Evolvulus alsinoides</i>		H				NE	
294	<i>Hewittia malabarica</i>					C	NE	
295	<i>Ipomoea alba</i>					C	LC	
296	<i>Ipomoea barlerioides</i>					C	NE	E
297	<i>Ipomoea cairica</i>					C	LC	
298	<i>Ipomoea campanulata</i>					C	NE	
299	<i>Ipomoea capitellata</i>					C	NE	
300	<i>Ipomoea aitonii</i>					C	NE	
301	<i>Ipomoea eriocarpa</i>					C	NE	
302	<i>Ipomoea hederifolia</i>					C	NE	
303	<i>Ipomoea nil</i>					C	NE	
304	<i>Ipomoea obscura</i>					C	NE	

305	<i>Ipomoea wightii</i>					C	LC	
306	<i>Merremia hederacea</i>					C	NE	
307	<i>Rivea ornata</i>					C	NE	
308	<i>Rivea hypocrateriformis</i>					C	LC	
309	<i>Xenostegia tridentata</i>		H				NE	
310	<i>Cestrum aurantiacum</i>	Solanaceae				C	LC	
311	<i>Cestrum nocturnum</i>			S	T		LC	
312	<i>Cestrum parqui</i>			S			LC	
313	<i>Datura metel</i>		H	S			NE	
314	<i>Datura stramonium</i>			S			NE	
315	<i>Ioichroma arborescens</i>			S	T		NE	
316	<i>Physalis angulata</i>		H				LC	
317	<i>Physalis peruviana</i>		H				LC	
318	<i>Solanum aculeatissimum</i>			S			NE	
319	<i>Solanum americanum</i>		H				NE	
320	<i>Solanum brownii</i>			S			NE	
321	<i>Solanum capsicoides</i>			S			NE	
322	<i>Solanum diphyllum</i>			S	T		NE	

323	<i>Solanum giganteum</i>			S			LC	
324	<i>Solanum leave</i>		H	S			NE	
325	<i>Solanum mauritianum</i>			S			NE	
326	<i>Solanum pseudo-capsicum</i>			S			NE	
327	<i>Solanum seaforthianum</i>					C	NE	
328	<i>Solanum torvum</i>			S			NE	
329	<i>Adenosma subrepens</i>	Scrophulariaceae	H				NE	
330	<i>Artanema longifolium</i>		H				NE	
331	<i>Bacopa monnieri</i>		H				LC	
332	<i>Bonnaya antipoda</i>		H				LC	
333	<i>Bonnaya ciliata</i>		H				LC	
334	<i>Bonnaya oppositifolia</i>		H				LC	E
335	<i>Buchnera hispida</i>		H				NE	
336	<i>Centranthera indica</i>		H				LC	
337	<i>Dopatrium junceum</i>		H				LC	
338	<i>Limnophila aromatica</i>		H				LC	
339	<i>Limnophila chinensis</i>		H				LC	
340	<i>Lindernia parviflora</i>		H				LC	

341	<i>Lindernia hyssopioides</i>		H				NE	
342	<i>Lindernia rotundifolia</i>		H				LC	
343	<i>Mazus pumilus</i>		H				NE	
344	<i>Mecardonia procumbens</i>		H				NE	
345	<i>Micrargeria wightii</i>		H				NE	E
346	<i>Mimulus orbicularis</i>		H				LC	E
347	<i>Pedicularis zeylanica</i>		H				NE	
348	<i>Scoparia dulcis</i>		H				NE	
349	<i>Torenia anagallis</i>		H				NE	
350	<i>Torenia bicolor</i>		H				LC	E
351	<i>Torenia courtallensis</i>		H				NE	
352	<i>Torenia crustacea</i>		H				LC	
353	<i>Yamazakia viscosa</i>		H				NE	
354	<i>Yamazakia pusilla</i>		H				LC	
355	<i>Aeginetia indica</i>		H				LC	
356	<i>Aeginetia acaulis</i>		H				NE	
357	<i>Campbellia cytinooides</i>		H				NE	
358	<i>Christisonia bicolor</i>		H				NE	

359	<i>Christisonia calcarata</i>	Orobanchaceae	H				NE	E
360	<i>Christisonia indica</i>		H				NE	E
361	<i>Christisonia tubulosa</i>		H				NE	E
362	<i>Parasopubia delphiniifolia</i>		H				NE	
363	<i>Parasopubia raghavendrae</i>		H				NE	
364	<i>Striga angustifolia</i>		H				NE	
365	<i>Striga asiatica</i>		H				NE	
366	<i>Striga gesnerioides</i>		H				NE	
367	<i>Utricularia graminifolia</i>	Lentibulariaceae	H				LC	
368	<i>Utricularia praeterita</i>		H				NT	E
369	<i>Utricularia uliginosa</i>		H				LC	
370	<i>Utricularia caerulea</i>		H				LC	
371	<i>Utricularia striatula</i>		H				LC	
372	<i>Utricularia lazulina</i>		H				LC	E
373	<i>Utricularia scandens</i>		H				LC	
374	<i>Utricularia polygaloides</i>		H				NE	
375	<i>Utricularia bifida</i>		H				LC	
376	<i>Rhynchoetechum permolle</i>			S			NE	

377	<i>Rhynchoglossum notonianum</i>	Gesneriaceae	H				NE	
378	<i>Epithema ceylanicum</i>		H				NE	E
379	<i>Aeschynanthus perrottetii</i>					C	NE	E
380	<i>Jerdonia indica</i>		H				NE	E
381	<i>Henckelia fischeri</i>		H				NE	E
382	<i>Henckelia humboldtiana</i>		H				NE	
383	<i>Henckelia incana</i>		H				NE	
384	<i>Henckelia innominata</i>		H				NE	E
385	<i>Henckelia lyrata</i>		H				NE	
386	<i>Henckelia macrostachya</i>		H				NE	E
387	<i>Henckelia meeboldii</i>		H				NE	E
388	<i>Henckelia ovalifolia</i>		H				NE	E
389	<i>Henckelia wightii</i>		H				NE	E
390	<i>Dolichandrone arcuata</i>	Bignoniaceae			T		NE	E
391	<i>Pajanelia longifolia</i>				T		LC	
392	<i>Radermachera xylocarpa</i>				T		NE	E
393	<i>Stereospermum tetragonum</i>				T		NE	
394	<i>Sesamum indicum</i>	Pedaliaceae	H				NE	

395	<i>Andrographis atropurpurea</i>	Acanthaceae		S			NE	E
396	<i>Andrographis affinis</i>			S			NE	E
397	<i>Andrographis macrobotrys</i>			S			NE	
398	<i>Andrographis neesiana</i>		H				NE	E
399	<i>Asystasia chelonoides</i>		H				NE	
400	<i>Asystasia crispata</i>			S			NE	E
401	<i>Asystasia gangetica</i>		H				NE	
402	<i>Asystasia travancorica</i>		H				NE	E
403	<i>Barleria involucrata</i>			S			NE	
404	<i>Barleria lawii</i>			S			NE	E
405	<i>Barleria prionitis</i>			S			LC	
406	<i>Blepharis maderaspatensis</i>		H				NE	
407	<i>Dicliptera baphica</i>		H				NE	
408	<i>Dicliptera cuneata</i>		H				NE	E
409	<i>Dicliptera foetida</i>			S			NE	
410	<i>Ecbolium ligustrinum</i>			S			NE	
411	<i>Gymnostachyum latifolium</i>		H				NE	E
412	<i>Gymnostachyum pubescens</i>			S			NE	E

413	<i>Lepidagathis incurva</i>		H				NE	
414	<i>Nicotaba betonica</i>			S			NE	
415	<i>Rhinacanthus nasutus</i>			S			NE	
416	<i>Rostellularia mollissima</i>		H				NE	
417	<i>Rostellularia procumbens</i>		H				NE	
418	<i>Rostellularia simplex</i>		H				NE	E
419	<i>Ruellia prostrata</i>		H				NE	E
420	<i>Rungia apiculata</i>		H				NE	
421	<i>Rungia latior</i>		H				NE	
422	<i>Rungia pectinata</i>		H				NE	
423	<i>Strobilanthes anceps</i>			S			NE	
424	<i>Strobilanthes aurita</i>			S			NE	
425	<i>Strobilanthes consanguinea</i>			S			NE	E
426	<i>Strobilanthes gracilis</i>			S			NE	E
427	<i>Strobilanthes heyneana</i>			S			NE	
428	<i>Strobilanthes kunthianus</i>			S			NE	E
429	<i>Strobilanthes lurida</i>			S			NE	E
430	<i>Strobilanthes perrottetiana</i>			S			NE	E

431	<i>Strobilanthes pulneyensis</i>			S			NE	E
432	<i>Strobilanthes sessilis</i>			S			NE	E
433	<i>Strobilanthes tristis</i>			S			NE	E
434	<i>Thunbergia fragrans</i>					C	NE	
435	<i>Callicarpa tomentosa</i>	Verbenaceae			T		LC	
436	<i>Volkameria inermis</i>			S			NE	
437	<i>Gmelina arborea</i>				T		LC	
438	<i>Gmelina asiatica</i>			S			LC	
439	<i>Lantana indica</i>			S			NE	
440	<i>Lippia javanica</i>		H				NE	
441	<i>Premna coriacea</i>					C	NE	
442	<i>Premna glaberrima</i>			S			NE	
443	<i>Premna herbacea</i>		H				NE	E
444	<i>Premna paucinervis</i>					C	NE	E
445	<i>Premna tomentosa</i>				T		LC	
446	<i>Premna wightiana</i>				T		NE	E
447	<i>Priva cordifolia</i>		H				NE	
448	<i>Rothea serrata</i>			S			NE	

449	<i>Stachytarpheta jamaicensis</i>			S			LC	
450	<i>Vitex altissima</i>				T		NE	
451	<i>Vitex leucoxylon</i>				T		LC	
452	<i>Anisomeles indica</i>	Lamiaceae/ Labiatae	H				NE	
453	<i>Coleus adenanthus</i>			S			NE	E
454	<i>Coleus argenteus</i>		H				NE	E
455	<i>Coleus barbatus</i>		H				NE	
456	<i>Coleus stobilifer</i>		H				NE	
457	<i>Coleus dysophylloides</i>			S			NE	E
458	<i>Coleus scaber</i>		H				NE	
459	<i>Gomphostemma eriocarpon</i>		H				NE	E
460	<i>Hyptis capitata</i>			S			NE	
461	<i>Isodon japonicus</i>		H				NE	
462	<i>Isodon nilgherricus</i>			S			NE	E
463	<i>Leanotis nepetifolia</i>		H				NE	
464	<i>Leucas angularis</i>		H				NE	
465	<i>Leucas aspera</i>		H				NE	
466	<i>Leucas hirta</i>		H				NE	E

467	<i>Leucas biflora</i>		H				NE	
468	<i>Leucas chinensis</i>		H				NE	
469	<i>Leucas ciliata</i>			S			NE	
470	<i>Leucas pubescens</i>		H				NE	E
471	<i>Mesospaerum suaveolens</i>		H				NE	
472	<i>Micromeria imbricata</i>		H				NE	
473	<i>Orthosiphon thymiflorus</i>		H				NE	
474	<i>Pogostemon benghalensis</i>			S			NE	
475	<i>Pogostemon pubescens</i>			S			NE	
476	<i>Scutellaria violacea</i>		H				NE	
477	<i>Scutellaria wightiana</i>		H				NE	E
478	<i>Scutellaria barbata</i>		H				NE	
479	<i>Teucrium wightii</i>			S			NE	
480	<i>Plantago erosa</i>	Plantaginaceae	H				NE	
481	<i>Plantago lanceolata</i>		H				VU	

*H = Herbs; S = Shrubs; T = Trees; C = Climbers; E = Endemic species; VU = Vulnerable; NE = Not evaluated; LC = Least concern; NT = Near threatened; DD = Data deficient; CD = Conservation dependent; CR = Critically endangered; EN = Endangered.

Table 4: Nativity and Endemism of wild plants from Idukki

Sl. No	Name of plant	Family	Native to India	Endemic to southern western Ghats (Sasidharan, 2013)
1	<i>Argostemma courtallense</i>	Rubiaceae	+	
2	<i>Catunaregam torulosa</i>		+	
3	<i>Gardenia gummifera</i>		+	
4	<i>Hedyotis articularis</i>		+	
5	<i>Hedyotis bourdillonii</i>		+	
6	<i>Ixora elongata</i>		+	
7	<i>Ixora johnsonii</i>		+	
8	<i>Lasianthus acuminatus</i>		+	
9	<i>Lasianthus parvifolius</i>		+	
10	<i>Mussaenda tomentosa</i>		+	
11	<i>Mycetia acuminata</i>		+	
12	<i>Neanotis decipiens</i>		+	
13	<i>Ophiorrhiza eriantha</i>		+	
14	<i>Pavetta siphonantha</i>		+	
15	<i>Pavetta monticola</i>			+
16	<i>Pavetta travancorica</i>		+	
17	<i>Psychotria anamalayana</i>		+	
18	<i>Psychotria flavida</i>		+	
19	<i>Psychotria nudiflora</i>		+	
20	<i>Psychotria nilgiriensis</i>		+	
21	<i>Valeriana hookeriana</i>	Valerianaceae		+
22	<i>Valeriana leschenaultii</i>		+	
23	<i>Adenostemma macrophylla</i>		+	
24	<i>Anaphalis aristata</i>		+	
25	<i>Anaphalis bournei</i>		+	
26	<i>Anaphalis elliptica</i>		+	

27	<i>Anaphalis leptophylla</i>	Asteraceae	+	
28	<i>Anaphalis meeboldii</i>		+	
29	<i>Anaphalis wightiana</i>		+	
30	<i>Anaphalis lawii</i>		+	
31	<i>Anaphalis travancorica</i>		+	
32	<i>Gynura travancorica</i>		+	
33	<i>Vernonia peninsularis</i>		+	
34	<i>Vernonia salviifolia</i>		+	
35	<i>Vernonia travancorica</i>		+	
36	<i>Asyneuma cupulare</i>	Campanulaceae		+ (new species)
37	<i>Campanula alphonsii</i>		+	
38	<i>Vaccinium symplocifolium</i>	Vacciniaceae		+
39	<i>Vaccinium neilgherrense</i>			+
40	<i>Rhododendron nilagiricum</i>	Ericaceae		+
41	<i>Lysimachia leschenaultii</i>	Primulaceae	+	
42	<i>Antistrophe serratifolia</i>	Myrsinaceae	+	
43	<i>Ardisia blatteri</i>		+	
44	<i>Ardisia rhomboidea</i>		+	
45	<i>Ardisia sonchifolia</i>		+	
46	<i>Ardisia stonei</i>		+	
47	<i>Embelia adnata</i>		+	
48	<i>Myrsine daphnoides</i>		+	
49	<i>Isonandra perrottetiana</i>	Sapotaceae	+	
50	<i>Isonandra stocksii</i>		+	
51	<i>Manilkara roxburghiana</i>		+	
52	<i>Palaquium ellipticum</i>		+	
53	<i>Palaquium ravii</i>		+	
54	<i>Diospyros pruriens</i>	Ebenaceae	+	
55	<i>Diospyros ghatensis</i>		+	
56	<i>Diospyros nilagirica</i>		+	
57	<i>Diospyros bourdillonii</i>		+	
58	<i>Symplocos foliosa</i>		+	

