RIPARIAN FLORA OF THE CHALAKKUDY RIVER BASIN AND ITS ECOLOGICAL SIGNIFICANCE

The Thesis

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IN

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By

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CERTIFICATE

This is to certify that the thesis entitled **Riparian flora of the Chalakkudy river basin and its ecological significance** submitted to the University of Calicut by Mr. Amitha Bachan K.H. in partial fulfilment for the award of the Degree of Doctor of Philosophy in Botany is a bonafide record of the research work carried out by him under my guidance during period from 2001-2010. No part of this work has formed the basis for the award of any degree or diploma previously.

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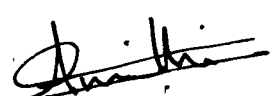
DECLARATION

I here by declare that the thesis entitled **Riparian flora of the Chalakkudy river basin and its ecological significance** submitted by me for the award of the degree of Doctor of Philosophy in Botany of the University of Calicut is an original research work carried out by me in the Department of Botany, University of Calicut. No part of the work has formed the basis for the award of any other degree or diploma.



K. H. Amitha Bachan

Dedicated to my guide, 'guru'
parents, wife and beloved daughter,
teachers, friends and to 'the river'

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Introduction

General Introduction

The word 'riparian' is derived from the Latin 'riparious' meaning 'inhabiting or belonging to the banks of a river' ('ripa' = riverbank). The biotic communities living in the riparian areas, their interaction with immediate environment, role in functioning of the river basin as a whole have gained more focus of the researchers of the past two decades (Naiman *et al.* 2000, Anbumozi *et al.* 2003). Riparian zones have played great role in the development of human civilizations from the time immemorial.

Ancient civilaizations recorded in the history were flourished on floodplains of great rivers such as Nile, Sindh and Ganges, when human began to grow plants in his control to produce food grains. Even today the floodplains of rivers and associated wetlands support a great number of human population all over the world (Wiseman *et al.* 2003). People living in the mountains, valleys, deep moist forests also have recognized the significance of riparian zones. This can be seen in the traditional knowledge, practices, culture and customary laws existing in the tribal, agricultural and fishery communities all over the world. This intimate relationship, understanding and management existing between resources and people, evolved traditionally through time and maintained through their own customary laws. These intricate relationships are the backbone of conservation of natural resources all over the world.

People living in the mountains, hill valleys, floodplains, backwaters, estuaries up to the coasts and islands had a good understanding about wetlands, the area of land where water merges with the terrestrial environment. In a tropical mountainous landscape, this interface of water and land exist from the Shola-Grassland ecosystem in the mountaintops, freshwater swamps in the hill valleys, paddy lands in

the flood plains, mangrove forests in the backwaters and estuaries and screw pine thickets along the seashores. Riparian areas are very significant to human as well as for other organisms. It being an area of land in which the flowing water spreads and merges with land, we can include the 'riparian area' in the broad definition provided for wetlands. Cowardin *et al.* (1979) defines wetland as "Lands transitional between terrestrial and aquatic environment, where the water table is usually at or near the surface or the land is covered by shallow water".

Delineating the riparian zone

The riparian terminology was rather obscure because of the inconsistency in its usage. Anna and Michael (1998) define riparian areas as "the geographically delineated areas with distinct resource values that occur adjacent to streams, rivers, lakes, ponds and other specified water bodies". The term 'Riparian' was used by many scientists to address diverse conditions of wetlands, including marginal vegetation of waterbodies with stagnant water such as lakes and ponds. It is clear that all the riparian zones are wetlands and a clear delineation from all other wetlands is currently not available. But the difference of the riparian zone from other wetlands is within the spatial geometry and rate flow of water.

Newson (1994) identifies river channels, ponds, lakes and wetlands as part of a river basin; a natural landscape unit where geomorphologic processes and the environmental factors depend on the flowing water which in turn determine and stabilize the pace of water flow. He has delineated the river channel, lakes, ponds and the wetlands based on three important criteria. 1. Scale and geometry, 2. Water level and content and 3. Flow through time. It is presented in the table (0.1) below with slight modification to suit also for the small rivers occurring in the

monsoonal tropical continents and landscapes such as the Western Ghats.

Table 0.1 – Key characters determining different wet habitat

Habitat	**Scale/Geometry**	**Water level/ content**	**Flow through time**
River Channel	Continental, sub continental or landscape/ linear	Variable/ mainly water filled	Minutes to weeks
Ponds/lakes	Local to sub-continental	Fluctuating/ water filled	Days to years
Wetlands	Sub-basins, coastal/ often linear or concentric	Fluctuating/ saturated	Minutes (surface) To years (sub-surface)

Modified from Newson (1994)

Hence, "Riparian area" can be defined as the land area adjacent to the river channel from their origin up to the river mouth, where the flowing water keep in contact or influence. (Characterized from other wet habitats being variably water filled with faster flow from minutes to weeks, seen subcontinent or landscape level with linear geometry). This can be a small portion of a river basin, defined itself by its spatial position in the watershed or landscape unit where its characters are determined chiefly by the geomorphic, environmental and biotic factors existing in the upstream and downstream influencing the pace of water. All other wetlands with their slower pace of water-flow and aerial geometry may also posses such narrow riparian zone at least along their immediate interface of water and land, where the flow of the water is comparatively faster.

The significance of the Riparian Vegetation

The vegetation represents the total effect produced by abundance and scarcity of plants and it is an expression of the overall interaction of the climatic, physiographic and biotic factors. The vegetation is characteristic to each and every ecosystem ranges from large biomes to micro-ecosystems. The forest vegetation is composed of plant communities or units of vegetation developed and arranged in accordance with definite biological laws and is not an aggregation of trees and other plants brought together by chance.

Understanding the vegetation of an ecosystem or landscape unit is an important step in understanding the overall dynamics and functions of an ecosystem. Vegetation of an area is chiefly determined with latitude and longitude (geographical) position, climate, water availability or precipitation and also the physiographic and biotic features. The availability of water is an important factor determining vegetation of an area especially within a tropical condition, where availability of energy is abundant. Highly rain-fed tropical regions represent world's richest terrestrial ecosystems named wet-evergreen forests or rainforests. The Western Ghats of Peninsular India comprises the major portion of the Western Ghats and Sri Lanka Hotspot, one of 34 global biodiversity hotspots for conservation and one of the three on the Indian subcontinent. The area is extraordinarily rich in biodiversity. Although the total area is less than 6 percent of the land area of India, the Western Ghats contains more than 30 percent of all plant, fish, herpetofauna, bird, and mammal species found in India (Bawa *et al.* 2007). Which harbours more than 5000 species of flowering plants (27% of the country) and of which more than 1800 species are endemics.

The difference in the precipitation or rainfall characteristically differentiates eastern slopes of the Western Ghats (900-1400 mm rainfall) with dry forest types from western slopes (1500-4500 mm rainfall) with moist forest types. Hence, availability of a watered condition is important in determining the vegetation and plant community dynamics in a tropical environment. The riparian ecotone provides a wet environment suitable for both the aquatic and terrestrial plant communities and other organisms to prevail.

Vegetation of an area represents future or past vegetation components (communities) in its ecotones. The riparian environment of a forest strand provides more watered condition and would have a better microclimate than its other zones. In a highly disturbed condition of vegetation the riparian zone would have a chance for representation of components for future flora and plant communities of the given vegetation type.

The riparian areas are among the biospheres most complex ecological systems and also among the most important for maintaining the vitality of the landscape and its rivers (Naiman & Decamps 1997). The interface of land and water is the most productive systems of a landscape. Wetlands are one of the most productive ecosystems, among them the riparian ecosystems with more dynamic water environment is more complex and diverse. Biodiversity and productivity of stream system in particular are strongly influenced by the composition and structure of streamside vegetation (Cummins 1974).

Riparian areas are more productive and regions of great diversity in aquatic benthic organisms (Maridet 1995) and fish diversity (Penzak, *et al.* 1994, Penzak 1995). The riparian zones influences the organization, diversity and dynamics of communities associated with

aquatic ecosystems (Gregory *et al.* 1991). Riparian ecosystems are recognized in USA as a natural resource of inestimable values (Warner & Hendrix 1984). The removal of riparian vegetation resulted in decline in diversity of fish population and its replanting increased only the abundance. (Penzak 1995). The riparian vegetation is also valued for its benefits to wildlife recreation and watershed protection besides the fish and aquatic diversity (Johnson & Mc Cormich 1978, Naiman *et al.* 2000).

The riparian forest structure dynamics have been studied for the dragonfly distribution correlated with the health of the riparian vegetation and recommended for riparian area management for the conservation of species (Samways & Steytler 1996). The riparian zones are valued for the agriculture (Wiseman *et al.* 2003) and wildlife conservation (Anna & Michael 1998).

The very structure of the riparian vegetation of an area will be in accordance with the available climax vegetation, aquatic flora and geomorphic process in the natural environment. These also include various landuse practices and other anthropogenic activities. The riparian plant communities are also influenced by the upstream and downstream (longitudinal) and transverse linkages of species recruitment and diversity (Vannote *et al.* 1980, Noss 1983, Newbold *et al.* 1981). A good number of studies are available from the temperate regions, but a few from the tropics on the significance of riparian vegetation. However, little is known about spatial patterns in the diversity of plant communities along riparian environment. (Decamps & Tabacchi 1993, Tabacchi *et al.* 1996).

Like other vegetation types the riparian vegetation also influence or modify its surroundings. It becomes more significant influencing the riverine as well as the terrestrial environment. The function of the

riparian vegetation in stream base stabilization (Beeson & Doyle 1995), water quality improvement (Tremolierers *et al.* 1997), controlling the future stream flow (Auble *et al.* 1994), role in shaping stream channels and biotic communities in a natural landscape are major areas of interest in the modern context of riparian and watershed based development and management.

Indicators such as fish community as measure to monitor the structure of riparian systems (Wichert *et al.* 1998) and more detailed understanding of the bounce back nutrient support of Salmon-derived nitrogen in riparian forest growth (James & Naiman 2001) provides future hopes to understand the complexities of the ecological functions of riparian systems. Effect of stream flow regulation of riparian forest also gained main attention in the recent time relating the role of vegetation in shaping the land, or controlling the geomorphologic and hydrologic peculiarities of a landscape.

The Flora and plant communities in Riparian Vegetation Ecology

The term 'Vegetation Ecology' is concerned not only with identifying the flora or plant communities on an area, but also with determining how they are related to one another and to the environmental factors (Muller & Dombois 1974).

The vegetation of any landscape unit is a product of overall interaction of climatic, hydro-geographic and biotic process over a period of time. In the present conditions, understanding of the past biotic, especially human interference is very important in understanding the dynamics of vegetation of an area. The plant cover is a good indicator of the environmental conditions and it also integrates the variability aspects of the climate (Meher-Homji 2001). In such a context understanding the

floristic composition, community structure, its spatial distribution related with the bioclimate is important.

Structure of vegetation is defined as "Organisation in space of the individuals that form a stand and the primary elements of structure are growth forms, stratification, and coverage (Dansereau 1957). Muller-Domboise and Ellenberg (1974) describes five levels in understanding the vegetation structure, viz., 1. Vegetation physiognomy, 2. Biomass structure, 3. Life form structure, 4. floristic structure and 5. Stand structure. Floristic descriptions of the vegetation structure usually initiates the structural interpretations, identification and classifications of the vegetation types and most often described conveniently through physiognomic descriptions.

However, different vegetation varies in their floristic composition and that must have evolved along with their modification of their immediate environment. The primitive vegetation in the adverse conditions to the climatic climax in the tropical environments is represented by definite flora. The abundance of families such as Orchidaceae, Dipterocarpaceae, Myrtaceae, and Moraceae in the tropical wet forests, dominance of Fabaceae, Combretaceae and Euphorbiaceae in the dryer climates and dominance of gymnosperms in the temperate zones are examples (Whitmore 1975).

Within a landscape unit, vegetation composition also changes with the changes in the climate along with altitudinal gradient. In the tropical mountainous evergreen Shola-forests plants such as Myrtales and Laurales becomes dominant while families such as Dipterocarpaceae and Clusiaceae dominate among the emergents of the lower elevations. The species diversity of Dipterocarpaceae, one of the dominant family of the tropical rain forests decreases with increasing altitudes. Floristic analysis

of a region is the preliminary tool to understand the structure and ecological functioning of vegetation mosaic of a landscape.

The River basin (watershed) - a natural landscape unit

Within a particular geographical location, a watershed or more suitably its higher integrated level, a river basin would be an ideal natural landscape unit. Where maximum possibility of relationship could be found between the biotic and abiotic components and flow of water inter connects all the bio-physiochemical processes from the mountainous catchments to the river mouth. Within a river basin the lowland forest represent maximum diversity. The low altitude rainforest and the mangrove ecosystem in the river deltas represent maximum energy and material transaction within their intricate community structure. The coral reef ecosystem, most biodiverse ecosystem of the world (Osborne 2000) in the coastal shallow waters of the tropical seas is supported with nutrient input from the most biodiverse terrestrial ecosystems of the world, the wet evergreen forests in the river catchments through the rivers.

A landscape is a heterogeneous land area composed of a cluster of interacting ecosystems. It is characterized by matrix vegetation types, homogenous mosaics and corridors that connect this homogenous vegetation mosaics. Its structure is patterned by physical factors (bioclimate, soil, topography and drainage) and modified by human activities (Turner *et al.* 2001). The climate, geology and topography delineate major geographical units (Singh 1977). In a finer scale the morpho-pedological characteristics along with the natural vegetation types are also important (Bourgeon *et al.* 2007).

River basin as a tangible unit of landscape

A watershed is a geo-hydrological and social unit of land which collects water and drains it through a common point by a system of streams. Naturally, it consist of a catchment area, the land area in which the water flowing through the stream get collected, a transition zone as the valley portion and an exit point or the delta. The boundary of the catchments usually will be ridges of the hilly portions and the ridgeline forms the watershed boundary. The area of the watershed becomes narrow from the catchments to this exit point. Watershed is the most natural basic configuration, which has say in the fate of everything on land. Sprouting of tiny seed, the type of forest covering a mountain slope, birth and death of mighty rivers and the course of illustrious human civilizations are all decided by watersheds.

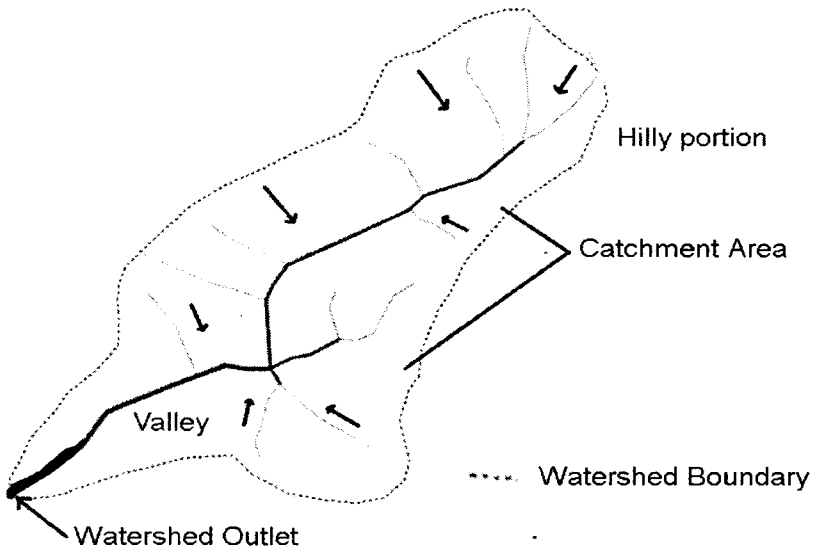


Fig. 0.1. – A watershed (Schematic Diagram)

All landscapes in all continents are mosaics of multitudinous small unit watersheds strung together in an orderly fashion. They are not unidimensional. They also have depth. And they have story, the

dimension of time, a past and future too. Guided by a force from within, that is the energy of flowing water, they evolve over time. Their shape changes, their shapes get modified (Nair 1991).

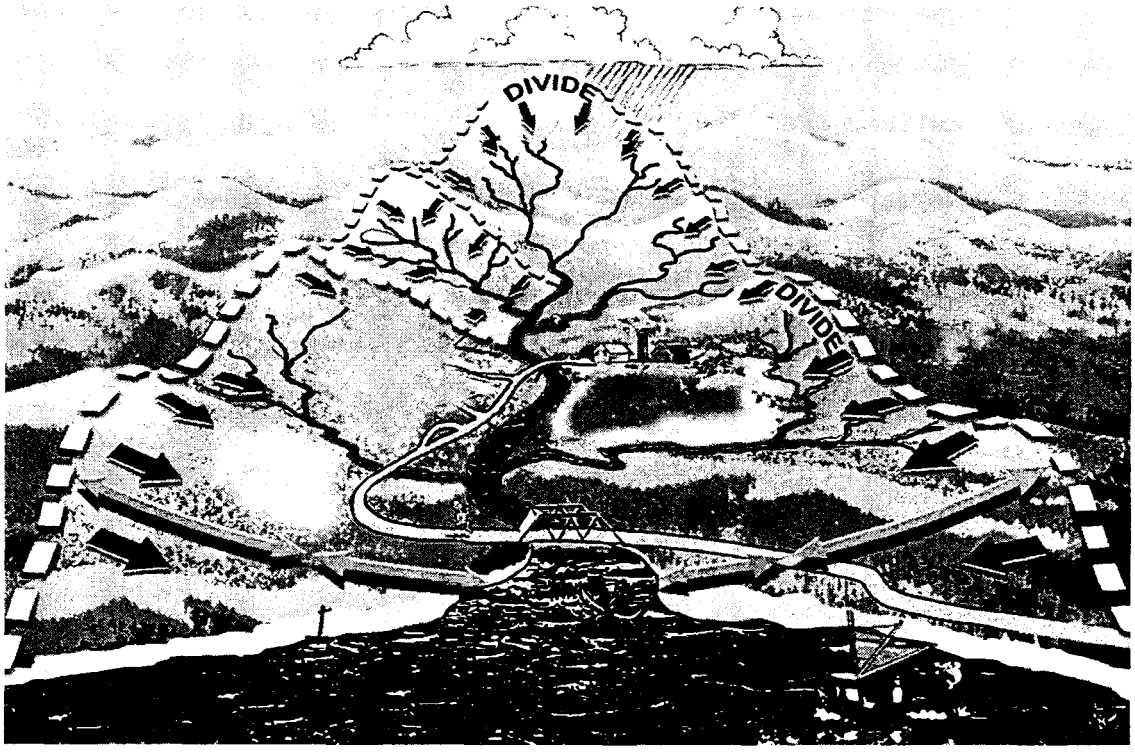


Fig. 0.2 A Watershed as an Eco-social and Hydrological unit

The river basin may be the most suitable watershed area, where human administrative boundaries almost agree with the natural geographical unit. And it would be much easier to restructure our minds to larger administration boundaries like districts, taluks, to a river basin.

An understanding of structure, diversity and functioning of different ecosystems would help much for the proper practical management of ecosystems, conservation activities and sustainable development.

In the entire country, most complex and species rich vegetation assemblages are in the wet evergreen forests and the biologically and

biogeographically richest tracts are in the southern Western Ghats (Nair 1991). The Kerala part of southern Western Ghats alone posses 1637 endemic species of flowering plants. Of which 263 are restricted to Kerala (Sasidharan 2004). The richest assemblage of such species occurred in 32 low-elevation wet evergreen forest valleys. Of these, 12 valleys have been totally destroyed by river valley projects, seven valleys have lost their natural vegetation to teak and eucalyptus plantations, and four wholly and four partially to encroachments and extensive agriculture and eight valleys are left with some residual forests with nominal protection (Nair 1991). The Anamalai region represent one of three important biodiversity 'hot spots of the Western Ghats' and the Chalakkudy River basin is exclusively within the landscape. The Nelliyampathy, Parambikulam, Vazhachal and Sholayar forests in the Chalakkudy River basin and the adjoining Edamalayar-Pooyamkutty valley represent one of the most extensive tropical moist forests in the entire Western Ghats (Nair 1991).

An effort at conserving the total spectrum of biological diversity must therefore taken into account the distribution of plant and animal species in terms of ecosystems as well as biogeographic provinces. The ecosystems are best characterised in terms of vegetation (Meher-Homji 2001). Bench mark data on each and every ecosystem types has to be collected in order to protect and manage our tremendous biodiversity and genetic resource potential. The floristic and vegetation studies on each representative ecosystem samples and their area or extent in a broader canvas of a landscape unit or river basins of the Western Ghats should be identified for long-term conservation and management. The advancement of ecological science has brought recent trends supplemented with phytosociological and eco-physiological approach in pure taxonomical works all over the world and also in India.

Relevance of the present work

Floristic or structural studies of the riparian forests were seldom conducted from the Indian region and also from the Western Ghats. Only reference to some species, belonging to the stream banks was documented in regional floras. Riparian vegetation of the less rainfed warmer parts of country alone is recognized as the separate riparian system up to very recent time (Champion & Seth 1968). The existence of character differences of riparian system in the moist localities especially of the rainforest formations of the Western Ghats has not been recognized or addressed even today. The unique features of the riparian forests and its ecological significance now became a matter of discussion and have attracted many workers all over the world, and the present work may be a pioneering work on this aspect from our region.

Floristic and vegetation analysis revealing the structure and dynamics of plesioclimax as well pre-climax and understanding the dynamics within a landscape is important for the efficient resource management. Such an understanding of the past and present landuse practices, along with details of all the available sample vegetative mosaic, acknowledging the available climatic factors and possible climatic climax of a natural landscape unit will provide useful data in developing conservation programme and sustainable utilization of biological resources.

In this context, the present study to understand the floristic composition and community structure and ecological significance of the riparian forests of one of the important river basin (Chalakkudy river) of the Southern Western Ghats of the Indian subcontinent is more appropriate. The study has the following major **objectives:**

1. To analyze the floristic composition of the riparian vegetation of the Chalakkudy river basin
2. To reveal the plant community structure, associations and derive a classification of the riparian vegetation within a natural landscape unit
3. To determine the bioclimate of the river basin while depicting the rainfall, temperature, vegetation and physiography in support of the riparian vegetation structure and dynamics
4. To record the ecological significance and responses of riparian plant communities along various environmental gradients in support of the future landscape, conservation and management

Plan of the thesis

The thesis is divided in to four chapters based on the different aspects of the work. Each chapter contains an introduction, review of literature, detailed methodology, observation and analysis and the result and discussion.

The thesis begins with a general introduction, which defines the riparian zone and riparian vegetation and its significance. Also, the need of depicting the bioclimate and physiography in defining the dynamics of vegetation. This is followed by the objectives, an explanation of the organization of the thesis.

The first chapter deals with the study area within the Anamalai landscape unit of the Western Ghats. It briefly explains the bioclimate, physiography, vegetation and extent of riparian vegetation in the study area. 20 years of rainfall data from six different stations were used for defining the rainfall and bioclimate. Vegetation mapping was done using GIS to understand the extent of vegetation and its dynamics. Terrain features and stream characteristics were also explained. Various thematic maps were provided to substantiate the conclusion.

The second chapter provides a systematic account on the floristic diversity of the riparian zone. The chapter begins with a brief Introduction on floristic history of the region and significance of riparian flora followed by methodology, result and discussion. The systematic treatment is provided in the beginning of part two after the general discussion, conclusion and summary. Which includes artificial key to the included families, genera, species and other intraspecific categories. A brief taxonomic description, phenology distribution, RET status, notes on nomenclature wherever necessary, and habitat indication to voucher specimens were also provided. Illustrations, photographs and distribution maps of some important taxa were also given.

The third chapter begins with an introduction on riparian plant community associations, its significance, explanation of the methodologies for phyto-sociological sampling and statistical analysis. The chapter concludes with a discussion on major riparian plant associations along the Chalakkudy River and their classification. Figures and charts were presented wherever required.

The general discussion and summary is provided in the fourth chapter, which correlates the responses of the riparian plant communities to varying physiographic and bioclimatic attributes, explains community dynamics and responses to disturbances. This is followed by the executive summary.

The systematic treatment is followed by the appendices, which contain the list of obligate and facultative riparian plants and phytosociological tables. The list of tables, figures, plates and maps provided after the appendices. A detailed bibliography on literature cited and an index to families, genera and scientific names are provided as the last session.

The Study Area -Identifying the physiographic, bioclimatic and vegetation features of the area

Amitha Bachan K.H. “Riparian flora of the Chalakkudy river basin and its ecological significance ” Thesis. Department of Botany , University of Calicut, 2010

Chapter 1-
The study area

The Study Area - Identifying the physiographic, bioclimatic and vegetation features of the area

Introduction

All the plant communities in course of time develop progressively towards a form, which is in equilibrium with prevailing climates and then be stabilized as the climatic climax Clements (1916). This will be accompanied with enrichment of the soil and microclimate of the region. Any changes from climatic climax with a preclimax can be considered as the expression of interference (disturbance). This monoclimax theory was challenged by many later workers and argued polyclimax vegetation indicating chances for a preclimax community due to edaphic (soil) factors in a prevailing climatic condition.

The 'continum' concept interprets the climax as a partially stabilized 'steady state' adapted to the whole pattern of environmental factors in which it exist, exhibiting similar convergent patterns in adaptation to similar environments, but showing a continuous environmental gradient.

However, vegetation of an area is determined by the overall interaction of the climatic, edaphic, and biotic factors. The climate in other hand depends upon the rainfall, temperature and length of the dry season. Hence, bioclimate is an important factor determining the types of vegetation and its dynamics in any region (Meher-Homji 2001). The Western Ghats with very complex physiography in its hilly terrain harbour a wide array of bioclimate with corresponding forest types (Pascal 1982)

Bioclimate of a region is determined by rainfall (precipitation), temperature and length of dry months (Meher-Homji 2001). The rainfall,

especially of the Western Ghats region is greatly influenced with its geographical position, the monsoon phenomenon and the influence of the Western Ghats interesting monsoon. The Western Ghats may be responsible for accounting for about 60% of the observed rainfall, on rare occasion over it reaches up to 80% (Sarkar 1967). The topographical features of the Western Ghats prevails a wide range of local and microclimatic diversity. The forest cover in the mountains plays a major role as a generator of humidity in the air.

Interpretation of rainfall is an important component in defining the bioclimate of a region. Pattern and distribution of rainfall in the overall year provides real expression of the other climatic defining bioclimate. This include mainly the temperature and duration of dry months. Data for a long period, at least twenty years is necessary for the correct interpretation of the rainfall of a region. The average year rainfall usually do not provide an explanation for the stability and instability of the climate and hence the bioclimate. But the concept of probable year rainfall will be more meaningful in depicting the bioclimate of a region (Meher-Homji 2001). Hence here it is important to analyze the precipitation, number of rainy days and dry months of the study area.

The riparian vegetation was classified as an edpahic formation by Champion and Seth (1968). It would be inadequate if we believe that the particular edaphic condition prevailed in the riverfront alone determines the vegetation of the riparian environment. Many features of the riparian zone such as the presence of watered environment, rich nutrient inputs, more exposure of light and the upward and downward wind flow through the gap provided by the river channel and the hydrology of the river make the riparian zone a unique ecosystem. More than an edaphic formation it is a much complex, highly dynamic and specialized plant community associations.

The changes in the adjacent landuse (vegetation) due to past and present landuse (mainly forestry) practices in the catchments had great impact on the hydrology of the river and hence on the micro-climate of the riparian zone. Submergence of forest cover and diversion and control of river water due to river valley projects are also an important factor to consider. The Chalakkudy River alone has 6 large dams and a diversion scheme in its catchments. Hence drawing information on the physiographic, bioclimatic and vegetation features of the area on a broad canvas of the river basin is important for the present study and which comes under the purview of this chapter.

Methodology

The phytogeographical and landscape level identity of the Chalakkudy river basin were confirmed based on the information provided by Singh (1977), Meher-Homji (2001) and Bourgeon *et al.* (2007). Mapping of the river basin and its tributaries were done to derive characteristics of the study area.

Mapping

A map of the river basin was prepared using Geographic Information System (GIS) in order to derive characters of the river basin. The base map was prepared from Toposheets (58 B/7, 58 B/8, 58 B/10, 58 B/11, 58 B/14, 58 B/15 and 58 F/3) of Govt. of India with a scale 1: 50000. The sheets were geo-referred into Map Info (Vers. 6) and ILWIS 3.6 (GIS) open source software and digitized for the topographic and watershed features. Physical and drainage maps were prepared for the basin and also for the sub-basins (tributaries). Care was taken to delineate exact boundary of watershed and tributaries. The order of the streams and tributaries were taken as the scale for the delineation of tributaries. Various physiographic and geomorphological features of the

basin and sub-basins were derived from the maps. It includes watershed area, drainage pattern, drainage density, relief, elevation classes and vegetation.

Description of the bioclimate of the river basin

Defining the bioclimate of the region is important for the description of the flora and classification of the vegetation. Twenty years of rainfall data were gathered from various stations (Kerala Forest Department, Department of Irrigation, Kerala State Electricity Board) of the river basin and all pooled together for a preliminary analysis. Among these data, data from eight important stations (critical for the interpretation of rainfall of the basin) were analysed in detail. Average annual and monthly rainfall, Temperature (mean of the coldest months) and number of dry months were taken into account for the interpretation of bioclimate (Meher-Homji, 2001). Average annual and monthly rainfall was derived from the mean of probable year rainfall. Mean temperature in ^{0}C of the coldest months were taken into account for the temperature (Meher-Homji, 2001). Number of dry months were identified using the formula P<_2T by Bagnouls and Gaussen (1953). Where 'P' is the average monthly precipitation and 'T' is the mean of the temperature of the coldest months in ^{0}C.

Mapping the vegetation of the river basin and the extent of riparian vegetation

Data developed from continuous field survey with GPS readings (2001-2005) in the entire basin and data provided in the GoI (Govt. of India) toposheets were used to draw drainage, physiographic and vegetation features of the river basin. Data derived from satellite pictures (2007-Summer) from Google Earth and CGIAR-CSI SRTM 90m DEM Digital Elevation Database were used to update vegetation features

provided in the GoI toposheets. And a detailed vegetation map was prepared for the entire river basin. The vegetation map was cross checked with studies by Pascal (1982), Ramesh *et al.* (1997) and Ramesh & Gurukkal (2007). The classification of the vegetation was done according to Meher-Homji (1982 & 2001) and Gadgil & Meher-Homji (1982) with inputs from the works of Pascal (1982) and Ramesh *et al.* (1997).

Results and discussion

Location and boundaries

The Chalakkudy River Basin lies between 10^0 13' to 10^0 55' North latitudes and 76^0 25' to 77 Eastern longitudes in the Anamalai landscape unit of the southern Western Ghats immediate south of the Palagaht Gap. The river originates from the north-western part of the Anamalai hills and flow westward to reach Lakshadweep sea near Kodungallur in the west. It has an average length of 144 km and the total drainage area covers 1704 km^2 in the Thrissur, Eranakulam and Palakkad districts of Kerala (1404 km^2) and Coimbatore district (Valparai part) of Tamil Nadu (300 km^2). The river basin is bounded by the Karuvannur and Bharathapuzha river basins in the North, upper catchments of Bharathapuzha river and Anamalais of Tamil Nadu part in the East, Periyar basin part of Anamalais, Edamalayar-Pooyamkutty valleys in the South-East, Lower plains of Periyar river in the Eranakulam in the South and Lakshadweep sea near the Kodungallur coast in the West. It is the fifth longest, sixth largest by catchment size and eighth high yielding river in Kerala.

Phytogeographic and landscape identity

Clarke (1898) divided the Indian region into 11 phyto-geographical regions based on the geographic, climatic and vegetation aspects. Later Hooker (1906) provided 9 regions in his classification. In which the southern India was considered under Deccan and Malabar regions. The Western Ghats identified under the Malabar region. Chatterjee (1939) modified it into 10 regions excluding the Malaya and Ceylon. Chatterjee (1962) also modified it into suit for the Independent India with 9 phyto-geographic regions. Singh (1977) has given more detailed biogeography zonation for India. He also considered faunal elements along with flora and used widely accepted four macro level divisions for India, Great Plains, Himalayan Mountain region, Peninsular uplands and Indian costs and Islands. These were further divided into 28 meso level regions and are then further divided into first order, second order and third order regions. The Kerala region is included in the three measo level regions including the neighboring regions Karnataka Plateau (XXII), Tamilnadu uplands and south Sahyadri (XXIV) and West Coast region (XXVI). These are divided into 9 first-order regions, 27-second order regions and 54-third order regions. Among these 15 represents the southern Western Ghat region and are entirely or partly within Kerala state. And the boundaries were well delineated and mapped by Bourgeon *et al.* (2007).

The Western Ghats extend over 1400 km along the states of Maharasthra, Goa, Karnataka, Kerala and Tamil Nadu. Geographically it is divided into three distinct subregions (Nair 1991). The northern Western Ghats starts in the Maharasthra Sahyadris from the Tapti River to south of Goa with an elevation of 900-1200m elevations. It is composed of Deccan lava descending steeply to the undulating narrow Konkan coast. The central Western ghats extent from Goa to 320 km south to Coorg. The southern Western Ghats starts from the Netravathi

Valley south of the southern Canara. It is rises abruptly to gneissic bosses such as Nilgiris. The mountain chain continue unbroken after the Palghat Gap throughout the Nelliyampathi-Anamalai hills upto the Mahendragiri peak at the southern tip of the peninsula.

The Nelliyampathi-Anamalai area included under the 55ai Anamalai sub region of the XXIV meso level region - the Tamilnadu uplands and south Sahyadri. The present study area, the Chalakkudy river basin is exclusively within this Anamalai landscape unit of the Southern Western Ghats.

Tributaries and sub-basins

The Chalakkudy River is formed by the confluence of four major tributaries, viz. The Sholayar originating from the Akkamalai-Grass hills region near Valparai in Tamil Nadu in the North Western part of Anaimudi and Eravikulam plateau, The Parambikulam tributary originating from an arc shaped eastern high elevation ridge between Perukundru-malai (1733 m) and Umaya Malai (1250 m) and Vengoli Peak (1128 m) in the North-west part of Sholayar-Valpaarai plateau. The Kuriyarkuttyar tributary originates from a narrow South-West valley between the 1300 m elevated South-Eastern part of Nelliyampathy hills and 1290 m Pandara Varai and the low elevated Topslip area (750 m) in between Panadaravarai and Perukundru malai-Vengoli ridge separating the Parambiulam Valley. Karapara tributary originates exclusively from the south western slopes of Nelliyampathy hills.

The Kuriyarkutty tributary and the Parambikulam tributary confluence at Kuiyarkutty and flows as Kuriyarkutty-Parambikulam river. The longest tributary Sholayar confluences with the Kuriyarkuttiyar at 2 km upstream to Orukombankutty from left and the Karappara river at Orukombankutty from right. From here onwards the

river is known as the Chalakkudy River. Further it flows South-West direction and turns Westward at Poringalkuthu and flows westward through the famous Vazhachal, Athirappilly regions. In this stretch the river gives birth to lot of rapids and waterfalls including the famous Athirapilly-Vazhachal waterfalls and drain into the Chalakkudy plains. Finally the river joins to the Kodungallur backwaters along with the northern distributary of Periyar River at Elanthikkara (Chouka-kadavu) in the Puthenvelikkara Grama Panchayath of Eranakulam District.

The Chalakkudy River is a 6th order stream and the tributaries are of 5th order. First Sixth order river is formed when the Kuriyarkutty tributary and the Parambikulam tributary confluence at Kuriyarkutty and all the other tributaries (5th order) joins to the main downstream to this point. So physiographically the river from the Kuriyarkutty downwards should be considered as the Chalakkudy main river. According to this, the Chalakkudy river basin and its sub-basins of the tributaries are classified as (clock wise direction) i. Karappara sub-basin of Karappara tributary (Ka), ii. Kuriyarkutty sub-basin of Kuriyarkutty tributary (Ku), iii. Parambikulam sub-basin of the Parambikulam tributary (Pa), iv. Sholayar sub-basin of the Sholayar tributary (Sh) and v. the Chalakkudy-main sub-basin of the Chalakkudy main river (downstream to Kuriyarkutty). Three small (4th order) streams Anakkyam thodu, Charpa thodu and Kannankuzhi thodu also joins to the Chalakkudy main river.

The Karappara sub-basin has an area of 134 km^2 and perimeter of 69 km. The river has a length of 37 km. Drainage density (Dd) is about 2.3 and aerial length width ration 3.6. and slope about 33.8 m.

The Kuriyarkutty sub-basin has an area of 233 km^2 and perimeter of 76 km. The river has a length of 35 km. Drainage density (Dd) is about 2.28, aerial length width ration 1.3 and slope about 42.3 m.

The Parambikulam sub-basin has an area of 261.8 km^2 and perimeter of 93.5 km. The river has a length of 43.5 km. Drainage density (Dd) is about 2.8, aerial length width ration 3.8 and slope about 39 m.

The Sholayar sub-basin has an area of 261.8 km^2 and perimeter of 124 km. The river has a length of 124 km. Drainage density (Dd) is about 2.6, aerial length width ration 2 and slope about 147m.

The Chalakkudy main-river sub-basin has an area of 594.2 km^2 and perimeter of 207 km. The river has a length of 92 km. Drainage density (Dd) is about 1.7, aerial length width ratio 1.4 and slope about 66 m.

The whole Chalakkudy River basin has an area of 1484 km^2 and perimeter of 271 km. The river has a length of 145 km. Drainage density (Dd) is about 2.3, aerial length width ratio 2 and slope about 67 m.

A comparison of the physiographic features of the tributaries (sub-basins) is provided in the table 1.1

Geology and soil

Information on geology gathered from Geological and Mineral Map of Kerala (Balasundaram 1970) and soil characters obtained from soil map (Krishnan *et al.* 1996). The main rock formations in the Chalakkudy River Basin consists of crystalline rocks of Achaean-Pre Cambrian era (2600 million years old) mainly charanockite, and biotite gneiss, hornblende gneiss and migmatitic gneisses. There is intrusion of granites (acidic rocks) mainly in the Parambikulam and Nelliyampathy plateaus.

The terrain has undergone an earlier plastic deformation phase which resulted in an intense folding with axes tending north west- south east to east west direction and a later brittle deformation phase which resulted in a number of lineaments and fractures. Many tributaries and various sections of mainstream are apparently controlled by lineaments and fractures (CESS 2003).

Most of the study area have deep soil structure and are rich in organic content. They can be i. Very deep well drained clayey-loam with moderate erosion mixed with gravely-loam soils on gentle slopes (Typic Haplohumults associated with Oxic Dystrudepts-unit 36) along the forested areas of the Sholayar sub-basin, Karappara sub-basin and upstream areas of the Parambikulam sub-basin, ii. Very deep well drained clayey loam with moderate erosion mixed with rocks (Typic Palehumults associated rocks –unit 38) distributed mainly along the forested areas with exposed rocky terrain of the Sholayar, Nelliyampathy and Chalakkudy main sub basins, iii. Very deep well drained gravely-loam with moderate erosion (Humic Dystrudepts with Typic Palehumults- unit 31) along the forested borders of Parambikulam and Chalakkudy main and Chalakkudy sub-basins. iv. Deep well drained gravely-loam soils with moderate erosion (Humic Dystrudepts associated with Typic haplohumults-unit 32) upstream areas of Kuriyarkutty-Nelliyampathy border, v. Deep well drained gravely-clay soils with severe erosion (Oxic dystrudepts associated with rocks- unit 33) Parambikulam and Kuriyarkutty sub basins (Krishnan *et al* 1996).

Physiography

The Chalakkudy river basin composed of distinctive four levels in its catchments based on the area of the height classes, (i). Highly elevated plateaus of >1000 m in the Malakkapara-Valparai region in the

southern boundary (adjacent to Anaimudi-Eravikulam plateau) and the Nelliyampathy plateau in the northern boundary of the basin (adjacent to the Palghat Gap); (ii). A unique medium elevation (500-600 m) plateau in the Kuriyarkutty-Parambikulam sub-basin in between the Valparai-Nelliyampathy plateaus; (iii). Slightly ascending zone from the (200 m) Vazhachal region to the (500 m) medium elevation area and (iv). The lower plains 0-100 m elevation from the Athirappilly downstream to the Chalakkudy plains and up to the river mouth.

The two highly elevated platues (>1000m) were highly guarded by almost arc shaped (1200-1400 m in the Nelliyampathy hills & 1200-2000 m in the Valparai-Parambikulam) mountain ridges. This makes these two upper reaches wet and highly rainfed (3000-5000 mm).

The medium elevation Kuriyarkutty-Parambikulam plateau are well exposed to the dry eastern Coimbatore plains of Tamil Nadu with a Three-Six kilometer wide, 500-600 m high, almost 'U' shaped gap in the eastern boundary of Kuriyarkutty basin in between the Pandarai-varai (1290 m) and Kolambu-malai (1101 m) and adjacent Perukundru-malai (1733 m) with its base at Topslip area (700-765 m). This physiographic feature makes the Parambikulam plateau unique with characteristic dry vegetation and low rainfall, especially the entire Thekkadi, Veetiyar, Kuriyarkutty-Orukombankutty and lower reaches of Parambikulam sub-basin. The dryness extend westward to 500-700 m elevation areas of the entire Kuriyarkutty sub-basin catchments, through the Topslip, Kolkamatti Pallam, catchments of Thunacadau, Peruvaripallam, Thekkadiyar and Veetiyar until it is sheltered by the Nelliyampathy ridges (>1000 m) in the north west. The dryness further extent southwest upto Kuriyarkutty and Orukombankutty and finally it is sheltered by the Chalakkudy ridges continuous to Nelliyampathy (Poyya-malai 1100 m) from west and Kanchilakunnu extending to Karimala (1400 m) Sholayar

ridge in the east. The upstream areas of the Parambikulam is guarded from the dryness by the Vengoli-malai (1128 m) separating the Parambikulam and Kuriyarkutty sub-basins and the contigous >1500 m high North-Eastern ridges of the Parambikulam sub-basin.

The Karapra valley is an average 6.6 km wide and 24.5 km long narrow valley well sheltered from the drier Palakkad Gap by the arc shaped mountain chain. The Karappara River takes a south west direction and turns north east and further eastward to join to the Chalakkudy River at Orukombankutty. The narrow opening to the confluence point through a meandering of the river from westward to eastward direction also protects the valley from the influence of the drier climate of the Parambikulam plateau.

The Malakkapara-Valparai plateau is well supported with the 2000 m high Eravikulam-Anaimudi plateau from the south east and is well guarded from the dryness of the Parambikulam plateau by the >1500 m high mountain ridges along the Valparai Parambikulam valley border.

The lower reaches of the river basin (the mid land and low land portion) downstream to Kanjirapilly upto river mouth are gently sloping (CESS 2003, Chattopadhyay 2003). The 100-500 m elevation zone lies from Athirappilly-Vazhachal (100-200 m) to the Orukombankutty (500 m) in the border of Parambikulam in the north east and extend upto the Anakkayam Valley (400-600 m) in the East. This zone also receives rainfall more than 3000 mm.

Climate

The Anamalai landscape unit comes under high rainfall region of the Western Ghats and represented with one of the largest extent climax wet evergreen forests in the southern Western Ghats. But the particular warmer physiography of the Parambikulam plateau make the climatic

regime of the basin much complex. Major part of rain obtained during the south-west monsoon period (June – September), followed by north-east monsoon (December – March) and intermittent inter-monsoons during October-November and April-May.

Temperature

The average mean temperature of the basin is 22.2 ^{0}C and that is highest for Parambiukulam subbasin 23.3 ^{0}C and lowest for Sholayar sub basin. Since the vegetation of an area is limited with the climate of the region, with in a monsoonal subcontinent with a high average rainfall the mean temperatures of the coldest months and length of the dry months are critical. The temperature gradient is linked to elevation and it has been estimated that the decrease in temperature is almost 0.8-0.9^{0}C for every increase in 100 m in the 400-1500 m elevation (Pascal 1982). In this elevation the mean temperature of the coldest months is 16-23^{0}C and that of the lower elevations is greater than 23^{0}C. The length of the dry season is the 3-4 dry months in a year in the lower and central region (Chalakkudy main river). It becomes 4-5 months and 5-6 months in the catchments of Parambikulam Sub-basin near Tamil Nadu. In the Sholayar and Nelliyampathy sub basins it becomes 3 dry months in a year or even < 3 months in its upper reaches.

Rainfall distribution

The river basin receives a 3300 mm rainfall annually. Of which higher rainfall is received in the upper catchments of Sholayar (> 4000 mm), then Karapara (> 3500 mm), Poringal (> 3500 mm) Chalakkudy main river and the least in the Thellikkal section of the Parambikulam subbasin (1342 mm). The probable year rainfall derived from 20 years of data is given below.

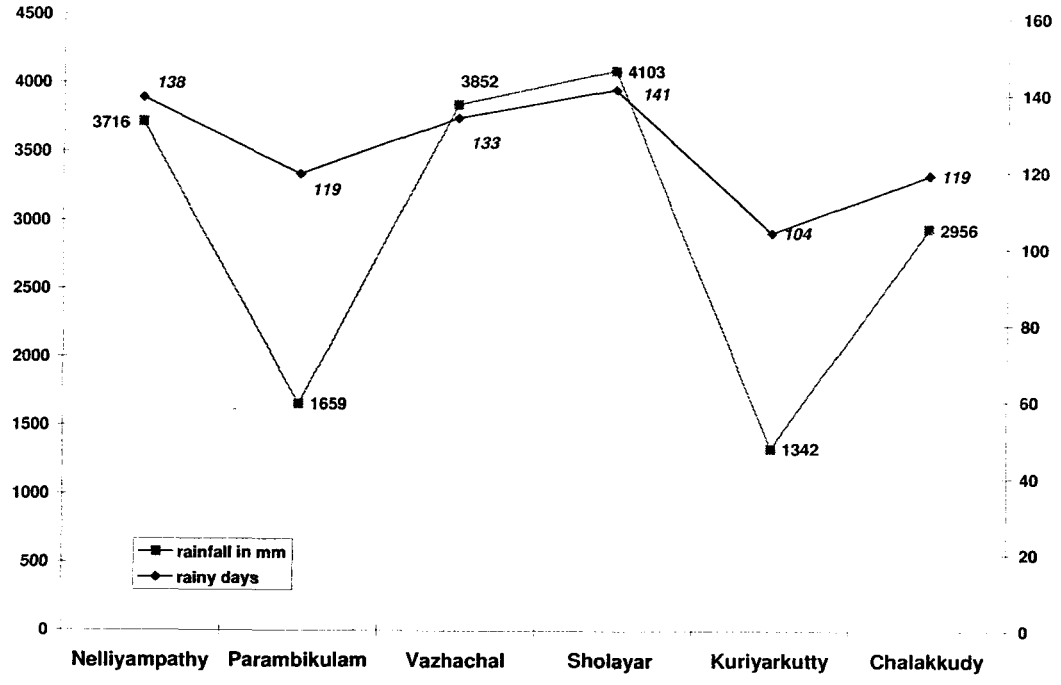


Fig. 1.1. Rainfall and No. of Rainy Days (mean probabale year)

Bioclimate

The mean probable year rainfall, mean temperature of the coldest months and the number of dry months are important in the description of the bioclimate of the area. This can only provide basis for the correct interpretation of the vegetation. The monthly (probable year) rainfall (P) and temperature T (mean of the coldest months) and number of dry months were for different climatic regimes of the Chalakkudy river basin was anlysed and presented in the table (1.2 (appendix 1) & fig. 1.2 -1.7).

The analysis indicate that the entire area comes under typical tropical climate with T>15^{0}C, P >1500 mm and dry months >4 with a potential for the Tropical Evergreen Forest Vegetation types as described by Meher-Homji (2001). There is an exception for the Kuriyarkutty sub-basin, where the rainfall (P) is <1500mm and 4-5 months of dry span. So the climax vegetation should be of Deciduous-dry evergreen types.

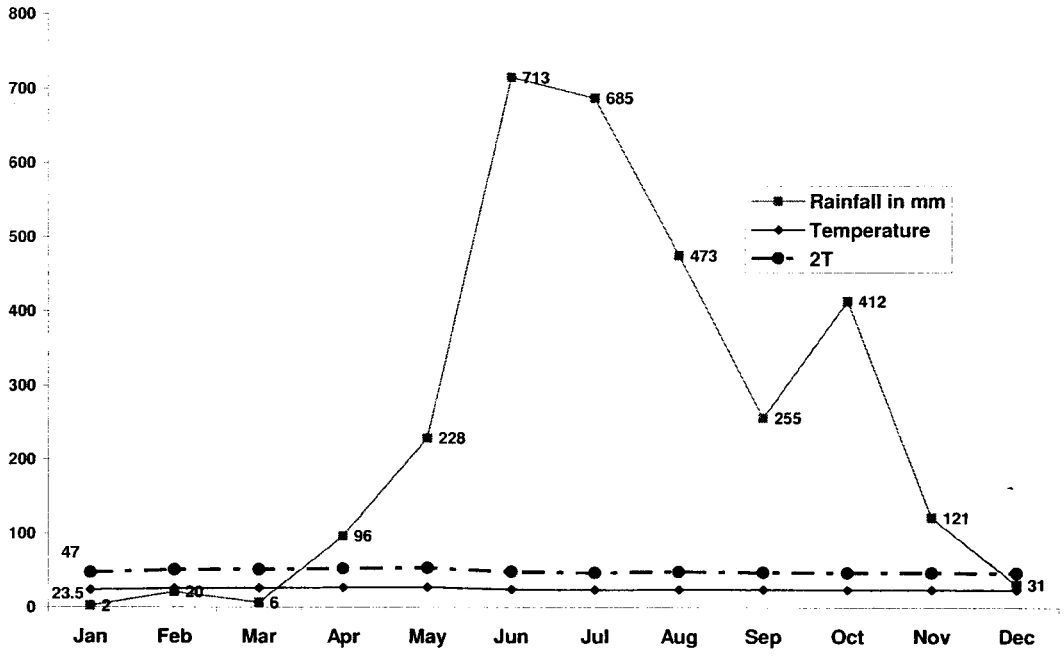


Fig. 1.2 Mean monthly Rainfall, Temperature & Dry Months (Chalakkudy)

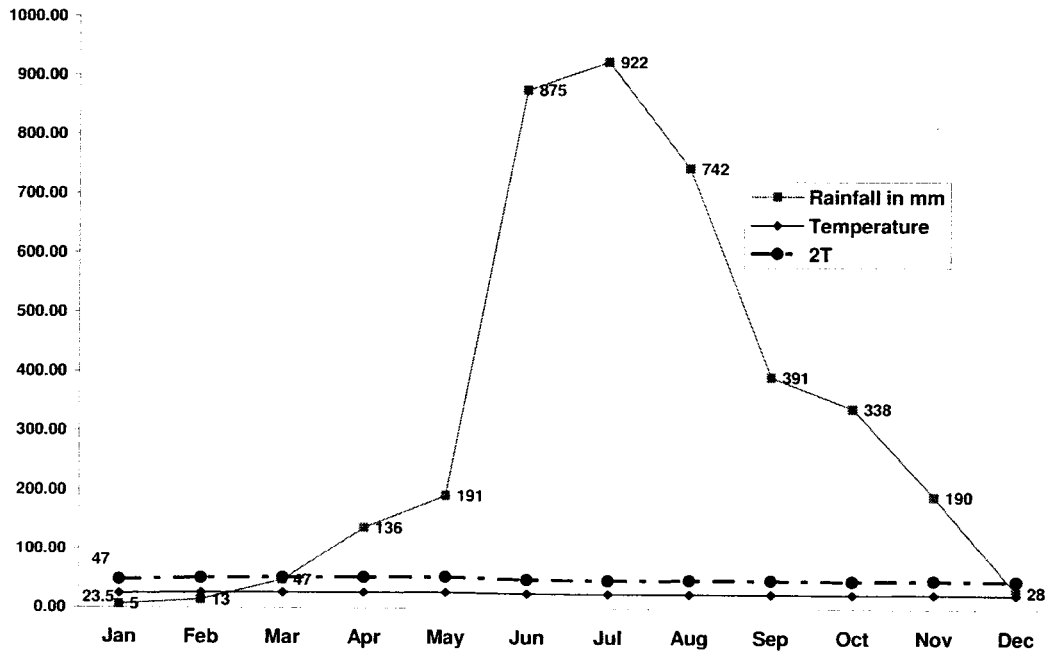


Fig. 1.3. Mean monthly Rainfall, Temperature & Dry Months (Vazhachal-Poringalkuthu)

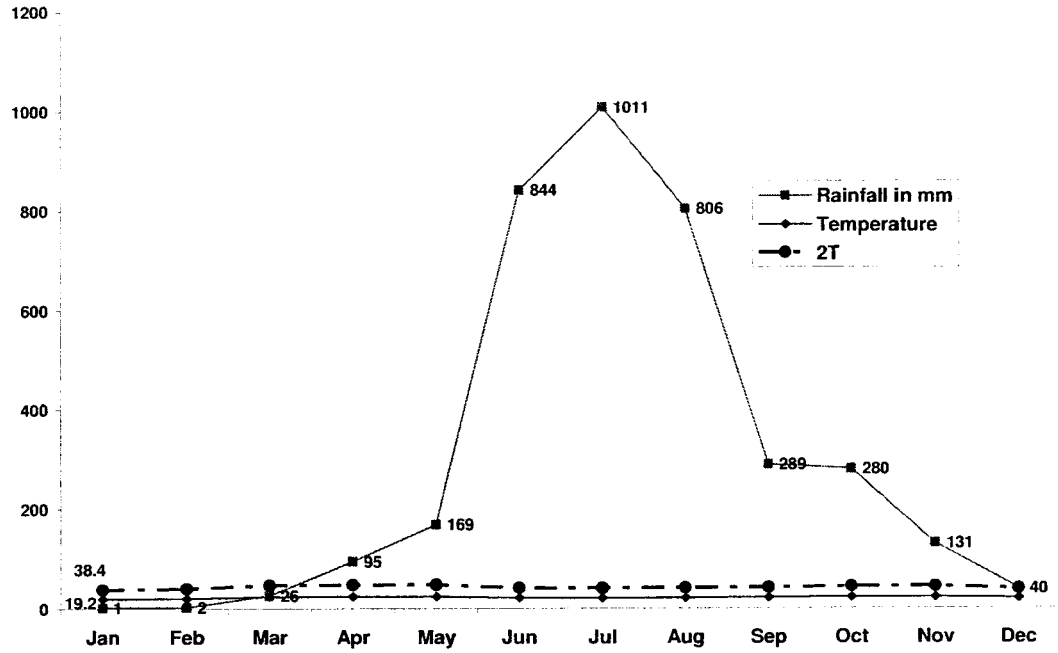


Fig. 1.4. Mean monthly Rainfall, Temperature & Dry Months (Karapara-Nelliyampathy)

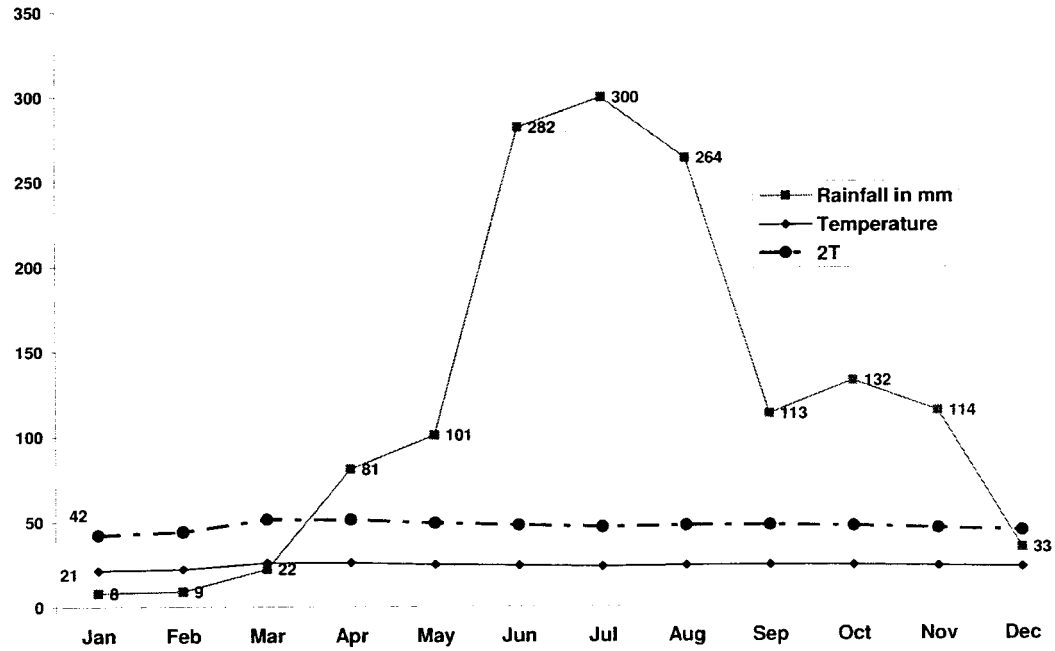


Fig. 1.5. Mean monthly Rainfall, Temperature & Dry Months (Kuriyarkutty-Thellikkal)

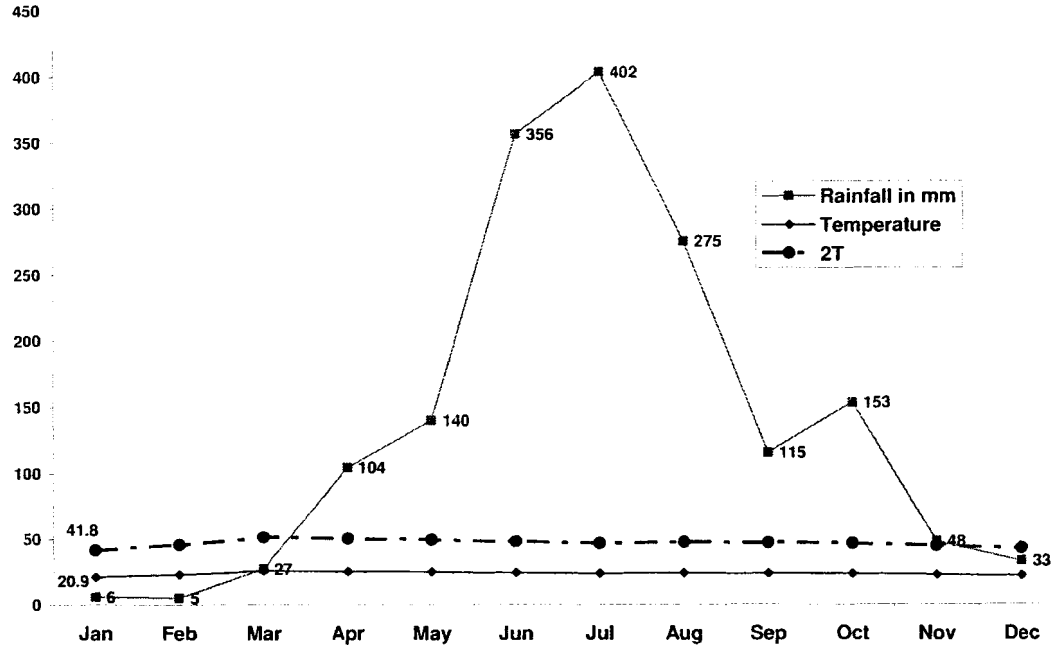


Fig. 1.6. Mean monthly Rainfall, Temperature & Dry Months (Parambikulam)

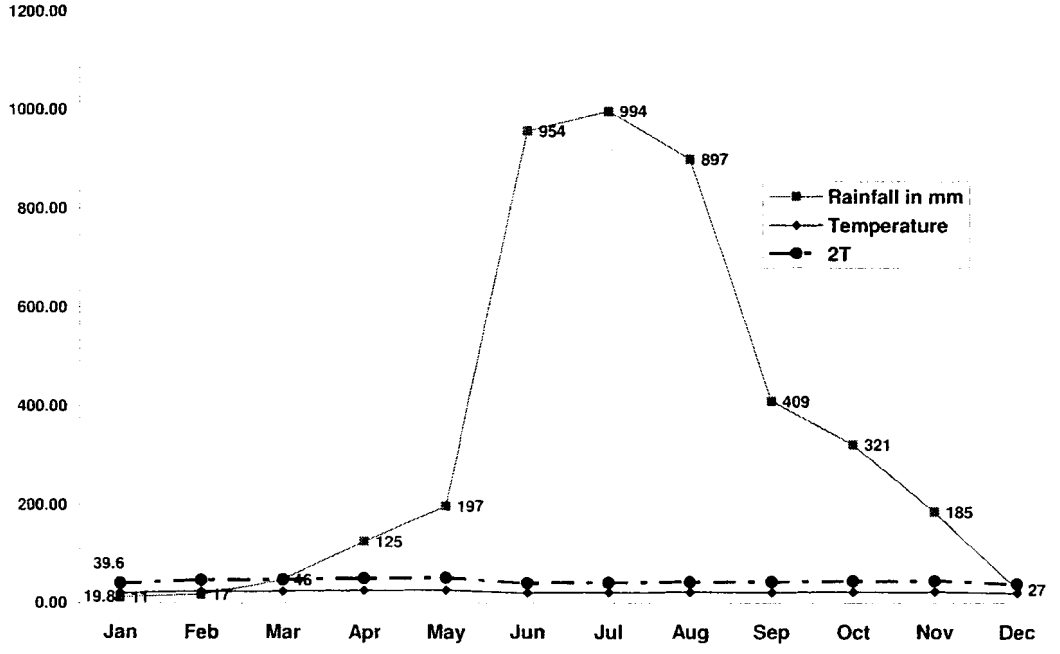


Fig. 1.7. Mean monthly Rainfall, Temperature & Dry Months (Sholayar-Malakkappara)

Vegetation and landuse

The extent of vegetation of the river basin and also for the sub basins were estimated (table 1.4 & 1.5 (appendix-1) while preparing the vegetation map (Map 4). The river basin has a total forest area of 1181.4 Km^2 (80%) and 256.2 Km^2 (20 %) of non forest lower plains. Of which primary forests dominates with 519 Km^2 (36%) followed by forest plantations 179.6 Km^2 (12%), secondary forests 197.4 Km^2 (17%), tea, coffee and other plantations constitute 198.3 Km^2 (13%), degraded non forest vegetation 86.9 Km^2 (6%) and reservoir, streams and rivers 46.5 Km^2 (3%). Fig. 1.8

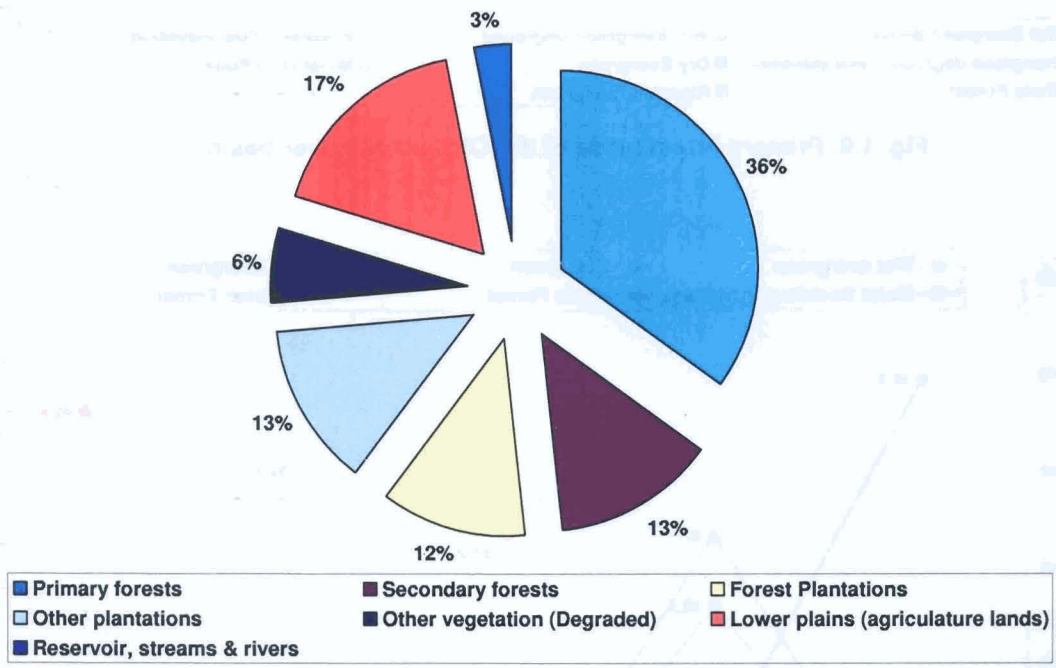


Fig. 1.8. Vegetation of the Chalakkudy River Basin (An overview)

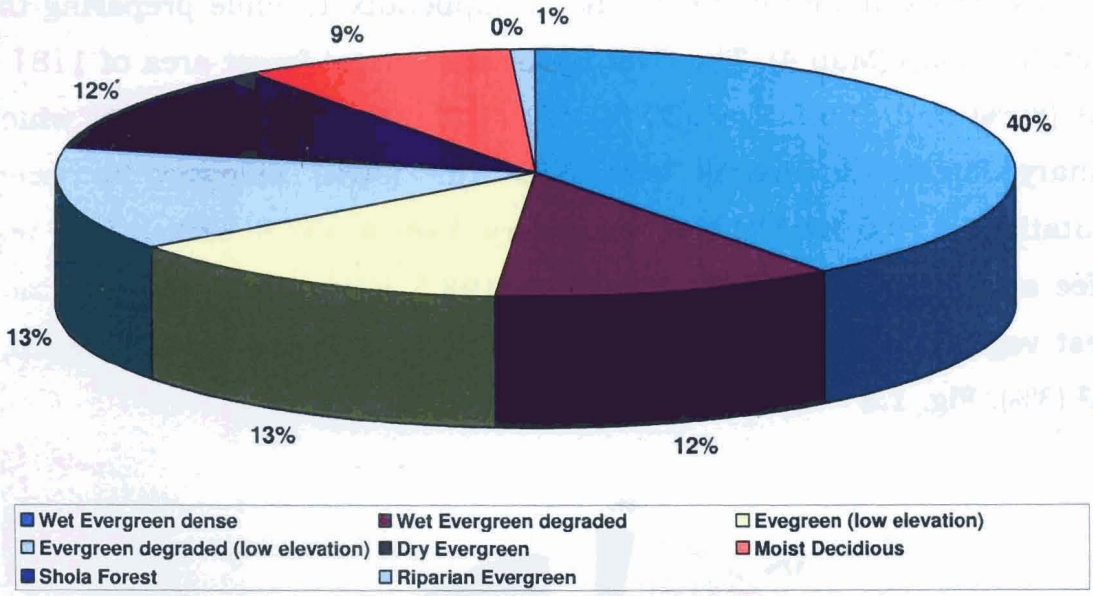


Fig. 1.9. Primary forest types of the Chalakkudy river basin

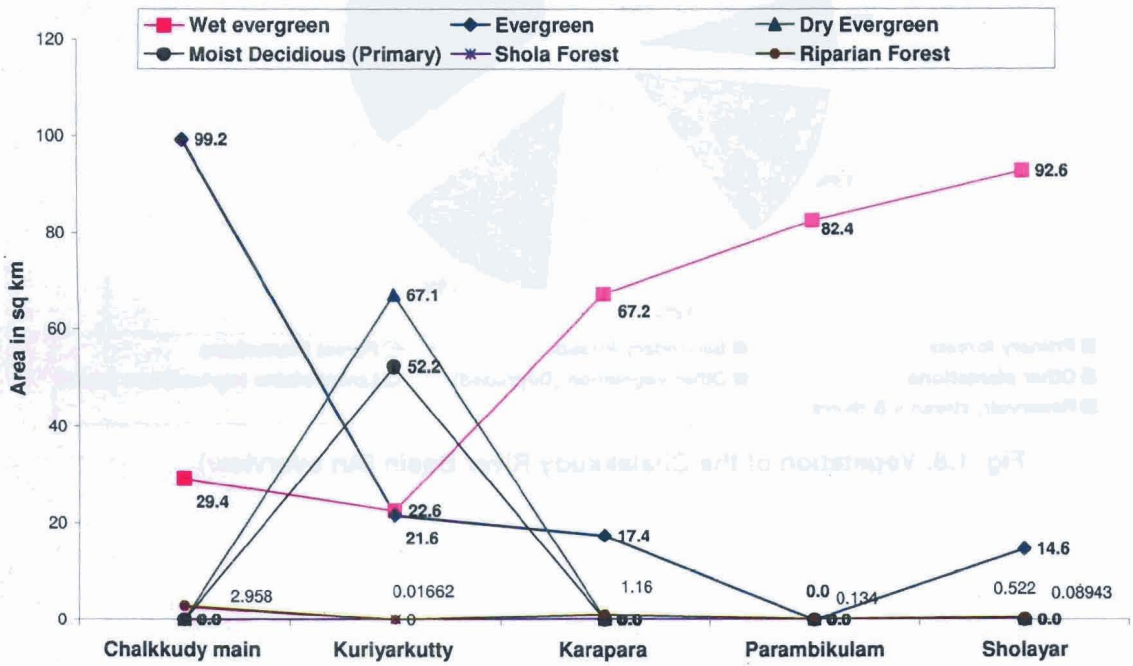
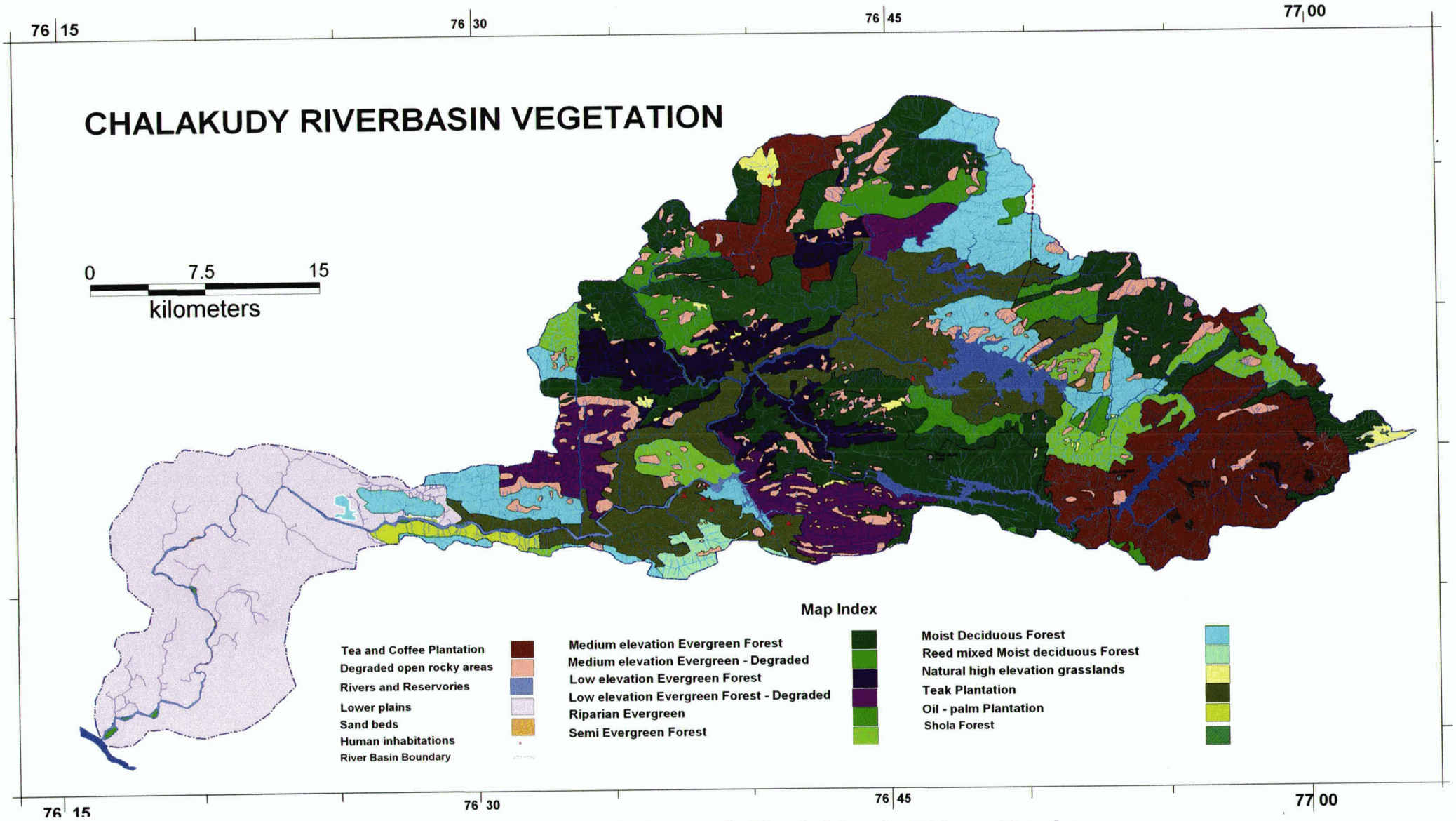


Fig.1.10. Distribution of Primary forests in the basin



Map 2. Vegetation of Chalakkudy River Basin

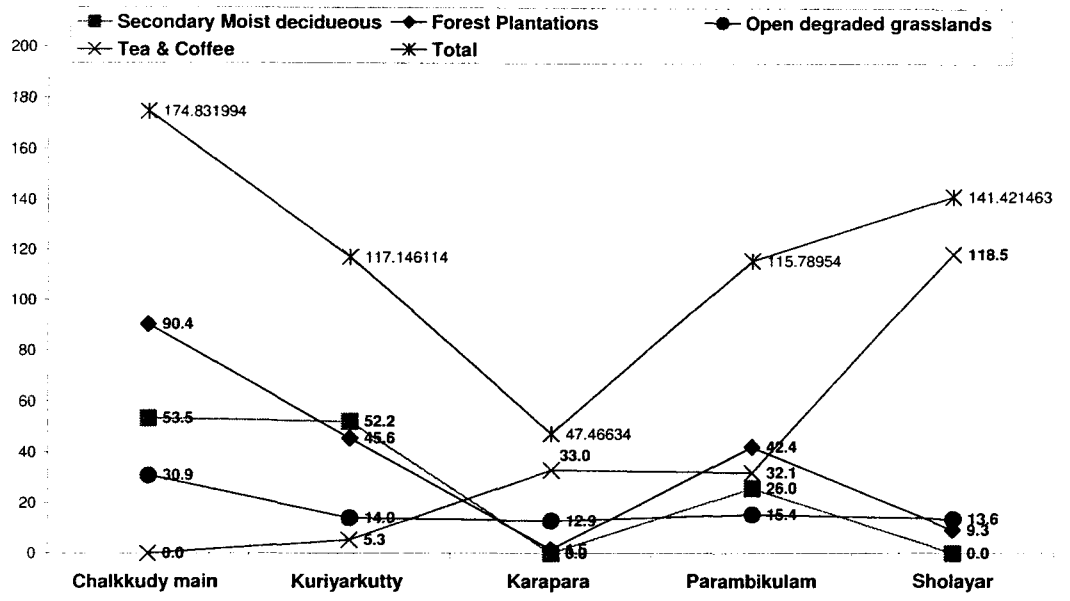


Fig. 1.11. Distribution of Secondary forests, plantations and other degraded vegetation types in the basin

The primary forests in the basin dominated with wet evergreen forests of 361 Km^2 (69%) of which 294 Km^2 is dense forest and 67 Km^2 is degraded forests. The low elevation evergreen forest covers an area of 152 Km^2 (30%) of which both dense and degraded types share 76 Km^2 each. This is followed by riparian forest with an area of 4.79 Km^2 (1%). The true Shola forests restricted to an area of 9 ha in the extreme origin point of the Sholayar tributary at Valpara-Akkamalai.

Distribution of primary forest types in various tributaries of the river basin showed maximum extent 128.6 Km^2 evergreen (low and medium elevation) types in the medium elevation zone (Chalakkudy main river), followed by the Sholayar sub basin 107.2 Km^2, Parambikulam 82.4 Km^2 Karappara 84.6 Km^2 and least extent for Kuriyarkutty sub basin 44.2 Km^2. The dense evergreen forests are more distributed in the Sholayar and Karappara sub basin followed by Chalakkudy main river.

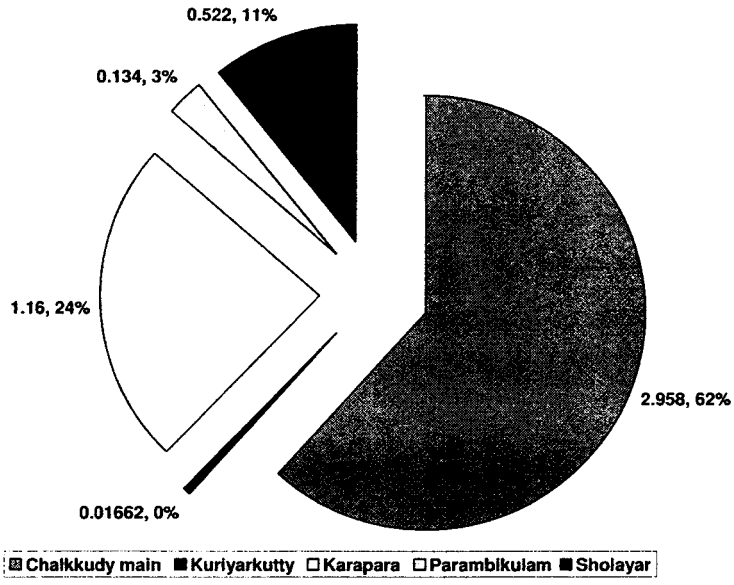


Fig. 1.12. Distribution of Riparian vegetation in the river basin

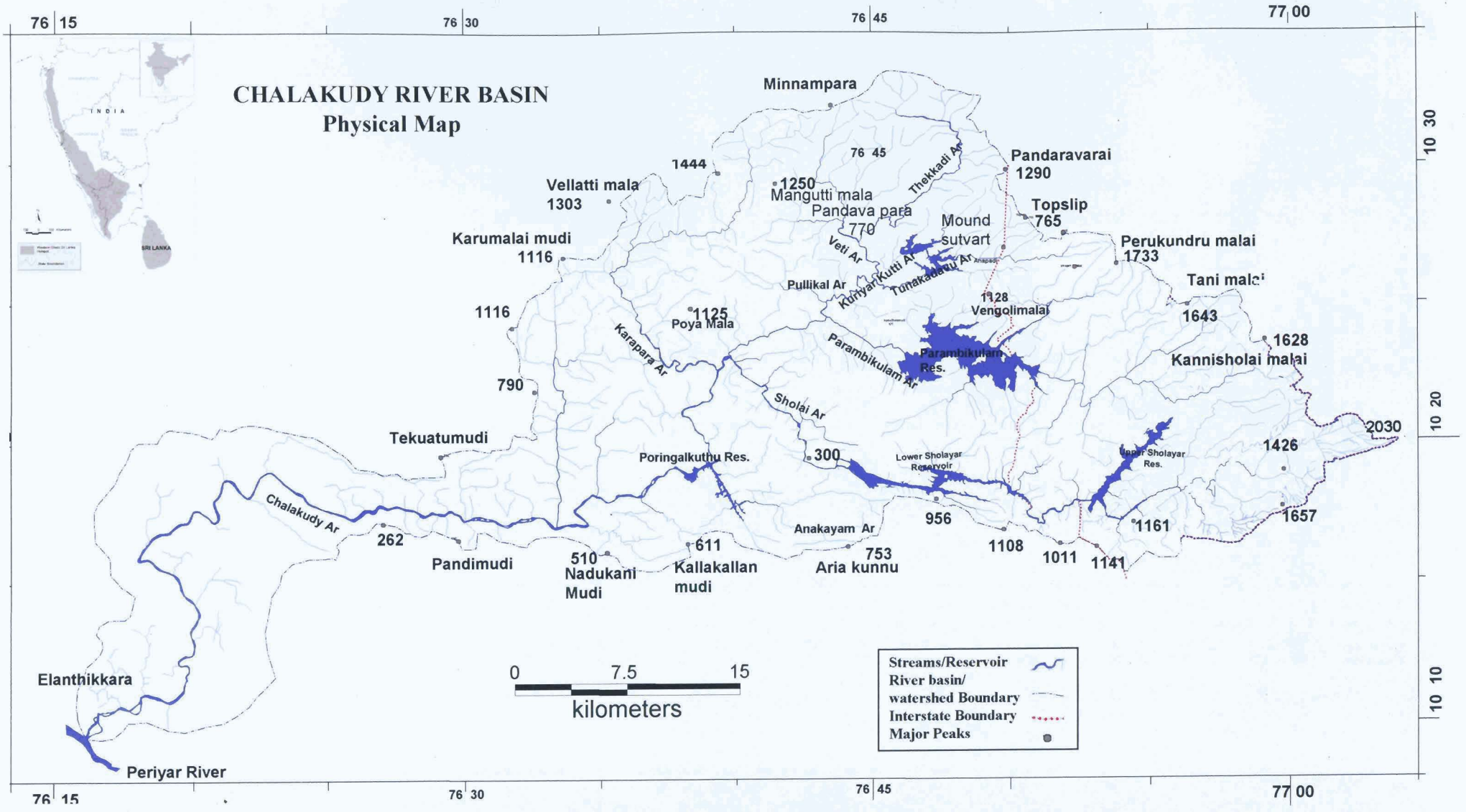
Extent of degradation of forest was high for the Chalakkudy main river 174.8 followed by Sholyar sub basin 141.14 (tea & coffee plantation), Parambikulam sub basin 115.7, Kuriyarkutty 117. 1 and Karappara sub basin 47.4. The degraded forest area of the Sholayar sub basin is entirely due to the tea and coffee plantations in the Tamil Nadu (Valparai) part and its Kerala part represents the high extent unfragmented forest in the basin.

The riparian vegetation

The riparian vegetation is estimated to have nearly 480 ha, distributed in the low-medium elevation area of the Chalakkudy river. It is distributed mainly along the Chalakkudy main river (290 ha, Athirappilly-Vazhachal to Orukombankutty), followed by Karappara river (116 ha, Nelliyampathy-Orukombankutty), Sholayar river 52.2 ha (downstream of Sholayar dam to Orukombankutty), Parambikulam 13 ha (Kuriyarkutty-Orukombankutty) and lest (1.6 ha) along the Kuriyarkutty river at Kuriyarkutty-Thelliakkal area.

Conclusion

The Chalakkudy river basin has a much complex physiography with four levels of landscape subunits. The medium elevation, eastward exposed dry Parambikulam plateaus covering the entire Kuriyarkutty sub-basin. The lower reaches of Parambikulam sub-basin sandwiched between the well sheltered, highly rainfed, wet, medium to high elevation Karappara (Nelliyampathy) and Sholayar (Sholayar-Valparai) sub-basins. All contribute to the complex physiography and bioclimate. This variation in the physiography makes diverse bioclimatic regimes from low rainfed, dry-moist-forest zones to ever wet rainforest regimes in the basin. The vegetation map shows the presence of dry-moist to wet evergreen and montane evergreen forest formations in the basin. The medium elevation areas in the Kerala part of Chalakkudy main river (Vazhachal-Orukombankutty), Sholayar sub-basin (entire Sholayar valley), Karappara sub-basin (Nelliyampathy-Orukombankutty) and upstream areas of Parambikulam sub-basin (Valparai-Tamilnadu part) have great conservation value. The riparian vegetation is distributed throughout and that present along the Chalakkudy main river from Athirappilly-Vazhachal to Orukombankutty is important. The basic morphologic, physiographic and bioclimatic features derived here provided a basic canvas for the study of floristics, community structure and classification of the riparian flora of the river basin. It also brings out some important points towards standardization of methodologies for assessment of morphologic and physiographic features of river basins in the Western Ghats. This is an immediate necessity to describe proper bioclimatic and vegetation features and its dynamics in each conservation units along the Western Ghats for a long-term sustainable conservation and management of our biodiversity.



Map. 1 Physical Map of Chalakkudy River Basin

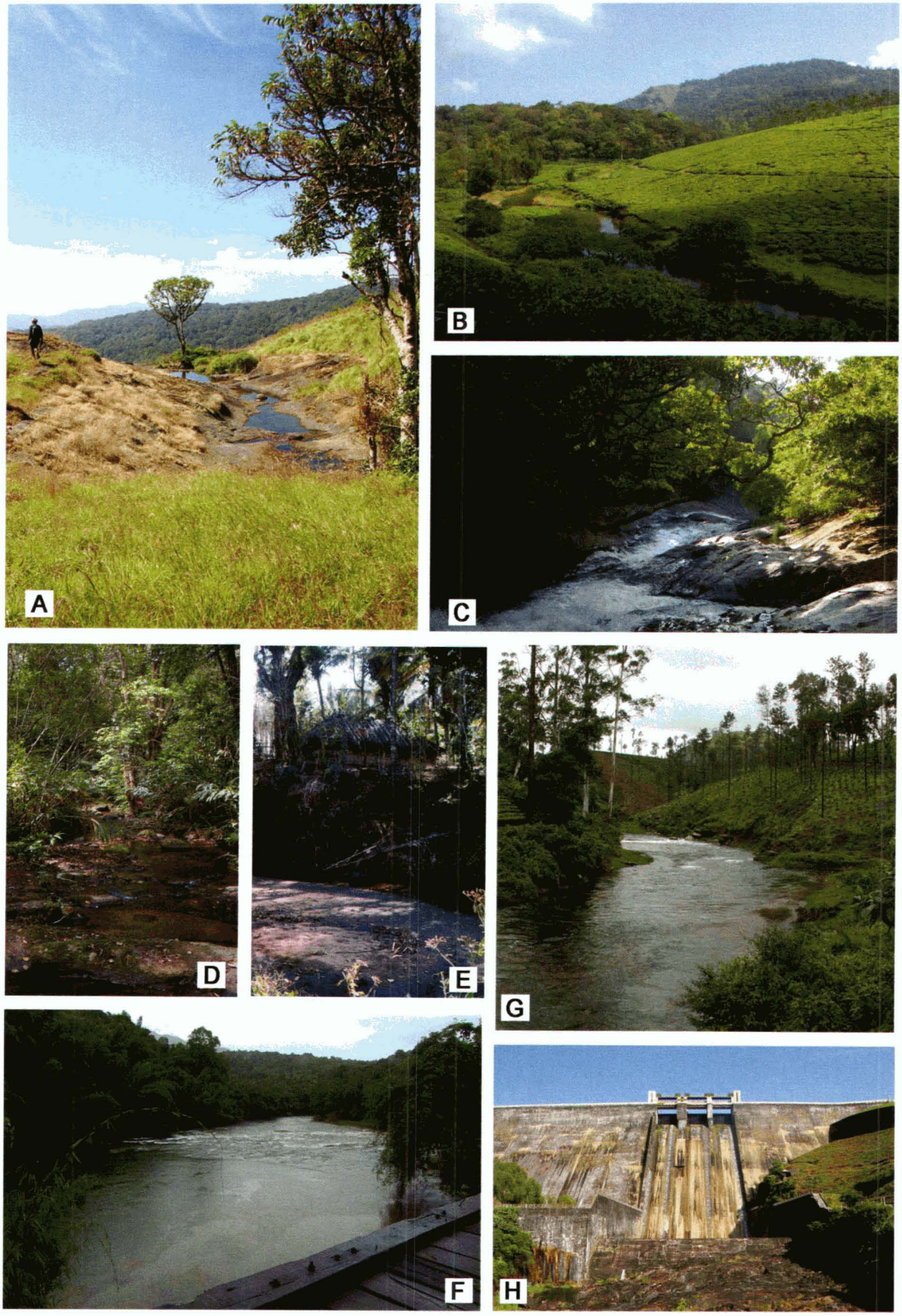


Plate 1. A, B & C. Karappara river at Nelliyampathy; D. Veettiyar ; E. Thekkadiyar (tributeries of Kuriyarkuttyar); F. Kuriyarkutty river; G. Upper Sholayar river; H. Upper Sholayar Dam.

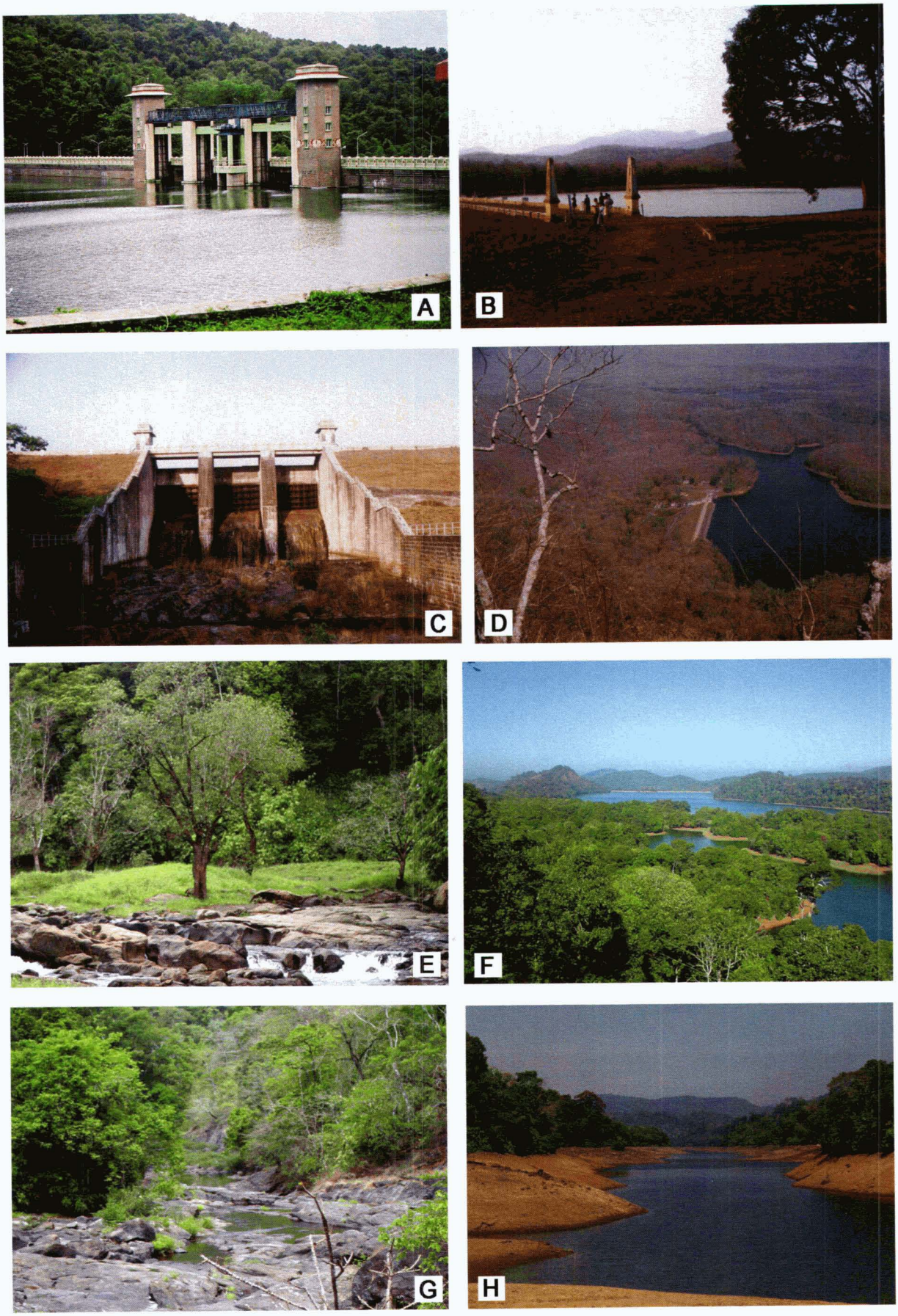


Plate 2. A. Parambikkulam Dam; B. Peruvaripallam Dam; C. Thunacadavu Dam; D. Catchments of Kuriyarkutty river; E. Sholayar River (Malakkappara); F. Kerala Sholayar Dam & reservoir; G. Sholayar river downstream to dam; H. Poringalkuthu reservoir.

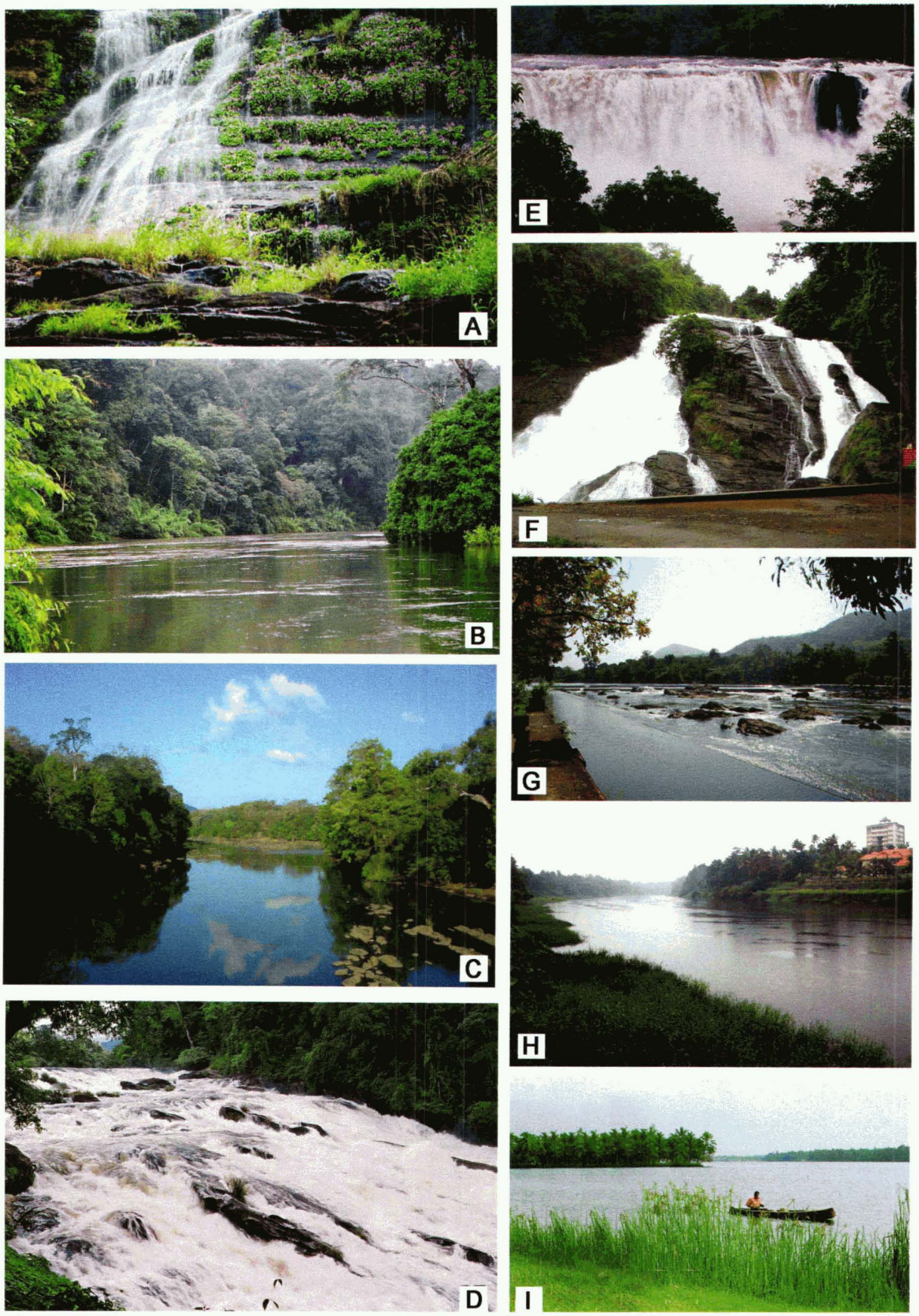


Plate 3. A. Meenchaliyali waterfalls -Sholayar; B. Orukombankutty - confluence point of major tributaries of Chalakkudy River; C. Chalakkudy River and the Riparian Forest -Vazhachal; D. Vazhachal rapids; E. Athirapilly waterfalls; F. Charpa waterfalls; G. Thumboormuzhi river diversion; H. Chalakkudy river at Chalakkudy; I. Chalakkudy river-mouth at Kodunagllur backwaters along with Periyar river (right)- Elanthikkara Chouka-kadavu.

The riparian Flora

Amitha Bachan K.H. “Riparian flora of the Chalakkudy river basin and its ecological significance ” Thesis. Department of Botany , University of Calicut, 2010

Chapter 2

The Riparian Flora

The Riparian flora

Introduction

For conservation of the entire gamut of biodiversity, the protection of one or a group of species, threatened, rare or endemic, is not going to be very effective. If tiger is to be protected, the entire habitat in which the tiger needs protection (Meher-Homji 2001). The floristic studies provide basic information to analyse vegetation of a wide range of ecosystems all over the world.

Meher – Homji (1967) recognized two stocks of floristic elements in the south Indian hill stations of the Western Ghats 1. Temperate or Himalayan elements and 2. species of the tropical stock. The other regions of the Western Ghats including the coastal shore show similarity to the Indo-Malayan tropical stock of flora. Which indicate the high rainfall and short span of dry period in many of the western slopes of the Western Ghats.

About 60% of the angiosperm flora of the world exists in the tropics. Highest number is in the tropical America and then in Tropical Asia (Prance 1982). In India, the number of Angiosperms estimated to be 17000 species, of which 27% distributed along the Western Ghats. India is considered as one of the 18 mega diversity centers of the world with two biodiversity hotspots i.e., the Himalayas and the Western Ghats. Chatterjee (1939) estimates 61.55 % endemism for the country of which 3169 species in Himalayas and 2045 species in Indian Peninsula, out of which 1500 endemic to the Western Ghats.

The latest estimate for Kerala provides 4679 species of angiosperms belonging to 1360 genera and 212 families, of which 1637 are endemic to Peninsular India. Among them 263 species are confined

to Kerala (Sasidharan 2004). Nayar (1980) estimates 4000 species of flowering plants in Western Ghats of which 3900 occur in southern Western Ghats and 3800 in Kerala. Of which 1272 are Southern Western Ghats endemic and 102 species restricted to Kerala. He has identified three hotspots based on endemism, viz., Agasthyamala, Anamala–Highranges and Silent Valley – Wyanad.

Sasidharan (2004) estimates 60 endemic genera from the Western Ghats, of which Poaceae (13) and Acanthaceae (6) predominate. The six dominant families in terms of endemic species are Rubiaceae (131), Orchidaceae (129), Poaceae (125), Acanthaceae (93) and Balsaminaceae (75).

The Indian region is not far behind when compared to the advancement of floristic and vegetation studies of many other tropical countries. Floristic studies for different region were advanced but geographical accountability and habitat wise data or distributional records were very poor. Phytogeographical accountability and vegetation aspects were not stressed or not properly addressed in many of the regional floras.

The riparian flora, structure of the vegetation and its significance were hardly understood or described from the Indian region. Many studies are available on the different aspects of riparian vegetation from the temperate zones. In the tropical region, if present were limited to physiognomicaly contrasting, clearly identifiable riparian stretches of warmer zones such as the description of the Riparian Fringing Forest type of the Moist Deciduous Forests by Champion and Seth (1968).

Review of earlier works

Scientific exploration of the Indian region was started with the arrival of Europeans. The first among the published books on the botany

of this region was van Rheede's (1678-1703) monumental work *Hortus Indicus Malabaricus*. It is of great importance as it formed the main source of information about many Indian plants for Linnaeus. He adopted 265 Indian plant names into botanical nomenclature and many them are lectotypified by Rheedean figures. The early botanical studies in India are mainly centered around East Coast. William Roxburgh had made extensive collections in Bengal and eastern India. His major contributions were *Hortus Bengalensis* (1814) and *Flora Indica* (1832).

Almost during the same period, Robert Wight had made extensive collections in South India, and jointly with G.A. Walker Arnott, published *Prodromus Florae Peninsular Indiae Orientalis* (1834). The *Prodromus* was the first attempt at a comprehensive flora of any part of India in which the natural system of classification was followed. In 1839 Robert Wight published his well known work, *Icons Plantarum Indiae Orientalis*. He has contributed about 28 important publications, Arnott (1834) and R. H. Beddome (1868-1874) contributed considerably to document the floristic wealth of the Peninsular India.

The early botanical studies in India reached its climax when J.D. Hooker (1872-1897) published his seven volume work *Flora of British India*. This initiated publication of regional floras from many parts of the Indian subcontinent. *Flora of Presidency of Bombay* by Cooke (1901-1908) and *Flora of Presidency of Madras* by J.S. Gamble and C.E.C. Fischer (1915-1936) are noticeable. Floristic exploration of important geographic areas were made during that time. As for the forest flora, the works of Bourdillon (1908), Talbolt (1909-1911), Rama Rao (1914) are the main source of information. The publication of *Flora of Anamalais* (Fischer 1921) and *Flora of South Indian Hill Stations* (Fyson 1932) are important contribution on the plant wealth of high altitude hills of this region.

As far as Kerala is concerned a series of district floras were published from this region starting from *Flora of Calicut* (Manilal & Sivarajan 1982). *Flora of Cannanore* (Ramachandran & Nair 1988), *Flora of Silent Valley* (Manilal 1988), *Flora of Palghat* (Vajravelu 1990), *Flora of Thiruvananthapuram district* (Mohanan & Henry 1994), *Flowering Plants of Thrissur Forests* (Sasidharan & Sivarajan 1996), *Flora of Nilambur* (Sivarajan & Mathew 1996) *Flora of Agasthyamala* (Mohanan & Sivadasan 2002), *Flora of Pathanamthitta district* (Anil Kumar *et al.* 2005) and *Flora of Alappuzha District* (Sunil & Sivadasan 2009).

Apart from district floras, accounts on selected families were published in the recent times, and that of special groups or monographs are important in the advancement of the floristic and vegetation studies. In this context studies on the important plant groups like *Introduction to Orchids* (Abraham & Vatsala 1981), *Flora of Kerala Grasses* (Sreekumar & Nair 1991), *Taxonomic and Phylogenetic study of South Indian Zingiberaceae* (Sabu 2006), *The family Eriocaulaceae in India* (Ansari & Balakrishnan 1994 & 2009), *Malvaceae of Southern Peninsular India* (Sivarajan & Pradeep 1996) and *Palms of Kerala* (Renuka 1999) are significant. Sasidharan (2004) published checklist of *Flowering Plants* of Kerala, this is followed by another checklist by Nair *et al.* (2006). The first volume of the flora of Kerala was published by Botanical Survey of India, Southern Circle (Daniel 2005).

Methodology

The Chalakkudy river basin includes five important forest areas in its catchments 1. Nelliyampathy forests of Nenmara Forest Division in the catchments of the Karpara tributary, 2. Forest areas of Parambikulam Wildlife Sanctuary and Tiger Reserve in the catchments of Kuriyarkutty tributary and the Parambikulam tributary, 3. Sholayar and

Malakkapara forests of Vazhachal Forest Division in the catchments of the Sholayar tributary, 4. Valparai forest areas of Indira Gandhi Wildlife Sanctuary of Tamil Nadu in the catchments of Parambikulam and Sholayar tributaries, and 5. Forests of Chalakkudy, Athirappilly - Vazhachal- Poringalkuthu areas of the Chalakkudy and Vazhachal forest divisions in the catchments of main Chalakkudy River. Two third of the catchments of the river basin is within interior forest areas of the central Kerala. It needs 3-6 days of field trips to cover a particular area of the river basin. Field trips were conducted at regular intervals in all the tributaries for eight years beginning from 2001. Study area was thouroghly explored, and specimens were collected for the herbarium and laboratory studies during 2004-2009. The riparian areas of all the tributaries and important streams were surveyed repeatedly and systematically at least 5-6 times covering pre monsoon, monsoon and post monsoon seasons. About 696 individual plants were collected and 3-5 specimens of each taxa were collected for detailed study.

The important riparian areas were identified from the vegetation map and also during reconnaissance survey. The riparian vegetation found to have an average width of 15-30 meters. Areas of each and every tributary and their important streams, covering all the available altitude ranges from sea level to 1400m MSL were surveyed to document floristic diversity. Aquatic plants and plants from the riverbeds were also collected during the study. The weeds, ruderal, facultative and obligate riparian species were collected and analyzed for the floristic inventory. Specimens were collected usually in flowering or fruiting (generative) stages or rarely vegetative stages (if generative stages are not available) following the procedures given by Jain and Rao (1977) and Van Balgooy (1987). Plant specimens belonging to families such as Arecaceae, Araceae, and Pandanaceae Bamboos were collected and preserved

following the methods given by Fosberg and Sachet (1965). Help of the tribesmen especially of the 'Kadar' endemic tribe of the Anamalai region were sought for the interior forest dwelling and collection of specimens from tall trees. Specimens from fallen twigs in generative stages from tall trees due to browsing of arboreal mammals and birds especially Nilgiri Langur, Lion Tailed Macaque, civets and hornbills, and also due to wind fall were also helped. River transported seeds and fruits were also collected during the study.

The sample plots selected for the phytosociological analysis (detailed in chapter 4) were surveyed intensively for floristic inventory. This was very helpful in identification of obligate riparian species as well as the structure of the vegetation in relation with the longitudinal and vertical affinity of the species towards the river front. Filed notes such as date of collection, locality, altitude, habit, habitat etc. were noted for each of the collected specimen. Identification and description was made from fresh and dried specimens. For detailed study specimens were preserved in 70% methylated alcohol. All the voucher specimens of this study were deposited at Calicut University Herbarium (CALI).

The plants collected were identified using *the Flora of Presidency of Madras* (Gamble & Fischer, 1915-1936), *Flora of British India* (Hooker, 1872-1897), *Flora of Tamil Nadu and Carnatic* (Matthew 1983), *Revised Handbook to the flora of Ceylon* (Dassanayake & Fosberg, 1980-1991; Dassanayake, Fosberg & Clayton, 1994 & 1995), *Flora of Anamalais* (Fischer 1921), *Flora of South Indian Hill Stations* (Fyson 1932), *Flora of Kerala Grasses* (Sreekumar & Nair 1991) and all other available regional floras, revisions, and other relevant taxonomic literature. Besides herbaria such as Calicut University (CALI), Botanical Survey of India , Coimbatore (MH), Tropical Botanical Garden and Research Institute

(TBGT) and Kerala Forest Research Institute (KFRI) were also visited to confirm the determination of some specimens.

Plan of Presentation of the Flora

Being the flora of riparian plants, care has taken to include vegetative and ecological features including habitat, locality, altitude and distribution for each species. Photographs of important riparian elements have been provided for easy identification of the species. The study area, vegetation and other bioclimatic features have been provided in detail in the Chapter 1 of the thesis and hence it is not dealt. A detailed analysis of the flora is given in this chapter substantiated with tables and figures. The Keys and Systematic treatment have been provided after the summary and conclusion.

Artificial dichotomous keys are provided for the families, genera, species and infraspecific taxa. The families have been arranged based on Bentham and Hookers's System of Classification (1862-1883) with slight modification. The genera and species have been arranged in alphabetical order for practical use. Citation of the family and generic names have been given in accordance with *Index Nominum Genericorum* (Farr *et al.* 1979), *The Plant Book* (Mabberley 2008) and *International Code of Botanical Nomenclature* (Vienna Code – 2006 by Mc Neil *et al.* 2006). For the abbreviation of authors name, *Authors of Plant Names* by Brummitt and Powel (1992) was followed. For the abbreviations of the periodicals *Botanico Periodicum Huntianum* (B-P-H) (Lawrence *et al.* 1968) was used.

Each species is provided with short nomenclature citations with reference to *Flora of British India* (Hooker, 1872-1897), *Flora of presidency of Madras* (Gamble & Fischer, 1915-1936), *Flora of Silent Valley* (Manilal 1988), *Flowering Plants of Thrissur Forests* (Sasidharan & Sivarajan 1996), *Flora of Agasthyamala* (Mohanana & Sivadasan 2002),

Flora of Pathanamthitta (Anil Kumar *et al.* 2005) and *Flora of Alappuzha District* (Sunil & Sivadasan 2009). *Icones* of Wight (1838-1853) and Beddome (1868-1874) were also cited. Besides these floras, relevant monographs, revisions and publications were also cited wherever applicable. Local names were provided at the end of citation in bold whenever available. Information on habit of the plant, nature of leaves, inflorescence, flowers, fruits and seeds were provided in the description. This is followed by phenology, distribution and details of voucher specimens.

Result and Discussion

Enumeration of the riparian flora of the Chalakkudy river basin brings out 696 taxa of flowering plants within 145 km long Chalakkudy river basin. They belong to 450 genera under 129 families. Dicots represented with 534 taxa under 351 genera and 111 families. Monocots represented with 162 taxa under 99 genera and 18 families. Family Poaceae is the dominant family with 48 species followed by Euphorbiaceae (29), Orchidaceae (27), Cyperaceae (26), Acanthaceae (25), Rubiaceae (24), Moraceae (24), Fabaceae (21), Asteraceae (20), Araceae (16), Clusiaceae (14) and Scrophulariaceae (13). Details of 20 dominant families are given in the table 2.2.

	Species	Genera	Families
Dicotyledons	534	351	111
Monocotyledons	162	99	18
Total	**696**	**450**	**129**

Table 2.1. An overview of the riparian flora

The dominant families with respect to endemic species are Orchidaceae (17), Acanthaceae (15), Rubiaceae (12), Araceae, Melastomataceae, Annonaceae and Poaceae 11 species each,

Euphorbiaceae (10), Clusiaceae (10) and Lauraceae (9). The genera *Impatiens* ranks first with maximum number of endemic species (8). This is followed by *Ficus* (6), *Syzygium* (6), *Strobilanthes* (5), *Garcinia* (5), *Osbeckia* (5) and *Memecylon* (4). The important representative families of the Tropical Rain Forest showed 75-100 percentage of endemism viz. *Dipterocarpaceae* (100%), followed by *Lauraceae* (81%), *Myristicaceae* (75 %), *Myrtaceae* (75%) and *Clusiaceae* (71%). Some important families indicating microclimatic importance such as *Balsaminaceae* (90%), *Orchidaceae* (62%), *Melastomataceae* (84%) and *Podostemaceae* (80%) also showed high percentage of endemism.

Table 2.2 Twenty important families of the riparian vegetation

Sl. No.	Family	No of Species	No. of Endemic Species
1	POACEAE	48	11
2	EUPHORBIACEAE	29	10
3	ORCHIDACEAE	27	17
4	CYPERACEAE	26	1
5	ACANTHACEAE	25	15
6	RUBIACEAE	24	12
7	MORACEAE	24	8
8	FABACEAE	21	5
9	ASTERACEAE	20	2
10	ARACEAE	16	11
11	CLUSIACEAE	14	10
12	SCROPHULARIACEAE	13	1
13	MELASTOMATACEAE	13	11
14	ANNONACEAE	13	11
15	CAESALPINIACEAE	12	2
16	LAMIACEAE	11	4
17	LAURACEAE	11	9
18	CONVOLVULACEAE	10	1
19	PANDANACEAE	9	3
20	COMMELINACEAE	9	4

About 350 plant species from 92 families found to occur frequently along the riparian zone. The important riparian plant families are *Lecythidaceae, Salicaceae, Sabiaceae, Podostemaceae, Capparaceae, Elaeocarpaceae, Urticaceae, Pandanaceae, Myrsinaceae. Leeaceae, Dipterocarpaceae, Clusiaceae, Myristicaceae, Chloranthaceae, Lentibulariaceae, Hydrocharitaceae, Typhaceae, Cyperaceae, Poaceae, Rhizophoraceae, Avicenniaceae, Acanthaceae, Annonaceae, Flacourtiaceae, Pittosporaceae, Euphorbiaceae, Eriocaulaceae, Araceae, Moraceae, Orchidaceae, Zingiberaceae, Melastomataceae, Rubiaceae, Ulmaceae, Ebenaceae, Polygonaceae, Onagraceae, Balsaminaceae, Butomaceae, Nympaceae, Begoniaceae, Caryophyllaceae, Datiscaceae, Gesneriaceae, Gentianaceae* and *Lythraceae.* The important riparian and associated plants are listed in the Table 2.3 of Appendix 1.

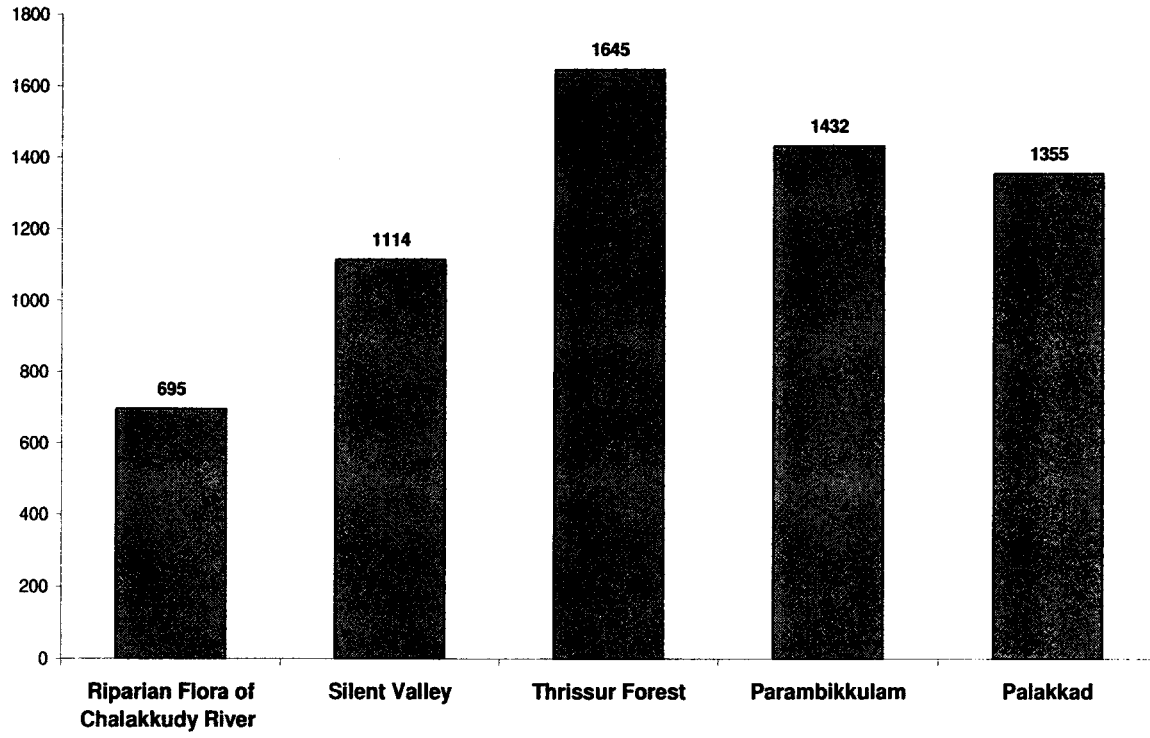
There were 254 endemic species in the flora representing 36.5 % endemism. The percentage of endemism is relatively high when compared to Thrissur forest (15.2%) and entire Kerala (27.18%). Among the endemic species 149 are endemics of Western Ghats and Sri Lanka Hot Spot, of which 95% (142 species) are confined to the Western Ghats alone and 89 species are of Southern Western Ghats. Among the endemic species recorded, 30 species were of Peninsular India endemics, 27 species of Peninsular India-Sri Lanka endemics, 17 species of South India-Sri Lanka endemics and 4 species were endemic to India.

Among the representing species 270 (40%) are indigenous elements, 172 (25%) Indo-Malayan elements, 30 Tropical Asian, 49 Pantropical, 29 Paleotropical, and 22 Tropical and South American.

The percentage of plants under RET (Rare, Endangered, Vulnerable and Threatened) category is also high 4.7% (33 species out of 695) when compared to Thrissur forest flora 3% (50 species out of 1645). The

endangered species include *Desmos viridiflorus* (Bedd.) Safford, *Atuna travancorica* (Bedd.) Kosterm., *Symplocos macrophylla* Wall. ex A. DC. subsp. *rosea* (Bedd.) Nooteb., *Aporosa bourdillonii* Stapf, *Syzygium chavaran* (Bourd.) Gamble, *Bulbophyllum aureum* (Hook. f.) J. J. Smith, *Cryptocarya anamalayana* Gamble, *Syzygium bourdillonii* (Gamble) Rathkr. & Nair and *Ardisia sonchifolia* Mez..

Fig. 2.1. Comparison with other flora



Plants from 'Rare' category include *Mallotus resinosus* (Blanco) Merr., *Trias stocksii* Benth. ex Hook, *Oxytenanthera bourdillonii* Gamble, *Salacia beddomei* Gamble, *Semecarpus travancorica* Bedd., *Sonerila versicolor* Wight, *Dalzellia gracilis* C. J. Mathew, *Willisia selaginoides* (Bedd.) Warming ex Willis, *Dysoxylum malabaricum* Bedd. ex Hiern,

Crotalaria clarkei Gamble, *Mycetia acuminata* (Wight) Kuntze, *Capparis rheedei* DC., *Oberonia brachyphylla* Blatt. & McCann, *Cyclea fissicalyx* Dunn, *Coscinium fenestratum* (Gaertn.) Colebr. and *Humboldtia vahliana* Wight. The Threatened category include *Cinnamomum riparium* Gamble, *Impatiens herbicola* Hook., *Syzygium occidentalis* (Bourd.) Gandhi. *Ochreinauclea missionis* (Wall. ex G. Don) Ridsd., *Myristica malabarica* Lam., *Aglaia perviridis* Hiern and *Orophea uniflora* Hook. f. & Thomson. The Threatened category was represented with *Arisaema barnesii* C. E. C. Fisch.

The Community Structure and Classification of the Riparian Vegetation

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Chapter 3

The Community Structure and Classification of the Riparian Vegetation

The Community Structure and Classification of the Riparian Vegetation

Introduction

The riparian vegetation was considered as a part of the wetland system having unique vegetation characteristics adapted to the climatic features prevailing in that region. (Naiman *et al.* 1993, Naiman & Decamps 1997). Each vegetation types, its formations and associations are characterized by plant communities with individual structural identity. According to Clements (1928), vegetation can be divided into formations and each formation into associations. Individuality of plant communities in its structural and floristic composition makes different vegetation types and sub-types within a prevailing bioclimate.

Muller-Dombois and Ellenberg (1974) defines Plant community as the composition of integrated species with characteristic individuality for a given bioclimate in space and time. Each plant community composed of independently responding populations of different species. Gleason (1926) states that, populations independently respond to environmental variables. Understanding the structure of plant communities and their degree of association and dissociation of different species populations provide basic information for defining vegetation types.

Misra (1968) defines the community structures as the varying quality and quantity of the community. It is expressed with the presence, absence and abundance of individual species populations. Plant community is the level at which populations and species can be identified (Kent & Coker 1992) and the degree of abundance and occurrence of different species populations is the expression of the structure of the community.

Analyzing the community structure and composition of the riparian plant communities along varying degree of bioclimate prevailed in the Chalakkudy river basin would yield relevant information on riparian vegetation types of the Chalakkudy River.

Fosberg (1961) gave first world wide accepted physiognomic classification for the vegetation of the humid tropics. The rainforests of the Far East were considered under the Evergreen closed forest types in his classification and hardly describe any riparian vegetation types. Fosberg's (1961) physiognomic classification system was critically commended by many scientists at that time and according to the methods accepted in the Yangambi conference. Main vegetation types were classified under climatic and edaphic formations. In which the riparian forests of the humid tropics comes under IB4. Similar pattern was followed by Champion (1936) and Champion and Seth (1968) in the description of Indian Vegetation.

Champion and Seth (1968) in their revised classification of forest types of India considered the type Riparian Fringing Forest (RS1) as a subgroup (4E) of Littoral and Swamp Forest (edaphic and seral types) under the Moist Deciduous Forest types. This was based on the characteristic difference in floristic composition of riparian plant communities from that of general moist deciduous vegetation. They also explain the Dry Tropical Riverine Forests (IS1) from warmer, less rainfed eastern part of South India under Dry Forest Types and mentioned need for further description. The Champion and Seth's (1968) classification of the Indian vegetation do not provide information on the riparian vegetation types in the highly rainfed western slopes of the Western Ghats. It was not mentioned in the seral or edaphic vegetation types of the evergreen forest types.

In the tropical climate, the climax vegetation is determined mainly by the constant precipitation, greatly influenced with the local topographic features (Whitmore 1975, Good 1964, Osborne 2000). The climax vegetation of the tropics with high rainfall is mainly influenced with edaphic conditions and span of the dry months (Meher-Homji 2001). Anthropogenic interferences like deforestation, cultivation, raising of plantations can restrict the vegetation from reaching the climax. Hence the potential climax vegetation of the high rainfed western slopes of the Western Ghats should be Tropical Wet- Evergreen type. However, the anthropogenic disturbances in the recent past have resulted in occurrence of pre-climax and other vegetation types. Champion and Seth (1968) in their revised classification not provided adequate reasons for describing the Moist Deciduous Forests as the predominant vegetation representing the western side of the Kerala part of Western Ghats.

The interpretation in Champion and Seth's (1968) classification was based on fewer samples and also reliability of various environmental terminologies used in naming vegetation types. This classification was critically reviewed by many authors (Meher-Homji 1978, Puri *et al.* 1983). UNESCO accepted the world wide Physignomic-Ecological classification presented by Schmithusen and Ellenberg (1965). This classification was subsequently modified by Gaussen *et al.* (1966), Ellenberg and Muller-Dombois (1967) and published in 1973. In this classification the riparian vegetation of the evergreen forests were classified as Riparian (sub formation- IA1f(1)) of the Tropical Ombrophilous alluvial forests (formation – IA1f) under the Evergreen – Tropical Ombrophilous forests. Later Gaussen *et al.* (1961-78) provided vegetation maps for the Indian Peninsula including the madras region (1961). But the riparian forest sub-formation was not explained along with other sub-formations due to lack of field data or further studies or description.

Meher –Homji (1978) criticized the use of broad, non-characteristic and confusing environmental terminologies and advocated for use of two to three characteristic species with the proper physiognomy. Gadgil and Meher-Homji (1982) provided more detailed explanations to the vegetation types supplemented with climatic and biogeographic attributes. Chandrasekharan (1962 & 1968) has modified and elaborated the Champion and Seth's (1968) classification for Kerala. Nair (1991) has described both the Champion and Seth's (1968) and Gadgil and Meher-Homji's (1982) classification for the southern Western Ghats region and discussed in detail for each biogeographic regions or landscape units.

The vegetation of an area represents sum total of the overall interaction of the plant communities with the immediate climatic and biotic factors in space and time. A climax or combination of climaxes based on edaphic factors within a climatic regime is the mature, stable and optimal state of a phytocoenosis, representing the final outcome of a progressive series of successive stages of vegetation. Under a given climate all the succession converge towards a unique climax or climaxes, and which is the climatic climax (Clements, 1936). So the pre-climax vegetation due to interferences has to be treated as secondary vegetation types for a given bioclimate.

This chapter analyses different riparian vegetation types along various environmental gradients prevailing in the Chalakkudy river basin. They were grouped under various bioclimatic regimes for a hierarchical classification. A gradient from the seral, degraded, edaphic to climax type was constructed under each bioclimatic type and dominant plant communities are explained for different strata. A detailed classification of the riparian vegetation of the Chalakkudy river basin in the Anamalai part of Western Ghats is provided here.

Review of literature

Earlier accounts on basic concepts of plant communities, vegetation dynamics were provided by Gleason (1926) and Clements (1928 & 1936). Elementary methodologies for vegetation analysis were developed by Daubenmire (1949), Weaver and Clements (1936). It was Shannon and Weaver (1949) and Simpson (1949) who developed methodologies for measuring diversity. The publication of *'A preliminary survey of the forest types of India and Burma'* by Champion (1936) was a landmark in the vegetation studies of the Indian sub continent. This evoked a new outlook and enthusiasm for studies on the vegetation aspects of the Indian subcontinent. He has provided first account of riparian terminology in the vegetation classification of India. He considered the riparian vegetation under edaphic formation of the moist deciduous forest types of southern India.

A worldwide accepted preliminary vegetation classification was provided by Fosberg (1961), followed by a series of publication by Schmithusen and Ellenberg (1965) and Gaussen *et al.* (1961-78). This was followed by little important contributions from the Indian region. Important among them are *A forest classification for Kerala* published by Chandrasekharan (1962) following Champion & Seth's (1936) classification, *A revised survey of the forest types of India,* Champion & Seth (1968) and *A revised classification of vegetation types for Kerala* region by Chandrasekharan (1962). These works were critically anlysed and a phytogeographic, bioclimatic and physiognomic accounts of vegetation of Peninsular India was provided by Meher-Homji (1965, 1967, 1967a, 1967b).

Some important aspects of statistical inputs to the vegetation were discussed by Misra (1968). Inputs on similarity index, cluster analysis

and vegetation classification were provided by Ward (1963), Pielou (1969).

Publications such as *A geography of flowering plants* by Good (1964), *Comprehensive account of the world vegetation classification* by Ellenberg and Muller-Dombois (1967) and *Tropical rain forests of the far east* (Whitmore 1975) contributed to our knowledge on vegetation studies, especially for the much complex tropical ecosystems. This was followed by the publications of

Publication of *'Aims and methods of vegetation ecology' by* Mueller-Domboise and Ellenberg (1974) discusses methodology and details for vegetation analysis, mapping and classification. Later, Meher-Homji (1978, 1982) and Gadgil and Meher-Homji (1982) provided significant contribution through providing a detailed account of the phytogeography and vegetation of India. Nair (1991) provided a comprehensive account of the important conservation units along the Western Ghats with a detailed account of the area, administrative units, potential vegetation, flora, fauna, biodiversity significance and human ecology. This was followed by a significant contribution *The Bioclimatology and Phytogeography of Peninsular India* by (Meher-Homji 2001). Publication of these works has brought a new dimension in the vegetation and floristic studies of the Peninsular India.

The riparian vegetation and its various aspects were well documented from the temperate region. Yolanda (1994) provided a preliminary classification of riparian vegetation of Mexico. A similar classification for Portugal was provided by Augiar (1996), for North America by Patten (1998), and for North Western peninsulvania by Williams and Morarity (1998). This was followed by studies on various aspects of riparian vegetation dynamics (Naiman *et al.* 1993, Naiman &

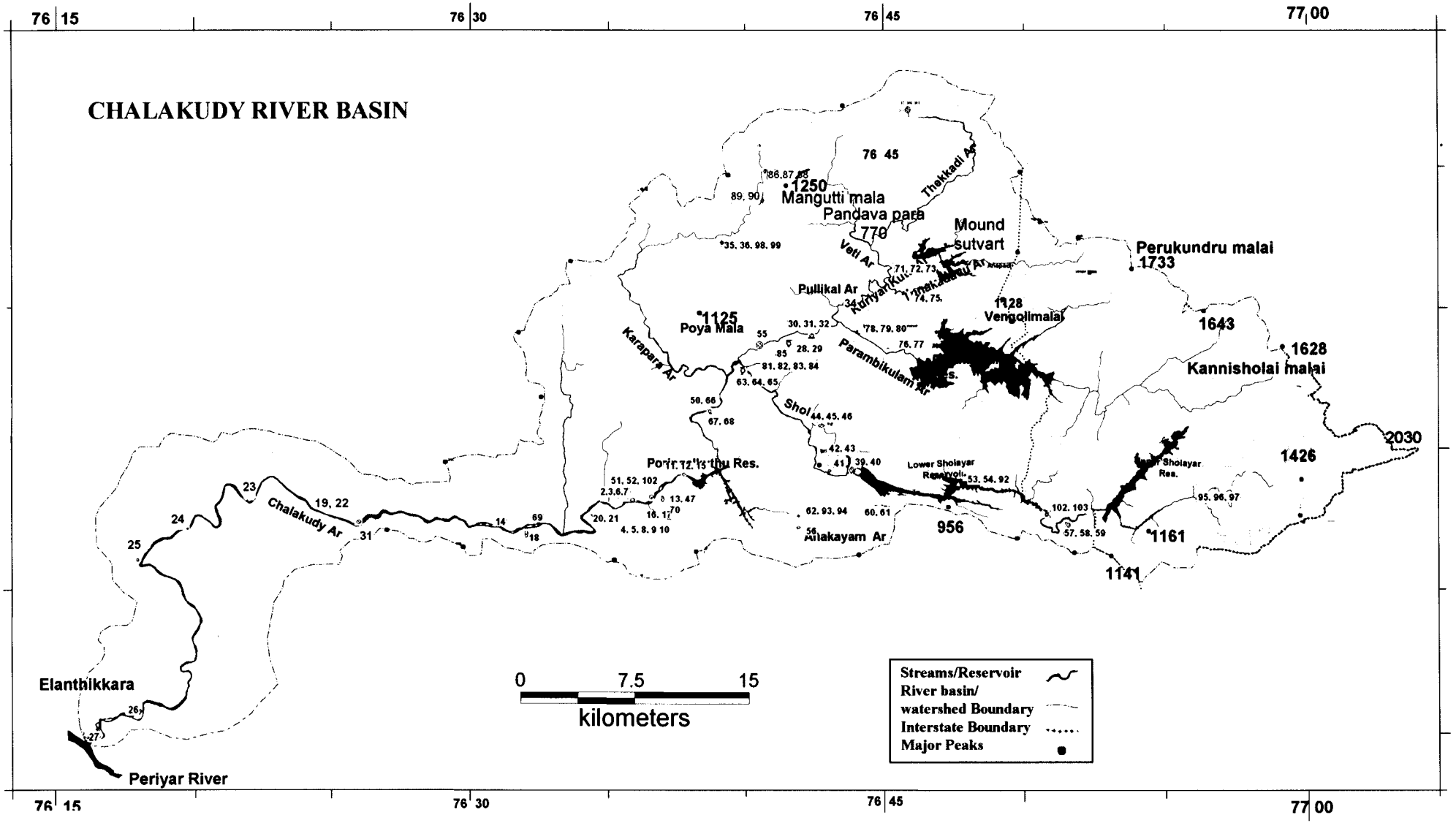
Decamps 1990, 1997 & 2000, Huerta *et al.* 1994, Tabachi *et al.* 1996). Significance of riparian vegetation in maintaining water quality was studied by Maridet (1994) and Anbumozhi *et al.* (2003). Relationship between fish diversity and riparian vegetation was brought by Penzak *et al.* (1994, Penzack 1995) and the role of riparian vegetation in the conservation of biodiversity was documented by Samways and Steytler (1996), Michael and Rosa (2003). Studies on riparian vegetation and its characteristics were hardly documented from the Western Ghats or even from India.

Methodology

Vegetation sampling of the riparian vegetation was conducted during 2004-2009 covering all the seasons. The natural vegetation of the basin had been subjected to various forestry operations that has altered the structure of natural vegetation in various degrees. The physiography and bioclimate of sub-basins varies considerabley and there had been lot of changes in the hydrology of the river due to reservoir operations. Hence a stratified (relieve) random sampling method was adopted for the study (Haullier and Carpentier 1998).

Sampling

A reconnaissance survey was conducted in the entire basin during 2001-2003. The vegetation was mapped and the sampling sites were identified. The maps were prepared from GoI Toposheets using Map. Info 6 GIS software. About 25 sampling sites were identified along various tributaries of the Chalakkudy river basin. At least three sampling plots measuring 15 x 20 m (300 m^2) were laid at each sampling sites.



Map - 3. Sampling (Quadrat) Locations

Collection of data

The sample plots were established longitudinally from the stream boundary from the edge of the water or active channel. All species were tallied as to species, number of individuals and Girth at Breast Height (GBH). All the plants above 20 cm GBH were identified up to species level and recorded. All the individuals at least 50% of the base was not with in the quadrat boundary were excluded. For buttressed trees measurements were taken above the buttress. Total culms were counted and multiplied with average GBH of the culms for the bamboos and reeds. GBH of individual stems were summed for multi-stemmed plants. Distance from the river front was also noted for all important species.

Abundance of shrubs, herbs and saplings were noted from each sampling locations. Plants were collected, tagged and herbarium specimens were prepared for identification. Species were identified by systematic analysis of the collected plants were prepared (detailed in chapter 2).

The bio-climatic features like precipitation, temperature and altitude. The stream characteristics recorded include stream order, type, width, perenniality, nature of flow (natural or controlled), colour and turbidity of water. Terrain features include adjacent landuse, nature of terrain, river bed and soil, rate of soil erosion (low-high), sources of pollution, type of vegetation in the river bed or river and GPS reading for the Altitude, Latitude and Longitude.

Analysis

All the sample plots (quadrats) were subjected to Bray-Curtis similarity using Group-Average clustering (Ward 1963, Pielou 1984, Huerta *et al* 1994). The plot data in each cluster were summarized to analyze density, frequency, basal area (cover) and diversity indices

(Romesburg 1984, Weaver & Clements 1983). Relative value of the frequency, density and basal area used to produce constancy value, Important Value Index (IVI) (Daubenmire 1949, Weaver & Clements 1983) to develop hierarchical classification. The vegetation types obtained were grouped under various representing bioclimate of the Chalakkudy river basin according to Meher-Homji (1982, 2001). Each types under different bioclimatic groups were brought into similar vegetation types based on physiognomy, floristic and community associations. Stream characters were accounted for the separation of Riparian and Stream bank vegetation. The Principal Component Analysis (PCA) (Jeffers 1978, Pielou, 1969, 1984) of Shanon Diversity Index (H') (Shannon & Weaver 1949, Pielou 1975, Magurran 1988), Simpsons's Index (1/D) (Simpson 1949) and Basal Area in m^2/ha (BA/ha) used to develop hierarchical relationship between identified riparian vegetation types within each bioclimatic group.

Dominant species associations for different strata in each cluster were identified from the relative IVI value of the species (Meher-Homji 2001). Community types names were denoted by listing co-dominant species representing various strata. Most dominant species were listed first, co-dominants separated by (-) and different strata by using (/) (Huerta *et. al.* 1994). Facultative and alien species were masked for obligate riparian species (Stephenson & Cook 1980). The statistical analysis for Cluster analysis, Diversity Indices and PCA were done by Biodiversity Pro. Prof. Mc-Aleece *et al.* (1997).

All the identified vegetation types were brought into a classification following Bioclimatic forest Classification by Gadgil and Meher-Homji (1982) and Meher-Homji (2001). Additional details on vegetation of the area were obtained from Nair (1991), Pascal (1982) and Ramesh *et al.* (1997).

1. Density (D) = $\frac{\text{Total number of individual of species}}{\text{Total number of quadrats}}$

2. Frequency (F) = $\frac{\text{Total number of quadrats of occurrence}}{\text{Total number of quadrats}} \times 100$

3. Basal area (BA) = $\frac{GBH^2}{4\Pi}$

4. Dominance = $\frac{\text{Basal area of the species}}{\text{Total area sampled}}$

5. Relative frequency (RF) = $\frac{\text{Frequency of the species}}{\text{Total frequency of all the species}} \times 100$

6. Relative density (RD) = $\frac{\text{Density of the species}}{\text{Total density of all the species}} \times 100$

7. Relative basal area (RBA) = $\frac{\text{Basal area of species}}{\text{Total basal area of all species}} \times 100$

8. Importance Value Index (IVI) = RF + RD+ RBA

9. Shannon index of species diversity (H') (Shannon & Weaver 1949).

$$H' = - \Sigma [(ni / N) \log2 (ni / N)]$$

10. Index of dominance of the community (1/D) (Simpson 1949)

$$D = \Sigma (ni/N)^2$$

Where ni = Number of individual of species

N = total number of individual of all the species in the community

D= negative dominance index

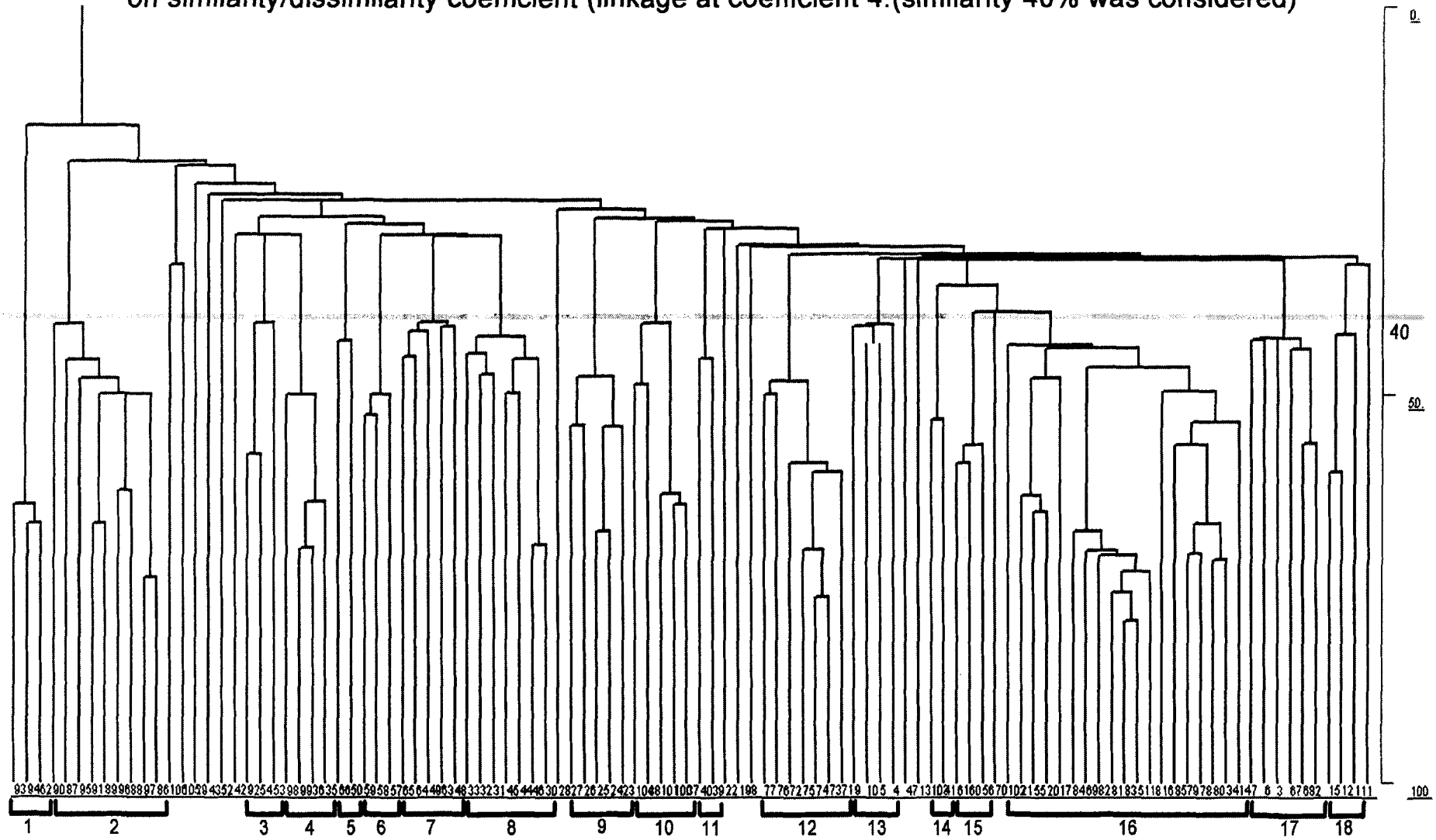
Observation and Analysis

Cluster analysis based on Bray-Curtis similarity dissimilarity/ similarity coefficient yielded 18 significant vegetation types. Detailed similarity matrix is given in the table 3.1 and similarity values in table 3.2 (appendix 2). Similarity coefficient dendrogram (fig. 3.1) provides similarity and dissimilarity relationship between 106 plot data. Where significant clustering (similarity coefficient 4) was obtained for 91 quadrats and remaining stood separate representing intermediates. Bioclimatic features of the significant clusters were given in table 3.5.

Table 3.5 Bioclimatic features of the clusters

Cluster No.	Altitude (m)	Rainfall (mm)	Temperature (°C)	No of Dry months	Terrain	Locality
Cluster -1	400-500	3800	21	3-4	Sandy	Ankayam Sholayar
Cluster -2	900-1100	3700	19	2-3	Sandy &rocky	Nelliyampathy & Valparai
Cluster -3	800-900	4100	21	3-4	Loamy	Sholayar
Cluster -4	700-800	3700	21	2-3	Rocky	Nelliyampathy
Cluster -5	400-500	3500	21	4-5	Rocky	Karanthodu
Cluster -6	1000-1100	4100	19	2-3	Rocky	Malakkapara
Cluster -7	400-500	2500	21	4-6	Loamy	Orukombankutty
Cluster -8	30-600	1900	22	4-5	Loamy & Rocky	Sholayar - Kudal& Kuriyarkutty
Cluster -9	0-15	29000	23	4-5	Sandy	Chalakkudy
Cluster -10	1000-1100	3700	19	2-3	Rocky	Nelliyampathy
Cluster -11	700-800	4100	21	3-4	Loamy	Sholayar
Cluster -12	500-600	1650	22	4-5	Loamy	Parambikulam
Cluster -13	200-300	3800	21	4-5	Loamy	Vazhachal
Cluster -14	700-800	4100	21	3-4	Rocky	Sholayar
Cluster -15	400-600	3800	21	3-4	Loamy	Ankayam Sholayar
Cluster -16	80-600	2500	22	4-5	Loamy	Vazhachal-Orukomban
Cluster -17	100-500	3000	22	4-5	Loamy	Vazhachal-Karanthodu
Cluster -18	300-400	3800	21	4-5	Rocky	Poringalkuthu

Fig. 3.1.Dendrogram showing the relationship between different clusters (vegetation groups) based on similarity/dissimilarity coefficient (linkage at coefficient 4.(similarity 40% was considered)



Diversity and Basal Area

The values of Basal area ranges from 1.27 m^2/ha (cluster 16) to 0.013/m^2 (cluster 2). Cluster 17 and 16 showed >0.8 m^2/ha values for Basal area.

Twelve clusters showed >1 values for Shannon diversity Index H'. Simpson Index (D) of negative dominance obtained higher for six clusters. It was highest for cluster 14 (0.4) and least for cluster 13 (0.026). Detailed account of the three parameters for all the vegetation types were provided in the table 3.6

Table 3.6. Diversity Indices (Shanon & Simpson) and Basal area for identified 18 vegetation types

Vegetation type/Clusters	Shannon Diversity Index			Simpson Index D	Bam2 /Ha
	Shannon H' Log Base 10.	Shannon Hmax Log Base 10.	Shannon J'		
C-1	0.828	0.954	0.868	0.163	0.191
C-2	0.767	0.954	0.804	0.197	0.013
C-3	0.99	1.204	0.822	0.156	0.052
C-4	1.127	1.23	0.916	0.085	0.328
C-5	1.242	1.301	0.955	0.045	0.215
C-6	1.373	1.477	0.93	0.043	0.23
C-7	1.618	1.826	0.886	0.032	0.63
C-8	1.447	1.633	0.886	0.047	0.35
C-9	1.043	1.431	0.729	0.19	0.094
C-10	0.931	1.23	0.757	0.208	0.154
C-11	1.053	1.301	0.809	0.131	0.32
C-12	1.028	1.176	0.874	0.12	0.09
C-13	1.589	1.716	0.926	0.026	0.48
C-14	0.466	0.699	0.667	0.4	0.13
C-15	1.419	1.531	0.926	0.036	0.264
C-16	1.588	1.869	0.85	0.036	1.27
C-17	1.518	1.732	0.876	0.045	0.828
C-18	0.752	0.778	0.966	0.148	0.019

Analysis of Importance Value Index IVI for Dominance

The quadrat data of the identified 18 clusters were pooled independently and analysed for the Density, Frequency, Basal Area and Importance Value Index (table 3.7–Appendix 2). Graphical representation of important species based on IVI value is given below (Fig. 3.2 - 3.19)

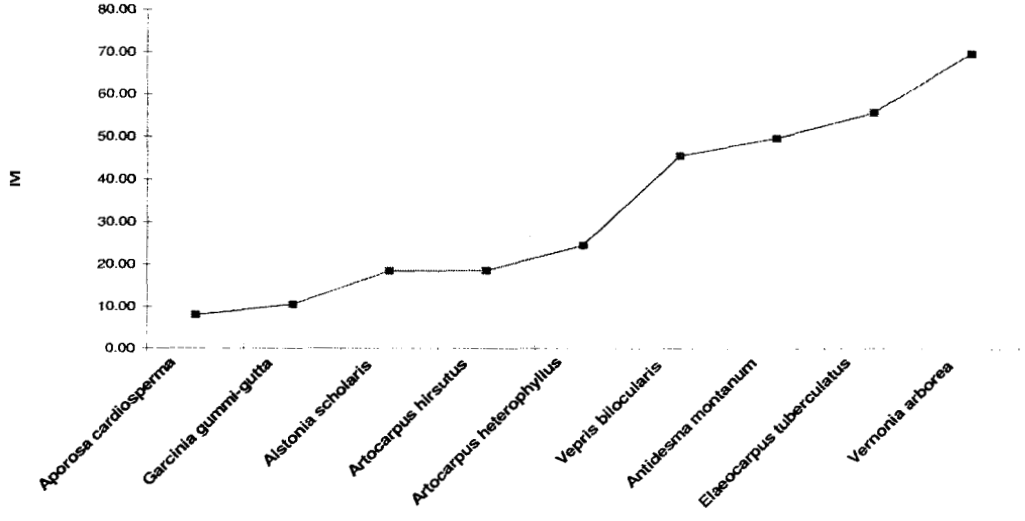


Fig. 3.2. Dominant Species -Vegetation Type 1 (Cluster-1)

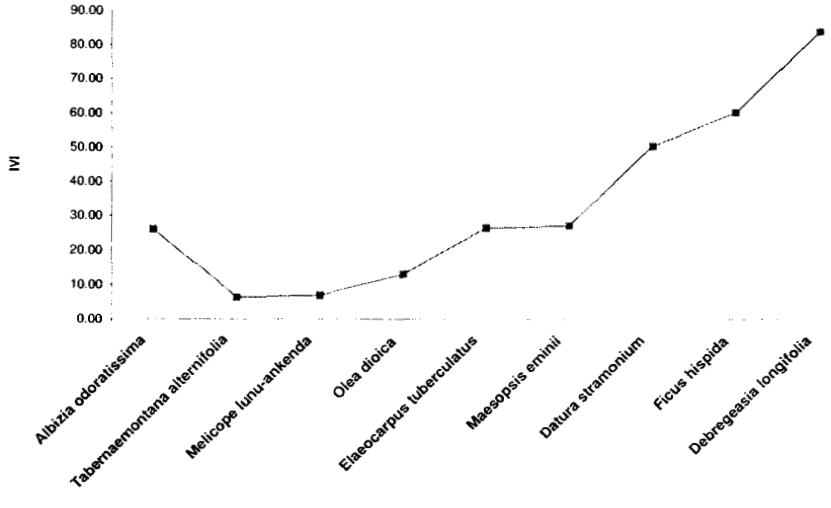


Fig. 3.3. Dominant Species -Vegetation Type 2 (Cluster-2)

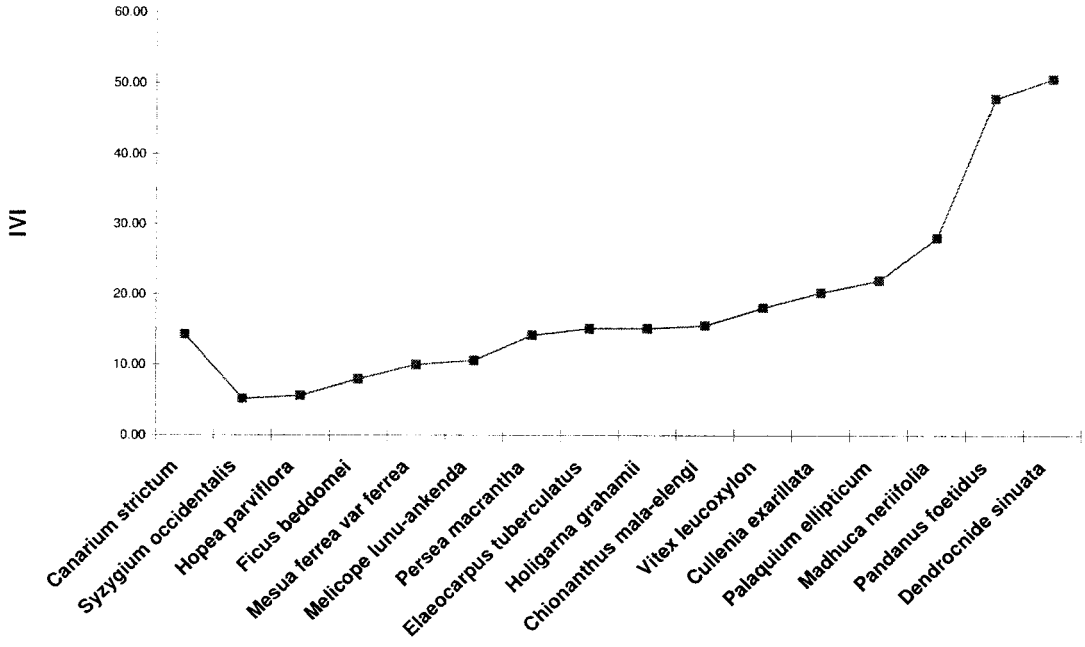


Fig. 3.4. Dominant Species -Vegetation Type 3 (Cluster-3)

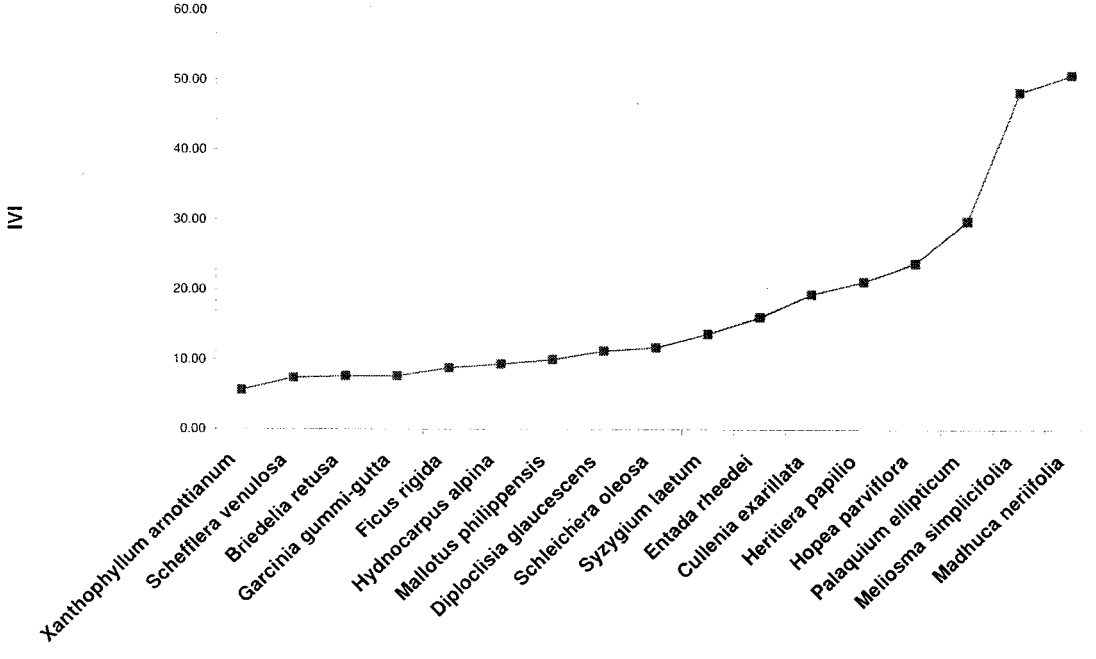


Fig. 3.5. Dominant Species -Vegetation Type 4 (Cluster-4)

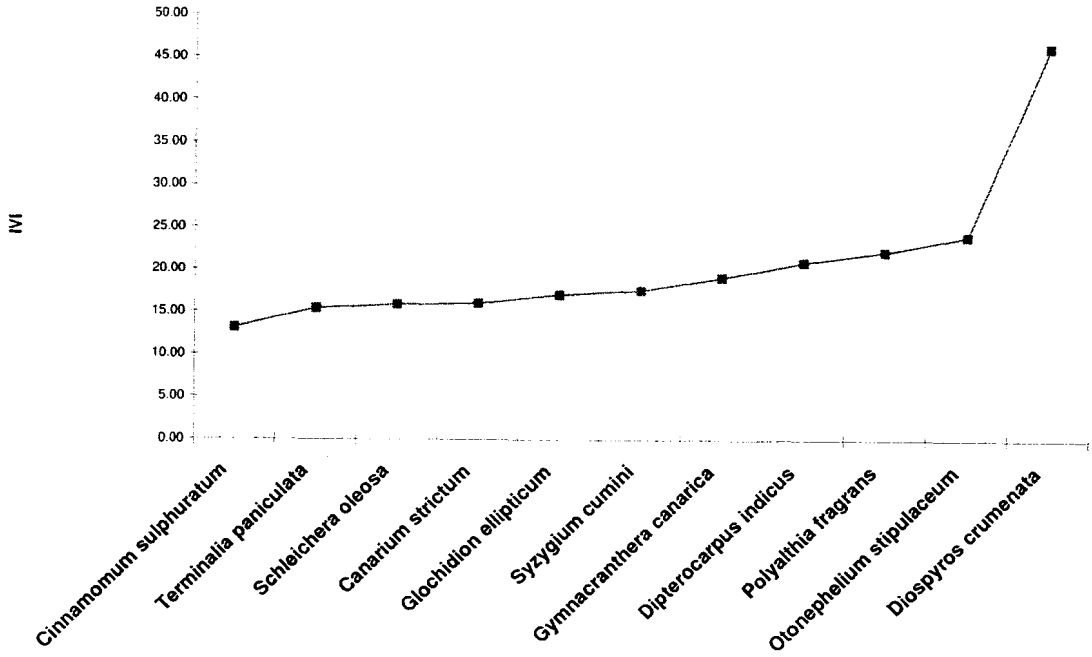


Fig. 3.6. Dominant Species -Vegetation Type 5 (Cluster-5)

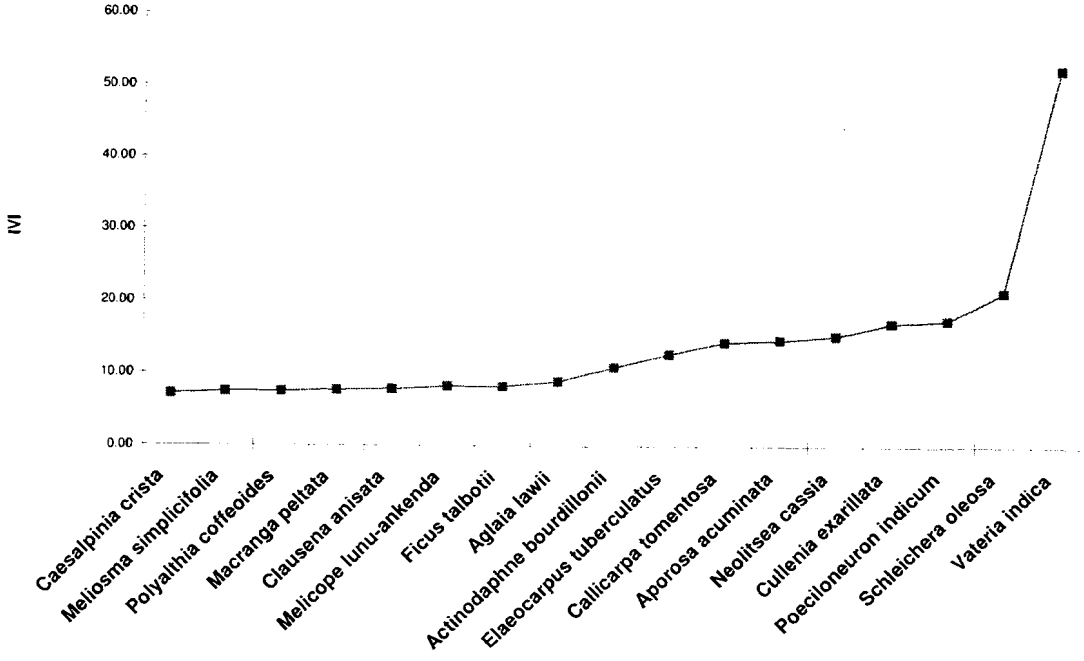


Fig. 3.7. Dominant Species -Vegetation Type 6 (Cluster-6)

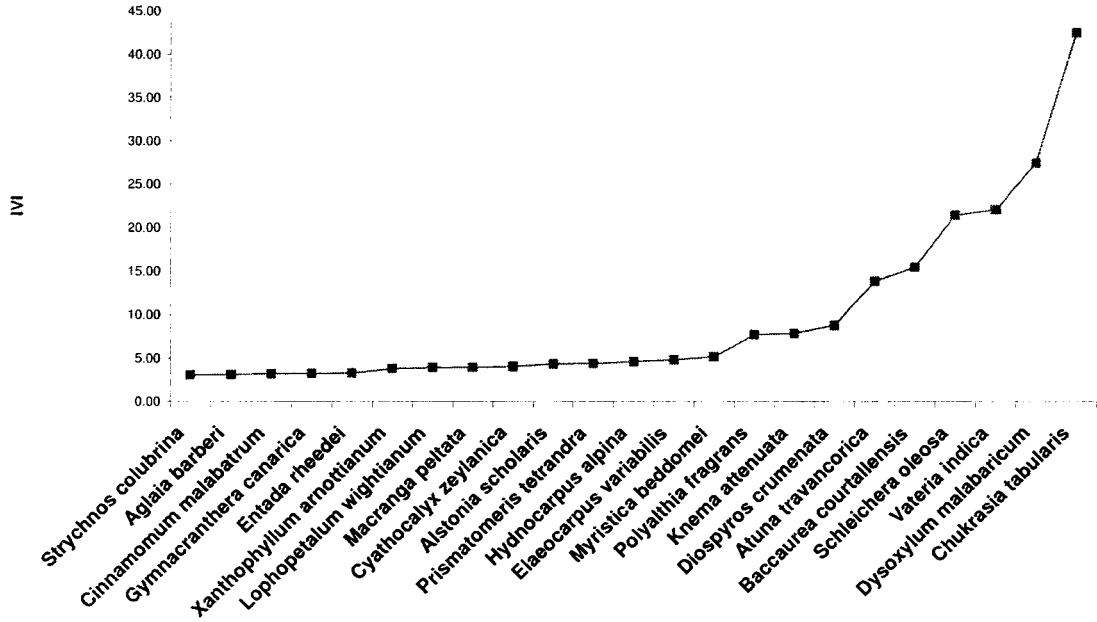


Fig. 3.8. Dominant Species -Vegetation Type 7 (Cluster-7)

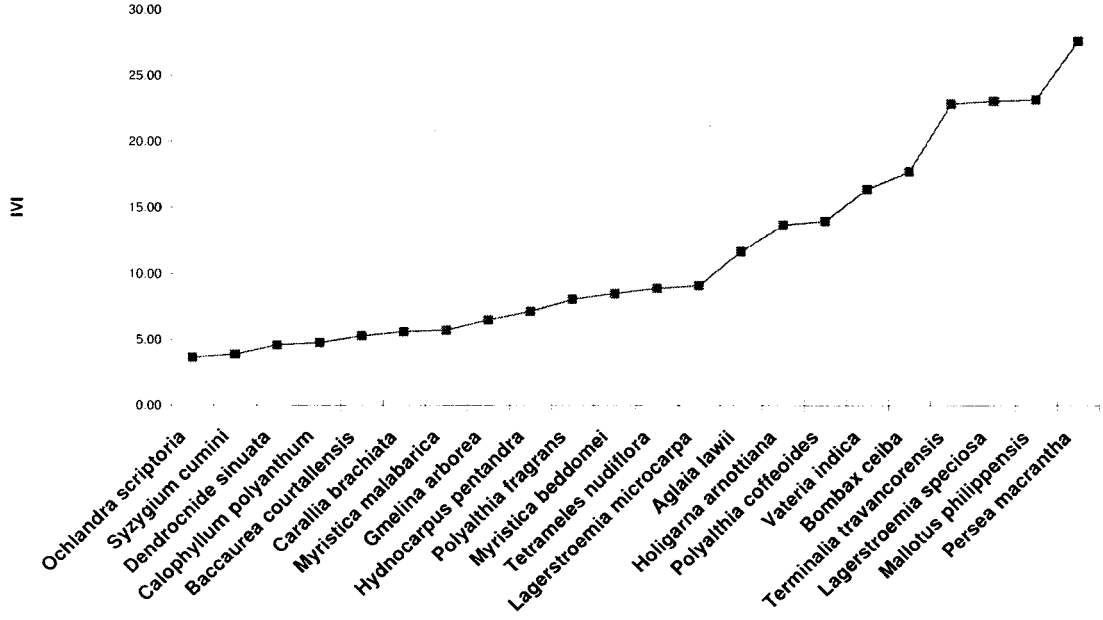


Fig. 3.9. Dominant Species - Vegetation Type 8 (Cluster-8)

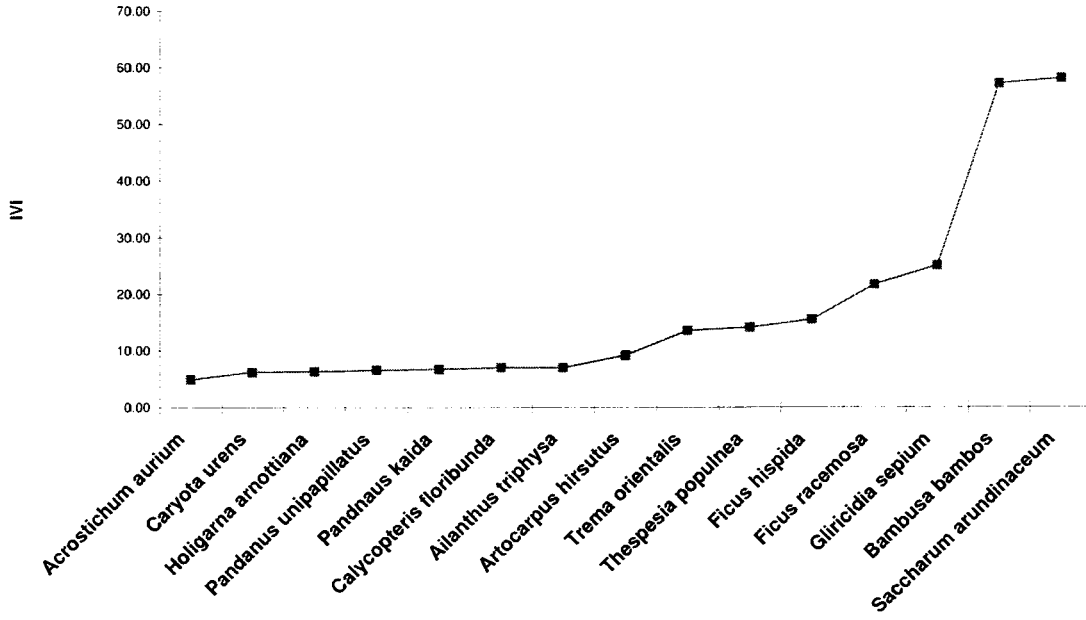


Fig. 3.10. Dominant Species -Vegetation Type 9 (Cluster-9)

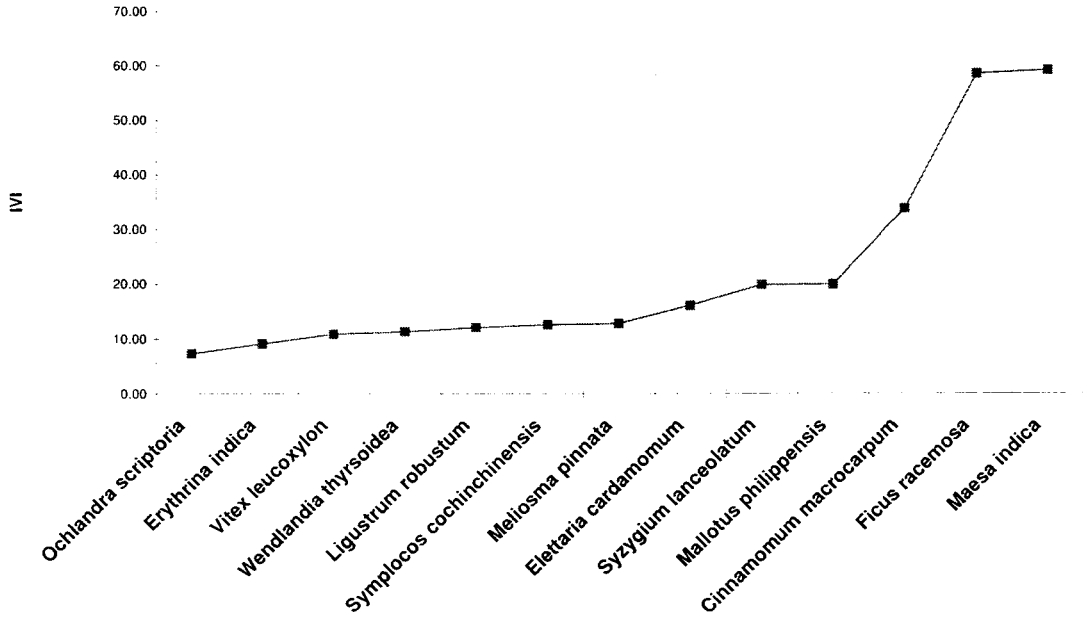


Fig. 3.11. Dominant Species -Vegetation Type 10 (Cluster-10)

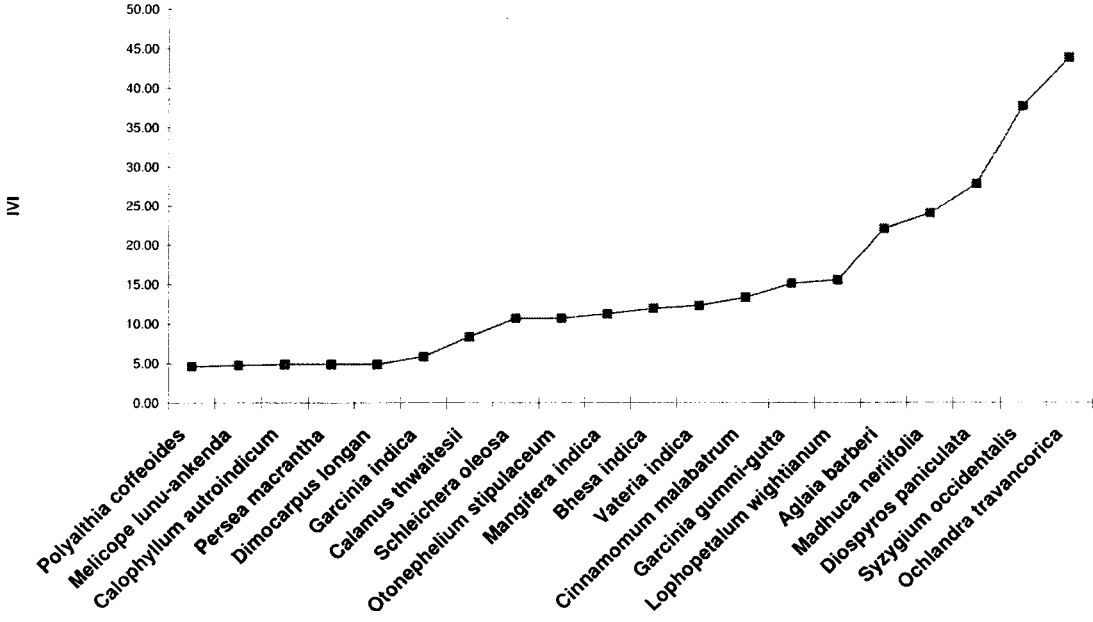


Fig. 3.12. Dominant Species - Vegetation Type 11 (Cluster-11)

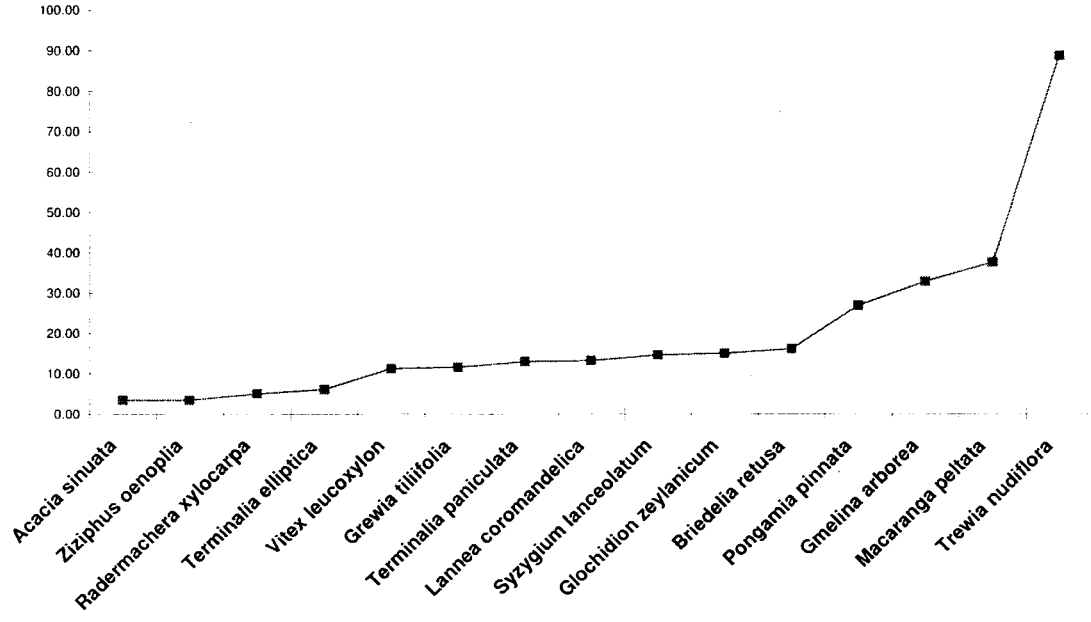


Fig. 3.13. Dominant Species - Vegetation Type 12 (Cluster-12)

767

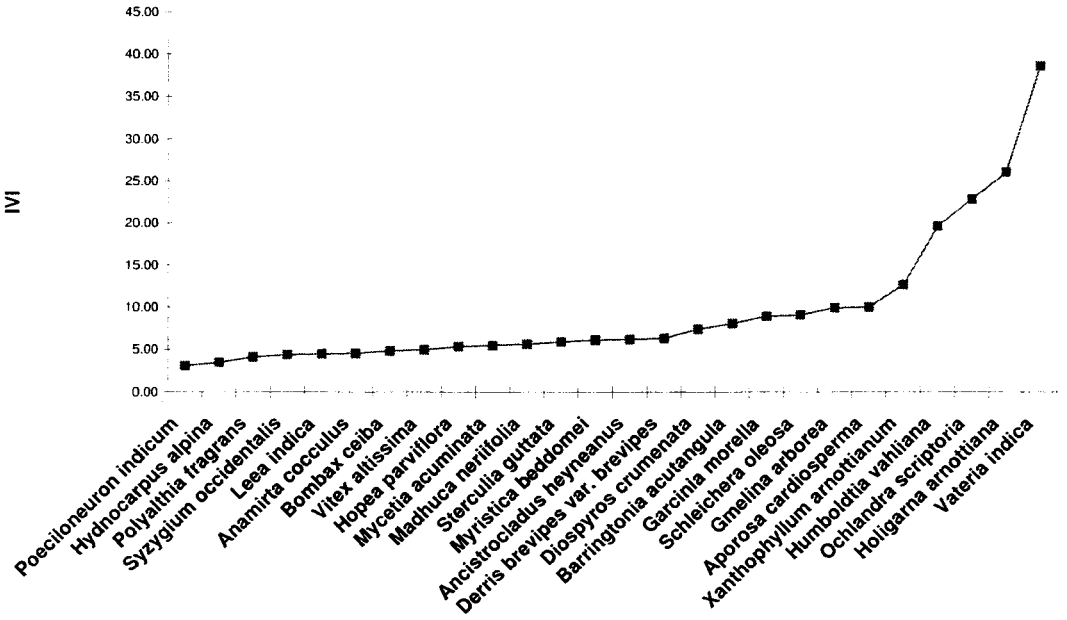


Fig. 3.14. Dominant Species -Vegetation Type 13 (Cluster-13)

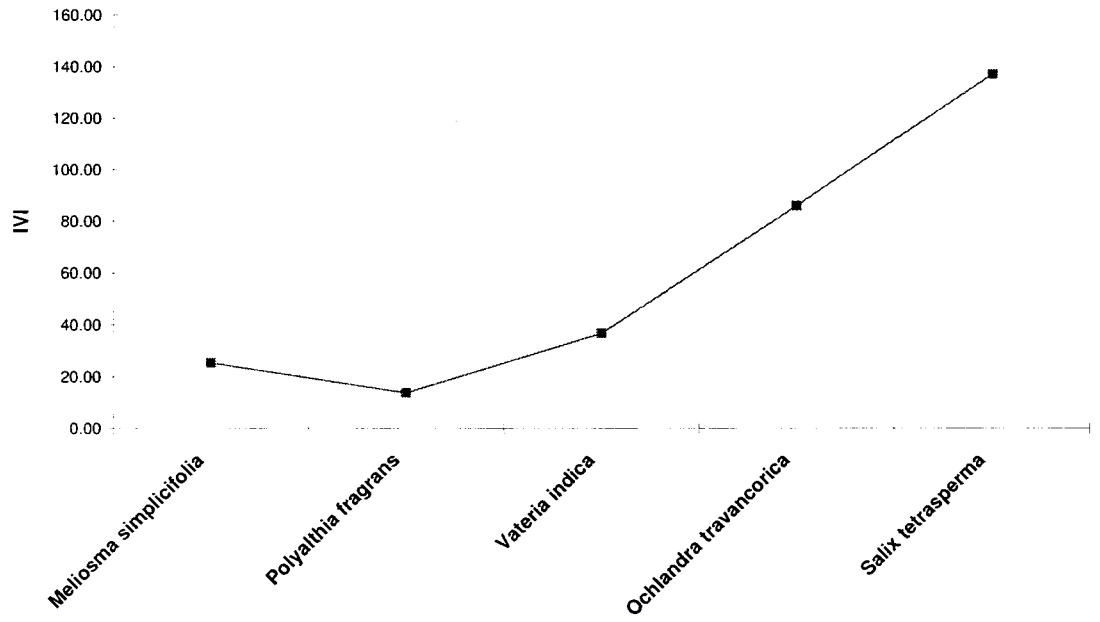


Fig. 3.15. Dominant Species -Vegetation Type 14 (Cluster-14)

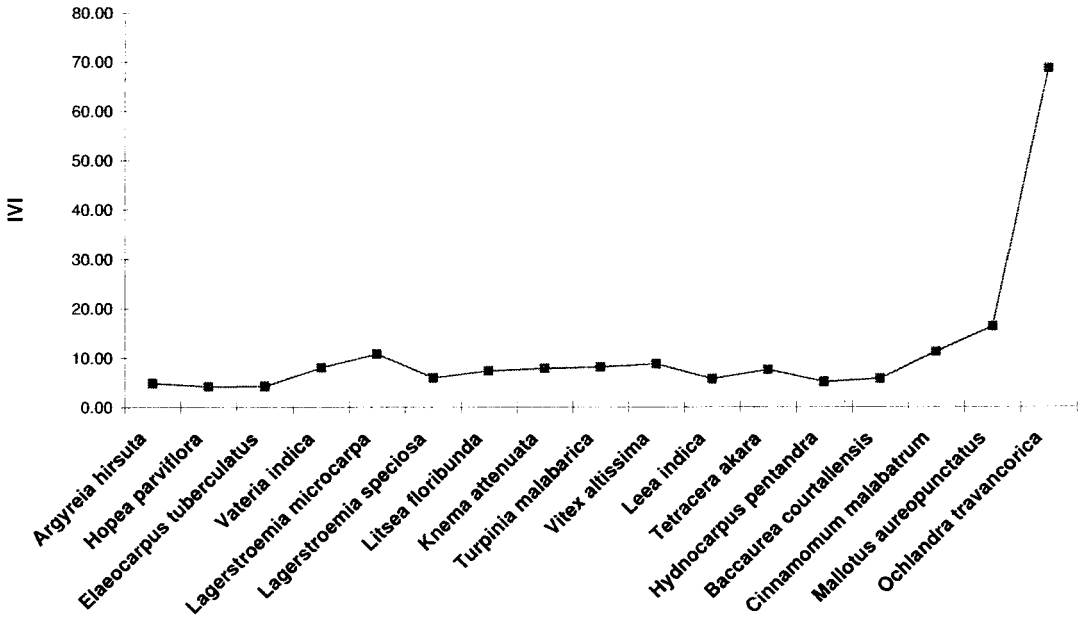


Fig. 3.16. Dominant Species - Vegetation Type 15 (Cluster-15)

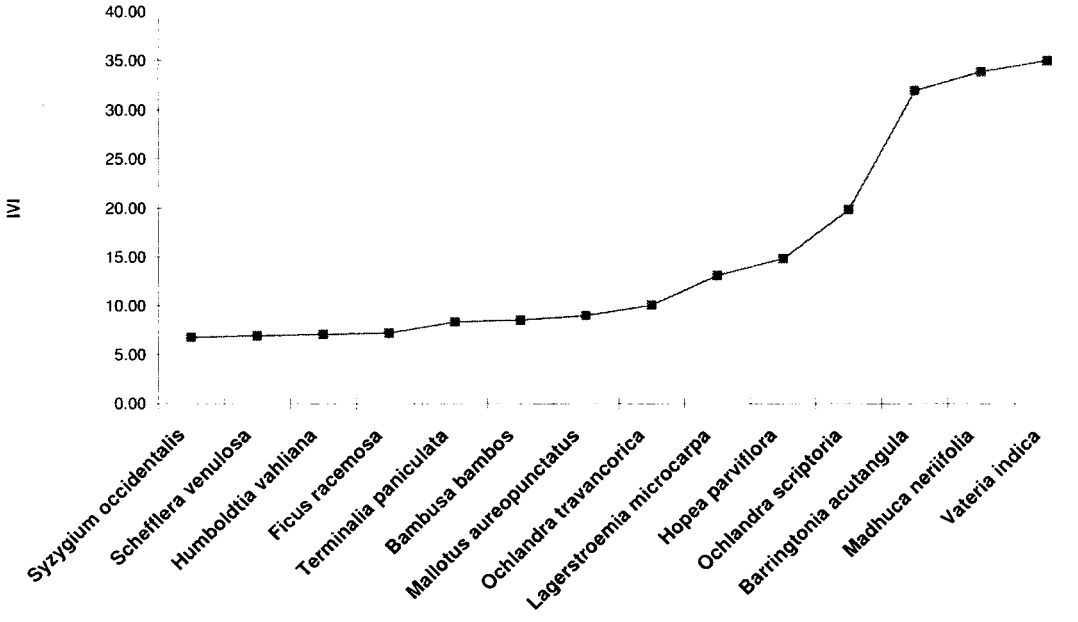


Fig. 3.17a. Dominant Species - Vegetation type 16a (Cluster 16 a)

767

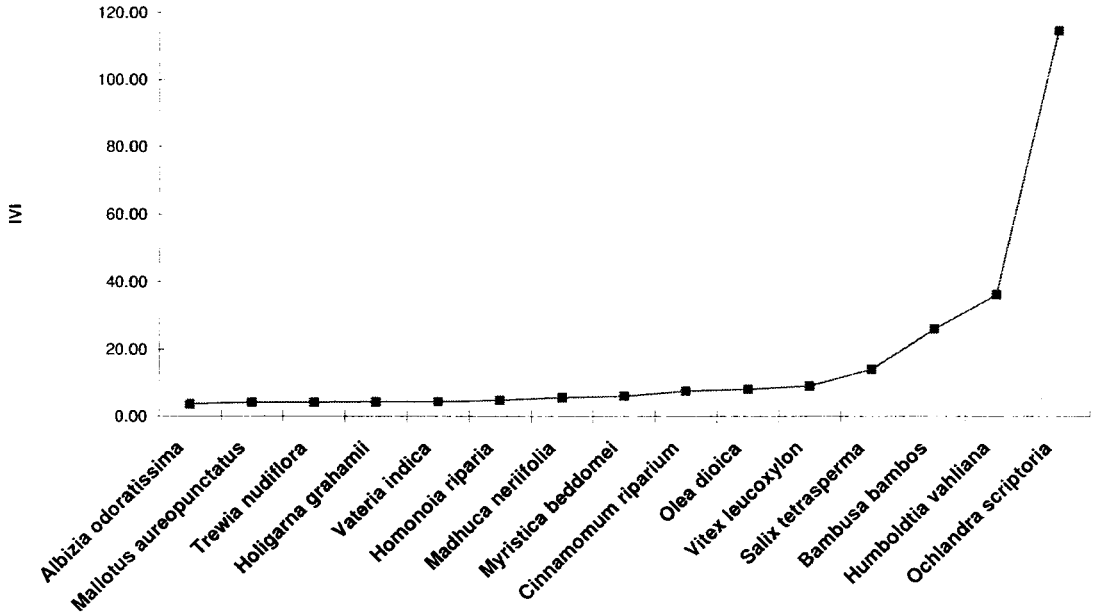


Fig. 3.17b. Dominant Species - Vegetation type 16b (Cluster 16 b)

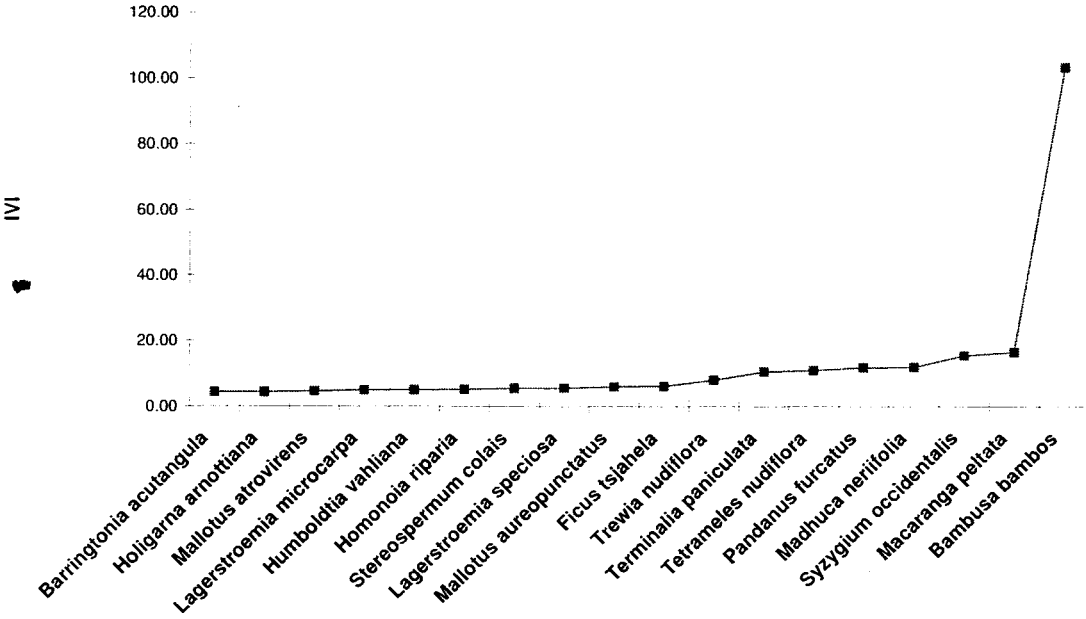


Fig. 3.17c. Dominant Species - Vegetation type 16c (Cluster 16 c)

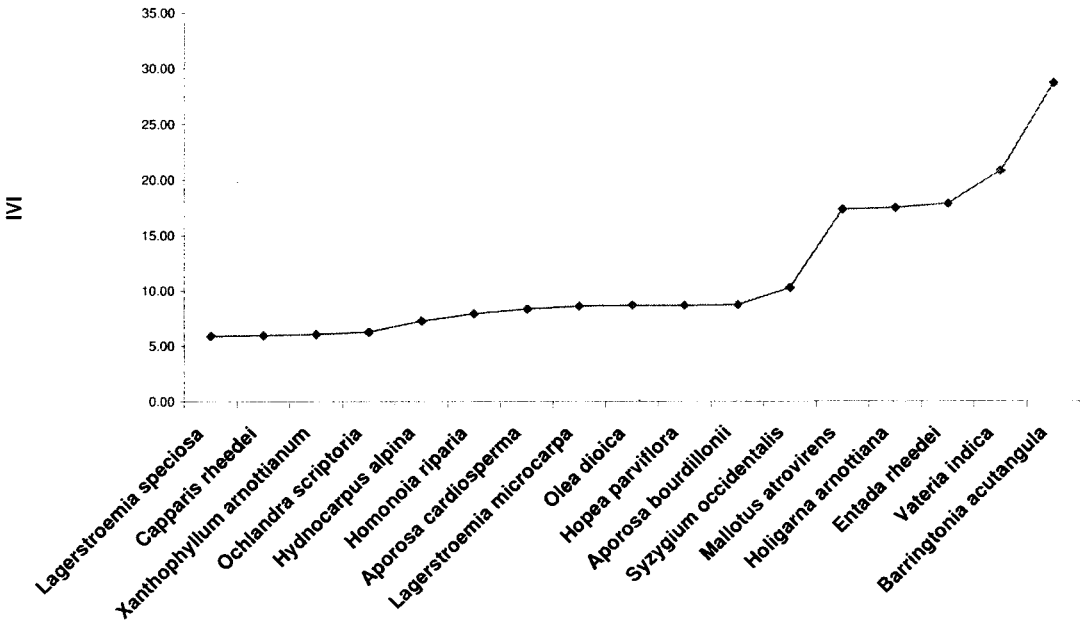


Fig. 3. 18. Dominant Species -Vegetation Type 17 (Cluster-17)

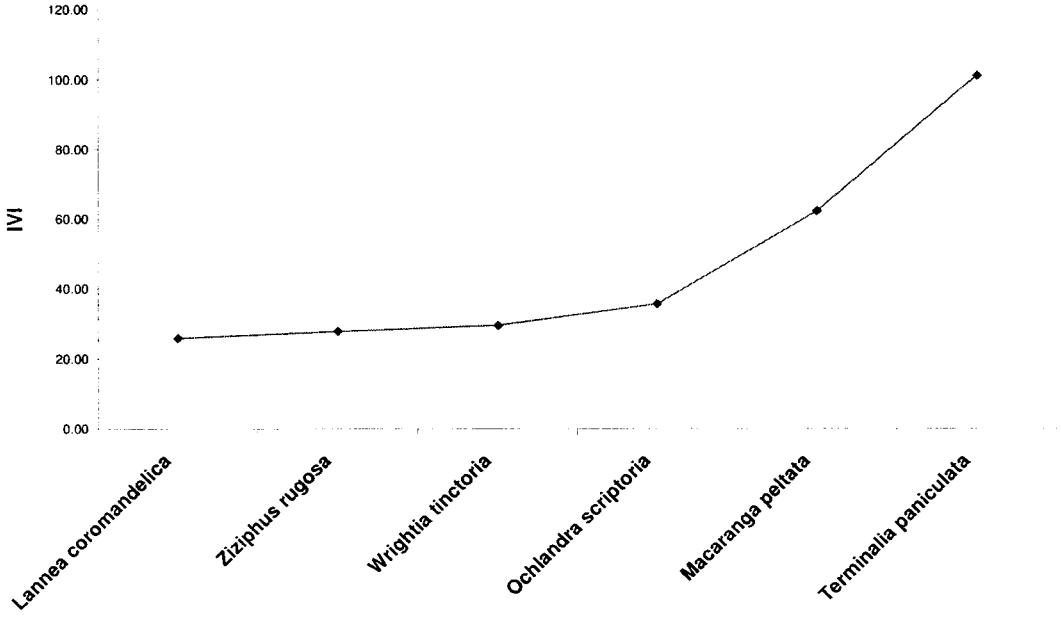


Fig. 3. 19. Dominant Species -Vegetation Type 18 (Cluster-18)

Results and Discussion

Eighteen riparian vegetation types (clusters) were segregated out with a similarity Coefficient 4 (40% similarity) table 3.1 Similarity coefficient dendrogram (fig. 3.1) provides graphical representation of similarity and dissimilarity relationship between identified vegetation types (clusters).