59	<i>Symplocos macrophylla</i> subsp. <i>rosea</i>	Symplocaceae	+	
60	<i>Symplocos monantha</i>		+	
61	<i>Symplocos nicolsonii</i>			+
62	<i>Symplocos pulchra</i> subsp. <i>villosa</i>		+	
63	<i>Symplocos wynadense</i>		+	
64	<i>Jasminum cordifolium</i>	Oleaceae	+	
65	<i>Jasminum trichotomum</i>		+	
66	<i>Jasminum calophyllum</i>		+	
67	<i>Alstonia venenata</i>	Apocynaceae	+	
68	<i>Kamettia caryophyllata</i>		+	
69	<i>Tabernaemontana gamblei</i>			
70	<i>Tabernaemontana alternifolia</i>		+	
71	<i>Ceropegia ensifolia</i>	Asclepiadaceae	+	
72	<i>Ceropegia intermedia</i>		+	
73	<i>Ceropegia beddomei</i>		+	
74	<i>Ceropegia ciliata</i>		+	
75	<i>Hemidesmus indicus</i>		+	
76	<i>Hoya wightii</i>		+	
77	<i>Vincetoxicum capparidifolium</i>		+	
78	<i>Fagraea coromandelina</i>	Loganiaceae	+	
79	<i>Exacum anamallayanum</i>	Gentianaceae	+	
80	<i>Exacum atropurpureum</i>		+	
81	<i>Exacum courtallense</i>		+	
82	<i>Exacum lawii</i>		+	
83	<i>Exacum wightianum</i>		+	
84	<i>Canscora perfoliata</i>		+	
85	<i>Swertia corymbosa</i>		+	
86	<i>Swertia minor</i>		+	
87	<i>Swertia trichotoma</i>		+	
88	<i>Ehretia wightiana</i>	Boraginaceae	+	

89	<i>Torenia bicolor</i>	Scrophulariaceae	+	
90	<i>Christisonia indica</i>	Orobanchaceae	+	
91	<i>Christisonia tubulosa</i>		+	
92	<i>Parasopubia raghavendrae</i>	Gentianaceae		+
93	<i>Utricularia praeterita</i>	Lentibulariaceae	+	
94	<i>Utricularia lazulina</i>		+	
95	<i>Aeschynanthus perrottetii</i>	Gesneriaceae	+	
96	<i>Jerdonia indica</i>		+	
97	<i>Henckelia fischeri</i>		+	
98	<i>Henckelia innominata</i>		+	
99	<i>Henckelia lyrata</i>		+	
100	<i>Henckelia macrostachya</i>		+	
101	<i>Henckelia meeboldii</i>		+	
102	<i>Henckelia ovalifolia</i>		+	
103	<i>Henckelia wightii</i>		+	
104	<i>Dolichandrone arcuata</i>	Bignoniaceae	+	
105	<i>Radermachera xylocarpa</i>		+	
106	<i>Premna glaberrima</i>	Verbenaceae	+	
107	<i>Premna paucinervis</i>		+	
108	<i>Premna wightiana</i>		+	
109	<i>Coleus adenanthus</i>	Lamiaceae/ Labiatae	+	
110	<i>Coleus argenteus</i>		+	
111	<i>Coleus dysophylloides</i>		+	
112	<i>Coleus scaber</i>		+	
113	<i>Gomphostemma eriocarpon</i>		+	
114	<i>Isodon nilgherricus</i>		+	
115	<i>Leucas hirta</i>		+	
116	<i>Leucas pubescens</i>		+	
117	<i>Scutellaria wightiana</i>		+	
118	<i>Andrographis atropurpurea</i>		+	
119	<i>Andrographis affinis</i>		+	
120	<i>Andrographis neesiana</i>		+	

121	<i>Asystasia crispata</i>	Acanthaceae	+	
122	<i>Asystasia travancorica</i>		+	
123	<i>Barleria lawii</i>		+	
124	<i>Dicliptera cuneata</i>		+	
125	<i>Gymnostachyum latifolium</i>		+	
126	<i>Gymnostachyum pubescens</i>		+	
127	<i>Rostellularia simplex</i>		+	
128	<i>Strobilanthes aurita</i>		+	
129	<i>Strobilanthes consanguinea</i>		+	
130	<i>Strobilanthes gracilis</i>		+	
131	<i>Strobilanthes luridus</i>			+
132	<i>Strobilanthes perrottetiana</i>		+	
133	<i>Strobilanthes pulneyensis</i>		+	
134	<i>Strobilanthes sessilis</i>		+	
135	<i>Strobilanthes tristis</i>		+	

Table 5: Classification of economically important plants according to their uses

A total of 191 plants are classified on the basis of their economic value according to POWO, 2022.

Sl. No	Name of plant	Family	Uses (POWO, 2022)	IUCN Status
1	<i>Browallia americana</i>	Solanaceae	medicine	NE
2	<i>Brugmansia arborea</i>		medicine	EW
3	<i>Brugmansia suaveolens</i>		medicine	EW
4	<i>Brunfelsia americana</i>		medicine	NE
5	<i>Brunfelsia grandiflora</i>		medicine	LC
6	<i>Capsicum annuum</i>		vegetable	LC
7	<i>Capsicum annuum</i> var. <i>glabriusculum</i>		vegetable	NE
8	<i>Capsicum chinense</i>		vegetable	NE
9	<i>Capsicum frutescens</i>		vegetable	LC
10	<i>Cestrum elegans</i>		ornamental& medicinal	LC
11	<i>Cyphomandra betacea</i>		fruits	NE
12	<i>Lycopersicon esculentum</i>		vegetable	LC
13	<i>Lycopersicon pimpinellifolium</i>		fruits	LC
14	<i>Nicotiana tabacum</i>		medicine	NE

15	<i>Petunia hybrida</i>		ornamental	NE
16	<i>Solanum jasminoides</i>		ornamental	NE
17	<i>Solanum macrocarpon</i>		medicine	NE
18	<i>Solanum mammosum</i>		medicine	NE
19	<i>Solanum melongena</i> var. <i>insanum</i>		medicine	NE
20	<i>Solanum melongena</i> var. <i>melongena</i>		medicine	NE
21	<i>Solanum muricatum</i>		medicine	NE
22	<i>Solanum sisymbirifolium</i>		medicine	NE
23	<i>Solanum tuberosum</i>		vegetable	NE
24	<i>Solanum wendlandii</i>		ornamental	NE
25	<i>Solanum wrightii</i>		ornamental	LC
26	<i>Streptosolen jamesonii</i>		fodder	NE
27	<i>Chrysothemis pulchella</i>	Gesneriaceae	ornamental	NE
28	<i>Episcia cupreata</i>		ornamental	NE
29	<i>Gloxinia perennis</i>		ornamental	NE
30	<i>Gloxinia sylvatica</i>		ornamental	NE
31	<i>Plumbago auriculata</i>	Plumbaginaceae	ornamental	NE
32	<i>Plumbago indica</i>		ornamental	NE

33	<i>Rhododendron mucronatum</i>	Ericaceae	ornamental	NE
34	<i>Rhododendron simsii</i>		ornamental	NE
35	<i>Adenocalymna alliaceum</i>	Bignoniaceae	medicine	NE
36	<i>Jacaranda mimosifolia</i>		medicine	VU
37	<i>Kigelia africana</i>		medicine	LC
38	<i>Millingtonia hortensis</i>		medicine	NE
39	<i>Pandorea jasminoides</i>		ornamental	NE
40	<i>Podranea ricasoliana</i>		ornamental	NE
41	<i>Pyrostegia venusta</i>		ornamental	NE
42	<i>Saritaea magnifica</i>		ornamental	NE
43	<i>Spathodea campanulata</i>		ornamental	LC
44	<i>Tecoma stans</i>		medicine & ornamental	LC
45	<i>Tecomaria capensis</i>		medicine	LC
46	<i>Buddleja madagascariensis</i>	Loganiaceae	ornamental	LC
47	<i>Chrysophyllum cainito</i>	Sapotaceae	medicine	LC
48	<i>Manilkara zapota</i>		fruit & medicine	LC
49	<i>Pouteria campechiana</i>		confectionary	LC
50	<i>Cordia sebastiana</i>	Boraginaceae	ornamental & medicine	NE

51	<i>Jasminum auriculatum</i>	Oleaceae	ornamental	NE
52	<i>Jasminum azoricum</i>		ornamental	CR
53	<i>Jasminum grandiflorum</i>		ornamental & medicine	NE
54	<i>Jasminum laurifolium</i>		ornamental	NE
55	<i>Jasminum mesnyi</i>		ornamental & medicine	NE
56	<i>Jasminum sambac</i>		ornamental & medicine	NE
57	<i>Chrysojasminum bignoniaceum</i>		ornamental	NE
58	<i>Sesamum indicum</i>	Pedaliaceae	medicine & food	NE
59	<i>Citharexylum spinosum</i>	Verbenaceae	medicine	LC
60	<i>Rothea microphylla</i>		medicine	LC
61	<i>Clerodendrum paniculatum</i>		ornamental & medicine	NE
62	<i>Clerodendrum chinense</i>		ornamental & medicine	LC
63	<i>Clerodendrum thomsonae</i>		ornamental & medicine	NE
64	<i>Clerodendrum laevifolium</i>		ornamental & medicine	VU
65	<i>Duranta erecta</i>		ornamental & medicine	LC
66	<i>Glandularia tenera</i>		ornamental	NE
67	<i>Holmskioldia sanguinea</i> f. <i>citrina</i>		ornamental	NE
68	<i>Holmskioldia sanguinea</i> f. <i>sanguinea</i>		ornamental	NE

69	<i>Lantana camara</i>		ornamental & medicine	NE
70	<i>Lantana splendens</i>		ornamental & medicine	NE
71	<i>Lantana montevidensis</i>		ornamental & medicine	NE
72	<i>Petrea volubilis</i>		ornamental & medicine	NE
73	<i>Tectona grandis</i>		construction works & medicine	LC
74	<i>Verbena bonariensis</i>		medicine	NE
75	<i>Verbena rigida</i>		medicine	NE
76	<i>Vitex negundo</i>		medicine	LC
77	<i>Argyreia nervosa</i>	Convolvulaceae	medicine	NE
78	<i>Evolvulus glomeratus</i>		ornamental & medicine	NE
79	<i>Ipomoea batatas</i>		vegetable & medicine	LC
80	<i>Ipomoea carnea</i>		ornamental & medicine	NE
81	<i>Ipomoea horsfalliae</i>		ornamental	NE
82	<i>Ipomoea indica</i>		ornamental & medicine	DD
83	<i>Ipomoea purpurea</i>		medicine	NE
84	<i>Ipomoea quamoclit</i>		ornamental & medicine	NE
85	<i>Ipomoea turbinata</i>		medicine	NE
86	<i>Jacquemontia pentantha</i>		ornamental	NE

87	<i>Merremia tuberosa</i>		ornamental & medicine	NE
88	<i>Angelonia salicariifolia</i>	Scrophulariaceae	ornamental & medicine	NE
89	<i>Calceolaria mexicana</i>		ornamental	NE
90	<i>Otacanthus caeruleus</i>		ornamental	NE
91	<i>Penstemon rubicundus</i>		ornamental & medicine	NE
92	<i>Russelia equisetiformis</i>		ornamental & medicine	NE
93	<i>Torenia fournieri</i>		ornamental & medicine	NE
94	<i>Asclepias physocarpa</i>	Asclepiadaceae	medicine	NE
95	<i>Adenium obesum</i>	Apocynaceae	ornamental & medicine	LC
96	<i>Allamanda blanchetii</i>		ornamental & medicine	NE
97	<i>Allamanda cathartica</i>		ornamental & medicine	NE
98	<i>Carissa carandas</i>		medicine	NE
99	<i>Catharanthus roseus</i>		ornamental & medicine	NE
100	<i>Kopsia fruticosa</i>		ornamental & medicine	NE
101	<i>Mandevilla boliviensis</i>		ornamental & medicine	NE
102	<i>Nerium oleander</i>		ornamental & medicine	LC
103	<i>Pentalinon luteum</i>		ornamental & medicine	NE
104	<i>Plumeria obtusa</i>		medicine	LC

105	<i>Plumeria pudica</i>		ornamental & medicine	LC
106	<i>Plumeria rubra</i>		medicine	LC
107	<i>Tabernaemontana divaricata</i>		ornamental & medicine	LC
108	<i>Cascabela thevetia</i>		ornamental & medicine	LC
109	<i>Vallaris solanacea</i>		medicine & for extracting essential oils	NE
110	<i>Vinca major</i>		ornamental & medicine	NE
111	<i>Wrightia antidysenterica</i>		medicine	NE
112	<i>Ocimum basilicum</i>	Lamiaceae/ Labiatae	medicine	NE
113	<i>Ocimum americanum</i>		medicine & for extracting oils	NE
114	<i>Ocimum gratissimum</i>		medicine & for extracting oils	NE
115	<i>Ocimum tenuiflorum</i>		medicine & for spiritual purposes	NE
116	<i>Mentha arvensis</i>		medicine	LC
117	<i>Mentha piperita</i>		medicine & for extracting oils	NE
118	<i>Coleus amboinicus</i>		medicine	NE
119	<i>Coleus scutellarioides</i>		medicine	NE
120	<i>Pogostemon cablin</i>		medicine & for extracting oils	NE
121	<i>Salvia rosmarinus</i>		medicine	LC

122	<i>Salvia coccinea</i>		ornamental	NE
123	<i>Salvia leucantha</i>		ornamental	NE
124	<i>Salvia officinalis</i>		medicine	LC
125	<i>Salvia splendens</i>		medicine	NE
126	<i>Acanthus montanus</i>	Acanthaceae	medicine	LC
127	<i>Asystasia intrusa</i>		medicine	NE
128	<i>Barleria cristata</i>		medicine	NE
129	<i>Clinacanthus nutans</i>		medicine	NE
130	<i>Crossandra infundibuliformis</i>		ornamental & medicine	LC
131	<i>Fittonia albivenis</i>		ornamental	NE
132	<i>Graptophyllum pictum</i>		medicine	NE
133	<i>Strobilanthes alternata</i>		medicine	NE
134	<i>Strobilanthes sinuata</i>		ornamental	NE
135	<i>Hypoestes phyllostachya</i>		ornamental	NE
136	<i>Justicia adhatoda</i>		medicine	LC
137	<i>Odontonema tubaeforme</i>		medicine	NE
138	<i>Pachystachys lutea</i>		ornamental	NE
139	<i>Pseuderanthemum maculatum</i>		ornamental & medicine	NE

140	<i>Ruellia elegans</i>		ornamental	NE
141	<i>Ruellia simplex</i>		ornamental	NE
142	<i>Sanchezia oblonga</i>		medicine	NE
143	<i>Schaueria calytricha</i>		ornamental	NE
144	<i>Thunbergia alata</i>		food, medicine & ornamental	NE
145	<i>Thunbergia coccinea</i>		ornamental & medicine	NE
146	<i>Thunbergia erecta</i>		ornamental & medicine	NE
147	<i>Thunbergia grandiflora</i>		ornamental & medicine	NE
148	<i>Cosmos sulphureus</i>	Asteraceae	ornamental	NE
149	<i>Centratherum punctatum</i>		ornamental	NE
150	<i>Glebionis segetum</i>		ornamental	NE
151	<i>Cichorium endivia</i>		medicine	LC
152	<i>Coreopsis grandiflora</i>		ornamental & medicine	NE
153	<i>Cosmos caudatus</i>		ornamental & medicine	NE
154	<i>Dahlia hortensis</i>		ornamental & medicine	NE
155	<i>Dahlia imperialis</i>		ornamental, medicine & edible	NT
156	<i>Erigeron karvinskianus</i>		ornamental & medicine	NE
157	<i>Euryops pectinatus</i>		ornamental	NE

158	<i>Gaillardia pulchella</i>		ornamental	NE
159	<i>Gerbera jamesonii</i>		ornamental	NE
160	<i>Helianthus annuus</i>		ornamental & medicine	LC
161	<i>Helichrysum bracteatum</i>		ornamental & medicine	NE
162	<i>Leucanthemum vulgare</i>		ornamental & medicine	NE
163	<i>Melampodium divaricatum</i>		ornamental	NE
164	<i>Senecio macroglossus</i>		ornamental	NE
165	<i>Solidago canadensis</i>		medicine	NE
166	<i>Spilanthes radicans</i>		medicine	NE
167	<i>Stevia rebaudiana</i>		medicine	NE
168	<i>Stokesia laevis</i>		ornamental	NE
169	<i>Symphyotrichum laeve</i>		ornamental & medicine	NE
170	<i>Tagetes erecta</i>		ornamental & medicine	NE
171	<i>Tagetes patula</i>		ornamental & medicine	NE
172	<i>Tanacetum parthenium</i>		ornamental & medicine	LC
173	<i>Taraxacum javanicum</i>		ornamental	NE
174	<i>Tithonia diversifolia</i>		ornamental & medicine	NE
175	<i>Tithonia rotundifolia</i>		ornamental & medicine	NE

176	<i>Baccharoides anthelmintica</i>		medicine	NE
177	<i>Tarlmounia elliptica</i>		medicine	NE
178	<i>Spahneticola trilobata</i>		ornamental & medicine	NE
179	<i>Zinnia elegans</i>		ornamental & medicine	NE
180	<i>Cinchona calisaya</i>	Rubiaceae	medicine	LC
181	<i>Coffea arabica</i>		beverages & medicine	EN
182	<i>Coffea liberica</i>		beverages	LC
183	<i>Gardenia jasminoides</i>		ornamental, dye & medicine	NE
184	<i>Hamelia patens</i>		ornamental & medicine	LC
185	<i>Ixora coccinea</i>		ornamental & medicine	NE
186	<i>Mussaenda erythrophylla</i>		ornamental & medicine	LC
187	<i>Mussaenda philippica</i>		medicine	LC
188	<i>Pentas lanceolata</i>		ornamental & medicine	NE
189	<i>Pseudomussaenda lanceolata</i>		ornamental & medicine	NE
190	<i>Rondeletia odorata</i>		ornamental & medicine	NE
191	<i>Ixora finlaysoniana</i>		medicine	NE

*NE = Near threatened; LC = Least concern; EN = Endangered; NT = Near threatened; DD = Data deficient; VU = Vulnerable; CR = Critically endangered; EW = Extinct in the wild.

Figure 1: Top 5 families with maximum number of species

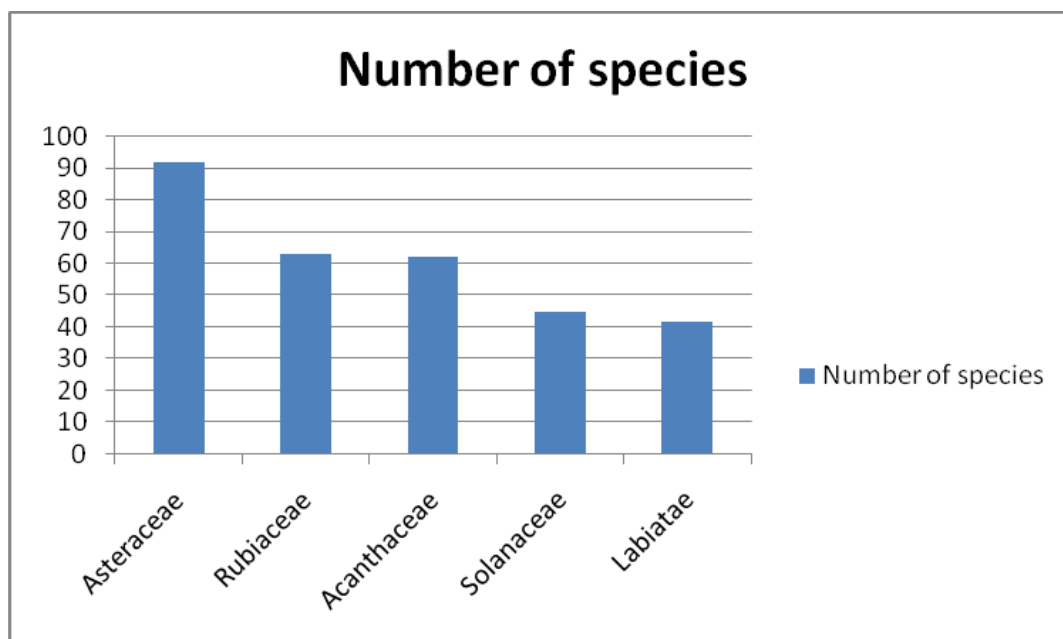


Figure 2: Top 6 families with maximum number of genera

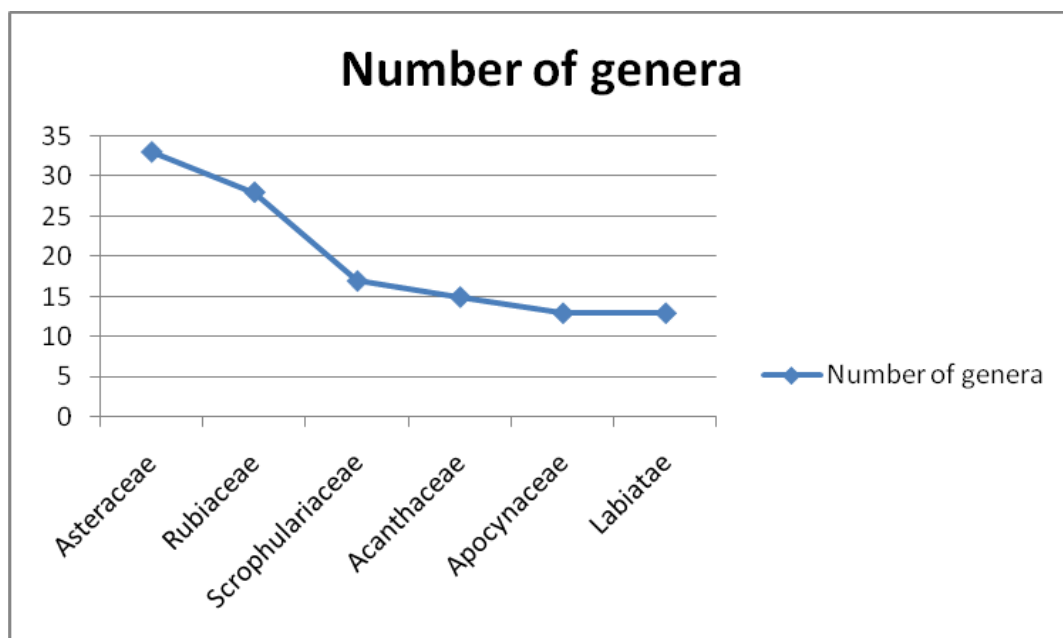


Figure 3: Top 6 genera with maximum number of species

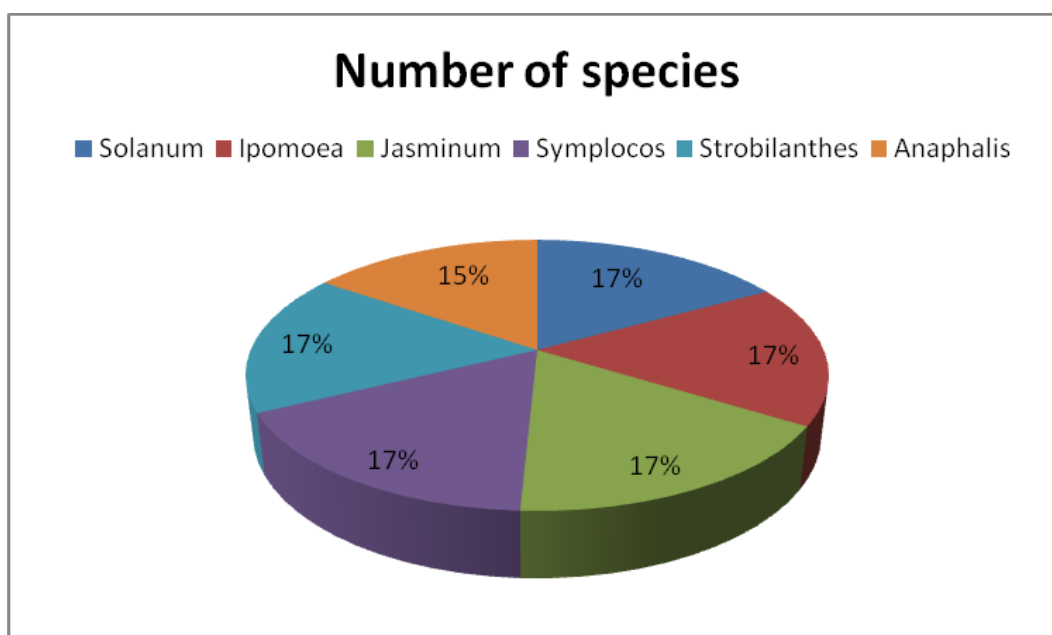
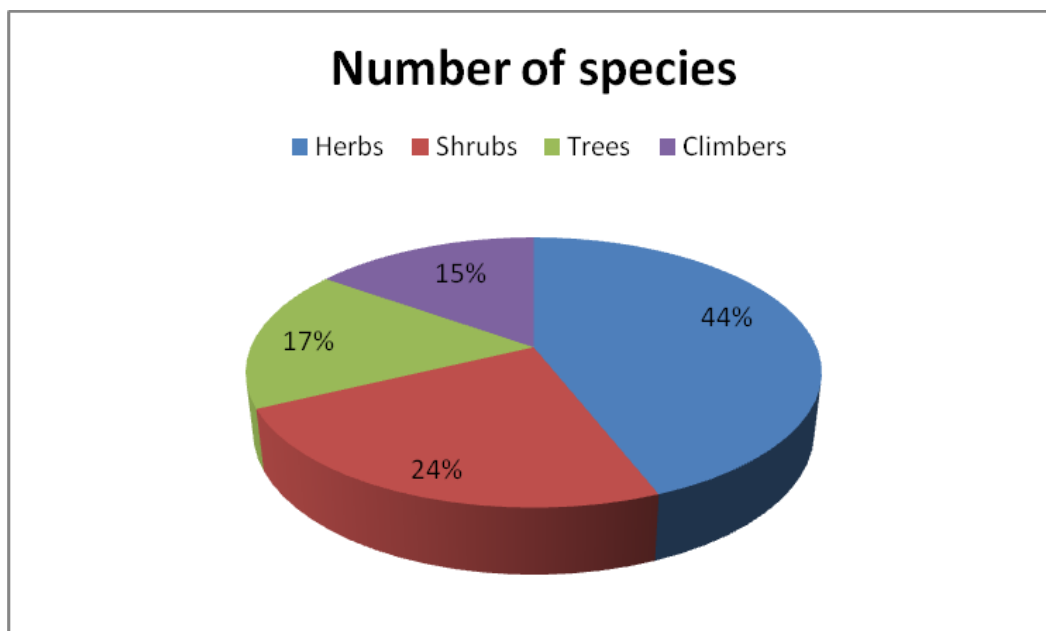


Figure 4: Classification of wild plants according to habits



Recommendations

Recommendations

- The morphological differences between the two Loganiaceae species, *Fagraea obovata* and *Fagraea coromandelina* (reinstated species) have to be confirmed by molecular investigations.
- The taxonomic identity of *Asyneuma cupulare* sp. nov. from the allied species *Asyneuma fulgens* (Campanulaceae) and *Parasopubia raghavendrae* sp. nov. from the allied species *Parasopubia delphiniifolia* & *Parasopubia hoffmanii* have to be verified by molecular analysis.
- The ecological studies of chosen Orobanchaceae members like *Striga* and *Utricularia* is recommended for studying interrelationship between associated species.
- It is possible to conduct pollination research on endemic plants of Orobanchaceae and Lentibulariaceae members to relate the role of pollinators in the distribution of species.
- Research on ethnobotanical aspects of rare and endemic medicinal plants highlighting their pharmaceutical properties will serve as a resource for future drug development.
- *Meesapulimala*, *Panchalimedu*, and *Elaveezhapoonchira* are popular tourist destinations of Idukki district that include a variety of uncommon and intriguing plants and demands immediate conservation. Therefore, tourism activities need to be regulated here.
- The emerging tourist destinations of Idukki district include areas like *Vaguvarai*, *Vakavanam*, *Pothadi*, *Mesthirikettu*, *Lakkamkudi* and *Kadalaar* which are home to rare and endangered plant species. Hence, special conservation status has to be granted to them.
- Building of dams, tall resorts and tea plantations encourages deforestation and increases the likelihood of landslides, soil erosion, heavy rains and cloud bursts. Therefore, there needs to be a check on anthropogenic activity and deforestation in order to lessen these natural disasters.
- Of the plants that have been collected, there are 6 Vulnerable, 2 Critically endangered, 6 Endangered, 2 Near Threatened and 1 Conservation Dependent species according to IUCN status. Therefore, *in situ* and *ex situ* conservation strategies are to be adopted for protecting these species from extinction.

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Publications and Conference Presentations

Journal Papers

- Notes on taxonomic Identity and typification of *Fagraea coromandelina* (Gentianaceae). **Divya K. Venugopal**, Dani Francis, Vishnu Mohan & Santhosh Nampy. *Phytotaxa* 360 (3): 292-295, 2018.
- New record of *Ioichroma arborescens* (Solanaceae) for India, a potential invasive plant from America with notes on its typification. Santhosh Nampy, **Divya K. Venugopal**, Dani Francis & Vishnu Mohan *Rheedea* 29(3): 222–226, 2019
- A new species of *Eriocaulon* (Eriocaulaceae) from the southern Western Ghats of Kerala, India. D. Francis, V. Mohan, **D. K. Venugopal** & S. Nampy. *Edinburgh Journal of Botany* 77(2): 281-290, 2020.
- Two new scapigerous species of *Impatiens* (Balsaminaceae) from southern Western Ghats, India. Mohan Vishnu, **Divya K. Venugopal**, Dani Francis & Santhosh Nampy. *Taiwania* 65(2):187–194, 2020.
- *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. *Nordic Journal of Botany* 39(1):1–7, 2021.
- *Burmammia munnarensis* (Burmammiaceae) a new species and rediscovery of *B. indica* after 110 years from southern Western Ghats, Kerala, India. Dani Francis, Vishnu Mohan, **Divya K. Venugopal** & Santhosh Nampy. *Phytotaxa* 507(1): 105–112, 2021.
- *Impatiens rakthakesara* (Balsaminaceae), a new species from southern Western Ghats, India. Vishnu Mohan, Dani Francis, Santhosh Nampy & **Divya K. Venugopal**. *Brittonia* 73(3):316–322, 2021.
- A new species of *Parasopubia* (Orobanchaceae) from the southern Western Ghats, India. **Divya Korappara Venugopal**, Santhosh Nampy, Ayilliath Kuttiyeri Pradeep, Dani Francis, Vishnu Mohan & Syam Radh Sasi. *Anales del Jardín Botánico de Madrid* 78(1): e106, 2021.