Basal area ranges from 1.27 m^2/ha (cluster 16) to 0.013/m^2 (cluster 2). Shannon Index H' found maximum for cluster 7 (1.618) and minimum for cluster 14 (0.466). Simpson Index for negative dominance was highest for cluster 14 (0.4) and least for cluster 13 (0.026). Detailed comparison of the three parameters for all the vegetation types were provided in the table fig. 3.20

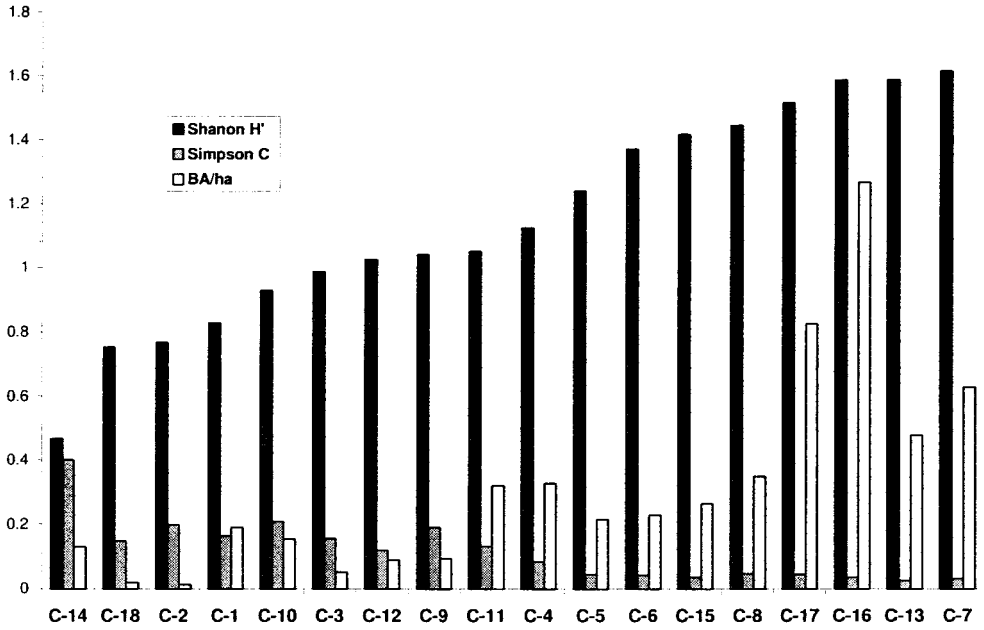


Fig. 3.20. Comparison of Diversity Indices (Shanon & Simpson) and Basal area for identified 18 riparian vegetation types (clusters)

Analysis of the IVI values (Fig 4.2 – 4.19) for individual species for each clusters brought out dominant species in each vegetation type and segregation of IVI values for different height class provided detailed

account of the community composition and structure for the identified eighteen riparian vegetation types. Relative frequency of the dominant species used to exclude non-riparian species from the community composition.

Community composition of the identified 18 major riparian vegetation types

Type-1. *Vernonia arborea /Elaeocarpus tuberculatus/ Antidesma montanum /Vepris bilocularis /Artocarpus/ Garcinia gummi-gutta*

Type-2. *Debregeasia longifolia / Ficus hispida /Datura stramonium*

Type-3. *Dendrocnide sinuate /Pandanus foetidus / Madhuca neriifolia / Palaquium ellipticum – Cullenia exarillata /Vitex leucoxylon*

Type -4. *Madhuca neriifolia - Meliosma simplicifolia / Palaquium ellipticum - Hopea parviflora - Cullenia exarillata /Syzygium / Entada*

Type-5. *Diospyros crumenata /Otonephelium stipulaceum /Dipterocarpus indicus - Polyalthia fragrans /Gymnacranthera /Syzygium cumini*

Type -6. *Vateria indica /Schleichera oleosa - Poeciloneuron indicum / Cullenia exarillata / Aporosa acuminate/ Clausena anisata / Elaeocarpus tuberculatus*

Type -7. *Chukrasia tabularis / Dysoxylum malabaricum - Vateria indica / Schleichera oleosa /Baccaurea courtallensis / Diospyros crumenata /Leea asiatica - Memecylon angustifolium / Entada rheedei - Strychnos colubrina*

Type-8. *Persea macrantha - Mallotus philippensis - Lagerstroemia speciosa / Terminalia travencorensis - Bombax ceiba - Vateria indica / Holigarna arnottiana /Hydnocarpus pentandra - Baccaurea courtallensis - Ochlandra scriptoria*

Type-9. *Saccharum arundinaceum / Bambusa bambos - Gliricidia sepium / Ficus racemosa - Ficus hispida / Thespesia populnea / Trema orientalis*

Type-10. *Maesa indica / Ficus racemose - Syzygium lanceolatum / Meliosma pinnata / Vitex leucoxylon*

Type-11. *Ochlandra travancorica - Syzygium occidentalis / Diospyros paniculata - Madhuca neriifolia / Aglaia baraberi i- Garcinia gummi-gutta / Lophopetalum wightianum - Vateria indica*

Type-12. *Trewia nudiflora / Gmelina arborea / Pongamia pinnata / Bridelia retusa / Glochidion zeylanicum / Syzygium lanceolatum / Vitex leucoxylon*

Type-13. *Vateria indica - Holigarna arnottiana / Humboldtia vahliana/ Ochlandra scriptoria - Garcinia Morella - Barringtonia acutangula*

Type-14. *Salix tetrasperma / Ochlandra travancorica / Meliosma spp. / Vateria indica*

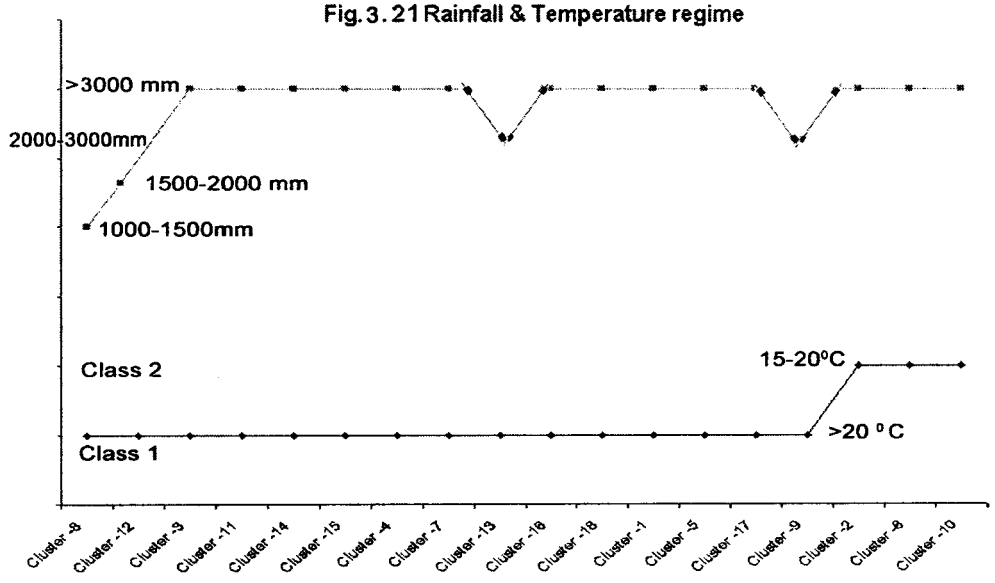
Type-15. *Ochlandra travancorica - Mallotus aureopunctatus-Cinnamomum malabatrum / Baccaurea courtallensis / Hydnocarpus spp. / Vateria indica*

Type-16. *Ochlandra scriptoria - Bambusa bambos / Humboldtia vahliana - Madhuca neriifolia / Barringtonia acutangula / Syzygium occidentalis / Vateria indica- Hopea spp.*

Type-17. *Barringtonia acutangula - Mallotus atrovirens / Vateria indica / Humboldtia vahliana / Syzygium occidentalis - Homonoia riparia / Ochlandra scriptoria*

Type-18. *Terminalia paniculata - Macaranga peltate / Ochlandra scriptoria - Wrightia tinctoria*

Fig. 3. 21 Rainfall & Temperature regime



Considering the bioclimatic features (table 3.3 & fig. 3.21) for the 18 identified vegetation types, all correspond to typical tropical climate with Temperature >15°C (mean of the coldest month), rainfall >1000-1500mm/year and number of dry months <8 as described by Meher-Homji (2001). Based on the bioclimatic features all the identified vegetation types corresponds to Moist Decidious type (14) and Evergreen bioclimatic types 21, 26 and 27 of Meher-Homji (2001). The identified four groups are as follows.

I. Group I. Moist deciduous riparian forest (Primary) (II. 14. Rip)

Including riparian types-(Types 8, 16(a,b,c) & 12)

Location: Parambikulam-Kuriyarkutty region

Bioclimate : Elevation 500-700 m, Rainfall >1500 mm, T-> 20°C, Dry months 4-5 months.

Corresponding bioclimate of Meher-Homji (2001)

Elevation 0-600 m (+1000 m) MSL, rainfall >2000 – 4000 mm (1500-3000 mm -Ramesh *et al.* 1997), T-> 20°C, Dry months 3-5 months.

Corresponding vegetation of Meher-Homji (2001)

Vegetation Type –II 10b (14). Moist Deciduous Forest (Primary)

II. Group II. (IV. 21) Montane Shola streamside/Evergreen riparian vegetation

Including riparian types-(Types 2, 6 & 10)

Location: Nelliyampathy-Hilltop, Valparai, Akkmalai-Malakkapara

Bioclimate : Elevation >1000 m, Rainfall >3000 mm, T> 15°C (10-15°C), Dry months 2-3 months (1-2).

Corresponding bioclimate of Meher-Homji (2001)

elevation >1000 m MSL, rainfall >1500 mm, T-15°C, Dry months 1-3

Corresponding vegetation of Meher-Homji (2001)

Evergreen type (IV. 21) Shola or Montane.

III. Group III. (IV. 26) Evergreen riparian vegetation (Medium elevation Primary)

Included riparian types (13, 7, 17, 5, 16a, 16b. 18 & 9)

Location: Chalakkudy, Vettilappra, Athirapilly, Vazhachal (Orukomban), Sholayar, Parambikulam (>700 m).

Bioclimate : Elevation 0-1000 m, Rainfall >2000 mm, T> 20°C (15-20°C), Dry months 4-5 months (3-5).

Corresponding bioclimate of Meher-Homji (2001)

elevation 0-1500 m MSL, rainfall >2000 mm, T-> 15°C 4-5 dry months

Corresponding vegetation of Meher-Homji (2001)

Evergreen type (IV. 26)- Evergreen -*Dipterocarpus-Mesua-Palaquium*

IV. Group IV. Moist Evergreen Riparian Forest

Including riparian types-(Types 1, 4, 3, 11, 14, 15)

Location: Sholayar & Karappara (Nelliyampathy) areas, Upper reaches of Parambikulam and Malakkppara-Valparai

Bioclimate : Elevation 500-1200 m, Rainfall >3000 mm, T> 20^{0}C (15-20^{0}C), Dry months 3-4 months .

Corresponding bioclimate of Meher-Homji (2001)

elevation 0-1500 m MSL, rainfall >3000 mm, T-> 20^{0}C, <5 dry months

Corresponding vegetation of Meher-Homji (2001)

(Evergreen type 27-*Cullenia-Mesua-Palaquium*)

Fig. 3.23 Principal Components Analysis Group-I (Diversity Indices & Basal Area)

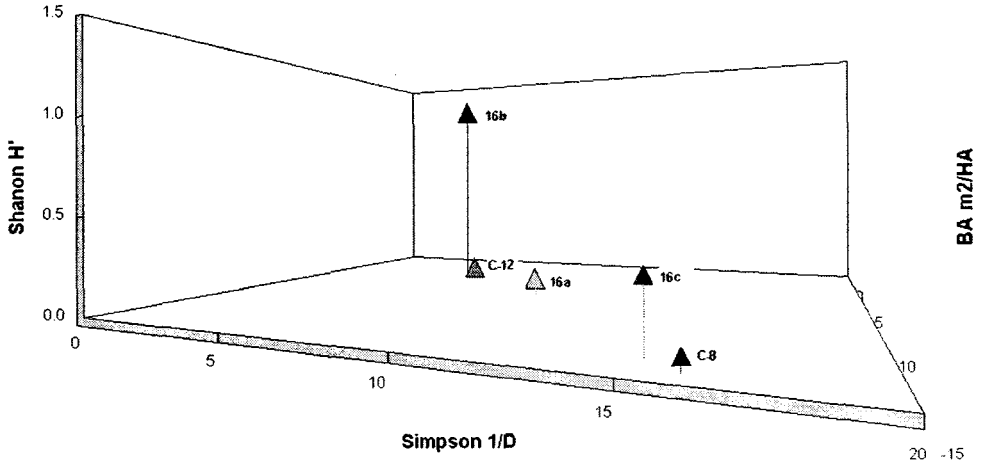


Fig 3.23. Hierarchy relationship of the riparian vegetation types under moist deciduous (Primary)

Fig. 3.24 Principal Components Analysis Group-2 (Diversity Indices & Basal Area)

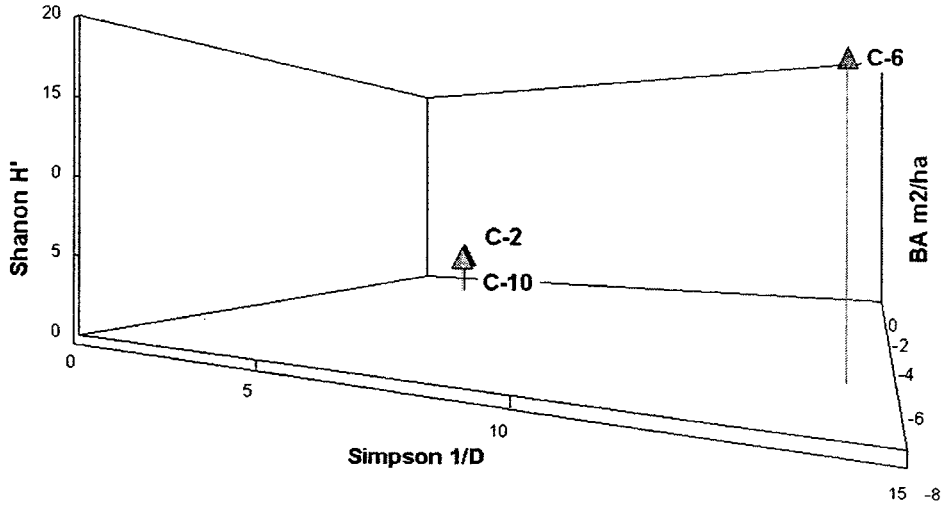


Fig 3.24. Hierarchy relationship of the riparian vegetation types under Montane Streamside/ riparian evergreen category

Fig. 3.25 Principal Components Analysis Group-3 (Diversity Indices & Basal Area)

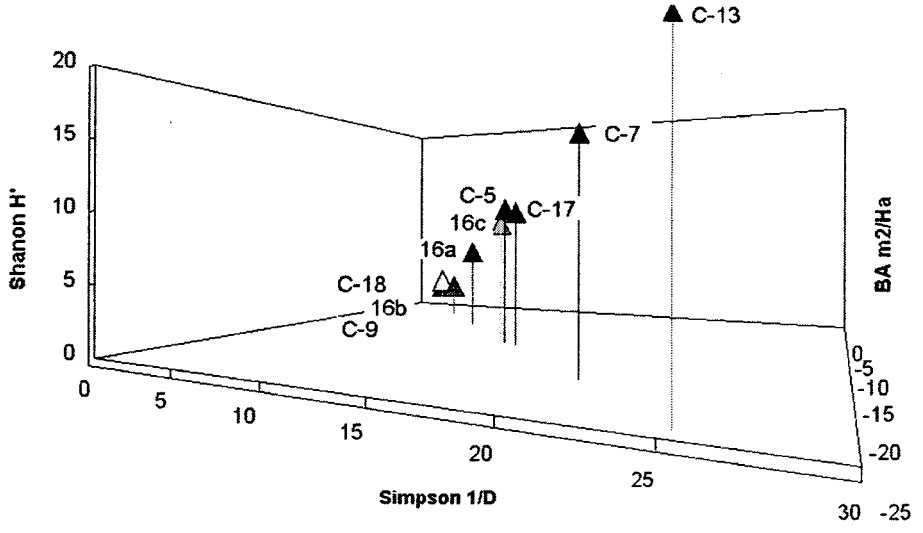


Fig. 3.25. Hierarchy relationship of the riparian vegetation types under Evergreen (medium elevation) riparian forests

Fig. 3.26 Principal Components Analysis Group-4 (Diversity Indices & Basal Area)

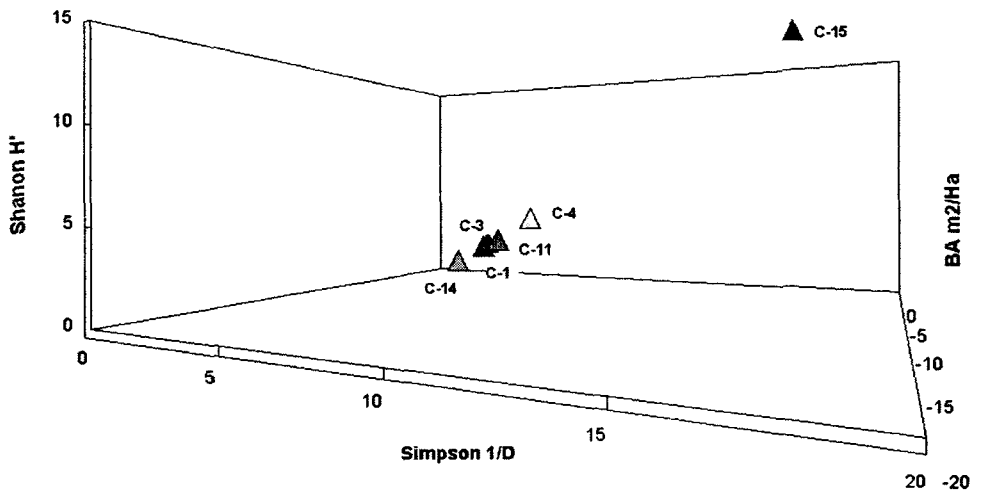


Fig. 3.26 Hierarchy relationship of the riparian vegetation types under the wet evergreen category

The PCA of Shanon H', Simpson C diversity indices and BA/ha provided significant hierarchical relationship between vegetation types under each bioclimatic groups (Fig. 3. 23, Fig. 3. 24, Fig. 3. 25 & 3.26)

The PCA analysis of Group I (Fig. 4. 23) provided separation of the climax, secondary and degraded subtypes in each major riparian vegetation category.

Based on bioclimatic features and the diversity, dominance values the 18 identified vegetation types were classified under four major vegetation groups following the methods of Bioclimatic classification of Gadgil and Meher-Homji (1982) and Meher-Homji (2001) is provided below.

Group 1.

II. 14. Rip. Moist Deciduous Riparian Forest (Primary)

Including riparian types-(Types 8, 16c & 12)

Location: Parambikulam-Kuriyarkutty region

Bioclimate : Elevation 500-700 m, Rainfall >1500 mm, T->20^{0}C, Dry months 4-5 months.

Corresponding bioclimate of Meher-Homji (2001)

Elevation 0-600m (+1000 m) MSL, rainfall >2000-4000 mm (1500-3000 mm -Ramesh *et al.* 1997), T->20^{0}C, Dry months 3-5 months.

Corresponding vegetation of Meher-Homji (2001)

Vegetation Type –II 10b (14). Moist Deciduous Forest (Primary)

Group 1a.

II. 14. Rip a. Moist Deciduous Riparian Forest (Primary)

Lagerstroemia microcarpa/ Barringtonia / Madhuca / Mallotus aureo-punctatus type

(Included Type (16c), *Lagerstroemia microcarpa* is the characteristic Primary moist deciduous climax species

This type include three layers of vegetation

Upper canopy- Presence of *Lagerstroemia microcarpa* and occasionally *Terminalia paniculata.* Semi evergreen / evergreen elements replaces the upper canopy for more wet environment and more dry species (*Terminalia*) replaces in more dry conditions

Middle canopy : *Barringtonia acutangula - Madhuca neriifolia - Mallotus aureo-punctatus*

Lower layer: : *Ochlandra travancorica - Ochlandra scriptoria / Syzygium occidentalis and Homonoia riparia*

Location: Parambikulam-Kuriyarkutty, Orukomban.

Bioclimate: Elevation 0-600m (+1000 m) MSL, rainfall >1500-2500 (1500-3000 mm -Ramesh *et al.* 1997), T->20^{0}C, Dry months 3-5 months.

b. Group 1b.

II. 14. Rip b. Secondary Dry Deciduous (intermediate) Riparian Forest

Trewia nudiflora / Gmelina arborea / Pongamia pinnata type

Included Type12 (cluster 12)

Usually with two tree layers, the dominate lower layer composed of distantly placed small trees *Trewia nudiflora, Pongamia pinnata, Glochidion zeylanicum, Lannea coromandelica.*

There is occurrence of much large trees like *Gmelina arborea, Terminalia paniculata.*

Location: Downstream to Parambikulam Dam, Thunacadvu Dam Kuriyarkutty region.

Bioclimate: Elevation 500-600 m (+750 m) MSL, rainfall >1500 (-1200)mm -2500mm, T->20°C, Dry months 3-5 months.

In the much drier part (1000-1500mm) of the upper reaches of Kuriyarkutty large tree such as *Terminalia spp.* occurs indicating a Dry Deciduous climax.

Note: According to Meher-Homji (2001) the rainfall for Moist Deciduous vegetation type ranges between 2000-4000 mm and lower rainfall 1000-1500 correspond to Dry Deciduous Forests or intermediate type. According to Ramesh *et al.* (1997) the primary Moist Deciduous forest in this region corresponds to rainfall around 1500 mm. According to our observation the floristic composition (Dominance of *Terminalia* and *Dillenia-Lagerstroemia–Terminalia* association) and the rainfall regime (1000-1500 mm) in the Thekkady-Veetiyar area of Kuriyarkutty catchments shows tendency towards Dry Deciduous Forest Types. The peculiar physiographic feature (see chapter 1) accounts for the Dry Deciduous bioclimate and that has to be studied in detail. Hence there is a chance of occurrence of a *Dry Deciduous Riparian Vegetation (Primary)*

(II. 11. Rip.) coinciding the bioclimatic type (II. 11.) of Meher-Homji (2001).

Stream characteristics: 4-5th order streams (rivers), width is 3-12m, ephemeral due to degradation of catchments. Hence high sediment load and turbidity

Terrain features: Soil : Red lateritic loam, sandy along river beds. Soil erosion is very high.

Adjacent Vegetation: Moist deciduous Teak plantations and more dry formations in the Kuriyarkutty catchments.

Group 2.

IV. 21. Rip. Montane Shola streamside/Evergreen riparian Forest

Including riparian types-(Types 2, 6 & 10)

Location: Nelliyampathy-Hilltop, Valparai, Akkmalai-Malakkapara

Bioclimate : Elevation >1000 m, Rainfall >3000 mm, T>15^{0}C (10-15^{0}C), Dry months 2-3 months (1-2).

Corresponding bioclimate of Meher-Homji (2001)

elevation >1000 m MSL, rainfall >1500 mm, T-15^{0}C, Dry months 1-3

Corresponding vegetation of Meher-Homji (2001)

Evergreen type (IV. 21) Shola or Montane.

Group 2. a.

IV. 21 Rip.a. Montane-Shola Streamside Forest

Included riparian type (Cluster 2)

Cinnamomum spp. – Mallotus - Syzygium - Ficus racemosa/ Meliosma / Maesa types

The upper stratum include *Cinnamomum spp. - Mallotus philippensis*

Second layer include *Syzygium lanceolatum - Ficus racemose - Meliosma pinnata*

Lower stratum composed of *Maesa indica* and *Vitex leucoxylon*

The shrubby and ground vegetation includes *Vibrunum, Osbeckia reticulate, Strobilanthes spp., Drosera indica, Utricularia graminifolia, Pecteilis gigantean, Habenaria spp., Eriocaulon thwaitesii, Eriocaulon ritchieanum etc.*

Abundance of rare epiphytes such as *Trias stocksii, Eria mysorensis, Oberonia brachyphylla* and *Oberonia brunoniana*

The riverbed composed of *Polypleurum stylosum* and other members of Podostemaceae

Group 2.b.

IV. 21.Rip.b. Montane-Shola Streamside Vegetation-degraded

Included riparian type (Cluster 10)

Debregeasia longifolia /Ficus hispida /Datura stramonium

This association found in much degraded stream sides of the Montane riparian / streamside vegetation

Group 2. c.

IV. 21.Rip.c. Montane Evergreen Riparian Forest

Included type (Cluster 6)

Cullenia- Elaeocarpus tuberculatus - Vateria/ Poeciloneuron indicum - /Meliosma -Clausena type

The upper stratum composed of *Cullenia* and *Elaeocarpus tuberculatus* (dominance of *Vateria indica* 800-1000 elevations and *Cinnamomum spp., Mallotus philippensis, Syzygium spp.* in 1000+ elevations)

Second strata is of *Neolitsea spp., Actinodaphne spp.* (dominance of *Poeciloneuron indicum* 800-1000 elevations and *Syzygium spp.* in 1000+ elevations) Usually the second and third layer merges in this vegetation

type and second tree layer becomes prominent when the elevation is much lower (900-1000)

It also composed of medium trees like Meliocope, *Meliosma pinnata* (*Ficus racemose* and *Meliosma pinnata* dominates in the 1000+ elevations and *Schleichera oleosa* and *Polyalthia coffeoides* dominates in the 900-1000m elevations

The lower stratum include *Callicarpa tomentose, Aporosa acuminate, Clausena anisata, Meliosma simplicifolia, Antidesma montanum* (dominance of *Antidesma montanum* in 900-1000 elevations and *Debregeasia longifolia* in 1000+ elevations)

The shrubs include *Clerodendrum infortunatum, Hedychium coronarium, Schumannianthus virgatus, Oreocnide integrifolia* and wild varieties *of Elettaria cardamomum*

The river bed is composed of *Cyperus corymbosus, Lagenandra meeboldii* and crustaceous members of Podostemaceae (replaced by thalloid members of Podostemaceae in 1000+ elevations)

Epiphytes include *Medinilla beddomei, Aeschynanthus perrottetii, Peperomia tetraphylla, Dendrobium barbatulum, Oberonia anamalayana*

Stream characteristics: Stream type – usually ripples and rapids (Group 1a & 1b) rarely pools and small if present (Groups 1c); Stream width 1-10 m (10-15 m for Group 1c); Stream order-3-4; flow –natural; usually perennial with very low sediment loads and turbidirty-some times ephemeral, turbid with sediments if the catchment forest were replaced with Tea-Coffee plantations

Terrain features: Soil : Loamy wet, exposed sheet rocks in the stream beds

Adjacent Vegetation/Landuse: Montane Shola-Grasslands (Group Ia); Tea-coffee plantations (Group Ib); Montane evergreen (Group Ib).

Bioclimate: elevation >1000 m (except for Group-I.c. 900-1000m) MSL, rainfall >3000 mm, T-15^{0}C, Dry months 1-3

Corresponding bioclimate of Meher-Homji (2001) (Evergreen type 21-Shola or Montane. elevation >1000 m MSL, rainfall >1500 mm, T-15^{0}C, Dry months 1-3

Group 3.

IV. 26. Rip. Evergreen Riparian Forest (Low elevation)

Included riparian types (13, 7, 17, 5, 16a, 16b. 18 & 9)

Location: Chalakkudy, Vettilappra, Athirapilly, Vazhachal (Orukomban), Sholayar, Parambikulam (>700 m).

Bioclimate : Elevation 0-1000m, Rainfall >2000 mm, T>20^{0}C (15-20^{0}C), Dry months 4-5 months (3-5).

Corresponding bioclimate of Meher-Homji (2001)

elevation 0-1500m MSL, rainfall >2000 mm, T->15^{0}C 4-5 dry months

Corresponding vegetation of Meher-Homji (2001)

Evergreen type (IV. 26)- *Evergreen -Dipterocarpus-Mesua-Palaquium*

Group 3.a.i.

IV. 26. Rip. a.i. Evergreen Riparian Forest (Low-Elevation) -1.

Included riparian type (cluster 7)

Chukrasia tabularis - Dysoxylum malabaricum - Vateria indica/ Atuna travencorica- Diospyros crumenata -Myristica-Baccaurea type

Include 3-4 layers of evergreen trees, abundance of liana, ground vegetation and epiphytes.

Upper stratum : *Chukrasia tabularis, Dysoxylum malabaricum, Vateria indica* and emergant trees like *Lophopetalum wightianum or Dipterocarpus indica* .

Second stratus is very prominent, which include: *Diospyros crumenata, Schleichera oleosa, Myristica spp., Knemma* and *Aglaia spp.*

Third layer composed *of Atuna travencorica, Elaeocarpus variabilis, Xanthophyllum arnottianum, Hydnocarpus spp., Gymnacranthera canarica* and *Cinnamomum malabatrum*

The lower layer includes: *Baccaurea courtallensis, Prismatomeris tetrandra, Leea asiatica* and *Memecylon angustifolium*

The lianas include: *Entada rheedei, Schleichera oleosa, Strychnos colubrina*

Location: Orukombankutty, Sholayar-Kudal.

Bioclimate : Elevation 500-700 m, Rainfall >2000 mm, T>20^{0}C (15-20^{0}C), Dry months 3-4 months.

This is an intermediate condition of Wet evergreen types.

Group 3. a. ii.

IV. 26. Rip. a. ii. Evergreen Riparian Forest -2(Low-Elevation)

Included riparian type (cluster 13)

Vateria indica –Hopea- Holigarna arnottiana/ Humboldtia vahliana

Diospyros crumenata / *Ochlandra scriptoria -Garcinia - Barringtonia* type

Include 3-4 layers of evergreen trees,

Upper strata: *Vateria indica, Hopea parviflora, Poeciloneuron indicum* and *Kingiodendron pinnatum* (lower 100-500m elevations)

Second layer is the prominent and include more diverse association of: *Diospyros crumenata, Holigarna arnottiana, Gmelina arborea Myristica spp., Knemma Garcinia gummi-gutta,* and *Calophyllum spp.*

Third layer predominates as : *Humboldtia vahliana, Schleichera oleosa, Xanthophyllum arnottianum, Aporosa cardiosperma, Madhuca neriifolia*

The fourth layer consist of: *Ochlandra scriptoria, Barringtonia acutangula, Garcinia Morella, Syzygium occidentalis*

The shrubs include: *Homonoia riparia, Cratave magna,*

The lianas include: *Entada rheedei, Strichnos colubrina*

Ground vegetation composed of: *Eragrostis spp., Cleome spinosa, Lindernia spp., Rotula aquatica and Cyperus corymbosus.*

Group III.b.

IV. 26. Rip. b.i. Semi Evergreen Riparian Forest-1

Included riparian type (cluster 5)

Dipterocarpus indicus – Diospyros crumenata / Otonephelium stipulaceum Gymnacranthera - Syzygium cumini Type

The emergent layer is not prominent except occasional appearance of *Dipterocarpus indicus* and *Canarium strictum*

Characteristic vegetation is of *Diospyros crumenata, Otonephelium stipulaceum, Gymnacranthera, Schleichera oleosa* and *Litsea coriacea*

Ochlandra scriptoria and *Madhuca neriifolia* appears along river margins

Group 3.b.ii.

IV. 26. Rip. b.ii. Semi Evergreen riparian vegetation-2

Included riparian type (cluster 17)

Vateria indica- Humboldtia vahliana - Barringtonia acutangul a -Mallotus atrovirens Syzygium occidentalis - Homonoia riparia - Ochlandra scriptoria

The upper layer composed of *Vateria indica* and *Hopea parviflora. Dipterocarpus indica* occurs in more wet environments and *Lagerstroemia speciosa* and *Lagerstroemia microcarpa* occurs towards more dry conditions

Middle layer include : *Holligarna arnottiana, Humboldtia vahliana, Mallotus atrovirens, Ficus racemosa.*

Third layer include: .*Madhuca nerifolia, Barringtonia acutangula*

The lower layer composed of: *Ochlandra scriptoria, Syzygium occidentalis, Homonoia riparia*

Lianas include *Entada rheedei, Calmus spp., Diploclisia glaucescens, Gnetum etc.*

Scandant climbers include *Pothos scandens, Piper hymenophyllum, Uvaria hookerii*

Epiphytes include *Dendrobium herbaceum, Sirhookera, latifolia,*

Ground cover includes, *Boesenbergia pulcherrima*

River beds vegetation includes *Homonoia riparia, Rotula aquatica, lagenandra nairii, Phragmatis karka*

Differentiation of middle and third layer is not clear and usually appear as a single layer. Secondary evergreen species like *Polyalthia fragrance, Diospyros buxifolia, Schleichera oleosa* indicate secondary regeneration towards climax.

Location: Vazhachal

Bioclimate : Elevation 100-400 m, Rainfall >2000mm, T>20^{0}C), Dry months 3-4 .

This shows a tendency towards intermediate condition of Wet evergreen types.

Group 3. c.

IV. 26 Rip. c. Secondary Moist Deciduous Riparian Forest

Included riparian type (cluster 16a with sub types 16b & 16c)

IV. 26 Rip. c.i. Secondary Moist Deciduous Riparian Forest-1

Barringtonia acutangula / Madhuca neriifolia / Vateria indica / Humboldtia vahliana / Ochlandra travancorica /Mallotus aureo-punctatus / Lagerstroemia microcarpa / Syzygium occidentalis

In this type the vegetation characterized with *Barringtonia acutangula-Madhuca neriifolia / Mallotus aureo-punctatus* and *Vateria indica.* Appearance of emergent deciduous element *Lagerstroemia microcarpa and Terminalia paniculata*

Secondary regeneration of *Ochlandra travancorica*

Ochlandra scriptoria towards river margins

Sub type c.i.a (16b). *Humboldtia vahliana /Bambusa bambos/ Ochlandra scriptoria / Salix tetrasperma*

This type is a degraded condition dominated with *Ochlandra scriptoria, Humboldtia vahliana* and *Bambusa bambos*

This type is represented from Athirapilly (100 m) to Orukomabn area. *Salix tetrasperma* is absent in the lower elevations

Sub type c.i.b.

(16c.) *Bamboosa bambos / Syzygium occidentalis /* Madhuca neriifolia

Here *Bambusa bambos* dominate exceptionally, *Syzygium occidentalis Madhuca neriifolia* and *Ochlandra scriptoria* seen towards river margins

It was also located from Athirappilly – Kuriyarkutty region where adjacent vegetation is highly degraded Teak plantations

IV. 26. Rip. c.ii Secondary Moist Deciduous Riparian-2 (Degraded)

c.ii.b Secondary Moist Deciduous Riparian-2a

Included riparian type (cluster 18)

Terminalia paniculata - Macaranga peltate /Ochlandra scriptoria - Wrightia tinctoria

This type is located downstream to Poringalkuthu reservoir, where the river flow is diverted for power generation. The rocky dry terrain features and teak plantations in the adjacent vegetation account for the degradation

River bed consist of *Vitex leucoxylon, Blumea lacera and Canscora spp.*

c.ii.b Secondary Moist Deciduous Riparian-2b

Included riparian type (cluster 9)

Saccharum arundinaceum / Bambusa bambos - Gliricidia sepium / Ficus racemose - Ficus hispida / Thespesia populnea / Trema orientalis

This type is common to the lower elevations (0-70m) where the adjacent areas are coconut plantations or human settlements and the riparian system is highly degraded. The riparian vegetation present is the secondary plantations of *Bambusa bambos* and mass gatherings of *Saccharum arundinaceum.* Trees like *Ficus racemosa-Ficus hispida* appears in the upstream, *Trema orientalis* in the medim elevations and *Thespesia populnea* along the lower saline zones. Moisture loving tree like *Holligarna arnottiana, Garcinia gummi-gutta* etc could be seen.

Stream characteristics: Stream type – usually pools and rapids; Stream width 10-300 m; Stream order-5; flow–natural and controlled, downstream to Poringalkuthu dam the flow is diverted; usually perennial with medium sediment loads and low turbidirty.

Terrain fetures: Soil : Loamy-lateraitic wet, exposed sheet rocks in the stream beds

Adjacent Vegetation/Landuse: Evergreen to Moist deciduous and Moist deciduous Teak.

Group 4.

IV. 27. Rip. Wet (Moist) Evergreen Riparian Forest

Including riparian types-(Types 1, 4, 3, 11, 14, 15)

Location: Sholayar & Karappara (Nelliyampathy) areas, Upper reaches of Parambikulam and Malakkppara-Valparai

Bioclimate : Elevation 500-1200 m, Rainfall >3000 mm, T>20^{0}C (15-20^{0}C), Dry months 3-4 months .

Corresponding bioclimate of Meher-Homji (2001)

elevation 0-1500 m MSL, rainfall >3000 mm, T->20^{0}C, <5 dry months

Corresponding vegetation of Meher-Homji (2001)

(Evergreen type 27-*Cullenia-Mesua-Palaquium*)

Group 4 a.

IV. 27. Rip. a. Wet (Moist) Evergreen Riparian Forest-1.

Including type (Cluster 4)

Palaquium - Hopea parviflora - Cullenia exarillata / Madhuca neriifolia--Meliosma simplicifolia / Syzygium spp. / Entada

Upper dense canopy layer with tall climax species like *Palaquium - Hopea parviflora – Cullenia exarillata*

Second layer include *Mallotus philippensis / Garcinia gummi-gutta/ Schleichera oleosa*

Third layer include *Syzygium laetum, Hydnocarpus alpina*

The lower layer include *Madhuca neriifolia, Meliosma simplicifolia, Ficus rigida*

The shrubs include *Schumannianthus virgatus* - wild varieties of *Elettaria cardamomum - Oreocnide integrifolia*

Epiphytes include *Medinilla beddomei - Aeschynanthus perrottetii- Peperomia tetraphylla - Oberonia spp..*

Terrestrial orchids in the Montane vegetation replaced with saprophytic terrestrial orchids.

The river bed is composed of *Cyperus corymbosus, Lagenandra meeboldii, Lagenandra ovata* and crustaceous members of Podostemaceae

There is abundant occurrence of epiphytic ferns like *Asplenium spp., Huperzia phlegmaria*

Climbing aroids such as *Pothos armatus, Pothos crassipedunculatus* and *Pothos scandens*

Ground cover *: Dendrocnide sinuata, Strobilanthes spp.*

Location: Nelliyampathy

Group 4 b.

IV. 27. Rip. b. Wet (Moist) Evergreen Riparian Forest-2.

Including type (Cluster 11)

Location : Downstream to Kerala Sholayar dam

Vateria Indica - Lophopetalum wightianum - Bhesa indica - Diospyros paniculata

This type is seen towards 600-700 m elevations along Sholayar river. Intermediate between the Evergreen riparian (medium elevation) and Wet evergreen riparian evergreen bioclimate. Rain fall is >4000 mm.

Vateria Indica - Lophopetalum wightianum - Bhesa indica dominates in the upper layer. *Mesua* and *Palaquium* is seen towards more wet condition

Otonephelium stipulaceum, Polyalthia coffeoides, Persea macrantha, Schleichera oleosa in the second layer

Diospyros paniculata, Melicope lunu-ankenda , Aglaia baraberii- Garcinia gummi-gutta, Garcinia indica in the third layer

The lower layer includes *Aglaia baraberii, Madhuca neriifolia, Cinnamomum malabatrum*

Lianas like *Calamus thwaitesii,* aroids including *Pothos armatus, Pothos scandense* and *Piper spp.* are abundant

The ground cover include *Psychotria anamalayana, Pellionia heyneana, Dendrocnide sinuata*

Ochlandra travancorica occurs towards river margins near river pools. The rocky river bed is dominated with *Syzygium occidentalis, Pittosporum neelgherrense, Homonoia riparia, Rotula aquatica* and *Osmunda regalis..*

Ochlandra travancorica Persea macrantha, Schleichera oleosa and *Vateria* shows more secondary evergreen nature. This slight degradation from the climax vegetation may be due to the diversion of the river flow by the Kerala Sholayar Dam.

Group IV c.

IV. 27. Rip. c. Wet (Moist) Evergreen Streamside Vegetation

Including type (Cluster 3) Kulamali-Sholayar

Palaquium ellipticum – Cullenia - Elaeocarpus tuberculatus

Dendrocnide sinuate / Pandanus foetidus / Madhuca neriifolia / Palaquium ellipticum - Cullenia- Elaeocarpus tuberculatus

This type is seen along the third-order streamside of the wet evergreen forests

The emergent near the streams include *Palaquium ellipticum – Cullenia - Mesua* and characteristic riparian species *Elaeocarpus tuberculatus*

Other trees like *Canarium strictum, Myristic species, Chionanthus mala-elengi, Madhuca nerifolia, Holigarna grahamii, Melicope lunu-ankenda, Pandanus foetidus, Dendrocnide sinuata* were seen in different strata

In some locations the stramside vegetation dominated with *Antidesma montanum and Oreocnide integrifolia*

The streambed lined with *Impatiens verticillata* and the boulders covered with *Elatostema acuminatum, Elatostema lineolatum var. lineolatum, Procris crenata, Begonia malabarica, Begonia floccifera, Microtropis and Salaginella spp..*

The streams are usually perennial

Group 4 d.

IV. 27. Rip. d. Secondary Semi Evergreen Streamside Vegetation

Including type (Cluster 1)

Vernonia arborea / Elaeocarpus tuberculatus/ Antidesma montanum/ Vepris bilocularis /Artocarpus/ Garcinia gummi-gutta

Ankayam streamside

This type is observed along streams with degraded catchments and flow is negligible during summer months

Here *Elaeocarpus tuberculatus/ Antidesma montanum* dominates but presence of *Ochlandra spp.,* and other rheeds. The stream margins and boulders are not covered with diverse vegetation as that of the evergreen type

This is located along Sholayar-Anakayam stream banks.

Group 4 e.

IV. 27. Rip. e. Secondary Semi Evergreen Riparian Forest

Including type (Cluster 15)

Ochlandra travancorica - Mallotus aureopunctatus - Cinnamomum malabatrum / Baccaurea courtallensis/ Hydnocarpus/ Vateria

This is much more dense semi evergreen type supported with secondary regeneration of *Vateria indica, Schleichera oleosa* and species of *Hydnocarpus, Artocarpus and Aglaia* .

This was found along Anakayam stream banks downstream to discharge of water from the Sholayar power House. The stream flow support the growth of secondary species and unnatural pace and fluctuation may restricting from reaching climax or appearance of more wet evergreen species.

Group 4 f.

IV. 27. Rip. f. Secondary Semi Evergreen Riparian Forest -Degraded

Including type (Cluster 14)

Type-14. *Salix tetrasperma/ Ochlandra travancorica/ meliosma / Vateria*

Sholayar – Malakkppara

This is found downstream to Malakkapara just upstream to the Kerala Sholayar reservoir. Flash flow occurs during discharge from the upper Sholayar reservoir. The Tea plantations and the impact of reservoir in the downstream (Partial flood during monsoon) and flash discharge from upper Sholayar may be the degradting factor.

The river margins are dominated with *Ochlandra travancorica and Vateria patches.*

Salix tetrasperma is abundant along rocky river beds.

Stream characteristics: River and streams are 3-5 th order, usually perennial or with w short span of flow less period during extreme summer months, then catchments will be degraded (Plantations, reservoirs, fire damage) or river flow is diverted or controlled by dams in the upstream. Stream width 2-10 (100m); Very low sediment load and turbidity.

Terrain fetures: Soil : Wet Loamy

Adjacent Vegetation/Landuse: Wet evergreen, secondary evergreen or plantations of coffee and tea.

Conclusion

Out of the 106 quadrat samples, 91 provided 18 significant clusters at similarity coefficient level 4. All the clusters were analyzed separately for dominant community associations using IVI. They were grouped into 4 bioclimatic groups *ie.* 1. Moist Deciduous Riparian vegetation, 2. Montatne-Evergreen Riparian /streamside vegetation, 3. Evergreen riparian vegetation and 4. Wet evergreen riparian vegetation. The climax and degraded types were segregated using PCA analysis of the Diversity Indices, Shanon H' and Simpson 1/D and the Basal Area (BA m^2/ha). The climax types were treated as Primary vegetation types of the corresponding bioclimate and others were treated as secondary riparian vegetation types. A detailed Classification is provided here. This also provided a deep insight into the riparian vegetation dynamics, influencing factors, vegetation and physiographic peculiarities and bioclimatic peculiarities of the Chalakkudy river basin in the Anamalai landscape unit of the Western Ghats.

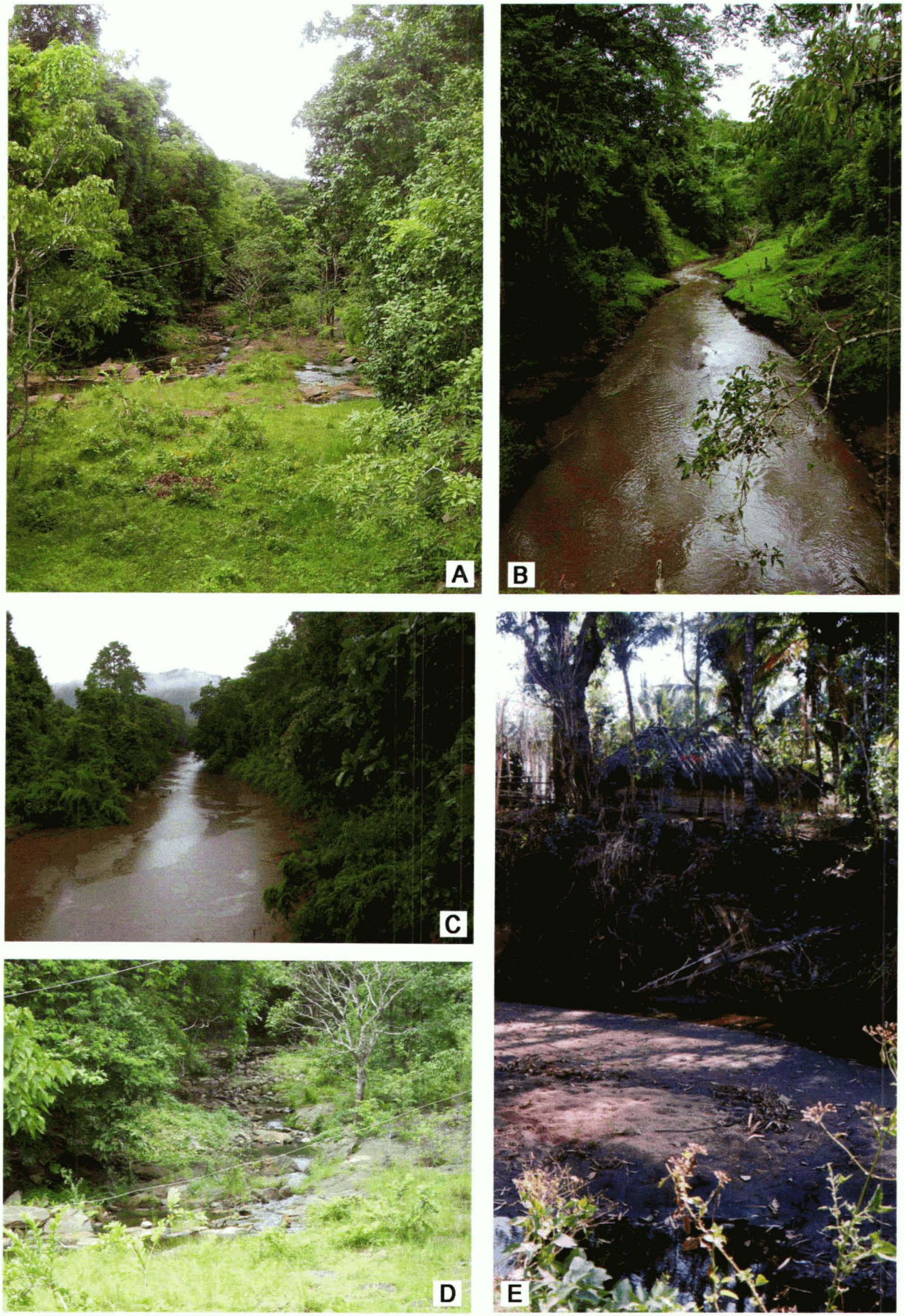


Plate 4. Group I. (14. Rip - I.) Moist Deciduous Riparian Forest (Primary), A-C. (14. Rip a.) Moist Deciduous Riparian Forest (Primary)- Thunacadavu; D & E. (14. Rip b.) Secondary Dry Deciduous (intermediate) Riparian Forest - Thunacadavu & Veetiyar

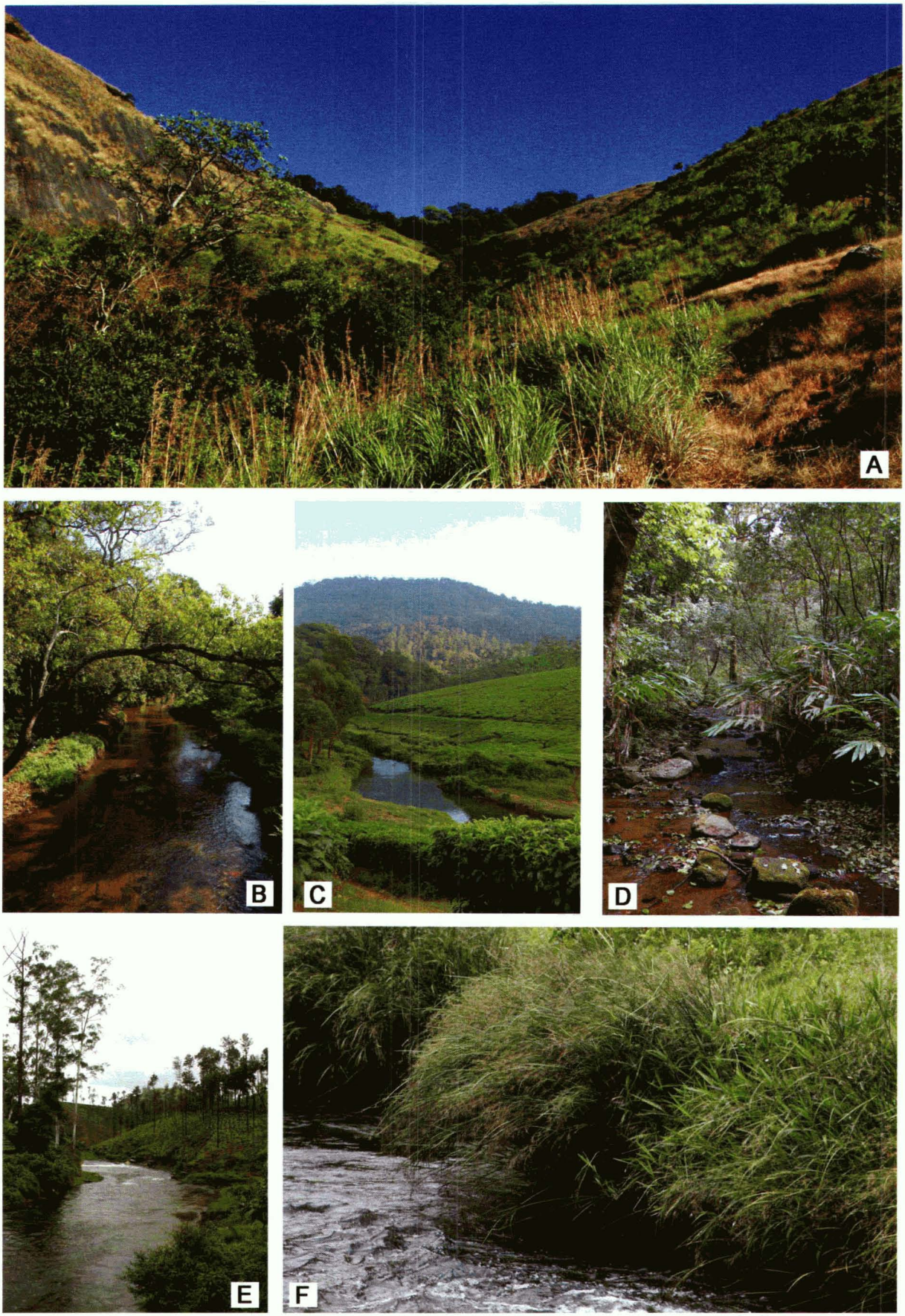


Plate 5. Group II. (IV. 21 Rip.a.) Montane-Shola Streamside Riparian Forest, A. & B. - Karappara river (Nelliyampathy), C & f. (IV. 21.Rip.b.) Montane-Shola Streamside Vegetation-degraded, C.Karappara river - Nelliyampthy, D. Veetiyar - Karimala Nelliyampathy, E. & F. Upper Sholayar River - Valparai.

Plate 6. Group II. (IV. 21.Rip.c.) Montane Evergreen Riparian Forest; A, B. & C. Karappara river Nelliyampathy; D. & E. Degraded stages - Karappara; F. Transition between Montane Streamside and Montane Evergreen riparian vegetation-Nelliyampathy.

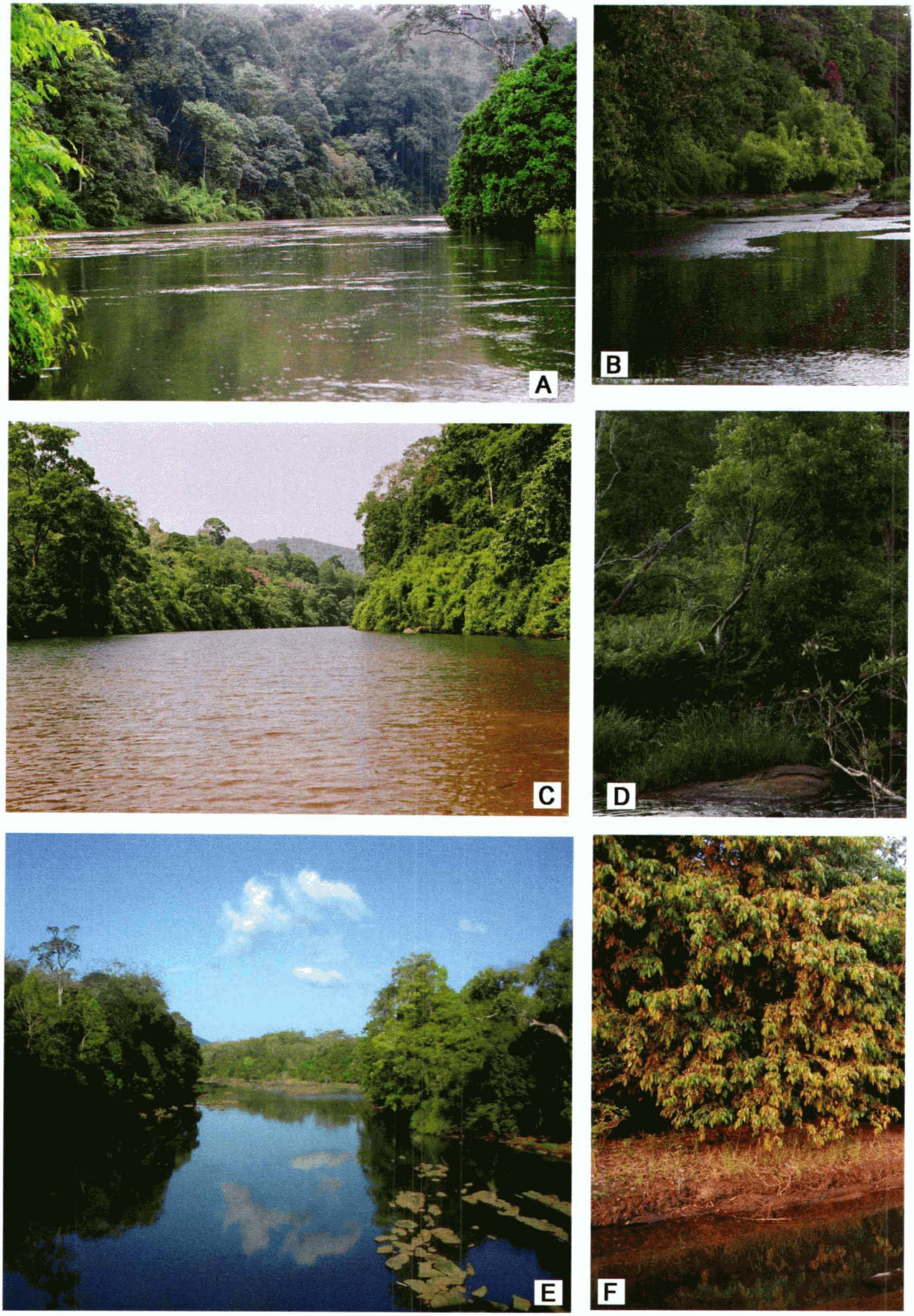
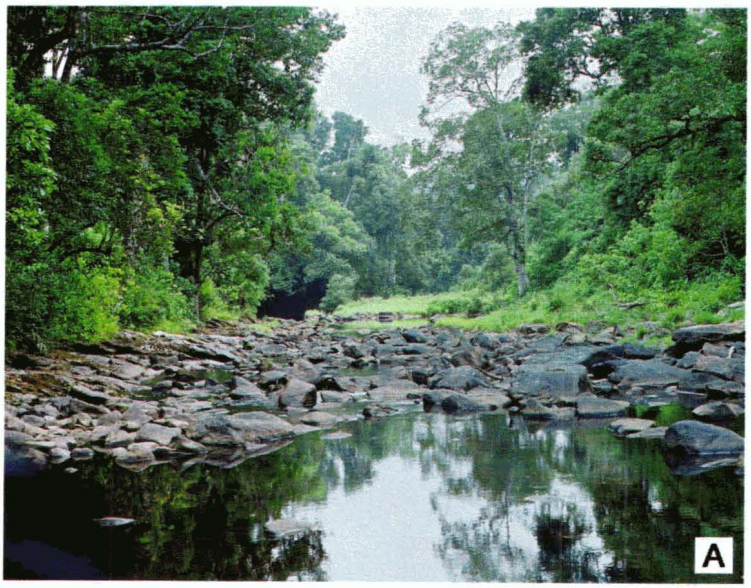
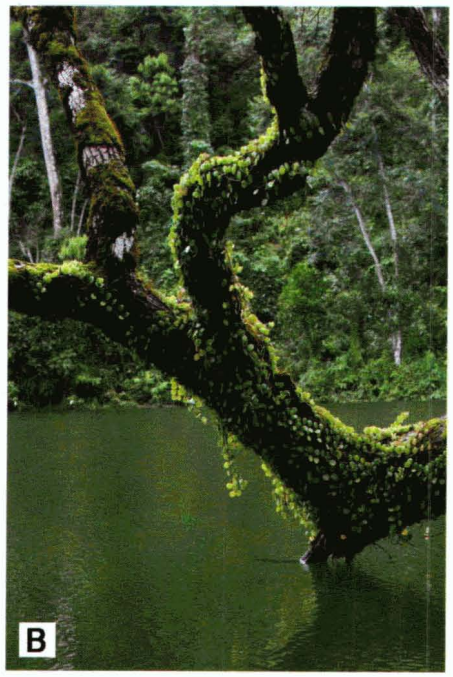
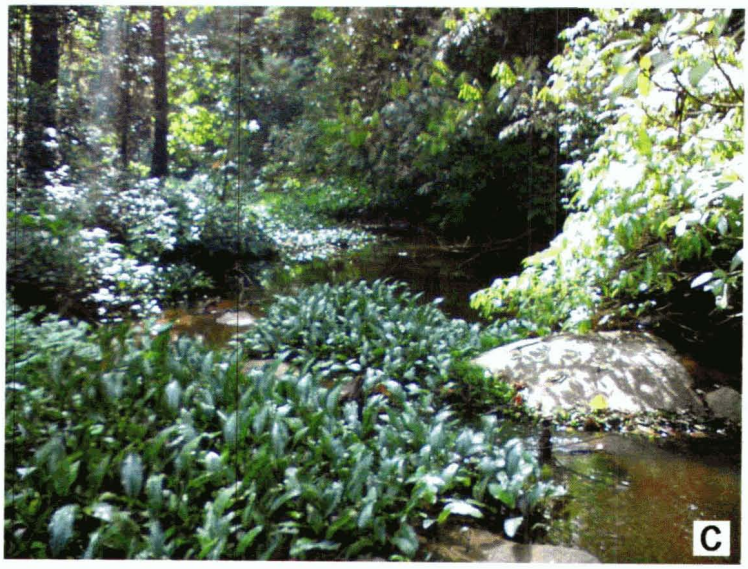
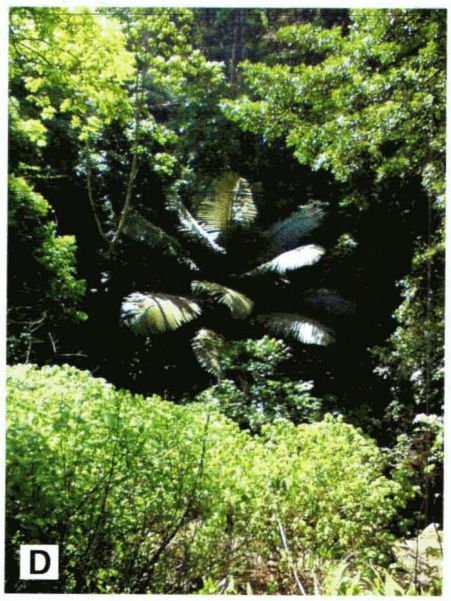


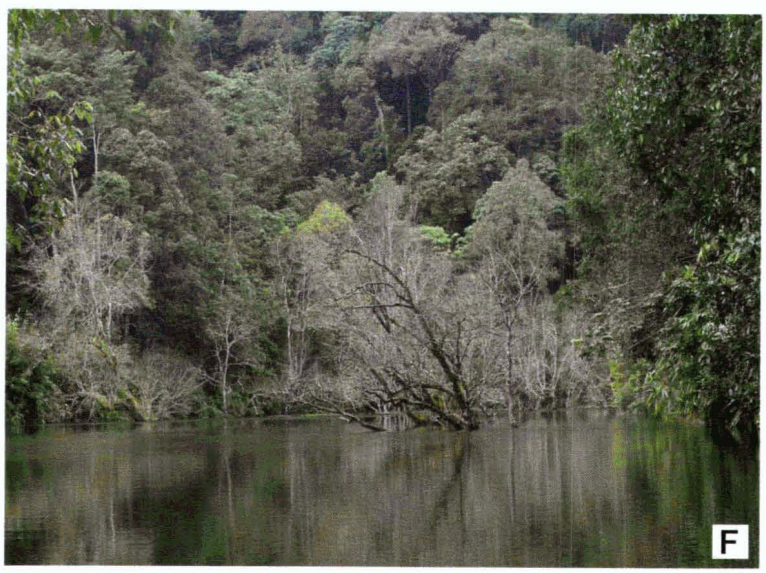
Plate 7. Group III. (IV. 26. Rip. a.i.) Evergreen Riparian Forest (Low-Elevation), A & B Orukombankutty, C & D. Karanthodu - Vazhachal; E & F.(IV. 26. Rip. b.i.) Semi Evergreen Riparian Forest











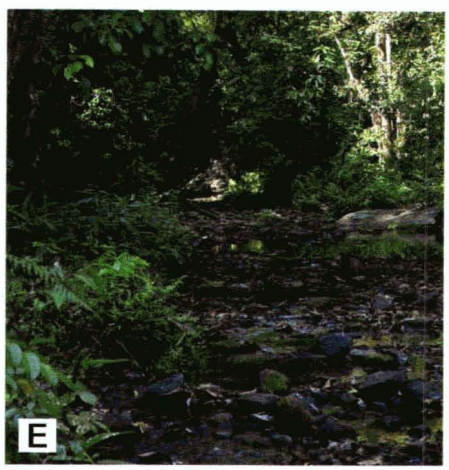


Plate 8. Group IV. A & B. Wet (Moist) Evergreen Riparian Forest - (IV. 27. Rip. a.), A. & B. Sholayar; C & D. Wet (Moist) Evergreen Streamside Vegetation - (IV. 27. Rip. c.) - Meenchaliyali stream - Sholayar; E. Kulamaly stream Sholayar; F. Secondary Semi Evergreen Riparian Forest -Degraded (IV. 27. Rip. f.).

General Discussion and Summary

Amitha Bachan K.H. “Riparian flora of the Chalakkudy river basin and its ecological significance ” Thesis. Department of Botany , University of Calicut, 2010

Chapter 4

General Discussion and Summary

General discussion, summary and conclusion

Particular vegetation types are characteristics to each and every ecosystem and plant communities are the expressions of vegetation types. The floristics and vegetation features of an area provide basic and essential tools for the conservation and management of biodiversity. The present work brings out floristics, community composition, vegetation classification and ecological significance of the riparian vegetation along various bioclimatic regimes of the Chalakkudy river basin in the Anamalai part of southern Western Ghats.

The collected phytosociological sample data of the riparian vegetation was segregated significantly according to major vegetation types of the region on statistical analysis. All the segregated vegetation types had characteristic plant species of the representing bioclimate. About 50% of the enumerated flora showed (excluding the weeds and exotics) greater than 60% frequency of occurrence in the sampling. These features indicate that the riparian vegetation has characteristic community structure and species composition similar to other major vegetation types.

The riparian flora and their conservation status

The angiospermic riparian flora of the Chalakkudy river basin includes 696 number taxa under 450 genera and 129 families. This includes 76 % (534) of dicots and 24 % (162) of monocots. The riparian flora showed 36.5 % of endemism. This include 30 species endemic to Peninsular India, 94 to the Western Ghats and Sri Lanka hot spot, 142 to the Western Ghats alone, and 85 endemics to southern Western Ghats. The 36.5 % of endemism was high comparing to general flora from the region. The Palakkad district showed 29 % of endemism and flora of Thrissur forests showed 15. 2 % (Sasidharan 2004). Percentage of

RET plants was also high when comparing to the Palakkad and Thrissur districts.

The phytpgeographic affinity of the vegetation found to be 40% of indigenous elements and 25 % of Indo-Malayan elements and it is comparable to that indicated by Legris and Meher-Homji (1968) for the evergreen forests of the Western Ghats.

The extent of riparian vegetation along the Chalakkudy River estimated as 480 ha, which is only 0.32% of the total area of the River Baisn and 0.92% of the total primary forests in the river basin. But it harbors 50-60 % flora of the entire basin with relatively high percentage of endemism and rarity. These indicate the high conservation value of the riparian forest.

Past forestry practices in the river basin has affected considerably the primary forests of the river basin. Among the total forest area 1181 km^2, about 40% (519 km^2) is the available primary forest in the basin. It is more concentrated Sholayar-Vazhachal area of the river basins. The forest plantations (Teak) (15%-179 km^2), tea and coffee plantations (16% - 198 km^2) and various thinning practices and forest fire (secondary forests – 16% -197 km^2; degraded open areas 7% -87 km^2) were the major reasons for the degradation of the primary forests in the basin. The riparian forests in the basin also reduced to 4.8 km^2, mainly because of the forest conversions.

There are six major dams in the Chalakkudy river and 40% of the water is being diverted to Tamil Nadu through the Parambikulam-Aliyar Treaty (Ravi *et al.* 2007). The diversion of the river for power generation also has serious impact on the riparian forests of the basin. Presence of secondary and degraded riparian forest types downstream to Poringalkuthu, Parambikulam, Thunacadavu, Peruvaripallam and

Sholayar dams account for the impact of diversion of river flow due to river valley projects. The impact of dams and flow regulation on riparian vegetation were well documented from the temperate regions (Nilsson *et al.* 1991, Stevens & Cummins 1999). The dams and reservoirs has fragmented the riparian vegetation of the Chalakkudy river basin considerably. About 88 km length of riparian vegetation has either submerged or dried up due to six major dams in the river basin (Amitha Bachan 2005). Similar effects had been observed by Jansson *et al.* (2000) from Sweden. The fragmentation of river channel disrupts the natural dispersal pathways of riparian plant communities.

The present study indicates the decrease in species diversity (Fig. 3.20) in the riparian forest along flow diverted river stretches similar to as indicated by Nilsson *et al.* (1991). The flow regulation has a divergent response on the riparian vegetation. The species diversity of the riparian vegetation along the Anakkayam stream (secondary semi evergreen riparian vegetation (IV. 27. Rip. d) were less compared to similar vegetation type along rivers and streams with natural flow. This indicate that the regulated river flow support to develop degraded riparian vegetation. But that can't bring back the climax vegetation type and species diversity.

The river length (145 km^2) and the river basin area (1484 km^2) derived through mapping shows variations from previous assessment by Govt. of Kerala (1704 km^2 of which 300 km^2 in Tamail Nadu) and Madusudhanan (2009). This indicates the need for standardizing methodology and a reassessment of physiographic features of the river basins of Western Ghats.

Assessment of rainfall with the probable year mean rainfall (Meher-Homji 2001) yielded a clear picture of the dry and moist bioclimate in the

Kuriyarkutty subbasin of the Parambikulam plateau. And provided an explantation to the ambiguities existed in the previous vegetation and physiographic assessments (Ramesh *et al.* 2007). The particular physiography of the region with an exposure to the dry Coimbatore plains through Topslip area accounted for the low rainfall (1000-1500 mm) and dry vegetation type in the area. A detailed study on may yield a further explanation.

The riparian vegetation types, extent, distribution and conservation priorities

About 85 % of the phytosociological samples collected during the study successfully into 18 major vegetation types based on their species similarity/dissimilarity coefficient value (40% similarity). Out of the 18 vegetation types 17 types were segregated according to their characteristic bioclimatic features. The cluster 16 showed a mixed bioclimate and on further separation with similarity coefficient 5 (50%) yielded another three sub types (16a, 16b & 16c). All the derived vegetation types represented various stages (climax, secondary, seral & degraded) communities under four major tropical moist forest types described by Meher-Homji (2001). These include riparian vegetation types under Moist Deciduous, Montane evergreen, Evergreen (low elevation) and Wet evergreen forest types.

The present study brought out four major and 18 sub riparian vegetation types and their associations corresponding to varying bioclimate of the Chalakkudy river basin. The major riparian vegetation types include 1. Moist Deciduous Riparian forest (Primary) (II. 14. Rip.), 2. Montane Shola/Evergreen Streamside/riparian forest (IV.21. Rip.), 3. Evergreen Riparian vegetation (Low-elevation) (IV. 26. Rip.) and 4. Moist

(Wet) Evergreen Riparian forest (IV. 27. Rip.). The sub types and associations are provided below.

1. II. 14. Rip. Moist Deciduous Riparian Forest (Primary) with two subtypes II. 14. Rip a. Moist Deciduous Riparian Forest (Primary), and II. 14. Rip b. Secondary Dry Deciduous (intermediate) Riparian Forest.

2. IV. 21 Rip. Montane Shola Streamside/Evergreen Riparian Forest with three sub types IV. 21 Rip.a. Montane-Shola Streamside Forest, IV. 21.Rip.b. Montane-Shola Streamside Vegetation-degraded, and IV. 21.Rip.c. Montane Evergreen Riparian Forest

3. IV. 26. Rip. Evergreen Riparian Forest (Low-Elevation) with 7 sub types. IV. 26. Rip. a.i. Evergreen Riparian forest -1 (Low-Elevation *Chukrasia - Dysoxylum - Vateria,* IV. 26. Rip. a.ii. Evergreen Riparian Forest-2 (Low-Elevation) *Vateria – Holigarna – Humboldtia - Barringtonia,* IV.26. Rip. b.i. Semi Evergreen Riparian Forest-1., IV. 26. Rip. b.ii. Semi Evergreen Riparian Forest -2, IV. 26 Rip. ci. Secondary Moist Deciduous Riparian Forest-1., IV. 26. Rip. c.ii Secondary Moist Deciduous Riparian Forest-2 (Degraded).

4. IV. 27. Rip. Wet (Moist) Evergreen Riparian Forest with sub types. IV. 27. Rip. a. Wet (Moist) Evergreen Riparian Forest-1. (*Palaquium - Hopea – Cullenia – Madhuca - -Meliosma.,* IV. 27. Rip. b. Wet (Moist) Evergreen Riparian Forest-2. *Vateria Indica – Lophopetalum - Bhesa - Diospyros*, IV. 27. Rip. c. Wet (Moist) Evergreen Streamside Vegetation, IV. 27. Rip. d. Secondary Semi Evergreen Streamside Vegetation, IV. 27. Rip. e. Secondary Semi Evergreen Riparian Forest and IV. 27. Rip. f. Secondary Semi Evergreen Riparian Forest-degraded.

The Evergreen Riparian Forest (Low elevation) dominates in the basin with an area of 290 ha (62%) distributed in the Vazhachal-Orukombankutty region of Vazhachal Forest Division along the

Chalakkudy Main river. The second extent riparian forest (116 ha) was seen along Karappara River from Nelliyampathy to Orukombankutty along the boarder of Parambikulam Wildlife Sanctuary, Vazhachal and Chalakkudy Forest Divisions. This is followed by the riparian forests along the Sholayar River 52 ha and least along the Parambikulam (13.4 ha) and Kuriyarkutty (1.6 ha) rivers.

Maximum diversity was shown (Shannon H') by Evergreen Riparian Forest (Low elevation) types (H'=1.6), followed by Primary Moist Deciduous Riparian Forest (h'=1.44), Wet Evergreen Riparian Forests (H'= 1.41) and Montane Evergreen Riparian Forest (H'=1.37). It is comparable to the observation that the low elevation evergreen forests harbor maximum diversity (Osborne 2000, Ramesh *et al.* 2007). The Shannon Divesity value H' found intermediate (1.6) with that observed by Ramesh *et al.* (2007) from the evergreen forest types of Vazhachal forests.

The Chalakkudy river is the highest fish diverse river in the Western Ghats or even in India (NBFGR 2000). This extent and quality of riparian vegetation may be the reason behind the fresh water fish diversity. The relationship between the riparian forest and fish diversity is well established (Penzak 1995). The riparian vegetation in the Vazhachal-Orukombankutty area accounted for the 62% of the riparian vegetation available in the region and 70-80% of flora including many endemics and threatened species. The riparian forest at Vazhachal is the only known locality of the aroid, *Lagenandra nairii* Ramamurthy & Rajan. Further flow regulation or diversion would wipe out the population from the area. The low-elevation riparian forest at Vazhachal is the only available nesting location of threatened Malabar Pied Hornbill in Kerala (Amitha Bachan 2006).

Responses of Riparian Plant communities to Disturbances

The riparian plant communities were found responding to different environmental and degradation factors and that is reflected in their community composition and characteristics. These responses of vegetation could be used as a tool (indicator) to assess the status and health of the river, the landuse and the river basin.

The deforestation and subsequent degradation of the adjacent vegetation found to have great influence on the riparian vegetation. The vegetation types IV. 21.Rip.b. (Montane-Shola Streamside Vegetation-degraded) indicate the heavily destroyed Montane ecosystem for Tea, Coffee and Cardamom plantations. About 189 km^2 of Montane-Evergreen catchment forest have bee lost for such plantations. The Secondary Riparian forest types in the Evergreen and Wet Evergreen Riparian forest types indicate the degradation of the adjacent forest types due to conversion into forest plantations mainly Teak. The secondary Moist Deciduous Riparian Vegetation degraded (IV. 26. Rip. c.ii) indicate maximum degradation of the adjacent lands use and others (IV. 26 Rip. b-c) indicate a gradient from less disturbed to heavily disturbed landuse the adjacent vegetation or catchment forests.

Indicators of river health

The health of a river system is depended on its quality of the catchment landuse (forests), natural flow and the quality of the riparian vegetation. The degradation of cathment forest and diversion and regulation of natural flow due to dams and reservoirs are the major reason depletion of water quality of the river basin and also has great impact on the biodiversity conservation. According to the present study the riparian plant communities found to respond accordingly with the

intervention in the natural flow of the river system and this could be used as a good indicator for monitoring river health.

The climax riparian vegetation types observed in the study area correspond to the rivers and stream with natural and perennial flow. The degraded riparian vegetation types found along varying gradient (controlled to diverted) stream flows. Highly degraded (less diverse and less dominant) vegetation type (IV. 26. Rip. c.ii) Secondary Moist Deciduous Riparian Forest-2 (Degraded) of Evergreen riparian types and the (II. 14. Rip c.) Secondary Dry Deciduous Degraded Riparian Forest in the Moist deciduous riparian types were found downstream to Poringalkuthu and Thunacadavu reservoirs indicate the impact of stream flow diversion. Hence, the riparian vegetation could be used as an indicator to asses the health and status of river system. Monitoring of its dynamics (Changes in community composition) in a long-term scale would indicate positive and negative effects of our interventions in the river basin. This could be used as a tool for the management and conservation of the river basin as whole.

Systematic Treatment

Amitha Bachan K.H. “Riparian flora of the Chalakkudy river basin and its ecological significance ” Thesis. Department of Botany , University of Calicut, 2010

Systematic Treatment

SYSTEMATIC TREATMENT

Artificial key to the families of Angiosperms

1a. Leaf venation reticulate; flowers usually 4 or 5-merous (except Annonaceae, Myristicaceae, *Sonerila*, *Lagerstroemia*); embryo with 2 cotyledons (Dicotyledons) 2

1b. Leaf venation parallel (except Araceae, Dioscoreaceae); flowers 3-merous; embryos with one cotyledon (Monocotyledons).....138

2a. Perianth absent or uniseriate (Monochlamydeae) 108

2b. Perianth always biseriate 3

3a. Inner perianth lobes (petals) free 4

3b. Inner perianth lobes (petals) united 74

4a. Ovary superior; flowers hypogynous or perigynous 5

4b. Ovary inferior; flowers epigynous 62

5a. Carpels free..... ..6

5b. Carpels united 9

6a. Flowers unisexual.....**4. Menispermaceae** (p.p.)

6b. Flowers bisexual.....7

7a. Flowers trimerous..... .....**3. Annonaceae**

7b. Flowers 4 or 5-merous.....8

8a. Ovules solitary in each carpel.....**1. Ranunculaceae** (p.p.)

8b. Ovules 2-many in each carpel.....**2. Dilleniaceae**

9a. Stamens 15 or less..... 10

9b. Stamens more than 15.....49

10a. Flowers zygomorphic..... 11

10b. Flowers actinomorphic.....16

11a. Ovary 1-locular.....12

11b. Ovary 2-many-locular.....13

12a. Stamens 8; fruit a drupe.....**13. Xanthophyllaceae**

12b. Stamens 9 or 10, fruit a legume or pod.....**43. Fabaceae** (p.p.)

13a. Fruit elastically opening; stamens confluent above.....
.....**26. Balsaminaceae**

13b. Fruit and stamens otherwise.....14

14a. Leave pinnate; parts of inflorescence produced into tendril.....
.....**39. Sapindaceae** (*Cardiospermum*)

14b. Leaves simple; parts of inflorescence not as above.....15

15a. Ovary 5-celled; capsule twisting; seeds not carunculate.....
.....**22. Sterculiaceae** (*Helicteres*)

15b. Ovary 2-celled; capsule not twisting; seeds carunculate.....
.....**12. Polygalaceae**

16a. Placentation parietal.....17

16b. Placentation otherwise 23

17a. Gynandrophore present.....18

17b. Gynandrophore absent.....19

18a. Tendrillate climbers; flower with 3-5 whorls of corolline corona.....
....**56. Passifloraceae**

18b. Erect shrubs or non tendrillate climbers; corolline corona absent
.....**8. Capparaceae** (p.p.)

19a. Insectivorous plants; leaves covered with sticky hairs
..... .**48. Droseraceae**

19b. Non insectivorous plants; leaves otherwise.....20

20a. Flowers unisexual.....**10. Flacourtiaceae** (p.p.)

20b. Flowers bisexual.....21

21a. Stamens antipetalous.....**10. Flacourtiaceae** (p.p.)

21b. Stamens alternipetalous.....22

22a. Fruit a globose capsule; trees or shrubs.....**11. Pittosporaceae**

22b. Fruit a linear capsule; herbs.....**8. Capparaceae** (p.p.)

23a. Ovary 1-celled.....24

23b. Ovary 2-many-celled.....31

24a. Placentation free-central.....25

24b. Placentation not free-central.....26

25a. Sepals 2; fruit a circumscissile capsule.....**15. Portulacaceae**

25b. Sepals 5; fruit not as above.....**14. Caryophyllaceae**

26a. Disc present below the ovary.....27

26b. Disc absent.....28

27a. Flowers polygamous; disc intra-staminal..**41. Anacardiaceae** (p.p.)

27b. Flowers all bisexual; disc extra staminal.....**32. Icacinaceae**

28a. Calyx lobes persistent on the wings of the fruit; branches with hooks.. .....**19. Ancistrocladaceae**

28b. Calyx not as above; branches without hooks.....29

29a. Flowers with few sterile carpels and one fertile carpel..... ..... **42. Connaraceae**

29b. Flowers with fertile carpels only.....30

30a. Fruit a pod or legume.....**45. Mimosaceae**

30b. Fruit a capsule or drupe.....**46. Rosaceae**

31a. Flowers perigynous; perianth tube present.....32

31b. Flowers hypogynous; perianth tube absent.....33

32a. Leaves strongly ribbed from base; anthers attenuate to the apex .....**53. Melastomataceae** (p.p.)

32b. Leaves not or slightly 3-ribbed from base; anthers orbicular to ovoid.. .....**54. Lythraceae** (p.p.)

33a. Staminal filaments united into a staminal tube.....34

33b. Staminal filaments free or united only at base..... 36

34a. Leaves simple; disc below the ovary absent.....**22. Sterculiaceae**

34b. Leaves usually pinnate; disc present.....35

35a. Anthers 5; base of the petiole sheathing; lateral nerves of leaf blade always opposite.....**37. Leeaceae**

35b. Anthers 4-12; base of the petiole not sheathing; lateral nerves of leaf blade not opposite..... .....**30. Meliaceae**

36a. Flowers strictly unisexual; ovary 3-celled.....**107. Euphorbiaceae**

36b. Flowers bisexual or rarely polygamous; ovary 1-5-celled.....37

37a. Disc below the ovary intra-staminal or absent.....38

37b. Disc below the ovary extrastaminal.....48

38a. Stamens opposite to petals.....39

38b. Stamens alternate to petals.....51

39a. Plants tendrillate climbers.....**36. Vitaceae**

39b. Plants without tendrils.....40

40a. Sepals valvate.....**35. Rhamnaceae**

40b. Sepals imbricate..... 41

41a. Petals 3; disc annular.....**40. Sabiaceae**

41b. Petals 5; disc 5-glandular.....**31. Dichapetalaceae**

42a. Stamens 3 only, filaments curved out... .....**34. Hippocrateaceae**

42b. Stamens 5-10; filaments erect.....43

43a. Leaves gland-dotted.....**28. Rutaceae**

43b. Leaves not gland-dotted.....44

44a. Leaves pinnate or palmate..... 45

44b. Leaves simple.....47

45a. Stamens 10 ; flowers umbellate.....**27. Oxalidaceae**

45b. Stamens 5 or 6; flowers in panicles.....46

46a. Petals 3; stamens 6 .....**29. Burseraceae**

46b. Petals 5; stamens 5.....**38. Staphyleaceae**

47a. Stamens equal to the number of sepals.....**33. Celastraceae**

47b. Stamens double the number of sepals.....**25. Malpighiaceae**

48a. Carpels 3, all fertile.....**39. Sapindaceae** (p.p.)

48b. Carpels only one, fertile.....**41. Anacardiaceae** (p.p.)

49a. Flowers strictly unisexual.....50

49b. Flowers bisexual or polygamous.....51

50a. Ovary 3-celled; styles 3, linear..... **107. Euphorbiaceae** (p.p.)

50b. Ovary 4-10-celled; styles short or absent.....
.....**17. Clusiaceae** (*Garcinia*)

51a. Leaves opposite 52

51b. Leaves alternate.....53

52a. Petals twisted; leaves decussate, small shrubs or herbs.....
.....**16. Hypericaceae**

52b. Petals imbricate; leaves bifarious; large trees with yellow or green juice.....**17. Clusiaceae**

53a. Placentation parietal.....54

53b. Placentation axile or basal.....56

54a. Seed covered by long cottony hairs.....**9. Cochlospermaceae**

54b. Seeds not as above.....55

55a. Gynandrophore present..... ..... **7. Capparaceae** (p.p.)

55b. Gynandrophore absent.....**10. Flacourtiaceae** (p.p.)

56a. Hypanthium cup present.....**46. Rosaceae**

56b. Hypanthium cup absent. 57

57a. Two sepals larger and persistent.....**18. Dipterocarpaceae** (p.p.)

57b. Sepals equal.....58

58a. Staminal filaments produced into a long staminal tube.....59

58b. Stamens free or if united not produced into a staminal tube.....60

59a. Sepals free; anther cells with 2-chambers..**22.Sterculiaceae** (p.p.)

59b. Sepals united; anther cells with one chamber.....**20. Malvaceae**

60a. Sepals united; stamens combined at base.....**21. Bombacaceae**

60b. Sepals and stamens free.....61

61a. Petals fimbriate above..... **24. Elaeocarpaceae**

61b. Petals entire .....**23. Tiliaceae**

62a. Stamens numerous, more than twice the number of sepals 75

62b. Stamens equal to pr twice the number of sepals.....65

63a. Leaves opposite, gland dotted.....**51. Myrtaceae**

63b. Leaves alternate, not gland-dotted.....64

64a. Flowers unisexual; sepals unequal.....**58. Begoniaceae**

64b. Flowers bisexual; sepals equal.....**52. Lecythidaceae**

65a. Leaves sheathing at base.....66

65b. Leaves not sheathing at base.....67

66a. Shrubs or trees; fruit a drupe .....**62. Araliaceae**

66b. Herbs or small shrubs; fruit a cremocarp with longitudinal ridges .....**61. Apiaceae**

67a. Tendrillate climbers; placentation parietal.....**57. Cucurbitaceae**

67b. Not tendrillate plants; placentation not parietal.....68

68a. Parasitic epiphytes with haustoria; calyx a truncate rim..... .....**105. Loranthaceae** (p.p.)

68b. Non parasitic; haustoria absent; calyx not as above.....69

69a. Flowers polygamous.....**50. Combretaceae** (p.p.)

69b. Flowers all bisexual.....70

70a. Leaves opposite.....71

70b. Leaves alternate.....72

71a. Petals smaller than sepals.... .....**49. Rhizophoraceae**

71b. Petals larger than sepals.....**53. Melastomataceae** (p.p.)

72a. Ovules many in each cell; petals caducus; flowers axillary, solitary .....**55. Onagraceae**

72b. Ovules few; petals not as above; flowers in clusters.....73

73a. Stamens twice the number of sepals; flowers axillary fascicles..... .....**64. Alangiaceae**

73b. Stamens equal to the number of sepals; flowers in terminal or axillary panicles..... .....**66. Cornaceae**

74a. Flowers epigynous.....75

74b. Flowers hypogynous.....80

75a. Parasitic epiphytes with haustoria; calyx rim like, truncate .....**105. Loranthaceae** (p.p.)

75b. Non-parasitic; haustoria absent; calyx not as above.....76

76a. Ovules parietal.....**57. Cucurbitaceae** (p.p.)

76b. Ovules basal or axile.....77

77a. Stamens 10 or more.....**72. Symplocaceae**

77b. Stamens 5 or equal to the calyx lobes.....78

78a. Ovary 1-celled; sepals modified into small spines or long cottony bristles (pappus) ....**65. Asteraceae**

78b. Ovary 2-many-celled; sepals not modified as above.....79

79a. Interpetiolar stipule present .....**63. Rubiaceae**

79b. Interpetiolar stipule absent..... .....**68. Caprifoliaceae**

80a. Flowers zygomorphic.....81

80b. Flowers ctinomorphic 92

81a. Scapigerous plants with insect catching bladders; sepals 2..... .....**86. Lentibulariaceae**

81b. Non scapigerous plants; insect catching bladders absent; sepals 4 or 5 82

82a. Leaves alternate or rosetted 83

82b. Leaves opposite or absent.....84

83a. Placentation parietal .....**87. Gesneriaceae** (p.p.)

83b. Placentaation axile..... **84. Scrophulariaceae** (p.p.)

84a. Leaves pinnately compound .....**88. Bignoniaceae**

84b. Leaves simple, rarely palmately 3-5-foliolate (*Vitex*) or absent ...85

85a. Leafless root parasites.....**85. Orobanchaceae**

85b. Leafy, non-parasites or semi-parasites.....86

86a. Ovules solitary in each cell of the ovary.....87

86b. Ovules 2-many in each cell of the ovary.....89

87a. Clusters of flowers surrounded by radiate involucral bracts.....
..... **90. Verbenaceae** (p.p.)

87b. Clusters of flowers not surrounded by involucral bracts.....88

88a. Style gynobasic; fruits of 4 nutlets.....**93. Lamiaceae**

88b. Style not gynobasic; fruit not of 4 nutlets....**90. Verbenaceae** (p.p.)

89a. Placentation parietal.....90

89b. Placentation not parietal.....91

90a. Anthers united in pairs..... **87. Gesneriaceae** (p.p.)

90b. Anthers not united in pairs.....**78. Gentianaceae** (p.p.)

91a. Placenta thick; anthers usually joined in pairs.....
....**84. Scrophulariaceae**

91b. Placenta thin; anthers free .....**89. Acanthaceae**

92a. Carpels free.....93

92b. Carpels united.....94

93a. Styles 2; staminal corona present.....**75. Asclepiadaceae**

93b. Styles 1; staminal corona absent.....**74. Apocynaceae**

94a. Leaves alternate..... ..95

94b. Leaves opposite.....102

95a. Ovules parietal..... 96

95b. Ovules not parietal.....97

96a. Aquatic herbs.....**80. Menyanthaceae**

96b. Tendrillate climbers..... ...**56. Passifloraceae** (*Adenia*)

97a. Flowers strictly unisexual.. .....**71. Ebenaceae**

97b. Flowers bisexual, rarely polygamous.....98

98a. Ovary1-celled.....**69. Myrsinaceae**

98b. Ovary 2-5-celled 99

99a. Stamens double the number of sepals or more.....**70. Sapotaceae**

99b. Stamens equal to the number of calyx.....100

100a. Ovules solitary in each cell of the ovary..... 101

100b. Ovules many in each cell of the ovary.....**83. Solanaceae**

101a. Style gynobasic; stamens equal..... **81. Boraginaceae** (p.p.)

101b. Style terminal; stamens unequal..... **89. Convolvulaceae**

102a. Stamens 2.....**73. Oleaceae**

102b. Stamens 4 or 5 103

103a. Ovules solitary in each cell of the ovary.....104

103b. Ovules few-many in each cell of the ovary.....105

104a. Corolla valvate.....**77. Loganiaceae** (p.p.)

104b. Corolla imbricate..... **90. Verbenaceae**

105a. Ovules parietal.....**87. Gesneriaceae** (p.p.)

105b. Ovules not parietal.....106

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106b. Calyx tube wingless.....107

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107b. Placenta thin.....**77. Loganiaceae** (p.p.)

108a. Aquatic herbs in flowing waters..... **98. Podostemaceae**

108b. Terrestrial or epiphytes.....109

109a. Leaflessroot-parasites.....**106. Balanophoraceae**

109b. Leafy plants or epiphytic parasites 110

110a. Ovary inferior or half inferior.....111

110b. Ovary superior.....113

111a. Ovary 1-celled; perianth calyx-like.....112

111b. Ovary 3-6-celled; perianth tubular, petal-like.....
..... **99. Aristolochiaceae**

112a. Ovules many.....**59. Datiscaceae**

112b. Ovules few.....**50. Combretaceae** (p.p.)

113. Flowers bisexual.....114

113. Flowers unisexual.....127

114a. Carpels free.....**1. Ranunculaceae**

114b. Carpels united.....115

115a. Anthers opening by valves.....**103. Lauraceae** (p.p.)

115b. Anthers opening otherwise.....116

116a. Disc present.....117

116b. Disc absent.....118

117a. Leaves 3-ribbed; fruit a drupe.....**35. Rhamnaceae**

117b. Leaves 1-ribbed.....**39. Sapindaceae**

118a. Perianth tubular.....119

118b. Perianth not tubular.....120

119a. Flowers supported by 5 sepals-like bracts at base.....
.....**94. Nyctaginaceae**

119b. Flowers not supported by bracts as above.....**104. Elaeagnaceae**

120a. Base of the petiole form of a closed tubular sheath (Ochrea) .....**97. Polygonaceae**

120b. Base of the petiole not forming a sheathing closed tube.....121

121a. Leaves pinnate..... **39. Sapindaceae** (p.p.)

121b. Leaves simple.....122

122a. Flowers collected in with yellow coloured bracts; xylem vessels absent .....**01. Chloranthaceae**

122b. Flowers not collected in with coloured bracts; vessels present..... 123

123a. Cells of ovary 3 or more.....124

123b. Cells of ovary 1.....126

124a. Ovules solitary in each cell; leaves alternate. **96. Phytolaccaceae**

124b. Ovules 2-many in each cell; leaves opposite in verticillate.....125

125a. Perianth united.....**54. Lythraceae** (p.p.)

125b. Perianth free.....**60. Molluginaceae**(*Mollugo*)

126a. Perianth chaffy.....**95. Amaranthaceae**

126b. Perianth not chaffy or absent.....**100. Piperaceae**

127a. Anthers open by valves.....**103. Lauraceae** (p.p.)

127b. Anthers open not by valves.....128

128a. Flowers inside a closed fleshy chamber (Hypanthodium)..... ....**109. Moraceae** (p.p.)

128b. Flowers not as above.....129

129a. Carpels elevated on a gynophore.....**22. Sterculiaceae** (p.p.)

129b. Carpels not elevated as above.....130

130a. Pistil 1-celled.....161

130b. Pistil 2-many-celled 172

131a. Female flowers 3-8 together in the axils of bracts along the..... raceme; male flowers with petals.....**5. Menispermaceae** (p.p.)

131b. Female flowers not as above; male flowers devoid of petals.....132

132a. Flowers densely packed in fleshy receptacle; maturing together in to a multiple fruit.....**109. Moraceae**(p.p.)

132b. Flowers and fruits otherwise.....133

133a. Seeds embedded in cottony hairs.....**111. Salicaceae**

133b. Seeds not embedded in cottony hairs.....134

134a. Seeds arillate; male flowers with a staminal column..... .....**102. Myristicaceae**

134b. Seeds not arillate; male flowers without staminal column.....135

135a. Ovule solitary.....136

135b. Ovules few.....137

136a. Stigma 1.....**110. Urticaceae**

136b. Stigmas 2 .....**108. Ulmaceae**

137a. Placentation parietal.....**10. Flacourtiaceae** (p.p.)

137b. Placentation otherwise.....**119. Euphorbiaceae** (p.p.)

138a. Ovary superior.....139

138b. Ovary inferior.....147

139a. Fruit a caryopsis *i.e.,* a grain covered by chaffy lemmas .....**129. Poaceae**

139b. Fruit otherwise.....140

140a. Perianth lobes sepal-like or absent.....141

140b. Perianth lobes corolla-like..... 145

141a. Fruit a 1-seeded achene; perianth absent; flowers arranged in spikelets..... .....**128. Cyperaceae**

141b. Fruit not a 1-seeded achene; perianth lobes present or absent; flowers not in spikelets..... 142

142a. Flowers dense on terminal heads on erect leafless scape.....**127. Eriocaulaceae**

142b. Flowers not as above.....143

143a. Fruit a woody syncarp.....**123. Pandanaceae**

143b. Fruit not a woody syncarp.....144

144a. Spadix unbranched.....**125. Araceae**

144b. Spadix branched.....**122. Arecaceae**

145a. Perianth lobes similar.....146

145b. Perianth lobes dissimilar, differentiated into inner petals and outer sepals .....**121. Commelinaceae**

146a. One stamen larger than others; marshy or aquatic herbs..... .....**120. Pontederiaceae**

146b. All stamens equal; terrestrial herbs.....**119. Liliaceae**

147a. Pollen grains collected in pollinia; seeds very minute..... .....**113. Orchidaceae**

147b .Pollen grains not collected into pollen-mass; seeds not minute... 148

148a. Flowers regular..... 149

148b. Flowers irregular.....151

149a. Flower unisexual.....150

149b. Flowers bisexual.....**117. Hypoxidaceae**

150a. Aquatic herbs.....**112. Hydrocharitaceae**

150b. Terrestrial or climbing shrubs.....**118. Dioscoreaceae**

151a. Anther with two anther lobes.....152

151b. Anther with only one anther lobe.....**116. Marantaceae**

152a. Leaves alternate; sheath spitted.....**114. Zingiberaceae**

152b. Leaves spiral; sheath tubular.....**115. Costaceae**

1. **RANUNCULACEAE** Juss.

Gen. Pl. : 231. 1789.

NARAVELIA Adanson

Fam. Pl. 2: 460, 581. 1763, *nom. cons.*

Naravelia zeylanica (L.) DC., Syst. Nat. 1: 167. 1817; Hook. f. & Thomson in Hook. f., Fl. Brit. India 1: 7. 1872; Dunn in Gamble, Fl. Pres. Madras 3. 1915; Manilal, Fl. Silent Valley 1. 1988; M. A. Rau in B. D. Sharma *et al.*, Fl. India 1: 106. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 24. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 48. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 35. 2005; N. P. Balakr. in P. Daniel, Fl. Kerala 1: 115. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 69. 2009. *Atragene zeylanica* L., Sp. Pl. 542. 1753. **Vathakkodi.**

Climbing shrubs, young shoots pubescent. Leaves trifoliolate; Leaflets broadly ovate, abruptly acute at apex, rounded at base, tomentose beneath, 10-12 x 5-8 cm, basally 5-ribbed, terminal leaflets modified into a trifid tendril; petiole 5-10 cm long, petiolule 2 cm long. Inflorescence a terminal or axillary panicle, 5-15 cm across. Flowers greenish-yellow, 1.5 cm across; sepals 4, ovate, pubescent outside, 0.6 cm; petals 10, clavate, green, to 7 mm long; stamens many, filaments flat, connective produced beyond the anthers; carpels 8, densely hairy. Achenes few, 0.7cm long, ellipsoid, with long feathery stigma, to 5 cm long.

Fl. & Fr. : December-March

Distribution: Endemic to South East India. Moist forests in the hills to lower plains. *Amitha Bachan 98821* (Chiklai, riparian forest, banks of Chalakkudy river, 50 m).

2. **DILLENIACEAE** Salisb.

Parad. Lond. 2: ad. t. 73. 1807

DILLENIA Linnaeus

Sp. Pl. 535. 1753.

Dillenia pentagyna Roxb., Pl. Coromandel. 1: 21, t. 20. 1795; Hook. f. & Thomson in Hook. f., Fl. Brit. India 1: 38. 1872; Dunn in Gamble, Fl. Pres. Madras 8. 1915; Hoogland, Blumea 7: 117. 1952; Manilal, Fl. Silent Valley 2. 1988; Majumdar in B. D. Sharma *et al.*, Fl. India 1: 156. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 25. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 49. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 36. 2005; N. P. Balakr. & K. G. V. S. Murthy in P. Daniel, Fl. Kerala 1: 122. 2005.

Vazhapunna. **Plate 9.a**

Medium sized deciduous trees to 25 m high; bark smooth, leaf scars V-shaped, prominent. Leaves simple, alternate, clustered at the tip of branchlets, estipulate, obovate to oblong-oblanceolate, to 60 x 25 cm, acute or attenuate at base, obtuse at apex, serrate, glabrous above, puberulent beneath; lateral nerves many; petiole to 5 cm long, sheathing, winged. Flowers bisexual, fascicled on old branches, yellow, fragrant, to 3 cm across; sepals 5, obovate or elliptic, to 1 cm long, glabrous, accrescent; petals 5, obovate, to 2 cm, obtuse, bright yellow; stamens numerous, yellow in 2 series; carpels 5-10, cohering, unilocular, ovules many. Fruit aggregate of berries, drooping, subglobose, 1.5 cm acorss, fleshy, yellow, orange or red, subtended by persistent sepals.

Fl. & Fr. : February -June.

Distribution : Indo-Malaysia. Moist forests. Riparian area with exposed rocky terrain. *Amitha Bachan 123355* (Vazhachal, on exposed rocky riparian zone, banks of Chalakkudy river, 200 m).

3. **ANNONACEAE** Juss.

Gen. Pl. 283. 1789.

Key to Genera

1a. Petals equal or subequal.....2

1b. Petals unequal.....5

2a. Climbers.....3

2b. Eerect trees or shrubs.....4

3a. Flowers on hooked peduncles.....**Artabotrys**

3b. Flowers not on hooked peduncles..... **Desmos**

4a. Flowers sessile; fruitlets 2 or more seeded.....**Meiogyne**

4b. Flowers pedicelled; fruitlets 1-seeded..... **Polyalthia**

5a. Connectives widened above the anthers 6

5b. Connectives not widened, apiculate.....7

6a. Inner petals shorter than the outer; lateral nerves of leaf lamina looping into an intramarginal vein.....**Goniothalamus**

6b. Inner petals larger than the outer; lateral nerves of leaf lamina not looping into an intramarginal vein.....**Phaeanthus**

7a. Inner petals clawed, with nectaries.....**Orophea**

7b. Inner petals not clawed, without nectaries.....**Miliusa**

ARTABOTRYS R. Brown

Bot. Reg. 5: 423. 1820.

Artabotrys zeylanicus Hook. f. & Thomson, Fl. India 128. 1855 & in Hook. f., Fl. Brit. India 1: 54. 1872; Dunn in Gamble, Fl. Pres. Madras 14. 1915; Manilal, Fl. Silent Valley 2. 1988; Deb. Mitra in B. D. Sharma

et al., Fl. India 1: 253. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 26. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 51. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 40. 2005; N. Mohanan in P. Daniel, Fl. Kerala 1: 131. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 74. 2009. **Manoranjini.**

Woody climber, young parts pubescent, peduncles hooked which later support the plant in climbing. Leaves 8-20 x 3-5 cm, oblong or elliptic oblong, acuminate, base rounded or truncate, glabrous; lateral nerves 5-8 pairs. Flowers singly or few on leaf opposed peduncles, hooks compressed. Sepals 3, to 5mm long, ovate. Petals 3 + 3, 2-3 cm long, linear-lanceolate, pubescent. Stamens many, concealed. Carpels many, subglobose, silky without; ovules 2 in each carpel. Fruit aggregate; fruitlets sessile, ovoid or ellipsoid, seeds 1 or 2.

Fl & Fr. : August-December

Distribution : Endemic to Peninsular India and Sri Lanka. Riparian evergreen forests *Amitha Bachan 72015* (Pokalppara, riparian vegetation banks of Chalakkudy river, 240 m).

DESMOS Louriero

Fl. Cochinch. 1: 352. 1790.

Desmos viridiflorus (Bedd.) Safford, Bull. Torrey Bot. Club 39: 506. 1912; Deb. Mitra in B. D. Sharma *et al.*, Fl. India 1: 262. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 27. 1996; M. Mohanan in P. Daniel, Fl. Kerala 1: 144. 2005. *Unona viridiflora* Bedd., Icon. Pl. India Orient. t. 158. 1868-1874; Hook. f. & Thomson, in Hook. f., Fl. Brit. India 1: 60. 1872; Dunn in Gamble, Fl. Pres. Madras 15. 1915.

Woody climbers, young shoots rufous. Leaves 7-15 x 3 cm, alternate, ovate, lanceolate, acuminate, base obtuse, rounded or cordate; petiole to 7 mm long. Flowers solitary, axillary or extra axillary, pedicels

slender with a cordate bract at middle. Sepals ovate-lanceolate, 1-2 cm long, dark green. Petals 3+3, inner 2-4.5 x 1.5 cm, inner petals narrower, silky pubescent.

Fl & Fr. : February - April

Distribution : Endemic to Southern Western Ghats, Endangered. Evergreen forests along banks of rivers, *Amitha Bachan 72027* (Pokalppara, riparian forests, banks of Chalakkudy river, 240 m).

GONIOTHALAMUS (Blume) J.D. Hooker & T. Thomson

Fl. India 105. 1855.

Goniothalamus wightii Hook. f. & Thomson, Fl. India 106. 1855 & in Hook. f., Fl. Brit. India 1: 76. 1872; Bedd., Icon. Pl. India Orient. t. 63. 1868-1874; Dunn in Gamble, Fl. Pres. Madras 18. 1915; Deb. Mitra in B. D. Sharma *et al.*, Fl. India 1: 240. 1993; N. Mohanan & Sivad., Fl. Agasthyamala 56. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 43. 2005; M. Mohanan in P. Daniel, Fl. Kerala 1: 148. 2005. **Plate 9. C & D**

Large shrubs. Leaves 8-18 x 2-4 cm, linear–lanceolate, acute at apex, acute or broadly attenuate at base, nerves looping at margins. Flowers solitary; pedicel to 1 cm, pubescent. Sepals 3, broadly ovate, to 5mm long. Petals 3+3; outer larger, ovate, flat, clawed, covering above stamens when young. Stamens many; anthers concealed. Carpels many, 3-4 mm long, oblong; style short; stigma 2-fid. Fruit aggregate; fuitlets to 1.5 cm long, oblong.

Fl & Fr. : January - June

Distribution : Endemic to Southern Western Ghats, Riparian evergreen forests *Amitha Bachan 99080* (Sholayar, riparian evergreen forests, banks of Sholayar river, 900 m).

MEIOGYNE Miquel

Ann. Mus. Bot. Lugd.-Bat. 2: 12. 1865.

Key to species

1. Leaves oblong, to 7cm wide; flowers sessile.....**M. ramarowii**

1. Leaves ovate, to 3 cm wide; flowers subsessile.....**M. pannosa**

Meiogyne pannosa (Dalzell) J. Sinclair, Sarawak Mus. J. 5: 604. 1951; Debika in B. D. Sharma *et al.*, Fl. India 1: 266. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 27. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 56. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 43. 2005; M. Mohanan in P. Daniel, Fl. Kerala 1: 149. 2005. *Unona pannosa* Dalz. in Hooker's J. Bot. Kew. Gard. Misc. 3: 207. 1851; Hook. f. & Thomson, in Hook. f., Fl. Brit. India 1: 58. 1872; Dunn in Gamble, Fl. Pres. Madras 14. 1915. *Desmos pannosus* (Dalzell) Saff., Bull. Torrey Bot. Club 39: 506. 1912.
Panthalmaram. **Plate 9.b**

Small trees, young shoots puberulous. Leaves 2-7 x 1.5-3 cm, elliptic-ovate, simple, alternate, distichous, estipulate; base obtuse or rounded; apex acuminate or caudate acuminate; margin entire, coriaceous; petiole 5-9 mm long, slender, pubescent; intercostae reticulate. Flowers subsessile, axillary or terminal, solitary, yellowish-green; sepals 3, 4-6 x 4-5 mm, ovate, tomentose outside, glabrous inside, connate at base; petals 3+3, 2.5-5 x 0.5-1.5 cm, outer clawed, inner erect and smaller, oblong-lanceolate; stamens numerous, cuneate, connective broad, concealing the anthers, capitate; carpels many, sessile or subsessile, oblong, 2-2.5 mm long, strigose; ovules 2-8 in one row, stigma capitate. Fruit aggregate, fruitlets 12 x 8 mm, obovoid, fulvous tomentose, apiculate; seeds 1-3, globose, shiny.

Fl & Fr. : January - June

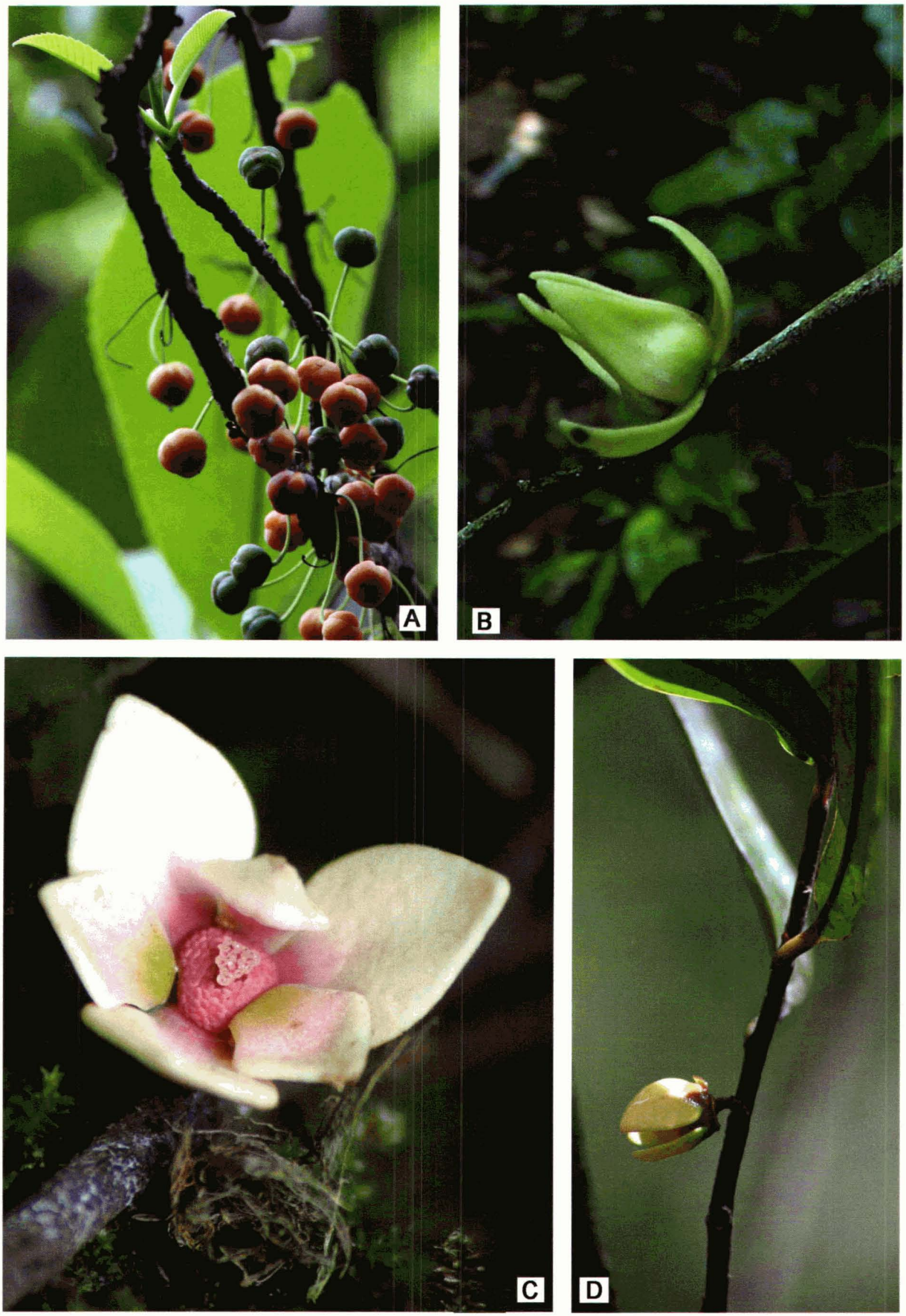


Plate 9. A. *Dillenia pentagyna* Roxb.; B.*Meiogyne pannosa* (Dalzell) J. Sinclair; C & D. *Goniothalamus wightii* Hook. f. & Thomson.

Distribution : Endemic to the Western Ghats. Evergreen forests. *Amitha Bachan 99144* (Vazhachal, riparian evergreen, banks of Chalakkudy river, 230 m).

Meiogyne ramarowii (Dunn) Gandhi in Saldanha & Nicolson, Fl. Hassan Dist. 38. 1976; Deb. Mitra in B. D. Sharma *et al.*, Fl. India 1: 266. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 27. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 45. 2005. *Unona ramarowii* Dunn, Bull. Misc. Inform. Kew 1914: 183. 1914; Dunn in Gamble, Fl. Pres. Madras 15. 1915. *Desmos ramarowii* (Dunn) Das, Bull. Bot. Surv. India 5: 42. 1963.

Large shrubs to small trees; branchlets hirsute. Leaves oblong or ovate acuminate, base truncate or rounded, glabrous above and tomentose below, nerves to 6-9 pairs, nervules parallel; petiole 8 mm long. Flowers dull white, sessile; sepals 12 x 6 mm, ovate, acute, hispid; petals lanceolate, saccate at base, densely hispid; carpels densely villous. Fruitlets 1-2.5 x 1 cm, oblong, shortly stalked, subglabrous, depressed between seeds; seeds 1-3, globose.

Fl & Fr. : January -June

Distribution : Endemic to Southern Western Ghats. Evergreen forests, *Amitha Bachan 123434* (Sholayar-Anakkyam thodu, riparian Vegetation, along banks of Anakkyam-Thodu, 600 m).

MILIUSA Leschenault ex Alph. de Candolle

Mem. Soc. Phys. Geneve 5: 213. 1832.

Miliusa tomentosa (Roxb.) Finet & Gagnep., Bull. Soc. Bot. France 4: 153. 1906; J. Sinclair, Gard. Bull. Singapore 14: 378. 1955; Deb. Mitra in B. D. Sharma *et al.*, Fl. India 1: 221. 1993; M. Mohanan in P. Daniel, Fl. Kerala 1: 153. 2005. *Uvaria tomentosa* Roxb., Pl. Coromandel t. 35. 1795. *Saccopetalum tomentosum* (Roxb.) Hook. f. & Thomson, Fl. India

152. 1855 & in Hook. f., Fl. Brit. India 1: 88. 1872; Dunn in Gamble, Fl. Pres. Madras 22. 1915. **Kanakaitha**.

Trees to 20 m high; twigs tomentose. Leaves simple, alternate, distichous to 14 x 6 cm, ovate, acute at apex, rounded at base, nerves 8-10 pairs; petiole 5 mm long, hispid. Flowers bisexual, greenish-yellow, solitary or a few together, leaf opposed or subterminal cymes, pedicels 3-7 cm long, very slender, tomentose; sepals 3, 5 x 1.5 mm, linear-lanceolate, tomentose; petals 6 (3+3), outer petals sepalloid, linear-lanceolate, 4-7 mm long, tomentose, inner ones ovate-oblong, saccate at base, obtuse, 1.5-2 x 0.5 cm, tomentose on both sides; stamens many, connectives apiculate, not concealing the anthers; carpels many, stalked, broadly ovate, brown tomentose; ovary curved, hispid, ovules 4-6; style absent; stigma oblong. Fruitlets 2.5 cm across, globose, glabrous; stipe 2-3 cm long. Seeds 4-5.

Fl. & Fr. : December-May

Distribution : India, Nepal and Sri Lanka. Moist forests. *Amitha Bachan 123613* (Athirappilly, riparian forests, along Chalakkudy river, 120 m).

OROPHEA Blume

Bijdr. 18. 1825.

Key to species

1a. Flowers solitary .....**O. sivarajanii**

1b. Flowers in cymes or fascicles.....2

2a. Twigs pubescent; flowers in cymes.....**O. erythrocarpa**

2b. Twigs glabrous; flowers in fascicles.....**O. uniflora**

Orophea erythrocarpa Bedd., Trans. Linn. Soc. London 20: 5. 1846 & Madras J. Lit. Sci. (n.s.) 6: 71. 1861 & Ic. t. 68. 1868-1874; Hook. f. & Thomson, in Hook. f., Fl. Brit. India 1: 91. 1872; Dunn in Gamble, Fl. Pres. Madras 24. 1915; Deb. Mitra in B.D. Sharma *et al.*, Fl. India 1: 224. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 29. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 59. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 45. 2005; M. Mohanan in P. Daniel, Fl. Kerala 1: 158. 2005.

Small trees; young plants softly pubescent. Leaves 5-14 x 2-5 cm, simple, alternate, distichous, estipulate, ovate, elliptic or oblong; base round or truncate; apex acuminate or acute, glabrous above, pubescent on the midrib beneath, membranous; lateral nerves 6-8 pairs, pinnate, prominent, intercostae scalariform.; petiole 3-4 mm, pubescent, stout, slightly grooved above. Flowers axillary; racemes tomentose, 7 mm across; pedicels 1-2 cm long, villous; sepals 3, broadly ovate, tomentose, 1.5 mm long; petals 3+3; outer petals 4 x 3 mm, orbicular, brown tomentose outside, glabrous inside; inner rhomboid, clawed, curved inward, pubescent at tips; stamens 12 in 2 rows, outer 6 imperfect, very small, connectives slightly apiculate at top; carpels 6; ovules 2; style short, stigma sessile; Fruit aggregate, fruitlets oblong, sessile, reddish, 2.5 cm long.

Fl & Fr. : February- June

Distribution : Endemic to Peninsular India and Sri Lanka. Riparian evergreen forest undergrowth, *Amitha Bachan 98926* (Orukombankutty, riparian forests, banks of Chalakkudy river, 400 m).

Orophea sivarajanii Sasidh., Nordic J. Bot. 19: 341. 1999; M. Mohanan in P. Daniel, Fl. Kerala 1: 159. 2005.

Shrub; young plants pubescent. Leaves 8-16 x 2-4 cm, simple, alternate, elliptic or elliptic-oblong; base round obtuse, slightly oblique; apex acuminate or acute or obtusely acute; lateral nerves 7-10 pairs, pinnate, prominent intercostae scalariform, midrib groved; petiole 2-4 mm, pubescent, stout; Flowers, axillary, solitary; pedicels 1-2 cm long, pubescent; sepals 3, broadly ovate, tomentose, 2 mm; petals 3+3; outer petals 4-8 mm long, tomentose outside; inner clawed.

Fl & Fr. : November - February

Distribution : Endemic to Southern Western Ghats. Riparian evergreen undergrowth, *Amitha Bachan 72039* (Vazhachal, riparian forests, banks of Chalakkudy river, 220m).

Orophea uniflora Hook. f. & Thomson, Fl. India 111. 1855 & in Hook. f., Fl. Brit. India 1: 90. 1872; Dunn in Gamble, Fl. Pres. Madras 24. 1915; Deb. Mitra in B. D. Sharma *et al.*, Fl. India 1: 229. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 32. 1996; M. Mohanan in P. Daniel, Fl. Kerala 1: 160. 2005. **Plate 10. A**

Shrubs or small trees; young shoots glabrous. Leaves 6 x 3 cm, elliptic-oblong or lanceolate, obtusely acuminate, base acute or rounded; lateral nerves 4-6 pairs; petiole 2 mm long. Flowers creamy yellow, solitary or axillary clusters; pedicel to 1.5mm long; petals glabrous. Stamens 12, two seriate.

Fl & Fr. : February – June.

Distribution : Endemic to Southern Western Ghats, Vulnerable. Evergreen riparian forests. *Amitha Bachan 99089* (Karanthodu, riparian forests, banks of Chalakkudy river, 400 m).

PHAEANTHUS J. D. Hooker & Thomson

Fl. India 1: 146. 1855.

Phaeanthus malabaricus Bedd., Icon. Pl. India Orient. t. 76. 1868-1874; Hook. f. & Thomson, in Hook. f., Fl. Brit. India 1: 72. 1872; Dunn in Gamble, Fl. Pres. Madras 17. 1915; Deb. Mitra in B. D. Sharma *et al.*, Fl. India 1: 230. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 32. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 59. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 45. 2005; M. Mohanan in P. Daniel, Fl. Kerala 1: 161. 2005. **Plate 10. B**

Shrubs; young shoots tomentose. Leaves 7-18 x 2-6.5 cm, elliptic, oblong-lanceolate, acute or caudate acuminate, broadly attenuate at base, glabrous; lateral nerves 8-12 pairs, joining along the margins; petiole 3 mm long. Flowers solitary, terminal or extra axillary, pedicels to 1.2 mm long. Sepals 3, to 2 mm long, ovate. Petals 3+3, outer smaller, sepal like, ovate; inner larger, 1.2 mm long, ovate lanceolate. Stamens many. Fruit an aggregate of red berries.

Fl & Fr. : February -June.

Distribution : Endemic to Southern Western Ghats (Kerala), Low risk. Riparian evergreen forests. *Amitha Bachan 98964* (Vazhachal, riparian evergreen forests, banks of Chalakkudy river, 220 m)

POLYALTHIA Blume

Fl. Jav. Annonac. 68. 1830.

Key to species

1a. Flowers in axillary racemes or fascicles.....2

1b. Flowers on tubercles on old wood.....**P. coffeoides**

2a. Leaves 4-12 cm broad, long-acuminate; berry irregularly wrinkled, pubescent.....**P. fragrans**

2b. Leaves <4cm broad, short acuminate; berry smooth, glabrous..... .....**P. longifolia**

Polyalthia coffeoides (Thwaites. ex Hook. f. & Thomson) Twwaites, Enum. Pl. Zey. 339/ Hook. f. & Thoms in Hook. f., Fl. Brit. India 1: 62. 1872; Dunn in Gamble, Fl. Pres. Madras 16. 1915; Manilal, Fl. Silent Valley 3. 1988; Deb. Mitra in B.D. Sharma *et al.*, Fl. India 1: 270. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 33. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 60. 2002; M. Mohanan in P. Daniel, Fl. Kerala 1: 164. 2005. *Guatteria coffeoides* Thwaites ex Hook. f. & Thoms, Fl. India 141. 1855. **Villa**. **Plate 10. C**

Trees 15-25 m tall; bark dark green, often mottled with greyish-white, young shoots slender, minutely puberulous; branches horizontally spreading. Leaves 10-28 x 4-8 cm, simple, alternate, distichous, young leaves red at first; oblong, oblong-lanceolate or elliptic-lanceolate, base obtuse, cuneate-round or acute; apex acute or acuminate, coriaceous, lateral nerves pinnate, 8-14 pairs, intercostae scalariform. petiole 10-13 mm, stout, glabrous; Flowers yellow, solitary, extra axillary or some times fascicled on woody tubercles on trunk; pedicels 1-4 cm long; sepals 3, 2 x 5 mm, tomentose; petals 3+3, 4 x 1 cm, yellow; stamens numerous, 1 mm long, cuneate, connectives concealing the anthers; carpels numerous, oblong; ovule one. Fruit aggregate of berries, 2.5 x 1.5 cm, ovoid, apiculate, dark purple.

Fl & Fr. : May -July.

Distribution : Endemic to South India and Sri Lanka. Evergreen forests, *Amitha Bachan 99088* (Sholayar, riparian forests, banks of Sholayar river 800 m).

Polyalthia fragrans (Dalzell) Bedd., Fl. Sylv. t. 74. 1871; Hook. f. & Thomson, in Hook. f., Fl. Brit. India 1: 63. 1872; Dunn in Gamble, Fl. Pres. Madras 16. 1915; Debika Mitra in Sharma *et al.*, Fl. India 1: 271. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 33. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 61. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 48. 2005. *Guatteria fragrans* Dalzell in Hooker's J. Bot. Kew Gard. Misc. 3: 200. 1851. **Nedunar.** **Plate 10. D**

Tall trees, buttressed; branches horizontal, spreading. Leaves 9-27 x 3-12 cm, simple, alternate, estipulate, elliptic to oblong-lanceolate; base acute, obtuse; apex acute to short acuminate; margin entire, glabrous and shiny above, slightly pubescent on veins beneath, lateral veins 16-21 pairs; petiole 10-15 mm long, stout, grooved above, glabrous. Flowers bisexual, greenish-yellow, fragrant, in few flowered cymes from the axils of fallen leaves or on tubercles; sepals 3, orbicular, 4 x 3 mm, pubescent; petals 3+3, subequal, linear-lanceolate, tomentose; stamens numerous, cuneate, connectives concealing the anther cells; carpels many, oblong-ovoid, ovules basal and ascending. Fruit aggregate of berries; berry 3-5, 1.5-2 cm, ovoid or ellipsoid.

Fl & Fr. : February-May.

Distribution : Endemic to Southern Western Ghats. Evergreen forests. *Amitha Bachan 98825* (Sholayar-Malakkapara, evergreen riparian, banks of Sholayar river, 800 m).

Polyalthia longifolia (Sonner.) Thwaites Enum. Pl. Zeyl. 398. 1864; Hook. f. & Thomson, in Hook. f., Fl. Brit. India 1: 62. 1872; Dunn in Gamble, Fl. Pres. Madras 16. 1915; Sasidh. & Sivar., Fl. Pl. Thrissur For. 34. 1996; M. Mohanan in P. Daniel, Fl. Kerala 1: 164. 2005. *Uvaria longifolia* Sonner., Voy. Aux. Indes 2: 233. pl. 131. 1782. **Aranamaram.**

Tall trees to 15-20 m, young branches spreading, pendulous, slender. Leaves simple, alternate, distichous, estipulate; 15-23 x 2-4 cm, ovate-lanceolate or lanceolate; base round; apex acuminate, coriaceous; lateral nerves up to 30 pairs, obscure; petiole 10-15 mm, pubescent when young, slender. Flowers bisexual, green; 2.5-3 mm long, numerous, in umbels or fascicles at the axis of fallen leaves; pedicels slender, 2-3 cm long; sepals 3, 4 x 4 mm, ovate, pubescent; petals 3+3, subequal, linear, broad at base, puberulous; outer petals 65 x 2 mm; inner ones 10-25 x 2.5 mm; stamens numerous, cuneate; carpels many, puberulous, ovoid. Fruit aggregate of berries, ovoid, small, smooth, reddish to black.

Fl & Fr. : August – March.

Distribution : Native of Sri Lanka; introduced to many Tropical countries

Amitha Bachan 98708 (Puthenvelikkara, riverside, banks of Chalakkudy river, sea level).

4. MENISPERMACEAE Juss.,

Gen. Pl. : 284. 1789.

ANAMIRTA Colebrooke

Trans. Linn. Soc. London 13: 52, 66. 1821.

Anamirta cocculus (L.) Wight & Arn., Prodr. Fl. India Orient. 446. 1834; Hook. f., Fl. Brit. India 1: 93. 1872; Dunn in Gamble, Fl. Pres. Madras 28. 1915; A. Pramanik in B. D. Sharma *et al.*, Fl. India 1: 311. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 35. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 50. 2005; M. Mohanan in P. Daniel, Fl. Kerala 1: 178. 2005. *Menispermum cocculus* L., Sp. Pl. 340. 1753. **Nanchuvalli.**

Large, woody climbers. Leaves alternate, coriaceous, broadly ovate, acute at apex, truncate at base, to 26 x 29 cm, 5-ribbed; petiole to 13 cm

long. Flowers unisexual, many, in large drooping panicles on old branches; sepals 6 in 2 rows, ovate, 3 x 2 mm, yellow; petals absent; stamens 9, capitate in many whorls on the top of the staminal column; anthers sessile, two-celled, opening transversely; female flowers: staminodes 9, obovate, scaly; carpels 3, free on a short gynophore; style absent; stigma recurved. Fruit of 1-3 drupes, 1 cm across, obliquely ovoid, smooth black when ripe; seeds 1, globose, black, glabrous.

Fl. & *Fr.* : August-October

Distribution: Indo-Malaysia. Common in evergreen forests. *Amitha Bachan 123382* (Vazhachal, riparian evergreen forest, banks of Chalakkudy river, 240 m).

COSCINIUM Colebrooke

Trans. L. Soc. London 13: 51. 1822.

Coscinium fenestratum (Gaertn.) Colebr., Trans. Linn. Soc. London 13: 65. 1822; Hook. f. & Thomson in Hook. f., Fl. Brit. India 1: 99. 1872; Dunn in Gamble, Fl. Pres. Madras 27. 1915; A. Pramanik in B. D. Sharma *et al.*, Fl. India 1: 313. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 36. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 65. 2002; M. Mohanan in P. Daniel, Fl. Kerala 1: 183. 2005. *Menispermum fenestratum* Gaertn., Fruct. Sem. Pl. 1: 219, t. 45, f.5. 1788. **Maramanjal.**

Climbing shrubs; stem deep yellow inside; young shoots hoary. Leaves ovate, acuminate at apex, truncate at base to 18 x 15 cm, deltoid, glabrous above and hoary below, basally 5-7-ribbed; petiole 8-12 cm long. Flowers in dense globular racemose or solitary heads; sepals 6; petals 3, elliptic; Stamens 6; carpels 3-6, densly pilose, subglobse; styles subulate, reflexed. Drupes and seeds globose.

Fl. & *Fr.* : August – October.

Distribution: Indo-Malaysia. Evergreen forests, rare. *Amitha Bachan 123439* (Sholayar-Karimalathodu, streamside vegetation in the evergreen forest, 900 m).

CYCLEA Arnott ex R. Wight

Ill. Indian Bot. 1: 22. 1840

Cyclea fissicalyx Dunn in Gamble, Fl. Pres. Madras 31. 1915 & Bull. Misc. Inform. Kew 1916: 60. 1916; Manilal, Fl. Silent Valley 5. 1988; M. Gangop. in B. D. Sharma *et al.*, Fl. India 1: 324. 1993; M. Mohanan in P. Daniel, Fl. Kerala 1: 185. 2005.

Twiner; stem striate. Leaves to 11 x 7 cm, ovate, sharply long acuminate, truncate at base, 5-nerved, reticulate, glabrous; petiole 2.5 cm long. Flowers 2 mm across, in large drooping panicles, glabrous, shortly pedicelled; peduncles slender; bracts foliar; calyx campanulate, divided nearly to the base, glabrous.

Fl. & Fr.: January - April

Distribution: Endemic to Kerala part of Southern Western Ghats. Rare. *Amitha Bachan 99020* (Orukombankutty, Parambikulam, riparian evergreen forests, banks of Chalakkudy river, 500 m).

Cyclea peltata Miers, Contr. Bot. 3: 236. 1871. *Cyclea peltata* (Lam.) Hook. f. & Thomson, Fl. India 201. 1855 & in Hook. f., Fl. Brit. India 1: 104. 1872; Dunn in Gamble, Fl. Pres. Madras 31. 1915; Manilal, Fl. Silent Valley 5. 1988; M.Gangop. in B. D. Sharma *et al.*, Fl. India 1: 325. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 36. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 66. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 51. 2005; M. Mohanan in P. Daniel, Fl. Kerala 1: 186. 2005. *Menispermum peltatum* Lam., Encycl. 4: 96. 1797. *Cyclea burmannii*

(DC.) Hook. f. & Thomson, Fl. India 201. 1855 & Hook. f., Fl. Brit. India 1: 104. 1872. *Clypea burmannii* Wight & Arn., Prodr. 1: 14. 1834. *Cyclea arnottii* Miers, Ann. Mag. Nat. Hist. ser. 3, 18:19.1866; Gamble, Fl. Pres. Madras 31.1915; V.S.Ramach. & V. J. Nair, Fl. Cannanore Dist. 42. 1988. *Cocculus burmannii* DC., Syst. Nat. 1: 517. 1817. **Padakizhangu.**

Herbaceous twiner, stem pubescent. Leaves ovate to oblong, acute, base shortly hastate, or truncate, thinly coriaceous, hairy on the veins. Flowers in axillary pedunculate panicles, staminate panicles longer than the pistillate; calyx globose or broadly campanulate, 4-5 lobed; petals 4-8; anthers 4-6, connate around a disk-like top of the staminal column. Fruits subglobose, white, 3-4 mm across.

Fl. & Fr.: April-May.

Distribution: Endemic to lower plains and hills of India and Sri Lanka. *Amitha Bachan 72087* (Vazhachal, riparian evergreen forests, banks of Chalakkudy river, 220 m); *Amitha Bachan 120440* (Sholayar- Meenchal-iyali, riparian vegetation in the evergreen forests, 850 m).

DIPLOCLISIA Miers

Ann. Mag. Nat. Hist (Ser. 2) 7: 37, 42. 1851

Diploclisia glaucescens (Blume) Diels in Engl., Pflanzenreich Menispermaceae. 225, t. 77. 1910; Dunn in Gamble, Fl. Pres. Madras 28. 1915; Manilal, Fl. Silent Valley 6. 1988; A. Pramanik in B. D. Sharma *et al.*, Fl. India 1: 327. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 36. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 66. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 51. 2005; M. Mohanan in P. Daniel, Fl. Kerala 1: 178. 2005. *Cocculus glaucescens* Blume, Bijdr. 25. 1825. *Cocculus macrocarpus* Wight & Arn., Prodr. Fl. India Orient. 13. 1834; Wight,

Illustr. Indian-Bot. 1: t. 7. 1840; Hook. f. & Thomson in Hook. f., Fl. Brit. India 1: 101. 1872. **Vattavalli, Malathangi.** **Plate 10. E-G**

Woody climber; stem ridged, old stem with 4-6 concentric rings of secondary wood. Leaves 4-8 x 5-9 cm, ovate to orbicular, obtuse or slightly acute at apex, truncate at base, glabrous above, glaucous below, membranous, 5–7 nerved from base, nerves pinkish, young leaves purplish; petiole to 12 cm long. Flowers unisexual, in large drooping panicles on old branches, bright yellow; sepals 6 in two whorls, 3 mm long, obovate; petals 6, smaller than sepals concave with incurved margins, 2 mm long, obovate, emarginated. Male flowers: stamens 6, enclosed by petals, staminodes absent. Female flowers: carpels 3, free, staminodes 6; style cylindric. Drupe compressed, curved, tubercled. Seeds curved.

Fl. & Fr.: February-April

Distribution: Indo-China and Malaysia. Evergreen forests. *Amitha Bachan 123383* (Vazhachal, riparian evergreen forests, along the banks of Chalakkudy river, 220 m).

STEPHANIA Loureiro

Fl. Cochinch. 608. 1790.

Stephania japonica (Thunb.) Miers, Ann. Mag. Nat. Hist. ser.3, 18: 14. 1866; Dunn in Gamble, Fl. Pres. Madras 29. 1915; Manilal, Fl. Silent Valley 6. 1988; M. Gangop. in B. D. Sharma *et al.*, Fl. India 1: 335. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 37. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 67. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 52. 2005; M. Mohanan in P. Daniel, Fl. Kerala 1: 189. 2005. *Menispermum japonicum* Thunb., Fl. Japan 193. 1784. *Cissampelos hernandifolia* Willd., Sp. Pl. 4: 861. 1806. *Stephania hernandifolia* sensu Hook. f. &

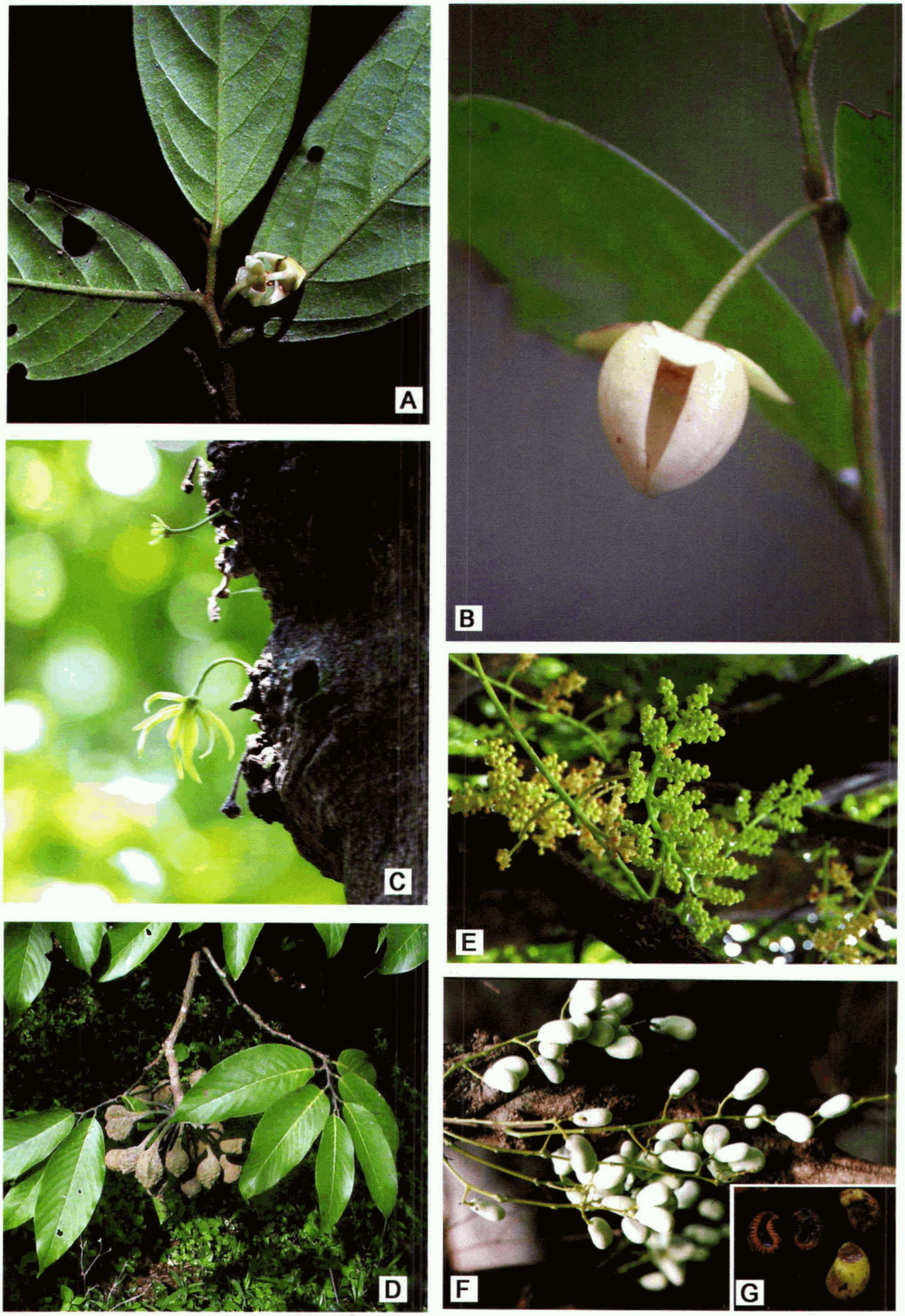


Plate 10. A. *Orophea uniflora* Hook. f. & Thomson; B. *Phaeanthus malabaricus* Bedd.; C. *Polyalthia coffeoides* Thw. ex Hook. f. & Thomson;D. *Polyalthia fragrans* (Dalzell) Bedd.; E-G. *Diploclisia glaucescens* (Blume) Diels, E. Inflorescence, F. infructescence, G. seeds.

Thomson in Hook. f., Fl. Brit. India 1: 103. 1872, non Walp. *Cyclea hernandifolia* (Willd.) Wight & Arn., Prodr. Fl. India Orient. 14. 1834. **Patavalli.**

Twining herb, stem ridged. Leaves peltate, broadly ovate, to 10 x 7 cm, truncate to cordate at base, acute at apex, palmately 7-9-nerved, glabrous on both surfaces; petiole to 9 cm long. Flowers on stalked axillary umbels, peduncle 3-5 cm long, erect, slender; flowers many, 2 mm across, sessile; sepals 5, free, glabrous; petals 5, oblong, glabrous, greenish-yellow. Drupe oblong to obovoid, curved, to 0.5 cm long, shortly stalked, glabrous; endocarp compressed, horse-shoe-shaped; seeds to 0.5 cm long, curved.

Fl. & Fr.. : March – September.

Distribution: Indo-Malaysia and Sri Lanka. Open areas in evergreen forests and grasslands. *Amitha Bachan 123386* (Sholayar-Karimala, open areas in evergreen streamside vegetation, 900 m).

TILIACORA Colebrooke

Trans. Linn. Soc. London 13: 53, 67.1821, *nom. cons.*

Tiliacora acuminata (Poir.) Miers ex Hook. f. & Thomson, Fl. India 187. 1855; Dunn in Gamble, Fl. Pres. Madras 28.1915; A. Pramanik in B. D. Sharma *et al.*, Fl. India 1: 343. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 37. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 52. 2005; M. Mohanan in P. Daniel, Fl. Kerala 1: 178. 2005. *Menispermum acuminatum* Poir. in Lam., Encycl. 4: 101. 1797. *Tiliacora racemosa* Coleb., Trans. Linn. Soc. London 13: 67. 1821; Hook. f., Fl. Brit. India 1: 99. 1872. **Vallikanjiram.**

Woody climbing shrubs. Leaves 6-13 x 3-6 cm, ovate-lanceolate, truncate or cordate at base, acuminate at apex, 3-5-nerved from base,

coriaceous; petiole to 1.5 cm long. Flowers yellow in axillary pendulous racemes or panicles. Sepals 6 in two series; outer sepals ovate, to 1.5 mm long; inner oblong, acute to 3.5 mm long; petals 6, to 1.5 mm long, obovate-obtuse, yellow. Male flowers: stamens 3-9, free, 2-3 mm long, dehiscing vertically. Female flowers: carpels 3-12, 1 mm long. Drupes 12 x 10 mm, oblong-ovoid to obovoid, orange- reddish.

Fl. & Fr.: September-March.

Distribution: India, Sri Lanka and S.E. Asia. Extensive climbers. *Amitha Bachan 72086* (Athirappilly-Pillappara, open areas in riparian zone, banks of Chalakkudy river, 80 m).

5. NYMPHAEACEAE Salisb.

Ann. Bot. (Koenig & Sims) 2: 70. 1805.

NYMPHAEA Linnaeus

Sp. Pl. 510. 1753, *nom. cons.*

Nymphaea nouchali Burm.f., Fl. India 120. 1768; R.L. Mitra in B. D. Sharma *et al.*, Fl. India 1: 426. 1993; N. Mohanan & Sivad., Fl. Agasthyamala 69. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 54. 2005. C. N. Sunil & Sivad., Fl. Alappuzha 46. 2009. *Nymphaea stellata* Willd., Sp. Pl. 2: 1153. 1799; Wight, Icon. Pl. India Orient. t. 178. 1839; Hook. f. & Thomson in Hook. f., Fl. Brit. India 1: 114. 1872; Dunn in Gamble, Fl. Pres. Madras 33. 1915. **Ambal.**

Perennial, stoloniferous, aquatic herbs. Leaves floating, orbicular, 10-25 x 8-20 cm, cordate at base with a deep sinus up to the attachment of petiole, apex rounded; margins dentateor entire, nerves radiating and dichotomously branching towards the periphery, green above and reddish purple beneath. Flowers white, solitary on long axillary scapes, sheathing at base; sepals 4, triangular-ovate, to 6 x 3 cm; petals many,

arising from receptacle; outer ones lanceolate to oblong-lanceolate, to 5 x 1.5 cm; stamens many; filaments 1.5-2.0 cm long, petaloid; carpels many, connate, sunk in the receptacle forming a many-celled ovary; ovules many; stigma sessile, incurved, radiating over the ovary. Berry, globose, 1.5-3.0 cm across, fleshy; seeds many, ellipsoid, 1.5 mm long, longitudinally ribbed.

Fl. & Fr.: throughout the year.

Distribution.: Indo- Malaysia and tropical Africa. Very common in fresh water pools, ponds, lakes and flooded paddy fields. *Amitha Bachan 123490* (Kanakkankadavu, banks of Chalakkudy river, sea level).

6. NELUMBONACEAE (DC.) Dumort

Anal. Fam. Pl. 53. 1829.

NELUMBO Adanson

Fam. 2:76.1763.

Nelumbo nucifera Gaertn., Fruct. 1: 73, t. 19, f. 2. 1788; R. L. Mitra in B. D. Sharma *et al.,* Fl. India 1: 441. 1993; Anil Kumar *et al.*, Fl. Pathanamthitta 54. 2005; R. L. Mitra & N. P. Balakr. in . Daniel, Fl. Kerala 1: 205. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 84. 2009. *Nymphaea nelumbo* L., Sp. Pl. 511.1753. *Nelumbium speciosum* Willd., Sp. Pl. 2: 1258. 1799; Wight & Arn., Prodr. 16. 1834; Hook. f. & Thomson in Hook. f., Fl. Brit. India 1:116.1872; Dunn in Gamble, Fl. Pres. Madras 34.1915. **Tamara.**

Rhizomatous aquatic herbs. Leaves flat, peltate, raised above water, suborbicular, 30-90 cm across, shallowly notched at one side, with minute apicula at opposite side, glabrous and glaucous on both surfaces, coriaceous, veins radiating; petiole to 1.5 m long, beset with scattered hard minute papillae. Flowers to 20 cm across, emergent, rose-

pinkish, fragrant. Perianth many, free; outer ovate or elliptic, concave, pinkish-green 2.5-4 x 2-2.5 cm; inner petal-like, elliptic, obtuse, rose-pinkish 5-10 x 2-5 cm. Stamens numerous; filaments 1-2 cm long; anthers 1-1.2 cm long, linear; connectives projecting. Receptacles 2-3.5 cm across, spongy. Carpels numerous, free, oblong, 6-8 x 2-3 mm, loosely embedded in pits on receptacle; stigma peltate; seeds smooth.

Fl. & Fr. : September - December.

Distribution: India, South-East Asia to far Eastern-Russia and N. Australia. In flooded lowlands, ponds and lakes, also grown as an ornamental plant. *Amitha Bachan 123491* (Elanthikkara, stream draining to Chalakkudy river, sea level).

7. CABOMBACEAE A. Rich.

Nouv. Elem. Bot. ed. 4: 420. 1828.

CABOMBA Aubl.

Hist. Pl. Guiane Franc. 1: 321.1775.

Cabomba caroliniana Gray, Ann. Lyc. N. Y. 4: 47. 1837; R.L. Mitra in Nayar *et al.*, Fasc. Fl. India 20: 6. 1990 & in B. D. Sharma *et al.*, Fl. India 1: 439. 1993; R. L. Mitra & N. P. Balakr. in . Daniel, Fl. Kerala 1: 205. 2005. Sunil, Fl. Alappuzha Dist. 85. 2009.*Cabomba aquatica* sensu Aley. & Inamdar, Curr. Sci. 47: 136. 1978, non Aubl. 1775.

Submerged aquatic herbs with highly dissected submerged leaves; stem branched, thinly mucilaginous, green to reddish-brown. Submerged leaves finely dissected, flabellate, to 5 cm across; terminal segments slightly spathulate; petiole to 2 cm long. Floating leaves linear-oblong to linear-elliptic, to 2 x 0.3 cm, peltate; petiole to 3.5 cm long. Flowers axillary, solitary, 1.5 cm across, pinkish; pedicels to 5 cm long; sepals 3, elliptic; petals obovate. base auriculate with a pair of yellow

spots, apex rounded, to 1cm long, Stamens 3-6. Carpels 2-4, divergent at maturity, puberulous. Seeds ovoid, to 0.3 cm across, covered with hygroscopic hairs.

F & Fr. : May – August.

Distribution: Native of N. America; introduced and naturalized in India. In fresh water canals and rivers. *Amitha Bachan 123489* (Kankkankadavu, aquatic, Chalakkudy river, sea level.)

8. CAPPARACEAE Juss.

Gen. Pl. 242. 1789.

Key to genera

1a. Shrubs or small trees.....2

1b. Herbs.....**Cleome**

2a. Shrubs armed with recurved stipular thorns..... **Capparis**

2b. Trees, unarmed.....**Crateva**

CAPPARIS Linnaeus

Sp. Pl. 503. 1753.

Capparis rheedei DC., Prodr. 1: 246. 1824; Sundararagh. in B.D. Sharma & N.P. Balakr., Fl. India 2: 285. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 40. 1996; R. L. Mitra & N. P. Balakr. in . Daniel, Fl. Kerala 1: 222. 2005. *Capparis heyneana* Wall. *ex* Wight & Arn., Prodr. 25. 1834; Hook. f. & Thomson in Hook. f., Fl. Brit. India 1: 174. 1872; Gamble, Fl. Pres. Madras 45. 1915. *Capparis baducca* sensu Jacobs, Blumea 12: 435. 1965, non L. 1753. **Plate 11.C**

Scandent Woody, shrubs; armed with small recurved stipular thorns. Leaves elliptic, 10-14 x 4-5 cm, rounded or obtuse at base, acute at apex, acuminte, subcoriaceous, glossy; petiole to 1 cm long. Flowers

few on terminal panicles, to 10-18 cm long. Flowers white with bluish patch on centre, fragrant, 6-10 cm across; bracts linear, to 4 mm long; pedicel to 1 cm long. Sepals subequal, ovate or orbicular, to 4 x 2.5 mm. Petals 4-6 cm long, ovate, apex obtuse. Gynophore 4-6 mm long; ovary 1.5 mm long, ovoid. Fruits 1.5-2 cm across, globose, orange-red. Seeds 1-3, 1 cm long.

Fl. & Fr. : February - June.

Distribution : Endemic to the Western Ghats. Rare. Evergreen and semi evergreen forests, usually along open riparian areas. *Amitha Bachan 99145* (Vazhachal, Riparian forest, Chalakkudy riverside, 240 m).

CLEOME Linnaeus

Sp. Pl. 671. 1753.

Key to species

1a. Leaves 3 foliolate.....**C. rutidosperma**

1b. Leaves 3-7 foliolate.....2

2a. Stem and leaves tomentose; flowers pink.....**C. spinosa**

2b. Stem viscous with glandular hairs; flowers yellow..... **C. viscosa**

Cleome rutidosperma DC., Prodr. 1: 241. 1824; Mukherjee, India For. 95: 237. 1969; *Cleome burmannii* sensu Hook. f. & Thomson in Hook. f., Fl. Brit. India 1: 170. 1872; Gamble, Fl. Pres. Madras 41. 1915; Sundararagh. in B. D. Sharma & N. P. Balakr., Fl. India 2: 313. 1993; Anil Kumar *et al.*, Fl. Pathanamthitta 55. 2005; Sundararagh. & N. P. Balakr. in P. Daniel, Fl. Kerala 1: 243. 2005; non Wight & Arn., 1834;

Annual herbs. Stem and leaves glabrous. Leaves 3-foliolate; leaflets subsessile, elliptic or ovate – lanceolate, to 3 x 1.5 cm, cuneate at base, acute at apex, membranous, glabrous; petiole to 4 cm long.

Flowers in lax, few-flowered, corymbiform, terminal racemes. Flowers to 1 cm across, purple; pedicels to 2 cm long, elongated in fruit. Sepals 4, lanceolate, 0.6 cm, apex acute. Petals 4, purple, obovate to oblong-spathulate, to 9 x 4 mm, rounded. Stamens 6. Ovary sessile, oblong-cylindric, 5-7 mm long, stigma cpitate. Capsules 5-6 cm long, linear-oblong, terete, glabrous. Seeds many, 1-1.5 mm across, yellow-brown.

Fl. & Fr. : February-August.

Distribution : Indo-Malaysia. Wet areas in the forests and plantations. *Amitha Bachan 72085* (Malakkapara, riparian, banks of Sholayar river, 1000 m).

Cleome spinosa Jacq., Enum. Carib. Pl. 26. 1760; Sundararagh. in B.D. Sharma & N. P. Balakr., Fl. India 2: 321. 1993; Sivar. & Sunil, Rheedea 5: 184. 1995; Sundararagh. & N. P. Balakr. in P. Daniel, Fl. Kerala 1: 245. 2005. **Plate 11.B**

Erect annual herbs. Stem and leaves viscous tomentose with glandular hairs. Leaves 5-7-foliolate; leaflets sessile, elliptic, to 5 x 2.5 cm, cuneate at base, acute or acuminate at apex, pubescent; petiole to 6 cm long. Flowers on terminal, lax, many-flowered, corymbiform racemes. Flowers 3-4 cm across, pinkish white; pedicels to 4 cm long, elongated in fruits. Sepals 4, lanceolate, 5-8 x 2-3 mm, apex acute. Petals 4, clawed, white, obovate to spathulate, to 3 x 1.5 cm, apex rounded, claw pink. Stamens 6, long ; filaments pink. Ovary sessile, oblong-cylindric, to 1 cm long, stigma capitate. Capsules linear-oblong, to 5 cm long, terete. Seeds many.

Fl. & Fr. : February – December.

Distribution : Native of Tropical South America, often cultivated. Riparian. *Amitha Bachan 99112* (Muthuvarachal, riparian, Karappara streamsides,

500 m); *Amitha Bachan 123332*, (Karanthodu, stream bed, Chalakkudy river, 400m); *Amitha Bachan 98983* (Sholayar, riparian, Sholayar River side, 700 m).

Cleome viscosa L., Sp. Pl. 672. 1753; Hook. f. & Thomson in Hook. f., Fl. Brit. India 1: 170. 1872; Gamble, Fl. Pres. Madras 41. 1915; Sundararagh. in B.D. Sharma & N.P. Balakr., Fl. India 2: 317. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 42. 1996; Mohanan & Sivad., Fl. Agasthyamala 69. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 55. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 93. 2009.

Erect profusely branched annual herbs. viscous with stalked glandular hairs. Leaves 3-5 or 7-foliolate; leaflets subsessile, elliptic or obovate to spathulate, to 2 x 0.8 cm, cuneate at base, ciliate on margins, obtuse to acute at apex, membranous, glandular pubescent; petiole to 4 cm long. Flowers on terminal, lax, few-flowered, corymbiform racemes. Flowers 1-1.5 cm across; pedicels to 1 cm long, elongated in fruit. Sepals 4, lanceolate, 7 x 3 mm, acute, glandular hairy without. Petals 4, yellow, obovate to oblong-spathulate, 5-12 x 3-5 mm, rounded. Stamens 12; filaments to 6 mm long, broadened at tip; anthers linear. Ovary sessile, oblong-cylindric, 5-8 mm long, glandular-hairy. Capsules linear-oblong, terete, to 6 cm long, striate, glandular hairy. Seeds many, 1-1.5 mm across, reniform, reddish-brown.