Conference Presentations

- **Divya K. Venugopal**, Santhosh Nampy., oral presentation on “Reinstating *Fagraea coromandelina* Wight (Loganiaceae), with notes on its typification” at the XXVII Annual Conference of Indian Association for Angiosperm Taxonomy & International Symposium on “Plant Systematics: Priorities and Challenges” held at Department of Botany, University of Delhi during 10th–12th, November, 2017.
- **Divya K. Venugopal**, Santhosh Nampy., oral presentation on “*Acnistus arborescens* (Solanaceae): potential invasive plant from America with notes on its typification” at the XLI All India Botanical Conference of the Indian Botanical Society & “Ecological Restoration, Carbon sequestration and Biotechnological Approaches for Biodiversity Conservation” held at School of studies in Botany, Jiwaji University, Gwalior during 25th–27th October, 2018.
- **Divya K. Venugopal**, Santhosh Nampy., oral presentation on “A new species of *Parasopubia* H. –P. Hofm. & Eb. Fisch. (Scrophulariaceae) from Idukki district, Kerala, India” at the National seminar on “Plant Sciences: Current Challenges & Perspectives” held at Department of Botany, University of Calicut during February 28, March 1, 2, 2019 and received best paper award.
- **Divya K. Venugopal**, Santhosh Nampy., oral presentation on “Studies on the diversity of *Anaphalis* species of Idukki district, Kerala” at the XLII All India Botanical Conference of the Indian Botanical Society and National Symposium on ‘Innovations and Inventions in Plant Science Research’ held at Department of Botany, University of Calicut during 6–8 November 2019.
- **Divya K. Venugopal**, Santhosh Nampy., oral presentation on “Taxonomy and distribution of Solanaceae in Idukki district, Kerala” at the International conference on “sustainable utilisation of Bioresources” held at Department of Botany, University of Kerala during 10–15 January 2022.



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	<i>F. coromandelina</i>	<i>F. obovata</i>	<i>F. ceilanica</i>
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!]).

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, ditheous, 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*.

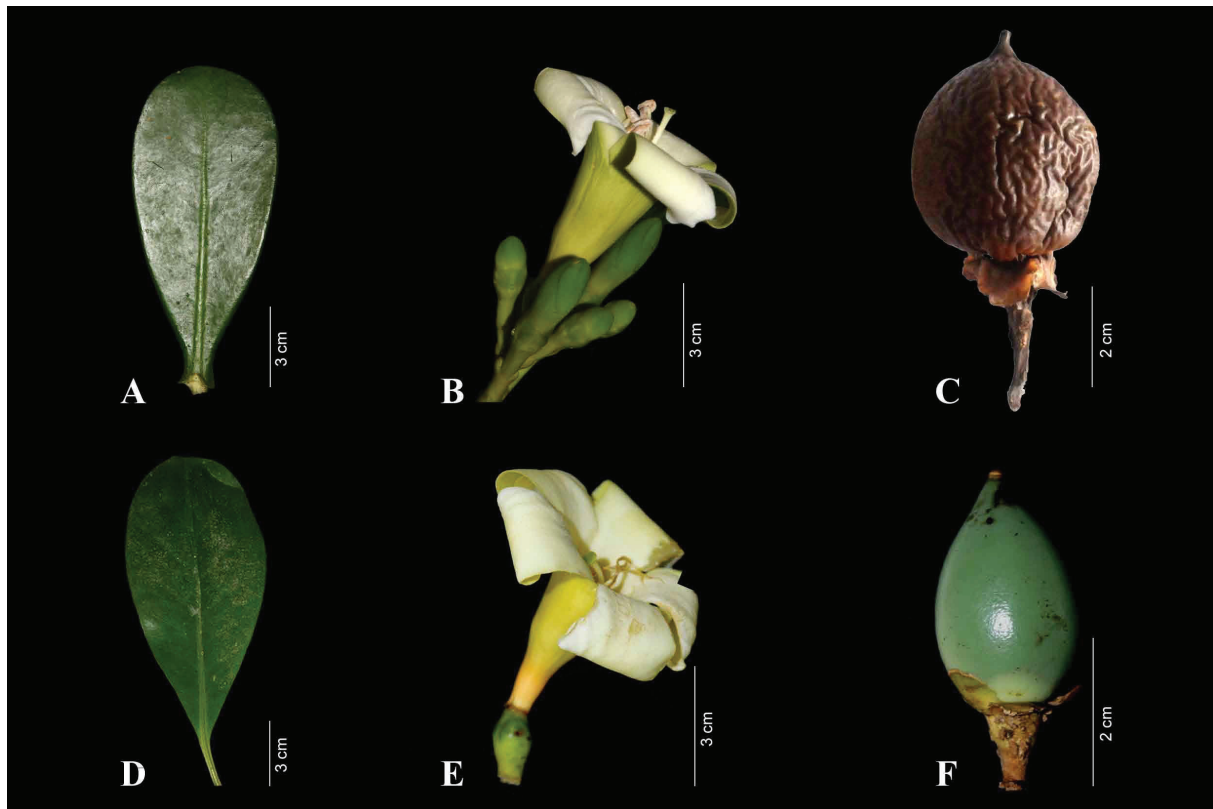


FIGURE 1. A–C. *Fagraea coromandelina* Wight, D–F. *Fagraea obovata* Wall. A and D. Leaves; B and E. Flowers; C and F. Fruits.

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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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-ribbed, puberulent along the ribs, dehiscence 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 km². 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 corolla 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).

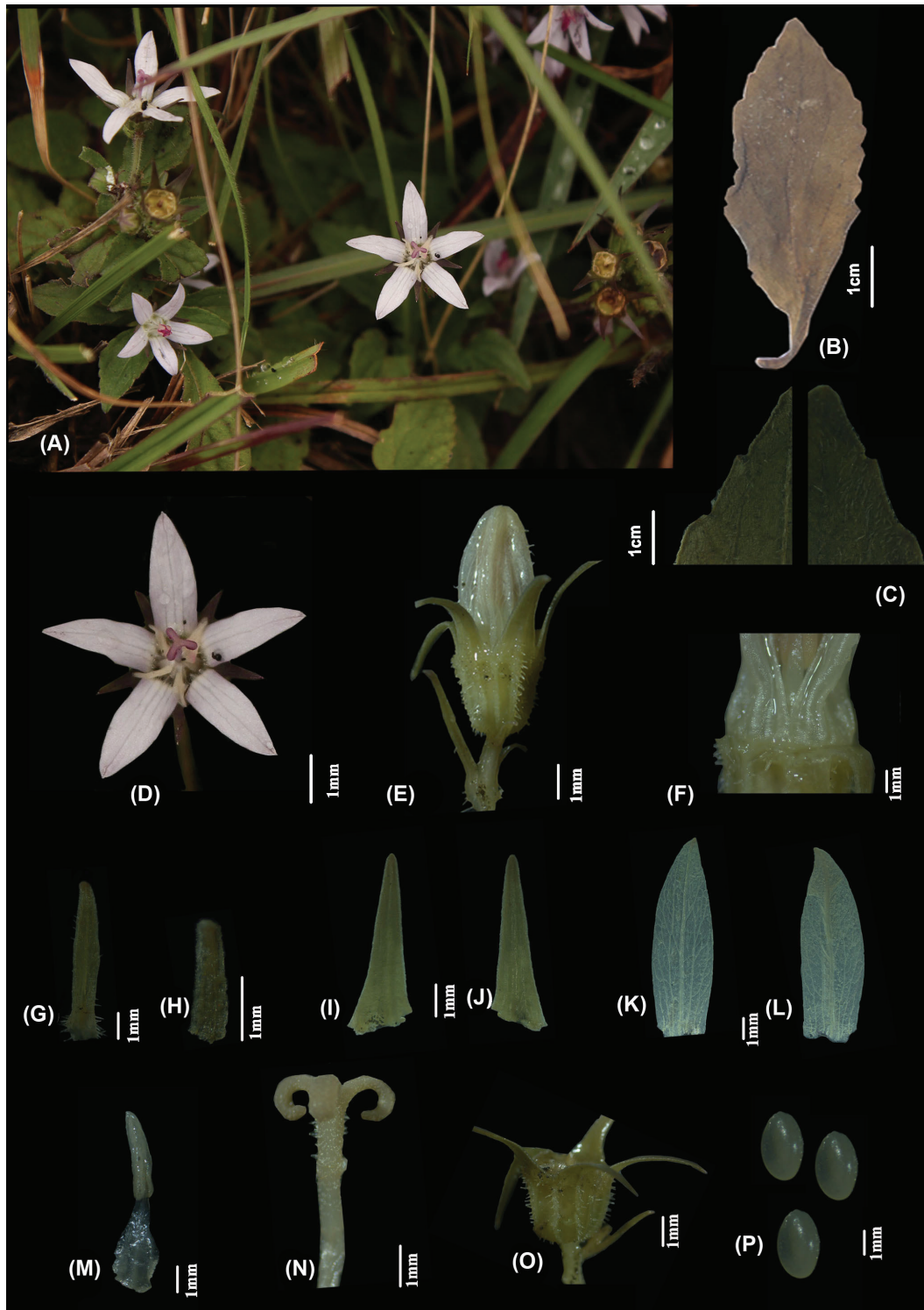


Figure 1. *Asyneuma cupulare* sp. nov. (A) habit, (B) leaf, (C) a portion of leaf showing pubescence, (D) flower, (E) flower bud, (F) corolla lobes split up to the base, (G) bract, (H) bracteole, (I) calyx lobe (adaxial view), (J) calyx lobe (abaxial view), (K) corolla (adaxial view), (L) corolla (abaxial view), (M) stamen, (N) style and stigma, (O) capsule, (P) seeds (all Divya K. Venugopal & Santhosh Nampy 170375, CALI). Photos by Vishnu Mohan.

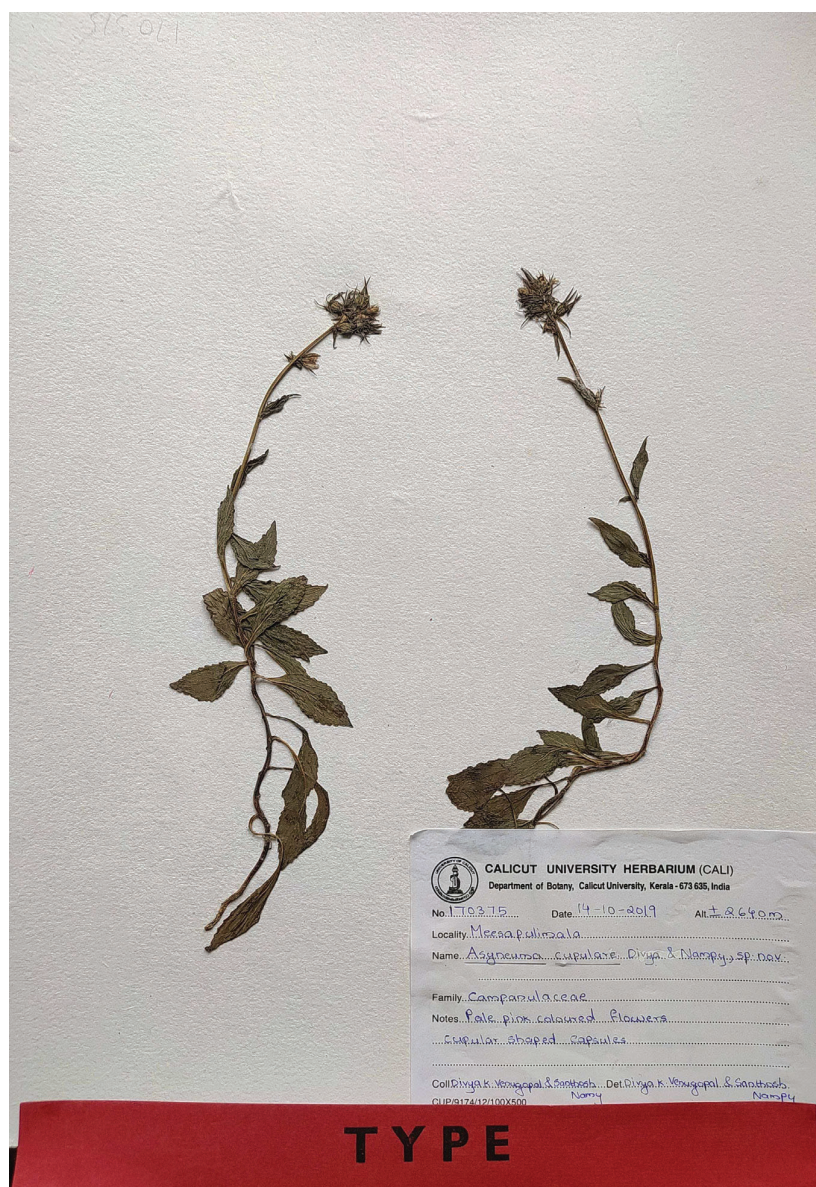


Figure 2. Holotype of *Asyneuma cupulare* sp. nov. deposited at CALI.

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.

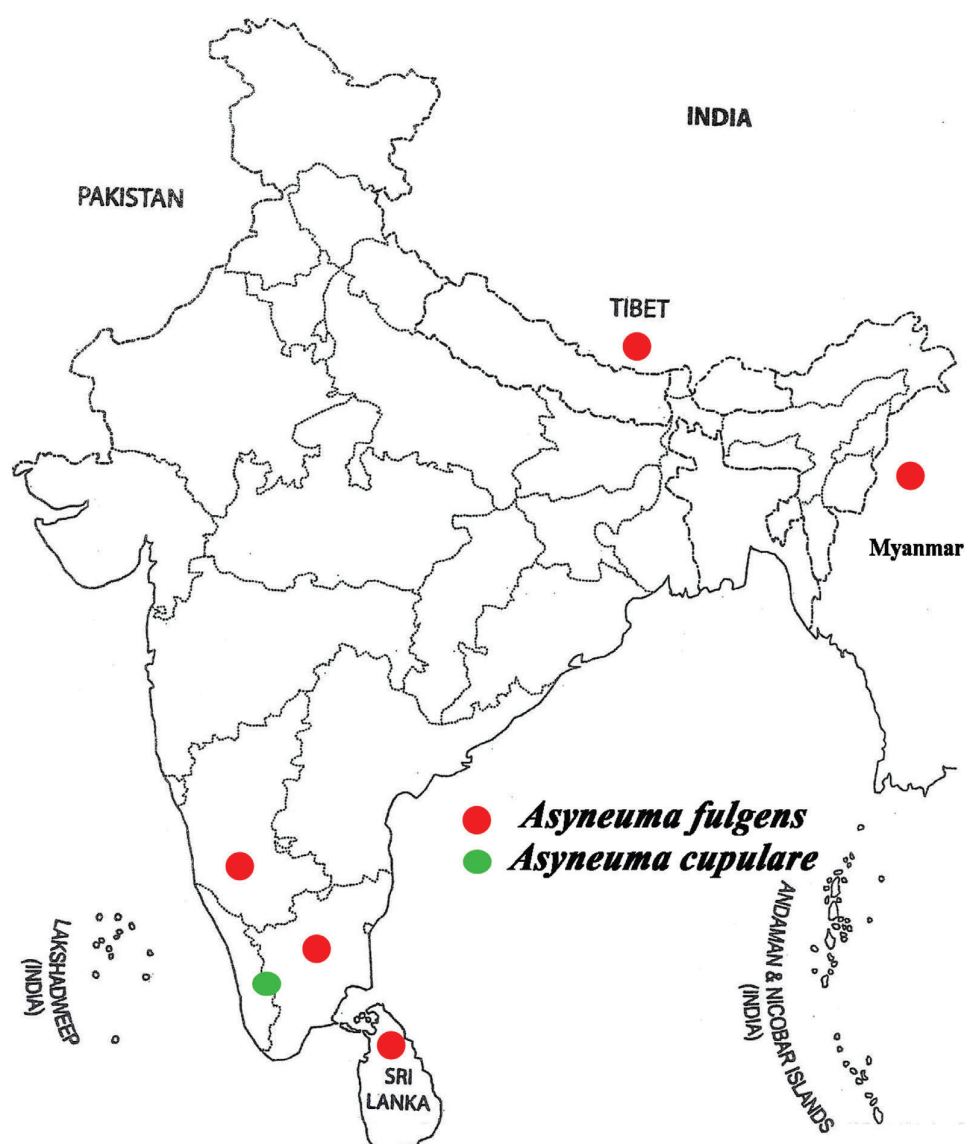


Figure 3. Distribution map of *Asyneuma cupulare* sp. nov. and *Asyneuma fulgens*.

Table 1. Diagnostic morphological features of *Asyneuma cupulare* and *A. fulgens*.

Characters	<i>A. cupulare</i> sp. nov.	<i>A. fulgens</i>
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.

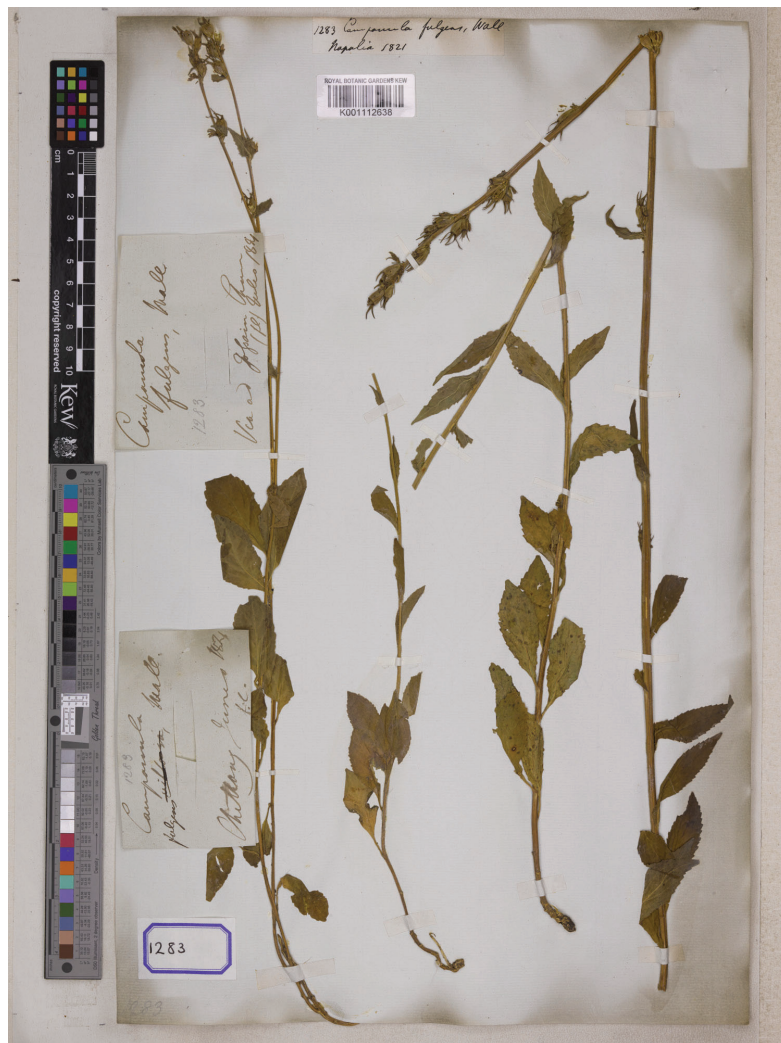


Figure 4. Lectotype of *Asyneuma fulgens* (Wall.) Briq. (K000112638). (c) The board of trustees of Royal Botanic Gardens, Kew. Reproduced with permission.

Acknowledgements – Authors are grateful to The Head, Dept of Botany, Univ. of Calicut for the facilities; Chief Wildlife Warden (Kerala) and Officials of KFDC for granting permission to explore the Meesapulimala; Dr. K. N. Gandhi (Harvard University) for correcting the specific epithet according to the gender of the species. **Funding** – This study was supported by research grants from Kerala State Council for Science, Technology and Environment, Thiruvananthapuram (126/2016/KSCSTE dated 26 May 2016).

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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.

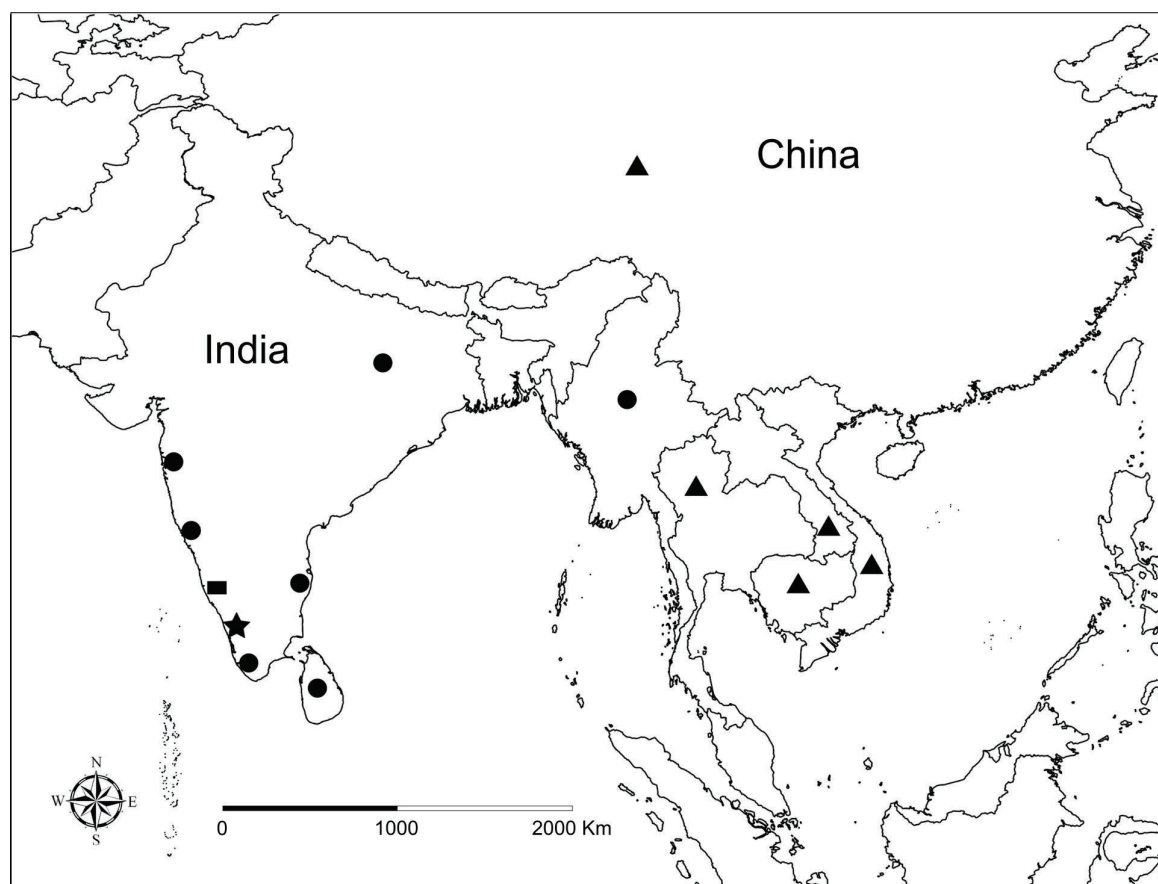


Fig. 1. Map showing the approximate location of the known herbarium records of *Parasopubia* species: *P. delphinifolia* (circle), *P. bonatii* (triangle), *P. hofmannii* (square), *P. raghavendrae* (star). Base map modified from version available at <https://d-maps.com>.

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 parallelly 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, $1-1.5 \times 0.5-1$ cm. Pedicels $1-1.5$ cm long, tomentose, green; bracteoles 2, linear, $2-2.3 \times 0.5-1$ mm, glabrous, green. Calyx 5-lobed, persistent in fruit; tube $4-4.5$ mm long, longer than lobes, glabrous; lobes linear, $3.5-3.8 \times 1-1.1$ mm, acute at apex, glabrous, green. Corolla campanulate, puberulent on outer surface, glabrous on inner surface, pink; tube $6.8-7 \times 1-1.5$ mm; lobes nearly sub-rotund, $3-3.2 \times 4-4.1$ 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, $8-8.2 \times 1-1.1$ mm, puberulent distally, pale pink; stigma globose, glabrous. Capsules oblong, erect, $5-5.3$ mm long, glabrous; $\frac{3}{4}$ portion enclosed in calyx tube; fruiting calyx lobes erect. Seeds numerous, oblong, 0.57 mm long, brown; testa uniformly ribbed and parallelly 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), *Polycarpha 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 km² [B₂]; number of mature individuals in each population ≤ 50 [C₂a]; 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 parallelly 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. hofmannii* 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	<i>P. delphinifolia</i>	<i>P. hofmannii</i> var. <i>hofmannii</i>	<i>P. raghavendrae</i>
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 $\frac{1}{2}$ of the capsule enclosed in calyx tube	Oblong Glabrous $\frac{3}{4}$ 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. raghavendrar*
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. König s.n. (S 09-26708 digital image); s.loc., 1831, N. Wallich 3890 (K 000999981 digital image).—*Parasopubia hofmannii* 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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New record of *Ichroma arborescens* (Solanaceae) for India, a potential invasive plant from America with notes on its typification

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Abstract: *Ichroma 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, *Ichroma*, 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 *Ichroma arborescens* (L.) J.M.H. Shaw, a species so far not reported from India. The genus *Ichroma* Benth. includes nearly c. 26 species worldwide (Mabberley, 2017; but IPNI records 98 names under *Ichroma*), ranging from Mexico to Tropical America. *Ichroma 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 *Ichroma arborescens* in India.

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Taxonomic treatment

Ichroma arborescens (L.) J.M.H. Shaw, *Plantsman* 17(3): 200. 2018. *Atropa arborescens* L., *Cent. Pl.* II: 10. 1756. *Acnistus arborescens* (L.) Schtdl., *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, dithecal, 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. *lochroma 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.

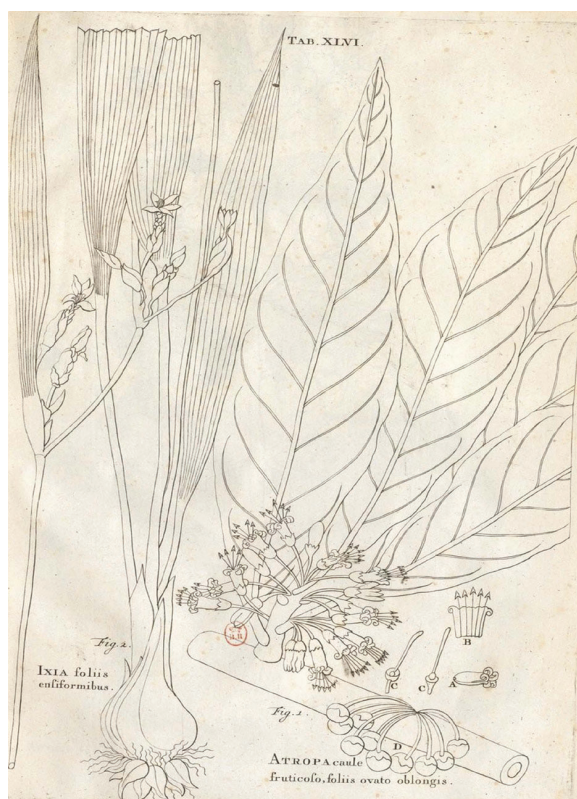


Fig. 2. Neotype of *Iochroma arborescens* (L.) J.M.H. Shaw (Plumier, Pl. Amer. fasc. 2. t. 46. f.1. 1756).

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* (Staffleu & Cowan, 1983). According to Jarvis (2007), the type of this name has not yet been designated as per Linnaean typification 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 typification 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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***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.

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., $10^{\circ}08'00.2''$ N, $77^{\circ}03'22.5''$ 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 $\times$ 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 $\times$ 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 $\times$ 1–1.5 mm; outer perianth triangular, 1–1.5 $\times$ 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, tricarpeal, 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, dehiscent 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 wallichii* 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, mycoheterotrophic), flowers (10–15 mm vs. 6.5 mm long), bracts (ca. 2.5×0.8 –1 vs. ca. $1.5 \times$ 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 $\times$ 0.3–0.5 vs. ca. $4.5 \times$ ca. 0.5 mm).

Additional specimens examined:—INDIA. Kerala: Idukki district, Pettimudi, near Subran shed, ± 1897 m a.s.l., $10^{\circ}9'39.76''$ N, $77^{\circ}0'39.51''$ 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 km² and the area of occupancy (AOO) less than 10 km². 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).