Fl. & Fr. : July-September.

Distribution : Pantropical, open areas of the forests and plains. Sandy streamsides or riverbanks. *Amitha Bachan 72084* (Sholayar, riverbanks and river beds, banks of Sholayar river, 800 m).

CRATEVA Linnaeus

Sp. Pl. 444. 1753.

Crataeva magna (Lour.) DC., Prodr. 1: 243. 1824; Jacobs, Blumea 12: 206. 1964; Sundararagh. in B. D. Sharma & N. P. Balakr., Fl. India 2: 324. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 42. 1996; Sundararagh. & N. P. Balakr. in P. Daniel, Fl. Kerala 1: 248. 2005. *Capparis magna* Lour., Fl. Cochinch. 330. 1790. *Crataeva nurvala* Buch.-Ham., Trans. Linn. Soc. London 15: 121. 1827; Anil Kumar *et al.*, Fl. Pathanamthitta 56. 2005. *Crataeva religiosa* var. *nurvala* (Buch.-Ham.) Hook. f. & Thomson in Hook.f., Fl. Brit. India 1: 172. 1872. **Neer-mathalam**.

Plate 11. A

Small trees; branchlets greyish-brown, lenticellate. Leaves palmately trifoliate; leaflets elliptic, elliptic-lanceolate, to 15 x 4 cm, cuneate at base, acuminate at apex, chartaceous, glossy, glaucous beneath; petiole to 8 cm long. Corymbs terminal, many-flowered. Flowers polygamous, fragrant, 3-4 cm across, cream coloured; pedicels 3-5 cm long. Sepals ovate-oblong, to 3 x 1.5 cm, acute. Petals obovate-obtuse, 2.5-3 x 1.5-2 cm, cream, clawed. Stamens many; filaments to 4 cm long, lilac. Gynophore to 4 cm long; ovary oblong-ellipsoid, 4 mm long. Fruits oblong-ellipsoid, to 4 cm, brown. Seeds dark brown, tubercled.

Fl. & Fr. : March – April

Distribution : Indo-Malaysia and China. Riverbanks in forests and plains. Evergreen riparian. *Amitha Bachan 72058* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m); *Amitha Bachan 98972* (Karanthodu, riparian forest, banks of Chalakkudy river, 400 m).

9. COCHLOSPERMACEAE

Planch., London J. Bot. 6: 305. 1847.

COCHLOSPERMUM Humboldt, Bonpland *et* Kunth.

Nova Gen. Sp. 5: 297. 1822, *nom. cons.*

Cochlospermum religiosum (L.) Alston in Trimen, Handb. Fl. Ceylon 6 (Suppl.): 14. 1931; Paul & Nayar, Fasc. Fl. India 19: 16. 1988; Balakr. in Sharma & Balakr., Fl. India 2: 383. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 43. 1996; N. P. Balakr. in P. Daniel, Fl. Kerala 1: 259. 2005. *Bombax religiosum* L., Sp. Pl. 512. 1753. *Cochlospermum gossypium* DC., Prodr. 1: 527. 1824; Hook. f. & Thomson in Hook. f., Fl. Brit. India 1: 90. 1872; Dunn in Gamble, Fl. Pres. Madras 50. 1915.

Plate 11. F

Small trees to 10 m tall; leafless during flowering. Leaves simple, alternate, palmately 3-5-lobed, 10-15 x 8-20 cm, cordate at base; 5-7 nerved from the base, palmate; lobes, elliptic-lanceolate, acute or acuminate at apex, entire to crenate-serrate, glabrous above, white tomentose beneath; petiole 6-20 cm long, stout, swollen at base, pubescent. Flowers bright yellow, to 10 cm across, in terminal panicles; sepals 5, obovate, 2.5 x 1.5 cm, unequal, tomentose, deciduous; petals 5, obovate, 5 x 3 cm, deeply emarginate; stamens many, inserted on a disc, shortly connate at base; ovary superior, 3-5-celled, globose; ovules many; style filiform. Capsule oblong- obovoid, leathery, brown to 8 cm, 5-valved; seeds many, black, curved, embedded in white cotton.

Fl. & Fr. : February- March.

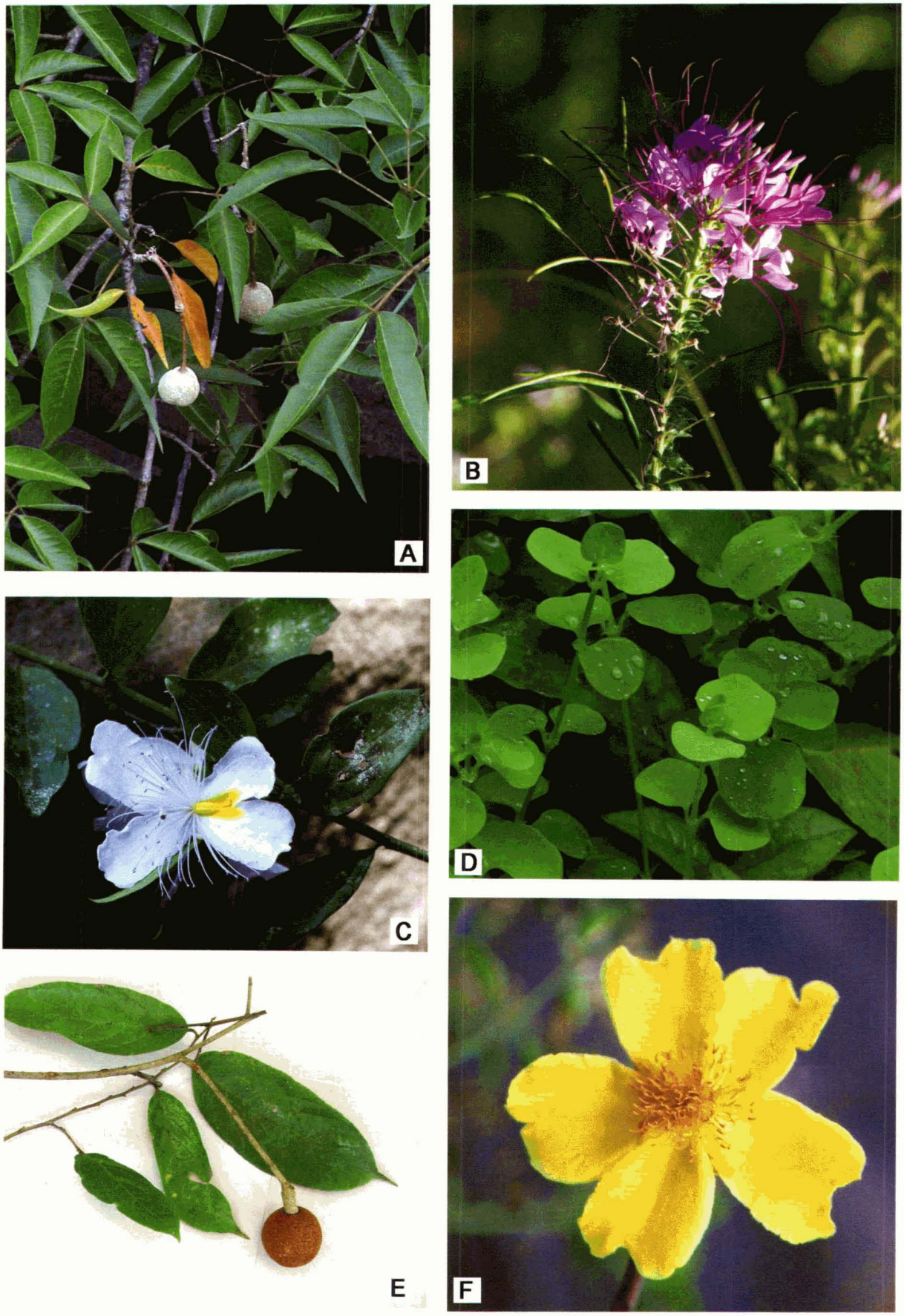


Plate 11 . A. *Crataeva magna* (Lour.) DC.; B. *Cleome spinosa* Jacq.; C. *Capparis rheedei* DC.; D. *Drymaria cordata* (L.) Willd. ex Roem. & Schult. subsp. *diandra* (Blume) Duke; E. *Hydnocarpus pentandra* (Buch.-Ham.) Oken; F. *Cochlospermum religiosum* (L.) Alston

Distribution: Indo-Malaysia. Moist and dry deciduous forests, usually on exposed rocks, exposed dry streamside. *Amitha Bachan 98998* (Ittiany-Athirappilly, exposed dry rocks along banks of Chalakkudy river, 140 m).

10. FLACOURTIACEAE Rich. ex DC.

Prodr. 1: 255. 1824.

Key to genera

1a. Petals present.....2

1b. Petals absent.....**Flacourtia**

2a. Flowers bisexual in racemes or panicles.....**Homalium**

2b. Flowers unisexual, in axillary fascicles.....**Hydnocarpus**

FLACOURTIA Commerson ex L' Heritier de Brutelle

Stirp. Nov. 59. 1786.

Flacourtia montana J. Graham, Cat. Pl. Bombay 10. 1839; Hook. f. & Thomson in Hook. f., Fl. India 1: 192. 1872; Dunn in Gamble, Fl. Pres. Madras 54. 1915; Manilal, Fl. Silent Valley 10. 1988; R. L. Mitra in B. D. Sharma & Balakr., Fl. India 2: 406. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 44. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 74. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 58. 2005; N. P. Balakr. in P. Daniel, Fl. Kerala 1: 271. 2005. **Kattu-loobi.**

Small thorny trees to 8 m high, thorns to 5 cm long, branched or simple. Leaves simple, alternate, spiral, elliptic, ovate to 22 x 7 cm, acute or round at base, acute or acuminate at apex, margin serrate, coriaceous, glabrous except midrib below, shining above; basally 3-5-nerved. Flowers unisexual, small, in axillary cymes, pubescent; sepals 4 tomentose, small, imbricate; petals absent; stamens many; anthers versatile; ovary superior, glabrous, 2-5-locular with 2 ovules in each cell;

styles 5, reflexed. Berry, globose, obtusely ribbed, 1 cm across, bright red, acidic, edible; seeds few, reddish.

Fl. & Fr. : April – June.

Distribution : Endemic to Peninsular India. Evergreen and semi evergreen forests. *Amitha Bachan 117715* (Vazhachal, riparian evergreen, banks of Chalakkudy river, 250 m).

HOMALIUM N. J. Jacquin

Enum. Pl. Carib. 5. 1760.

Homalium ceylanicum (Gardener) Benth., J. Proc. Linn. Soc., Bot. 4: 35. 1860 (as *zeylanicum*); Bedd., Fl. Sylv. S. India t. 210. 1872; C.B. Clarke in Hook. f., Fl. Brit. India 2: 596. 1879; Dunn in Gamble, Fl. Pres. Madras 522. 1915; Manilal, Fl. Silent Valley 10. 1988; R. L. Mitra in B. D. Sharma & N. P. Balakr., Fl. India 2: 410. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 45. 1996; N. P. Balakr. in P. Daniel, Fl. Kerala 1: 272. 2005. *Blackwellia zeylanica* Gardener in Calcutta J. Nat. Hist. 7: 452. 1847. *Homalium tetrandra* Wight, Icon. Pl. India Orient. t. 1851.1852. **Manthalamukhi.**

Medium sized evergreen trees, to 30 m high; branchlets puberulus. Leaves simple, alternate, broadly elliptic to 12 x 6 cm, attenuate at base, caudate acuminate at apex, margin crenate, glabrous, coriaceous. Lateral nerves 6-8 pairs, pinnate, fused at the margins forming intramarginal nerves; petiole 1.5 cm long, slender, slightly grooved above, pubescent. Flowers small, greenish-white, bisexual, in axillary racemes; sepals 4, ovate, pubescent; petals 4, oblanceolate, pubescent, inserted at the throat of the calyx; stamens 4, alternating with staminodes; ovary pubescent; single celled, ovules many on parietal placentation; styles 4. Fruit a capsule; seeds small, albumen fleshy.

Fl. & Fr. : February - July.

Distribution : Endemic to South India and Sri Lanka. Evergreen and semi-evergreen forests. *Amitha Bachan 98908* (Panjanamkuthu-Vazhachal, streamside vegetation, stream draining to Chalakkudy river, 280 m).

HYDNOCARPUS J. Gaertner

Fruct. 1: 288, t. 60. 1788.

Hydnocarpus alpina Wight, Icon. Pl. India Orient. t. 942. 1845; Hook f. & Thomson in Hook. f., Fl. Brit. India 1: 197. 1872; Dunn in Gamble, Fl. Pres. Madras 52. 1915; Manilal, Fl. Silent Valley 11. 1988; R. L. Mitra in B. D. Sharma & N. P. Balakr., Fl. India 2: 418. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 45. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 75. 2002; N. P. Balakr. in P. Daniel, Fl. Kerala 1: 275. 2005. *Hydnocarpus pendula* Manilal *et al.*, Trop. Plant. Sci. Res. 1: 355. 1983. **Malamaravatti.**

Small trees to 15 m; branchlets puberulus. Young leaves copper red. Leaves simple, alternate, drooping, elliptic-oblong or elliptic-lanceolate, to 22 x 8 cm, obtuse, acute, oblique at base, acute or acuminate at apex, entire, glabrous, glossy, coriaceous, lateral nerves 7-10 pairs; petiole to 1 long cm, grooved above and glabrous. Flowers unisexual 2 cm across, yellowish-white, solitary or in axillary fascicles; sepals 5, long, oblong, pubescent, 8 mm long, imbricate; petals 5, 1 cm long, narrow, glabrous, with a scale at the base; scales linear, as long as petals; stamens 5-15; filaments glabrous; connectives broad; ovary 1-celled, tomentose, stigmas 5, free, radiating, recurved. Berry 5-7 cm across, densely tomentose, dark brown.

Fl. & Fr. : February – July.

Distribution : Endemic to South India and Sri Lanka. Evergreen and semi-evergreen forests. *Amitha Bachan 123357* (Orukombankutty, Riparian evergreen, banks of Chalakkudy river, 400 m).

Hydnocarpus pentandra (Buch.-Ham.) Oken, Allg. Naturgesh 3: 1381. 1841; N. Mukh., Bull. Bot. Surv. India 14: 183. 1972; Nicolson *et al.* in Regnum Veg. 119: 147. 1988; R. L. Mitra in B. D. Sharma & Balakr., Fl. India 2: 422. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 46. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 59. 2005; N. P. Balakr. in P. Daniel, Fl. Kerala 1: 276. 2005. C. N. Sunil & Sivad., Fl. Alappuzha 97. 2009. *Chilmoria pentandra* Buch.-Ham., Trans. Linn. Soc. London 13. 501. 1822. *Hydnocarpus wightiana* Blume, Rumph. 4: 22. 1848; Hook f. & Thomson in Hook. f., Fl. Brit. India 1: 196. 1872; Dunn in Gamble, Fl. Pres. Madras 52. 1915. *Hydnocarpus laurifolia* (Dennst.) Sleum. in Engl., Bot. Jahrb. Syst. 69: 33. 1938. **Marotti.** **Plate 11.E**

Medium sized dioecious trees; branchlets pubescent. Leaves simple, alternate, elliptic or elliptic-oblong, 10-20 x 4-8 cm, acute at base, acuminate at apex, crenate, serrate or entire, glabrous, coriaceous, lateral nerves 6-8 pairs; petiole 1 cm long, stout, pubescent, grooved above; Flowers unisexual, 0.5-1 cm across, greenish-yellow, in small fascicle; sepals 5, broadly ovate, pubescent; petals 5, broadly ovate, greenish-yellow, with a scale at the base; scales half as long as petals, densely hairy; stamens 5-15; female flowers with staminodes; ovary globose, 1-celled, tomentose. Berry globose, 6 cm across, rough with uneven surface; seeds numerous, yellowish, obtusely angular.

Fl. & Fr. : December – May.

Distribution: Endemic to Western Ghats. Evergreen and semi-evergreen forests. *Amitha Bachan 72066* (Vazhachal, Evergreen riparian forests, 220 m).

11. PITTOSPORACEAE R. Brown

in Flinders, Voy. Terra Austr. 2: 542. 1814.

PITTOSPORUM Banks ex Solander

in Geartner, Fruct. 1: 286, t. 59. 1788.

Pittosporum neelgherrense Wight & Arn., Prodr. 154. 1834; Wight, Illustr. India Bot. 1: t. 70. 1840; Hook. f. & Thomson in Hook. f., Fl. Brit. India 1: 198. 1872; Dunn in Gamble, Fl. Pres. Madras 55. 1915; Manilal, Fl. Silent Valley 12. 1988; M.P. Nayar & G.S. Giri in B.D. Sharma & N.P. Balakr., Fl. India 2: 446. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 47. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 76. 2002; N. P. Balakr. in P. Daniel, Fl. Kerala 1: 283. 2005. **Analivegam**. **Plate 12. E**

Shrubs to small tree to 1.5 m high. Leaves simple, alternate, elliptic or elliptic-ovate, acuminate at apex, acute at base, to 12 x 3 cm, nerves indistinct; petiole 2 cm long, hirtus. Racemes 2-5-together, terminal, 2-3 cm long, stout, tomentose; pedicel 5 mm long. Sepals subulate, to 1.5 mm long. Petals yellow, oblong-lanceolate, to 8 mm long. Capsule globose, rugulose, brown, to 1 cm across; seeds 7-10, shining.

Fl. & Fr. : July-December.

Distribution: Endemic to Indian Subcontinent. Evergreen forests, banks of streams at medium to high elevations. *Amitha Bachan* 117770 (Sholayar, riparian forests, banks of Sholayar river, 700 m).

12. POLYGALACEAE R. Brown

in Flinders, Voy. Terra Austr. 2: 542. 1814.

Key to genera

1a. Keel petal crested; stamens 8.....**Polygala**

1b. Keel petal hooded; stamens 4.....**Salmonia**

POLYGALA Linnaeus

Sp. Pl. 701. 1753.

Key to species

1a. Flowers pink; capsule suborbicular.....**P. bolbothrix**

1b. Flowers yellow; capsule rhomboid..... **P. rosmarinifolia**

Polygala bolbothrix Dunn in Gamble, Fl. Pres. Madras 58. 1915, var. **bolbothrix** Manilal, Fl. Silent Valley 14. 1988; R. N. Banerjee in B. D. Sharma & N. P. Balakr., Fl. India 2: 462. 1993; Anil Kumar *et al.*, Fl. Pathanamthitta 61. 2005; R. N. Banerjee & N. P. Balakr. in P. Daniel, Fl. Kerala 1: 292. 2005. *Polygala ciliata sensu* Wight & Arn., Prodr. 38. 1834, *non* L. 1753. *Polygala ramaswamiana* Mukerjee var. *palniensis* Mukerjee, J. Bombay Nat. Hist. Soc. 53: 56. 1955 & Bull. Bot. Soc. Bengal 12: 38. 1958. *Polygala ramaswamianus* f. *devicolamensis* Mukerjee, J. Bombay Nat. Hist. Soc. 53: 56. 1955. *Polygala bolbothrix* Dunn var. *devicolamensis* (Mukerjee) R. N. Banerjee in B. D. Sharma & N. P. Balakr., Fl. India 2: 463. 1993; R. Banerjee & N. P. Balakr. in P. Daniel, Fl. Kerala 1: 301. 2005.

Diffuse herbs; whole plant bulbous hairy. Leaves obovate or elliptic oblong, to 1-1.5 x 0.5-0.6 cm, obtuse to slightly emarginated at apex, cuneat at base; petiole 0.1 cm long; racemes 2-4 cm long, 2-4-flowered, extra axillary; pedicels 3-4 mm long. Flowers pink; outer sepals ovate, acute, 2 x 1 mm, densely hairy; wing sepals ovate, acuminate, 4 x 2 mm; corolla pink, keel crested with 2 mm long filiform appendage, dorsal petal 3 x 2 mm. Stamens 8; sheath cleft at apex. Capsule suborbicular, 3.5 x 3 mm, densely bulbous based hairy along the margins; seeds oblong, 3 x 1.5 mm black hairy; caruncle 1.5 long, 3-toothed.

Fl. & Fr. : July-December

Distribution: Endemic to Southern Western Ghats. Open grasslands in the evergreen forests and streamside vegetation. *Amitha Bachan 117763* (Karimala, rocky streamside vegetation, banks of streams draining to Sholayar river, 1100 m).

Polygala rosmarinifolia Wight & Arn., Prodr. 37. 1834; Benn. in Hook. f., Fl. Brit. India 1: 204. 1872; Dunn in Gamble, Fl. Pres. Madras 58. 1915; R. N. Banerjee in B.D. Sharma & N.P. Balakr., Fl. India 2: 480. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 47. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 78. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 62. 2005; R. Banerjee & N. P. Balakr. in P. Daniel, Fl. Kerala 1: 301. 2005.

Erect herbs, glabrous. Leaves linear-oblong, to 2.5 x 0.3 cm, acute, scabrous. Racemes 1.5 cm long, axillary or extra axillary, 3-5-flowered. Flowers yellow; pedicels 2 mm long, outer sepals ovate-lanceolate, 1.5 x 1 mm, obtuse, ciliate; inner sepals obliquely ovate-elliptic, 5 x 2 mm, curved, ciliate; corolla yellow, wing petals 2.5 x 2 mm, oblong; dorsal petal 2 x 3 mm, erect, stalked, crested with shortly forked filiform appendages. Capsule rhomboid, 4.5 x 3 mm, pubescent; seeds oblong, 3 x 1 mm, pubescent, black.

Fl. & Fr. : July-December

Distribution: Endemic to India and Sri Lanka. Open grasslands and streamside vegetation in Evergreen forests. *Amitha Bachan 117742* (Nelliyampathy, open vegetation in the rocky streamsides, banks of stream draining to Karappara river, 1100 m).

SALOMONIA Louriero

Fl. Cochinch. 1.1790, *nom. cons.*

Salomonia ciliata (L.) D C., Prodr. 1: 334: 1824; Benn. In Hook. f., Fl. Brit. India 1: 206. 1872; R. N. Banerjee in B. D. Sharma & N. P. Balakr., Fl. India 2: 490. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 48. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 64. 2005; R. Banerjee & N. P. Balakr. in P. Daniel, Fl. Kerala 1: 305. 2005. *Polygala ciliata* L., Sp. Pl. 705.1753. *Salomonia oblongifolia* DC., Prodr. 1: 334. 1824; Benn. In Hook. f., Fl. Brit. India 1: 206. 1872; Dunn in Gamble, Fl. Pres. Madras 56. 1915.

Annual erect small herbs, stem angular, narrowly winged. Leaves sessile, very small, linear-oblong, to 0.7 x 0.3 cm, acute at apex, truncate at base, hairy along margins. Spikes slender, terminal to 5 cm long. Flowers small, to 0.2 cm long; sepals lanceolate, ciliate. Petals 3, pink, lateral broadly-ovate, keel galeate; stamens 4, monoadelphous. Ovary elliptic, 2-locular, margin toothed; seed black.

Fl. & Fr. : September-November.

Distribution: Endemic to India. Open grasslands and rocky streamside vegetation. *Amitha Bachan 98793* (Nelliyampathy, streamside vegetation, banks of stream draining to Karappara river, 1000 m).

13. XANTHOPHYLLACEAE (Chodat) Gagnep. ex Reveal & Hoogland

Bull. Mus. Natl. Hist. Nat., B, Adansonia Sér. 4. 12(2): 206. 1990.

XANTHOPHYLLUM Roxburgh

Pl. Coramandel 3: 81. 1820 (1819), *nom. cons.*

Xanthophyllum arnottianum Wight, Illustr. India Bot. 1: 50. t. 23. 1840; Manilal, Fl. Silent Valley 16. 1988; Sasidh. & Sivar., Fl. Pl.

Thrissur For. 48. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 80. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 64. 2005. *Xanthophyllum flavescens* sensu Bennett in Hook. f., Fl. Brit. India 1: 209. 1874, *non* Roxb. 1814; Dunn in Gamble, Fl. Pres. Madras 59. 1915; R. N. Banerjee & N. P. Balakr. in B. D. Sharma & N. P. Balakr., Fl. India 2: 497. 1993; R. Banerjee & N. P. Balakr. in P. Daniel, Fl. Kerala 1: 307. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 99. 2009. *Xanthophyllum angustifolium* Wight, Ill. 1: 50. t. 23.1840. **Madakka.**

Small trees; crown spreading; branchlets puberulus. Leaves alternate, simple, ovate, lanceolate, 7-15 x 3-7 cm, acuminate at apex, acute at base, glabrous, shining, drying to yellow; nerves 5-7 pairs; petiole 0.5 cm long. Flowers zygomorphic, in terminal or axillary panicled racemes; sepals 5, subequal, ovate, to 3 x 2 mm, acute; petals yellow, unequal, lower one boat-shaped, pubescent; others ovate, to 10 x 4 mm; stamens 8, filaments free, adhered to the base of petals in pairs; ovary 1-celled; ovules 4-16, style curved; disc 5-lobed. Drupe globose, 2 cm across, rugose, 1-seeded.

Fl. & Fr. : September-March.

Distribution: Endemic to the Western Ghats. Evergreen riparian forest. *Amitha Bachan 72013* (Pokalppara, riparian forest, banks of Chalakkudy river, 240 m).

14. CARYOPHYLLACEAE Juss.

Gen. Pl. 299. 1789.

DRYMARIA Willdenow ex J.A. Schultes

in J.J. Romer & J.A. Schultes, Syst. Veg. 5: 406. 1819-1820.

Key to genera

1. Leaves ovate, reniform; stamens 2-3..... **Drymaria**

2. leaves linear-spathulate; stamens 5.....**Polycarpon**

Drymaria diadra Blume, Bijdr. 62. 1825; Majumdar in B. D. Sharma & N. P. Balakr., Fl. India 2: 533. 1993; P. Daniel, Fl. Kerala 1: 310. 2005. *Drymaria cordata* auct. Non. Willd. Ex Roem. & Schult. 1819; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1:244.1874; Dunn in Gamble, Fl. Pres. Madras 63. 1915. *Drymaria cordata* (L.) Willd. ex Roem. & Schult. subsp. *diandra* (Blume) Duke, Ann. Miss. Bot. Gard. 48: 253. 1961; Majumdar, Bull. Bot. Surv. India 10: 294. 1969; Manilal, Fl. Silent Valley 17. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 49. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 67. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 100. 2009.

Plate 11.D

Spreading, prostrate, annual, slender herbs; rooting at nodes. Leaves ovate, reniform, to 1.5 x 2 cm, round at apex, cordate at base; stipules interpetiolar, 1-2 mm long, lacerate. Flowers in terminal or axillary lax cymes; pedicels 2-4 mm long; bracts 2-3 mm long, lanceolate. Sepals 5, oblong, 2-4 mm long, keeled. Petals 3-5, 2-fid, oblong, 2-3 mm long, white. Stamens 2-3. Ovary trigonous; ovules 5-6; style 3-fid. Capsule trigonous, to 2 mm long, 2-3-valved. Seeds orbicular, tuberculate.

Fl. & Fr. : Throughout the year.

Distribution : Paleotropics. Moist localities, stream and riversides. *Amitha Bachan 72075* (Karapara-Nelliyampathy, riparian, Karappara river, 900 m); *Amitha Bachan 98962* (Vazhachal, riparian, Chalakkudy riverside, 220 m).

Polycarpon prostratum (Forssk.) Asch. & Sehweinf., Osterr. Bot. Z. 39: 128. 1889; Majumdar in B. D. Sharma & N. P. Balakr., Fl. India 2: 553. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 49. 1996; Anil Kumar *et al.*,

Fl. Pathanamthitta 67. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 101. 2009. *Alsine prostrata* Forssk., Fl. Aeg.-Arab. 207. 1775. *Polycarpon loeflingiae* (Wall. ex Wight & Arn.) Benth. ex Edgew. & Hook. f., Fl. Brit. India 1: 245. 1874; Dunn in Gamble, Fl. Pres. Madras 64. 1915. *Hapalosa loeflingiae* Wall. ex Wight & Arn., Prodr. 358. 1834.

Annual prostrate herbs; pubascent. Leaves subsessile, linear-oblong, obovate or spathulate, to 1.5 X 0.5 cm, acute to obtuse at apex, attenuate at base, puberulous; stipules lanceolate, to 3 mm long. Flowers in terminal dichasial paniculate cymes, to 6 mm long. Sepals 5, subequal, linear-oblong or ovate-oblong, keeled, to 5 mm long. Petals 5, linear, dentate at apex, 1 mm long. Stamens 3-5. Ovary 1-celled; Capsule ovoid, to 2 mm long. Seeds many, subcylindric, 0.5 mm long, pale brown.

Fl. & Fr. : January-June.

Distribution: Paleotropics. Moist localities, along river riversides and river beds. *Amitha Bachan 123486* (Arangali, riverbed, alng Chalakkudy river, 3 m).

15. **PORTULACACEAE** Juss.

Gen. Pl. 312. 1789.

PORTULACA Linnaeus

Sp. Pl. 445. 1753.

Portulaca oleracea L., Sp. Pl. 445. 1753, Dyer in Hook. f., Fl. Brit. India 1: 246. 1874; Dunn in Gamble, Fl. Pres. Madras 66. 1915; Manilal, Fl. Silent Valley 17. 1988; M. K.V. Rao in B.D. Sharma & Sanjappa, Fl. India 3: 4. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 50. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 68. 2005; var. **oleracea**; N. P. Balakr. in P. Daniel, Fl. Kerala 1: 316. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 102. 2009; *Portulaca oleracea* L. var *linefolia* Sivar. & Manilal in New Botanist

4: 30. 1977; Sivar in J. Bombay Nat. Hist. Soc. 78: 258. 1981. **Manalkeera, Nilacheera.**

Annual, spreading, succulent herbs. Leaves alternate or subopposite, obovate to spathulate, to 1-3 x 0.5-1.6 cm, attenuate at base, rounded or truncate at apex, fleshy, subsessile. Flowers in sessile clusters at the tips of branches, bright yellow. Sepals 2, unequal, to 0.7x 0.7 cm, connate below. Petals 5, obovate, obtuse or truncate, to 0.8 x 0.5 cm. Stamens 7-10; filaments to 0.4 cm long. Ovary obovoid; styles to 0.5 cm long with 3-5 arms. Capsules, ovoid, 0.4 cm across.

Fl. & Fr. : July-September.

Distribution: Pantropical. Sandy river beds. *Amitha Bachan 117677* (Sholayar, along sandy river bed, Sholayar river, 700 m).

16. HYPERICACEAE Juss.

Gen. Pl. 254. 1789

HYPERICUM Linnaeus

Sp. Pl. 783. 1753.

Hypericum mysurense Heyne *ex* Wight & Arn., Prodr. Fl. India Orient. 99. 1834; Dyer in Hook. f., Fl. Brit. India 1: 253. 1874; Gamble, Fl. Pres. Madras 70. 1915 (as *mysorensis*) ; Manilal, Fl. Silent Valley 18. 1988; S.N. Biswas in B.D. Sharma & Sanjappa, Fl. India 3: 71. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 51. 1996; Vivek. in P. Daniel Fl. Kerala 1: 326. 2005. *Norisca mysurensis* (Heyne ex Wight & Arn.) Wight, Icon. Pl. India Orient. t. 56. 1838.

Shrubs to 1 m high; young branches 4-angled, with leaves closely arranged. Leaves opposite, lanceolate, to 2.5 x 0.7 cm, acute at both ends, closely placed, sessile; nerves 2 or 3 pairs, very oblique. Flowers 5-6 cm across, yellow, in terminal cymes, 2-3 together; sepals 1 cm long,

lanceolate; petals obovate, 2.5 x 1 cm, obtuse, glabrous; stamens in 5 bundles; filaments 1 cm long; ovary 5-celled; styles 5, exceeding the ovary. Capsule 5-valved, 1.5 cm long, glabrous.

Fl. & Fr. : Throughout the year.

Distribution : Tropical Asia. Grasslands and margins of Shola forests, streamside vegetation near Shola. *Amitha Bachan 98735, 99094* (Karimala, streamside near shola margins, Karimalathodu, 1200 m).

17. CLUSIACEAE LIndia

Intr. Nat. Syst. Bot., ed. 2: 74. 1836; *nom.alt.* **Guttiferae**

Key to genera

1a. Lateral primary and secondary nerves distinct, intercostae reticulate; ovary with 2-many 1-ovuled cells.....**Garcinia**

1b. Lateral primary veins alone distinct, intercostae parallel; ovary 1-celled with one ovule or 2-celled with 2 ovules in each cells.....2

2a. Ovary 1-celled, 1 ovuled.....**Calophyllum**

2b. Ovary 2-celled; ovules 2 in each cell..... 3

3a. Flowers solitary or pairs at axils; style single..... **Mesua**

3b. Flowers in terminal panicles; style 2 .....**Poeciloneuron**

CALOPHYLLUM Linnaeus

Sp. Pl. 513. 1753.

Key to species

1a. Leaves acuminate; petiole 2 cm or above..... **C. polyanthum**

1b. Leaves obtuse or acute; petiole <2 cm.....2

2a. Leaves large, 10-18 x 4 cm, broadly elliptic-oblong.....**C. inophyllum**

2b. leaves small, >10 cm, obovate or obovate elliptic.....3

3a. Leaves acute; petioles >1cm, petals present .....**C. austroindicum**

3b. Leaves obtuse; petiole <1cm, petals absent..... **C. calaba**

Calophyllum austroindicum Kosterm. *ex* P. F. Stevens, J. Arnold Arbor. 61: 250. 1980; Manilal, Fl. Silent Valley 18. 1988; N. P. Singh in B. D. Sharma & Sanjappa, Fl. India 3: 90. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 51. 1996; Arisdason & P. Daniel in P. Daniel Fl. Kerala 1: 330. 2005. *Calophyllum trapezifolium sensu* Anders. in Hook.f., Fl. Brit. India 1: 275. 1874, *non* Thwaites 1858; Dunn in Gamble, Fl. Pres. Madras 76. 1915.

Evergreen trees, to 25 m high, bark rough with shallow vertical irregular fissures; branchlets quadrangular. Leaves simple, opposite-decussate, obovate, elliptic, cuneate at base, acute or round at apex, to 3-7 x 1.5-3 cm, entire, coriaceous; lateral nerves many, parallel, very close, prominent. petiole 0.6 cm, stout, glabrous, grooved above; Flowers bisexual, white, in short axillary and terminal panicles; sepals 4, 0.6 cm long; inner ones petalloid, as long as petals; petals 4, 0.8 cm long, ovate-oblong, slightly narrowed at base, inner pairs shorter; stamens many, 0.6 cm long; ovary superior, globose-ellipsoid, 1-celled, ovule 1; style 0.7cm long; stigma peltate, small. Drupe to 1.6 cm long, ovoid, purple.

Fl. & Fr. : November –June.

Distribution: Endemic to Southern Western Ghats. Not Common; Evergreen and Riparian evergreen forests. *Amitha Bachan 98763* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m).

Calophyllum calaba L., Sp. Pl. 514. 1753; Sasidh. & Sivar., Fl. Pl. Thrissur For. 51. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 81. 2002; Arisdason & P. Daniel in P. Daniel Fl. Kerala 1: 330. 2005.

Calophyllum apetalum Willd., Ges. Naturf. Fr. Berlin Mag. 5: 79. 1811; N. P. Singh in B.D. Sharma & Sanjappa, Fl. India 3:88.1993. *Calophyllum decipiens* Wight, Icon. Pl. India Orient. t. 106. 1839; Dunn in Gamble, Fl. Pres. Madras 76. 1915. *Calophyllum wightianum* Wall. ex Planch. & Triana, Ann. Sci. Nat. Bot. ser. 4. 15: 256. 1862; Ander. in Hook. f., Fl. Brit. India 1: 274. 1874. **Cherupunna.** **Plate 22. G**

Trees up to to 20 m high, bark yellow-brown rough, deeply fissured; exudation yellow. Leaves simple, opposite, decussate, estipulate, ovate-oblong, obovate, acute at base, obtuse at apex, 6-12 x 3-5 cm, entire, glabrous, coriaceous; lateral nerves parallel, many, very close, intercostae obscure. Flowers bisexual, white in axillary panicles; perianth 4, white, oblong or obovate, to 0.8 cm long; stamens numerous, filaments long, slender; anthers large; ovary superior, globose, 1-celled, ovule 1; style slender; stigma peltate. Drupe 1 cm, globose-ovoid, bright dark-purplish.

Fl. & Fr. : September- November.

Distribution : Endemic to the Western Ghats. Common along the riverside at lower elevations also in sacred groves. *Amitha Bachan 98764* (Vazhachal, riparian forests, banks of Chalakkudy river, 220m); *Amitha Bachan 12379* (Sholayar-Vavalala, riparian evergreen forest, banks of Sholayar river, 700 m,).

Calophyllum inophyllum L., Sp. Pl. 513. 1753; Ander. in Hook. f., Fl. Brit. India 1: 273. 1874; Dunn in Gamble, Fl. Pres. Madras 76. 1915; N. P. Singh in B.D. Sharma & Sanjappa, Fl. India 3: 92. 1993; Arisdason & P. Daniel in P. Daniel Fl. Kerala 1: 332. 2005. *Calophyllum bintagor* Roxb., Fl. India 2: 606. 1832. *Calophyllum blumei* Wight, Illustr. 1: 128. 1840.

Tree to 20 m high, glabrous. Leaves simple, opposite, decussate, estipulate; broadly elliptic-oblong, acute-round or decurrent at base, round, retuse at apex, to 20 x 6 cm, entire, glabrous, shining, coriaceous; petiole 1-3 cm, stout, grooved above, glabrous; lateral nerves many, parallel, close, slender, prominent. Flowers bisexual, white, fragrant, in axillary racemose panicles; peduncle slender, 1-4 cm long; pedicel slender, 2-5 cm long; sepals 4, outer ones 4-6 cm long, concave, inner longer, reflexed, petalloid; petals 4, spreading, obovate, to 1.5 cm long; stamens many, connate at the base into 4-6 bundles; ovary superior, globose, 1-celled, ovule 1, erect; style long, twisted, stigma large, mushroom shaped. Drupe globose, 2-3 cm across, greenish, smooth.

Fl. & Fr. : December – May.

Distribution : Paleotropics. Along river banks near sea level. *Amitha Bachan 117731* (Chouka-Kadavu, river banks, banks of Chalakkudy river, sea level).

Calophyllum polyanthum Wall. ex Choisy, Descr. Guttif. India 43. 1849; Manilal, Fl. Silent Valley 19. 1988; N. P. Singh in B.D. Sharma & Sanjappa, Fl. India 3: 94. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 52. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 82. 2002; Arisdason & P. Daniel in P. Daniel Fl. Kerala 1: 333. 2005. *Calophyllum elatum* Bedd., Fl. Sylv. t. 2. 1869; Dunn in Gamble, Fl. Pres. Madras 76. 1915. *Calophyllum tomentosum* sensu Ander. in Hook. f., Fl. Brit. India 1: 274. 1874, *non* Wight 1839. **Punnappam.**

Large evergreen trees to 35 m, bole straight with characteristic deep fissures; branchlets subquadrangular, minutely tomentose. Leaves simple, opposite, decussate, elliptic, elliptic-lanceolate, acute at base, acute or acuminate at apex, to 12 x 7 cm, entire, glabrous, coriaceous;

lateral nerves many, parallel, close, prominent. Flowers bisexual, white, in panicles or racemes, terminal or on the axils of the upper leaves; sepals 4, concave, elliptic; petals 4, white, orbicular, cauducous, inner ones smaller; stamens numerous; filaments united at the base; ovary 1-celled, ovule 1; stigma peltate, concave, obscurely lobed. Drupe 2.5 cm long, ovoid, dark purple, smooth.

Fl. & Fr. : September-November.

Distribution : Indo-Malaysia and China, Canopy trees of the evergreen forests, usually distributed in the medium to higher elevation evergreens. In the lower elevations its rather restricted to riparian forests. *Amitha Bachan 98966* (Karanthodu, riparian forests, banks of Chalakkudy river, 300m); *Amitha Bachan 98010* (Sholayar, evergreen riparian, banks of Sholayar river, 800m).

GARCINIA Linnaeus

Sp. Pl. 443. 1753.

Ke to species

1a. Leaves linear-lanceolate or linear-oblong, <=3cm broad; fruit <=1 cm across ..... **G. wightii**

1b. Leaves not linear, elliptic to ovate lanceolate or obovate, 1.5-8 cm broad; fruit >1 cm across..... 2

2a. Ovary 4-10 loculed; Fruit 2.5-5cm across; pedicel 0.6-1.5 cm 3

2b. Ovary 2 loculed, Fruit 1-2.5 cm across; sessile.....5

3a. Fruit 6-10 grooved; ovary 6-10 celled.....**G. gummi-gutta**

3b. Fruit not groved, smooth; ovary 4 or 4-8 celled..... 4

4a. Ovary 4 celled; fruiting calyx not prominent <1 cm, thin, not ensheathing the base of the fruit; pedicel 0.6-1.2 cm.....**G. spicata**

4b. Ovary 4-8 celled; fruting calyx prominent >1 cm, coriacious, ensheathing the base of the fruit; pedicel to 0.6 cm.....**G. indica**

5a. Seeds enclosed in a thick leathery covering; leaves 1.5-4 cm broad, elliptic or oblanceolate .....**G. imberti**

5b. Seeds not enclosed in a thick leathery covering; leaves 3-8 cm broad, ovate-elliptic or elliptic-lanceolate.....***G. morella***

Garcinia gummi-gutta (L.) Robson., Brittonia 20: 103. 1968, var. *gummi-gutta*; Kostermans, Ceylon J. Sci. Biol. Sci. 12 1: 55. 1976; Manilal, Fl. Silent Valley 19. 1988; N. P. Singh in B. D. Sharma & Sanjappa, Fl. India 3:110.1993; Sasidh. & Sivar., Fl. Pl. Thrissur Forests. 52. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 84. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 70. 2005; Arisdason & P. Daniel in P. Daniel Fl. Kerala 1: 335. 2005. *Cambogia gummi-gutta* L., Gen. Pl. ed.5: 522. 1754. *Garcinia cambogia* (Gaertn.) Desr. in Lam., Encycl. 3: 701. 1792; Ander. in Hook. f., Fl. Brit. India 1: 261. 1874; Dunn in Gamble, Fl. Pres. Madras 73. 1915. *Mangostana cambogia* Gaertn., Fruct. 2: 106. 1790. *Garcinia cambogia* (Gaertn.) Desr. var. *conicarpa* (Wight) Anders. in Hook. f., Fl. Brit. India 1: 262. 1874; *Garcinia conicarpa* Wight, Icon. Pl. India Orient. t. 121. 1839. **Kodapuli.** **Plate 11.D**

Evergreen trees up to 20 m high, bark black, rough; exudation pale yellow, sticky; branchlets terete, glabrous, drooping. Leaves simple, opposite, decussate, estipulate, elliptic-oblanceolate or lanceolate, to 6-14 x 2-6 cm, cuneate at base, acute or shortly acuminate at apex, thick, shining; nerves pinnate, close. Flowers polygamodioecious, yellowish; male flowers 3-5 in short axillary fascicles, sepals 4, thick; petals 4, ovate, concave; stamens 10-20 or more, forming a globular head; female flowers: 1-3 in terminal and axillary fascicles, larger than male flowers; staminodes 10-20, ovary superior, globular, 8-10 locular, ovule one in

each locule; Berry, subglobose, 4-8 cm across, yellow, 8-10 grooved, grooves ending about the middle; seeds 6-8, ovoid, compressed, pale brown, veined; aril succulent, sweet, white or red.

Fl. & Fr. : April - June.

Distribution : Endemic to Peninsular India, Sri Lanka. Evergreen forests, along stream banks especially in the low altitude forests, also cultivated in the plains and costs. *Amitha Bachan 98968* (Vazhachal, riparian forests, banks of Chalakkudy river, 220m).

Garcinia imberti Bourd., J. Bombay Nat. Hist. Soc. 12: 349. 1899; Dunn in Gamble, Fl. Pres. Madras 74. 1915; N.P. Singh in B.D. Sharma & Sanjappa, Fl. India 3: 112. 1993; N. Mohanan & Sivad., Fl. Agasthyamala 85. 2002; Arisdason & P. Daniel in P. Daniel Fl. Kerala 1: 337. 2005.

Evergreen trees, to 15 m high, bark rough, vertically fissured; branchlets quadrangular, glabrous. Leaves simple, opposite, decussate, elliptic or oblanceolate, narrowly or cuneate at base, acuminate at apex, 4-10 x 1.5-4 cm entire, glabrous, shining, coriaceous; petiole 0.5 cm long, slender, glabrous, grooved above; lateral nerves to 14-25, slender, pinnate, ascending, close, prominent, looped near the margin forming intramarginal nerve. Flowers yellow, polygamodioecious, sessile; male flowers: 3-9 in terminal fascicles. Female flowers: usually solitary, terminal, rarely in pairs; 0.5 cm across; sepals 4, in 2 rows, orbicular or suborbicular, concave, outer 2 smaller, 0.2 cm long, inner ones larger, 0.3 cm long, greenish-yellow; petals 4, 0.4cm long, imbricate, broadly ovate, concave, yellow. Male flowers: stamens 16-20, monadelphous in a central mass round the rudimentary pistil, 0.2 cm in diameter, stalk 0.1cm long; ovary superior, globose, 0.2 cm across, 2-loculed, ovule 1 in each locule; stigma sessile, capitate, convex; staminodes many, united

and surrounding the ovary in a ring. Berry 2.5 cm, green; seeds 1 or 2, enclosed in a thick leathery covering.

Fl. & Fr. : August – September.

Distribution : Endemic to Southern Western Ghats. Evergreen forests. *Amitha Bachan 117612* (Karanthodu-Vazhachal, riparian forest, banks of Sholayar river, 350 m).

Garcinia indica (Thouars) Choisy in DC., Prodr. 1: 561. 1824; Ander. in Hook. f., Fl. Brit. India 1: 261. 1874; Dunn in Gamble, Fl. Pres. Madras 73. 1915; N. P. Singh in B.D. Sharma & Sanjappa, Fl. India 3: 113. 1993; Arisdason & P. Daniel in P. Daniel Fl. Kerala 1: 337. 2005. *Brindonia indica* Thouars, Dict. Sci. Nat. 5: 340. 1804. *Garcinia purpurea* (G. Don) Roxb., Fl. India 2: 624. 1832. *Stalagmitis indica* (Thouars) G.Don, Gen. Hist. 1: 621. 1831. *Stalagmitis purpurea* G. Don, Gen. Hist. 1: 621. 1831.

Medium sized trees up to 18 m high, stem angled, young branches subterete. Leaves simple, opposite, decussate, elliptic or obovate-oblong, attenuate at base, acute or acuminate at apex, to 20 x 8 cm; entire, glabrous, shining; lateral nerves 15-30 pairs, slender, prominent; petiole 1-2 cm long; Flowers polygamodioecious. Male flowers: 4-8 in axillary and terminal fascicles; pedicels 0.6 cm long; sepals 4, yellowish-orange; petals 4, as long as sepals, thick; stamens many, inserted on a torus. Female flowers: solitary, terminal; pedicels 0.3 cm long; sepals and petals as in male flowers; ovary superior, 4-8 locular, subglobose. Berry, to 4 cm across, 4-8 loculed, orange- brown, calyx persistent; pulp red; seeds 5-8.

Fl. & Fr. : November – August

Distribution: Endemic to Central and Northern Western Ghats, Cultivated in other places. *Amitha Bachan 98844* (Sholayar, riparian forests, banks of Sholayar river, 800m).

Garcinia morella (Gaertn.) Desv. in Lam., Encycl. 3: 701. 1792; Ander. in Hook. f., Fl. Brit. India 1: 204. 1874; Dunn in Gamble, Fl. Pres. Madras 74. 1915; Manilal, Fl. Silent Valley 20. 1988; N.P. Singh in B.D. Sharma & Sanjappa, Fl. India 3: 119. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur Forests. 52. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 85. 2002; Arisdason & P. Daniel in P. Daniel Fl. Kerala 1: 338. 2005. *Mangostana morella* Gaertn., Fruct. 2: 106. 1790.

Evergreen trees, to 18 m high; branchlets quadrangular, glabrous. Leaves simple, opposite, decussate, elliptic-obovate or elliptic-oblanceolate, obtuse to caudate-acuminate at apex, to 5-18 x 3-8cm; petiole very shortly sheathing at base; lateral nerves 8-16 pairs, pinnate, forming intramarginal nerve, slender, prominent. Flowers polygamodioecious, reddish, sessile. Male flowers: 2-4 in axillary fascicles or on old wood; sepals 4 outer pairs smaller than the inner, glabrous; petals 4, little larger than sepals, orbicular, veined, concave; stamens 10-12, monadelphous, the filaments combined in to a subquadrangular central column, anthers red. Female flowers: axillary, solitary, larger than male flowers; staminodes 10-12 in a ring round the ovary; ovary 4-celled, ovule one in each cell; stigma peltate, sessile, irregularly lobed. Berry, to 2.5 cm long, globose, smooth, yellowish surrounded at the base by persistent sepals, crowned round persistent stigmas, pulp sweet, acidic; seeds 2-4, kidney shaped, laterally compressed, dark brown.

Fl & Fr. : February - August

Distribution : Indo-Malaysia. Evergreen forests, *Amitha Bachan 123410* (Vazhachal riparian forests, banks of Chalakkudy river, 240m).

Garcinia spicata (Wight & Arn.) Ander. in Hook. f., J. Linn. Soc. Bot. 14:486.1875; Dunn in Gamble, Fl. Pres. Madras 74. 1915; N.P. Singh in B.D. Sharma & Sanjappa, Fl. India 3: 125. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 53. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 72. 2005; Arisdason & P. Daniel in P. Daniel Fl. Kerala 1: 342. 2005. *Xanthochymus spicatus* Wight & Arn., Prodr. 102. 1834. *Garcinia ovalifolius* (Roxb.) Hook.f., Fl. Brit. India 1:269. 1874, incl. vars. except *macrantha*, non Oliver 1868. *Garcinia spicata* (Wight & Arn.) Hook.f. var. *glomerata* Vesque in A. & C. DC., Monogr. Phan. 8: 311. 1893.

Plate 12. A

Small to medium evergreen trees, exudation orange-yellow, sticky; branchlets quadrangular, glabrous. Leaves simple, opposite, decussate, elliptic-obovate or elliptic-oblanceolate, acute or cuneate at base, obtuse obtusely acuminate or caudate-acuminate at apex, to 15 x 6 cm, entire, glabrous, coriaceous; lateral nerves 8-16 pairs. Flowers polygamodioecious, reddish, sessile. Male flowers: 2-4 in axillary fascicles or on old wood; sepals 4 orbicular, decussate, outer pairs smaller than the inner, glabrous; petals 4, little larger than sepals, orbicular, veined, concave; stamens 10-12, monadelphous, the filaments combined in to a subquadrangular central column. Female flowers: axillary, solitary, larger than male flowers; staminodes 10-12 in a ring round the ovary, connate at the base; ovary superior, 4-celled, ovule one in each cell. Berry, to 2.5 cm long, subglobose.

Fl. & Fr. : March- August.

Distribution : Endemic to India & Sri Lanka. Riparian evergreen forests *Amitha Bachan* 123455 (Vazhachal-Karanthodu, riparian evergreen forests, banks of Chalakkudy river, 340 m).

Garcinia wightii Anders. in Hook.f., Fl. Brit. India 1: 205. 1874; Dunn in Gamble, Fl. Pres. Madras 74. 1915; N. P. Singh in B.D. Sharma & Sanjappa, Fl. India 3: 129. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 53. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 87. 2002; Arisdason & P. Daniel in P. Daniel Fl. Kerala 1: 344. 2005. **Plate 12. C**

Small trees to 10 m; branchlets 4 angled, glabrous. Leaves simple, opposite, decussate, linear, linear-lanceolate, acute at base, acuminate at apex, to 12 x 3 cm, glabrous, shining, coriaceous; lateral nerves 8-18 pairs, faint. Flowers polygamodioecious, yellow. Male flowers: axillary, solitary or 2-3, sessile; sepals 4, equal, orbicular; petals 4, 0.5 cm, yellow, concave; stamens 18-20, united in a column enclosing the tetragonal stylodium, filaments free above, anthers peltate. Female flowers: axillary, solitary, sessile; sepals and petals as in male flowers; ovary superior, globular, 4-locular, stigmas sessile, large. Berry 1 cm, globose.

Fl & Fr. : November- March

Distribution : Endemic to Southern Western Ghats. Along stream banks in evergreen and semi-evergreen forests. *Amitha Bachan 98965* (Vazhachal, riparian forests, banks of Chalakkudy river, 220m).

MESUA Linnaeus

Sp. Pl. 515. 1753.

Key to species

1a. Flowers pedicelled, 0.4-1 cm long.....**M. ferrea**

1b. Flowers sessile.....**M. pulchella**

Mesua ferrea L., Sp. Pl. 515. 1753, var. **ferrea**; Ander. in Hook. f., Fl. Brit. India 1: 277. 1874; Dunn in Gamble, Fl. Pres. Madras 77.1915; N. P. Singh in B.D. Sharma & Sanjappa, Fl. India 3:136.1993; Sasidh. &

Sivar., Fl. Pl. Thrissur For. 53. 1996; Arisdason & P. Daniel in P. Daniel Fl. Kerala 1: 349. 2005. *Mesua nagassarium* (Burm. f.) Kosterm., Ceylon J. Sci. 12, 1: 71. 1976; Manilal, Fl. Silent Valley 21. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 88. 2002. Anil Kumar *et al.*, Fl. Pathanamthitta 72. 2005. **Churuli, Nangu**. **Plate 11.F**

Large buttressed trees to 30 m high; bark reddish-grey, flaking off in thin large scales. Leaves simple, opposite, decussate linear-lanceolate, or oblong-lanceolate, acute or obtuse at base, acuminate at apex, to 15 x 4 cm, glabrous, shining, coriaceous; lateral nerves many, parallel, close. Flowers bisexual, axillary, solitary, pedicel 0.5 cm; sepals 0.6 cm, fleshy, concave, puberulous outside, persistent; petals 4 x 1.5 cm, white, obovate or obcordate, curled at margin, cauducous; stamens numerous, yellow, polyadelphous, 0.5 cm long; ovary superior, ovoid, 2-celled, ovule 2 in each cell. Capsule ovoid to globose.

Fl. & Fr.: December -June

Distribution : Indo-Malaysia, Dominant tree of the evergreen forests. *Amitha Bachan 98860, 98851* (Sholayar, riparian forests, banks of Sholayar river, 700 m).

Key to varieties

1a. Leaves >10cm long, elliptic –lanceolate, acuminate.....var. **ferrea**

1b. Leaves <10cm, elliptic, caudate acuminate ..... var. ***coromandeliana***

var. **coromandeliana** (Wight) Singh, J. Econ. Tax. Bot. 10: 203. 1987; N. P. Singh in B.D. Sharma & Sanjappa, Fl. India 3: 137. 1993. *Mesua ferrea* L. ssp. *pulchella* Vesque var. *coromandeliana* (Wight) Mahesh., Bull. Bot. Surv. India 5: 336. 1964. *Mesua coromandeliana* Wight, Icon. Pl. India Orient. t. 117. 1839.

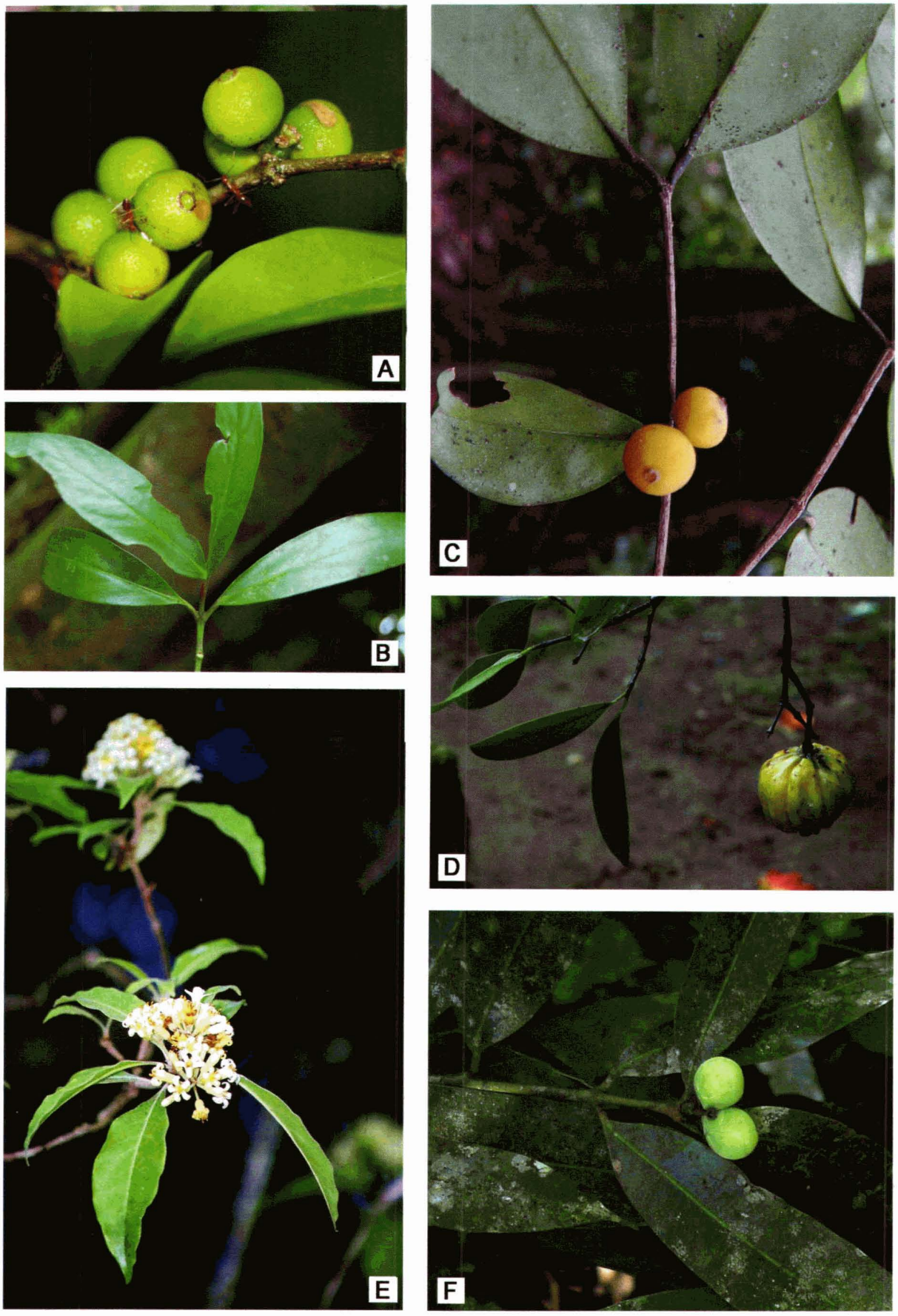


Plate 12. A. *Garcinia spicata* (Wight & Arn.) Ander.; B. *Garcinia wightii* Anders.; C. *Garcinia morella* (Gaertn.) Desv.; D. *Garcinia gummi-gutta* (L.) Robson.;E. *Pittosporum neelgherrense* Wight & Arn.; F. *Mesua ferrea* L. var. *ferrea*

Large buttressed evergreen trees up to 25 m high; Leaves simple, opposite, decussate, elliptic to elliptic-lanceolate, acute or obtuse at base, caudate-acuminate or acuminate at apex, to 4-8 x 2-3 cm entire, glabrous, shining, coriaceous; petiole to 1 cm, slender, glabrous; lateral veins many, parallel, close, obscure. Flowers bisexual, solitary, axillary, 1.5 cm across, white; pedicel 0.2-0.8 cm long, stout; sepals 4, outer 2 oblong, 1 cm, inner 2 orbicular, 1.5 cm, glabrous; petals 4, 2.5-3 x 1.5 cm, white, obovate; stamens numerous; ovary superior, 2-locular, globose; ovules 2 per cell. Capsule ovoid, to 3 cm long, shortly acuminate at apex, subtended by lignified sepals, greenish-yellow. Seed one.

Fl. & Fr. : December – February.

Distribution : Endemic to Southern Western Ghats. Large trees of the Evergreen forests with comparatively small leaves. *Amitha Bachan 98869* (Sholayar, riparian forests, banks of Sholayar river, 900m).

Mesua pulchella Planch. & Triana, Ann. Sci. Nat. Bot. ser. 4, 15: 307. 1861; N. P. Singh in B.D. Sharma & Sanjappa, Fl. India 3: 143. 1993. *Mesua ferrea* L. subsp. *pulchella* Vesque var. *pulchella* (Planch. & Triana) Mahesh., Bull. Bot. Surv. India 5: 339. 1963. *Mesua nagassarium* (Burm.f.) Kosterm. var. *pulchella* (Planch. & Triana) Kosterm., Reinwardtia 7: 427. 1969.

Medium sized buttressed evergreen trees, to 20m high, brown rough, irregularly flaking. Leaves simple, opposite, decussate, elliptic or narrowly lanceolate, acute at base, acuminate at apex, to 10 x 3 cm, entire, glabrous, shining, coriaceous; petiole to 1 cm long, slender; lateral nerves many, close. Flowers axillary, solitary or in pairs, bisexual, 3 cm across, white, sessile, fragrant; sepals 4, in pairs, outer pair 0.8 cm long, suborbicular, inner 1 cm long, orbicular; petals 4, oblong; stamens numerous, yellow; ovary 2-celled, ovules 2 in each cell; styles as long as

ovary; stigma small, peltate. Capsule ovoid, 3 cm, with persistent sepals; seeds smooth.

Fl. & Fr. : February-April.

Distribution: Endemic to South India Sri Lanka. Evergreen riparian forests. *Amitha Bachan 98845* (Malakkapara, riparian forest, banks of Sholayar river, 900m).

POECILONEURON Beddome

J. Linn. Soc., Bot. 8: 267, t. 17. 1865.

Poeciloneuron indicum Bedd., J. Linn. Soc. Bot. 8: 267,t.17. 1865 & Fl. Sylv. t.3. 1869; Ander. in Hook. f., Fl. Brit. India 1: 278. 1874; Dunn in Gamble, Fl. Pres. Madras 77. 1915; Manilal, Fl. Silent Valley 22. 1988; N. P. Singh in B.D. Sharma & Sanjappa, Fl. India 3: 146. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 54. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 89. 2002; Arisdason & P. Daniel in P. Daniel Fl. Kerala 1: 352. 2005.

Large evergreen trees up to 30 m high, straight, buttressed; branchlets terete, hairy. Leaves simple, opposite, estipulate, elliptic, elliptic-oblong; acute at base; caudate acuminate at apex, 10-20 x 4-8 cm; entire, glossy, glabrous, coriaceous; lateral nerves many, close, parallel, slender; petiole 1-1.5 cm, stout, glabrous, grooved above; Flowers in axillary and terminal panicles, yellowish-white; pedicels 1-2 cm, puberulous; bracteoles triangular; sepals 5, ovate, puberulous without, 0.3 mm long; petals 5, elliptic to obovate, to 0.6 cm; stamens numerous, free or slightly connate; ovary 0.2 cm, bilocular; ovules 2 in each locule. Capsule to 2.5 cm across, 1-celled; seed one, fleshy.

Fl. & Fr. : December - June

Distribution : Endemic to the Western Ghats. Evergreen forests, usually along riparian evergreen forest. *Amitha Bachan 98846* (Malakkapara, riparian forests, banks of Sholayar river, 900 m); *Amitha Bachan 98761* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m).

18. DIPTEROCARPACEAE Blume,

Bijdr. Fl. Ned. India : 222. 1825.

Key to genera

1a. Fruits nut like; sepals winged in fruits.....2

1b. Fruits capsular; sepals not winged..... **Vateria**

2a. Leaves large, 10-22 x 5-10 cm; calyx wings large in fruits, 9-12cm braod.....**Dipterocarpus**

2b. Leaves small, 3-8 x 2-5 cm ; calyx wing small in fruits, 2-6 cm broad .....**Hopea**

DIPTEROCARPUS C.F. Gartner

Fruct. 3: 50. 1805.

Dipterocarpus indicus Bedd., Fl. Sylv. t. 94. 1871; Dunn in Gamble, Fl. Pres. Madras 81. 1915; Janardh. in B. D. Sharma & Sanjappa, Fl. India 3: 214. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 55. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 93. 2002; Janardhanan & Arisdason in P. Daniel Fl. Kerala 1: 361. 2005. **Kalpain. Plate 13. A & B**

Large evergreen trees, to 35 m high, bole straight to 20m ; Leaves simple, alternate; tomentose, elliptic, 10-22 x 5-10 cm, acute, obtuse or cordate at base, acute or acuminate at apex, crenate, undulate, glabrous, coriaceous, lateral nerves 10-15 pairs, parallel. petiole 1.5-4 cm, slender, pubascent; Flowers 3-5 together in axillary racemes, white; calyx cupular at base, lobes 5, unequal; petals 5, tinged with pink; stamens 30;

filaments yellowish, often dilated at base; connective aristate; ovary superior, slightly adherent to the calyx tube, 3-celled, ovules 2 in each cell. Fruit a nut; wings 2, oblong, 8-12 cm, reddish-brown.

Fl.& Fr. : February-July

Distribution: Endemic to The Western Ghats. Important tree of the low-medium elevation evergreen forests also in the riparian forest. *Amitha Bachan 98967* (Vazhachal, riparian evergreen, banks of Chalakkudy river, 200 m).

HOPEA Roxburgh

Pl. Coromandel. 3: 1811, *nom. cons.*

Key to species

1a. Panicle tomentose; petals glabrous; fruits with 2 longer wings .....**H. parviflora**

1b. Panicles glabrous; petals pubescent; fruits with 2 longer and 3 smaller unequal wings .....**H. ponga**

Hopea parviflora Bedd., Fl. Sylv. t. 7. 1869; Dyer in Hook. f., Fl. Brit. India 1: 308. 1874; Dunn in Gamble, Fl. Pres. Madras 82. 1915; Janardh. in B. D. Sharma & Sanjappa, Fl. India 3: 228. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 56. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 93. 2002; Janardhanan & Arisdason in P. Daniel Fl. Kerala 1: 365. 2005. C. N. Sunil & Sivad., Fl. Alappuzha 111. 2009.
Thambakam. **Plate 13. F**

Large buttressed trees up to 35 m high, bark light brown, rough, vertically fissured. Leaves simple, alternate, lanceolate, to 14 x 5 cm, acute to obtuse at base, acute to acuminate at apex, glabrous, coriaceous; petiole slender, 1cm long, pubescent when young. Flowers in racemose panicles, axillary or unilateral terminal; sepals 5, 3 mm long,

tomentose outside; petals 5, oblong, 0.6 cm long, glabrous, fimbriate at apex; stamens 5, rarely 10, slightly connate; connective of anthers produced into a subulate point; ovary superior, glabrous, ovules 2 in each cell; style short, subulate. Nut, terete, 0.5 cm long, glabrous, winged; wings 2, to 7 x 1.7 cm, 8-10 nerved, glabrous.

Fl. & Fr. : January- June

Distribution: Endemic to southern Western Ghats. Evergreen riparian vegetation at lower elevations. *Amitha Bachan 98963* (Vazhachal, riparian evergreen, banks of Chalakkudy River, 220 m).

Hopea ponga (Dennst.) Mabb., Taxon 28: 587. 1979; Janardh. in B. D. Sharma & Sanjappa, Fl. India 3: 230. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 56. 1996; Janardhanan & Arisdason in P. Daniel Fl. Kerala 1: 366. 2005. *Artocarpus ponga* Dennst., Schluss. Hort. Malab. 15,18,30. 1818. *Hopea wightiana* Wall.ex Wight & Arn., Prodr. 85.1834; Dyer in Hook. f., Fl. Brit. India 1:309.1874; Dunn in Gamble, Fl. Pres. Madras 82. 1915. **Thambakam, Irumbakam.** **Plate 13. C & D**

Medium sized trees up to 20 m high, bark dark grey, smooth; branchlets pubescent. Leaves simple, alternate, lanceolate or lanceolate-oblong, 8-22 x 3-7 cm, rounded, or obtuse at base, acute to acuminate at apex, glabrous, coriaceous, lateral nerves 5-10 pairs; petioles 0.4-1.5 cm long, stout, glabrous, grooved above; Flowers in axillary unilateral drooping racemose panicles, yellowish-pink; sepals 5, ovate, shortly united at base, glabrous, two outer, larger than the 3 inner ones; petals 5, ovate-lanceolate, 0.6 mm long, pubescent; stamens 10 or 15; ovary superior, 3-celled, ovules 2 in each cell. Nut, ovoid, 1.2 cm long, winged. 2 longer wings 10 x 1.5 cm, 8-nerved, 3 smaller ones unequal.

Fl. & Fr. : March-June

Distribution: Endemic to Southern Western Ghats. Endangered (IUCN, 2000). Seen along riparian forests. *Amitha Bachan 98758* (Vazhachal, riparian evergreen, banks of Chalakkudy river, 250 m) ; *Amitha Bachan 98759* (Vazhachal, riparian evergreen, banks of Chalakkudy river, 240m).

VATERIA Linnaeus

Sp. Pl. 515. 1753.

Vateria indica L., Sp. Pl. 513. 1753; Dyer in Hook. f., Fl. Brit. India 1: 313. 1874; Dunn in Gamble, Fl. Pres. Madras 85. 1915; Janardh. in B. D. Sharma & Sanjappa, Fl. India 3: 245. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 56. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 94. 2002; Janardhanan & Arisdason in P. Daniel Fl. Kerala 1: 370. 2005. *Vateria malabarica* Blume, Mus. Bot. Lugd.-Bat. 2: 29. 1852. **Vellapain**

Plate 13. L

Large evergreen trees, to 30 m high; exudation, sticky, white resinous. Leaves simple, alternate, oblong, 8-28 x 4-10 cm, obtuse to cordate at base, acuminate or obtusely acute at apex, entire, coriaceous, lateral nerves 12-18 pairs, parallel, prominent; petiole 2.5-4.0 cm, stout, stellate-pubescent, swollen tipped. Flowers in terminal panicles, 2-3 cm across, fragrant, densely stellate puberulus; sepals 5, free, lanceolate, covered with stellate hairs; petals 5, white, obovate, spreading, shortly united at base; stamens many, free; filaments hairy; anthers often slightly hairy at base; ovary superior, tomentose, 3-celled, 2-ovules in each cell. Capsule, ovoid, 15 x 6 cm, pale brown; seed one.

Fl. & Fr. : March-August

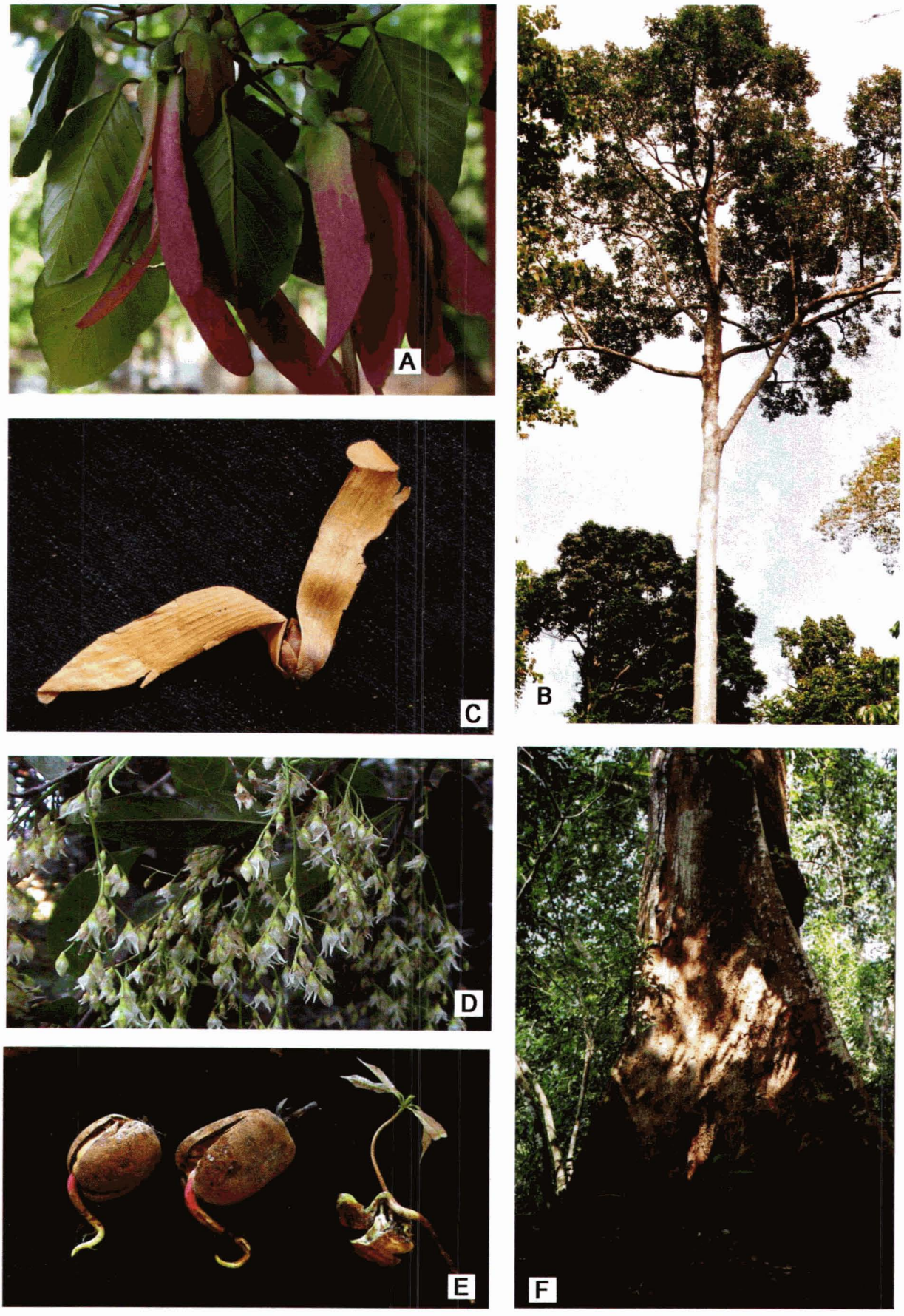


Plate 13. A. & B. *Dipterocarpus indicus* Bedd., A. Fruiting branch, B. Habit; C & D. *Hopea ponga* (Dennst.) Mabb., C. Fruit, D. Inflorescence; E. *Vateria indica* L. (germinating seeds); F. *Hopea parviflora* Bedd.

Distribution: Endemic to Southern Western Ghats, critically endangered. Riparian forests at low elevations. *Amitha Bachan 72020* (Thumboormuzhi, riparian evergreen, banks of Chalakkudy river, 50 m).

19. ANCISTROCLADACEAE Planchon ex Walp.

ANCISTROCLADUS Wallich

Num. List 1052. 1929, *nom. cons.*

Ancistrocladus heyneanus Wall. ex Graham, Cat. Pl. Bombay 28. 1839; Wight, Icon. Pl. India Orient. t. 1987. 1853; Dyer in Hook. f., Fl. Brit. India 1: 299. 1874; Dunn in Gamble, Fl. Pres. Madras 86. 1915; Manilal, Fl. Silent Valley 24. 1988; Silpi Das in B. D. Sharma & Sanjappa, Fl. India 3: 254. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 57. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 95. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 75. 2005; R. Chandrasekh. In P. Daniel, Fl. Kerala 1: 374. 2005.

Scandant climbing shrubs with hooked branches; twigs glabrous. Leaves to 18 x 6 cm sessile, crowded at the apex of branchlets, oblanceolate, acute, attenuate at base. Flowers 1 cm diameter, bisexual, sessile on terminal lax panicles; sepals 5, unequal, connate into a tube and adnate to the ovary, lobes 3 mm long; petals 5, to 6 mm long, subequal, oblong, obtuse, slightly connate at base, greenish yellow; stamens 10, filaments connate at base, anthers orbicular; ovary 1-celled; ovules solitary; style 3, free. Fruit a nut covered with large wing like sepals; fruiting sepals unequal, to 5 x 3 cm, 3 larger ones and 2 smaller ones, obovate, obtuse, reticulate, glabrous.

Fl. & Fr. : March-April

Distribution : Endemic to South India and Sri Lanka. Common in evergreen forests, *Amitha Bachan 99139* (Vazhachal, riparian forests,

banks of Chalakkudy river, 220 m); *Amitha Bachan 98868* (Sholayar, riparian forests, banks of Chalakkudy river, 800 m).

20. MALVACEAE Juss.

Gen. Pl. 271. 1789.

Key to genera

1a. Involucral bracts absent..... **Sida**

1b. Involucral bracts present.....2

2a. Mericarps 1-seeded.....**Urena**

2b. Mericarps many-seeded.....3

3a. Capsule glabrous.....**Thespesia**

3b. Capsule pubescent or bristly hairy.....4

4a. Calyx spathaceous, split on to one-side, deciduous.....**Abelmoschus**

4b. Calyx 5-lobed, not split on to one-side, persistent.....5

5a. Erect trees; stipules foliaceous, enclosing the developing shoots..... .....**Talipariti**

5b. Under shrubs or stragllers; stipules not foliaceous, not enclosing the developing shoots .....**Hibiscus**

ABELMOSCHUS Medikus

Malvenfam. 45. 1787.

Abelmoschus manihot (L.) Medik., Malv. 46. 1787; T.K. Paul & M.P. Nayar, Fasc. Fl. India 19: 74. 1988; T.K. Paul in B.D. Sharma & Sanjappa, Fl. India 3:304.1993; Sivar. & Pradeep, Malvaceae South. Penins. India 67. 1996; M. Mohanan & A. V. N. Rao in P. Daniel, Fl. Kerala 1: 402. 2005. *Hibiscus manihot* L., Sp. Pl. 696. 1753; Mast. in Hook. f., Fl. Brit. India 1: 341. 1874; Dunn in Gamble, Fl. Pres. Madras

97. 1915. *Abelmoschus manihot* (L.) Medik. subsp. *tetraphyllus* (Hornem.) Borss., Blumea 14: 97. 1996; T.K. Paul & M.P. Nayar, Fasc. Fl. India 19: 75. 1988; T.K. Paul in B.D. Sharma & Sanjappa, Fl. India 3:306.1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 58. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 78. 2005. *Abelmoschus manihot* subsp. *tetraphyllus* var. *pungens* (Roxb.) Hochr., Candollea 1: 87. 1924; T.K. Paul & M.P. Nayar, Fasc. Fl. India 19: 77. 1988.

Shrubs, to 2 m tall; whole plant hirtus with stiff hairs. Leaves to 15 x 12 cm, 3-5-lobed, lobes acute, crenate-serrate, nerves with few adpressed setae on both sides; petiole to 15 cm long; stipule 1 cm long, lanceolate. Flowers in terminal raceme; pedicel 7 cm long; involucral bracts ovate, 3.0 x 1.7 cm, acute, densely hairy; bracteoles persistent, distinct; calyx membranous, glabrous; petals white, changing to pink, obovate, to 6 x 4 cm, glabrous. Capsule oblong, 6 x 2 cm, acute, densely yellow-hispid; seeds many, reniform, hispid along concentric lines.

Fl. & Fr. : August-December.

Distribution: Indo-China, Malaysia and Australia. Cultivated in Southeast Asia. Open areas and waste lands *Amitha Bachan 11771* (Ittiany, open riparian areas, banks of Chalakkudy river, 130 m).

HIBISCUS Linnaeus

Sp. Pl. 693. 1753, *nom. cons.*

Hibiscus lobatus (Murray) Kuntze., Rev. Gen. Pl. 2: 19. 1898; Manilal, Fl. Silent Valley 26. 1988; T.K. Paul in B.D. Sharma & Sanjappa, Fl. India 3: 336. 1993; Sivar. & Pradeep, Malvaceae South. Penins. India 125. 1996; Sasidh. & Sivar., Fl. Pl. Thrissur For. 59. 1996; M. Mohanan & A. V. N. Rao in P. Daniel, Fl. Kerala 1: 414. 2005. *Solandra lobata* Murray, Comm. Soc. Reg. Sc. Geotting 6: 20. t.1. 1785. *Hibiscus*

solandra L' Herit., Stirp. Nov. 1: 103. t. 49. 1788. *nom. illeg.*, Mast. in Hook. f., Fl. Brit. India 1: 336. 1874; Dunn in Gamble, Fl. Pres. Madras 98. 1915.

Annual herbs, to 1.5 m high; stem pubescent with simple hairs. Leaves lanceolate, to 10 x 8 cm, serrate, pubescent; entire or 3-5-lobed, upper leaves smaller linear-oblong; petiole to 7 cm long. Flowers initially axillary solitary, axillary, later due to reduction of distal leaves become terminal racemose; pedicels 2-4 cm long; involucral bracts reduced; calyx to 1 cm long, lobes fine, glabrous; petals white, obovate, 1 x 0.8 cm, obtuse, glabrous. Capsule ovoid, 1.2 cm long, acute, hispid; seeds 2 mm across, trigonous, hispid.

Fl. & Fr.: October-March.

Distribution: Paleotropics. Moist forests along riverbanks. *Amitha Bachan 98820* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m).

SIDA Linnaeus

Sp. Pl. 683. 1753.

Key to species

1a. Leaves and branches distichous; stipules unequal, falcate.... **S. acuta**

1b. Leaves and branches not distichous; stipules equal, linear.....2

2a. Mericarps long-awned at apex, stellate-hairy.....**S. fryxellii**

2b. Mericarps with a pair of short mucro at apex, glabrous.... **S. alnifolia**

Sida acuta Burm. f., Fl. India 147. 1768; subsps. *acuta* Borss., Blumea 14:186.1966; Dunn. in Gamble, Fl. Pres. Madras 90. 1915; Manilal, Fl. Silent Valley 28. 1988; T.K. Paul in B.D. Sharma & Sanjappa, Fl. India 3: 281.1993; Sivar. & Pradeep, Malvaceae South. Penins. India 238. 1996; Sasidh. & Sivar., Fl. Pl. Thrissur For. 61. 1996; N. Mohanan & Sivad., Fl.

Agasthyamala 99. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 86. 2005; M. Mohanan & A. V. N. Rao in P. Daniel, Fl. Kerala 1: 387. 2005. C.N. Sunil & Sivad., Fl. Alappuzha 126. 2009. *Sida lanceolata* Retz., Obs. Bot. 4: 119. 1786. *Sida carpinifolia sensu* Mast. in Hook. f., Fl. Brit. India 1: 323. 1874 p.p. *non* L.f. 1781. **Penkurunthotti.**

Subshrubs. Leaves lanceolate to linear, 4-8 x 1-4 cm, acute at apex rounded or acute at base, dentate-serrate, glabrate; petiole 5 mm long; stipules unequal, falcate, 1 x 0.5 cm, falcate. Flowers axillary, solitary or in clusters, on short lateral branchlets; pedicels 0.5 cm long; calyx 0.6 cm across, lobes subulate, ciliate; corolla 1 cm across, petals obovate, yellow; staminal column short. Mericarps 6-10, reticulate. Seeds trigonous.

Fl. & Fr. : August-January

Distribution: Pantropical, moist forests to plains, *Amitha Bachan 123340* (Orukombankutty-Parambikulam, open riverbanks, along the Chalakkudy river, 450 m).

Sida alnifolia L., Sp. Pl. 2, 684. 1753; Sivar. & Pradeep, Sida 16: 69 1994 & Malvaceae South. Penins. India 241. 1996; Sasidh. & Sivar., Fl. Pl. Thrissur For. 61. 1996; M. Mohanan & A. V. N. Rao in P. Daniel, Fl. Kerala 1: 388. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 127. 2009. *Sida retusa* L., Sp. Pl. (ed. 2) 961. 1763. *Sida rhombifolia* L. var. *retusa* (L.) Mast. in Hook. f., Fl. Brit. India 1: 324. 1874. *Sida rhombifolia* L. subsp. *retusa* (L.) Borss., Blumea 14: 198. 1966; T.K. Paul & M.P. Nayar, Fasc. Fl. India 19: 216. 1988; T. K. Paul in B. D. Sharma & Sanjappa, Fl. India 3: 289. 1993; Anil Kumar *et al.*, Fl. Pathanamthitta 90. 2005. *Sida rhombifolia* L. subsp. *alnifolia* (L.) Ugborogho, Bol. Soc. Brot. ser. 54:70. 1980. **Kurunthotti.**

Erect woody herbs; branches green or purplish tinged, minutely stellate-hairy. Leaves, petiole and pedicels minutely stellate pubascent. Leaves obovate, to 4 x 3 cm, obtuse or retuse at apex, emarginate, crenate on the upper half, densely tomentose below; petiole 5 mm long, stipules filiform. Flowers 12 mm across, yellow, axillary, solitary or sometimes due to reduction of distal leaves in terminal clusters; pedicels 6 mm long; calyx 8 mm across, lobes acute. Corolla yellow, 1-1.5 cm across. Mericarps trigonous, with a pair of short mucro at apex; seeds black.

Fl. & Fr. : September-December

Distribution: Indo-Malaysia. Moist forests, hills to plains in open areas. *Amitha Bachan 123346* (Malakkapara, along river banks of evergreen forests, Sholayar river, 900 m).

Sida fryxellii Sivar. & Pradeep, Kew Bull. 45: 725. 1990; Sivar. & Pradeep, Malvaceae South. Penins. India 259. 1996. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 89. 2005; *Sida rhombifolia* sensu M. Mohanan & A. V. N. Rao in P. Daniel, Fl. Kerala 1: 394. 2005; C .N. Sunil & Sivad., Fl. Alappuzha 127. 2009.

Erect undershrubs; stem densely soft stellate pubescent. Leaves dimorphic, early ones orbicular and later ones ovate-elliptic, to 5 x 7 cm, obtuse at base, retuse, obtuse or acute at apex, margins crenate serrate, pubescent below, nerves 5 pairs, erose, petiole to 1 cm long; stipule 7 mm long, filiform. Flowers 1.2 cm across, axillary, solitary; pedicels 1.5 cm long, calyx 6 mm across, 10-ribbed. Mericarps 8-10, trigonous with long stellate hairy awns. Seeds subreniform.

Fl. & Fr.: Throughout the year

Distribution: Endemic to South-west Peninsular India. Common in open areas. *Amitha Bachan 12368* (Vazhachal, open degraded riparian forest edges, banks of Chalakkudy river, 220 m).

TALIPARITI (L.) Fryxell,

Contr. Univ. Michigan Herb. 23: 258. 2001.

Talipariti tiliaceum (L.) Fryxell, Contr. Univ. Michigan Herb. 23: 258. 2001. *Hibiscus tiliaceus* L., Sp. Pl. 694. 1753; Mast. in Hook. f., Fl. Brit. India 1: 343. 1874; Dunn in Gamble, Fl. Pres. Madras 98. 1915; T.K. Paul in B.D. Sharma & Sanjappa, Fl. India 3: 322. 1993; Sivar. & Pradeep, Malvaceae South. Penins. India 91. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 84. 2005; M. Mohanan & A. V. N. Rao in P. Daniel, Fl. Kerala 1: 424. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 122. 2009. *Paritium tiliaceum* (L.) St.-Hil., Fl. Bras. Merid. 1: 256. 1828. **Veliparuthi.**

Plate 14. F

Tree; branchlets stellate-tomentose. Leaves orbicular, to 16 x 14 cm, cordate at base, acute at apex, coarsely crenate-serrate or entire, 7-9-nerved from base, upper surface green, glabrous or minutely stellate-hairy, lower surface greyish, densely stellate-tomentose; foliar nectaries 3, linear; petioles to 12 cm long; stipules foliaceous, ovate, 2 x 1 cm, subobtuse at apex, enclosing the developing shoots, deciduous leaving scars. Flowers axillary, solitary or in apparent terminal racemes; pedicel to 2 cm long, stout, thickened and lenghtened in fruits. Calyx tube campanulate to 0.7 cm long, lobes 5, lanceolate, coriaceous. Corolla 6-8 cm across, bright yellow with a deep purple center fading to pink; petals obovate, to 6 x 4 cm. Staminal column 3 cm long, yellow. Ovary globose, 0. 5 cm lacross, 10-celled; Capsules ovoid, to 2.5 cm across, woody, densely pubescent, beaked.

Fl. & Fr.: Throughout the year.

Distribution : Pantropics. Grown as hedge plant in costal areas, seen along backwater-bodies. *Amitha Bachan 98714* (Elanthikkara, river banks, along Chalakkudy river, sea level).

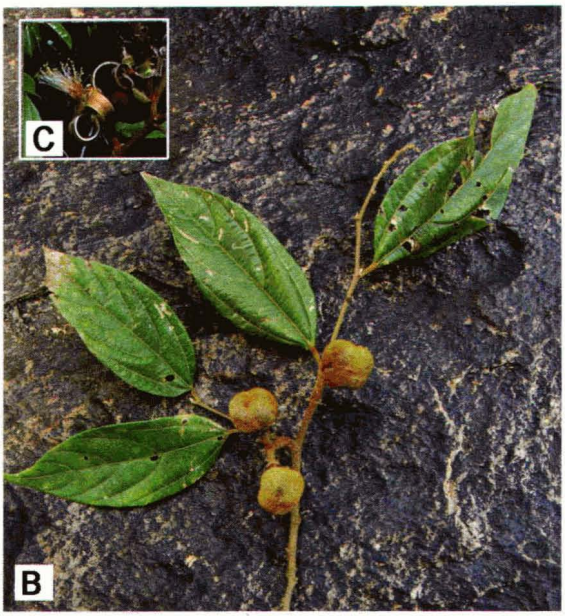
THESPESIA Solander ex Correa

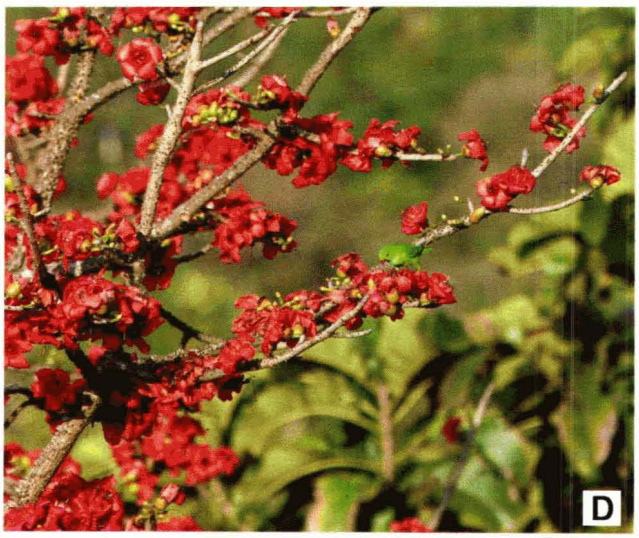
Ann. Mus. Nat. Hist. Nat. 9: 290. 1807 (*nom. cons.*).

Thespesia populnea (L.) Soland. ex Correa, Ann. Mus. Natl. Hist. Nat. Paris 9: 290.t. 8. f.2. 1807 *nom. cons.*; Wight, Icon. Pl. India Orient. t. 8. 1807; Mast in Hook. f., Fl. Brit. India 1: 345.1874; Dunn in Gamble, Fl. Pres. Madras 101. 1915; Borss., Blumea 14: 105. 1960; T.K. Paul in B.D. Sharma & Sanjappa, Fl. India 3: 352. 1993; Sivar. & Pradeep, Malvaceae South. Penins. India 37. 1996; M. Mohanan & A. V. N. Rao in P. Daniel, Fl. Kerala 1: 431. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 131. 2009. *Hibiscus populneus* L., Sp. Pl. 694. 1753. **Pooparuthi**.

Trees to 12 m tall; young branches covered with peltate scales. Leaves broadly ovate, to 15 x 12 cm, cordate at base, acuminate at apex, 5-7-nerved from base, peltate-scaly or glabrescent; petiole 4-10 cm long, scaly; stipules 6 mm long, linear-lanceolate, cauducous. Flowers solitary, axillary; pedicels 2-8 cm long, jointed at base. Calyx tube 1.2 cm long, cupular. Corolla 5-7 cm across, campanulate, yellow, usually with a dark purple center; petals broadly obovate with rounded apex, to 7 x 6 m; staminal column 2.5 cm long; ovary 6-8 mm across, ovoid. Capsules globose, 2.5 cm across, indehiscent; seeds 2-4 per cell, 1 cm long, obovoid.

Fl. & Fr.: Throughout the year.





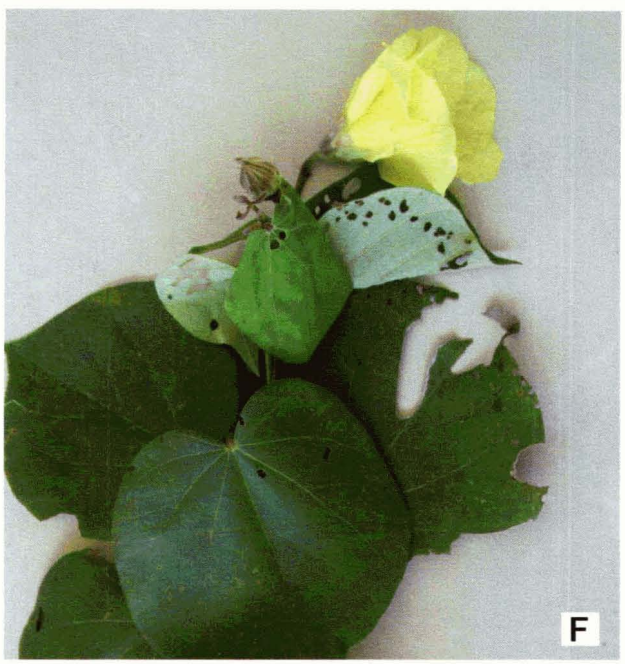


Plate 14. A. *Cullenia exarillata* Robyns; B & C. *Grewia serrulata* DC., B. Fruitng branch, C. Flower; D. *Bombax ceiba* L.; E. Dehiced fruit of *Sterculia guttata* Roxb. ex DC.; F. *Taliparitì tiliaceum (L.) Fryxell*; G. *Helicteres isora* L.

Distribution: Pantropical. Along water bodies in the costal areas and backwaters. *Amitha Bachan 123444* (Elanthikkara, banks of Chalakkudy river, sea level).

URENA Linnaeus

Sp. Pl. 692. 1753.

Urena lobata L., Sp. Pl. 692. 1753; subsps. **lobata** Mast. in Hook. f., Fl. Brit. India 1: 329. 1874; Gamble, Fl. Pres. Madras 92. 1915 Borss., Blumea 14: 140. 1966; Manilal, Fl. Silent Valley 29. 1988; T. K. Paul in B. D. Sharma & Sanjappa, Fl. India 3: 380. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 63. 1996; Sivar. & Pradeep, Malvaceae South. Penins. India 180. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 102. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 92. 2005; M. Mohanan & A. V. N. Rao in P. Daniel, Fl. Kerala 1: 440. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 133. 2009. **Uran.**

Erect branched subshrubs to 2 m tall; vegetative parts densely stellate-pubescent. Leaves ovate, broadly ovate-lanceolate, to 10 x 7 cm, truncate or cordate at base, 3-5 angular to shallowly lobed; lobes acute or acuminate, obscurely crenate-serrate, 5-7-nerved from base, stellate-pubescent with 1-3 elliptic nectaries on principal nerves; petioles to 7 cm long, stellate-pubescent; stipules linear to subulate. Flowers axillary, usually solitary or 2 or 3 in a cluster; pedicels 3-8 mm long. Involucral bracts 5, spathulate, connate at base, 0.5 x 1cm, clothed with rigid hairs. Calyx campanulate, 0.9 cm long, 5-parted. Corolla pink with dark center; petals obovate with rounded apex, to 1.5 cm long. Staminal column to 1 cm long, pinkish. Ovary subglobose, 4 mm across, stiff-hirsute; Stigmas capitate. Schizocarp globose, 1.2 cm across; mericarps 5, trigonous, rounded, to 8 x 5 mm, clothed with many glochidiate spines.

Fl. & Fr.: August – February.

Distribution: Pantropical. Degraded areas of forests to plains. *Amitha Bachan 123450* (Vazhachal, open areas in riparian forests, banks of Chalakkudy river, 230 m).

21. BOMBACACEAE Kunth

Malvac. Buttner., Tiliac. : 5. 1822.

Key to genera

1a. Leaves palmatly lobed; branchlets prickled.....**Bombax**

1b. Leaves simple; branches covered with tubercles.....**Cullenia**

BOMBAX Linnaeus

Sp. Pl. 511.1753.

Key to species

1a. Large trees to 40 m; leaves plamatly lobed.....**B. ceiba**

1b. Medium sized trees to 25 m high; leaves digitately compound.....
.....**B. insigne**

Bombax ceiba L., Sp. Pl. 511. 1753; Manilal, Fl. Silent Valley 30. 1988; M.P. Nayar & Biswas in B.D. Sharma & Sanjappa, Fl. India 3: 398. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 64. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 104. 2002; Anil Kumar *et al.,* Fl. Pathanamthitta 93. 2005; S. K. Srivast. & Vivek in P. Daniel, Fl. Kerala 1: 443. 2005; *Bombax malabaricum* DC., Prodr. 1: 479. 1824; Mast. in Hook. f., Fl. Brit. India 1: 349. 1874; Dunn in Gamble, Fl. Pres. Madras 99. 1915. *Salmalia malabarica* (DC.) Schott & Endl., Melet. Bot. 35. 1832. **Elavu**.

Plate 14. D

Large trees with broad buttresses, to 40 m high, branchlets prickled. Leaves palmatly lobed, Leaflets 12-18 x 4-6 cm, elliptic, caudate-acuminate at apex, attenuate at base; petiole to 16 cm long. Flowers solitary or 2-5 together, large, appear before leaves; calyx cup-shaped, irregularly lobed, sepals 3 x 3 cm, campanulate, densely villous within, lobes obtuse; petals reddish, 10 x 3 cm, oblong, obtuse, stellate-hairy outside, basaly united; stamens many, polyadelphous. Ovary 5-celled, oblong; Fruit a dehiscent capsule, to 10 x 3 cm, 5-valved, valves thick, leathery, downy tomentose, terete becoming ridged when dry, dehiscing at the ridges when dry.

Fl. & Fr. : January – April.

Distribution: Tropical Asia and New Guinea. Moist forests, streamside and riparian forests, *Amitha Bachan 98971* (Vazhachal, riparian forests, banks of Chalakkudy river, 230 m).

Bombax insigne Wall., Pl. Asiat. Rar. 1: 71. 1830; Hook. f., Fl. Brit. India 1: 349. 1784; Dunn in Gamble, Fl. Pres. Madras 100. 1915; M. P. Nayar & Biswas in B. D. Sharma & Sanjappa, Fl. India 3: 398. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 64. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 104. 2002; S. K. Srivast. & Vivek in P. Daniel, Fl. Kerala 1: 444. 2005 *Salmalia insignis* (Wall.) Schott & Endl., Melet. Bot. 35. 1832.

Deciduous trees to 25 m high; buttressed, straight armed with conical prickles. Leaves digitately compound, crowded at the tip of branchlets; rachis to 25 cm long, stout, pubescent, swollen at base, grooved above; leaflets 6-8, whorled to 20 x 8 cm, obovate-oblong, or elliptic-obovate. Flowers bisexual, pale pink or creamy yellow, solitary, axillary; calyx irregularly lobed, 3-5 cm long, campanulate, densely silky within; petals 5, 8-12 x 2.5 cm, linear-oblong; stamens about numerous

in 5 bundles; ovary ovoid, tomentose. Fruit a capsule, 5-angled, 8-10 x 4-4.5 cm, 5-valved, glabrous.

Fl. & Fr. : November – March.

Distribution : India and Myanmar. Moist forests. *Amitha Bachan 123454* (Vazhachal-Karanthodu, rocky streamside or cliffs in evergreen or moist forests, banks of Chalakkudy river, 320 m).

CULLENIA R. Wight

Icon. Pl. India Or. 5(1): 22, tt. 1761 & 1762. 1851.

Cullenia exarillata Robyns, Bull. Jard. Bot. Nat. Belg. 40: 249. 1970; Manilal, Fl. Silent Valley 30. 1988; M.P. Nayar & Biswas in B.D. Sharma & Sanjappa, Fl. India 3: 402. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 64. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 105. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 94. 2005; S. K. Srivast. & Vivek in P. Daniel, Fl. Kerala 1: 448. 2005 *Cullenia excelsa* Wight, Icon. Pl. India Orient. t. 1701, 1762.1851, *p.p.*; Mast. in Hook. f., Fl. Brit. India 1:350.1874; Dunn in Gamble, Fl. Pres. Madras 101.1915. *Cullenia rosayroana* Kosterm., Comm. For. Res. Inst. Indones. Bogor 51: 4, f. 2e & 3. 1956 & in Reinwardtia 4: 72. 1956. **Vediplavu, Kurangupali.**

Plate 14. A

Evergreen trees to 40 m high, buttressed; older branches covered with large tubercles; young branchlets and underside of leaves with peltate scales. Leaves simple, elliptic-oblong, acute or acuminate at apex, rounded or obtuse at apex; lamina to 10-20 x 4-8 cm, entire, coriaceous, shiny above, covered with orange peltate scales beneath; petiole to 15 mm, stout, grooved above; Flowers bisexual, 3 cm long, golden brownish-yellow, densely clustered on tubercles on old branches; pedicel 2 cm long; calyx tube 3 cm long, 5-lobed at apex, densely lepidote

outside; corolla absent; staminal tube 3-5 cm long, 5-lobed at apex with many stamens along the margin; ovary superior, syncarpous, densely lepidote, 5-locular; ovules 2 in each locule; Fruit a capsule, 10-20 cm across, globose, spiny, 5-valved; seeds 2 in each locule, 4 x 2 cm dark brown, shining.

Fl. & Fr. : January – November.

Distribution: Endemic to Southern Western Ghats. Large canopy trees of the wet-evergreen forests, riparian vegetation in the low-medium elevations. *Amitha Bachan 72081* (Sholayar, riparian evergreen forests, banks of Sholayar river, 700 m); *Amitha Bachan 98737* (Karimalathodu - Sholayar, riparian evergreen forests, Karimalathodu, 1000 m).

22. STERCULIACEAE (DC.) Bartl.

Ord. Nat. Pl. : 225. 1830.

Key to genera

1a. Flowers unisexual; petals absent.....2

1b. Flowers bisexual; petals present..... 4

2a. Fruit winged, 1-seeded, indehiscent..... **Heritiera**

2b. Fruit unwinged, 2-many seeded, dehiscent.....3

3a. Branches glabrous; seeds winged..... **Pterygota**

3b. Branches tomentose; seeds wingless.....**Sterculia**

4a. Fruit a spirally twisted follicle; petals unequal..... **Helicteres**

4b. Fruit not spirally twisted; petals equal.....5

5a. Ovary 1-celled; capsule 1-seeded.....**Waltheria**

5b. Ovary 5-celled; capsule many-seeded.....6

6a. Herbs; stamens 5; seeds wingless .....**Melochia**

6a. Trees; stamens numerous; seeds winged.....**Pterospermum**

HELICTERES Linnaeus

Sp. Pl. 963. 1753.

Helicteres isora L., Sp. Pl. 963. 1753; Mast. in Hook. f., Fl. Brit. India 1: 365. 1874; Dunn in Gamble, Fl. Pres. Madras 107. 1915; Manilal, Fl. Silent Valley 31. 1988; K. C. Malick in B. D. Sharma & Sanjappa, Fl. India 3: 426. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 66. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 107. 2002; Anil Kumar *et al.,* Fl. Pathanamthitta 94. 2005; Chithra in P. Daniel, Fl. Kerala 1: 456. 2005 C. N. Sunil & Sivad., Fl. Alappuzha 155. 2009. **Idampiri-Valampiri**.

Plate 14. G

Large shrubs to small trees. Leaves obovate, orbicular, to 16 x 6 cm, obliquely cordate at base, obtuse at apex, serrate, 3-nerved from base, scabrous. Flowers axillary, fascicled or solitary; calyx 1.5 cm long, tubular, 5-toothed, yellowish; petals to 3.5 cm long, unequal, reddish; gynophore 4 cm long, curved; stamens 5, filaments short, united at base; ovary 5-celled; ovules many; style 5. Fruit a spirally twisted follicle, 5 cm long; seeds many, tubercled.

Fl. & Fr. : September – December.

Distribution: Indo-Malysia, China and Australia. Moist forests. *Amitha Bachan 123459* (Vazhachal, open degraded areas in the riparian forests, banks of Chalakkudy river, 240 m).

HERITIERA W. Aiton

Hort. Kew. ed. 1, 3: 546. 1789.

Heritiera papilio Bedd., Fl. Sylv. t. 218. 1872; Mast. in Hook. f., Fl. Brit. India 1: 363. 1874; Dunn in Gamble, Fl. Pres. Madras 104. 1915;

Manilal, Fl. Silent Valley 32. 1988; K. C. Malick in B. D. Sharma & Sanjappa, Fl. India 3: 430. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 66. 1996; Chithra in P. Daniel, Fl. Kerala 1: 458. 2005. **Cholachaachi.**

Medium sized trees. Leaves simple, alternate, ovate-lanceolate, to 10 x 4 cm, acute at apex, rounded or cordate at base, entire, 3-nerved from base, densely white scaly below. Flowers unisexual, in axillary panicles; peduncle tomentose; calyx campanulate, 0.4 cm long, 5-lobed, lobes acute; Petals absent; stamens 5; anthers 5, sessile on tip of staminal column; carpels 5-6, free, ovules 1-2 in each; styles recurved; stigmas globose. Fruit of 5 distinct winged 1-seeded samaras, to 5 cm long; wings membranous.

Fl. & Fr. : January – May.

Distribution: India and Bangladesh. Evergreen forests. Rocky river margins. *Amitha Bachan 123484* (Orukombankutty-Parambikulam, riparian forest, banks of Kuriyarkutty river, 500 m).

MELOCHIA Linnaeus

Sp. Pl. 674. 1753.

Melochia corchorifolia L., Sp. Pl. 675. 1753; Mast. in Hook. f., Fl. Brit. India 1: 374. 1874; Dunn in Gamble, Fl. Pres. Madras 110. 1915; K. C. Malick in B. D. Sharma & Sanjappa, Fl. India 3: 441. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 67. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 108. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 95. 2005; Chithra in P. Daniel, Fl. Kerala 1: 462. 2005C. N. Sunil & Sivad., Fl. Alappuzha 138. 2009.

Slender herbs, stellate pubescent. Leaves ovate-lanceolate, 1-4 x 0.5-2 cm, rounded at base, serrate, scabrid. Flowers bisexual, 2-6 together, in densly crowded terminal clusters; cymes sessile; sepals

campanulate, 0.3 cm long, lobes subulate; petals pink, obovate, equal, 0.5 cm long, glabrous; stamens 5, united at base; ovary 5-celled, 2-ovules in each, densely hairy; styles 5, free. Capsule 5-valved, depressed globose, 0.5 cm across; seeds 1 or 2, angular.

Fl. & Fr. : Throughout the year.

Distribution : Pantropical. A common weed in open areas. *Amitha Bachan 123689* (Poringalkuthu, open areas near river, banks of Chalakkudy river, 350 m).

PTEROSPERMUM Schreber

Gen 2: 461. 1791, *nom. cons.*

Pterospermum diversifolium Blume, Bijdr. 88. 1825; Mast. in Hook. f., Fl. Brit. India 1: 367. 1874; Dunn in Gamble, Fl. Pres. Madras 108. 1915; Chandra in B. D. Sharma & Sanjappa, Fl. India 3: 449. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 67. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 95. 2005; Chithra in P. Daniel, Fl. Kerala 1: 464. 2005. *Pterospermum glabrescens* Wight & Arn., Prodr. 69. 1834. **Pambaram**.

Medium sized trees to 25 m high; branches horizontal; bark greyish brown. Leaves oblong, to 25 x 14 cm, abruptly acuminate at apex, cordate at base; nerves 12 pairs; petiole 1.5 cm long. Flowers bisexual, axillary, solitary; pedicel 1.5 cm long; sepals oblong, 10 x 1 cm, pubescent outside; petals oblong, equal, to 8 x 1 cm, glabrous, white; stamens numerous; ovary 5-celled. Capsule 5-angled, to 15 cm long, smooth; seeds many in each cell, winged at one end.

Fl. & Fr. : December – May.

Distribution: Indo-Malaysia. Moist forests. *Amitha Bachan 99193* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m).

STERCULIA Linnaeus

Sp. Pl. 1007. 1753.

Key to species

1a. Leaves palmatly lobed.....2

1b. Leaves undivided..... **S. guttata**

2a. Leaves with 5-7 long acuminate lobes; calyx pink..... **S. villosa**

2b. Leaves with 5 short caudate lobes; calyx yellow..... **S. urens**

Sterculia guttata Roxb. ex DC., Prodr. 1: 482.1824; Mast. in Hook. f., Fl. Brit. India 1:355.1874; Dunn in Gamble, Fl. Pres. Madras 106. 1915; Manilal, Fl. Silent Valley 33. 1988; K. C. Malick in B. D. Sharma & Sanjappa, Fl. India 3: 462. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 70. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 111. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 96. 2005; Chithra in P. Daniel, Fl. Kerala 1: 472. 2005 C. N. Sunil & Sivad., Fl. Alappuzha 140. 2009. **Kavalam, Thondi**. **Plate 14. E**

Trees, to 20 m high; branchlets stellate-tomentose. Leaves simple, alternate, broadly ovate-oblong, 10-24 x 5-15 cm, obtuse to truncate at base, acuminate or caudate-acuminate at apex, entire, glabrous above, stellate-tomentose beneath, coriaceous; 3-5-ribbed from base, prominent, lateral nerves 5-7 pairs; petiole to 5 cm long, stout, swollen at both ends, stellate-tomentose. Flowers unisexual, polygamous, arranged in simple cymes, white, dotted with pink; calyx campanulate, stellate tomentose, lobes 5, broadly ovate, united to middle; acute; petals absent; male flowers: staminal column recurved, anthers 10-12 arranged at tip, column hairy at apex; bisexual flowers: ovary 5, free, superior, globose, strigose with stellate hairs. Fruit an aggregate of 1-5 radiating follicles, obovoid, red; seeds ovoid, black, smooth, shining.

Fl. & Fr. : October- March.

Distribution: Indo-Malaysia. Moist forests. *Amitha Bachan 117710* (Vazhachal, riparian forest, banks of Chalakkudy river, 200 m).

Sterculia urens Roxb., Pl. Coromandel t. 24. 1795; Mast. in Hook. f., Fl. Brit. India 1: 355. 1874; Dunn in Gamble, Fl. Pres. Madras 106. 1915; K. C. Malick in B. D. Sharma & Sanjappa, Fl. India 3: 471. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 70. 1996; Chithra in P. Daniel, Fl. Kerala 1: 473. 2005. **Paravakka**.

Small deciduous trees, to 15 m high; branches tomentose. Leaves simple, alternate, palmately 3-5 lobed, clustered at the tips of branchlets, orbicular, to 30 x 25 cm, cordate at base, acuminate or caudate-acuminate at apex, entire, glabrous above, velvety pubescent beneath, coriaceous; 3-5-ribbed from base. Flowers unisexual, polygamous, greenish-yellow, in axillary tomentose panicles; calyx yellow, campanulate, hairy on both surfaces, lobes 5, a small hairy gland at the base of each lobe; petals absent; male flowers: staminal column short with 10 anthers at its tip; bisexual flowers: carpels usually 5, free, superior, on a short gynophore; style short, thick, hairy; stigmas 5; stamens in a ring round the carpel. Fruit an aggregate of 4-6 follicles, red, dense pubescent; seeds brown, 3-6, oblong.

Fl. & Fr. : January-May.

Distribution: Indo-Malaysia. Rocky stream banks. *Amitha Bachan 99159* (Vazhachal, rocky river banks, banks of Chalakkudy river, 200 m)

Sterculia villosa Roxb. ex Smith in Rees, Cyclop. 36: n.16. 1816; Mast. in Hook. f., Fl. Brit. India 1: 355. 1874; Dunn in Gamble, Fl. Pres. Madras 106. 1915; K.C. Malick in B.D. Sharma & Sanjappa, Fl. India 3: 472. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 70. 1996; N. Mohanan

& Sivad., Fl. Agasthyamala 112. 2002; Chithra in P. Daniel, Fl. Kerala 1: 474. 2005. **Vakka. Vakkanarumaram.**

Small trees to 10 m high; bark pale brown, fibrous; branchlets pubescent. Leaves simple, palmately 5-7 lobed, alternate, to 25 cm across, cordate at base; lobes caudate-acuminate at apex, penninerved, downy pubescent below; petioles 15-20 cm long. Flowers unisexual, on terminal panicles, cream-coloured, 2 cm across; pedicels 0.5 cm long; calyx 0.8 cm long, lobes oblong, tomentose outside; petals absent; stamens 10, anthers along the rim of staminal column; column hairy at apex; staminodes 10 in female flowers. Fruit an aggregate of 2-7 follicles, to 7 cm long, brown, tomentose, seeds many, black, smooth.

Fl. & Fr. : February-May.

Distribution: South Asia and Myanmar. Rocky outcrops in moist forests. *Amitha Bachan 123473* (Vazhachal, rocky river margins, banks of the Chalakkudy river, 200 m).

WALTHERIA Linnaeus

Sp. Pl. 673. 1753.

Waltheria indica L., Sp. Pl. 673. 1753; Mast. in Hook. f., Fl. Brit. India 1: 374. 1874; Dunn in Gamble, Fl. Pres. Madras 111. 1915; K.C. Malick in B.D. Sharma & Sanjappa, Fl. India 3: 473. 1993; N. Mohanan & Sivad., Fl. Agasthyamala 112. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 97. 2005; Chithra in P. Daniel, Fl. Kerala 1: 476. 2005 C. N. Sunil & Sivad., Fl. Alappuzha 141. 2009. *Waltheria americana* L., Sp. Pl. 673. 1753.

Herbs, to 70 cm high, densely tomentose. Leaves ovate, to 1.5-5 x 0.5-3 cm, acute at apex, obtuse to cordate at base, crenate; petiole 1.5 cm long. Flowers 3-10-together, in axillary or terminal heads, bisexual,

sessile; calyx tubular, 0.4 cm long, lobes subulate; petals yellow, equal, obovate, 0.4 cm long, stamens 5, monadelphous; ovary 1-celled, 2-ovuled, pubescent; style lateral. Capsule 2-valved; 1-seeded, hairy at apex.

Fl. & Fr. : October- April.

Distribution: Pantropical. Open wet areas, usually as a weed. *Amitha Bachan 123473* (Vazhachal, riparian open areas, banks of Chalakkudy river, 230 m).

23. TILIACEAE Juss.

Gen. Pl. 289. 1789

Key to Genera

1a. Fruit a drupe..... **Grewia**

1b. Fruit a capsule..... ..... **Triumfetta**

GREWIA Linnaeus

Sp. Pl. 964. 1753.

Key to species

1a. Large tree; leaves broadly ovate.....**G. tiliifolia**

1b. Small tree or large shrubs; leaves elliptic-lanceolate..... **G. serrulata**

Grewia tiliifolia Vahl, Symb. Bot. 1: 35. 1790; Mast. in Hook. f., Fl. Brit. India 1: 386. 1874, "*tiliaefolia*"; Dunn in Gamble, Fl. Pres. Madras 118. 1915; Manilal, Fl. Silent Valley 34. 1988; P. Daniel & M. Chandra. in B.D. Sharma & Sanjappa, Fl. India 3: 511. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 72. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 115. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 99. 2005; P Chithra in P. Daniel, Fl. Kerala 1: 493. 2005. *Grewia leptopetala* Brandis, Indian Trees

100. 1906. *Grewia tiliifolia* Vahl var. *leptopetala* (Brandis) Cooke, Fl. Pres. Bombay 142. 1901. *Grewia tiliifolia* Vahl var. *argentea* Burret, Notizbl. Bot. Gart. Berlin-Dahlem. 9: 659. 1926; V. Naray & R. S. Rao in J. Indian Bot. Soc. 29: 179. 1950. **Chadachi.**

Large trees; branchlets tomentose. Leaves simple, alternate, broadly ovate or obliquely ovate, 6-25 x 3-18 cm, obliquely cordate or subcordate at base, acute at apex, crenate-serrate, glabrescent above, pubescent beneath, coriaceous, 5-7-ribbed from base, prominent. Flowers in axillary umbels; peduncle 1.5-2 cm long; sepals 5, pubescent; petals 5, yellow, half the length of sepals, entire or notched, densely tomentose outside; stamens many, free, inserted on a glandular torus; gland densely villous on the margin; ovary superior, globose, hirsute, 2-4-celled, ovules 2-many; style subulate. Drupe subglobose, 2-lobed, reddish, hairy.

Fl. & Fr. : February –May.

Distribution: Tropical-Africa, India to Indo-China. Moist forests. Dry riparian areas. *Amitha Bachan 98773* (Vazhachal, degraded riparian forest, banks of Chalakkudy river, 180 m).

Grewia serrulata DC., Prodr. 1: 510. 1824; ; V. Naray & R. S. Rao in J. Indian Bot. Soc. 29: 179. 1950; P. Daniel & M. Chandra. in B.D. Sharma & Sanjappa, Fl. India 3: 509. 1993; P. Daniel, Fl. Kerala 1: 492. 2005. *Grewia glabra* Blume, Bijdr. 115. 1825; Manilal, Fl. Silent Valley 33. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 72. 1996; Chitra in P. Daniel Fl. Kerala 1: 492: 2005. *Grewia laevigata sensu* Mast. in Hook. f., Fl. Brit. India 1: 389. 1874, *non* Vahl 1790. *Grewia disperma sensu* Dunn in Gamble, Fl. Pres. Madras 118. 1915 *non* Rottl. ex Spreng. 1825; Anil Kumar *et al.,* Fl. Pathanamthitta 99. 2005. **Plate 14. B & C**

Small trees or shrubs, branchlets slender, glabrous. Leaves simple, alternate, distichous, elliptic, elliptic-lanceolate, 5-12 x 2-4 cm, acute or round at base, acuminate to caudate-acuminate at apex, serrate, sparsely stellate-pubescent; 3-ribbed from base. Flowers yellowish-white, in axillary umbellate cymes; peduncles 3 times longer than petiole; sepals 5, free, 3-nerved, stellate pubescent outside; petals 5, white, ovate, shorter than sepals, often notched; stamens many, inserted on a short glandular torus; style longer than stamens; stigma fimbriate. Drupe, globose,1-4-lobed, glabrous, greenish-black.

Fl. & Fr. : August-November.

Distribution: Indo-Malaysia and Africa. Moist forests. *Amitha Bachan 98873* (Sholayar, riparian forests, banks of Sholayar river, 700 m).

TRIUMFETTA Linnaeus

Sp. Pl. 444. 1753.

Key to species

1a. Leaves elliptic-lanceolate; capsule 2.5 cm across..... **T. pilosa**

1b. Leaves rhomboid-ovate; capsule under 0.5 cm long.....**T. rhomboidea**

Triumfetta pilosa Roth, Nov. Pl. Sp. 223. 1821; Mast. in Hook. f., Fl. Brit. India 1: 394. 1874; Dunn in Gamble, Fl. Pres. Madras 120. 1915; Manilal, Fl. Silent Valley 34. 1988; P. Daniel & M. Chandra. in B.D. Sharma & Sanjappa, Fl. India 3: 519. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 73. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 101. 2005; Chitra in P. Daniel in Fl. Kerala 1: 496. 2005. *Triumfetta cana* Blume, Bijdr. 113. 1825; Mast. in Hook. f., Fl. Brit. India 1: 396. 1874.

Large perennial herbs or undershrubs, to 2 m high; branches stellate-hairy. Leaves ovate-lanceolate, to 14 x 5 cm, rounded at base, acuminate at apex, serrate, densely stellate-hairy below, 5-nerved from

base. Flowers 3-10-together; pedicel 3 mm long; sepals 1 cm, hairy outside; petals yellow, oblanceolate, 0.7 mm, hairy at base; stamens 10, filaments 0.7 mm long. Capsule hirsute, densely glochidiate-bristled, 2.5 cm across including bristles.

Fl. & Fr. : November-February.

Distribution: Tropical Africa and central and east Asia. Moist forests. *Amitha Bachan 117784* (Vazhachal, riparian forest vegetation, banks of Chalakkudy river, 240 m).

Triumfetta rhomboidea Jacq., Enum. Syst. Pl. 22. 1760; Mast. in Hook. f., Fl. Brit. India 1: 395. 1874; Gamble, Fl. Pres. Madras 120. 1915; Manilal, Fl. Silent Valley 35. 1988; P. Daniel & M. Chandra. in B.D. Sharma & Sanjappa, Fl. India 3: 520. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 73. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 118. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 101. 2005; Chithra in P. Daniel, Fl. Kerala 1: 497. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 144. 2009. *Triumfetta angulata* Lam., Encycl. 3: 421. 1789. *Triumfetta trilocularis* Roxb., Fl. India 2: 462. 1832. *Triumfetta tungarensis* Billore, J. Econ. Tax. Bot. 3: 621. 1982.

Erect undershrubs or herbs; stem hairy, hairs simple or stellate or mixed. Leaves rhomboid-ovate, 3-lobed, to 7 x 6 cm, cordate or rounded at base, acuminate at apex, densely stellate-tomentose below, 3-5-ribbed from base; petiole to 3 cm long. Flowers on terminal or leaf opposed cymes, 3-15 together; pedicels 0.5 cm long; sepals 0.7 x 0.1 cm, sparsely stellate-hairy; petals oblanceolate, 0.6 x 0.2 cm, with two tufts of hairs at base. Capsule subglobose, to 0.5 cm across with fibrous bristles.

Fl. & Fr. : August – February.

Distribution: Pantropical. Common in open areas. *Amitha Bachan 117783* (Vazhachal, riparian forests, banks of Chalakkudy river, 240 m).

24. ELAEOCARPACEAE Juss. ex DC.

Prodr. 1: 519. 1824.

ELAEOCARPUS Linnaeus

Sp. Pl. 515. 1753.

Key to species

1a. Flowers under 1 cm acorss, sepals under 1 cm.....2

1b. Flowers > 1 cm across; sepals 1-2 cm..... **E. tuberculatus**

2a. Anthers ciliate on the longer valve..... **E. serratus**

2b. Anthers not ciliate on the longer valve..... **E. variabilis**

Elaeocarpus serratus L., Sp. Pl. 515. 1753, var. **serratus**; Mast. in Hook. f., Fl. Brit. India 1:401.1874; Dunn in Gamble, Fl. Pres. Madras 124. 1915; S. K. Murti in B. D. Sharma & Sanjappa, Fl. India 3: 553. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 74. 1996; Zmarzty, Kew Bull. 56: 434. 2001; N. Mohanan & Sivad., Fl. Agasthyamala 121. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 102. 2005; Reemakumari *et al.* in P. Daniel, Fl. Kerala 1: 502. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 146. 2009. *Elaeocarpus oblongus* Gaertn., Fruct. 1:202. t. 43. 1788. **Kara.**

Plate 15. E

Small trees, to 20 m high, large buttresses often with aerial roots; branchlets, petioles, peduncles and young leaves densely pubescent. Leaves simple, alternate, elliptic-ovate or elliptic-obovate, 5-12 x 2-5 cm, acute at base, acute to caudate-acuminate or obtusely acuminate at apex, crenate-serrate, glabrous, coriaceous; lateral nerves 3-8 pairs, pinnate; petiole to 3 cm, slender, pubescent. Racemes axillary, to 8 cm

long; sepals 5, ovate, pubescent on outside, densely glandulose, valvate; petals 5, laciniate, inserted round the base of glandular disc; stamens many, inserted between the glands on the disc; anthers not awned, tipped with hairs; ovary superior, densely tomentose, raised on torus, 3-celled, ovules 2 in each cell. Drupe subglobose, green; stone tubercled; seed one.

Fl. & Fr. : April-June.

Distribution : Indo – Malaysia. Evergreen forests, also sacred groves in the lower plains. *Amitha Bachan 123416* (Vazhachal, riparian evergreen forests, banks of Chalakkudy river, 220 m).

Elaeocarpus tuberculatus Roxb., Fl. India 2: 594.1832; Mast. in Hook. f., Fl. Brit. India 1:404.1874; Dunn in Gamble, Fl. Pres. Madras 124. 1915; Manilal, Fl. Silent Valley 37. 1988; Murti in B. D. Sharma & Sanjappa, Fl. India 3: 559. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 74. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 121. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 102. 2005; Reemakumari *et al.* in P. Daniel, Fl. Kerala 1: 503. 2005; *Monocera tuberculata* (Roxb.) Wight & Arn., Prodr. 83. 1834. **Puzhathanni, Poumbu**. **Plate 15. A**

Medium sized buttressed trees, to 25 m high; young parts densely brown villous; branches monopodial; branchlets terete, marked with leafscars. Leaves simple, alternate, clustered at the tip of branchlets, obovate, to 10-20 x 5-12 cm, cuneate or round at base, acute, obtuse or retuse at apex, subentire to distantly serrate, glabrous above, pubescent beneath, lateral nerves 8-11 pairs; petiole to 2.5 cm, pubescent, swollen tipped; Racemes axillary to 12 cm long; flowers bisexual, white; pedicel to 2 cm long, deflexed; sepals 5, lanceolate, tomentose outside, valvate; petals 5, white, fimbriate, fulvous tomentose inserted round the base of glandular disc; stamens numerous, inserted; anthers terminating in long

bristle; ovary superior, tomentose, placed on raised torus, 2-celled with 2 ovules in each cell. Drupe oblong or ellipsoid, green, to 4 × 2 cm, tomentose, stones single, compressed, coarsely tuberculate, 1-2-celled.

Fl. & Fr. : December- June.

Distribution : Indo-Malaysia. Along banks of streams in evergreen forests. *Amitha Bachan 99019* (Orukombankutty, riparian evergreen forests, banks of Chalakkudy river, 500 m).

Elaeocarpus variabilis Zmarzty, Kew Bull. 56: 429. 2001. *Elaeocarpus oblongus* sensu Mast. in Hook.f., Fl. Brit. India 1: 403. 1874, non Gaertn. 1788; Dunn in Gamble, Fl. Pres. Madras 124. 1915. *Craspedum tectorium* Lour., Fl. Cochinch. 336. 1790. *Elaeocarpus tectorius* (Lour.) Poir. in Lam., Encycl. Suppl. 2: 704. 1812; S. K. Murti in B. D. Sharma & Sanjappa, Fl. India 3: 559. 1993. *Elaeocarpus glandulosus* sensu *auctt.* Manilal, Fl. Silent Valley 36. 1988; S. K. Murti in B. D. Sharma & Sanjappa, Fl. India 3: 539. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 74. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 119. 2002; Reemakumari *et al.* in P. Daniel, Fl. Kerala 1: 499. 2005, non Wall. ex Merr. 1951. **Nakara.** **Plate 15. C**

Small to medium sized tree; buttressed; branchlets, young leaves and buds densely pubescent. Leaves simple, alternate, elliptic-ovate to elliptic-obovate to 10 x 5 cm, acute at base, acuminate at apex, distantly crenate or serrate, glabrous on both sides, coriaceous, glandular, lateral nerves pinnate, 4-8 pairs; petiole to 2 cm long, slender, pubescent when young, swollen at both ends, 2 minute glands at tip. Racemes axillary and terminal; flowers bisexual, white; pedicel 0.3 cm long; sepals 5, ovate-lanceolate, 0.5 cm, puberulous outside, glandular inside; petals 5, white, 0.6 cm, laciniate, glandular, inserted on the base of glandular disc; stamens many, inserted; anthers tipped with hairs; ovary superior,

subglobose, placed on a raised torus, densely hairy outside, 3-celled, ovules 2 in each cell; style subulate, entire. Drupe oblong, green, 2.5 × 2 cm, with a single stone inside.

Fl. & Fr. : December - May.

Distribution : Indo-Malaysia. Evergreen forests. *Amitha Bachan 99104* (Orukombankutty, riparian evergreen forests, banks of Chalakkudy river, 500 m).

25. **MALPIGHIACEAE** Juss.

Gen. Pl. 252. 1789.

HIPTAGE J. Gaertner

Fruct. 2: 169. 1790, *nom. cons.*

Hiptage benghalensis (L.) Kurz, J. Asiat. Soc. Bengal 43: 136. 1874; Manilal, Fl. Silent Valley 38. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 75. 1996; R.C. Srivastava. in Hajra *et al.*, Fl. India 4:14.1997; N. Mohanan & Sivad., Fl. Agasthyamala 125. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 104. 2005; V. Chandras. in P. Daniel, Fl. Kerala 1: 515. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 147. 2009. *Banisteria benghalensis* L., Sp. Pl. 427. 1753. *Hiptage madablota* Gaertn., Fruct. Sem. Pl. 2: 169, t. 116. 1790; Dunn in Gamble, Fl. Pres. Madras 128. 1915. *Gaertnera racemosa* Roxb., Pl. Coromandel 1; 74, t. 18. 1795 & Fl. India 2: 368. 1832. **Chittilakody.**

Large woody climber. Leaves opposite, elliptic, to 15 x 7 cm, acuminate at apex, obtuse at base, nerves 7 pairs, coriaceous; petiole 1 cm long, hirtus. Flowers on terminal and axillary racemes; racemes to 10 cm long; pedicels to 2 cm long, hispid; bracts lanceolate. Flowers white, calyx lobes ovate, obtuse, hispid, with a large red gland on one lobe, decurrent on petiole; petals 5, obovate, 1.2 x 1.0 cm, obtuse, fimbriate on

margins, clawed; stamens 10, free, one much longer than the other; ovary 3-lobed, densely hairy; style 1, 1.2 cm long, curved. Samara 3 winged, wings elliptic to obovate, to 5 x 1.5 cm; seeds globose 0.5 cm across, compressed.

Fl. & Fr. : November- April.

Distribution: Indo-Malaysia and China. Along riverbanks in moist forests. also in sacred groves in the plains. *Amitha Bachan 99157* (Poringalkuthu, riparian forests, banks of Chalakkudy river, 350 m).

26. BALSAMINACEAE

A. Rich. in Bory, Dict. Class. Hist. Nat. 2: 173. 1822.

IMPATIENS Linnaeus

Sp. Pl. 937. 1753.

Key to species

1a. Acaulescent scapigerous herbs; leaves radical..... **I. scapiflora**

1b. Caulescent non scapigerous herbs; leaves cauline.....2

2a. Epiphytic perennial herbs.....**I. parasitica**

2b. Non epiphytic herbs.....4

3a. leaves opposite.....5

3b. leaves alternate or vericillate.....8

4a. Spur 0-2 mm long.....**I. herbicola**

4b. Spur 0.5-4 cm long.....6

5a. Leaves sessile.....**I. chinensis** var. **brevicornis**

5b. Leaves petioled.....7

6a. Leaves linear-lanceolate; short petioled.....**I. minor**

6b. Leaves ovate; long petioled.....**I. goughii**

7a. Leaves vericillate; flowers scarlet coloured.....**I. verticillata**

7b. Leaves alternate or scattered; flowers pink or rose.....9

8a. Leaves alternate, to 7 cm long; flowers pink; .....**I. flaccida**

8b. Leaves scattered, to 16 cm long; flowers rose.....**I. maculata**

Impatiens chinensis L. var. brevicornis Barnes J. Indian Bot. Soc. 18: 99. 1939. Vivek *et al.* in Hajra et al. Fl. India 4: 131. 1997; *Impatiens chinensis* L., Sp. Pl. 937. 1753; Hook. f., Fl. Brit. India 1: 444. 1874; Gamble, Fl. Pres. Madras 139. 1915; Manilal, Fl. Silent Valley 39. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 77. 1996; Vivek. *et al.* in Hajra *et al.*, Fl. India 4: 131. 1997; N. Mohanan & Sivad., Fl. Agasthyamala 130. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 107. 2005; Rathakr. *et al.* in P. Daniel Fl. Kerala 1: 534. 2005, non L. 1753. *Impatiens fasciculata* Lam., Dict. 1: 359. 1873. **Plate 15. B**

Succulent herbs, usually unbranched, to 40 cm high, reddish. Leaves simple, opposite, linear-oblong, cordate at base, distantly crenate, glabrous. Flowers pink, axillary, pedicelled; pedicels 3 cm long, deflexed in fruits. lip 8 mm long, acuminate and curved back at apex, Sepals 3, 2 lateral smaller, the lower large and spurred, linear-lanceolate, spur 15 mm long, slender. Petals 5, standard petal ovate; wings broadly obovate, without claw; spur longer than the wing petal. Capsule 10 mm long, glabrous, Seeds black, smooth.

Fl. & Fr. : August-December.

Distribution : India and China. Wet areas and streamside. *Amitha Bachan 99093* (Sholayar, wet streamside, Kulamalithodu, 800 m); *Amitha Bachan 98954* (Nelliyampathy, streamside vegetation, Veettiyar, 1100 m).

Impatiens flaccida Arn., Comp. Bot. Mag. 1: 322.1836; Hook. f., Fl. Brit. India 1:457.1874; Gamble, Fl. Pres. Madras 143. 1915; Sasidh. & Sivar., Fl. Pl. Thrissur For. 78. 1996; Vivek. *et al.* in Hajra *et al.*, Fl. India 4: 146. 1997; Anil Kumar *et al.*, Fl. Pathanamthitta 107. 2005; Rathakr. *et al.* in P. Daniel Fl. Kerala 1: 540. 2005

Erect herbs, to 40 cm high, glabrous. Leaves to 7 x 3 cm, all alternate, elliptic, ovate, acute or shortly acuminate at tip, acute at base, serrate crenate, eglandular, glabrous; lateral nerves to 10; petiole to 3 cm long. Flowers solitary or paired, axillary, pink in color; pedicels to 5 cm long; lip 6 x 3.5 cm, acute; spur to 2-3.5 cm long, slender, glabrous; sepal 2 x 1 mm, ovate, acute; standard 8-10 mm long, broadly oblong, emarginate at apex, keeled; lobes of wings equal, 13 mm long, obtuse, pink, obtuse. Capsule 12 x 5 mm, ellipsoid, glabrous; seeds minutely hairy.

Fl. & Fr. : July – October.

Distribution: Endemic to South India and Sri Lanka. Wet open rocky areas. Streamside wet rocky areas, *Amitha Bachan 99092* (Sholayar, streamside, banks of Sholayar river, 700 m).

Impatiens goughii Wight, Illustr. Ind. Bot. 1: 160. 1840; Hook. f., Fl. Brit. India 1: 452. 1874; Gamble, Fl. Pres. Madras 144. 1915; Sasidh. & Sivar., Fl. Pl. Thrissur For. 78. 1996; Vivek. *et al.* in Hajra *et al.*, Fl. India 4: 152. 1997; Anil Kumar *et al.*, Fl. Pathanamthitta 107. 2005; Rathakr. *et al.* in P. Daniel Fl. Kerala 1: 542. 2005. *Impatiens anamallayensis* Bedd., Icon. Pl. Indiae Oriant. t. 150. 1868-1874. *Impatiens microtheca* Hook. f., Hooker.'s Icon. Pl. 30: t. 2910. 1910. **Plate 16. D**

Annual slender herbs, to 25 cm tall. Leaves opposite rarely alternate, to 2.5 x 1-2 cm, ovate- lanceolate, acute, base rounded, coarsely serrate; petiole to 6 mm long. Flowers pink, in axillary 4-7 cm

long peduncles; pedicels slender 1-2 cm long. Sepals linear, minute. Standard petal orbicular, retuse, mucronate; wing petals variable, lower 2- lobed; spur shorter than petals. Capsule ovoid; seeds tubercled.

Fl. & Fr. : July – December.

Distribution: Endemic to the Western Ghats. Wet rocky areas, stream sides. *Amitha Bachan 99091* (Sholayar, riparian vegetation, banks of Sholayar river, 700 m).

Impatiens herbicola Hook. f., Bull. Misc. Inform. Kew 1911: 354. 1911; Gamble, Fl. Pres. Madras 141. 1915; Vivek. *et al.* in Hajra *et al.*, Fl. India 4: 156. 1997; Anil Kumar *et al.*, Fl. Pathanamthitta 107. 2005; Rathakr. *et al.* in P. Daniel Fl. Kerala 1: 544. 2005. **Plate 15. D**

Branched glabrous herbs, 25 cm high, erect. Leaves opposite, to 4.5 x 0.5 cm, linear-oblong, nearly entire, young ones pubescent above. Flowers paired, axillary; pedicels 1.5 cm long, pubescent on one side along a line. Lip 5 x 2 mm, boat-shaped, cuspidate, hairy; spur inconspicuous; sepals 4.5 mm long, linear, pubescent; standard 3 x 3.5 mm, obovate; keel ciliate, produced into a short cusp; wings 5 x 2 mm, 2-lobed; basal lobe shorter, dorsal auricle minute. Capsule 7-10 mm long, glabrous; seeds many, glabrous, dark-brown.

Fl. & Fr. : November-January.

Distribution: Endemic to Southern Western Ghats, vulnerable. Rocky cuttings in the riparian areas. *Amitha Bachan 123650* (Karimala-Parambikulam, streamside rock cuttings, banks of Karimalathodu, 1000m).

Impatiens maculata Wight, Madras J. Lit. Sci. ser. 1, 5: 12. 1837; Hook. f., Fl. Brit. India 1: 465. 1875; Gamble, Fl. Pres. Madras 145. 1915;

Vivek. *et al.* in Hajra *et al.*, Fl. India 4: 177. 1997; Rathakr. *et al.* in P. Daniel Fl. Kerala 1: 550. 2005. **Plate 17. B**

Large fleshy herbs, to 1-1.5 high; stems blotched with brown spots. Leaves alternate or scattered, simple, scattered, pubescent, to 16 x 6 cm, elliptic, acute at both ends, crenate-serrate; petiole to 5 cm long; upper part of the petiole and base of the lamina with stalked glands. Racemes axillary, to 15 cm long,; pedicels to 2 cm long. Flowers solitary on nodes, 3 cm across; lip 10 mm long, cuspidate; spur 15 mm long, tubular; sepals 6 x 3.5 mm, ovate; standard 5 x 6 mm, orbicular; wings 15-17 mm long; lower lobe very small, rose coloured; upper lobe 15-17 x 10-11 mm, obovate, obtuse. Capsule 8 x 6 mm, bulged to one side, glabrous; seeds many, brown.

Fl. & Fr. : July –September.

Distribution : Endemic to Southern Western Ghats. Along the stream sides of evergreen forests at medium to higher elevations. *Amitha Bachan 99070* (Sholayar, stream bank, Kulamalithodu, 1000 m).

Impatiens minor (DC.) Bennet, Indian J. For. 2: 283. 1979; Sasidh. & Sivar., Fl. Pl. Thrissur For. 78. 1996; Vivek. *et al.* in Hajra *et al.*, Fl. India 4: 181. 1997; Anil Kumar *et al.*, Fl. Pathanamthitta 108. 2005; Rathakr. *et al.* in P. Daniel Fl. Kerala 1: 550. 2005. *Balsamina minor* DC., Prodr. 1: 686. 1824. *Impatiens kleinii* Wight & Arn., Prodr. 140.1834; Hook. f., Fl. Brit. India 1:445.1874; Gamble, Fl. Pres. Madras 140.1915; Manilal, Fl. Silent Valley 40. 1988. **Plate 15.F**

Slender glabrous branched herbs, to 30 cm high, glabrous. Leaves opposite, to 8 x 1.5 cm, elliptic oblong, acute, base serrulate, with a pair of stalked glands at the base, petiole to 5 mm long. Flowers paired, axillary; pedicel 15 mm long, deflexed in fruit; lip 4 x 1.5 mm, acute; spur 10 mm long, straight, slender; sepals 4 mm long, ovate; standard 5

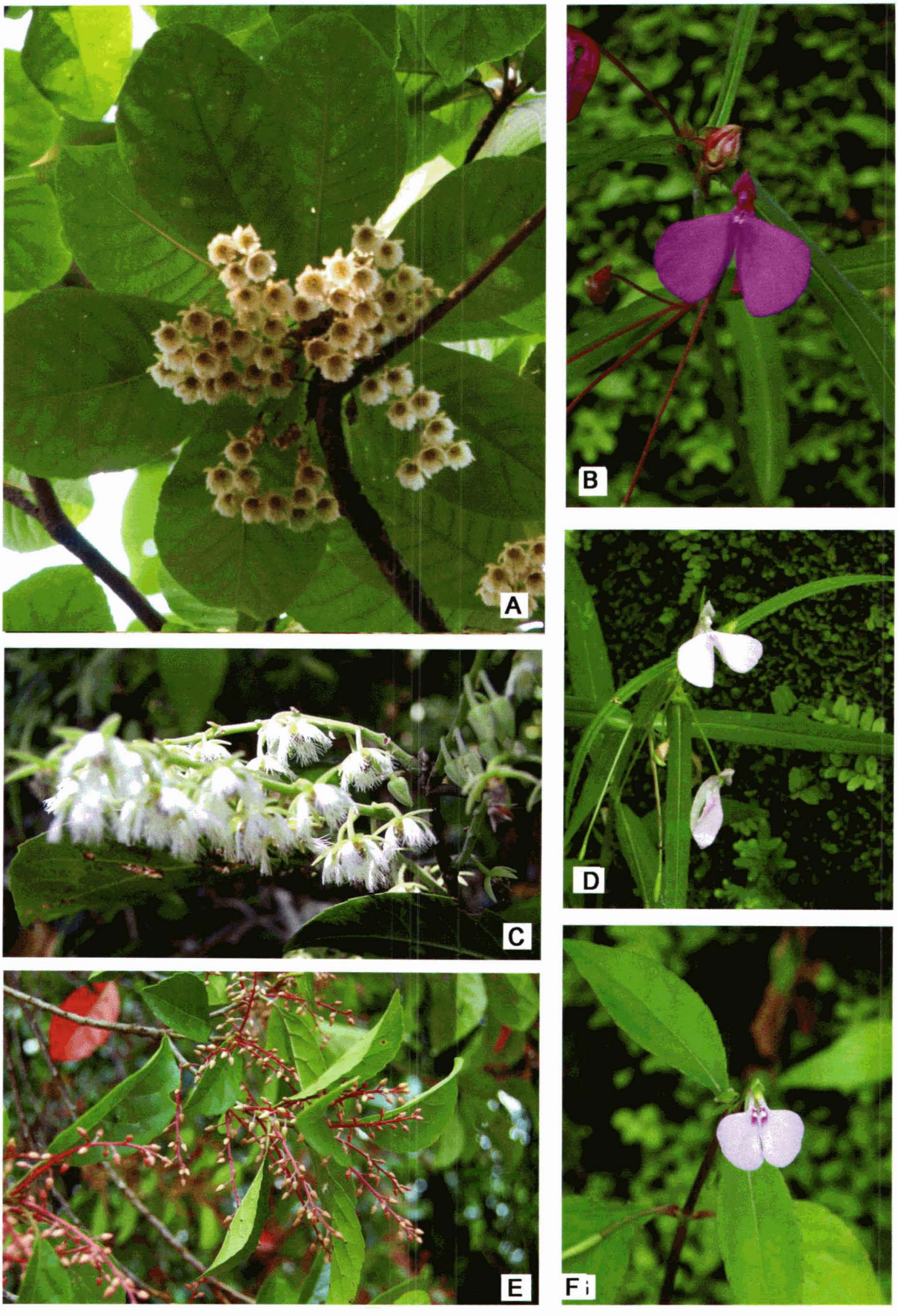


Plate 15. A. *Elaeocarpus tuberculatus* Roxb.; B. *Impatiens chinensis* L.; C. *Elaeocarpus variabilis* Zmarzty; D. *Impatiens herbicola* Hook. f.; E. *Elaeocarpus serratus* L. var. *serratus*; F. *Impatiens minor* (DC.) Bennet

x 4 mm, concave, acute; wings 8 x 3 mm, unlobed, obovate, stalked, white to pink. Capsule linear, 2 cm long; seeds black.

Fl. & Fr. : August – December.

Distribution: Endemic to Peninsular India, Moist forest areas, rocky or muddy streamside vegetation *Amitha Bachan* (Orukombankutty, riparian vegetation, banks of Chalakkudy river, 400 m).

Impatiens parasitica Bedd., Madras J. Lit. Sci. ser. 2, 20: 66. t.7. f.2. 1859 & Icon. Pl. Ind. Oriant. t. 140. 1868-1874; Gamble, Fl. Pres. Madras 139. 1915; Vivek. *et al.* in Hajra *et al.*, Fl. India 4: 191. 1997; Rathakr. *et al.* in P. Daniel Fl. Kerala 1: 554. 2005. *Impatiens jerdoniae* Wight var. *parasitica* (Bedd.) Hook. f., Fl. Brit. India 1: 460. 1874.

Plate 17. A

Epiphytic succulent herbs, stem stout, very succulent, unevenly thickened, reddish. Leaves to 6 x 3.5 cm, elliptic-ovate, acute or shortly acuminate, base acute, serrate, collected towards the apex, glabrous; petiole to 4 cm long. Cymes 2-4- flowered, axillary; peduncle 2 cm long, glabrous. Flowers 2.5 cm long; pedicels to 2 cm long; lip greenish at mouth, rest scarlet; spur 12 mm, reddish, striate; sepals 3 mm long, linear, green, acute; standard 12 x 14 mm, green with yellow margins, with a strong midrib; wings 2-lobed, lower lobe larger, flat, enter into the spur of the lip, red. Capsule 5mm long.

Fl. & Fr. : November-January.

Distribution: Endemic to Southern Western Ghats. Epiphytic herbs on the evergreen streamside vegetation. *Amitha Bachan 72080* (Sholayar-Chandanthodu, streamside vegetation, 800 m).

Impatiens scapiflora Heyne ex Roxb., Fl. India 2: 464. 1824; Hook. f., Fl. Brit. India 1: 443. 1874; Gamble, Fl. Pres. Madras 138. 1915;

Manilal, Fl. Silent Valley 41. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 79. 1996; Vivek. *et al.* in Hajra *et al.*, Fl. India 4: 208. 1997; N. Mohanan & Sivad., Fl. Agasthyamala 133. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 108. 2005; Rathakr. *et al.* in P. Daniel Fl. Kerala 1: 557. 2005. *Impatiens rivalis* Wight, Icon. Pl. Ind. Oriant. t. 751. 1844.

Plate 16. A, B & C

Scapigerous herbs with tuberous rootstock. Leaves to 17 x 11 cm ovate, obtuse, base cordate, distantly serrate, glabrous, all radical, basally 7-11 nerved; petiole to 15 cm long. Flowers pink, racemose, confined to the apex of long scape, scape to 30 cm long ; pedicels to 3.5 cm long. Sepals lanceolate, acute. Petals pink in colour, standard petal orbicular- rhomboid; wings 3- lobed; spur slender, to 5.5 cm long, incurved. Seeds very minute, clothed with spiral hairs.

Fl. & Fr. : July – September.

Distribution: Endemic to the Western Ghats. Wet dripping rocks in evergreen riparian forests. *Amitha Bachan 99090* (Sholayar, streamside vegetation on rocky cuttings, banks of Sholayar river, 700 m).

Impatiens verticillata Wight, Madras J. Lit. Sci. ser. 1, 5: 15. 1837; Hook. f., Fl. Brit. India 1: 452. 1874; Gamble, Fl. Pres. Madras 144. 1915; Vivek. *et al.* in Hajra et al., Fl. India 4: 225. 1997; N. Mohanan & Sivad., Fl. Agasthyamala 135. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 108. 2005; Rathakr. *et al.* in P. Daniel Fl. Kerala 1: 564. 2005.

Plate 17. A

Erect branching herbs attached to rocky streamsides, 30-45 cm high; stems reddish, glabrous. Leaves whorled, 10-14 x 1-2 cm, narrowly elliptic, acute at either ends, serrate, glabrous; petiole 1.5 cm long. Peduncle 5 cm long, few-flowered. Flowers orange-red; pedicels 3.5 cm

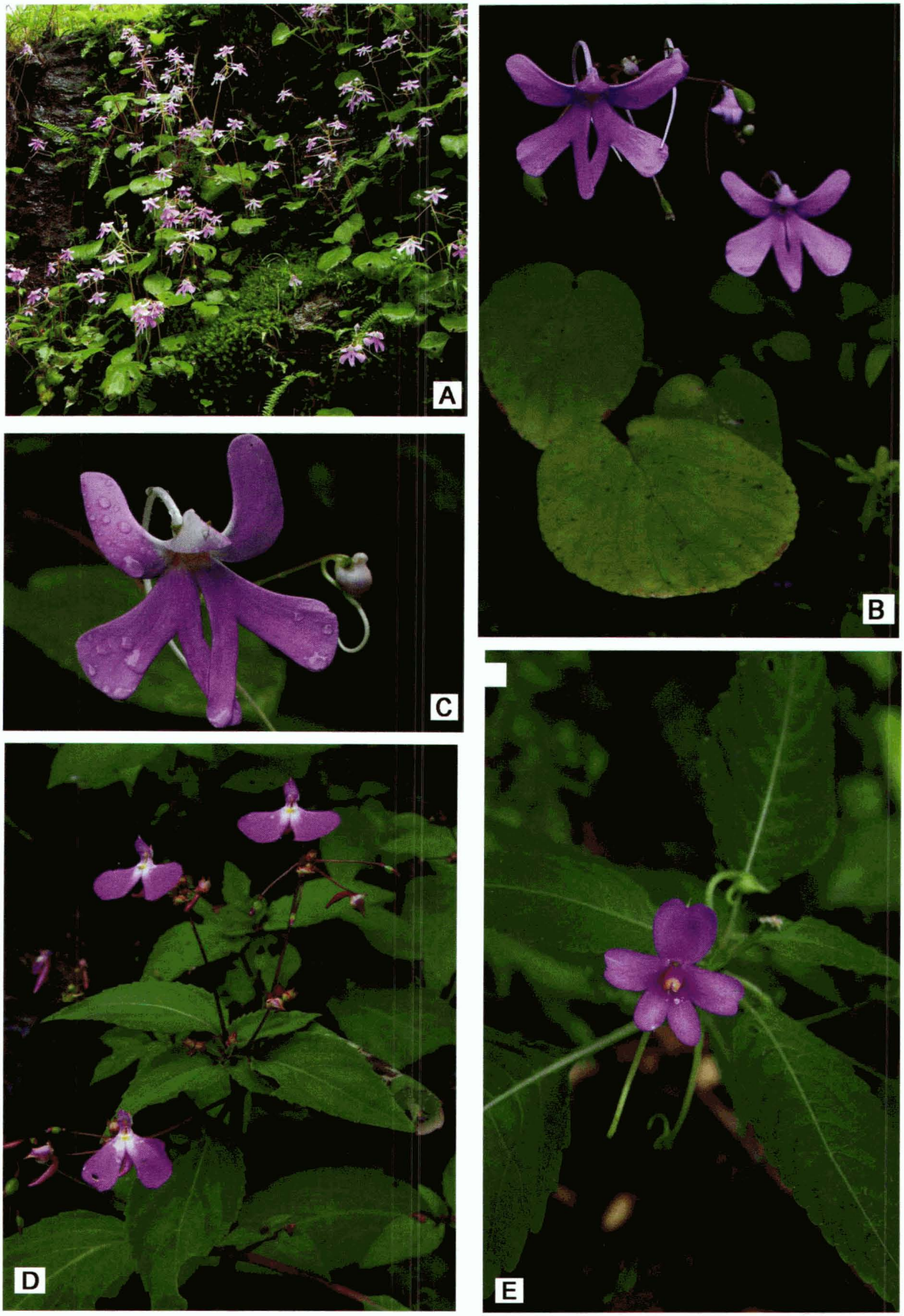


Plate 16. A, B & C. *Impatiens scapiflora* Heyne ex Roxb., A. & B. Habit, C. Flower; D. *Impatiens goughii* Wight; E. *Impatiens flaccida* Arn.

long, slender; lip 12 x 5 mm, curved, aristate; spur 35 mm long, curved, slender; sepals 12 x 3 mm, falcate; standard 12 x 10 mm, orbicular, cuspidate; wings 30 mm long, stalked, unequally 2-lobed. Capsule 20 mm long, glabrous; seeds many, 3 mm across, obovoid, densely hairy.

Fl. & Fr. : July-January.

Distribution: Endemic to Southern Western Ghats. Along stream banks in evergreen forests. *Amitha Bachan 123488* (Meenchaliyali-Sholayar, stream banks, banks of Meenchaliyali stream, 800 m)

27. OXALIDACEAE R. Br.

in Tuckey, Narr. Exped. Zaire : 433. 1818.

Biophytum reinwardtii (Zucc.) Klotzsch. in Peters Reise Mossamb. Bot. 1: 85. 1861, var. **reinwardtii**; Edgew. & Hook.f. in Hook. f., Fl. Brit. India 1: 437. 1874; Gamble, Fl. Pres. Madras 133. 1915; Sasidh. & Sivar., Fl. Pl. Thrissur For. 76. 1996; Manna in Hajra *et al.*, Fl. India 4: 236. 1997; N. Mohanan & Sivad., Fl. Agasthyamala 126. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 104. 2005; N. P. Balakr. & Arisdason in P. Daniel Fl Kerala 1: 573. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 150. 2009. *Oxalis reinwardtii* Zucc., Abh. Math.-Phys. Cl. Koenigl. Bayer. Akad. Wiss. 1: 274. 1829-1830. **Mukkutty**.

Unbranched erect herbs; stem to 20 cm tall. Leaves 5-12 cm long, collected at apex into a caudex; leaflets 6-15 pairs, terminal pairs oblong, to 1 x 0.6 cm, slightly oblique truncate at base, obtuse at apex, margin ciliate, glabrous; basal smaller, ovate, to 0.5 x 0.3 cm. Inflorescence Umbels, clustered, long peduncles; peduncle to 15 cm long, glandular-hispid. Flowers to 8 per umbel; pedicels slender, glandular; sepals ovate-lanceolate, 4 x 1 mm, acute, brown; petals yellow, 7 x 2 mm, oblanceolate, retuse, with a red line in the middle; stamens 10,

dimorphic, connate below. Capsule ovoid, to 0.4 cm, glandular pubescent; seeds ovoid, tubercled, red.

Fl. & Fr. : July-October.

Distribution: Indo-Malaysia and China. On moist soils in the moist forests to lower plains. *Amitha Bachan 98702* (Elanthikkara, riparian, banks of Chalakkudy river, sea level).

28. RUTACEAE Juss.

Gen. Pl. 296. 1789.

Key to genera

1a. Leaves 1-foliolate.....2

1b. Leaves 3-many-foliolate..... 4

2a. Leaves opposite..... .... **Acronychia**

2b. Leaves alternate..... 3

3a. Large shrubs, unarmed..... **Atalantia**

3b. Woody climbers, armed with axillary thorns .....**Paramignya**

4a. Stamens equal to the number of sepals 5

4b. Stamens twice the number of sepals 6

5a. Leaves opposite; unarmed trees.....**Melicope**

5b. Leaves alternate; armed climbers or shrubs.....**Toddalia**

6a. Large dioecious trees, flowers unisexual.....**Vepris**

6b. Shrubs or small trees; flowers bisexual.....7

7a. Style persistent.....**Glycosmis**

7b. Style deciduous.....**Clausena**

ACRONYCHIA J. R. Forster & J. G. A. Forster

Charact. Gen. 53, t. 27. 1776, *nom. cons.*

Acronychia pedunculata (L.) Miq., Fl. India Bat. Suppl. 532. 1861; Manilal, Fl. Silent Valley 42. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 80. 1996; K. N. Nair & M. P. Nayar in Hajra *et al.*, Fl. India 4: 392.1997; N. Mohanan & Sivad., Fl. Agasthyamala 137. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 110. 2005; Premnath in P. Daniel Fl. Kerala 1: 582. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 155. 2009. *Jambolifera pedunculata* L., Sp. Pl. 349. 1753. *Acronychia laurifolia* Blume, Cat. Gew. Buitenz. 63. 1823; Hook. f., Fl. Brit. India 1: 498. 1875; Gamble, Fl. Pres. Madras 152. 1915. *Acronychia barberi* Gamble, Bull. Misc. Inform. Kew 1915: 345. 1915 & Gamble, Fl. Pres. Madras 152. 1915. **Mavaranchi, Verukutheenni**.

Small to medium sized evergreen trees; branchlets stout, terete, glabrous. Leaves unifoliolate, opposite, decussate, estipulate, obovate to oblong, obtusely acute at apex, acute at base, 8-15 x 3-6 cm; nerves to 13 pairs, strongly reticulate; rachis 1-3 cm long, slender, glabrous, grooved above; Flowers bisexual, yellowish-white; in trichotomous, corymbose, axillary cymes, pedicelled; sepals 4, 0.15 cm long, ovate, obtuse; petals 4, 0.6 x 0.2 cm, oblong, densely hairy within; stamens 8, 2-seriate; filaments unequal, densely reflexed-hairy; anthers oblong; ovary 4-celled, superior, conical, partly immersed in the disc, tomentose; style 1, 3 mm long. Fruit a berry, subglobose, pale-brown, obscurely lobed, to 1 cm across; seeds black.

Fl. & Fr. : July-August.

Distribution: Indo-Malaysia and China. Evergreen forests. *Amitha Bachan 117771* (Sholayar, riparian forest, banks of Sholayar river, 700m)

ATALANTIA Correa

Ann. Mus. Natl. Hist. Nat. 6: 383. 1805, *nom. cons.*

Atalantia racemosa Wight var. **bourdillonii** K.N. Nair & M.P. Nayar, Indian J. For. 13: 69. 1990; Sasidh. & Sivar., Fl. Pl. Thrissur For. 80. 1996; K.N. Nair & M.P. Nayar in Hajra *et al.*, Fl. India 4: 271. 1997; Premnath in P. Daniel Fl. Kerala 1: 582. 2005. **Kattunarenga.**

Large shrubs to small trees, unarmed, branchlets glabrous. Leaves elliptic-oblong, acute at either ends, to 13 x 5 cm; nerves many, obtuse; petiole to 1 cm long. Raceme 1-3 cm long, axillary. Flowers 0.5 cm across; pedicels 0.2 cm long; sepals orbicular, ciliate; petals white, orbicular, 0.4 x 0.3 cm, ciliate at apex; stamens monadelphous, staminal tube 0.1 cm long; anthers 0.15 cm long, cordate at base; ovary 2-celled; style short or absent; stigma clavate.

Fl. & Fr. : January-March

Distribution: Endemic to Southern Western Ghats. Evergreen forests, riparian forests. *Amitha Bachan 117780* (Vazhachal, riparian forests, banks of Chalakkudy river, 240 m).

CLAUSENA N. L. Burman

Fl. Indica 87, t. 29, f. 2. 1768

1a. Flowers 4-merous, leaflets serrulate, inflorescence shorter than leaves .....**C. anisata**

1b. Flowers 5-merous, leaflets subentire, inflorescence longer than leaves .....**C. indica**

Clausena anisata (Willd.) Hook.f. ex Benth. in Hook., Niger Fl. 256. 1849; K.N. Nair & M.P. Nayar in Hajra *et al.*, Fl. India 4: 321.1997; Premnath in P. Daniel Fl. Kerala 1: 593. 2005. *Amyris anisata* Willd., Sp.

Pl. 2: 337. 1799. *Amyris dentata* Willd., Sp. Pl. 2: 337. 1799. *Clausena dentata* (Willd.) Roem., Syn. Hesper. 1: 44. 1846; Manilal, Fl. Silent Valley 43. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 139. 2002. *Clausena willdenowii* Wight & Arn., Prodr. 96. 1834; Hook. f., Fl. Brit. India 1:506. 1875; Gamble, Fl. Pres. Madras 155. 1915. *Clausena willdenowii* Wight & Arn. var. *nana* (Roxb.) Balakr., Bull. Bot. Surv. India 22: 173. 1982. *Clausena willdenowii* Wight & Arn. var. *pubescens* (Wight & Arn.) Hook.f., Fl. Brit. India 1: 506. 1875. *Clausena willdenowii* Wight & Arn. var. *dulcis* (Bedd.) Bedd., Fl. Sylv. S. India 45. 1871. *Clausena dentata* (Willd.) Roem. var. *dulcis* (Bedd.) Swingle, J. Wash. Acad. Sci. 28: 532. 1938. *Clausena dentata* (Willd.) Roem. var. *pubescens* (Wight & Arn.) Tanaka, J. Bot. 68:277.1930; Sasidh. & Sivar., Fl. Pl. Thrissur For. 81. 1996. **Kattukariveppila.** **Plate 17.E**

Shrubs to small trees; bark brown; twigs puberulus. Leaves to 25 cm long; leaflets 7-9 pairs, sub-opposite, ovate, acute, to 6 x 3 cm, base oblique, serrulate; membranous. Panicles to 10 cm long, axillary; racemes tomentose, shorter than the leaves Flowers greenish white, pedicelled; to 1 cm across; sepals 4, 0.1 cm long, oblong, obtuse; petals 0.5 cm long, obovate, concave; stamens 8, filaments unequal, glabrous. Ovary 4 grooved. Berry 8 mm across, globose, glandular; seeds few, seated in yellow pulp.

Fl. & Fr. : March-June.

Distribution: Endemic to the Western Ghats and Sri Lanka. Evergreen riparian forests. *Amitha Bachan 123324* (Vavalala-Sholayar, riparian forest, banks of Sholayar river, 600 m).

Clausena indica (Dalz.) Oliver, J. Linn. Soc. Bot. 5: 36. 1861; Hook. f., Fl. Brit. India 1: 505. 1875; Gamble, Fl. Pres. Madras 155. 1915; Manilal, Fl. Silent Valley 44. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For.

81. 1996; K.N. Nair & M.P. Nayar in Hajra *et al.*, Fl. India 4: 328. 1997; Premnath in P. Daniel Fl. Kerala 1: 582. 2005. *Piptostylis indica* Dalz. in Hooker's J. Bot. Kew Gard. Misc. 3: 33. t.2. 1851. **Kattumunthiri.**

Small evergreen trees; branchlets puberulus. Leaves 7-11 foliolate, to 23 x 10 cm; leaflets alternate, ovate, oblique at base, acute or obtuse at apex, to 6 x 3 cm, subentire; lateral nerves 5 pairs; petiolule 0.3 cm long. Panicle to 10 cm across, terminal or subterminal, branches puberulus. Flowers sessile, 0.3 cm across; sepals ovate, acute, ciliate; petals greenish white, to 0.2 cm, ovate, glabrous; stamens 10, filaments glabrous. Ovary globose, gland dotted. Berry 0.8 cm across, globose, dark blue; seeds 1-4, biconvex, glabrous.

Fl. & Fr. : July-August.

Distribution: Endemic to Peninsular India and Sri Lanka. Evergreen forests, river margin vegetation. *Amitha Bachan 98892* (Sholayar, riparian forest, banks of Sholayar river, 800 m).

GLYCOSMIS Correa

Ann. Mus. Natl. Hist. Nat. 6: 384. 1805, *nom. cons.*

Glycosmis pentaphylla (Retz.) DC., Prodr. 1:538. 1824, *quoad* basionym; Hook. f., Fl. Brit. India 1:499.1875, p.p; Sasidh. & Sivar., Fl. Pl. Thrissur For. 82. 1996; K.N. Nair & M.P. Nayar in Hajra *et al.*, Fl. India 4:343.1997; N. Mohanan & Sivad., Fl. Agasthyamala 144. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 112. 2005; Premnath in P. Daniel Fl. Kerala 1: 599; 2005 C. N. Sunil & Sivad., Fl. Alappuzha 155. 2009. *Limonia pentaphylla* Retz., Obs. Bot. 5: 24. 1788. *Limonia arborea* Roxb., Pl. Corom. t. 85. 1798. *Glycosmis arborea* (Roxb.) DC., Prodr. 1: 538. 1824. *Glycosmis cochinchinensis* Gamble, Fl. Pres. Madras 153. 1915 p.p, non (Lour.) Pierre ex Engl. 1896. **Kuttippanel.** **Plate 15.C**

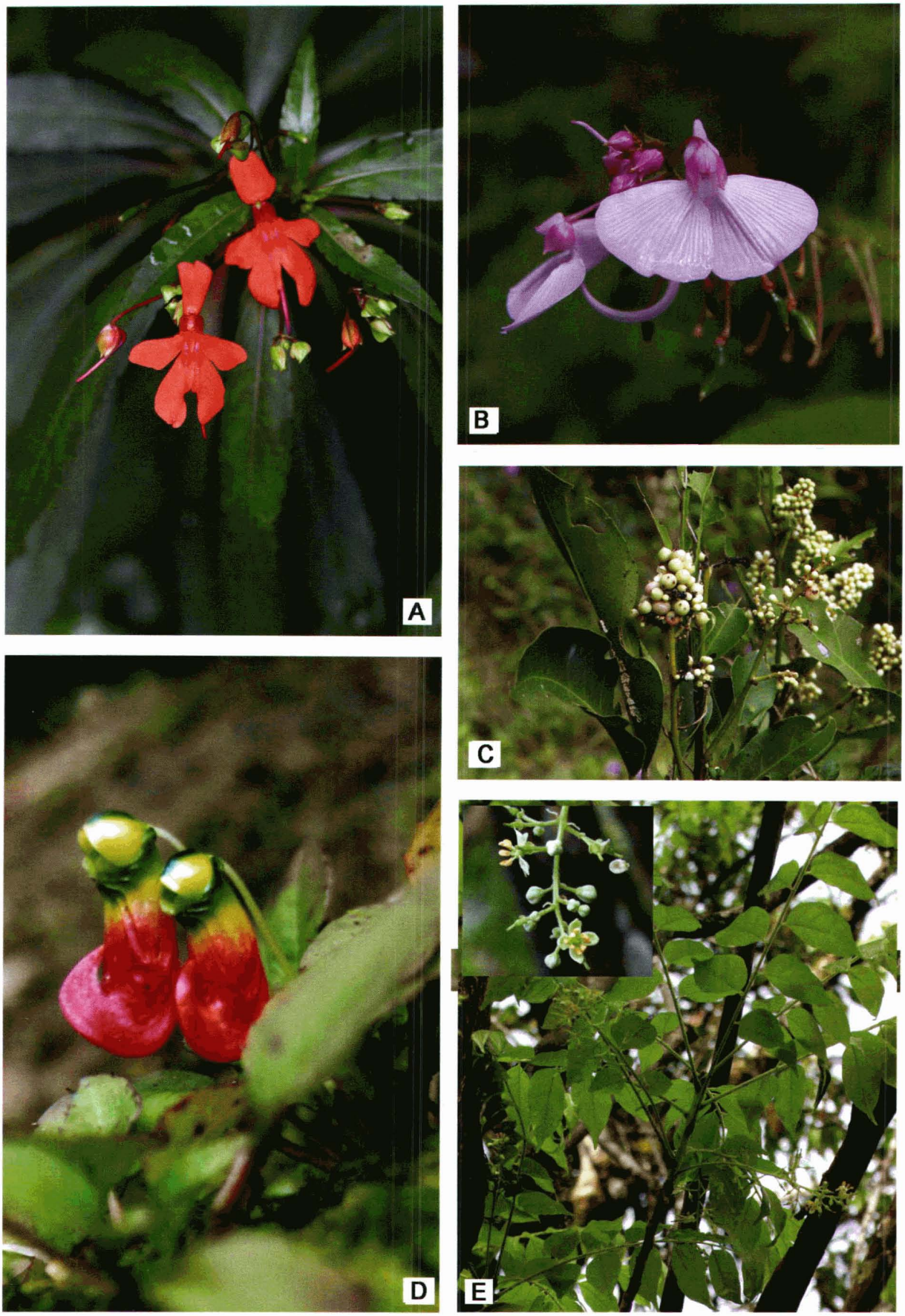


Plate 17. A. *Impatiens verticillata* Wight; B. *Impatiens maculata* Wight; C. *Glycosmis pentaphylla* (Retz.) DC.; D. *Impatiens parasitica* Bedd.; E. *Clausena anisata* (Willd.) Hook.f. ex Benth.

Small erect shrubs to small trees. Leaves 3-7-foliolate; leaflets subopposite, elliptic-lanceolate, attenuate at base, entire to minutely crenulate-serrate on the margins, acute to round at apex, to 16 x 6 cm, glandular, glabrous; rachis 6-10 cm long; petiolule 0.2 cm long. Flowers in terminal or axillary, spiciform panicles. Sepals 5(4), ovate-acute, 0.1 cm long, ciliate on margins. Petals 5(4), white obovate, 0.5 cm, surface gland-dotted. Stamens 8-10, filaments of longer ones 0.3 cm long, shorter, 0.2 cm long. Disc prominent, annular. Ovary 0.2 cm across, ovoid, 5-celled; stigma flat or obscurely lobed. Berry 1 cm, ovoid, white pink on ripening, 1-2-seeded.

Fl. & Fr. : September – March.

Distribution: Indo-Malaysia, evergreen forests and moist locations in plains. *Amitha Bachan 98976* (Vazhachal, riparian forests, banks of Chalakkudy river, 200 m).

MELICOPE J. R. Forster & G. Forster

Charact. Gen. 55. 1776.

Melicope lunu-ankenda (Gaertn.) Hartley, Sandakania 4: 61. 1994; K.N. Nair & M.P. Nayar in Hajra *et al.*, Fl. India 4: 369.1997; Premnath in P. Daniel Fl. Kerala 1: 603. 2005. *Fagara lunu-ankenda* Gaertn., Fruct. Sem. Pl. 334, t. 68. f. 9. 1778. *Euodia lunu-ankenda* (Gaertn.) Merr., Philipp. J. Sci. 7: 378.1912; Gamble, Fl. Pres. Madras 148. 1915; Manilal, Fl. Silent Valley 44. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 82. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 141. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 111. 2005. *Zanthoxylum roxburghianum* Cham., Linnaea 5: 58. 1830. *Euodia roxburghiana* (Cham.) Benth., Fl. Hongk. 59. 1861; Hook. f., Fl. Brit. India 1: 487. 1875. *Euodia lunu-ankenda* (Gaertn.) Merr. var. *tirunelvelica* Henry & Chandrab., Bull. Bot.