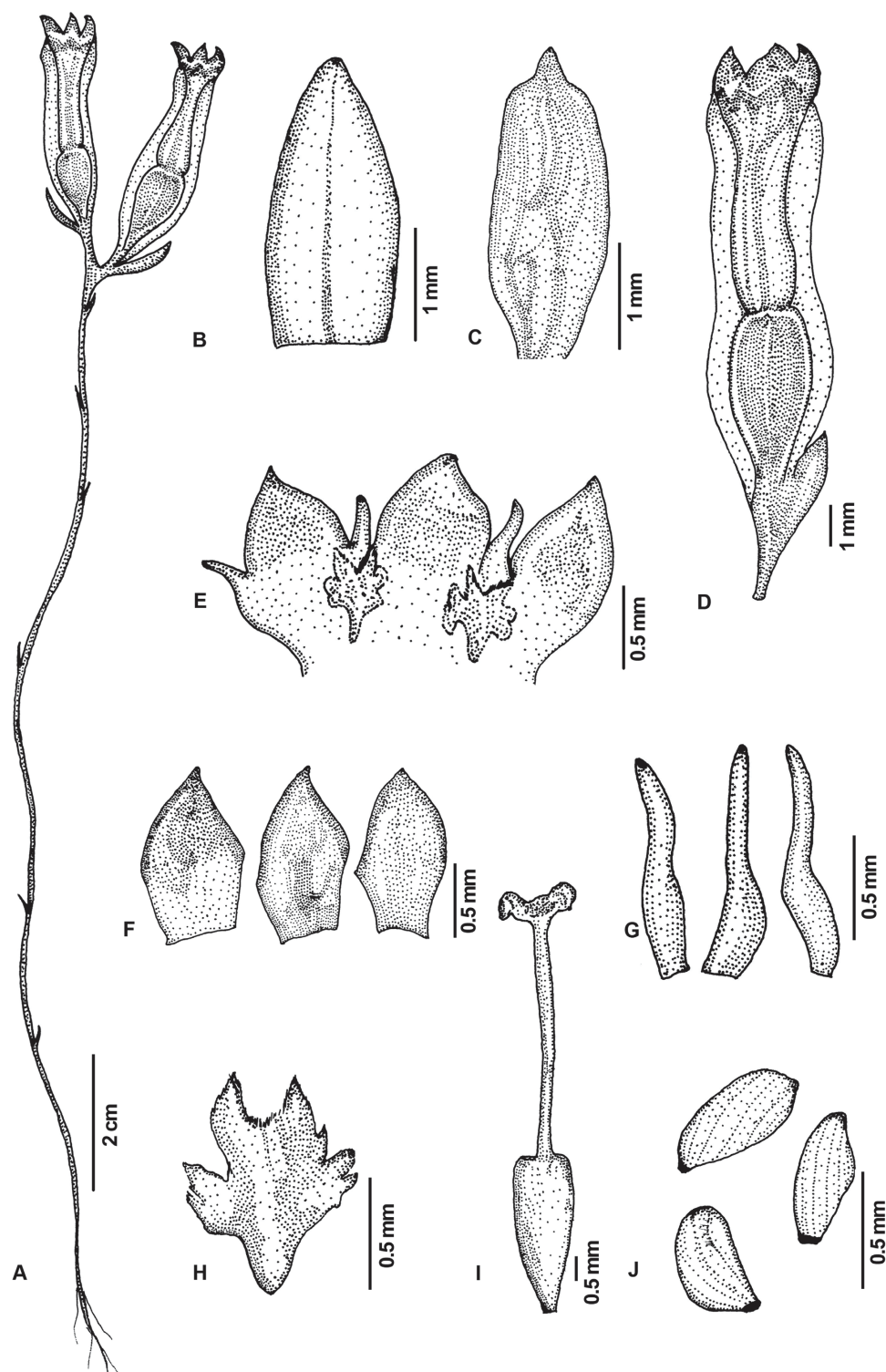


FIGURE 1. *Burmannia munnarensis* Dani & Nampy *sp. nov.*, A. Habit; B. Scale leaf; C. Bract; D. Single flower; E. Upper part of flower split open showing perianth lobes and stamens; F. Outer perianth lobes; G. Inner perianth lobes; H. Stamen, see the two lateral thecae, apical crests and basal spur; I. Gynoecium; J. Seeds. (Drawn by *Dani Francis* from *Dani Francis, Vishnu Mohan & Santhosh Nampy 173331*).

Burmattia 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, tricarpeal, 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, dehiscent 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 *Burmattia coelestis* D. Don (1825: 44) (Burmattiaceae), *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:—*Burmattia indica* was first described by F.P. Jonker in 1938 in his monograph of Burmattiaceae 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 mycoheterotrophic nature of the species, but our collection is chlorophyllous and not mycoheterotrophic. 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:—*Burmattia 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 km² and the area of occupancy (AOO) less than 10 km². 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 *Burmattia*

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. 1×0.3 cm *B. coelestis*

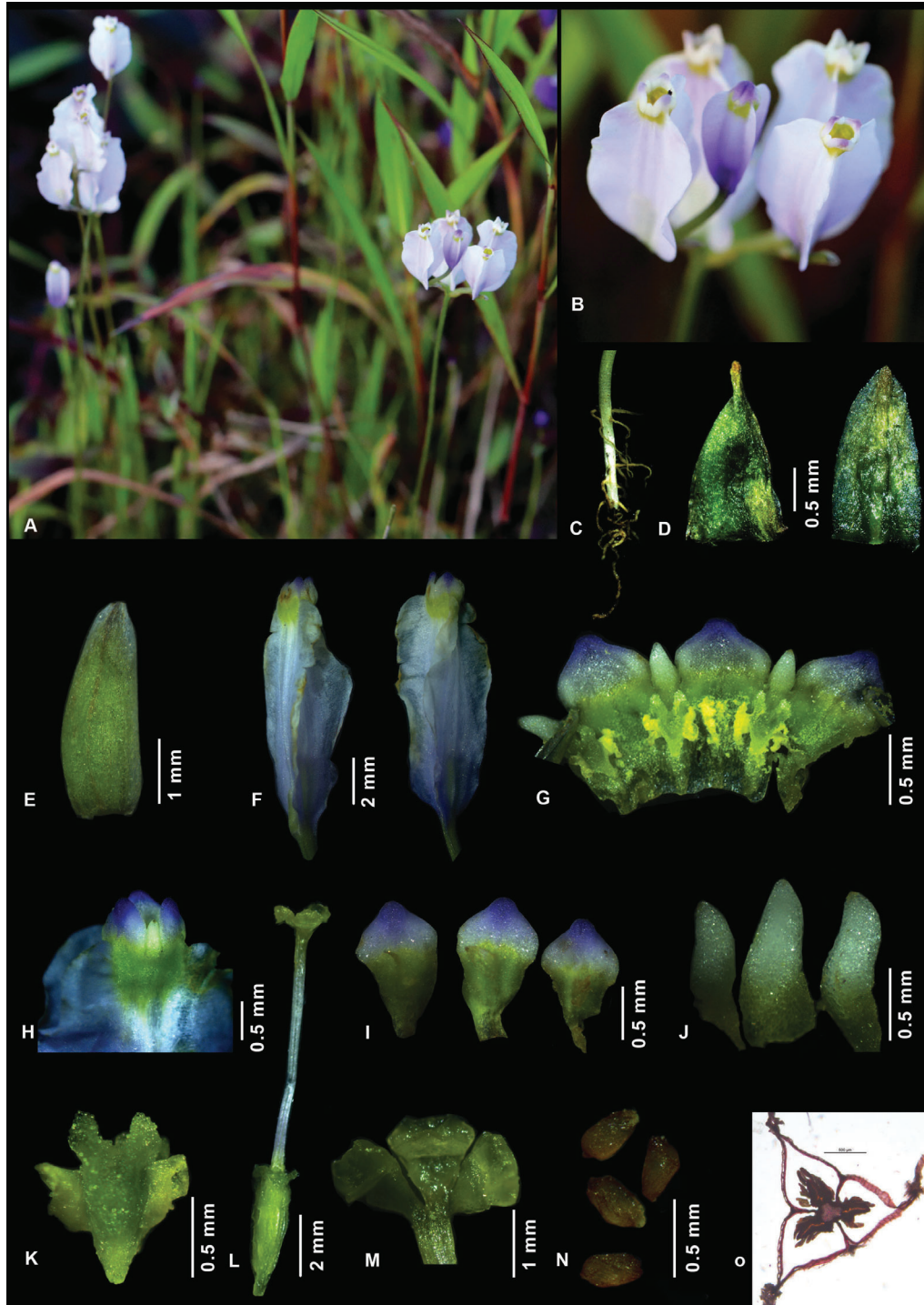


FIGURE 2. *Burmammia indica* Jonker, A. Habitat; B. Inflorescence; C. Basal part of the plant, see the absence of radical leaves; D. Scale-like leaves; E. Bract; F. Flowers; G. Upper part of flower split open showing perianth lobes and stamens; H. Upper part of flower showing closeup of perianth; I. 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).

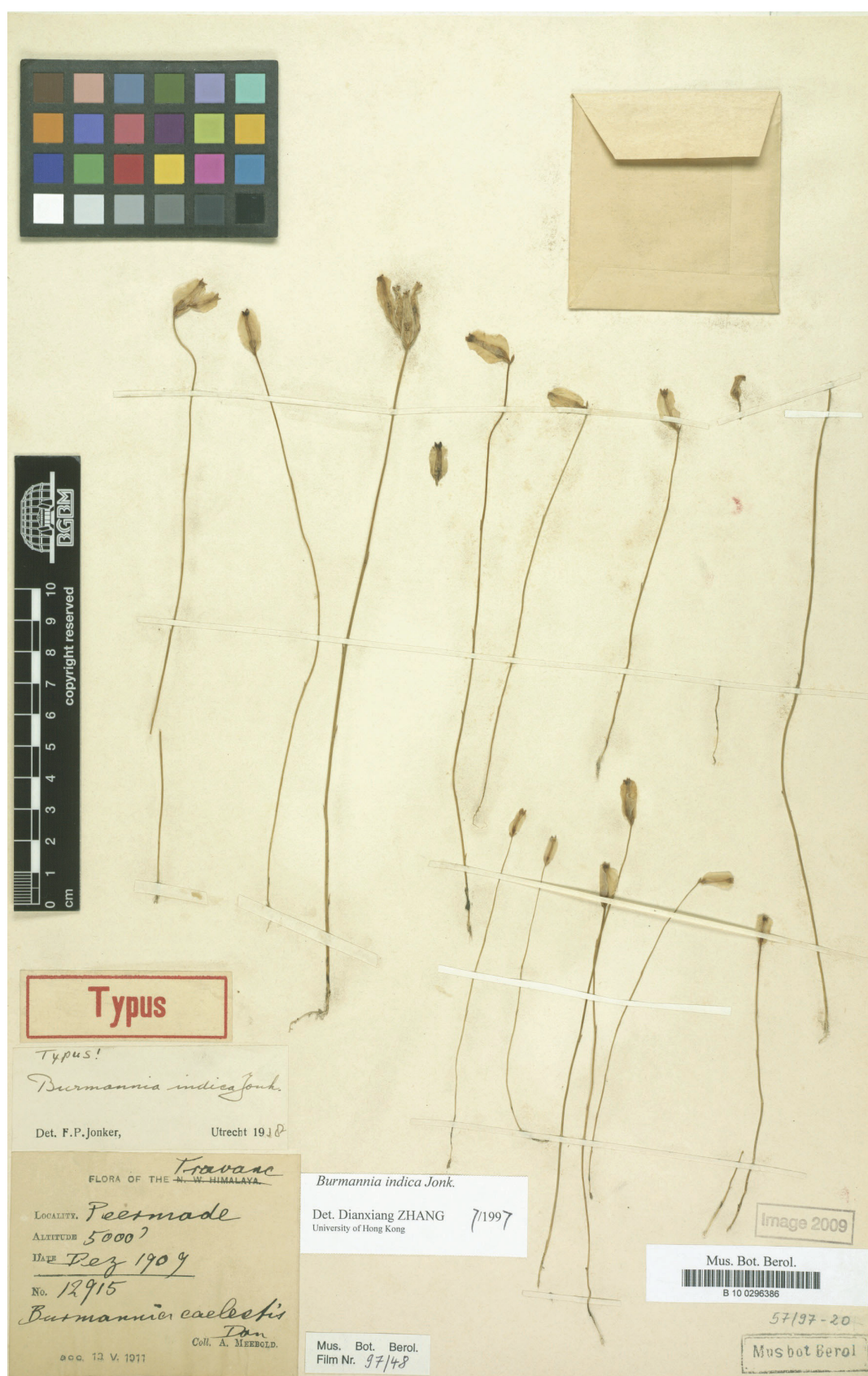


FIGURE 3. Type of *Burmannia indica* Jonker.

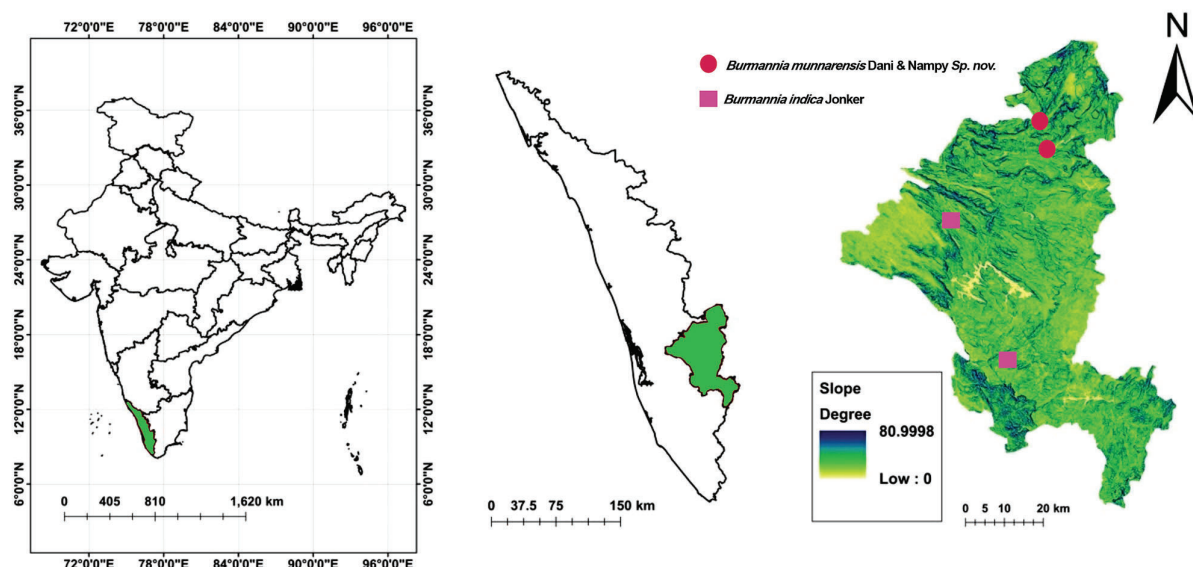


FIGURE 4. Map showing the distribution of *Burmannia munnarensis* Dani & Nampy and *B. indica* Jonker.

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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 vamanæ*.