Surv. India 15: 144. 1973; N. Mohanan & Sivad., Fl. Agasthyamala 141. 2002. **Nasakam**.

Medium size trees to 18 m high; bark brown, smooth; branchlets minutely pubescent. Leaves opposite, 3-foliolate; rachis 40-80 mm long, stout, pubescent, slightly grooved above; leaflets elliptic, abruptly acuminate at apex, acute at base, to 18 x 8 cm; nerves 8-20 pairs, parallel. Panicle 15 x 5 cm, axillary, densely pubescent. Flowers unisexual, polygamous, 3 mm across; sepals 4, connate at base; ovate-orbicular; petals 4, 2-3 mm long, white, glabrous; stamens 4, inserted at the base of the disc, slightly longer than petals; filaments subulate; anthers oblong; disc annular, thick, 4 or more lobed, densely pubescent; ovary deeply 4-lobed, 4-celled; ovules 2 in each cell; stigma 4-lobed. Capsule ovoid, 0.5 cm long; seeds globose, rugose.

Fl. & Fr. : August-December

Distribution: Indo-Malaysia. Evergreen forests, usually on river banks *Amitha Bachan 117602* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

PARAMIGNYA Wight

Illustr. Ind. Bot. 1: 108, t. 42. 1838.

Paramignya beddomei Tanaka, J. Bot. 68: 230. 1930; Gamble, Fl. Pres. Madras 1872. 1936; K.N. Nair & M.P. Nayar in Hajra *et al.*, Fl. India 4: 309. 1997; N. Mohanan & Sivad., Fl. Agasthyamala 146. 2002. *Paramignya armata* Bedd., Icon. Pl. Ind. Oriant. t. 275. 1868-1874; Hook. f., Fl. Brit. India 1: 511. 1875; Gamble, Fl. Pres. Madras 158. 1915, non (Thwaites) Oliver 1861; Manilal, Fl. Silent Valley 46. 1988.

Woody climbing shrubs, armed with axillary thorns. Leaves simple, alternate, elliptic-ovate, caudate acuminate at apex, rounded at base, 10

6 x 3 cm; petiole to 1-1.5 cm; Flowers axillary, solitary. Pedicels slender to 1.5 cm. Calyx copular, 4-lobed, with 4 minute teeth, 1 cm, glabrous. Petals 5, white, 1.2 cm, linear-oblong. Stamens 10; filaments densely villous. Ovary globose, 4-5 celled; style elongated, ovules 1 in each cell. Berry 1.2 cm, globose.

Fl & Fr. : June – January.

Distribution: Endemic to the Western Ghats and Sri Lanka. Evergreen forests. *Amitha Bachan 99100* (Karimala, streamside vegetation, banks of Karimala-Thodu, 1200 m).

TODDALIA A. L. Jussieu

Gen. 371. 1789, *nom. cons.*

Toddalia asiatica (L.) Lam., Tabl. Encycl. 2: 116. 1797; Gamble, Fl. Pres. Madras 150. 1915; K. N. Nair & M. P. Nayar in Hajra *et al.*, Fl. India 4: 403.1997; Premnath in P. Daniel Fl. Kerala 1: 610. 2005. *Paullinia asiatica* L., Sp. Pl. 365. 1753. *Toddalia aculeata* (Smith) Pers., Syn. Pl. 1: 249. 1805; Hook. f., Fl. Brit. India 1: 497. 1875. *Toddalia floribunda* Wall., Pl. Asiat. Rar. 3: 17, t. 232. 1832. *Toddalia asiatica* (L.) Lam. var. *floribunda* (Wall.) Kurz, J. Asiat. Soc. Bengal pt.2, Nat. Hist. 44: 130. 1875; Gamble, Fl. Pres. Madras 151. 1915; Manilal, Fl. Silent Valley 46. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 85. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 113. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 159. 2009. *Toddalia asiatica* (L.) Lam., Illustr. 2: 116. 1797, var. *obtusifolia* Gamble, Fl. Pres. Madras 151. 1915; Manilal, Fl. Silent Valley 47. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 146. 2002; Sasidh. & Sivar., Fl. Pl. Thrissur For. 85. 1996. *Toddalia asiatica* (L.) Lam. var. *gracilis* Gamble, Fl. Pres. Madras 151. 1915.

Erect or climbing woody shrubs, usually armed with prickles. Stem, petiole and peduncles bluish. Leaves 3-foliolate; leaflets elliptic-obovate, obtuse or obtusely acute, to 9 x 4 cm; crenulate, nerves many, closely packed. Panicles axillary 3-4 cm; Bracts minute. Flowers pedicelled, unisexual; sepals 4 or 5, united below; petals 4 or 5, oblong, yellow; stamens in male flowers 5, filaments equal, spreading; anthers oblong, obtuse; ovary 4 or 5-celled, ovoid, glabrous, ovule 2 in each cell; style absent, stigma capitate, sessile. Berry 7 x10 mm, ovoid to globose; seeds 1-4, ovoid, in fleshy pulp.

Fl. & Fr. : December-August.

Distribution: Indo-Malaysia and Africa. Evergreen forests. *Amitha Bachan 117769* (Malakkapara, riparian forest, banks of Chalakkudy river, 900 m).

VEPRIS Commerson ex A. Jussieu

Mem. Mus. Hist. Nat. Paris 12: 509. 1825.

Vepris bilocularis (Wight & Arn.) Engl. in Engl. & Prantl, Naturl. Pflanzenfam. 3(4): 178. 1896; Gamble, Fl. Pres. Madras 151. 1915; Sasidh. & Sivar., Fl. Pl. Thrissur For. 85. 1996; K.N. Nair & M.P. Nayar in Hajra *et al.*, Fl. India 4: 405. 1997; Anil Kumar *et al.*, Fl. Pathanamthitta 113. 2005; Premnath in P. Daniel Fl. Kerala 1: 610. 1. 2005. *Toddalia bilocularis* Wight & Arn., Prodr. 149. 1834; Hook. f., Fl. Brit. India 1: 497. 1875. *Dipetalum bioculare* (Wight & Arn.) Dalz. in Hook.'s J. Bot. Kew Gard. Misc. 2: 138. 1850.

Evergreen dioecious trees, to 25 m high; bark white corky; branchlets glabrous. Leaves 3-foliolate; leaflets obovate-oblanceolate, abruptly acuminate, to 20 x 7 cm, entire; nerves many, closely parallel, joining into an intramarginal vein; petiole to 7 cm long. Panicles

terminal. Flowers 4 mm across, polygamous; pedicels 3 mm long; sepals 3, ovate, free; petals 3, orbicular; stamens 3, equal, filaments broad at base; anthers ovate, sagitate at base; ovary superior, globose, 2-4-celled, ovules 2 in each cell; stigma capitate. Fruit a berry, globose, 2-celled, fleshy, glandular; seeds 2, planoconvex, brownish.

Fl. & Fr. : February-May.

Distribution: Endemic to the Western Ghats. Evergreen and riparian forests. *Amitha Bachan 98914* (Karanthodu, riparian forest, banks of Chalakkudy river, 450 m).

29. BURSERACEAE Kunth

Ann. Sci. Nat. (Paris) 2: 346. 1824.

CANARIUM Linnaeus

Amoen. Acad. 4: 121. 1759.

Canarium strictum Roxb., Fl. India 3: 138. 1832; Bennett in Hook. f., Fl. Brit. India 1: 534. 1875; Gamble, Fl. Pres. Madras 172. 1915; Manilal, Fl. Silent Valley 47. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 86. 1996; Chithra & A. N. Henry in Hajra *et al.*, Fl. India 4: 440. 1997; N. Mohanan & Sivad., Fl. Agasthyamala 147. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 115. 2005; A. N. Henry & Chithra in P. Daniel Fl. Kerala 1: 628. 2005. **Mullanpali, Vediplavu**. **Plate 18. A, B & C**

Large buttressed trees to 30 m high; resinous; exudation aromatic, brownish-black, branchlets velvety-tomentose. Leaves imparipinnate, alternate; rachis 22-35 cm long, tomentose, swollen at base; leaflets 7-11, opposite; ovate, ovate-lanceolate; acute or oblique at base, acuminate at apex, to 26 x 11 cm, crenulate, glabrous above, rusty tomentose beneath, coriaceous; lateral nerves 15-20 pairs, parallel. Flowers polygamous, small to 5 mm across, bright yellow in large axillary

panicles. pedicles elongate; calyx 4 mm, pubescent; lobes 3, valvate; petals 3, white, 1 cm long, oblong, pubescent without; disc obscurely lobed, pilose above; staminal tube to 3 mm; filaments 0.5 mm; anthers subequal; ovary superior, to 3.5 mm, 3-celled. Fruit a drupe, 3.5 x 1.5 cm, ellipsoid, dark blue, 1-3-celled; seeds 1-3.

Fl. & Fr. : December-January.

Distribution: India and Upper Myanmar. Evergreen forests, riparian evergreen vegetation, *Amitha Bachan 98904* (Karanthodu-Vazhachal, riparian vegetation, banks of Chalakkudy river, 400 m).

30. MELIACEAE Juss.

Gen. Pl. 263. 1789.

Key to genera

1a. Young parts covered with stellate hairs or fimbriate scales.....**Aglaia**

1b. Young parts not covered with stellate hairs or fimbriate scales.....2

2a. Leaves simple; flowers to 5 cm long.....**Turraea**

2b. Leaves compound; flowers to 3 cm long.....3

3a. Seeds many, winged.....4

3b. Seeds to 10, wingless.....5

4a. Stamens monadelphous.....**Chukrasia**

4b. Stamens free.....**Toona**

5a. Panicles longer than the leaves, drooping; petals 3.....**Aphanamixis**

5b. Panicles shorter than the leaves, erect; petals 5.....**Dysoxylum**

AGLAIA Loureiro

Fl. Cochinch.173. 1790, *nom. cons.*

Key to species

1a. Anthers 10.....**A. lawii**

1b. Anthers 5.....2

2a. Rachis to 12 cm long.....3

2b. Rachis 25-60 cm long.....**A. perviridis**

3a. Leaflets 3-7, to 3 cm broad.....**A. barberi**

3b. leaflets 5-13, to 3-8 cm broad..... **A. edulis**

Aglaia barberi Gamble, Bull. Misc. Inform. Kew 1915: 346. 1915 & Gamble, Fl. Pres. Madras 180. 1915; Sasidh. & Sivar., Fl. Pl. Thrissur For. 88. 1996; S.S. Jain & S.S.R. Bennet in Hajra *et al.*, Fl. India 4: 457.1997; N. C. Nair & N. P. Balakr. in P. Daniel, Fl. Kerala 1: 638. 2005. **Chuvanna akil.** **Plate 18. D**

Small trees, bark smooth. Leaves imparipinnate, alternate, estipulate, leaflets 3-7, opposite or subopposite, estipellate; elliptic-oblong, elliptic-lanceolate, to 10 x 3 cm, obliquely acute at base, acuminate at apex, entire, coriaceous; rachis to 10 cm long, slender, slightly swollen at base, covered with reddish-brown lepidote scales; Flowers polygamo-dioecious, yellow, in axillary panicles; peduncle scaly; bracts minute; calyx-saucer shaped; lobes 5, acute, margin ciliate; petals 5, orbicular, glabrous; staminal tube 1 mm long, globose, anthers 5, included; ovary superior, hairy, 1-2-celled, ovules 1-2 in each cell; style short; stigma capitate. Berry, globose, depressed, to 2 cm across, brown.

Fl. & Fr. : December-June.

Distribution: Endemic to the Western Ghats. Evergreen forests. *Amitha Bachan 98855* (Sholayar, riparian evergreen forests, banks of Sholayar river, 700 m).

Aglaia edulis (Roxb.) Wall., Calc. Gard. Rep. 26. 1840; Hiern in Hook.f., Fl. Brit. India 1: 556. 1875; Pannell, Kew Bull. Addl. ser. 16, 229.1992; Jain & Bennet in Hajra *et al.*, Fl. India 4: 461.1997. *Milnea edulis* Roxb., Fl. India 2: 430. 1824. *Nyalelia racemosa* Dennst., Schluss. Hort. Malab. 14, 23,30. 1818; Hiern in Hook. f., Fl. Brit. India 1: 554. 1875. *Beddomea indica* Hook.f. in Benth. & Hook.f., Gen. Pl. 1: 336. 1862; Hiern in Hook. f., Fl. Brit. India 1: 566. 1875; Gamble, Fl. Pres. Madras 184. 1915. *Aglaia khasiana* Hiern in Hook. f., Fl. Brit. India 1: 554. 1875. *Aglaia indica* (Hook. f.) Harms in Engl. & Prantl, Nat. Pflanzenf. (ed.2.) 9bI:146. 1940; Jain & Bennet in Hajra *et al.*, Fl. India 4: 468.1997; N. C. Nair & N.P. Balakr. in P. Daniel, Fl. Kerala 1: 641. 2005.

Small to medium sized trees, buttressed; young parts pubascent. Leaves imparipinnate, alternate, estipulate, leaflets 5-13, opposite or subopposite, estipellate; elliptic, elliptic obovate or ovate, 5-22 x 3-8 cm, oblique at base, acuminate or obtuse at apex; rachis to 12 cm long, slender, swollen at base, pubescent; petiolule 0.5-1.8 cm long, grooved above. Flowers polygamodioecious, in axillary inflorescence, yellow-orange; male flowers: calyx cup shaped; lobes 4-6, covered with scales; petals 4-6; staminal tube cup-shaped, thick, crenulate at mouth, anthers 5-6; female inflorescence 5 cm long, peduncle 2.5 cm long, calyx lobes 5, ovate, covered with hairs; petals 5; ovary superior, 3-celled. Capsule 3 cm across, subglobose.

Fl. & Fr. : May – June.

Distribution : Indo-Malaysia. Evergreen forests, *Amitha Bachan 123372* (Sholayar, riparian forests, banks of Sholayar river, 800 m).

Aglaia lawii (Wight) C. J. Saldanha in C. J. Saldanha & Nicolson, Fl. Hassan Dist. 392. 1976; Sasidh. & Sivar., Fl. Pl. Thrissur For. 88. 1996; Jain & Bennet in Hajra *et al.*, Fl. India 4: 471.1997; N. C. Nair & N.P. Balakr. in P. Daniel, Fl. Kerala 1: 641. 2005. *Nimmonia lawii* Wight, Calcutta J. Nat. Hist. 7: 13. 1847. *Amoora lawii* (Wight) Bedd., Fl. Sylv. t. 133. 1871; Hiern in Hook. f., Fl. Brit. India 1: 561. 1875; Gamble, Fl. Pres. Madras 181. 1915. *Aglaia andamanica* Hiern in Hook.f., Fl. Brit. India 1: 555. 1875. *Amoora canarana* (Turcz.) Hiern in Hook. f., Fl. Brit. India 1: 560.1875; Gamble, Fl. Pres. Madras 182. 1915; Manilal, Fl. Silent Valley 48. 1988. *Aglaia jainii* Viswan. & V. S. Ramach., Bull. Bot. Surv. India 24: 212. 1982; Jain & Bennet in Hajra *et al.*, Fl. India 4: 469.1997. *Aglaia tamilnadensis* N. C. Nair & Rajan in N. C. Nair & A. N. Henry, Fl. Tamil Nadu ser. 1, 1: 66. 1983. **Karakil.**

Small trees; young parts, inflorescence, calyx and fruits covered by yellowish-brown lepidote scales. Leaves imparipinnate, alternate, estipulate, leaflets 3-5, opposite or subopposite, estipellate, elliptic-lanceolate or elliptic-obovate to 20 x 7 cm, obliquely acute or obtuse at base, acuminate, obtuse or obtusely acuminate at apex, entire, coriaceous; rachis 4-16 cm long, slender, swollen at base; petiolule 3-10 mm, grooved above. Flowers polygamo-dioecious, white; calyx short, 4 lobed; lobes obscure; petals 4, orbicular, glabrous; stamens 8-10; ovary superior, 3-locular, one ovule in each locule; stigma 3-lobed. Capsule 2 cm long, obovoid, yellow.

Fl. & Fr. : December – February.

Distribution : Indo-Malaysia to Pacific Islands. Evergreen forests. *Amitha Bachan 123391* (Sholayar, riparian forests, banks of Sholayar river, 800m).

Aglaia perviridis Hiern in Hook. f., Fl. Brit. India 1: 556. 1875; Pennell, Kew Bull. Addl. ser. 16, 198.1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 91. 1996; Jain & Bennet in Hajra *et al.*, Fl. India 4: 473.1997; Anil Kumar *et al.*, Fl. Pathanamthitta 116. 2005. *Aglaia maiae* Bourd., J. Bomb. Nat. Hist. Soc. 12: 350. t.11. 1899; Gamble, Fl. Pres. Madras 180. 1915; Jain & Bennet in Hajra *et al.*, Fl. India 4: 473.1997. *Aglaia canarensis* Gamble, Fl. Pres. Madras 180.1915; N. C. Nair & N.P. Balakr. in P. Daniel, Fl. Kerala 1: 639. 2005. **Karakil.** **Plate 18. F**

Medium sized trees to 25 m high. Leaves imparipinnate, alternate, estipulate; leaflets 7-13, oblong, oblong-lanceolate, to 18 x 6 cm oblique at base, acute or acuminate at apex, entire; petiolule to 1.2 cm long, stout; rachis 25-60 cm long, swollen at base, covered with reddish-brown peltate scales; Flowers in lax axillary panicles; pedicel articulated with 3 small ovate, bracteoles; calyx cup-shaped; lobes 5, ovate with fimbriate margins; petals 5, yellow, elliptical; anthers 5, inserted near the base or about half way up the tube; ovary superior, 1-celled, one ovuled, to 0.4 mm across; Berry ellipsoid with one side flat or slightly concave, 3 cm long, yellow or brown.

Fl. & Fr. : September-April.

Distribution : Indo-Malaysia and China. Vulnerable. *Amitha Bachan 123433* (Anakkyamthodu, riparian forests, banks of Anakkayam stream, 600 m).

APHANAMIXIS Blume

Bijdr. 165. 1825.

Aphanamixis polystachya (Wall.) Parker, Indian For. 57: 486. 1931; Manilal, Fl. Silent Valley 48. 1988; Mabb., Taxon 20:528. 1977 & Blumea 31: 136. 1985; Sasidh. & Sivar., Fl. Pl. Thrissur For. 94. 1996; S.S. Jain

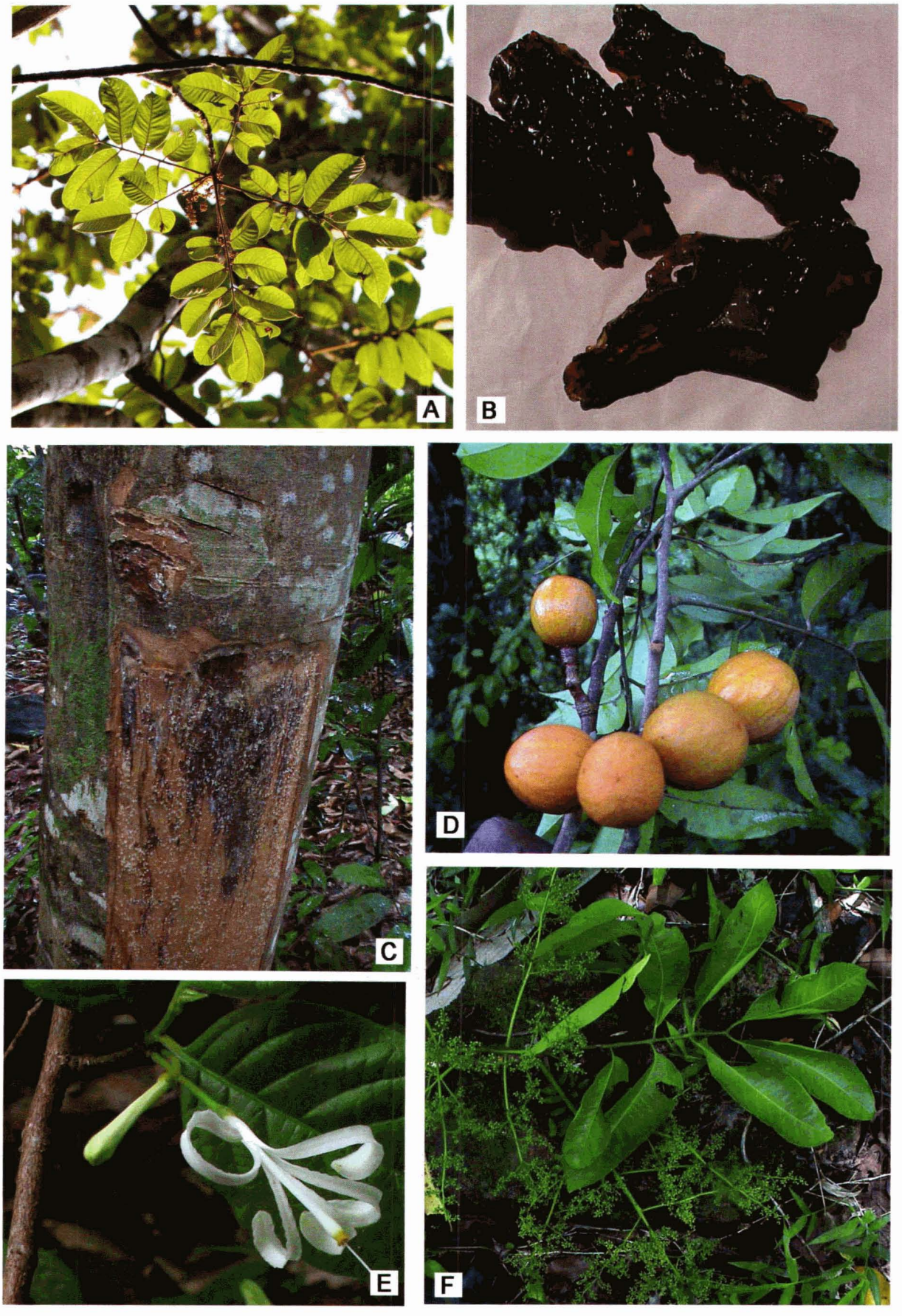


Plate 18. A - C. *Canarium strictum* Roxb.; A. Flowering branch; B. Black dammar (resin extracted from *Canarium strictum* Roxb.); C. Extracted bark; D. *Aglaia barberi* Gamble; E. *Turraea villosa* Bennett; F. *Aglaia perviridis* Hiern

& S.S.R. Bennet in Hajra *et al.*, Fl. India 4: 477. 1997; N. Mohanan & Sivad., Fl. Agasthyamala 150. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 116. 2005; N. C. Nair & N.P. Balakr. in P. Daniel, Fl. Kerala 1: 646. 2005. Sunil, Fl. Alappuzha Dist. 339. 2009. *Aglaia polystachya* Wall. in Roxb., Fl. India 2: 429. 1824. *Andersonia rohituka* Roxb., Fl. India 2: 213. 1832. *Amoora rohituka* (Roxb.) Wight & Arn. in Wight, Cat. 24. 1833 & Prodr. 119. 1834; Hiern in Hook. f., Fl. Brit. India 1: 559. 1875; Gamble, Fl. Pres. Madras 181. 1915. *Amoora beddomei* Kosterm., Acta Bot. Neerl. 31: 133. 1982; Kamble & Sharma, J. Econ. Tax. Bot. 5: 493.1984. **Chemmaram.**

Shrubs or small trees. Leaves imparipinnate, alternate, estipulate, 7-17-foliolate, to 65 cm long; leaflets opposite, ovate-oblong, to 10-20 x 3-7 cm, acute at both ends, glabrous; lateral nerves to 13 pairs; petiolule 5 mm long. Panicle drooping, many-flowered, to 70 cm long; pedicels 6 mm long. Flowers 8 mm across; sepals 5, orbicular, thick; petals 3, orbicular; staminal tube 4 mm long, globose; anthers 8, oblong, sessile; ovary 3-celled, conical; ovules 2 in each cell; style absent, stigma capitate, 3-ridged. Capsule 3-lobed, to 3 cm across, shortly stalked, glabrous.

Fl. & Fr. : December-April.

Distribution: Indo-Malaysia. Common, in evergreen forests. *Amitha Bachan 123380* (Vazhachal, riparian evergreen forests, along the banks of Chalakkudy river, 220 m).

CHUKRASIA A. Jussieu

Mem. Mus. Hist. Nat. 19. 251. 1830.

Chukrasia tabularis A. Juss., Mem. Mus. Hist. Nat. Paris 19: 251. t.22. 1830; Hiern in Hook. f., Fl. Brit. India 1: 568. 1875; Gamble, Fl. Pres.

Madras 186. 1915; Sasidh. & Sivar., Fl. Pl. Thrissur For. 94. 1996; Jain & Bennet in Hajra *et al.*, Fl. India 4: 481. 1997; N. C. Nair & N.P. Balakr. in P. Daniel, Fl. Kerala 1: 649. 2005. **Chuvannakil.**

Large trees. Leaves paripinnate, alternate, estipulate; leaflets 10-20, subopposite, ovate-lanceolate, to 12 x 6 cm, oblique at base, acuminate at apex, entire, coriaceous, glabrous above, tomentose beneath; petiolule to 1 cm long, slender, pubescent; lateral nerves 6-8 pairs, pinnate; rachis 10-30 cm long, slender. Flowers bisexual, yellowish-white, in terminal panicles; calyx small, campanulate, lobes 5, ovate, pubescent; petals 5, oblong, obovate, pubescent, contorted; disc obscure; staminal tube terete, glabrous, dark purple, with 10 short crenate lobes; anthers 10, linear, exserted; ovary superior, stipitate, ovoid, pubescent, ovules many in each cell; style stout; stigma capitate. Capsule, ovoid, 4-5 valved, 4 cm across, dark brown.

Fl. & Fr. : February-April.

Distribution : Indo-Myanmar. Moist forests. *Amitha Bachan 123381* (Vazhachal, riparian evergreen forest, banks of Chalakkudy river, 240 m).

DYSOXYLUM Blume

Bijdr. 172. 1825.

Dysoxylum malabaricum Bedd. ex Hiern in Hook. f., Fl. Brit. India 1: 548. 1875; Gamble, Fl. Pres. Madras 178. 1915; Sasidh. & Sivar., Fl. Pl. Thrissur For. 95. 1996; S.S. Jain & S.S.R. Bennet in Hajra *et al.*, Fl. India 4: 489. 1997; Anil Kumar *et al.*, Fl. Pathanamthitta 118. 2005; N. C. Nair & N.P. Balakr. in P. Daniel, Fl. Kerala 1: 653. 2005. **Vellakil.**

Large trees with warty-lenticellate verrucose bole, aromatic, Leaves imparipinnate, alternate, estipulate; leaflets 7-11, opposite, subopposite or alternate, estipellate, elliptic-oblong, lanceolate to 23 x 6 cm oblique or

acute at base, acuminate at apex, entire, coriaceous; lateral nerves 6-20 pairs; petiolule 0.5-1 cm, stout, pubescent; rachis 17-28 cm long, stout, angular, swollen at base, pubescent; Flowers bisexual, greenish-yellow, fragrant, 5-6 mm long; calyx deeply 4 lobed; petals 4, linear-oblong, subacute; anthers 8, included; disc cup shaped, entire, nearly enclosing the ovary; ovary superior, densely pubescent, 4-celled, ovules 2 in each cell; tapering into style; stigma 4-lobed. Capsule globose, 5 cm across, yellow on ripeining.

Fl. & Fr. : February – June.

Distribution : Endemic to Southern Western Ghats. Rare. *Amitha Bachan 123376* (Orukombankutty, riparian forests, banks of Chalakkudy river, 400 m).

TOONA (Endlicher) M. Roemer

Fam. Nat. Syn. Monogr. 1: 131. 1846.

Toona ciliata Roem., Syn. Fam. Nat. Monogr. 139. 1846; Manilal, Fl. Silent Valley 50. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 98. 1996; Jain & Bennet in Hajra *et al.*, Fl. India 4: 504. 1997; Anil Kumar *et al.*, Fl. Pathanamthitta 121. 2005; N. C. Nair & N.P. Balakr. in P. Daniel, Fl. Kerala 1: 663. 2005. *Cedrela toona* Roxb. *ex* Rottl. & Willd., Ges. Naturf. Freunde Berlin Neue Schriften 2: 198. 1803; Hiern in Hook. f., Fl. Brit. India 1: 568. 1875; Gamble, Fl. Pres. Madras 186. 1915. **Chandanavembu.**

Large trees to 30 m high, Leaves paripinnate, alternate, clustered at the tips of branchlets, estipulate; leaflets 12-30, opposite or subopposite, estipellate, ovate, ovate-lanceolate, 6-16 x 2-6 cm; oblique at base, acuminate at apex; lateral nerves 10-15 pairs; rachis 12-80 cm long, slender; Flowers bisexual, 8 mm across, white, in terminal or

axillary drooping panicles; peduncle to 2 cm; pedicel to 2 mm long; calyx cupular; lobes 5, ovate, tomentose, margin ciliate; petals 5, white, oblong, 0.5 cm, spreading, ciliate, imbricate; stamens 5, free, inserted on the top of disc; filaments subulate; anthers oblong, versatile; disc thick, 5-lobed, pubescent; ovary superior, ovoid, 2 mm long, pubescent, 5-celled, ovules 7-12 per cell, pendulous. Capsule to1.5 cm, 5-valved.

Fl. & Fr. : November-February.

Distribution : Indo-Myanmar; cultivated in Sri Lanka, Afghanistan, Africa and the Hawaiian Islands. Evergreen and moist forests. *Amitha Bachan 123488* (Sholayar-Karimala, evergreen streamside vegetation, banks of Koodalthodu, 900 m).

TURRAEA Linnaeus

Mantissa Pl. 2: 150. 1771.

Turraea villosa Bennett, Fl. Jav. Rar. 1: 182. 1840; Hiern in Hook. f., Fl. Brit. India 1: 542. 1875; Gamble, Fl. Pres. Madras 174. 1915; Sasidh. & Sivar., Fl. Pl. Thrissur For. 99. 1996; S.S. Jain & S.S.R. Bennet in Hajra *et al.*, Fl. India 4: 515. 1997; N. C. Nair & N. P. Balakr. in P. Daniel, Fl. Kerala 1: 665. 2005. *Turraea virens* Hiern in Hook.f., Fl. Brit. India 1: 541. 1875, non L. 1771. **Plate 18. E**

Densely villous shrubs. Leaves simple, alternate, broadly ovate, to 12 x 8 cm, abruptly acuminate at apex, rounded at base, entire. Flowers in axillary fascicles, 2-3-together; pedicel 3 cm long; sepals 5, ovate, connate at base; petals linear-oblong, 5 cm long, spathulate at apex; white, partially connate; staminal tube 4 cm long, slender, toothed; anthers 10, projected above, disk tubular, 4 mm long; ovary 5-celled, ovules solitary in each cell; style 4 cm long, slender, bulged below the stigma. Capsule depressed globose, 10 mm across, seeds 5, reddish.

Fl. & Fr. : February-August.

Distribution : India to Malaysia. Common; in evergreen forests. *Amitha Bachan 123437* (Sholayar-Anakayam, riparian areas, banks of Anakkyam stream, 600 m).

31. DICHAPETALACEAE

Baill. in Martius, Fl. Bras. 12(1): 365. 1886.

DICHAPETALUM Thouars

Gen. Nov. Madaga. 23. 1806.

Dichapetalum gelonioides (Roxb.) Engl. in Engl. & Prantl, Naturl. Pflanzenfam. 3(4): 348. 1896. Gamble, Fl. Pres. Madras 188. 1915; Sasidh. & Sivar., Fl. Pl. Thrissur For. 100. 1996; N.C. Nair in Hajra *et al.*, Fl. India 4: 528. 1997; N. Mohanan & Sivad., Fl. Agasthyamala 153. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 121. 2005; N. C. Nair in P. Daniel, Fl. Kerala 1: 670. 2005. *Moacurra gelonioides* Roxb., Fl. India 2: 69. 1832. *Chailletia gelonioides* (Roxb.) Hook. f. in Bent. & Hook., Gen. Pl. 1: 341. 1862; Bedd., Fl. Sylv. S. India t.9. f.1. 1871; Hook. f., Fl. Brit. India 1: 570. 1875. **Kattukappikkuru.** **Plate 36.E**

Shrubs with slender pubescent subterete branchlets. Leaves alternate, simple, oblanceolate to obovate-elliptic, to 12 x 4 cm, acute at base, caudate-acuminate at apex, entire, pubescent; petiole to 0.5 cm long, puberulous. Stipules 2, deciduous. Flowers polygamo-diocious, in axillary short peduncled cymes, densely villous; bracts lanceolate; sepals 5, ovate, 1.5 mm long; petals obovate, as long as sepals, bilobed at apex, glabrous; stamens 5, filaments short; anthers ovoid, disc 4-lobed, scale like; ovary 3-celled; ovule 2 in each cell; style 1, 3 fid above. Drupe 2-lobed, 1.0 cm across, compressed, rugose; seeds arillate.

Fl. & Fr. : March – July.

Distribution : Indo-Malaysia. Evergreen forest. *Amitha Bachan 99149* (Vazhachal, riparian evergreen forests, banks of Chalakkudy river, 220 m).

32. ICACINACEAE (Benth.) Miers

Ann. Mag. Nat. Hist. ser. 2, 8: 174. 1851.

Key to Genera

1a. Woody climbers..... **Sarcostigma**

1b. Shrubs or trees.....2

2a. Shrub; Leaves oblong-oblanceolate, acuminate.....**Gomphandra**

2b. Trees; leaves broadly ovate, obtuse-apiculate..... **Nothapodytes**

GOMPHANDRA Wallich ex Lindley

Nat. Syst. ed. 2, 439. 1876.

Gomphandra tetrandra (Wall.) Sleumer, Notizbl. Bot. Gart. Berlin-Dahlem. 15: 238. 1940 & Blumea 17: 204. 1969; Manilal, Fl. Silent Valley 52. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 102. 1996; R. Mathur in N.P. Singh *et al.*, Fl. India 5: 25. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 155. 2002; N. C. Nair & N. P. Balakr. in P. Daniel, Fl. Kerala 1: 685. 2005. *Lasianthera tetrandra* Wall. in Roxb., Fl. India 2: 238. 1824. *Gomphandra axillaris* Wall. ex Bedd., Fl. Sylv. t. 61. 1870; Mast. in Hook. f., Fl. Brit. India 1: 586. 1875. *Gomphandra polymorpha* Wight, Illustr. Ind. Bot. 1: 103. 1840; Gamble, Fl. Pres. Madras 195. 1915.

Shrubs to small trees, to 2 m high; branchlets green. Leaves oblong-lanceolate or elliptic acuminate, to 16 x 4.5 cm, acute at base, acuminate at apex, dark green, nerves to 9 pairs; petiole to 1 cm. Flowers in pedunculate polygamous axillary cymes; peduncle 1.0 cm long.

Flowers 3-10 together; calyx cupular, 1 mm long; corolla 6 mm long, lobes cuspidate; filaments 8 mm long, connate. Drupe obovate, 1.3 x 0.6 cm, acute.

Fl. & Fr. : September – December.

Distribution : South and southeast Asia. Evergreen forests. *Amitha Bachan 117625* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

NOTHAPODYTES Blume

Mus. Bot. Lugd.-Bat. 1: 248. 1850.

Nothapodytes nimmoniana (Graham) Mabb. in Manilal, Bot. Hist. Hort. Malab. 88. 1980; Manilal, Fl. Silent Valley 53. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 104. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 156. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 123. 2005; N.P. Balakr. in P. Daniel, Fl. Kerala 1: 688. 2005. *Premna nimmoniana* Graham, Cat. Pl. Bombay 155. 1839. *Stemonurus foetidus* Wight, Icon. Pl. India Orient. t. 955. 1845. *Mappia foetida* (Wight) Miers, Ann. Mag. Nat. Hist. ser. 2, 9: 395. 1852; 1: 589. 1875; Gamble, Fl. Pres. Madras 196. 1915. *Nothapodytes foetida* (Wight) Sleumer, Notizbl. Bot. Gart. Berlin-Dahlem. 15: 247. 1940 & Blumea 17: 232. 1969. *Mappia wightiana* Miers, Ann. Mag. Nat. Hist. ser. 2, 9: 397. 1852; Gamble, Fl. Pres. Madras 197. 1915. *Mappia tomentosa* Miers, Ann. Mag. Nat. Hist. ser. 2, 9: 397. 1852; Mast. in Hook. f., Fl. Brit. India 1: 589. 1875; Gamble, Fl. Pres. Madras 196. 1915. *Mappia ovata* Miers, Ann. Mag. Nat. Hist. ser. 2. 9: 396. 1852; Mast. in Hook. f., Fl. Brit. India 1: 589. 1852; Gamble, Fl. Pres. Madras 197. 195. **Peenari.**

Trees, to 10 m high. Leaves simple, alternate, estipulate, broadly ovate, ovate-oblong; to 8-18 x 4-8 cm, oblique at base, round or acute at

apex, entire, glabrous above, pubescent beneath, coriaceous; lateral nerves 6-10 pairs, pinnate, prominent; petiole 3-6 cm, pubescent, grooved above. Flowers bisexual, creamy yellow, 0.5 cm across, in terminal pubescent corymbose cymes or panicles; calyx cupular, 1 mm long, 5-toothed; petals 5, 3 mm long; stamens 5, free; disc cupular; ovary ovoid, hairy, 1-celled, ovules 2. Drupe ellipsoid, 2 x 1 cm, blackish-purple; seed glabrous.

Fl. & Fr. : June – September.

Distribution : Indo-Malaysia and China. Evergreen forests. *Amitha Bachan* 123374 (Sholayar-Meenchaliyali, Streamside vegetation in the evergreen forests, banks of Meenchaliyali stream, 850 m).

SARCOSTIGMA Wight & Arnott

Edinburgh New Philos. J. 14: 299. 1833.

Sarcostigma kleinii Wight & Arn., Edinb. New Phil. J. 14: 299. 1833; Mast. in Hook. f., Fl. Brit. India 1: 594. 1875; Gamble, Fl. Pres. Madras 199. 1915; Sasidh. & Sivar., Fl. Pl. Thrissur For. 104. 1996; R. Mathur in N.P. Singh *et al.*, Fl. India 5: 35. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 157. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 125. 2005; N.P. Balakr. in P. Daniel, Fl. Kerala 1: 690. 2005. **Odal.**

Large woody climbers, branchlets glabrous. Leaves simple, alternate, ovate, to 22 x 12 cm, acute at both ends; lateral nerves 8 pairs; petiole to 1.5 cm long. Spikes to 40 cm long, slender, from old branches, clustered. Flowers 3-6 together; calyx cupular, 2 mm across, 5-toothed; petals oblong, 3-5 mm long, recurved; stamens 5, anthers versatile, staminodes 5, in female flowers, hairy; ovary 1-celled, densely hairy; stigma sessile, discoid; pistillode in male flowers conical. Drupe ovoid, 3 cm long, orange, glabrous.

Fl. & Fr. : November – March.

Distribution : Indo – Malaysia. Evergreen forests to sacred groves. *Amitha Bachan 117734* (Elanthikkara, riparian, banks of Chalakkudy river, sea level).

33. CELASTRACEAE R. Br.

in Flinders, Voy. Terra Austr. 2: 554. 1814.

Key to genera

1a. Large trees.....2

1b. Large climbers.....**Celastrus**

2a. Flowers pale yellow; fruit 2-angled, 2-lobed..... **Bhesa**

2b. Flowers pink to dull red; fruit 3-angled, 3-lobed.....**Lophopetalum**

Bhesa indica (Bedd.) Ding Hou, Blumea Suppl. 4: 152. 1958; Sasidh. & Sivar., Fl. Pl. Thrissur For. 105. 1996; K. Ramam. in Singh *et al.*, Fl. India 5: 77. 2000; K. Ramam. & P. Venu in P. Daniel, Fl. Kerala 1: 697. 2005. *Trochisandra indica* Bedd., Fl. Sylv. t. 120. 1872. *Kurrimia bipartita* M. A. Lawson in Hook.f., Fl. Brit. India 1: 622. 1875.*Kurrimia indica* (Bedd.) Gamble, Fl. Pres. Madras 209. 1918. *Kurrimia paniculata* sensu M. A. Lawson in Hook.f., Fl. Brit. India 1: 622. 1875, p.p. non Wall. ex Arn. 1836. **Plate 19. A**

Large evergreen trees to 30 m high. Leaves alternate broadly elliptic-ovate, to 8-18 x 6-10 cm, obtuse at base, acute at apex, entire, glabrous, coriaceous; lateral nerves 15-20 pairs; stipule large, deciduos; petiole 1.5-6 cm long, stout, swollen at base and tip, glabrous. Flowers bisexual, in terminal panicles, to 0.8 cm across, pale yellow; calyx deeply 5-fid, lobes imbricate; petals 5, deflexed; disc fleshy, 5-lobed; stamens 5, inserted below the margin of disc, filaments subulate; ovary ovoid, seated on the disc, 2-celled, ovules 2 in each cell; styles two, free, stigma small,

capitate. Capsule 2-lobed, lobes flat, 3.5 cm long, 2-valved, reddish-brown; seeds 1-3, fleshy with aril.

Fl. & Fr. : March-April.

Distribution : Indo-Malaysia. Evergreen forests at medium to higher elevations. *Amitha Bachan 123344* (Malakkapara, Evergreen riparian, banks of Sholayar river, 1000 m).

CELASTRUS Linnaeus

Sp. Pl. 196. 1753

Celastrus paniculatus Willd., Sp. Pl. 1: 1125. 1797; M. A. Lawson in Hook. f., Fl. Brit. India 1: 617. 1875; Gamble, Fl. Pres. Madras 208. 1918; Sasidh. & Sivar., Fl. Pl. Thrissur For. 105. 1996; K. Ramam. in N. P. Singh et al., Fl. India 5: 87. 2000; Anil Kumar *et al.*, Fl. Pathanamthitta 125. 2005; K. Ramam. & P. Venu in P. Daniel, Fl. Kerala 1: 700. 2005.

Large climbers; stem lenticellate. Leaves alternate, broadly ovate, to 12 x 7 cm, caudate acuminate at apex, acute at base, membranous, crenulate; petiole 6 mm long. Panicle to 15 x 8 cm, terminal, axillary, oblong; pedicel 6 mm long. Flowers many, 6 mm across; sepals 5, small, imbricate, ciliate; petals white, ovate, 2.5 x 2 mm, obtuse; stamens 5, erect, anthers sagitate at base; ovary 3-celled, ovules 2 in each cell; stigmas 3, recurved. Capsule, yellow, 1 x 1 cm, loculicidal, 3-celled; seeds 3, aril reddish.

Fl. & Fr. : December – May.

Distribution : South Asia and Australia. Moist forests. *Amitha Bachan 123389* (Ambalapara-Sholayar, riparian evergreen forest, banks of Sholayar river, 800 m).

GLYPTOPETALUM Thwaites

In Hooker's J. Bot. Kew Gard. Misc. 8: 267. 1856

Glyptopetalum zeylanicum Thwaites in Hooker's J. Bot. Kew Gard. Misc. 8: 267. t. 7B. 1856; M. A. Lawson in Hook. f., Fl. Brit. India 1: 612. 1875; Gamble, Fl. Pres. Madras 204. 1918; Manilal, Fl. Silent Valley 55. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 106. 1996; K. Ramam. in N. P. Singh *et al.*, Fl. India 5: 114. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 160. 2002; K. Ramam. & P. Venu in P. Daniel, Fl. Kerala 1: 706. 2005.

Small trees or large shrubs. Leaves simples, opposite, elliptic or ovate-elliptic, 8-15 x 4-6 cm, acuminate at apex, acute-attenuate at base, distantly spinulose serrate, greenish on drying. Flowers few, 2-3 in axillary to extra-axillary cymes; peduncle to 1.5 cm long, glabrous; pedicels to 0.5 cm; bracts minute, subulate. Calyx 4-lobed, lobes ovate, to 0.1 cm long, fimbriate; petals 4, broadly ovate, to 0.15 cm, pitted; stamens 4, attached in the 4-lobed disc; ovary globose, 2-celled, immersed in the disc; ovules 1 in each cell; style short or 0; stigma subulate. Capsule globose; to 1 cm across.

Fl. & Fr.: January-March.

Distribution: Endemic to Peninsular India and Sri Lanka. Evergreen forests. *Amitha Bachan 117750* (Meenchaliyali-Sholayar, streamside vegetation in the evergreen forest, banks of Meenchaliyali stream, 850m).

LOPHOPETALUM R. Wight & Arnott.

Ann. Nat. Hist. 3: 150. 1839.

Lophopetalum wightianum Arn., Ann. Nat. Hist. 3: 151. 1839; M. A. Lawson in Hook. f., Fl. Brit. India 1: 615. 1875; Gamble, Fl. Pres. Madras 205. 1918; Manilal, Fl. Silent Valley 55. 1988; Ramach. & Nair, Fl.

Cannanore Dist. 96. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 106. 1996; K. Ramam. in Singh *et al.*, Fl. India 5: 116. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 161. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 126. 2005; K. Ramam. & P. Venu in P. Daniel, Fl. Kerala 1: 709. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 171. 2009. **Venkotta.**

Plate 19. D

Large evergreen buttressed trees to 30 m high; bark white-yellow; Leaves simple, opposite or subopposite, estipulate, elliptic, elliptic-oblong, ovate-oblong, to 10-25 x 5-10 cm, obtuse at base, obtuse or acute at apex, entire, coriaceous, glabrous; lateral nerves to 8-12 pairs, pinnate; petiole to 2 cm long, stout, grooved above, glabrous; Flowers in lax axillary or terminal dichasial cyme, pinkish to dull red, 1.5 cm across; calyx broad, broadly flattened at base, obtuse, to 0.6 cm; lobes 5, very short; petals 5, to 0.6 cm long, continuous with the disc, clawed, crispate above; spreading disc 5 lobed; stamens 5, inserted on the disc; ovary small, immersed in the disc, triquetrous, 3-celled, ovules 4 or more in each cell; Capsule 3-angled, to 10 x 3 cm, 3 valved, brown, smooth, loculicidal; seeds thin, surrounded by long linear wing, arillate, compressed.

Fl. & Fr. : December – July.

Distribution : Indo Malaysia. Wet areas of the evergreen forests up to medium elevations. *Amitha Bachan 123347* (Vazhachal, evergreen, riparian forests, banks of Chalakkudy river, 230 m).

34. HIPPOCRATEACEAE Juss.

Ann. Mus. Natl. Hist. Nat. 18: 486. 1811.

SALACIA Linnaeus

Mantissa Pl. 159. 1771, *nom .cons.*

Key to species

1a. Flowers fascicled on axillary tubercles.....**S. beddomei**

1b. Flowers in axillary pedunculate heads or cymes..... **S. fruticosa**

Salacia beddomei Gamble, Bull. Misc. Inform. Kew 1916: 133. 1916 & Gamble, Fl. Pres. Madras 215. 1918; K. Ramam. & B. D. Naithani in N. P. Singh *et al.*, Fl. India 5: 151. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 163. 2002; K. Ramam. & P. Venu in P. Daniel Fl. Kerala 1: 719. 2005.

Climbing shrubs, branches lenticellate. Leaves opposite, estipulate, elliptic-oblong, to 20 x 6.5 cm, obtusely acute at base, acute at apex, irregularly wague serrate, coriaceous; petiole to 0.7cm long, thick, grooved above, terete; lateral nerves regular. Flowers fascicled on axillary tubercles, pedicel short to 0.8 mm long. Calyx 5-lobed, lobes long and prominently fringed; petals 5, imbricate; stamens 3, inserted on the inner side of the disk; ovary conical, sunken in the disk, 3-celled; style short. Fruit an indehiscent berry, 3-celled; Seeds angular.

Fl. & Fr. : January – March.

Distribution : Endemic to Southern Western Ghats, rare; Evergreen forests. *Amitha Bachan 72060* (Vazhachal, evergreen riparian forests, banks of Chalakkudy river, 220 m).

Salacia fruticosa Heyne *ex* M. A. Lawson in Hook. f., Fl. Brit. India 1: 628. 1875; Gamble, Fl. Pres. Madras 215. 1918; Sasidh. & Sivar., Fl. Pl. Thrissur For. 108. 1996; K. Ramam. & B. D. Naithani in N. P. Singh *et al.*, Fl. India 5: 153. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 164. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 127. 2005; K. Ramam. & P. Venu in P. Daniel Fl. Kerala 1: 720. 2005. **Ponkorandi.**

Climbing shrubs, branchlets rough, looped, puberulous when young. Leaves ovate-lanceolate, to 10 x 4 cm, acuminate at apex, rounded at base, greyish when dry. Flowers in axillary much branched pedunculate heads; peduncle slender; cymes to 1.3 cm long, much branched; calyx lobes minutely ciliate; petals usually yellow with white margins, orbicular, 2 mm across; stamens 3, inserted on the inner side of the disk; ovary round, partially exserted. Berry globose, orange-red, to 3 cm across; seeds 1-3.

Fl. & Fr. : February – May.

Distribution : Endemic to the Western Ghats, common in moist evergreen vegetation upto scared grooves in the plains. *Amitha Bachan 123370* (Kuriyarkutty, riparian forests, banks of Kuriyarkutty river, 500 m).

35. RHAMNACEAE Juss.

Gen. Pl. 376. 1789.

ZIZIPHUS P. Miller

Gard. Dict. Abr. ed. 4. 1754.

Key to species

1a. Petals absent; fruit white; leaves to 7 cm broad.....**Z. rugosa**

1b. Petals present; fruit black; leaves to 3 cm broad.....**Z. oenoplia**

Ziziphus oenoplia (L.) Mill., Gard. Dict. (ed. 8). 3.1768; M. A. Lawson in Hook. f., Fl. Brit. India 1:634.1875; Gamble, Fl. Pres. Madras 220.1918; Sasidh. & Sivar., Fl. Pl. Thrissur For. 110. 1996; Bhandari & Bhansali in N.P. Singh *et al.*, Fl. India 5: 238. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 166. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 131. 2005; P. V. Sreek. & A. N. Henry in P. Daniel, Fl. Kerala 1: 734. 2005. C.

N. Sunil & Sivad., Fl. Alappuzha 175. 2009. *Rhamnus oenoplia* L., Sp. Pl. 194. 1753. **Thodali.** **Plate 19. B**

Large climbing thorny shrubs, thorns many, stout, strong, recurved; branchlets densely silky hairy. Leaves ovate, acuminate, oblique at base, to 4-6 x 2-3 cm, 3-4-ribbed from the base, densely fulvous hairy, sessile or shortly petioled. Flowers 3 mm across, shortly pedicelled, 6-25 in dense axillary clusters; sepals triangular, hispid outside; petals clawed, concave, greenish yellow; disk flat, glabrous. Drupe globose, 0.5 cm, black.

Fl. & Fr. : November-March.

Distribution: Tropical Asia, Australia and warmer parts of India. Moist and dry forests, along stream banks. *Amitha Bachan 98755* (Pokalppara, riparian forest, banks of Chalakkudy river, 240 m).

Ziziphus rugosa Lam., Encycl. 3: 319. 1789; M. A. Lawson in Hook. f., Fl. Brit. India 1: 636. 1875; Gamble, Fl. Pres. Madras 221. 1918; Manilal, Fl. Silent Valley 58. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 110. 1996; Bhandari & Bhansali in N. P. Singh *et al.*, Fl. India 5: 241. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 166. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 132. 2005; P. V. Sreek. & A. N. Henry in P. Daniel, Fl. Kerala 1: 734. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 175. 2009. **Kottamullu.** **Plate 19. C**

Large woody stragglers, stem prickly; thorns to 6 mm long, recurved. Leaves ovate-orbicular, acute at apex, cordate at base, unequal, to 12 x 6 cm, fulvous-tomentose beneath, coriaceous, crenulate; petiole 1 cm long. Flowers 5-20 together; subsessile, 5 mm across; sepals densely tomentose outside; disk flat, glabrous; ovary densely tomentose, 2-celled; styles 2, curved out. Drupe 8 mm across, white, glabrous.

Fl. & Fr. : November – April.

Distribution : India, Sri Lanka, Bangladesh and Myanamr. Moist forests, along stream banks. *Amitha Bachan 98755* (Charpa, riparian forest, banks of Chalakkudy river, 150 m).

36. VITACEAE Jussieu

Gen. Pl. 267. 1789.

CISSUS Linnaeus

Sp. Pl. 117. 1753.

Cissus discolor Blume, Cat. Gew. Buitenz. 39. 1823; Gamble, Fl. Pres. Madras 235. 1918; Manilal, Fl. Silent Valley 59. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 112. 1996; B. V. Shetty & P. Singh in N. P. Singh *et al.*, Fl. India 5: 282. 2000 & in P. Daniel, Fl. Kerala 1: 750. 2005 *Vitis discolor* (Blume) Dalz. in Hooker's J. Bot. Kew Gard. Misc. 2: 39. 1850; Dalz. In Hook. f., Fl. Brit. India 1: 648. 1875. *Cissus javana* DC., Prodr. 1: 628. 1824; Anil Kumar *et al.*, Fl. Pathanamthitta 135. 2005. **Njerinjapuli**. **Plate 19. E**

Creeping or climbing shrubs; stem quadrangular, reddish, glabrous. Leaves ovate-acuminate, 4-10 x 2.5-6 cm, cordate at base, sharp serrate, pink beneath; petiole 1-3 cm long. Cymes 2 cm across, reddish; peduncle 1 cm long. Flowers pedicelled; calyx 0.2 cm across, rim white; petals reddish, 1-2 cm long; disk pubescent. Berry, obovoid, to 0.4cm, smooth, glabrous, reddish-purple; seeds pitted.

Fl. & Fr. : July – September.

Distribution: Indo-Malaysia. Moist forests. *Amitha Bachan 123415* (Vazhachal, riparian forests, banks of Chalakkudy river, 180 m).

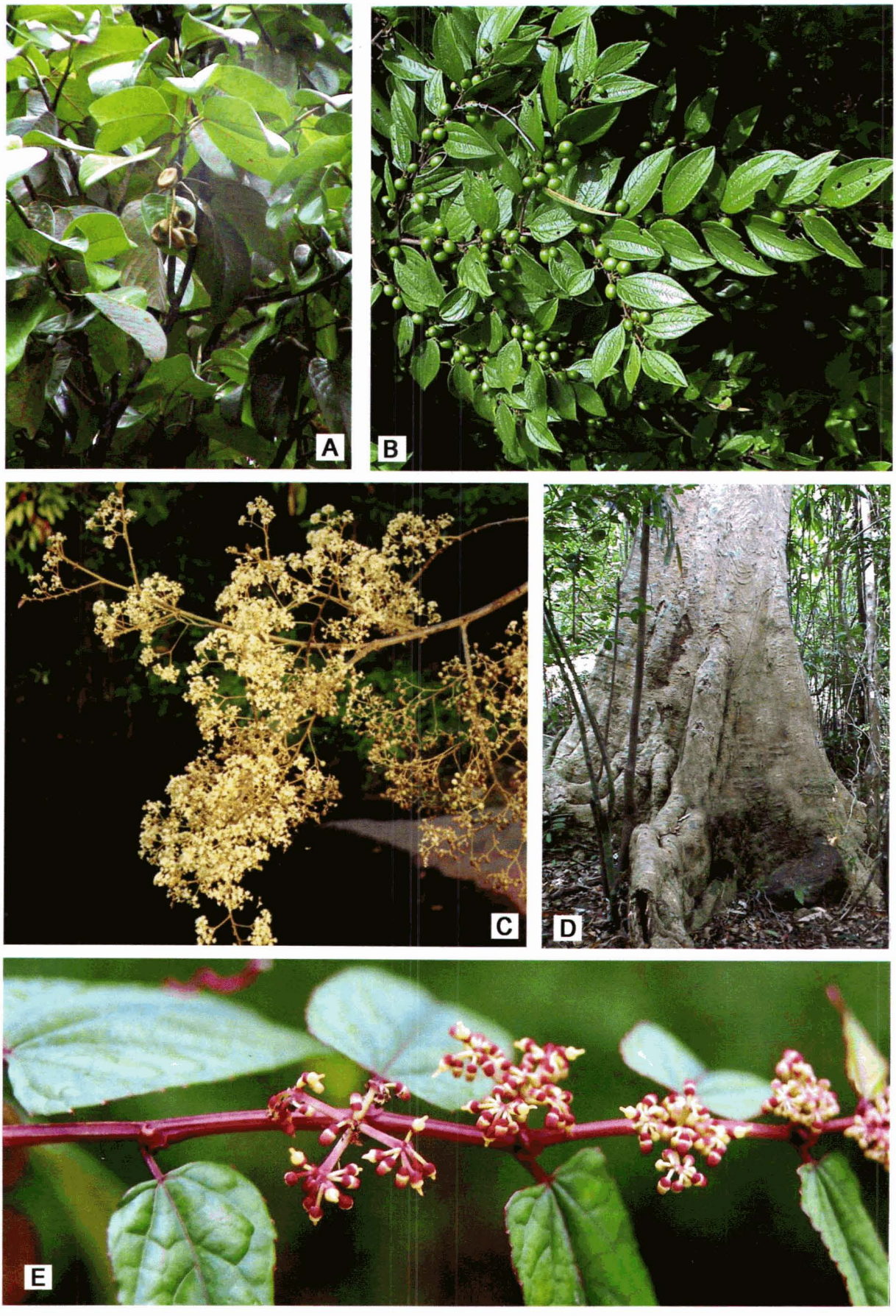


Plate 19. A. *Bhesa indica* (Bedd.) Ding Hou; B. *Ziziphus oenoplia* (L.) Mill.; C. *Ziziphus rugosa* Lam.; D. *Lophopetalum wightianum* Arn.; E. *Cissus discolor* Blume

37. LEEACEAE (DC.) Dumort.

Anal. Fam. Pl. 21, 27. 1829.

LEEA D. Van Royen ex Linnaeus

Syst. Nat. ed. 12, 2: 608, 627. 1767.

Key to species

1a. Flowers crimson red..... **L. guineensis**

1b. Flowers white or greenish white.....2

2a. Anthers united in bud.....**L. asiatica**

2b. Anthers not united in bud..... **L. indica**

Leea asiatica (L.) Ridsdale in Manilal, Bot. & Hist. Hort. Malab. 189. 1980; Manilal, Fl. Silent Valley 61. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 114. 1996; B.D. Naithani in N.P. Singh *et al.*, Fl. India 5: 330. 2000; Arisdasan *et al.* in P. Daniel, Fl. Kerala 1: 765. 2005. *Phytolacca asiatica* L., Sp. Pl. 474. 1753. *Leea crispa* Royen ex L., Syst. Nat. (ed. 12) 2: 627. 1767; Hook. f., Fl. Brit. India 1: 665. 1875; Gamble, Fl. Pres. Madras 240. 1918; Ridsdale, Blumea 22: 1. 88. 1974. *Leea aspera* Edgw., Trans. Linn. Soc. London 20: 36. 1846; Gamble, Fl. Pres. Madras 240. 1918. *Leea herbacea* Ham., Trans. Linn. Soc. London 14: 228. 1823; Gamble, Fl. Pres. Madras 240. 1918. *Leea pumila* Kurz, J. Asiat. Soc. Bengal 41: 303. 1872; Hook. f., Fl. Brit. India 606. 1875. *Leea edgeworthii* Sant., Rec. Bot. Surv. India 19: 54. 1953. **Nalungu**.

Large shrubs, stems branches and petiole with crispate wings; leaves 3-5 foliolate, leaflets usually oblong, to 12 x 5 cm acute or acuminate at apex, truncate or cordate at base, glabrous. Flowers greenish-white in terminal corymbose cymes; calyx cupular, 5 lobed; petals 5 connate at the base with staminal tube; stamens 5, anthers not

united in bud; ovary 3-6-celled, style short, stigma thickened. Berry 3-6 celled, grey when ripe.

Fl. & Fr. : Throughout the year.

Distribution: Indo-Malaysia and China. Moist forests. *Amitha Bachan 123605* (Vazhachal, riparian evergreen, banks of Chalakudy river, 220m).

Leea guineensis G. Don, Gen. Hist. 712. 1831; Ridsdale, Blumea 22: 1. 92. 1974; Sasidh. & Sivar., Fl. Pl. Thrissur For. 114. 1996; B. D. Naithani in N. P. Singh *et al.*, Fl. India 5: 336. 2000; Anil Kumar *et al.*, Fl. Pathanamthitta 137. 2005; Arisdasan *et al.* in P. Daniel, Fl. Kerala 1: 766. 2005. *Leea wightii* Clarke, J. Bot. 19: 105. 1881; Gamble, Fl. Pres. Madras 239. 1918. **Plate 20. A**

Glabrous under-shrubs. Leaves bipinnate, rachis to 20 cm long; leaflets ovate-lanceolate, to 19 x 6 cm, caudate-acuminate at apex, truncate or acute at base, serrate, dark brown to nearly black on drying; lateral nerves 7-10 pairs; petiolule 6-7 mm long; stipules obovate, 4 cm long. Flowers bright crimson red, densely packed, 4 mm across; calyx and corolla glabrous; staminal tube shortly notched at apex, anthers united in bud. Berry 6-lobed, 0.5 cm across.

Fl. & Fr. : August – March.

Distribution: Indo-Malaysia and Africa. Moist localities in the evergreen forests. *Amitha Bachan 123371* (Orukombankutty, riparian evergreen forests along Chalakkudy river, 450 m).

Leea indica (Burm. f.) Merr., Philipp. J. Sci. 14. 245. 1919; Ridsdale, Blumea 22: 1. 95. 1974; Manilal, Fl. Silent Valley 61. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 114. 1996; B.D. Naithani in N.P. Singh *et al.*, Fl. India 5: 337. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 170.

2002; Anil *Kumar et al.*, Fl. Pathanamthitta 137. 2005; Arisdasan *et al.* in P. Daniel, Fl. Kerala 1: 767. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 182. 2009. *Staphylea indica* Burm. f., Fl. India 75, t.23. f. 2. 1768. *Leea sambucina* (L.) Willd., Sp. Pl. 1: 1177. 1798, *nom. illegit.*; Lawson in Hook. f., Fl. Brit. India 1: 666. 1875; Gamble, Fl. Pres. Madras 240. 1918.

Large shrubs or small trees, usually with stilt roots; stem often hollow. Leaves large, 2 or 3-pinnate; leaflets oblong or elliptic-lanceolate, 14 x 5 cm, attenuate at base, acuminate at apex, serrate-dentate, lateral nerves 12-15 pairs; stipules broad, deciduous, sheathing, obovate-obtuse, amplexicauli, to 3 x 2 cm; young leaves, reddish. Flowers in leaf-opposed or lateral corymbose panicles; calyx cup-shaped, lobes 5, 1 mm, triangular; Petals 5, free, ovate, 2mm, greenish white, connate with staminal tube at the base. Disc annular. Staminal tube cylindric, 5-lobed, stamens 5, attached between lobes of the tube. Ovary 3-6-lobed; ovules 1 in each cell; style short; stigma capitate. Berry 0.7 cm across, globose.

Fl. & Fr. : March – August.

Distribution: Indo- Malaysia, China and Australia. Moist localities in the forests and also in the lower plains. *Amitha Bachan 123629* (Chalakkudy, riparian, banks of Chalakkudy river, 3 m).

38. SAPINDACEAE Juss.

Gen. Pl. 246. 1789.

Key to genera

1a. Herbaceous climbers; inflorescence with a pair of tendrils.....
.....**Cardiospermum**

1b. Woody shrubs or trees; inflorescence without tendrils.....2

2a. Leaves trifoliolate, margins serrate.....**Allophylus**

2b. Leaves pinnate, margins entire.....3

3a. The lowest pair of leaflets reniform and stipule-like.....**Otonephelium**

3b. All leaflets similar, not stipule-like.....4

4a. Petals absent.....**Schleichera**

4b. Petals present.....5

5a. Ovules 2 in each cell .....**Harpullia**

5b. Ovules 1 in each cell.....6

6a. Fruits tubercled.....**Dimocarpus**

6b. Fruits smooth.....**Sapindus**

ALLOPHYLUS L.

Sp. Pl. 348. 1753

Allophylus cobbe (L.) Raeusch., Nomencl. Bot. (ed. 3) 108. 1797; Hiern. in Hook. f., Fl. Brit. India 1: 673. 1875*p.p*; Leench., Blumea 15: 329. 1968; Manilal, Fl. Silent Valley 62. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 116. 1996; P. C. Pant in N. P. Singh *et al.*, Fl. India 5: 346. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 172. 2002; P. Singh & Vajravelu in P. Daniel, Fl. Kerala 1: 771. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 184. 2009. *Rhus cobbe* L., Sp. Pl. 267. 1753. *Schmidelia rheedei* Wight, Icon. Pl. India Orient. t. 964. 1845. *Allophylus rheedei* (Wight) Radlk. in Engl. & Prantl, Naturl. Pflanzenfam. 3(5): 313. 1895; Gamble, Fl. Pres. Madras 246. 1918. **Mukkannanpezhu.**

Large shrubs, Young stem and peduncles pubescent. Leaves trifoliolate; Leaflets elliptic to ovate-elliptic, acuminate at apex, cuneate at base, entire or crenate towards distal half, to 14 x 6 cm, terminal

leaflets large; petiole to 10 cm long. Thyrses axillary, branched, longer than the leaves. Sepals 4, ovate-obtuse, 0.1 cm. Petals 4, unequal, as long as sepals, white. Fruit subglobose, 0.8 cm across.

Fl. & Fr. July-September

Distribution: South India, Sri Lanka and Southeast Asia. Moist forests. *Amitha Bachan 117603* (Vazhachal, riparian forest, banks of Chalakkudy river, 220 m).

CARDIOSPERMUM Linnaeus

Sp. Pl. 366. 1753.

Cardiospermum halicacabum L., Sp. Pl. 366. 1753; Wight, Icon. Pl. India Orient. t. 508. 1841; Hiern. in Hook. f., Fl. Brit. India 1: 670. 1875; Gamble, Fl. Pres. Madras 244. 1918; Sasidh. & Sivar., Fl. Pl. Thrissur For. 116. 1996; P. C. Pant in N. P. Singh *et al.*, Fl. India 5: 356. 2000; Anil Kumar *et al.*, Fl. Pathanamthitta 141. 2005; P. Singh & Vajravelu in P. Daniel, Fl. Kerala 1: 774. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 185. 2009. **Uzhinja.**

Slender herbaceous climbers. Leaves alternate, bi-ternate; Leaflets ovate-lanceolate, deeply dentate or lobed, apex acute to acuminate, membranous; shortly decurrent on the petiolule, membranous, to 4 x 2.5 cm. Flowers white, polygamous in 3-7-flowered axillary tendril-bearing peduncles; Sepals 4, in 2-pairs, outer pair smaller. Petals 4, white, unequal, with basal scales. Stamens 8; filaments unequal, pilose. Ovary 3-locular; ovule 1-per locule; stigma 3-fid. Capsule papery, inflated, 3-lobed, winged.

Fl. & Fr. July-December.

Distribution: South India, Sri Lanka and Southeast Asia. Moist forests. *Amitha Bachan 117616* (Malakkapara, riparian forest, banks of Sholayar river, 900 m).

DIMOCARPUS Loureiro

Fl. Cochinch. 233. 1790.

Dimocarpus longan Lour., Fl. Cochinch. 233. 1790; Leench., Blumea 19: 125. 1971; Manilal, Fl. Silent Valley 63. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 117. 1996; P.C. Pant in N.P. Singh *et al.*, Fl. India 5: 358. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 174. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 141. 2005; P. Singh & Vajravelu in P. Daniel, Fl. Kerala 1: 776. 2005; *Euphoria longan* (Lour.) Steud., Nomencl. Bot. 1: 328. 1821. *Euphoria longana* Lam., Encycl. 3: 574. 1792. *Nephelium longana* (Lam.) Camp., Mem. Mus. Hist. Nat. Paris 18: 30. 1829; Hiern. in Hook. f., Fl. Brit. India 1: 688. 1875; Gamble, Fl. Pres. Madras 252. 1918. *Scytalia longan* (Lour.) Raeusch., Nomencl. Bot. (ed.3) 113. 1797. **Chempoovam, Pasakotta.** **Plate 20. C**

Small evergreen trees; branchlets white lenticellate, tomentose. Leaves paripinnate, alternate; leaflets 8-20, subopposite or alternate; rachis to 16 cm long, stout, grooved above, swollen at base, glabrous; petiolule 5-13 mm, stout, grooved above, glabrous; leaflets elliptic-oblong or oblong-lanceolate, oblique or acute at base, acute or acuminate at apex, to 20 x 6 cm, entire, coriaceous. Flowers polygamous, 0.5 cm across, yellowish-white, in terminal and axillary brown tomentose panicles or racemes; calyx cupular, tomentose; lobes 5 or 6, ovate, saccate at base; petals 5 or 6, oblong, pilose at base, deflexed; disc annular; stamens 8 or 10, inserted within the disc; filaments slender, hairy; ovary superior, ovoid, 2-lobed, pubescent, 2-celled, ovule 1 in each

cell. Schizocarp to 1.5 cm long, globose, reddish-brown, with round tubercles or sometimes nearly smooth.

Fl. & Fr. : February-April.

Distribution: Indo-Malaysia. Evergreen forests. *Amitha Bachan 72037* (Vazhachal, riparian forest, banks of Chalakkudy river, 240 m).

HARPULLIA Roxburgh

Fl. Indica 2: 441. 1824.

Harpullia arborea (Blanco) Radlk., Sitzungsber. Math.-Phys. Cl. Koenigl. Bayer. Akad. Wiss. Muenchen 16: 404. 1890; Leench. & Vente, Blumea 28: 11. 1982; Sasidh. & Sivar., Fl. Pl. Thrissur For. 117. 1996; P.C. Pant in N.P. Singh *et al.*, Fl. India 5: 365. 2000; Anil Kumar *et al.*, Fl. Pathanamthitta 142. 2005; P. Singh & Vajravelu in P. Daniel, Fl. Kerala 1: 779. 2005; *Ptelea arborea* Blanco, Fl. Filip. (ed. 1) 63. 1837. *Harpullia imbricata* (Blume) Thwaites, Enum. Pl. Zeyl. 56. 1858; Gamble, Fl. Pres. Madras 253. 1918. *Octonychium imbricatum* Blume, Rumphia 3: 180. 1849. *Harpullia cupanoides* sensu Hiern in Hiern. in Hook.f., Fl. Brit. India 1: 692. 1875 p.p., non Roxb. 1832. **Puzhukolli.** **Plate 20.B**

Small to medium sized trees; branchlets tomentose. Leaves paripinnate, alternate, estipulate; rachis 9-31 cm long, slender, pubescent, swollen at base; leaflets 8-12, lanceolate, elliptic-oblong or elliptic-lanceolate, base oblique, acuminate at apex, to 20 x 10 cm, entire, glabrous, membranous; lateral nerves 7-12 pairs, prominent. Flowers polygamodioecious, 1 cm long, yellowish-green, in axillary, or subterminal drooping panicles; sepals 5, free, imbricate; petals 5, long clawed, oblong; disc small, 5-lobed; stamens 5-8, inserted within the disc; Ovary superior, ovoid, 2-celled, ovules 2 in each cell, stigma linear,

usually more or less twisted. Capsule 2 x 3 cm, scarlet, 2-lobed, 2-celled, inflated, loculicidally 2-valved, coriaceous; seeds 2, black.

Fl. & Fr. February-April..

Distribution: Indo-Malaysia and Australia. Riparian evergreen forest. *Amitha Bachan 99057* (Sholayar, riparian forest, banks of Sholayar river, 800 m).

OTONEPHELIUM Radlkofer

Sitzungsber. Math.-Phys. Kl. Bayer. Akad. Wiss.

Muenchen 20: 253-288. 1890.

Otonephelium stipulaceum (Bedd.) Radlk., Sapindaceae Holl.-India 71. 1879; Gamble, Fl. Pres. Madras 252. 1918; Leench., Blumea 31: 429. 1986; Sasidh. & Sivar., Fl. Pl. Thrissur For. 118. 1996; P.C. Pant in N.P. Singh *et al.*, Fl. India 5: 378. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 175. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 143. 2005; P. Singh & Vajravelu in P. Daniel, Fl. Kerala 1: 783. 2005; *Nephelium stipulaceum* Bedd., Trans. Linn. Soc. London 25: 212. 1865 & Ic. t. 103. 1868-1874; Hiern. in Hook. f., Fl. Brit. India 1: 690. 1875; Gamble, Fl. Pres. Madras 252. 1918.

Medium sized evergreen trees, bark pale-brown, peels off in irregular thin scales. Leaflets obovate or elliptic, acuminate at apex, cuneate to obtuse at base, to 6-20 x 3-10 cm, glabrous above and glaucous beneath; lower pair of leaflets stipule-like, sessile, to 1-2.5 x 1-2 cm, reniform. Flowers polygamous, cream-coloured, 0.5 cm across, in axillary and terminal panicles; calyx cupular; lobes 6, villous within; petals 0; disc annular, fleshy, lobed; stamens 8, filaments unequal, slender, inserted within the disc; ovary superior, 2-4-lobed, 2-4-celled,

pubescent, ovules 1 in each cell; Drupe 1 -1.6 cm long, oblong or ovoid, covered with soft prickles; seeds 1-2, brown, smooth.

Fl. & Fr. March-April.

Distribution: Endemic to Western Ghats. Evergreen riparian forests. *Amitha Bachan 99046* (Karanthodu, riparian forest, banks of Chalakkudy river, 350 m). *Amitha Bachan 98901* (Orukombankutty, riparian forest, banks of Chalakkudy river, 450 m).

SAPINDUS Linnaeus

Sp. Pl. 367. 1753.

Sapindus trifoliatus L., Sp. Pl. 367. 1753; Hiern. in Hook. f., Fl. Brit. India 1: 682. 1875; Sasidh. & Sivar., Fl. Pl. Thrissur For. 119. 1996; C. N. Sunil & Sivad., Fl. Alappuzha 186. 2009; P. C. Pant in N. P. Singh *et al.*, Fl. India 5: 382. 2000 P. Singh & Vajravelu in P. Daniel, Fl. Kerala 1: 785. 2005. *Sapindus laurifolius* Vahl, Symb. Bot. 3: 54. 1794; Gamble, Fl. Pres. Madras 250. 1918; N. Mohanan & Sivad., Fl. Agasthyamala 176. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 143. 2005.

Medium sized trees; branchlets lenticellate. Leaves paripinnate, alternate, leaflets 4-6, opposite or subopposite, elliptic-oblong, elliptic-lanceolate, oblique round or acute at base, acuminate at apex, to 7-25 x 2.5-10 cm, entire, glabrous, chartaceous. Flowers polygamous, greenish-white, 0.5 cm across, in axillary or terminal panicles; densely pubescent; sepals 5, ovate, unequal, in 2 series; petals 5, linear-lanceolate, clawed; disc concave; stamens 8, inserted within the disc; ovary superior, tomentose, 2-3-celled, not lobed, ovule 1 in each cell; stigma 2-3-lobed. Drupe, 1.5 cm across, globose, greenish-yellow, wrinkled when ripe; seeds 2-3, globose, black.

Fl. & Fr. March-April.

Distribution: South Asia. Evergreen Riparian forests. *Amitha Bachan 117781* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

SCHLEICHERA Willdenow

Sp. Pl. 4: 1096. 1809, *nom. cons.*

Schleichera oleosa (Lour.) Oken, Allg. Naturgesch. 3: 1341. 1841; Manilal, Fl. Silent Valley 64. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 119. 1996; P.C. Pant in N.P. Singh *et al.*, Fl. India 5: 384. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 176. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 143. 2005; P. Singh & Vajravelu in P. Daniel, Fl. Kerala 1: 786. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 186. 2009. *Pistacia oleosa* Lour., Fl. Cochinch. 615. 1790. *Schleichera trijuga* Willd., Sp. Pl. 4: 1096. 1805; Hiern. in Hook. f., Fl. Brit. India 1: 681. 1875; Gamble, Fl. Pres. Madras 248. 1915. **Poovam.**

Medium sized tree. Leaves paripinnate, alternate, exstipulate; leaflets 4-6, opposite or subopposite; elliptic-oblong, ovate or obovate, oblique at base, acute or obtuse at apex, 14 x 4 cm, entire, glabrous, coriaceous; Flowers polygamodioecious, greenish-yellow, to 0.5 cm, in axillary spicate panicles; calyx lobes 5; petals 0; disc complete, stamens 7 or 8, free, inserted within the disc; pistillode small; ovary 2 mm, superior, 3-celled, ovule 1 in each cell. Drupe to 1.8 cm across, subcrustaceous, often echinate; seed 1 or 2, enclosed in a pulpy aril.

Fl. & Fr. March-May.

Distribution: Indo-Malaysia. Evergreen Riparian forests. *Amitha Bachan 98970* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

39. **STAPHYLEACEAE** Martinou.

TURPINIA Ventenat

Mem. Cl. Sci. Math. Inst. Natl. France 1807 (1): 3. 1807, *nom. cons.*

Turpinia malabarica Gamble, Bull. Misc. Inform. Kew 1917: 135. 1916. & Gamble, Fl. Pres. Madras 241. 1918; Manilal, Fl. Silent Valley 62. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 115. 1996; P. C. Pant in N. P. Singh *et al.*, Fl. India 5: 416. 2000; Anil Kumar *et al.*, Fl. Pathanamthitta 139. 2005; Arisdasan *et al.* & P. Daniel in P. Daniel, Fl. Kerala 1: 765. 2005. **Alunkumaram, Pamabaetti.**

Medium sized trees to 20 m high. Leaves imparipinnate, opposite, elliptic-obovate, elliptic-ovate, 4-12 x 1.5-5 cm, acute or cuneate at base, acuminate or obtusely acuminate at apex, serrate, glabrous, coriaceous, lateral nerves 4-7 pairs; rachis 19-25 cm long, stout, swollen at base, glabrous, leaflets opposite, 3-7, stipellate; Flowers in axillary and terminal panicles, white, to 1 cm across; sepals 5, 0.3cm long, ovate, slightly connate at base, obtuse, ciliate; petals 5; stamens 5; filaments shortly villous, inserted outside the disc; disc erect, crenate; ovary sessile, superior, 3-lobed, 3-celled. Berry, subglobose, 1-3 pointed, glabrous, not lobed.

Fl. & Fr. : December-May.

Distribution: Endemic to South India and Sri Lanka. Evergreen forests, stream banks. *Amitha Bachan 99111* (Muthuvarachal, riparian forests, banks of Karappara river, 450 m).

40. **SABIACEAE** Blume

Key to genera

1a. Small trees; flowers in panicles..... **Meliosma**

1b. Climbing shrubs; flowers in corymbose cymes.....**Sabia**

MELIOSMA Blume

Cat. Buitenzorg 10. 1823.

Key to species

1a. Leaves simple 2

1b. Leaves pinnate .....**M. pinnata**

2a. Branchlets densely tomentose..... **M. simplicifolia** subsp. **pungens**

2b. Branchlets glabrescent.....**M. simplicifolia** subsp. **simplicifolia**

Meliosma pinnata (Roxb.) Maxim. subsp. **barbulata** (Cufod.) Beus. in Dassan. & Fosb., Rev. Handb. Fl. Ceylon 3: 384. 1981; Manilal, Fl. Silent Valley 65. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 120. 1996; S.C. Majumdar in N.P. Singh *et al.*, Fl. India 5: 423. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 177. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 144. 2005; N. P. Balakr. in P. Daniel, Fl. Kerala 1: 792. 2005. *Meliosma rhoifolia* Maxim. subsp. *barbulata* Cufod., Oest. Bot. 88. 254. 1939. *Millingtonia arnottiana* Wight, Illustr. Ind. Bot. 1: t. 53. 1840. *Meliosma arnottiana* (Wight) Walp., Rep. 1: 423. 1842; Hook. f., Fl. Brit. India 2: 6. 1876, *p.p.*; Gamble, Fl. Pres. Madras 256. 1918. *Meliosma pinnata* (Roxb.) Maxim. subsp. *arnottiana* (Wight) Beus., Blumea 19: 499. 1971. *Millingtonia pinnata* Roxb., Fl. India 1: 103. 1820.

Medium sized evergreen trees to 18 m high; branchlets brown villous, prominently lenticellate. Leaves imparipinnate, alternate, estipulate; rachis 6.5-18 cm long, stout, rusty pubescent; Leaflets 9-11, lanceolate, acuminate or acute at apex, chartaceous, tawny tomentose beneath, to 10 x 4 cm. Flowers bisexual, yellowish-white in large terminal and axillary tomentose panicles; bracteoles sepaloid. sepals 5, basally connate, triangular, ciliate on margins; petals 3+2; inner ones 2-

fid; outer 3 suborbicular, unequal; fertile stamens 2; ovary tomentose, 2-celled, ovule 2 in each cell; style single. Fruit a drupe, 5-6 mm across, globose.

Fl. & Fr. : March-June.

Distribution: Inod-Malaysia and China. Evergreen forests. *Amitha Bachan 117768* (Malakkapara-Valparai, riparian forest, banks of Sholayar river, 1100 m).

Meliosma simplicifolia (Roxb.) Walp., Repert. 1: 423. 1842. subsp. **pungens** (Wall. ex Wight & Arn.) Beus., Blumea 19: 466. 1971; S. C. Majumder in N. P. Singh *et al.*, Fl. India 5: 427. 2000; N. P. Balakr. in P. Daniel, Fl. Kerala 1: 793. 2005; *Millingtonia pungens* Wall. ex Wight & Arn., Edinb. New Phil. J. 15: 178. 1833. *Meliosma pungens* (Wight & Arn.) Walp. Rep. 1: 423. 1842. *Meliosma wightii* Planch. ex Brandis, For. Fl. 116. 1874; Hook. f., Fl. Brit. India 2: 4. 1876; Gamble, Fl. Pres. Madras 256. 1918.

Trees, to 20 m high; branchlets densely tomentose. Leaves simple, alternate, estipulate, elliptic-oblong, elliptic-obovate or oblanceolate; acute to round at base, acute or acuminate at apex, to 30 x 10 cm; petiole 1.5-5 cm, stout, puberulent, grooved above; moderately pubescent especially on midrib and nerves beneath, coriaceous; lateral nerves 7-18 pairs. Flowers small, bisexual, sessile, in lax or dense panicles, densely tomentose; sepals 5, and 3 or more sepal like empty bracts, ovate, ciliolate; petals 3+ 2; stamens 5; fertile stamens 3; anthers globose; sterile ones bifid at apex; disc annular; ovary superior, glabrous, to 0.1 cm, 2-celled, ovules 2 per cell. Fruit a drupe, 0.5 cm across, globose, purple-black, crustaceous.

Fl. & Fr. : September – March.

Distribution: Indo-Malaysia and China. Evergreen forests, evergreen forests usually along the stream banks. *Amitha Bachan 98948* (Karappara, riparian forest, banks of Karappara river, 918 m). *Amitha Bachan 98842* (Malakkapara, riparian forest, banks of Sholayar river, 900 m).

Meliosma simplicifolia (Roxb.) Walp. Rep. 1: 423. 1842, subsp. **simplicifolia**: Hook. f., Fl. Brit. India 2: 5. 1876; Gamble, Fl. Pres. Madras 256. 1918; Manilal, Fl. Silent Valley 65. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 120. 1996; S. C. Majumdar in N. P. Singh *et al.*, Fl. India 5: 423. 2000; Anil Kumar *et al.*, Fl. Pathanamthitta 144. 2005; N. P. Balakr. in P. Daniel, Fl. Kerala 1: 794. 2005; *Millingtonia simplicifolia* Roxb., Pl. Coromandel 3: 50. t. 254. 1820, *p.p.*

Trees, to 15 m high; branchlets glabrescent. Leaves simple, alternate, estipulate, lanceolate to oblong-lanceolate, cuneate or acute at base, acute at apex, to 35 x 12 cm, entire, sometimes more or less dentate, glabrous; petiole 1.5-4 cm long, stout, puberulent, grooved above; lateral nerves 8-23 pairs, pinnate, ascending, prominent. Flowers bisexual, subsessile, yellowish-white, solitary or more less crowded in lax panicles, to 40 cm, sparsely to densely pubescent but never tomentose. Sepals 4 or 5, ciliolate; petals 3+2, yellow; inner petals bifid, lobes more or less divergent, narrow, glabrous, sometimes slightly fimbriate or ciliolate at the very tips; disc small, annular and toothed; ovary superior, glabrous, 2-celled, 2-ovuled; style short. Fruit a drupe, globose, purple-black.

Fl. & Fr. : March-June.

Distribution: Evergreen forests usually among riparian forest. *Amitha Bachan 98843* (Malakkapara, riparian forest, banks of Sholayar river, 900 m).

SABIA Colebr.

Sabia limoniacea Wall. ex Hook.f. & Thomson, Fl. India 1: 210. 1855; Sasidh. & Sivar., Fl. Pl. Thrissur For. 120. 1996; S. C. Majumdar in N. P. Singh *et al.*, Fl. India 5: 432. 2000; N. P. Balakr. in P. Daniel, Fl. Kerala 1: 795. 2005; *Sabia malabarica* Bedd., Ic. 39, t. 177. 1868-1874; Hook. f., Fl. Brit. India 2: 2. 1876; Gamble, Fl. Pres. Madras 254. 1918.

Woody climbers. Leaves alternate, simple, oblong-lanceolate, rounded or acute at base, acute to acuminate at apex, to 15 x 5 cm, glabrous, entire; petiole 0.5 cm long. Inflorescence axillary or terminal corymbose cymes. Flowers usually bisexual, calyx 4-5-lobed; petals 4-5; disk annular 4-5-lobed. Stamens 4-5, inserted at the base of the disk. Carpels 2, rarely 3; ovules 2 in each carpel.

Fl & Fr. : April-May.

Distribution: Indo-Malaysia and China. riparian forests, banks of streams. *Amitha Bachan 98935* (Nelliyampathy-Hill top, stream bank vegetation, banks of Karappara river, 1100 m).

41. ANACARDIACEAE Lindley

Instr. Nat. Syst. Bot. 127. 1830.

Key to genera

1a. Leaves compound.....2

1b. Leaves simple.....4

2a. Leaflets with intramarginal nerve.....3

2b. Leaflets without intramarginal nerve.....**Lannea**

3a. Leaflets serrulate; style 1.....**Solenocarpus**

3b. Leaflets entire; styles 5.....**Spondias**

4a. Carpel 5, distinct (only 1 fertile)..... **Buchanania**

4b. Carpel 1.....5

5a. Style 1..... **Mangifera**

5b. Styles 3.....6

6a. Leaves with petiolar appendages; drupe partly enclosed by the hypocarp .....**Holigarna**

6b. Leaves without petiolar appendages; drupe seated on the basal hypocarp .....**Semecarpus**

BUCHANANIA Spreng.

Buchanania lanzan Spreng., J. Bot. (Schr.) 2: 234. 1800; Hook. f., Fl. Brit. India 2: 23. 1876; Gamble, Fl. Pres. Madras 258. 1918; N. Mohanan & Sivad., Fl. Agasthyamala 178. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 145. 2005; V. Chandrasekharan in P. Daniel, Fl. Kerala 1: 800. 2005; *Buchanania latifolia* Roxb., Fl. India 2: 385. 1832. **Kulamavu.**

Trees to 18 m high, bark rough. Leaves simple, alternate, estipulate; petiole to 2cm, stout, glabrous; lamina to 20 x 10 cm, broadly oblong, base round or acute, apex obtuse glabrous above and densely tomentose beneath, entire, coriaceous; lateral nerves 10-20 pairs, pinnate. Flowers bisexual, greenish-white, sessile, in pubescent terminal and axillary panicles; calyx lobes 5, persistent; petals 5, oblong; stamens 10, inserted at the base of fleshy disc; filaments free, glabrous; disc cupular, 5 lobed; carpels 5-6, free, superior, tomentose, 4 reduced to thread like processes, one fertile, ovule one, pendulous; style lateral; stigma truncate. Fruit a drupe, to 1cm, oblong, laterally compressed, black; seed one.

Fl. & Fr.: January-April

Distribution: India and Myanmar. Moist forests, along riverbanks. *Amitha Bachan 123375* (Thellikkal-Parambikulam, riparian forests, banks of Thellikkal river, 550 m).

HOLIGARNA Ham. ex Roxb.

Pl. Corom. 3: 79. 1820, *nom. cons.*

Key to species

1a. Leaves narrowly obovate- oblanceolate, 6 cm broad.....**H. arnottiana**

1b. Leaves broadly oblanceolate, 6-20 cm broad..... **H. grahamii**

Holigarna arnottiana Hook. f., Fl. Brit. India 2: 36. 1876; Gamble, Fl. Pres. Madras 268. 1918; Sasidh. & Sivar., Fl. Pl. Thrissur For. 121. 1996; D. Chandra & S. K. Mukh. in N. P. Singh *et al.*, Fl. India 5: 457. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 179. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 146. 2005; V. Chandrasekharan in P. Daniel, Fl. Kerala 1: 803. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 188. 2009.
Cheru. **Plate 20. E**

Evergreen trees, to 20 m high with buttresses; bark pale brown, rough; young shoot brown tomentose. Leaves simple, alternate, crowded at the tips of branchlets, estipulate; petiole to 1.5 cm, tomentose; lamina to 20 x 6 cm, oblanceolate, base cuneate, apex obtusely acute, entire, glabrous, coriaceous; Flowers polygamous, yellowish-brown, 3 mm across, in axillary panicles, calyx cupular, 5-fid; petals 5, cohering at the base, villous inside, valvate; disc lining the calyx tube, obscure in bisexual flowers; stamens 5, inserted outside the disc; filaments subulate; anthers red, versatile; ovary inferior, 1-celled, ovule pendulous; styles 3, divergent; stigmas capitate. Fruit a drupe, 2.5 cm long, ovoid, resinous; seed parietal.

Fl. & Fr.: January-July

Distribution: Endemic to Southern Western Ghats. Evergreen forests, moist localities, near water bodies *Amitha Bachan 123463* (Vazhachal, riparian vegetation, banks of Chalakkudy river, 220 m).

Holigarna grahamii (Wight) Kurz, J. Asiat. Soc. Bengal 42: 305. 1872; Hook. f., Fl. Brit. India 2: 37. 1876; Gamble, Fl. Pres. Madras 268. 1918; Sasidh. & Sivar., Fl. Pl. Thrissur For. 121. 1996; D. Chandra & S.K. Mukh. in N.P. Singh *et al.*, Fl. India 5: 460. 2000; Anil Kumar *et al.*, Fl. Pathanamthitta 146. 2005; V. Chandrasekharan in P. Daniel, Fl. Kerala 1: 805. 2005; *Semecarpus grahamii* Wight, Icon. Pl. India Orient. t. 235. 1839. *Holigarna wightii* Balakr., J. Bomb. Nat. Hist. Soc. 63: 327. 1966.
Kattucheru. **Plate 20. D**

Large evergreen trees to 30 m high, branchlets brown tomentose. Leaves simple, alternate, to 60 x 20 cm clustered at the tips of branchlets, estipulate, oblanceolate, base cuneate, apex acuminate, entire, glabrous above, densely golden brown tomentose below, coriaceous; petiole to 4 cm long, stout, broadened at base, brown tomentose; spur 2 pairs, stout, persistent, brown tomentose. Flowers small, polygamous, dull white, in terminal tomentose panicles; calyx cupular, shortly 5-toothed; petals 5, cohering at the base; stamens 5, inserted outside the disc; filaments subulate; anthers versatile; ovary inferior, 1-celled, ovule pendulous from near the top of the cell; style 3. Fruit a drupe, major portion included in hypocarp, ovoid, reddish-purple.

Fl. & Fr.: October - March

Distribution: Endemic to the Western Ghats. Evergreen forests, *Amitha Bachan 123453* (Vazhachal-Pachakkadu, streamside vegetation, banks of Charpa thodu, 240 m).

LANNEA A. Rich.

in J.B.A. Guillemin and Perrottet Fl. Seneg. Tent. 153. 1831, *nom. cons.*

Lannea coromandelica (Houtt.) Merr., J. Arnold Arbor. 19: 353. 1938; Manilal, Fl. Silent Valley 66. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 122. 1996; D. Chandra & S.K. Mukh. in N.P. Singh *et al.*, Fl. India 5: 463. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 180. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 146. 2005; V. Chandrasekharan in P. Daniel, Fl. Kerala 1: 806. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 189. 2009. *Dialium coromandelicum* Houtt., Nat. Hist. ser. 2. 2: 39. t. 5. f. 2. 1774. *Odina wodier* Roxb., Fl. India 2: 293. 1832; Hook. f., Fl. Brit. India 2: 29. 1876; Gamble, Fl. Pres. Madras 263. 1918. **Kalasu.**

Trees to 25 m high, decidious. Leaves alternate, compound, imparipinnate, clustered at the end of branchlets, estipulate; rachis to 25 cm, swollen at base; leaflets 7-11, opposite; petiolule 3-5 mm, slender, pubescent; lamina to 10 x 7 cm, oblong-ovate, base oblique, acute or round, apex acuminate, entire, chartaceous. Flowers unisexual, yellowish-green, small. Male flowers : in compound racemes;calyx 4-lobed; lobes ovate, imbricate, persistent; petals 4, lanceolate, reflexed, imbricate; disc annular, 8-lobed; stamens 8, inserted below the disc, filaments unequal, ovary abortive. Female flowers : in simple racemes; petals and sepals as in male flowers; stamens very short and small; anthers sterile; ovary superior, ovule pendulous; styles 4; stigma peltate. Fruit a drupe, 12 mm long, ovoid, red.

Fl. & Fr.: January - May

Distribution: Indo-Malaysia and China. Moist places from forests to plains. *Amitha Bachan 123377* (Vazhachal, riparian forests along banks of Chalakkudy river, 220 m).

MANGIFERA Linnaeus

Sp. Pl. 200. 1753.

Mangifera indica L., Sp. Pl. 200. 1753; Hook. f., Fl. Brit. India 2: 13. 1876; Gamble, Fl. Pres. Madras 259. 1918; Manilal, Fl. Silent Valley 67. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 122. 1996; D. Chandra & S.K. Mukh. in N.P. Singh *et al.*, Fl. India 5: 466. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 181. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 147. 2005; V. Chandrasekharan in P. Daniel, Fl. Kerala 1: 808. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 190. 2009. **Mavu.**

Evergreen trees to 30 m high, Leaves simple, alternate, estipulate, to 30 x 8 cm, elliptic, linear-oblong, base acute, apex acuminate, acute, entire, glabrous, shiny, coriaceous; petiole 10-75 mm long, stout, glabrous, pulvinate; Flowers polygamous, yellowish-green, in terminal panicles; calyx 4-5 partite, ovate, imbricate, cauducous; petals 4-5, oblong-obovate, subequal; disc fleshy, cupular, 4-5 lobed; stamens 4-5, inserted inside or on the disc, fertile stamens 1 or 2; filaments free, glabrous; ovary sessile, superior, oblique, 1-celled, ovule pendulous; style 1, lateral; stigma simple. Fruit a drupe, 5-15 cm long, oblong-reniform, yellowish-red when ripe, mesocarp fleshy, endocarp fibrous; seed subreniform.

Fl. & Fr.: January - May

Distribution: Indo-Malaysia. Evergreen riparian forests. *Amitha Bachan 123378 (*Vazhachal, riparian evergreen forests, banks Chalakkudy River, 230 m).

SEMECARPUS L. f.

Suppl. Pl. 25, 182. 1782.

Semecarpus travancorica Bedd., Fl. Sylv. t. 232.1872; Hook. f., Fl. Brit. India 2: 31. 1876; Gamble, Fl. Pres. Madras 267. 1918; Sasidh. & Sivar., Fl. Pl. Thrissur For. 124. 1996; D. Chandra & S.K. Mukhrjee in N.P. Singh *et al.*, Fl. India 5: 504. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 186. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 148. 2005; V. Chandrasekharan in P. Daniel, Fl. Kerala 1: 817. 2005; **Avukkaram.**

Evergreen trees to 30m. Leaves simple, alternate clustered at the tips of branchlets, estipulate to 20-60 x 10-15 cm, obovate or obovate-oblong, base acute, apex obtuse, round or emarginated; lateral nerves 12-20 pairs. Flowers polygamous, greenish-yellow in axillary and terminal glabrous panicles; calyx lobes 5, imbricate, deciduous; petals 5, ovate, glabrous, imbricate; disc broad annular; stamens 5, inserted below the disc; filaments filiform, as long as or longer than the petals in male flowers, shorter than petals in bisexual flowers; anthers oblong; ovary superior, 1-celled, glabrous; ovules pendulous from a basal funicle; style 3. Fruit a drupe, to 3 cm long, fleshy, obliquely oblong, black, striate, seated on a short broad furrowed hypocarp.

Fl. & Fr. : November- March.

Distribution: Endemic to Southern Western Ghats, Rare. *Amitha Bachan 123300* (Sholayar-Ambalapara, streamside vegetation in evergreen forest, 800 m).

SOLENOCARPUS Wight & Arn.

Prodr. 172. 1834.

Solenocarpus indicus Wight & Arn., Prodr. 172. 1834; Hook. f., Fl. Brit. India 2: 27. 1876; Gamble, Fl. Pres. Madras 262. 1918; Sasidh. & Sivar., Fl. Pl. Thrissur For. 125. 1996; D. Chandra & S.K. Mukh. in N.P. Singh *et al.*, Fl. India 5: 505. 2000. *Spondias indica* (Wight & Arn.) Airy Shaw & Forman, Kew Bull. 21: 16. 1967-1968; Manilal, Fl. Silent Valley 68. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 186. 2002; V. Chandrasekharan in P. Daniel, Fl. Kerala 1: 8-8. 2005.

Small trees, often growing among the crevices of rocks. Leaves alternate, imparipinnate, crowded to the ends of branhlets. Rachis 14-20 cm long; Leaflets 9-15, oblong or oblong-lanceolate, acuminate, base oblique, subcoriaceous, serrulate, 5-10 cm long, forming intramarginal nerve. Panicles axillary and clustered at the tips of the branchlets. Flowers yellowish, 2 mm across; style 1 Drupe yellowish, 6 x4 mm, ovoid, glabrous.

Fl. & Fr. : March- May.

Distribution : Endemic to Southern Western Ghats, rare. *Amitha Bachan 123470* (Sholayar-Kulamali, Streamside in Evergreen forests, 900 m).

SPONDIAS Linnaeus

Sp. Pl. 371. 1753.

Spondias pinnata (L. f.) Kurz, Prelim. Rep. For. & Veg. Pegu Append. A.44. & B.42. 1875; Sasidh. & Sivar., Fl. Pl. Thrissur For. 125. 1996; D. Chandra & S.K. Mukh. in N.P. Singh *et al.*, Fl. India 5: 507. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 186. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 149. 2005; V. Chandrasekharan in P. Daniel, Fl. Kerala 1: 819. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 190. 2009. *Mangifera*

pinnata L. f., Suppl. Pl. 156. 1781. *Spondias mangifera* Willd., Sp. Pl. 2: 751. 1799; Hook. f., Fl. Brit. India 2: 42. 1876; Gamble, Fl. Pres. Madras 261. 1918. **Ambazham**.

Deciduous trees; bark greyish brown, smooth, pink inside. Leaves odd-pinnate; leaflets opposite or subopposite, oblong ovate, rounded at base, acuminate at apex, to 5-10 x 4-7 cm, coriaceous, entire, nerves numerous, close and parallel, forming intramarginal nerve. Flowers in terminal panicles, polygamous, yellowish-white. Calyx lobes 5, triangular, cauducous. Petals 5, yellow, 1.5-2 mm long, ovate-valvate. Stamens 10, inserted below the disc; filaments to 1 mm, equal; anthers oblong. Ovary ovoid, 5-celled; style 5; Drupe 3.5 cm long, ovoid.

Fl. & Fr.: February-April.

Distribution: Indo-Malaysia. Plains to moist forests. *Amitha Bachan 123487* (Muthuvarachal, riparian forests, banks of Karappara river, 450m).

42. CONNARACEAE R. Br.

in Tuckey, Narr. Exped. Zaire : 431. 1818.

Key to genera

1a. Panicles rusty pubescent; calyx persistent on the pedicel....**Connarus**

1b. Panicles glabrous; calyx accrescent, on the fruit base.....**Rourea**

CONNARUS Linnaeus

Sp. Pl. 675. 1753.

Connarus monocarpus L., Sp. Pl. 675. 1753; Hook. f., Fl. Brit. India 2: 50. 1876; Gamble, Fl. Pres. Madras 272. 1918; Sasidh. & Sivar., Fl. Pl. Thrissur For. 126. 1996; M.S. Mondal in N.P. Singh *et al.*, Fl. India 5: 526. 2000; Anil Kumar *et al.*, Fl. Pathanamthitta 149. 2005; N. P.

Balakr. in P. Daniel, Fl. Kerala 1: 795. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 192. 2009. **Kuriel**. **Plate 20. F**

Large climbing shrubs; branchlets glabrous. Leaves imparipinnate; Leaflets 5-7, ovate, to 13 x 5 cm, obtusely acuminate; nerves 5-7 pairs, reddish brown beneath; petiole 8 mm long. Panicles to 15 x 10 cm, terminal, branches fulvous-tomentose. Flowers many; pedicels hispid; sepals oblong, 4 x 1.5 mm, obtuse, hispid outside; petals 8 x 2 mm, acute, hispid outside; filaments glandular-hairy; ovary densely hairy. Capsule biconvex, 5 x 2.5 cm, stipitate, reddish, glabrous inside; seeds polished.

Fl. & Fr. : April-July.

Distribution: Endemic to Peninsular India and Sri Lanka. Moist forests from plains to forested mountains. *Amitha Bachan 123620* (Athirappilly, riparian forests along banks of Chalakkudy river,130 m).

ROUREA Aublet

Hist. pl. Guiane 467. 1775, *nom. cons.*

Rourea minor (Gaertn.) Merr., Interpr. Rumph. Herb. Amboin. 413. 1917; Sasidh. & Sivar., Fl. Pl. Thrissur For. 126. 1996; M.S. Mondal in N.P. Singh *et al.*, Fl. India 5: 538. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 188. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 151. 2005; N. P. Balakr. in P. Daniel, Fl. Kerala 1: 829. 2005; C. N. Sunil & Sivad. Fl. Alappuzha Dist. 192. 2009. *Aegiceras minor* Gaertn., Fruct. 1: 216. t.46. 1788. *Rourea santaloides* (Vahl) Wight & Arn., Prodr. 144. 1834; Hook. f., Fl. Brit. India 2: 47. 1876; Gamble, Fl. Pres. Madras 271. 1918. *Connarus santaloides* Vahl, Symb. Bot. 4: 87. 1794. **Plate 20. G**

Lianas or climbing shrubs, bark brown, smooth; branchlets slender. Leaves imparipinnate; Leaflets, subopposite, 5-9, elliptic-

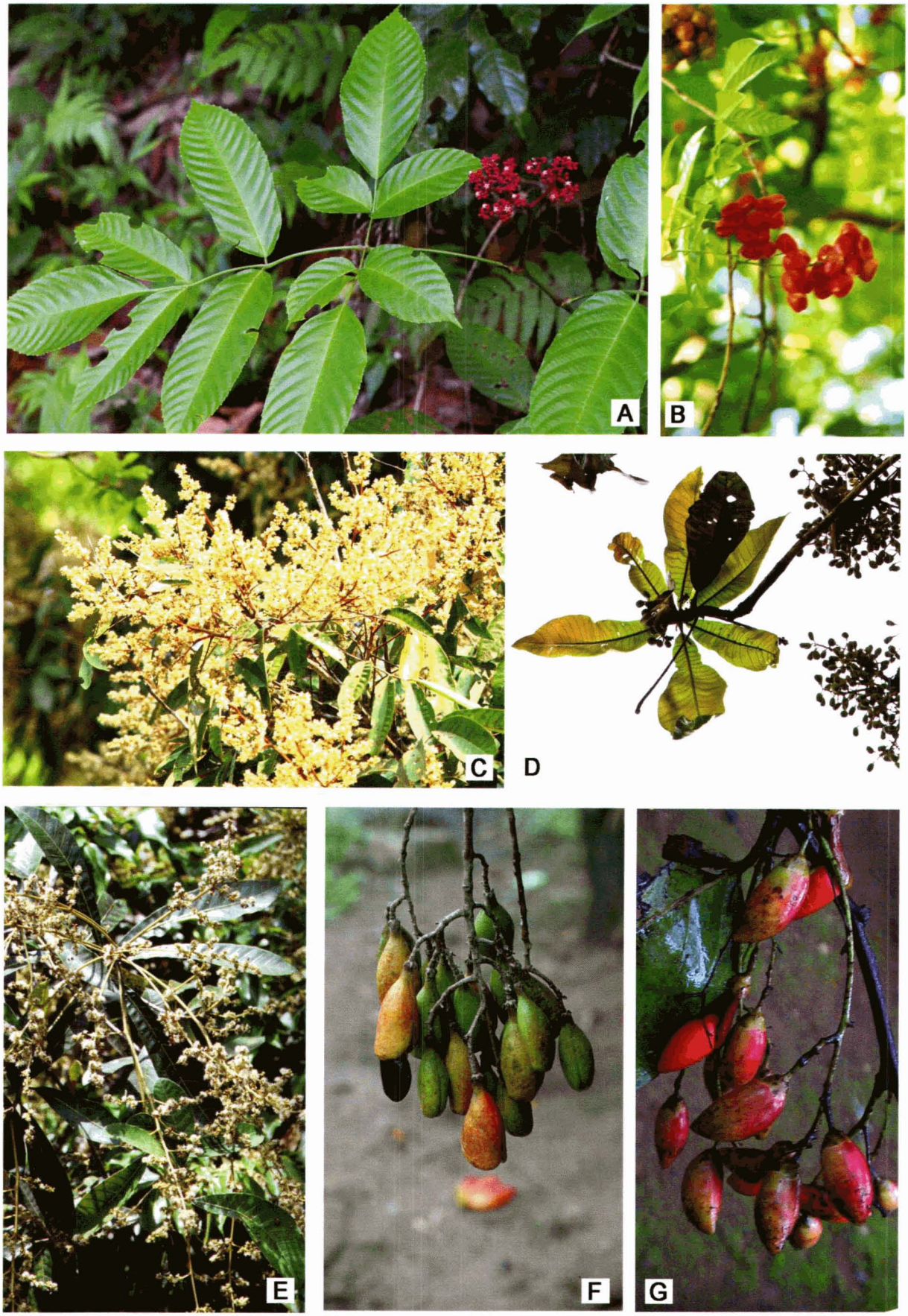


Plate 20. A. *Leea guineensis* G. Don; B. *Harpullia arborea* (Blanco) Radlk.; C. *Dimocarpus longan* Lour.; D. *Holigarna grahamii* (Wight) Kurz ; E. *Holigarna arnottiana* Hook. f.; F. *Connarus monocarpus* L.; G. *Rourea minor* (Gaertn.) Merr.

lanceolate or elliptic, caudate-acuminate, base rounded, glabrous, to 6 x 3 cm; lateral veins and reticulations prominent. Flowers small in axillary panicles. Sepals 5, orbicular; Petals 5, linear; stamens 10, filiform, alternatively longer and shorter, connate in a ring at the base. Carpels 5, syncarpous. Follicle ovoid, orange-yellow, to 2 cm long; aril yellow.

Fl. & Fr. : December – August.

Distribution : India, Sri Lanka, Bangladesh and Malaysia. Evergreen and semi evergreen forests, riparian. *Amitha Bachan 123427* (Vazhachal, riparian evergreen, banks of Chalakkudy river, 220 m).

43. FABACEAE Lindl.

Intr. Nat. Syst. Bot., ed. 2:148. 1836.

LEGUMINOSAE, *nom. alt.*

Key to genera

1a. Anthers dimorphic..... **Crotalaria**

1b. Anthers uniform.....2

2a. Stamens 9 + 1; vexillary stamen always free.....3

2b. Stamens monadelphous or isodiadelphous (9, 10 or 5 + 5).....10

3a. Leaves more than 3-foliolate..... **Derris**

3b. Leaves 1-3-foliolate.....4

4a. Pods turgid..... **Flemingia**

4b. Pods not turgid.....5

5a. Pods twisted so as the joints face each other.....**Uraria**

5b. Pods not as above.....6

6a. Leaves 1-foliolate.....7

6b. Leaves 3-foliolate.....8

7a. Joints of pods turgid.....**Alysicarpus**

7b. Joints of pods flat.....**Desmodium**

8a. Margins of pods thickened; flowers umbellate.....**Centrosema**

8b. Margins of pods not as above; flowers not umbellate.....9

9a. Pods viscid-glandular hairy.....12

9b. Pods not viscid-glandular hairy.....**Desmodium** (p.p.)

10a. Standard smaller than wings; stem armed .....**Erythrina**

10b. Standard equal to or larger than wings; stems unarmed.....11

11a. Pods orbicular; anthers versatile.....**Pterocarpus**

11b. Pods oblong; anthers terminal.....**Dalbergia**

12a. Pods with oblique or transverse lines between seeds..... **Cajanus**

12b. Pods not as above.....13

13a. Trees.....14

13b. Herbs or shrubs; erect or climbing.....15

14a. Stamens monadelphous; pods woody, indehiscent.....**Pongamia**

14b. Stamens diadelphous; pods not woody, dehiscent..... **Gliricidia**

15a. Erect shrubs.....**Pseudarthria**

15b. Climbers.....**Calopogonium**

ALYSICARPUS Necker ex Desvaux

J. Bot. Agric. 1: 120. 1813, *nom. cons.*

Alysicarpus racemosus Benth., Linnaea 24: 642. 1851; Gamble, Fl. Pres. Madras 339. 1918; Sanjappa, Legumes India 80. 1992. *Alysicarpus*

belgaumensis Wight *var. racemosus* (Benth.) Baker in Hook. f., Fl. Brit. India 2: 160. 1876.

Erect or prostrate herbs. Leaves 1-foliate, upper leaves trifoliolate, petioled, stipulate, stipel filiform; leaflets to 1 x 3 cm, ovate, acute at apex, obtuse at base. Flowers in terminal raceme or axillary long pedicels. Flowers paired, densely arranged, pink; calyx 4-lobed, lobes to 5 mm long, not imbricate in fruit, golden pilose; petals not exerted; standard obovate to orbicular; wings obliquely oblong, adherent to the keel; keel obovate, incurved, obtuse; stamens diadelphous, vexillary stamen free; anthers uniform; ovary many-ovuled; style incurved at apex; stigma capitate. Pod fragile, joints 3-4; joints terete or turgid, 1-seeded.

Fl. & Fr. : November – December

Distribution: India. Grass lands and forests. Streamside near shola forests. *Amitha Bachan 98956* (Pullala-Nelliyampathy, stream bank, stream draining to Karappara river, 1100 m).

CAJANUS Adanson

Fam. Pl. 2: 326, 529. 1763, *nom. cons.*

Cajanus trinervius (DC.) van der Maesen, Agric. Univ. Wageningen Pap. 85-4: 199. 1985; Sanjappa, Legumes India 100. 1992. *Collaea trinervia* DC., Mem. Leg. 247. 1826. *Atylosia major* Wight & Arn., Prodr. 247.1834. *Atylosia trinervia* (DC.) Gamble var. *major* (Wight & Arn.) Prain, J. Asiat. Soc. Bengal 66: 45. 1897; Gamble, Fl. Pres. Madras 368. 1918.

Erect subshrubs. Stem densely yellowish-hairy. Leaves 3 foliolate; leaflets obovate, to 6 x 2.5 cm, obtusely acute, mucronate, 3-ribbed from base; petiole 2 cm long. Flowers paired, peduncled; bracts 1.3 cm across, orbicular; pedicels 6 mm long; calyx 16 mm long, lobes acuminate, densely hairy; standard obovate, emarginate, auricled, claw 0.5 cm long;

wings 2.5 cm long; keel 2.5 cm, clawed, yellowish pink. Pods oblong, brown silky pubescent, to 3 cm; 3-4 seeded.

Fl. & Fr. : November – January

Distribution : Endemic to India and Sri Lanka. Streamside near shola forests, *Amitha Bachan 123358* (Charpapadam-Vazhachal, banks of Charpa thodu, stream draining to Chalakkudy river, 800 m).

CALOPOGONIUM Desvaux

Ann. Sci. Nat. (Paris) 9: 423. 1826.

Calopogonium mucunoides Desv., Ann. Sci. Nat. (Paris) 9: 423. 1826; Sanjappa, Legumes India 104. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 132. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 159. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 201. 2009.

Climbers, densely strigose-hairy. Leaves 3-foliolate; leaflets elliptic-rhomboid, 3-7 x 2-4 cm, rounded or oblique at base, obtuse at apex, lateral nerves 4 pairs; petiole to 8 cm long; stipels to 3 mm long, linear. Flowers in axillary racemes, pale blue; bracts and bracteoles small, caducous; pedicels to 3 mm long. Calyx lobes unequal, 4-6 mm long; upper 2 calyx lobes free or connate, others linear-lanceolate. Standard petal obovate, with 2 inflexed auricles at base; keel petals shorter than wing petals. Stamens 9+1. Ovary densely villous, sessile; ovules many; style slender; stigma capitate. Pods oblong, to 3 cm long, 4-6-seeded, compressed, densely villous.

Fl. & Fr. : August – December.

Distribution : Introduced from tropical Asia, now wide spread in south India. Forest opening and plains. *Amitha Bachan 117636* (Annamanada, open riparian zone, banks of Chalakkudy river, 3 m).

CROTALARIA Linnaeus

Sp. Pl. 714. 1753.

Key to species

1a. Branches erect; leaves 2-9 cm long, retuse..... **C. retusa**

1b. Branches slender; leaves < 2.5 cm long, acute ..... **C. clarkei**

Crotalaria clarkei Gamble, Bull. Misc. Inform. Kew 1917: 27. 1917; Gamble, Fl. Pres. Madras 296. 1918; Sanjappa, Legumes India 118. 1992; Anil Kumar *et al.*, Fl. Pathanamthitta 162. 2005. **Plate 21. A**

Slender undershrubs upto about 60 cm high, branches slender, 4 angled. Leaves small, lanceolate-oblong, to 2.5 x 0.6 cm, obtusely acute at apex, acute at base, chartaceous. Stipule ovate-lanceolate. Flowers in single racemes, terminal, sub terminal or lateral; racemes 3-8-flowered; pedicel 6 mm long, pubescent; flowers over 1 cm; calyx tube short, lobes linear; corolla equal or exceeding the calyx, yellow. Pods oblong, to 3 cm, with spreading silky hairs.

Fl. & Fr. : November – January.

Distribution : Endemic to the Western Ghats; rare. Streamside near shola margins. *Amitha Bachan 98928* (Pullala-Nelliyampathy, stream bank, stream draining to Karappara river, 1100 m).

Crotalaria retusa L., Sp. Pl. 715. 1753; Baker in Hook. f., Fl. Brit. India 2: 75. 1876; Gamble, Fl. Pres. Madras 293. 1918; Sanjappa, Legumes India 128. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 135. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 197. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 165. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 210. 2009. **Kilukilukki.**

Erects subshrubs up to 1 m tall; branches minutely pubescent. Leaves oblanceolate, to 2-9 x 1-3 cm, cuneate at base, obtuse or retuse

at apex, glabrous above, white puberulous beneath; stipules minute, subulate. Flowers in few to many-flowered terminal racemes; bracts 4-6 mm long, subulate. Calyx to 1 cm long, puberulous without; lobes 5, broadly ovate, acuminate. Corolla to 2 cm long, yellow with red striations. Staminal sheath 6-7 mm long; filaments 5-7 mm long. Ovary to 1 cm long; ovules many; style 1-1.5 cm long; stigma pubescent. Pods oblong, 3-4 x 1 cm, cylindrical, slightly narrowed at base. Seeds brown to black.

Fl. & Fr. : September – January.

Distribution : Throughout the tropics. Moist forests, usually along river channels. *Amitha Bachan 99044* (Vazhachal, riparian zones, banks of Chalakkudy river, 200 m).

DALBERGIA Linnaeus f.

Suppl. 52, 316. 1782, *nom. cons.*

Dalbergia latifolia Roxb., Coromandel Pl. 2: 7, t. 113. 1799; Baker in Hook. f., Fl. Brit. India 2: 231. 1876; Gamble, Fl. Pres. Madras 383. 1918; Sanjappa, Legumes India 137. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 137. 1996; Mohanan & Sivad., Fl. Agasthyamala 200. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 168. 2005. *Dalbergia emarginata* Roxb., Fl. India 3: 224. 1832; C. N. Sunil & Sivad., Fl. Alappuzha 214. 2009. **Cholaveetti.**

Large deciduous trees; bark brown, yellow inside. Leaves odd-pinnate; leaflets broadly obovate to orbicular, 5-9, to 4 x 3 cm, attenuate at base, obtuse to emarginate at apex, sub-coriaceous, glaucous below; petiolule to 1 cm long. Flowers in corymbose short panicles, axillary or from the axils of fallen leaves of previous years; pedicels 3-3.5 mm long. Calyx lobes 5, subequal, to 1.5 mm long. Corolla white or cream, 5-6 mm long; standard obovate; wings and keels oblong. Stamens 9,

monadelphous. Ovary 3-3.5 mm long; style curved, 4-5 mm long. Pods oblong, to 6 x 2 cm, acute at both ends.

Fl. & Fr. : August – September.

Distribution : Indo-Malaysia. Moist & dry deciduous forests. Dry rocky riparian areas. *Amitha Bachan 123359* (Athirappilly, dry riparian areas, 150 m).

DERRIS Laureiro

Fl. Cochinch. 432. 1790, *nom.cons.*

Key to species

1a. Branchlets lenticellate; leaves obtuse to acute ..... **D. scandens**

2a. Branchlets glabrous; leaves abruptly acuminate..... **D. brevipes**

Derris brevipes (Benth.) Baker in Hook. f., Fl. Brit. India 2: 244. 1878, *var.* **brevipes**; Gamble, Fl. Pres. Madras 388. 1918; Manilal, Fl. Silent Valley 75. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 138. 1996; Sanjappa, Legumes India 144. 1992; Anil Kumar *et al.*, Fl. Pathanamthitta 169. 2005. *Derris heyneana* Benth. var. *brevipes* Benth., J. Linn. Soc. 4 (Suppl.): 110. 1860. **Nanchuvalli**.

Twining woody climbers, branchlets slender, glabrous. Leaves 3-9-foliolate; leaflets elliptic-obovate, to 10 x 3.5 cm, abruptly acuminate at apex, retuse or acute at base, coriacious. Panicles to 10 cm long, axillary, rusty tomentose. Flowers 1.4 cm long; calyx cupular, 4 mm long, lobes obtuse; standard obovate, 11 x 7 mm, emarginate, white, clawed; wing to 8 mm, oblong; keel glabrate; stamens monadelphous; ovary densely hairy. Pods ovate, 5 x 2.5 cm, obtuse at both ends, ferruginous tomentose; seeds 2.

Fl. & Fr. : February – December.

Distribution : Endemic to the Western Ghats. Moist forests. *Amitha Bachan 123360* (Vazhachal, riparian forests, banks of Chalakkudy river, 200 m).

Derris scandens (Roxb.) Benth., J. Linn. Soc. Bot. 4 (Suppl.) 103. 1860; Baker in Hook. f., Fl. Brit. India 2: 240. 1878; Gamble, Fl. Pres. Madras 387. 1918; Sanjappa, Legumes India 148. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 138. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 169. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 215. 2009. *Dalbergia scandens* Roxb., Pl. Coromandel 2: 49, t. 192. 1805. *Brachypterum scandens* (Roxb.) Benth., Ann. Wiener Mus. Naturgesch. Vienna 2: 101. 1838. **Ponnamvalli.** **Plate 21. C**

Large woody climbing shrubs; branchlets brown, lenticellate. Leaflets 5-9, elliptic, lanceolate or elliptic-oblong, 10 x 2.5 cm, rounded to cuneate at base, obtuse to acute at apex, sometimes emarginate, coriaceous, shining above; lateral nerves 7-9 pairs, slender. Racemes axillary, 8-25 cm long, with flowers clustered on brown-pubescent rachis. Flowers 9 mm long; pedicels 4 mm long, slender. Calyx 3 mm long, shortly adpressed tomentose, lobes obscure. Petals pink or white. Stamens 10, alternate ones short. Pods narrow, oblong, 2.5-6.5 x 1-1.4 cm, narrowly winged on the upper suture, acute at both ends, minutely adpressed tomentose, 2-4-seeded.

Fl. & Fr. : June – December.

Distribution : Indo – Malaysia. Evergreen vegetation also in plains. *Amitha Bachan 72017* (Vazhachal, riparian evergreen forests, banks of Chalakkudy river, 200 m).

DESMODIUM Desvaux

J. Bot. Agric. 1: 122. 1813 *nom. cons.*

Key to species

1a. Pods distinctly divided into several 1-seeded joints.....2

1b. Pods not distinctly divided, joints not separating..... **D. motorium**

2a. Flowers in short dense peduncled axillary umbels..... **D. triangulare**

2b. Flowers in elongated racemes.....3

3a. Joints of pod indehiscent.....4

3b. Joints of pod dehiscent on ventral suture..... **D. triflorum**

4a. Joints of pod oblong, compressed..... **D. laxiflorum**

4b. Joints of pod not oblong.....5

5a. Petiole broadly winged.....**D. triquetrum**

5b. Petiole unwinged..... **D. gangeticum**

Desmodium gangeticum (L.) DC., Prodr. 2: 327.1825; Baker in Hook. f., Fl. Brit. India 2:168.1876; Gamble, Fl. Pres. Madras 345. 1918; Sanjappa, Legumes India 153. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 139. 1996; Mohanan & Sivad., Fl. Agasthyamala 205. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 174. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 218. 2009. *Hedysarum gangeticum* L., Sp. Pl. 746. 1753. *Hedysarum collinum* Roxb., Fl. India 3: 439. 1832. **Orila.**

Erect subshrubs to 1.2 m; stem angular, hairy when young. Leaves 1-foliolate, ovate, lanceolate, to 7 x 4 cm, acute at apex, rounded at base, glabrescent above, densely appressed hairy below; petiole to 2.5 cm long; stipules to 8 mm long; linear-lanceolate. Flowers white, fascicled in terminal and axillary, 20 cm long racemes; pedicels 4 mm

long; bracts subulate. Calyx lobes 2 mm long, triangular. Corolla 4 mm across. Stamens diadelphous. Ovary 3 mm long, compressed; stigma capitate. Pods moniliform, 4-7-jointed, to 2.4 x 0.1 cm, constricted in ventral suture, pubescent with hooked hairs, reticulate.

Fl. & Fr. : October – December.

Distribution : Paleotropics. Moist forests to plains. *Amitha Bachan 123465* (Vazhachal, riparian forests, banks of Chalakkudy river, 200 m).

Desmodium laxiflorum DC., Ann. Sci. Nat. (Paris) 4: 100. 1825 & Prodr. 2: 335. 1825; Baker in Hook. f., Fl. Brit. India 2: 164. 1876; Gamble, Fl. Pres. Madras 344. 1918; Manilal, Fl. Silent Valley 77. 1988; Sanjappa, Legumes India 156. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 140. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 175. 2005. *Desmodium recurvatum* (Roxb.) Graham ex Wight & Arn., Prodr. 226. 1834. *Hedysarum recurvatum* Roxb., Fl. India 3: 358. 1832.

Erect undershrub to 1.5 m tall with angular pubescent branchlets. Leaves 3 foliolate; leaflets broad ovate, to 10 x 6 cm, ovate-oblong, acute at apex, obtusely acute at base, membranous, pubescent. Flowers on axillary or terminal racemes, racemes slender, pubescent; calyx tube short; corolla standards white; keels blue. Stamens diadelphous 9+1. Pods oblong, compressed, 6-10-jointed, 4 times longer than broad, pubescent with sticky hooked hairs.

Fl. & Fr. : September – January.

Distribution : India to Taiwan , Malaysia. Moist forests. *Amitha bachan 99014* (Orukombankutty, riparian moist areas, banks of Kuriyarkutty River, 500 m).

Desmodium motorium (Houtt.) Merr., J. Arnold Arbor. 19: 345. 1938; Manilal, Fl. Silent Valley 78. 1988; Sanjappa, Legumes India 158. 1992;

Sasidh. & Sivar., Fl. Pl. Thrissur For. 140. 1996; Mohanan & Sivad., Fl. Agasthyamala 207. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 175. 2005. *Hedysarum motorium* Houtt., Nat. Hist. (ed. 2) 10: 246. 1779. *Desmodium gyrans* (L. f.) DC., Prodr. 2: 326. 1825; Baker in Hook. f., Fl. Brit. India 2: 174. 1876; Gamble, Fl. Pres. Madras 348. 1918. *Hedysarum gyrans* L. f., Suppl. Pl. 332. 1781. *Codariocalyx motorium* (Houtt.) Ohashi, J. Jap. Bot. 40: 367. 1965. **Thozukanni.**

Subshrub to 1.5 m tall. Leaves trifoliate; terminal leaflets elliptic-oblong, 7 x 2.5 cm, obtuse at either ends, glabrous above, tomentose below; nerves to 8 pairs, arching; lateral leaflets oblong, small, to 1.5 x 0.3 cm, folding. Raceme to 10-20 cm long, axillary and terminal; bracts ovate, acute. Flowers 1 cm across, shortly pedicelled, pink; standard to 1 cm, orbicular; wings curved; keel glabrous. Pods oblong, slightly curved, 5-10-jointed, to 4 cm long, joints not separating, pods dehiscing in a continuous line ventral suture, minutely pubescent.

Fl. & Fr. : October – January.

Distribution : Indo-Malaysia to Australia. Moist deciduous forests. *Amitha Bachan 123342* (Orukombankutty, riparian moist localities, banks of Kuriyarkutty river, 500 m).

Desmodium triangulare (Retz.) Merr., J. Arnold Arbor. 23: 170. 1942; Manilal, Fl. Silent Valley 78. 1988; Sanjappa, Legumes India 162. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 141. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 176. 2005. *Hedysarum triangulare* Retz., Obs. Bot. 3: 40. 1783. *Desmodium cephalotes* (Roxb.) Wall. ex Wight & Arn., Prodr. 224. 1834; Baker in Hook. f., Fl. Brit. India 2: 161. 1876; Gamble, Fl. Pres. Madras 344. 1918. *Desmodium triangulare* (Retz.) Merr. var. *congestum* (Prain) Sant., Kew Bull. 1948: 276. 1948; N. Mohanan & Sivad., Fl. Agasthyamala 208. 2002. **Plate 21. B**

Shrubs to 2 m high; branchlets triquetrous, adpressed hairy. Leaves 3-foliolate; leaflets subequal, elliptic, to 10 x 4 cm, acuminate at apex, acuminate at bas, hairy when young; nerves 8-10 pairs; petiole 3 mm long; stipules 1 cm long, ovate, acuminate. Flowers many-together, in axillary dense peduncled axillary, umbels; upper calyx lobes united and longer than the others; petals white; standard orbicular, to 0.8 cm across, glabrous; wings obovate, 0.6 cm long; keels smaller, glabrous. Pods curved, to 2.5 cm long, jointed, joints 4-6, adpressed, tomentose.

Fl. & Fr. : September- January.

Distribution: Indo-Malaysia and China. Moist forests to Plains. *Amitha Bachan 117795* (Orukombankutty, riparian forest, banks of Chalakkudy river, 450 m).

Desmodium triflorum (L.) DC., Prodr. 2: 334. 1825; Baker in Hook. f., Fl. Brit. India 2: 173. 1876; Gamble, Fl. Pres. Madras 347. 1918; Manilal, Fl. Silent Valley 79. 1988; Sanjappa, Legumes India 163. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 141. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 176. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 155. 2009. *Hedysarum triflorum* L., Sp. Pl. 249. 1753. *Desmodium triflorum* (L.) DC. *var. minus* Wight & Arn., Prodr. 229. 1834. **Cherupulladi.**

Prostrate trailing herbs, rooting at nodes. Leaves 3-foliolate; leaflets small obovate, to 3 x 3 mm, cuneate at base, turncate or emarginate at apex, lateral leaflets smaller than the terminal; petiole 1.5 cm long. Flowers 3-4 mm long, 1-4 together in the leaf axils; pedicels 4-6 mm long, capillary; bracts 2 mm long, ovate, ciliate. Calyx 3 mm long, covered with long silky hairs; lobes unequal, lanceolate. Petals pink to violet. Pods 3-5-jointed, to 1.5 cm long, deeply indented along the lower suture, upper entire; joints hairy or glabrous, reticulate-veined, longer than broad.

Fl. & Fr. : July – December.

Distribution : Indo–Malaysia and Australia. Moist forests, grasslands and plains. *Amitha Bachan 123601* (Vazhachal, river beds and riparian zones, banks of Chalakkudy river, 200m).

Desmodium triquetrum (L.) DC., Prodr. 2: 326. 1825; Baker in Hook. f., Fl. Brit. India 2: 163. 1876; Gamble, Fl. Pres. Madras 345. 1918; Manilal, Fl. Silent Valley 79. 1988; Sanjappa, Legumes India 163. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 141. 1996; Mohanan & Sivad., Fl. Agasthyamala 208. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 177. 2005. *Hedysarum triquetrum* L., Sp. Pl. 746. 1753. *Tadehagi triquetrum* (L.) Ohashi, Ginkgoana 1: 290. 1973. **Adakkappanal.**

Erect under shrubs to 1 m tall; branches trigonous, ciliate with stiff hairs on angles. Leaves 1-foliolate, ovate-lanceolate or oblong, 10 x 3 cm, cordate to subcordate at base, acuminate at apex, glabrous above and tomentose below; petiole to 2 cm long, broadly winged. Flowers on terminal racemes; racemes 10-28 cm long; bracts subulate, to 6 x 4 mm; pedicels to 0.5 cm long. Calyx campanulate, 4 mm long; lobes lanceolate, acuminate. Corolla pink, 6-7 mm long. Stamens monadelphous. Ovary 4 mm long, pubescent without; style curved; stigma capitate. Pods laterally compressed, 5-8-jointed, to 3 cm long, ventral suture slightly indented, loosely appressed hairy.

Fl. & Fr. : July – December.

Distribution : Indo-Malaysia to Pacific Islands and China. Evergreen to moist forests up to plains. *Amitha Bachan 123341* (Orukombankutty, riparian evergreen, banks of Chalakkudy river, 450 m).

ERYTHRINA Linnaeus

Sp. Pl. 706. 1753.

Erythrina variegata L. **var. orientalis** (L.) Merr., Interpr. Herb. Amboin. 276. 1917; Sanjappa, Legumes India 173. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 143. 1996; C. N. Sunil & Sivad., Fl. Alappuzha 224. 2009. *Erythrina indica* Lam., Encycl. 2: 391. 1786; Baker in Hook. f., Fl. Brit. India 2: 188. 1876; Gamble, Fl. Pres. Madras 353. 1918. **Murikku.**

Deciduous tree; armed with black prickles. Leaves trifoliate, alternate; stipules small, leaflet widely ovate, rhomboid, 10 x 8 cm, truncate or obtuse at base, acuminate at apex, entire, glabrous, membranous; 3 ribbed from base. Flowers bisexual, bright red, in dense racemes; calyx spathaceous, oblique, recurved, split to the base on one side, 5-toothed at the tip; petals 5, sessile, standard oblong-elliptic, to 5 x 2 cm, obtuse, wings 1.5 x 1 cm, obovate, keel oblong-falcate, broader free; stamens 10, monadelphous, alternately longer and shorter; ovary 1-celled, pubescent; ovules many; style curved, subulate, not bearded; stigma capitate. Pod oblong, constricted between seeds, to 24 cm long, dehiscent; seeds 6-8.

Fl. & Fr. : March – April.

Distribution : Indo-Malaysia. Moist and dry forests, open areas in moist forests. Riparian rocky riversides. *Amitha Bachan 123400* (Sholayar, downstream to Sholayar dam, rocky riverside, 700 m).

FLEMINGIA Roxburgh ex W. Aiton et E. T. Aiton

Hortus Kew. ed. 2, 4: 349. 1812, *nom. cons.*

Flemingia strobilifera (L.) R. Br. ex Ait.f., Hort. Kew (ed. 2) 4: 350. 1812; Baker in Hook. f., Fl. Brit. India 2: 227. 1876; Gamble, Fl. Pres. Madras 377. 1918; Manilal, Fl. Silent Valley 83. 1988; Sanjappa, Legumes India

178. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 143. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 181. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 225. 2009. *Hedysarum strobiliferum* L., Sp. Pl. 746. 1753. *Hedysarum bracteatum* Roxb., Fl. India 3: 351. 1832. *Flemingia bracteata* (Roxb.) Wight, Ic. t. 268. 1840; Gamble, Fl. Pres. Madras 378. 1918; Anil Kumar *et al.*, Fl. Pathanamthitta 179. 2005. *Flemingia strobilifera* (L.) R. Br. ex Ait.f. var. *bracteata* (Roxb.) Baker in Hook.f., Fl. Brit. India 2:227.1876.

Erect branching subshrubs to 2 m tall; branchlets terete. Leaves 1-foliolate, floral leaves large, ovate-lanceolate, 13 x 6 cm, acuminate, glabrate; nerves more than 8 pairs, close, lowest pair rib-like; petiole 1 cm long. Racemes axillary and terminal, simple or branched, flexuous, tomentose to 20 cm long, axis zig-zag; bracts ovate-cordate, to 2 x 2.5 cm, folded, membranous, each enclosing short few-flowered cymes. Flowers 1 cm long; pedicels 2 mm long. Calyx-tube 2 mm long; lobes 6 mm long, lanceolate. Petals white; standard oblong-obovate, 7 mm long; wings oblanceolate; keels obliquely oblong. Pods enclosed by the bracts 8 x 4 cm, oblong, pubescent.

Fl. & Fr. : February – March.

Distribution : Indo-Malaysia. Dry and moist forests. *Amitha Bachan 123448* (Orukombankutty, dry riparian areas, banks of Kuriyarkutty river, 400 m).

GLIRICIDIA Humboldt, Bonpland *et* Kunth

Nova. Gen. Sp. ed. 6: fol. 309. 1824.

Gliricidia sepium (Jacq.) Kunth ex Walp., Rep. 1: 679. 1842; Sanjappa, Legumes India 181. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 158. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 194. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 227. 2009. *Robinia sepium* Jacq., Enum. Syst. Pl.

28. 1760. *Gliricidia macualata* (Steud.) Kunth, Nov. Gen. Sp. 6: 393. 1824. **Seemakonna.**

Small deciduous trees to 6 m high. Leaves odd-pinnate, alternate, spiral; rachis pulvinate, 8-30 cm, slender, pubescent; leaflets 7-21, opposite, estipellate; ovate, elliptic-ovate, to 6 x 4 cm, obtuse or oblique at base, acuminate or obtuse at apex, entire, glabrous above, glaucous and puberulent beneath, membranous. Flowers rose-pink, to 20 cm long racemes; pedicels to 2 cm; calyx campanulate, to 5 mm long; petals exserted; standard orbicular, 2 x 1.5 cm; wings oblong, to 2 x 0.5 cm, auricled; keels obovate, 2.2 x 0.8 cm, incurved; stamens 9+1; anthers uniform; ovary sessile, 1.5 cm long half inferior; style incurved; stigma capitate. Pod, to 15 cm long.

Fl. & Fr. : December – May.

Distribution : Native of South America, introduced and now widely grown in India. Lower plains. *Amitha Bachan 123499* (Muzhikkakadavu, riparian, banks of Chalakkudy river, 3 m).

PONGAMIA Adanson

Fam. Pl. 2: 322, 593. 1763, *nom. cons.*

Pongamia pinnata (L.) Pierre, Fl. Forest. Cochinch. sub. t. 385. 1899; Sanjappa, Legumes India 230. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 148. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 215. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 187. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 234. 2009. *Cytisus pinnatus* L., Sp. Pl. 741. 1753. *Pongamia glabra* Vent., Jard. Malm. 28. t.28.1803; Baker in Hook. f., Fl. Brit. India 2:240.1876; Gamble, Fl. Pres. Madras 385. 1918. *Derris indica* (Lam.) Bennet, J. Bomb. Nat. Hist. Soc. 68. 303. 1971. *Galedupa indica* Lam., Encycl. 2:594.1788. **Vungu**.

Small to medium sized evergreen trees, branched from base. Leaves alternate, imparipinnate; stipules lateral, small, cauducous; rachis 12 cm long, slender, pulvinate, pubescent; leaflets 5-7, opposite, estipellate, pubescent; leaflet elliptic-ovate or ovate-oblong, 9 x 5 cm, acuminate at apex, entire, glabrous, chartaceous; lateral nerves 5-8 pairs; petiolule to 1 cm; Flowers in axillary to terminal racemose panicles; pedicels 3-5 mm long. Calyx campanulate, 3 mm long, turncate to slightly 5-toothed, rufous hairy without. Corolla pinkish-white, exserted; standard to 1 cm long, orbicular; wings obliquely oblong, adherent to keel; keels obtuse. Stamens 10, monadelphous, anthers uniform; ovary subsessile, inferior, 1-celled, ovules 2; style in curved, beardless; stigma capitate. Pod obliquely broad-oblong, 5 x 2.5 cm, flat, thick, pointed at both ends, indehiscent, slightly falcate; seed one, reniform.

Fl. & Fr. : April – December.

Distribution : Indo- Malaysia. Dry and Moist forests. Usually river and stream banks. *Amitha Bachan 123361* (Vazhachal, riparian forests, banks of Chalakkudy river, 200 m).

PSEUDARTHRIA R. Wight *et* Arnott
Prodr. 209. 1834.

Pseudarthria viscida (L.) Wight & Arn., Prodr. 209. 1834; Baker in Hook. f., Fl. Brit. India 2: 154. 1876; Gamble, Fl. Pres. Madras 334. 1918; Sanjappa, Legumes India 230. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 149. 1996; Mohanan & Sivad., Fl. Agasthyamala 216. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 187. 2005. *Hedysarum viscidum* L., Sp. Pl. 747. 1753.

Pubescent viscid subshrubs. Leaves 3-foliolate; terminal leaflet ovate-rhomboid, to 8 x 4 cm; laterals obliquely ovate, 3 x 2 cm, cuneate

or obtuse at base, acute at apex, glabrescent above and densely woolly below; petioles 4-6 cm long; stipules 5-6 mm long, subulate. Flowers small, in axillary or terminal, often branched slender racemes; Calyx-tube campanulate, cleft to the middle in 2 lips, 1-1.5 mm long; subulate, hairy. Corolla purplish, ovate-obtuse, standard 4-5 mm long. Stamens 9+1; staminal sheath 4 mm long. Ovary 4 mm long, terete, densely pubescent without; style subulate, incurved; stigma capitate. Pods linear-oblong, compressed, to 2 x 0.5 cm, pubescent with hooked hairs.

Fl. & Fr. : November – March.

Distribution : Endemic to Peninsular India and Sri Lanka. Moist forests and plains. *Amitha Bachan 99035* (Orukombankutty, riparian forests, banks of Kuriyarkutty river, 450 m).

PTEROCARPUS N. J. Jacquin

Sel. Strip. Amer. Hist. 283. 1763, *nom. cons.*

Pterocarpus marsupium Roxb., Pl. Coromandel t. 116. 1799; Baker in Hook. f., Fl. Brit. India 2: 239. 1876; Gamble, Fl. Pres. Madras 385. 1918; Sanjappa, Legumes India 232. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 149. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 217. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 188. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 235. 2009. **Venga**.

Large trees; bark rough, black, reddish inside, red exudate. Leaves pinnate, leaflets 3-13, alternate, ovate-oblong, to 10 x 7 cm, obtuse to retuse at apex, obtusely acute at base, nerves many, close. Flowers on terminal panicles to 20 cm across, rusty tomentose; bracts ovate. Flowers many, 1.5 cm long; calyx campanulate, 0.5 cm long, shortly lobed, brown; petals yellow; standard obovate, crisped along the margins; wings obovate, auricled; keel similar to wings; stamens 5 + 5; ovary

stalked, ovules 2, style incurved. Pods 5 cm across, compressed, orbicular, stalked, winged.

Fl. & Fr.: September – October.

Distribution: Endemic to India and Sri Lanka. Moist and dry forests, also in the lower plains. *Amitha Bachan 117623* (Athirappilly, riparian, banks of Chalakkudy river, 120 m).

URARIA Desvaux

J. Bot. Agric. 1 : 122. 1813.

Uraria rufescens (DC.) SchIndia, Feddes Repert. 21: 14. 1925; Manilal, Fl. Silent Valley 88. 1988; Sanjappa, Legumes India 268. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 156. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 223. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 192. 2005. *Desmodium rufescens* DC., Ann. Sci. Nat. (Paris) 4: 101. 1825. *Doodia hamosa* Roxb., Fl. India 3: 367. 1832. *Uraria hamosa* (Roxb.) Wall. ex Wight & Arn., Prodr. 222.1834; Baker in Hook. f., Fl. Brit. India 2: 150. 1876; Gamble, Fl. Pres. Madras 336. 1918. **Moovila.**

Undershrubs with straggling branches. Leaves 3-foliolate; stipules scarious; leaflets unequal; terminal elliptic–obovate, 6 x 3, obtuse at both ends; laterals small, ovate-oblong, 3 x 1.5, obtuse at both ends. Inflorescence terminal panicles or sometimes axillary, slender up to 30 cm long. Flowers small to 6 mm; calyx 2-lipped; corolla pinkish; stamens diadelphous (9+1). Pods folded like a spiral, sticky pubescent, 4-6, brown or black, hispid.

Fl. & Fr. : November – January.

Distribution : Indo–Malaysia. Moist forests. *Amitha Bachan 99007* (Orukombankutty, riparian, banks of Kuriyarkutty river, 450 m).

44. CAESALPINIACEAE R. Br.

Key to genera

1a. Leaves all bipinnate.....2

1b. Leaves simple or simple pinnate.....3

2a. Shrubs, climbers or liana; stem armed..... **Caesalpinia**

2b. Trees; unarmed..... **Peltophorum**

3a. Leaves simple, bilobed..... **Bauhinia**

3b. Leaves pinnate.....4

4a. Calyx lobes free to the base.....5

4b. Calyx lobes free to the disk.....6

5a. Leaf lets odd pinnate.....8

5b. Leaflets even pinnate.....**Senna**

6a. Ovary 1-2 ovuled.....**Kingiodendron**

6b. Ovary 3-many ovuled.....7

7a. Stamens 5, free.....**Humboldtia**

7b. Stamens 3, monadelphous.....**Tamarindus**

8a. Leaflets 5-7..... ..... **Cassia**

8b. Leaflets more than 25.....**Chamaecrista**

BAUHINIA Linnaeus

Sp. Pl. 374. 1753

Bauhinia malabarica Roxb., Fl. India 2: 321. 1832; Baker in Hook. f., Fl. Brit. India 2: 227. 1878; Gamble, Fl. Pres. Madras 407. 1919; Sanjappa, Legumes India 3. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 159. 1996;

N. Mohanan & Sivad., Fl. Agasthyamala 227. 2002. *Piliostigma malabaricum* (Roxb.) Benth. in Miq., Pl. Jungh. 261. 1852. **Arambuli.**

Small Trees. Leaves orbicular, bilobed, to 12 cm long, lobes obtuse at apex, cordate at base, 9-ribbed; petiole 4 cm long. Flowers in axillary corymbs, to 2 cm long, few; calyx oblong, connate, rusty pubescent, with 5 short lobes; petals 5, oblong, greenish yellow, glabrous, shortly stalked; stamens 10, inner 5, smaller, anthers oblong; ovary oblong, many-ovuled. Pods oblong 25 x 2 cm, compressed, longitudinally striate; seeds many, oblong.

Fl. & Fr. : September-February.

Distribution: Indo-Malaysia. Low elevation forests. *Amitha Bachan 98994, 99127* (Vazhachal, riparian forest, banks of Chalakkudy river, 220 m).

CAESALPINIA Linnaeus

Sp. Pl. 380. 1753.

Key to species

1a. Leaflets 3 paired..... **C. cucullata**

1b. Leaflets 4 or more paired.....2

2a. Leaflets 4-5 paired..... **C. bonduc**

2b. Leaflets 10-45 paired..... **C. mimosoides**

Caesalpinia bonduc (L.) Roxb., Fl. India 2: 362. 1832; Sanjappa, Legumes India 9. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 161. 1996. *Guilandina bonduc* L., Sp. Pl. 381. 1753. *Caesalpinia bonducella* (L.) Flem., Asiat. Res. 11: 159. 1810; Baker in Hook. f., Fl. Brit. India 2: 254. 1878. *Caesalpinia crista* sensu Gamble, Fl. Pres. Madras 393. 1919, non L. 1753. **Kazhanji.**

Scandent climbing shrubs; stems armed with recurved prickles. Leaves bipinnate, to 50 cm long; pinnae 4-5 pairs; leaflets 5-8 pairs per pinna, elliptic-oblong, to 4 x 2 cm, rounded at base, obtuse at apex; petiole to 15 cm long; stipules foliaceous, to 1.5 cm long, lobed or pinnate. Racemes terminal or supra-axillary, many-flowered, to 15 cm long. Flowers.1.5 cm across; pedicels 2-5 mm long; bracts caducous. Calyx lobes 5, free, to 8 mm long. Petals oblanceolate, as long as the sepals, yellow, reflexed; upper one smaller. Stamens 10; filaments villous. Ovules 2. Pods elliptic, to 8.5 x 4.5 cm, turgid, beaked, covered with straight, puberulent spines.

Fl. & Fr. : March-April

Distribution : Paleotropics. Open and degraded stream sides in the forests. *Amitha Bachan 98995* (Vazhachal, open degraded riparian areas, along Chalakkudy river, 200 m).

Caesalpinia cucullata Roxb., Fl. India 2: 358. 1832; Manilal, Fl. Silent Valley 90. 1988; Sanjappa, Legumes India 10. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 161. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 195. 2005. *Mezoneurum cucullatum* (Roxb.) Wight & Arn., Prodr. 283. 1834; Baker in Hook. f., Fl. Brit. India 2: 258. 1878; Gamble, Fl. Pres. Madras 395. 1919. **Virimullu.**

Armed straggling lianas with black hard recurved prickles. leaves 2-5 pinnate, to 40 cm long; leaflet usually 3-pairs, elliptic ovate, to 8 cm long, acute or acuminate at apex, obtuse at base, glabrous. Flowers on large panicles; flowers 1.5 cm across; calyx 5 lobed, lobes obovate, lower one culcullate. Petals yellow, claws short. Stamens 10, excerted. Ovules 2; style filiform; stigma capitate. Pods oblong, to 10 x 3 cm broadly winged along upper suture.

Fl. & Fr. : December – March.

Distribution : Indo-Malaysia. Open stream sides in the moist forests. *Amitha Bachan 117691* (Orukombankutty, open riparian areas, banks of Chalakkudy river, 450 m).

Caesalpinia mimosoides Lam., Encycl. 1: 452.1785; Baker in Hook. f., Fl. Brit. India 2: 256.1878; Gamble, Fl. Pres. Madras 394. 1919; Manilal, Fl. Silent Valley 90. 1988; Sanjappa, Legumes India 12. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 161. 1996; Anil Kumar et al., Fl. Pathanamthitta 195. 2005. **Theemullu.**

Straggling shrubs, branches with reddish glandular hairs and hard dense prickles, pungent smelling when cut. Leaves to 40 cm; pinnules 10-14 pairs; leaflets to 10 mm long, oblong, obtuse. Raceme to 40 cm long, axillary or terminal, densely prickly, pedicels solitary. Flowers 3 cm across; sepals oblong, to 0.8 cm, obtuse; petals yellow, orbicular, to 1.5 cm long, wavy along the margins. Pods compressed, 5 x 2.5 cm, brown, 1 or 2 seeded.

Fl. & Fr. : January – March.

Distribution : Indo-Malysia. Along open stream banks. *Amitha Bachan 117703* (Vazhachal, open –degraded riparian areas, banks of Chalakkudy river, 200 m).

CASSIA Linnaeus

Sp. Pl. 376. 1753.

Cassia fistula L., Sp. Pl. 377. 1753; Baker in Hook. f., Fl. Brit. India 2: 201. 1878; Gamble, Fl. Pres. Madras 400. 1919; Manilal, Fl. Silent Valley 91. 1988; Sanjappa, Legumes India 15. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 163. 1996; Mohanan & Sivad., Fl. Agasthyamala 229. 2002; Anil Kumar et al., Fl. Pathanamthitta 197. 2005. *Cassia rhombifolia* Roxb., Fl. India 3: 334. 1832. **Kanikonna.**

Small deciduous trees with attractive yellow flowers. Leaves to 35 cm long; leaflets 4-7 pairs, opposite to subopposite, ovate-lanceolate, to 10 x 3 cm, rounded to attenuate at base, acute to slightly acuminate at apex; stipules small, caducous. Flowers bright yellow to 4 cm across, in many flowered drooping, 15-35 cm long racemes; pedicels to 4 cm long. Calyx lobes 5, broadly ovate to 1 0.6 cm. Petals 5, ovate-elliptic to 2 x 1 cm. Stamens 10, all fertile, unequal. Ovary sickle shaped, to 1.5 cm long; ovules numerous; stigma punctiform. Pods oblong-terete, cylindric, to 50 x 1.5 cm, woody, drooping, copper black, indehiscent, septate within. Seeds many, discoid, embedded in blackish pulp.

Fl. & Fr. : February – April.

Distribution: Indo – Malaysia. Wild in moist forests, degraded forests and stream sides. also planted in gardens. *Amitha Bachan 123333* (Sholayar, degraded forest areas, banks of Anakkayam stream, 650 m).

CHAMAECRISTA Moench

Methodus (Moench) 272. 1794.

Chamaecrista mimosoides (L.) Greene, Pittonia 4:27.1899. *Cassia mimosoides* L., Sp. Pl. 379. 1753; Baker in Hook. f., Fl. Brit. India 2: 266. 1878; Gamble, Fl. Pres. Madras 403. 1919; Manilal, Fl. Silent Valley 92. 1988; Sanjappa, Legumes India 17. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 163. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 231. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 198. 2005. **Cheruthakara.**

Erect diffuse undershrubs to 60 cm high. Leaves to 8 cm long, leaflets to 40- 60 pairs, oblong, inequilateral, to 0.4 cm long, hirsute; stipule lanceolate, to 1 cm long, subulate at apex. Flowers axillary, solitary or paired, 1 cm across; sepals lanceolate, acuminate, hairy;

petals obovate, yellow; all stamens with fertile, filaments equal. Pods oblong, 6 x 0.6 cm, sparsely hairy; seeds many.

Fl. & Fr. : September – December

Distribution. Old world-tropics. Open areas and streamsides in the forest. *Amitha Bachan 98799* (Elanthikkara, riparian, banks of Chalakkudy river, sea level); *Amitha Bachan 123436* (Vazhachal-Karanthodu, openings of riparian forests, banks of Chalakkudy river, 320 m).

HUMBOLDTIA Vahl

Symb. Bot. 3: 106. 1794, *nom. cons.*

Humboldtia vahliana Wight, Icon. Pl. India Orient. tt. 1607,1608. 1850; Baker in Hook. f., Fl. Brit. India 2: 274. 1878; Gamble, Fl. Pres. Madras 411. 1919; Sanjappa, Blumea 31: 338. 1986 & Legumes India 30. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 165. 1996; Ravikumar & Ved, Illustr. Field Guide 100 Red Listed Med. Pl. 192. 2000. Mohanan & Sivad., Fl. Agasthyamala 234. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 200. 2005. **Attuvanchi.** **Plate 21. D-F**

Medium sized trees to 20 m high; bark dark brown. Leaves even pinnate, alternate; Leaflets 3 pairs, oblong-lanceolate, to 22 x 6 cm, acuminate at apex, obtuse at base; nerves 8-14 pairs, reticulate; stipules broad, foliacious, to 3 x 2 cm, appendaged, deciduous; rachis flat, winged or wingless. Racemes erect, axillary, to 18 cm long; bracts ovate, obtuse, densely tomentose; bracteoles 2, similar. Flowers pedicelled; sepals oblong, 7 x 3 mm, obtuse; petals obovate, 10 x 5 mm, clawed; stamens 5, filaments glabrous, redish; ovary densely hairy. Pods oblong, compressed, 13-20 x 3-5 cm, acute at base and apex, rusty tomentose. Seeds discoid.

Fl & Fr. : February – April.

Distribution : Endemic to Southern Western Ghats endemic, rare. Strictly riparian tree of the low elevation evergreen forests. with restricted distribution *Amitha Bachan 98996, 72007* (Vazhachal, riparian forests , banks of Chalakkudy river, 200 m).

Note: This is an obligate riparian evergreen tree species with spreading rounded canopy. Seeds germinate on rocky-river beds in torrent water currents, or in the river margins, later spongy coral-like semi-aquatic roots cover the entire rocky surface. It is distributed only in the 50-400m elevation along major river course.

KINGIODENDRON H. A. T. Harms

in Engl. & Prantl, Pflanzenf. Nachtr. 1: 194. 1897.

Kingiodendron pinnatum (Roxb. ex DC.) Harms in Engl. & Prantl, Naturl. Pflanzenfam. 1(1): 194. 1897; Gamble, Fl. Pres. Madras 412. 1919; Sanjappa, Legumes India 32. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 165. 1996; Ravikumar & Ved, Illustr. Field Guide 100 Red Listed Med. Pl. 215. 2000. *Hardwickia pinnata* Roxb. ex DC., Prodr. 2: 487. 1825; Baker in Hook. f., Fl. Brit. India 2: 270. 1878. **Kulavu.**

Large evergreen trees to 30 m high, bark rough, brown; exudation oily and sticky resinous. Leaves imparipinnate; leaflets 5-9, alternate, estipellate, ovate-lanceolate, to 9 x 4 cm, falcate or oblique, apex acuminate, margin entire, glabrous, coriaceous; lateral nerves 8-12, pinnate. rachis slender, to 14 cm long, pulvinate, glabrous; petiolule to 1cm, stout, grooved above, glabrous. Flowers bisexual, small, white, 0.3 cm across, in axillary and terminal panicled racemes; calyx tube almost wanting, lobes 5, broadly ovate, imbricate; petals absent; disc very small; stamens 10, equal, filaments filiform, villous at base; anthers versatile;

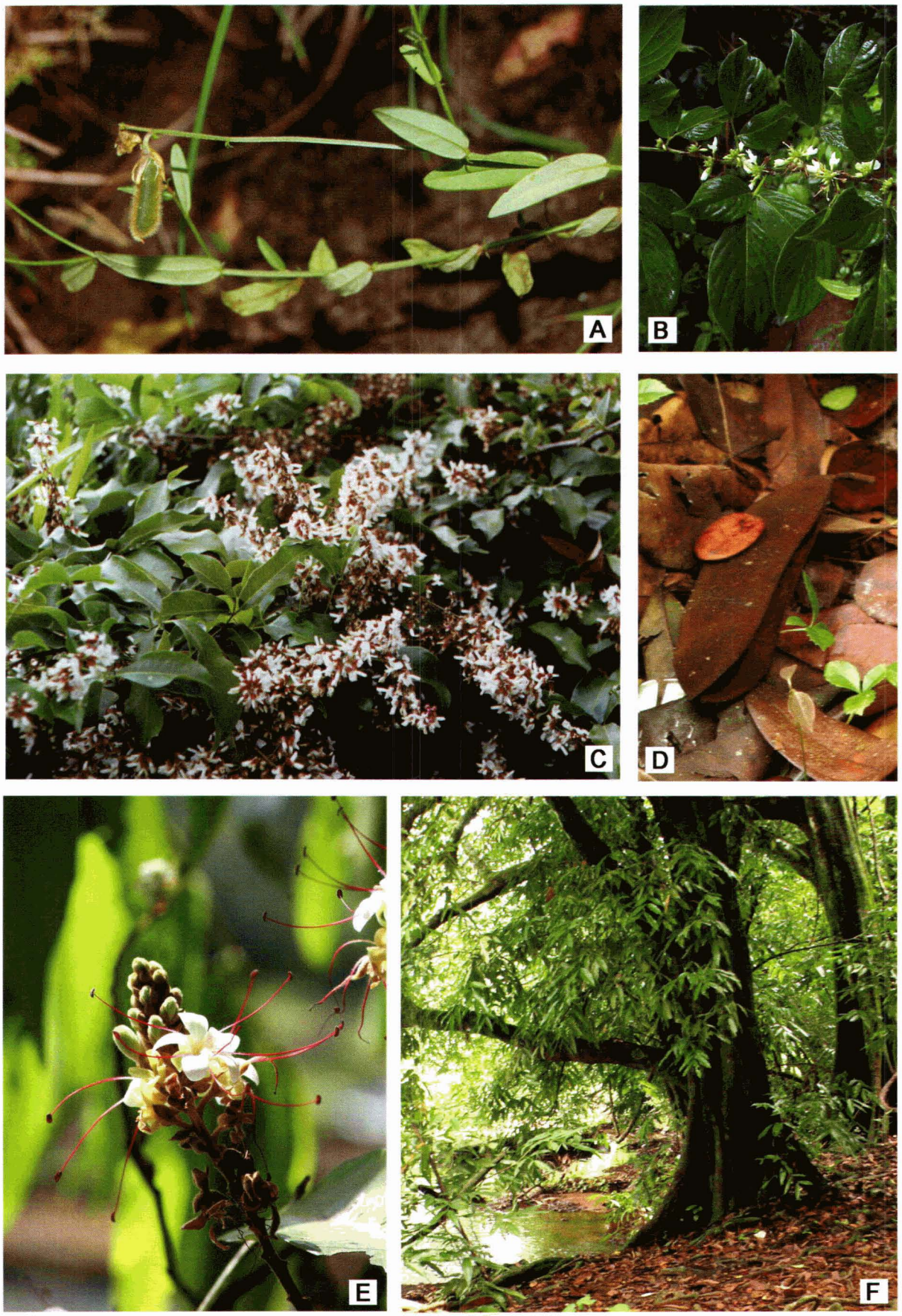


Plate 21. A. *Crotalaria clarkei* Gamble; B. *Desmodium triangulare* (Retz.) Merr.; C. *Derris scandens* (Roxb.) Benth.; D-F. *Humboldtia vahliana* Wight, D. Fruit & Seed, E. Inflorescence; F. Habit.

ovary half inferior, sessile, villous at base; ovules 2; style subulate; stigma minute, oblique. Pod, ovate-ellipsoid, to 5 x 2 cm, turgid, beaked, prominently veined, dark brown, indehiscent; seed one, pendulous.

Fl & Fr. : September-December.

Distribution: Endemic to Southern Western Ghats. Evergreen and riparian forests in the lower to medium elevations. *Amitha Bachan 117704* (Vazhachal, riparian evergreen forest, banks of Chalakkudy river, 200 m).

Note: This is a climax species of the low elevation evergreen and riparian forest. It's a keystone species for large hole-nesting birds like hornbills. It is facing threat due to illegal extraction of resinous extract as 'Kulavu-Oil' and also due to forest fire.

PELTOPHORUM (Vogel) Bentham

J. Bot. (Hooker) 2: 75. 1840. *nom.cons.*

Peltophorum pterocarpum (DC.) Backer ex Heyne, Nutt. Pl. Ned. India (ed.2) 2:755.1927; Sanjappa, Legumes India 33. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 166. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 201. 2005. *Inga pterocarpa* DC., Prodr. 2: 441. 1825. *Peltophorum ferrugineum* Benth., Fl. Austr. 2: 279. 1864; Baker in Hook. f., Fl. Brit. India 2: 257. 1878. *Poinciana roxburghii* G. Don, Gen. Hist. 2: 433. 1832. *Peltophorum roxburghii* (Don) Degener, Fl. Haw. Fam. 169b.1938. **Manjvaka.**

Medium sized trees to 20 m high, young shoots rusty tomentose. Leaves bipinnate; pinnae 4-14 pairs alternate, stipulate; leaflets 8-17 pairs, oblong, 1-2 x 0.3-1 cm, acute or rounded at base, obtuse at apex; rachis stout, to 30 cm long, pulvinate. Inflorescence terminal, paniculate. Flowers bright yellow fragrant, showy; pedicels to 1 cm long;

bracts deltoid. Sepals to 10 mm long. Petals bright yellow, long, obovate, to 2.5 cm hairy at base. Stigma peltate. Pods oblong-elliptic, 4-8 x 2-2.5 cm, copper-red. Seeds lenticular, to 4 x 0.5 cm, compressed, light brown.

Fl. & Fr. : December-March.

Distribution: Native of Sri Lanka, Andamans, Malaya Peninsula and North Australia, Introduced as avenue tree. Streamsides in the lower elevations. *Amitha Bachan 123435* (Chalakkudy, river margins, banks of Chalakkudy river, 10 m).

SENNA Mill.

Gard. Dict. Abr., ed. 4.1280. 1754.

Key to Species

1a. Leaflets to 6-12 pairs..... **S. alata**

1b. Leaflets to 2-4 pairs..... **S. tora**

Senna alata (L.) Roxb., Fl. India 2: 349. 1832. *Cassia alata* L., Sp. Pl. 378. 1753; Baker in Hook. f., Fl. Brit. India 2: 264. 1878; Gamble, Fl. Pres. Madras 404. 1919; Sanjappa, Legumes India 14. 1992; Anil Kumar *et al.*, Fl. Pathanamthitta 197. 2005. **Malamthakara**.

Erect shrubs to 4 m tall. Leaves even pinnate, to 50 cm long; leaflets 6-12 pairs, oblong to obovate-oblong, 5-12 x 2-5 cm, rounded to subcordate at base, rounded at apex; stipules 1-2 cm long, deltoid, auriculate at base, acute to acuminate at apex. Inflorescence terminal sometimes axillary, many-flowered spicate raceme, showy to 60 cm long. Flowers yellow; pedicels 4-8 mm long; bracts petaloid, yellow, ovate-elliptic, 1-2 cm long, subacute. Sepals 1.5 cm long, yellow. Petals yellow, obovate, 2 cm long. Stamens 10, anthers 2 large, 5 medium-

sized, and 3 small. Pods linear, 4-winged, to 14 x 2 cm, septate, dehiscent. Seeds many, compressed, dark brown.

Fl. & Fr. : September - January.

Distribution: Pantropical. Open areas, wetlands, sandbanks. *Amitha Bachan 98800* (Nelliyampathy, riparian, banks of Karappara river, 1000 m).

Senna tora (L.) Roxb., Fl. India 2:340.1832. *Cassia tora* L., Sp. Pl. 376. 1753; Baker in Hook. f., Fl. Brit. India 2: 263. 1878; Gamble, Fl. Pres. Madras 401. 1919; Sanjappa, Legumes India 22. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 164. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 199. 2005. **Thakara.**

Glabrous shrubs up to 1 m tall. Leaves even pinnate, to 14 cm long; rachis glandular between leaflets of the lower 2 pairs; leaflets 2-4 pairs, obovate, to 5 x 3 cm, obtuse; stipules linear 1.5 x 0.2 cm. Flowers 3 cm across, in axillary fascicles, pedicellate Sepals 5, 0.5 cm long, obovate-obtuse. Petals 5, obovate-obtuse, to 1.2 cm long, yellow. Stamens 10, unequal, only 7 fertile, 3 staminodal. Ovary subsessile, pubescent; ovules numerous. Pods to terete, 16 cm long, glabrous.

Fl. & Fr. : August – December.

Distribution : Native of South America. Introduced, common along roadsides and streamsides in open forest areas. *Amitha Bachan 99016* (Kuriyarkutty, riparian, banks of Kuriyarkutty river, 400 m).

TAMARINDUS Linnaues

Sp. Pl. 34. 1753.

Tamarindus indica L., Sp. Pl. 34. 1753; Baker in Hook. f., Fl. Brit. India 2: 273. 1878; Gamble, Fl. Pres. Madras 409. 1919; Sanjappa, Legumes

India 36. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 166. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 201. 2005. **Kolpuli.**

Medium sized trees, to 20 m high, bark brown with vertical fissures. Leaves paripinnate, alternate; leaflets leaflets 20-30, opposite, sessile, estipellate, oblong, to 1.5 x 0.8 cm, obtuse at base, unequal, obtuse at apex, entire, glabrous; lateral nerves pinnate, 10-15 pairs, slender, obscure; Flowers bisexual, 1 cm across, yellow with reddish-pink dots, in lax terminal racemes; calyx lobes 4, subequal; petals 3, outer one, to 1 x 0.3 cm, pink dotted, lateral 2, smaller, clawed; lower pair scaly; stamens 9 monadelphous, only 3 fertile; anthers versatile; ovary adnate to the disc, ovules many. Pod oblong, to 15 x 2 cm, mesocarp pulpy, endocarp septate, leathery, indehiscent; seeds 3-8 or more, compressed, brown.

Fl. & Fr. : September – April.

Distribution : Native of Tropical West Africa; widely cultivated and naturalised in many countries. Cultivated for its fruits which is used in culinary purposes. Common in plains and rare river banks at lower elevations. *Amiha Bachan 98997* (Elanthikkara, agricultural lands, along banks of Chalakkudy river, sea level).

45. **MIMOSACEAE** Abarema Pittier

Bol. Minist. R.R.E.E. 10-12: 340. 1927 alt. title: Arb. Arbust. Venez. 1: 56. Dec 1927.

Key to genera

1a. Spreading stragglers or woody climbers, armed or unarmed.....3

1b. Trees, unarmed.....2

2a. Pods twisted.....**Archidendron**

2b. Pods straight.....3

3a. Pods woody, to 6 cm wide ..... **Xylia**

3b. Pods not woody, under 3 cm wide..... **Albizia**

4a. Woody climbers armed or unarmed.....5

4b. Spreading prickled herbs or ramblers, pods indented..... **Mimosa**

5a. Prickled climbers; pods under 15 cm long..... **Acacia**

5b. Unarmed lianas; pods to 30-70 cm long..... **Entada**

ACACIA P. Miller

Gard. Dict. Abr. ed. 4. 28. 1754.

Key to species

1a. Flattened glands at the base of the petiole..... **A. caesia**

1b. Glands not present at the base of the petiole..... **A. sinuata**

Acacia caesia (L.) Willd., Sp. Pl. 4: 1090. 1806; Gamble, Fl. Pres. Madras 428. 1919; Manilal, Fl. Silent Valley 92. 1988; Sanjappa, Legumes India 37. 1992; Anil Kumar *et al.*, Fl. Pathanamthitta 202. 2005. *Mimosa caesia* L., Sp. Pl. 522. 1753 *p.p. Acacia intsia* Willd. var. *caesia* (L.) Baker in Hook. f., Fl. Brit. India 2: 297. 1878. *Acacia columnaris* Craib., Bull. Misc. Inf. Kew 1915: 410. 1915; Gamble, Fl. Pres. Madras 429. 1919.

Climbing shrubs with prickles on stem and rachis; old stem 4-6-angled; prickles strong, recurved, bark fibrous. Leaves 20-25 cm long, pinnae 5-8 pairs, to 7 cm long, flattened glands present near the base of the petiole. Leaflets 10-22 pairs, to 11 x 3.5 mm, oblong, truncate at base, apiculate at apex; thinly pubescent below, 3-nerved from base, distant not overlapping. Heads terminal, panicled, flowere sessile. Pods to 13 x 2 cm, oblong, flat, thin, acuminate at both ends.

Fl. & Fr. : February-May.

Distribution : Indo-Malaysia. Open areas in evergreen and semi-evergreen forests. *Amitha Bachan 123384* (Vazhachal, open areas in riparian evergreen forests, banks of Chalakkudy river, 220 m).

Acacia sinuata (Lour.) Merr. Trans. Amer. Philos. Soc. ser. 2, 24(2): 186. 1935; Chakrab. & Gangop., J. Econ. Tax. Bot. 20: 625. 1996. *Mimosa sinuata* Lour., Fl. Cochinch. 653. 1790. *Mimosa concinna* Willd., Sp. Pl. 4: 1039. 1806. *Acacia concinna* (Willd.) DC., Prodr. 2: 464. 1825; Baker in Hook. f., Fl. Brit. India 2: 296. 1878; Gamble, Fl. Pres. Madras 429. 1919; Sanjappa, Legumes India 38. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 167. 1996. *Acacia concinna* (Willd.) DC. var. *rugata* (Benth.) Baker in Hook. f., Fl. Brit. India 2: 297. 1878. *Acacia rugata* (Lam.) J. Voigt, Hort. Suburb. Calcutt. 263. 1845, non Benth. 1842; Gamble, Fl. Pres. Madras 429. 1919.**Cheevakka.**

Scandent shrubs with stout recurved prickles, bark dark brown with warty tubercles. Leaves to 10 cm long, pinnae 5-9 pairs; leaflets 25-30 pairs, oblong-acute, to 8 x 1.3 mm. Flower heads 1 cm across, in terminal and axillary racemes. Calyx dull red, 3 mm long. Petals white, longer than the calyx. Pods oblong, compressed, rugose and wrinkled, reddish-brown, to 10 x 1.8 cm; seeds 7-12.

Fl. & Fr. : February- March.

Distribution : Indo-Malaysia. Moist forests. *Amitha Bachan 117716* (Vazhachal, open degrades areas in riparian forests, banks of Chalakkudy river, 240 m).

ALBIZIA Durazzini

Mag. Tosc. 3(4): 13. 1772.

Albizia odoratissima (L. f.) Benth. in Hook.'s London J. Bot. 3: 88. 1844; Baker in Hook. f., Fl. Brit. India 2: 299. 1878; Gamble, Fl. Pres. Madras 431. 1919; Manilal, Fl. Silent Valley 93. 1988; Sanjappa, Legumes India 57. 1992; Chakrab. & Gangop., J. Econ. Tax. Bot. 20: 593. 1996; Sasidh. & Sivar., Fl. Pl. Thrissur For. 168. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 236. 2002; Sunil & Sivad. Fl. Alapuzha Dist. 267. 2009. *Mimosa odoratissima* L. f., Suppl. Pl. 437. 1781. *Acacia odoratissima* (L.f.) Willd., Sp. Pl. 4: 1063. 1806. **Kunnivaka, Pulivaka.**

Trees to 25 m high; branhlets pubescent. Leaves to 15-25 cm long; pinnae 3-5 pairs to 15 cm long; leaflets to 6-18 pairs, oblong, obtuse at either ends, pubescent below; rachis to 8 cm long with a gland near its base. Panicle axillary or terminal; heads 2 cm across, 15-25-flowered. Flowers 5 mm long, sessile; calyx 0.5 mm long, cupular; corolla 5-fid to half way down; lobes acute, hispid; staminal filaments 10 mm long. Pods flat, strap-shaped, to 15 x 3 cm, brown, polished. Seeds ovoid, 1.5 cm long.

Fl. & Fr. : October-May

Distribution : Indo-Malaysia. Moist deciduous and Evergreen forests. *Amitha Bachan 123467* (Vazhachal, riparian evergreen forest, banks of Chalakkudy river, 220 m).

ARCHIDENDRON F. H. Jacob von Mueller

Fragm. 5: 59. 1865.

Archidendron bigeminum (L.) Neilson, Opera Bot. 76: 73. 1985. *Mimosa bigemina* L., Sp. Pl. 517. 1753. *Archidendron monadelphum* (Roxb.) Nielson, Adansonia 19: 21. 1979; Sanjappa, Legumes India 61. 1992;

Sasidh. & Sivar., Fl. Pl. Thrissur For. 169. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 204. 2005. *Mimosa monadelpha* Roxb., Fl. India 2: 544. 1832. *Pithecellobium bigeminum* (L.) Mart. *ex* Benth. in Hookers's London J. Bot.3: 206. 1844; Baker in Hook. f., Fl. Brit. India 2: 303. 1878; Gamble, Fl. Pres. Madras 435. 1919. *Pithecellobium monadelphum* (Roxb.) Kosterm., Reinwardtia 3: 11. 1954; Manilal, Fl. Silent Valley 94. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 238. 2002. *Abarema bigemina* (L.) Kosterm., Bull. Org. Sci. Res. Indonesia 51, f. 34,35. 1954.

Pannivaka. **Plate 22.D**

Small Evergreen trees to 12 m high; branchlets minutely hairy. Leaves bipinnate, alternate, stipulate, 11-13 cm long, slender, puberulent, a gland in between 2 pinnae; leaflets 4-8, opposite, estipellate, with a gland in between every pair of leaflets; leaflets obovate, oblong or elliptic-acuminate, to 10 x 3 cm, unequally acute at base, acuminate at apex; rachis 10 cm long, slender, pulvinate, pubescent, with a gland near its base; Flowers bisexual, white, in terminal and axillary panicled globose heads; bracteoles lanceolate, persistent; calyx campanulate 4 lobed; petals 4, basally connate, 4 mm long, lobes ovate, acute, valvate; stamens 4, monadelphous, much exserted; ovary sessile; style filiform; stigma minute; ovules many. Pod twisted, 10 x 2 cm, strap-shaped, dehiscent, red.

Fl. & Fr. : January-March

Distribution: Endemic to Southern Western Ghats. Evergreen forests. *Amitha Bachan* 72069 (Vazhachal, riparian evergreen forests, along the banks of Chalakkudy river, 220 m).

ENTADA Adanson

Fam. 2: 318, 554. 1763, *nom. cons.*

Entada rheedei Spreng., Syst. Veg. 2: 325. 1825 "rheedii"; Sanjappa, Legumes India 66. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 170. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 238. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 204. 2005. *Mimosa entada* L., Sp. Pl. 518. 1753. *Entada pursaetha* DC., Prodr. 2: 425. 1825; Mohanan, Fl. Quilon Dist. 167. 1984; Ansari, Fl. Kasaragod Div. 150. 1985. *Entada monostachya* DC., Prodr. 2: 425. 1825; M. Mohanan & Henry, Fl. Thiruvanthapuram 174. *Entada scandens* sensu Hook.f., Fl. Brit. India 2: 86. 1878, non Benth. 1841; Gamble, Fl. Pres. Madras 417. 1919. **Kakkumkai.**

Plate 22. A-C

Woody climbers, stems glabrous, younger shoots tendrillate, becomes spirally twisted on maturity. Leaves bipinnate, pinnae 2-3 pairs, the terminal pair modified into a tendril; leaflets curved-oblong, obtuse, inequilateral to 5 x 2.5 cm, 4-7 pairs. Spikes to 34 cm long, axillary, solitary or paired, erect, yellowish. Flowers dense, yellow, to 3 mm long; calyx cupshaped, truncate; petals 4, free, valvate; stamens 10, free; ovary many-ovuled; style slender; stigma concave. Pods woody, crenate on both sutures to 1 m long; seeds 4-14 biconvex, 5 cm across, orbicular, smooth, hard.

Fl. & Fr. :December- June

Distribution : Indo-Malaysia. Evergreen forests. *Amitha Bachan 123456* (Vazhachal-Karanthodu, riparian evergreen forest, banks of Chalakkudy river, 350 m); *Amitha Bachan 123632* (Vazhachal, riparian evergreen forest, banks of Chalakkudy river, 240 m).

MIMOSA Linnaeus

Sp. Pl. 516. 1753.

Key to species

1a. Straggling under shrubs; stem 4-angular..... **M. diplotricha**

1b. Spreading herbs; stem terete..... **M. pudica**

Mimosa diplotricha C. Wight ex Sanvalle var. **inermis** (Adelb.) Veldk., Fl. Males. Bull. 9: 416. 1987; Sanjappa, Legumes India 67. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 170. 1996; *Mimosa invisia* C. Mart., Flora 20: Biebl. 8: 121. 1837, *non* C. Mart. ex Colla 1834. *Mimosa invisa* C. Mart. var. *inermis* Adelb. in Reinwardtia 2(2):359.1953; M.P. Nayar & Giri, J. Econ. Tax. Bot. 3: 603.1982; Anil Kumar *et al.*, Fl. Pathanamthitta 205. 2005. **Anathottavadi.**

Straggling undershrubs, showy and spreading; stem 4-angular, with recurved prickles. Leaves bipinnate, to 12 cm long; rachis angled, armed with prickles; pinnae 5-10 pairs, pinnately arranged; leaflets to 20 pairs, oblong, to 6 x 1.5 mm, oblique-truncate at base, acute-mucronate at apex, sessile, overlapping. Heads globose, 1-1.5 cm across, pink, arranged in terminal racemes. Fruit a lomentum, flat, margin with recurved prickles.

Fl. & Fr.: October – December.

Distribution : Native of Tropical America. As a weed in India. *Amitha Bachan 123468* (Vazhachal, open degraded areas in riparian forests, banks of Chalakkudy river, 220 m,).

Mimosa pudica L., Sp. Pl. 518. 1753; Baker in Hook. f., Fl. Brit. India 2: 291. 1878; Gamble, Fl. Pres. Madras 421. 1919; Manilal, Fl. Silent Valley 94. 1988; Sanjappa, Legumes India 69. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 171. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 238.

2002; Anil Kumar *et al.*, Fl. Pathanamthitta 205. 2005; Sunil & Sivad. Fl. Alapuzha District 269. 2009. **Thottavadi.**

Spreading herbs; stem terete with distant, recurved prickles. Leaves bipinnate, sensitive; pinnae 2-3 pairs, palmately arranged, to 4-6 cm long; leaflets 12-20 pairs, elliptic-oblong, to 7 x 2 mm, truncate at base, acute at apex, margin ciliate, overlapping; petiole to 4 cm long; stipule up to 8 mm long, linear-lanceolate, acute. Flowers pink on axillary clustered globose heads, 2-3 in a cluster; peduncles to 2 cm long; calyx minute, campanulate, 4-lobed; petals 4, to 1 mm long, pilose. stamens 4, exserted; filaments pink and showy; ovary linear, hairy; pods 3-5-jointed, flat, 1.5 cm long, bristly; seeds compressed.

Fl. & Fr. : July – December.

Distribution : Native of South America. Now naturalized in the tropics. *Amitha Bachan 123633* (Vazhachal, degraded riparian areas, banks of Chalakkudy river, 220 m).

XYLIA Bentham

in Hooker's J. Bot. 4: 417. 1842.

Xylia xylocarpa (Roxb.) Taub., Bot. Centralbl. 47: 395. 1891; Gamble, Fl. Pres. Madras 417. 1919; Sanjappa, Legumes India 73. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 171. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 206. 2005. *Mimosa xylocarpa* Roxb., Pl. Coromandel t. 100. 1798. *Xylia dolabriformis* sensu Bedd., Fl. Sylv. t. 186. 1872, non. Benth. 1842; Baker in Hook. f., Fl. Brit. India 2: 286. 1878 *p.p.* **Irul, Irumulli.**

Medium sized deciduous trees; bark rough, transversely splitting. Leaves bipinnate, alternate, stipulate; leaflets 5-7 pairs, elliptic-oblong, to 10 x 5 cm, acute at both ends, glabrous; rachis 4-18 cm long,

glandular between the leaflets. Spike globose, 1.5-2 cm across, racemose; Flowers dull yellow in axillary globose heads, numerous, 5 mm long, sessile; calyx 4 mm long, tubular, toothed at apex; petals 5, free or united at base, valvate; stamens 10, free, filaments 8 mm long; ovary many-ovuled; stigma minute. Pods flat, broadly falcate, to 16 x 6 cm woody, compressed, dehiscent, septate between the seeds; seeds 4-8, oblong, brown.

Fl. & Fr. : February – May.

Distribution : Indo-Malaysia. Moist forests. *Amitha Bachan 123469* (Vazhachal, dry and rocky riparian forests, banks of Chalakkudy river, 200 m).

46. **ROSACEAE** Juss.,

Gen. Pl. 334. 1789.

PRUNUS Linnaeus

Sp. Pl. 473. 1753

Prunus ceylanica (Wight) Miq., Fl. India Bot. 1: 366. 1855; Manilal, Fl. Silent Valley 97. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 172. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 241. 2002. *Polydontia zeylanica* Wight, Illustr. Ind. Bot. 1: 203. 1840, *"Polyodontia"*. *Pygeum zeylanicum* Bedd., Fl. Sylv. t. 59. 1871. *Pygeum acuminatum* Colebr., Trans. Linn. Soc. London 12: 300. t.18. 1818; Hook. f., Fl. Brit. India 2: 318. 1878; Gamble, Fl. Pres. Madras 439. 1919, non *Prunus acuminata* (Wall.) Dietr. 1803. *Pygeum wightianum* Blume ex Muell. in Walp., Ann. 4: 642. 1857; Hook. f., Fl. Brit. India 2: 319. 1878; Gamble, Fl. Pres. Madras 439. 1919. *Pygeum gardneri* Hook. f., Fl. Brit. India 2: 321. 1878; Gamble, Fl. Pres. Madras 439. 1919. *Pygeum sisparense* Gamble, Bull. Misc. Inform.

Kew 1918: 238. 1918; Gamble, Fl. Pres. Madras 438. 1919. **Nai-Kambakam**.

Evergreen trees, to 25 m high, bark black, splitting into rectangular pieces. Leaves alternate, simple, ovate, ovate-lanceolate, to 12 x 5 cm, acuminate at apex, base acute, rounded or oblique, entire, nerves 8 pairs, prominent; petiole 1-2 cm long, stout, grooved above, glabrous. Racemes to 10 cm long, axillary, erect, densely flowered. Flowers white, 0.6 cm across; pedicels to 0.6 cm long, slender; calyx 0.2 cm long, cupular, campanulate, lobes ovate, acute, densely hairy; petals obovate, stamens many, filaments 0.3 cm long; ovary sessile, 1-celled, glabrous; ovules 2, pendulous; style 1, subulate; stigma capitate. Fruit a drupe, 2-lobed, 1 x 2 cm, depressed globose, obscurely 2-lobed, glabrous; seeds 2, globose.

Fl. & Fr. :May-August.

Distribution: Indo-Malaysia. Evergreen forests, streamside vegetation. *Amitha Bachan 123475* (Anakkayam, riparian forest, banks of Anakkayam stream, 650 m).

47. CHRYSOBALANACEAE

ATUNA Raf.

Sylva Tellur. 153. 1838.

Atuna travancorica (Bedd.) Kosterm., Reinwardtia 7: 423. 1969; Sasidh. & Sivar., Fl. Pl. Thrissur For. 172. 1996. *Parinarium travancoricum* Bedd., Icon. Pl. India Orient. t. 189. 1868-1874; Hook. f., Fl. Brit. India 2: 311. 1878; Gamble, Fl. Pres. Madras 437. 1919.

Evergreen trees to 25 m high. Leaves simple, alternate, elliptic, elliptic-oblong to elliptic-lanceolate, 8-15 x 2-4 cm, acute at base, acuminate or acute at apex, entire, glabrous and glossy above except

silky pubescent midrib, coriaceous; lateral nerves 11-17 pairs, pinnate, prominent; stipules free; petiole to 0.6 cm long, stout, grooved above, silky tomentose when young. Flowers bisexual, 1.5 cm across, usually in axillary silky-villous, slender drooping racemes; bracts ovate-lanceolate, villous; calyx tube funnel-shaped, lobes ovate-cuspidate, villous outside; petals 5, 6 mm long, inserted on the mouth of calyx tube, deciduous; stamens numerous, purple; filaments connate at base; anthers small; ovary superior, adnate to the side of the calyx tube, 2-celled, ovules 2. Drupe to 3 x 2.5 cm, suborbicular, compressed greenish-brown, smooth.

Fl. & Fr. : February – May.

Distribution : Endemic to Southern Western Ghats. Endangered. Evergreen and evergreen riparian forests. *Amitha Bachan 98839* (Malakkapara, evergreen riparian, banks of Sholayar river, 900 m); Amitha Bachan *98912* (Karanthodu-Orukombankutty, evergreen riparian, banks of Chalakkudy river, 450 m).

48. DROSERACEAE Salisb.

Parad. Lond. 2: ad. t. 95. 1808.

DROSERA Linnaeus

Sp. Pl. 218. 1753.

Drosera indica L., Sp. Pl. 282. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 2: 424. 1878; Gamble, Fl. Pres. Madras 452. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 173. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 244. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 208. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 275. 2009. **Theepullu**.

Plate 22.E

Small insectivorous caulescent herbs up to 8 cm tall; stem covered with glandular stalked hairs. Leaves linear, 3 x 0.3 cm, glandular hairy

above, glabrous below; vernation circinate, lower leaves deflexed. Flowers to 1 cm across in axillary 3 cm long, 2-10 flowered racemes; pedicels 0.5 cm long; bracts 1-2 mm long, linear. Calyx lobes 1-2 mm, glandular hairy. Petals spathulate, rose-coloured, 4-6 mm long, obtuse. Ovary ovoid, to 1 mm, 3-celled, 2 ovules in each cell; styles 3, 2-fid. Capsules oblong, 3-4 mm long. Seeds minute, many, reticulate.

Fl. & Fr. : August –December.

Distribution : Paleotropics. On exposed moist areas from plains to forests and grasslands. *Amitha Bachan 98941* (Pullala-Nelliyampathy, open-moist rocky streamside near grasslands, stream bank of stream draining to Karappara river, 1000 m).

49. RHIZOPHORACEAE R. Brown

in Flinders, Voy. Terra. Austr. 2: 549. 1814.

CARALLIA Roxburgh

Pl. Coromandel 3: 8. t. 211, 1811, *nom. cons.*

Carallia brachiata (Lour.) Merr., Philipp. J. Sci. 15: 249. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 174. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 247. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 208. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 277. 2009. *Diatoma brachiata* Lour., Fl. Cochinch. 296. 1790. *Carallia integerrima* DC., Prodr. 3: 33. 1828; Henslow in Hook.f., Fl. Brit. India 2: 439. 1878; Gamble, Fl. Pres. Madras 459. 1919. **Kara-Kandal, Varungu.**

Evergreen trees; to 25 m; bark dark brown. Leaves opposite, obovate, obtuse at apex, attenuate at base, to 11 x 7 cm, coriaceous, nerves indistinct; lateral nerves 6-10 pairs, slender, pinnate, obscure; petiole 6-10 mm, stout, glabrous; stipule interpetiolar, ovate. Flowers in axillary resinous, peduncled cymes with dichotomous branches, 5 mm

across; bisexual, cream coloured, sessile; sepals 8, ovate, acute; petals 8, smaller, orbicular, reddish, inserted on a crenulate disc, lacerate; stamens 10-16, filaments villous, free; ovary half inferior, 4-celled; ovules 2 in each cell; style subulate; stigma 4-lobed. Fruit a drupe, 5-6 mm across, red, filiform; seed one, bright orange, subreniform.

Fl. & Fr. : October – April.

Distribution: Indo-Malaysia and Australia. Moist forests, also in the plains, streamside vegetation. *Amitha Bachan 117683* (Vazhachal, riparian forests, banks of Chalakkudy river, 230 m).

50. COMBRETACEAE R. Brown,

Prodr. 351. 1810.

Key to genera

1a. Straggling shrubs or climbers.....2

1b. Trees..... **Terminalia**

2a. Petals absent..... **Calycopteris**

2b. Petals 5..... **Quisqualis**

CALYCOPTERIS Lamarck

Tabl. Encycl. t. 357; 2(2): 485. 1793.

Calycopteris floribunda Lam., Tabl. Encycl. 2: 485. t. 357.1793; Clarke in Hook. f., Fl. Brit. India 2: 449.1878; Gamble, Fl. Pres. Madras 467. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 176. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 248. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 211. 2005.; C. N. Sunil & Sivad., Fl. Alappuzha 280. 2009. *Getonia floribunda* (Lam.) Roxb., Fl. Coromandel t. 87. 1798. **Pullani.**

Straggling lianas. Leaves opposite, elliptic, elliptic-ovate to elliptic obovate, to 10 x 5 cm, acuminate at apex, obtusely acute at base, entire, punctuate and tomentose below, lateral nerves pinnate, 9-11, nervules reticulate; petiole to 7 mm, pubescent. Flowers sessile, on dense axillary, 5- 12 cm long panicles, towards the end of branches; bracts leafy. Calyx tube campanulate, 0.5 cm long, lobes oblong, enlarged in fruit; petals absent; stamens 10, in two series of 5 stamens, alternating; ovary elliptic, 1-celled, 5-ribbed, densely hispid; ovules 1-3, pendulous. Drupe ellipsoid 10 x 2.5 cm, crowned by persistent sepals.

Fl. & Fr. : January – May.

Distribution : Indo-Malaysia. Usually in the degraded-moist forests, also in the plains especially lateritic hillocks. *Amitha Bachan 98772* (Athirappilly, degraded riparian areas, banks of Chalakkudy river, 80 m).

QUISQUALIS Linnaeus

Sp. Pl. ed. 2, 1: 556. 1762.

Quisqualis indica L., Sp. Pl. (ed. 2) 556. 1762; Clarke in Hook. f., Fl. Brit. India 2: 459. 1878; Gamble, Fl. Pres. Madras 469. 1919; Gangop. & Chakrab., Journ. Econ. Tax. Bot. 21: 331. 1997; C. N. Sunil & Sivad., Fl. Alappuzha 283. 2009. **Pookkulamariyam.**

Woody climbers; young branchlets tomentose. Leaves opposite to subopposite, elliptic to oblong-elliptic, 6-12 x 3-5 cm, rounded to subcordate at base, unequal, acuminate at apex, chartaceous; petiole to 1 cm long. Flowers on terminal spikes to 8 cm long, fragrant; bracts linear, to 0.5 cm. Receptacles narrowly tubular, 4-8 cm long, expanding towards the apex, pubescent without. Sepals 3 x 2.5 mm, triangular reflexed. Petals obovate-oblong, to 1.5 x 1 cm, obtuse, white, turning deep red at maturity, finely pubescent. Filaments 5-7 mm long. Style

adnate to the wall of the upper receptacle for most of its length. Fruit ovate-elliptic, to 3 x 1 cm, black.

Fl. & Fr. : December – August.

Distribution: Native of Myanmar. Introduced. *Amitha Bachan 117718* (Chalakkudy, riparian vegetation, banks of Chalakkudy river, 7 m).

TERMINALIA Linnaeus

Syst. Nat. ed. 12, 2: 74. 1767, *nom. cons.*

Key to species

1a. Fruit winged.....2

1b. Fruit not winged.....3

2a. Fruit with 3 unequal wings.....**T. paniculata**

2b. Fruit with 5 equal wings..... **T. elliptica**

3a. Leaves cordate at base; fruit ellipsoid..... **T. catappa**

3b. Leaves cuneat at base; fruit subglobose.....**T. bellirica**

Terminalia bellirica (Gaertn.) Roxb., Pl. Coromandel t. 198. 1805; Clarke in Hook. f., Fl. Brit. India 2: 445. 1878; Gamble, Fl. Pres. Madras 463. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 177. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 249. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 212. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 284. 2009. *Myrobalanus bellirica* Gaertn., Fruct. 2: 90. t. 97. ff. a-d.1791, "*bellirica*". **Thanni.**

Large emergent trees with large buttresses. Leaves simple, opposite to alternate, clustered at the tip of branchlets, obovate, elliptic or obovate-elliptic to 8-28 x 5-14 cm, acute to cuneate base, oblique, obtusely acuminate at apex, entire, grayish green, coriaceous; lateral

nerves 6-10 pairs; petiole to 0.8 cm, glabrous. Flowers in axillary spikes, to 0.5 cm across, greenish-yellow; bracteoles minute; calyx tube pubescent, to 2 x 1.5 mm; lobes 5, cream, triangular, tomentose; disc 5-lobed, villous; petals absent; ovary 1-celled, 1.5 mm, tomentose; ovules 2 or 3, pendulous. Drupe obovoid, obscurely 5-ridged, to 2.5 x 2 cm, yellowish-brown, pointed at both ends, soft-tomentose; seed one, ellipsoid.

Fl. & Fr. : December – January.

Distribution : Indo-Malaysia. Important component of moist forests especially of moist forests. *Amitha Bachan 98999* (Vazhachal, riparian forests, along the banks of Chalakkudy river, 230 m).

Terminalia catappa L., Syst. Nat. (ed.12) 2: 674. 1767 & Mantissa Pl. 2: 519. 1771; Clarke in Hook. f., Fl. Brit. India 2: 444. 1878; Gamble, Fl. Pres. Madras 463. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 178. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 213. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 284. 2009. **Indian-Badam**.

Medium sized fast growing trees. Leaves simple, alternate, clustered at the tip of branchlets, obovate, orbicular-obovate, to 10-35 × 8-20 cm, acute to cuneate at base, obtuse at apex, entire, glabrous above, puberulent beneath, coriaceous; lateral nerves 6-13 pairs; petiole 0.6-14 cm long, stout, pubescent; Flowers polygamous, sessile, white or yellowish-green, small, to 4 mm across, in axillary pubescent simple racemes; calyx tube 4 x 1.2 mm, pubescent, lobes 5, triangular, ovate, 1-2 x 1.5-2 mm, acute, glabrous; petals absent; stamens 10; ovary, 1-celled, 0.5 cm long, ovule pendulous. Drupe, broadly ellipsoid to ovoid, laterally compressed, inflated, to 6 × 4 cm, reddish-brown, glabrous, glossy.

Fl. & Fr. : March – January.

Distribution : Malaysia to North Australia and Polynesia, commonly planted in the tropics. Introduced, usually in moist localities of the plains. *Amitha Bachan 123500* (Chalakkudy, banks of Chalakkudy river, 5 m).

Terminalia elliptica Willd., Sp. Pl. 4: 969. 1806; Gangop. & Chakrab., J. Econ. Tax. Bot. 16:601.1992 & 21: 351. 1997. *Terminalia alata* Heyne ex Roth, Nov. Pl. Sp. 379. 1821. *Terminalia crenulata* Roth, Nov. Pl. Sp. 380. 1821; Gamble, Fl. Pres. Madras 465. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 178. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 250. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 212. 2005. *Terminalia coriacea* (Roxb.) Wight & Arn., Prodr. 315. 1834; Gamble, Fl. Pres. Madras 465. 1919. *Pentaptera coriacea* Roxb., Fl. India 2: 438. 1832. *Terminalia tomentosa* (Roxb. ex DC.) Wight & Arn., Prodr. 314. 1834; Clarke in Hook. f., Fl. Brit. India 2: 447. 1878; Gamble, Fl. Pres. Madras 465. 1919. *Terminalia tomentosa* (Roxb. ex DC.) Wight & Arn. var. *crenulata* (Roth) Clarke in Clarke in Hook. f., Fl. Brit. India 2: 448. 1878. *Pentaptera crenulata* (Roth) Roxb., Fl. India 2: 438. 1832. **Karimaruthu, Thembavu.** **Plate 22. F**

Large deciduous trees, to 30 m high. Leaves oblong, elliptic-oblong; to 18 x 10 cm, oblique at base; obtuse to acute at apex, entire or crenulate, glabrous, coriaceous, midrib with 2 stalked glands near the base beneath; lateral nerves 10-20 pairs. Flowers in terminal and axillary paniculate spikes, dull yellow; peduncle tomentose; bracteoles linear, 1-2 mm long; calyx tube angled, 2 mm, lobes 5, ovate, yellow, densely villous inside; petals absent; stamens 10 in 2 rows; disc 5-lobed, villous; ovary 2.5 mm long, inferior, densely villous, 1-celled; ovules 2 or 3, pendulous. Drupe longitudinally 5-winged, 5 cm, glabrous; wings equal, reddish-brown; seed one.

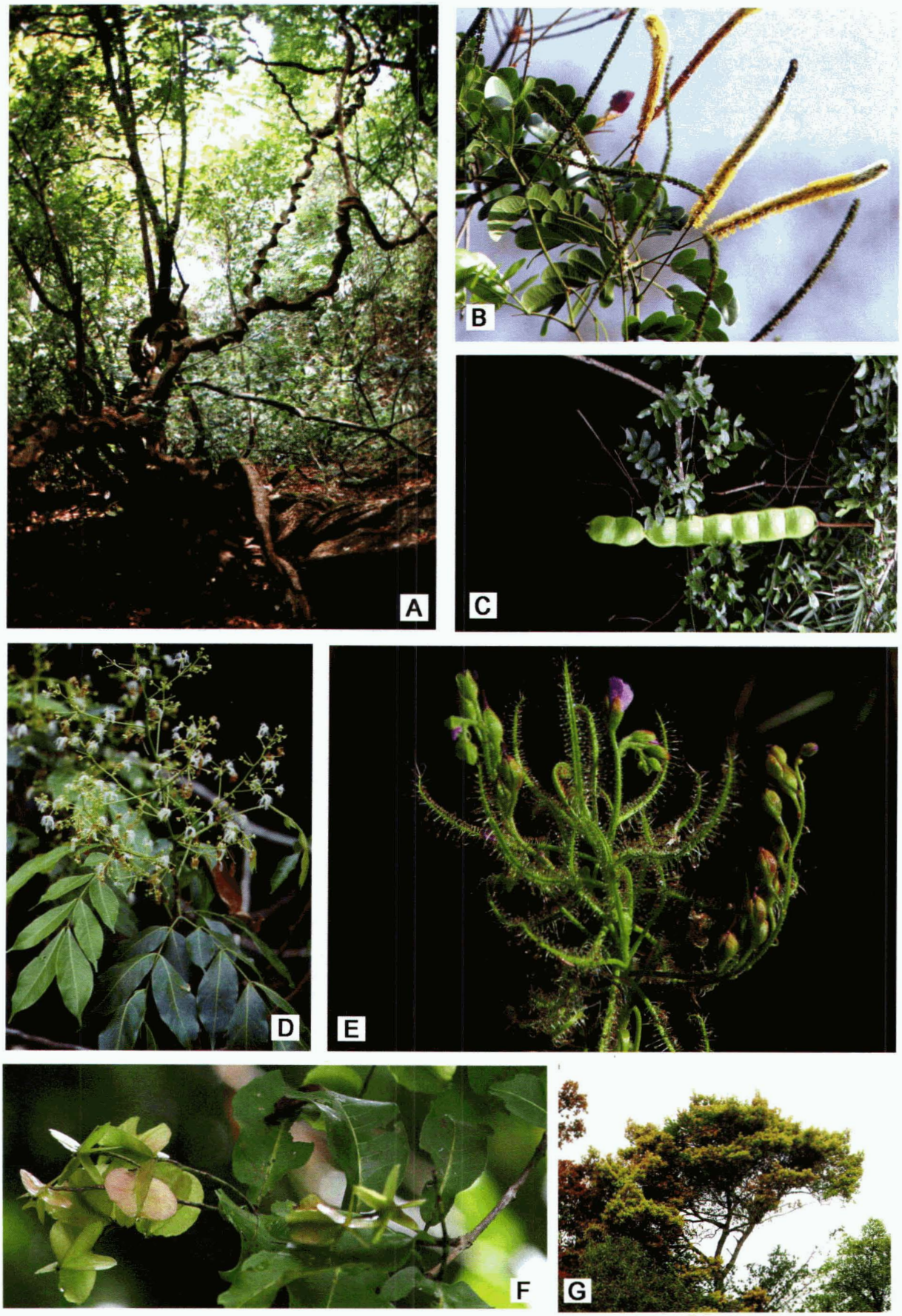


Plate 22. A-C. *Entada rheedei* Spreng., A. habit, B. Inflorescence, C. fruit; D. *Archidendron bigeminum* (L.) Neilson; E. *Drosera indica* L.; F. *Terminalia elliptica* Willd.; G. *Calophyllum calaba* L.

Fl. & Fr. : April – May.

Distribution: India and Sri Lanka. Moist and Dry forests. Along riverbanks in dry forests. *Amitha Bachan 123443* (Parambikulam Thellikkal, riparian vegetation, along Thellikkal river, 520 m).

Terminalia paniculata Roth, Nov. Pl. Sp. 383.1821; Clarke in Hook. f., Fl. Brit. India 2:448.1878; Gamble, Fl. Pres. Madras 465. 1919; Manilal, Fl. Silent Valley 102. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 178. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 251. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 212. 2005. *Pentaptera paniculata* (Roth) Roxb., Fl. India 2: 442. 1832. **Pullmaruthu.**

Large deciduous trees to 30 m high, bark thick, rough with vertical shallow fissures. Leaves simple, alternate-subopposite, elliptic-oblong - ovate-oblong, to 10-25 x 7-10 cm, round to cordate at base; acute or acuminate at apex, margin entire; 2 sessile glands the at the junction of petiole and lamina beneath; lateral nerve 6-14 pairs, pinnate, prominent, reticulate; petiole to 1.2 cm long, glabrous. Flowers white, sessile, to 1.0 cm across, in axillary and terminal tomentose panicles; calyx tube 1× 0.8 mm, constricted above the ovary, lobes 5, cream, triangular, villous; petals absent; stamens 10 in 2 rows; disc 5-lobed, villous; ovary, 1-celled; ovules 2 or 3, pendulous; Drupe winged, one large and 2 small, reddish-brown; seed one.

Fl. & Fr. : August – February.

Distribution : Endemic to Peninsular India. Moist forests, usually along degraded, dry–exposed stream banks. *Amitha Bachan 98749* (Thellikkal, riparian vegetation, banks of Thellikkal river, 530 m).

51. MYRTACEAE Juss.

Gen. Pl. 322. 1789.

SYZYGIUM R. Brown ex Gaertner

Fruct. 1: 166. 1788, *typ. cons.*

Key to species

1a. Branchlets terete or sub terete.....2

1b. Branchlets quadrangular, flat..... **S. munronii**

2a. Staminal disk present; fruit crowned by disk.....3

2b. Staminal disk absent; fruit not crowned by staminal disk.....4

3a. Leaves 12-30 cm long, oblong..... **S. mundagam**

3b. Leaves under 12 cm, elliptic, elliptic-lanceolate..... **S. bourdillonii**

4a. Leaves linear-lanceolate, under 2 cm wide..... **S. occidentalis**

4b. Leaves elliptic, elliptic oblong or ovate, >2 cm wide.....5

5a. Small trees, petiole under 0.6 cm long.....6

5b. Large tree, petiole >1cm long 7

6a. Fruit 2-2.5 cm, crowned by calyx lobes..... **S. laetum**

6b. Fruit 0.8-1.4 cm, not crowned by calyx lobes.....**S. lanceolatum**

7a. Fruit 3 x 2 cm, crowned by calyx limb..... **S. chavaran**

7b. Fruit 1 x 0.7 cm, not crowned by calyx limb..... **S. cumini**

Syzygium bourdillonii (Gamble) Rathkr. & Nair, J. Econ. Tax. Bot. 4: 287. 1983; N. Mohanan & Sivad., Fl. Agasthyamala 258. 2002. *Jambosa bourdillonii* Gamble, Bull. Misc. Inform. Kew 1918: 239. 1918 & Fl. Pres. Madras 414. 1919.

Small to medium sized trees, to 10 m high. Leaves elliptic, lanceolate, elliptic-oblanceolate, to 11 x 4 cm, acute to cuneate at base, acuminate or obtusely acuminate at apex, entire, glabrous, chartaceous, glandular-punctate; petiole 3-5 mm, slender; lateral nerves 6-10 pairs, looped at the margin forming a prominent intramarginal nerve 0.3-0.4 cm away from the margin, all distinct on the lower side. Flowers bisexual, white, in terminal few flowered cymes; pedicel to 0.5 cm long, subtetragonal; calyx tube campanulate, 1 cm; lobes 4, round, 0.3 cm long, recurved, persistent, furnished with thickened staminal disc; petals 4, orbicular, gland-dotted; stamens many, free, longer than the petals; ovary inferior, 2-celled, many ovuled; style slender, hairy; stigma slightly acute. Berry, apparently small, 1.5-2 x 1-1.3 cm, crowned by the calyx tube and thickened disc, crown 0.8-1 cm wide.

Fl. & Fr. : February-April.

Distribution : Endemic to Southern Western Ghats, Endangered. Evergreen riparian forests. *Amitha Bachan 123387* (Sholayar-Karimala, evergreen riparian forest, streamside, 900 m).

Note: This species is very rare and treated as "Endangered and Possibly Extinct" by Nair and Sastry (1987).

Syzygium chavaran (Bourd.) Gamble, Fl. Pres. Madras 480. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 181. 1996. *Eugenia chavaran* Bourd., For. Trees Travancore 188. 1908.

Medium to large trees, branchlets terete. Leaves elliptic, elliptic-oblong, to 18 x 8 cm, attenuate or acute at base, acuminate at apex, entire, glabrous, coriaceous, pellucid-dotted; lateral nerves many, parallel, close, slender, looped at the margin forming intramarginal nerve; Petiole 1.3-3cm, grooved above, glabrous. Flowers bisexual, 1-1.5 cm across, white, in axillary and terminal compound cymes, branches

stout, divaricating at right angles; pedicel not distinct; calyx tube turbinate, lobes 4; petals calyptrate; stamens many, free, bent inwards at the middle when in bud; ovary inferior, 2-celled, ovules many in each cell. Berry, to 3 x 2 cm, obliquely ventricose, bluish-purple, crowned by the 3-5 mm long calyx limb, no thickened disc.

Fl. & Fr. : December – April.

Distribution: Peninsular India and Thailand. Endangered. Riparian evergreen forests of Thrissur and Palakkad Districts. *Amitha Bachan 98887* (Vazhachal-Karanthodu, riparian evergreen forest, banks of Chalakudy river, 450 m,).

Syzygium cumini (L.) Skeels, U. S. D.A. Bur. Pl. Industr. Bull. 248: 2. 1912, var. **cumini**; Manilal, Fl. Silent Valley 104. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 181. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 261. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 216. 2005. *Myrtus cumini* L., Sp. Pl. 471. 1753. *Eugenia jambolana* Lam., Encycl. 3: 198. 1789; Duthie in Hook. f., Fl. Brit. India 2: 499. 1879. *Syzygium jambolanum* (Lam.) DC., Prodr. 3: 259. 1828; Gamble, Fl. Pres. Madras 481. 1919. **Perinjaval, Njaval**. **Plate 23. C**

Medium sized trees; branchlets glabrous. Leaves ovate-elliptic to oblong, to 6-18 x 3-7 cm, long-acuminate at apex, acute at base, entire, glabrous, coriaceous, minutely punctate; nerves many, close, shining above; looped near the margin forming intramarginal nerve; petiole 1.5-2 cm long. Flowers 6-9 mm across, subsessile; in compound trichotomous cymes from leafless nodes, sometimes terminal and axillary; calyx tube 2 x 3 mm, turbinate; lobes 4, obscure; petals 4, calyptrate; stamens many; filaments red, subulate, 2-5 mm long; ovary inferior, 2 mm, 2-celled; ovules many. Berry obovoid, 10 x 7 mm, purplish black when mature.

Fl. & Fr. : December – April.

Distribution : Indo-Malaysia. Evergreen forests to plains. *Amitha Bachan 123462* (Vazhachal, riparian evergreen forest, banks of Chalakudy river, 200 m).

Syzygium laetum (Buch.-Ham.) Gandhi in C.J. Saldanha & Nicolson, Fl. Hassan Dist. 282. 1976; Manilal, Fl. Silent Valley 106. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 181. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 262. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 217. 2005. *Eugenia laeta* Buch.-Ham., Mem. Wern., Nat. Hist. Soc. 5: 338. 1826; Duthie in Hook. f., Fl. Brit. India 2: 479. 1878. *Jambosa laeta* (Buch.-Ham.) Blume, Mus. Bot. Lugd.-Bat. 1:104.1849; Gamble, Fl. Pres. Madras 474. 1919. *Eugenia pauciflora* Wight, Icon. Pl. India Orient. t. 526. 1842. *Jambosa pauciflora* (Wight) Wight, Ill. India Bot. 2: 14. 1850. **Kollinjaval.**

Small trees to 10m tall, branchlets terete, slender. Leaves elliptic, ovate, to 12 x 5 cm, cuneate, attenuate or acute at base, acuminate or obtusely acuminate apex, entire, glabrous, chartaceous, pellucid-punctate; lateral nerves 10-15 pairs, forming intramarginal nerve near the margin; petiole 5 mm long. Flowers bisexual, 4-5 cm across, crimson or lemon yellow, solitary or 2-5 together in axillary or terminal cymes; pedicels 2.5 cm long; calyx tube 15 mm long, obconical; sepals 8 x 8 mm, orbicular, persistent; petals 10 x 10 mm, glabrous; stamens 2-3 cm long, yellow or pink. Berry oblong, to 2.5 x 1.5 cm, crowned by calyx lobes.

Fl. & Fr. : December – July.

Distribution : Endemic to Southern Western Ghats. Common in evergreen forests. *Amitha Bachan 99121* (Vazhachal–Charpathodu, evergreen forest, stream sides, 300m); *Amitha Bachan 99136* (Poringal, evergreen forest, streamside, 275 m).

Syzygium lanceolatum (Lam.) Wight & Arn., Prodr. 330. 1834; Manilal, Fl. Silent Valley 106. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 183. 1996. *Eugenia lanceolata* Lam., Encycl. 3: 200. 1789. *Syzygium wightianum* Wall. *ex* Wight & Arn., Prodr. 330. 1834; Gamble, Fl. Pres. Madras 478. 1919. *Eugenia wightiana* (Wall. ex Wight & Arn.) Wight, Icon. Pl. India Orient. t. 529. 1842; Duthie in Hook. f., Fl. Brit. India 2: 485. 1878. **Njaval.**

Small highly branched trees, branchlets terete. Leaves elliptic-oblong to elliptic-lanceolate, 5-10 x 1.5-3 cm, cuneate or acute at base, obliquely acuminate or acute at apex, entire, glabrous, chartaceous, pellucid-dotted; lateral nerves many, not always close, obscure, looped at the margin forming intramarginal nerve; petiole 4-6 mm long, slender, grooved above, glabrous; Flowers bisexual, white, 5 mm across, in axillary and terminal cymes; pedicel to 2 mm; calyx tube, elongate, funnel shaped, 1.2 vm long, lobes 4, short; petal 4, often many, 3 x 3 mm, suborbicular; stamens many, bent inwards at the middle in bud, 6 mm long; ovary inferior, 2-celled; ovules many; style 1; stigma simple. Berry ovoid to 1.2 cm long.

Fl & Fr. : March – April.

Distribution: Endemic to South India and Sri Lanka. Evergreen and Shola forests. *Amitha Bachan 98933* (Pullala-Nelliyampathy, streamside vegetation, stream draining to Karappara river, 1100 m).

Syzygium mundagam (Bourd.) Chithra in Henry *et al.*, Fl. Tamilnadu 1: 157. 1983; Manilal, Fl. Silent Valley 107. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 183. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 263. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 217. 2005. *Eugenia mundagam* Bourd., For. Trees Travancore 182. 1908; Subram., Fl.

Thenmala Div. 133. 1995. *Jambosa mundagam* (Bourd.) Gamble, Fl. Pres. Madras 473. 1919. **Kattuchamba**. **Plate 23. B**

Small to medium sized trees, bark brown, smooth; branchlets tetragonous. Leaves broadly elliptic-oblong or oblong, 12-32 x 5-12 cm, cordate or obtuse at base, acute or obtuse at apex, entire, coriaceous; lateral nerves 18-22 pairs, pinnate, looped near the margin forming intramarginal nerve; petiole short, 3-7 mm long 3 mm wide, stout, glabrous, Flowers in terminal many flowered corymbs, bisexual, 4 cm across, white; pedicel 5 mm long; calyx tube stout, funnel-shaped, forming a staminal disc, lobes 4, 6 mm across; petals 4, to 1.5 cm, orbicular; stamens many, free; ovary inferior, 2-celled, many ovuled; style slender, longer than stamens; stigma slightly acute. Berry, ovoid, 2.5 cm across, crowned by disc, greenish-pink.

Fl. & Fr. : February – March.

Distribution: Endemic to Southern Western Ghats. Evergreen forests. *Amitha Bachan 99122* (Pachakkadu-Vazhachal, streamside vegetation, 300m); *Amitha Bachan 98887* (Karanthodu-Vazhachal, Evergreen riparian forest, banks of Chalakudy river, 450m).

Syzygium munronii (Wight) Chandrab., Biol. Mem. 2:58. 1977; Manilal, Fl. Silent Valley 107. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 183. 1996; Mohanan & Sivad., Fl. Agasthyamala 263. 2002. *Eugenia munronii* Wight, Icon. Pl. India Orient. t. 546. 1842; Hook. f., Fl. Brit. India 2: 472. 1878. *Jambosa munronii* (Wight) Walp., Rep. 2: 191. 1843; Gamble, Fl. Pres. Madras 473. 1919. **Plate 23. A**

Large shrubs to small trees; branchlets quadrangular. Leaves lanceolate, oblong-lanceolate, to 11-22 x 1.5-7 cm, obtuse at base, narrowly acuminate at apex, subsessile, glabrous; veins many, parellel, prominent, forming intramarginal veins. Cymes terminal, 5-10 cm broad.

Flowers few, 4 cm across; pedicels 1 cm long; calyx 2.5 cm long, funnel-shaped; lobes orbicular, 1 x 1 cm; petals larger, yellowish white; filaments 2.5 cm long, white. Berry 2.5 x 1.5 cm, ellipsoid, glabrous.

Fl. & Fr. :December-April

Distribution: Endemic to the Western Ghats. Evergreen forests. *Amitha Bachan 98985* (Sholayar, evergreen riparian, banks of Anakkyam stream, 700 m); *Amitha Bachan 72043* (Poringal, evergreen riparian forest, banks of Chalakudy river, 275 m).

Syzygium occidentalis (Bourd.) Gandhi in Saldanha & Nicolson, Fl. Hassan Dist. 282. 1976; Sasidh. & Sivar., Fl. Pl. Thrissur For. 185. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 217. 2005. *Eugenia occidentalis* Bourd., Indian For. 30: 195. t.3. 1904. *Jambosa occidentalis* (Bourd.) Gamble, Fl. Pres. Madras 474. 1919. **Attuchamba. Plate 23. D**

Large shrubs usually seen along the rocky river courses. Leaves linear-lanceolate, linear-oblong to 10-20 x 1.5-2 cm, acute at base, acuminate at apex; nerves many not so close, forming intramarginal nerves, indistinct; petiole short, to 1 cm long. Cymes 10 cm broad, terminal. Flowers white-yellow; calyx tube 15 mm long, funnel shaped; lobes ovate, obtuse, 6 mm across; petals 4, 8 mm broad, orbicular, white; filaments 25 mm long, white-yellow; style 3.5 cm long. Berry globose, 2 x 2 cm.

Fl. & Fr. : December-May

Distribution : Endemic to Southern Western Ghats. Vulnerable. Along water courses, riparian forests. *Amitha Bachan 72030* (Vazhachal, riparian evergreen forest, banks of Chalakudy river, 220 m).

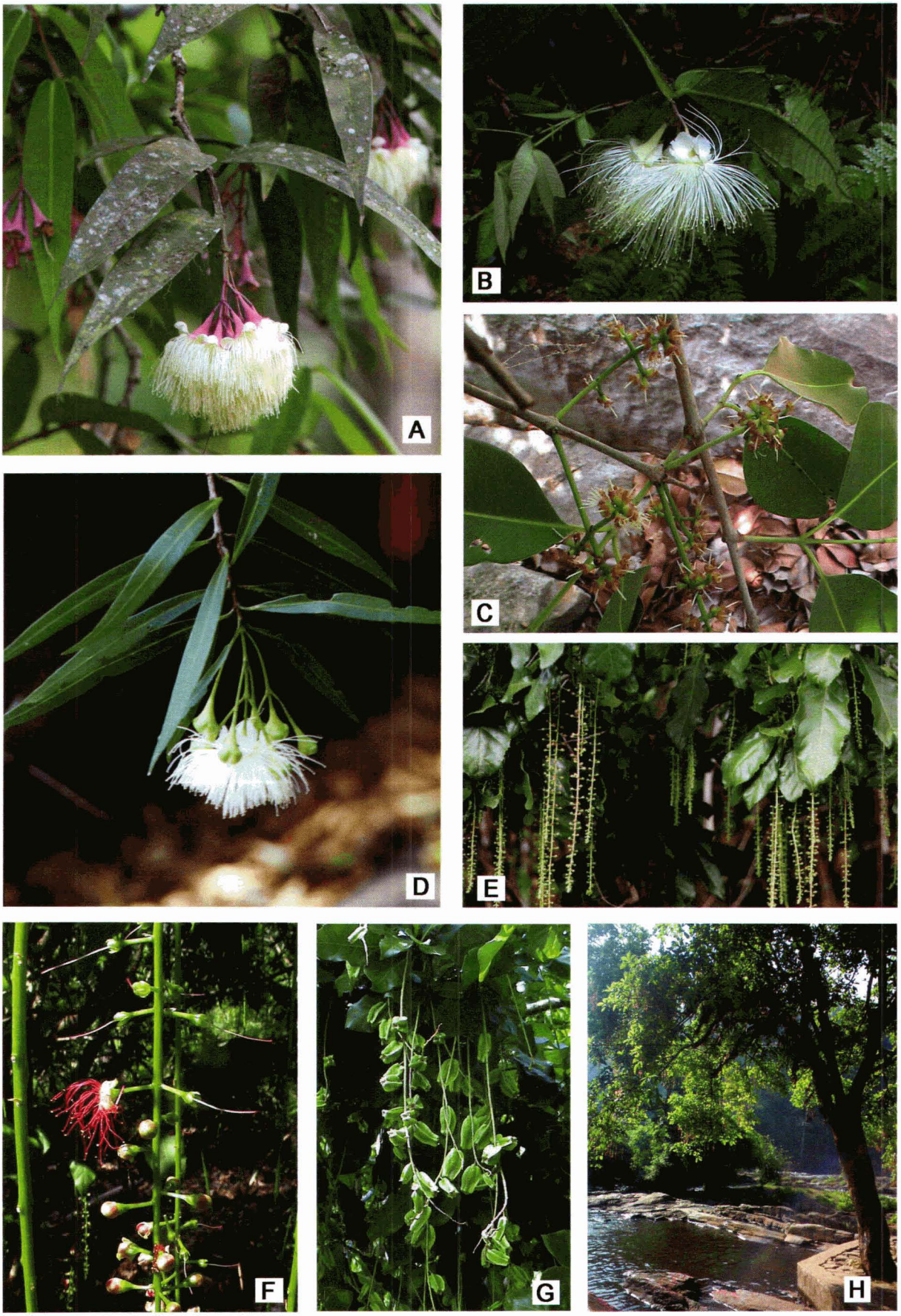


Plate 23. A. *Syzygium munronii* (Wight) Chandrab.; B. *Syzygium mundagam* (Bourd.) Chithra; C. *Syzygium cumini* (L.) Skeels var. *cumini*; D. *Syzygium occidentalis* (Bourd.) Gandhi; E–H. *Barringtonia acutangula* (L.) Gaertn., E & F. Inflorescence, G. Infructescence, H. Habit.

52. LECYTHIDACEAE Poit.

in Mem. Mus. Hist. Nat. 13: 143. 1825.

BARRINGTONIA J.R. Forster *et* J.G.A. Forster

Charact. Gen. 75, t. 38. 1776, *nom. cons.*

Barringtonia acutangula (L.) Gaertn., Fruct. 2: 97, t.101. 1790; C. B. Clarke in Hook. f., Fl. Brit. India 2: 508. 1879; Gamble, Fl. Pres. Madras 487. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 185. 1996; Anil Kumar *et al.,* Fl. Pathanamthitta 219. 2005. *Eugenia acutangula* L., Sp. Pl. 471. 1753. **Attuvanchimaram, Neerpezhu**. **Plate 23. E-H**

Riparian evergreen trees, to 15 m high; branchlets tomentose. Leaves simple, alternate, clustered towards the tip of branchlets, oblanceolate, to 18 x 7 cm, cuneate, or attenuate at base, obtuse or obtusely acute at apex, finely serrate, glabrous, subcoriaceous; lateral nerves pinnate, stipules lateral, cauducous; petiole 1 cm long, slender, glabrous; Flowers in terminal 20-40 cm long, pendulous showy racemes; red, bisexual, 8 mm across; bracts small, deciduous; calyx tube campanulate, adnate and scarcely produced above the ovary; lobes 4, ovate, acute; petals 4, ovate, obtuse, basally connate, adnate to the staminal tube; stamens numeraous, in several rows, connate below; filaments exserted, filiform, 1.5 cm long, pink, connate below; ovary 2-celled, ovules 6-8 in each cell; style filiform; stigma small. Fruit a fibrous quadrangular berry, oblong-ovoid, to 3.5 cm long.

Fl. & Fr. : March – May.

Distribution : Indo-Malaysia to Australia. Along watercourses in low elevation evergreen forests. *Amitha Bachan 72004* (Vazhachal, riparian evergreen forests, banks of Chalakudy river, 220 m).

53. MELASTOMATACEAE Juss.

Gen. Pl. 328. 1789.

Key to genera

1a. Leaves 3-9-nerved from the base.....2

1b. Leaves penninerved.....**Memecylon**

2a. Flowers 3-merous.....**Sonerila**

2b. Flowers 4 or 5-merous.....3

3a. Epiphytic shrubs; leaves succulent.....**Medinilla**

3b. Terrestrial plants; leaves not succulent.....4

4a. Stamens equal; fruit opening by pores at apex.....**Osbeckia**

4b. Stamens unequal; fruit bursting irregularly..... **Melastoma**

MEDINILLA Gaudichaud

in Freyc., Voy. Uranie Bot. 484. 1830.

Medinilla beddomei C. B. Clarke in Hook. f., Fl. Brit. India 2: 548. 1879; Gamble, Fl. Pres. Madras 496. 1919; Manilal, Fl. Silent Valley 108. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 186. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 268. 2002; Sasidh. & Sujanapal, Rheedea 15: 105. 2005; Anil Kumar *et al.*, Fl. Pathanamthitta 221. 2005. *Medinilla radicans* sensu Bedd., Icon. Pl. Ind. Orient. t. 184. 1872, non Blume 1831. **Plate 24. C**

Epiphytic shrubs, branches fleshy, terete, pendulous. Leaves opposite, thick, very succulent, orbicular, 3-ribbed from base to 2.5 cm across, obtuse at base and apex, ribs indistinct; petiole 5 mm long. Flowers 5-merous, few to many, in axillary cymes; Cymes 1-3-flowered; pedicels 2 cm long, glabrous. Flowers white; calyx tube 7 mm long, wavy

along the rim, short, adnate to the ovary and projected a little above; petals white, obovate, 1.5 x 1.2 cm, spreading; stamens 10, anthers 8 mm long, dehiscing by apical pore, connective with two small tubercles and a spur-like appendage at base 1.5 mm long, curved up. Ovary 4-5-celled, ovules many, style slender. Berry, crowned by the calyx limb.

Fl. & Fr. : May-June.

Distribution: Endemic to Southern Western Ghats. Epiphytic on large trees of Evergreen forests. *Amitha Bachan 123480* (Malakkapara, on the trees of riparian forests, along banks of Sholayar river, 900 m).

MELASTOMA Linnaeus

Sp. Pl. 390. 1753.

Melastoma malabathricum L., Sp. Pl. 390. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 2: 523. 1879; Gamble, Fl. Pres. Madras 495. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 187. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 269. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 221. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 293. 2009. **Chenkadali.**

Branched shrubs, branchlets covered with adpressed fimbriate brownish scales. Leaves opposite, petioled, 3-7-ribbed, elliptic, to 13 x 5 cm, acute at both ends, adpressed hairy, on both sides with fimbriate scales on the petiole and veins beneath. Flowers 4 cm across, 5 merous, purple, in terminal cymes; calyx tube covered with adpressed fimbriate scales and strigose hairs; calyx lobes ovate alternating with appendages. Petals as many as calyx lobes 5, broadly ovate, large, purple. Stamens 10, unequal, anthers purple, produced to appendages on base. Ovary, ovoid, adnate to calyx tube.

Fl. & Fr.: Throughout the year.

Distribution: Southeast Asia. Along stream banks and marshy areas. *Amitha Bachan 123445* (Kundur, wet lateritic riparian area, banks of Chalakkudy river, 10 m).

MEMECYLON Linnaeus

Sp. Pl. 349. 1753.

Key to species

1a. Leaves petioled.....2

1b. Leaves sessile or subsessile.....3

2a. The ultimate branches of cymes umbelllulate..... **M. angustifolium**

2b. The ultimate branches of cymes not umbellulate.....**M. molestum**

3a. Calyx tube in fruits not abruptly widened; berry 7 mm across .... **M. deccanense**

3b. Calyx tube in fruits abruptly widened above the ovary to saucer shape; berry 7 mm across.....**M. depressum**

Memecylon angustifolium Wight, Icon. Pl. India Orient. t. 276. 1840 & Ill. India Bot. 1: 215. 1840; C. B. Clarke in Hook. f., Fl. Brit. India 2: 562. 1879; Gamble, Fl. Pres. Madras 504. 1919; N. Mohanan & Sivad., Fl. Agasthyamala 272. 2002. **Aattukanala.**

Large shrubs to small trees; branchlets slender, subterete. Leaves opposite, linear-lanceolate, to 7 x 1.2 cm, acuminate at apex, cuneate at base, glabrous, glossy, penninnerved, lateral nerves, ascending, not prominent. Flowers blue, mostly from mature stem. Cymes shortly peduncled, the ultimate branches umbelllulate. Calyx tube above the ovary campanulate, saucer-shaped. Petals 4, broadly elliptic ovate, blue; Stamens 8, equal. Fruit a globose berry crowned by the calyx limb.

Fl. & Fr.: February – May.

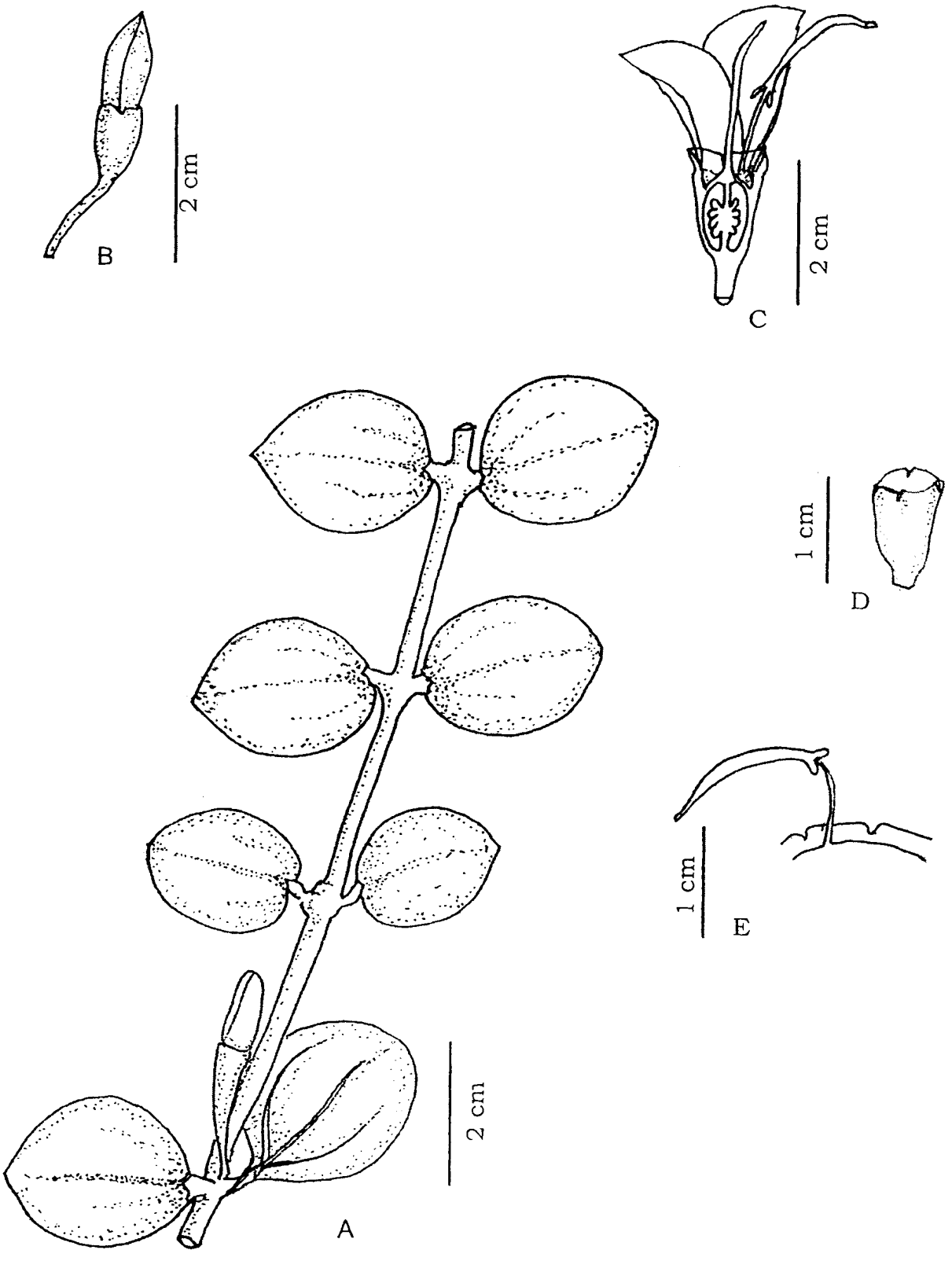


Fig. 2.2. *Medinilla beddomei* C. B. Clarke A. Flowering twig, B. Flower bud, C. Flower L. S., D. Calyx tube, E. Stamen.

Distribution: Endemic to South India and Sri Lanka. Along river banks. *Amitha Bachan 72023* (Vazhachal, riparian forests, along the banks of Chalakkudy river, 250 m).

Memecylon deccanense C. B. Clarke in Hook. f., Fl. Brit. India 2: 560. 1879; Gamble, Fl. Pres. Madras 505. 1919. *Memecylon wightianum* Triana, Trans. Linn. Soc. London 28: 158. 1871. **Kattukayampoo**.

Large shrubs to small slender trees, branchlets subterete. Leaves opposite, oblong-lanceolate or elliptic-oblong, to 11 x 3.5 cm, acute or acuminate at apex, rounded at base, glabrous, brown on drying; lateral nerves 15 pairs, pinnate, faint. Flowers mostly fascicled on tubercles; pedicels slender, 2.5 mm long. Calyx cupular, lobes obscure, pink. Petals blue. Stamens 8, equal. Berry to, 0.7 cm across, crowned by the saucer-shaped calyx limb.

Fl. & Fr.: January – March.

Distribution : Endemic to Southern Western Ghats. Fairly common in riparian evergreen forests. *Amitha Bachan 98906* (Karanthodu, riparian forest, banks of Chalakkudy river, 400 m); *Amitha Bachan 123393* (Sholayar, riparian forest, banks of Sholayar river, 700 m).

Memecylon depressum Benth. *ex* Triana, Trans. Linn. Soc. London 25: 158. 1865-1866; Gamble, Fl. Pres. Madras 505. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 187. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 272. 2002. **Kaikkathetti.**

Shrubs to small trees; branchlets terete and tetragonous towards the upper part of each internode. Leaves ovate-oblong, to 12 x 3.5 cm, acute at apex, subsessile, brown when dried, nerves pinnate, about 12 pairs, obscure. Cymes 3 cm across, densely branched, usually axillary. Flowers 4 mm across, many-together; calyx teeth acute; petals ovate, 2.2

x 1.5 cm, acute, bluish white, filaments 1.5 mm long, anthers 1.5 mm long, curved; style 3 mm long. Calyx tube in fruits abruptly widened above the ovary to saucer shape; berry 6 mm across.

Fl. & Fr.: June – August.

Distribution : Endemic to Southern Western Ghats. In the evergreen and semi-evergreen forests. *Amitha Bachan 123394* (Sholayar, riparian evergreen forests, banks of Sholayar river, 700 m).

Memecylon molestum (Clarke) Cogn. in A. & C. DC., Monogr. Phan. 7:1169.1891; Gamble, Fl. Pres. Madras 505. 1919. *Memecylon edule* Roxb. var. *molesta* C. B. Clarke in Hook. f., Fl. Brit. India 2: 564. 1879.

Plate 24. A & B

Shrubs to small trees; branchlets terete, quadrangular. Leaves opposite, coriaceous, petioled, elliptic, ovate-oblong, to 8 x 2 cm, acute at base, acutely obtuse at apex, yellow when dry; lateral nerves 6-8 pairs, faintly visible. Flowers clearly pedicellate, to 5 mm, in pedunculate branched cymes. Cymes 1.4 cm across. Calyx tube above the ovary saucer-shaped. Petals 4, bright blue, conspicuous, enclosing a disk. Stamens 8, equal. Calyx in fruit saucer-shaped; berries to 5 mm across.

Fl. & Fr.: September – November.

Distribution: Endemic to Peninsular India. Evergreen forests. *Amitha Bachan 99114* (Orukombankutty, riparian forests, banks of Parambikulam-Kuriyarkutty river, 450 m).

OSBECKIA Linnaeus

Sp. Pl. 345. 1753.

Key to species

1a. Flowers 4-merous.....**O. muralis**

1b. Flowers 5-merous.....2

2a. Leaves 7-9-nerved, reticulate to bullate.....**O. reticulata**

2b. Leaves 3-5 (-7) nerved, not reticulate to bullate.....3

3a. Sepals 7-8 mm long.....**O. walkerii**

3b. Sepals 2-6.5 mm long.....4

4a. Sepals distinctly asymmetrically emarginated, many lines of crystalliferous cells branched above and beneath.....**O. aspera**

4b. Sepals triangular and narrowed into an attenuate terete tip, lines of crystalliferous cells not branched.....**O. virgata**

Osbeckia aspera (L.) Blume var. **travancorica** (Bedd. *ex* Gamble) Hansen, Ginkgoana. 4: 84. 1977; Sasidh. & Sivar., Fl. Pl. Thrissur For. 190. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 274. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 296. 2009. *Osbeckia travancorica* Bedd. ex Gamble, Bull. Misc. Inform. Kew 1919: 404. 1919 & Fl. Pres. Madras 493. 1919. **Kattukadhali.**

Shrubs; branches covered with reddish retrose bristles. Leaves ovate-oblong, to 14 x 5 cm, acuminate, 5-7-ribbed, covered with adpressed hairs above and below; petiole 1 cm long. Flowers, 5-merous, 6 cm across, 5-15 together in terminal cymes, bracts 3.5-6 cm across, orbicular; calyx cup 1.3 cm long, densely covered with stalked emergences and hairs, lobes obovate, 6 x 4 mm, emarginate, bristled on dorsual nerves; intersepalar emergences stellate bristly; petals 3.5 x 2.5 cm, obovate, pink; filaments 13 mm long, anthers 9 mm long, acuminate, constricted at base.

Fl. & Fr. : February-August.

Distribution: Endemic to Southern Western Ghats. *Amitha Bachan 123479* (Sholayar, riparian forests, banks of Sholayar river, 800 m).

Osbeckia muralis Naud., Ann. Sci. Nat. Bot. ser. 3, 14: 456. 1850; Sasidh. & Sivar., Fl. Pl. Thrissur For. 190. 1996; Hansen, Ginkogana 4: 41. 1977. Anil Kumar *et al.*, Fl. Pathanamthitta 223. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 298. 2009. *Osbeckia truncata* D. Don ex Wight & Arn., Prodr. 322. 1834, *p.p.*; C. B. Clarke in Hook. f., Fl. Brit. India 2: 514. 1879; Gamble, Fl. Pres. Madras 494. 1919. *Osbeckia truncata* var. *kurzii* C. B. Clarke in Hook. f., Fl. Brit. India 2: 514. 1879. **Cherkulathi.**

Woody herbs slightly angled bristy stem. Leaves opposite, petioled, elliptic-ovate, 2-4 cm long and 1-1.5 cm broad, acute at both ends; hairy. Flowers small in terminal panicles, 4-merous,, to 1.5-2 cm across, pink-purple. Calyx lobes 4, with a stellate cluster of bristles in fruit; bristles crowned on very short stalks. Petals 4, pink. Anthers short truncate at apex.

Fl. & Fr.: September –April.

Distribution: Endemic to Western Ghats. Open wet rocky areas in moist forests. *Amitha Bachan 98862* (Sholayar-Thachanthoni, wet rocks in riparian evergreen forests, banks of Sholayar river, 600 m); *Amitha Bachan 123322* (Sholayar, on wet rocks along riparian forests of Sholayar river, 700 m).

Osbeckia reticulata Bedd., Trans. Linn. Soc. London 25: 216. 1865; C. B. Clarke in Hook. f., Fl. Brit. India 2: 520. 1879; Gamble, Fl. Pres. Madras 493. 1919; Hansen, Ginkgoana 4: 115. 1977.

Shrubs, the whole plant except the petals covered with ferruginous hairs, stem terete to slightly angled at the young branches. Leaves ovate, ovate oblong, to 5 x 2 cm, obtusely acute at apex, obtuse at base, densly

tawny-bristly at both surface, bristles wooly, 7-9 ribbed. Flowers on terminal cymes, 5-merous, 2.5-3.5 cm across. Calyx tube with conspicuous tuft of bristles, simple at the base only, stalks of bristles and appendages very short, bristles wooly. Petals 5, obovate, obtuse, to 1.5 cm long, deep pink. Fruiting calyx wooly.

Fl. & Fr. : February – Januaray.

Distribution : Endemic to Southern Western Ghats. High altitude grasslands. *Amitha Bachan 98943* (Nelliyampathy, streamside vegetation near shola -grassland, stream draining to Karappara river, 1100 m)

Osbeckia virgata D. Don. *ex.* Wight. & Arn., Prodr. 1: 323. 1834; Hansen, Ginkogana 4 : 107. 1977; Manilal, Fl. Silent Valley 111. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 190. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 280. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 223. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 297. 2009. *Osbeckia octandra auct. non.* (L.) DC., Prodr. 3: 142. 1828; C. B. Clarke in Hook. f., Fl. Brit. India 2: 521. 1879; Gamble, Fl. Pres. Madras 493. 1919. *Melastoma octandra* L., Sp. Pl. 560. 1753. *Osbeckia cupularis* D. Don. *ex.* Wight. & Arn., Prodr. 1: 323. 1834.

Herbs, apressed hairy all over, stems terete or slightly angular. Leaves opposite, ovate or ovate-elliptic lanceolate, to 4 x 1.5 cm, acute at both ends, 3 ribbed from base, stellate pubescent. Flowers small, 0.6-1.5 cm across, 5-merous. Calyx lobes acute, 6 mm long, ending in a stellate tuft of bristles. Petals small, pink-purple.

Fl. & Fr. : August – December.

Distribution: Endemic to Peninsular India and Sri Lanka. In evergreen forests. *Amitha Bachan 123392* (Malakkappara, riparian evergreen forests, along banks of Sholayar river, 900 m).

Osbeckia walkeri Arn., Companion Bot. Mag. 2: 309. 1837; Hansen, Ginkogana 4: 93. 1977. *Osbeckia walkeri* (Arn.) blume, Mus. Bot. Lugduno-Batavum 1: 50. 1849. *Osbeckia walkeri* var. *bechetii* Cogn. in A. *et* C. DC., Monogr. Phan. 7: 315. 1891, *non* Triana 1872. *Osbeckia buxifolia* var. *bechetii* Trim. J. Ceylon Branch Roy. Asiat. Soc. 9: 34. 18885 nom. nud. & Fl. Ceylon 2: 196. 1894. *Osbeckia becketii* (Trim.) Alston, in Trim. Fl. Ceylon 6. Suppl. 121. 1931.

Much branched shrubs to 2 m high with more or less brownish indumentum all over; young branches densly hairy. Leaves broadly elliptic, rarely ovate, 0.8-3 x 0.6-2 cm, broadly obtuse at base, broadly obtuse to acute at apex, revolute or reflexed on margins; 3 nerved from base; apressed short-long hairy at upper side and patent, long, thin hairy underside; lines of crystalliferous cells not distinct above and absent or few beneath. Flowers 5-merous; hypanthium to 7 x 6 mm, covered with emergences and bristles or bristles only; inter sepalar emergences terete, apressed hairy, 1.5-2.5 mm long, ending in an inconspicuous tuft of short hairs, deciduous. Sepals broad, 7-8 mm long, soon narrowed into a narrowly triangular lobe with acute apex, 1 nerved, ciliate and apressed hairy dorsally, deciduous. Petals obovate, 2-2.5 cm long, pink, ciliate on outer half. Stamens 10; filaments 0.7-0.9 cm long; anthers yellow, narrowly ovate, twisted 6-9.5 mm long, beak 1-1.5 mm, pore oblique on ventral side of the apex, connective prolonged into a distinct collar with two dorsal tubercles or two smaller and two larger ventral lobes. Ovary united to half of the hypanthium cup; free part of the ovary densely covered with apressed and bulbous hairs. Fruit to 1 x 0.8 cm, as long or slightly longer than the hypanthium.

Fl. & Fr.: November-March.

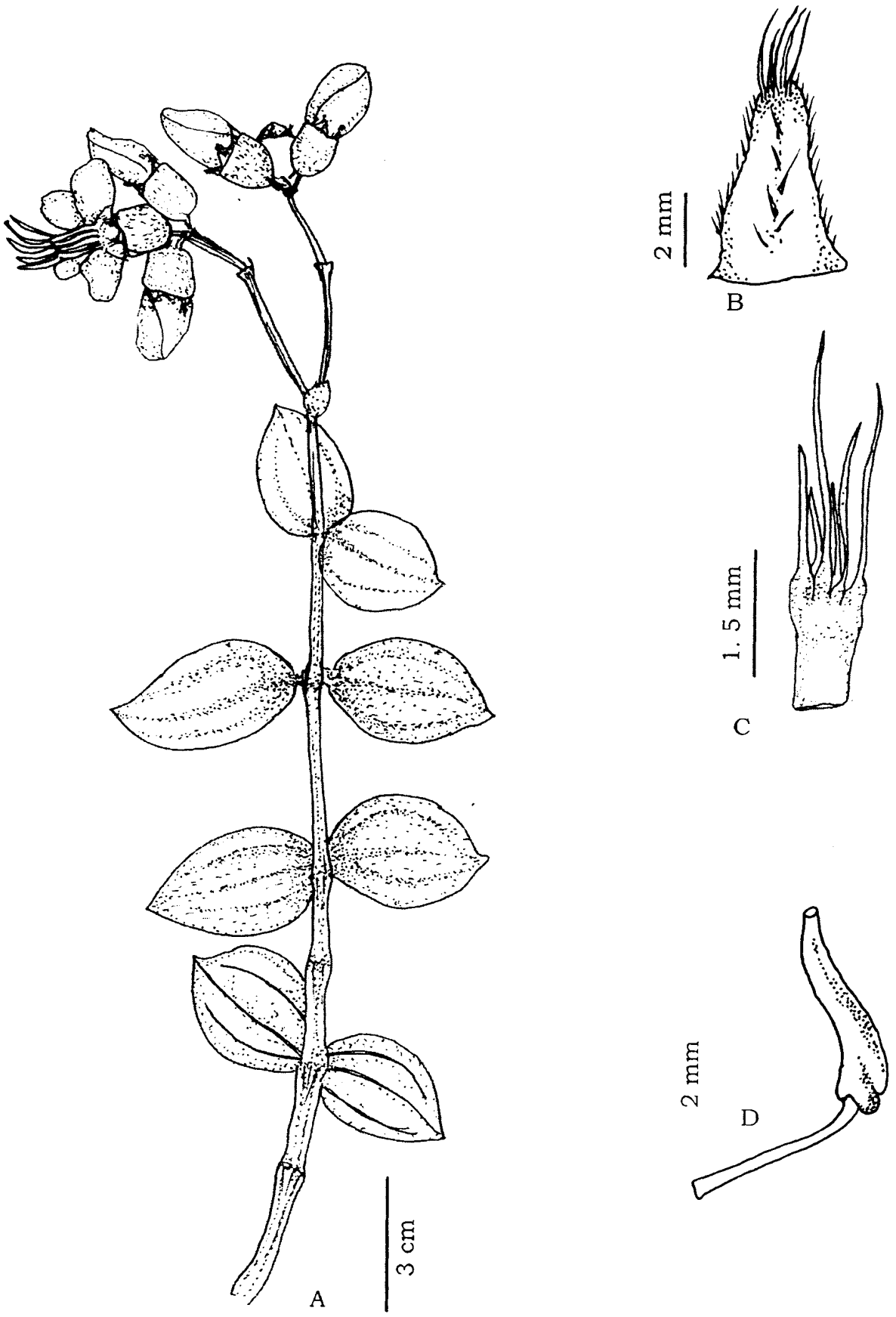


Fig. 2.3 *Osbeckia walkeri* Arn. A. Habit, B. Sepal, C. Emergence, D. Single stamen.

Distribution: Endemic to Southern Western Ghats and Sri Lanka. Wet rocky, open, streamside vegetation near grasslands *Amitha Bachan 98943* (Vengoli-Parambikulam, open streamside vegetation near grasslands, 1100 m).

Note: This is a new record for India (South India). This species was considered endemic to Sri Lanka (Hansen, 1977). The present collection extents its distribution to Southern Western Ghats.

SONERILA Roxburgh

Fl. India 1: 180. 1820, *nom. cons.*

Key to genera

1a. Anthers truncate; nerve a pair just above the base..... **S. tenera**

1b. Anthers acuminate or rostrate; penninerved..... **S. versicolor**

Sonerila tenera Royle, Illustr. Bot. Himal. 215. 1834.

Small herbs with erect and elongate glandular pilose stems. Leaves opposite, pairs slightly unequal, petioled, ovate, to 2 cm long, finely serrulate, acute to shortly acuminate at tip, acute at base, a pair of nerves from above the base; membranous. Flowers purple in scorpioid cymes, 3 merous. Calyx tube funnel-shaped; petals 3 small.

Fl. & Fr.: September – October.

Distribution: India, Himalayas, China and Philippines. Wet areas in evergreen forests. *Amitha Bachan 98718* (Nelliyampathy, along streamside vegetation in the evergreen forests in the catchments of Kuriyarkuttiyar, 1000 m).

Note: This is a new record for Kerala.

Sonerila versicolor Wight, Icon. Pl. India Orient. t. 1057. 1846, var. *versicolor*; C. B. Clarke in Hook. f., Fl. Brit. India 2: 535. 1879; Gamble,

Fl. Pres. Madras 499. 1919; Manilal, Fl. Silent Valley 113. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 193. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 284. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 224. 2005.

Small herbs with erect stems. Leaves opposite ovate, lanceolate, to 8 cm long, acute at apex, acute to subcordate at base, unequal; penninerved with 8-10 nerves on either side of the midrib; petiole to 3 cm long. Flowers small on terminal second racemes, Petals 3, pink, one side of the petal darker than other.

Fl. & Fr.: September – October.

Distribution: Endemic to Southern Western Ghats, rare. *Amitha Bachan 99034* (Orukombankutty, riparian evergreen forests, along the banks of Chalakkudy river, 450 m).

54. LYTHRACEAE J. St.-Hil.

Expos. Fam. Nat. 2: 175. 1805.

Key to genera

1a. Shrubs or trees.....2

1b. Herbs..... **Rotala**

2a. Petals 4; stamens 8; capsule irregularly dehiscing..... **Lawsonia**

2b. Petals 6; stamens numerous; capsule 3-6 valved..... **Lagerstroemia**

LAGERSTROEMIA Linnaeus

Syst. Nat. ed. 10, 2: 1068, 1076, 1372. 1759.

Key to species

1a. Petals small, to 3 mm long, white; fruits to 1.2 cm long.....
..... **L. microcarpa**

1b. Petals showy, to 4 cm long, pink; fruits to 3 cm long..... **L. speciosa**

Lagerstroemia microcarpa Wight, Icon. Pl. India Orient. t. 109. 1839; Manilal, Fl. Silent Valley 113. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 195. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 286. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 228. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 298. 2009. *Lagerstroemia lanceolata* Wall. ex C. B. Clarke in Hook. f., Fl. Brit. India 2: 576. 1879; Gamble, Fl. Pres. Madras 513. 1919. *Lagerstroemia thomsonii* Koehne in Engl., Pflanzenreich Lythraceae 257. 1903; Gamble, Fl. Pres. Madras 513. 1919. **Venthekku.**

Plate 24. F & G

Deciduous trees, to 30 m high, bark greyish-white, smooth, peeling off in thin long flakes. Leaves simple, opposite, distichous, stipulate, to 5-10 x 3.5-6.5 cm, elliptic, ovate, elliptic-lanceolate or ovate-lanceolate, base attenuate or acute, apex acute or acuminate, margin entire, glabrous and shining above, velvety pubescent beneath, chartaceous; lateral nerves 6-10 pairs, pinnate; stipules 2, intrapetiolar, deciduous; Flowers bisexual, 5-6 mm across, white, in axillary and terminal panicles; calyx smooth, lobes 6, triangular, persistent, reflexed; petals 6, to 3 mm long, obovate, white, clawed; stamens numerous, inserted at the base of calyx tube; filaments long, exserted; ovary half inferior, 4-6-celled, ovules many; style long, curved; stigma capitate. Fruit a capsule, 8-12 mm long, ovoid, 4-6-valved, dehiscent; seeds many, elongate, falcately winged, brownish.

Fl. & Fr.: November-May.

Distribution: Endemic to Western Ghats. Moist forests also along open riparian zone. *Amitha Bachan 123401* (Vazhachal, riparian forests, banks of Chalakkudy river, 200 m).

Lagerstroemia speciosa (L.) Pers., Syn. 2: 72.1806; *Munchausia speciosa* L. in Munchhausen's Der Hausvater 5 (1): 357, t.2. 1770. *Lagerstroemia reginae* Roxb., Pl. Coromandel t. 65. 1795. *Lagerstroemia flos-reginae* Retz., Obs. Bot. 5: 25.1788; C. B. Clarke in Hook. f., Fl. Brit. India 2: 577. 1879; Gamble, Fl. Pres. Madras 513. 1919. *Lagerstroemia hirsuta* (Lam.) Willd., Sp. Pl. 2: 1178. 1799; Sasidh. & Sivar., Fl. Pl. Thrissur For. 195. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 286. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 227. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 299. 2009. *Adambea hirsuta* Lam., Encycl. 1: 39. 1783. **Manimaruthu.** **Plate 24. D & E**

Medium sized trees to 25 m high. Leaves simple, opposite or subopposite to 8-25 x 4-10 cm, oblong, ovate-lanceolate to elliptic-lanceolate, obtuse at base, acute at apex, margin entire, glabrous, coriaceous; lateral nerves parallel, prominent beneath to 11-19 pairs; stipules intrapetiolar, deciduous; petiole 6-12 mm long, stout, glabrous. Flowers to 7 cm across, mauve or pink, in terminal panicles; inflorescence branches puberulous; pedicel 1 cm long; calyx tube to 1 cm, hemispherical, puberulous, ribbed without; lobes 6, triangular, acute; petals 6, 4 x 2.5 cm, obovate, clawed, margins crispate; stamens many, inserted near the base of the calyx tube; filaments exserted; ovary half inferior, sessile, glabrous, 6-celled, ovules many; style 2 cm long, curved; stigma capitate. Fruit a capsule, 18-30 mm long, ovoid, brown, woody, dehiscent; seeds 10-12 mm long, winged, pale brown.

Fl. & Fr.: February-June.

Distribution: Indo-Malaysia. Moist forests, usually seen along riverbanks. *Amitha Bachan 123432* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m).

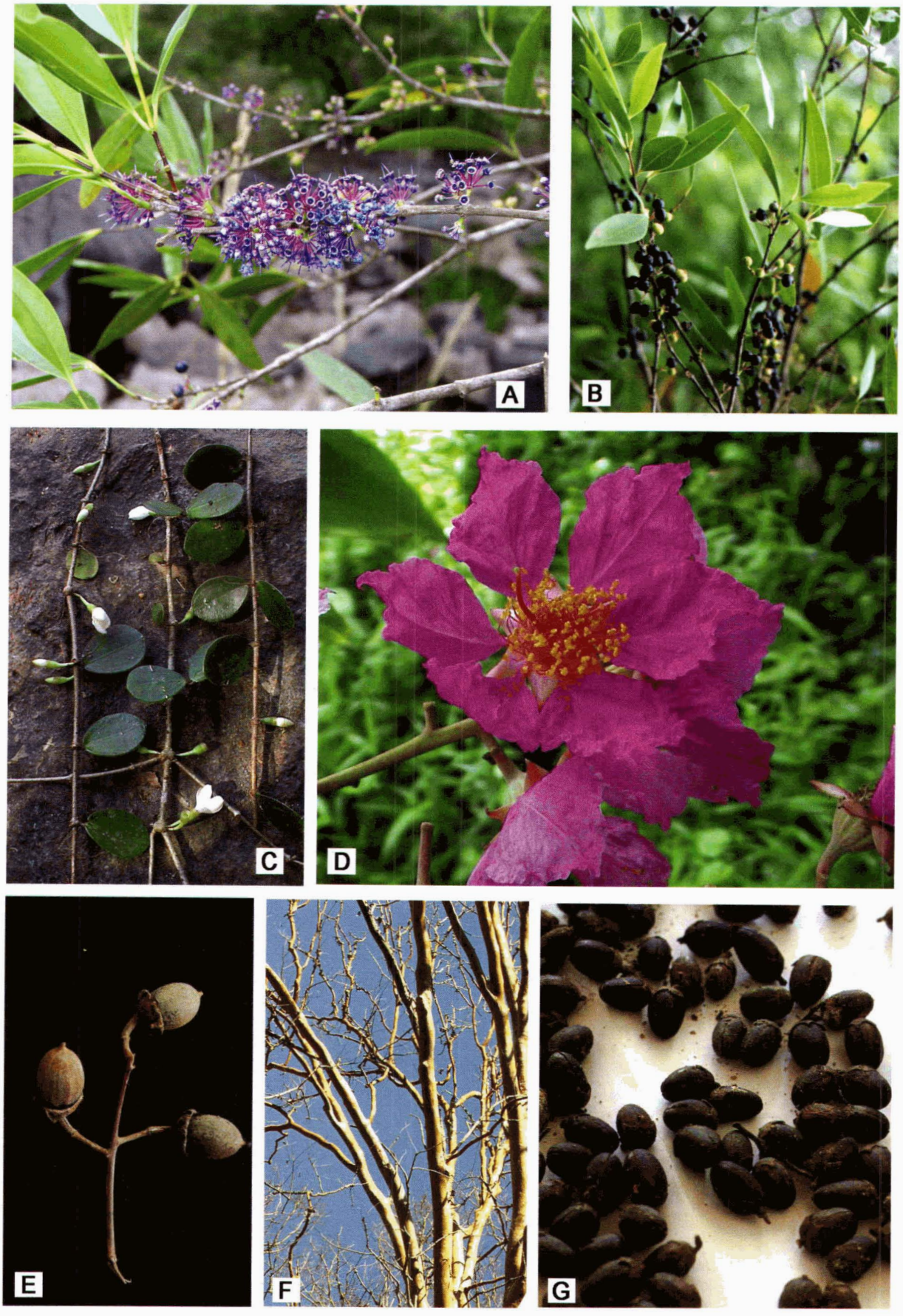


Plate 24. A-B. *Memecylon molestum* (Clarke) Cogn.; A. Inflorescence; B. Fruiting branch; C. *Medinilla beddomei* C. B. Clarke; D & E. *Lagerstroemia speciosa* (L.) Pers., D. Flower, E. Fruits; F-G. *Lagerstroemia microcarpa* Wight; F. Habit; G. Fruits;

LAWSONIA Linnaeus

Sp. Pl. 349. 1753.

Lawsonia inermis L., Sp. Pl. 349. 1753; Gamble, Fl. Pres. Madras 514. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 196. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 229. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 300. 2009. *Lawsonia alba* Lam., Encycl. 3: 106. 1789; C. B. Clarke in Hook. f., Fl. Brit. India 2: 573. 1879. **Mailanchi.**

Shrubs; bark ashy grey or brown, smooth, branchlets terete, ending in spines. Leaves 2-4.5 x 1-2 cm, elliptic to oblanceolate, base attenuate, apex acute or rounded, subsessile. Flowers in terminal cymose panicles; pedicels 2-4 mm long. Flowers 4-merous, sweet-scented, creamy white. Calyx tube 2 mm long, cupular, lobes 4, 2-3 mm long. Petals 4, 3-4 mm long, orbicular or obovate. Stamens 8; filaments 4-5 mm long, inflexed in bud. Ovary globose, 4-celled. Fruit purplish green, to 4 x 6 mm, globose, dehiscing irregularly. Seeds numerous.

Fl. & Fr.: March-June.

Distribution: Central Asia and India. Grown as hedge plant, along banks of backwater streams. *Amitha Bachan 72100* (Elanthikkara, riparian, banks of Chalakkudy river, sea level).

ROTALA Linnaeus

Mantissa Pl. 143, 175. 1771.

Key to species

1a. Flowers 4-5 merous.....2

1b. Flowers trimerous ..... **R. malampuzhensis**

2a. Capsule 2-valved..... **R. indica**

2b. Capsule 4-valved.....**R. macrandra**

Rotala indica (Willd.) Koehne in Engl., Bot. Jahrb. Syst. 1: 172. 1881; Van Leeuw., Blumea 19: 54. 1971; Gamble, Fl. Pres. Madras 508. 1919; C.D.K. Cook, Boissieva 29: 108. 1979; K.T. Joseph & Sivar. Proc. India Acad. Sci. (Pl. Sc.) 99: 184. 1989; Anil Kumar *et al.*, Fl. Pathanamthitta 228. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 305. 2009. *Peplis indica* Willd., Sp. Pl. 2: 244. 1799. *Ammannia peploides* Spreng., Syst. Veg. 1: 444. 1825; C. B. Clarke in Hook. f., Fl. Brit. India 2: 566. 1879. *Ammannia nana* Roxb., Fl. India 1: 427. 1820.

Diffuse herb; stem erect or decumbent to 35 cm long, rooting at the nodes. Leaves decussate, sessile or subsessile, to 1.5 x 1 cm, obovate-spathulate or suborbicular, cuneate or obtuse at base, acute or obtuse at apex, margins cartilaginous. Bracts dimorphic, leaf-ike on major branches, much smaller elliptic-oblong on flowering branches, which ultimately give the appearance of a bracteate spikes. Bracteoles 2, to 2 mm long, linear lanceolate. Flowers sessile, axillary, solitary. Calyx tube pink or red, turning brown, 1.5-2.5 mm long, campanulate; lobes 4, 1 mm long, triangular, appendages absent. Petals 4, pink, 0.5 mm long, elliptic. Stamens 4 or some times fewer, filaments inserted at about the middle of calyx tube. Ovary 1 mm long, ellipsoidal; style to 1 mm long; stigma capitate. Capsule ellipsoid, mm long, 2-valved. Seeds hemispherical.

Fl. & Fr.: December-April.

Distribution: Tropical Asia, naturalized in Europe, Africa and America. Waterlogged areas. Wet rock crevices and marshlands near riparian forests. *Amitha Bachan 123494* (Elanthikkara-Kanakkankadavu, muddy banks of Chalakkudy river, sea-level).

Rotala macrandra Koehne in Engl., Bot. Jahrb. Syst. 1: 176. 1880; Gamble, Fl. Pres. Madras 509. 1919; C.D.K. Cook, Boissieva 29: 54.

1979; K.T. Joseph & Sivar. Proc. India Acad. Sci. (Pl. Sc.) 99: 185. 1989; Sasidh. & Sivar., Fl. Pl. Thrissur For. 196. 1996; C.N.Sunil & Sivad., Fl. Alappuzha 298. 2009. *Ameletia rotundifolia* Wight, Icon. Pl. India Orient. t. 258. 1840.

Amphibious herbs to 30 cm tall; stem terete, creeping and rooting below, branches decumbent; aerial stem reddish tinged. Leaves variable, lower submerged leaves in whorls of 3, lanceolate and decussate becomes ovate-acute later on; aerial leaves decussate, sessile, to 2 cm across, ovate-orbicular, cordate at base, obtuse or rounded at apex, fleshy, reddish tinged. Flowers in terminal, simple or branched, bracteate spikes, monomorphic. Bracts closely imbricating, to 3 mm long, broadly ovate-acute. Bracteoles linear. Calyx tube to 1 mm long, campanulate; lobes 4, to 1 mm long, triangular-acute, pink, appendages absent. petal 4, to 2 mm long, obovate - obtuse, rose. Stamens 4, exserted, inserted at the base of the calyx tube. Ovary globose; style to 3 mm long. Capsule 1.5-2 mm across, globose, 4-valved. Seeds semi-ellipsoid.

Fl. & Fr.: October – January.

Distribution: Endemic to Peninsular India. Common in flooded paddy fields and riparian wetlands. *Amitha Bachan 123493* (Kundoor, moist riverbanks, banks of Chalakkudy river, sea level).

Rotala malampuzhensis R.V. Nair ex C.D.K. Cook, Boissiera 29: 98. 1979; K.T. Joseph & Sivar. Proc. India Acad. Sci. (Pl. Sc.) 99: 186. 1989; C.N. Sunil & Sivad., Fl. Alappuzha 306. 2009.

Tender marshy, tuft-forming herbs, stems creeping and rooting below, reddish. Leaves decussate, sessile, 1.2 x 0.4 cm, linear to lanceolate. Bracts leaf-like. Bracteoles 1 mm long, almost equalling calyx tube. Flowers axillary, solitary, sessile. Calyx tube, 1 mm long, campanulate, bright red; lobes 3, ovate-acute, appendages 3, minute.

Petals 3, small, bright red. Stamens 3, inserted above the base of the calyx tube. Nectar scales 3, prominent, linear and alternating with the stamens. Ovary globose; style very short; stigma capitate. Capsule globose, bright red, exceeding the calyx tube, opening by 3 valves. Seeds smooth, red, sub-ovoid,.

Fl. & Fr.: July – September.

Distribution: Endemic to Costal plains of Kerala, Banks of streams. *Amitha Bachan 123492* (Elanthikkara, riparian sandy marshes, along Chalakkudy river, sea level).

55. ONAGRACEAE Juss.

Gen. Pl. 317. 1789.

LUDWIGIA Linnaeus

Sp. Pl. 118. 1753 ('*Ludvigia*'); Corr. Linnaeus, Gen. ed. 5, 55. 1754.

Key to species

1a. Plants prostrate; adventitious roots present; leaves obtuse at apex; petals white..... **L. adscendens**

1b. Plants erect to semi erect; adventitious roots absent; leaves acute or acuminate at apex; petals yellow.....2

2a. Stems and leaves pubescent to villous.....**L. peruviana**

2b. Stems and leaves glabrous.....3

3a. Stems woody below; stamens 8..... **L. linifolia**

3b. Stems herbaceous; stamens 4.....4

4a. Stems winged; capsules 4-angular..... **L. prostrata**

4b. Stems not winged; capsules terete..... **L.perennis**

Ludwigia adscendens (L.) Hara, J. Jap. Bot. 28: 290. 1953; Raven in Reinwardtia 6: 387. 1963; Paul in Bull. Bot. Surv. India 40: 17. 1998. Anil Kumar *et al.*, Fl. Pathanamthitta 230. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 310. 2009; I.C. Barua, Rheedea 20: 60. 2010. *Jussiaea adscendens* L., Mantissa Pl. 1: 69. 1767. *Jussiaea repens* L., Sp. Pl. 1: 388. 1753, non *Ludwigia repens* Forst. 1771; C. B. Clarke in Hook. f., Fl. Brit. India 2: 587. 1879; Gamble, Fl. Pres. Madras 516. 1919. **Plate 25.A**

Aquatic floating herbs with spongy aerophores; stem reddish cylindrical, rooting at nodes. Leaves obovate to oblanceolate, 1.5-3 x 0.5-1.2 cm, attenuate at base, obtuse at apex, lower surface glossy. Flowers white, solitary, axillary, to 4 cm across. Calyx tube 1 cm long, pubescent; lobes 5, narrow-lanceolate. Petals 5, obovate, emarginate or rounded at apex, cream or white with a yellowish blotch inside. Stamens 10; filaments subequal. Ovary 5-locular; ovules many. Capsule terete, to 2.5 cm long, 10-ribbed.

Fl. & Fr. : Throughout the year.

Distribution : Continental Asia, Malaysia and Australia. *Amitha Bachan 123647* (Chalakkudy, wetlands and riversides, banks of Chalakkudy river, 5 m).

Ludwigia linifolia (Vahl) R.S. Rao, Fl. Goa, Diu, Daman & Nagarhaveli 1: 179. 1985; Poul in Bull. Bot. Surv. India 40: 17. 1998; I.C.Barua, Rheedea 20: 61. 2010. *Jussiaea linifolia* Vahl, Ecolg. Amer. 2: 32. 1798, non Poir. 1813. Gamble, Fl. Pres. Madras 1875. 1936. *Jussiaea hyssopifolia* G. Don, Gen. Hist. 2: 693. 1832. *Jussiaea fissendocarpa* Haines in J. Asiat. Soc. Bengal 15: 314. 1919. *Ludwigia hyssopifolia* (G. Don) Exell, Garcia de Orta 5: 471. 1957; Sasidh. & Sivar., Fl. Pl. Thrissur For. 197. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 230. 2005; C. N.

Sunil & Sivad., Fl. Alappuzha 311. 2009. *Fissendocarpa linifolia* (Vahl) Bennet, Journ. Bombay Nat. Hist. Soc. 67: 126. 1970.

Annual erect subshrubs, well branched, branchlets angled or winged, woody below. Leaves elliptic-lanceolate, to 1.5-8 x 1-2.5 cm, cuneate at base, glabrous, membranous. Flowers solitary, axillary. Petals 4, yellow, obovate; stamens 8; ovary quadrangular, 4-loculed, glabrous; Capsule terete, to 2 x 0.2 cm; seeds dimorphic, upper ones larger.

Fl. & Fr. : June-November.

Distribution: India, Sri Lanka to SE Asia, N. Australia, Pacific Islands, Tropical America and W. Africa. *Amitha Bachan 117687* (Orukombankutty, river bed, along Chalakkudy river, 400 m).

Ludwigia perennis L., Sp. Pl. 119. 1753; Raven in Reinwardtia 6: 367. 1963; Paul in Bull. Bot. Surv. India 40: 19. 1998. N. Mohanan & Sivad., Fl. Agasthyamala 288. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 231. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 311. 2009; I.C.Barua, Rheedea 20: 65. 2010. *Ludwigia parviflora* Roxb., Fl. India 1:440.1820; C. B. Clarke in Hook. f., Fl. Brit. India 2:588.1879; Gamble, Fl. Pres. Madras 517.1919. *Jussiaea perennis* (L.) Brenan, Kew Bull. 8: 163. 1953.

Erect herbs to 40 cm. Leaves elliptic-lanceolate or linear-lanceolate, 1.5-5 x 0.5-1.5 cm, attenuate at base, acute to acuminate at apex, glabrous. Flowers sessile, 4-merous. Calyx tube adnate to ovary; lobes 4, 2 mm long, ovate acuminate. Petals yellow, 4-5 mm long, elliptic. Stamens 4. Ovary 1-1.5 cm long, linear, 4-celled, 4-angled. Ovules many. Capsule linear, subterete, 1-2 cm long, 4-ribbed. Seeds ellipsoid, in many rows in each locule.

Fl. & Fr. : Throughout the year.

Distribution : Tropical Africa, Asia and Australia. *Amitha Bachan 123307* (Sholayar-Vavalala, open rocky riverbed, banks of Sholayar river, 700 m).

Ludwigia peruviana (L.) H. Hara, J. Jap. Bot. 28: 293. 1953; Raven in Reinwardtia 6: 387. 1963; Paul in Bull. Bot. Surv. India 40: 17. 1998. Manilal, Fl. Silent Valley 114. 1988; I.C. Barua, Rheedea 20: 66. 2010. *Jussiaea peruviana* L., Sp. Pl. 388. 1753. *Jussiaea speciosa* Ridley, J. Bot. 59. 1921; Gamble, Fl. Pres. Madras 1875. 1936. **Plate 25. B & C**

Erect herbs to 1.5 m tall, branchlets hirsute, stem cylindric hollow. Leaves lanceolate or ovate-lanceolate, 4 x 1.5 cm, acuminate at apex, cuneate at base, hairy; petiole to 1 cm long. Flowers yellow, axillary, solitary to 3 cm across, on upper leaf axils. Sepals ovate, 1.2 cm, long cuspidate, brown tomentose. Petals 4, shortly clawed, yellow to 1.5 2 cm. Stamens as many as number of calyx lobes. Capsule sharply quadrangular, to 1 cm long, brown tomentose, opening irregularly. Seeds smooth in many rows.

Fl. & Fr. : January – June.

Distribution : Native of America, now naturalized in the old world. *Amitha Bachan 99133* (Vazhachal-Poringal, open riverbeds, streamside and riparian forests, banks of Chalakkudy river, 240 m).

Ludwigia prostrata Roxb., Fl. India 1: 441. 1820; C. B. Clarke in Hook. f., Fl. Brit. India 2: 588. 1879; Gamble, Fl. Pres. Madras 517. 1919; Raven in Reinwardtia 6: 374. 1963; Paul in Bull. Bot. Surv. India 40: 19. 1998; C. N. Sunil & Sivad., Fl. Alappuzha 312. 2009; I. C. Barua, Rheedea 20: 68. 2010.

Annual semi-erect herbs; 20-60 cm tall, red tinged; branchlets angled and slightly winged. Leaves elliptic to lanceolate, 2-6 x 0.8-2.5 cm, attenuate at base, acute or acuminate at apex, glabrous or slightly

adpressed hairy beneath; petiole to 1 cm long. Flowers 5-7 mm across, in the upper leaf axils, solitary or clusters of 2-10 together, subsessile. Sepals 4, ovate-lanceolate, 0.2 cm long, margin ciliate, acute, persistent. Petals yellow, oblanceolate or narrowly spathulate, 3 cm long, cuneate at base, acute at apex, 1-nerved. Stamens 4; filaments 1 mm long, yellow. Ovary linear, 4-angled, 7 mm, hirsute. Capsule linear, 2 x 0.15 cm, curved, 4-angled, pale brown, thin-walled. Seeds in one row in each locule, 0.5 mm long, ovoid, pale pink, transversely striped with fine brown lines.

Fl. & Fr. : June – December.

Distribution : India, China, Sri Lanka and South East Asia. *Amitha Bachan 123449* (Vazhachal, river beds or riverbanks, banks of Chalakkudy river, 230 m).

56. **PASSIFLORACEAE** Juss. ex Kunth

in Humboldt *et al.*, Nov. Gen. Sp. 2, ed. 4. 126 [& ed. f. 100]. 1817.

ADENIA Forssk.

Adenia hondala (Gaertn.) de Wilde, Blumea 15: 265. 1967; Rao *et al.*, J. Econ. Tax. Bot. 11: 243. 1987; Sasidh. & Sivar., Fl. Pl. Thrissur For. 197. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 289. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 232. 2005. *Granadilla hondala* Gaertn., Fruct. 2: 480. t.180. f.10. 1791. *Adenia palmata* (Lam.) Engl., Bot. Jahrb. Syst. 14: 375. 1892; Gamble, Fl. Pres. Madras 525. 1919. *Modecca palmata* Lam., Encycl. 4: 209. 1797; Mast. in Hook. f., Fl. Brit. India 2: 603. 1879. **Karimuthukku, Penkolli.**

Scandent tendril bearing climbers with tuberous rootstock, glabrous. Leaves palmately 3-4 lobed, lobes elliptic, acute at apex, entire, 14-20 x 18-22 cm; petiole to 8 cm. Calyx campanulate, 1 cm long, lobes

minute; Petals greenish-yellow, linear lanceolate; attached to the base calyx tube; anthers long, filaments forming a cup below. Capsule 5 cm long.

Fl. & Fr. : July-August.

Distribution. : Endemic to the Western Ghats and Sri Lanka. Evergreen forest, riverbanks. *Amitha Bachan 117614* (Malakkapara, riparian evergreen forest, banks of Sholayar river, 800 m).

PASSIFLORA Linnaeus

Sp. Pl. 955. 1753

Passiflora foetida L., Sp. Pl. 959. 1753, var. **foetida**; Gamble, Fl. Pres. Madras 524. 1919; Manilal, Fl. Silent Valley 114. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 198. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 289. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 233. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 314. 2009. **Poochapazham.**

Glandular-hispid herbaceous vines. Leaves roughly to deeply 3-5-lobed, suborbicular to ovate, cordate at base, to 6 x 4.5 cm, lobes acuminate, glandular-pubescent. Petiole to 1.5 cm long. Stipules deeply dissected. Bracts and bracteoles deeply pinnatisect. Flowers 3-4 cm across, axillary or often solitary. Calyx lobes 5, 1-0.7 cm, broadly ovate. Petals white, shorter than calyx lobes. Coronal segments in 2 whorls; outer coronal hairs many, to 1 cm long; inner ones 2-3 mm long. Gynandrophore 5 mm long. Stamens 5. Ovary 1-celled; ovules many; styles 3; stigma capitate. Berries to 2 cm across, yellow, subglobose, subtended by the bracts and bracteoles. Seeds many.

Fl. & Fr. : November – March.

Distribution : Native of tropical America, now naturalized in India, China and Africa. Moist forests. *Amitha Bachan 117631* (Kottat-Chalakkudy, riparian vegetation, banks of Chalakkudy river, 10 m).

Passiflora leschenaultii DC., Prodr. 3: 326. 1828; Mast. in Hook. f., Fl. Brit. India 2: 599. 1879; Gamble, Fl. Pres. Madras 524. 1919; Manilal, Fl. Silent Valley 115. 1988.

Twining tendril bearing vines. Leaves, semi-orbicular, trilobed, rounded at base, glandular beneath; stipule slender or leafy. Flowers white, calyx tube fleshy, lobes-5. Petals 5, inserted on the throat of the calyx. Corona tinged light pink-purple. Berry yellowish, ovoid.

Fl. & Fr. : March-May.

Distribution: Endemic to Peninsualr India. Evergreen and Shola forests. *Amitha Bachan 117651* (Nelliyampathy, streamside vegetation, stream draining from shola vegetation, 1100 m).

57. CUCURBITACEAE Juss.

Gen. Pl. 393. 1789.

MUKIA Arnott

Madras J. Lit. Soc. 17 : 50. 1840.

Mukia maderaspatana (L.) Roem., Syn. Monogr. 2: 47. 1846; Sasidh. & Sivar., Fl. Pl. Thrissur For. 204. 1996 Anil Kumar *et al.*, Fl. Pathanamthitta 236. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 323. 2009. *Cucumis maderaspatanus* L., Sp. Pl. 1012. 1753. *Bryonia cordifolia* L., Sp. Pl. Pl. 1012. 1753. *Bryonia scabrella* L. f., Suppl. Pl. 424. 1781. *Mukia scabrella* (L. f.) Arn. in Hooker's J. Bot. 3: 276. 1841; Clarke in Hook. f., Fl. Brit. India 2: 623. 1879. *Melothria maderaspatana* (L.) Cogn. in A. & C. DC., Monogr. Phan. 3: 623. 1881; Gamble, Fl. Pres. Madras 539. 1919. **Mukkappeera.**

Slender scandant or prostrate herbs; tendrils simple; stem coarsely scabrous. Leaves ovate, to 10 x 7 cm, cordate at base; entire or shallowly 5-lobed; spineus serrate, densely scabrous from peltate tubercles; petiole 6 cm long. Flowers monoecious; Male flowers 8-12 together, 4 mm across, yellow, fascicled; pedicel 6 mm long; calyx densely hairy outside, lobes subulate; petals obovate, 2.5 mm long, yellow; anthers 1 mm long, subsessile, connective apiculate. Female flowers solitary or 2-3 together. Berry small, globose, 1 cm across; seeds obovate, 5 x 3 mm, yellowish white, rugose.

Fl. & Fr. : Throughout the year.

Distribution: Paleotropics. Forests to lower plains. *Amitha Bachan 117733* (Kanakkankadavu, riparian vegetation, banks of Chalakkudy river, sea level).

58. BEGONIACEAE C. Agardh,

Aphor. Bot. : 200. 1824.

Key to the species

1a. Scapigerous herbs; leaves orbicular.....**B. floccifera**

1b. Sub-shrubs with thick jointed leafy stem; leaves unequally ovate cordate.....**B. malabarica**

Begonia floccifera Bedd., Icon. L. Ind. Oriant. t. 11. 1868-1874; Clarke in Hook. f., Fl. Brit. India 2: 654. 1879; Gamble, Fl. Pres. Madras 546. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 207. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 295. 2002. **Kal-thamara**. **Plate 25. F & G**

Stem rhizomatous. Leaves alternate, cauline, to 12 x 20 cm, broader than long, orbicular-cordate, dentate or subentire, subcoriaceous, densely yellowish-white, tomentose on both sides when young, becoming glabrescent except the nerves beneath, greenish above

and dull white below, 7-9-nerved from base; petiole to 15 cm long, brown tomentose; stipules ovate, long cuspidate, membranous. Flowers small to 5 mm across, pink, in compound cymes, peduncles to 30 cm long. Tepals 2 in male flowers, orbicular, 8 mm across, stamens many. Capsule to 1.8 x 1.5 cm, 3-winged.

Fl. & Fr. : January – February.

Distribution: Endemic to Southern Western Ghats. Evergreen forests, rocky wet stream sides. *Amitha Bachan 98958* (Karappara-Nelliyampathy, riparian vegetation, banks of Karappara river, 900 m).

Begonia malabarica Lam., Encycl. 1: 393. 1785; Clarke in Hook. f., Fl. Brit. India 2: 655. 1879; Gamble, Fl. Pres. Madras 546. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 207. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 295. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 239. 2005. *Diploclinium dipetala* Wight, Icon. Pl. India Orient. t. 1813. 1852.

Kal-thamara. **Plate 25. D & E**

Perennial herbs, to 1 m tall, stem fleshy, hairy when young, all parts reddish. Leaves to 18 x 5 cm, lanceolate, acute or acuminate, base unequally cordate, margin serrate-dentate, membranous, spiculate along the upper surface, , 4 or 5-nerved from base; petiole to 3.5 cm; stipule lanceolate, 8 x 2 mm. Inflorescence terminal to axillary, few flowered corymbs. Flowers pink, in axillary cymes. Tepals 1 cm across. Capsule 1.8 x 1.5 cm, 3-winged.

Fl. & Fr. : December-April.

Distribution: Endemic to Peninsular India and Sri Lanka. Evergreen and semi evergreen forests, wet rocky streamside. *Amitha Bachan 98960* (Karappara-Nelliyampathy, riparian vegetation, banks of Karappara river, 900 m).

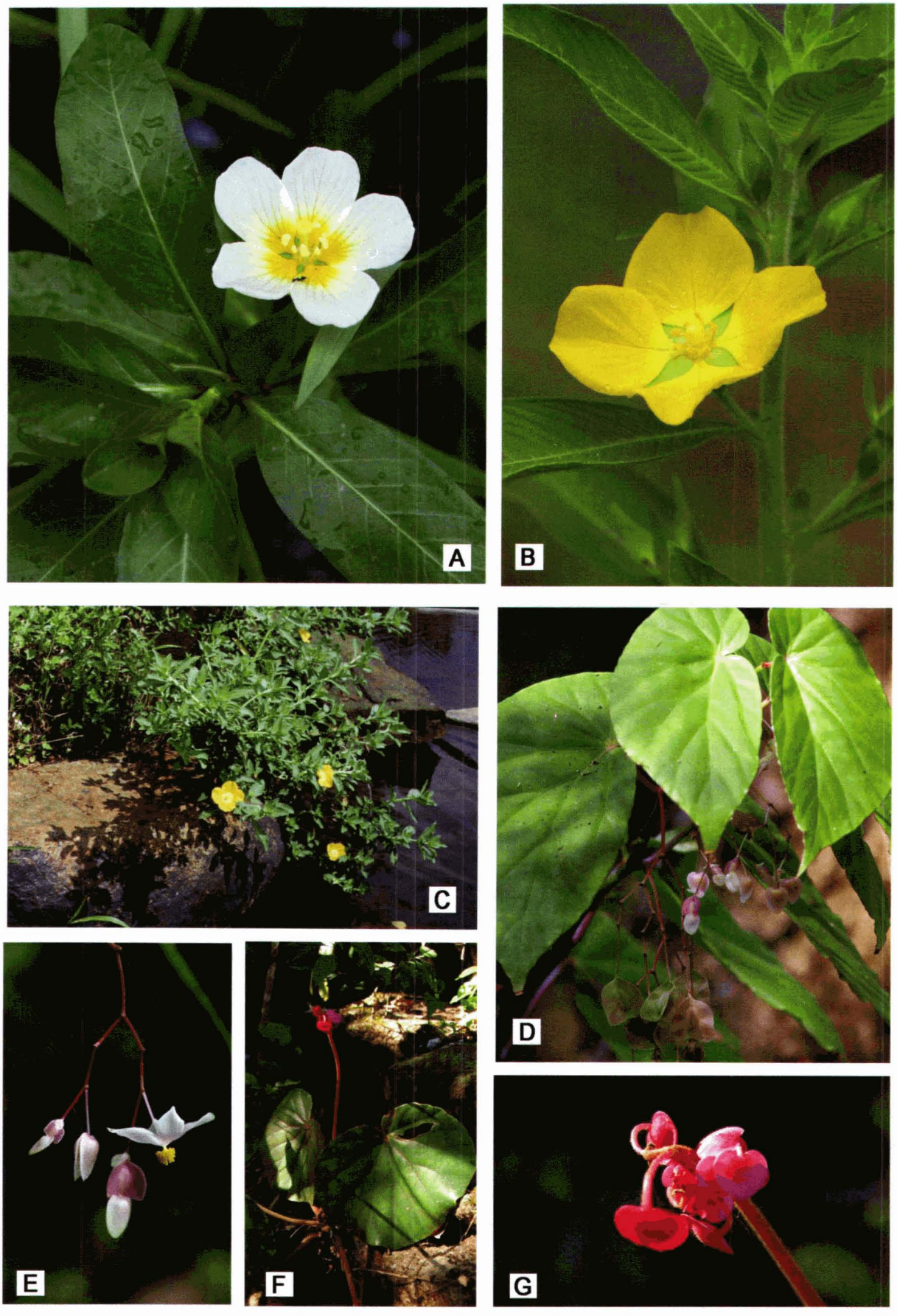


Plate 25. A. *Ludwigia adscendens* (L.) Hara; B & C. *Ludwigia peruviana* (L.) H. Hara (Vahl) R.S. Rao, B. Flower, C. Habit; D & E. *Begonia malabarica* Lam., D. Habit, E. Flower; F-G. *Begonia floccifera* Bedd., F. Habit, G. Flower.

59. DATISCACEAE R. Brown ex. Lindl.360

Intr. Nat. Syst. Bot. 109. 1830.

TETRAMELES R. Brown

Observ. Pl. Denham & Clapperton 230. 1826.

Tetrameles nudiflora R. Br. in Bennett, Pl. Jav. Rar. 79. t. 17. 1838; Hook. f., Fl. Brit. India 2: 627. 1879; Gamble, Fl. Pres. Madras 544. 1919; Sasidh. & Sivar., Fl. Pl. Thrissur For. 208. 1996. N. Mohanan & Sivad., Fl. Agasthyamala 293. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 239. 2005. *Tetrameles grahamiana* Wight, Icon. Pl. India Orient. t. 1956. 1853. **Cheeni.** **Plate 26. A-C**

Buttressed large deciduous dioecious trees to 45 m high; buttresses to 2-3 m. Leaves simple, alternate, exstipulate, crowded at the apex of branchlets broadly ovate, to 20 x 10 cm, cordate at base, acute-acuminate at apex, glandular-serrate, coriaceous; nerves 3-5 from base, palmate, lateral nerves 4-9 pairs; petiole to 12 cm long, slender, tomentose. Flowers unisexual, yellowish-green; male flowers subsessile, in pubescent panicles; 4 mm across, calyx tube very short; lobes 4, ovate, united at base; petals absent; stamens 4, opposite the calyx lobes, inserted around a flat central disc. Female flowers sessile, in spicate pendulous panicles; 4 x 3 mm; calyx connate with the ovary, tetragonous; lobes 4, short; petals absent; staminodes absent; ovary 1-celled, ovules numerous. Capsule, 5-6 mm long, crowned by persistent calyx segments, opening at top; seeds minute, brown.

Fl. & Fr. : March – May.

Distribution : Paleotropics. Moist forests, along on rocky riparian area *Amitha Bachan 123354* (Vazhachal, riparian and rocky stream banks, along the banks of Chalakkudy river, 200 m).

60. MOLLUGINACEAE Hutch.

Fam. Fl. Pl. 1: 128. 1926.

Key to genera

1a. Staminodes present; seeds with a pair of hilar appendages.....**Glinus**

1b. Staminodes absent; seeds without hilar appendages.....**Mollugo**

GLINUS Linnaeus

Sp. Pl. 463. 1753.

Glinus oppositifolius (L.) A. DC., Bull. Herb. Boissier ser. 2, 1: 559. 1901; Backer in Steenis, Fl. Males. 1. 4: 270. 1951; Sivar., J. Taiwan Mus. 41: 82. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 208. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 240. 2005. C. N. Sunil & Sivad., Fl. Alappuzha 330. 2009. *Mollugo oppositifolia* L., Sp. Pl. 89. 1753; Gamble, Fl. Pres. Madras 552. 1919. *Mollugo spergula* L., Syst. Nat. (ed. 10) 881. 1759; C. B. Clarke in Hook. f., Fl. Brit. India 2: 662. 1879. **Kaippujeerakam.**

Diffuse or prostrate herbs; glabrous or sparsely pubescent. Leaves simple, opposite in whorls of 3-5, unequal, obovate-spathulate to 0.6-1.8 x 0.3-0.7 cm, attenuate at base, obtuse or acute at apex, subsessile. Flowers white in axillary, 5-8-flowered fascicles; pedicel to 1.4 cm. Tepals 5, oblong, to 0.5 x 0.3 cm, with green central stripe, broad thin white or hyaline margins, apex obtuse or acute, spreading at anthesis; stamens 5, often alternating with linear, bifid staminodes; anthers oblong; ovary ellipsoid, 3-celled; ovules many; styles 3, recurved; stigmas capitate. Capsule 0.3 cm long, oblong, 3-loculed, enclosed in erect calyx. Seeds ovoid, curved, tubercled, dark reddish brown, with a pair of unequal green hilar appendages.

Fl. & Fr. : February -April

Distribution : Pantropical. Along stream and lake banks, river beds. *Amitha Bachan 99132* (Poringalkuthu, river bed, along Chalakkudy river, 275 m).

MOLLUGO Linnaeus

Sp.Pl. 89.1753.

Mollugo pentaphylla L., Sp. Pl. 89. 1753; Gamble, Fl. Pres. Madras 553. 1919; Backer in Steenis, Fl. Males. 1. 4: 268. 1951; Sivar. & Usha, Taxon 32: 125. 1983; Sivar. J. Taiwan. Mus. 41: 86. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 209. 1996; Mohanan & Sivad., Fl. Agasthyamala 296. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 241. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 333. 2009. *Mollugo stricta* sensu C. B. Clarke in Hook. f., Fl. Brit. India 2: 663. 1879 *p.p.*, *non* L. 1762.

Herbs, ascending. Leaves lower ones in rosette, upper ones in whorls of 2-6, unequal, obovate to oblong-lanceolate, 1.5-3 x 0.6-1 cm, attenuate at base, subacute or obtuse at apex, glabrous. Flowers axillary and sub-terminal corymbose panicles. Pedicels filiform to 0.8 cm long. Tepals 5, 2-3 mm long, elliptic-oblong, obtuse, green with white scarious margins, somewhat accrescent in fruit; stamens 3-5; ovary ovoid, 2 mm long, 3-5-celled; ovules many; styles 3-5. Capsules 2-2.5 mm across, ovoid, membranous; seeds many, reniform, areolate, reddish brown.

Fl. & Fr.: July – September.

Distribution: Pantropical. banks of streams. *Amitha Bachan 72093* (Vazhachal, banks of Chalakkudy river, 230 m).

61. APIACEAE Lindl.

Intr. Nat. Syst. Bot. ed. 2: 21. 1836

UMBELLIFERAE, *nom. alt.*

Key to Genera

1a. Leaves 9-lobed; flowers 20-30 together, pedicelled..... **Hydrocotyle**

1b. Leaves not lobed; flowers 2-5 together, sessile..... **Centella**

CENTELLA Linnaeus

Sp. Pl. ed. 2, 1393. 1763.

Centella asiatica (L.) Urban in Mart., Fl. Bras. 11:287. t.78. f. 1879; Gamble, Fl. Pres. Madras 556. 1919; Manilal, Fl. Silent Valley 124. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 209. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 297. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 241. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 336. 2009. *Hydrocotyle asiatica* L., Sp. Pl. 234. 1753; Clarke in Hook. f., Fl. Brit. India 2: 669. 1879. **Kodangal.**

Small herbs with tuberous roots and running stem. Stem terete, glabrous. Leaves orbicular reniform, lamina to 6 cm across, sharply serrate; petiole to 12 cm long, sheathing at base. Flowers sessile, pink, 1 mm across in 2-5 flowered umbels; calyx 5-toothed; petals 5, white, broadly ovate, cuspidate at apex with a strong midrib; stamens 5, erect; ovary 2-celled, style 2-fid. Fruit 3-4 mm, ovoid, obtuse, to 9 ridged, brown.

Fl. & Fr. : Throughout the year

Distribution : Tropical Asia and Africa. Wet places form lower to higher elevations. *Amitha Bachan 72091*(Vazhachal, riparian forest floor, banks of Chalakkudy river, 220 m).

HYDROCOTYLE Linnaeus

Sp. Pl. 234. 1753.

Hydrocotyle javanica Thunb., Diss. Hydroc. n. 17. t. 2. 1798; Clarke in Hook. f., Fl. Brit. India 2: 667. 1879; Gamble, Fl. Pres. Madras 556. 1919; Manilal, Fl. Silent Valley 125. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 210. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 298. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 242. 2005. *Hydrocotyle hispida* Buch.-Ham ex D. Don, Prodr. Fl. Nepal. 182. 1825. *Hydrocotyle polycephala* Wight & Arn., Prodr. 366. 1834.

Creepers, rooting at nodes, stem villous. Leaves 9-lobed, 9-ribbed from base, obtuse, villous, crenate. Umbels fascicled; peduncles 1.5 cm long. Flowers 20-30 together, pedicellate; petals 0.6 mm long, ovate, acute. Fruit 1.5 x 2 mm, mericarps compressed, hemispherical, smooth.

Fl. & Fr. : October-May.

Distribution: Tropical Asia and Australia. Stream banks in evergreen forests. *Amitha Bachan 123664* (Nelliyampathy, riparian forests, banks of Karappara river, 800 m).

62. ARALIACEAE Juss.

Gen. Pl. 217. 1789.

SCHEFFLERA J. R. Forster & G. Forster

Charact. Gen. 45. 1776.

Schefflera venulosa (Wight & Arn.) Harms in Engl. & Prantl, Naturl. Pflanzenfam. 3(8): 39. 1894; Gamble, Fl. Pres. Madras 570. 1919;

Manilal, Fl. Silent Valley 128. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 212. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 243. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 337. 2009. *Paratropia venulosa* Wight & Arn., Prodr. 377. 1834. *Heptapleurum venulosum* (Wight & Arn.) Seem., J. Bot. 3: 80. 1865; Clarke in Hook. f., Fl. Brit. India 2: 729. 1879. **Unga-Valli.**

Spreading and climbing shrubs or small trees, some times epiphytic at earlier stages, branchlets like woody climbers. Leaves palmately compound, 5 or 6 foliolate; leaflets to 16 x 8 cm, ovate-oblong, abruptly acuminate, rounded at base; petiolule 7-10 cm long; stipule 5 mm broad, black. Panicles 20 cm across, glabrous; umbels 2 cm across, to 12 flowered. Flowers brown; pedicel to 12 mm long; calyx truncate; petals 2 x 2.5 mm, triangular. Berry 4 x 4 mm, globose, 5-angled.

Fl. Fr. : March – June.

Distribution: India, Myanmar and Indo-China. Evergreen forests and sacred groves. *Amitha Bachan 123616* (Vazhachal, riparian forests, banks of Chalakkudy river, 200 m).

63. RUBIACEAE Juss.

Gen. Pl. 196. 1789.

Key to genera

1a. Flowers in globose heads.....2

1b. Flowers not in globose heads.....5

2a. Corolla lobes valvate; bracts present.....3

2b. Corolla lobes imbricate; bracts absent.....4

3a. Leaves cordate at base; calyx cupular.....**Haldina**

3b. Leaves not cordate at base; calyx truncate.....**Mitragyna**

4a. Seeds winged.....**Neonauclea**

4b. Seeds not winged.....18

5a. Ovules 2 or more in each locule of the ovary.....6

5b. Ovules in 1 each locule of the ovary.....11

6a. Corolla lobes valvate.....7

6b. Corolla lobes twisted..... .19

7a. Calyx lobe unequal, one enlarged, petalloid.....**Mussaenda**

7b. Calyx lobes equal.....8

8a. Fruit a fleshy berry.....**Mycetia**

8b. Fruit a dehiscent capsule.....9

9a. Capsule obcordate; calyx lobes 5; flowers in scorpioid cymes.....
.....**Ophiorrhiza**

9b. Capsule otherwise; calyx lobes 4; flowers not in scorpioid cymes.....10

10a. Seeds with a ventral cavity .....**Neanotis**

10b. Seeds without a ventral cavity.....17

11a. Corolla lobes valvate.....13

11b. Corolla lobes twisted.....16

13a. Erect or creeping herbs.....**Spermacoce**

13b. Shrubs or trees.....14

14a. Corolla tube with a transverse row of deflexed hairs inside.. **Psydrax**

14b. Corolla tube not with a transverse row of deflexed hairs inside....15

15a. Ovules basal.....20

15b. ovules on the septum ..... **Prismatomeris**

16a. Stigma 2.....**Ixora**

16b. Stigma 1.....**Pavetta**

17a. Capsule few seeded..... **Hedyotis**

17b. Capsule many seeded..... **Oldenlandia**

18a. Calyx tube fused into a fleshy mass ..... .**Ochreinauclea**

18b. Calyx tube not fused into a fleshy mass.....**Neolamarckia**

19a. Shrubs; leaves <4cm wide, acute or acuminate at apex .....**Tarenna**

19b. Trees; leaves >4 cm wide, obtuse or round at apex..... **Tamilnadia**

20a. Corolla tube curved.....**Chassalia**

20b. Corolla tube not curved..... **Psychotria**

CHASSALIA Commerson ex Poiret

in Dict. Sc. Nat. 8: 198. 1817.

Chassalia curviflora (Wall. ex Kurz) Thwaites var. **ophioxyloides** (Wall.) Deb & Krishna, Bull. Bot. Surv. India 24: 222. 1982(1983); Sasidh. & Sivar., Fl. Pl. Thrissur For. 218. 1996. *Psychotria ophioxyloides* Wall. in Roxb., Fl. India 2: 167. 1824. *Chassalia ophioxyloides* (Wall. ex Kurz) Craib, Gard. Bull. Straits Settlem. 6:474.1930; Manilal, Fl. Silent Valley 131. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 310. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 249. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 344. 2009. **Vellakurinji.**

Subshrubs to 1.5 m high. Leaves simple, opposite, oblanceolate, 8-18 x 3-8 cm, caudate acuminate or acuminate at apex, attenuate at base; petiole 1-3 cm long, stipule 2-fid, connate, ovate, membraneous. Cymes terminal, panicled, 8 x 4 cm, glabrous. Flowers 1.5 cm long, subsessile; calyx ovate, 5-lobed, 0.1-0.2 cm long, globose; corolla curved,

0.8cm long, lobes ovate, obtuse, white-pink; stamens 5, included; anthers linear. Ovary 2-celled, ovule one in each cell, basal; style 2-fid at apex. Fruit 6 mm across, globose, glabrous, 2-seeded.

Fl. & Fr. : January-April.

Distribution: Indo-Malaysia. Moist forests from high elevations to lowers plains. *Amitha Bachan 72019* (Vazhachal, riparian forest undergrowth, banks of Chalakkudy river, 230 m).

HALDINA Ridsdale

Blumea 24: 360. 1978.

Haldina cordifolia (Roxb.) Ridsd., Blumea 24: 361. 1978; Sasidh. & Sivar., Fl. Pl. Thrissur For. 219. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 312. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 250. 2005. *Nauclea cordifolia* Roxb., Pl. Coromandel t. 53. 1796. *Adina cordifolia* (Roxb.) Hook. f. ex Brand., For. Fl. 263. t.33. 1874; Hook. f., Fl. Brit. India 3: 24. 1880; Gamble, Fl. Pres. Madras 584. 1921. **Manjakadambu.**

Large trees to 30m high. Leaves simple, opposite, orbicular or broadly ovate, 8-20 x 6-16, cordate at base, acuminate at apex, entire, glabrous above, pubescent beneath, chartaceous; stipule intrapetiolar, foliaceous, cauducous; petiole stout, 3-8 cm long, pubescent; nerves 5-7 from base, Flowers in axillary globose heads, 3-4 mm long, mixed with filiform bracteoles; hypanthium 1-2 mm long, densely hairy; calyx cupular, 1.5-2 mm long, lobes 5, 1.5 mm long; corolla 7-9 mm long, hairy outside, lobes 5, oblong, 1-2 mm long, hairy; stamens 5, exserted; ovary inferior, 2-celled, ovules many on a pendulous placenta; style filiform; stigma globose. Capsule clustered, 2-3 mm long, brown; seeds many with tail and a bifid wing.

Fl. & Fr. : December-March.

Distribution: India, Myanmar, Sri Lanka and Indo-China. Moist forests. *Amitha Bachan 117786* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

HEDYOTIS Linnaeus

Sp. Pl. 101. 1753

Hedyotis neesiana Arn., Nova Acta Acad. Caes. Leop.-Carol. German. Nat. Cur. 18: 341. 1836. *Hedyotis nitida* Wight & Arn., Prodr. Fl. India Orient. Fl. India Orient. 1: 412. 1834, *nom. illeg.*; Hook. f., Fl. Brit. India 3: 61. 1880; Sasidh. & Sivar., Fl. Pl. Thrissur For. 221. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 317. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 252. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 352. 2009. *Oldenlandia nitida* (Wight & Arn.) Gamble, Fl. Pres. Madras 597. 1921. **Kallukoduveli.**

Diffuse woody herbs; stems 4-angled, coarsely scabrid. Leaves simple, opposite, linear-lanceolate to elliptic, 2.5-6.5 x 0.5-1.5 cm, coriaceous, pale below, midrib prominent; stipule ovate, to 8 mm long, rounded at apex, with many long hair like bristles, villous. Flowers sessile in axillary clusters, 1-3 together; calyx 4 mm long, lobes acute, ciliate; corolla 4-5 mm long, lobes spreading, white. Capsule ovoid, 3 mm long, glabrous, dehiscent at the top; seeds angled, deep brown.

Fl. & Fr. : September- December.

Distribution: Endemic to Peninsular India and Sri Lanka. *Amitha Bachan 117744* (Nelliyampathy, riparian forests openings, banks of Karappara river, 800 m).

IXORA Linnaeus

Sp. Pl. 110. 1753.

Ixora brachiata Roxb. ex DC., Prodr. 4: 488. 1830; Hook. f., Fl. Brit. India 3: 142. 1880; Gamble, Fl. Pres. Madras 631. 1921; Sasidh. & Sivar., Fl. Pl. Thrissur For. 225. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 324. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 255. 2005. **Marachethi.**

Small evergreen trees to 8m high. Leaves simple, opposite, decussate, obovate, elliptic-oblanceolate, 7.5-18 x 3-7 cm, attenuate at base, acute or cuneate, obtuse at apex, entire, glabrous, coriaceous. Flowers bisexual, small, sessile, in terminal long peduncled bracteate panicled cyme; calyx tube minute, 4 toothed, membranous; corolla tube slender, 6 mm long, lobes 4, oblong, white, recurved; stamens 4, attached to the mouth of corolla tube; anthers sagitate; ovary 2-celled, inferior, ovules one in each cell; stigma bifid. Berry, globose, red-purple, 0.5 cm across.

Fl. & Fr. : January-May.

Distribution: Endemic to the Western Ghats. Evergreen forests. *Amitha Bachan 72011* (Charpa-Vazhachal, riparian forest, banks of Chalakkudy river, 180 m).

Ixora elongata Heyne ex G. Don, Gen. Hist. 3: 571. 1834; Hook. f., Fl. Brit. India 3: 141. 1880; Gamble, Fl. Pres. Madras 630. 1921; Manilal, Fl. Silent Valley 134. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 225. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 325. 2002.

Shrubs or subshrubs to 1.5m tall. Leaves simple, opposite, elliptic-oblanceolate, to 15 x 3.5 cm, acuminate at apex, acute-cuneate at base; nerves parallel, regular. Flowers on long brachiate corymbs, dense,

congested, peduncle to 4-20 cm. Calyx lobes about equal to the tube, pubescent; corolla tube, 1-1.5 cm long, lobes reflexed, to 0.5 cm, pubescent; stamens 4; style slender, 2-fid. Berry globose.

Fl. & Fr. : December-February.

Distribution: Endemic to India. Evergreen forests. *Amitha Bachan 99156* (Poringalkuthu, riparian forest, banks of Chalakkudy river, 350 m); *Amitha Bachan 99138* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

Ixora nigricans R. Br. ex Wight & Arn., Prodr. Fl. India Orient. 1: 428.1834; Hook. f., Fl. Brit. India 3: 148. 1880; Gamble, Fl. Pres. Madras 631. 1921; Sasidh. & Sivar., Fl. Pl. Thrissur For. 225. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 326. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 256. 2005. **Plate 26. D**

Shrubs, glabrous. Leaves to 13 x 4 cm, elliptic to oblanceolate, long-acuminate, attenuate at base; nerves 8-10 pairs, reticulate; petiole 1 cm long; stipule to 7 mm long, ovate, acuminate. Cymes 10 cm across; peduncles 4-6 cm long. Flowers pedicelled, many; calyx 2.5 mm long, lobes 1.5 mm long, acuminate; corolla tube 11 mm long, slender; lobes 5 x 2 mm, ovate, acute; style 16 mm long. Fruits not seen.

Fl. & Fr. : October-April.

Distribution: Indo-Malaysia. Evergreen forest. *Amitha Bachan 72012* (Charpa-Vazhachal, riparian forest, banks of Chalakkudy river, 180 m).

MITRAGYNA P. W. Korthals

Observ. Naucleis India 19: 1839, *nom. cons.*

Mitragyna tubulosa (Arn.) Hav., J. Linn. Soc. Bot. 33: 71. 1897; Gamble, Fl. Pres. Madras 585. 1921; Sasidh. & Sivar., Fl. Pl. Thrissur For. 227. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 331. 2002; Anil Kumar *et*

al., Fl. Pathanamthitta 257. 2005. *Nauclea tubulosa* Arn. in Thwaites, Enum. Pl. Zeyl. 137. 1859. *Stephegyne tubulosa* (Arn.) Hook.f. ex Bedd., Fl. Sylv. t.29. f.1. 1869; Hook. f., Fl. Brit. India 3: 25. 1880. **Naikadambu.**

Small to medium sized trees to 15 m high. Leaves simple, opposite, decussateovate, elliptic-ovate 10-20 x 4-12 cm, truncate, obtuse or broadly attenuate at base, acute to acuminate at apex, entire, glabrous, coriaceous; petiole 10-30 mm long, slender, lateral nerves pinnate, 7-12 pairs; stipules interpetiolar, to 0.8 cm long; Flower in in terminal globose heads, purplish, 1 cm long, bracts 2, leafy, ciliate; bracteoles many, ciliate; calyx tube truncate, glabrous; corolla tube funnel-shaped, lobes 5, reflexed; stamens 5, attached at the throat of corolla tube, filaments short; anthers oblong, apiculate; ovary 2-celled. Capsule ovoid, in globose heads to 2 cm across; seeds many, minute, winged.

Fl. & Fr. : February-May.

Distribution: Endemic to Peninsular India. *Amitha Bachan 117799* (Karanthodu, riparian forest, banks of Chalakkudy river, 400 m); *Amitha Bachan 72042* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

MUSSAENDA Linnaeus

Sp. Pl. 177. 1753

Mussaenda frondosa L., Syst. Nat. (ed.10) 2: 931.1759; Hook. f., Fl. Brit. India 3: 89. 1880; Gamble, Fl. Pres. Madras 610. 1921; N. Mohanan & Sivad., Fl. Agasthyamala 335. 2002. *Mussaenda belilla* Buch.-Ham., Trans. Linn. Soc. London 14: 203. 1824; Sasidh. & Sivar., Fl. Pl. Thrissur For. 228. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 335. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 258. 2005; C. N. Sunil &

Sivad., Fl. Alappuzha 360. 2009. *Mussaenda laxa* (Hook. f.) Hutch. ex Gamble, Fl. Pres. Madras 610. 1921. *Mussaenda frondosa* L. var. *laxa* Hook. f., Fl. Brit. India 3: 89. 1880. **Vellilamthali.**

Straggling or climbing shrubs. Leaves broadly ovate, acuminate, 4-10 x 2-8 cm, rounded at base, thinly hairy; nerves 10-12 pairs, parallel; petiole 1.5 cm long, slender; stipule 12 mm long. Flowers pedicelled, on terminal hairy cymes; one clayx lobe larger and leaf like, 3-7cm wide, ovate-orbicular, white, hirsute; others linear, 0.5-1 cm; corolla tube 2.5cm long, slender, adpressed hairy; petals yellow, densely villous inside. Fruits ovoid, 0.8mm long.

Fl. & Fr. : July-October.

Distribution: Endemic to Peninsular India. Moist forests also in the plains. *Amitha Bachan 72090* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

MYCETIA Reinwardt

in Syll. Ratisb. 2: 9. 1828.

Mycetia acuminata (Wight) Kuntze, Rev. Gen. Pl. 1: 289. 1891; Gamble, Fl. Pres. Madras 612. 1921; Manilal, Fl. Silent Valley 137. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 299. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 336. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 258. 2005. *Lawia acuminata* Wight, Icon. Pl. India Orient. t. 1070. 1846. *Adenosacme lawii* Hook. f., Fl. Brit. India 3: 96. 1880.

Erect fleshy herbs. Leaves elliptic-oblong, acuminate at apex, 8-25 x 3-10 cm; nerves to 20 pairs, prominent, parallel; petiole 5-8 cm long, stipule 1.2 cm long, ovate, acute, membraneous. Flowers on axillary peduncled cymes, 5-7 cm across. Flowers 0.7 cm long, pedicelled, yellow or greenish; calyx lobes 5, acuminate, to 0.5 cm long; corolla ovate, blue,

tube short, lobes 5, spreading; stamens 5, adnate to the corolla tube, anthers linear; ovules many on peltate placentas; style short; stigmas linear. Berry, 8 mm across, white, fleshy; seeds many, angular.

Fl. & Fr. : December-February.

Distribution: Endemic to the Western Ghats. Rare. *Amitha Bachan 98756* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

NEANOTIS W. H. Lewis

Ann. Missouri Bot. Gard. 53: 34. 1966.

Neanotis indica (DC.) Lewis, Ann. Miss. Bot. Gard. 53: 38. 1966, var. **indica**. *Putoria indica* DC., Prodr. 4: 577. 1830. *Anotis leschenaultiana* (Wall. ex Wight & Arn.) Hook.f., Fl. Brit. India 3: 72. 1880; Gamble, Fl. Pres. Madras 604. 1921. *Hedyotis leschenaultiana* Wall. ex Wight & Arn., Prodr. Fl. India Orient. 1: 411. 1834. *Neanotis indica* (DC.) Lewis var. *affinis* (Wall. ex Wight & Arn.) Lewis, Ann. Miss. Bot. Gard. 53: 39. 1966; Manilal, Fl. Silent Valley 137. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 231. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 259. 2005. *Hedyotis affinis* Wall. ex Wight & Arn., Prodr. Fl. India Orient. 1: 411. 1834, *nom. illeg. Anotis leschenaultiana* (Wall. ex Wight & Arn.) Hook.f. var. *affinis* (Wall. ex Wight & Arn.) Hook.f., Fl. Brit. India 3: 72. 1880; Gamble, Fl. Pres. Madras 604. 1921.

Diffuse herbs with unpleasant scent; rooting at nodes. Leaves opposite, ovate, 2.5-5 x 1-2 cm, acuminate at apex, acute, obtuse to emarginated at base, hairy, foetid, entire; stipule membranous, ciliate. Flowers in terminal cymes, dense flowered, villous, pedicelled, pubescent; calyx tube globose, lobes 4; corolla tube slender, to 0.7 cm long, lobes 4, valvate; stamens 4, inserted at the mouth of the corolla tube; ovary 2-5-

celled; ovules few in each cell; style slender; stigma linear. Fruit a few-seeded capsule, loculicidal; seeds planoconvex.

Fl. & Fr. : November – December.

Distribution: Endemic to the Western Ghats. Evergreen forests. *Amitha Bachan 98797* (Nooradi-Nelliyampathy, rocky riparian forest openings, banks of Karappara river, 900 m); *Amitha Bachan 98717* (Ranimedu, Nelliyampathy, riparian forest openings, banks of stream draining to Kuriyarkutty river, 950 m).

NEOLAMARCKIA Bosser

Adansonia Ser. 4, 6: 247. 1984

Neolamarckia cadamba (Roxb.) Bosser, Adansonia ser. 4. 6: 247. 1984; Sasidh. & Sivar., Fl. Pl. Thrissur For. 232. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 338. 2002; Anil Kumar *et al.,* Fl. Pathanamthitta 259. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 361. 2009. 2005. *Nauclea cadamba* Roxb., Fl. India 2: 121. 1824. *Anthocephalus chinensis* sensu A. Rich. ex Walp., Rep. 2: 491. 1843, non *Cephalanthus chinensis* Lam. 1785. *Anthocephalus cadamba* (Roxb.) Miq., Fl. India Bat. 2: 135. 1850; Hook. f., Fl. Brit. India 3: 23. 1880. *Anthocephalus indicus* A. Rich., Mem. Rubiac. 157. 1830; Gamble, Fl. Pres. Madras 583. 1921. **Kadambu, Vellakdambu.**

Small to medium sized trees to 20 m high. Leaves simple, opposite, decussate, ovate or elliptic-oblong, 10-30 x 5-13 cm, truncate or obtuse at base, acuminate at apex, entire, glabrous above, pubescent below; lateral nerves 10-14 pairs, prominent; petiole 2-5 cm, stout, glabrous. Flowers in globose heads, yellowish, 2-5 cm across; calyx tube globose, lobes 5, 5-6 x 3-4 mm, membranous; corolla tube 6-8 mm long, lobes 5, oblong, acute, 3-4 cm long, glabrous; stamens 5, anthers sagittate,

sessile; ovary 2-4-celled, ovules many. Fruit a capsule on a fleshy globose receptacle, 3.5-5 cm across, orange yellow.

Fl. & Fr. : July-August.

Distribution: Asia, pacific and Australia. Along river banks in forests at higher elevations to lower plains. *Amitha Bachan 117633* (Vettilappara, river banks, banks of Chalakkudy river, 50 m).

OLDENLANDIA L.

G. Pl. 5. 1754.

Oldenlandia auricularia (L.) K. Schum. in Engl. & Prantl, Naturl. Pflanzenfam. 4(4): 25. 1891; Gamble, Fl. Pres. Madras 597. 1921. *Hedyotis auricularia* L., Sp. Pl. 101. 1753; Hook. f., Fl. Brit. India 3: 58. 1880; Manilal, Fl. Silent Valley 131. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 220. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 314. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 251. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 348. 2009. *Exallage auricularia* (L.) Bremek., Verh. Acad. Wet. afd. Natuurk. Sect. 2, 48: 142. 1952.

Diffuse herbs to 50 cm high; branches 4-angled, blue, pubescent. Leaves simple, opposite, ovate to ovate lanceolate, acute at apex, to 8 x 3 cm, scabrous below; nerves 5 pairs, prominent; petiole 5 mm long; stipules obovate, short, teeth 7, 3-5 mm long, hairy. Flowers 10-20 together, in axillary cymes, pedicelled, to 3 mm long; calyx lobes spreading; corolla white. Capsule indehiscent, globose, 2 mm, glabrous.

Fl. & Fr. : September-December.

Distribution: Indo-Malaysia. Open areas in forests. *Amitha Bachan 117679* (Malakkapara, riparian forest openings, banks of Sholayar river, 900 m).

Oldenlandia corymbosa L., Sp. Pl. 119.1753; Hook. f., Fl. Brit. India 3: 64. 1880, *p.p.*; Gamble, Fl. Pres. Madras 600. 1921. *Hedyotis corymbosa* (L.) Lam., Encycl. 1: 272. 1792; N. Mohanan & Sivad., Fl. Agasthyamala 315. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 251. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 349. 2009. **Purpadakapullu.**

Diffuse spreading herbs, stem 4-angled, scabrous. Leaves simple, opposite, lanceolate, acute, to 2 x 0.3 cm, lineolate-serrate, subsessile. Umbels axillary; peduncle to 1 cm long, slender. Flowers 2-3, usually in pairs, 5 mm long, pedicelled; pedicels to 6 mm long, slender; calyx 3 mm long, lobes ovate, serrate; corolla white, tube short and broad, capsule 3 x 3 mm, globose, opening apically; seeds many, angled.

Fl. & Fr. : June-October.

Distribution: Pantropical. Moist localities in forests to plains. *Amitha Bachan 72091* (Vazhachal, river beds, along Chalakkudy river, 220 m).

OCHREINAUCLEA Ridsdale

Blumea 24: 332. 1978.

Ochreinauclea missionis (Wall. ex G. Don) Ridsd., Blumea 24: 332. 1978; Sasidh. & Sivar., Fl. Pl. Thrissur For. 231. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 260. 2005. *Nauclea missionis* Wall. ex G. Don, Gen. Hist. 3: 467. 1834; Hook. f., Fl. Brit. India 3: 27. 1880; Gamble, Fl. Pres. Madras 582. 1921. *Sarcocephalus missionis* (Wall. ex G. Don) Havil, J. Linn. Soc. Bot. 33: 32. 1897. **Attuvanchi, Neervanchi. Plate 26. E & F**

Small evergreen trees to 12 m high. Leaves simple, opposite, lamina elliptic, elliptic-obovate, 7-14 x 3-6 cm, attenuate at base, acute-obtuse at apex, entire, glabrous; petiole to 1.5 cm long, stout, glabrous; stipules to 1 cm long, persistent, glabrous; lateral nerves 10-13 pairs, prominent beneath. Flowers yellowish-white, 0.5 cm in terminal 3 cm

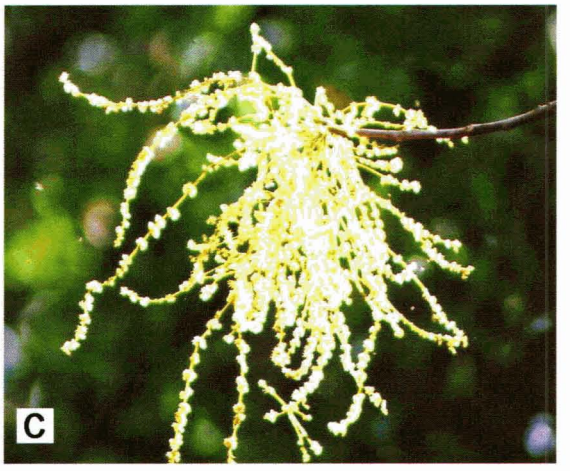


Plate 26. A-C. *Tetrameles nudiflora* R. Br., A. Habit, B. Flowering, C. Inflorescence; D. *Ixora nigricans* R. Br. ex Wight & Arn.; E. & F. *Ochreinauclea missionis* (Wall. ex G. Don) Ridsdale, E. Fruits, F. Fruiting branch.

diameter heads, hypanthia mutually connate at apex; calyx tube short; lobes 4-5, oblong, 3 mm long, pubescent below; corolla infundibular, 1cm, greenish-yellow; lobes 4-5, 3 mm long, pubescent; stamens 4-5, attached to the throat of corolla; filaments short; anthers 1 mm long, protruding from the throat; ovary 2-locular; ovules many. Fruit a drupe, globose, fleshy.

Fl. & Fr. : June- September.

Distribution: Endemic to Southern Western Ghats. Vulnerable. Riparian. *Amitha Bachan 117632* (Thumboormuzhi, riparian, banks of Chalakkudy river, 50 m).

OPHIORRHIZA Linnaeus

Sp. Pl. ed. 1, 150. 1753.

Ophiorrhiza mungos L., Sp. Pl. 150. 1753; Hook. f., Fl. Brit. India 3: 77. 1880; Gamble, Fl. Pres. Madras 607. 1921; Manilal, Fl. Silent Valley 139. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 232. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 342. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 261. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 361. 2009. **Avilpori.** **Plate 27. B**

Erect herbs or subshrubs; stems scabrous. Leaves ovate-elliptic, to 15 x 6 cm, acuminate at apex, long attenuate at base; nerves 14 pairs, scabrid below; petiole 2-3 cm long; stipule of 2 slender triangular teeth with small glands between. Flowers on subumbellate cymes to 7 cm wide, spreading, tomentose. Flowers pedicelled; calyx glabrous; corolla tube, villous in a ring at mouth. Capsule 4 x 8 mm, glabrous; seeds angled, brown.

Fl. & Fr. : July-September.

Distribution: India, Myanamar and Sri Lanka. Evergreen forests. *Amitha Bachan 117626* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

PAVETTA Linnaeus

Sp. Pl. 110. 1753.

Pavetta breviflora DC., Prodr. 4: 491. 1830; Hook. f., Fl. Brit. India 3: 151. 1880, p. p.; Gamble, Fl. Pres. Madras 633. 1921, var. **breviflora** Bremek., Feddes Repert. 37: 98. 1934; Manilal, Fl. Silent Valley 140. 1988; Rout & Deb, Bull. Bot. Surv. India 41: 75. 1999. *Pavetta brevifolia* DC. var. *subcoriacea* Gamble, Fl. Pres. Madras 634. 1921; Sebastine & Vivek., Bull. Bot. Surv. India 9: 174. 1967. **Malampichi.**

Shrubs. Leaves opposite, elliptic-oblong or oblanceolate, 4-9 x 1.2-3.5 cm, acuminate at apex, long cuneate at base, membraneous, glabrous; stipule entire, connate, deciduous. Flowers in terminal dense corymbose cyme; branches trichotomous; calyx tube turbinate, lobes 4, short, subulate, recurved; corolla tube slender, 0.8 cm long; lobes 4, twisted, acute at apex, spreading; stamens 4, inserted on the mouth of the corolla tube; anthers linear; ovary 2-celled; ovule 1 in each cell; style short; stigma fusiform. Fruit a berry with 2 pyrenes; seeds 2, planoconvex.

Fl. & Fr. : August-October.

Distribution: Endemic to Southern Western Ghats. Evergreen forests. *Amitha Bachan 123314* (Vavalala-Sholayar, riparian forest, banks of Sholayar river, 600 m).

Pavetta indica L., Sp. Pl. 110. 1753, var. **indica**, Hook. f., Fl. Brit. India 3: 150. 1880; Gamble, Fl. Pres. Madras 633. 1921; Anil Kumar *et al.*, Fl.

Pathanamthitta 262. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 362. 2009. **Vellachethi.**

Shrubs; branchlets subquadrangular, glabrescent. Leaves elliptic-ovate or oblanceolate, 6-11 x 2.5-4 cm, acute-attenuate at base, acuminate at apex, chartaceous, glabrous; petiole to 1.5 cm long, pubescent or glabrous. Flowers on terminal corymbs. Calyx teeth 4, minute. Corolla white; tube 1.5 cm long, slender, sparsely pilose within; lobes obovate. Stamens 4, inserted between the lobes, exserted; anthers linear-oblong. Ovule solitary; style slender, exserted; stigma fusiform. Berry globose, 0.5-1cm across, black .

Fl. & Fr. : March-May.

Distribution: Endemic to India and Sri Lanka. Evergreen forests to Sacred groves. *Amitha Bachan 98814* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

Pavetta indica L. var. **tomentosa** (Roxb. ex J. E. Smith) Hook. f., Fl. Brit. India 3: 150. 1880; Gamble, Fl. Pres. Madras 633. 1921. *Pavetta tomentosa* Roxb. ex J. E. Smith in Rees, Cyclop. 26:52.1813; Gamble, Fl. Pres. Madras 1879. 1936; Sasidh. & Sivar., Fl. Pl. Thrissur For. 233. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 348. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 262. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 362. 2009. **Vellachethi.**

Erect shrubs; softly tomentose. Leaves obovate-elliptic to oblanceolate, 8-15 x 4-6 cm, acute at base, acuminate at apex, softly tomentose beneath; petiole to 2.5 cm long, tomentose. Flowers on terminal much branched cymes to 12 cm; Flowers white; pedicels 0.5 cm, tomentose. Lower node of the flowering shoots much longer than others. Calyx 3 mm long, tomentose, teeth minute. Corolla-tube 1-1.3

cm long; lobes 5, oblong, 7-8 mm long, apiculate. Stamens 5; stigma fusiform, puberulous. Berry globose, 0.6 cm across.

Fl. & Fr. : May-July.

Distribution: India and Indochina. Evergreen forests to plains. *Amitha Bachan 117639* (Athirappilly, riparian forest, banks of Chalakkudy river, 120 m).

PRISMATOMERIS Thwaites

In Hook. f. J. Bot. Kew Gard. Misc. 8: 268. 1856.

Prismatomeris tetrandra (Roxb.) K. Schum. in Engl. & Prantl, Naturl. Pflanzenfam. 4(4): 138. 1891; Sasidh. & Sivar., Fl. Pl. Thrissur For. 233. 1996. *Prismatomeris albidiflora* Thwaites in Hook.'s J. Bot. Kew Gard. Misc. 8: 286. t. 7A. 1856 & Enum. Pl. Zeyl. 154. 1859; Hook. f., Fl. Brit. India 3: 159. 1880; Gamble, Fl. Pres. Madras 653. 1921.

Shrubs, branchlets tetragonous, compressed; Leaves simple, opposite, elliptic lanceolate to oblanceolate, 5-14 x 2-5 cm, acuminate, caudate acuminate at apex, acute at base. Flowers in axillary few flowered cymes or fascicled, white, pedicel to 1 cm long. Calyx teeth 4-5, short; corolla tube cylindric, lobes 4-5, spreading . Anthers 4-5, inserted in the corolla tube. Ovary 2-celled, 1 ovule in each cell, on the septum. Berry 1-2 seeded, dark blue.

Fl. & Fr. : December-January.

Distribution: Endemic to South India and Sri Lanka. Evergreen forests. *Amitha Bachan 117706* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

PSYCHOTRIA Linnaeus

Syst. Nat. ed. 10. 929, 1364. 1759, *nom. cons.*

Psychotria anamalayana Bedd., Icon. Pl. India Orient. t. 236. 1868-1874; Hook. f., Fl. Brit. India 3:171.1880; Gamble, Fl. Pres. Madras 641.1921; Sasidh. & Sivar., Fl. Pl. Thrissur For. 236. 1996; Anil Kumar *et al.,* Fl. Pathanamthitta 264. 2005.

Shrubs, 2.5 m tall; branchlets stout. Leaves oblanceolate, 14-20 x 6-7 cm, obtuse, apiculate, attenuate to the base, coriaceous; nerves 10-12 pairs, regular, 8-12 mm apart, reticulate towards the margins; domatia absent; petiole to 3 cm long, stipule to 3 cm long, lanceolate, glabrous within. Flowers on terminal glabrous corymbose cymes, 5 mm long, sessile; calyx 4-toothed; corolla tube villous at the base; ovary 2-celled, ovules one in each cell, basal. Drupe oblong-obovoid, 13 x 7 mm, obovoid, 4-angled, glabrous.

Fl. & Fr. : March-July.

Distribution: Endemic to Southern Western Ghats. Evergreen forests. *Amitha Bachan 99073* (Karimalathodu, riparian vegetation, banks of Karimala stream draining to Sholayar river, 1000 m); *Amitha Bachan 99041* (Karanthodu-Vazhachal, riparian forest, banks of Chalakkudy river, 400 m); *Amitha Bachan 123417* (Vazhachal, riparian forests, banks of Chalakkudy river, 230 m).

PSYDRAX Gaertn.

Fruct. Sem. Pl. i. 125. t.26. 1788.

Psydrax dicoccos Gaertn., Fruct. 1: 125. t.26. f.2. 1788, var. **dicoccos**. *Canthium didymum* (Brandis) Hook.f., Fl. Brit. India 3: 132. 1880, non Gaertn. f. 1806. *Plectronia didyma* Benth. & Hook. f. ex Brandis, For. Fl.

276.1874; Gamble, Fl. Pres. Madras 624. 1921. *Canthium dicoccum* (Gaertn.) Merr., Philipp. J. Sci. 35: 8. 1928. **Kara. Irumbarappan.**

Plate 27. A

Small to medium sized evergreen trees; bark yellowish-grey; branchlets tetragonous. Leaves simple, opposite, distichous, elliptic-oblong or obovate, 6-15 x 4-6 cm, cuneate at base, shortly acuminate at apex, coriaceous, glabrous and glossy; petiole to 1 cm long. Flowers in dense umbellate axillary cymes, 5-merous; pedicels short, 2-8 mm. Calyx short, 5-lobed, glabrous. Corolla campanulate, cream coloured, lobes 5, oblong, 1.5 mm long, acute villous within. Stamens 5, inserted on the mouth of corolla. Ovary 1.5 mm long; stigma capitate. Drupe subglobose to 0.8 cm across, black; pyrene rugose.

Fl. & Fr. : February – March.

Distribution: Indo-Malaysia and China. Moist forests. *Amitha Bachan 98931* (Malakkapara, riparian forest, banks of Chalakkudy river, 900 m).

SPERMACOCE Linnaeus

Sp. Pl. 102. 1753.

Spermacoce latifolia Aubl., Hist. Pl. Guinea Fr. 1: 55. t.19/1. 1775; Deb & Dutta, J. Bombay Nat. Hist. Soc. 87: 332. 1990; Sivar. *et al.*, Proc. Indian Acad. Sci. (Pl. Sci.) 97:355.1987; Manilal, Fl. Silent Valley 143. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 238. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 359.2002; Anil Kumar *et al.*, Fl. Pathanamthitta 267. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 368. 2009. *Borreria latifolia* (Aubl.) K. Schum. in Mart., Fl. Bras. 4:61. 1888. *Borreria articularis* Mukerjee, Rec. Bot. Surv. India 20: 116. 1973, non K. Schum. 1888. *Borreria eradii* Ravi, Journ. Bombay Nat. Hist. Soc. 6: 539. 1970. **Pachapalla.**

Diffuse herbs; stem 4-angled and prominently winged, hispid. Leaves simple opposite, broadly elliptic or ovate, 1-4 x 0.5 - 2.5 cm, rounded or cuneate at base, acute to shortly acuminate at apex, loosely hispid on both sides, lateral veins prominent; stipules sheathing, with subulate hispid bristles. Flowers in axillary few-flowered cymes. Calyx tube to 1.5 mm long; lobes ovate-acuminate, unequal. Corolla white, 4 mm long, hairy at throat; lobes 4. Stamens attached at throat between the lobes. Capsule ellipsoid, 4 mm long, pubescent. Seeds 2, ellipsoid, to 2 mm long.

Fl. & Fr. : August – October.

Distribution : Native of Tropical America, naturalized in tropical Africa and tropical Asia. *Amitha Bachan 99040* (Kuriyarkutty, riparian, banks of Kuriyarkutty river, 500 m).

TAMILNADIA Tirveng. & Sastre

in Mauritius Inst. Bull., 8 (4): 84. 1979.

Tamilnadia uliginosa (Retz.) Tirveng. & Sastry, Mauritius Inst. Bull. 8: 85. 1979; Sasidh. & Sivar., Fl. Pl. Thrissur For. 239. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 361. 2002. *Gardenia uliginosa* Retz., Obs. Bot. 2: 14. 1781. *Randia uliginosa* (Retz.) DC., Prodr. 4: 386. 1830; Hook. f., Fl. Brit. India 3: 110. 1880; Gamble, Fl. Pres. Madras 615. 1921. *Catunaregam uliginosa* (Retz.) Sivar. in Manilal & Sivar., Fl. Calicut 132. 1982. *Xeromphis uliginosa* (Retz.) Mahesh., Bull. Bot. Surv. India 3: 92. 1961. **Punnankara. Pindichakka**.

Small trees to 6-7 m high; branchlets 4 angled, terminating with one or two pair of sharp thorns. Leaves simple, opposite, decussate, obovate, oblanceolate, to 18 x 7 cm, cuneate or attenuate at base, obtuse or round at apex, entire, glabrous above, pubescent and glaucous

beneath. Flowers solitary, at the end of branchlets, white, to 5 cm across; calyx tube 1 x 0.4 cm, turbinate, silky pubescent at throat, lobes 5, suborbicular; corolla tube short, lobes 5, large, spreading, orbicular, hairy at mouth, imbricate; stamens 5; anthers linear; ovary 2-celled, ovules many; style stout; stigma thick, 2 lobed. Berry ovoid or ellipsoid, to 5 cm, smooth, yellow.

Fl. & Fr. : July –March.

Distribution: India and Myanmar. Wetlands in moist forests. *Amitha Bachan 117762* (Parambikulam, riparian wetlands, banks of Parambikulam river, 500 m).

TARENNA J. Gaertner

Fruct. 1: 139. 1788.

Tarenna asiatica (L.) Kuntze ex K. Schum., Bot. Tidsskr. 24: 332. 1902; N. Mohanan & Sivad., Fl. Agasthyamala 362. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 268. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 369. 2009. *Rondeletia asiatica* L., Sp. Pl. 172. 1753; Hook. f., Fl. Brit. India 3: 102. 1880. *Chomelia asiatica* (L.) Kuntze, Rev. Gen. Pl. 1: 278. 1891; Gamble, Fl. Pres. Madras 613. 1921. **Kuppipoovu.**

Shrubs. Leaves elliptic to elliptic-oblong, 6-15 x 3-5 cm, attenuate at base, acute to acuminate at apex, drying black; petiole 1.2-1.8 cm long; stipules ovate. Flowers on terminal corymbose cymes, 5-merous, white; campanulate, calyx 3-4 mm long. Corolla salver-shaped, lobes 5, 5-6 mm, twisted, white turning yellow; stamens 5, exserted, connective produced above. Ovary 2-locular, ovules many per locule. Berry globose, 0.5-1 cm across, black.

Fl. & Fr. : February – July.

Distribution: Indo-Malaysia. Moist forests, also in the lower plains. *Amitha Bachan 72019* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

64. ALANGIACEAE DC.

Prodr. 3: 203. 1828.

ALANGIUM Lamarck

Encycl. Meth. Bot. 1: 174. 1783, *nom. cons.*

Key to sub species

1a. Straggling or climbing shrubs; leaves oblong-obovate; flowering twig leafy; inflorescence pedunculate; petals 4-7..... subsp. **hexapetalum**

1b. Erect shrubs or trees; leaves oblong-lanceolate, often obovate; flowering twig generally leafless; inflorescence subsessile; petals 5-10 .....subsp. **salvifolium**

Alangium salvifolium (L.f.) Wang. subsp. **hexapetalum** (Lam.) Wang. in Engl., Pflanzenreich Alangiac. 9. 1910; Gamble, Fl. Pres. Madras 572. 1919. *Alangium hexapetalum* Lam., Encycl. 1: 175. 1783. *Alangium salviifolium* var. *hexapetalum* (Lam.) Gamble, Fl. Madras 3: 572. 1919. *Alangium glandulosum* Thwaites, Enum. Pl. Zeyl. 133. 1859. *Alangium salvifolium* (L. f.) Wang. ssp. *sundanum* (Miq.) Bloem., Bull. Jard. Bot. Buitenz. Ill, 16: 156. 1939; Matthew, Fasc. Fl. India 19: 5. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 213. 1996; C. N. Sunil & Sivad., Fl. Alappuzha 339. 2009. **Valli-Angolam**. **Plate 27. C**

Stragglers or climbers. Leaves alternate, to 14 x 6 cm, oblong-lanceolate, cuneate at base, obtuse at apex, subcoriaceous, glabrescent, nerves 5 pairs, 2 nerves from base, rib-like; petiole to 1 cm long. Inflorescence axillary, subsessile, densely rusty-tomentose, often in clusters of 4-8 flowers, sometimes solitary. Flowers 2 cm long, in axillary

fascicles; pedicels 0.8 cm long pubescent; calyx cupular, 0.5 cm across, 7-teethed, densely tomentose; petals 7, linear-oblong, 1.6 cm, tomentose; stamens 14, filaments ciliate below; anthers linear, 0.7 cm long; ovary inferior, 1-celled, 1-ovuled; style 1, elongate, stigma capitate. Berry ellipsoid 2 x 1.3 cm, tomentose.

Fl. & Fr. : March – August.

Distribution: Indo-Malaysia. Moist forests and sacred groves in the lower plains. *Amitha Bachan 99042* (Vazhachal, riparian forests, banks of Chalakkudy river, 180 m).

Alangium salvifolium (L. f.) Wang. in Engl., Pflanzenreich Alangiac. 9. 1910, subsp. **salvifolium**; Gamble, Fl. Pres. Madras 572. 1919; Matthew, Fasc. Fl. India 19: 5. 1988; Anil Kumar *et al.*, Fl. Pathanamthitta 244. 2005; Sunil, Fl. Alappuzha Dist. 338. 2009. *Grewia salvifolia* L. f., Suppl. Pl. 409. 1781. *Alangium lamarckii* Thwaites, Enum. Pl. Zeyl. 133. 1859; Hook. f., Fl. Brit. India 2: 741. 1879. **Ankolam**.

Shrubs or small trees up to 18 m tall; branchlets spinescent, tomentose to glabrescent. Leaves oblong-lanceolate, to 10 x 4 cm, cuneate at base, obtuse at apex, chartaceous, glabrescent. Inflorescence axillary, sessile, densely rusty-tomentose, often in clusters of 4-8 flowers, sometimes solitary. Flowers to 3 cm long, cream coloured, fragrant; pedicels 0.7cm long. Calyx-tube 2.5 mm long. Petals 5-10, 1-3 cm long, swollen at base, obtuse at apex, tomentose. Stamens 10-30; filaments 5, bearded. Ovary 1-celled, 1-ovuled, pendulous. Drupes subglobose, to 2 x 1.5 cm, red when ripe.

Fl. & Fr. : March-June

Distribution: India, Sri Lanka, Thailand, Vietnam, China and Africa. Forests to waste lands. *Amitha Bachan 99029* (Kuriyarkutty, riparian forests, along Chalakkudy river, 450 m).

65. **ASTERACEAE** Dumort.

Comment. bot. 55. 1822.

nom. alt., Compositae.

1a. Heads with similar flowers..... 2

1b. Heads with dissimilar flowers.....8

2a. Leaves opposite..... 3

2b. Leaves alternate.....6

3a. Weak climbing shrubs.....**Mikania**

3b. Erect or prostrate herbs or shrubs.....4

4a. Receptacle spicate..... **Spilanthes**

4b. Receptacle flat concave or convex, not spicate.....5

5a. Anthers appendaged at apex; pappus scaly..... **Ageratum**

5b. Anthers not appendaged; pappus of hairs.....**Chromolaena**

6a. Groups of heads supported by 3-4 spathes; leaves radical.....
.....**Elephantopus**

6b. Heads not supported by spathes; leaves cauline.. 7

7a. Capitula sessile in close axillary clusters.....**Struchium**

7b. Capitula peduncled, terminal.....16

8a. Capitula densely packed into a globose head..... **Sphaeranthus**

8b. Capitula not packed as above.....9

9a. Leaves opposite.....10

9b. Leaves alternate.....14

10a. Capitula axillary, sessile.....**Synedrella**

10b. Capitula terminal or axillary, peduncled.....11

11a. Leaves pinnately compound or pinnatifid..... **Bidens**

11b. Leaves simple, entire.....12

12a. Pappus absent or reduced into minute teeth.....**Eclipta**

12b. Pappus developed.....13

13a. Achenes terete, densely hairy; pappus many, setaceous..... **Tridax**

13b. Achenes 3-4 angled, glabrous; pappus 3-4, scaly.....**Wedelia**

14a. Bracts spreading; bisexual flowers all sterile.....**Anaphalis**

14b. Bracts not spreading; bisexual flowers usually fertile.....15

15a. Aromatic plants; heads panicled or corymbose; bracts green.**Blumea**

15b. Not aromatic; heads densely packed in terminal panicles bracts hyaline .....**Erigeron**

16a. Bracts uniseriate; heads long peduncled.....**Emilia**

16b. Bracts 2-3-seriate; heads short peduncled.....**Vernonia**

AGERATUM L.

Sp. Pl. 839. 1753.

Ageratum conyzoides L., Sp. Pl. 839. 1753; Clarke, Comp. India 30. 1876; Hook. f., Fl. Brit. India 3: 243. 1881; Gamble, Fl. Pres. Madras 677. 1921; Manilal, Fl. Silent Valley 147. 1988; Uniyal in Hajra *et al.*, Fl. India 12: 348. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 244. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 368. 2002; Anil Kumar *et al.*, Fl.

Pathanamthitta 274. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 374. 2009. **Appa.**

Annual herbs, stem pubescent. Leaves ovate, acute to obtuse, base truncate or obtuse, hirsute on both sides, dentate, to 6 x 4 cm; petiole 4 cm long Heads 3-4 mm across. Corolla white. Achenes 4-angled, 2 mm long, oblong, black, sparsely hirsute along the angles. Pappus scales 5, 2 mm long, lanceolate.

Fl. & Fr.: Most of the seasons.

Distribution : Pantropical. Common weed in the forest areas. *Amitha Bachan 123665* (Nelliyampathy, riparian open areas, banks of Karappara river, 800 m).

ANAPHALIS A.P. Candolle

Prodr. 6: 271. 1838.

Key to species

1a. Leaf margins flat, not folded back except the upper ones of the scape; leaves very white wooly; achenes minute.....**A. lawii**

2b. Leaf margins always folded back; leaves softly grey wooly; achenes papillose .....**A. aristata**

Anaphalis aristata DC., Prodr. 6: 274. 1838; Hook. f., Fl. Brit. India 3: 285. 1881; Gamble, Fl. Pres. Madras 696. 1921; Manilal, Fl. Silent Valley 147. 1988; P.C. Pant in Hajra *et al.*, Fl. India 13: 55. 1995; Anil Kumar *et al.*, Fl. Pathanamthitta 275. 2005.

Slender cottony herb. Leaves simple, alternate, linear oblong to linear-lanceolate, 2-6 cm long, base auricled, margins revalute, acute at apex, 1 veined, softly grey wooly. Capitula in terminal panicles, heterogamous. Bracts ovate oblong, pink tinged. Outer florets female and

sterile. Inner florets fertile, bisexual. Corolla filiform. Stamens 5. Cypsella angled, papillose.

Fl. & Fr. : July – April.

Distribution : Endemic to Peninsular India. Stream sides rocks and grasslands. *Amitha Bachan 99095* (Karimala-Parambikulam, stream-banks, 1300 m)

Anaphalis lawii (Hook. f.) Gamble, Fl. Pres. Madras 696. 1921; P.C. Pant in Hajra *et al.*, Fl. India 13: 66. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 245. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 276. 2005. *Anaphalis oblonga* DC. var. *lawii* Hook. f., Fl. Brit. India 3: 283. 1881.

Slender herbs, stem terete, short, white tomentose. Leaves linear-lanceolate to 5 cm, linear to filiform towards inflorescence, apex acute, base subamplexicaul, margins flat or revolute only the upper ones of the scpae, dense cottony. Panicles branced; bracts elliptic, white or cream coloured. Cypsella ellipsoid, glandular.

Fl. & Fr. : September – March.

Distribution: Endemic to Peninsular India. Grasslands and rocky streamsides *Amitha Bachan 98720* (Nelliyampathy, Streamside, stream draining to Veettiyar, 1200 m). *Amitha Bachan 98750* (Karimala-Parambikulam, stream bank, stream draining to Sholayar river, 1300 m).

BIDENS Linnaeus

Sp. Pl. 831. 1753.

Bidens biternata (Lour.) Merr. & Sheriff, Bot. Gaz. 88. 293. 1929; Manilal, Fl. Silent Valley 149. 1988; H.J. Chowdhery in Hajra *et al.*, Fl. India 12: 367. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 245. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 369. 2002; Anil Kumar *et al.*, Fl.

Pathanamthitta 276. 2005. *Coreopsis biternata* Lour., Fl. Cochinch. 508. 1790.

Erect herbs to 1 m tall, young shoots pubescent. Leaves 3-5-foliolate; leaflets ovate, acuminate, base attenuate, serrate, to 6 x 1.5 cm. Heads several, to 1 cm across; peduncle to 10 cm long. Corolla of ray florets yellow or white; disc florets yellow. Achenes 4-angled, black, 1 cm long; papus bristles 3.5 mm long.