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 vamanæ* Dani & Nampy, sp. nov.**

Eriocaulon vamanæ is morphologically close to *Eriocaulon nepalense* var. *luzulifolium* (Mart.) Praj. & J.Parn. but differs in the shape of its involucre 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. *Involucre 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,

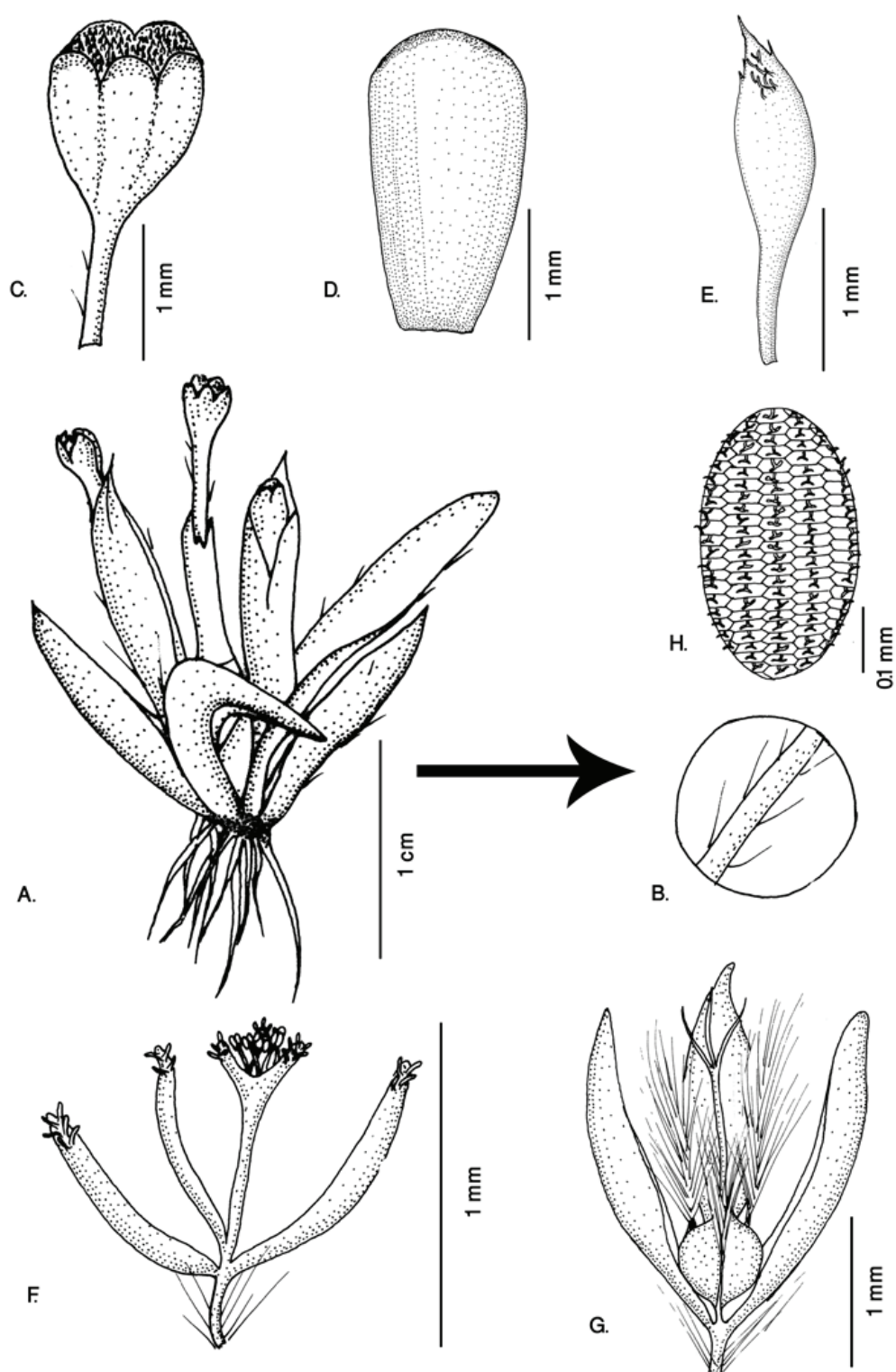


FIG. 1. *Eriocaulon vamanae* Dani & Nampy, sp. nov. A, Habit; B, hair pattern; C, head; D, involucral bract; E, floral bract; F, male flower; G, female flower; H, seed. Drawn by Dani Francis.



FIG. 2. *Eriocaulon vamanæ* 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.

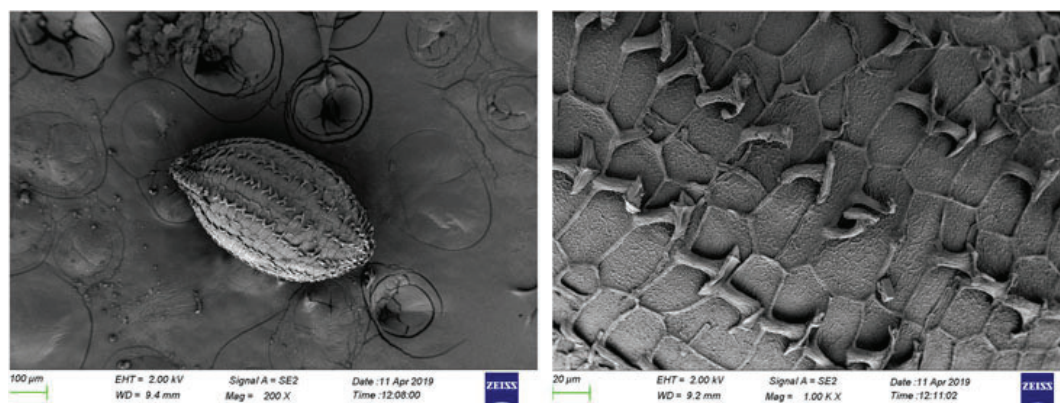


FIG. 3. Scanning electron micrograph showing seeds of *Eriocaulon vamanae* Dani & Nampy.

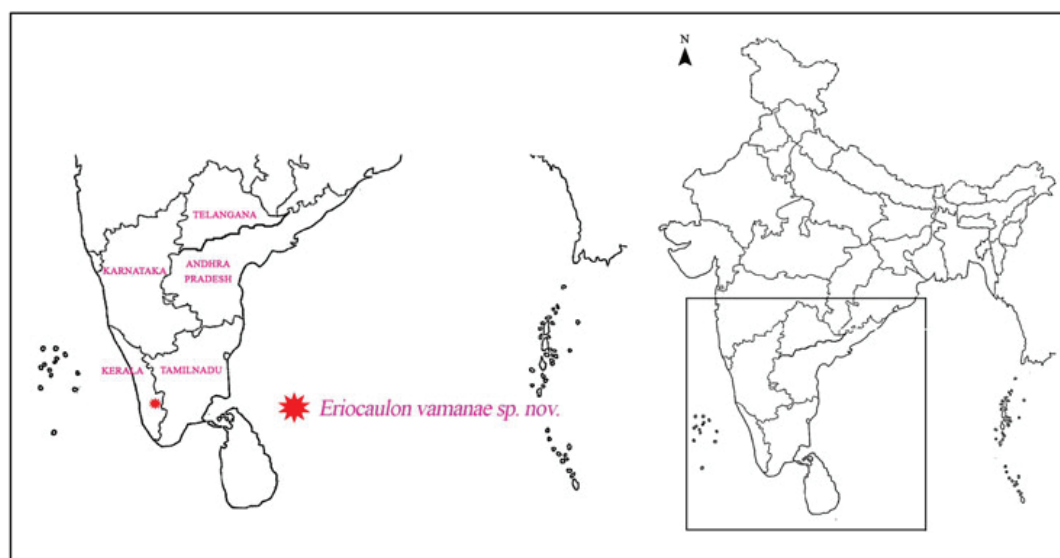


FIG. 4. Map showing the distribution of *Eriocaulon vamanae* Dani & Nampy.

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), *Apocopsis*

TABLE. Diagnostic morphological characters of *Eriocaulon vamanae* sp. nov., *E. nepalense* var. *luzulifolium* (Mart.) Praj. & J.Pam., *E. duthiei* Hook.f. and *E. thwaitesii* K m.

Character	<i>Eriocaulon vamanae</i>	<i>Eriocaulon nepalense</i> var. <i>luzulifolium</i>	<i>Eriocaulon duthiei</i>	<i>Eriocaulon thwaitesii</i>
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

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 involucre 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 ($0.9\text{--}2 \times 0.1\text{--}0.2$ cm versus $c.9 \times 0.2$ 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

-
- 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. vamanai***
- 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 $15\text{--}40 \times 1.2$ 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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Two new scapigerous species of *Impatiens* (Balsaminaceae) from southern Western Ghats, India

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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. tirunelvelica*.

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 grandisporea* 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.

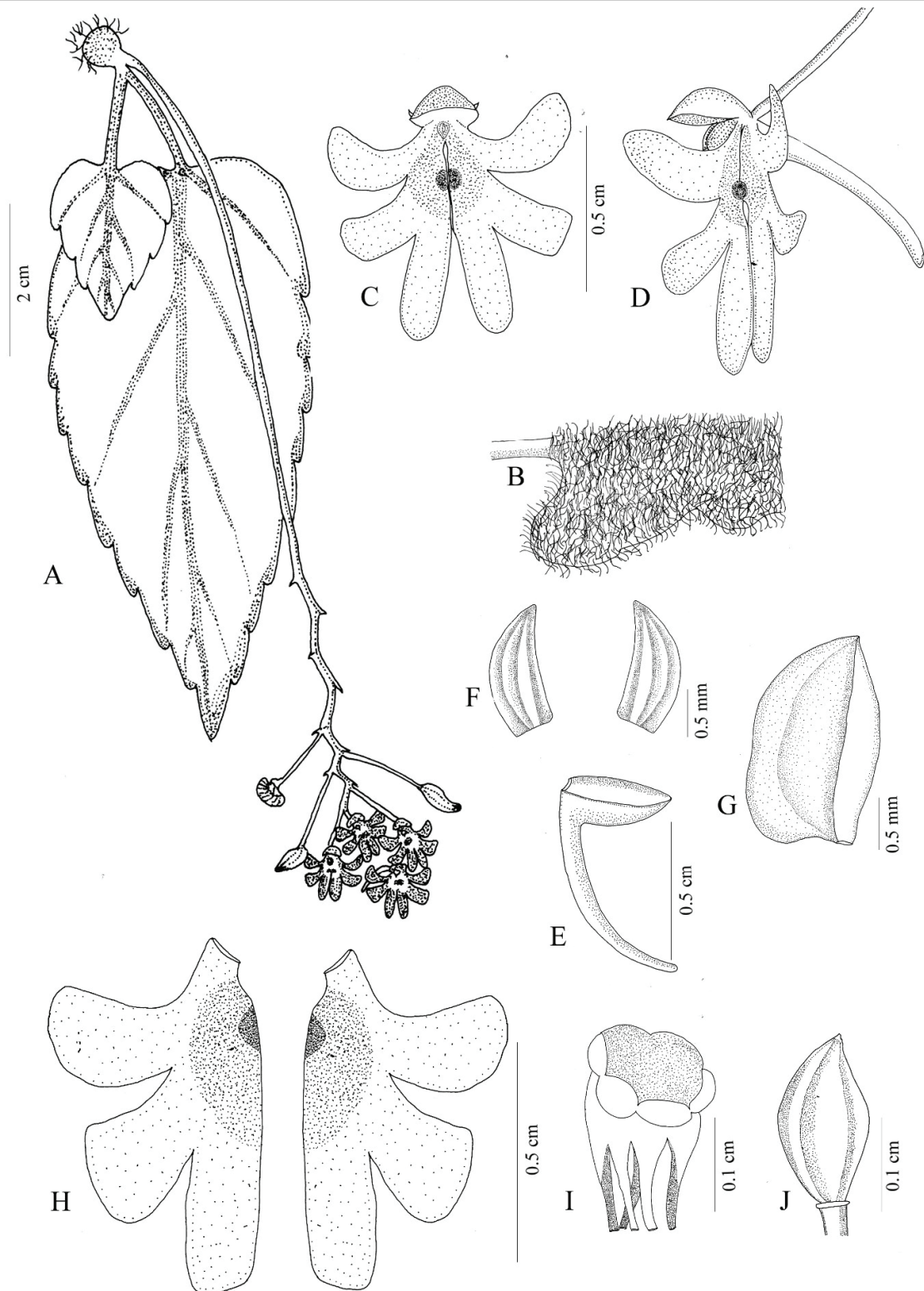


Fig. 3. *Impatiens nidholapathra* Vishnu & Nampy. **A:** Habit. **B:** Leaf abaxial side (a portion enlarged showing hairs). **C & D:** Flower (front and lateral views). **E:** Lower sepal with spur. **F:** Lateral sepals. **G:** Dorsal petal. **H:** Lateral united petals. **I:** Androecium. **J:** Ovary.



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 dehiscent; staminodes absent; pollen spheroidal, porate, golden yellow, $c. 38 \pm 4 \times 38 \pm 4 \mu\text{m}$; 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 m² 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 dehiscent; 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 flower 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.

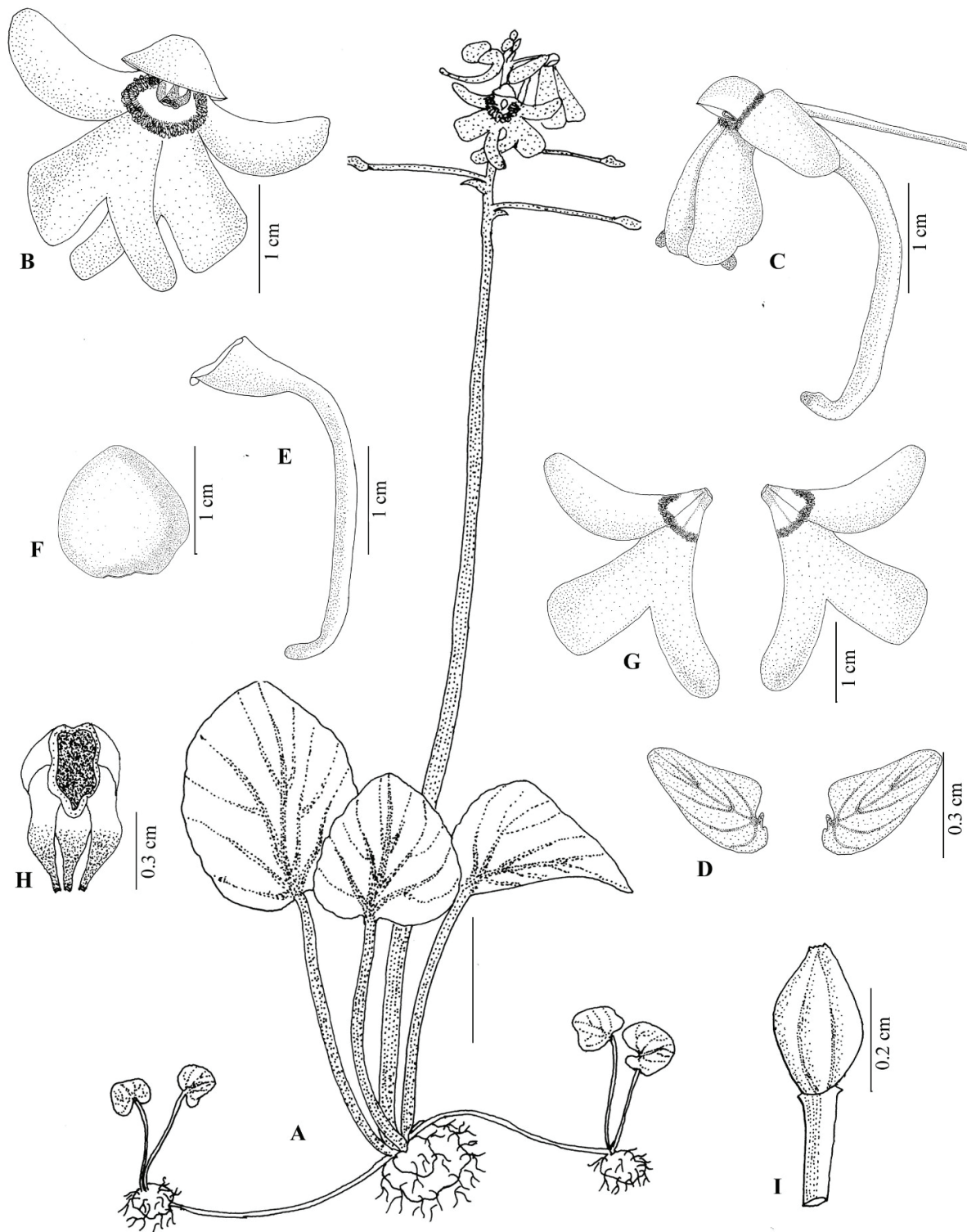


Fig. 5. *Impatiens grandisporea* Nampy & Vishnu. **A:** Habit. **B & C:** Flower (front and lateral views). **D:** Lateral sepals. **E:** Lower sepal with spur. **F:** Dorsal petal. **G:** Lateral united petals. **H:** Androecium. **I:** Ovary.