Fl. & Fr. : August - February.

Distribution : Tropical Africa, Indo-Malaysia to Australia. Wet stream-sides near townships at high altitudes, weed. *Amitha Bachan 123666* (Nelliyampathy, riparian forests, Banks of Karappara river, 900 m).

BLUMEA A. P. de Candolle

Arch. Bot. (Paris) 2 : 514. 1833, *nom. cons.*.

Blumea lacera (Burm. f.) DC. in Wight, Contrib. 14. 1834; Hook. f., Fl. Brit. India 3: 263. 1881; Gamble, Fl. Pres. Madras 687. 1921; S. Kumar in Hajra *et al.*, Fl. India 13: 128. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 247. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 371. 2002; C.N.Sunil & Sivad., Fl. Alappuzha 377. 2009. *Conyza lacera* Burm. f., Fl. India t. 59. 1768. *Blumea subcapitata* DC., Prodr. 5:439.1836. *Blumea lacera* (Burm. f.) DC. var. *cinerascens* Hook. f., Fl. Brit. India 3: 263. 1881. *Blumea lacera* (Burm. f.) DC. var. *glandulosa* (DC.) Hook. f., Fl. Brit. India 3: 263. 1881; Gamble, Fl. Pres. Madras 687. 1921. *Blumea glandulosa* DC. in Wight, Contrib. 14. 1834.

Small erect herbs. Stems white villous. Leaves both radical and cauline, to 5 x 1.5 cm, spathulate to oblanceolate, dentate, hairy on both sides. Heads yellow, terminal. Involucre bracts many-seriate to 5mm long. Flowers outer female, inner bisexual, few. Female flowers: corolla

tube filiform, 2-4 lobed. Bisexual flowers: corolla tube stout, 5-lobed; stamens 5. Achenes 1mm long, tetragonous, hairy.

Fl. & Fr. : January-May.

Distribution: Paleotropics. Common in open areas. Riparian openings, streamsides. *Amitha Bachan 9130* (Poringal, Banks of Chalakkudy river, 260 m).

CHROMOLAENA A. P. de Candolle

Prodr. 5: 133. 1836.

Chromolaena odorata (L.) King & Robins., Phytologia 20: 204. 1970; Manilal, Fl. Silent Valley 152. 1988; Ramach. & V.J. Nair, Fl. Cannanore Dist. 247. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 248. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 373. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 280. 2005; C.N.Sunil & Sivad., Fl. Alappuzha 379. 2009. *Eupatorium odoratum* L., Syst. Nat. (ed. 10) 1205. 1759; Hook. f., Fl. Brit. India 3: 244. 1881; Uniyal in Hajra *et al.*, Fl. India 12: 354.1995. **Communist Pacha**.

Aromatic subshrubs. Leaves ovate, acute or acuminate at apex; cuneate at base, to 6-8 x 2-5 cm serrate, basally 3-nerved, densely pubescent; petiole to 3 cm long. Heads homogamous in terminal and axillary corymbose panicles, non-rayed, white. Involucral bracts many seriate, scarious, unequal; outer ovate, concave; inner oblong to linear. Florets bisexual. Corolla tube 4-5 mm long, 5-lobed. Stamens 5, subexserted. Pappus white-silky barbellate.

Fl. & Fr. : November –March.

Distribution: Native of Tropical America, widely distributed in Tropical parts of the world. *Amitha Bachan 123621* (Athirappilly, riparian forests, degraded areas along the banks of Chalakkudy river, 120 m).

ECLIPTA Linnaeus

Mantissa Pl. 2: 157, 286. 1771 *nom. cons.*

Eclipta prostrata (L.) L., Mantissa Pl. 2: 286. 1771, var. **prostrata**; H.J. Chowdhery in Hajra *et al.*, Fl. India 12: 381. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 249. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 281. 2005; C.N.Sunil & Sivad., Fl. Alappuzha 382. 2009. *Verbesina prostrata* L., Sp. Pl. 902. 1753. *Eclipta alba* (L.) Hassk., Pl. Jav. Rar. 528. 1848; Hook. f., Fl. Brit. India 3: 304. 1881; Gamble, Fl. Pres. Madras 705. 1921. *Verbesina alba* L., Sp. Pl. 902. 1753. **Kayyunni.**

Herbs, stem and leaves strigose hairy. Leaves to 7 x 1 cm, elliptic, oblong-lanceolate, serrate to subentire, petiolate or subsessile. Heads axillary, peduncles as long as the leaves. Phyllaries of outer series 5, broad; inner 3, narrow. Achenes black.

Fl. & Fr. : Throughout the year.

Distribution : Pantropical. Moist localities along riverbanks. *Amitha Bachan 98770* (Vazhachal, river banks, along Chalakkudy river, 230 m)

ELEPHANTOPUS Linnaeus

Sp. Pl. 814. 1753.

Elephantopus scaber L., Sp. Pl. 814. 1753; Hook. f., Fl. Brit. India 3: 242. 1881; Gamble, Fl. Pres. Madras 676. 1921; Uniyal in Hajra *et al.*, Fl. India 13: 333. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 249. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 375. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 281. 2005; C.N.Sunil & Sivad., Fl. Alappuzha 382. 2009. **Anachuvadi.**

Rosette herbs with rhizomatous rootstock. Radical leaves towards the base, to 18 x 5 cm, oblong or oblanceolate, acute, crenate-serrate, base narrowed, petiole sheathing at base. Heads terminal on erect

peduncles. Glomerules surrounded by three leafy bracts; phyllaries white hirsute. Corolla lilac or white, lobes linear. Achenes oblong, 4 mm long.

Fl. & Fr. : October – January.

Distribution: Pantropical. Moist forest areas. Wet Riparian forest floor. *Amitha Bachan 98768* (Vazhachal, riparian forests, banks of Chalakkudy river, 230 m).

EMILIA Cassini

Bull. Sci. Soc. Philom. Paris 1817: 68. 1817.

Emilia sonchifolia (L.) DC. in Wight, Contrib. 24.1834; Hook. f., Fl. Brit. India 3: 336. 1881; Gamble, Fl. Pres. Madras 716. 1921; Manilal, Fl. Silent Valley 154. 1988; R. Mathur in Hajra *et al.*, Fl. India 13: 212. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 251. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 376. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 282. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 384. 2009. *Cacalia sonchifolia* L., Sp. Pl. 835. 1753. **Muyalchevian**.

Erect or diffuse slender herbs. Lower leaves lyrate or obovate, entire or toothed, upper ovate or oblong, dentate, auricled at base. Heads homogamous, in lax terminal corymbose cymes on long peduncles. Phyllaries puberulous at apex. Flowers bisexual. Corolla tube slender 8 mm long, 5-lobed. Style arm 0.75 mm long. Achenes pale brown, sub terete, 5-ribbed.

Fl. & Fr. : July – December.

Distribution: Tropical and subtropical Africa and Asia. Plains to moist open areas of the forest. *Amitha Bachan 99050* (Karanthodu-Vazhachal, river bed vegetation, along Chalakkudy river, 400 m).

ERIGERON L.

Erigeron karvinskianus DC., Prodr. 5: 285. 1836; Hajra in Hajra *et al.*, Fl. India 12: 122. 1995; *Erigeron mucronatus* DC., Prodr. 5: 285. 1836; Gamble, Fl. Pres. Madras 682. 1921.

Prostrate herbs, with pretty white flowers. Leaves trilobed, obovate, to 2 x 0.5 cm; lobes acute. Heads solitary, on terminal leaf axils, to 1 cm across, peduncle to 3 cm, terete. Flowers with two type of florets, outer ray florets, with white ray to 4mm; inner disc florets, bisexual.

Fl. & Fr. : November – April.

Distribution: India, Europe, Nepal, Bhutan, Mynmar and Japan. Wet areas of high elevations. *Amitha Bachan 98798* (Nelliyampathy, riparian evergreen forests & stream sides, Karappara streamside 1000 m).

MIKANIA Willdenow

Sp. Pl. 3 (3): 1742. 1803, *nom. cons.*

Mikania micrantha Kunth in HBK, Nov. Gen. Sp. 4: 134. 1820; Uniyal in Hajra et al., Fl. India 12: 357.1995. *Mikania scandens* Clarke, Comp. India 34. 1876, non L.; Hook. f., Fl. Brit. India 3: 144. 1881. *Mikania cordata* (Burm. f.) Robins., Contrib. Gray Herb. 104:65.1934; Sasidh. & Sivar., Fl. Pl. Thrissur For. 251. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 286. 2005; C.N.Sunil & Sivad., Fl. Alappuzha 386. 2009. *Eupatorium cordatum* Burm. f., Fl. India 176. t. 58. 1768.

Fast growing and spreading climbing shrubs. Leaves ovate-cordate, acute or acuminate, margin dentate or subentire, glabrescent; petiole to 4 cm. Heads numerous on corymbs, 4-flowered. Corolla greenish-white. Achenes brown, glabrous, glandular.

Fl. & Fr. : February – April.

Distribution: Pantropical. As weed in the riparian forests. *Amitha Bachan 99135* (Pokalppara, riparian forests, banks of Chalakkudy river, 260 m).

Note: A completely covering and gradually fast spreading weed in forest plantations and disturbed forests, destroying the natural vegetation and plantations.

SPHAERANTHUS Linnaeus

Sp. Pl. 927. 1753.

Sphaeranthus africanus L., Sp. Pl. (ed. 2) 1314. 1763; Hook. f., Fl. Brit. India 3: 275. 1881; Gamble, Fl. Pres. Madras 692. 1921; S. Kumar in Hajra *et al.*, Fl. India 13: 159.1995; C.N. Sunil & Sivad., Fl. Alappuzha 388. 2009. *Sphaeranthus microcephalus* Willd., Sp. Pl. 3: 2395. 1802. **Vella-Adakkamaniyan.**

Branched annual herbs, to 30 cm tall, with an aromatic smell; stems much branched, 3-4-winged, wings entire or distantly denticulate. Leaves, oblanceolate or obovate, attenuate at base, to 2-6 x 0.5-2.5 cm margins serrulate, apex acute, pubescent on both surfaces, sessile. Heads 0.6-1 cm across, globose, terminal on the branches; peduncle stout, up to 2 cm long. Flowers white; corollas 2 mm long, lower half swollen, upper part spreading. Achenes 1 mm long, glandular.

Fl. & Fr.: November- May

Distribution: Indo-Malaysia, China and Australia. Marshy places and river beds. *Amitha Bachan 123687* (Kanakkankadavu, riparian vegetation, banks of Chalakkudy river, Sea level).

SPILANTHES N. J. Jacquin

Enum. Pl. Carib. 8, 28. 1760.

Key to species

1a. Heads heterogamous.....**S. ciliate**

1b. Heads homogamous.....**S. calva**

Spilanthes calva DC. in Wight, Contrib. 19. 1834; Sivar. & Ramesan, J. Econ. Tax. Bot. 10: 144. 1987; Manilal, Fl. Silent Valley 158. 1988; H.J. Chowdhery in Hajra *et al.,* Fl. India 12: 409. 1995; N. Mohanan & Sivad., Fl. Agasthyamala 388. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 287. 2005; *Spilanthes acmella* var. *calva* (DC.) Clarke, Comp. India 138. 1876. *Spilanthes acmella* sensu Hook. f., Fl. Brit. India 3: 307. 1881, non (L.) Murr. 1844; Gamble, Fl. Pres. Madras 708. 1921.

Diffuse herbs, rooting at lower nodes, stem sparsely pubescent. Leaves ovate, to 3-8 x 2-4 cm, acute, base truncate, serrate, sparsely hispid on both sides, cm. Heads terminal, solitary, peduncle to 10 cm long. Corolla yellow. Achenes narrowly obovate, glabrous on margins. Pappus 0.

Fl. & Fr. : February – April.

Distribution : Indo-Malaysia and China. Marshy areas. Moist riparian ground floor. *Amitha Bachan 98823* (Malakkapara, riparian vegetation, Sholayar streamside, 1000 m).

Spilanthes ciliata HBK, Nov. Gen. & Sp. Pl. 4: 621. 1836; Sivar. et al., Anci. Sci. of Life 3: 171. 1984; Sivar. & Remesan, J. Econ. Tax. Bot. 10: 145. 1987; H.J. Chowdhery in Hajra *et al.*, Fl. India 12: 409. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 254. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 288. 2005; C.N.Sunil & Sivad., Fl. Alappuzha 390. 2009. *Acmella ciliata* (HBK) Cass., Dict. Sc. Nat. 24: 331. 1822. **Pallu-Vedana-Cheadi.**

Diffuse herbs, rooting at lower nodes; stem terete. Leaves ovate, acute at apex rounded or subcordate at base, to 7 x 3.5 cm, serrate; petiole to 2 cm long. Heads rayed, axillary, usually solitary, rarely 2-3 in

each axil, 1 cm across, subglobose, turning conical, yellow; peduncle 3-8 cm long. Involucral bracts 2-seriate, shorter than ray florets, inner series narrower and smaller, up to 6 x 2 mm, elliptic, subacute. Palea. 3 mm long, boat-shaped, concave, obtuse, keeled. Ray florets 8-12, female, ligulate; corolla tube 1 mm long, limb 3-lobed; pappus of 3 awns, deciduous; achenes trigonous, black, strongly margined and ciliate along the margins. Disc florets many, bisexual; achenes 2 mm, oblong, truncate at apex, laterally compressed, black, ciliate along the margins.

Fl. & Fr.: August – March.

Distribution: Neotropics. Now naturalized in Western Peninsular India. *Amitha Bachan 9908*5 (Sholayar, riparian vegetation, banks of Sholayar river, 900 m).

STRUCHIUM P. Browne

Civ. Nat. Hist. Jamai. 312, t. 34. 1756.

Struchium sparganophorum (L.) Kuntze, Rev. Gen. Pl. 1: 366. 1891; Vasudevan, Bull. Bot. Surv. India 8: 202. 1966; Uniyal in Hajra *et al.*, Fl. India 13: 347. 1995; Anil Kumar *et al.*, Fl. Pathanamthitta 288. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 391. 2009. *Ethulia sparganophora* L., Sp. Pl. (ed. 2) 1171. 1763.

Erect, semi-aquatic herbs. Leaves alternate, elliptic-lanceolate, to 13 x 4.5 cm, attenuate at base, decurrent on the petiole, acute or acuminate at apex, serrulate-denticulate; petiole to 2.5 cm long. Heads axillary, sessile, clusters, globose, o.5 cm wide, white, homogamous. Involucre in 4-5 series, outer smaller and inner larger, triangular to oblanceolate, acuminate, greenish, margins scarious and hairy. Receptacle convex, pitted. Florets all tubular, without palea, 4-5 mm long, bisexual. Calyx of three white, 0.5 mm long, acute scales united variously, persistent. Corolla 2-3 mm long, white, tube narrow, lobes 5,

spreading glandular. Stamens 3; filaments filiform, white. Ovary 1.5 mm long, stigma bifid, purple. Achenes triangular, 1.5 mm long, blackish.

Fl. & Fr. : August-February.

Distribution: Native of Tropical America, Introduced in all warmer parts of the world. Wet areas, river margins. *Amitha Bachan 117646* (Kadukutty, riparian, banks of Chalakkudy river, 5 m).

SYNEDRELLIA J. Gaertner

Fruct. 2: 456. 1791 *nom. cons.*

Synedrella nodiflora (L.) Gaertn., Fruct. 2: 456. t. 171. 1791; Hook. f., Fl. Brit. India 3: 308. 1881; Gamble, Fl. Pres. Madras 708. 1921; Manilal, Fl. Silent Valley 159. 1988; H.J. Chowdhery in Hajra *et al.*, Fl. India 12: 413. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 254. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 389. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 289. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 392. 2009. *Verbesina nodiflora* L., Cent. Pl. 1: 28. 1755 & Ameon. Acad. 4: 290. 1759.

Erect branched herbs. Leaves opposite, elliptic-ovate, acute at apex, cuneate to truncate at base, to 6 x 3 cm, deccurent on the petiole, serrate; Heads solitary, axillary and terminal, few-flowered, 0.5-1 cm across, radiate. Flowers heterogamous, yellow. Ray flowers: female; corolla tube to 2.5 mm long; ligule 1-2 mm long, 2-3-lobed; ovary 3 mm long, oblong, winged. Disc flowers bisexual; corolla tube 2-3 mm long, lobes 5; stamens 5, included, ovary 2-3 mm long. achenes 3-4 mm long, dimorphic.

Fl. & Fr. : Throughout the year.

Distribution: Native of West Indies, naturalized in Tropical Asia. Moist areas. *Amitha Bachan 123693* (Elanthikkara, riparian vegetation, banks of Chalakkudy river, sea level).

TRIDAX Linnaeus

Sp. Pl. 900. 1753.

Tridax procumbens L., Sp. Pl. 900. 1753; Hook. f., Fl. Brit. India 3: 311. 1881; Gamble, Fl. Pres. Madras 711. 1921; Manilal, Fl. Silent Valley 160. 1988; H. J. Chowdhery in Hajra *et al.*, Fl. India 12: 418. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 255. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 289. 2005; C.N.Sunil & Sivad., Fl. Alappuzha 393. 2009.

Procumbent herbs, rooting at lower nodes, stem terete, tomentose. Leaves ovate-acute, base cuneate, to 5 cm long, smaller towards the tip, margin coarsely dentate or trilobed, hirsute on both sides. Heads to 1 cm across, solitary on long, terete, hirsute peduncles,. Corolla of ray florets creamy white. Alternate papus hairs short.

Fl. & Fr. : Throughout the year.

Distribution: Native of Tropical America, widespread in tropics and subtropics. Sandy or wet areas from plains to high altitudes. *Amitha Bachan 98813* (Vazhachal, riparian vegetation, banks of Chalakkudy river, 220 m).

VERNONIA Schreber

Gen. 1: 541. 1791. *nom. cons.*

1a. Small to medium sized trees.....**V. arborea**

1b. Small erect herbs.....**V. cinerea**

Vernonia arborea Buch.-Ham., Trans. Linn. Soc. London 14: 218. 1824, var. **arborea**; Hook. f., Fl. Brit. India 3: 239. 1881; Manilal, Fl. Silent Valley 160. 1988; Uniyal in Hajra et al., Fl. India 13: 359. 1995; Sasidh.

& Sivar., Fl. Pl. Thrissur For. 255. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 391. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 290. 2005. *Monosis wightiana* DC. in Wight, Contrib. 1. 1834 & Icon. Pl. ind. Orient. t. 1085. 1846. *Vernonia monosis* Benth. ex Clarke, Comp. India 24. 1876 p.p., non Sch.-Bip. 1847; Gamble, Fl. Pres. Madras 672. 1921. *Vernonia arborea* Buch.-Ham. var. *wightiana* (DC.) Hook.f., Fl. Brit. India 3: 239. 1881. **Vettilakarintha.**

Small Trees, to 12 m high; Branchlets brown silky tomentose. Leaves simple, alternate, obovate to elliptic-obovate; acuminate at apex acute or attenuate at base, to 23 x 8 cm, entire or distantly serrate, chartaceous, glabrous above and densely brown tomentose beneath; lateral nerves to 12 pairs; petiole to 2 cm long, pubescent; Flowers bisexual, in heads arranged in terminal tomentose panicles; capitula single flowered, receptacle small; calyx tube adnate to the ovary, pappus 1 seriate; corolla 5 mm across; anthers 2.5 mm, base fimbriate; ovary oblong, 1-celled, shortly beaked above, ovule solitary, erect, style bifid; Fruit an achene, to 2 mm long, 10-ribbed with glands in between, pappus white.

Fl. & Fr. : September - March

Distribution : Indo-Malaysia. Common tree in the evergreen vegetation *Amitha Bachan 123640* (Sholayar, riparian forest, Sholayar riverside 800 m).

Vernonia cinerea (L.) Less., Linnaea 4: 291. 1829; Hook. f., Fl. Brit. India 3: 233. 1881; Gamble, Fl. Pres. Madras 676. 1921; Uniyal in Hajra *et al.*, Fl. India 13: 367. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 256. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 392. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 290. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 394. 2009. *Conyza cinerea* L., Sp. Pl. 862. 1753. **Puvankurunnila.**

Erect herbs. Leaves ovate to obovate-acute to acuminate, irregularly crenate-serrate, sparsely hispid on both sides, very variable in size, to 3 x 2 cm, becomes smaller towards tip. Heads in small terminal corymbs. Corolla bluish-purple. Achenes 4 or 5 angled, villous, pappus white.

Fl & Fr. : Throughout the year.

Distribution: Pantropics. Wet riparian streambeds. *Amitha Bachan 72088* (Vazhachal, Riparian vegetation, banks of Chalakkudy river, 220 m).

WEDELIA N. Jacquin

Enum. Pl. Carib. 8, 28. 1760, *nom. cons.*

Wedelia chinensis (Osbeck) Merr., Philipp., J. Sci. 12: 111. 1917; H.J. Chowdhery in Hajra *et al.*, Fl. India 12: 424. 1995; C.N. Sunil & Sivad., Fl. Alappuzha 397. 2009. *Solidago chinensis* Osbeck, Dagbock OstIndia Resa 241. 1757. *Wedelia calendulacea* (L.) Less., Syn. 222. 1832; Hook. f., Fl. Brit. India 3: 306. 1881; Gamble, Fl. Pres. Madras 707. 1921. *Verbesina calendulacea* L., Sp. Pl. (ed. 2) 1272. 1763. **Kammalchedi.**

Procumbent or ascending herbs, rooting at the nodes. Leaves, spathulate or oblanceolate, acute or apiculate at apex, cuneate at base, to 5 x 1 cm, entire or coarsely serrate, narrowly inrolled; petiole to 1 cm long. Head 2 cm across, axillary, solitary, yellow; peduncle 3-8 cm long. Ray flowers 8-12; corolla tube 1 mm long, ligules 6-8 x 3-4 mm, 2-3-lobed at the apex. Disc flower corollas 4 mm long, lobes 5. Stamens 5. Ovary oblong. Achenes 4 mm, those of ray flowers triquetrous, those of disc flowers compressed, dark brown, rugulose. Pappus minute.

Fl. & Fr. : Throughout the year.

Distribution: Indo-Malaysia. Common along river margins and wet stream sides. *Amitha Bachan 98707* (Puthenvelikkara, river margins, banks of Chalakkudy river, sea level).

66. CORNACEAE (Dumort.) Dumort.

Anal. Fam. Pl. 33, 34. 1829.

MASTIXIA Blume

Bijdr. 654. 1825.

Mastixia arborea (Wight) Bedd. subsp. **meziana** (Wang.) Matthew, Blumea 23: 89. 1976; Sasidh. & Sivar., Fl. Pl. Thrissur For. 213. 1996. *Mastixia meziana* Wang., Feddes Repert. 4: 336. 1907; Gamble, Fl. Pres. Madras 573. 1919. *Mastixia pentandra* sensu Clarke in Hook.f., Fl. Brit. India 2: 746. 1879, non Blume 1826; Gamble, Fl. Pres. Madras 574. 1919.

Medium to large trees. Leaves simple, alternate, estipulate, elliptic-ovate to obovate, to 8-22 x 4-10 cm, cuneate at base, obtusely acuminate or acute at apex, entire; lateral nerves 4-6 pairs; petiole to 3 cm long, stout, glabrous; Flowers bisexual, greenish-yellow, 0.3 cm across, in terminal dense panicles, velvety when young; lower bracts foliaceous, upto 1.5 cm, villous; calyx tube campanulate, to 2 mm, lobes 5; disc fleshy, yellow, 4-5-lobed; petals to 2.5 mm long, thin, appressed hairy outside, valvate; stamens 5; ovary inferior, single ovuled, single celled, pendulous. Drupe ovoid, 3 x 2 cm, smooth, greenish-purple.

Fl. & Fr. : January – May.

Distribution : Endemic to Southern Western Ghats, evergreen forests. *Amitha Bachan 98900* (Sholayar, evergreen riparian forests, banks of Sholayar river, 800 m).

67. LOBELIACEAE R. Br.

in Trans. Linn. Soc. London 12: 133. 1817.

LOBELIA Linnaeus

Sp. Pl. 929. 1753.

Lobelia alsinoides Lam., Encycl. 3: 588. 1792; Haridasan & P.K. Mukh., Fasc. Fl. India 19: 42. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 257. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 399. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 292. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 398. 2009 *Lobelia trigona* Roxb., Fl. India 2: 111. 1824; Hook. f., Fl. Brit. India 3: 423. 1881; Gamble, Fl. Pres. Madras 736. 1921.

Annual glabrous laticiferous herbs; stem 3-angled. Leaves ovate or elliptic to 2 x 1.5 cm, acute at apex, truncate at base, serrate, lower petiolate and upper sessile. Flowers solitary, in the axills of upper nodes; pedicels 1-2 cm long, slender. Calyx lobes 5, 2-3 mm long, subulate; tube 1-2 mm long; corolla bluish, 4-6 mm long, 2-lipped, lower 3-lobed, upper lip 2-lobed. Staminal tube 3-4 mm long; filaments adnate to lower half; ovary 2-celled, many ovuled; stigma shortly 2-fid, ciliate. Capsules 5-ribbed, to 4 x 3 mm, turbinate. Seeds trigonous, smooth.

Fl. & Fr. : August – October.

Distribution: Indo-Malaysia. Wet areas in forests. *Amitha Bachan 117642* (Orukombankutty, stream banks, banks of Chalakudy river, 450 m)

68. CAPRIFOLIACEAE Juss.

Gen. Pl. 210. 1789.

VIBURNUM Linnaeus

Sp. Pl. 267. 1753.

Viburnum punctatum Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 142. 1825; C. B. Clarke in Hook. f., Fl. Brit. India 3: 5. 1880; Anil Kumar *et al.*, Fl. Pathanamthitta 245. 2005. *Viburnum acuminatum* Wall. ex DC.,

Prodr. 4: 325. 1830; Wight, Icon. Pl. India Orient. t. 1021. 1845; Gamble, Fl. Pres. Madras 575. 1919. **Konakarimaram.**

Small evergreen trees. Leaves simple, opposite, elliptic-oblong, 4-13 x 2-5 cm, abruptly acuminate at apex, attenuate at base, punctuate below with peltate scales, nerves 8 pairs; petiole 1.5 cm long. Flowers 5 mm across, on a compound umbellate panicle to 8 cm across, pedicelled; calyx tube 2 mm long, lobes obtuse; corolla white, gamopetalous, campanulate, 2.5 mm long, lobes ovate, obtuse; stamens 5; ovary 1-celled, 1-ovuled; ovule pendulous. Drupe oblong-ellipsoid, ridged, 8 x 5 mm, 1-seeded, reddish brown.

Fl. & Fr.: January-April.

Distribution: Indo-Malaysia. Evergreen forests. *Amitha Bachan 98934* (Nelliyampathy, streamside vegetation, stream draining to Karappara river, 900 m).

69. MYRSINACEAE R. Br.

Prodr. 532. 1810.

Key to genera

1a. Climbing or scandent shrubs.....**Embelia**

1b. Erect trees or shrubs.....2

2a. Leaves ovate-elliptic, serrate..... **Maesa**

2b. Leaves elliptic-obovate, serrulate except the lower two third.. **Ardisia**

ARDISIA O. Swartz

Prodr. 3, 48. 1788 *nom. cons.*

Ardisia sonchifolia Mez in Engl., Pflanzenreich Myrsinac. 116. 1902; Gamble, Fl. Pres. Madras 755. 1921; Sasid. & Sivar., Fl. Pl. Thrissur For. 259. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 405. 2002. *Ardisia*

villosa Roxb. var. *obtusa* C. B. Clarke in Hook. f., Fl. Brit. India 3: 525. 1882. **Plate 34.F**

Large shrubs. Leaves elliptic–oblong to obovate, base cuneate to obtuse at the extreme base, acute to shortly acuminate at tip, chartacious, serrulate except at the lower one third; lateral nerves 10-14 pairs, slender; petiole to 0.5 cm. Inflorescence axillary or terminal short panicles, rusty tomentose; Flowers in umbels, pink, drooping; pedicel 0.6 mm; Calyx lobes 6, ovate-lanceolate, 1.2 mm long. Corolla pink-red, lobes broadly ovate, cuspidate; Anthers 6, acute; ovary globose. Fruit a globose or sub-globose berry.

Fl. & Fr. : March – April.

Distribution : Endemic to Southern Western Ghats. Endangered. Streamside in evergreen forest. *Amitha Bachan 99061* (Karimala-Sholayar, streamside vegetation in the wet evergreen forest, banks of Karimalathodu, 1000 m).

EMBELIA N. L. Burman

Fl. In. 62. 1768, *nom. cons.*

Embelia ribes Burm. f., Fl. India 62. t.23.1768; C. B. Clarke in Hook. f., Fl. Brit. India 3: 513.1882; Gamble, Fl. Pres. Madras 752. 1921; Manilal, Fl. Silent Valley 166. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 263. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 408. 2002; Anil Kumar *et al.,* Fl. Pathanamthitta 294. 2005. *Embelia glandulifera* Wight, Icon. Pl. Indi. Orent. t. 1207. 1848. **Vizhal.**

Lianas, stem brown, tuberculatue; branchlets slender. Leaves obovate-oblong, to 8 x 3 cm, acute to shortly acuminate at apex, rounded at base, chartaceous, glabrous, gland dotted at either sides of the midrib.

Peduncle pubescent. Calyx lobes ovate, ciliate along margins. Petals 2 mm long, greenish-white, villous inside. Berry globose, 4 mm across.

Fl. & Fr. : December-May.

Distribution: Indo-Malaysia and south China. Evergreen forests. Along rocky exposed stream banks. *Amitha Bachan 117712* (Ittiany-Vazhachal, exposed riparian forest, banks of Chalakkudy river, 150 m).

MAESA Forssk.

Maesa indica (Roxb.) DC., Trans. Linn. Soc. London 17: 134. 1834; Manilal, Fl. Silent Valley 166. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 263. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 409. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 294. 2005. *Baeobotrys indica* Roxb., Fl. India 2: 230. 1824. *Maesa dubia* (Wall.) DC., Trans. Linn. Soc. London 17: 134. 1834; Clarke in Hook. f., Fl. Brit. India 3: 510. 1882; Gamble, Fl. Pres. Madras 749. 1921. *Maesa perrottetiana* A. DC. in DC., Prodr. 8: 80. 1844; Gamble, Fl. Pres. Madras 749. 1921. *Maesa indica* (Roxb.) DC. var. *perrottetiana* (A. DC.) C. B. Clarke in Hook. f., Fl. Brit. India 3:509. 1882. **Kattuvizhal.**

Large shrubs; branchlets glandular. Leaves alternate, ovate-elliptic, acute at apex, rounded at base, to 14 x 7 cm, cuneate, serrate, glandular lined; lateral nerves 10 pairs, regular; petiole to 3 cm long. Flowers in axillary branched racemes; pedicels 2 mm long; calyx tube adnate to the ovary, lobes 5, orbicular, 0.5 mm long; corolla white, 4 mm across; stamens 5; anthers orbicular; ovary 1-celled, ovules many, immersed in globose, placenta, stigma capitate. Fruit a rose, fleshy berry; seeds few, angular, black.

Fl. & Fr. : September – May.

Distribution : Indo-Malaysia and Pakistan. streamside in evergreen forest, shola forest and grasslands. *Amitha Bachan 98955* (Nelliyampathy-Pullala, streamside vegetation in evergreen forest, 1000 m).

70. SAPOTACEAE Juss.

Gen. Pl. 151. 1789.

Key to genera

1a. Corolla lobes 18-24.....**Mimusops**

1b. Corolla lobes less than 10.....2

2a. Stamen 5-6; nerves of the leaves many, close and parallel.....
.....**Chrysophyllum**

2b. Stamens 8-20; nerves of the leaves not as above.....3

3a. Calyx lobes 6.....**Palaquium**

3b. Calyx lobes 4.....4

4a. Stamens 8; corolla lobes 4.....**Isonandra**

4b. Stamens 16; corolla lobes 8.....**Madhuca**

CHRYSOPHYLLUM Linnaeus

Sp. Pl. 192. 1753

Chrysophyllum roxburghii G. Don, Gen. Hist. 4: 33. 1837-1838; C. B. Clarke in Hook. f., Fl. Brit. India 3: 535. 1882; Gamble, Fl. Pres. Madras 758. 1921; Sasidh. & Sivar., Fl. Pl. Thrissur For. 264. 1996. *Donella roxburghii* (Don) Pierre ex Lecomte, Fl. Indo-Chine 3: 897. 1930. *Chrysophyllum lanceolatum* (Blume) A. DC. in DC., Prodr. 8: 162. 1844, *nom. illeg. Nycterisition lanceolatum* Blume, Bijdr. 676. 1826. **Velinjeen-Pali**.

Large evergreen trees with milky exudation. Leaves simple, alternate, distichous, estipulate; elliptic, oblong, elliptic-oblong, acute at base, acuminate at apex, to 16 x 5 cm, entire, glabrous, shining, coriaceous; petiole 1 cm long; lateral nerves many; Flowers bisexual, green, in axillary fascicles, pedicels to 0.5 cm long, pubescent; calyx lobes 5-6, sepals 0.2 cm long, imbricate, concave, obtuse; corolla campanulate, lobes 5-6, 0.1 cm long, villous along margin; stamens 5-6, included; anthers ovate; ovary 5-6-locular, superior, hairy, ovules one in each cell. Berry, globose, 3-5 cm across, yellowish-green; seeds subellipsoid, compressed, black.

Fl. & Fr. : July-October.

Distribution: Tropical Asia. Evergreen riparian forests. *Amitha Bachan 117688* (Orukombankutty, riparian evergreen forest, banks of Chalakkudy river, 400 m).

ISONANDRA Wight

Icon. Pl. India Orient. t. 359. 1840.

Isonandra lanceolata Wight, Icon. Pl. India Orient. t. 359. 1840; C. B. Clarke in Hook. f., Fl. Brit. India 3: 539. 1882; Gamble, Fl. Pres. Madras 761. 1921; Truken, Blumea 6: 568. 1952; Manilal, Fl. Silent Valley 167. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 264. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 411. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 295. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 407. 2009. *Isonandra wight*iana A. DC. in DC., Prodr. 8: 187. 1844; C. B. Clarke in Hook. f., Fl. Brit. India 3: 539. 1882. *Isonandra lanceolata* Wight var. *anfractuosa* C. B. Clarke in Hook.f., Fl. Brit. India 3: 539. 1882; Gamble, Fl. Pres. Madras 761. 1921. *Isonandra lanceolata* Wight forma *anfractuosa* (C. B. Clarke) Jeuken, Blumea 6: 560. 1952. **Vellapala.**

Small trees to 8 m high; branchlets slender. Leaves simple, alternate or alternate spiral. estipulate, Leaves lanceolate to oblanceolate, thin, to 15 x 6 cm, 9-13-nerved, abruptly acuminate at apex, cuneate at base; petiole 1 cm long. Flowers in axillary fascicles, shortly pedicelled; bracts acute; bracteoles rounded; sepals 0.1 cm, lobes 4, ovate, acute, tomentose; corolla greenish-yellow, 0.7 cm long, lobes 4, acute; stamens 8, anthers cuspidate at apex. Ovary 0.1 cm long, 4-celled, hairy. Berry, 1.5 cm long, ellipsoid, orange-yellow.

Fl. & Fr. : August-October.

Distribution: Indo-Malaysia. Evergreen riparian forests. *Amitha Bachan 117689* (Orukombankutty, riparian evergreen forest, banks of Chalakkudy river, 450 m).

MIMUSOPS Linnaeus

Sp. Pl. 349. 1753.

Mimusops elengi L., Sp. Pl. 349. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 3: 548. 1882; Gamble, Fl. Pres. Madras 765. 1921; Royen, Blumea 6: 594. 1952; Sasidh. & Sivar., Fl. Pl. Thrissur For. 267. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 414. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 296. 2005; N. Sunil & Sivad., Fl. Alappuzha 407. 2009. **Elengi.**

Large evergreen trees; branchlets stout, rusty tomentose. Leaves broadly elliptic, abruptly acuminate, to 13 x 5 cm, glabrous, glossy above; nerves many, closely placed, parallel; petiole 1.5-4 cm long, slender, grooved above, pubescent. Flowers 2-5 together, in axillary fascicles; pedicels 7 mm long, stout, rusty tomentose; corolla 1 cm across; lobes 24, 3 series of 8 each, with hairs on back and margins, acuminate; stamens 8, alternating with pilose staminodes. Ovary 0.1-

0.15 cm long, 6-8-celled; 1 ovule in each cell. Berry, yellow, ovoid, 2.5 cm long.

Fl. & Fr. : December & May.

Distribution: Indo-Malaysia. Evergreen forests. *Amitha Bachan 117787* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

MADHUCA Hamilton ex J. F. Gmelin

Syst. Nat. 2: 773, 799. 1791.

Madhuca neriifolia (Moon) H. J. Lam, Bull. Jard. Bot. Buitenz. ser. 3, 7.182,265. 1925; Royen, Blumea 10: 98. 1960; Sasidh. & Sivar., Fl. Pl. Thrissur For. 265. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 413. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 296. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 407. 2009. *Bassia neriifolia* Moon, Cat. Pl. Ceylon 36. 1824. *Bassia malabarica* Bedd., For. Man. Bot. 140.1872; C. B. Clarke in Hook. f., Fl. Brit. India 3:544.1882; Gamble, Fl. Pres. Madras 763. 1921. **Attu-ilippa**. **Plate 45. D.**

Evergreen trees, to 15 m high; branchlets stout. Leaves simple, alternate, crowded at the tip of branchlets, to 15 x 5 cm, entire; Flowers in axillary fascicles; pedicels 2-3 cm long, thinly tomentose; sepals 4, biseriate, outer sepals 0.8 cm, ovate, hairy, inner smaller; corolla yellowish-red, 1.5 cm long, campanulate; oblong, obtuse; stamens 16, filaments short, densely hairy; anthers lanceolate, long-ciliate at base, connective produced; ovary 0.5 cm long, oblong, superior, glabrous without, 6-8-celled, ovules 1 in each cell. Berry, 2-3 cm long, ellipsoid, beaked; seed one.

Fl. & Fr. : December - January.

Distribution: India and Sri Lanka. Evergreen riparian forests. *Amitha Bachan 72001* (Athirappilly, riparian evergreen forest, banks of

Chalakkudy river, 120 m); *Amitha Bachan 123471* (Kulamali-Sholayar, riparian evergreen forest, banks of Kulamalithodu, 900 m).

PALAQUIUM Blanco

Fl. Filip. 403. 1837.

Palaquium ellipticum (Dalz.) Baill., Traite, Bot. Med. Phan. 1500. 1884; Gamble, Fl. Pres. Madras 764. 1921; Manilal, Fl. Silent Valley 168. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 267. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 414. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 296. 2005. *Bassia elliptica* Dalz. in Hooker's J. Bot. Kew Gard. Misc. 3: 36. 1851. *Dichopsis elliptica* (Dalz.) Benth. in Benth. & Hook. f., Gen. Pl. 2: 658. 1876; C. B. Clarke in Hook. f., Fl. Brit. India 3: 542. 1882. **Pali.**

Large trees; bark reddish inside; branches glabrous. Leaves alternate, subopposite or in indistinct whorls, estipulate, obovate, oblanceolate or obovate-elliptic, cuneate at base, obtuse, acute, obtusely acuminate at apex, to 8 x 4 cm, entire; lateral nerves 9 pairs, prominent below, parallel. Flowers bisexual, yellowish, in solitary or in few flowered axillary clusters; pedicels 2.5-4 cm long, pubescent, brown; calyx lobes 6 in 2 series; corolla campanulate, 0.5 cm long, lobes 6; stamens 12, attached to the base of corolla. Ovary villous, 6-celled. Berry 3.5 cm, glabrous, fleshy, ellipsoid, beaked. Seed one.

Fl & Fr. : March to July.

Distribution: Climax species of the Evergreen forests. riparian evergreen forests. *Amitha Bachan 117773* (Sholayar, riparian evergreen forest, banks of Sholayar river, 700 m).

71. EBENACEAE Gurke

in Engler & Prantl, Nat. Pflanzenfam. 4 (1): 153. 1891.

DIOSPYROS Linnaeus

Sp. Pl. 1057. 1753.

Key to species

1a. Leaves small, < 4 cm long..... **D. buxifolia**

1b. Leaves large, >4 cm long.....2

2a. Branchlets glabrous; fruit 3-5 cm across.....**D. crumenata**

2b. Branchlets not glabrous; fruit under 3 cm across.....3

3a. Leaves pubescent; berry 5 angled, pubescent..... **D. paniculata**

3b. Leaves glabrous; berry smooth, glabrous..... **D. assimilis**

Diospyros assimilis Bedd., Madras For. Rep. 20. t.1. 1866-1867; C. B. Clarke in Hook. f., Fl. Brit. India 3: 558. 1882; Gamble, Fl. Pres. Madras 775. 1923. **Nanchimaram, Karimthali.** **Plate 27. D**

Medium sized evergreen trees, dioecious, branchlets minutly tomentose. Leaves simple, alternate, estipulate, ovate-elliptic, elliptic-oblong, 7-18 x 3-6 cm, unequally acute to obtuse at base, acuminate at apex, entire, glabrous, chartaceous; lateral nerves 4-7 pairs; petiole to 1 cm long. Flowers yellowish-white, sessile, unisexual; Male flowers: in dense axillary cymes, 0.8 cm across, stamens 36, in groups of 4. Female flowers: larger, solitary; covered with imbricating bracts; pedicel to 0.4 cm long, calyx cupular, 0.2 cm long, densely tomentose; lobes 4, ovate, obtuse, glabrous, margin ciliate, reflexed; corolla salver shaped, 1 cm long, densely tomentose; lobes 4, ovate, acute, 0.6 cm long, tomentose outside; ovary superior, 8-celled, ovule 1-in each cell. Berry, oblong-globose, 2 x 1 cm, smooth.

Fl. & Fr. : March-July.

Distribution: Endemic to the Western Ghats. Evergreen forests. *Amitha Bachan 123671* (Kulamali-Sholayar, streamside vegetation in evergreen forest, banks of Kulamalithodu draining to Sholayar reservoir, 800 m).

Diospyros buxifolia (Blume) Hiern, Trans. Cambridge Philos. Soc. 12: 218. 1873; Sasidh. & Sivar., Fl. Pl. Thrissur For. 270. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 416. 2002. *Leucoxylum buxifolium* Blume, Bijdr. 1169. 1826. *Diospyros microphylla* Bedd., Icon. Pl. Ind. Orient. t. 133. 1868-1874; C. B. Clarke in Hook. f., Fl. Brit. India 3: 559. 1882; Gamble, Fl. Pres. Madras 776. 1923. **Malamuringa.**

Large evergreen trees, dioecious, buttressed. Leaves simple, alternate, bifarious, estipulate; ovate, to 4 x 2 cm, acute or cuneate at base, acute at apex, entire, glabrous above except midrib and pubescent beneath; lateral nerves 2-3 pairs; petiole 2-3 mm. Flowers unisexual, Male flowers: white, 2-3 mm long, 1-4 together in subsessile axillary cymes; calyx lobes 4, densely fulvous-hairy outside; corolla campanulate, lobes 4, orbicular, apiculate with a line of hairs on the back; stamens 16, in pairs, filaments connate at base. Female flowers: solitary, subsessile; calyx and corolla as in males; staminodes absent; ovary superior, ovoid, pubescent, 4-celled, ovule 1 in each cell. Berry, oblong, pointed, to 1.75 cm long, purple when ripe, glabrous.

Fl. & Fr.: March-May.

Distribution: Indo-Malaysia. Evergreen forests. *Amitha Bachan 123610* (Vazhachal, riparian forest, banks of Chalakkudy river, 180 m).

Diospyros crumenata Thwaites, Enum. Pl. Zeyl. 179. 1860; C. B. Clarke in Hook. f., Fl. Brit. India 3: 567. 1882; Sasidh. & Sivar., Fl. Pl. Thrissur For. 270. 1996. **Karimbudan, Karimaram**.

Medium sized evergreen trees, dioecious, bark black; branchlets glabrous. Leaves simple, alternate, estipulate, ovate-oblong or elliptic-oblong, to 14 x 6 cm, obtuse to acute at base, acute or acuminate at apex, entire, glabrous, glossy, coriaceous; lateral nerves 6-10 pairs; petiole to 1.2 cm. Flowers unisexual. male flowers. 3-7 flowers in shortly stalked cymes; peduncle to 1 cm long, pilose; calyx large, cupular, tomentose on outside; lobes 4, obtuse; corolla tubular, yellow; lobes 4; stamens about 12. Female flowers: solitary, axillary; calyx large, cupular, tomentose, lobes 4, broad acute; ovary superior, pilose, 8-celled, ovule 1-in each cell. Berry, subglobose, 3-5 cm across, smooth; calyx persistent, enlarged, woody; seeds 1-8, oblong, compressed, to 2.2 x 1 cm, glossy black.

Fl. & Fr.: February-April.

Distribution: Endemic to South West India and Sri Lanka. Low-elevation evergreen forest. *Amitha Bachan 123612* (Charpathodu-Vazhachal, riparian forest, banks of Charpa thodu, 300 m).

Diospyros paniculata Dalz. in Hooker's J. Bot. Kew Gard. Misc. 4: 109. 1852; C. B. Clarke in Hook. f., Fl. Brit. India 3: 570. 1882; Gamble, Fl. Pres. Madras 775. 1923; Sasidh. & Sivar., Fl. Pl. Thrissur For. 271. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 418. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 300. 2005. **Karivela.**

Small to medium sized dioecious trees; branchlets angular, pubescent. Leaves simple, alternate, estipulate, oblong or oblong-lanceolate, 10-18 x 3-6 cm, acute, round or cuneate at base, acute, to obtusely acuminate at apex, entire, reflexed near the base, glabrous, coriaceous; lateral nerves 6-9 pairs; Flowers unisexual. Male flowers: 3-5 together in short panicled cymes, bracts; bracts ovate-cordate, 1 x 0.8 cm, pubescent; calyx globose, 5-angled, 5-lobed; corolla creamy; 5-lobed

oblong; stamens 16-20 in pairs, equal. Female flowers: solitary, axillary; pedicel to 2 cm long; bracts larger; calyx glabrescent; staminodes 10; ovary superior, 4-celled, ovule 1 in each cell, tomentose. Berry, ovoid to 4 x 1.5 cm, 5-angled, yellowish-brown, puberulous; calyx persistent, saccate.

Fl. & Fr.: September-February.

Distribution: Endemic to the Western Ghats. Evergreen forests. *Amitha Bachan 99013* (Orukombankutty, riparian vegetation, banks of Chalakkudy river, 450 m).

72. SYMPLOCACEAE Desf.

Mem. Mus. Hist. Nat. 6: 9. 1820.

SYMPLOCOS N. J. Jacquin

Enum. Pl. Carib. 5: 24. 1760.

Key to species

1a. Flowers pink; drupe ovoid, oblong..... **S. macrophylla**

1b. Flowers white; drupe globose, ampulliform..... **S. cochinchinensis**

Symplocos cochinchinensis (Lour.) Moore subsp. **laurina** (Retz.) Nooteb., Rev. Symplocaceae 156. 1975; Manilal, Fl. Silent Valley 169. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 272. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 419. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 300. 2005. *Myrtus laurina* Retz., Obs. Bot. 4: 26. 1786. *Drupatris cochinchinensis* Lour., Fl. Cochinch. 314. 1790. *Symplocos spicata* Roxb., Fl. India 2: 542. 1832; Clarke in Hook. f., Fl. Brit. India 3: 573. 1882. *Symplocos spicata* Roxb. var. *laurina* (Retz.) Clarke in Hook. f., Fl. Brit. India 3: 573. 1882; Gamble, Fl. Pres. Madras 782. 1921. *Symplocos spicata* Roxb. var. *malasica* Clarke in Hook. f., Fl. Brit. India

3: 573. 1882. *Symplocos spicata* Roxb. var. *attenuata* (A.DC.) Clarke in Hook. f., Fl. Brit. India 3: 573. 1882. *Symplocos laurina* (Retz.) Wall. ex G. Don, Gen. Hist. 4: 3. 1837-1838. **Pachoti.** **Plate 27.F**

Small trees. Leaves simple, alternate elliptic, to 13 x 6 cm, acute at base and apex, dentate-crenulate, coriaceous, glabrous; lateral nerves 7-10 pairs; petiole 1.5 cm long, glabrous. Flowers in axillary usually three branched spikes; spikes to 3-7 cm long, hispid on axis; flowers white, sessile, many, sepals rounded, 1 mm across, hairy; corolla 7 mm across, glabrous, lobes orbicular; stamens numerous, equal, arranged, in 5 groups; style glabrous. Drupe globose, ampulliform, ribbed, 0.5cm long, glabrous.

Fl. & Fr. : December-March.

Distribution: Indo-Malaysia and China. Evergreen forests, streambanks. *Amitha Bachan 98930* (Nelliyampathy-Pullala, streamside vegetation, banks of stream draining to Karappara river, 900 m).

Symplocos macrophylla Wall. ex A. DC subsp. **rosea** (Bedd.) Nooteb., Rev. Symplocaceae 229. 1975; Sasidh. & Sivar., Fl. Pl. Thrissur For. 272. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 423. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 301. 2005. *Symplocos rosea* Bedd., Trans. Linn. Soc. London 25: 219. 1866; Clarke in Hook. f., Fl. Brit. India 3: 583. 1882; Gamble, Fl. Pres. Madras 783. 1921. *Symplocos barberi* Gamble, Bull. Misc. Inform. Kew 1921: 219. 1921 & Gamble, Fl. Pres. Madras 783. 1921. **Plate 27. E**

Large shrubs to small trees; branchlets hispid. Leaves oblanceolate, to 15 x 5 cm, bluntly acuminate, sharply serrate, coriaceous, glabrous; nerves 4-5 pairs, midrib hairy below; petiole 1 cm long. Spikes 4 cm long, unbranched, hispid; bracts ovate, acute, hispid. Flowers few, shortly pedicelled; sepals rounded, densely hairy; corolla 1

cm across, pink, glabrous, lobes roundish; stamens 50, unequal; disk hairy. Drupe ovoid-oblong, to 1.5 cm, rose-red turning blue, glabrous.

Fl. & Fr. : January-May.

Distribution: Endemic to Southern Western Ghats; Endangered. Riparian evergreen forests. *Amitha Bachan 99120 & 72067* (Vazhachal, riparian forest, banks of Chalakkudy river, 230m); *Amitha Bachan 99108* (Karanthodu, riparian forest, banks of Chalakkudy river, 350m); *Amitha Bachan 99108* (Pokalppara, riparian forest, banks of Chalakkudy river, 250 m).

73. OLEACEAE Hoffmanns & Link

Fl. Portug. 1: 385. 1813-1820.

Key to genera

1a. Woody Climbers.....2

1b. Shrubs or trees.....3

2a. Stem 4-angled; leaves prominently ribbed from base; corolla lobes valvate..... **Myxopyrum**

2b. Stem terete; leaves not ribbed from base; corolla lobes imbricate .... **Jasminum**

3a. Petals united in pairs or free..... **Chionanthus**

3b. Petals united at the base into a tube.....4

4a. Flowers polygamous; panicle axillary .....**Olea**

4b. Flowers all bisexual; panicles terminal..... **Ligustrum**

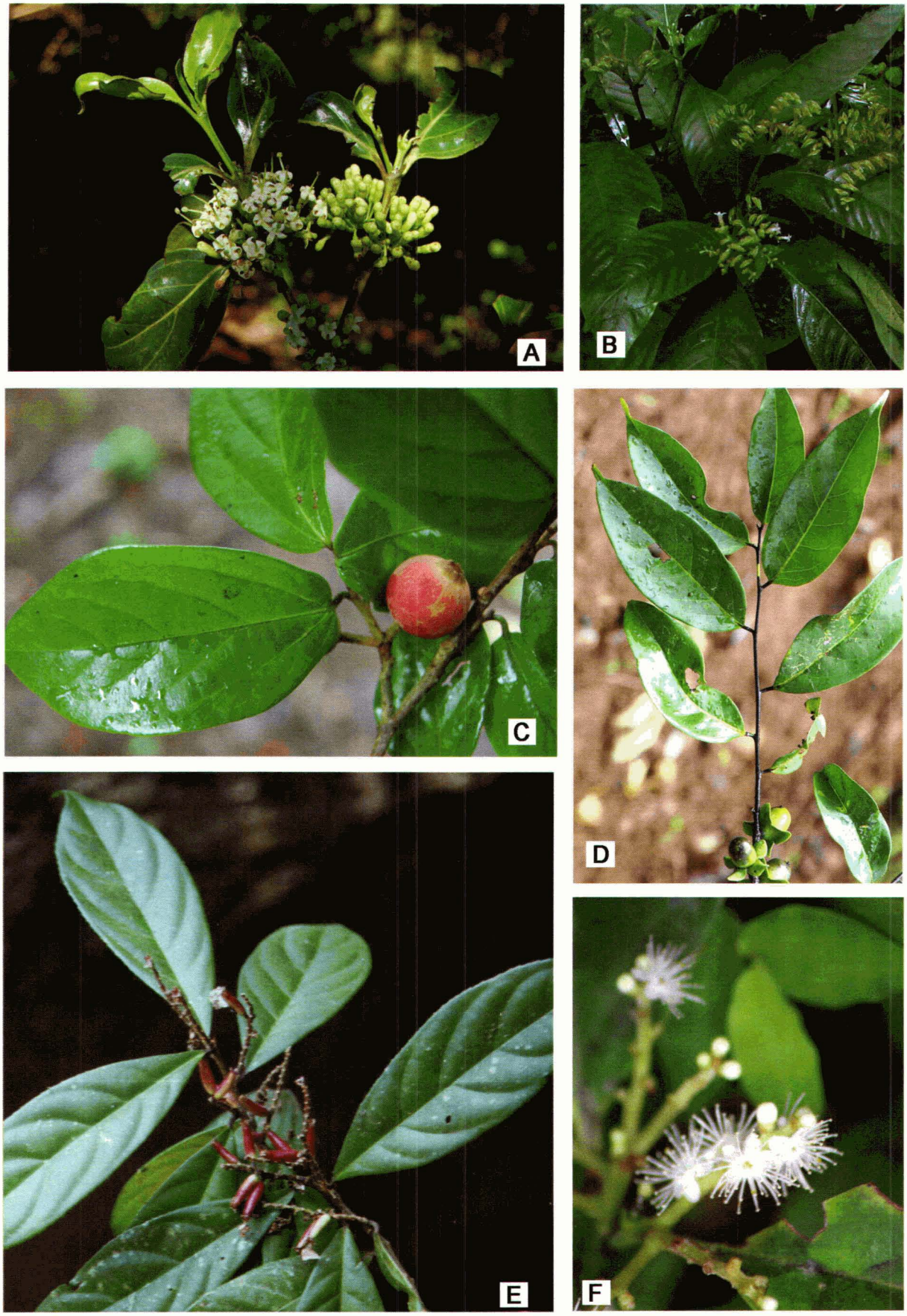


Plate 27. A. *Psydrax dicoccos* Gaertn. var. *dicoccos*; B. *Ophiorrhiza mungos* L.; C. *Alangium salvifolium* (L. f.) Wang. subsp. *salvifolium*; D. *Diospyros assimilis* Bedd.; E. *Symplocos macrophylla* Wall. ex A. DC. subsp. *rosea* (Bedd.) Nooteb.; F. *Symplocos cochinchinensis* (Lour.) Moore subsp. *laurina* (Retz.) Nooteb.,

CHIONANTHUS Linnaeus

Sp. Pl. 8. 1753.

Chionanthus mala-elengi (Dennst.) P. S. Green, Bull. Bot. Surv. India 26. 124. 1984 subsp. **mala-elengi** Sasidh. & Sivar., Fl. Pl. Thrissur For. 273. 1996; P. S. Green, Kew Bull. 58: 264. 2003; Anil Kumar *et al.*, Fl. Pathanamthitta 302. 2005. *Forsythia mala-elengi* Dennst., Schluss. Hort. Malab. 12,21, 31. 1818. *Linociera malabarica* Wall. ex G. Don, Gen. Hist. 4: 53. 1837-1838; C. B. Clarke in Hook. f., Fl. Brit. India 3: 607. 1882; Gamble, Fl. Pres. Madras 794. 1923. *Chionanthus malabaricus* (Wall. ex G. Don) Bedd., Fl. Sylv. t. 239. 1872. **Kallidala, Mala-elangi. Plate 28. A**

Trees to 15 m high. Leaves simple, opposite, estipulate, obovate to 10 x 5 cm, apex obtuse or suddenly narrowed to a small blunt acumen, acumen twisted, base cuneate, margin entire, glabrous, glaucous beneath, coriaceous; lateral nerves 9-13 pairs, slender, pinnate; intercostae reticulate, faint. Cymes congested, pedunculate, yellowish-white, in axillary clusters. Flowers sessile; calyx 1.5 mm long, ovate; corolla 7 mm long, attached in pairs; stamens 2, anthers sessile; ovary densely hairy. Drupes 10 x 5 mm, ellipsoid, acute, ridged.

Fl. & Fr. : December – April.

Distribution: Endemic to Peninsular India. Evergreen to moist deciduous forests. *Amitha Bachan 123624* (Sholayar, streamside vegetation, 650 m).

JASMINUM Linnaeus

Sp. Pl. 7. 1753.

Key to species

1a. Stem glabrous.....**J. angustifolium**

1b. Stem pubescent.....**J. coarctatum**

Jasminum angustifolium (L.) Willd., Sp. Pl. 1: 36. 1797, var. **angustifolium** C. B. Clarke in Hook. f., Fl. Brit. India 3: 598. 1882; Gamble, Fl. Pres. Madras 790. 1923; Manilal & Sivar., Fl. Calicut 159. 1982; P. S. Green, Kew Bull. 58: 293. 2003; Anil Kumar *et al.*, Fl. Pathanamthitta 303. 2005. *Nyctanthes angustifolia* L., Sp. Pl. 6. 1753. **Pichakam, Kattumallika, Kattumulla.**

Scandent shrubs; stem glabrous. Leaves simple, opposite, ovate to lanceolate, to 8 x 2.5 cm, acuminate at apex, rounded at base, glabrous; petiole 1 cm long. Cymes 3-flowered, peduncled or sessile, terminal; pedicel 2 cm long; bracts linear. Flowers white; calyx tube 3 mm long, lobes 5-6, 10 mm long, subulate, glabrous; corolla tube 2.5 cm long, lobes 5-9, oblong, obtuse, glabrous. Berry globose, glabrous.

Fl. & Fr. : November-March.

Distribution: Endemic to Peninsular India. Wild, usually in the lower elevations and plains, sacred groves. *Amitha Bachan 117637* (Annamanada, riparian, banks of Chalakkudy river, 3 m)

Jasminum coarctatum Roxb., Fl. India 1: 91. 1820; P. S. Green, Kew Bull. 58: 289. 2003. *Jasminum rottlerianum* Wall. ex A. DC. in DC., Prodr. 8: 305. 1844; C. B. Clarke in Hook. f., Fl. Brit. India 3: 593. 1882; Gamble, Fl. Pres. Madras 789. 1923; Sasidh. & Sivar., Fl. Pl. Thrissur For. 274. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 303. 2005. *Jasminum rottlerianum* Wall. ex A. DC. var. *glabrior* C. B. Clarke in Hook. f., Fl. Brit. India 3:593. 1882; Manilal, Fl. Silent Valley 171. 1988.

Climbing shrubs, stem pubescent. Leaves elliptic, oblong, to 8-10 x 4 cm, acute or acuminate at apex, rounded at base, glabrescent above, softly villous below, membranous; lateral nerves 5-6; petiole 0.5 cm long. Peduncle 1.5-2 cm long, tomentose. Flowers in terminal lax-flowered cymes, many, densely packed; bracts lanceolate, to 8 x 3 mm, hairy;

calyx lobes 4 mm long, subulate; corolla tube 2 cm long, lobes 7, oblong, white.

Fl. & Fr. : January – July

Distribution: Endemic to Peninsular India and Sri Lanka, common in moist forests. *Amitha Bachan 123326* (Sholayar, riparian evergreen, banks of Sholayar river, 600 m).

LIGUSTRUM Linnaeus

Sp. Pl. 1753

Ligustrum robustum (Roxb.) Blume subsp. **walkeri** (Decne.) P. S. Green, Kew Bull. 40: 130. 1985 & Rev. Handb. Fl. Ceylon 270. 1987; Sasidh. & Sivar., Fl. Pl. Thrissur For. 274. 1996; P. S. Green, Kew Bull. 58: 267. 2003; Anil Kumar *et al.*, Fl. Pathanamthitta 304. 2005. *Ligustrum walkeri* Decne., Nouv. Arch. Mus. Hist Nat. Paris 2: 27. 1879; Hook. f., Fl. Brit. India 3: 614. 1882; Gamble, Fl. Pres. Madras 797. 1923.

Large shrubs to small trees, branchlets lenticellate. Leaves lanceolate or ovate-lanceolate to 8 x 3 cm, acute at base, acute or abruptly acuminate at apex, glabrous, coriaceous. Lateral nerves 5-7 pairs. Flowers on terminal thyrsoid panicles to 15 cm, minutely puberulent. Calyx 1 mm long, shortly toothed, glabrescent. Corolla 2.5 mm, lobes reflexed, valvate. Ovules 2 in each cell, pendulous. Drupe 1 or 2 celled.

Fl. & Fr. : May – September

Distribution : Endemic to Sri Lanka and Peninsular India. Evergreen forests. *Amitha Bachan 98715* (Ranimedu-Nelliyampathy, streamsides, Kuriyarkutty river, 1100 m); *Amitha Bachan 98736* (Karimala-Sholayar, streamside near shola, 1300 m).

MYXOPYRUM Blume

Bijdr. 683. 1825, '1826'.

Myxopyrum smilacifolium (Wall.) Blume, Mus. Bot. Ludg.-Bat. 1: 320. 1851; Hook. f., Fl. Brit. India 3: 618. 1882; Kiew, Blumea 29: 509. 1984; Manilal, Fl. Silent Valley 172. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 275. 1996; Mohanan & Sivad., Fl. Agasthyamala 431. 2002; P. S. Green, Kew Bull. 58: 273. 2003; Anil Kumar et al., Fl. Pathanamthitta 304. 2005; Sunil, Fl. Alappuzha Dist. 507. 2000. *Chionanthus smilacifolia* Wall. in Roxb., Fl. India 1: 108. 1820. *Myxopyrum serratulum* Hill., Bull. Misc. Inform. Kew 1910: 41. 1910; Gamble, Fl. Pres. Madras 798. 1923. **Chathuramulla.**

Twining shrubs; branches 4-angular, glabrous. Leaves elliptic-ovate or oblong to 7-12 x 3-5 cm, , rounded to subcordate at base, acuminate at apex, serrate, 3-5 nerved from base, subcoriaceous; petiole to 1.2 cm long. Flowers in axillary trichotomous panicles, small, 4-merous, bisexual. Calyx 1-1.5 cm long, shortly 4 lobed, ovate, acute, pubascent. Corolla yellowish,companulate, tube 1.3 mm long; lobes 4. Stamens 2, included. Ovary 2-celled; ovules 1-2-per locule; stigma 2-lobed; style indistinct. Berry 1-1.5 cm across, sub globose, black. Seeds 1-2.

Fl. & Fr. : May – July.

Distribution: Endemic to Sri Lanka and Peninsular India. Evergreen forests. *Amitha Bachan 99189* (Vazhachal, riparian evergreen forest, banks of Chalakudy river, 230 m).

OLEA Linnaeus

Sp. Pl. 8. 1753.

Olea dioica Roxb., Fl. India 1: 105. 1820; Hook. f., Fl. Brit. India 3: 612. 1882; Gamble, Fl. Pres. Madras 796. 1923; Manilal, Fl. Silent Valley 173. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 275. 1996; P.S. Green, Kew. Bull. 57: 121. 2002; Mohanan & Sivad., Fl. Agasthyamala 432. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 304. 2005; Sunil, Fl. Alappuzha Dist. 507. 2009. *Olea laevis* Stokes, Bot. Comm. 1: 30. 1830. **Oli, Edala**.

Small to medium trees; bark greyish- brown. Leaves very variable in size and shape, elliptic-oblong, cuneate at base, acuminate at apex 6-17 x 2-5 cm, margin dentate, distantly serrate or rarely entire, chartaceous; lateral nerves 8-10 pairs. Flowers polygamous in axillary or terminal cymose panicles, 4-merous. Male panicles larger than that of bisexual flowers. Calyx tube minute, ovate, 4-toothed. Corolla white, 3 mm long, campanulate, 4-lobed, acute. Stamens 2, included; anthers subsessile. Ovary 2-locular; stigma capitate. Drupe 1 cm across, ellipsoid, purple. Seed 1.

Fl. & Fr. : February- July

Distribution: Endemic to Peninsular India and Sri Lanka. Evergreen forests. *Amitha Bachan 72018* (Vazhachal, riparian evergreen forests, banks of Chalakkudy river, 230 m).

74. APOCYNACEAE Juss.

Gen. Pl. 143. 1789.

Key to genera

1a. Large trees, butreesed; leaves whorled.....**Alstonia**

1b. Shrubs or small trees.....2

2a. Small-medium shrubs; fruit small, 0.5 cm long ..... **Rauvolfia**

2b. Small trees or large shrubs; fruit 3-30 cm long.....3

3a. Fruit a capsule, to 5 cm long.....**Tabernaemontana**

3b. Fruit a follicle, elongated, to 3 or to 30 cm long..... **Wrightia**

ALSTONIA R. Brown

Wern. Nat. Hist. Soc. 1: 75. 1811, *nom. cons.*

Alstonia scholaris (L.) R. Br., Mem. Wern. Nat. Hist. Soc. 1: 76. 1811; Wight, Icon. Pl. India Orient. t. 422. 1843; Hook. f., Fl. Brit. India 3: 642. 1882; Gamble, Fl. Pres. Madras 810. 1923; Sasidh. & Sivar., Fl. Pl. Thrissur For. 277. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 434. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 307. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 418. 2009. *Echites scholaris* L., Mantissa Pl. 1: 53.1767. **Ezhilampala**.

Large trees, buttresses on old growth ones; bark grayish brown, corky with milky latex. Leaves in whorled, 5-9, oblanceolate, obtuse, to 18 x 6 cm, glabrous; lateral nerves numerous, parallel; petiole to 1.5 cm long. Cymes globose, in panicled umbels, pedicels short, puberulus; sepals ovate, acute, ciliate along margins; corolla tube broad, lobes 4 mm across, obovate to orbicular. Follicle to 40 cm long, terete; seeds elliptic-oblong, papillose.

Fl. & Fr. : December-April

Distribution : India, Malaysia and Sri Lanka. Moist forests. *Amitha Bachan 123615* (Vazhachal, Riparian forests, banks of Chalakkudy river, 200 m).

RAUVOLFIA Linnaeus

Sp. Pl. 208. 1753.

Rauvolfia serpentina (L.) Benth. ex Kurz, For. Fl. Burma 2: 171. 1877; Hook. f., Fl. Brit. India 3: 632. 1882; Gamble, Fl. Pres. Madras 807. 1923; Sasidh. & Sivar., Fl. Pl. Thrissur For. 282. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 443. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 313. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 427. 2009. *Ophioxylon serpentinum* L., Sp. Pl. 1043. 1753. **Sarpagandhi.**

Herbs to small shrubs, to 1 m high; rootstock thick, latex watery. Leaves oblanceolate, acuminate at apex, attenuate at base, to 15 x 5 cm, glabrous; lateral nerves to 14 pairs. Flowers in umbellate cymes, axillary and terminal. Flowers white; sepals 4 mm long, oblong, acute; corolla tube 15 mm long, lobes 5 mm long, oblong, obtuse, white with pale purple shade on the tube. Capsule 5 mm long, ovoid, smooth.

Fl. & Fr. : April - July

Distribution : South and Southeast Asia. Occasional; in openings of evergreen and moist deciduous forests. *Amitha Bachan 99009* (Orukombankutty, moist riparian forest openings, along Chalakkudy river, 450 m).

TABERNAEMONTANA Linnaeus

Sp. Pl. 210. 1753.

Key to species

1. Capsule 1-seeded, beak short; sepals ciliate.....**T. gamblei**

1. Capsule many seeded, beak curved; sepals glabrous.....**T. alternifolia**

Tabernaemontana alternifolia L., Sp. Pl. 211.1753; N. Mohanan & Sivad., Fl. Agasthyamala 445. 2002; Anil Kumar *et al.*, Fl.

Pathanamthitta 313. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 431. 2009. *Tabernaemontana heyneana* Wall., Bot. Reg. 15: t. 1273. 1829; Hook. f., Fl. Brit. India 3: 646. 1882; Sasidh. & Sivar., Fl. Pl. Thrissur For. 283. 1996; *Ervatamia heyneana* (Wall.) Cooke, Fl. Pres. Bombay 2:134.1904; Gamble, Fl. Pres. Madras 813.1923. **Kuruttupala.**

Large shrubs or small deciduous trees; bark corky with shallow fissures. Leaves to 18 x 7 cm, elliptic-oblong, acuminate at apex, acute at base; lateral nerves to14 pairs; petiole 1.5 cm long. Cymes terminal or axillary; peduncles to 4 cm long. Flowers pedicellate; calyx 4 mm long, lobes short, oblong, obtuse; corolla white, tube 2.5 cm long; lobes oblong, 1.5 cm long, obtuse, apex crisped. Capsule yellow, 5 x 1.5 cm, beak acuminate; aril red.

Fl. & Fr. : April - June

Distribution : Endemic to southern Western Ghats. Low risk. High elevation evergreen forests to lower plains. *Amitha Bachan 123614* (Athirapilly-Ittiyani, riparian forests, along banks of Chalakkudy river, 150 m).

Tabernaemontana gamblei Subram. & Henry, Bull. Bot. Surv. India 12: 1. 1970; Sasidh. & Sivar., Fl. Pl. Thrissur For. 282. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 446. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 314. 2005. *Ervatamia caudata* Gamble, Bull. Misc. Inform. Kew 1921: 310. 1921 & Gamble, Fl. Pres. Madras 813. 1923, *non Tabernaemontana caudata* Merr. 1909.

Shrubs, to 1.5 m tall; branchlets white, subterete. Leaves opposite, often unequal, to 10 x 4 cm, elliptic, acute at base, caudate acuminate at apex, tip of the acumen obtusely-blunt, lateral nerves 7 pairs, petiole 1 cm long. Cymes terminal. Flowers white; pedicels stout, 1 cm long;

sepals ovate, obtuse; corolla tube to 17 mm long, cylindrical; lobes 15 mm long, oblong, obtuse. Capsule 3 x 1.25 cm, not curved; aril red.

Fl. & Fr. : September-April.

Distribution: Endemic to Southern Western Ghats. Low risk. Undergrowth in evergreen forests. *Amitha Bachan 99081* (Vazhachal, riparian forest, banks of Chalakkudy river, 240 m); *Amitha Bachan 123309* (Vavalala-Sholayar, riparian evergreen forests, banks of Sholayar river, 650 m).

WRIGHTIA R. Brown

Mem. Wern. Nat. Hist. Soc. 1: 73. 1811.

Key to species

1a. Follicle small to 3 cm long; flowers reddish brown.....**W. arborea**

1b. Follicle elongated to 30cm long; flowers white.....**W. tinctoria**

Wrightia arborea (Dennst.) Mabb., Taxon 26: 533. 1977; Sasidh. & Sivar., Fl. Pl. Thrissur For. 283. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 314. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 434. 2009 *Periploca arborea* Dennst., Schluss. Hort. Malab. 23, 25. 1818. *Wrightia tomentosa* Roem. & Schult., Syst. Veg. 4: 414. 1819; Wight, Icon. Pl. India Orient. t. 443. 1841; Hook. f., Fl. Brit. India 3: 653. 1882; Gamble, Fl. Pres. Madras 816. 1923. **Nelampala.**

Small trees; branchlets pubescent, tomentose, latex yellow. Leaves to 13 x 6 cm, elliptic, acuminate at apex, base acute; lateral nerves to 12 pairs; petiole 5 mm long. Flowers in short peduncled, tomentose, terminal cymes. Flowers reddish brown; pedicels 1 cm long, stout; sepals 4 mm long, obtuse, hairy; corolla tube 5 mm long, lobes 15 x 10 mm, white, obovate, puberulus; corona thick, erect, toothed, reddish brown; anthers conical, 8 mm long, hairy. Follicles orange yellow, to 3 x 1 cm.

Fl. & Fr. : June- August.

Distribution : Indo-Malaysia. In moist forests. *Amitha Bachan 123618* (Pokalppara- Vazhachal, riparian forests, banks of Chalakkudy river, 240m).

Wrightia tinctoria (Roxb.) R. Br., Mem. Wern. Nat. Hist. Soc. 1: 47. 1811; Hook. f., Fl. Brit. India 3: 653. 1882; Gamble, Fl. Pres. Madras 815. 1923; Manilal, Fl. Silent Valley 175. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 283. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 446. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 314. 2005; C.N.Sunil & Sivad., Fl. Alappuzha 4436. 2009. *Nerium tinctorium* Roxb., Orient. Repert. 1: 39. 1791. **Danthappala**.

Small trees with milky latex; branchlets glabrous. Leaves to 14 x 4 cm, elliptic-oblong, acuminate, base acute, membranous; lateral nerves 7-10 pairs; petiole 3-5 mm long. Flowers in terminal cymes; pedicels to 12 mm long, slender; bracts ovate. Flowers white; sepals ovate, obtuse, glabrous; corolla tube 4 mm long, broad, lobes 12 x 5 mm, oblong, obtuse; corona many, erect, linear; anthers acuminate, coriaceous, 6 mm long. Follicles 30 cm long, terete, joined at apex, glabrous; seeds oblong.

Fl. & Fr. : March-July.

Distribution : Indo-Malaysia. In moist forests. *Amitha Bachan 123608* (Athirappilly-Ittiany, riparian vegetation, banks of Chalakkudy river, 140m).

75. ASCLEPIADACEAE R. Brown

Asclepideae 12,19. 1810.

1a. Erect herbs of shrubs..... 2

1b. Twiners ....**Ceropegia**

2a. Herbs to 1m high, flowers yellow .....**Asclepias**

2b. Shrubs >1m, flowers pale purple or greenish white..... **Calotropis**

ASCLEPIAS Linnaeus

Sp. Pl. 214. 1753.

Asclepias curassavica L., Sp. Pl. 215. 1753; Hook. f., Fl. Brit. India 4: 18. 1883; Gamble, Fl. Pres. Madras 833. 1923; Sasidh. & Sivar., Fl. Pl. Thrissur For. 284. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 322. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 437. 2009. **Kammalchedi.**

Plate 28. B

Herbs, to 1 m tall; stem terete, glabrous, glaucous. linear-lanceolate, to 10 x 3 cm, glabrous; petiole 1 cm long. Flowers terminal or axillary peduncled cyme; peduncle to 5 cm long; pedicels 6-15 together, to 2 cm long, slender; sepals ovate, 2.5 mm long; corolla to 1 cm across, tube short, lobes oblong, yellow, deflexed; coronal lobes yellow, 7 mm long. Follicle to 8 x 1 cm, terete; seeds many.

Fl. & Fr.: October – March.

Distribution: Native of Tropical America. Naturalized throughout the tropics. Seen throughout the sandy river banks. *Amitha Bachan 99049* (Karanthodu-Vazhachal, riparian forests, banks of Chalakkudy river, 320m).

CALOTROPIS R. Brown

On Asclepaid. 28. 1810.

Calotropis gigantea (L.) R. Br. in Ait.f., Hort. Kew (ed. 2) 2: 78. 1811; Hook. f., Fl. Brit. India 4: 17. 1883; Gamble, Fl. Pres. Madras 832. 1923; Manilal, Fl. Silent Valley 176. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 285. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 315. 2005; C. N.

Sunil & Sivad., Fl. Alappuzha 438. 2009. *Asclepias gigantea* L., Sp. Pl. 214. 1753. **Ericu.**

Erect shrubs to 1.5 m tall. Leaves elliptic-ovate to obovate, cordate at base, to 10-20 x 5-8 cm, acute or obtuse at apex, pubescent when young, glabrous on maturity. Inflorescence an umbellate cyme, subterminal. Peduncle 5-7 cm long. Flowers pale purple or greenish-white, 0.3 cm across. Calyx deeply 5-lobed, lobes 3- 4 mm long, ovate, glandular. Corolla purple, 3-4 cm across, rotate; lobes 5, ovate, 1.5 cm long, spreading. Coronal lobes 1 cm long, laterally compressed, horny. Stamens 5, filaments connate into a staminal column; pollinia 2 per anther, pendulous. Ovaries 2, free; ovules many. Follicles in pairs.

Fl. & Fr.: Most of the seasons.

Distribution: Tropical Asia. Common along exposed lands. *Amitha Bachan 123488* (Kanakkankadavu, riverbanks, banks of Chalakkudy river, sea level).

CEROPEGIA Linnaeus

Sp. Pl. 211. 1753.

Ceropegia hirsuta Wight & Arn. in Wight, Contrib. 30. 1834; Hook. f., Fl. Brit. India 4: 7. 1883; Gamble, Fl. Pres. Madras 562. 1922; Manilal, Fl. Silent Valley 177. 1988; Bruyns, Rheedea 7: 113. 1997. *Ceropegia ophiocephala* Dalz. in Hooker's J. Bot. Kew. Gard. Misc. 2: 259. 1850. *Ceropegia hirsuta* var. *stenophylla* Hook. f., Fl. Brit. India 4: 71. 1983; Gamble, Fl. Pres. Madras 859. 1923. *Ceropegia hispida* Blatt. & McCann, J. Bombay Nat. Hist. Soc. 35: 409. 1931.

Hirsute twiner. Leaves linear, acuminate at apex, acute at base, to 8-12 x 0.5-1 cm, pubescent; petiole to 5.5 cm long. Flowers purple, 3-10 together, 3 cm long; peduncle 0.5cm long, stout; pedicels 1.2 cm long;

calyx lobes 0.8 cm long, linear, ciliate; corolla dark purplish brown, tube 2.5 cm long, dialated at base, cylindric, broaden above, hairy inside, lobes 0.6 cm long, ovate, acute, hairy within; outer corona 0.5 cm across, lobes deltoid, bifid, densely ciliate, inner corona linear, erect, 0.2 cm long, hooked at tips, villous at base.

Fl. & Fr. : June- September.

Distribution : Endemic to India. Evergreen riparian forests. *Amitha Bachan 117676* (Sholayar, riparian forest, banks of Sholayar river, 700m).

76. PERIPLOCACEAE Schltr.

HEMIDESMUS R. Brown

Mem. Wern. Nat. Hist. Soc. 1: 56. 1811.

Hemidesmus indicus (L.) R. Br. in Ait.f., Hort. Kew (ed. 2) 2: 75. 1811; Wight, Icon. Pl. India Orient. t. 594. 1842, var. **indicus**; Wight, Icon. Pl. India Orient. t. 594. 1842; Hook. f., Fl. Brit. India 4: 5. 1883; Gamble, Fl. Pres. Madras 825. 1923; Manilal, Fl. Silent Valley 178. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 289. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 455. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 319. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 442. 2009. *Periploca indica* L., Sp. Pl. 211. 1753. **Naruneendi.**

Twining herbs, stem brown, slender, glabrous. Leaves variable, linear-lanceolate to elliptic-oblong, to 12 x 2 cm acute to acuminate at apex, acute at abse; lateral nerves to 12 pairs; petiole to 5 mm long. Flowers many, in axillary cymes; peduncles short; pedicels many, short, bracteate; sepals free, ovate, 1 mm long; corolla yellow or purple, 7 mm across, lobes ovate, acute; corona 5, scale-like, connate with corolla tube;

stamens 5, filaments subconnate at base; pollinia in pairs; gynostegium obovoid. Follicles 2, slender, terete.

Fl. & Fr. : August – December

Distribution: India and Sri Lanka. Forests in the medium elevations to lower plains. *Amitha Bachan 99141* (Vazhachal, Riparian forests, banks of Chalakkudy river, 220 m).

77. LOGANIACEAE R. Br. ex Mart.

Nov. Gen. Sp. Pl.2: 133. 1827.

Key to genera

1a. Leaves 3-5-ribbed from base; pericarp hard ..... **Strychnos**

1b. Leaves penni-nerved; pericarp fleshy .....**Fagraea**

FAGRAEA Thunberg

Kongl. Vetensk. Acad. Nya. Handl. 3: 132. 1782.

Fagraea ceilanica Thunb., Vetensk. Acad. Handl. 3: 132. 1782; Hook. f., Fl. Brit. India 4: 83. 1883 "*zeylanica*"; Gamble, Fl. Pres. Madras 865. 1923; Manilal, Fl. Silent Valley 180. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 295. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 456. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 323. 2005. *Fagraea obovata* Wall. in Roxb., Fl. India 2: 33. 1824; C. B. Clarke in Hook. f., Fl. Brit. India 4: 83. 1883; Gamble, Fl. Pres. Madras 865. 1923. *Fagraea coromandelina* Wight, Icon. Pl. India Orient. t. 1316. 1848. *Fagraea malabarica* Wight, Icon. Pl. India Orient. t. 1317. 1848.

Small trees, usually epiphytic on tree trunks; branchlets stout with prominent leaf-scars. Leaves fleshy, obovate or oblanceolate to 18 x 8 cm, obtuse at apex, cuneate at base, entire, shining, glabrous; petiole to 2.5 cm long. Inflorescence terminal or axillary, few-flowered corymbose cymes. Flowers creamy white, large to 6-8 cm across. Calyx deeply 5-

lobed; lobes obovate, 0.8 cm long, acute or obtuse. Corolla funnel-shaped; tube 4-5 cm long; lobes 5, broad, twisted to right. Stamens 5, adnate to the base of corolla tube. Ovary 2-celled with many ovules in each cell; stigma capitate. Berry globose or ellipsoid, to 4 x 3 cm, beaked, Shining. Seeds many.

Fl. & Fr. : Throughout the year.

Distribution : Indo-Malaysia. Moist forests from high elevations to sacred groves in the lower plains. *Amitha Bachan 123630* (Vazhachal, epiphytic on riparian forest trees, banks of Chalakkudy river, 200 m).

STRYCHNOS Linnaeus

Sp. Pl. 189. 1753.

Key to species

1a. Woody climbers; fruit 6-8 cm across..... **S. colubrina**

1b. Erect trees; fruit 3-4 cm across..... **S. nux-vomica**

Strychnos colubrina L., Sp. Pl. 189. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 4: 87. 1883; Gamble, Fl. Pres. Madras 868. 1923; Sasidh. & Sivar., Fl. Pl. Thrissur For. 297. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 457. 2002. *Strychnos wallichiana* Steud. *ex* A. DC. in DC., Prodr. 9: 13. 1845; Anil Kumar *et al.*, Fl. Pathanamthitta 325. 2005. *Strychnos rheedei* Clarke in Hook. f., Fl. Brit. India 4: 87. 1883. *Strychnos cinnamomifolia* Thwaites, Enum. Pl. Zeyl. 201. 1860, var. *wightii* Hill, Bull. Misc. Inform. Kew 1917: 194. 1917; Gamble, Fl. Pres. Madras 869. 1923. **Vallikanjiram.** **Plate 28. D**

Large woody climbers with terete glabrous branchlets. Leaves ovate to broadly elliptic, to 8 x 5 cm, acute or acuminate at apex, obtuse or rounded at base, glabrous; 3 nerved from little above the base; petiole up to 1 cm. Flowers yellow on pubescent cymes. Calyx lobes 0.5 mm long.

Corolla tube 0.7 cm long; lobes 2 mm; stigma entire. Berry globose, to 8 cm across, seeds 6-12, discoid.

Fl. & Fr. : July –February.

Distribution : Indo Malaysia. Moist forests. *Amitha Bachan 127405* (Vazhachal, riparian forests, banks of Chalakudy river, 220 m).

Strychnos nux-vomica L., Sp. Pl. 189. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 4: 90. 1883; Gamble, Fl. Pres. Madras 868. 1923; Sasidh. & Sivar., Fl. Pl. Thrissur For. 297. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 324. 2005. **Kanjiram.** **Plate 28. C**

Medium sized to large deciduous trees; bark yellowish-grey. Leaves simple, broadly ovate to suborbicular, 4-8 x 3-7 cm, obtuse at apex, cuneate at base, 3-5-nerved from base, glabrous, coriaceous; petiole to 1.2 cm long. Flowers on terminal tomentose cymes. Calyx lobes ovate, tomentose to 1 mm long. Corolla tube 1 cm long; Stamens subexserted. Ovary depressed globose. Berry globose to 3-4 cm across, orange-red when ripe. Seeds 3 or 4 enclosed in a bitter pulp, to 2 cm across.

Fl. & Fr. : December-March.

Distribution : Indo-Malaysia. Moist and dry forests in medium elevation to lower plains. *Amitha Bachan 127406* (Chiklai, riparian rocky islands, banks of Chalakkudy river, 50 m).

78. GENTIANACEAE Juss.

Gen. Pl. 141. 1789.

Key to genera

1a. Flowers irregular.....**Canscora**

1b. Flowers regular..... **Exacum**

CANSCORA Lamarck

Encycl. Meth. Bot. 1: 601. 1785.

Key to species

1a. Flowers white; bracts at the branches of the inflorescence perfoliate.....**C. perfoliata**

1b. Flowers pink; bracts at the branches of the inflorescence not perfoliate.....**C. diffusa**

Canscora diffusa (Vahl) R. Br. ex Roem. & Schult., Syst. Veg. 3: 301. 1818; Clarke in Hook. f., Fl. Brit. India 4: 103. 1883; Gamble, Fl. Pres. Madras 878. 1923; Manilal, Fl. Silent Valley 181. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 298. 1996; M. Thiv, Blumea 48 (1): 11. 2003; Anil Kumar *et al.*, Fl. Pathanamthitta 325. 2005. *Gentiana diffusa* Vahl, Symb. Bot. 3: 47. 1794. *Canscora decurrens* Dalz. in Hooker's J. Bot. Kew Gard. Misc. 2:136.1850; Gamble, Fl. Pres. Madras 878. 1923; N. Mohanan & Sivad., Fl. Agasthyamala 458. 2002. *Canscora pauciflora* Dalz. in Hook.'s J. Bot. Kew Gard. Misc. 2: 136. 1850; Clarke in Hook. f., Fl. Brit. India 4: 103. 1883; Gamble, Fl. Pres. Madras 878. 1923. *Canscora lawii* Wight, Icon. Pl. India Orient. t. 1327. 1848. **Jeerakapullu**.

Annual branched dichotomous herbs; stem 4-angled or winged. Lower leaves elliptic, petiolate; upper ones ovate-acute, sessile, 3-ribbed, glabrous. Cymes terminal; membranous bracts at the bifurcations of the infloresence, branches few. Flowers many; pedicel 1 cm long, filiform; calyx 6 mm long, narrowly winged or wingless, 5-toothed, glabrous;

corolla pale pink, 8 mm long, tube cylindrical, lobes lanceolate, acute; two stamens fertile, two sterile; capsule 5 mm long, linear-oblong.

Fl. & Fr. : October-February.

Distribution : Tropical Africa, Asia and Australia. Along stream banks. *Amitha Bachan 72099, 98978* (Vazhachal, on rocks in the river bed, along the banks of Chalakkudy river, 220m). *Amitha Bachan 72009* (Poringalkuthu, riparian evergreen, banks of Chalakkudy river, 300 m); *Amitha Bachan 98819* (Panjanamkuthu-Vazhachal, rocky streams, Charpa thodu, 250 m).

Note : Several Indian species of *Canscora* (*C. decurrens, C. pauciflora, C. khandalensis* and *C. lancifolia)* characterized by linear bracts and few-flowered inflorescence were united together under *C. diffusa* by M. Thiv (2003). Our study also indicates *C. diffusa* as highly variable and no clear boundary between *C. diffusa* and *C. pauciflora* can be detected in the area of study.

Canscora perfoliata Lam., Encycl. 1: 601. 1785; Clarke in Hook. f., Fl. Brit. India 4: 1094. 1884; Gamble, Fl. Pres. Madras 879. 1923; Manilal, Fl. Silent Valley 182. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 298. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 459. 2002; M. Thiv, Blumea 48 (1): 16. 2003; Anil Kumar *et al.*, Fl. Pathanamthitta 326. 2005. *Canscora grandiflora* Wight, Icon. Pl. India Orient. t. 1326. 1848.

Branched annual herb, 40 cm high; stems 4-winged. Leaves 2-4 x 1.5 cm, ovate, acute, 3-nerved. lower petiolate, upper ones sessile. Cymes terminal; bracts at the branches of the inflorescence perfoliate, bracts 10 mm across, membranous. Flowers many; pedicel 1 cm long, winged towards apex, wings of the short pedicels gradually widening to those of the calyx; calyx campanulate, 1.5 cm long, prominently winged, lobes 4, acuminate, wings strongly nerved; corolla white, 2 cm long,

glabrous, lobes 4, unequal; stamens 1 perfect, 3 barren, inserted on the throat of the corolla tube. Capsule 6 mm long, oblong; seeds brown.

Fl. & Fr. : November – February.

Distribution : Endemic to the Western Ghats. Wet areas in the moist forests. *Amitha Bachan 99059* (Sholayar-Meenchaliyali, rocky surface in the riparian evergreen forests, Meenchaliyali stream bank, 800 m).

EXACUM Linnaeus

Sp. Pl. 112. 1753.

Key to species

1a. Corolla large, lobes >1cm long..... **E. wightianum**

1b. Corolla small, lobes<0.7 cm long..... **E. sessile**

Exacum sessile L., Sp. Pl. 112. 1753; Clarke in Hook. f., Fl. Brit. India 4: 98. 1883; Gamble, Fl. Pres. Madras 874. 1923; Manilal, Fl. Silent Valley 183. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 299. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 461. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 327. 2005. **Plate 28. E**

Small erect herbs, to 15 cm high; stem 4-angled, narrowly winged. Leaves broadly ovate, to 10 x 8 mm, cordate at base, acute or obtuse at apex, 3-ribbed, sessile. Flowers few, in drooping terminal cymes, sessile and pedicelled, tetramerous; calyx 6 mm long, lobes 5, ovate, acute, unwinged, 3-nerved, distinct; corolla 4, violet or light blue, lobes deltoid; anthers 1.5 mm long; stamens 4, inserted at the throat of the corolla, small, to 2.5 mm long; Ovary 2-celled, ovules many in each cell. Capsule globose, 2-valved.

Fl. & Fr. : August-October.

Distribution : Endemic to Peninsular India and Sri Lanka. Moist forests. *Amitha Bachan 98728* (Pullala-Nelliyamptahy, streamside vegetation, banks of stream draining to Karappara river, 1000 m); *Amitha Bachan 123682* (Thachanthoni-Sholayar, wet rocky riparian zone, banks of Sholayar river, 670 m).

Exacum wightianum Arn., Ann. Sci. Nat Bot. ser. 2, 1: 176. 1839; Clarke in Hook. f., Fl. Brit. India 4: 97. 1883; C. E. C. Fisch. In Gamble, Fl. Pres. Madras 873. 1923; N. Mohanan & Sivad., Fl. Agasthyamala 462. 2002. *Exacum atropurpureum* Bedd. var. *palghatense* Gamble, Fl. Pres. Madras 874. 1923.

Erect subshruby herbs to 90 cm high; stems scarcely dichotomous or unbranched, stem 4-angled, 4-winged, wings obsolete towards base. Leaves ovate, lanceolate, 5 x 3 cm, acute at apex, cordate at base, 5-ribbed. Cymes terminal spreading, peduncled; bracts linear lanceolate. Flowers few; pedicels deflexed in fruit; calyx 1.4 cm long, lobes lanceolate, acuminate, wings 3 mm broad, obtuse to subcordate at base, nerves not prominent; corolla tube 4 mm long, lobes obovate, glandular; stamens 4, inserted on the throat of the corolla, anthers 4.5 mm long, black-glandular at apex. Capsule globose, 2-valved, pedicels recurved in fruit.

Fl & Fr. : April-July.

Distribution : Endemic to Southern Western Ghats. Shola and evergreen forests. *Amitha Bachan 99060* (Sholayar-Karimalathodu, streamside, banks of Karimalathodu, 800 m).

79. HYDROPHYLLACEAE R. Br.

in Bot. Reg. 3: adt. 242. 1817.

HYDROLEA Linnaeus

Sp. Pl. 328. 1762, *nom. cons.*

Hydrolea zeylanica (L.) Vahl, Symb. Bot. 2: 46.1791; C. B. Clarke in Hook. f., Fl. Brit. India 4: 133. 1883; Gamble, Fl. Pres. Madras 884. 1923; Sasidh. & Sivar., Fl. Pl. Thrissur For. 300. 1996; C. N. Sunil & Sivad., Fl. Alappuzha 457. 2009. *Nama zeylanica* L., Sp. Pl. 226.1753.

Decumbent, fleshy, amphibious herbs, rooting at nodes; stem erect or ascending. Leaves simple, alternate, elliptic- lanceolate, 2-5 x 1-2 cm, cuneate at base, acute or acuminate at apex, glabrous to densely pubescent; petiole 1 cm long. Flowers solitary or in terminal or axillary cymes. Sepals 5, elliptic-lanceolate, 5 x 1.5 mm, acute, hirsute. Corolla deep blue; lobes 5, elliptic-lanceolate, 6 x 2.5 mm. Stamens 5; filaments 2 mm long, filiform; anthers sagittate, 2 mm long. Ovary globose, hispid; styles 3 mm long; stigma capitate. Capsule ellipsoid, 0.5 cm long.

Fl. & Fr. : August – January.

Distribution : Pantropical, moist areas, near water bodies. *Amitha Bachan 123338* (Orukombankutty, riparian, along Chalakkudy river, 450 m).

80. MENYANTHACEAE (Dumort.) Dumort.

Anal. Fam. Pl. 20, 25. 1829.

NYMPHOIDES J. Hill

Brit. Herbal. 77. 1756.

Nymphoides indica (L.) Kuntze., Rev. Gen. Pl. 2: 429. 1891; Sivar. & Joseph, Aquat. Bot. 4: 156. 1993; Anil Kumar *et al.*, Fl. Pathanamthitta 329. 2005. *Menyanthes indica* L., Sp. Pl. 145. 1753. *Limnanthemum*

indicum (L.) Griseb., emend Thwaites, Enum. Pl. Zeyl. 205. 1860; C. B. Clarke in Hook. f., Fl. Brit. India 4: 131. 1883; Gamble, Fl. Pres. Madras 883. 1923. **Chinnambal.**

Submerged aquatic herbs with floating leaves; rooting at basal nodes of petiole-like stems. Leaves simple, peltate, alternate, orbicular, to 6 x 8 cm, deeply cordate at base, obtuse or rounded at apex, entire or faintly sinuate. Flowers in umbellate fascicles, bisexual, regular, long pedicelled. Calyx lobes 5, oblong; corolla lobes 5, straight, white with yellowish centre, fimbriate at margins; stamens 5; ovary 1-locular, superior. Capsule ellipsoid; seed smooth.

Fl. & Fr.: August-January.

Distribution: Paleotropics. Fresh water pools and streams. *Amitha Bachan 123695* (Kanakkankadavu, in streams, stream draining to Chalakkudy river, sea level).

81. BORAGINACEAE Juss.

Gen. Pl. 128. 1789.

Key to genera

1a. Erect herbs; flowers in terminal scorpioid cyme..... **Heliotropium**

1b. Spreading shrubs; flowers solitary, or few, axillary ..... **Rotula**

HELIOTROPIUM Linnaeus

Sp. Pl. 130. 1753.

Heliotropium keralense Sivar. & Manilal, J. Indian Bot. Soc. 51: 348. 1972; Sasidh. & Sivar., Fl. Pl. Thrissur For. 303. 1996. C.N. Sunil & Sivad., Fl. Alappuzha 461. 2009.

Erect herbs to 30 cm high; stem tomentose hispid. Leaves alternate, 6-10 x 3-6 cm, ovate, obtuse or obtusely acute at apex, rounded at base,

entire, hispid; petiole to 7 cm long. Flowers sessile, in terminal 5-14 cm long scorpioid cymes, densely packed; sepals 1.5 mm long, lanceolate, hispid outside; corolla white, 3 mm long, bottle shaped, white; lobes 5, rounded; stamens 5, anthers sessile, inserted inside the corolla tube; ovary 4-celled; style terminal, stigma capitate. Fruit a 4-lobed drupe, 4 x 3 mm, glabrous; seeds 4, subglobose.

Fl. & Fr. : March – May

Distribution: Endemic to Southern Western Ghats (Kerala). Moist open places, especially along the water body at lower elevations. *Amitha Bachan 72098* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m), *Amitha Bachan 98710* (Elanthikkara, riparian sandbeds, banks of Chalakkudy river, sea level).

ROTULA Loureiro

Fl. Cochinch. 121. 1790.

Rotula aquatica Lour., Fl. Cochinch. 121. 1790; Gamble, Fl. Pres. Madras 893. 1923; Manilal, Fl. Silent Valley 185. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 304. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 331. 2005. *Rhabdia lycioides* Mart. & Zucc., Nov. Gen. Sp. 2:136.1827; Clarke in Hook. f., Fl. Brit. India 4:145. 1883. *Ehretia cuneata* Wight, Icon. Pl. India Orient. t. 1385. 1848. **Kallurvanchi.** **Plate 28. F**

Stout branching and spreading shrubs in the streambeds; branhes rossete, spreading, terete, pinkish-brown glabrous. Leaves alternate or fascicled, 1.5 x 0.5 cm, oblong, obtuse, sessile. Flowers solitary or in few flowered cymes axillary; calyx 3 mm long, 5-partite, lobes lanceolate; corolla pink, 5 mm long, 7 mm across, campanulate, 5-lobed; stamens 5, anthers sagitate at base; ovary 4-celled, style filiform, stigma capitate. Drupe with 4, 1-seeded pyrenes, free, yellowish, smooth.

Fl. & Fr. : November-March.

Distribution: Pantropical. Rocky riverbeds. *Amitha Bachan 98776* (Vazhachal, rocky river bed, along Chalakkudy river, 230 m).

82. CONVOLVULACEAE Juss.

Gen. Pl. 132. 1789.

Key to genera

1a. Leafless, parasitic twiners; stems yellow; corolla with 5 epipetalous fimbriate scales inside ..... **Cuscuta**

1b. Leafy, non-parasitic plants; stems green or brown; corolla without 5 epipetalous fimbriate scales inside 2

2a. Style 1 or absent.....3

2b. Style 2 or more..... **Evolvulus**

3a. Pollen grains spinulose.....4

3b. Pollen grains smooth.....5

4a. Fruit indehiscent, epicarp fleshy or woody..... **Argyreia**

4b. Fruit dehiscent, epicarp thin, fragile..... **Ipomoea**

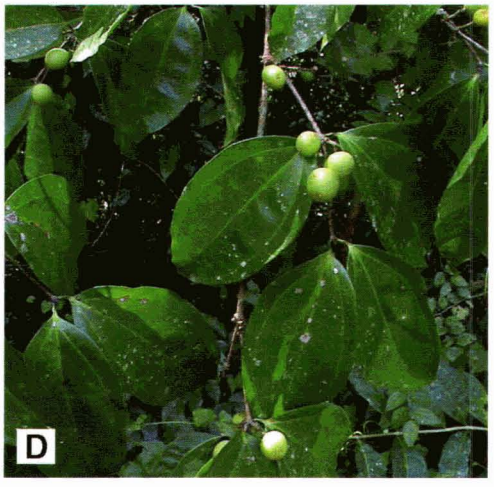
5a. Leaf base truncate or cordate; seeds hairy..... **Merremia**

5b. Leaf base auriculate or hastate; seeds glabrous.....**Xenostegia**

ARGYREIA Loureiro

Fl. Cochinch. 95, 134. 1790.

Argyreia hirsuta Wight & Arn., Nov. Acta Phys. Med. Acad. Caes. Leop. Carol. Nat. Cur. 18: 356. 1836; C. B. Clarke in Hook. f., Fl. Brit. India 4: 189. 1883; Gamble, Fl. Pres. Madras 909. 1923; Sasidh. & Sivar., Fl. Pl. Thrissur For. 305. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 335.



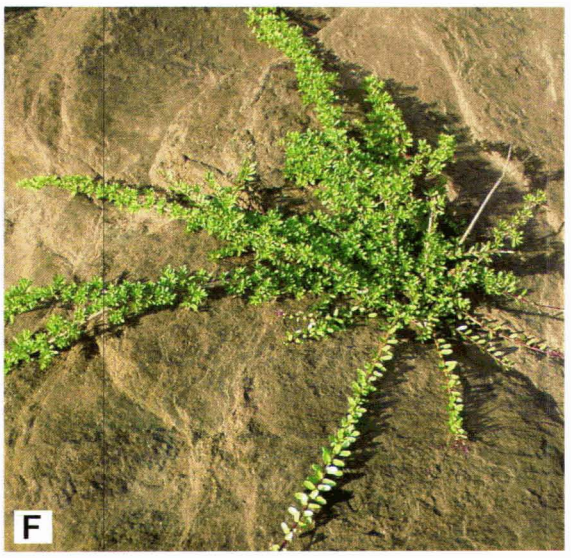


Plate 28. A. *Chionanthus mala-elengi* (Dennst.) P. S. Green, subsp. *mala-elengi*; B. *Asclepias curassavica* L.; C. *Strychnos nux-vomica* L. ; D. *Strychnos colubrina* L.; E. *Exacum sessile* L.; F. *Rotula aquatica* Lour.

2005; C. N. Sunil & Sivad., Fl. Alappuzha 464. 2009. *Rivea hirsuta* (Wight & Arn.) Wight, Icon. Pl. India Orient. t. 891. 1845. *Argyreia hirsuta* Wight & Arn. var. *coacta* C. B. Clarke in Hook.f., Fl. Brit. India 4: 189. 1883. **Plate 29. A & B**

Large climbers; stem hirsute. Leaves broadly ovate, to 18 x 12 cm, cordate at base, acute at apex, densely pubescent with adpressed hairs, more dense on lower surface; nerves 8-13 pairs, prominent below; petiole to 15 cm long. Peduncles axillary, to 12 cm long; bracts leafy, elliptic, 3-4 cm long, shortly petioled; sepals equal, ovate, 7 x 3 mm, obtuse, sparsely hairy; corolla campanulate, 7 x 6 cm, hispid outside, pink or pale purple, funnel-shaped; Stamens 5, included, villous at base, pollen grains spinulose. Berry globose, to 1.2 cm across, depressed, yellow and glabrous; epicarp fleshy; seeds embedded in pulp.

Fl. & Fr. : November – December.

Distribution : Endemic to India and Sri Lanka. Common along the margins of evergreen forest. Evergreen riparian forest margins. *Amitha Bachan 123351* (Vazhachal, riparian evergreen vegetation, banks of Chalakkudy river, 220 m).

CUSCUTA Linnaeus

Sp. Pl. 124. 1753.

Cuscuta reflexa Roxb., Pl. Coromandel t. 104. 1798; C. B. Clarke in Hook. f., Fl. Brit. India 4: 225. 1883; Gamble, Fl. Pres. Madras 931. 1923; Anil Kumar *et al.*, Fl. Pathanamthitta 336. 2005. C. N. Sunil & Sivad., Fl. Alappuzha 465. 2009. **Moodillathali.**

Leafless parasitic twiners growing on branches of other plants; stem 0.25 mm across, yellow, glabrous and flexible. Flowers sessile lateral racemes; Calyx cupular, lobes 1.5 mm long, suborbicular. Corolla

campanulate, 6 mm long, lobes ovate, triangular, erect; scale ; stamens 5, short; ovary conical, 2 mm long; stigma acute. Capsule globose-conical, 5 mm long, glabrous; seeds obovoid, 3 mm across, black.

Fl. & Fr. : November – March.

Distribution : Indo-Malaysia and China. Forests and plains, open riparian forests and stream sides. *Amitha Bachan 123352* (Malakkapara, riparian vegetation, banks of Sholayar river, 1000 m).

EVOLVULUS Linnaeus

Sp. Pl. ed. 2, 391. 1762.

Evolvulus nummularius (L.) L., Sp. Pl. (ed.2) 391. 1762; Sivar. *et al.*, Bull. Bot. Surv. India 12: 279. 1970; Sasidh. & Sivar., Fl. Pl. Thrissur For. 307. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 470. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 338. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 467. 2009. *Convolvulus nummularius* L., Sp. Pl. 175. 1753. *Volvulopsis nummularia* (L.) Roberty, Candollea 14: 28. 1952.

Slender prostrate spreading perennial herbs. Stem slender, hirsute. Leaves broadly ovate to orbicular, small to 1.5 x 1 cm, cordate or subcordate at base, obtuse to emarginiate at apex, sparsely hairy; petiole to 4 mm long , hairy. Flowers solitary or in pairs, axillary. Pedicels to 4 mm long, slender. Calyx lobes 5, free, acute, ovate, ciliate, 2.5 mm long. Corolla white, broadly campanulate, 6 mm across; stamens sub-excerted; style 2, bifid. Capsule globose, 3-4 mm across. Seeds brown to black.

Fl. & Fr. : Throughout the year.

Distribution : Native of Tropical America. Naturalized in Africa and Indo-Malaysia. On wet forest floors. *Amitha Bachan 98886* (Ambalappara-Sholayar, riparian forest floor, banks of Sholayar river, 800 m).

IPOMOEA Linnaeus

Sp. Pl. 159. 1753.

Key to species

1a. Shrubs.....**I. carnea** subsp. **fistulosa**

1b. Climbers or creepers.....2

2a. Corolla salver-form, lobes triangular; stamens and style exserted ..... **I. hederifolia**

2b. Corolla funnel-form; lobes indistinct; stamens and style included....3

3a. Leaves bilobed.....**I. pes-caprae**

3b. Leaves deeply palmately 5-9-lobed.....4

4a. Flowers subsessile in pedunculate capitate heads, white; leaves softly hirsute ..... **I. pes-tigridis**

4b. Flowers pedicellate, solitary or in short racemes or cymes, pink; leaves glabrous.....**I. cairica**

Ipomoea carnea Jack. subsp. **fistulosa** (Mart. ex Choisy) Austin, Taxon 26: 237. 1977; Anil Kumar *et al.*, Fl. Pathanamthitta 341. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 467. 2009. *Ipomoea fistulosa* Mart. ex Choisy in DC., Prodr. 9: 349. 1845. *Ipomoea crassicaulis* (Benth.) Robins., Proc. Amer. Acad. Sci. 51: 530. 1916. *Batatas crassicaulis* Benth., Voy. Sulph. 134. 1845. **Plate 29. C**

Erect shrubs to 2 m high; branches glabrous. Leaves ovate or lanceolate, to 15 x 7 cm, cordate at base, acute at apex, shining above. Flowers pale pink or pikish white, broadly companulate solitary or few in axillary corymbose cymes. Sepals subequal, persistent. Corolla to 6 cm across, funnel-form, tube to 2 cm long. Capsule globose, to 1 cm across, dehiscent, epicarp thin. Seeds glabrous.

Fl. & Fr. : November – March.

Distribution: Pantropics. Stream sides of the lower elevations. *Amitha Bachan 123446* (Kundoor, riparian, banks of Chalakkudy river, sea level).

Ipomoea cairica (L.) Sweet, Hort. Brit. (ed. 1) 287. 1827; Gamble, Fl. Pres. Madras 918. 1923; Anil Kumar *et al.*, Fl. Pathanamthitta 340. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 471. 2009. *Convolvulus cairicus* L., Syst. Nat. (ed.10) 922. 1759. *Ipomoea palmata* Forssk., Fl. Aeg.-Arab. 43. 1775; C. B. Clarke in Hook. f., Fl. Brit. India 4: 214. 1883.

Glabrous extensive climbers. Leaves divided below the middle, 5-7 foliolate to 7 x 6 cm, orbicular; lobes elliptic, ovate, chartaceous, acute at apex; petiole to 4 cm long. Flowers solitary or in few flowered cymes; calyx lobes subequal, 4-6 mm long, apiculate, pedicellate; corolla pink, 5 cm across, campanulate; Stamens 5, pilose below, pollen grains spinulose; stigma globose. Capsule globose, dehiscent, to 7 mm across, glabrous, epicarp thin; seeds pubescent.

Fl. & Fr. : September – January.

Distribution : Paleotropics. Climber on the evergreen open vegetation. *Amitha Bachan 98984* (Sholayar, on open or exposed riparian vegetation, banks of Sholayar river, 800 m).

Ipomoea hederifolia L., Syst. Nat. (ed. 10) 925. 1759; Manilal, Fl. Silent Valley 189. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 309. 1996; Mohanan & Sivad., Fl. Agasthyamala 472. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 341. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 472. 2009. *Quamoclit phoenicea* (Roxb.) Choisy, Mem. Soc. Phys. Geneve 6: 433. 1834; Gamble, Fl. Pres. Madras 919. 1923. *Ipomoea phoenicea*

Roxb., Fl. India 2: 92. 1824. *Ipomoea coccinea* sensu C. B. Clarke in Hook. f., Fl. Brit. India 4: 199. 1883, *non* Rottl. 1803.

Slender twining herbs. Leaves cordate-ovate, to 10 x 8 cm, cordate at base, acute to shortly acuminate at apex; entire or 3-5-angled, glabrous; petiole to 6 cm long. Flowers small deep red on few-flowered axillary cymes; peduncles 5-8 cm long; pedicels to 1 cm long. Calyx lobes 5, 2-4 mm long, elliptic. Corolla deep red, salver-shaped, tube to 3.5 cm long, limb 1.5-2.5 cm across, subentire. Stamens equal inserted inside, pollen grains spinulose. Ovary to 3 mm long, 4-celled; ovule single in each cell. Capsule subglobose, dehiscent, 5-6 mm across, glabrous. Seeds 4, to 3 mm long, pyriform, black, hairy.

Fl. & Fr. : October – December.

Distribution : Native of Tropical America. Now naturalized in tropical Asia. Along streamside and degraded forest areas. *Amitha Bachan 123353* (Vazhachal, along open riparian vegetation, banks of Chalakkudy river, 220 m).

Ipomoea pes-caprae (L.) R. Br. in Tuckey, Narr. Exped. Zaire 477. 1818, subsp. **pes-caprae**; Gamble, Fl. Pres. Madras 919. 1923; Anil Kumar *et al.*, Fl. Pathanamthitta 343. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 475. 2009. *Convolvulus pes-caprae* L., Sp. Pl. 159. 1753. *Ipomoea biloba* Forssk., Fl. Aeg.-Arab. 44. 1775; C. B. Clarke in Hook. f., Fl. Brit. India 4: 212. 1883. **Adambu.**

Stout creepers. Leaves shallowly bilobed, broadly orbicular, to 5 x 6 cm, truncate at base, apex of the lobes round, lateral nerves 6 pairs, coriaceous; petiole 2-4 cm long. Flowers solitary or few in axillary cymes. Calyx lobes 5, unequl, ovate, acuminate, outer surface wrinkled. Corolla pink, 5 cm across, funnel-shaped. Stamens 5, included, pollen grains

spinulose. Style solitary, long, pilose. Capsule subglobose, dehiscent, epicarps thin, glabrous. Seeds brownish-tomentose.

Fl. & Fr. : November – March.

Distribution : Circum tropical. Sandy sea coasts, mangroves, near sandy stream beds. *Amitha Bachan 123447* (Kundoor, sandy river bed, Chalakkudy river, sea level).

Ipomoea pes-tigridis L., Sp. Pl. 162. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 4: 204. 1883; Gamble, Fl. Pres. Madras 918. 1923; Sasidh. & Sivar., Fl. Pl. Thrissur For. 310. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 343. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 475. 2009. *Ipomoea pes-tigridis* L. var. *hepaticifolia* (L.) C. B. Clarke in Hook. f., Fl. Brit. India 4: 204. 1883. *Ipomoea hepaticifolia* L., Sp. Pl. 161. 1753. **Puli-chovadi**.

Densely hispid twining climbers. Leaves deeply 5-9-lobed, broadly orbicular; lobes obovate, apex acute to acuminate, to 4 cm; petiole 3-7 cm long. Flowers subsessile in axillary, capitate clusters; peduncle to 7 cm long. Bracts oblong, acute, villous. Calyx-lobes unequal, ovate-acuminate, 1.2 cm long, pubescent. Corolla white, 3-4 cm long, to 4 cm across, funnel-form. Stamens 5, pollen grain spinulose. Ovary 1 mm long, conical. Capsule ovoid, 8-10 mm long, brown, epicarp thin, dehiscent. Seeds 4 mm long, pubescent, black.

Fl. & Fr. : September – December.

Distribution : Pantropics. Open disturbed vegetation or edges of forests, also plains. *Amitha Bachan 123428* (Vazhachal, edges of riparian forests, banks of Chalakkudy river, 220 m).

MERREMIA Dennstedt ex Endlicher

Gen. Pl. 1403. 1841, *nom. cons.*

Merremia umbellata (L.) Hall. f. in Engl., Bot. Jahrb. Syst. 16: 552. 1893; Gamble, Fl. Pres. Madras 928. 1923; Manilal, Fl. Silent Valley 190. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 312. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 474. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 348. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 479. 2009. *Convolvulus umbellatus* L., Sp. Pl. 155. 1753. *Ipomoea cymosa* Roem. & Schult., Syst. Veg. 4: 241. 1819; C. B. Clarke in Hook. f., Fl. Brit. India 4: 211. 1883.

Twiners often spreading; stems sparsely hairy. Leaves ovate-lanceolate, to 8 x 4 cm, cordate or rounded at base, acuminate at apex, pubescent below; petiole 1.5-2.5 cm long. Inflorescence axillary umbelliform cymes; peduncle 1-3 cm long; pedicels 7-10 mm long. Sepals 6-8 mm long, ovate-lanceolate, apiculate, scarious on margins. Corolla white, campanulate; tube 2-3 cm long, pubescent without; limb 2.5-3 cm across. Stamens 5, unequal; anthers twisted. Ovary 2-celled, ovules 2 in each cell; style 1; stigma capitate. Capsule globose, 2 cm across, seeds angular, black, pubescent.

Fl. & Fr. : January – April.

Distribution : Pantropical. Moist forests, wet areas of dry forests. Open areas in the streamside vegetation. *Amitha Bachan 99199* (Vazhachal, open or degraded areas of evergreen riparian vegetation, banks of Chalakkudy river, 220 m).

XENOSTEGIA D. Austin & Slaples

Xenostegia tridentata (L.) Austin & Staples subsp. **hastata** (Desr.) Panigrahi & Murti, Fl. Bilaspur 1: 395. 1989. *Convolvulus hastatus* Desr.

in Lam., Encycl. 3: 542. 1792. *Merremia tridentata* (L.) Hall.f. subsp. *hastata* (Desr.) Ooststr., Blumea 3: 317, f.2. 1939 & Fl. Males. 4(4):445. f.27a.1953; Manilal & Sivar., Fl. Calicut 187. 1982; Sasidh. & Sivar., Fl. Pl. Thrissur For. 312. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 347. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 479. 2009. *Merremia hastata* (Desr.) Hall. f. in Engl., Bot. Jahrb. Syst. 16: 552. 1893; Gamble, Fl. Pres. Madras 929. 1923.

Trailing herbs with long slender branches and thick root-stock. Leaves linear-lanceolate, to 4 x 1 cm, base auricled and toothed, apex acute, mucronate, sessile to subsessile. Flowers axillary few-flowered cymes, sometimes solitary; peduncle 1-2 cm long. Sepals to 5-3 mm, lanceolate, acuminate. Corolla campanulate, cream coloured or yellow with a purplish eye at centre; tube 1-1.5 cm long; limb spreading 1-1.5 cm across, subentire. Stamens 5; pollen grains smooth. Ovary 2-celled; stigma 2-lobed. Capsules subglobose, 0.8 cm across. Seeds 4, glabrous, brown.

Fl. & Fr. : September – March.

Distribution: Paleotropics. Open forest areas and plains. Open or degraded vegetation in the riparian zone. *Amitha Bachan 99200* (Vazhachal, riparian vegetation, banks of Chalakkudy river, 220 m).

83. **SOLANACEAE** Juss.

Gen. Pl. 124. 1789.

Key to genera

1a. Leaves entire; calyx enclosing the fruit..... **Physalis**

1b. Leaves serrate or sinuate; calyx not enclosing the fruit.....2

2a. Calyx tube deeply lobed; corolla tube under 3 cm long.....**Solanum**

2b. Calyx tube not deeply lobed; corolla tube 8-15 cm long.....**Datura**

DATURA Linnaeus

Sp. Pl. 179. 1753.

Datura stramonium L., Sp. Pl. 179. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 4: 242. 1883; Gamble, Fl. Pres. Madras 941. 1923; Anil Kumar *et al.*, Fl. Pathanamthitta 349. 2005. *Datura stramonium* L. var. *tatula* C. B. Clarke in Hook. f., Fl. Brit. India 4: 242. 1883. *Datura tatula* L., Sp. Pl. (ed. 2) 256. 1762. *Datura inermis* Jacq., Hort. Vindov. 3: 44. t. 82. 1776. *Datura laevis* L. f., Suppl. Pl. 146. 1781. *Datura bertolonii* Paxt. ex Guss, Fl. Sic. Sy. 1: 267. 842. *Datura ferox* Nees, Trans. Linn. Soc. London 17: 75. 1837, non L. *Datura wallichii* Dunal in DC., Prodr. 13: 539. 1852. *Stramonium vulgatum* Gaertn., Fruct. 2: 243. t. 132. f. 4. 1791. **Ummam.**

Shrubs, stems terete. Leaves alternate, broadly elliptic-ovate, 7-16 x 3-9 cm, acute to shortly acuminate at apex, unequal at base, slightly pubescent, toothed or sinuate. Flowers solitary, axillary, pedicellate, large; calyx green, tubular, to 6 cm long, lobes 5, acute, glabrous, in fruit the upper part deciduous leaving the circumcises base; corolla large tubular, funnel shaped to 15 cm long, white, glabrous, lobes 5, truncate with short linear appendage; stamens 5, included, filaments equal, hairy at base, attached near the base of the tube, anthers oblong; ovary 2-celled; style filiform; stigma 2-lobed. Capsule 3.5 cm across, globose, prickly, 4-celled, 4-valved; seeds compressed, glabrous.

Fl. & Fr. : July-October.

Distribution: Widely distributed in the temperate regions of the world. Introduced. Stream banks. *Amitha Bachan 123644* (Valparai, streamside vegetation, Sholayar streamside, 1200 m).

PHYSALIS Linnaeus

Sp. Pl. 183. 1753.

Physalis angulata L., Sp. Pl. 183. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 4: 238. 1883; Gamble, Fl. Pres. Madras 939. 1923; Sasidh. & Sivar., Fl. Pl. Thrissur For. 316. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 350. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 483. 2009. *Physalis minima* L., Sp. Pl. 183. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 4: 238. 1883; Gamble, Fl. Pres. Madras 939. 1923; Manilal, Fl. Silent Valley 192. 1988. **Njotta-Njodiyan.**

Annual herbs; branches angular. ovate or elliptic- lanceolate, Leaves 6 x 3 cm, acute at apex cuneate at base, unequal, dentate or sinuate, glabrous or sparsely pubescent; petiole to 4 cm long. Flowers axillary, solitary; pedicels 0.8 cm long. Calyx campanulate, ovoid, 5-toothed, 2.5 cm across in fruit. Corolla campanulate, pale-yellow with a purple base, 0.8 cm across; limb plicate, shortly lobed. Stamens 5, unequal; anthers oblong. Style linear; stigma obscurely 2-lobed. Berry globose, 0.7 cm across, yellow, enclosed by the inflated calyx. Seeds many, discoid, minutely rugose.

Fl. & Fr. : July-October.

Distribution: Tropical Asia, Africa and Australia. Wet areas. *Amitha Bachan 98991* (Kundoor, river banks, Chalakkudy river, Seal level).

SOLANUM Linnaeus

Sp. Pl. 184. 1753.

Key to species

1a. Plants unarmed..... **S. americanum**

1b. Plants armed with prickles.....2

2a. Flowers white; prickles few, on stems and petioles only.....**S. torvum**

2b. Flowers blue; prickles many, on stem and leaves.....**S. violaceum**

Solanum americanum Mill., Gard. Dict. (ed. 8) 5. 1768; Sasidh. & Sivar., Fl. Pl. Thrissur For. 316. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 477. 2002; C. N. Sunil & Sivad., Fl. Alappuzha 485. 2009. *Solanum nigrum* sensu Gamble, Fl. Pres. Madras 936. 1923, *non* L. 1753; Manilal, Fl. Silent Valley 194. 1988. **Mani-Thakkali**.

Glabrous annual herbs to 50 cm high. Leaves ovate to broadly ovate, to 8 x 3.5 cm, attenuate at base, entire or distantly toothed, membranous. Peduncle to 1 cm long. Flowers white in lateral or axillary umbells; pedicels 1 cm long, filiform, glabrous; calyx deeply 5-partite, corolla white with bluish shade, 0.5 cm across, lobes oblong. Berry globose 0.6 cm acoross, black, smooth, glossy; seeds discoid, yellow, minutely pitted.

Fl & Fr. : August-March.

Distribution: Cosmopolitan. Wet areas in the forests. *Amitha Bachan 123645* (Malakkapara, wet areas in the river banks, banks of Sholayar river, 900 m).

Solanum torvum Sw., Prodr. 47. 1788; C. B. Clarke in Hook. f., Fl. Brit. India 4: 234. 1883; Gamble, Fl. Pres. Madras 937. 1923; Sasidh. & Sivar., Fl. Pl. Thrissur For. 317. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 478. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 352. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 487. 2009. **Chunda**.

Shrubs, to 2.5 m high. Stem densly stellate hairy when young, sparsely prickled; prickles stout, broaden at base. Leaves ovate, to 20 x 12 cm, 2-3 sinuate, acute at apex, subcordate to obtuse at base, entire or shallowly lobed, stellate pubascent, scattered with few prickles on mid

rib and on petiole; petiole to 4 cm long. Peduncle short; cymes congested, supra axillary. Flowers many; pedicel 1 cm long, narrow; calyx tube campanulate, to 0.2 cm long; corolla white, 1.5 cm across, stellate hairy outside, style glabrous. Berry globose 1.3 cm across, yellow; seeds pitted.

Fl. & Fr. : October – March..

Distribution: Throughout the tropics. Open areas. *Amitha Bachan 98848* (Malakkapara, open areas near streams, banks of Sholayar river, 900 m); *Amitha Bachan* 99195 (Malakkapara, open areas near streams, banks of Sholayar river, 800 m).

Solanum violaceum Ortega, Nov. Pl. Descr. Dec. 56. 1798, subsp. **violaceum**; Hepper in Dassan. & Fosb., Rev. Handb. Fl. Ceylon 6: 378. 1987; Anil Kumar *et al.*, Fl. Pathanamthitta 352. 2005. *Solanum anguivi auct. non* Lam. Sasidh. & Sivar., Fl. Pl. Thrissur For. 317. 1996; C. N. Sunil & Sivad., Fl. Alappuzha 487. 2009. *Solanum indicum* C. B. Clarke in Hook. f., Fl. Brit. India 4: 234. 1883, *non* L. 1753; Gamble, Fl. Pres. Madras 938. 1923. **Puthari-Chunda.**

Erect woody herbs; stems prickled; prickles stout, broaden towards the base. Leaves ovate, to 16 x 12 cm, shallowly lobed, sometimes deeply lobed, densely stellate hairy; petiole 3 cm long. Raceme 12-25-flowered, very shortly peduncled. Flowers blue, densely packed; pedicels 1.2 cm long, curved; calyx lobes triangular, prickly, not enlarged in fruit; corolla to 2 cm across, glabrous or hairy. Berry 0.8 cm across, orange-red, smooth.

Fl. & Fr. : October – February..

Distribution: Indo-Malaysia. Open areas. *Amitha Bachan 123642* (Perumbara-Malakkapara, open areas near streams, banks of Sholayar river, 1000 m).

84. SCROPHULARIACEAE Juss.

Gen. Pl. 117. 1789.

Key to genera

1a. Stamens 2 2

1b. Stamens 4 3

2a. Stem terete or subterete; anthers parallel; capsule loculicidal ..... **Dopatrium**

2b. Stem quadrangular; anthers disjunct; capsule septicidal .... **Lindernia**

3a. Calyx spathaceous, asymmetrical, split on oneside; roots orange-yellow..... **Centranthera**

3b. Calyx not spathaceous, symmetrical, not split on oneside; root not orange-yellow..... 4

4a. Calyx lobes 4; corolla rotate, lobes 4 ..... **Scoparia**

4b. Calyx lobes 5; corolla tubular, lobes 5, or corolla 2-lipped 5

5a. Stem terete. 6

5b. Stem quadrangular or angular 7

6a. Leaves serrate or pinnatifid to laciniate; calyx-lobes connate, not foliaceous; anther-cells stipitate ..... **Limnophila**

6b. Leaves entire; calyx-lobes free, foliaceous; anther-cells not stipitate ..... **Bacopa**

7a. Calyx-tube ribbed anthers with 1 fertile cell; lower lip of corolla enveloping the upper lip in bud..... 8

7b. Calyx-tube not ribbed; anthers with 2 fertile cells; upper lip of corolla enveloping the lower lip in bud.....9

8a. All leaves simple; Calyx 15-ribbed, all ribs extending to the apex of the lobe..... **Striga**

8b. Lower leaves pinnatifid; calyx not 15-ribbed, not extending to the apex of the lobe.....**Parasopubia**

9a. Calyx-lobes free, foliaceous ..... **Mecardonia**

9b. Calyx-lobes connate, not foliaceous. 10

10a. Calyx strongly keeled; corolla 2-2.5 cm long, deep purple.... **Torenia**

10b. Calyx not keeled, smooth; corolla up to 1 cm long, white, cream or pink ..... **Lindernia**

BACOPA Aublet

Hist. Pl. Guiane 128, t. 48. 1775, *nom. cons.*

Bacopa monnieri (L.) Pennell, Proc. Acad. Nat. Sci. Philad. 98: 94. 1946; Sasidh. & Sivar., Fl. Pl. Thrissur For. 319. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 355. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 490. 2009. *Lysimachia monnieri* L., Cent. Pl. 2: 9. 1756. *Gratiola monnieri* (L.) L., Syst. Nat. (ed. 10) 851.1759. *Moniera cuneifolia* Michx., Fl. Bor. Amer. 2: 22. 1803, "Monniera"; Gamble, Fl. Pres. Madras 953. 1923. *Herpestis monnieria* (L.) Kunth, Nov. Gen. Sp. 2: 366. 1818; Hook. f., Fl. Brit. India 4: 272. 1884. **Brahmi.**

Amphibious, semi-succulent, prostrate, creeping, herbs; rooting at nodes. Leaves obovate-oblong or spathulate, to 1.5-0.5 cm, acute at base, round at apex, thick, sessile. Flowers solitary, axillary; pedicels to 2.5 cm long; bracteoles 2, up to 3 mm long. Calyx-lobes 5, unequal; outer calyx lobe ovate, 5 x 4 mm, others smaller. Corolla bluish-white, campanulate, to 8 mm long, 2-lipped; lobes 5, subequal. Stamens 4,

didynamous. Ovary globose; style deflexed. Capsule ovoid-oblong, 3 x 2 mm, enclosed in persistent calyx. Seeds oblong, 0.5 mm long.

Fl. & Fr. : Throughout the year.

Distribution: Paleotropics. Wet areas in the lower plains. *Amitha Bachan 117724* (Kanakkankadavu, wet areas along riverside, Chalakkudy river, sea level).

DOPATRIUM F. Hamilton ex Bentham

in Lidley Edward's Bot. Reg. ad t. 1770(4). 1835.

Dopatrium junceum (Roxb.) Buch.-Ham. ex Benth., Scroph. India 31. 1835; Hook. f., Fl. Brit. India 4: 274. 1884; Gamble, Fl. Pres. Madras 954. 1923; Anil Kumar *et al.*, Fl. Pathanamthitta 356. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 493. 2009. *Gratiola juncea* Roxb., Pl. Coromandel 2: 16, t.127. 1798. **Plate 29. D & E**

Erect, semi-aquatic herbs to 20 cm high; stems much branched from the base, branches erect, green. Basal leaves larger, ovate-oblong, 1 x 0.4 cm, obtusely acute-acuminate at apex, obtuse at base; cauline distant. Flowers pink, axillary, solitary, sessile; bracts ovate, obtuse; sepals obtuse, 2 mm long, connate at base; corolla pale blue, bilabiate, 6 mm long; upper lip emarginate, lower lip equally 3-lobed, lobes obtuse; stamens 2; staminodes 2; ovary obovoid, glabrous; style 1 mm long, stigma truncate. Capsule globose, loculicidal, sessile; seeds many, brown.

Fl. & Fr. : July-October

Distribution: Eastern Tropics. Marshy areas and riverbeds. *Amitha Bachan 117672* (Sholayar, river bank, banks of Sholayar river, 750 m).

LIMNOPHILA R. Brown

Prodr. 442. 1810, *nom. cons.*

Limnophila aquatica (Roxb.) Alston, Ann. Roy. Bot. Gard. (Peradeniya) 11: 205. 1929; Philcox, Kew Bull. 24: 129. 1970; C. N. Sunil & Sivad., Fl. Alappuzha 494. 2009. *Cyrilla aquatica* Roxb., Pl. Coromandel t. 189. 1805. *Limnophila racemosa* Benth., Scroph. India 26.1835; Hook. f., Fl. Brit. India 4: 271. 1884; Gamble, Fl. Pres. Madras 952. 1923.

Emergent aquatic herbs, often rising 30 cm above water; stem rooting at lower nodes. Leaves dimorphic: aerial leaves opposite or ternately whorled, lanceolate to oblong-lanceolate, to 4 x 1.5 cm, rounded or semi-amplexicaul at base, acute at apex, serrulate, 3-5-nerved from base, glabrous, sessile; submerged leaves capillaceo-multifid. Flowers in apparent terminal racemes; pedicels 0.3-1 cm long, slender, glandular-pubescent. Calyx 4 mm long, lobes equal, ovate, abruptly acuminate. Corolla tube white, 7-10 mm long, puberulous without, villous within at throat, limb subequally 5-lobed, white or pale blue, purplish or reddish blotches on the lip. Stamens 4. Capsule globose or ellipsoid. Seeds globular, black.

Fl. & Fr. : October – January.

Distribution: Indo-Malaysia, East and South China. *Amitha Bachan 117725* (Kanakkankadavu, riverside vegetation, Chalakkudy river, sea level).

LINDERNIA Allioni

Melanges Philos. Math. Soc. Roy. Turin. (Misc. Taur.) 3(1): 178. 1766.

Key to species

1a. Perfect stamens 4; staminodes absent.....2

1b. Perfect stamens 2; staminodes 2..... **L. ciliata**

2a. Capsule about equalling the calyx or less..... **L. crustacea**

2b. Capsule twice as long as calyx or longer. 3

3a. Flowers sessile ..... **L. sessiliflora**

3b. Flowers pedicelled ..... **L. anagallis**

Lindernia anagallis (Burm. f.) Pennell, J. Arnold Arbor. 24. 252. 1943; Mukherjee, J. India Bot. Soc. 24: 133. 1945; Philcox, Kew Bull. 17. 484. 1964 & 22: 45. 1968; Sivar. & Philip Mathew, J. Bombay Nat. Hist. Soc. 80(1) 139. 1983; Manilal, Fl. Silent Valley 195. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 322. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 359. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 499. 2009. *Ruellia anagallis* Burm. f., Fl. India 135. 1768. *Vandellia pedunculata* Benth., Scroph. India 37.1835; Hook. f., Fl. Brit. India 4: 282. 1885; Gamble, Fl. Pres. Madras 959. 1923. *Vandellia angustifolia* Benth., Scroph. India 37. 1835 & in DC., Prodr. 10: 417. 1846; Hook. f., Fl. Brit. India 4: 282. 1884. *Lindernia angustifolia* (Benth.) Wettst. in Engl. & Prantl, Naturl. Pflanzenfam. 4. 3b.79. 1891; Ravi, J. Bombay Nat. Hist. Soc. 67: 611. 1971.

Procumbent herbs, rooting from nodes. Leaves ovate, to 2 x 1.5 cm, acute, crenate; nerves 5 pairs, pinnate. Flowers axillary, solitary; pedicel 2 cm long; Calyx divided to the base, lobes narrow, linear-lanceolate, 1 mm long, glabrous; corolla blue, 1.2 cm long, upper lip entire; lower lip equally 3-lobed, lobes obtuse; Stamens 4, didynamous, anthers tailed at base; filaments with a gland at the base of the lower stamen; stigma spoon-shaped. Capsule septicidal, 1.3 cm long; seeds oblong, 0.2 mm long.

Fl. & Fr. : July-October.

Distribution: Indo-Malaysia. Streambanks, *Amitha Bachan 117601* (Vazhachal, riverbed, banks of Chalakkudy river, 230 m).

Lindernia ciliata (Colsm.) Pennell, Brittonia 2: 182. 1936 & J. Arn. Arb. 24: 253. 1943; Mukherjee, J. India Bot. Soc. 24: 133. 1945; Philcox, Kew Bull. 22: 51. 1968; Sivar. & Philip Mathew, J. Bombay Nat. Hist. Soc. 80(1) 133. 1983; Sasidh. & Sivar., Fl. Pl. Thrissur For. 322. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 482. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 360. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 501. 2009. *Gratiola ciliata* Colsm., Prodr. Desc. Grat. 14. 1793. *Gratiola serrata* Roxb., Fl. India 1: 140. 1820. *Ilysanthes serrata* (Roxb.) Urban, Berl. Deutsch. Bot. Ges. 2: 436. 1884; Gamble, Fl. Pres. Madras 962. 1923. *Bonnaya brachiata* Link & Otto, Icon. Pl. Select. 25, t.11. 1820; Hook. f., Fl. Brit. India 4: 284. 1884. *Lindernia bracteoides* (Blatt. & Hallb.) Mukherjee, J. Indian Bot. Soc. 24: 133. 1945. **Plate 29. G**

Small erect diffusely branched herbs. Leaves oblong, 1-2.4 x 0.5-0.8 cm, sessile, obtuse, sharply serrate, glabrous. Flowers in terminal racemes; pedicels 1-2 mm long, slender; bracts subulate; sepals lanceolate, 4 mm long, united below the middle, acuminate; corolla blue,12 mm long, tube slender, upper lip orbicular, lower lip obtusely 3-lobed; stamens 2, anthers unequal; staminodes hooked. Capsule linear-oblong, septicidal, 1.2 cm long.

Fl. & Fr. : September- October.

Distribution: Indo-Malaysia. Wet areas in the forest. *Amitha Bachan 99051* (Orukombankutty, riverside vegetation, banks of Chalakkudy river, 450m).

Lindernia crustacea (L.) F.v. Muell., Syst. Cens. Austral. Pl. 1: 97. 1882; Mukherjee, J. India Bot. Soc. 24: 130. 1945; Philcox, Kew Bull. 22: 17. 1968; Sivar. & Philip Mathew, J. Bombay Nat. Hist. Soc. 80(1) 136. 1983;

Sasidh. & Sivar., Fl. Pl. Thrissur For. 322. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 483. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 360. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 502. 2009. *Capraria crustacea* L., Mantissa Pl. 1: 87. 1767. *Vandellia crustacea* (L.) Benth., Scroph. India 35. 1835; Hook. f., Fl. Brit. India 4: 274. 1884; Gamble, Fl. Pres. Madras 959. 1923. **Plate 29. F**

Erect diffusely branched herbs, to 15 cm high, rooting from lower nodes; stems bluish, glabrous. Leaves broadly ovate, to 1.5 x 1 cm, acute or obtuse, shortly serrate; nerves 4 pairs, pinnate; petioles to 0.5 cm long. Flowers usually on terminal racemes, sometimes axillary; pedicels to 1.5 cm long; calyx divided upto the middle, 0.3 cm long, lobes 5, acute, glabrous except on the rib; corolla 0.5 cm long, purple; staminal filament of lower stamen appendaged at middle. Capsule globose, septicidal, 0.3 cm, glabrous; seeds yellow, obovoid, rugose.

Fl. & Fr. : July-November.

Distribution: Africa, America and tropical and subtropical Asia. Wet areas, streamsides. *Amitha Bachan 117605* (Vazhachal, stream banks, Chalakkudy river, 240 m).

Lindernia sessiliflora (Benth.) Wettst. in Engl. & Prantl, Naturl. Pflanzenfam. 4(3b): 79. 1891; Mukherjee, J. India Bot. Soc. 24: 132. 1945; Philcox, Kew Bull. 22: 10. 1968; C. N. Sunil & Sivad., Fl. Alappuzha 505. 2009. *Vandellia sessiliflora* Benth., Scrop. India 37. 1835; Hook. f., Fl. Brit. India 4: 282. 1884; Gamble, Fl. Pres. Madras 959. 1923.

Much branched annual herbs to 15 cm high; stem creeping and rooting at the nodes, 4-angled, pubescent mainly on the angles. Leaves broadly ovate to suborbicular, 1-2.5 x 0.8-1.8 cm, rounded at base, rounded at apex, decurrent on petiole, crenate-serrate, nerves 2-4 pairs,

pinnate, subcoriaceous, glabrous above, pubescent on nerves beneath; petiole up to 0.8 cm long. Flowers axillary, usually solitary or 2-3, to 0.8 cm long, sessile, sometimes with 0.5 cm long pedicels. Calyx tube 5-lobed, to 0.5 mm long, ribbed, ciliate; lobes unequal, narrowly lanceolate to linear-sabulate, upper lobe up to 4 mm long, others shorter, 2-3 mm long, pubescent without. Corolla to 0.8 cm long, white; tube 0.5 cm long; upper lip entire, 2-3 mm long, brown, lower lip distinctly 3-lobed. Stamens 4, all fertile; anterior filaments with a thick, rounded papillose spur at the base. Capsule ellipsoid, cylindric to 1.2 cm long, septicidal. Seeds many, ellipsoid, tuberculate.

Fl. & Fr. : July- October.

Distribution: Indo-Malaysia. Wet areas and streambeds. *Amitha Bachan 117673* (Sholayar, riparian vegetation, banks of Sholayar river, 750 m).

MECARDONIA Ruiz & Pavon

Prodr. 95. 1794.

Mecardonia procumbens (Mill.) Small, Fl. Southeast. U.S. 1065, 1338. 1903; Joseph & Suresh, Indian J. Botany 5: 126. 1982; Sasidh. & Sivar., Fl. Pl. Thrissur For. 324. 1996; C. N. Sunil & Sivad., Fl. Alappuzha 507. 2009. *Erinus procumbens* Mill., Prodr. Veg. India Occ. 92. 1788. *Bacopa procumbens* (Mill.) Green., Publ. Field Columbian Mus. Bot. ser. Chicago 2: 261. 1907; Raiz., Indian For. 94: 436. 1968.

Diffuse spreading herbs, stems 4-angled. Leaves opposite, sessile, penninerved, ovate-lanceolate, to 1.5 x 0.6 cm, acute at base, crenate-serrate; black on drying. Flowers axillary, solitary; pedicels to 1 cm long; bracteoles oblong, 0.5 cm long; calyx deeply 5-partiate, inner 2 lobes much narrower, 0.4 x 0.5 cm; outer ovate-lanceolate, 0.6 x 0.3 cm; corolla yellow, 0.6 cm long, slightly 2-lipped with subequal lobes;

stamens 4, didynamous, anthers stalked, ovary oblong with short style; stigma lamellate. Capsule 2-valved; seeds many, reticulate.

Fl. & Fr. : July- October.

Distribution: Native of Tropical America, Introduced and naturalized in India. *Amitha Bachan 117791* (Orukombankutty, riverbeds vegetation, riverbed-Chalakkudy river, 450 m).

PARASOPUBIA H.-P. Hofm. & Eb. Fisch.

Bot. Jahrb. Syst. 125 (3): 357. 2004.

Parasopubia delphinifolia (L.) H.-P. Hofm. Eb. Fisch., Bot. Jahrb. Syst. 125 (3): 357. 2004. *Gerardia delphinifolia* L., Cent. Pl. 2: 21. 1756; Roxb., Pl. Coramandel 1: t. 90. 1795. *Sopubia delphinifolia* (L.) G. Don. Gen. Hist. 4: 560. 1838; Hook. f. Fl. Brit. India 4: 302. 1884; Gamble, Fl. Pres. Madras 970. 1924; Manilal, Fl. Silent Valley 196. 1988.

Stout rigid annual herbs; stems hispid. Leaves pinnatifid, opposite or verticillate; lobes linear-oblong, 1-2 cm long, coriaceous, covered with tubercle based hairs. Flowers axillary or in terminal racemes; pedicels 0.7 cm long; calyx campanulate, 5-lobed, inner margins of lobes glabrous; corolla campanulate, pink to rose-violet; Stamens 4, included, Capsule ovoid-globose, stigma capitate. Capsule dorsiventral. Seeds numerous.

Fl. & Fr. : December-April.

Distribution: Indo-Malaysia and China. Wet streamside vegetation. *Amitha Bachan 123335* (Nelliyampathy, streamside vegetation, stream draining to Karappara river, 900 m).

SCOPARIA Linnaeus

Sp. Pl. 116. 1753.

Scoparia dulcis L., Sp. Pl. 116. 1753; Hook. f., Fl. Brit. India 4: 289. 1884; Gamble, Fl. Pres. Madras 964. 1924; Manilal, Fl. Silent Valley 196. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 324. 1996; N. Mohanan & Sivad.,Fl. Agasthyamala 484. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 363. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 509. 2009. **Kallurukki.**

Erect annual herbs to 60 cm high; stems ridged. Leaves whorled, elliptic to obovate, 3.5 x 1.5 cm, acute at both ends, serrate; lateral nerves 3 pairs, pinnate; petiole to 0.7cm long. Flowers axillary, solitary; pedicels to 0.6 cm long, erect, slender; calyx deeply 4-lobed, 3 mm long, lobes ovate, obtuse, curved; corolla rotate, 4-lobed, white, throat densely hairy, lobes obovate; stamens 4, subequal; ovary globose, style clavate, stigma truncate. Capsule globose, 2-valved, longer than the calyx; seeds many, pitted.

Fl. & Fr. : July-March.

Distribution: Native of Tropical America, now Pantropical. Open riverbanks. *Amitha Bachan 98725* (Nelliyampathy, open streambanks, Karappara river side, 900 m).

STRIGA Loureiro

Fl. Cochinch. 17. 1790.

Striga angustifolia (D. Don) C.J. Saldanha, Bull. Bot. Surv. India 5: 70. 1963; Manilal, Fl. Silent Valley 197. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 325. 1996; C. N. Sunil & Sivad., Fl. Alappuzha 511. 2009. *Buchnera angustifolia* D. Don, Prodr. Fl. Nepal. 91. 1825. *Striga euphrasioides* auct. non Benth. excl. basionym.; Hook. f., Fl. Brit. India 4: 299. 1884; Gamble, Fl. Pres. Madras 968. 1924. **Plate 29. H**

Erect, little or not branched slender parasitic herbs, to 30 cm high. Leaves linear-lanceolate, narrow, to 4 x 0.4 cm, scabrid. Flowers in terminal spikes; bracts lanceolate; sepals 1.0 cm long; calyx 15-ribbed, all ribs continued to the apex of the lobe; corolla 2-lipped, 1.4 cm long, upper lip orbicular, lower lip 3-lobed. Capsule obovoid, 0.4 cm, glabrous; seeds cylindrical, brown.

Fl. & Fr. : August-December.

Distribution: Indo-Malaysia. Wet areas along streamsides. *Amitha Bachan 117741* (Nelliyampathy, Streamside vegetation, Karappara stream, 1000m).

TORENIA Linnaeus

Sp. Pl. 619. 1753.

Torenia bicolor Dalz. in Hooker's J. Bot. Kew Gard. Misc. 3: 38. 1851; Hook. f., Fl. Brit. India 4: 278. 1884; Gamble, Fl. Pres. Madras 957. 1923; Manilal, Fl. Silent Valley 198. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 326. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 487. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 365. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 512. 2009. **Kakkapoo.**

Small trailing and rooting herb. Leaves ovate, to 35 x 2 cm, acute at apex, truncate to subcordate at base, serrate, thinly hairy; nerves to 4 pairs; petiole to 2 cm long. Flowers axillary, solitary; pedicels 4-5 cm long, slender; calyx 1.5 cm long, ribbed with brown line, narrowly winged, glabrous, wing decurrent at base into the pedicel; lobes acuminate; corolla deep-violet, with pale lower lip, to 2.5 cm long, lobes obtuse, glabrous; appendages of lower filament shortly subulate.

Fl. & Fr. : July-September.

Distribution: Endemic to the Western Ghats. Wet areas along streamside. *Amitha Bachan 117606* (Vazhachal, Streamside vegetation, banks of Chalakkudy river, 240 m).

85. OROBANCHACEAE Ventenat

Tabl. Regne Veg. 2: 292. 1799.

1a. Calyx spathaceous, split at anterior side.....**Aeginetia**

1b. Calyx-tubular campanulate, faintly 2-lipped.....**Christisonia**

Aeginetia pedunculata Wall., Pl. Asiat. Rar. 3: 13.t.219.1831; Hook. f., Fl. Brit. India 4:320. 1884; Gamble, Fl. Pres. Madras 974. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 327. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 489. 2002.

Leafless parasitic herbs; rootstock erect, glabrous or scabrid. Scapes branched, 10-20 cm long, glabrous, pink or brownish yellow. Flowers many, crowded towards tip; calyx spathacious, 4 cm long, split along one side, puberulus, acute, pale orange; corolla 6 x 4 cm; tube widening above, yellowish pink; lobes rounded, deep purple to blue; sterile anthers with fleshy acute horn; filaments hairy at base; stigma peltate, very prominent, glabrous, white. Ovary sub globose, to 0.6 cm across. Capsule ovoid, to 1.5 cm across.

Fl & Fr. : September-November.

Distribution: September-November. Indo-Malaysia. Evergreen forests and grasslands. *Amitha Bachan 117737* (Anakkayam-Sholayar, riparian forest, banks of Anakkayam stream, 600 m).

Plate 29. A. & B. *Argyreia hirsuta* Wight & Arn., A. Habit, B. Inflorescence; C. *Ipomoea carnea* subsp. *fistulosa* (Mart. ex Choisy) Austin; D. & E. *Dopatrium junceum* (Roxb.) Buch.-Ham. ex Benth., D. Habit, E. flowering and fruiting twig; F. *Lindernia crustacea* (L.) F.v. Muell.; G. *Lindernia ciliata* (Colsm.) Pennell; H. *Striga angustifolia* (D. Don) C.

CHRISTISONIA G. Gardner

Calcutta J. Nat. Hist. 8: 153. 1847.

Christisonia tubulosa (Wight) Benth. ex Hook. f., Fl. Brit. India 4: 321. 1884; Gamble, Fl. Pres. Madras 975. 1924; Mohanan & Sivad., Fl. Agasthyamala 490. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 366. 2005; Sunil & Sivad., Fl. Alappuzha 513. 2009. *Oligopholis tubulosa* Wight, Icon. Pl. India Orient. t. 1422. 1849. **Plate 30. A**

Fleshy parasitic herbs, stem leafless to 15-25 cm high, scaly, simple or branched from the rootstock. Leaves scaly ovate-lanceolate, 2-3 mm long. Inflorescence terminal, lax racemes; flowers with one long bracts, no bracteoles; pedicels 1-2.5 cm long. Calyx tubular; tube to 1.2 cm long; lobes triangular. Corolla large, funnel-shaped, purplish white; tube to 4 cm long, 5-lobbed, 2-lipped; lobes orbicular, subequal, spreading, lower lip yellowish at throat. Stamens 4, didynamous, connivent in pairs; anthers 2-celled, 1 cell perfect, other sterile, spurred. Ovary 1-celled, ovules many; style slender; stigma peltate. Capsule 0.8-1.2 cm long, ovoid. Seeds many, minute, calyx tube persistent in fruits.

Fl. & Fr. : July – August.

Distribution: Endemic to Southern Western Ghats. *Amitha Bachan 123385* (Vazhachal, riparian evergreen, parasitic on reed roots, banks of Chalakkudy river, 220m); *Amitha Bbachan 123481* (Sholayar-Meenchaliyali, evergreen streamside vegetation, parasitic on roots of *Alpenia*, 700 m).

86. LENTIBULARIACEAE Rich.

in Poiteau & Turpin, Fl. Paris 1, ed. 4: 261.

UTRICULARIA Linnaeus

Sp. Pl. 18. 1753.

Key to species

1a. Submerged aquatic plants; foliar organs many, dissected..... **U. aurea**

1b. Terrestrial on wet rocks; foliar organs few, not dissected.....2

2a. Flowers white.....**U. striatula**

2b. Flowers blue.....**U. graminifolia**

Utricularia aurea Lour., Fl. Cochinch. 26.1790; M.K. Janarth. & Henry, Bladderworts India 30. 1992; Anil Kumar *et al.*, Fl. Pathanamthitta 367. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 515. 2009. *Utricularia flexuosa* Vahl, Enum. Pl. 1: 198. 1804; C. B. Clarke in Hook. f., Fl. Brit. India 4: 329. 1884; Gamble, Fl. Pres. Madras 980. 1924. *Utricularia fasciculata* Roxb., Fl. India 1: 143. 1820; Wight, Icon. Pl. India Orient. t. 1568. 1850.

Plate 30. B

Suspended aquatic herbs; stolon up to 1 m long, much branched. Foliar organs repeatedly dichotomously branched, whorled, upto 6 cm long, ultimate segments capillary, terete. Traps numerous, 2-5 mm across, ovoid. Racemes arising at intervals on the stolons, 5-7 flowered. Flowers yellow, up to 1 cm long; pedicels to 1.5 cm long, recurved and distally thickened in fruit. Calyx-lobes subequal, ovate, 3 mm long, becoming much larger and reflexing in fruit. Corolla yellow; upper lip erect, 4 mm, obtuse at apex; lower lip 7 mm, obovate, throat hairy; spur equals lower lip. Stamens 2; filaments curved, 1.5 mm long. Ovary ovoid; stigma 2-lipped. Capsule up to 5 mm across, globose with a long beak. Seeds with slightly winged margins.

Fl. & Fr. : August -April.

Distribution : Indo-Malaysia to Australia and East Asia. In stagnant and slow running waters especially in lower plains. *Amitha Bachan 123496* (Elanthikkara, slow running waters, stream joining Chalakkudy river, sea level).

Utricularia graminifolia Vahl, Enum. Pl. 1: 195. 1804; Gamble, Fl. Pres. Madras 981. 1924; Manilal, Fl. Silent Valley 199. 1988; M.K. Janarth. & Henry, Bladderworts India 57. 1992; N. Mohanan & Sivad., Fl. Agasthyamala 492. 2002. *Utricularia smithiana* Wight in Hooker's J. Bot. Kew Gard. Misc. 1: 373. 1849; Gamble, Fl. Pres. Madras 982. 1924; M.K. Janarth. & Henry, Bladderworts India 101. 1992. *Utricularia conferta* Wight, Icon. Pl. India Orient. t. 1575. 1850. *Utricularia caerulea* sensu C. B. Clarke in Hook.f., Fl. Brit. India 4: 331. 1884, non L. 1753.

Plate 30.C

Small terrestrial herbs of the wet rocky areas. Foliar organs, linear, obtuse, 3-nerved, up to 2 cm long. Traps subglobose, mouth basal, appendages 2, subulate, simple. Racemes to 25 cm long; bracts basifixed, ovate, lanceolate. Flowers blue to purple; calyx lobes unequal, ovate, acuminate; upper lip of corolla linear, oblong, lower lip obovate. Capsules ovoid, thickened along dehiscent margins; seeds reticulate with elongate aerioles.

Fl. & Fr. : September – March.

Distribution : Endemic to India and Sri Lanka. Marshy grasslands. *Amitha Bachan 98942* (Pullala-Nelliyampathy, streamside near shola, stream draining to Karappara river, 1100 m).

Utricularia striatula Smith, Res. Cyclop. 37: n.17. 1819; Gamble, Fl. Pres. Madras 983. 1924; M.K. Janarth. & Henry, Bladderworts India

106. 1992; Sasidh. & Sivar., Fl. Pl. Thrissur For. 328. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 493. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 368. 2005. *Utricularia orbiculata* Wall. ex A. DC. in DC., Prodr. 8: 18. 1844; C. B. Clarke in Hook. f., Fl. Brit. India 4: 334. 1884. *Utricularia glochidiata* Wight in Hooker's J. Bot. Kew Gard. Misc. 1: 373. 1849 & Icon. Pl. India Orient. t. 1581. 1850. **Plate 30. D**

Terrestrial herbs on wet rocks. Foliar organs orbicular or reniform, to 4 mm; scape scattered on stolon, filiform. Traps globose, mouth lateral; scape erect, 3-5-flowered to 7 cm long; bracts medifixed. Flowers white-lilac; calyx unequal, papillose, upper lip 2 mm, orbicular, lower lip ovate, 1 x 0.9 mm, rounded; corolla bluish violet with yellow throat; upper lip suborbicular, lower lip 5-lobed, throat hairy, spur cylindrical, acute. Capsule ovoid; seeds oblong, clavate, glochidiate.

Fl. & Fr. : July -December.

Distribution : Paleotropics. On wet rocks in the forest areas. *Amitha Bachan 123625* (Thachanthoni-Sholayar, rocky riparian area, banks of Sholayar river, 800 m).

87. GESNERIACEAE Dumort.

Comment. Bot. 57. 1822.

Key to genera

1a. Plants epiphytic; leaves elliptic; flowers red..... **Aeschynanthus**

1b. Plants not epiphytic; leaves cordate; flowers blue....**Rhynchoglossum**

AESCHYNANTHUS Jack

Trans. Linn. Soc. London 14: 42. 1823, *nom. cons.*

Aeschynanthus perrottetii A.DC. in DC., Prodr. 9: 261. 1845; C. B. Clarke in Hook. f., Fl. Brit. India 4: 339. 1884; Gamble, Fl. Pres. Madras

985. 1924; Manilal, Fl. Silent Valley 199. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 329. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 369. 2005. *Aeschynanthus ceylanica* sensu Wight, Icon. Pl. India Orient. t. 1347. 1848; *Aeschynanthus perrottetii* A. DC. var. *planiculmis* C. B. Clarke in Hook. f., Fl. Brit. India 4: 340. 1884, '*platyculmis*'; N. Mohanan & Sivad., Fl. Agasthyamala 494. 2002. *Aeschynanthus planiculmis* (C. B. Clarke) Gamble, Fl. Pres. Madras 985. 1924. **Plate 30. E**

Epiphytic pendulous herbs with woody stem; internodes shortened at older stems; stems terete, glabrous, scandent. Leaves opposite, elliptic, 6-9 x 1-4 cm, succulent, acute at both ends; petiole 0.5 cm long. Flowers axillary, solitary or rarely paired; pedicels 1 cm long; sepals 7 mm, free, lanceolate; corolla red, tubular, curved, widening above, 4.5 cm long, oblique at mouth, lobes 5, subequal, ovate, obtuse, glandular-ciliate; stamens 4, all perfect; filaments long, free, inserted at the middle of the corolla tube; upper stamens with smaller anthers; ovary 1-celled, long-stipitate linear, ovules many; Capsule to 15 cm long, linear; Seeds many.

Fl. & Fr. : November – January.

Distribution : Endemic to the Western Ghats. Evergreen and shola forests. *Amitha Bachan 98952* (Nelliyampathy, riparian evergreen, Karappara river side, 900 m); *Amitha Bachan 127404* (Malakkapara, epiphytic on riparian trees, banks of Sholayar river, 900 m).

RHYNCHOGLOSSUM Blume

Bijdr. 741. 1826.

Rhynchoglossum notonianum (Wall.) Burtt, Notes Roy. Bot. Gard. Edinb. 24: 170. 1962 & in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3: 99. 1981; Manilal, Fl. Silent Valley 200. 1988; Sasidh. & Sivar., Fl. Pl.

Thrissur For. 330. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 496. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 370. 2005. *Wulfenia notoniana* Wall., Tent. Fl. Nepal. 46. 1826. *Klugia notoniana* (Wall.) A. DC. in DC., Prodr. 9: 276. 1845; Wight, Icon. Pl. India Orient. t. 1353. 1848; C. B. Clarke in Hook. f., Fl. Brit. India 4: 366. 1889; Gamble, Fl. Pres. Madras 990. 1924. **Plate 30. F & G**

Fleshy succulent herbs. Leaves alternate and opposite, to 13 x 7 cm, ovate, acute at apex, obliquely cordate at base, glabrous. Flowers in terminal racemes; bracts green, ovate, acute; pedicels to 0.5 cm long; sepals 5, lanceolate, 0.8 cm long, united below; corolla blue, bilabiate, to 2.5 cm long, tube white, upper lip smaller, 2-lobed, lower lip broad; stamens 4, anthers connate in pairs; ovary 1-celled, ovules many, on 2-parietal placenta; style slender; stigma oblique. Capsule ovoid, to 6 mm long; seeds many, reticulate.

Fl. & Fr. : August-January.

Distribution : Endemic to Southwest India and Sri Lanka. Moist rocky places in evergreen forests. *Amitha Bachan 72003* (Athirappilly, rocky cutting in the riparian forests, 100 m); *Amitha Bachan 127403* (Malakkapara, wet rocky cuttings in the riparian zone, banks of Sholayar river, 900 m).

88. BIGNONIACEAE Juss.

Gen. Pl. 137. 1789.

STEREOSPERMUM Chamisso

Linnaea 7: 720. 1833.

Stereospermum colais (Buch.-Ham. ex Dillw.) Mabb., Taxon 27: 553. 1979, var. **colais**; Manilal, Fl. Silent Valley 201. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 332. 1996; N. Mohanan & Sivad., Fl. Agasthyamala

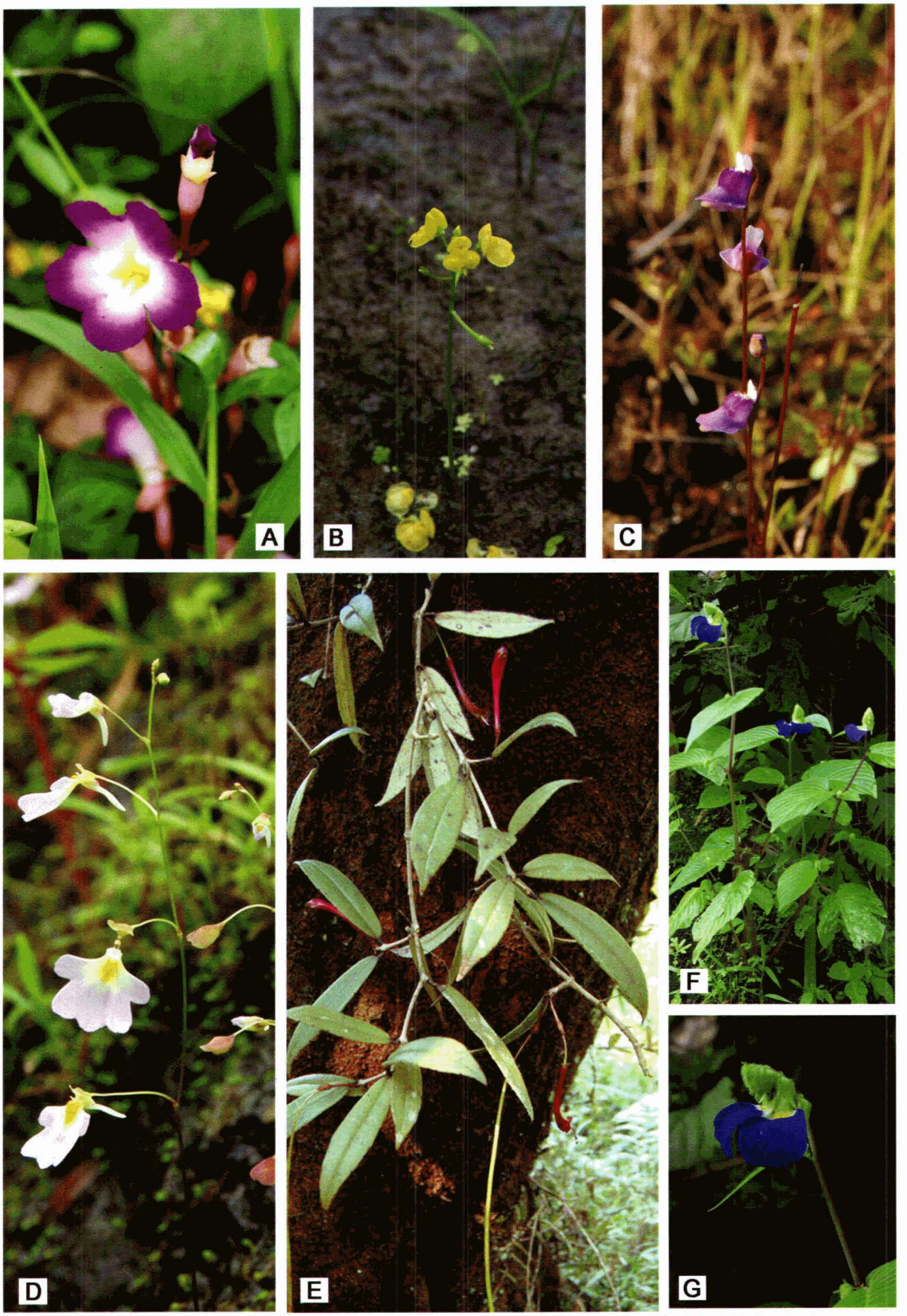


Plate 30. A. *Christisonia tubulosa* (Wight) Benth. ex Hook. f.; B. *Utricularia aurea* Lour.; C. *Utricularia graminifolia* Vahl; D. *Utricularia striatula* Smith; E. *Aeschynanthus perrottetii* A.DC.; F & G. *Rhynchoglossum notonianum* (Wall.) Burtt. F. Habit, G. Flower.

499. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 371. 2005. *Bignonia colais* Buch.-Ham. ex Dillw., Rev. Hort. Malab. 28. 1839. *Stereospermum tetragonum* DC., Prodr. 9: 210. 1845; Gamble, Fl. Pres. Madras 998. 1924. *Stereospermum chelonoides* sensu Wight, Icon. Pl. India Orient. t. 1341. 1845, non (L. f.) DC.1838; Clarke in Hook. f., Fl. Brit. India 4: 383. 1884. **Pathiri.**

Large trees with gray rugose bark. Leaves to 30 cm long, pinnate; leaflets 4-6 pairs, to 10 x 4 cm, ovate, entire to serrate, caudate-acuminate, unequaly obtuse at base; nerves 7-10 pairs. Flowers in terminal panicles, many; calyx, campanulate, to 6 mm long, shallowly lobed, lobes obtuse; corolla yellow, 2 x 1.5 cm, bilabiate, subequal, crisped; stamens 5, included, filaments pubescent at base; ovary sessile, oblong, 2-celled, ovules many, 1-seriate, style slender, stigmas 2, spoon shaped. Capsule to 32 cm long, slender, spirally splitting, subtetragonous; seeds 6-8 mm long, with membranous wings.

Fl. & Fr. : February – October.

Distribution: Indo- China and Malaysia. Moist forests, usually along the riversides and stream margins, *Amitha Bachan 99155* (Vazhachal, riparian forests, banks of Chalakkudy river, 240 m).

89. ACANTHACEAE Juss.

Gen. Pl. 102. 1789.

1a. Stamens 4.....2

1b. Stamens 2.....11

2a. Seeds more than two in each cell of the capsule; flowers in axillary clusters ..... **Hygrophila**

2b. Seeds 2 or 1 in each cell of the capsule.....3

3a. Leaves lobes ending in a sharp spine, also the base of the petiole..... ..... **Acanthus**

3b. Leaves not ending in a sharp spine, also the petiole.....4

4a. Corolla 2-lipped; bracts spinous.....**Lepidagathis**

4b. Corolla lobes subequal; bracts minute, not spinous.....5

5a. Petals twisted; filaments united into an adnate sheath..... .....**Strobilanthes**

5b. Petals imbricate; filaments free.....6

6a. Ovules more than 2 in each cell.....7

6b. Ovules 2 or 1 in each cell.....10

7a. Flowers mixed with axillary cladodes..... .....**Haplanthodes**

7b. Flowers not mixed with cladodes.....8

8a. Corolla tube 2-5 times longer than lip, lobes subequal..... .....**Gymnostachyum**

8b. Corolla tube equal to or shorter than the lip, lobes 2 lipped 9

9a. Seeds supported on retinacula .....**Andrographis**

9b. Seeds not supported on retinacula..... **Nelsonia**

10a. Flowers on one-sided spikes.....**Rungia**

10b. Flowers on cylindrical spikes, cymes or panicles.....11

11a. Corolla bilabiate 12

11b. Corolla equally 5-lobed 13

12a. Anther cells with white appendage; corolla tube broad.....**Justicia**

12b. Anther cells without appendages; corolla tube slender.....14

13a. Flowers in dense terminal spike; anther cells parallel.....**Ecbolium**

13b. Flowers in branched panicled cymes.....**Rhinacanthus**

14a. Corolla lobes twisted in bud.....15

14b. Corolla lobes imbricate in bud.....**Barleria**

15a. Corolla tube slender, not ventricose.....**Eranthemum**

15b. Corolla tube short, ventricose above.....**Strobilanthes**(p. p.)

ACANTHUS Linnaeus

Sp. Pl. 639. 1753.

Acanthus ilicifolius L., Sp. Pl. 639. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 4: 481. 1884; Gamble, Fl. Pres. Madras 1014. 1925; Anupama & Sivad., Rheedea 14: 10. 2004; C. N. Sunil & Sivad., Fl. Alappuzha 532. 2009. **Schully**.

Armed shrubs. Leaves sinuately lobed, to 11 x 5 cm, lobes end in a spine; petiole to 1 cm long, with a pair of short basal spines. Flowers blue-purple, 3-4.5 cm long, in terminal spikes; bracts 6-10 x 2-2.5 mm, ovate-lanceolate, apex acute; bracteoles 2, connate to 5 x 2 mm, ciliate. Calyx lobes 4, to 1.6 x 1 cm, ovate, mucronate, coriaceous. Corolla bluish-purple, to 4 cm long; tube to 6 mm long, throat villous; lower lip 3-lobed. Stamens 4, attached at the throat of the corolla tube, exserted; anther 1-1.2 cm long, bearded, one cell sterile. Capsule ellipsoid-oblong, to 3 x 1.5 cm.

Fl. & Fr.: March-May.

Distribution: Indo-Malaysia to Australia. Pioneer of Mangrove forests, Banks of saline streams and water bodies. *Amitha Bachan 123690* (Elanthikkara, saline stream banks, Banks of Chalakkudy river, Sea level).

ANDROGRAPHIS Wallich ex C.G.D. Nees

in Wallich, Pl. Asiat. Rar. 3: 77, 116. 1832.

Andrographis paniculata (Burm. f.) Wall. ex Nees in Wall., Pl. Asiat. Rar. 3: 116. 1832; C. B. Clarke in Hook. f., Fl. Brit. India 4: 501. 1884; Gamble, Fl. Pres. Madras 1048. 1924; Manilal, Fl. Silent Valley 202. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 503. 2002; C.N. Sunil & Sivad., Fl. Alappuzha 532. 2009. *Justicia paniculata* Burm. f., Fl. India 9. 1768. *Andrographis subspathulata* C. B. Clarke in Hook. f., Fl. Brit. India 4: 502. 1884. **Kiriyath.**

Erect woody herbs; branches glabrous, tetragonous. Leaves to 6 x 1.5 cm, elliptic, acuminate at apex, base acute, decussate, glabrous. Panicle terminal and upper axillary, glandular-hairy. Flowers many, distant, arise singly from node, pedicellate; pedicel to 6 mm long; calyx connate at base, lobes linear, hairy to 3 mm long; corolla 10 mm long, hairy, upper lip entire, midlobe of lower lip broader than laterals, acute, glandular-hairy; ovary puberulus, style hairy. Capsule 20-30 x 3 mm, oblong, acute, hairy; retinacula spoon-shaped.

Fl. & Fr. : March – December

Distribution: Endemic to Peninsular India and Sri Lanka. *Amitha Bachan 72096* (Vazhachal, Riparian forests, banks of Chalakkudy river, 220m).

BARLERIA Linnaeus

Sp. Pl. 636. 1753.

Key to species

1a. Flowers on terminal dense racemes; corolla tube 1 –2 cm long .....

.....**B. courtallica**

1b. Flowers on terminal helicoid panicles; corolla tube 4-6 cm long .....
.....**B. involucrata**

Barleria courtallica Nees in DC., Prodr. 11: 226. 1847; Wight, Icon. Pl. India Orient. t. 1529. 1850; C. B. Clarke in Hook. f., Fl. Brit. India 4: 489. 1884; Gamble, Fl. Pres. Madras 1060. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 336. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 505. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 377. 2005. **Plate 31. A**

Shrubs up to 2 m tall, stem sparingly branched, glabrous. Leaves broadly elliptic, acuminate at apex, acute to attenuate at base, 10-20 x 4-8cm glabrous. Flowers in terminal many dense-flowered pubescent racemes; Peduncles, pedicels and calyx lobes glandular pubascent; bracts small linear, glandular pubescent, up to1.5 cm long. Calyx lobes 4, 2+2, outer larger, ovate-lanceolate. Corolla tube 1–2 cm long, funnel-shaped; lobes blue, 5, subequal. Stigma 2-fid with unequal lobes. Capsules oblong, to 2-2.5 cm long.

Fl & Fr. : December - May

Distribution : Endemic to South India. Occasional along streamside evergreen or semi-evergreen vegetation. *Amitha Bachan 99182* (Sholayar, riparian evergreen forests, Banks of Sholayar river, 800m).

Barleria involucrata Nees var. **elata** (Dalz.) C. B. Clarke in Hook. f., Fl. Brit. India 4: 486. 1884; Manilal, Fl. Silent Valley 202. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 506. 2002. *Barleria elata* Dalz. in Hooker's J. Bot. Kew. Gard. Misc. 3: 227. 1851.

Unarmed shrubs, to 2-4 m high; branchlets quadrangular, tawny pubescent. Leaves elliptic, acuminate at both ends, thinly pubescent above, to 10-16 x 3-5 cm; nerves 7 pairs, prominent; petiole to 1-1.5 cm long. Inflorescence terminal helicoids panicles, densely pubescent; bracts

linear to oblanceolate, to 1.5 x 1 cm. Flowers many, outer sepals 3-3.5 x 1-1.3 cm, oblong-lanceolate, acute, densely tawny pubescent, one shortly bifid at apex, inner sepals 14 x 3 mm, lanceolate, pubescent; corolla 7-8 cm long, tube 4-6 cm long, cylindrical, thinly hairy externally, lobes spreading, blue; anther filaments villous at base. Capsules oblong, beaked at apex, to 2-2.5 x 0.5-0.7 cm.

Fl. & Fr. : November-January

Distribution: Endemic to Peninsular India. Evergreen forests. *Amitha Bachan 98832* (Malakkapara, riparian evergreen forests, Banks of Sholayar river, 900m).

ECBOLIUM S. Kurz

J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 40: 75. 1871.

Ecbolium ligustrinum (Vahl) Vollesen, Kew Bull. 44: 651. 1989, var. **ligustrinum**; Sasidh. & Sivar., Fl. Pl. Thrissur For. 338. 1996; *Justicia ligustrina* Vahl, Enum. Pl. 1: 118. 1804. *Ecbolium linneanum* Kurz, J. Asiat. Soc. Bengal 40: 75. 1871; C. B. Clarke in Hook. f., Fl. Brit. India 4: 544. 1885; Gamble, Fl. Pres. Madras 1074. 1924. *Ecbolium linneanum* Kurz var. *dentatum* (Klein ex Link) C. B. Clarke in Hook. f., Fl. Brit. India 4: 545. 1885; Gamble, Fl. Pres. Madras 1074. 1924. *Ecbolium linneanum* Kurz var. *laetevirens* (Vahl) C. B. Clarke in Hook. f., Fl. Brit. India 4: 545. 1885; Gamble, Fl. Pres. Madras 1074. 1924. *Ecbolium viride* (Forssk.) Alston var. *laetevirens* (Vahl) Raizada, Indian For. Rec. 84: 482. 1958.

Small shrubs. Leaves elliptic-lanceolate, acuminate, attenuate at base, membraneous, to 16 x 5.5 cm; lateral nerves 10-12 pairs; petiole, to 2.5-5 cm long. Inflorescence a terminal short spike to 10 cm long; bracts to 2 cm long, elliptic apiculate; bracteoles lanceolate. Calyx lobes

glandular pubescent, to 5mm long. Corolla bluish-green, to 2.5 cm long, lobes of the lower lip small. Capsule to 2 cm long.

Fl & Fr. : January - May

Distribution : Indo-Malaysia and Africa. Moist areas of forests and also in plains. *Amitha Bachan 99181* (Vazhachal, riparian forests, banks of Chalakkudy river, 200 m).

ERANTHEMUM Linnaeus

Sp. Pl. 9. 1753

Eranthemum capense L., Sp. Pl. 9. 1753, var. **capense**; C. B. Clarke in Hook. f., Fl. Brit. India 4: 525. 1885; Gamble, Fl. Pres. Madras 1078. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 338. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 378. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 537. 2009. *Eranthemum montanum* Roxb., Fl. India 1: 100. 1820; Gamble, Fl. Pres. Madras 1025. 1924. *Justicia montana* Roxb., Pl. Coromandel t. 176. 1798. *Daedalacanthus montanus* (Roxb.) J.P. Anderson in Thwaites, Enum. Pl. Zeyl. 229. 1860.

Subshrubs; branchlets glandular-pubescent. Leaves to 15 x 5 cm, elliptic, acuminate at both ends, entire, glabrous; nerves 5-7 pairs; petioles to 3 cm long. Spikes 3-7 cm long, terminal, branched; bracts 20 x 5 mm, lanceolate, acuminate, glandular hairy; bracteoles linear. Flowers blue-purple, many; sepals 5, united at the base, lanceolate, acuminate, hairy; corolla blue, tube 3 cm long, slender, glabrous, blue, lobes equal, 12 mm long, obovate, obtuse; stamens 2, anther cells subequal, parallel; staminodes 2, basely united; ovary 2-4-ovuled. Capsule oblong; seeds 2, orbicular, densely hairy; retinacula curved.

Fl. & Fr.: September – March.

Distribution: Endemic to Peninsular India and Sri Lanka. Evergreen forests. *Amitha Bachan 98812* (Vazhachal, riparian forests, banks of Chalakkudy river, 220m).

GYMNOSTACHYUM C. G. D. Nees

in Wallich, Pl. Asiat. Rar. 3: 76, 106. 1832.

Key to species

1a. Leaves broadly ovate, lamina deccurent on the petiole; cordate or truncate at base.....**G. febrifugum**

1b. Leaves broadly elliptic, lamina not deccurent on the petiole; acute to acuminate at base.....**G. canescens**

Gymnostachyum canescens (Nees) J.P. Anderson, J. Linn. Soc. Bot. 9: 505. 1867; C. B. Clarke in Hook. f., Fl. Brit. India 4: 509. 1884; Gamble, Fl. Pres. Madras 1053. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 339. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 379. 2005. *Cryptophragmium canescens* Nees in Wall., Pl. Asiat. Rar. 3: 100. 1832.

Subshrubs, stems hirsute, 4-angled. Leaves 15-20 x 10-12 cm, broadly elliptic, acute to acuminate at either ends, lateral nerves 12-17 pairs, prominent. Flowers in axillary and terminal panicles, hirsute; bracts and bracteoles similar, 2 mm long, ovate. Flowers many, densely packed; sepals 5 mm long, glandular hairy; corolla greenish white, 15 mm long, tube 10 mm long, narrow-cylindric, lobes obtuse, hispid; anthers unequal, glabrous, ciliate along margins. Capsule oblong, acute, hispid, to 1.5cm.

Fl. & Fr. : November-March.

Distribution: Endemic to the Western Ghats. Evergreen forests. *Amitha Bachan 98917* (Panjnakuthu-Vazhachal, streamside vegetation, banks of Charpathodu, 250 m).

Gymnostachyum febrifugum Benth., Flora 32: 558. 1849, var. **febrifugum**; C. B. Clarke in Hook. f., Fl. Brit. India 4: 508. 1884; Gamble, Fl. Pres. Madras 1053. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 339. 1996. *Gymnostachyum alatum* Wight, Icon. Pl. India Orient. t. 1525. 1850. **Plate 31. C**

Scapigerous herbs with short stem. Leaves broadly ovate, acute or obtuse at apex, cordate or truncate at base, decurrent on the petiole, to 16 x 12 cm, undulate, chartacious; lateral nerves to 6-8 pairs; petiole to 9 cm long. Flowers in terminal panicles to 30 cm long, puberulous, usually1-3 from apex; flowers solitary or in short racemes of terminal panicles. Corolla to 2.5 cm long, pink-yellow, tube funnel-shaped. Anthers bearded along valves. Capsule glabrous, 2 cm long.

Fl & Fr. : November- January.

Distribution : Endemic to Southern Western Ghats. Riparian evergreen forests. *Amitha Bachan 72025* (Vazhachal, stream banks near Charpa thodu, 250m).

ERANTHEMUM Linnaeus

Sp. Pl. 9. 1753

Eranthemum capense L., Sp. Pl. 9. 1753, var. **capense**; C. B. Clarke in Hook. f., Fl. Brit. India 4: 525. 1885; Gamble, Fl. Pres. Madras 1078. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 338. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 378. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 537. 2009. *Eranthemum montanum* Roxb., Fl. India 1: 100. 1820; Gamble, Fl. Pres. Madras 1025. 1924. *Justicia montana* Roxb., Pl. Coromandel t. 176. 1798. *Daedalacanthus montanus* (Roxb.) J.P. Anderson in Thwaites, Enum. Pl. Zeyl. 229. 1860.

Subshrubs; branchlets glandular-pubescent. Leaves elliptic, acuminate, base attenuate, to 15 x 5 cm, elliptic, acuminate at both ends, entire or crenulate; petioles to 3 cm long. Spikes 3-7 cm long, terminal, branched; bracts 20 x 5 mm, lanceolate, acuminate, glandular hairy; bracteoles linear. Flowers many; sepals 5, united at the base, lanceolate, acuminate, hairy; corolla blue, tube 3 cm long, slender, glabrous, blue, lobes equal, 12 mm long, obovate, obtuse; stamens 2, anther cells subequal, parallel; staminodes 2, basely united; ovary 2-4-ovuled.

Fl. & Fr. December -March

Distribution : Endemic to Peninsular India and Sri Lanka. Occasional near stream banks in moist forests. *Amitha Bachan 98812* (Vazhachal, Riparian vegetation, banks of Chalakkudy river, 220m).

HAPLANTHODES O. Kuntze

in Post et O. Kuntze, Lex. 265. 1903.

Haplanthodes neilgherryensis (Wight) R.B. Majumdar, Bull. Bot. Soc. Bengal 25: 76. 1971; Panigrahi & G.C. Das, Bull. Bot. Surv. India 23: 201. 1981; Sasidh. & Sivar., Fl. Pl. Thrissur For. 339. 1996; *Haplanthus neilgherryensis* Wight, Icon. Pl. India Orient. t. 1556. 1850; C. B. Clarke in Hook. f., Fl. Brit. India 4: 507. 1884; Gamble, Fl. Pres. Madras 1052. 1924. *Haplanthus tentaculatus* Nees. var. *neilgherryensis* (Wight) C. B. Clarke in Hook. f., Fl. Brit. India 4: 507. 1884. *Bremekampia neilgherryensis* (Wight) Sreemadh, Bull. Bot. Surv. India 6: 323. 1965.

Herbs, stem subterete, branched, pubescent. Leaves 8 x 4 cm, ovate-elliptic, acute or acuminate, base attenuate, decurrent on the petiole; lateral nerves 7-9 pairs; petiole to 9 cm long. Spikes 4-8 cm long. Cladodes slender, 2 toothed at apex, hispid or villous, 1.3 cm long. Calyx

lobes 4mm long. Corolla pale blue, 1 cm long. Stamens 2, included, anther cells unequal. Capsule glabrous to 6-8 mm long. Seeds hairy.

Fl & Fr. : January - March

Distribution: Endemic to the Western Ghats. Moist localities of evergreen forests. *Amitha Bachan 99140* (Vazhachal, Riparian forests, banks of Chalakkudy river, 230 m).

HYGROPHILA R. Brown

Prodr. 479. 1810.

Hygrophila schulli (Buch.-Ham.) M. R. & S. M. Almeida, J. Bombay Nat. Hist. Soc. 83 (Suppl.): 221. 1986; Sasidh. & Sivar., Fl. Pl. Thrissur For. 340. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 380. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 539. 2009. *Bahell schulli* Buch.-Ham., Trans. Linn. Soc. London 14: 289. 1825. *Asteracantha longifolia* (L.) Nees in Wall., Pl. Asiat. Rar. 3: 90. 1832; C. B. Clarke in Hook. f., Fl. Brit. India 4: 408. 1884; Gamble, Fl. Pres. Madras 1015. 1924. *Barleria longifolia* L., Cent. Pl. 2: t. 22. 1756, non *Hygrophila longifolia* Nees 1847. *Hygrophila auriculata* (K. Schum.) Heine, Kew Bull. 16: 172. 1962.

Erect armed subshrubs; stem purplish, generally with 8 leaves and 6 spines at each node, strigose-hispid; spines 1.8-3.3 cm long, curved or straight. Leaves apparently whorled, lanceolate, base cuneate, apex acute to acuminate, to 14 x 3 cm, margins undulate and minutely dentate. Flowers in axillary whorls, sessile; bracts and bracteoles foliaceous, to 1.5 cm long. Calyx-lobes 4, unequal, lanceolate. Corolla bluish-purple, to 1.5 cm long; tube to 1 cm long; lobes 5. Stamens 4; anther cells unequal. Ovary to 2 mm long, oblong, apically ciliate. Capsule to 1 cm long. Seeds orbicular.

Fl. & Fr. : November – March.

Distribution: India, Myanmar, Indo-China. Along water courses. *Amitha Bachan 123677* (Elanthikkara, banks of Chalakkudy river, sea level).

JUSTICIA Linnaeus

Sp. Pl. 15. 1753

Key to species

1a. Erect shrubs, leaves > 5 cm long.....2

1b. Erect or prostrate herbs, leaves < 5 cm long.....4

2a. Bracts white with green nerves .....**J. betonica**

2b. Bracts green.....3

3a. Bracts large, leafy, to 2.5 cm, ovate-acute; bracteoles subsimilar.... ..... **J. adhatoda**

3b. bracts small, to 0.5 x 0.1 cm, oblong, and bracteoles similar..... .....**J. santapaui**

4a. Bracts lanceolate, without hyaline margins; leaves to 1 cm broad... .....**J. japonica**

4b. Bracts oblanceolate with hyaline margin; leaves to 3 cm broad ....**J. procumbens**

Justicia adhatoda L., Sp. Pl. 15. 1753; Anil Kumar *et al.*, Fl. Pathanamthitta 383. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 541. 2009. *Adhatoda zeylanica* Medic., Hist. & Commen. Acad. Elect. Sci. Theod.-Palat. 6: 393. 1790. *Adhatoda vasica* Nees in Wall., Pl. Asiat. Rar. 3: 103. 1832; C. B. Clarke in Hook. f., Fl. Brit. India 4: 540. 1885; Gamble, Fl. Pres. Madras 1082. 1924. **Adalodakam**.

Tall shrubs. Leaves elliptic-lanceolate, acute to attenuate at base, acuminate at apex; to 22 x 6 cm, entire to minutely crenate; petiole to 5

cm long. Flowers white, subsessile, in axillary and terminal spikes. Bracts large, leafy, to 2.5 cm, ovate-acute in closely imbricating pairs; bracteoles subsimilar. Calyx lobes 5, equal, 1.2 cm long, lanceolate. Corolla 2-lipped, throat villous, upper lip erect, shortly 2-fid, lower 3-fid. Stamens 2, attached to the throat of the tube, exserted; filaments thick, villous below. Ovary oblong, pubescent, 4-ovuled; stigma minutely 2-fid. Capsules 1.8 cm long, ovate, clavate, compressed, pubescent. Seeds 1-2, discoid, rugose.

Fl. & Fr. : November – March.

Distribution: Indo-Malaysia. Along hedges and stream banks, often cultivated. *Amitha Bachan 123676* (Kanakkankadavu, banks of Chalakkudy river, sea level).

Justicia betonica L., Sp. Pl. 15. 1753, var**. betonica**; C. B. Clarke in Hook. f., Fl. Brit. India 4:525.1885; Gamble, Fl. Pres. Madras 1078.1924; Manilal, Fl. Silent Valley 205. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 341. 1996 Anil Kumar *et al.*, Fl. Pathanamthitta 381. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 542. 2009. *Adhatoda betonica* (L.) Nees in Wall., Pl. Asiat. Rar. 3: 103. 1832. **Venkurinji.**

Shrubs to 2 m tall; branchlets terete. Leaves opposite, elliptic or ovate-lanceolate, acuminate at apex, acute at base, to 12 x 4 cm, membranous, margin serrate-dentate; lateral nerves 8 pairs. Flowers in terminal racemes; Spikes 4-15 cm long, terminal or subterminal. bracts and bracteoles elliptic or ovate, acuminate, 1.5 x 0.7 cm, White with green reticulate nerves. Calyx lobes 3-ribbed, oblanceolate. Corolla white with purple streaks, 1 cm long. Ovary pubescent; style hairy. Capsule with a solid base, 15 x 5 mm.

Fl & Fr. : November - January

Distribution: Paleotropics. Riparian and moist localities. *Amitha Bachan 98822* (Sholayar, riparian forests, banks of Sholayar river, 700 m).

Justicia japonica Thunb., Fl. Jap. 20. 1784; Sasidh. & Sivar., Fl. Pl. Thrissur For. 342. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 382. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 543. 2009. *Rostellularia japonica* (Thunb.) Ellis, Bull. Bot. Surv. India 22: 196. 1980 (1982). *Justicia simplex* D. Don, Prodr. Fl. Nepal. 118. 1825; C. B. Clarke in Hook. f., Fl. Brit. India 4: 539. 1885; Gamble, Fl. Pres. Madras 1080. 1924; Manilal, Fl. Silent Valley 206. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 509. 2002. *Rostellularia mollissima* (Nees) Nees in DC., Prodr. 11: 373. 1847.

Erect or decumbent herbs, branchlets strigose-hispid, 4 angled and groved. Leaves up to 4 x 1.5 cm, elliptic, ovate or linear, obtuse to acute at apex, strigose hairy on both sides, Spikes terminal or axillary; bracts and bracteoles linear - lanceolate, scarious-margined, softly hairy. Calyx 4 partite, lobes linear, margins scarious, ciliate. Corolla 4 mm long, pink. Capsule pubescent, 4 mm long.

Fl. & Fr. September-February

Distribution: Indo-Malaysia, East Asia and Tropical Africa. Seen in moist open places, river and stream banks. *Amitha Bachan 98719* (Nelliyampathy, Streamside vegetation, Veettiar, 1400 m).

Justicia procumbens L., Sp. Pl. 15. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 4: 539. 1885; Gamble, Fl. Pres. Madras 1080. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 342. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 509. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 382. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 543. 2009. *Rostellularia procumbens* (L.) Nees in DC., Prodr. 11: 371. 1847.

Diffuse herbs, stem, leaves, bracts, bracteoles and calyx strigose hairy. Leaves to 3.5 x 2.5 cm, elliptic or ovate, acute at both ends, membranous, scabrous above; nerves 4-5 pairs. Flowers in terminal stout spikes; Spikes to 2.5 cm long, dense flowered; bracts obovate, margin ciliate; bracteoles lanceolate, margin scarious, ciliate. Calyx lobes subequal, midrib ridged, margin dentate. Corolla pink, 5 mm long. Anthers spurred. Seeds compressed.

Fl. & Fr. Throughout the year

Distribution : Indo-Malaysia to Australia. Common in open rocky moist areas and Streambanks. *Amitha Bachan 98896* (Malakkapara, riparian open vegetation, banks of Sholayar river, 1000 m).

Justicia santapaui Bennet, J. Bombay Nat. Hist. Soc. 67: 358. 1970; Sasidh. & Sivar., Fl. Pl. Thrissur For. 342. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 382. 2005. *Justicia montana* (Nees) Wall. ex J. P. Anderson., J. Linn. Soc. Bot. 9: 509. 1867, *non* Roxb. 1805; Gamble, Fl. Pres. Madras 1078. 1924. *Hemichoriste montana* Nees in Wall., Pl. Asiat. Rar. 3: 102. 1832. *Justicia andersonii* Ramam. in C. J. Saldanha & Nicolson, Fl. Hassan Dist. 551. 1976; Manilal, Fl. Silent Valley 204. 1988.

Shrubs, to 2 m high; branches terete or obtusely 4-angled, glabrous. Leaves oblanceolate, acute at apex, attenuate at base, to 24-36 x 6-10 cm, glabrous; petioles 5-6 cm long. Spike 20 cm long, axillary, peduncled, simple or branched; bracts and bracteoles similar, to 0.5 x 0.1 cm, oblong, pubescent. Flowers lax; calyx lobes lanceolate, to 0.9 mm long, puberulus; corolla white with pink spots, villous at the base between the filaments; ovary densely hairy. Capsule 25 mm long, clavate, glabrous.

Fl & Fr. : January – April.

Distribution: Endemic to the Western Ghats. Evergreen forests. *Amitha Bachan 123343* (Vazhachal, Riparian forests, banks of Chalakkudy river, 220 m).

LEPIDAGATHIS Willdenow

Sp. Pl. 3(1): 400. 1800.

Lepidagathis incurva Buch.-Ham. ex D.Don, Prodr. Fl. Nepal. 119. 1825, var. **incurva**; Sasidh. & Sivar., Fl. Pl. Thrissur For. 343. 1996; C. N. Sunil & Sivad., Fl. Alappuzha 544. 2009. *Lepidagathis hyalina* Nees in Wall., Pl. Asiat. Rar. 3: 95. 1832; C. B. Clarke in Hook. f., Fl. Brit. India 4: 521. 1884; Gamble, Fl. Pres. Madras 1068. 1924.

Prostrate perennial herbs; with elongated branches; stem angular. Leaves ovate, oblong or elliptic-lanceolate, acute at apex, cuneate at base, to 6-8 x 3 cm margin faintly crenate, hispid or glabrescent; petiole 1-2 cm long. Flowers sessile, aggregated in condensed terminal and axillary villous spikes. Bracts 1 x 0.5 cm, elliptic-lanceolate, long mucronate, 1-nerved, scarious; bracteoles lanceolate. Calyx-lobes 5, unequal, elliptic-lanceolate, aristate, 3-nerved. Corolla 8 mm long, white with dark pink dots on the lobes, 2-lipped. Stamens 4, included; anther-cells unequal, minutely ciliate. Ovary globose; ovules 2-per locule; style pubescent. Capsule 4-6 mm long, ellipsoid. seeds 4, compressed, rugose, brown.

Fl. & Fr.: February – April.

Distribution: India, Myanmar and China. Moist forests. *Amitha Bachan 98896* (Malakkapara, riparian forests, banks of Sholayar river, 1000 m).

NELSONIA R. Brown

Prodr. 480. 1810.

Nelsonia canescens (Lam.) Spreng., Syst. Veg. 1: 42. 1825; Sasidh. & Sivar., Fl. Pl. Thrissur For. 344. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 383. 2005. *Justicia canescens* Lam., Encycl. 1: 41. 1781. *Nelsonia campestris* R. Br., Prodr. 1: 481. 1810; C. B. Clarke in Hook. f., Fl. Brit. India 4: 394. 1884; Gamble, Fl. Pres. Madras 1010. 1924.

Prostrate spreading herbs, whole plant hairy pubescent. Leaves elliptic-lanceolate, cuneate at base, to 1-4.5 x 1-2 cm, tomentose, sub-entire. Flowering branches slender with smaller leaves. Spikes to 2 cm long; bracts ovate oblong, acute, glandular, villous. Calyx lobes also villous. Corolla bluish, small, lobes 5, 2-lipped. Stamens 2, exerted. Ovary 2-locular; ovules 8-10 per locule. Capsule oblong, glabrous, seeds 10, not supported on retinacula.

Fl. & Fr. : February-March.

Distribution : Pantropical. Marshy areas and stream banks in moist forests. *Amitha Bachan 99140* (Vazhachal, riparian vegetation, banks of Chalakkudy river, 220 m).

RHINACANTHUS C.G.D. Nees

in Wallich, Pl. Asiat. Rar. 3: 76, 108. 1832.

Rhinacanthus nasutus (L.) Kurz, J. Asiat. Soc. Bengal 39: 79. 1870; Sasidh. & Sivar., Fl. Pl. Thrissur For. 346. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 387. 2005. *Justicia nasuta* L., Sp. Pl. 16. 1753. *Rhinacanthus communis* Nees in Wall., Pl. Asiat. Rar. 3: 109. 1832; C. B. Clarke in Hook. f., Fl. Brit. India 4: 541. 1885; Gamble, Fl. Pres. Madras 1083. 1924.

Herbs or sub-shrubs, stem subterete, glabrescent, procumbent. Leaves elliptic-lanceolate, acute at apex, attenuate at base, to 10 x 5 cm, crenulate, Lateral nerves 8-10 pairs, petiole 1 cm long. Flowers subsessile in divaricate branches of lax panicles; bracts and bracteoles lanceolate, to 2 mm long, glandular-pubescent. Calyx lobes 5, subequal, 4 mm long, pubescent. Corolla white, sparsely pubescent, tube to 2 cm long, lobes 5, 2-lipped, lower lip 1 cm long, upper lip 7 mm long, narrow. Stamens 2, exserted, anther cells 2. Ovary 2 locular; ovules 2 per locule. Capsule pubescent, 2 cm long.

Fl. & Fr. January - April

Distribution : India, Sri Lanka, Java and Madagascar. Wet areas in moist forests. *Amitha Bachan 98824* (Sholayar, riparian vegetation, Anakkayam streamside, 700 m).

RUNGIA C.G.D. Nees

in Wallich, Pl. Asiat. Rar. 3: 77, 109. 1832.

Rungia pectinata (L.) Nees in DC., Prodr. 11: 469. 1847; Manilal, Fl. Silent Valley 211. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 346. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 516. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 388. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 549. 2009. *Justicia pectinata* L., Amoen. Acad. 4: 299. 1759. *Rungia parviflora* (Retz.) Nees var. *pectinata* (L.) C. B. Clarke in Hook. f., Fl. Brit. India 4: 550. 1885; Gamble, Fl. Pres. Madras 1071. 1924.

Erect, profusely branched herbs; stems hairy. Leaves ovate to linear-oblong or obovate, acute at apex, attenuate at base, to 6 x 2 cm. Spikes axillary and terminal, to 2 x 0.7 cm, 2-5 together, sessile; sterile bracts 4 x 2 mm, elliptic, narrowly winged on one- side; fertile bracts 3 x 2 mm, obovate, broadly winged on either sides, emarginate, pubescent;

bracteoles similar to bracts. Flowers small, densely packed; sepals linear, acuminate, hyaline, hairy; corolla 4 mm long, upper lip entire, white; upper anthers hairy. Capsule 2.5 mm long, oblong, glabrous; seeds orbicular, rugose, brown.

Fl. & Fr.: November – February.

Distribution: Endemic to Peninsular India and Sri Lanka. Along stream sides *Amitha Bachan 123617* (Vazhachal-Pokalppara, riparian forests, banks of Chalakkudy river, 240 m).

STROBILANTHES Blume

Bijdr. 781, 796. 1826.

1a. Seeds hairy.....3

1b. Seeds glabrous.....2

2a. Leaves elliptic-lanceolate, acuminate at apex, acute to decurrent at base; corolla white..... **S. barbatus**

2b. Leaves linear-elliptic, caudate-acuminate, cuneate at base; corolla pale blue, pink tinted.....**S. anamallaica**

3a Leaves glabrous; corolla white.....**S. lupulinus**

3b. Leaves pubescent; corolla blue or pale blue.....4

4a. Leaves subcordate at base, crenate; bracts decurrent.....**S. dupenii**

4b. Leaves cuneate at base, serrate; not decurrent.....**S. asperrimus**

Strobilanthes anamallaica Wood, Kew Bull. 50: 11. 1995. *Strobilanthes adenophorus* sensu J.P. Anderson 1860: Bedd., Icon. Pl. India Orient. t. 225. 1868-1874, non Nees 1847; C. B. Clarke in Hook. f., Fl. Brit. India 4: 440. 1884; Gamble, Fl. Pres. Madras 1040. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 348. 1996. *Didyplosandra lanceolata* (Hook. ex Nees)

Bremek., Verh. Acad. Wet. afd. Natuurk. Sect 2, 41: 178. 1944. *Nilgirianthus beddomei* Bremek., Verh. Acad. Wet. afd. Natuurk. Sect. 2, 41: 172. 1944; Anil Kumar *et al.*, Fl. Pathanamthitta 384. 2005.

Branched shrubs, to 2 m tall, branchlets slender. Leaves linear, elliptic, caudate acuminate at apex, cuneate at base, to 10-17 x 2-3.5 cm, Chartacious, slightly serrulate; lateral nerves 6-7 pairs; petiole to 2 cm; Spikes axillary; peduncle to 2.5 cm long; bracts obovate, acute to 1 cm long; bracteoles narrow. Corolla 2 cm, pale blue-pink tinted, funnel-shaped; Seeds apparently glabrous.

Fl. & Fr. April - May

Distribution : Endemic to Southern Western Ghats. Evergreen, along streamsides at medium elevations. *Amitha Bachan 99067* (Sholayar, stream-bank vegetation, Karimala stream side, 1100 m).

Strobilanthes asperrimus Nees in DC., Prodr. 11: 183. 1847; C. B. Clarke in Hook. f., Fl. Brit. India 4: 443; 1884; Gamble, Fl. Pres. Madras 1041. 1924. **Plate 31. B**

Shrubs, spreading branches, pubescent, Leaves ovate, acuminate at apex, cuneate at base, to 15 x 6 cm, serrate, tomentose with bulbous based hairs above, white strigose below; main nerves 8-10 pairs. Flowers in strobilatel spikes, axillary or lateral; bracts concave, orbicular, not deccureent on the rachis of the spike; bracteoles 0. Calyx lobes emarginated; corolla 2 cm long, pale blue, base very short. Seeds hairy.

Fl. & Fr. November - February

Distribution : Endemic to India and Sri Lanka. Under growth near stream sides of high elevation evergreen forests, *Amitha Bachan 98957* (Nelliyampathy-Pullala, stream bank vegetation, stream draining to Karappara river, 1200 m).

Strobilanthes barbatus Nees in Wall., Pl. Asiat. Rar. 3: 85. 1832, var. **barbatus**; C. B. Clarke in Hook. f., Fl. Brit. India 4: 437. 1884; Gamble, Fl. Pres. Madras 1037. 1924. *Nilgirianthus barbatus* (Nees) Bremek., Mat. Monogr. Strob. 172. 1944; Manilal, Fl. Silent Valley 208. 1988; Anil Kumar *et al.*, Fl. Pathanamthitta 384. 2005.

Gregarious shrubs; stems tetragonous, grooved, winged. Leaves elliptic-lanceolate , Acuminate at apex, acute decurrent at base, to 12-28 x 4.5-8 cm crenate, glabrous; 7-9 nerved, prominent. Flowers in capitate heads, close, to 2.5-5 cm long, enlarged in fruit. Bracts ovate, cuspidate with recurved tips. Flowers white, cylinder base of the corolla as long as the campanulate upper part; stamens 4, ineer pair shorter. Seeds glabrous.

Fl. & Fr. : September- December.

Distribution : Endemic to Western Ghats. Under growth of medium-high elevation evergreen forests near stream sides, *Amitha Bachan 99066* (Karimala-Parambikkulam, undergrowth of evergreen streamside vegetation, Karimala streamside, 1100 m).

Strobilanthes dupenii Bedd. ex C. B. Clarke in Hook. f., Fl. Brit. India 4:453.1884; Gamble, Fl. Pres. Madras 1043. 1924. *Kanjarum palghatense* Ramam., Bull. Bot. Surv. India 13: 153. 1971; Ramam., Bull. Bot. Surv. India 6: 333. 1964; Sasidh. & Sivar., Fl. Pl. Thrissur For. 343. 1996.

Shrubs, Leaves ovate, acuminate, subcordate, crenate, bristly pubescent, to 15 x 7 cm, broad, main nerves 9 pairs. Spikes sub tetragonous, lateral and terminal, to 5 cm long; bracts ovate, obtuse, reddish, viscous, deccurrent at base; bracteoles 0; Calyx lobes scarious; corolla large, blue. Seeds hairy.

Fl. & Fr. : December - February

Distribution : Endemic to Southern Western Ghats. Evergreen forests, undergrowth, streamside *Amitha Bachan 99064* (Kariamala, streamside, Kariamalathodu, 1100 m)

Strobilanthes lupulinus Nees in Wall., Pl. Asiat. Rar. 3: 85. 1832; C. B. Clarke in Hook. f., Fl. Brit. India 4: 443. 1884; Gamble, Fl. Pres. Madras 1041. 1924. *Nilgirianthus lupulinus* (Nees) Bremek., Verh. Acad. Wet. afd. Natuurk. Sect. 2, 41: 173. 1944. *Nilgirianthus heyneanus* (Nees) Bremek., Verh. Acad. Wet. afd. Natuurk. Sect. 2, 41: 173. 1944; Anil Kumar *et al.*, Fl. Pathanamthitta 385. 2005. *Strobilanthes heyneanus* Nees in Wall., Pl. Asiat. Rar. 3: 85. 1832; C. B. Clarke in Hook. f., Fl. Brit. India 4: 443. 1884; Gamble, Fl. Pres. Madras 1041. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 348. 1996. *Nilgirianthus heyneanus* (Nees) Bremek. var. *neesii* Bremek., Mat. Monogr. Strob. 173. 1944.

Small gregarious shrubs; branches glabrous. Leaves elliptic, acuminate, attenuate to the base, 8-17 x 4.5-6 cm, glabrous. Spikes axillary, 2-3 together on trichotomous peduncle, ovoid or globose, to 2 x 1.5 cm; bracts 14 x 11 mm, orbicular or obovate, concave, glabrous; bracteoles absent. Flowers 4-10 in each spike, blue; sepals 6 x 2 mm, united to the middle, glabrous; corolla 2.5 cm long, white; staminal sheath ciliate. Capsule 10 x 5 mm, glabrous; seeds 3 mm, biconvex, densely hairy along the margins.

Fl. & Fr. : September-January

Distribution: Endemic to Peninsular India. Evergreen forests, streamside, *Amitha Bachan 98957* (Kariamala, Riparian-streamside, Karimalathodu, 1100 m).

90. VERBENACEAE J. St.-Hil.

Expos. Fam. Nat. 1: 245. 1805.

Key to the Genera

1a. Leaves digitately 3-5-foliolate ..... **Vitex**

1b. Leaves simple.....2

2a. Corolla regular, lobes 4 ..... **Callicarpa**

2b. Corolla zygomorphic, lobes 5.....3

3a. Flowers in elongated or globes spikes.....4

3b. Flowers in racemes or cymes..... **Clerodendrum**

4a. Spikes elongated; calyx ribbed; stamens 2 .....**Stachytarpheta**

4b. Spikes globose; calyx not ribbed; stamens 4 .....**Lantana**

CALLICARPA Linnaeus

Sp. Pl. 111. 1753.

Callicarpa tomentosa (L.) L. in Murr., Syst. Veg. (ed. 13) 130. 1774; Manilal, Fl. Silent Valley 213. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 351. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 521. 2002; Rajendran & P. Daniel, Indian Verbenaceae 53. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 390. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 556. 2009. *Tomex tomentosa* L., Sp. Pl. 118. 1753. *Callicarpa lanata* L., Mantissa Pl. 2: 331. 1771, *nom. illeg.*; Gamble, Fl. Pres. Madras 1092. 1924. *Callicarpa arborea* Miq. ex C. B. Clarke in Hook. f., Fl. Brit. India 4: 507. 1885, *non* Roxb. 1832. **Cheruthekku**. **Plate 31.D**

Small trees, branchlets densely grey-pubescent. Leaves simple, alternate, broadly ovate, to 8-24 x 5-154 cm, acuminate at apex, rounded at base, entire, densely stellate pubescent below; lateral nerves 7 pairs;

petiole to 5 cm long. Flowers in axillary branched, densely tomentose, corymbose cymes; sessile; calyx campanulate, 2 mm long, lobes 5, obtuse; corolla regular, tube short, 4 mm long; lobes 4, spreading; stamens 4; filaments glandular, anthers sagittate; ovary pubescent; style slender, stigma capitate. Berry globose, 3 mm across, glabrous.

Fl. & Fr. : December – May.

Distribution: Endemic to Peninsular India and Sri Lanka. Moist forests. *Amitha Bachan 117793* (Orukombankutty, riparian forests, banks of Chalakkudy river, 400 m).

CLERODENDRUM Linnaeus

Sp. Pl. 637. 1753.

Clerodendrum infortunatum L., Sp. Pl. 637. 1753, *non* L. 1771; C. B. Clarke in Hook. f., Fl. Brit. India 4: 594. 1885; Gamble, Fl. Pres. Madras 1100. 1924; Rajendran & P. Daniel, Indian Verbenaceae 116. 2002. *Clerodendrum viscosum auct. non* Vent. 1804: Manilal, Fl. Silent Valley 214. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 351. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 523. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 561. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 155. 2009. **Peru, Periyila.**

Large shrubs to small trees to 1-7 m high; stems 4-angled, tawny-pubescent. Leaves orbicular, to 20 x 20 cm, cordate at base, acute at apex, densely glandular-pubescent, serrate-crenate; nerves 4-6 pairs; lower pairs basal; petiole to 8 cm long, pubescent. Flowers white, in large terminal pedunculate panicled cymes; calyx 1.2 cm long, lobes cupular, lanceolate, petaloid in fruits; corolla tube 2 cm long, slender, lobes 5, obovate, 1 x 0.5 cm, pubescent; filaments hairy at base. Berry 1-3-lobed, to 1 cm across, black, glabrous.

Fl. & Fr. : November – February.

Distribution: Indo-Malaysia, wet open forests to plains. *Amitha Bachan 98853* (Sholayar, open wet areas in riparian evergreen forests, banks of Sholayar river, 700 m).

Note: Linnaeus (1753) cited a Rheedian element from Malabar region 'Pergu' under *Clerodendrum infortunatum* L. Which was considered as belonging to *C. viscosum* Vent. By many authors (Manilal 1988, Sasidh. & Sivar. 1996, N. Mohanan & Sivad. 2002, Anil Kumar *et al.* 2005, C. N. Sunil & Sivad. 2009). However Rajendran and Daniel (2002) established that the plant occurs in the Western Ghats is *C. infortunatum* L. which is in corroboration with the views of earlier workers like Robert Wight (1849), R. H. Beddome (1872), C. B. Clarke (1885) and J. S. Gamble (1924).

GMELINA Linnaeus

Sp. Pl. 626. 1753.

Gmelina arborea Roxb., Pl. Coromandel t. 246. 1815; C. B. Clarke in Hook. f., Fl. Brit. India 4: 581. 1885; Gamble, Fl. Pres. Madras 1097. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 352. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 523. 2002; Rajendran & P. Daniel, Indian Verbenaceae 155. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 392. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 563. 2009. **Kumbil.**

Medium sized trees to 25 m; bark yellowish-grey, branchlets stout, tomentose. Leaves broadly ovate, to 18 x 16 cm, cordate or truncate at base, acute at apex, densely fulvous tomentose beneath, glabrous above; nerves 3-4 pairs, lowest pair from base; petiole 5-10 cm long, tomentose. Flowers in terminal racemes, subsessile; calyx campanulate, 6 mm long, 5-toothed, tomentose; corolla bilabiate, brownish-yellow, 3 cm across,

tube ventricose, lobes subequal, obovate, obtuse, densely hairy; stamens 4, didynamous, anthers divaricate; ovary globose, glabrous; style slender. Berry ovoid, yellow, to 2 cm, smooth.

Fl. & Fr. : January – April.

Distribution: Indo-Malaysia. Moist forests, along river banks. *Amitha Bachan 117785* (Vazhachal, riparian vegetation, banks of Chalakkudy river, 240 m).

LANTANA Linnaeus

Sp. Pl. 626. 1753.

Lantana camara L., Sp. Pl. 627.1757, var. **camara**; Rajendran & P. Daniel, Indian Verbenaceae 181. 2002. *Lantana aculeata* L., Sp. Pl. 627. 1753; Gamble, Fl. Pres. Madras 1087. 1924. *Lantana camara* L. var. *aculeata* (L.) Moldenke, Torreya 34: 9. 1934; C. B. Clarke in Hook. f., Fl. Brit. India 4: 562. 1885; Manilal, Fl. Silent Valley 214. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 353. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 524. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 392. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 563. 2009. **Konkinipoo, Idamukki.**

Armed rambling shrubs; prickles retrorse, along the angles of the stem. Leaves ovate, to 6 x 3 cm, acute at apex, rounded or cordate at base, scabrous pubescent, crenate; petiole to 2 cm long. Spikes 1.5 cm across, globose, axillary, solitary peduncled, condensed; bracts ovate, 8 x 3 mm, obtuse, floral bracts much smaller. Flowers densely packed; calyx 1 mm long truncate, ciliate; corolla reddish, 4 mm broad, tube 8 mm long, curved, slender; stamens 4. Berry globose, 4 mm across, dark blue, smooth.

Fl. & Fr. : April-July.

Distribution: A native of Tropical America, an naturalized at many regions, now a serious weed in tropics and subtropics. *Amitha Bachan 98724* (Nelliyampathy, degraded open riparian vegetation, banks of Karappara river, 900 m).

PHYLA Loureiro

Fl. Cochinch. 63, 66. 1790.

Phyla nodiflora (L.) Greene, Pittonia 4: 46. 1899; Rajendran & P. Daniel, Indian Verbenaceae 206. 2002; C. N. Sunil & Sivad., Fl. Alappuzha 564. 2009. *Verbena nodiflora* L., Sp. Pl. 20.1753. *Lippia nodiflora* (L.) A.Rich. in Michx., Fl. Bor. Amer. 2: 15. 1803; C. B. Clarke in Hook. f., Fl. Brit. India 4: 563. 1885; Gamble, Fl. Pres. Madras 1088. 1924.

Small prostrate herbs, rooting at nodes. Leaves obovate-oblanceolate or spathulate, to 2.5 x 1 cm, cuneate at base, obtuse or rounded at apex, sharp serrate in the upper half, fleshy, glabrescent. Flowers in axillary, solitary, globose-capitate or elongate, stalked spikes. sessile, 1-2.5 cm long; peduncle solitary in each axil, 1.5-6 cm long. Bracts small, obovate, imbricate. Calyx cupular, equal to the corolla tube, deeply 2-cleft; lobes lanceolate. Corolla pink to white, 2-2.5 mm long, salver-form, 2-lipped, upper lip 2-lobed, emarginate, lower 3-lobed. Stamens 4, included. Drupe small, contains two pyrenes.

Fl. & Fr. : November – December.

Distribution: Tropics and subtropics. Open wet areas. *Amitha Bachan 117726* (Kanakkankadavu, open wet areas along river banks, sea level).

STACHYTARPHETA Vahl

Enum. Pl. 205. 1804, *nom. cons.*

Stachytarpheta jamaicensis (L.) Vahl, Enum. Pl. 1: 206. 1804; Sasidh. & Sivar., Fl. Pl. Thrissur For. 354. 1996; Rajendran & P. Daniel, Indian

Verbenaceae 307. 2002; Anil Kumar *et al.,* Fl. Pathanamthitta 394. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 566. 2009. *Verbena jamaicensis* L., Sp. Pl. 19. 1753. *Stachytarpheta indica* (L.) Vahl var. *jamaicensis* (L.) Moon, Cat. Pl. Ceylon 68. 1885 & Handb. Fl. Ceylon 3: 348. 1895; Gamble, Fl. Pres. Madras 1090. 1924. *Stachytarpheta indica* sensu C. B. Clarke in Hook. f., Fl. Brit. India 4: 564. 1885, p.p; non (L.) Vahl 1804.

Erect glabrous herbs or shrubs. Leaves opposite, ovate, 3-10 x 2-6 cm, obtuse to acute at apex, cuneate at base sharp crenate-serrate; petiole 1-3 cm long. Spikes terminal, to 20 cm long, linear. Flowers sunken in the rachis; bracts linear-ovate, 0.6 cm long; calyx tubular, 6 mm long, ridged; lobes acuminate; corolla blue, 7 mm long; tube cylindrical, lobes 5, obtuse, spreading, stamens 2, included; ovary glabrous, 2-celled; style slender, stigma globose. Fruit separating into 2, 1-seeded pyrenes; seeds oblong.

Fl. & Fr. : June – December.

Distribution: Pantropical. Open, wet degraded riparian vegetation. *Amitha Bachan 72095* (Vazhachal, open degraded riparian area, banks of Chalakkudy river, downstream to Poringalkuthu dam, 250 m).

VITEX Linnaeus

Sp. Pl. 638. 1753.

Key to species

1a. Leaves 3-foliolate, leaflets sessile; inflorescence terminal.**V. altissima**

1b. Leaves 5-foliolate, leaflets petiolulate; inflorescence axillary.....
.....**V. leucoxylon**

Vitex altissima L. f., Suppl. Pl. 294. 1781; Hook. f., Fl. Brit. India 4: 584. 1885; Gamble, Fl. Pres. Madras 1102. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 355. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 526.

2002; Rajendran & P. Daniel, Indian Verbenaceae 344. 2002; Anil Kumar *et al.,* Fl. Pathanamthitta 395. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 567. 2009. *Vitex alata* Willd., Gen. Naturf. Fr. New Schr. 4: 203. 1803, *non* Heyne ex Roth 1821; C. B. Clarke in Hook. f., Fl. Brit. India 4: 584. 1885. *Vitex altissima* L.f. var. *alata* (Willd.) Trimen, Handb. Fl. Ceylon 3: 358. 1895. **Myla, Mylellu.**

Large trees 30m high; bark grey, branchlets lenticellate, minutely tomentose. Leaves 3-5-foliolate; leaflets sessile, elliptic, to 15 x 5 cm, acuminate to caudate acuminate at apex, cuneate at base, undulate-serrate; petiole to 10 cm long, winged; wings oblong, 0.8 cm wide, acute, cordate at base. Panicles to 25 x 15 cm, branches tomentose. Flowers on terminal or sub terminal tomentose 30 x 15 cm, panicles; 3-10 together; calyx campanulate, 3 mm long, lobes ovate, white, tomentose; corolla 5 mm long, blue, throat villous, lobes obtuse; filaments hairy at base; ovary densely hairy. Drupes globose, 0.5 cm across, glabrous, blue.

Fl. & Fr. : India, Indo-China, Malaysia and Sri Lanka. Evergreen forests, along river margins. *Amitha Bachan 99134* (Pokalppara, riparian forest, Banks of Chalakkudy river, 240 m).

Vitex leucoxylon L. f., Suppl. Pl. 293. 1781; C. B. Clarke in Hook. f., Fl. Brit. India 3: 587. 1885; Gamble, Fl. Pres. Madras 1103. 1923; Sasidh. & Sivar., Fl. Pl. Thrissur For. 355. 1996; Rajendran & P. Daniel, Indian Verbenaceae 356. 2002; Anil Kumar et al., Fl. Pathanamthitta 395. 2005. *Wallrothia leucoxylon* (L. f.) Roth, Nov. Pl. Sp. 391. 1821.

Shrubs, branchlets glabrous. Leaves 3-5-foliolate, petiole to 8 cm long; leaflets elliptic to lanceolate-oblong, to 15 x 5 cm, acute at both ends, glabrous; petiolule 2 cm long; lateral nerves 12-14 pairs. Cymes axillary, dichotomous, long-peduncled, hispid; peduncle to 8 cm long. Flowers few to many; pedicels 5 mm long, calyx 0.5 cm long, sub-

bilabiate, tomentose, lobes acute; corolla 1.4 cm long, lobes oblong to orbicular, curved, white, throat hairy; filaments unequal, hairy at base. Drupe ellipsoid, to 2 cm, succulent.

Fl. & Fr. : Endemic to Peninsular India and Sri Lanka. Along river margins. *Amitha Bachan 72063* (Pokalppara-Vazhachal, riparian forest, banks of Chalakkudy river, 240 m).

91. AVICENNIACEAE Endlicher

Ench. Bot. 314. 1841.

AVICENNIA Linnaeus

Sp. Pl. 110. 1753.

Avicennia officinalis L., Sp. Pl. 110. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 4: 604. 1885; Gamble, Fl. Pres. Madras 1105. 1924; C. N. Sunil & Sivad., Fl. Alappuzha 571. 2009. Anupama & Sivad., Rheedea 14: 17. 2004. *Avicennia tomentosa* Jacq., Enum. Syst. Pl. 25. 1760.

Small halophytic trees with pneumatophores; bark grey, thin. Leaves elliptic or obovate, 4-9 x 2-3.5 cm, cuneate to obtusely cuneate at base, obtuse at apex, coriaceous, glabrous above, pubescent beneath; petiole to 1.5 cm long. Flowers in axillary long-peduncled, capitate cymes; peduncle to 2.5 cm long; pedicel to 0.8 cm. Bracts small ovate-obtuse, sessile, densely tomentose at base, caducous; bracteoles ovate, to 0.5cm long, obtuse at apex. Calyx lobes 4, ovate, obtuse, 0.6 cm, margin ciliate. Corolla campanulate yellowish-brown; lobes 4, unequal, thick, oblong-obtuse, 0.5 cm. Stamens 4, exserted. Ovary conical. Capsules ovoid, acute or apiculate, 2 cm long, compressed.

Fl. & Fr.: Mar.-May.

Distribution: Indo-Malaysia to Pacefic Ocean. Mangorve forests and saline or backwater areas. *Amitha Bachan 117732* (Elanthikkara, river margins, along backwaters, banks of Chalakkudy river, sea level).

92. SYMPHOREMATACEAE Roxb.

SYMPHOREMA Roxburgh

Pl. Coromandel 2: 46. 1805.

Symphorema involucratum Roxb., Pl. Coromandel t.186. 1798; C. B. Clarke in Hook. f., Fl. Brit. India 4: 559. 1885; Gamble, Fl. Pres. Madras 1104. 1924; Ramach. *et al.*, J. Econ. Tax. Bot. 5: 141. 1984; Sasidh. & Sivar., Fl. Pl. Thrissur For. 357. 1996.

Large woody climbers, stems with warty tubercles; branchlets yellow-tomentose. Leaves elliptic or oblong, acute to acuminate at apex, rounded at base, to 8 x 4 cm, inequilateral, subentire. Flowers 6 or 7, in peduncled capitate cymes; peduncle 2-2.5 cm long; involucral bracts 6, 0.7 x 0.2 cm, elliptic-oblong, enlarged in fruit; calyx campanulate, 0.6 cm long, 4-8-lobed, tomentose; corolla white, campanulate, 0.6 cm long, 6-8-lobed, hairy; stamens 6-8; ovary 2 or imperfectly 4-celled. Fruit 1-seeded. enclosed by the calyx.

Fl. & Fr. : March-May

Distribution: Indo-Malaysia. Evergreen forestsin the riparian areas. *Amitha Bachan 99110* (Muthuvarachal, riparian evergreen forest, banks of Karappara river, 450 m).

93. LAMIACEAE Lindl.

Intr. Nat. Syst. Bot. ed. 2: 275. 1836

LABIATAE, *nom. alt.*

1a. Nutlets dry.....2

1b. Nutlets succulent..... **Gomphostemma**

2a. Large shrub to small trees, to 3m high .....**Colebrookea**

2b. Herbs or subshrubs, under 1.5 m.....3

3a. Stamens ascending to the upper lip or projecting straight forward....4

3b. Stamens descending, enclosed in the lower lip.....6

4a. Calyx 8-10-toothed; filaments glabrous. ..... **Leucas**

4b. Calyx 5-lobed; filaments bearded.....5

5a. Corolla-lobes 5; stamens didynamous..... **Anisomeles**

5b. Corolla-lobes 4; stamens not didynamous..... **Pogostemon**

6a. Calyx campanulate, equally 5-toothed; corolla 2+3 ..... **Hyptis**

6b. Calyx tubular, distinctly 2-lipped, corolla 4+1..... **Ocimum**

ANISOMELES R. Brown

Prodr. 503. 1810.

Anisomeles indica (L.) Kuntze, Rev. Gen. Pl. 2: 512. 1891; Gamble, Fl. Pres. Madras 1140. 1924; Manilal, Fl. Silent Valley 216. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 359. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 530. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 398. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 573. 2009. *Nepeta indica* L., Sp. Pl. 571. 1753. *Anisomeles ovata* R. Br. in Ait.f., Hort. Kew. (ed. 2) 3: 364. 1811; Wight, Icon. Pl. India Orient. t. 865. 1845; Hook. f., Fl. Brit. India 4: 672. 1885. *Anisomeles heyneana* Benth. in Wall., Pl. Asiat. Rar. 1: 59. 1830; Hook. f., Fl. Brit. India 4: 672. 1885; Gamble, Fl. Pres. Madras 1140. 1924. **Karinthumba.**

Erect aromatic herbs to 1.2 m high, densely pubescent, stem 4-angled, woody. Leaves broadly ovate, to 7 x 3 cm, acuminate at apex,

obtusely cuneate at base, densely woolly, serrate-crenate; petiole to 2.5 cm long. Flowers in axillary sessile clusters or in terminal interrupted spikes. Calyx campanulate, tube 4 mm long, lobes 5, ovate, 2 mm long, ciliate on margin; corolla violet or purple, 1.4 cm long, upper lip entire, acute, lower lip 4-lobed, lobes obtuse, white or lilac, covered with purple hairs; stamens 4, filaments hairy; stigma 2-lobed; nutlets 4, plano-convex, lenticular, reddish-brown.

Fl. & Fr. : August – Decemebr.

Distribution : Indo-Malaysia and China. Moist forests and wastelands. Evergreen forest floor. *Amitha Bachan 123604* (Vazhachal, riparian forests, banks of Chalakkudy river, 250 m).

COLEBROOKEA J. J. Smith

Exot. Bot. 2: 111. 1806.

Colebrookea oppositifolia Smith, Exot. Bot. 2: 111, t.115. 1805; Hook. f., Fl. Brit. India 4: 642. 1885; Gamble, Fl. Pres. Madras 1138. 1924; Manilal, Fl. Silent Valley 216. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 359. 1996; *Colebrookea tenuifolia* Roxb., Pl. Coromandel t. 245. 1815.

Large shrubs or small trees to 3 m tall; stem angled, densely tomentose. Leaves simple, opposite, elliptic, to 23 x 6 cm, long acuminate at apex, acute to attenuate at base, crenulate, nerves 10 pairs. Flowers on terminal tomentose panicled spikes to 15 x 0.5 cm; peduncle to 6 cm long. Flowers in close whorls; calyx tube very short, 1.5 mm long, densely white-hairy, lobes subulate, larger in fruit; corolla 2 mm long, equally 4-lobed; stamens 4, exserted in male flowers, included in female flowers, filaments glabrous; style 2-fid at tip. Nutlets hairy at apex.

Fl. & Fr. : January -May.

Distribution : South and Southeast Asia. Evergreen forests. *Amitha Bachan 98895* (Malakkapara, riparian evergreen, banks stream draining to Sholayar reservoir, 1000 m); *Amitha Bachan 98842* (Chandanthodu-Sholayar, riparian, along stream draining to Sholayar reservoir, 800 m).

GOMPHOSTEMMA Wallich

Cat. 2151. 1830.

Gomphostemma heyneanum Benth. var. **rottleri** Prain, Ann. Roy. Bot. Gard. (Calcutta) 3: 249. t. 80. 1891; Gamble, Fl. Pres. Madras 1157. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 360. 1996.

Erect subshrubs; stem sharply 4-angled, densely stellate pubescent. Leaves broadly elliptic, 20 x 10 cm, acute to shortly acuminate at apex, acute tocuneate at base, stellate hairy, crenate; petiole to 3 cm long, terete, densly hairy. Racemes terminal spikes, to 18 x 2.5 cm. Flowers 10 to 20 together, densely packed; bracts linear-elliptic, acute. Calyx to 1 cm long, lobed to the middle, lobes lanceolate; corolla 1.5 cm long, cylindric, midlobe of lower lip obtuse, emarginate; stamens 4, didynamous, filaments unequal, glabrous. Nutlets succulent, glabrous.

Fl. & Fr. : September – January.

Distribution : Endemic to Southern Western Ghats. Moist forests. *Amitha Bachan 98754* (Vazhachal, riparian evergreen, banks of Chalakkudy river, 250 m).

HYPTIS N.J. Jacquin

Collectanea 1:101, 103. 1787, *nom. cons.*

Hyptis suaveolens (L.) Poit., Ann. Mus. Natl. Hist. Nat. Paris 7: 472. t.27. f.2. 1806; Hook. f., Fl. Brit. India 4: 630. 1885; Gamble, Fl. Pres. Madras 1129. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 360. 1996; N.

Mohanan & Sivad., Fl. Agasthyamala 532. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 400. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 577. 2009. *Ballota suaveolens* L., Syst. Nat. (ed. 10) 1100. 1759.

Erect aromatic subshrubs to 1.5m tall, stem obtusely 4-angled, glandular-hispid. Leaves ovate to suborbicular, to 6 x 4 cm, cordate or rounded at base, acute to obtuse at apex, irregularly dentate, strigose-hairy; petiole to 3 cm long, hairy. Flowers in short axillary cymes. Calyx campanulate; tube to 4 mm long, ribbed, enlarged in fruits; lobes 5, aristate, 2 mm long. Corolla pale blue, 2-lipped, tube 4-5 mm long. Stamens 4; filaments bearded. Ovary 4-partite; stigma shortly 2-fid. Nutlets compressed, 3 mm long, black, white mucilagenous on wetting.

Fl. & Fr. : July– February.

Distribution: Native of America, now Pantropical. Open areas. *Amitha Bachan 117638* (Choukakadavu-Elanthikkara, riparian, banks of Chalakkudy river, sea level).

LEUCAS P. Brown

Prodr. 504. 1810.

Key to species

1a. Mouth of the calyx oblique.....**L. zeylanica**

1b. Mouth of the calyx straight.....2

2a. Calyx teeth not spreading; throat naked.....**L. angularis**

2b. Calyx teeth spreading; throat villous.....3

3a. Upper lip of the corolla with rufous hairs..... **L. ciliate**

3b. Upper lip of the corolla with white hairs..... **L. eriostoma**

Leucas ciliata Benth. ex Wall., Pl. Asiat. Rar. 1: 61. 1830.

Key to Varieties

1a. Leaf elliptic-oblong, marginal teeth of calyx 8-14, densely hispid... .....var. **vestita**

1b. Leaf lanceolate, marginal teeth of calyx 4-8, puberulous .....var. **ciliata**

var. **ciliate.** Sunojk., Candollea 63: 83. 2008. Leucas ciliata var. hirsuta Bent., Labiat. Gen. Spec. 614. 1834; Hook. f., Fl. Brit. India 4: 687. 1885; Gamble, Fl. Pres. Madras 1153. 1924; N. Mohanan & Sivad., Fl. Agasthyamala 533. 2002.

Villous herbs, stems 4 angled. Leaves opposite, ovate, to 8 x 4 cm, acute at apex, serrate pubescent. Verticils 1 or 2 terminal, large. Calyx not oblique at mouth, teeth erect over 4 mm long, stellate spreading, villous at throat; corolla 2 lipped, lower lip spreading, upper lip densely bearded with rufous hairs; stamens 4, didynamous, lower pair longer; ovary 4 partite; fruit 4 ovoid, triquetrous, obtuse nutlets, grey-black, plano convex, dry .

Fl. & Fr. : November – March.

Distribution : Endemic to Temperate Himalayas and the Western Ghats. Evergreen forests. *Amitha Bachan 98739* (Karimala, stream bank vegetation, stream draining to Parambikulam river, 1100 m). *Amitha Bachan 123321* (Pullala-Nelliyampathy, stream bank vegetation, stream draining to Karappara river, 1100 m).

var. **vestita** (Hook. f.) Sunojk., Candollea 63: 83. 2008. *Leucas vestita* Benth. in Wall., Pl. Asiat. Rar. 1: 61. 1830, var. *vestita* Hook. f., Fl. Brit. India 4: 686. 1885; Gamble, Fl. Pres. Madras 1153. 1924; Anil Kumar *et al.*, Fl. Pathanamthitta 401. 2005.

Stout herbs, to 50 cm high, branches 4 angled, rufous hairy. Leaves ovate-lanceolate, to 6 x 2.5 cm, obtuse at apex, acute at base, crenate-serrate, densely pubescent; petiole 5-7 mm long. Heads 2 cm across, 1 or 2 terminal, large; bracts 10 x 1 mm, linear, hairy. Flowers to 30 in each head; calyx tube 8 mm long, not oblique at mouth, mouth rufous hairy, teeth 1.5 mm long, spreading; corolla tube 8 mm long, upper lip covered with brown hairs; lower lip 10 x 7 mm, 3-lobed; midlobe orbicular, emarginate with undulate margins. Nutlets 4, dark brown, black.

Fl. & Fr. : November -January.

Distribution : Endemic to Southern Western Ghats. Grasslands. Streamside near Shola. *Amitha Bachan 123398* (Upper-Sholayar, stream bank, stream draining to Upper Sholayar reservoir, 1300 m).

Leucas eriostoma Hook.f., Fl. Brit. India 4: 686. 1885, var. **eriostoma** Gamble, Fl. Pres. Madras 1154. 1924.

Erect slender herbs; stem 4-angled, tomentose with stiff spreading hairs. Leaves linear-lanceolate, to 8 x 0.5 cm, acute at both ends, crenate, brown-hispid hairy nerves few, very oblique. Bracts linear, pectinately ciliate. Heads in upper axills, many, to 2 cm across; calyx mouth straight, teeth short, subulate, throat villous, villi conspicuous; corolla white, bilabiate, upper lip densely bearded with white hairs. stamens 4, didynamous; ovary 4-partite. Nutlets 4.

Fl. & Fr. : December-April.

Distribution: Endemic to Southern Western Ghats. Grasslands. *Amitha Bachan 98847* (Malakkappara, stream-banks near grasslands, stream draining to Sholayar river, 900 m).

Leucas marrubioides Desf., Mem. Mus. Hist. Nat. Paris 11: 6. t. 3. f. 1. 1824; Hook. f., Fl. Brit. India 4: 683. 1885; Gamble, Fl. Pres. Madras 1152. 1924.

Slender herbs; stem 4-angled; pubescent with deflexed hairs. Leaves ovate to lanceolate, to 7 x 5 cm, cordate, obtuse to acute at base, acute at apex, crenate; nerves 4-6 pairs, thick, tawny to bullate pubescent; petiole slender, 0.7-1.2 cm long. Bracts filiform with long soft silky appendages, to 1.2 cm long. Flowers axillary; calyx tubular, softly silky, teeth unequal, to 2 mm long, slender, filiform. Corolla white, bilabiate, 2 cm long; stamens 4, didynamous; ovary 4-partite. Nutlets 4.

Fl. & Fr. : November-January.

Distribution: Indo-Malaysia. Evergreen forests. *Amitha Bachan 117774* (Valparai, streamside vegetation, banks of Upper Sholayar stream, 1200m).

Leucas zeylanica (L.) R. Br., Prodr. 504. 1810; Hook. f., Fl. Brit. India 4: 689. 1885; Gamble, Fl. Pres. Madras 1150. 1924; Manilal, Fl. Silent Valley 220. 1988; Anil Kumar *et al.*, Fl. Pathanamthitta 401. 2005. *Phlomis zeylanica* L., Sp. Pl. 586. 1753. **Poothumba.**

Small erect herbs; branches villous. Leaves elliptic-Lanceolate, 8 x 1 cm, obtuse at apex, acute at base, scabrous, subentire; petiole to 0.5 cm long. Heads terminal and sub-termianl; bracts 0.6 cm long, linear, acute, ciliate. Flowers 10-20 in a head; calyx 0.6 cm long, mouth slightly oblique, teeth 8, 0.1 cm long, scabrous; corolla white, tube 0.7 cm long, upper lip obovate, with black hairs, midlobe of lower lip rounded. Nutlets smooth, brownish.

Fl. & Fr. : May-July.

Distribution: South and Southeast Asia. *Amitha Bachan 98713* (Elanthikkara, riparian, banks of Chalakkudy river, Sea level).

OCIMUM Linnaeus

Sp. Pl. 597. 1753.

Ocimum gratissimum L., Sp. Pl. 1197. 1753; Hook. f., Fl. Brit. India 4: 608. 1885; Gamble, Fl. Pres. Madras 1111. 1924; Sasidh. & Sivar., Fl. Pl. Thrissur For. 362. 1996; C. N. Sunil & Sivad., Fl. Alappuzha 582. 2009. **Kattuthulasi.**

Undershrubs; branchlets 4-angled, glabrescent. Leaves ovate, to 8 x 5 cm, attenuate or decurrent at base, acute to acuminate at apex, deeply serrate, glabrous except on the nerves; petiole to 5 cm long. Racemes to 10 cm long. Bracts oblanceolate. Calyx 5 mm long, sparsely hispidulous; lobes 5, upper lip 3 mm long, lower lip 2 mm long, 3-4 ribbed, ciliate. Corolla white, 5 mm long, lobes 5, acute. Stamens 4; filaments villous at base. Ovary obovoid. Nutlets 4, subglobose, 2 mm across, reticulate or pitted.

Fl & Fr. : July-December.

Distribution: Pantropical. Forests to lower plains. *Amitha Bachan 127407* (Thumboormuzhi, riparian forest, banks of Chalakkudy river, 50 m).

POGOSTEMON Desfontaines

Mem. Mus. Hist. Nat. 2: 154. 1815.

Pogostemon paniculatus (Willd.) Benth. in Wall., Pl. Asiat. Rar. 1:30.1830; Hook. f., Fl. Brit. India 4: 631. 1885; Gamble, Fl. Pres. Madras 1132. 1924; Manilal, Fl. Silent Valley 222. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 364. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 538. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 403. 2005. *Elsholtzia paniculata* Willd., Sp. Pl. 3: 59. 1800.

Subshrubs. Leaves ovate, 3-8 x 2-5 cm, acuminate at apex, cuneate at base, irregularly dentate, densely hirtus-tomentose; lateral nerves 3-4 pairs; petiole 2 cm long, tomentose. Panicle large, clusters inrupted in the spikes, 1-sided, with a pair of pair of unequal small floral leaves; bracteoles oblique, falcate, 0.5 x cm long, imbricating regularly. Flowers densely packed; calyx 4 mm long, 5-ribbed; lobes acuminate, hirtus; corolla purplish, 6 mm long; pubescent outside; filaments bearded.

Fl. & Fr.: September- February.

Distribution: Peninsular India and Myanmar. Moist forests. *Amitha Bachan 99001* (Orukombankutty, open riparian forests, banks of Chalakkudy river, 450 m).

94. NYCTAGINACEAE Juss.

Gen. Pl. 90. 1789.

BOERHAVIA Linnaeus

Sp. Pl. 3. 1753.

Boerhavia diffusa L., Sp. Pl. 3. 1753; Gamble, Fl. Pres. Madras 1162. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 366. 1996; Sunil, Fl. Alappuzha Dist. 586. 2000. *Boerhavia repens* L., Sp. Pl. 3. 1753; Hook. f., Fl. Brit. India 4: 709. 1885; Anil Kumar *et al.*, Fl. Pathanamthitta 404. 2005. *Boerhavia procumbens* Banks ex Roxb., Fl. India 1: 148. 1820. **Thazhuthama.**

Diffuse herbs with purplish elongated trailing branches. Leaves broadly ovate, to 1.5-3x 1.5-3 cm, base truncate, apex obtuse or acute, margin often undulate; petiole to 1.5 cm long. Flowers on umbellate cymes, mostly axillary, 5-6 cm long. Perianth pink, 3 mm across;

stamens 2 or 3; filaments unequal. Fruit clavate, 3 mm long, 5-ribbed, glandular, apex rounded.

Fl. & Fr.: Most of the seasons.

Distribution: Pantropical. Very common. *Amitha Bachan 117765* (Sholayar, open riparian forests, banks of Chalakkudy river, 220 m).

95. AMARANTHACEAE Juss.

Gen. Pl. 87. 1789.

Key to genera

1a. Leaves opposite.....2

1b. Leaves alternate.....4

2a. Anthers one- celled.....**Alternanthera**

2b. Anthers 2-celled.....3

3a. Prostrate small herbs, branches ascending, slender..... **Cyathula**

3b. Erect large herbs or subshrubs, branches stout.....**Achyranthes**

4a. Flowers bisexual.....5

4b. Flowers unisexual..... **Amaranthus**

5a. Erect decumbent herbs, white pubescent; flowers in spikes; staminodes present.....**Aerva**

5b. Diffuse herbs, not white pubescent; flowers in globose heads; staminodes absent.....**Allmania**

ACHYRANTHES Linnaeus

Sp. Pl. 204. 1753.

Achyranthes aspera L., Sp. Pl. 204. 1753; Wight, Icon. Pl. India Orient. t. 1777. 1852, var. **aspera** Hook. f., Fl. Brit. India 4: 730. 1885; Gamble,

Fl. Pres. Madras 1176. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 367. 1996; C.N. Sunil & Sivad., Fl. Alappuzha 588. 2009. **Kadaladi.**

Erect herbs; stems tomentose. Leaves opposite, elliptic to obovate, acuminate, to 10 x 6 cm, tomentose, lateral nerves 6 pairs; petiole 5 mm long. Spike to 20 cm long, hispid; bracts 6 mm long, lanceolate, aristate; bracteoles entire, aristate. Flowers deflexed; tepals to 8 x 2 mm, elliptic, acute, glabrous, equal; staminal sheath truncate, anthers 2 celled; ovary truncate at apex. Achenes 3 mm long, ovoid, brown.

Fl. & Fr.: December – March.

Distribution: Pantropical. Plains to forests in open moist areas. Riparian forest margins. *Amitha Bachan 98753* (Nelliyampathy, riparian forests, banks of Karapara river, 900 m).

AERVA Forsskal

Fl. Aegypt. - Arab. 170, cxxii. 1775, *nom. cons.*

Aerva lanata (L.) Juss. ex Schult., Ann. Mus. Natl. Hist. Nat. Paris 11: 131. 1808; Wight, Icon. Pl. India Orient. t. 723. 1840. Hook. f., Fl. Brit. India 4: 728. 1885; Gamble, Fl. Pres. Madras 1178. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 368. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 405. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 588. 2009. *Achyranthes lanata* L., Sp. Pl. 204. 1753. *Aerva floribunda* Wight, Icon. Pl. India Orient. t. 723. 1840.***Cherula***

Erect or decumbent, white-pubescent herbs. Leaves obovate or orbicular, cuneate at base, obtuse, apiculate or acute at apex, 1.5-3 x 1-2.5 cm, pubescent; petiole to 5 mm long. Flowers minute, bisexual, in dense terminal and axillary sessile spikes. Bracts and bracteoles membranous, oblong ovate, to 1 mm long. Tepals 5, greenish-white, oblong, obtuse, densely lanate dorsally, to 1.5 mm long,. Stamens 5,

shortly connate below, alternate with subulate staminodes. Ovary 1-ovuled; stigma 2-fid. Seed reniform, black.

Fl. & Fr.: July - October.

Distribution.: Tropics and subtropics. *Amitha Bachan 123690* (Elanthikkara, riparian open areas, banks of Chalakkudy river, sea level).

ALLMANIA R. Brown ex R. Wight

J. Bot. (Hooker) 1: 226. 1834.

Allmania nodiflora (L.) R. Br. ex Wight in Hooker's, J. Bot. 1: 226. t. 128. 1834; Gamble, Fl. Pres. Madras 1167. 1925; Manilal, Fl. Silent Valley 225. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 368. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 540. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 406. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 589. 2009. *Celosia nodiflora* L., Sp. Pl. 205. 1753. *Chamissoa aspera* Wight, Icon. Pl. India Orient. t. 1772. 1852. *Allmania nodiflora* (L.) R. Br. ex Wight var. *longipedunculata* Trimen, Handb. Fl. Ceylon 3: 394. 1895. *Allmania longipedunculata* (Trimen) Gamble, Fl. Pres. Madras 1168. 1925.

Diffuse herbs. Leaves alternate, to 5 x 1.5 cm, elliptic-oblong, acute or obtuse, slightly oblique at base, glabrous. Flowers in terminal and axillary globose compressed cymes, pedicelled; bracts and bracteoles 4 mm long, lanceolate, acuminate with filiform tips; tepals 5, equal, to 5 mm, lanceolate, acute, free to the base, 1-nerved, glabrous; stamens 5, filaments united below into a membranous cup, glabrous; ovary obovoid, 1-celled, 1-ovuled; style 1, slender; stigma 2-toothed. Achenes 3 x 2 mm, ellipsoid with a long beak, biconvex, black.

Fl. & Fr.: October-January

Distribution: Tropical Asia. Common plains to forests. *Amitha Bachan 98731* (Vazhachal, riparian forests, banks of Chalakkudy river, 230 m).

ALTERNANTHERA Forsskal

Fl. Aegypt.-Arab. 28. 1775.

Key to species

1a. Flowers in long-peduncled axillary heads; stem fistular.....
.....**A. philoxeroides**

1b. Flowers in axillary, sessile heads; stem not fistular.....**A. sessilis**

Alternanthera philoxeroides (Mart.) Grisb., Wiss. Gnett. 24: 36. 1879; Madhus. & Ajit, J. Econ. Tax. Bot. 17: 652. 1993; C.N.Sunil & Sivad., Fl. Alappuzha 590. 2009. *Bucholzia philoxeroides* Mart., Nov. Acta Phys. Med. Acad. Caes. Leop. Carol. Nat. Cur. 13: 315. 1826. **Kozuppa.**

Perennial aquatic or marshy herbs usually with many erect branches from a prostrate stem; stem fistular, longitudinally striate, with a longitudinal groove each on two opposite sides. Leaves opposite, elliptic-lanceolate to obovate-lanceolate, narrow acuteat base, to 4-8 x 0.5 - 2 cm; petiole to 5 mm long. Inflorescence axillary, pedunculate, ovoid to globular-ellipsoid, white heads, sometimes terminal and sessile, 1-2 cm across; peduncles usually1-5 cm long. Bracts and bracteoles subequal, ovate, 1-nerved, apiculate, glabrous, persistent. Tepals 5, subequal, 5 x 2 mm, oblong-acute, white, dorsally compressed. Stamens 5, one celled, filaments united below into a tube, 3-4 mm long, linear; anthers unilocular. Ovary shortly stalked, ovoid; style slender; stigma capitate, papillose.

Fl. & Fr.: September – March.

Distribution: South America, Asia, Australia and U.S.A. Common weed in streams and ponds. *Amitha Bachan 123692* (Elanthikkara, riverside, banks of Chalakkudy river, sea level).

Alternanthera sessilis (L.) R. Br. ex. DC., Cat. Hort. 4: 77. 1813; Wight, Icon. Pl. India Orient. t. 727. 1843; Hook. f., Fl. Brit. India 4: 731. 1885. Anil Kumar *et al.*, Fl. Pathanamthitta 406. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 591. 2009. *Gomphrena sessilis* L., Sp. Pl. 225. 1753. *Alternanthera triandra* Lam., Encycl. 1: 95. 1785; Gamble, Fl. Pres. Madras 1179. 1925. **Kozuppa.**

Prostrate or erect herbs; stems glabrous. Leaves opposite to 4 x 1 cm, elliptic-oblong to oblanceolate, obtuse, attenuate at base, glabrous. Spike 7-12 x 5 mm, sessile, solitary or 2-3 together; bracts and bracteoles similar, 1 mm long, broadly ovate, acute, glabrous. Flowers yellowish red; tepals equal, 2.5 x 1.5 mm, ovate, acute, glabrous, 3-nerved at base; stamens 3, anthers one-celled. Achenes 2 x 2 mm, obovoid, emarginate at apex; seed orbicular, compressed, brown.

Fl. & Fr.: Throughout the year.

Distribution: Pantropical. Moist soils from sea level to moist forest localities. *Amitha Bachan 98704* (Elanthikkara, riparian openings, banks of Chalakkudy river, sea level).

AMARANTHUS Linnaeus

Sp. Pl. 989. 1753.

Amaranthus spinosus L., Sp. Pl. 991. 1753; Wight, Icon. Pl. India Orient. t. 513. 1841. Hook. f., Fl. Brit. India 4: 718. 1885; Gamble, Fl. Pres. Madras 1170. 1925; Manilal, Fl. Silent Valley 226. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 369. 1996; N. Mohanan & Sivad., Fl.

Agasthyamala 541. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 407. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 594. 2009. **Mullancheera.**

Erect herbs, spiny at the axills. Leaves alternate, ovate, oblong, apex obtuse, base attenuate, to 10 x 4 cm,; young leaves ending in bristles. Bracts and bracteoles minute, ovate, lanceolate bristled at the tips. Flowers to 2 mm across, uniisexual; Male flowers: tepals 5, unequal, ovate; stamens 5. Female flowers: tepals 5, oblong acute; ovary one celled with single ovule. Seeds minute, discoid, glabrous, black.

Fl. & Fr.: June - October.

Distribution: American in origin. Widespread in warmer parts of the world. *Amitha Bachan 123693* (Elanthikkara, riparian, banks of Chalakkudy river, Sea level).

CYATHULA Blume

Bijdr. 548. 1826, *nom. cons.*

Cyathula prostrata (L.) Blume, Bijdr. 549. 1826; Hook. f., Fl. Brit. India 4: 722. 1885; Gamble, Fl. Pres. Madras 1172. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 370. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 541. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 407. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 595. 2009. *Achyranthes prostrata* L., Sp. Pl. (ed. 2) 296. 1762. **Cheru-Kadaladi.**

Small prostrate slightly erect herbs, usually rooting at lower nodes. Leaves opposite, 7 x 3.5 cm, rhomboid, acute at either ends, thinly pubescent; petiole 5-15 mm long. Spikes terminal, fascicled at the nodes of the rachis, each fascicle with 1 or 2 perfect and other sterile flowers. bracts and bracteoles similar, 1.5 mm long, lanceolate, acuminate, pubescent; sepals 5, free, 3 x 1 mm, elliptic, acute, hooked awn like in neutor flowers; stamens 5, 2 celled, filaments united into a membranous

truncate cup; staminodes membranous, alternate with stamens, fimbriate; ovary minute, 1 celled; ovule 1, pendulous.

Fl. & Fr.: September - April.

Distribution: Pantropical. Distributed in moist areas from plains to forests. *Amitha Bachan 98961* (Nelliyampathy-Karappara, riparian forests, banks of Karappara river, 900 m).

96. PHYTOLACCACEAE R. Brown

in Tuckey, Narr. Exped. Cango 454. 1818.

PHYTOLACCA Linnaeus

Sp. Pl. 441. 1753.

Phytolacca octandra L., Sp. Pl. (ed. 2) 631. 1762; Ghosh & Sikdar, J. Econ. Tax. Bot. 4: 159. 1983.

Erect fleshy herbs. Leaves alternate, obovate to spathulate, acute at apex, narrowed at base, lineolate, to 8 x 3 cm,. Flowers 5-7 mm across, in long, axillary, 15 cm long racemes, shortly pedicelled; perianth lobes 5, ovate, spreading; stamens 5, free, filaments erect, anthers versatile; ovary depressed-globose, 6-7-lobed, 6-7-celled; ovules solitary in each cell, styles 6-7, short, curved out. Capsule 8 mm across, depressed-globose, fleshy; seeds 6-8, biconvex, black, glabrous, polished.

Fl. & Fr. : October-December

Distribution : Native of Tropical America, widely spread in many tropical countries. *Amitha Bachan 117615* (Malakkapara, river and stream banks, banks of Sholayar river, 900 m).

97. POLYGONACEAE Juss.

Gen. Pl. 82. 1789.

PERSICARIA

Key to species

1a. Leaves ovate, > 3 cm broad..... **P. chinensis**

1b. Leaves elliptic-lanceolate or linear, under 3 cm broad.....2

2a. Leaves acute or cuneate at base; flowers pink..... **P. glabra**

2b. Leaves acuminate at base; flowers white..... **P. barbata**

Persicaria barbata (L.) Hara, Fl. E. Himal. 1: 70. 1966, var. **barbata** *Polygonum barbatum* L., Sp. Pl. 362. 1753; Wight, Icon. Pl. India Orient. t. 1798. 1852; Hook. f., Fl. Brit. India 5: 37. 1886; Gamble, Fl. Pres. Madras 1189. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 371. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 542. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 409. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 600. 2009. **Velutha-muthalamooku, Vell-Kozhivalan**.

Erect stout herbs to 1m tall. Leaves elliptic-lanceolate, acuminate at either ends, to 6-14 x 1.5-3 cm, glabrate or pubescent, subsessile; nerves many, slender; ochrea 15 mm long, strigose, mouth oblique, shortly bristled, pubescent. Spike 2-4 cm long, shortly peduncled, stout, in 15-20 cm long panicles; bracts obovate, obtuse, long-ciliate. Flowers white, 4-10 in each bracts, long-pedicelled; pedicels persistent; tepals 5, free, 2.5 mm long, oblong, obtuse, glandular; stamens 8; styles 3. Nuts trigonous, acute, glabrous.

Fl. & Fr. : October-March.

Distribution: Paleotropics. Along streamsides. *Amitha Bachan 99082* (Sholayar, stream sides, along Sholayar river, 900 m)

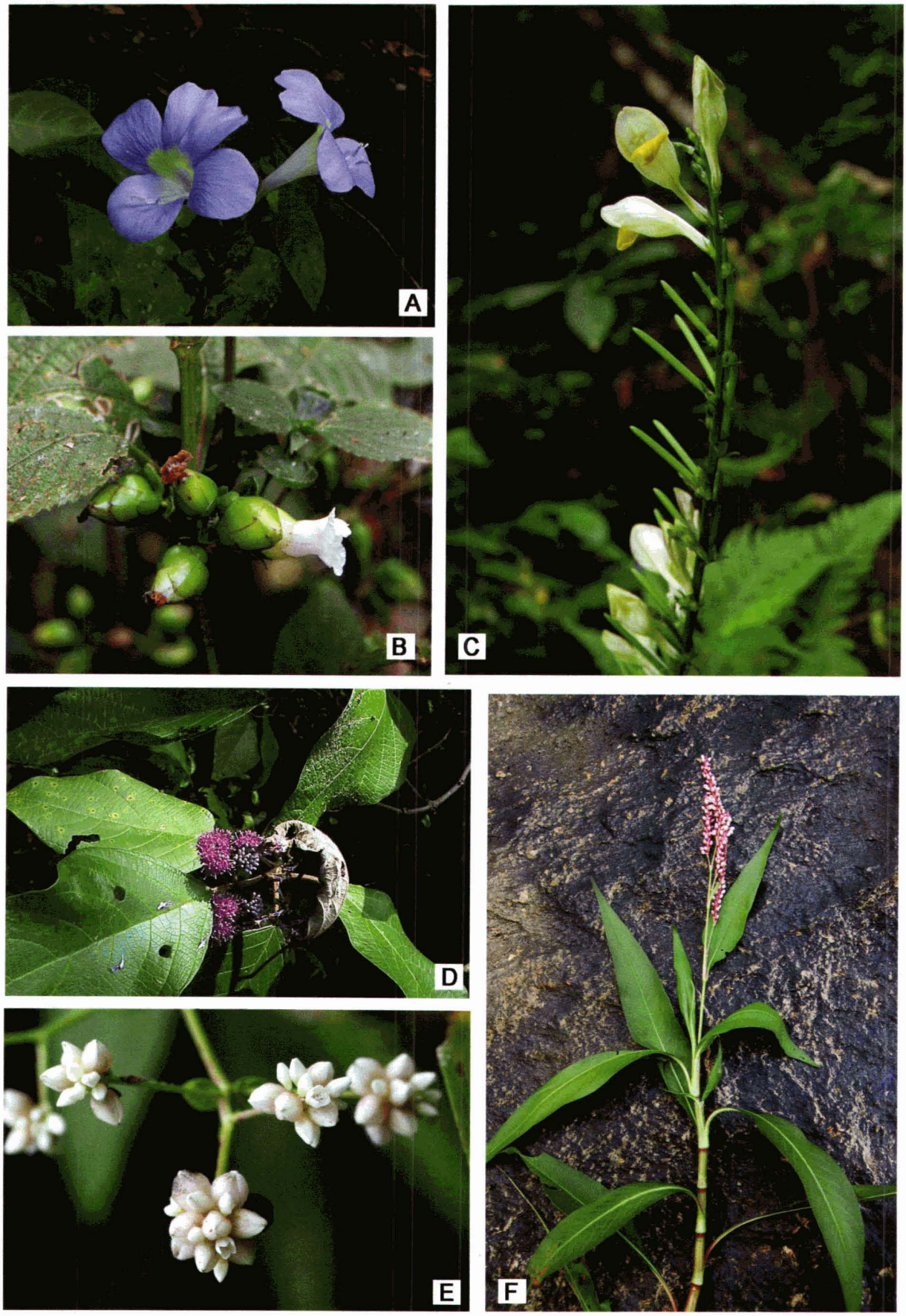


Plate 31. A. *Barleria courtallica* Nees; B. *Strobilanthes asperrimus* Nees; C. *Gymnostachyum febrifugum* Benth. var. *febrifugum*; D. *Callicarpa tomentosa* (L.) L.; E. *Persicaria chinensis* (L.) Gross.; F. *Persicaria glabra* (Willd.) Gomez

Persicaria chinensis (L.) Gross. in Engl., Bot. Jahrb. Syst. 49: 269, 277, 315. 1913; Manilal, Fl. Silent Valley 226. 1988 *Polygonum chinense* L., Sp. Pl. 363. 1753; Wight, Icon. Pl. India Orient. t. 1806. 1852; Hook. f., Fl. Brit. India 5: 44. 1886; Gamble, Fl. Pres. Madras 1190. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 371. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 543. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 410. 2005. **Poovalikodi, Mukkala.** **Plate 31. E**

Trailing or scandent semi-aquatic shrubs; stem glabrous. Leaves ovate, cordate at base, oblique, abruptly acuminate, to 11 x 5 cm punctuate, glabrous except the midrib below; nerves many; petiole 1.5 cm long; ochrea 2-3 cm long, membranous, oblique at mouth, ribbed, glabrous. Spike to 7 mm, panicled, globose; peduncles glandular-hairy; bracts ovate, obtuse, 1-flowered. Flowers pedicelled; tepals 4, white, 0.5 x 0.2 mm, oblong, obtuse, glabrous; stamens 8, styles 3. Nuts 0.5 cm, trigonous, glabrous, acute, brown.

Fl. & Fr. : December-April.

Distribution: Indo-Malaysia and China. Along stream sides. *Amitha Bachan 98987* (Sholayar, along river banks, Sholayar river, 700 m); *Amitha Bachan 98742* (Thellikkal, riparian vegetation, banks of Thellikkal river, 520 m).

Persicaria glabra (Willd.) Gomez, Ann. Inst. Segunda Ensef. Habana 2: 278. 1896; Manilal, Fl. Silent Valley 227. 1988. *Polygonum glabrum* Willd., Sp. Pl. 2: 447.1799; Hook. f., Fl. Brit. India 5:34.1886; Gamble, Fl. Pres. Madras 1189. 1925; Anil Kumar *et al.*, Fl. Pathanamthitta 410. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 600. 2009. **Cuvann-Kozhivalan, Chuvanna-muthalmooku.** **Plate 31.F**

Stout glabrous herbs. Leaves linear-lanceolate, acute or cuneate at base, gradually acuminate at apex, 5-12 x 1.5-2.5 cm; ochrea tubular,

1.5-3 cm long, mouth truncate, long barbellate, smooth; petiole to 1.5 cm long. Spikes terminal or from the upper axils, paniculate, 4-12 cm long; pedicels to 0.3 cm long. Bracts oblong or broadly triangular, margin scarious. Perianth tubular-campanulate, pink; lobes 5, 0.2 cm long, oblong, obtuse. Stamens 5. Nuts biconvex, included within the perianth tube, black.

Fl. & Fr. : July-December.

Distribution: Paleotropics. Along streams. *Amitha Bachan 117617* (Malakkapara, riparian vegetation, banks of Sholayar river, 800 m).

98. PODOSTEMACEAE Rich. ex C. Agardh,

Aphor. Bot. 125. 1822.

Key to genera

1a. Flowers actinomorphic, carpels 3; spathella absent, cupule present .....**Dalzellia**

1b. Flowers zygomorphic, carpels 2, Spathella present, cupule absent...2

2a. Capsule isolobous, without ribs.....**Polypleurum**

2b. Capsule anisolobous, with 2 ribs.....**Willisia**

DALZELLIA Wight

Icon.. Pl. India Orient. (Wight) v. 34. t. 1919, 1920 (1852).

Key to species

1a. Fruiting pedicel 7-24 mm long, anthers big in relation to the ovary .....**D. gracilis**

1b. Fruiting pedicel 3-6 mm long, anthers small in relation to the ovary .....**D. ceylanica**

Dalzellia gracilis C. J. Mathew, I. Jager-Zurn & C. B. Nileena, Int. J. Pl. Sci. 162: 900. 2001.

The crust of the plant body is flattened, thick, green colored and irregularly branched; roots Present. The leaves are upto 1.5 cm, midrib prominent. Floral shoot consist of a solitary flower on a long terminal pedicel; base of the pedicel is surrounded by free spirally arranged leaves. Some leaves are broad thin, membranous, without midribs. Some times the spirally arranged leaves show some degree of fusion to form an inconspicuous cupule. Perianth is 3-lobed, united at base, lobes with a central nerve. Stamens 3, alternating with the perianth lobes, 2 mm long, equal to the gynoecium at anthesis, elongates after anthesis. Anthers are sagittate, larger. Ovary to 1.5 mm, tricarpellary, syncarpous, trilocular with numerous ovules on axile placenta. Stigmas 3, 0.25-0.5 mm long. Fruit a 3-valved capsule, elliptic, dehiscent, to 1.5-2.5 mm long; each valve is 3 ribbed; fruiting pedicel 7-25 mm long.

Fl. & Fr. : November-January.

Distribution: Endemic to Southern Western Ghats, Rare. Along the rocks of the river bed in the forest areas. *Amitha Bachan 117790* (Orukombankutty, rocks on the river bed, along Chalakkudy river, 400m).

Note: This species is known only from the type locality (Idukki). Present collection extends its distribution into the northern part of Anamalai landscape unit.

Dalzellia zeylanica (Gard.) Wight, Icon. Pl. India Orient. t. 1919-1920. 1852; Nagendran & Arekal, Bull. Bot. Surv. India 23: 229. 1981; N. Mohanan & Sivad., Fl. Agasthyamala 544. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 412. 2005. *Tristicha zeylanica* Gard., Calcutta J. Nat. Hist. 7: 117. 1847. *Lawia zeylanica* (Gard.) Tul., Ann. Sci. Nat. Bot. ser.

3, 2: 112. 1849; Gamble, Fl. Pres. Madras 1195. 1925. *Terniola zeylanica* (Gard.) Tul., Podost. Monogr. 190. t. 13. 1852; Hook. f., Fl. Brit. India 5: 62. 1886. **Plate 32. C**

Submerged rheophytic plants with ribbon-shaped, flattened crust growing from a central point in dendritic manner. Roots absent. The leaves are short 8-1.5 cm with prominent midrib. The floral shoot terminates in a terminal flower with a leafy cupule at the base of the pedicel. The perianth is fused at base and each lobe has a mid rib at base. Stamens 3, alternating with the perianth lobes, 1.5-3 mm long, longer or equal to the gynoecium, elongate after the anthesis. Ovary tricarpellary, syncarpous, elliptic, 1-2 mm long, trilocular with numerous ovules on axile placentation. Stigma 3-lobed. Fruit a dehiscent capsule, 1.5-2 mm long, 3-valved.

Fl. & Fr. : February – March.

Distribution: Endemic to Southwest India and Sri Lanka, on rocky river beds in the forest areas. *Amitha Bachan 117798* (Kuriyarkutty, on rocky beds, Kuriyarkutty river, 500 m).

POLYPLEURUM (Taylor ex Tulsane) Warming

Kongel. Danske Vidensk.-Selsk. Skr. Ser. 6, II: 64. 1901.

Key to species

1a. Thallus upto 30 cm long, attached at the base only, not creping; pedicel 2-4 cm long ..... **P. stylosum**

1b. Thallus less than 10 cm long, attached at certain points, creeping; pedicel to 1 cm long ..... **P. wallichii**

Polypleurum stylosum (Wight) Hall, Kew Bull. 26: 131. 1971; Nagendran & Arekal, Bull. Bot. Surv. India 23: 232. 1981; Sasidh. & Sivar., Fl. Pl. Thrissur For. 373. 1996; Anil Kumar *et al.*, Fl.

Pathanamthitta 412. 2005. *Dicraeia stylosa* Wight, Icon. Pl. India Orient. t. 1917. f. 2. 1852; Gamble, Fl. Pres. Madras 1196. 1925; Manilal, Fl. Silent Valley 228. 1988. *Podostemon stylosus* (Wight) Benth. ex Hook. f., in Hook. f., Fl. Brit. India 5: 64. 1886. *Podostemon algaeformis* (Bedd.) Benth. ex Hook .f., in Hook. f., Fl. Brit. India 5: 65. 1886. **Plate 32.F & G**

Thallus ribbon-shaped, to 30 cm long, 5-8 mm broad, thick, brown, attached at the base only, other portions free floating; vegetative and floral shoots marginal. Bracts 2-4, lower ones lanceolate and upper ones broad. Flowers zygomorphic, pedicellate; Pedicel to 5mm long, elongated after anthesis. Spathella funnel-shaped, 2-3-lobed, some times one lobe 2-forked. Tepals 2, to 2.5 mm long shorter than the ovary. Stamens 2, andropodium to 3 mm long, equal to the gynoecium, elongates after anthesis. Ovary elliptic, 2-3 mm long, bicarpellary, syncarpous, isolobous with numerous ovules on axile placentation. Stigma 2, 1.25 mm long, equal. Capsule elliptic, isolobous, to 3.5 mm long, 2-valved, each valve with 3 ribs.

Fl. & Fr. December-February.

Distribution: Endemic to India and Sri-Lanka. On rocks of fast flowing hill streams and rivers. *Amitha Bachan 98939* (Karappara-Nelliyampathy, stream bed rocks, streams draining to Karappara river, 1000m).

Polypleurum wallichii (R.Br. ex Griff.) Warm. Kongel. Danske Vidensk. Selsk. Skr., Naturvidensk. Math. Afd. Ser. 6, 11(1): 57. 1901. T.P. Raveendran & P. Mathew, Rheedea 2: 106. 1994. *Podostemon wallichii* R.Br. ex Griff., Asiat. Res. 19:103. t.17.1836; Hook. f., Fl. Brit. India 5:67.1886. *Dicraeia wallichii* (R.Br. ex Griff.) Tul., Ann. Sci. Nat. Bot. ser. 3, 11: 101. 1849. *Dicraeia minor* Wedd. in DC., Prodr. 17: 71.

1873. *Podostemon minor* (Wedd.) Benth. in Benth. & Hook.f., Gen. Pl. 3: 112. 1880; Hook. f., Fl. Brit. India 5: 67. 1886. **Plate 32. D & E**

Plant body thalloid, 4-7 cm long, 4-6 mm broad, thick, fleshy, green or brown, more or less creeping attached to the rocks at certain points only using haptera. Secondary and floral shoots marginal to sub marginal with 2-4 subulate leaves. Flowers zygomorphic, pedicellate; bracts 2-4, fleshy, imbricate, keeled, raised above the thallus. Pedicel to 6 mm long, elongated after anthesis. Spathella 3 mm long, funnel shaped, 2-lobed. Tepals 2, to 2.5 mm. Stamens 2, monadelphous, andropodium to 2.5 mm long, longer than the gynoecium, elongates after anthesis. Ovary elliptic, 2.5 mm long, bicarpellary, syncarpous, isolobous with numerous ovules on axile placentation. Stigma 2, 0.75 mm long, sub-equal. Capsule elliptic, isolobous, to 2.5 mm long, 2-valved, 8-ribbed.

Fl. & Fr. : February-April.

Distribution : India and Myanmar. On rocks in the fast flowing stream and river beds. *Amitha Bachan 98818* (Panjanamkuthu-Vazhachal, on rocks in the streambed, stream draining to Chalakkudy river, 270m).

Note: P. wallichi closely resemble *P. prostratum* C. J. Mathew & Nileena. A clear distinction of *P. prostratum* from *P. wallichii* is difficult to draw as the latter appear to be highly polymorphic.

WILLISIA Warming

In Fam. Podost. Kgl. Dansk. Vidensk. Selsk. Skr., 6 Raekke, t.XI., p. 58, 1901.

Willisia selaginoides (Bedd.) Warming ex Willis, Ann. Roy. Bot. Gard. (Peradeniya) 1: 235. 1902; *Willisia selaginoides* (Bedd.) Warming, Danske Vidensk. Selsk. Sk., Ser. 6, Nat. 11(1): 58, 1901. Gamble, Fl. Pres.

Madras 1198. 1925; Nagendran & Arekal, Bull. Bot. Surv. India 23: 231. 1981; Manilal, Fl. Silent Valley 228. 1988; Anil Kumar *et al.*, Fl. Pathanamthitta 412. 2005. *Mniopsis selaginoides* Bedd., Madras J. Lit. Sci. ser. 3, 1: 54. 1864. *Podostemon selaginoides* (Bedd.) Benth. in Benth. & Hook.f., Gen. Pl. 3: 113. 1880; Hook. f., Fl. Brit. India 5: 68. 1886. **Plate 32. A & B**

Rheophytic aquatic herbs with tufts of erect vegetative shoots, of the swift-flowing, rocky rivers in the forest areas. Thallus crust-like, closely attached to rocks by haptera. Vegetative shoots erect, slightly arched towards stream flow, to 2-12 cm long, crowded on the thallus; shoots per tuft numerous, 14-40. Leaves scale-like, oblong, 3.5-5 x 2-2.5 mm, acute at apex, with an apical notch, cuneate at base to form a 1.5 mm petiole-like broad base; opposite, decussate, arranged in four rows, closely adpressed each on base of the upper, exposed parts are brittle with silica; leaves remain on the fruiting shoot at least, lower two third on most of the shoots, or lower half on few on seed dispersal; leaves remains in the lower half after dispersal. Spathella 6-8 mm long with an apical notch. Flowers terminal, pedicellate, 2-merous, 5-7 mm long before anthesis, elongating after anthesis; pedicel 2mm long, with two strong ribs attached to the flower. Tepals 6 mm long, longer than the ovary. Stamens 2, monadelphous; andropodium 5-6 mm on anthesis. Ovary 3 x 2 mm, ovules many on axile placentation; stigma 1-2 mm long, 2-lobed, subequal. Capsule ellipsoid, 4-5 x 2-2.5 mm, two valved, valves sub-equal, each valve one ribbed excluding the dehiscence ribs, the mid portion of the dehiscence rib is swollen; dehise longitudinally, the smaller half separates out and the larger half remain attached on the two ribbed pedicel. Seeds flat, oblong, 0.4-0.5 x 0.2-0.3 mm, acute at both ends, reddish brown.

Fl. & Fr. : January-February.

Distribution: Endemic to Southern Western Ghats. Rare. On rocks in the fast flowing hill streams or rivers with rapid currents. *Amitha Bachan 99103* (Muthuvarachal-Karappara, on rocks of the rapids, Karappara river at Muthuvarachal, 500m).

Note: This rare species is found in the Karppara tributary of the Chalakkudy river, in the boundary of Parambikkulam Wildlife Sanctuary, Vazhachal and Chalakkudy Forest Divisions. It is only undammed tributary of the Chalakkudy river, and has a natural flow of clear water without any flow diversion.

99. ARISTOLOCHIACEAE Juss.

Gen. Pl. 74. 1789.

THOTTEA Rottboell

in Nye, Dansk. Videnskr. Selsk. Skrift. 2: 529, t. 2. 1783.

Thottea siliquosa (Lam.) Ding Hou, Blumea 27: 327. 1981; Manilal, Fl. Silent Valley 229. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 374. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 548. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 416. 2005. *Apama siliquosa* Lam., Encycl. 1: 91. 1783; Gamble, Fl. Pres. Madras 1200. 1925. *Bragantia wallichii* R. Br. ex Wight & Arn., Edinb. New Phil. J. 15: 181. 1833; Hook. f., Fl. Brit. India 5: 73. 1886. **Plate 33. A**

Shrubs; branchlets angled, slightly pubescent with stellate hairs. Leaves elliptic-oblong, to 10-25 x 3-8 cm, acuminate at apex, acute at base, unequal, tomentose below; nerves 5-7 pairs, 3 ribbed from base; petiole 5 mm long. Flowers in axillary fascicles, 1-5 together, 1.5 cm across; perianth united into a cup, lobed, acute; stamens 12, united in 3 groups; stigma peltate, many-lobed. Capsule to 10 x 0.5 cm, cylindrical; seeds 2 mm long, trigonous, rugose.

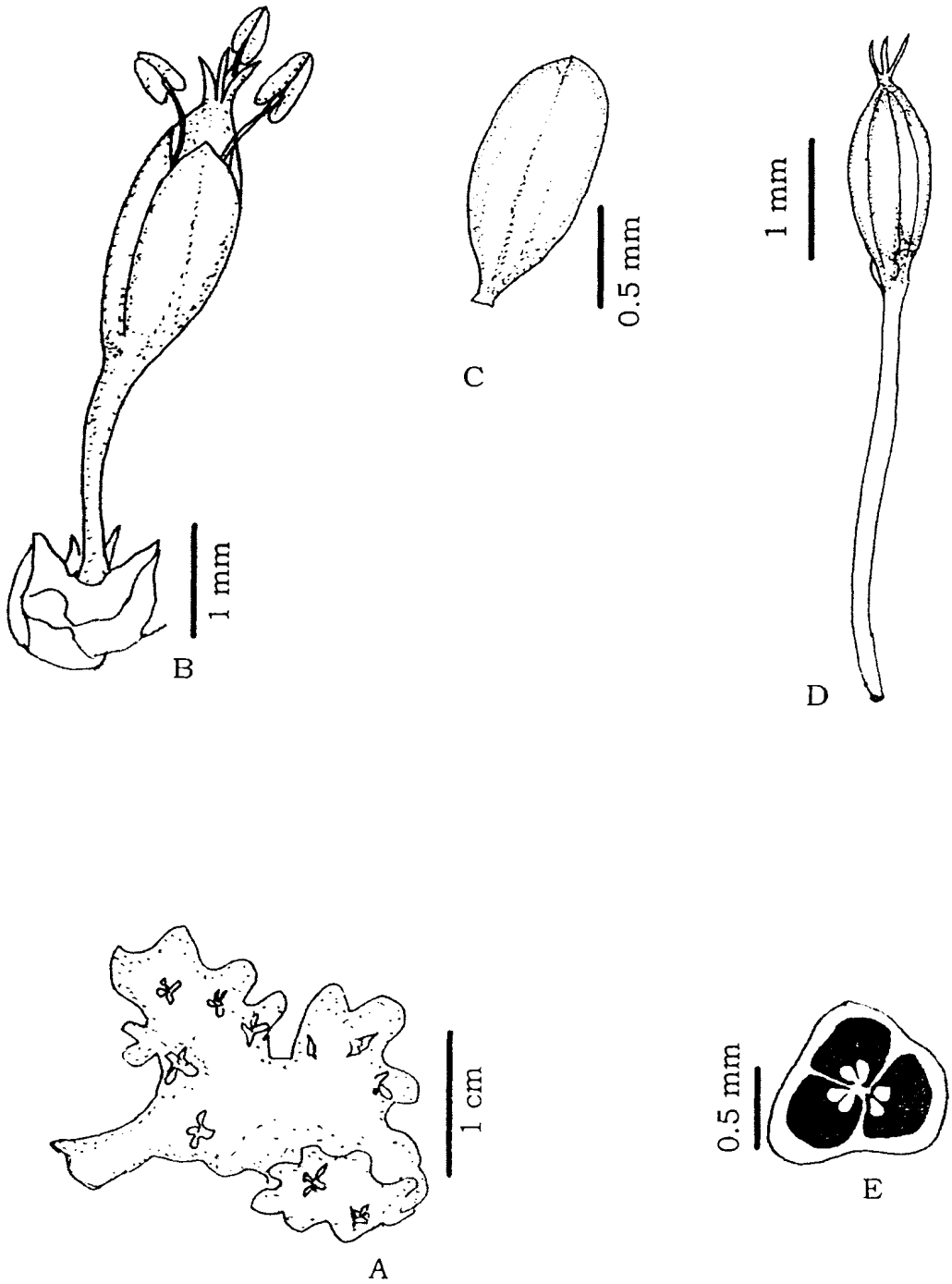


Fig. 2.4. *Dalzellia gracilis* C. J. Mathew A. Habit, B. Flower, C. Perianth, D. Fruit, E. Cross section of ovary.

Fl. & Fr. : Throughout the year

Distribution: Endemic to Peninsular India & Sri Lanka. Evergreen forests, lower to higher elevations. *Amitha Bachan 99128* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m).

100. PIPERACEAE C. Agardh

Aphor. Bot. 201. 1824.

Key to genera

1a. Woody climbing shrubs, rooting at nodes; spikes unisexual.....**Piper**

1b. Erect herbs or subshrubs; not rooting at nodes; spikes bisexual.....2

2a. Bracts triangular, stalked; spikes umbellate; leaves over 20 cm across.....**Lepianthes**

2b. Bracts orbicular, sessile; spike not umbellate; leaves below 5 cm across.....**Peperomia**

LEPIANTHES Rafinesque

Sylva Tellur. 84. 1838.

Lepianthes umbellata (L.) Rafin., Sylva Tellur. 85. 1838; Manilal, Fl. Silent Valley 230. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 374. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 549. 2002; Anil Kumar *et* al., Fl. Pathanamthitta 416. 2005. *Piper umbellatum* L., Sp. Pl. 30. 1753. *Hackeria subpeltata* (Willd.) Kunth, Linnaea 13: 571. 1839; Gamble, Fl. Pres. Madras 1208. 1925. *Piper subpeltatum* Willd., Sp. Pl. 1: 166. 1797; Hook. f., Fl. Brit. India 5: 95. 1886. *Pothomorphe subpeltata* (Willd.) Miq., Comm. Phyt. 37. 1840. **Attanari**.

Erect shrubs, to 1.5 m high; stems ridged. Leaves orbicular, rounded at apex, cordate at base, to 20-40 x 20-40, entire, pubescent; nerves palmately radiating from base; petiole to 20 cm long, sheathing at

base. Spikes 7-15 x 0.3 cm, cylindric, 3-7 together, umbellate, peduncled, axillary, bracts peltate, stalked, triangular, ciliate. Flowers densely packed; stamens 3, filaments short; ovary obovoid, truncate, stigmas 3, sessile. Berry trigonous, minute.

Fl. & Fr. : Throughout the year

Distribution: Paleotropics. Evergreen forests, undergrowth of riparian forests. *Amitha Bachan 117670* (Thachanthoni-Sholayar, riparian forest undergrowth, banks of Sholayar river, 700 m).

PEPEROMIA Ruiz. & Pavon

Prodr. 8. 1794.

Key to species

1a. All leaves whorled, not more than 10 mm long; spike pubescent .....**P. tetraphylla**

1b. Leaves alternate, opposite or rarely whorled, more than 10 mm long; spikes glabrous..... **P. pellucida**

Peperomia pellucida (L.) Kunth, Nov. Gen. Sp. 1: 64. 1815; Gamble, Fl. Pres. Madras 1210. 1925; N. Mohanan & Sivad., Fl. Agasthyamala 551. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 417. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 605. 2009 *Piper pellucidum* L., Sp. Pl. 30.1753. *Peperomia exigua* (Blume) Miq., Syst. Piperac. 77. 1843; Hook. f., Fl. Brit. India 5: 97. 1886. **Makapacha, Mashithandu.**

Fleshy succulent herbs, to 20 cm high; stem transparent. Leaves alternate, decussate, ovate, to 3 x 2 cm, cordate at base, acute at apex, glabrous, 5-ribed from base, fleshy, shortly petioled. Spikes axillary, solitary, to 3 cm long, slender, glabrous.

Fl. & Fr.: August-December.

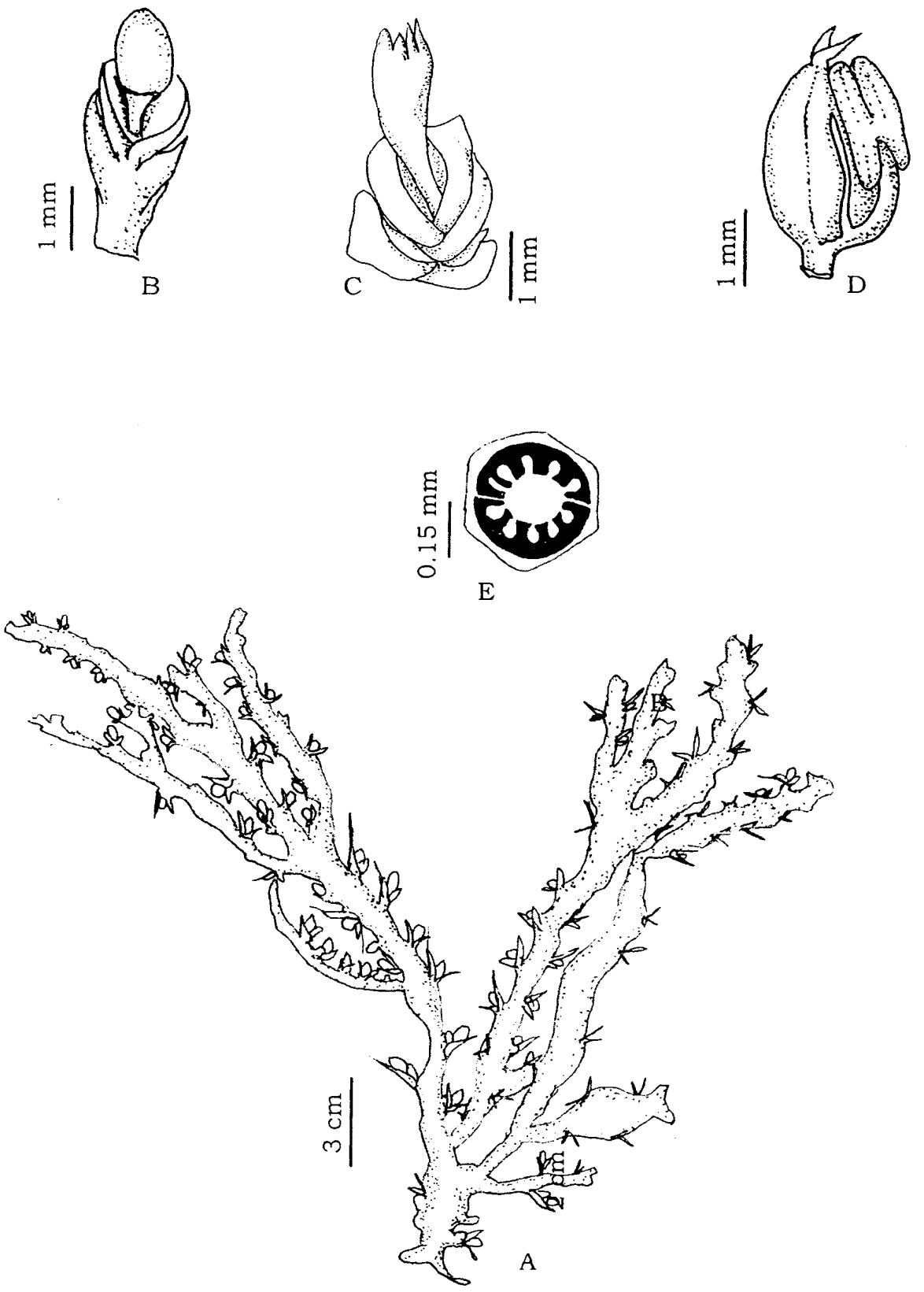


Fig. 2.5. *Polypleurum stylosum* (Wight) Hall A. Habit, B. Flower bud, C & D. Flower, E. Cross section of ovary.

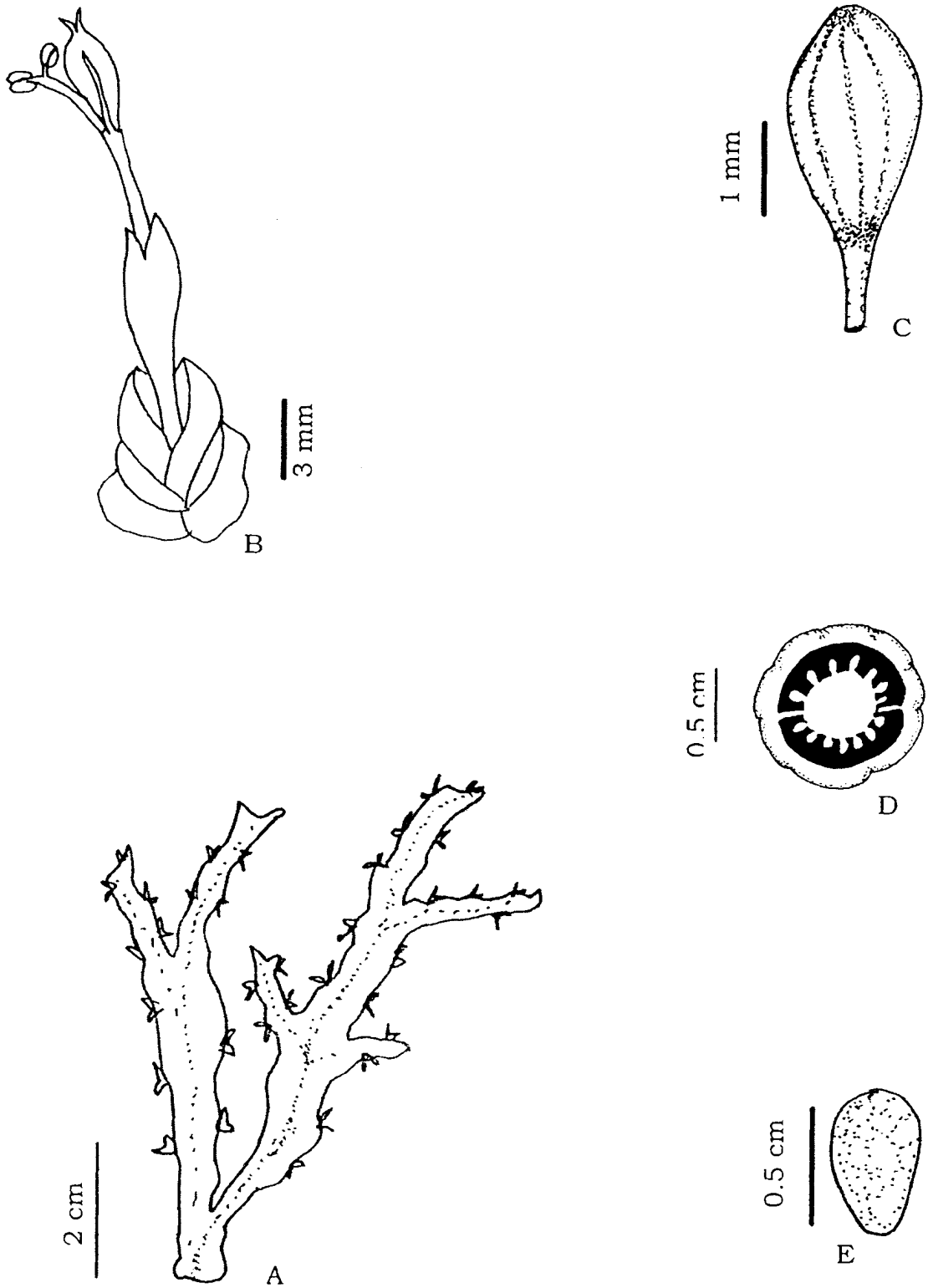


Fig. 2.6. *Polypleurum wallichii* (R.Br. ex Griff.) Warm. A. Habit, B. Flower, C. Fruit, D. Cross section of ovary, E. Seed.

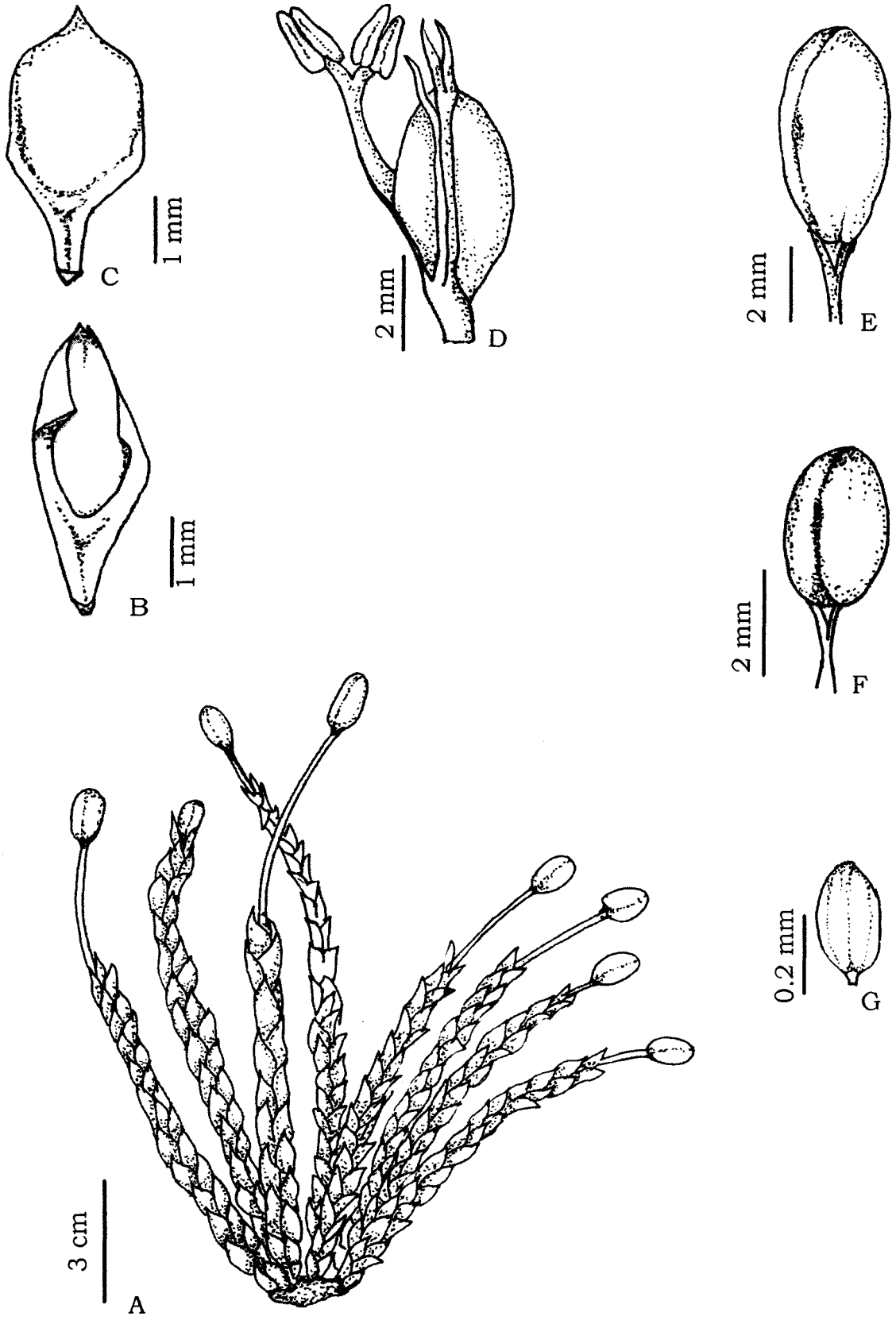


Fig. 2.7. *Willisia selaginoides* (Bedd.) Warming ex Willis A. Habit, B & C. Leaf, D. Flower, E & F. Fruit, G. Seed.

Distribution: Native of Tropical America, now Pantropical. Wet places. *Amitha Bachan 117644* (Athirappilly, on wet riparian rocks, banks of Chalakkudy river, 100 m).

Peperomia tetraphylla (G.Forst.) Hook. & Arn., Bot. Beech Voy. 97. 1841; Manilal, Fl. Silent Valley 230. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 552. 2002. *Piper tetraphylla* G.Forst., Prod. 5. 1759. *Peperomia reflexa* (L. f.) Dietr., Sp. Pl. 1:180.1839, *non* H.B.K. 1815; Hook. f., Fl. Brit. India 5:99.1886; Gamble, Fl. Pres. Madras 1209. 1925.

Plate 33. B

Small epiphytic herbs to 10 cm; branches diffuse to procumbent; stem and leaves thinly pubescent. Leaves, orbicular, obtuse, to 1 x 0.6 cm, few. Spike erect, stout, to 1.5 cm long; peduncle 0.8 cm long; bracts peltate, sessile, with white margins. Flowers densely arranged; stamens 2; stigmas 3-toothed. Nutlets ovoid, beaked, brown, to 0.8 mm long, glabrous.

Fl & Fr. : December-March.

Distribution: Pantropical. Evergreen forests. *Amitha Bachan 98945* (Karappara-Nelliyampathy, epiphytic on riparian forest trees, banks of Karappara river, 800 m).

PIPER Linnaeus

Sp. Pl. 28. 1753.

Key to species

1a. Spikes erect.....2

1b. Spikes pendulous.....3

2a. Leaves cordate at base; female spikes to 3 cm long.....**P. longum**

2b. Leaves acute at base; female spikes below 1 cm long.....**P. mullesua**

3a. Branchlets and leaves pubescent; berry beaked...**P. hymenophyllum**

3b. Branchlets and leaves glabrous; berry not beaked..**P. argyrophyllum**

Piper argyrophyllum Miq., Syst. Piperac. 330.1844; Hook. f., Fl. Brit. India 5:93.1886; Gamble, Fl. Pres. Madras 1207. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 375. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 418. 2005. **Kattukurumulaku**.

Climbing shrubs, branchlets glabrous. Leaves ovate or elliptic, 8-14 x 4-6 cm, acuminate at apex, acute or rounded at base, oblique, lower side covered with white scales, glabrous, basely 7 nerved; petiole to 1 cm long; stipule lanceolate, to 1.5 cm long. Spikes slender, leaf-opposed, drooping; peduncle 2-3 cm long; bracts oblong, adnate to the rachis with free margins, ciliate; stamens 2. Berry 3 x 3 mm, globose, stigma 4, curved.

Fl. & Fr. : July-February.

Distribution: Endemic to the Western Ghats and Sri Lanka. Evergreen forests. *Amitha Bachan 127401* (Malakkapara, riparian forest, banks of Chalakkudy river, 900m); *Amitha Bachan 117601* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

Piper hymenophyllum Miq. in Hooker's London J. Bot. 5: 554. 1846; Hook. f., Fl. Brit. India 5: 93. 1886; Gamble, Fl. Pres. Madras 1207. 1925; Manilal, Fl. Silent Valley 231. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 555. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 418. 2005.

Slender climbers; branchlets pubascent. Leaves ovate, to 13 x 6 cm, rounded to subcordate or often unequal at base, acuminate at apex, 7-ribbed, membranous; petiole to 1 cm long. Spike 20 cm long, slender, drooping; male spike shorter; bracts oblong, adnate to the rachis with

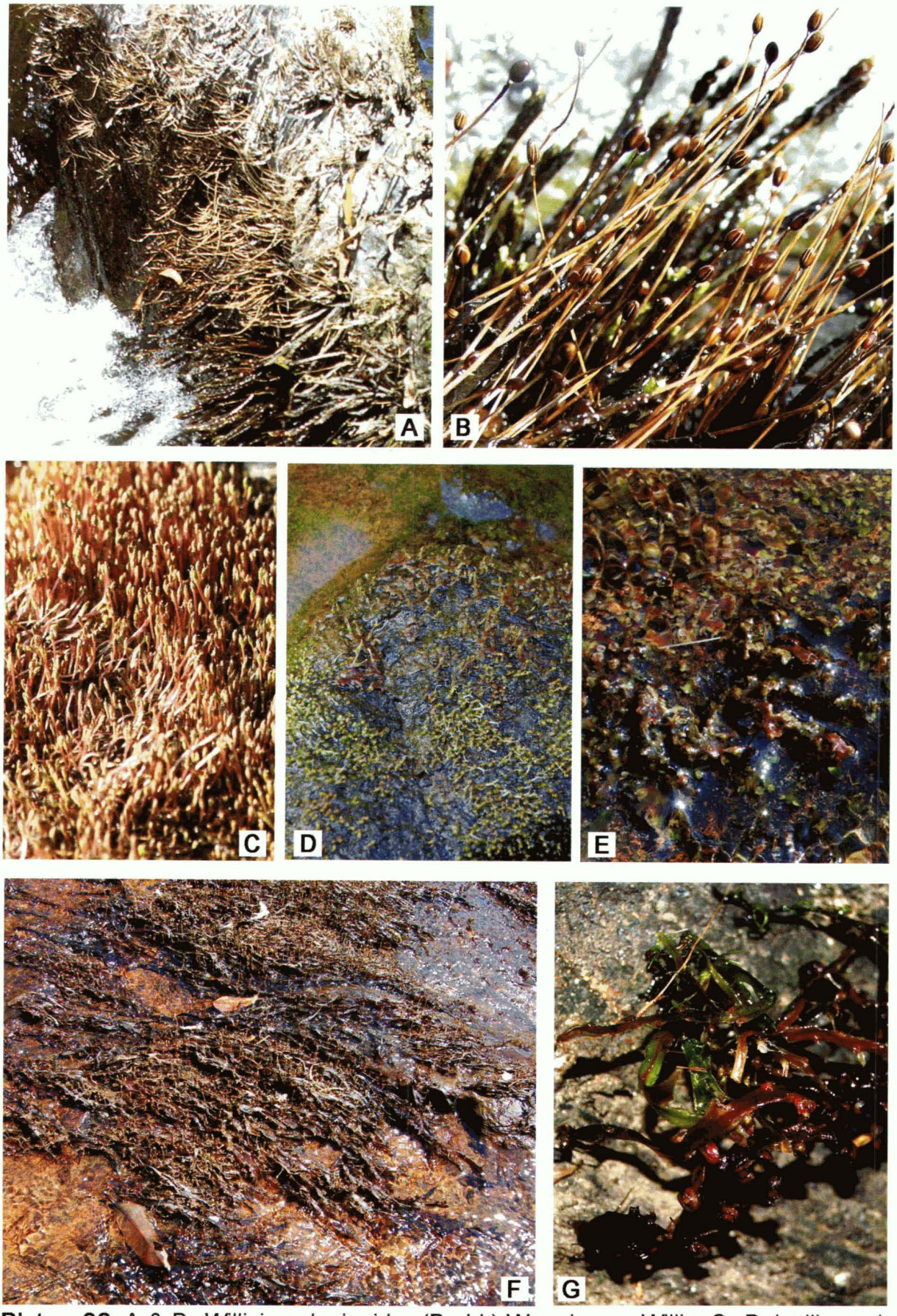


Plate 32. A & B. *Willisia selaginoides* (Bedd.) Warming ex Willis; C. *Dalzellia zeylanica* (Gard.) Wight; D. & E. *Polypleurum wallichii* (R.Br. ex Griff.) Warm; F & G. *Polypleurum stylosum* (Wight) Hall

free margins, hairy; stamens 2 or 3; stigma 3-lobed. Berry ovoid, beaked, to 5 mm long.

Fl. & Fr. : January – March.

Distribution: Endemic to Peninsular India. Riparian forests. *Amitha Bachan 99148* (Vazhachal, riparian forests, banks of Chalakkudy river, 240m); *Amitha Bachan 127402* (Malakkapara, riparian forest, banks of Sholayar river, 900 m).

Piper longum L., Sp. Pl. 29. 1753; Hook. f., Fl. Brit. India 5: 83. 1886; Wight, Icon. Pl. India Orient. t. 1928. 1853; Gamble, Fl. Pres. Madras 1205. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 376. 1996; Anil Kumar et al., Fl. Pathanamthitta 418. 2005; C.N. Sunil & Sivad., Fl. Alappuzha 606. 2009. *Chavica roxburghii* Miq., Syst. Piperac. 239. 1843. **Kattu-Thippali**.

Scandent or straggling shrubs, sometimes ascending and climbing. Leaves heteromorphic, ovate, 5-20 x 4-6 cm, acute at apex, cordate and oblique at base, 5-7-nerved, membranous, shining above; nerves impressed; petiole to 1-3 cm long, leaves of flowering shoots smaller with oblique base. Female spike stout, erect, to 3 cm long; peduncle 1.5 cm long; bracts peltate, orbicular. Male spike to 5 cm long, erect, slender; stamens 2. Berry 0.2 cm across, glabrous, black or deep red.

Fl. & Fr. : August-December.

Distribution: Indo-Malaysia. Evergreen forest. *Amitha Bachan 117794* (Orukombankutty, riparian forest floor, banks of Kuriyarkutty river, 450m).

Piper mullesua Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 20. 1825; N. Mohanan & Sivad., Fl. Agasthyamala 556. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 418. 2005. *Piper brachystachyum* Wall. ex Hook. f., Fl.

Brit. India 5: 87. 1886; Gamble, Fl. Pres. Madras 1206. 1925; Manilal, Fl. Silent Valley 231. 1988. **Kattuthippali, Kattukurumulaku**.

Slender climbers. Leaves elliptic, 7-14 x 2-6 cm, acuminate at apex, acute at base, 3-5 ribbed from base, secondary nerves prominent, glabrous. Female spike to 7 x 4 mm, erect, oblong; peduncle 3 mm long; male spike to 4 cm long, erect, slender; bracts peltate, orbicular; stamens 3. Berry 1.5 mm across, red; stigmas 3, spreading.

Fl. & Fr.: July-January.

Distribution: Endemic to Peninsular and Northeast India. Evergreen forests. *Amitha Bachan 123409* (Vazhachal, riparian forest, banks of Chalakkudy river, 240 m).

101. CHLORANTHACEAE R. Brown ex Lindl.

Coll. Bot. ad. t. 17. 1821.

SARCANDRA Gardner

Calcutta J. Nat. Hist. 6: 348. 1846.

Sarcandra chloranthoides Gard., Calcutta J. Nat. Hist. 6: 348. 1846; Wight, Icon. Pl. India Orient. t. 1946. 1853. Sasidh. & Sivar., Fl. Pl. Thrissur For. 376. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 557. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 419. 2005. *Chloranthus brachystachya* sensu Hook. f., Fl. Brit. India 5: 100. 1886, *p.p., non* Blume 1829; Gamble, Fl. Pres. Madras 1211. 1925. *Sarcandra irvingbaileyi* Swamy, Proc. Natn. Inst. Sci. India 19: 301. 1953. *Sarcandra grandifolia* (Miq.) Subram. & Henry, Bull. Bot. Surv. India 12: 5. 1972; Manilal, Fl. Silent Valley 232. 1988. *Chloranthus grandifolius* Miq., Fl. India Bat. 1: 802. 1856.

Erect evergreen shrubs to 1.5m high; branchlets glabrous, terete, broader at nodes. Leaves simple, opposite, elliptic- obovate, to 17 x 6 cm,

acute at base, acuminate at apex, dentate-serrate, glabrous; nerves to 8 pairs. Flowers in terminal, trichotomous spikes to 5-10 cm long, unisexual, clustered; bracts yellow, petalloid, 0.6 cm long, perianth absent; stamen 1, filaments and connectives broad, thick; ovary 1-locular, 1- ovuled, stigma sessile, truncate. Berry ovoid, to 8 mm, purplish-black, smooth.

Fl. & Fr. : December – May.

Distribution : Endemic to India and Sri Lanka. Evergreen forests. *Amitha Bachan 99196* (Malakkapara, evergreen riparian, banks of Sholayar river, 1000 m).

102. MYRISTICACEAE R. Br.

Prodr. 399. 1810.

Key to Genera

1a. Leaves 3-6 cm wide; capsule ellipsoid, rusty tomentose.....**Knema**

1b. Leaves 5-12 cm wide; capsule globose, pubescent.....2

2a. Anther column sessile; capsule under 3 cm.....**Gymnacranthera**

2b. Anther column stipitate; capsule > 3 cm.....**Myristica**

GYMNACRANTHERA Warburg

Ber. Oentsch. Bot. Ges. 13: 90, 91, 94. 1896.

Gymnacranthera farquhariana (Hook.f. & Thomson) Warb., Monogr. Myris. 365. 1897; Sasidh. & Sivar., Fl. Pl. Thrissur For. 377. 1996. *Myristica farquhariana* Hook. f. & Thomson, Fl. India 162. 1855, *non* Hook. f. 1886. *Myristica canarica* Bedd. *ex* King, Ann. Roy. Bot. Gard. (Calcutta) 3: 306. t.138. 1891. *Gymnacranthera canarica* (Bedd. ex King) Warb., Monogr. Myris. 368. 1897; Gamble, Fl. Pres. Madras 1212. 1925; N. Mohanan & Sivad., Fl. Agasthyamala 558. 2002. *Gymnacranthera*

eugeniifolia (A.DC.) Sinclair, Gard. Bull. Singapore 16: 447. 1958; Anil Kumar *et al.*, Fl. Pathanamthitta 420. 2005. **Unda-Payin.**

Tall evergreen dioecious trees to 30 m high, branchlets densely brown, pubescent. Leaves simple, alternate, estipulate, oblong or elliptic-lanceolate, to 25 x 10 cm, obtuse at base, acuminate at apex, entire, coriaceous, glabrous, glaucous beneath; lateral nerves 8-17 pairs, pinnate; petiole 1-1.5 cm long, stout, grooved above. Flowers unisexual, yellow; males in axillary and lateral, panicles; females 6-10 in axillary racemes; perianth tubular; lobes 4, pubescent; stamens 6-12, united into a sessile column; ovary superior, ovoid, 1-celled, ovule 1. Capsule, globose, to 3 cm across, glabrous; seed one, globose, 1.6 cm across, pale brown; aril laciniate, as long as seeds.

Fl. & Fr. : March – April.

Distribution : Indo-Malaya. Along banks of rivers in evergreen forests. *Amitha Bachan 123457* (Vazhachal-Karanthodu, evergreen riparian forests, banks of Chalakudy river, 350 m).

KNEMA Loureiro

Fl. Cochinch. 604. 1790.

Knema attenuata (Hook. f. & Thomson) Warb., Monogr. Myris. 590. 1897; Gamble, Fl. Pres. Madras 1215. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 377. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 558. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 420. 2005. *Myristica attenuata* Wall. ex Hook. f. & Thomson Fl. India 157. 1855; Hook. f. & Thomson in Hook. f., Fl. Brit. India 5: 110. 1886. *Myristica corticosa* Bedd., Fl. Sylv. t. 278. 1872. **Chorakali.** **Plate 33. E**

Medium sized evergreen trees, with radiating branches; branchlets rusty tomentose. Leaves simple, alternate, distichous, estipulate; elliptic-oblong, to 20 x 6 cm, acuminate at apex, rounded at base; tomentose below; nerves to 18 pairs, parallel; petiole 1-1.5 cm long, stout, grooved above, rusty pubescent when young and glabrous when mature. Cymes axillary, peduncled, densely tomentose; pedicels 7-8 mm long. Male: 1-6 flowered, 7 mm across; perianth 3-lobed to the base; lobes triangular; spreading; stamens 12-14, arranged along the rim of the stipitate disc, anthers vertical. Female: 1-3 flowered; pedicel 7-8 mm long; perianth larger than in males, rusty tomentose; ovary 1-celled. Capsule ellipsoid, cuspidate at apex, to 4 x 2 cm, 2-valved, rusty tomentose; seed 1, ellipsoidal; aril brilliant crimson.

Fl. & Fr. : December – June.

Distribution : Endemic to the Western Ghats. Evergreen forests, usually along riparian forests. *Amitha Bachan 98922* (Karanthodu, evergreen riparian forest, banks of Chalakudy river, 400 m).

MYRISTICA Gronovius

Fl. Orient. 141. 1755, *nom. cons.*

Key to species

1a. Leaves coriaceous, lower surface glaucous; peduncle stout.....
.....**M. beddomei**

1b. Leaves chartaceous, lower surface brownish; peduncle slender.....
.....**M. malabarica**

Myristica beddomei King, Ann. Roy. Bot. Gard. (Calcutta) 3: 291, t. 118. f.1-8,1891, subsp. **beddomei**: de Wilde, Blumea 42: 151. 1997; Gamble, Fl. Pres. Madras 1214. 1915. *Myristica dactyloides auct. non* Gaertn. 1788; Sinclair, Gard. Bull. Singapore 23: 445. 1968; Manilal, Fl. Silent

Valley 233. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 378. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 559. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 421. 2005. *Myristica laurifolia auct. non* Hook. f. & Thomson Fl. India 163. 1855; Hook. f., Fl. Brit. India 5: 103. 1886. *Myristica laurifolia* var. *lanceolata* Hook.f., Fl. Brit. India 5: 103. 1886. *Myristica contorta* Warb., Monogr. Myris. 5-7. 1897; Gamble, Fl. Pres. Madras 1214. 1925. **Pathripoo, Kattu-Jhadikka.** **Plate 33. C & D**

Dioecious evergreen trees, to 25 m high; branchlets glabrous except for terminal bud and inflorescence; leaves simple, alternate, distichous, estipulate, oblong or elliptic-ovate, 14-24 x 5-10 cm, acute or round at base, acute at apex, entire, glabrous, shining above and glaucous beneath, coriaceous; petiole 1-2.5 cm long, grooved above, glabrous; lateral nerves 10-25 pairs, pinnate, prominent. Flowers unisexual, white. Male flowers: 10-20 together in short axillary dense clusters; Female flowers: generally 3-4 in the heads; ovary superior, sessile, 1-celled, ovule 1. Capsule, ovoid, 3-6 x 2-5 cm, apiculate, grooved on one side along the suture, pericarp rufous pubescent when young, thick, succulent; seed one, ovoid; aril orange red, encircling the seed.

Fl. & Fr. : December – June.

Distribution: Endemic to South India and Sri Lanka. Forests, along swamps and riparian forests. *Amitha Bachan 123441* (Sholayar-Ambalapara, riparian evergreen, banks of Sholayar river, 750 m); *Amitha Bachan 117748* (Kulamali-Sholayar, stream bank vegetation, banks of Kulamali stream draining to Sholayar reservoir, 700 m).

Note : Many authors considered *Myristica beddomei* King and *M. dactyloides* Gaertn. as conspecific. de Wilde (1997) after having a critical study on Southern Asian and Malaysian *Myristica* concluded that both

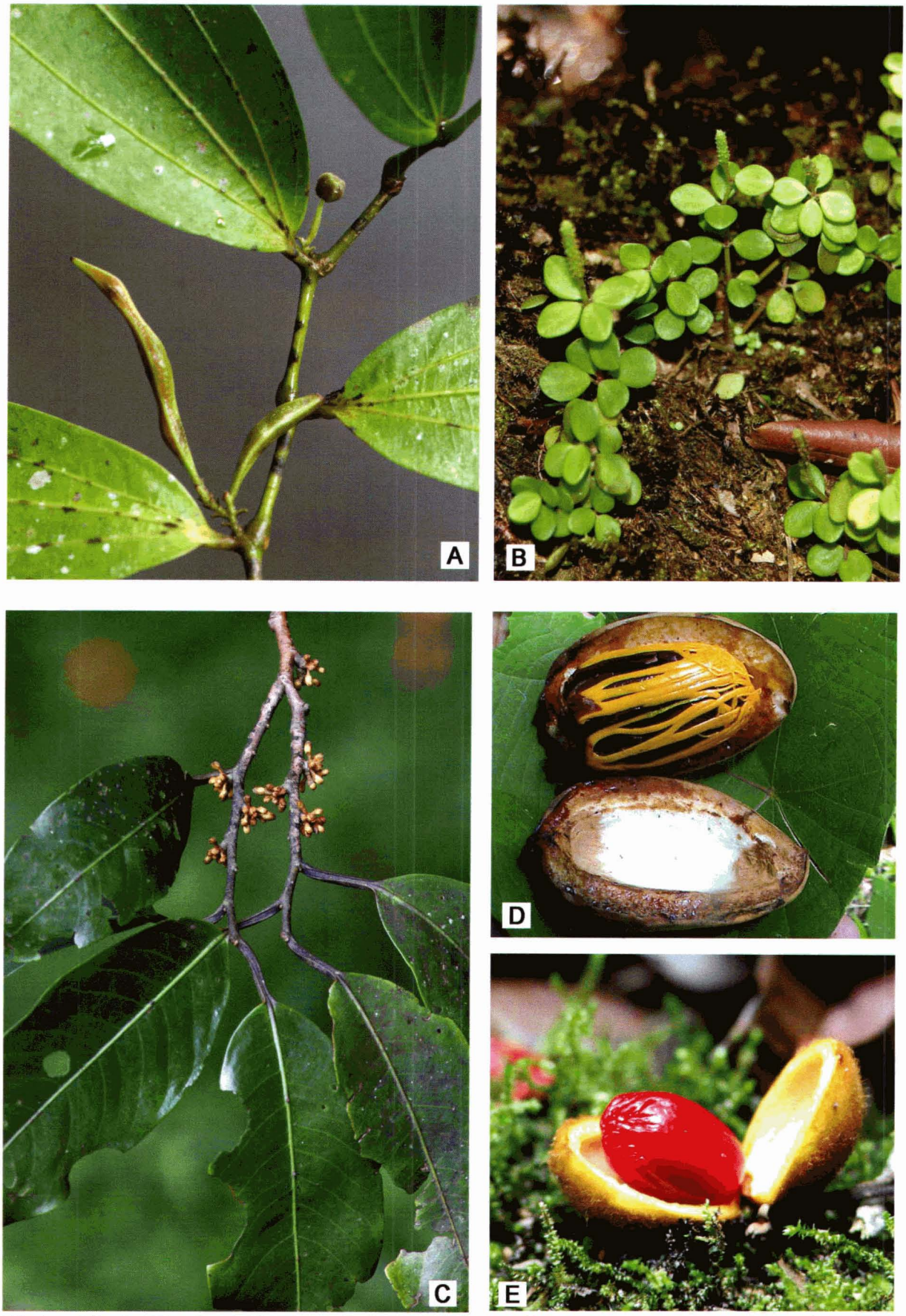


Plate 33. A. *Thottea siliquosa* (Lam.) Ding Hou; B. *Peperomia tetraphylla* (G.Forst.) Hook. & Arn.; C & D. *Myristica beddomei* King subsp. *beddomei*, C. Flowering twig, D. Fruit; E. Fruit of *Knema attenuata* (Hook. f. & Thomson) Warb.

M. beddomei King and *M. dactyloides* Gaertn. as distinct. He recognized three varieties under *M. beddomei* King, of which our specimen agrees with the typical variety var. *beddomei*. *M. dactyloides* Gaertn. (*sensu* de Wilde) is endemic to Sri Lanka.

Myristica malabarica Lam., Acad. Roy. Sci. Mem. Math. Phys. (Paris) 162. 1791; Hook. f. & Thomson Fl. India 163. 1855; Hook. f., Fl. Brit. India 5: 103. 1886; Gamble, Fl. Pres. Madras 1213. 1925; Manilal, Fl. Silent Valley 233. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 378. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 559. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 421. 2005. **Pathri, Pathripoo**.

Medium sized trees with greenish-black, tuberculate-lenticellate bark; sap red; branchlets glabrous. Leaves elliptic-oblong, to 20 x 10 cm, acute at apex, obtuse or rounded at base, glabrous; nerves to 8-14 pairs, obscure; petiole 2.5 cm long. Panicle to 5 cm across; peduncle slender. Flowers unisexual, white; Male: in axillary cymes or from the old axils below the leaves, 7.5 mm long; perianth yellow, urceolate, 3-lobed at apex; androphore 6 mm long, shortly stipitate; anthers 10-20, 2.5 mm long. Capsule oblong, to 7 x 3.5 cm, pubescent, seed one, oblong, obtuse, slightly flattened on one side, aril yellow, irregularly lobed, laciniate, extending to the apex of the seed.

Fl. & Fr. : December – April.

Distribution : Endemic to the Western Ghats; Vulnerable, very rare. Evergreen forests. *Amitha bachan 98903* (Vazhachal, Karanthodu, riparian evergreen forest, Banks of Chalakudy river, 400 m).

Note: Fruits of *Myristica beddomei* King and *M. malabarica* Lam. are extracted for their aril. It is one of the important Non-Timber Forest Produce (NTFP) collected by the tribes. Massive drying out of the *Myristica* trees was observed from many parts of the study area where

the forest is heavily fragmented or degraded. This is intensively seen near reservoirs, road cutting, clearance for electricity lines and also near settlements. Unscientific logging of branches for fruit collection also found badly affecting the trees.

103. LAURACEAE Juss.

Gen. Pl. 80. 1789.

Key to genera

1a. Stamens of 3rd row, when present with extrorse anthers.....2

1b. Stamens of all rows with introrse anthers 4

2a. Anthers 2-celled..... ..... **Cryptocarya**

2b. Anthers 4-celled 3

3a. Leaves opposite or sub opposite, rarely alternate, usually 3 or more ribbed.....**Cinnamomum**

3b. Leaves alternate, penninerved..... ..... **Phoebe**

4a. Fertile stamens 9 or 12 or more; involucral bracts persistent in flower; leaves alternate or sub opposite, peninerved..... **Litsea**

4b. Fertile stamens 6 or 9, involucral bracts deciduous in flower, leaves sub-verticillate or alternate, penninerved or 3-ribbed.....5

5a. Fertile stamens 6; involucral bracts early deciduous; leaves alternate or sub verticillate, penninerved. ..... **Neolitsea**

5b. Fertile stamens 9; involucral bracts deciduous in flower; leaves usually subverticillate, 3-ribbed or penninerved ..... **Actinodaphne**

ACTINODAPHNE C.G.D. Nees

In Wall., Pl. Asiat. Rar. 2: 61. 1831.

Actinodaphne malabarica Balakr., J. Bomb. Nat. Hist. Soc. 63: 329. 1967; Sasidh. & Sivar., Fl. Pl. Thrissur For. 379. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 422. 2005. *Actinodaphne hirsuta* Hook.f., Fl. Brit. India 5: 152. 1886, non Blume 1851; Gamble, Fl. Pres. Madras 1231. 1925. **Eyoli**.

Medium sized trees, young shoots densely fulvous tomentose. Leaves simple, subverticillate, opposite or subopposite, estipulate, elliptic or elliptic-lanceolate, 8-25 x 2-6 cm, acute or attenuate at base, acuminate at apex, chartaceous; lateral nerves 8-12 pairs, pinnate; Flowers unisexual, yellowish. Male flowers: in densely tomentose racemes of 2.5 cm long; tepals 6, subequal, oblong, obtuse, silky brown tomentose; stamens 9, in 3 rows; filaments 2-galndular, densely hispid; anthers 4-celled, oblong, introrse. Female flowers: staminodes 9, in 3 rows, those of row 3 with 2-glands; ovary half inferior, ovoid, attenuate into the style; stigma dilated. Berry, globose, to 1 cm across, seated in a perianth cup, red.

Fl. & Fr. : August-January

Distribution: Endemic to Southern Western Ghats, Evergreen and semi-evergreen forests. *Amitha Bachan 98898* (Malakkapara, riparian forest, banks of Sholayar river, 900 m).

CINNAMOMUM Schaeffer

Bot. Exped. 74. 1760, *nom. cons.*

Key to species

1a. Flowers few, axillary; leaves linear-lanceolate .....**C. riparium**

1b. Flowers many in axillary or terminal panicles; leaves not linear-lanceolate 2

2a. Leaves glabrous, 10-30 cm long.....**C. malabatrum**

2b. Leaves yellow pubescent beneath, less than 14 cm long.....
.....**C. sulphuratum**

Cinnamomum malabatrum (Burm.f.) Blume, Bijdr. 568. 1826; Kosterm., Bull. Bot. Surv. India 25:102. 1983; Manilal, Fl. Silent Valley 234. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 380. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 423. 2005. *Laurus malabatrum* Burm. f., Fl. India 92. 1768.*Cinnamomum iners* sensu Gamble, Fl. Pres. Madras 1224. 1925, *non* Reinw. ex Blume 1826. **Vayana.** **Plate 34. D**

Medium sized trees, to 20 m high, bark reddish-brown; Leaves simple, opposite or subopposite, estipulate, elliptic-oblong, oblong or oblong-lanceolate, 10-30 x 3-9 cm, acute at base, acute or acuminate at apex, entire, glabrous above, highly aromatic when bruised, coriaceous; 3-ribbed from the base. Flowers bisexual, in axillary and pseudo terminal paniculate cymes to 25 cm long. Perianth tube shallow, 1 mm broad; tepals 6, ovate, 3-3.5 mm long, acute. Stamens 9 perfect, in 3 rows; filaments pilose, slender, slightly longer than the anthers; anthers 4-celled; ovary half inferior, 2 mm, ellipsoid; stigma small, peltate. Berry, to 8 x 10 mm, subtended by shallow fleshy cup.

Fl. & Fr. : March-April

Distribution: Endemic to Southern Western Ghats. Evergreen and semi-evergreen forests. *Amitha Bachan 72068* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

Cinnamomum riparium Gamble, Bull. Misc. Inform. Kew 1925. 128. 1925 & Gamble, Fl. Pres. Madras 1224. 1925; Kosterm., Bull. Bot. Surv.

India 25:114. 1983; Sasidh. & Sivar., Fl. Pl. Thrissur For. 381. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 567. 2002. Attukaruka. **Plate 34.A**

Shrubs or small trees, riparian. Leaves simple, opposite, petiole 4mm, lamina 4.5-7.5 x 1-2 cm, linear, lanceolate, base acute, slightly unequal, tip acute or shortly acuminate, 3-ribbed just above the base, intercostae obscure. Flowers few, small 5mm long, grey- pubescent, in subumbellate cymes. Perianth 6, ovate-obtuse, 2x3mm. Stamens 9 perfect; anthers 4 celled; ovary sessile. Fruit a berry, seated in the cup shaped perianth tube.

Fl. & Fr.: February-March

Distribution: Endemic to Southern Western Ghats, Vulnerable. Along stream banks, in the lower elevation forests. *Amitha Bachan 72065* (Vazhachal, riparian forest, banks of Chalakkudy river, 250 m).

Cinnamomum sulphuratum Nees in Wall., Pl. Asiat. Rar. 2: 74. 1831; Hook. f., Fl. Brit. India 5: 132. 1886; Gamble, Fl. Pres. Madras 1225. 1925; Kosterm., Bull. Bot. Surv. India 25:114. 1983; Manilal, Fl. Silent Valley 235. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 381. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 567. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 424. 2005.

Trees, to 8 m high. Leaves simple, opposite or sub-opposite, estipulate, elliptic, elliptic-oblong to elliptic-ovate, 4-22 x 2-9 cm, acute obtuse or shortly cuneate at base, acute or obtusely acuminate or acuminate at apex, entire, coriaceous; 3-ribbed from at or a little above the base; side ribs reaching nearly to the apex, prominent beneath. Flowers bisexual, in axillary or terminal panicles, branchlets few slender; perianth tube 1-1.5 mm long, densely yellow pilose on both sides; tepals 6, ovate, 2-4 mm long, acute, yellow pilose on both sides; stamens 9

perfect; ovary half inferior, ellipsoid, as long as the style, stigma minute, peltate. Berry, 1 x 1.5 cm, cup-shaped.

Fl. & Fr.: March-April

Distribution: Endemic to Western Ghats. Evergreen and shola forests. *Amitha Bachan 72089* & *99187* (Vazhachal, riparian forest, banks of Chalakkudy river, 220m); *Amitha Bachan 98769* (Sholayar, riparian forest, banks of Sholayar river, 700 m).

CRYPTOCARYA R. Br.

Prodr. Fl. Nov. Holland. 402. 1810.

Cryptocarya anamalayana Gamble, Bull. Misc. Inform. Kew 1925: 126. 1925 & Gamble, Fl. Pres. Madras 1218 1925. **Plate 34. A & B**

Evergreen trees, to 8 m high; young shoots tomentose. Leaves simple, alternate, estipulate, elliptic, elliptic-obovate, 8-16 x 2-6 cm, obtuse, acute or cuneate at base, obtusely acuminate at apex, entire, coriaceous; lateral nerves 6-10 pairs, pinnate, nervules transverse, prominent; nerves and nervules fulvous tomentose beneath. Flowers bisexual, in short axillary fulvous-tomentose cymose panicles 2-5 cm long; perianth 2-5 mm long, tube ultimately narrowed at the top; lobes 6, in 2 rows, subequal, tomentose; stamens 9 perfect, in 3 rows, those of the 2 outer series with eglandular, filaments and introrse anthers, those of the third series with 2 glandular filaments and extrorse anthers; those of the fourth series replaced by 3 stipitate staminodes; anthers 2-celled; ovary sessile, half inferior, enclosed in the tube; style short exserted. Drupe, ovoid, 1.5 x 1.2 cm, smooth surrounded by the perianth tube.

Fl. & Fr. : December-April

Distribution: Endemic to Southern Western Ghats, Endangered. Evergreen forests, vary rare. *Amitha Bachan 98740* (Chandanthodu,

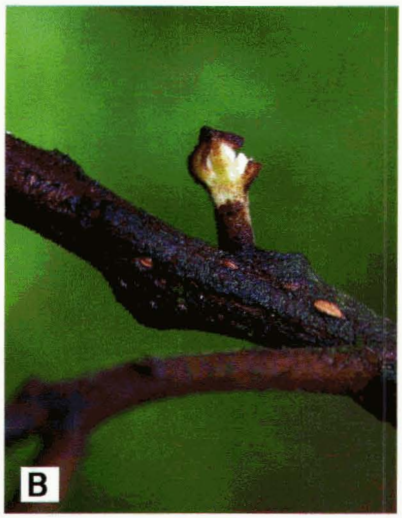


Plate 34. A & B. *Cryptocarya anamalayana* Gamble, A. Fruiting twig, B. young bud; C. *Cinnamomum riparium* Gamble; D. *Cinnamomum malabatrum* (Burm.f.) Blume; E. *Salix tetrasperma* Roxb. F. *Ardisia sonchifolia Mez*.

Sholayar, streamside vegetation, stream draining to Sholayar reservoir, 800 m).

Note: It is a lesser known species originally described by Gamble (1925). Its distribution is highly restricted to few locations in its distribution range. In the present study we could locate only few trees from the Sholayar region, near the Sholayar reservoirs along stream banks. Its original habitat must be submerged under the reservoir.

LITSEA Lamarck

Encycl. 3: 574. 1792, *nom. cons.*

1a. Leaves glabrous beneath; umbellules sessile.....**L. coriacea**

1b. Leaves pubescent or tomentose beneath; umbellules in racemes.. ..2

2a. Leaves large up to 25 cm, main nerves 10-15 pairs.....**L. floribunda**

2b. Leaves small under 10 cm, main nerves 4-8 pairs.....**L. wightiana**

Litsea coriacea (Heyne ex Meisner) Hook.f., Fl. Brit. India 5: 166. 1886; Gamble, Fl. Pres. Madras 1236. 1925; Manilal, Fl. Silent Valley 236. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 382. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 569. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 425. 2005. *Tetranthera coriacea* Heyne ex Meisner in DC., Prodr. 15: 186. 1864. **Vettithali.**

Dioecious trees, to 12 m high. Leaves simple, alternate, estipulate, elliptic-lanceolate or elliptic-ovate, to 17 x 8 cm, acute or cuneate at base, acute or acuminate at apex, entire, coriaceous; lateral nerves 6-9 pairs, pinnate, slender, prominent. Flowers unisexual, white, in 4-flowered axillary, subsessile, crowded, umbels; bracts 4, silky; perianth tube funnel-shaped, finely silky, lobes 6; stamens 12, in 4 rows. Ovary alf inferior, ovoid; style slender; stigma small, erect. Berry, ovoid, `1.2 cm long, greenish-white, seated on a thickened perianth tube.

Fl. & Fr. : December-January

Distribution : Endemic to Western Ghats,. Evergreen forests especially on the streamside vegetation. *Amitha Bachan 98746* (Thellikkal, riparian, banks of Thellikkal river, 500 m).

Litsea floribunda (Blume) Gamble, Fl. Pres. Madras 1238.1925; Manilal, Fl. Silent Valley 236. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 382. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 569. 2002; Anil *Kumar et al.*, Fl. Pathanamthitta 425. 2005. *Cylicodaphne floribunda* Blume, Mus. Bot. Lugd.-Bat. 1: 387. 1851. *Litsea wightiana* Hook.f., Fl. Brit. India 5: 177. 1886. **Chevukodi, Pattuthali**.

Dioecious trees, to 15m high, Leaves simple, alternate, estipulate, petiolate, obovate-oblong, elliptic-oblong, 8-30 x 3-10 cm, acute at base, acute, or acuminate at apex, entire, glabrous above except midrib above and rusty tomentose beneath, coriaceous; lateral nerves 10-15 pairs, pinnate, prominent. Flowers unisexual, in axillary racemose umbellule, 6-8 in an umbellule; perianth lobes 6; stamens 12, in 4 rows; filaments hairy, those of rows 1 and 2 usually eglandular, those of rows 3 and 4 with 2-glands; anthers 4-celled, introrse; staminodes in female flowers as the stamens of males, those of the outer rows clavate or linear, those of the inner rows subulate and 2 glandular; ovary half inferior, stigma capitate. Berry, oblong, 1.2-1.8 cm long, seated on a turbinate perianth tube.

Fl. & Fr. : December – April

Distribution: Endemic to the Western Ghats, Evergreen, semi-evergreen and shola forests. *Amitha Bachan 99179* (Sholayar, riparian forest, banks of Sholayar river, 700 m).

Litsea wightiana (Nees) Hook. f. in Benth. & Hook. f., Gen. Pl. 3: 162. 1880, *p.p*, var. **wightiana**; Gamble, Fl. Pres. Madras 1238. 1925; N. Mohanan & Sivad., Fl. Agasthyamala 572. 2002. *Cylicodaphne wightiana* Nees in Wall., Pl. Asiat. Rar. 2: 68. 1831. **Chevukodi.**

Evergreen dioecious trees, to 15 m high; Leaves simple, alternate, estipulate, obovate or oblong, 6-16 x 3-8 cm, acute at base, obtuse at apex, margins often recurved, entire, glabrous above, rusty brown pubescent beneath, coriaceous; lateral nerves 4-8 pairs. Flowers in axillary racemose umbellules; perianth lobes 5, oblong, densely fulvous hairy; stamens 12, in 4 rows; filaments hairy, of rows 1 and 2 usually eglandular, those of 3 and 4 with 2-glands; anthers 4-celled, introrse; staminodes in female equal to the stamens in males; ovary globose, half inferior, 1 mm across, 1-celled, 1-ovuled, enclosed in perianth tube, pendulous. Berry ovoid, seated on the cup-shaped perianth tube.

Fl. & Fr. : March –July

Distribution : Endemic to Southern Western Ghats. Evergreen and Shola forests. *Amitha Bachan 98716* (Pullala-Nelliyampathy, streamside vegetation, stream draining to the Karappara river, 1200 m).

NEOLITSEA (Benth.& J.D. Hook.) Merr.

Philipp. J. Sci. 1, Suppl. 56. 1906, *nom. cons.*

Neolitsea cassia (L.) Kosterm., J. Sci. Res.(Jakarta) 1: 85. 1952; Sasidh. & Sivar., Fl. Pl. Thrissur For. 383. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 573. 2002. *Laurus cassia* L., Sp. Pl. 369. 1753. *Litsea zeylanica* Nees, Cinnam. Disp 1: 58, t.5. 1823; Wight, Icon. Pl. India Orient. t. 132. 1839; Hook. f., Fl. Brit. India 5: 178. 1886. *Neolitsea zeylanica* (Nees) Merr., Philipp. J. Sci. Suppl. 1: 57. 1906; Gamble, Fl. Pres. Madras 1239. 1925.

Medium sized trees; Leaves simple, alternate, opposite or in whorls elliptic-lanceolate or oblong-lanceolate, 8-24 x 3-7.5 cm, acute or attenuate at base, acute at apex, entire; coriaceous; 3-ribbed near the base, faint; lateral nerves 4-8 pairs, pinnate. Flowers unisexual, yellowish-green, in sessile umbels on extremely short branchlets at internodes; tepals 4, ovate, 2-3 mm long, acute; stamens 6, in 3 rows; those of 2 outer rows eglandular, those of the inner row 2-glandular opposite the first row; anthers 0.5 mm long, introrse; ovary half inferior, ovoid; staminodes 6, in 3 rows. Drupe globose, 10-12 mm across, seated on disc like, crenate perianth cup.

Fl. & Fr. : March-April.

Distribution : India, Sri Lanka, Malaysia, Shola and evergreen forests. *Amitha Bachan 99028* (Orukombankutty, riparian forest, banks of Chalakkudy river, 450 m).

PERSEA Mill. *nom. cons.*

Persea macrantha (Nees) Kosterm., Reinwardtia 6: 193. 1962; Sasidh. & Sivar., Fl. Pl. Thrissur For. 383. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 573. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 426. 2005. *Machilus macrantha* Nees in Wall., Pl. Asiat. Rar. 2: 70. 1831; Hook. f., Fl. Brit. India 5: 140. 1886; Gamble, Fl. Pres. Madras 1227. 1925. **Kulamavu**

Medium to large evergreen. Leaves simple, alternate, clustered at the tip of branchlets, estipulate, elliptic-oblong or ovate-oblong, 8-24 x 4-12 cm, oblique or acute at base obtuse or obtusely acute at apex, glabrous, glaucous beneath, coriaceous; lateral nerves 6-12 pairs, pinnate. Flowers bisexual, 10-12 mm across, pale yellow, in terminal panicles or from the upper axils; tepals 6, subequal, in 2 series, obovate, 5 mm, puberulous; persistent, spreading or reflexed in fruit; stamens 9

perfect, anthers 4-celled; staminodes 3, in row 4 and opposite the row 2, 4 mm long, stalked, arrow-shaped, pubescent; ovary half inferior, sessile, 1-celled; ovule 1, pendulous. Berry globose, 15-18 mm across.

Fl. & Fr. : December -May

Distribution : Endemic to Peninsular India and Sri Lanka. Evergreen, semi-evergreen forests, also in sacred groves. *Amitha Bachan 127417* (Kuriyarkutty, riparian, banks of Thekkadiyar, 500 m).

PHOEBE Nees.

Phoebe lanceolata Nees, Syst. Laurin. 109. 1836; Hook. f., Fl. Brit. India 5: 141. 1886; Gamble, Fl. Pres. Madras 1228. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 384. 1996.

Small evergreen trees. Leaves simple, alternate, estipulate, clustered at the tip of branchlets, 8-25 x 2.5-6.5 cm, elliptic, elliptic-oblanceolate, cuneate at base, long acuminate at apex, entire, glabrous, coriaceous; lateral nerves 6-13 pairs, pinnate. Flowers bisexual, 2-5 mm across, yellowish-green, in axillary, slender panicles; perianth lobes 6, ovate, tomentose, unequal, accrescent; stamens 9 perfect, in 3 rows; anthers 4-celled; ovary half inferior, sessile, globose, pubescent. Drupe, ovoid or ellipsoid, 1.2 cm long, glabrous, black.

Fl. & Fr. : January-March

Distribution : India and Myanmar, Semi-evergreen and evergreen forests, also in secondary forests. *Amitha Bachan 99178* (Sholayar, riparian forest, banks of Sholayar river, 700 m).

104. **ELAEAGNACEAE** Juss.

Gen. Pl. 74. 1789.

ELAEAGNUS Linnaeus

Sp. Pl. 121. 1753

Elaeagnus conferta Roxb., Fl. India 1: 460. 1820; Gamble, Fl. Pres. Madras 1246. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 384. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 427. 2005. *Elaeagnus latifolia* Bedd., Fl. Sylv. t. 180.1872, *non* L. 1753; Hook. f., Fl. Brit. India 5: 202. 1886.

Thorny climbers, densely covered with silvery scales; thorns axillary, straight, 1-2 cm long. Leaves ovate, to 12 x 6 cm, acute, glabrous above, silvery-white, or coppery below; nerves 5 pairs, indistinct. Flowers bisexual, 3-6 in axillary fascicles, pedicelled; perianth greenish white, 1 cm long, urceolate, gamotepalous, lobes 4, ovate; stamens 4, filaments free, broadened below; anthers transverse; ovary 1-celled; inferior; ovules solitary; style filiform, stigma lateral. Drupe large, oblong, 2.5 cm, covered with thickened perianth base, 2.6 x 1.2 cm, reddish, fleshy.

Fl. & Fr. : December-March.

Distribution : Indo-Malaysia and China. Evergreen and semi-evergreen forests. *Amitha Bachan 117759* (Kulamali – Sholayar, evergreen riparian vegetation, banks of Kulamali stream draining to Sholayar river, 800 m).

105. LORANTHACEAE Juss.

Ann. Mus. Natl. Hist. Nat. 12: 292. 1808.

Key to genera

1a. Leaves penninerved.....2

1b. Leaves ribbed from base..... **Helicanthes**

2a. Petals 4..... **Helixanthera**

2b. Petals 5-6, united..... **Dendrophthoe**

DENDROPHTHOE C. F. P. Martius

Flora 13. 1830.

Dendrophthoe falcata (L. f.) Etting., Denkschr. Kaisel. Akad. Wiss. Math.-Naturwiss. Klasse 32: 52,53,58. t.13. 1871, var. **falcata**; Manilal, Fl. Silent Valley 239. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 385. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 579. 2002; C. N. Sunil & Sivad., Fl. Alappuzha 612. 2009. *Loranthus* falcatus L. f., Suppl. Pl. 211. 1781. *Loranthus longiflorus* Desr. in Lam., Encycl. 3: 598. 1792; Hook. f., Fl. Brit. India 5: 214. 1886; Gamble, Fl. Pres. Madras 1253. 1925. *Loranthus longiflorus* Desr. var. *falcata* (L. f.) Kurz, For. Fl. Burma 2: 321. 1877; Hook. f., Fl. Brit. India 5: 215. 1886; Gamble, Fl. Pres. Madras 1253. 1925. *Loranthus longiflorus* Desr. *var. amplexifolia* (DC.) Thwaites, Enum. Pl. Zeyl. 134. 1859; Hook. f., Fl. Brit. India 5: 215. 1886; Gamble, Fl. Pres. Madras 1253. 1925. **Ittilkanni.**

Epiphytic and parasitic shrubs; branches erect drooping, stout, terete, smooth. Leaves opposite, ovate-falcate, to 18 x 7 cm, acute or obtuse at apex, cordate at base, glabrous, thick, coriaceous; lateral nerves 4 or 5 pairs. Flowers in racemes, axillary; bracts ovate, obtuse; racemes to 8 cm long, axillary, drooping, glabrous. Flowers many, closely packed; pedicel 3 mm long; calyx cupular; corolla 5 cm long, pink, lobes

greenish, 5-6; style glabrous, stigma slightly wider than style. Berry ovoid, crimson to 10 mm across, smooth.

Fl. & Fr. : October – May

Distribution : Indo-Malaysia to Australia. Moist forests to lower plains.

Amitha Bachan 117662 (Vazhachal, riparian forests, banks of Chalakudy river, 220 m).

HELICANTHES Danser

Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk. Tweede Sect. 29(6): 5. 1933.

Helicanthes elastica (Desr.) Danser, Verh. Akad. Wet. afd. Natuurk. Sect. 2. 29: 55. 1933; Manilal, Fl. Silent Valley 239. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 385. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 580. 2002; C. N. Sunil & Sivad., Fl. Alappuzha 612. 2009. *Loranthus elasticus* Desr. in Lam., Encycl. 3: 599. 1792; Hook. f., Fl. Brit. India 5: 216. 1886; Gamble, Fl. Pres. Madras 1254. 1925. *Dendrophthoe elasticus* (Desr.) Danser, Bull. Jard. Bot. Buitenz. ser. 3, 10: 308. 1929; Anil Kumar *et al.*, Fl. Pathanamthitta 428. 2005. **Velutha-Ittilkanni.**

Erect parasitic shrubs; branches glabrous, woody, thickened at nodes. Leaves simple, opposite, ovate, to 8 x 4 cm, acute or obtuse at apex, obtuse or truncate at base, ribbed from base, glabrous. Flowers axillary, fascicled, 1-3-together, sessile; bracts minute; calyx tube cupular, truncate; corolla lobes 5, spirally twisted, 2.5 cm long, pale pink whitish, tube pubescent inside; stamens 5; filaments and style slender, crimson. Berry globose, to 0.5 cm across, red.

Fl. & Fr. : December – March.

Distribution : Endemic to the Western Ghats. Parasitic on trees of Moist forests to lower plains. *Amitha Bachan 117643* (Athirappilly, riparian forests, banks of Chalakkudy river, 100 m).

HELIXANTHERA Loureiro

Fl. Cochinch. 142. 1790.

Helixanthera lepidophylla (Walp.) Danser, Bull. Jard. Bot. Buitenz. ser. 3, 10:317. 1929; *Loranthus lepidophyllus* Walp., Ann. 2:730. 1852. *Loranthus wightii* Hook. f., Fl. Brit. India 5: 207. 1886; Gamble, Fl. Pres. Madras 1251. 1925.

Epiphytic and parasitic shrubs on evergreen forest trees. Branches terete, densely puberulus, rugose. Leaves obovate to orbicular, to 4-8 x 1.5-3 cm, obtuse at apex, cuneate at base, puberulus; petiole 0.4-0.8 cm long; spike to 3 cm long, puberulus. Flowers many; bud 1.0 cm long; calyx rim hairy; corolla 0.7 cm long, lobes 4, free, puberulus, pinkish brown.

Fl. & Fr.: June- August.

Distribution: Endemic to Southern Western Ghats. Epiphytic on evergreen forest trees. *Amitha Bachan 117681* (Sholayar, riparian forest, banks of Sholayar river, 650 m).

106. BALANOPHORACEAE Rich.

Mem. Mus. Hist. Nat. 8: 429. 1822.

BALANOPHORA J. R. & G. Forster

Charact. Gen. 99, 100. 1776.

Balanophora fungosa J. R. & G. Forst., Char. Gen. Pl. 100. t. 50. 1776, subsp. **indica** (Arn.) Hansen, Dansk. Bot. Ark 28: 100. ff. 20 & 21. 1972; Manilal, Fl. Silent Valley 242. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 587. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 431. 2005. *Langsdorffia indica* Arn., Ann. Nat. Hist. 2:37. 1838. *Balanophora*

indica (Arn.) Wall. ex Griff., Trans. Linn. Soc. London 20: 95. 1846; Hook. f., Fl. Brit. India 5: 237. 1886; Gamble, Fl. Pres. Madras 1263. 1925.

Dioecious herbs; root parasite, fleshy; root stock globular, warted with lenticels; stem stout, very short, cylindric. Peduncle stout, to 12 cm long, 2 cm thick; covered by imbricating sheathing leaves. Flowers densely packed in globose or oblong, heads; male and female flowers dissimilar. Male inflorescence obovoid, perianth lobes 5, valvate, erect, yellowish; stamens 5, filaments united into a column; anthers horse-shoe-shaped. Female inflorescence globose heads, perianth absent; ovary 1-celledellipsoid. Fruit a 1-seeded capsule.

Fl. & Fr. : January – March.

Distribution: Indo-Malaysia and Australia. Root parasite in evergreen forests, Riparian evergreen forest at medium elevations. *Amitha Bachan 98751* (Sholayar-Karimala, Riparian vegetation, Karimala streamside, 1100 m).

107. EUPHORBIACEAE Juss.

Gen. Pl. 384. 1789.