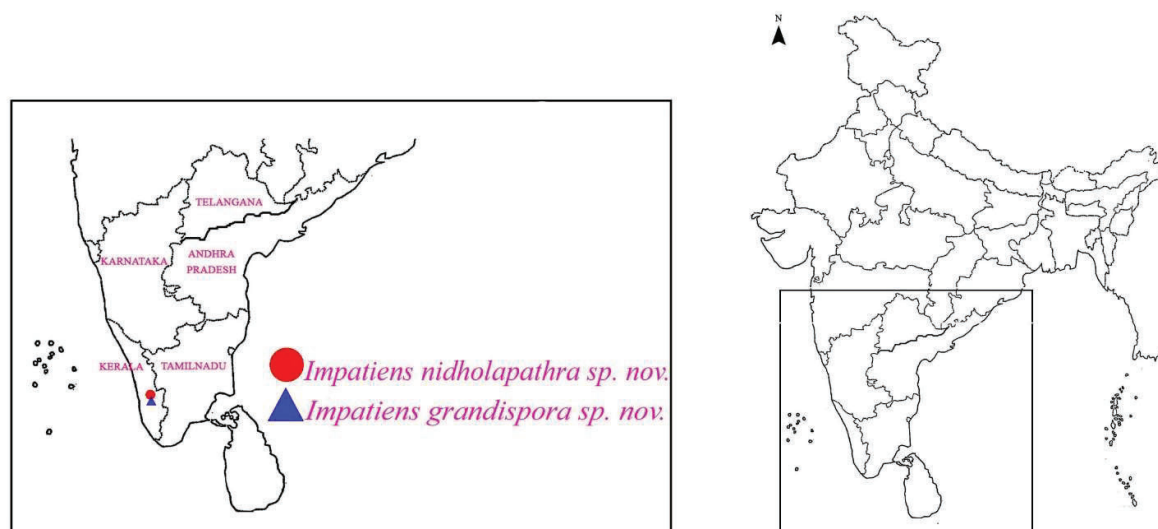


Fig. 6. Map showing distribution of *Impatiens nidholapathra* and *I. grandispora*.

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 μ m) 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 μ m).

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 m². 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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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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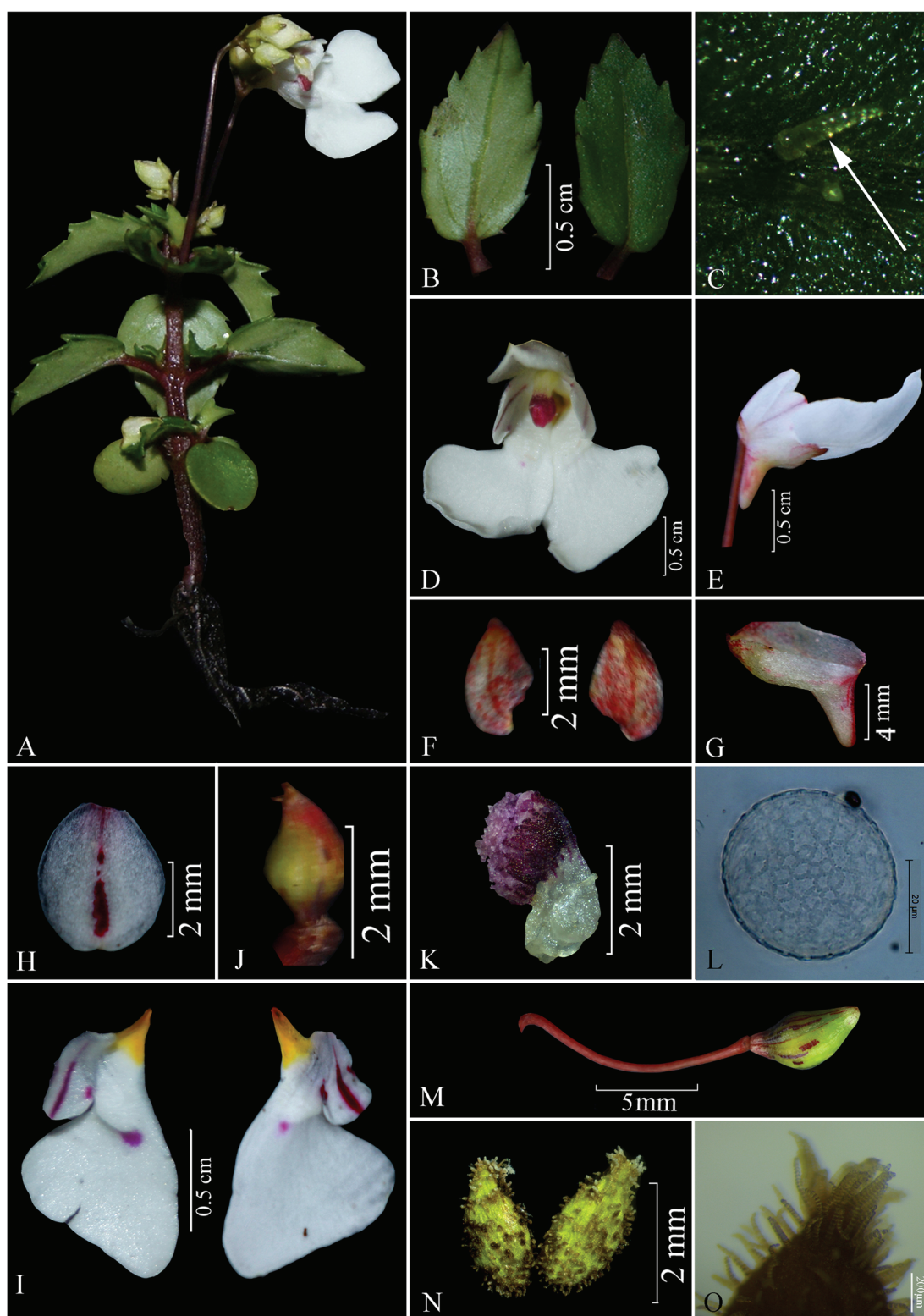


FIG. 1. *Impatiens raktakesara*. **A.** Habit. **B.** Leaf abaxial (left) and adaxial (right) surfaces. **C.** Detail of leaf adaxial surface showing trichome. **D.** Flower, frontal view. **E.** Flower, lateral view. **F.** Lateral sepals. **G.** Dorsal sepal with spur. **H.** Dorsal petal. **I.** Lateral 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.)

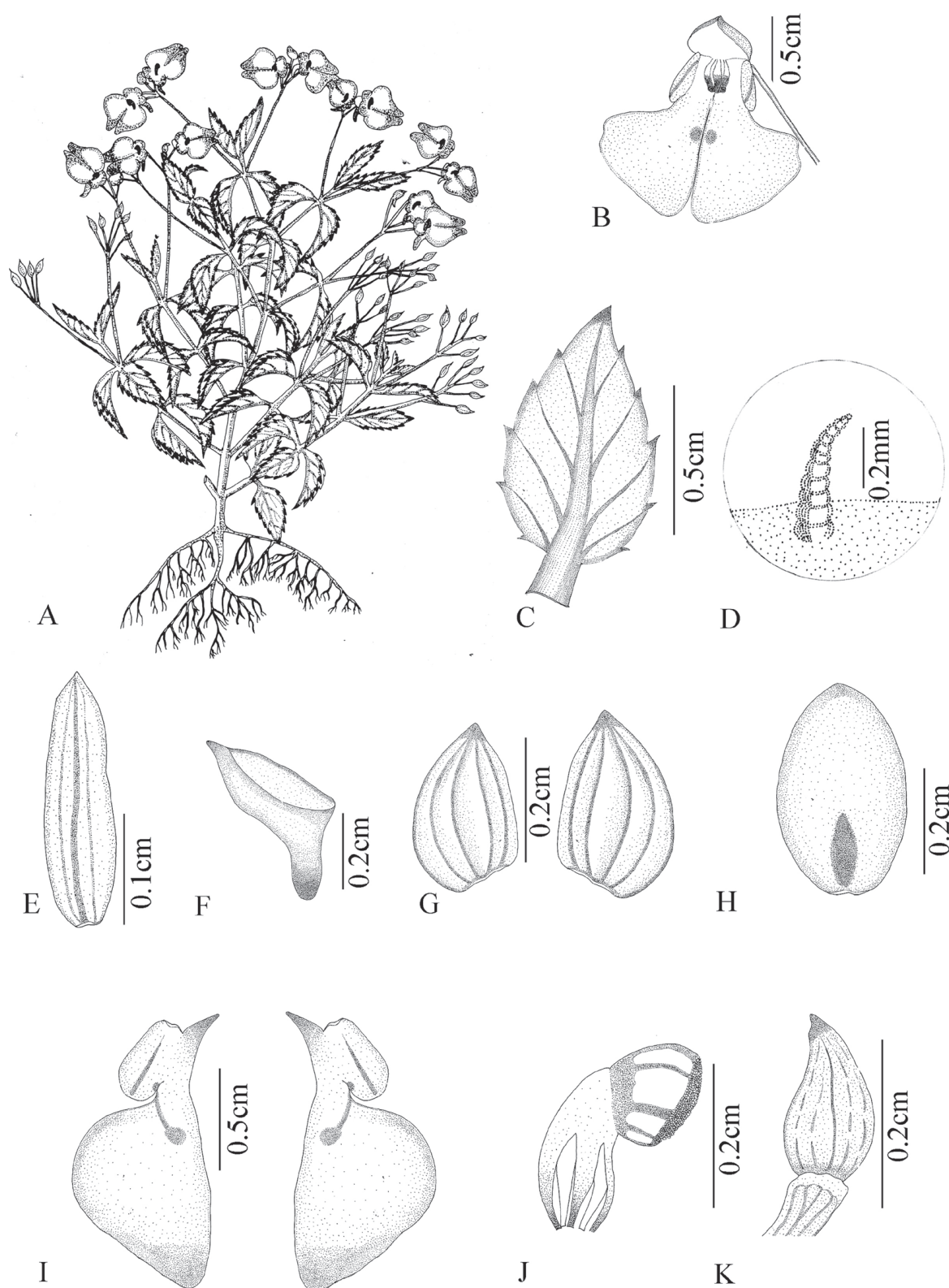


FIG. 2. *Impatiens raktakesara*. A. Habit. B. Flower, frontal view. C. Leaf, abaxial view. D. Leaf trichome. E. Bract. F. Dorsal sepal with spur. G. Lateral sepals. H. Dorsal petal. I. Lateral united petals. J. Connate stamens. K. Ovary. (A–K from the holotype; illustrated by Vishnu Mohan.)



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 Nampy*170254 (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 dehiscent; 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,

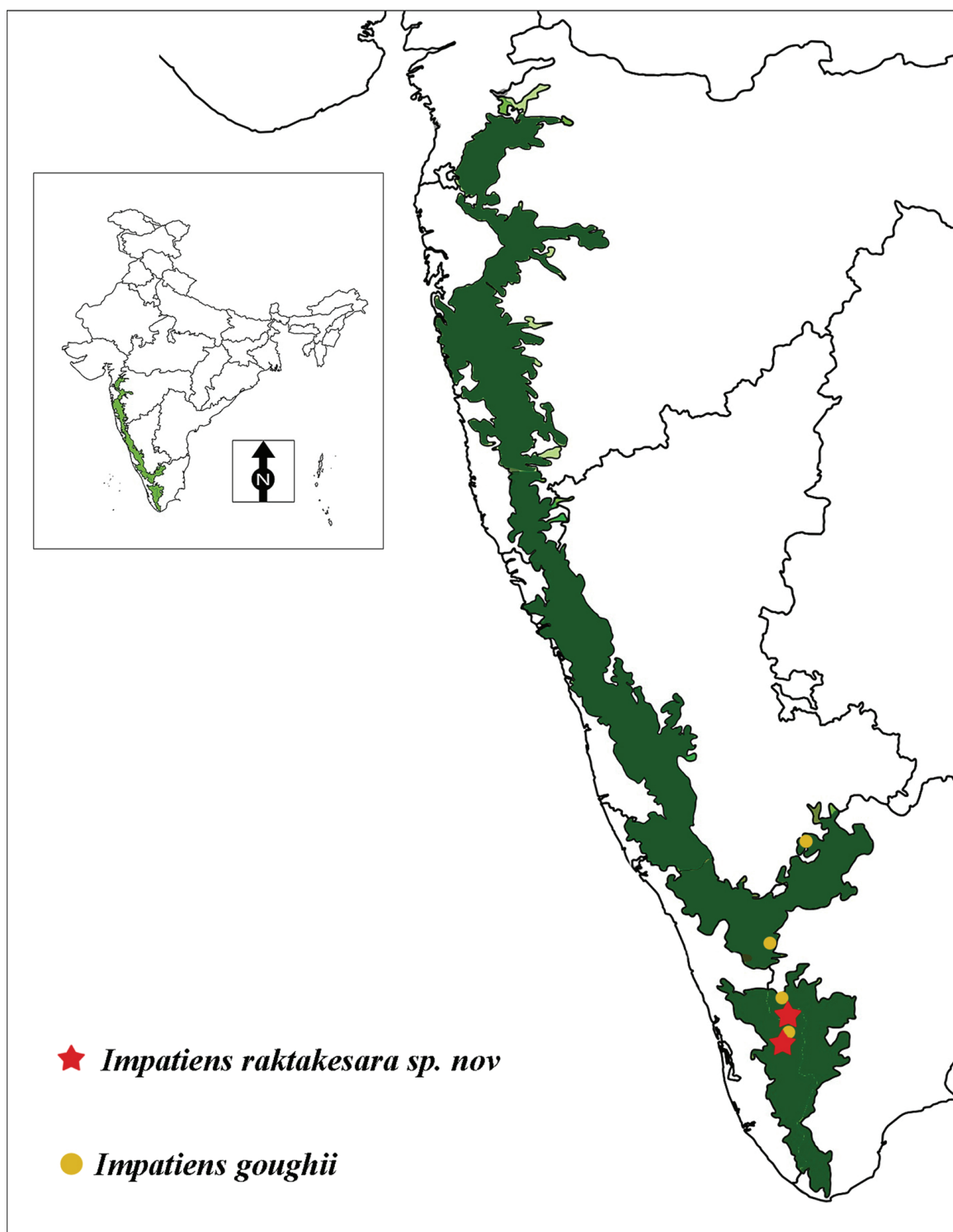


FIG. 4. Geographical distribution of *Impatiens raktakesara* and *I goughii*.

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 km² and the Area of Occupancy (AOO) is less than 10 km². 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>I. raktakesara</i>	<i>I. goughii</i>
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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