Key to Genera

1a. Leaves 3-foliolate.....**Bischofia**

1b. Leaves simple.....2

2a. Flowers in cyathea; perianth absent; stamen 1.....**Chamaesyce**

2b. Flowers not in cyathea; perianth present; stamens 2 or more.....3

3a. Cells of ovary 1-ovuled.....4

3b. Cells of ovary 2-ovuled.....11

4a. Stamens 2 in male flowers..... **Macaranga**

4b. Stamens 7 to many in male flowers.....5

5a. Petals present in male flowers.....6

5b. Petals absent in male flowers.....8

6a. Filaments inflexed in bud; plants monoecious .....**Croton**

6b. Filaments erect in bud; plants dioecious 7

7a. Male sepals valvate; stamens 8-13, pistillode prominent.....
.....**Agrostistachys**

7b. Male sepals imbricate; stamens numerous, pistillode absent.....
..... **Paracroton**

8a. Filaments branched.....**Homonoia**

8b. Filament not branched..... 9

9a. Flowers monoecious; herbs..... **Acalypha**

9b. Flowers dioecious; shrubs or trees.....10

10a. Leaves glandular; fruit a capsule..... .....**Mallotus**

10b. Leaves eglandular; fruit a drupe..... .....**Trewia**

11a. Male flowers in spikes or racemes.....12

11b. Male flowers in axillary fascicles or shortly peduncled cymes or umbels.....14

12a. Ovary 1-celled.....**Antidesma**

12b. Ovary 2-4-celled.....13

13a. Racemes densely clustered on the trunk.....**Baccaurea**

13b. Racemes axillary, solitary or 2-3 together.....**Aporusa**

14a. Styles united into a conical or slender column, toothed at apex; ovary 4-15-celled.....**Glochidion**

14b. Styles otherwise; ovary 1-3-celled..... 15

15a. Petals present.....**Bridelia**

15b. Petals absent 16

16a. Filaments free, alternating with lobes of disc..... **Flueggea**

16b. Filaments variously united; disc not lobed.....**Phyllanthus**

ACALYPHA Linnaeus

Sp. Pl. 1003. 1753.

Acalypha indica L., Sp. Pl. 1003. 1753; Hook. f., Fl. Brit. India 5: 416. 1887; Gamble, Fl. Pres. Madras 1330. 1925; Airy Shaw, Kew Bull. 26. 206. 1972; C. N. Sunil & Sivad., Fl. Alappuzha 617. 2009.

Annual herbs, to 60 cm. Leaves broadly ovate, to 6 x 3 cm, round at base, acute or obtuse at apex, serrate, 5-nerved from base; petiole to 5 cm long. Inflorescences axillary spikes, to 6.5 cm long, monoecious, rachis ending in a triradiate hood at the tip. Male flowers above, minute, clustered without barcts; anthers vermiculiform. Female flowers bracteate; bracts foliaceous, many-nerved, toothed bracts, to 0.7 cm long; ovary hispid, 3-lobed; styles 3, each 2-fid. Capsules 3-valved, concealed by bract, hispid.

Fl. & Fr. : July – December.

Distribution: Indo-Malaysia and Tropical Africa. Forest floors. *Amitha Bachan 117630* (Vazhachal, riparian forest floor, banks of Chalakkudy river, 200 m).

AGROSTISTACHYS Dalzell

in Hooker's Kew J. 2: 41. 1850

Agrostistachys borneensis Becc., Nelle For. Borneo 331. 1902; Manilal, Fl. Silent Valley 244. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 391.

1996; N. Mohanan & Sivad., Fl. Agasthyamala 592. 2002. *Agrostistachys longifolia* (Wight) Trimen, Syst. Cat. Fl. Pl. Ceylon 81. 1885, *nom. illeg.*; Hook. f., Fl. Brit. India 5: 407. 1887; Airy Shaw, Kew Bull. Add. Ser. 4: 27. 1975; *Sarcoclinium longifolium* Wight, Icon. Pl. India Orient. tt. 1887, 1888. 1852. *Agrostistachys meeboldii* Pax & Hoffm. in Engl., Pflanzenr., Euphorb.-Chrozoph. 100. 1912; Gamble, Fl. Pres. Madras 1318. 1925.

Mulimpala. **Plate 35. A**

Small to medium trees with white latex. Leaves simple, alternate, clustered at the tips of branchlets, oblanceolate, to 9-30 x 3-5 cm, acute at apex, acute or attenuate at base, coriaceous; nerves to 10-18 pairs, regular, nervules indistinct; petiole flat, 0.5-1 cm long, stout, glabrous. Flowers unisexual, yellow; Male racemes axillary, slender; bracts broadly ovate, ciliate. tepals 8-10, biseriate, outer tepals connate, cupular, splitting into 2-5 valvate segments; inner tepals petalloid, ovate, obtuse fleshy, fimbriate alternating with outer petals; disc glands 5, large, alternating with inner tepals; stamens 10, exserted; outer 5 alternating with disc; inner 5 shortly connate, around pistillode; anthers versatile, Female flowers lax in shorter racemes; sepals and petals similar to male flowers. Capsule 0.7-1.5 cm across, 3-lobed, cocci globose, reddish, crustaceous, smooth; seeds globose, smooth, shining.

Fl. & Fr. : December – March.

Distribution : Indo-Malaya. Evergreen forests. *Amitha Bachan 98992, 72061* (Vazhachal, riparian evergreen forest, banks of Chalakkudy river, 220 m).

ANTIDESMA Linnaeus

Sp. Pl. 1027. 1753

Key to species

1a. Spikes branched; leaves under 10 cm..... **A. bunius**

2a. Spikes not branched; leaves to 20 cm..... **A. montanum**

Antidesma bunius (L.) Spreng., Syst. Veg. 1: 826.1825; Hook. f., Fl. Brit. India 5:358.1887; Gamble, Fl. Pres. Madras 1298. 1925; Airy Shaw, Kew Bull. 26 (2): 353 1972; Manilal, Fl. Silent Valley 245. 1988; Chakrab. & Gangop., J. Econ. Tax. Bot. 24: 12. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 595. 2002. *Stilago bunius* L., Mantissa Pl. 1: 122. 1767. .

Plate 35. B

Small trees; slightly pubescent when young; becomes glabrous, hard, waxy on maturity. Leaves simple, alternate, elliptic to elliptic-lanceolate, 6-10 x 2-3.5 cm, acuminate at apex, acute or obtusely acute at base; Flowers on axillary, unbranched, to 10 cm. Peduncles pubescent, basal 1/3 portion without flowers. Male flowers to 1.5 cm across; spikes glabrous; tepals 1-seriate, 4-5 lobed, pubescent without; disk lobed, surrounding the stamen. Stamens 3-5. Female flowers racemed, 0.2-0.3 cm across. Tepals 4-5 lobed. Ovary 2 cm across, bottle shaped, hairy without, 1-celled; stigma 3-4-lobed. Drupe ovoid, laterally compressed, to 0.5 cm across, reddish on ripening.

Fl. & Fr. : March-May.

Distribution: Indo-Malaysia to Australia and South China. Evergreen forests. *Amitha Bachan 98785* (Vazhachal, riparian forest, banks of Chalakkudy river, 240 m).

Antidesma montanum Blume, Bijdr. 1124. 1826; Chakrab. & Gangop., J. Econ. Tax. Bot. 24: 26. 2000. *Antidesma pubescens* Roxb. var. *menasu* Tul., Ann. Sci. Nat. Bot. ser. 3, 15: 215. 1851. *Antidesma acuminatum* Wight, Icon. Pl. India Orient. t. 1991. 1853; Hook. f., Fl. Brit. India 5: 363. 1887. *Antidesma moritzii* (Tul.) Muell.-Arg., Linnaea 34: 67. 1865 & in DC., Prodr. 15: 252. 1866; Hook. f., Fl. Brit. India 5: 362. 1887. *Antidesma refractum* Muell.-Arg. in DC., Prodr. 15: 257. 1866. *Antidesma smile* Muell.-Arg. in DC., Prodr. 15: 259. 1866. *Antidesma menasu* (Tul.) Miq. ex Muell.-Arg. in DC., Prodr. 15:257. 1866; Hook. f., Fl. Brit. India 5: 364. 1887; Gamble, Fl. Pres. Madras 1297. 1925; Manilal, Fl. Silent Valley 245. 1988; Swarup. *et al.*, Shola For. Kerala 48. 1998; N. Mohanan & Sivad., Fl. Agasthyamala 596. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 436. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 619. 2009. *Antidesma menasu* (Tul.) Miq. ex Muell.-Arg. var. *linearifolia* Hook.f., Fl. Brit. India 5: 364. 1887. *Antidesma montanum* Blume var. *microcarpum* Airy Shaw, Kew Bull. 36: 263. 1981. **Puliyaranjan**.

Small trees, to 18 m high, branchlets sparsely pubescent or glabrous. Leaves simple, alternate, to 6-20 x 2-6 cm, elliptic to elliptic-oblong, acute to round at base, acuminate or caudate-acuminate at apex, entire, often glabrous or puberulous or pilose on midrib above; lateral nerves 4-12 pairs, pinnate. Flowers unisexual, yellow. Male flowers: in axillary and terminal simple or paniculate racemes; peduncle brown-puberulous; pedicels to 2 mm long, slender, glabrous; perianth cupular to 0.5-1.5 mm, glabrescent; disc 3-4-lobed; stamens 3-4; pistillode capitate. Female flowers: in terminal and axillary racemes; peduncle tomentose to glabrous; pedicel to 3 mm long; perianth cupular, 1 x 1-2 mm; lobes 4-5, deep, triangular, deltoid or suborbicular; ovary superior, to 1.5 mm long, ovoid or subglobose, glabrous, 1-2 locular,

ovules 2 in each cell. Drupe ellipsoid, not compressed, 6 x 4 mm, glabrous.

Fl. & Fr. : December-January.

Distribution : Indo Malaysia and Eastern Himalayas. Evergreen forests. *Amitha Bachan 117754* (Odankuzhal-Sholayar, Riparian evergreen, banks of Sholayar river, 200 m).

APOROSA Blume

Bijdr. 514. 1825-1826

Key to Species

1a. Capsule globose, glabrous; male catkins to 5 cm long.....
.....**A. cardiosperma**

1b. Capsule ovoid, villous or rugose; male catkins under 4 cm.....2

2a. Capsule villous, 0.6 cm; male catkins under 2.5 cm.....**A. acuminata**

2b. Capsule rugose, 2 cm; male catkins to 3.5 cm..... **A. bourdillonii**

Aporosa acuminata Thwaites, Enum. Pl. Zeyl. 288. 1861, '*Aporusa*'; Hook. f., Fl. Brit. India 5: 348. 1887; Gamble, Fl. Pres. Madras 1309. 1925; Chakrab. & Gangop., J. Econ. Tax. Bot. 17: 158. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 393. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 598. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 437. 2005. **Neervetti.** **Plate 35. C & D**

Shrubs to 2 m high, branchlets weak, slender, terete. Leaves simple, alternate, elliptic-oblong, to 13 x 4 cm, acute at base, entire, glabrous; nerves 7 or 8 pairs, irregular; petiole 1 cm long, stipule 2 mm long, ovate, tomentose. Male flowers in 1.5 cm long, axillary, densely packed spikes; stamens 3. Female flowers 1-3 together, axillary, fascicled; bracts ovate, tomentose; sepals 4, ovate, 1 mm long,

tomentose; styles bifid. Capsule ovoid, 1.2 x 1 cm, glabrous or hairy; seeds obovoid, 0.6 cm; glabrous; aril red.

Fl. & Fr. : January – May.

Distribution : Endemic to Peninsular India and Sri Lanka. Evergreen forest undergrowth. *Amitha Bachan 72071* (Vazhachal, riparian forests, banks of Chalakkudy river, 250 m); *Amitha Bachan 99058* (Sholayar, riparian forest undergrowth, banks of Sholayar river, 800 m). *Amitha Bachan 117761* (Orukombankutty, riparian evergreen, banks of Sholayar & Kuriyarkutty river, 500 m).

Aporosa bourdillonii Stapf. in Hooker's Icon. 23, t. 2204. 1892; Gamble, Fl. Pres. Madras 1309. 1925; Chakrab. & Gangop., J. Econ. Tax. Bot. 17:158.1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 393. 1996.

Shrubs to small trees, branchlets pubescent. Leaves oblong, to 18 x 6 cm, caudate acuminate at apex, base rounded or obtuse, glabrous above and tomentose below along midrib; petiole to 1.6 cm; lateral nerves pinnate, 7-9 pairs, joining along the margins. Male inflorescence 1.5 cm long with densely tomentose bract. Perinath lobes linear tomentose. Stamens 3. Female flowers in axillary catkins, bracteate similar as in male flowers. Capsule ovoid, to 2 cm long, beaked, ridged, tomentose, with 6-lobed persistent stigma.

Fl. & Fr. : March – May.

Distribution : Endemic to Southern Western Ghats (Kerala). Endangered. Evergreen forests. *Amitha Bachan 72070, 72038, 98969* (Vazhachal, riparian evergreen forests, banks of Chalakkudy river, 250 m); *Amitha Bachan 99086* (Sholayar, riparian evergreen forests, banks of Sholayar river, 700 m).

Note: This species is restricted to two locations in its whole distribution range, Kollam and Thrissur. In the present study area the species is rather restricted to the riparian forests.

Aporosa cardiosperma (Gaertn.) Merr., J. Arnold Arbor. 35: 139. 1954. *Croton cardiospermus* Gaertn., Fruct. Sem. Pl. 2: 120. 1790. *Scepa lindleyana* Wight, Icon. Pl. India Orient. t. 361. 1840. *Aporosa lindleyana* (Wight) Baill., Etud. Gen. Euphorb. 645. 1858; Hook. f., Fl. Brit. India 5: 349. 1887; Gamble, Fl. Pres. Madras 1309. 1925; Chakrab. & Gangop., J. Econ. Tax. Bot. 17: 164. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 393. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 598. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 437. 2005. **Vetti.**

Medium sized trees to 20 m height; bark pale brown, pink inside. Leaves oblong or elliptic, to 12 x 5 cm, rounded or broadly attenuate at base, obtusely acuminate at apex, glabrous, glossy, coriaceous; petiole to 1.5 cm long. Male flowers small, yellow, in axillary and terminal solitary or clustered catkins, to 4 cm; perianth 3-4-lobed, yellow, tomentose; stamens 3-4. Female flowers in racemes, pedicelled; racemes to 1.5 cm long, tomentose. Ovary 2-3-locular, fusiform, stipitate; ovules 2 in each cell; style short; stigma 2-3-lobed, plumose. Capsule globose to 0.8 cm across, yellow. Seeds 2-3, compressed, covered with yellow sugary pulp.

Fl. & Fr. : December – June.

Distribution : Endemic to Peninsular India and Sri Lanka. Evergreen and semi evergreen forests. *Amitha Bachan 72026* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m).

BACCAUREA Loureiro

Fl. Cochinch. 651. 1790.

Baccaurea courtallensis (Wight) Muell.-Arg. in DC., Prodr. 15: 459. 1866; Hook. f., Fl. Brit. India 5: 367. 1887; Gamble, Fl. Pres. Madras 1310. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 393. 1996; Chakrab. & Gangop., J. Econ. Tax. Bot. 21: 527. 1997; N. Mohanan & Sivad., Fl. Agasthyamala 599. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 437. 2005. *Pierardia courtallensis* Wight, Icon. Pl. India Orient. t. 1912. 1852. *Baccaurea sapida* Bedd., Fl. Sylv. t. 280. 1872. **Moottilpazham.**

Plate 35.G

Small trees; bark white. Leaves alternate, often clustered towards the tips of branches, to 18 x 6 cm, oblanceolate, caudate acuminate at apex, acute at base; lateral nerves pinnate 4-6 pairs; petiole 1-3 cm long. Flowers dioecious, cauliflorous, in densely clustered slender racemes on old stem, racemes to 15 cm long. Male flowers 2 mm across; sepals 5, ovate, obtuse, ciliate; stamens 5, free; pistillode clavate. Female flowers larger, sepals oblong, tomentose; ovary 3-celled, conical, fulvous tomentose, style absent, stigmas 3, stout. Capsule 5 cm across, clusterd towards the base of the stem close to ground, globose, 3-valved, tomentose, red; seeds 3, oblong, arillate with fleshy white pulp.

Fl. & Fr. : January – June.

Distribution : Endemic to Peninsular India. evergreen forests. *Amitha Bachan 98757* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m).

BISCHOFIA Blume

Bijdr. 1168. 1826-1827.

Bischofia javanica Blume, Bijdr. 1169. 1826; Hook. f., Fl. Brit. India 5: 345. 1887; Gamble, Fl. Pres. Madras 1312c. 1925; Airy Shaw, Kew Bull. 18. 253. 1965 & 20: 327. 1968; Manilal, Fl. Silent Valley 246. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 395. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 599. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 438. 2005. **Cholavenga.** **Plate 35. H**

Medium sized trees with spreading branches. Leaves trifoliate, alternate, stipulate, elliptic, elliptic-ovate, or obovate, to 6-18 x 3-9 cm, acute or round at base, acuminate at apex, margin serrate, glabrous, membranous; lateral nerves 6-9 pairs, slender, faint; rachis to 18 cm long, stout; petiolule of lateral leaflets to 2 cm long, of terminal leaflet to 4cm long, slender, glabrous; Flowers green, unisexual, in axillary and lateral paniculate racemes. Male flowers: 2-3 mm across; pedicels very short; tepals 5, obovate, concealing the anthers; stamens 5, filaments short; anthers globular; pistillode short, broad. Female flowers: to 3 cm across; pedicels longer than in the male, stout, elongating in fruit; tepals 5, linear lanceolate; ovary superior, globose, 3-celled, exserted, ovules 2, in each cell; style 3, linear. Berry, globose 0.7 cm across, reddish-brown; seeds 3, trigonus.

Fl. & Fr. : March – October.

Distribution : Indo-Malaysia to Pacific islands. Evergreen and semi evergreen forests. *Amitha Bachan 123373* (Vazhachal-Karanthodu, riparian evergreen forests, banks of Chalakkudy river, 340 m).

BRIDELIA Willdenow

Sp. Pl. 4(2): 978. 1806.

Key to species

1a. Trees; young parts armed..... **B. retusa**

1b. Scandant shrubs; unarmed..... **B. stipularis**

Briedelia retusa (L.) A. Juss., Euphorb. Gen. 109. 1824; Hook. f., Fl. Brit. India 5: 268. 1887 *p.p.*; Gamble, Fl. Pres. Madras 1280. 1925; Airy Shaw, Kew Bull. 26. 230. 1972; Chakrabarty *et al.*, J. Econ. Tax. Bot. 26: 321. 2002; N. Mohanan & Sivad., Fl. Agasthyamala 602. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 439. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 623. 2009. *Clutia retusa* L., Sp. Pl. 1475. 1753. *Briedelia spinosa* (Roxb.) Willd., Sp. Pl. 4:979.1806. *Briedelia crenulata* Roxb., Fl. India 3: 734. 1832. *Briedelia roxburghiana* (Muell.-Arg.) Gehrm., Bot. Jahrb. Syst. 41. 95: 30. 1908; Gamble, Fl. Pres. Madras 1280. 1925. 1982. *Briedelia airy-shawii* P. T. Li, Acta Phyt. Sin. 20: 117. 1982, *nom. illeg.*; Sasidh. & Sivar., Fl. Pl. Thrissur For. 397. 1996. **Mulluvenga.**

Medium sized trees, young trees armed with sharp thorns. Leaves simple, alternate, broadly elliptic-oblong, to 20 x 8 cm, cordate, obtuse or acute at base, retuse to subacute at apex, entire or slightly crenulate, finely tomentose beneath, coriaceous; lateral nerves to 15-22 pairs, dichotomously forked near the margin; stipules lanceolate, deciduous, to 0.7 cm; petiole stout, pubescent when young, to 1.5 cm; Flowers unisexual; greenish-yellow, in dense axillary or terminal, spikes; bracts scaly. Male flowers: 0.7 cm across, tepals 10, biseriate, valvate; stamens 5, monadelphous, born on a gonophore. Female flowers: to 0.6 cm across, tepals 10, biseriate, lanceolate, valvate; ovary half inferior, globose, 2-locular, with 2 ovules in each cell; disc with an inner,

membranous, fimbriate corona enclosing basal part of ovary. Drupe, to 0.8 cm across, purplish-black; seed one in each pyrene.

Fl. & Fr. : August – December.

Distribution : Indo- Malaya. Semi evergreen and deciduous forest. *Amitha Bachan 117610* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m).

Briedelia stipularis (L.) Blume, Bijdr. 597. 1825; Hook. f., Fl. Brit. India 5: 270. 1887; Gamble, Fl. Pres. Madras 1281. 1925; Chakrabarty *et al.*, J. Econ. Tax. Bot. 26: 324. 2002. *Clutia stipularis* L., Mantissa Pl. 1: 127. 1767. *Clutia scandens* Roxb., Pl. Coromandel t. 173. 1802. *Briedelia scandens* (Roxb.) Willd., Sp. Pl. 4: 979. 1805; Gamble, Fl. Pres. Madras 1281. 1925; Manilal, Fl. Silent Valley 247. 1988; Sasidh. *et al.*, Bot. Stud. Med. Pl. Kerala 16. 1996; Sasidh. & Sivar., Fl. Pl. Thrissur For. 397. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 603. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 439. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 623. 2009. **Cheruka.**

Scandant shrubs to 2.5 m high; branchlets brown tomentose. Leaves simple, alternate, broad elliptic-oblong, to 12 x 6 cm, acute or obtuse at apex, obtuse at base, minutely tomentose below; leaves of the flowering axis small; lateral nerves pinnate, 7-9 pairs; petiole short, stout to 0.7 cm long. Flowers in axillary fascicles of terminal small leaves. Sepals ovate,vto 2 mm long, acute, tomentose. Petals spathulate, yellowish, to 2 mm long. Drupe globose-oblong to 0.7 cm, black.

Fl. & Fr. : December – February.

Distribution : Endemic to Peninsular India. Moist forests to lower plains. *Amitha Bachan 98771; 72094* (Vazhachal, riparian forests, banks of Chalakkudy river, 200 m).

CHAMAESYCE Gray

Nat. Arr. Brit. Pl. 2: 260. 1821

Key to species

1a. Sub-erect herbs; leaves to 5 cm long..... **C. hirta**

1b. Prostrate, radiating herbs; leaves under 0.6 cm..... **C. thymifolia**

Chamaesyce hirta (L.) Millisp., Publ. Field Columbian Mus. Bot. Ser. 2: 303. 1909. *Euphorbia hirta* L., Sp. Pl. 454. 1753; Gamble, Fl. Pres. Madras 1275. 1925; Airy Shaw, Kew Bull. 26. 264. 1972; Manilal, Fl. Silent Valley 249. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 403. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 608. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 445. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 629. 2009. **Nilappala.**

Slender, sub-erect, pubescent herbs. Leaves simple, opposite-decussate, elliptic to elliptic-lanceolate, to 5 x 1.5 cm, obliquely truncate at base, acute at apex, serrulate, hispid on both sides, basally 3-nerved; petiole to 3 mm long. Cyathia aggregated in single or paired axillary clusters. Peduncle 0.2-1.5 cm long; involucre minute, 1 mm long; glands 5, red. Male flowers 4-6, ebracteolate. Female florets laterally pendulous; styles 2-fid from base. Capsule 1.5-2 mm across, pubescent. Seeds minute, red, 4-angled, minutely furrowed.

Fl. & Fr. : Throughout the year.

Distribution : Native of tropical America, now Pantropical. Plains to forests. *Amitha Bachan 72097* (Athirappilly, riparian forest floor, banks of Chalakkudy river, 100 m).

Chamaesyce thymifolia (L.) Millsp., Publ. Field Columbian Mus. Bot. Ser. 2: 412. 1916. *Euphorbia thymifolia* L., Sp. Pl. 454. 1753; Hook. f., Fl. Brit. India 5: 252. 1887; Gamble, Fl. Pres. Madras 1276. 1925; Sasidh. &

Sivar., Fl. Pl. Thrissur For. 404. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 445. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 631. 2009. **Chitrapala.**

Prostrate herbs; branches spreading, radiating, slender, reddish, pubescent. Leaves opposite, distichous, oblong or suborbicular, to 6 x 3 mm, obliquely cordate at base, obtuse at apex, margin serrulate, 1-nerved, ciliate, subsessile. Cyathia in axillary clusters, 0.5 mm across. Involucre campanulate, 8 mm long; 4-glandular. Male flowers 1-4, ebracteolate. Female laterally pendulous; ovary tomentose; style 3-forked from base. Capsule 2 mm across, minutely adpressed pubescent; seeds 3-angled, transversely rugose.

Fl. & Fr. : November – May.

Distribution : Tropical Asia. Riverbeds from plains to forests. *Amitha Bachan 117752* (Thachanthoni-Sholayar, riparian forest floor, banks of Sholayar river, 700 m).

CROTON Linnaeus

Sp. Pl. 1004. 1753.

Key to species

1b. Scandant shrubs or climbers; leaves ovate-cordate.....**C. caudatus**

1a. Erect herbs; leaves lanceolate, not cordate.....**C. bonplandianus**

Croton bonplandianus Baill., Adansonia 4: 339. 1864; Sasidh. & Sivar., Fl. Pl. Thrissur For. 399. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 604. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 441. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 624. 2009. *Croton sparsiflorus* Morong. in Ann. New York Acad. Sci. 7: 221. 1893; Gamble, Fl. Pres. Madras 1316. 1925.

Erect herbs, branches, stout stellate-scaly. Leaves ovate-lanceolate, to 5 x 1 cm, attenuate at base, gradually acute at apex,

serrulate, densely stellate scaly on both sides when young, glabrous above on ageing; petiole to 1.5 cm long. Racemes to 8 cm long; pedicels glandular on either side. Male flowers 3-4 mm across; perianth 2-seriate, greenish-white, outer 1 mm long, inner 2 mm long; stamens many. Female flowers few, towards base, 2.5-3 mm across; perianth 1-seriate, lobes 5; ovary subglobose, tomentose; style short; stigma 3, each forked to form 6 lobes. Capsule ovoid, 0.6 cm across, warty; seeds 4.5 mm, minutely pitted.

Fl. & Fr. : February – May.

Distribution : Native of South America, now naturalized in Paleotropics. Degraded and open areas of forests also in the plains. *Amitha Bachan 98975* (Vazhachal, open wet areas in riparian forests, banks of Chalakkudy river, 220 m).

Croton caudatus Geisel., Crot. Monogr. 73. 1807; Hook. f., Fl. Brit. India 5: 388. 1887; Gamble, Fl. Pres. Madras 1315. 1925; Anil Kumar *et al.*, Fl. Pathanamthitta 441. 2005. *Croton caudatus* Geisel. var. *obovoideus* Balakr. & Chakrab., Bull. Bot. Surv. India 25: 190. 1983; Sasidh. & Sivar., Fl. Pl. Thrissur For. 399. 1996. **Plate 35. E & F**

Scandent shrubs or climbers. Leaves ovate to cordate, to 14 x 6 cm, acuminate at apex, cordate at base, irregularly crenate, sparsely stellate hairy; petiole to 4 cm long, densely stellate hairy, stipule 1.5 cm long, divided into 2-5 linear lobes. Racemes terminal to 20 cm long, densely tomentose. Male flowers many; sepals ovate; petals similar to sepals; torus densely villous; stamens many, filaments, glabrous. Female flowers pedicelled, 8 mm across; sepals lanceolate; petals hispid; ovary densely stellate hairy, style linear, not divided, 6 mm long. Capsule obovoid, to 2 cm, retuse, densely stellate hairy.

Fl. & Fr. : March – May.

Distribution : Indo-Malaysia. Evergreen and semi-evergreen forests. *Amitha Bachan 99137* (Poringal, Evergreen riparian forests, Chalakkudy river banks, 300 m).

FLUEGGEA Willd.

Sp. Pl., ed. 4(2): 637, 757. 1806

Flueggea virosa (Roxb. ex Willd.) Voigt, Hort. Suburb. Calcutt. 152. 1845; Gamble, Fl. Pres. Madras 1296. 1925. *Securinega virosa* (Roxb. ex Willd.) Baill., Adansonia 6: 334. 1866; Airy Shaw, Kew Bull. 26. 340. 1972; Manilal, Fl. Silent Valley 255. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 415. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 457. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 652. 2009. *Phyllanthus virosus* Roxb. *ex* Willd., Sp. Pl. 4: 578. 1805. *Flueggea microcarpa* Blume, Bijdr. 580. 1826; Hook. f., Fl. Brit. India 5: 328. 1887.

Branched shrubs; often thorny. Leaves simple, alternate, obovate, to 5 x 2.5 cm, obtuse at apex, acute at base, glabrous; nerves 5-7 pairs, reticulate; petiole 5 mm long. Flowers dioecious, in axillary fascicles, 5-20 together, pedicels 6 mm long, slender; calyx lobes 5, 1 mm, oblong, white; stamens in male flowers 5, free, disk 5-lobed, staminode-like; ovary conical, glabrous; styles 3, free, 2-fid; pistillode in male flowers 3 fid. Capsule depressed globose, 4 mm across, glabrous, 3-valved; seeds 3, trigonous, rough.

Fl. & Fr. : March – July.

Distribution : Tropical Africa, Asia and Australia. Dry and open areas in forests. *Amitha Bachan 123356* (Sholayar, riparian open areas, banks of Sholayar river, 700 m).

GLOCHIDION J. R. Forster & J. G. A. Forster

Charact. Gen. 113, t. 57. 1775, *nom. cons.*

Key to species

1a. Stamens 4 or more; leaves under 3.5 cm wide, base acute, unequal... ..... **G. ellipticum**

1b. Stamens 3; leaves 3.5-6 cm wide, base obtuse, not sharply unequal... ..... **G. zeylanicum**

Glochidion ellipticum Wight, Icon. Pl. India Orient. t. 1906. 1852; Hook. f., Fl. Brit. India 5: 321. 1887; Gamble, Fl. Pres. Madras 1308. 1925; Chakrab. & Gangop., J. Econ. Tax. Bot. 19: 199. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 404. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 609. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 446. 2005. *Phyllanthus malabaricus* Muell.-Arg., Linnaea 34: 69. 1865, in Flora 48: 386. 1865 & in DC., Prodr. 15: 305. 1866. *Glochidion malabaricum* (Muell.-Arg.) Bedd., Fl. Sylv. 193. 1872; Hook. f., Fl. Brit. India 5: 319. 1887; Gamble, Fl. Pres. Madras 1308. 1925; N. Mohanan & Sivad., Fl. Agasthyamala 609. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 446. 2005. **Neerola.** **Plate 36. A**

Small glabrous trees to 15 m high; bark with shallow vertical striations. Leaves simple, alternate, distichous; elliptic-oblong, to 11 x 3.5 cm, abruptly acuminate at apex, acute and oblique at base; lateral nerves 5-12 pairs; petiole 0.5 cm long. Flowers unisexual, yellow, in dense clusters from the axils of fallen leaves. Female flowers 2 mm across, 6-10 together; pedicels 5 mm long; sepals 6, obovate, 2 mm long, obtuse, hispid inside; ovary densely hispid, 8-celled. Capsule depressed, 1 x 1.5 cm, shallowly to deeply lobed, crustaceous, hirsute; pedicels 2-8 mm long; seeds brown, glabrous.

Fl. & Fr. March-May.

Distribution : Endemic to the Western Ghats, Evergreen forests. *Amitha Bachan 127457* (Vazhachal, Riparian evergreen, banks of Chalakkudy river, 220 m).

Glochidion zeylanicum (Gaertn.) A. Juss., Euphorb. Gen. 107. 1824, var. **zeylanicum**; Hook. f., Fl. Brit. India 5: 310. 1887; Gamble, Fl. Pres. Madras 1306. 1925; Chakrab. & Gangop., J. Econ. Tax. Bot. 19: 226. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 405. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 610. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 447. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 635. 2009. *Briedelia zeylanica* Gaertn., Fruct. 2: 128. t.109. 1790. **Neervetti**.

Small trees to 10 m heigh, branches radiating from main stem and clustered towards the tips; bark longitudinally cracked. Leaves broadly ovate elliptic, oblong-elliptic, to 6-12 x 3.5-6 cm, obliquely cuneate or truncate at base, acute to shortly acuminate at apex, glabrous, coriaceous; lateral nerves 4-12 pairs; petiole 5 mm long. Flowers in axillary, short-peduncled umbels. Male flowers 5-7 mm across, pale yellow; tepals 6; stamens 4 or more; pedicels 0.8 cm long. Female flowers 3-4 mm across; tepals 6, ovate, 2 mm long, unequal, subacute. Ovary 1.5-2 mm long, 4-5-locular; style conical, cleft at tip. Capsule, depressed, unlobed or obscurely lobed, to 7 x 10 mm, 4-7 locular, beaked, orange; pedicels 2-8 mm long. Seeds subglobose, flat at one side, to 3 mm, deep red, shining.

Fl. & Fr. : March – May.

Distribution : Indo-Malaysia. Evergreen to semi evergreen forests. *Amitha Bachan 72034* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m).

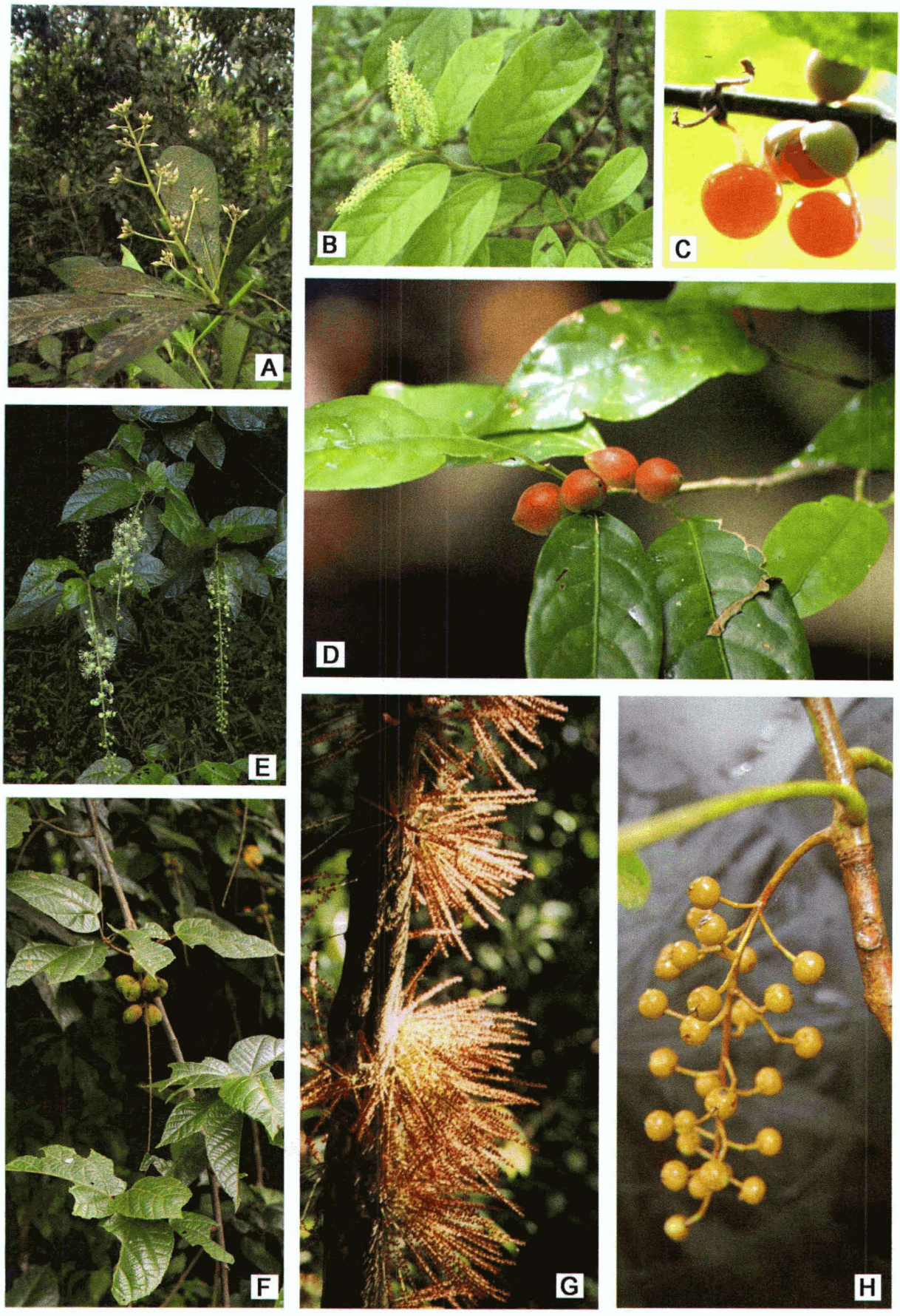


Plate 35. A. *Agrostistachys borneensis* Becc.; B. *Antidesma bunius* (L.) Spreng.; C & D. *Aporosa acuminata* Thw., C. Ripened fruits, D. Fruiting twig; E & F. *Croton caudatus* Geisel., E. Inflorescence, F. Plant with infructescence; G. *Baccaurea courtallensis* (Wight) Muell.-Arg.; H. *Bischofia javanica* Blume

HOMONOIA Loureiro

Fl. Cochinch. 601. 1760.

Homonoia riparia Lour., Fl. Cochinch. 637. 1790; Hook. f., Fl. Brit. India 5: 455. 1887; Gamble, Fl. Pres. Madras 1333. 1925; Airy Shaw, Kew Bull. 26. 282. 1972; Manilal, Fl. Silent Valley 251. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 405. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 447. 2005. *Adelia neriifolia* Heyne ex Roth, Nov. Pl. Sp. 375. 1821. **Attuvanchi**. **Plate 36. B & C**

Large rheophytic shrubs to 2-3 m high, usually on the rocky riverbeds; branchlets pubescent, reddish. Leaves simple, alternate, spiral, linear-oblong to linear–obalanceolate, to 17 x 2 cm, obtuse to acute at apex, acute at base; nerves 10-16, covered with yellow scales below and pubescent along nerves; petiole to 1 cm long, tomentose; stipule filiform. Flowers dioecious in axillary 10-15 cm long racemes. Male flowers 3 mm across, sepals glabrous, ciliate along the margins, yellowish red, 2-5; stamens many, free. Female flowers sessile, densely packed; bracts ovate; sepals lanceolate, to 2 mm long, ciliate; ovary densely hairy. Capsule globose, to 0.5 cm across, hairy.

Fl. & Fr. : December – June.

Distribution : Indo–Malaysia and South China. Along forested rocky riverbeds and streams. *Amitha Bachan 72021* (Vazhachal, rocky riverbed, Chalakkudy river, 220 m); *Amitha Bachan 123311, 123312* (Sholayar, rocky riverbed inside forests, Sholayar river, 700 m).

MACARANGA Du Petit-Thouars

Gen. Nova Madag. 26. 1806.

Macaranga peltata (Roxb.) Muell.-Arg. in DC., Prodr. 15: 1010. 1866; Gamble, Fl. Pres. Madras 1326. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur

For. 405. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 610. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 449. 2005. *Osyris peltata* Roxb., Fl. India 3: 755. 1832. *Mappa peltata* (Roxb.) Wight, Icon. Pl. India Orient. t. 817. 1844-45. *Macaranga roxburghii* Wight, Icon. Pl. India Orient. t. 1949, f.4. 1853; Hook. f., Fl. Brit. India 5: 448. 1887. *Macaranga tomentosa* Wight, Icon. Pl. India Orient. t. 1949, f.1. 1853. **Vatta.**

Medium sized, fast growing trees to 25 m high; bark white, lenticellate. Leaves simple, alternate, stipulate, orbicular, deltoid-ovate, to 24 x 18 cm, peltate at base, acute or acuminate at apex, entire, pubescent with reddish glands beneath, coriaceous; petiole to 30 cm long; nerves 8-10 ribs from base, palmate, prominent beneath. Flowers unisexual, greenish-yellow. Male flowers: in axillary, much branched, dense, tomentose, panicles, concealed in large bracts; bracteoles concave; tepals 3, minute, obovate, cuneate; stamens 2-8, free, shortly connate below, exserted. Female flowers: in much simpler panicles, 1 bracts arger; tepals 4, connate at base; ovary superior, densely glandular, 2-6-celled, ovule one in each cell; style lateral; stigma sessile. Capsule, globose, to 5-6 mm across, hairy, glandular, black; seed one, black.

Fl. & Fr. : January – February.

Distribution : Endemic to India and Sri Lanka and Andamans. Edges and gaps of moist forests. *Amitha Bachan 123464* (Vazhachal, riparian openings, banks of Chalakkudy river, 220 m).

MALLOTUS Loureiro

Fl. Cochinch. 601, 635. 1790.

Key to species

1a. Capsule muricate with spines.....2

1b. Capsule smooth.....3

2a. Capsule 1 cm across, with straight soft spines.....**M. aureopunctatus**

2b. Capsule 1.5 cm across, covered with curved spines..... **M. resinosus**

3a. Capsule red glandular; leaves red glandular below.... **M. philippensis**

3b. Capsule glabrous; leaves yellow glandular below..... **M. atrovirens**

Mallotus atrovirens Muell.-Arg., Linnaea 34: 195. 1865; Hook. f., Fl. Brit. India 5: 440. 1887; Gamble, Fl. Pres. Madras 1322. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 406. 1996; C. N. Sunil & Sivad., Fl. Alappuzha 639. 2009. **Plate 36.G**

Small trees, to 7 m high, Leaves opposite, elliptic-obovate or obovate, to 14 x 6 cm, acute or shortly acuminate at apex, acute or cuneate at base, entire, glabrous above, yellow glandular beneath, chartaceous; lateral nerves 5-7, pairs; stipules interpetiolar; petiole to 2 cm long, glabrous, grooved above; Flowers unisexual, yellow, in axillary and terminal racemes; pedicels yellow glandular; perianth globose, glabrescent, densely glandular, separating into 3-5 lobes; ovary 2-4-celled, ovules one in each cell; stigma sessile, 2, plumose; style deciduous; stamens many, exserted, free. Capsule 2-lobed, 5 x 7 mm, smooth, yellow glandular; seeds 2, plano-convex, to 4 mm, smooth.

Fl. & Fr. : January – July.

Distribution : Endemic to Southern Western Ghats. Riparian evergreen forests. *Amitha Bachan 72044* (Vazhachal, riparian forests, banks of Chalakkudy river, 200 m).

Mallotus aureopunctatus (Dalz.) Muell.-Arg. in DC., Prodr. 15: 973. 1866; Gamble, Fl. Pres. Madras 1323. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 406. 1996. *Rottlera aureopunctata* Dalz. in Hook.'s J.Bot.

Kew Gard. Misc. 3:122.1851. *Mallotus lawii* Muell.-Arg., Linnaea 34: 192. 1865; Hook. f., Fl. Brit. India 5: 438. 1887. **Plate 36. F**

Large shrubs with minutely pubescent branchlets. Leaves simple, opposite, obovate-elliptic, obovate oblong, to 14 x 4.5 cm, acute or acuminate at apex, obtuse or subtruncate at base, shortly sinuate crenate, margins recurved; lateral nerves pinnate, 7-10 pairs; petiole to 1.5 cm long. Racemes axillary usually on terminal leaves; Male racemes to 8 cm long, pubescent. Female racemes to 9 cm long, flowers few, distant. Perinath lobes ovate, tomentose, uniseriate, 3; Ovary 3 celled soft achinate, Style short; stigma 3 plumose. Capsule 1 cm across.

Fl. & Fr. : December – March.

Distribution: Endemic to Western Ghats. *Amitha Bachan 72035* (Vazhachal, riparian forests along Chalakkudy river, 220 m); *Amitha Bachan 99102* (Orukombankutty, riparian evergreen forests along Chalakkudy river, 450 m).

Mallotus philippensis (Lam.) Muell.-Arg., Linnaea 34: 196. 1865, var. **philippensis**; Hook. f., Fl. Brit. India 5: 442. 1887, "*philippinensis*"; Gamble, Fl. Pres. Madras 1322. 1925; Airy Shaw, Kew Bull. 21. 292. 1968 & 26. 300. 1972; Sasidh. & Sivar., Fl. Pl. Thrissur For. 408. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 612. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 450. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 640. 2009. *Croton philippensis* Lam., Encycl. 2: 206. 1786.

Small trees, to 15 m high, branchlets, young leaves and inflorescence tawny or rusty pubescent. Leaves simple, alternate ovate or ovate-lanceolate, to 22 x 8 cm, acuminate or acute at apex, acute or round at base, entire or sparsely serrate, glabrous above, tomentose with minute red glands beneath; coriaceous; 3-ribbed from base; lateral nerves up to 6 pairs; petiole to 6 cm long, stout, swollen at base, fulvous-

pubescent with 2 small sessile glands on each side of the submit. Flowers unisexual, brick red, in rusty puberulous, terminal spicate panicles. Male flowers: 4.5 mm across; tepals 4, lanceolate, stamens many. Female flowers: 4 mm across, tepals 3 or 4, thicker than in males, ovate-lanceolate; ovary with red glands. Capsule globose, to 8 mm across, 3-lobed, 3-valved, loculicidal, densely red-glandular, pubescent; seeds 1-4, globose, black, glabrous.

Fl. & Fr. : October – March.

Distribution : Indo-Malaysia and Australia. Moist and dry forests. *Amitha Bachan 98980* (Athirappilly, riparian evergreen forests, banks of Chalakkudy river banks, 100 m); *Amitha Bachan 127458* (Vazhachal, riparian forest, banks of Chalakkudy river, 220m).

Mallotus resinosus (Blanco) Merr., Sp. Blancoan. 222. 1918; Airy Shaw, Kew Bull. 26. 294. 1972, 31. 392. 1976, 35. 656. 1980, 36. 326. 1981. var. **resinosus** Balakr. & Chakrab., Rheedea 1: 37. 1991; N. Mohanan & Sivad., Fl. Agasthyamala 612. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 450. 2005. *Adelia resinosa* Blanco, Fl. Philipp. (ed. 2) 562. 1845. *Mallotus intermedius* (Baill.) Balakr., Bull. Bot. Surv. India 10: 245. 1969. Anil Kumar *et al.*, Fl. Pathanamthitta 451. 2005. **Plate 36.D**

Erect shrubs, branchlets subterete, rusty tomentose. Leaves simple, opposite, oblanceolate or obovate-elliptic, to 18 x 5 cm, acuminate at apex, acute at base, distantly serrate, glandular; lateral nerves pinnate, 9 pairs, prominent, nervules nearly parallel; petioles of opposite pairs unequal, to 1.5 cm long. Male racemes 1-4 cm long, rusty tomentose; flowers 3 mm across, closely packed, tomentose. Capsule trilocular, 1.5 cm across, covered with curved spines and yellow glands; seeds globose, 0.5 cm across, dull brown.

Fl. & Fr. : December – March.

Distribution : Endemic to Peninsular India. Rare. Evergreen forests. *Amitha Bachan 72038* (Vazhachal, riparian evergreen forests, banks of Chalakkudy river, 220 m).

PARACROTON Miquel

Fl. India Bat. 1(2): 382. 1859.

Paracroton pendulus (Hassk.) Miq. subsp. **zeylanicus** (Thwaites) Balakr. & Chakrab., Kew Bull. 48: 719. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 411. 1996. *Desmostemon zeylanicus* Thwaites, Enum. Pl. Zeyl. 278. 1861. *Ostodes zeylanica* (Thwaites) Muell.-Arg., Linnaea 34: 214. 1865; Hook. f., Fl. Brit. India 5: 400. 1887; Gamble, Fl. Pres. Madras 1336. 1925. *Fahrenheitia zeylanica* (Thwaites) Airy Shaw, Kew Bull. 20: 410. 1966; Manilal, Fl. Silent Valley 250. 1988.

Medium sized trees to 20 m high; Leaves simple, alternate, oblong, elliptic-oblong to 30 x 10 cm, acute at base, acute or obtusely acuminate at apex, margin distantly serrate, glabrous, coriaceous; lateral nerves 10-15 pairs, pinnate, ascending, prominent; petiole to 4-14 cm long, stout with 4 glands at the apex of the petiole in 2 rows on either side, lscales epidote; Flowers unisexual, white, in lax terminal and lateral elongate pendulous racemes; bracts ovate, ciliate; tepals 10 in 2 rows; outer 5 unequal, densely lepidote-scaly outside; inner 5 longer than outer lobes, white; disc glands 5-10; stamens many, filaments free; ovary 3-celled, ovule 1 in each cell; styles 3, bifid. Capsule, 2.5-6 cm across, rusty tomentose, globose or ellipsoid, splitting into 3, 2 valved cocci; seeds ovoid.

Fl. & Fr. : March – April.

Distribution : Endemic to Western Ghats and Sri Lanka. Evergreen forests. *Amitha Bachan 98918* (Vazhachal, riparian forest, banks of Chalakkudy River, 250 m).

PHYLLANTHUS Linnaeus

Sp. Pl. 981. 1753.

Key to species

1a. Capsules smooth.....2

1b. Capsules verrucose..... **P. urinaria**

2a. Stem angled; tepals 6..... **P. airy-shawii**

2b. Stem terete; tepals 5..... **P. amarus**

Phyllanthus airy-shawii Brunel & Roux, Nordic J. Bot. 4:470.1984; 1990; Sasidh. & Sivar., Fl. Pl. Thrissur For. 412. 1996; *Phyllanthus deblis sensu* Hook. f., Fl. Brit. India 5: 299. 1887, *non* Klein ex Willd. 1805; Gamble, Fl. Pres. Madras 1290. 1925; N. Mohanan & Sivad., Fl. Agasthyamala 617. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 453. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 646. 2009. **Keezharnelli**.

Erect herbs, to 40 cm tall; stem angled. Leaves elliptic or elliptic-oblong, to 1.5 x 0.4 cm obtuse or acute at apex, rounded at base; stipules lanceolate, acuminate. Perianth 6, oblong, obtuse, 1 mm long. Capsule globose, smooth, 2-3 mm; seeds trigonous, longitudinally striate.

Fl. & Fr. : July – January.

Distribution: Endemic to Peninsular India and Sri Lanka. Moist forests to lower plains. *Amitha Bachan 123306* (Sholayar, riparian, banks Sholayar river, 650 m).

Phyllanthus amarus Schum. & Thonn. in C.F. Schumacher, Besk. Guin. Pl. 421. 1827; Sasidh. & Sivar., Fl. Pl. Thrissur For. 412. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 616. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 452. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 646. 2009. *Phyllanthus fraternus* auct. non Webster 1955. *Phyllanthus niruri* sensu Hook. f., Fl. Brit. India 5: 298. 1887, non L. 1753; Gamble, Fl. Pres. Madras 1290. 1925. **Keezhar nelli**.

Erect herbs to 30 cm tall; stem terete. Leaves small oblong, to 8 x 4 mm, base unequally obtuse, apex obtuse to acute; stipules lanceolate. Flowers very small; Male flowers towards tip of branchlets, solitary, axillary; tepals 5, ovate; stamens 3, exserted; filaments connate; disc of 5 glands. Female flowers to 1.5 mm across; tepals 5, oblong; ovary globose; style erect, recurved; pedicel to 2 mm long. Capsule globose, 2 mm, smooth. Seeds 6, trigonous, vertically muricate.

Fl. & Fr. : July – October.

Distribution : Tropics. Moist and dry forests, also in the plains. *Amitha Bachan 117635* (Kanakkankadavu, riparian, banks Chalakkudy river, sea level).

Phyllanthus urinaria L., Sp. Pl. 982. 1753; Hook. f., Fl. Brit. India 5: 293. 1887; Gamble, Fl. Pres. Madras 1289. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 413. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 619. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 455. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 649. 2009. *Phyllanthus leprocarpus* Wight, Icon. Pl. India Orient. t. 1895. f. 4. 1852. **Chuvanna-Keezharnelli**.

Erect herbs to 30 cm tall; young stem and leaves reddish. Leaves oblong, 0.5-1.5 x 0.4-0.6 cm, oblique at base, acute to apiculate at apex, margin ciliate, glabrous; stipules linear. Male flowers in axillary clusters; tepals 6, 1-seriate, orbicular; stamens 5, filaments united; disc 6-lobed.

Female flowers solitary in lower axils; tepals 6, obovate-oblong; stigma 3, each 2-fid; disc annular. Capsule globose, 3 mm, 3-lobed, sessile, verrucose. Seeds 6, trigonous, transversely ridged.

Fl. & Fr. : July – October.

Distribution : Tropical Asia. Forests to plains. *Amitha Bachan 99006* (Orukombankutty, riparian forest floor, banks of Sholayar River, 550 m).

TREWIA Linnaeus

Sp. Pl. 1193. 1753

Trewia nudiflora L., Sp. Pl. 1193.1753; Hook. f., Fl. Brit. India 5: 423. 1887; Gamble, Fl. Pres. Madras 1319. 1925; Anil Kumar *et al.*, Fl. Pathanamthitta 459. 2005. *Trewia polycarpa* Benth. in Benth. & Hook.f., Gen. Pl. 3:318.1880; Hook. f., Fl. Brit. India 5:424.1887; Gamble, Fl. Pres. Madras 1319. 1925; Sasidh. & Sivar., Fl. Pl. Thrissur For. 416. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 459. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 653. 2009. **Pambarakumbil.** **Plate 36. H**

Small trees deciduous trees, young parts tomentose. Leaves simple, opposite, decussate, broadly ovate, to 20 x 10 cm, truncate to cordate at base, acuminate to caudate-acuminate at apex, entire, glabrous above, glaucous beneath, chartaceous; 3-ribbed from base, lateral nerves 3-6 pairs; stipules linear-lanceolate, inter-petiolar, to 1 mm; petiole to 12 cm long, slender, glabrous, unequal at each node, Flowers unisexual, pale green. Male flowers; 3-5 mm across, numerous on 10-20 cm long peduncle; bracts ovate-lanceolate, 3 mm across, pubescent; pedicels 4-5 mm long; tepals globose, ovate, splitting into 3-4 broad, concave, often reflexed segments, 6 x 4 mm; stamens many, clustered on a convex receptacle. Female flowers: to 8 mm across, tepals 3-5, broadly ovate, 5 mm long, densely tomentose beneath, cauducous;

ovary superior, 2-4-loculed, ovule one in each cell; styles 3, connate below, oblong. Fruit a woody capsule, 2-3 cm across, dark brown, broadly rounded, 3-4 loculed, pericarp very thick; seeds globose, ovoid.

Fl. & Fr. : July – October.

Distribution : Native of tropical Asia. Forests to plains, along stream Banks. *Amitha Bachan 98982* (Vazhachal, riparian also on rocky riverbed, banks of Chalakkudy river, 220 m).

108. ULMACEAE Mirb.

Elem. Physiol. Veg. Bot. 2: 905. 1815.

TREMA Loureiro

Fl. Cochinch. 539, 562. 1790.

Trema orientalis (L.) Blume, Mus. Bot. Lugd.-Bat. 2: 62. 1856; Hook. f., Fl. Brit. India 5: 484. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1350. 1928; Manilal, Fl. Silent Valley 258. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 424. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 623. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 459. 2005. *Celtis orientalis* L., Sp. Pl. 1044. 1753. *Sponia wightii* Planch., Ann. Sci. Nat. Bot. ser. 3, 10: 322. 1848. **Amathali, Ami**.

Small dioecious trees; branchlets scabrous to adpressed pubescent. Leaves alternate, ovate, acuminate, to 16 x 5 cm, serrulate, cordate at base, tomentose below, scabrous above, 3-5-ribbed from base; lateral nerves 5 or 6 pairs; petiole 1 cm long. Flowers in axillary fascicles or cymes. Male flowers usually sessile; sepals 4 or 5, equal, 0.2 cm long, curved; stamens 5. Female flowers in cymes; sepals unequal, ciliate; ovary ovate, 1-celled, style 2-fid, curved, stigmas plumose. Drupe ovoid or subglobose, 0.3 cm across.

Fl. & Fr. : September-December.

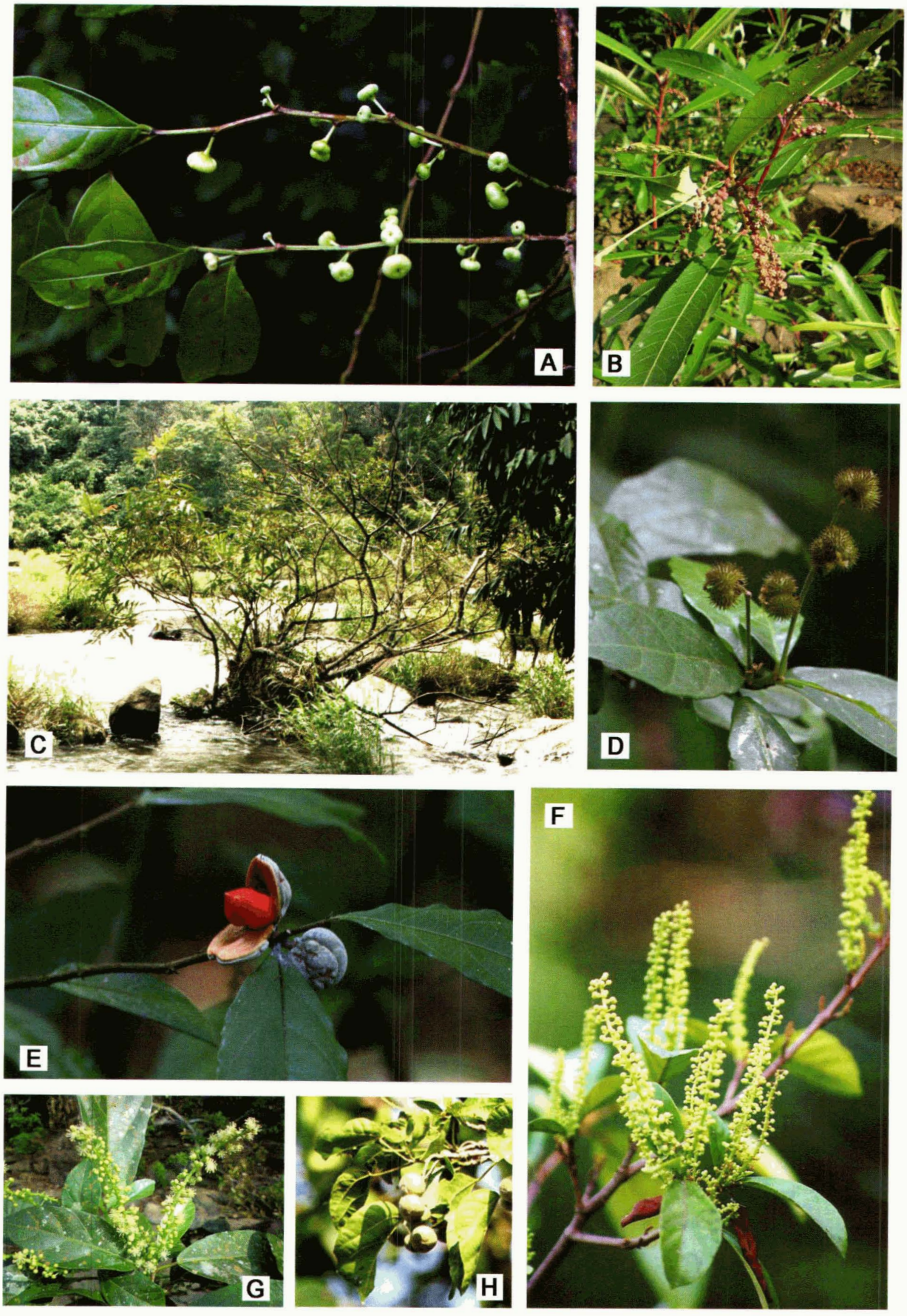


Plate 36. A. *Glochidion ellipticum* Wight; B & C. *Homonoia riparia* Lour., B. Inflorescence, C. Habit; D & E. *Mallotus resinosus* (Blanco) Merr. var. *resinosus*, D. Inflorescence, E. *Dichapetalum gelonioides* (Roxb.) Engl.; F. *Mallotus aureopunctatus* (Dalz.) Muell.-Arg.; G. *Mallotus atrovirens* Muell.-Arg.; H. *Trewia nudiflora* L.

Distribution: Tropical Africa, Asia and Australia. Moist forests, plains along river margins in the plains. *Amitha Bachan 99017* (Kuriyarkutty, riparian openings, banks of Parambikulam river, 450 m).

109. MORACEAE Link

Handbuch 2: 444. 1831.

Key to genera

1a. Flowers enclosed in syconia.....**Ficus**

1b. Flowers not enclosed in syconia.....2

2a. Leaves heart-shaped, cordate at base..... **Broussonetia**

2b. Leaves never heart-shaped, not cordate.....**Artocarpus**

ARTOCARPUS J. R. & J. G. A. Forster

Charact. Gen. 101. 1776, *nom. cons.*

Key to species

1a. Fruits smooth, 2-4 cm long.....**A. gomezianus**

1b. Fruits echinate; over 6 cm long.....2

2a. Under surface of leaves and young shoots hirsute; sorosis under 10cm long.....**A. hirsutus**

2b. Leaves and young shoots glabrous; sorosis >10 cm long..... .....**A. heterophyllus**

Artocarpus gomezianus Wall. ex Trecul subsp. **zeylanicus** Jarrett, J. Arnold Arbor. 41: 90. 1960; Sasidh. & Sivar., Fl. Pl. Thrissur For. 425. 1996; Anil Kumar *et al.,* Fl. Pathanamthitta 460. 2005. *Artocarpus lakoocha sensu* C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1369. 1928, *non* Roxb. 1832; N. Mohanan & Sivad., Fl. Agasthyamala 627. 2002. **Kattukadaplavu**. **Plate 37. A**

Large trees to 30 m high, branchlets minutely pubescent. Leaves simple, alternate, distichous, ovate-oblong to elliptic-oblong, 10-24 x 5-12 cm, obtusely acute to obtuse at base, acuminate at apex, entire, shining, glabrous above, subscabrous beneath; lateral nerves 9-16 pairs, stipules sheathing to 1 cm long; petiole 1.5-3 cm long, pubescent. Male and female flowers in separate axillary globose heads; Male spike globose, 0.8 cm across, peduncle 1-1.8 cm long. Female spikes stouter; Sorosis subglobose, 2-3 cm across, yellow, velvety; seeds few, broad.

Fl. & Fr.: January-April.

Distribution: Endemic to South West India and Sri Lanka. Evergreen forests. *Amitha Bachan 117736* (Vavalala-Sholayar, riparian forests, banks of Sholayar river, 600 m).

Artocarpus heterophyllus Lam., Encycl. 3: 209. 1789; Manilal, Fl. Silent Valley 258. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 426. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 625. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 460. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 657. 2009. *Artocarpus integrifolius* Wight, Icon. Pl. India Orient. t. 678. 1840; King in Hook. f., Fl. Brit. India 5: 541. 1888, non L.f. 1781; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1369. 1928. **Plavu.**

Evergreen trees to 25 m high. Leaves simple, alternate, obovate-oblong, or elliptic-ovate, 8-22 x 3-12 cm, acute to cuneate at base, acute or obtuse at apex, entire, glabrous and shining above, scabrous beneath; lateral nerves 6-8 pairs; stipules ovate-lanceolate, 3-5 cm long; petiole 2-4 cm long, grooved above, glabrous; Flowers minute, in spikes enclosed by spathe-like bracts, male from young branches, catkin narrow-cylindric. female catkins from the trunk and mature branches, more massive. Sorosis oblong, 25-50 x 15-25 cm, echinate fruiting perianth

yellow to light orange, fleshy; seeds elliptic-oblong, to 1.5 x 0.5 cm, smooth, glossy.

Fl. & Fr.: November-June.

Distribution: Originally from South India. Widely cultivated in the tropics. Evergreen forests. *Amitha Bachan 117749* (Kulamali-Sholayar, streamside vegetation, banks of Kulamalithodu, 700 m).

Artocarpus hirsutus Lam., Encycl. 3: 210. 1789; King in Hook. f., Fl. Brit. India 5: 541. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1369. 1928; Sasidh. & Sivar., Fl. Pl. Thrissur For. 426. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 626. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 461. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 658. 2009. **Anjily, Ayani.**

Large evergreen trees, to 50 m high; branchlets hirsute. Leaves simple, alternate, broadly ovate, to elliptic-obovate, 12-26 x 7-14 cm, acute to obtuse at base, subacute to shortly acuminate at apex, entire, undulate, coriaceous, glabrous above, hirsute-pubescent beneath; lateral nerves 6-12 pairs; stipules to 4 cm long, densely tawny strigose; petiole 1-3 cm long, stout, hirsute. Male flowers in in axillary, pendulous, narrowly cylindric spikes upto 15 cm long. Female flowers in axillary ovoid spikes. Sorosis globose or ovoid, 6-8 cm across, echinate, yellow when ripe; seeds to 0.8 cm long, ovoid, white.

Fl. & Fr.: December-March.

Distribution: Endemic to Southern Western Ghats. Evergreen forests to lower plains. *Amitha Bachan 99973* (Vazhachal, riparian forest, banks of Chalakkudy river, 180 m).

BROUSSONETIA L. Herit. Ex Vent.

Broussonetia papyrifera Vent., Table Regne Veg. 3: 547. 1799; King in Hook. f., Fl. Brit. India 5: 490. 1888. **Plate 37. B**

Small trees to 18 m high, young parts tomentose. Leaves simple, alternate, ovate, lanceolate or heart shaped, 6-20 x 2-12 cm, obliquely cordate or truncate at base, acuminate at apex, serrate or dentate, scabrous above and hirsute beneath, membranous; 3-ribbed from base, lateral nerves 4-15 pairs; stipules ovate-lanceolate, to 0.7 cm long, membranous, denticulate; petiole 3-10 cm long, slender, tomentose. Male flowers: in 20-60 mm long spikes with sterile tip on one side. Female flowers : in axillary globose heads to 0.8 cm across; peduncle t0 0.5 cm long. Sorosis 1-2.5 cm across, orange-red; achenes ovoid-compressed, to 2.5 mm long, smooth.

Fl. & Fr. : November-May.

Distribution: Malaysia, China and Japan; introduced in India. Moist forests. *Amitha Bachan 127416* (Karanthodu-Vazhachal, riparian forest, banks of Chalakkudy River, 300 m).

FICUS Linnaeus

Sp. Pl. 1059. 1753.

Key to species

1a. Leaves alternate.....2

1b. Leaves opposite.....**F. hispida**

2a. Leaves glabrous.....3

2b. Leaves scabrid or tomentose or pubescent.....12

3a. Leaves 3-7-ribbed at base, primary nerves more than 13 pairs.....4

3b. Leaves 3-7-ribbed, primary nerves not more than 13 pairs.....8

4a. Petiole 0.5-2.5 cm long.....5

4b. Petiole 4-7.5 cm long 7

5a. Leaves long and large (12-18.5 x 4-5 cm), elliptic oblong.....**F. rigida**

5b. Leaves small (5-11 x 2.5-3.7 cm), ovate oblong.....6

6a. Leaves ovate-elliptic, somewhat rounded, base acute, only midrib prominent..... **F. benjamina**

6b. Leaves ovate-oblong elliptic, base subcordate, midrib and nerves equally prominent on the lower surface.....**F. costata**

7a. Leaf base acute, leaves 23 x 8 cm, gland dotted on the lower surface .....**F. tsjahela**

7b. Leaf base truncate, leaves 32 x 10 cm, not gland dotted on the lower surface .....**F. beddomei**

8a. Petiole less than 2.5 cm long.....14

8b. Petiole more than 2.5 cm long.....9

9a. Petiole 3.5 cm long long.....10

9b. Petiole 5-10 cm long.....11

10a. Leaves thick, 4-ribbed; primary nerves 11 pairs .....**F. callosa**

10b. Leaves thin, 3-ribbed; primary nerves 6 pairs .....**F. racemosa**

11a. Leaves thick, base rounded, 22 x 9 cm, 8-pairs of primary nerves.....**F. religiosa**

11b. Leaves thin, base deeply cordate, 14 x 5.2 cm long, primary nerves 10 .....**F. arnottiana**

12a. Lateral nerves 3-6 pairs.....13

12b. Lateral nerves more than 6 pairs.....16

13a. Leaves sagittate.....**F. tinctoria**

13b. Leaves not sagittate.....**F. exasperate**

14a. Leaves deeply cordate at base; small trees.....**F. dalhousiae**

14b. Leaves subcordate to obtuse at base; large trees.....15

15a Leaf base round, apex acute, 7-ribbed, primary nerves 8 pairs, petiole 3.5 cm long.....**F. benghalensis**

15b. Leaf base acute, apex acuminate, 3-5 ribbed, of primary nerves13 pairs, petiole 2.5 cm long.....**F. drupacea**

16a. All nerves prominent below.....**F. nervosa**

16b. Midrib or mid riba and basal pair of nerves prominent.....17

17a. Leaves attenuate at base; midrib and first primary nerves prominaint beneath.....**F. microcarpa**

17b. Leaves obtuse or obtusely acute at base; midrib alone prominent beneath..... **F. amplissima**

Ficus amplissima J. E. Smith in Rees, Cyclop. 14: n.1. 1810; Manilal, Fl. Silent Valley 259. 1988; Corner, Gard. Bull. Singapore 21:11. 1965; Sasidh. & Sivar., Fl. Pl. Thrissur For. 427. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 462. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 660. 2009. *Ficus tsiela* Roxb. ex Buch.-Ham., Trans. Linn. Soc. London 15: 149. 1826; King in Hook. f., Fl. Brit. India 5: 515. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1362. 1928.

Large spreading trees, to 25 m high; aerial roots present. Leaves simple, alternate; broadly ovate or ovate-oblong, 5-14 x 2.5-9 cm, round, truncate or acute at base, acute at apex, entire, glabrous, coriaceous; 3-ribbed from base, lateral nerves 8-10 pairs; stipule lanceolate to 2.5 cm;

petiole 1.5-5 cm long. Syconium red or purple when ripe; achenes smooth.

Fl. & Fr. : September-January.

Distribution: Sri Lanka, Maldives and Peninsular India. Evergreen forests. *Amitha Bachan 117714* (Vazhachal, riparian forest, banks of Chalakkudy river, 240 m).

Ficus arnottiana (Miq.) Miq., Ann. Mus. Lugd.-Bat. 3: 287. 1867; King, Ann. Roy. Bot. Gard. (Calcutta) 1:tt. 68 A & 84. 1887; King in Hook. f., Fl. Brit. India 5:513. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1363. 1928; Corner in Dassan. & Fosb., Rev. Handb. Fl. Ceylon 3:244. 1981; Sasidh. & Sivar., Flow. Plant. Thrissur 428. 1996; N. Mohan. & Sivad., Fl. Agasthyamala 629. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 462. 2005. var. *arnottiana* Corner, Gard. Bull. Singapore 21:11. 1965. *Urostigma arnottiana* Miq., in Hooker's. London. J. Bot. 6: 564. 1847. **Amakanniyan, Kallal, Kallarayal.** **Plate 37. C**

Small trees or large shrubs. Aerial root absent. Bark smooth pale. Leaves simple, alternate, broadly ovate, 14.5 x 3.2-5.3 cm, deeply cordate at base, caudately acuminate at apex, glabrous, 5-ribbed; petiole to 4.5 cm long. Primary nerves 6-7 pairs. Receptacles are sessile or slightly pedunculate, small seen in clusters on the axils of fallen leaf.

Fl. & Fr: October- February.

Distribution: Endemic to India and Sri Lanka. Common along the rocky river banks in moist forests. *Amitha Bachan 99150* (Sholayar, riparian forest, banks of Sholayar river, 700 m).

Ficus beddomei King, Ann. Roy. Bot. Gard. (Calcutta) 1:26. t. 24 & 81 M. 1887; King in Hook. f., Fl. Brit. India 5: 513. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1364. 1928; Corner, Gard. Bull. Singapore 21:

12. 1965; Sasidh. & Sivar., Flow. Plant. Thrissur 428. 1996; N. Mohan. & Sivad., Fl. Agasthyamala 630. 2002. **Chela, Thavittaal.**

Large trees, branchlets with prominent stipular scars. Leaves simple, alternate, leaf broadly ovate 25-33 x 9-11 cm, abruptly acuminate at apex, rounded at base. 3-ribbed and primary nerves are 13-15 pairs, margin sinuate or entire; petiole 5-6 cm long.

Fl. & Fr: February-July

Distribution: Endemic to Western Ghats. Evergreen forests. *Amitha Bachan 99076* (Malakkapara, riparian forest, banks of Sholayar river, 1050 m).

Ficus benghalensis L., Sp. Pl. 1059. 1753; var. **benghalensis**; King, Ann. Roy. Bot. Gard. (Calcutta) 1: 18, t. 13. 1887; King in Hook. f., Fl. Brit. India. 5: 499. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1361. 1928; N. Mohan. & Sivad., Fl. Agasthyamala 630. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 463. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 661. 2009. *Urostigma benghalense* (L.) Gasp., Nov. Gen. Fic. 7. 1844; Wight, Icon. Pl. India Orient. T. 1989. 1853. **Peral.**

Large trees. Spreading crown. Grows as epiphyte as first. Aerial root present, bark light colour and red inside. Leaves broadly ovate to ovate oblong, to 22 x 12 cm, obtusely acute, obtuse or emarginated at apex, obtuse at base, pubescent on both side, 5-7 nerved from base, lateral nerves 4-6 pairs; petiole to 1.7 c, pubescent. Fig sessile, globose, axillary basal bract 3, slightly rounded, pubescent and red when ripe.

Fl. & Fr.: April-August.

Distribution: Indian subcontinent; widely grown as avenue tree, planted in all plains of India, wild only in the sub-Himalayan forest, Western Ghats and on the lower slope of Deccan hills. Seen as groves, rocky dry

riversides *Amitha Bachan 117713* (Vazhachal, riparian forest, banks of Chalakkudy river, 240 m).

Ficus benjamina L., Mantissa Pl. 1:129. 1767; King, Ann. Roy. Bot. Gard. (Calcutta) 1:t. 52A & 83h. 1887; King in Hook. F., Fl. Brit. India 5:508. 1888; C.E.C. Fisch. in Gamble, Fl . Pres. Madras 1367. 1928; Sasidh. & Sivar., Bio. Docu. Kerala Part 6: Flow. Plant. 438. 2004;

Key to varieties

1a. Petiole more than 1.5 cm long; usually wild..... *var.* **benjamina**

1b. Petiole not more than 1.5 cm long, usually cultivated..... *var.* **nuda**

Ficus benjamina var. **benjamina** Corner, Gard. Bull. Singapore 21:21. 1965.

Large trees, spreading crown and no aerial root, leaves simple, alternate, stipulate, ovate-elliptic or elliptic, 6-10.5 x 2-5.5 cm, caudate acuminate at apex, acute at base, sub coriaceous, greenish when dry, penninerved, lateral nerves many, very close, parallel, forming an intramarginal nerve, prominent below; petiole to 2 cm long. Figs 1.5 cm across, stalked, stalk to 0.2 cm long, yellowish when ripen, surface crimpled when dry.

Fl. & Fr.: April-May.

Distribution: Malaya Peninsula, Archipelago, Eastern hills of Indian Peninsula, the vallies of Eastern Himalayas, hills of Assam, Chitta gonghu, Burma. Evergreen forests 0-1500m MSL. *Amitha Bachan 117640* (Kannankuzhy-Athirappilly, riparian forest, banks of Kannankuzhythodu, 90 m).

Ficus benjamina L. var. **nuda** (Miq.) Barrett. 1951; Corner, Gard. Bull. Singapore 21:21. 1965. *Urostigama nudum* Miq. 1847. *U. benjamineum* Miq. var. *nudum* Miq. 1851.

Trees, aerial root present. Leaves simple, alternate, broadly elliptic to ovate elliptic, 4-8 x 2-4.5 cm caudate acuminate at apex, acute at base, sub-coriaceous, entire, brown coloured when dry, 3-ribbed from base, mid rib raised below, primary nerves numerous, very close, joined to form an intramarginal nerve; petiole to 1.5 cm long; stipule 0.5-0.7 cm long.

Distribution: Northeast India, South China, Indochina, Thailand, Philippines, New Guinea. Usually grown as ornamental tree, also found in abandoned areas in forests. *Amitha Bachan 117641* (Kannankuzhy, riparian forest, banks of Kannankuzhithodu, 90 m).

Ficus callosa Wild., Mem. Acad. Roy. Sci. Hist. (Berlin) 102. 1798; King, Ann. Roy. Bot. Gard. (Calcutta) 1:64. t. 84, v. 2 & 85. 1887; King in Hook. f., Fl. Brit. India 5: 516. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1364. 1928; Corner, Gard. Bull. Singapore 21:29. 1965; Corner in Dassan. & Fosb., Rev. Handb. Fl. Ceylon 3:263. 1981; Sasidh. & Sivar., Flow. Plant. Thrissur 428. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 631. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 463. 2005. **Kadaplavu.**

Large trees; aerial roots absent; bark grey colour. Leaves broadly elliptic or elliptic oblong, 13-22 x 7-13 cm, rounded at base, acute at apex, glabrous, coriaceous, 3-4 ribbed from bas; primary nerves 11 pairs, arched, prominent below; petiole to 3 cm long. Fig axillary, solitary, sub globose, to 2.5 cm across, puberulous, greenish.

Fl. & Fr: March - May.

Distribution: Indo-Malaysia. Moist forests. Also along the rocky riparian stretch. *Amitha Bachan 117738* (Sholayar, riparian forest, banks of Sholayar river, 700 m).

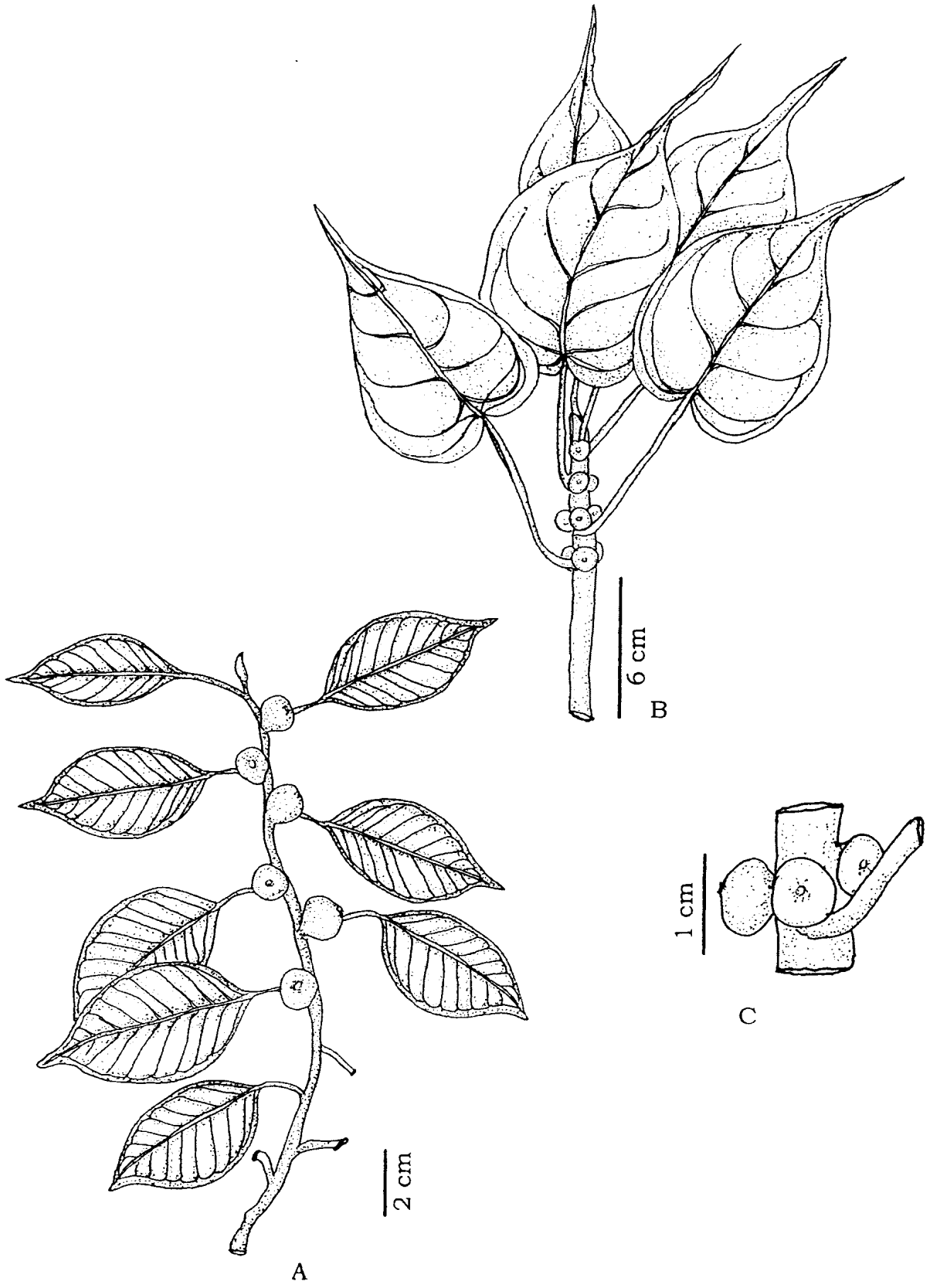


Fig. 2.8. A. *Ficus benjamina* var. *benjamina* Corner; B. & C. *Ficus arnottiana* (Miq.) Miq., B. Fruiting twig, C. Fruits.

Ficus costata Ait., Hort. Kew. (ed. 1) 3: 452. 1789; Corner, Gard. Bull. Singapore 21:11. 1965; *Ficus caudiculata* Trimen, J. Bot. 23: 243. King in Hook. f., Fl. Brit. India 5: 510. 1888. *Ficus mooniana* King in Hook. f., Fl. Brit. India 5: 514. 1888.

Trees, usually epiphytic when young, stranglers, branchlets slender, glabrous, leaves alternate, ovate-oblong, obovate oblong, 8-11 x 2-4 cm, cuspidate to slightly caudate acuminate at apex, acute to obtuse at base, 3-ribbed from base, lateral nerves 12-14 pairs, entire; petiole 1-2 cm long.

Fr. & Fl.: November- December

Distribution: Endemic to South India and Sri Lanka, evergreen forests at low elevation. Usually on rocky areas of riverside. *Amitha Bachan 117705* (Vazhachal, riparian forest, banks of Chalakkudy river, 240 m).

Ficus dalhousiae Miq. in Hooker's J. Bot. Kew Gard. Misc. 6: 571. 1854; King in Hook. f., Fl. Brit. India 5: 499. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1364. 1928; Sasidh. & Sivar., Fl. Pl. Thrissur For. 428. 1996. **Kallal.**

Small trees, to 10 m high, aerial roots absent; young shoots softly pubescent. Leaves simple, alternate, ovate or ovate-oblong, 25-30 x 12-18 cm, deeply cordate at base acute or acuminate at apex, entire, coriaceous, glabrous above and minutely pubescent beneath; 3-7-ribbed from base, lateral nerves 10-13 pairs; stipules ovate-lanceolate, to 3 cm long; petiole 4-10 cm long, pubescent. Syconium obovoid, yellow when ripe.

Fl. & Fr.: November-January.

Distribution: Endemic to Southern Western Ghats. Evergreen forests along rocky river beds. *Amitha Bachan 117709* (Vazhachal, riparian forest, banks of Chalakkudy river, 200 m).

Ficus drupacea Thunb., Diss. Fic. 11. 1786, var. **pubescens** (Roth) Corner, Gard. Bull. Singapore 17:381. 1960 & 21: 13. 1965; Sasidh. & Sivar., Flow. Plan. Thrissur 428. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 631. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 463. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 661. 2009. *Ficus mysorensis* Heyne *ex* Roth in Roem. & Schult., Syst. Veg. 1:508. 1817; King, Ann. Roy. Bot. Gard. (Calcutta) 1: 19, t. 14. 1887; King *in* Hook. f., Fl. Brit. India. 5: 500. 1888; C.E.C. Fisch. in Gamble, Fl. Madras 1361. 1928.

Plate 37. D

Large trees. Spreading crown, young shoots are hairy or pubescent; aerial root absent. Leaves elliptic-oblong, 12-18 x 6-9 cm, cordate or obtuse at base, cuspidate or slightly caudate acuminate at apex, 3-5 nerved from base, obscure, parallel nerves 16-22, parallel, looped near margin to form an intramarginal nerve, prominent below, upper surface glossy glabrous when mature, lower surface, brown velvety pubescent. Fruits to 2 cm across, orange yellow when ripe.

Fl. & Fr.: March- May.

Distribution: India, Sri Lanka, Bangladesh and Laos. Common in evergreen, semi evergreen, moist deciduous forests. Amitha Bachan 1176 84 & 123405 (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

Ficus exasperata Vahl, Enum. Pl. 2: 197& 402. 1806; Corner, Gard. Bull. Singapore 21: 74. 1965; N. Mohanan & Sivad, Fl. Agasthyamala 632. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 464. 2005; C. N. Sunil

& Sivad., Fl. Alappuzha 662. 2009. *Ficus asperrima* Roxb., Fl. India 3:554. 1832; Wight. Icon. Pl. Ind. Orient. t. 633. 1840; King, Ann. Roy. Bot. Gard. (Calcutta) 1:80, t. 100. 1887; King in Hook. f., Fl. Brit. India 51: 522. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1366. 1928. **Parakam, Therakam.** **Plate 37. E**

Small trees, greyish bark, and smooth; aerial roots are absent, leaves obovate, 5-11.5 x 2.5-4.5 cm, acuminate at apex, acute, or rounded at base, highly scabrous. Fig is axillary, solitary, scabrid, globose, yellowish when ripe, peduncle to 1cm long.

Fl. & Fr.: February- April.

Distribution: India, Sri Lanka, East Africa and Arabia. Moist forests, dry rocky areas of riparian stretch. *Amitha Bachan 117685* (Vazhachal, riparian forests, banks of Chalakkudy river, 240 m).

Ficus hispida L. f., Suppl. Pl. 442. 1781; King, Ann. Roy. Bot. Gard. (Calcutta) 1:16, tt. 154, 155. 1888; King in Hook. f., Fl. Brit. India 5: 522. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1367. 1928; Corner, Gard. Bull. Singapore 21:89. 1965; Sasidh. & Sivar., Flow. Plant. Thrissur 429. 1996; N. Mohanan & Sivad., Fl. Agasthyamala. 629. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 464. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 663. 2009. *Ficus oppositifolia* Roxb., Pl. Coromandel t. 124. 1799; Wight. Icon. Pl. Ind. Orient. t. 638. 1843. *Ficus daemona* Koen. ex Vahl, Enum. Pl. 2:198. 1805; Wight. Icon. Pl. Ind. Orient. t. 641. 1843. **Erumanakku, Thonditherakam.**

Small trees with sticky milky exudates. Leaves simple, opposite, elliptic-oblong, 20-39 x 9-14 cm, acute at base, acuminate at apex, hairy pubescent, scarbid on both surfaces; 3-ribbed from base, margin serrate; petiole 1.5-4 cm. Bracts lanceolate and turned to yellow or brown

coloured when mature, to 0.5 cm long. Fruits pedicellate, in clusters, on 0.3-5 m long slender, drooping stalks, hairy and cup shaped.

Fl. & Fr. : March- November

Distribution: Indo-Malaysia to Australia and S. China., Common in evergreen forests in high elevation to lower plains. Usually along water courses. *Amitha Bachan 117682* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

Ficus microcarpa L. f., Suppl. Pl. 442. 1781; Corner, Gard. Bull. Singapore 21:22. 1965; Sasidh. & Sivar., Flow. Plant. Thrissur 429. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 634. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 465. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 664. 2009. *Ficus retusa* auct., non L.: King. Ann. Roy. Bot. Gard (Culcutta) 1:50. tt. 61 & 84 P. 1887, King in Hook. f., Fl. Brit. India 5:511. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1362. 1928. *Ficus retusa* var. *nitida sensu* King in Hook. f., Fl. Brit. India 5:511, 1888, non- Thunb. 1781-1801; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1362. 1928. **Ithi, Kallithi.**

Trees, leaves simple, alternate, elliptic-oblong or ovate oblong, attenuate at base, obtusely apiculate or shortly caudate acuminate at apex entire, glabrous, 3 ribbed from base, 8-13 pairs of primary nerves, midrib and first primary ribs are prominent on the lower surface. petiole 0.7cm long.

Fl. & Fr.: March-April

Distribution: Indo-Malaysia to Pacific Islands and South China. Evergreen forests, also in the lower plains especially rocky riparian areas. *Amitha Bachan 117760* (Orukombankutty, riparian forests, banks of Kuriyarutty river, 500 m).

Ficus nervosa Heyne ex Roth in Roem. & Schult., Syst. Veg. 1: 513. 1817; King in Hook. f., Fl. Brit. India 5: 512. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1364(954). 1928; Sasidh. & Sivar., Fl. Pl. Thrissur For. 429. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 634. 2002. *Ficus angustifolia* Roxb., Fl. India 3: 554. 1832. **Karuthal.**

Plate 37. F

Large evergreen butressed trees, to 30 m high. Leaves simple, alternate, elliptic-oblong, 6-17.5 x 4-8 cm, round or acute at base, acute or acuminate at apex, entire, or slightly undulate, glabrous, coriaceous; 3-ribbed from base, glandular at basal nerve axils beneath; lateral nerves 5-12 pairs; stipule 1.2 cm long, lateral, ovate-lanceolate, membranous, cauducous, petiole 1-2.5 cm long. Fruit depressed globose, to 1 cm across, red, glabrous, on elongate stalks.

Fl. & Fr. : October – January.

Distribution: India-Malaysia to Australia. Evergreen forests. *Amitha Bachan 99084* (Sholayar, riparian forest, banks of Sholayar river, 900m).

Ficus racemosa L. Sp. Pl. 922. 1753; Corner, Gard. Bull. Singapore 21:34. 1965; Sasidh. & Sivar., Flow. Plant. Thrissur 430. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 635. 2002; C. N. Sunil & Sivad., Fl. Alappuzha 664. 2009. *Ficus glomerata* Roxb. Pl. Coromandel t. 123. 1799; Wight. Icon. Pl. Ind. Orient. t. 667. 1840; King in Hook. f., Fl. Brit. India 5:535. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1364. 1928. **Atthi.** **Plate 38. A & B**

Medium sized trees with crown spreading, bark dark; milky exudates are not sticky; aerial root absent. Leaves simple, alternate, exstipulate, ovate oblong to elliptic-oblong, 4-14 x 2-4.5 cm, obtusely acute or obtuse at base, acute at apex; 3-ribbed from base, lateral nerves

6-8 pairs, sub-opposite to alternate, entire; petiole 0.5-1.8 cm long. Fruit pyriform, pedicel 1.5-3 cm across. Fruit yellow or orange colour when ripe.

Fl. & Fr.: March- April.

Distribution: Indo-Malaysia to Australia and South China. Common in evergreen forests and lower plains, usually along the water courses. *Amitha Bachan 72036* (Orukombankutty, riparian forest, banks of Chalakkudy river, 450 m).

Ficus religiosa L., Sp. Pl. 1059. 1753; King, Ann. Roy. Bot. Gard. (Calcutta) 1:t. 67 A & 84U. 1887; King in Hook. f., Fl. Brit. India 5:513. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1363. 1928; Corner, Gard. Bull. Singapore 21:6. 1965; Anil Kumar *et al.*, Fl. Pathanamthitta 465. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 665. 2009. *Urostigma religiosum* (L.) Gasp., Ric. Caprifico 82. t. 7. ff. 1-5. 1845. **Arei- al, Arasu.**

Large trees, grow epiphytes at first. No aerial root. Leaves simple, alternate, ovate, heart-shaped, 10-16 x 5-8 cm, obtusely acute or rounded at base, caudate acuminate at apex, acumen 3-6 cm long, margin wavy, glabrous; 3- ribbed from base, 8-pairs of primary nerves, opposite, glabrous; petiole to 9 cm long. Fruits are axillary, bracteate, sessile, in pairs, blood red colour when ripe.

Fl. & Fr.:- June-July

Distribution: Wild in sub Himalayan forest, Bengal and Central India. Planted in India and Ceylon as sacred trees. Frequently in Myanamar and rarely in Malayan region. 0-700m MSL, Occasional in the moist deciduous forest.

Ficus rigida Jack, Malay. Misc. 2:72. 1822, var. **bracteata** (Corner) Bennet, Indian J. For. 5; 326. 1982; N. Mohanan & Sivad., Fl.

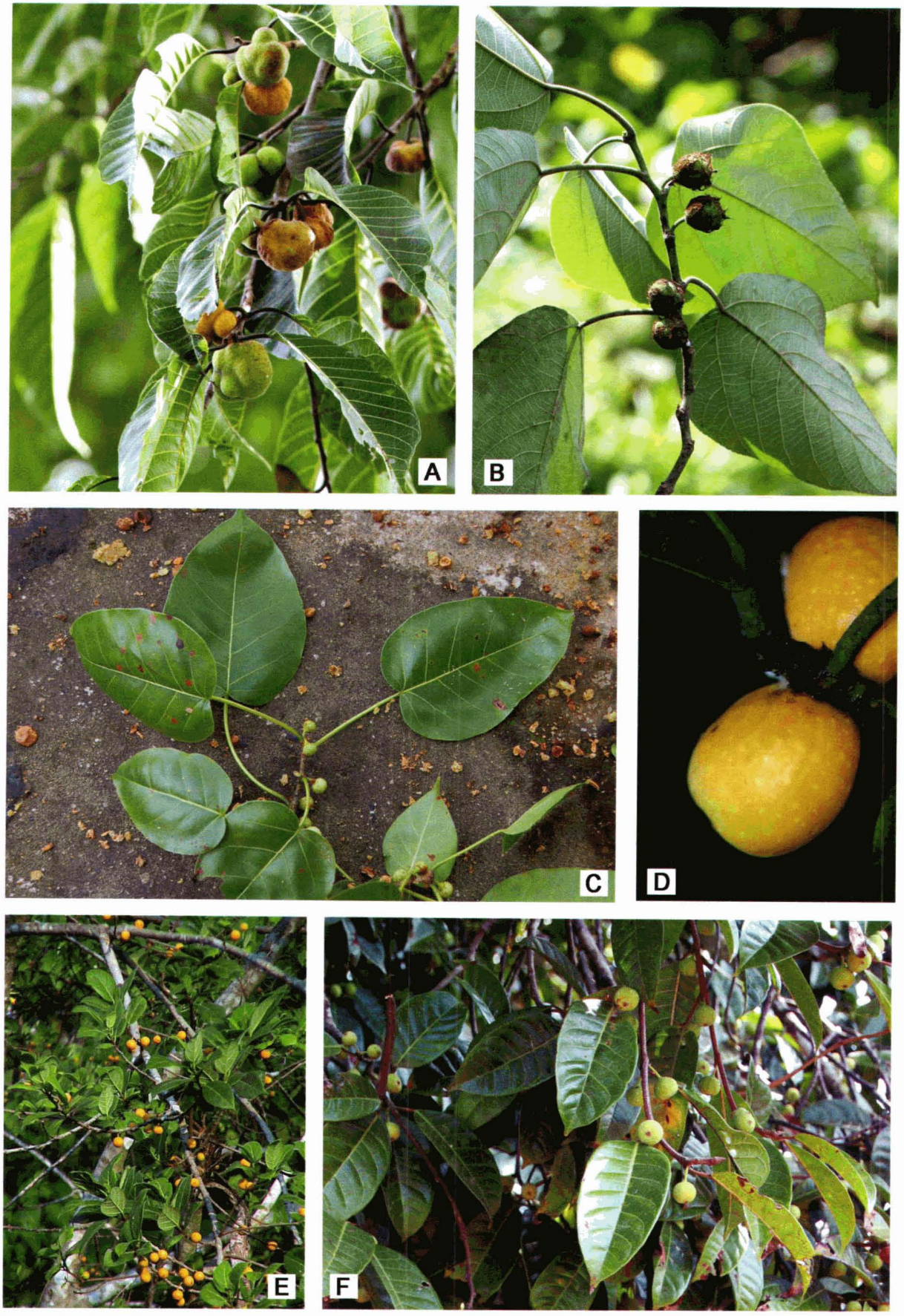


Plate 37. A. *Artocarpus gomezianus* Wall. ex Trecul subsp. *zeylanicus* Jarrett; B. *Broussonetia papyrifera* Vent.; C. *Ficus arnottiana* (Miq.) Miq.; D. *Ficus drupacea* Thunb. var. *pubescens* (Roth) Corner; E. *Ficus exasperata* Vahl; F. *Ficus nervosa* Heyne ex Roth

Agasthyamala 636. 2002. *Ficus glaberrima* Blume var. *bracteata* Corner, Gard. Bull. Singapore 21:17. 1965. *Ficus travancorica* King, Ann. Roy. Bot. Gard. (Calcutta) 1: 28. tt. 26 & 820. 1887; King in Hook. f., Fl. Brit. India 5:503. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1365. 1928; Anil Kumar *et al.*, Fl. Pathanamthitta 466. 2005.

Scandent epiphytic shrub, branchlets glabrous, leaves simple, alternate, elliptic-oblong, 7-22 x 3-6 cm, acute at base, shortly caudate acuminate at apex; 3-nerved from base, lateral nerves 12-17 pairs, sub opposite; petiole 1.5-3.5 cm long.

Fl. & Fr. : August- December.

Distribution : Endemic to South India, Evergreen and moist deciduous forests usually along the rocky areas. *Amitha Bachan 117739* (Sholayar, riparian forest, banks of Sholayar river, 700 m).

Ficus tinctoria G. Forst. Fl. Ins. Austr. 76. 1786.

Key to sub-species

1a. Leaves 6.5 x 2 to 4 x 2 cm long, primary nerves 5 pairs.....
.....subsp **gibbosa**

1b. Leaves 10 x 4 cm, primary nerves 6 pairs.....subsp. **parasitica**

Ficus tinctoria G. Forst. subsp. **gibbosa** (Blume) Corner var. ***cuspidifera*** (Miq.) Chitra in Henry *et al.,* Fl. Tamil Nadu 2: 255. 1987; Anil Kumar *et al.*, Fl. Pathanamthitta 466. 2005. *Ficus cuspidifera* Miq. in Hooker's London J. Bot. 7:434. 1848; King in Hook. f., Fl. Brit. India 5:497. 1888. *Ficus gibbosa* Blume var. *cuspidifera* (Miq.) King, Ann. Roy. Bot. Gard. (Calcutta) 1:6, t. 2A. 1887; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1366. 1928. **Ithimottu**

Small trees, often epiphytic with aerial roots, Leaves simple, alternate, elliptic, ovate-elliptic, to 5 x 2 cm, oblique, acute at base, acute

to shortly acuminate at apex, coriaceous, gibbous to one side, lateral nerves 5 pairs, alternate except the basal pair; petiole 0.4 cm long, stipule 0.5 cm long.

Fl.& Fr.: October-December.

Distribution: India, China and Sri Lanka. Occasional in evergreen forests. *Amitha Bachan 117755* (Sholayar, riparian forest, banks of Sholayar river, 650 m).

Ficus tinctoria Forst. f., Fl. Ins. Austr. 76. 1786, subsp. **parasitica** (Koen. *ex* Willd.) Corner, Gard. Bull. Singapore 17:476.1965; Sasidh. & Sivar., Flow. Plant. Thrissur 430. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 636. 2002; C. N. Sunil & Sivad., Fl. Alappuzha 666. 2009. *Ficus parasitica* (Koenig ex Willd.) King, Ann. Roy. Bot. Gard. (Calcutta) 1:t. 2, 16. 1887; King in Hook. f., Fl. Brit. India 5:497. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1365. 1928. **Itthi, Kallithi.**

Small to medium sized trees, often epiphytic with interlacing aerial roots. Leaves elliptic-ovate or oblanceolate, 8-22 x 3-9 cm, acute, oblique at base, acute to short acuminate at apex, gibbous to one side, Lateral nerves 5-6 pairs, alternate to sub-opposite, except the basal pair; petiole 1cm long, 3-ribbed and 6-7 pairs of primary nerves.

Fl. & Fr.: March- April.

Distribution: Indo-Malaysia. Occasionally seen in moist foress to lower plains. *Amitha Bachan 117622* (Athirappilly, riparian forest, banks of Chalakkudy river, 120 m).

Ficus tsjahela Burm. f., Fl. India. 227. 1768; King, Ann. Roy. Bot. Gard. (Calcutta) 1:58, t. 70. 1887; King in Hook. f., Fl. Brit. India 5:514. 1888; Corner, Gard. Bull. Singapore 21:7. 1965; Sasidh. & Sivar., Flow. Plant. Thrissur 430. 1996; Sasidh. & Sivar., Bio. Docu. Kerala Part 6: Flow.

Plant. 441. 2004; "tjakela" : C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1362. 1928; Mohan. & Sivad., Fl. Agasthyamala 637. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 466. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 666. 2009. **Kallal.** **Plate 38.C**

Medium sized trees; spreading crown, milk exudates are sticky. Aerial root absent. Leaves simple, alternate, ovate-oblong to elliptic oblong, 16-28 x 6-10 cm, acute to obtuse at base, obtusely cuspidate at apex, entire, 3-ribbed from base, lateral nerves 15 pairs; petiole to 7.5 cm long, Figs axillary, sessile, small, bracteate, lobed, rounded. white glands on tender stems and fruits. Stipule small, lanceolate, red.

Fl. & Fr.: April- September.

Distribution: Endemic to Peninsular India and Sri Lanka. Common in evergreen forests, along riverbanks. *Amitha Bachan 117756* (Sholayar, riparian forest, banks of Chalakkudy river, 650 m).

110. URTICACEAE Juss.

Gen. Pl. 400. 1789.

Key to Genera

1a. Fruiting perianth fleshy.....2

1b. Fruiting perianth not fleshy.....3

2a. Leaves densely white-grey tomentose beneath; flowers in globose spikes .....**Debregeasia**

2b. Leaves not white-grey tomentose beneath; flowers fascicled or cymose .....**Oreocnide**

3a. Flowers clustered in a receptacle ....**Elatostema**

3b. Flowers not in receptacle 4

4a. Flowers in peduncled erect cymes.....5

4b. Flowers in axillary clusters or drooping spikes.....**Pouzolzia**

5a. Leaves opposite, serrate.....**Pilea**

5b. Leaves alternate, entire.....**Pellionia**

DEBREGEASIA Gaudichaud-Beaupre

Voyage Bonite Bot. Atlas t. 90. 1844.

Debregeasia longifolia (Burm. f.) Wedd. in DC., Prodr. 16: 235. 1869; Manilal, Fl. Silent Valley 261. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 418. 1996. *Urtica longifolia* Burm. f., Fl. India 197. 1768. *Debregeasia velutina* Gaud., Voy. Bonite Bot. t. 90. 1844-46; Hook. f., Fl. Brit. India 5: 590. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1389. 1928; N. Mohanan & Sivad., Fl. Agasthyamala 639. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 469. 2005. *Conocephalus niveus* Wight, Icon. Pl. India Orient. t. 1959. 1853. **Neeranji. Poonoolmaram.** **Plate 38. D**

Shrubs to small trees; branchlets slender, densely shaggy-pubescent. Leaves linear-ovate to oblong-lanceolate, to 16 x 5 cm, acuminate at apex, base acute or obtuse at base, serrulate, 3-ribbed, midrib with 4 pairs of lateral nerves, nervules reticulate, densely white-ashy tomentose below, scabrous above; petiole 3 cm long; stipules linear-lanceolate. Flowers very small, heads in short, dichotomous cymes, covered along the branchlets. Spike 0.4 cm across; peduncles 0.5 cm long; bracts and bracteoles ovate, ciliate; male perianth lobes 4, free, 1 mm long, ovate, densely woolly; stamens 4, free. Seed with copious albumen.

Fl. & Fr. : April-May

Distribution: Indo-Malaysia. Evergreen forests, near streamsides. *Amitha Bachan 117664* (Valparai, riparian forests, banks of upper Sholayar river, 1200 m).

ELATOSTEMA J. R. & J. G. A. Forster

Charact. Gen. 105. 1776, *nom. cons.*

Key to species

1a. Leaves obovate-oblong, >2 cm wide..... **E. acuminatum**

1b. Leaves linear-rhomboid, =<2 cm wide.... **E. lineolatum** var. **falcigera**

Elatostema acuminatum (Poir.) Brongn. in Duper., Voy. Bot. 211. 1834; Hook. f., Fl. Brit. India 5: 566. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1377. 1928; Manilal, Fl. Silent Valley 261. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 418. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 640. 2002. *Procris acuminata* Poir. in Lam., Encycl. 5: 629. 1804. **Plate 38. E**

Herbs to subshrubs, leaves alternate, distichous, obliquely obovate-oblong, 7-15 x 2-5 cm, caudate acuminate at apex, acute at base, crenate toothed in the upper two third, glabrous, cystolith absent; nerves distinct. Flowers minute, crowded on involucral receptacle. Male receptacle sessile, Perinath 4-5, free. Female perianth 3-5 free, persistent, usually shorter than the ovary. Stamens 4-5, inflexed in bud; pistillode minute. Ovary straight; ovule erect; stigma sessile. Achene minute, ellipsoid.

Fl. & Fr. : March-April.

Distribution: Indo-Malaysia. Stream banks in evergreen forests. *Amitha Bachan 123336* (Nelliyampathy, stream-bank vegetation, banks of Karappara river, 900 m).

Elatostema lineolatum Wight var. **falcigera** Thwaites, Enum. Pl. Zeyl. 260. 1861; Hook. f., Fl. Brit. India 5: 565. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1377. 1928; Manilal, Fl. Silent Valley 262. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 419. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 642. 2002. **Plate 38.F**

Subshrubs or herbs; branches scandent, pilose. Leaves linear-rhomboid, to 8 x 2 cm, acuminate at apex, gibbous at one side, crenate, 3-ribbed from base, sessile, shortly hispid; lateral nerves 4 pairs from the midrib; cystolith scattered. Receptacle 0.5-1.5 cm across, 2-3 together, axillary, sessile. Male flowers pedicellate; bracteoles 3 mm long, oblanceolate; perianth lobes 4, 1.5 x 1 mm, hairy at apex, red-glandular; stamens 4, anthers deeply cleft at base.

Fl. & Fr. : December – March.

Distribution: Endemic to South India and Sri Lanka. Stream banks in evergreen forests. *Amitha Bachan 99087, 12334* (Sholayar, streamside vegetation, banks of Sholayar river, 700 m); *Amitha Bachan 99096* (Karimala, streamside vegetation, banks of Karimalathodu, 1400 m).

OREOCNIDE Miquel

Pl. Jungh. 39. 1851.

Oreocnide integrifolia (Gaud.) Miq., Ann. Mus. Lugd.-Bat. 4: 306. 1869; Manilal, Fl. Silent Valley 264. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 420. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 471. 2005. *Villebrunea integrifolia* Gaud., Voy. Bonite Bot. t. 91.1844; King in Hook. f., Fl. Brit. India 5: 589. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1388. 1928.

Small trees. Leaves alternate, oblong-oblanceolate, to 16 x 6 cm, entire, acuminate at apex, acute at base; nerves 6-9 pairs, lowest pairs

basal, punctate, glabrous; stipule 1 cm long, lanceolate. Flowers in globose clusters in shortly peduncled, dichotomous, hispid cymes, usually from the axils of the fallen leaves, monoecious or dioecious; male perianth 1.5 mm long, 4-lobed, united below; female perianth 2 mm long, tubular, narrowed above, toothed; stamens 3-5; pistillode obovate; ovary adnate to perianth tube, 1-celled, ovule basal; style absent; stigma discoid, fimbriate. Achenes adnate to the perianth, embraced by fleshy bracteoles, to 4 mm across. Seeds albuminous.

Fl. & Fr. : Jun-Jul.

Distribution: India, Sri Lanka and Myanmar. Evergreen forests, river margins. *Amitha Bachan 117674* (Sholayar, riparian vegetation, banks of Sholayar river, 700 m).

PELLIONIA Gaudichaud-Beaupre

in Freycinet Voyage Bot. 494, t 119. 1826, *nom. cons.*

Pellionia heyneana Wedd., Monogr. Urtic. 287. t.5. 1856; Hook. f., Fl. Brit. India 5: 561. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1380. 1928; Manilal, Fl. Silent Valley 264. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 421. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 643. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 471. 2005. **Nilampatti.**

Plate 38. G

Subshrubs; stem angled. Leaves simple, alternate to sub opposite, one of the pair very small, distichous, falcate-elliptic, inequilateral, 6-18 x 3-6 cm, acuminate to caudate acuminate at apex, acute at base, 3-ribbed; cystolith many, linear; petiole 1.5 cm long. Flowers in axillary peduncled cymes; peduncles stout, erect, to 12 cm. Male flowers pedicelled, perianth reddish, lobes 4, equal, 0.2 cm long, oblong; stamens 4, free. Female flowers pedicelled, in short lateral congested

cymes; peduncle to 1.5 cm long; perianth reddish, lobes 5, unequal, oblong to 1.5 mm long. Achenes obovate, acute, 0.6 mm, biconvex.

Fl. & Fr. : April-July.

Distribution: South West India and Sri Lanka. Wet areas in evergreen forest. *Amitha Bachan 98849* (Malakkapara, wet areas in evergreen forests, banks of Sholayar river, 1100 m).

PILEA Lindley

Collect. Bot. ad. t. 4. 1821, *nom. cons.*

Pilea microphylla (L.) Liebm., Vidensk. Selsk. Skr. 5:296. 1851; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1379. 1928; N. Mohanan & Sivad., Fl. Agasthyamala 644. 2002; Anil Kumar *et al.,* Fl. Pathanamthitta 472. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 655. 2009. *Parietaria microphylla* L., Syst. Nat. (ed.10):1308. 1759. *Pilea muscosa* (L.) Lindl., Coll. Bot. t. 4. 1821; Hook. f., Fl. Brit. India 5: 551. 1888.

Slender succulent herbs; branches and leaves bifarious; stem transparent. Leaves opposite unequal pairs, small, ovate-orbicular, to 4 x 3 mm, attenuate at base, obtuse at apex, subsucculent, 1-nerved; raphides transverse; petiole to 1 mm. Flowers monoecious in small umbellate clusters, 1-1.5 mm across. Male flowers: tepals 4, free, concave, obtuse; stamens 4. Female flowers: tepals connate, 2-4-toothed; ovary 0.5 mm long, ovoid, 1-celled; ovule 1. Achene 1 mm long, ellipsoid.

Fl. & Fr. : August – October.

Distribution: Native of South America, widely introduced. Wet rocky streamside. *Amitha Bachan 117618* (Malakkapara, wet rocks along streams, banks of Sholayar river, 900 m).

Plate 38. A. & B. *Ficus racemosa* L.; C. *Ficus tsjahela* Burm. f.; D. *Debregeasia longifolia* (Burm. f.) Wedd.; *Elatostema acuminatum* (Poir.) Brongn.; F. *Elatostema lineolatum* Wight var. *falcigera* Thw.; G. *Pellionia heyneana* Wedd.

POUZOLZIA Gaudichaud-Beaupre

in Freycinet Voyage Bot. 503. 1826.

Key to species

1a. Leaves >4 cm long; flowers on terminal spike..... **P. meeboldii**

1b. Leaves <4 cm long; flowers in axillary sessile clusters.... **P. zeylanica**

Pouzolzia meeboldii W.W. Smith & Ramaswami, Rec. Bot. Surv. India 6:40.1914; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1383. 1928; Sasidh. & Sivar., Fl. Pl. Thrissur For. 422. 1996.

Erect shrubs; stem glaucous, running out into a terminal spike. Leaves opposite, ternate, oblong-lanceolate, to 6-18 x 1-4 cm, acuminate at apex, rounded or cordate at base, sessile, glabrous. Racemes to 20 cm long, axillary. Flowers 3-5 together; bracts 6 x 3 mm, ovate. Male flowers 2 mm across, truncate at apex; perianth lobes 4, transversally plicate. Female flowers smaller; perianth lobe 0.5 mm long, ciliate at apex, stigma 2 mm long. Achenes 1 mm long, ridged, brown.

Fl. & Fr. : August – January.

Distribution: Endemic to Southern Western Ghats. Riparian evergreen vegetation. *Amitha Bachan 72002* (Vazhachal, riparian forest, banks of Chalakkudy river, 200m); *Amitha Bachan 117675* (Sholayar, wet areas in the riparian forests banks of Sholayar river, 700 m).

Pouzolzia zeylanica (L.) Bennett, Pl. Jav. Rar. 1: 67. 1838; Manilal, Fl. Silent Valley 265. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 422. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 646. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 473. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 655. 2009. *Parietaria zeylanica* L., Sp. Pl. 1052. 1753. *Parietaria indica* L., Mantissa Pl. 1: 128. 1767. *Pouzolzia indica* (L.) Gaud., Voy. Uranie 12:

503. 1830; Hook. f., Fl. Brit. India 5: 581. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1382. 1928.

Slender procumbent herbs. Leaves alternate or opposite ovate-elliptic, to 3 x 1.5 cm, acute at apex, rounded at base, sparsely strigose, membranous, lateral nerves 3-4 pairs, basal pair opposite; petiole to 2 cm long; bracts 2, concave scarious. Flowers in axillary, subsessile clusters. Male flowers: 3 mm across; tepals 4, ovate-lanceolate, 1.5 mm long, sparsely villous; stamens 4. Female flowers: tepals connate; style linear 2 mm long, thinly pubescent. Achenes 2-winged.

Fl. & Fr. : July-January.

Distribution: Tropical Asia. Open wet areas in the forests to lower plains. *Amitha Bachan 117607* (Vazhachal, open wet areas in riparian forests, banks of Chalakkudy river, 230 m).

111. SALICACEAE Mirb.

Elem. Physiol. Veg. Bot. 2: 905. 1815.

SALIX Linnaeus

Sp. Pl. 1015. 1753.

Salix tetrasperma Roxb., Pl. Coromandel t. 97. 1798; Hook. f., Fl. Brit. India 5: 626. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1390. 1928; Manilal, Fl. Silent Valley 266. 1988. **Plate 34. E; Plate 45. C.**

Small trees, to 25 m high, bark rough, vertically fissured; Leaves simple, alternate, ovate, lanceolate, acuminate at apex, acute or rounded at base, to 11 x 4 cm, serrate, nerves many, close, glaucous beneath. Flowers unisexual, dioecious, in long drooping, axillary racemes, to 5-15 cm long; bracts ovate, 0.2 cm, densely woolly, perianth absent; stamens 8, free; ovary stalked, 1-celled; tomentose; ovules few; stigma sessile,

notched. Fruit a capsule, 4 mm, 2-4-valved; seeds 1-4, oblong, with long deciduous hairs.

Fl. & Fr. : January-April

Distribution: Indo-Malaysia and South China. Along river banks in evergreen forests. *Amitha Bachan 123325* (Sholayar, along river banks, banks of Sholayar river, 600 m).

112. HYDROCHARITACEAE Juss.

Gen. Pl. 67. 1789.

Key to genera

1a. Stem branched; leaves cauline.....**Hydrilla**

1b. Stem absent; leaves radical..... **Blyxa**

BLYXA Noronha ex Petit-Thouars

Gen. Nova Madag. 4: 17. 1806.

Blyxa aubertii Rich., Mem. Cl. Sci. Math. Phys. Inst. France 12 (2): 77. t.4. 1812; C. D. K. Cook & Lound, Aquat. Bot. 15: 9. 1983; Manilal, Fl. Silent Valley 266. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 647. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 474. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 670. 2009. *Blyxa ceylanica* Hook. f., Fl. Brit. India 5: 661. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1397. 1928.

Key to varieties

1a. Seeds with tail-like spines at both ends.....var. **echinosperma**

1b. Seeds without tail-like spines at the ends..... var. **aubertii**

Blyxa aubertii Rich., Mem. Cl. Sci. Math. Phys. Inst. France 12: 77. t.4.1812; var. **aubertii** C. D. K. Cook & Lound, Aquat. Bot. 15: 10. 1983. Manilal, Fl. Silent Valley 266. 1988; N. Mohanan & Sivad., Fl.

Agasthyamala 647. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 474. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 670. 2009. *Blyxa ceylanica* Hook. f., Fl. Brit. India 5: 661. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1397. 1928.

Submerged aquatic herbs; leaves radical, linear-lanceolate, to 20 x 0.5 cm, acuminate. Flowers solitary, bisexual, enclosed in pedunculate spathe; perianth lobes 3 + 3, oblong, 0.5 cm long; stamens 3-9, free; ovary slender, 1-celled, many-ovuled Fruit a linear capsule, 2-4 cm long, 2 mm broad; seeds many, ellipsoidal, 3 mm long, without tail-like spines at ends.

Fl. & Fr. : December-Mach.

Distribution: India, Sri Lanka, Burma to SE Asia, New Guinea to Japan, Australia, Europe, Madagascar, S. Africa and America. In ponds, slow flowing streams. *Amitha Bachan 117751* (Meenchaliyali-Sholayar, streams, along Meenchaliyali stream, 850 m).

Blyxa aubertii Rich. *var.* **echinosperma** (Clarke) C. D. K. Cook & Lound, Aquat. Bot. 15: 14. 1983; *Hydrotrophus echinospermus* C.B. Clarke, J. Linn. Soc. Bot. 14: 4. t.1. 1875. *Blyxa echinosperma* (C. B. Clarke) Hook. f., Fl. Brit. India 5: 661. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1397. 1928; Anil Kumar *et al.*, Fl. Pathanamthitta 474. 2005. *Blyxa oryzetorum* (Decne.) Hook. f., Fl. Brit. India 5: 661. 1888. *Diplosiphon oryzetorum* Decne. in Jacquem., Voy. 167. 1884.

Submerged scpigerous plants, stems absent. Leaves densely tufted, linear-lanceolate, to 30 x 0.6 cm, acuminate. Flowers dioecious on long scapes; perianth lobes 3 + 3, oblong, 0.5 cm long; stamens 3-9, free; ovary slender, 1-celled, many-ovuled; stigmas 3, linear. Fruit a linear capsule, 2-4 cm long, 2 mm broad; seeds many, ellipsoidal, 3 mm long, echinate, tailed at both ends, white.

Fl. & Fr. : June – September.

Distribution: Cosmopolitan. Pools, ponds and strums. *Amitha Bachan 123602* (Sholayar, submerged in stream, Meenchaliyali streams, 900 m).

HYDRILLA L.C. Richard

Mem. Cl. Sci. Math. Inst. Natl. France 12(2): 9, 61, 76. 1814.

Hydrilla verticillata (L.f.) Royle, Illustr. Bot. Himal. t. 376. 1839; Hook. f., Fl. Brit. India 5: 659. 1888; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1396. 1928; Anil Kumar *et al.*, Fl. Pathanamthitta 474. 2005. *Serpicula verticillata* L.f., Suppl. Pl. 416. 1781.

Highly branched submerged perennial herbs, monoecious; stem, slender, nodes distant towards base, upper ones closer. Leaves in whorls of 3-7, narrow, linear, to 1.5 x 0.1-0.3 cm, serrulate, membraneous, 1-nerved. Flowers unisexual, axillary, solitary, enclosed in spathes. Female flowers: spathe sessile, 4 x 1 mm. Sepals 3, oblong, 2 x 1 mm, white. Ovary 3 mm oblong; long, style 2. Fruit softly echinate, with persistent style. Seeds 2 mm long, ellipsoid.

Fl. & Fr. : Throughout the year.

Distribution : Asia, Europe and Africa. Stagnant pools and ponds. *Amitha Bachan 123498* (Elanthikkara, stagnant streams, connecting to the river, sea level).

113. ORCHIDACEAE Juss.

Gen. Pl. 64. 1789.

Key to genera

1a. Epiphytic herbs.....2

1a. Terrestrials herbs.....13

2a. Leaves equitant, laterally compressed..... 3

2b. Leaves not equitant or laterally compressed.....4

3a. Stem very short; leaves tufted; scapes terminal, many-flowered .....**Oberonia**

3b. Stem elongate; leaves imbricating throughout; scapes terminal and lateral, few-flowered.....**Podochilus**

4a. Lip not spurred, sometimes saccate.....5

4b. Lip spurred..... 11

5a. Flowers with a mentum..... .....**Dendrobium**

5b. Flowers without a mentum..... 6

6a. Column-foot present.....7

6b. Column-foot absent.....9

7a. Lip clawed, joined to the foot, mobile..... 8

7b. Lip sessile, not mobile..... ..... **Eria**

8a. Inflorescence 1-2-flowered; flowers wide-opened; operculum with long tail-like prolongation.....**Trias**

8b. Inflorescence many-flowered; flowers not wide-opening; operculum without tail-like prolongation.....**Bulbophyllum**

9a. Bracts imbricating, convolute, almost concealing the flowers..... .....**Pholidota**

9b. Bracts not imbricating, not concealing the flowers..... 10

10a. Pseudobulb absent..... **Sirhookera**

10b. Pseudobulb present, ovoid or subglobose..... **Cymbidium**

11a. Spur distant from the base of the lip .....**Xenikophyton**

11b. Spur at the base of the lip.....12

12a. Spur longitudinally septate almost to the mouth.....**Cleisostoma**

12b. Spur not longitudinally septate..... **Acampe**

13a. Plants leafy, autophytes.....14

13b. Plants leafless, saprophytes.....16

14a. Lip superior..... **Satyrium**

14b. Lip inferior.....15

15a. Flowers to 3 cm across; stigmas stalked..... **Habenaria**

15b. Flowers to 5 cm across; stigmas sessile.....**Pecteilis**

16a. Lip spurred; flowers white, speckled with pink.....**Epipogium**

16b. Lip saccate, not spurred; flowers yellow.....**Aphyllorchis**

ACAMPE Lindley

Fol. Orch. Fasc. 4: 95. 1853, *nom. cons.*

Acampe praemorsa (Roxb.) Blatt. & McCann, J. Bombay Nat. Hist. Soc. 35: 495. 1932; Abraham & Vatsala, Introd. Orchids 450. 1981; Sasidh. & Sivar., Fl. Pl. Thrissur For. 433. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 652. 2002; Sath. Kumar & Manilal, Orchid Memories 163. 2004; Anil Kumar *et al.*, Fl. Pathanamthitta 477. 2005. C.N.Sunil & Sivad., Fl. Alappuzha 673. 2009. *Epidendrum praemorsum* Roxb., Pl. Coromandel 34, t.43. 1795. *Saccolabium praemorsum* (Roxb.) Hook.f., Fl. Brit. India 6: 62. 1890. *Acampe wightiana* Lindl., Fol. Orch. Acampe 2.1853; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1447. 1928. *Vanda wightiana* (Lindl.) Wight, Icon. Pl. Ind. Orient. t. 1670. 1851. *Saccolabium wightianum* (Lindl.) Hook.f., Fl. Brit. India 6: 62. 1890. **Maravazha.**

Epiphytic herbs. Stem stout, 20-50 cm high, with vermiform roots from basal nodes. Leaves distichous, 12-20 x 2-3 cm, linear, sheathing

at base, apex unequally 2-lobed, thick, coriaceous. Corymbs leaf-opposed; peduncle 3.5-5 cm long. Floral bracts scaly, broadly orbicular, broader than long. Flowers 0.8-1 cm across; sepals and petals 0.8-1 x 0.3-0.5 cm, ovate-lanceolate, creamy-yellow with reddish-brown transverse bands, thick, fleshy. Lip 8 x 4 mm, fleshy, white with red stripes, 3-lobed; lateral lobes small; mid-lobe ovate-obtuse, margin crispate; spur short. Anther terminal, 2-loculed; pollinia 2, globose. Capsule to 4 cm long, cylindrical, ribbed.

Fl. & Fr.: March- April

Distribution: India and Sri Lanka. Moist forests in higher elevations to lower plains. *Amitha Bachan 123452* (Vazhachal, epiphytic on riparian tress, banks of Chalakkudy river, 220 m).

APHYLLORCHIS Blume

Bijdr. t. 77. 1825.

Aphyllorchis montana Rchb.f., Linnaea 41: 57. 1877; Hook. f., Fl. Brit. India 6: 116. 1890; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1457. 1928; N. Mohanan & Sivad., Fl. Agasthyamala 655. 2002; Sath. Kumar & Manilal, Orchid Memories 166. 2004. *Aphyllorchis prainii* Hook. f., Fl. Brit. India 6: 117. 1890; Manilal, Fl. Silent Valley 270. 1988. **Plate 39. A**

Tall erect saprophytes, 50-60 cm tall, sheathed. Inflorescence deeply yellowish-violet. Flowers straw-coloured, 3 x 1 cm, racemose; bracts 10 x 2 mm, linear lanceolate; dorsal sepal 13 x 4 mm, oblong, obtuse; lateral sepals 11 x 3 mm, oblong, obtuse; petals 11 x 3 mm, oblong, obtuse; lip highly variable, ovate, acute, 3-lobed; midlobe ovate, acute; side lobes rounded at base.

Fl. & Fr. : July-September.

Distribution: Indo-Malaysia. Evergreen forest. *Amitha Bachan 123407* (Vazhachal, riparian forest floor, banks of Chalakkudy river, 180 m).

BULBOPHYLLUM Du Petit-Thouars

Hist. Pl. Orch., tabl. esp. 3 sub u. 1822, *nom. cons.*

Key to species

1a. Pseudobulbs to 1.5 cm long; inflorescence 1-2-flowered.... **B. aureum**

1b. Pseudobulbs 2-3 cm long; inflorescence 2-many flowered... **B. sterile**

Bulbophyllum aureum (Hook. f.) J.J. Smith, Bull. Buitz. ser. 2, 8: 22. 1912; Abraham & Vatsala, Introd. Orchids 338. 1981; Manilal, Fl. Silent Valley 270. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 435. 1996; Sath. Kumar & Manilal, Orchid Memories 168. 2004. *Cirrhopetalum aureum* Hook. f., Fl. Brit. India 5: 777. 1890; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1420. 1928.

Epiphytic herbs with distinct Pseudobulbs, ovoid, 1.5 x 1 cm, tapering towards apex, ridged, distantly placed on stout rhizomes. Leaves solitary, elliptic-oblong, to 5 x 1.5 cm, base subacuminate, apex obtuse-emarginate. Flowers 1 or 2, golden yellow, 3 x 1 cm, in about 4 cm long slender peduncle; bract 4.8 x 1.6 mm, lanceolate, acute, 3-veined; dorsal sepals 8.5 x 5.5 mm, elliptic, obtuse at apex, 5-veined; lateral sepals 17 x 3-4 mm, oblong, lanceolate, acute, 5-veined; petals ovate, oblong, as long as the dorsal sepal, broad at base, 3-veined; lip 8 x 2-3 mm, ovate-oblong, obtuse, curved, fleshy.

Fl. & Fr. : November-December.

Distribution: Endemic to Southern Western Ghats, Endangered. *Amitha Bachan 123319* (Sholayar, epiphytic on riparian trees or rocks, along Sholayar river, 700 m).

Bulbophyllum sterile (Lam.) Suresh in Nicolson, Suresh & Manilal, Interpr. Hort. Malab. 291. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 658. 2002; Sath. Kumar & Manilal, Orchid Memories 171. 2004; Anil Kumar *et al.*, Fl. Pathanamthitta 479. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 674. 2009. *Epidendrum sterile* Lam., Encycl. 1: 189. 1783. *Bulbophyllum neilgherrense* Wight, Icon. Pl. Ind. Orient. t. 1650. 1851; Hook. f., Fl. Brit. India 5: 761. 1890; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1418. 1928; Abraham & Vatsala, Introd. Orchids 334. 1981; Manilal, Fl. Silent Valley 271. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 435. 1996.

Epiphytes with uninodal pseudobulbs on a creeping rhizome, stolon-like. Pseudobulbs fleshy, yellowish-green, 2-3 cm long, conical-ovoid, faintly 4-angled. Leaves single, apical, sessile, 4-12 x 1.5-3 cm, elliptic-oblong, apex obtuse, narrowed at base, coriaceous. Racemes lateral, 6-10 cm long, sheathing at base. Flowers brownish-yellow, to 1 cm long, dense, bracts small, oblong-lanceolate. Lateral sepals 1 cm long, ovate-acuminate; dorsal sepal 5 mm long. Petals small; lateral petals ovate-triangular, awned. Lip dark red, 3-lobed, spurred at base.

Fl. & Fr.: February-April.

Distribution: Endemic to South West India. Moist forests to scared groves in plains. *Amitha Bachan 99097* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m).

CLEISOSTOMA Blume

Bijdr. 362. 1825.

Cleisostoma tenuifolium (L.) Garay, Bot. Mus. Leafl. Harvard Univ. 23: 175. 1972; Sasidh. & Sivar., Fl. Pl. Thrissur For. 436. 1996; Sath. Kumar & Manilal, Orchid Memories 174. 2004. *Epidendrum tenuifolium* L., Sp.

Pl. 952. 1753. *Sarcanthus peninsularis* Dalz. in Hooker's J. Bot. Kew Gard. Misc. 3: 343. 1851; Hook. f., Fl. Brit. India 6: 67. 1890; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1447. 1928. *Sarcanthus pauciflorus* Wight, Icon. Pl. Ind. Orient. t. 1747. 1851; Abraham & Vatsala, Introd. Orchids 471. 1981; Anil Kumar *et al.*, Fl. Pathanamthitta 494. 2005.

Plate 39. C

Pendulous epiphytic herbs, to 20-30 cm long. Leaves 10-12 x 0.5 cm, linear, strongly keeled, fleshy, acute. Sheaths ribbed. Flowers yellow with red margins, in 3-6 cm long, leaf-opposed racemes; dorsal sepal 4.5 x 1.2 mm, obovate-oblong, lanceolate, acute, 3-veined; lateral sepals 3 x 1 mm, elliptic, acute, 3-veined; petals 3 x 0.8 mm, falcately-oblong, truncate, 1-veined; lip 2 x 4 mm, 3-lobed, side lobes 1.5 x 1 mm, ovate, apiculate, midlobe, 2 x 1 mm, ovate, with 2 fleshy calli; spur 3 x 1 mm, oblong-ovoid.

Fl. & Fr. : July-August

Distribution: Southern Western Ghats, Sri Lanka and Thailand. Fairly common, in semi-evergreen and evergreen forests. *Amitha Bachan 99190* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m).

CYMBIDIUM Swartz

in Nova Acta Regiae Soc. Sci. Upsal. 6: 70. 1799.

Cymbidium aloifolium (L.) Sw., Nov. Acta Regiae Soc. Upsal. 6: 73. 1799; Hook. f., Fl. Brit. India 6: 8. 1890; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1436. 1928; Sasidh. & Sivar., Fl. Pl. Thrissur For. 437. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 664. 2002; Sath. Kumar & Manilal, Orchid Memories 177. 2004. *Epidendrum aloifolium* L., Sp. Pl. 953. 1753. *Epidendrum pendulum* Roxb., Pl. Coromandel 1: 35. t. 44. 1795. *Cymbidium pendulum* (Roxb.) Sw. & Lindl., Nova Acta Regiae Soc.

Sci. Upsal. 6: 73. 1799; Gamble, Fl. Pres. Madras 1436. 1928; Abraham & Vatsala, Introd. Orchids 325. 1981. *Cymbidium erectum* Wight, Icon. Pl. Ind. Orient. t. 1753. 1851.

Robust epiphytic herbs; roots numerous, densely covering the base. Leaves to 35 x 2 cm, oblong, obtuse at apex. Flowers in 30-40 cm long, pendulous, lax slender racemes; sepals similar, 25 x 5 mm, linear-lanceolate, acute, 7-veined; petals 20 x 6 mm, oblong-lanceolate, acute, 5-veined; lip 17 x 10 mm, trilobed, lateral lobes obliquely oblong, obtuse, less than column; midlobe ovate, acute, disc with 2 fleshy calli at the mouth of the small saccate base.

Fl. & Fr. : April-May.

Distribution: Indo-Malaysia. Moist forests. *Amitha Bachan 123408* (Vazhachal, epiphytic on riparian trees, banks of Chalakkudy river, 230m).

DENDROBIUM Swartz

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

Key to species

1a. Leafy during flowering..... **D. barbatulum**

1b. Leafless during flowering.....2

2a. Inflorescence 3-8 cm long..... **D. ovatum**

2b. Inflorescence 1-1.5 cm long..... **D. herbaceum**

Dendrobium barbatulum Lindl., Gen. Sp. Orchid. Pl. 84. 1830; Hook. f., Fl. Brit. India 5: 719. 1890; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1416. 1928; Manilal, Fl. Silent Valley 276. 1988; Sath. Kumar & Manilal, Orchid Memories 178. 2004.

Epiphytic stout herbs; stem 5-10 cm long, terete. Leaves lanceolate, acute, to 7 cm long. Racemes terminal or lateral, to 5-8 cm. Flowers creamy-white, 2.5 x 2 cm. Dorsal sepals lanceolate, obtuse. Lateral sepals ovate-lanceolate, acute. Petals obovate, obtuse. Lip 13 x 11 mm, 3-lobed, side lobes ovate, obtuse, midlobe obovate, truncate at apex, bearded at the base with yellow hairs.

Fl. & Fr. : December – January

Distribution : Endemic to Peninsular India. *Amitha Bachan 123628* (Sholayar, epiphytic on riparian tree trunks or rocks, along Sholayar river, 700 m).

Dendrobium herbaceum Lindl., Bot. Misc. 69.1840; Hook. f., Fl. Brit. India 5:719.1890; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1416. 1928; Abraham & Vatsala, Introd. Orchids 368. 1981; Manilal, Fl. Silent Valley 276. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 438. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 666. 2002; Sath. Kumar & Manilal, Orchid Memories 179. 2004. *Dendrobium ramosissimum* Wight, Icon. Pl. Ind. Orient. t. 1648. 1851.

Epiphytic herbs, stem 30-40 cm long, copiously branched, leafy, terete, leafless when flowering. Leaves 3-8 x 0.1-1 cm, narrowly linear. Flowers white, yellowish, in 4-6-flowered, 1-1.5 cm long, slender racemes from nodes; pedicel 6-7 mm long; dorsal sepal 5 x 1.5 mm, oblong-lanceolate, acute, 3-veined; lateral sepals 4 x 1.5-2 mm, oblong, subacute, apiculate, falcate, 3-veined; petals 4 x 1 mm, subfalcately oblong, obtuse, apiculate, 1-veined; lip 3 x 2 mm, side lobes ovate-orbicular, very narrow; midlobe thick, orbicular, entire, obtuse.

Fl. & Fr. : December-January.

Distribution: Endemic to Peninsular India. Moist forests. *Amitha Bachan 72005* (Vazhachal, epiphytic on riparian forest trees, banks of Chalakkudy river, 220 m).

Dendrobium ovatum (L.) Kranz. in Engl., Pflanzenr. Orch.-Dendrob. pars 1, 71. 1910; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1416. 1928; Abraham & Vatsala, Introd. Orchids 353. 1981; Sasidh. & Sivar., Fl. Pl. Thrissur For. 439. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 669. 2002; Sath. Kumar & Manilal, Orchid Memories 181. 2004; Anil Kumar *et al.*, Fl. Pathanamthitta 481. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 675. 2009. *Epidendrum ovatum* L., Sp. Pl. 952. 1753. *Cymbidium ovatum* (L.) Willd., Sp. Pl. 4: 101. 1805. *Dendrobium chlorops* Lindl., Bot. Reg. Misc. 44. 1844; Hook. f., Fl. Brit. India 5: 719. 1890. *Dendrobium barbatulum* Wight, Icon. Pl. Ind. Orient. t. 910. 1844, *non* Lindl. 1830. **Plate 39.B**

Epiphytic herbs; stem tufted, 10-25 cm long; internodes 2-3 cm long. Leaves oblong-lanceolate, acute, to 5 x 2 cm, base sheathing, acute at apex; flowering shoots laefless. Racemes many-flowered, 3-8 cm long, terminal or from the axils of fallen leaves. Flowers 1.5-2 cm across, creamy white; bracts ovate-lanceolate. Sepals to 1.5 x 0.6 cm, elliptic-oblong. Petals to 1.5 x 0.7 cm, lateral petals spathulate. Lip flat, 1.5 cm long, 3-lobed, yellow-hairy on dorsal side, mid-lobe large, obovate, side-lobes small, falcate; mentum 4-5 mm long. Pedicel and ovary 1.5-2 cm long. Capsule fusiform.

Fl. & Fr. : December – January.

Distribution: Endemic to the Western Ghats. *Amitha Bachan 123482* (Sholayar, epiphytic on riparian trees, banks of Sholayar river, 700m)

Epipogium Gmelin ex Borkhausen

Prodr. 330, 331. 1810.

Epipogium roseum (D. Don) Lindl., J. Proc. Linn. Soc. Bot. 1: 177. 1857; Manilal, Fl. Silent Valley 279. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 440. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 670. 2002; Sath. Kumar & Manilal, Orchid Memories 185. 2004. *Limodorum roseum* D. Don, Prodr. Fl. Nepal. 30. 1825. *Epipogium nutans* Rchb.f., Bonplandia 5: 36. 1836; Hook. f., Fl. Brit. India 6: 124. 1890; C. E. C. Fisch. Gamble, Fl. Pres. Madras 1460. 1928 '*Epipogum*'. **Plate 39. E**

Saprohytic leafless terrestrial herbs. Stem pale Yellowish-white, yellow when dry, hollow, to 30 cm long with many adpressed thin scales. Roots tuberous. Racemes terminal, few to many-flowered. Flowers 1.2-1.5 cm long, white, speckled with purple. Sepals and petals linear-lanceolate, subequal, narrow, free, erect, spreading. Lip slightly shorter than the petals, entire; disk with 2 or 3 glandular ridges.

Fl. & Fr.: April – June

Distribution: Indo-Malaysia. Evergreen forests. *Amitha Bachan 72082* (Sholayar, riparian evergreen forest, banks of Sholayar river, 700m); *Amitha Bachan 99077* (Karimalathodu-Sholayar, riparian evergreen forest, banks of Koodalthodu & Sholayar river, 800 m).

ERIA Lindley

Bot. Reg. 11: t. 904. 1825, *nom. cons.*

Eria mysorensis Lindl., J. Proc. Linn. Soc. Bot. 3: 54. 1859; Manilal, Fl. Silent Valley 279. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 440. 1996; Sath. Kumar & Manilal, Orchid Memories 187. 2004. *Eria pubescens* Wight, Icon. Pl. Ind. Orient. 5: 4. 1851; Hook. f., Fl. Brit. India 5: 793. 1890; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1425.1928. *Eria*

polystachya Wight, Icon. Pl. Ind. Orient. t. 1634. 1851, non A. Rich. 1841.

Large pseudobulbous epiphytic herbs. Pseudobulbs often elongate and stem like, thick, ovoid, to 3.5 cm. Leaves few, 1-4, oblong lanceolate, obtuse. Scapes many-flowered, to 8-12 cm long, slightly pubescent. Flowers white, tipped with pink, to 1.2-2 cm, glabrous; sepals lanceolate, dorsal a little longer, petals linear-lanceolate, as long as the laterals, lip ovate-subcordate, acute; disc with 5-7 thickened rugose nerves.

Fl. & Fr. : August – September.

Distribution: Endemic to the Western Ghats. Evergreen and shola forests. *Amitha Bachan 98936* (Nelliyampathy-Pullala, epiphytic on streamside trees, stream draining to Karappara river, 1000 m).

HABENARIA Willdenow

Sp. Pl. 4(1): 5, 44. 1805.

Key to species

1a. Side-lobes of lip equal or shorter than sepals.....**H. longicornu**

1b. Side-lobes of lip equal or shorter than sepals.....**H. longicorniculata**

Habenaria longicorniculata Graham, Cat. Bombay Pl. 202. 1839; Abraham & Vatsala, Introd. Orchids 238. 1981; Manilal, Fl. Silent Valley 287. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 444. 1996; Sath. Kumar & Manilal, Orchid Memories 195. 2004; Anil Kumar *et al.*, Fl. Pathanamthitta 486. 2005. *Habenaria longicalcarata* A. Rich., Ann. Sci. Nat. Bot. ser.2, 15: 71,t.3B.1841; Hook. f., Fl. Brit. India 6: 141. 1890; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1470. 1928. *Habenaria longicalcarata* var. *viridis* Blatt. & McCann, J. Bombay Nat. Hist. Soc. 36: 20. 1932. **Plate 40. B**

Terrestrial herbs; stem 20-60 cm high. Leaves clustered towards base of stem, to 15 x 2 cm, linear-lanceolate, acute. Scape to 40 cm long, with several large acuminate sheaths. Flowers white, 2.5 cm across; sepals 1 x 0.6 cm, obliquely ovate; dorsal sepal concave; petals 1 x 0.3 cm, spathulate, obtuse; lip 3-partite, side lobes 1 x 0.6 cm, oblong, subcuneate, oblique at apex, subentire, 1 x 0.6 cm; midlobe linear-oblong, little shorter than the side lobes, narrower; spur long linear, slender above, thickened in the middle, to 12 cm long.

Fl. & Fr.: July-August.

Distribution: Endemic to the Western Ghats. Grasslands and streamside vegetation in medium to high elevations. *Amitha Bachan 98721* (Nelliyampathy-Pullala, along streamside vegetation, stream draining to Karappara river, 1000 m).

Habenaria longicornu Lindl., Gen. Sp. Orchid. Pl. 322. 1835; Hook. f., Fl. Brit. India 6. 139. 1890; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1470. 1928; Abraham & Vatsala, Introd. Orchids 229. 1981; Manilal, Fl. Silent Valley 287. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 444. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 678. 2002; Sath. Kumar & Manilal, Orchid Memories 195. 2004; Anil Kumar *et al.*, Fl. Pathanamthitta 486. 2005. *Habenaria montana* A. Rich., Ann. Sci. Nat. Bot. ser 2, 15: 73 t. 4A. 1841.

Terrestrial herbs to 30-40 cm high. Leaves clustered towards the middle of the stem, linear-oblong, lanceolate, acute or acuminate, to 4-12 x 1-2.5 cm, sheathing at base. Scape to 25 cm tall. Racemes with flowers at extreme tip. Flowers to 4-6, 2.5 cm across; bracts shorter than the 2.5 cm long ovary; sepals ovate, 1 cm long, acute; petals linear-oblong, narrower; lip 3-lobes, to 3 cm long; side lobes 1.2 x 0.5 cm, cuneate,

apex obliquely truncate, fimbriate; midlobe linear, shorter; spur to 10 cm long, apex clavate to 5 cm.

Fl. & Fr.: December-January.

Distribution: Endemic to Peninsular India. Grasslands and open streamside grassy vegetation in evergreen forests. *Amitha Bachan 123661* (Nelliyampathy, on grassy vegetation along streamside, stream draining to Karappara river, 900 m).

OBERONIA Lindley

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

Key to species

1a. Leaves articulated at base.....2

1b. Leaves not articulated at base.....5

2a. Disc of lip saccate.....3

2b. Disc of lip not saccate, but cushion-like or indistinct.....4

3a. Lip papillose..... .....**O. chandrasekharanii**

3b. Lip glabrous..... .....**O. brunoniana**

4a. Lip directed upwards in flowers..... **O. wightiana**

4b. Lip directed downwards, reflexed in flowers.....**O. anamalayana**

5a. Lateral lobes of lip dentate; petals dentate along margins.....
.....**O. brachyphylla**

5b. Lateral lobes of lip subentire; petals subentire along margins.....
.....**O. recurva**

Oberonia anamalayana Joseph, J. Indian Bot. Soc. 42: 222. 1963; Abraham & Vatsala, Introd. Orchids 425. 1981; Manilal, Fl. Silent Valley 294. 1988; Sath. Kumar & Manilal, Orchid Memories 204. 2004.

Epiphytic herbs. Leaves to 8-20 x 3-6 cm, oblong, acute. Scape up to 7 cm, flattened. Spike up to 30 cm long. Flowers greenish yellow brown, 5 x 2 mm, in verticals, loosly arranged; dorsal sepal oblong, obtuse; lateral sepals oblong-ovate, obtuse; petals linear, obtuse, decurved along margins; lip 2.5 mm across, 3-lobed, erect, conical; lateral lobes longitudinally elongated; midlobe 2-lobuled; lobules orbicular, shallowly crenate, sinus with a rounded protuberance; disc ovate-lanceolate, cushion like.

Fl. & Fr.: January – March.

Distribution: Endemic to Southern Western Ghats. Evergreen forests. *Amitha Bachan 123646* (Malakkapara, riparian evergreen forests, banks of Sholayar river, 900 m).

Oberonia brachyphylla Blatt. & McCann, J. Bombay Nat. Hist. Soc. 35: 257. 1931; Joseph *et al.*, Bull. Bot. Surv. India 20: 169. 1978; Abraham & Vatsala, Introd. Orchids 416. 1981; Manilal, Fl. Silent Valley 296. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 685. 2002; Sath. Kumar & Manilal, Orchid Memories 204. 2004.

Very small, usually drooping epiphytic herbs. Leaves lanceolate to elliptic-ensiform, to 1-5 x 0.3-0.8 cm, acuminate, not articulated at base. Scape to 1 cm long. Flowers on 4-7 cm long spikes, 1mm, greenish-yellow. Sepals and petals dissimilar, 0.4-0.5 mm long. Lip 1 x 0.7 mm, 3-lobed; lateral lobes ear like, dentate on margins; mid lobe obovate, dentate, 2-lobuled. Ovary pedicelled, 1 mm long.

Fl. & Fr.: January – April.

Distribution : Endemic to Southern Western Ghats. Rare. Evergreen forests. *Amitha Bachan 99098* (Nelliyampathy, on streamside vegetation, stream draining to Karappara river, 1000 m).

Oberonia brunoniana Wight, Icon. Pl. Ind. Orient. t. 1622. 1851; Hook. f., Fl. Brit. India 5: 681. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1406. 1928; Abraham & Vatsala, Introd. Orchids 422. 1981; Manilal, Fl. Silent Valley 296. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 449. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 685. 2002; Sath. Kumar & Manilal, Orchid Memories 204. 2004; Anil Kumar *et al.*, Fl. Pathanamthitta 490. 2005.

Small epiphytic herbs. Leaves oblong-ensiform, acute, to 25 x 2 cm. Spike to 15 cm long, stout. Scape adnate to the upper leaves. Flowers yellow, in verticals, sessile. Sepals and petals reflexed. Sepals entire, 2 x 1.2 mm; dorsal oblong, obtuse; laterals obliquely ovate, subacute, sparsely gland-dotted. Petals lanceolate, subentire, 2 x 7 mm, pale yellowish. Lip ovate, 3-lobed, 2-25 mm across, gland-dotted, with a concave disc, dark brownish; lateral lobes oblong, subentire, midlobe 2-lobuled, lobules diverging, sinus broad.

Fl. & Fr. : December – January.

Distribution: Endemic to Southern Western Ghats. Evergreen forests. *Amitha Bachan 98932* (Nelliyampathy-Pullala, on streamside vegetation, stream draining to Karappara river, 1000 m).

Oberonia chandrasekharanii V.J. Nair, V.S. Ramach. & R. Ansari, Blumea 28:361.1983; Manilal, Fl. Silent Valley 296. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 450. 1996; Sath. Kumar & Manilal, Orchid Memories 204. 2004. *Oberonia rangannaiana* Murthy, Yoganarasimhan & K.V. Nair, Curr. Sci. 56: 621. 1987.

Medium sized epiphytic herbs, usually pendulous. Leaves ensiform articulated, long, to 15 x 2 cm, acute. Scape flattened. Spike to 25 cm long, pendulous. Flowers greenish-yellow, 2 x 1 mm, in verticils; bracts 2 x 1.3 mm, ovate, acute, denticulate, gland-dotted; dorsal sepals ovate-

obtuse; lateral sepals ovate, acute; petals linear, truncate and denticulate at apex; lip 1.5 x 2 mm, semi-orbicular in outline, 3-lobed, hairy, gland dotted; lateral lobes auriculiform, folded upwards; midlobe 2-lobuled with a broad sinus; lobules orbicular; disc ovate, concave, saccate.

Fl. & Fr. : December – April.

Distribution: Endemic to Southern Western Ghats. Evergreen forests. *Amitha Bachan 123623* (Sholayar, on riparian trees, banks of Sholayar river, 650 m)

Oberonia recurva Lindl., Bot. Reg. 25. Misc. 14. 1839 & Fol. Orch. Oberonia 5. 1859; Hook. f., Fl. Brit. India 5: 680. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1406. 1928; Sasidh. & Sivar., Fl. Pl. Thrissur For. 450. 1996; Sath. Kumar & Manilal, Orchid Memories 206. 2004. *Oberonia lingmalensis* Blatt. & McCann, J. Bombay Nat. Hist. Soc. 35: 255. 1931. *Oberonia recurva* Lindl. var. *lingmalensis* (Blatt. & McCann) Sant. & Kapadia, J. Bombay Nat. Hist. Soc. 57: 259. 1960. **Plate 39. D**

Very small erect or pendulous epiphyte. Leaves linear-ensiform, lower leaves broader, acute. Scape terete. Spike to 6 cm long, dense flowered. Flowers 1.5 x 1 mm, orange-yellow, in verticils; dorsal sepal oblong or ovate, obtuse; lateral sepals ovate, acuminate; petals oblong-ovate or oblanceolate, acute; lip 3-lobed; lateral lobes ear-like, curved upwards; midlobe oblong, 2-lobuled; lobules oblong-ligulate, diverging, sinus narrow, without any protuberance; disc obovate, concave.

Fl. & Fr.: February-May.

Distribution: India, Sri Lanka, Bhutan and Thailand. In riparian evergreen forest. *Amitha Bachan 72022* (Vazhachal, on riparian trees at low elevations, banks of Chalakkudy river, 220 m).

Oberonia wightiana Lindl., Bot. Reg. 25. Misc. 9. 1839; Hook. f., Fl. Brit. India 5: 683. 1888; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1407. 1928; Manilal, Fl. Silent Valley 298. 1988; Sath. Kumar & Manilal, Orchid Memories 209. 2004. *Oberonia arnottiana* Wight, Icon. Pl. Ind. Orient. t. 1628. 1851. *Oberonia wightiana* Lindl. var. *arnottiana* (Wight) R. Ansari *et al.*, J. Econ. Tax. Bot. 3: 118. 1982. *Oberonia wightiana* Lindl. var. *nilgirensis* R. Ansari *et al.*, J. Econ. Tax. Bot. 3: 118. 1982.

Very small epiphytic herbs. Leaves linear oblong-ensiform or narrow, to 15 x 1 cm, acute. Scape terete not adnate to the upper leaves. Spike to 15 cm long. Flowers 3.5 x 1.5 mm, orange-yellow, scattered on the rachis, shortly pedicelled; dorsal sepal oblong, obtuse, entire; lateral sepals ovate-oblong, subacute; petals linear, obtuse, entire; lip 2 mm across, 3-lobed; lateral lobes oblong, ligulate, wing-like on spreading; midlobe 2-lobuled; lobules ligulate, toothed at apex, diverging; disc ovate, indistinct.

Fl. & Fr.: August -November.

Distribution: Endemic to South India & Sri-Lanka. Evergreen forests. *Amitha Bachan 123661* (Nelliyampathy, on trees of the riparian forests, banks of Karappara river, 900 m).

PECTEILIS Rafinesque-Schmaltz

Fl. Tellur. 2: 37. 1836.

Pecteilis gigantea (J. E. Smith) Rafin., Fl. Tellur. 2: 38. 1837; Manilal, Fl. Silent Valley 299. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 452. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 689. 2002; Sath. Kumar & Manilal, Orchid Memories 211. 2004; Anil Kumar *et al.*, Fl. Pathanamthitta 491. 2005. *Orchis gigantea* J. E. Smith, Exot. Bot. 2: 79,t.100. 1805. *Habenaria susannae* Hook. f., Fl. Brit. India 6: 137.

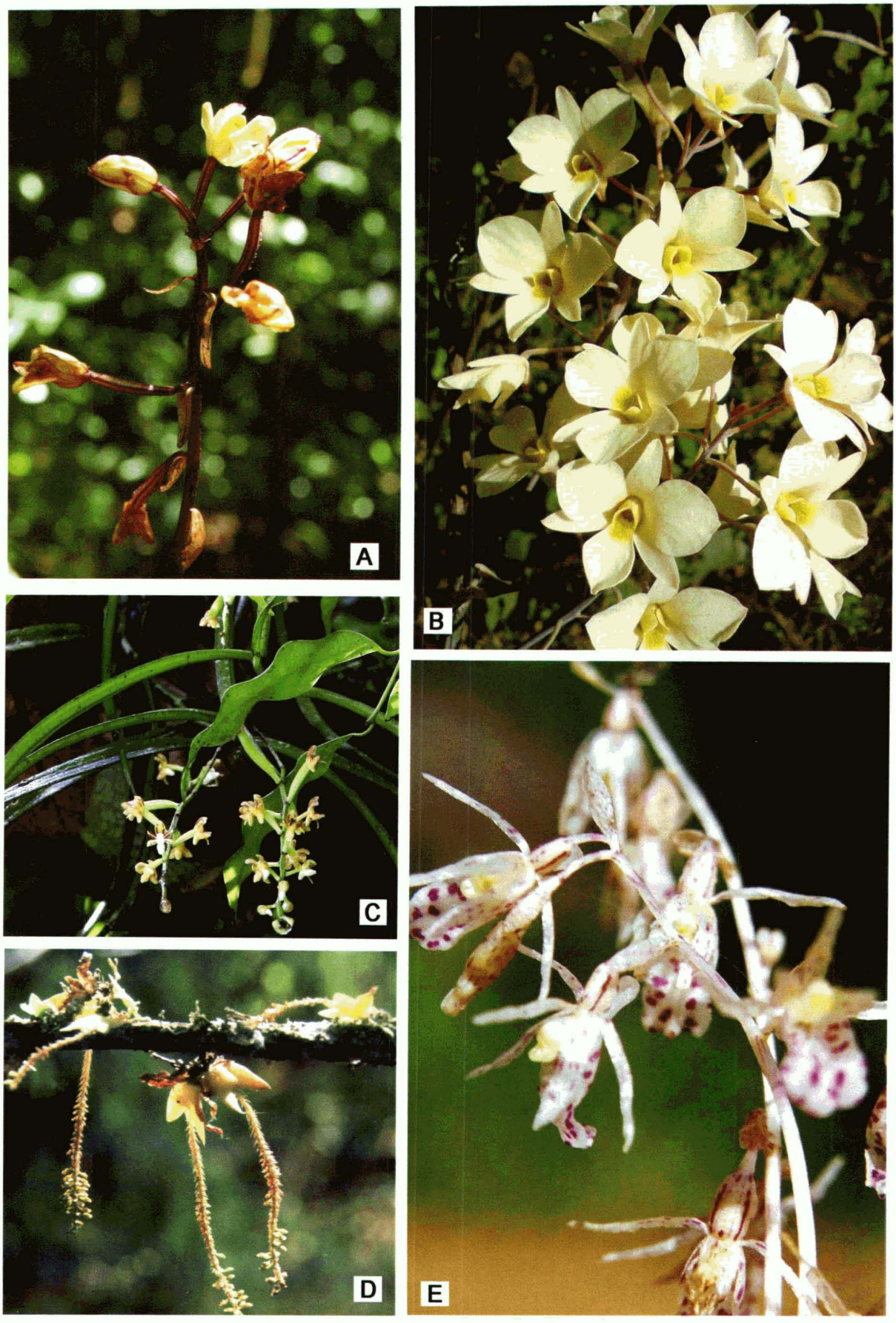


Plate 39. A. *Aphyllorchis montana* Rchb.f.; B. *Dendrobium ovatum* (L.) Kranz.; C. *Cleisostoma tenuifolium* (L.) Garay;D. *Oberonia recurva* Lindl.; E. *Epipogium roseum* (D. Don) Lindl.

1890, non (L.) R. Br. ex Spreng. 1826. *Platanthera susannae* Wight, Icon. Pl. Ind. Orient. t. 920. 1845, *non* (L.) Lindl. 1835; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1475. 1928. *Platanthera gigantea* (J.E. Smith) J. Vejik, Orchideea 27:133. 1965. **Plate 40. C**

Terrestrial tuberous, stout herbs, to 90 cm tall, leafy upto the infloresence. Leaves ovate-lanceolate, acute, sessile, to 10 x 7 cm, scattered. Flowers white, 10 x 8 cm, racemes terminal, 3-6-flowered, fragrant; bracts 7.5 x 3 cm, ovate-acuminate, foliaceous; dorsal sepal 4 x 5 cm, rhomboid, 7-9-veined; lateral sepals 5 x 2.5 cm, oblique at base, oblong, subacute, obtuse, 7-9-veined; petals 3.5 x 2-4 mm, linear, falcate, obtuse; lip 15 x 7 cm, including 12-13 x 0.5 cm cylindrical spur, 3-lobed; lateral lobes laciniate; midlobe oblong-lanceolate, obtuse; spur slender, cylindrical; column short, foot absent; pollinia 2, granular, with long caudicle.

Fl. & Fr. : September-October.

Distribution : Indo-Malaysia. Evergreen forests. *Amitha Bachan 98726* (Nelliyampathy-Ranimedu, in stream bank vegetation, banks of stream draining to Veetiyar, 900 m).

PHOLIDOTA Lindley ex W. J. Hooker

Exot. Fl. 2: 138. 1825.

Pholidota imbricata Hook., Exot. Fl. t. 138. 1825; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1431. 1928; Sath. Kumar & Manilal, Orchid Memories 213. 2004. *Pholidota pallida* sensu Abraham & Vatsala, Intr. Orch. 288. 1981, non Lindl. 1836; Manilal, Fl. Silent Valley 301. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 452. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 493. 2005; C. N. Sunil & Sivad., Fl. Pl. Alappuzha Dist. 679. 2009.

Large epiphytic herbs with crowded pseudobulbs and tufted roots, to 35 cm long. Pseudobulb sheathed, ovoid, subtetragonal smooth, crowded, to 4-6 cm long. Leaves solitary, oblanceolate-oblong, acute, coriaceous, shallowly plicate, to 40 x 5.5 cm, strongly 3-nerved. Racemes drooping, axillary 20-40 cm long. Flowering portion about 30 cm long; bracts 6-9 x 5-6 mm, ovate or orbicular, acute, imbricating distichous. Flowers many, closely arranged; dorsal sepal ovate, obtuse, 3-5-veined, creamy orange.; lateral sepals ovate, cymbiform, connate at base, acute, 3-5-veined; petals linear, subacute, 1-veined; lip 8 x 8.4 mm; saccate 5-veined; midlobe bifid, lobules rounded; column short, broadly winged; foot 0; pollinia 4, waxy, cohering in pairs. Capsule oblong-ellipsoid, pendulous.

Fl. & Fr. : October- May.

Distribution: Indo-Malaysia. Moist forests also in scared groves. *Amitha Bachan 123609* (Vazhachal, on riparian forest trees, banks of Chalakkudy river, 230 m).

PODOCHILUS Blume

Bijdr. 295. t. 12. 1825.

Podochilus malabaricus Wight, Icon. Pl. Ind. Orient. t. 1748. 1851; Hook. f., Fl. Brit. India 6: 80. 1880; Sath. Kumar & Manilal, Orchid Memories 213. 2004; Anil Kumar *et al.*, Fl. Pathanamthitta 493. 2005. *Podochilus falcatus auct. non* Lindl. 1833: *sensu* C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1450. 1928; Abraham & Vatsala, Introd. Orchids 390. 1981.

Epiphytic tufted herbs, to 15 cm tall. Leaves many, closely set, subulate, 7 x 1.2 mm, obtuse at apex, equitant, distichous, flat, laterally compressed, fleshy. Flowers white with violet tinge, in 4.5-5 cm long,

slender, flexuous terminal racemes; bracts ovate, 2 x 1 mm, acuminate, keeled, 1-veined, persistent; dorsal sepal ovate-lanceolate, acute, 1-veined; lateral sepals oblong-falcate, acute, 1-veined; petals oblong-lanceolate, acute, 1-veined; lip, 2.1 x 0.5 mm, oblong-lanceolate, subacute, jointed to the foot, forming a mentum; disc with 3 parallel ridges; column short with a well developed foot; pollinia 4, with a subclavate caudicle.

Fl. & Fr. : September- January.

Distribution: Endemic to South India and Sri Lanka. Evergreen forests. *Amitha Bachan 117621* (Malakkapara, on riparian trees, banks of Sholayar river, 900 m).

SATYRIUM Swartz

Kongl. Vetensk. Acad. Nya Handl. 21: 214. 1800, *nom. cons.*

Satyrium nepalense D. Don, Prodr. Fl. Nepal. 26: 1825; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1476. 1928; Abraham & Vatsala, Introd. Orchids 210. 1981; N. Mohanan & Sivad., Fl. Agasthyamala 694. 2002; Sath. Kumar & Manilal, Orchid Memories 218. 2004; Anil Kumar *et al.*, Fl. Pathanamthitta 495. 2005. *Satyrium wightianum* Lindl., Gen. Sp. Orch. 340. 1838; Wight, Icon. Pl. Ind. Orient. t. 1718. 1851. *Satyrium perottetianum* Ann. Sci. Nat. Bot. (Ser. 2) 15: 76. T. 5B. 1841; Wight, Icon. Pl. Ind. Orient. t. 1716. 1851. *Satyrium albiflorum* A. Rich., I. c. 76. 1841. Wight, Icon. Pl. Ind. Orient. t. 1717. 1851. **Plate 40. A**

Terrestrial, erect, leafy, unbranched herbs, to 30 cm tall. Roots tuberous. Leaves 2 or 3, ovate or elliptic-lanceolate, acute or subacuminate, to 5.5-14 x 3-6 cm. Flowers pink, in 10-35 cm long, dense terminal raceme; dorsal sepal oblong-lanceolate, 3-veined; lateral sepals elliptic, obtuse, 5-veined; petals oblong, obtuse, 3-veined; lip 21 x

6 mm, superior, concave, keeled, enclosing the column with two parallel spurs; column erect; foot 0; pollinia 2, with recurved caudicle.

Fl. & Fr. : August-September.

Distribution: India, Sri Lanka, Myanmar and China. Montane grasslands, open grassy vegetation along streamsides. *Amitha Bachan 98722* (Nelliyampathy, on streamside vegetation, stream draining to Karappara river, 1000 m).

SIRHOOKERA Kuntze

Rev. Gen. Pl. 2: 681. 1891.

Key to species

1a. Petiole short, 1-1.5 cm, sheathing..... **S. latifolia**

1b. Petiole long, 2-5 cm, not sheathing..... **S. lanceolata**

Sirhookera lanceolata (Wight) Kuntze., Rev. Gen. Pl. 2: 681. 1891; Abraham & Vatsala, Introd. Orchids 258. 1981; Manilal, Fl. Silent Valley 305. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 695. 2002; Sath. Kumar & Manilal, Orchid Memories 222. 2004; Anil Kumar *et al.*, Fl. Pathanamthitta 495. 2005. *Josephia lanceolata* Wight, Icon. Pl. Ind. Orient. t. 1753. 1851; Hook. f., Fl. Brit. India 5: 823. 1890; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1428. 1928.

Epiphytic stemless perennial herbs. Leaves elliptic-oblong or oblanceolate-oblong, subacute at apex, to 6-12 x 3.5-4 cm, petiole 2-5 cm long; lower side of the leaf purple. Flowers white, in 20-25 cm long, spreading panicles; branches slender; dorsal sepal 3 x 2.9 mm, elliptic-obtuse, 3-veined; lateral sepals 3 x 1.5 mm, oblong, obtuse, 3-veined; petals 3 x 1 mm, oblanceolate, obtuse, 1-veined; lip 35 x 1.5-2 mm, panduriform, 3-lobed; lateral lobes short, blunt; midlobe elliptic-oblong, bifid at apex. Pedicel and ovary to 0.3 cm long.

Fl. & Fr. : August – December.

Distribution : South India and Sri Lanka. Evergreen, riparian and Shola forests. *Amitha Bachan 98944* (Karappara-Nelliyampathy, on riparian trees, banks of Karappara river, 800 m).

Sirhookera latifolia (Wight) Kuntze, Rev. Gen. Pl. 2: 681. 1891; Manilal, Fl. Silent Valley 305. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 454. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 695. 2002; Sath. Kumar & Manilal, Orchid Memories 222. 2004. *Josephia latifolia* Wight, Icon. Pl. Ind. Orient. t. 1743. 1851; Hook. f., Fl. Brit. India 5: 823. 1890; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1428. 1928.

Epiphytic perennial herbs with very short stem and vermiform roots. Leaves 8-10 x 2-3 cm, oblong, acute at apex, attenuate at base into a very short or sub-sessile sheathing petiole; petiole 1-1.5 cm long, Flowers yellowish-white, in 15-20 cm long spreading panicle; branches slender; dorsal sepal obovate, obtuse, 3-veined; lateral sepals elliptic-oblong, obtuse, 3-veined; petals oblong, obtuse, 1-veined; lip 4 x 2 mm, 2-lobed; lateral lobes smaller, oblong, obtuse, incurved; midlobe ovate, obtuse or acute.

Fl. & Fr.: August-September.

Distribution : Endemic to Southern Western Ghats and Sri Lanka. Evergreen forests. *Amitha Bachan 72028* (Vazhachal, riparian forest, banks of Chalakkudy river, 220 m).

TRIAS Lindley

in Wallich, Cat. 1977. 1829.

Trias stocksii Benth. ex Hook. f., Fl. Brit. India 5: 781. 1890; Vivek. *et al.*, Bull. Bot. Surv. India 10: 240. 1969; Sasidh. & Sivar., Fl. Pl. Thrissur

For. 455. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 698. 2002; Sath. Kumar & Manilal, Orchid Memories 227. 2004.

Rihizomatous epiphytic herbs. Pseudobulb subglobose, 1.5 x 1.5 cm, distantly placed on stout rhizome, rooting below. Leaves solitary, 1.5-3.5 x 1.5 cm, elliptic, acute; petiole 5mm. Flowers pinkish, 2 or 3 from the base of the pseudobulb; dorsal sepal ovate, obtuse, 7-veined; lateral sepals obliquely ovate, obtuse, 7-veined; petals linear, apiculate; lip 4 mm long, oblong, acute, fleshy, puberulus; column 3 mm; wing oblong, truncate; operculum 2.5 x 0.8 mm, including 1.5 mm long prolongation.

Fl. & Fr. : December-January

Distribution : Endemic to Southern Western Ghats. Rare. evergreen, Shola forests. *Amitha Bachan 98927* (Pullala-Nelliyampathy, epiphytic on trees of streamside vegetation, stream draining to Karappara river, 1000 m).

XENIKOPHYTON Garay

Bot. mus. Leafl. 23:374. 1974.

Xenikophyton smeeanum (Rchb.f.) Garay, Bot. Mus. Leafl. Harvard Univ. 23:374.1974; Manilal, Fl. Silent Valley 308. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 702. 2002; Sath. Kumar & Manilal, Orchid Memories 230. 2004. *Saccolabium smeeanum* Rchb. f., Gard. Chron. ser. 3, 2: 214. 1887. *Rhynchostylis latifolia* C. E. C. Fisch., Bull. Misc. Inform. Kew 1927: 358. 1927; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1440. 1928. *Schoenorchis latifolia* (C. E. C. Fisch.) Saldanha, J. Bombay Nat. Hist. Soc. 70: 414. 1974; Abraham & Vatsala, Introd. Orchids 475. 1981.

Epiphytic herbs, stem stout. Leaves thick, flat-oblong, keeled, to 3.5-8 x 1.5-2.5 cm, emarginate at apex. Flowers in axillary simple or

branched spikes, 5-12 cm long; Flowers whitish-brown, small. Spur pouch-like, at right angle to the pedicel. Lip fleshy, 2 mm long, obscurely 3-lobed. Pollinia 4.

Fl. & Fr. : April- August.

Distribution: Endemic to Southern Western Ghats, Evergreen-riparian forests. *Amitha Bachan 98809* (Vazhachal, riparian evergreen forests, banks of Chalakkudy river, 230 m).

114. ZINGIBERACEAE Lindl.

Key Bot. 69. 1835.

Key to genera

1a. Ovary 1-celled; placentation parietal.....**Globba**

1b. Ovary 3-celled; placentation axile.....2

2a. Bracts pouched, basally connate, sterile terminal bract basally coloured .....**Curcuma**

2b. Bracts not as above.....3

3a. Inflorescence lateral, usually arising directly from rhizome.....4

3b. Inflorescence terminal on leafy stem.....6

4a. Flowers in lax trailing panicle.....**Elettaria**

4b. Flowers in dense strobilioid spike.....5

5a. Anthers diverging towards the apex, connective not developed into a beak.....**Amomum**

5b. Anthers not diverging, connective produced into a long beak at apex. .....**Zingiber**

6a. Spikes 1-sided; sheath saccate.....**Boesenbergia**

6b. Spikes radiate; sheath otherwise.....**Hedychium**

AMOMUM Roxburgh

Fl. Ind. 1: 317. 1820, *nom. cons.*

Amomum muricatum Bedd., Madras J. Lit. Sci. ser. 3, 1: 59. 1864; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1487. 1928; Manilal, Fl. Silent Valley 310. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 458. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 707. 2002; M. Sabu, Zingiberaceae & Costaceae of South India 88. 2006.

Tall herbs, stem 1.5-3 m high, leafy, densely clumped, erect. Leaves elliptic-oblong, to 32 x 8 cm, abruptly-finely acuminate at apex, short petioled, glabrous; ligule 3 mm long, truncate, Spike 2-5-together, 14-15 cm long, shortly peduncled; floral bracts obovate, 3.5 x 1.5 cm, obtuse, ciliate; yellow with brown lines; bracteoles 2 cm long, lobes obtuse. Flowers densely packed; calyx tube 2.5 cm long, lobes obtuse, cuspidate; corolla tube 2.8 cm long, lobes unequal, oblong, to 3 x 1.6 cm, obtuse, yellow with red lines; anthers 0.9 cm long, crest, 1.5 cm broad, auriculate; lip 4 x 3 cm; middle lobes emarginate, yellow, with brown streaks. Capsule 1.5-2 cm across, brown.

Fl. & Fr. : January-June.

Distribution: Endemic to Southern Western Ghats. Undergrowth in evergreen forests. Riparian forests. *Amitha Bachan 117620* (Malakkapara, riparian forest, banks of Sholayar river, 800 m).

BOESENBERGIA Kuntze

Rev. Gen. Pl. 2: 685. 1891.

Boesenbergia pulcherrima (Wall.) Kuntze, Rev. Gen. Pl. 2: 685. 1891; Mangaly & Swarup., Bull. Bot. Surv. India 23: 235. 1981 Manilal, Fl. Silent Valley 310. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 458. 1996;

M. Sabu, Zingiberaceae & Costaceae of South India 121. 2006. *Gastrochilus pulcherrimus* Wall., Pl. Asiat. Rar. 1: 22, t. 24. 1829; Baker in Hook. f., Fl. Brit. India 6: 217. 1890. **Plate 40. E**

Herbs, to 15-25 cm high, suberect. Leaves simple, few, scattered, broadly elliptic, to 18 x 6.5 cm, acute-acuminat at apex, acute-obtuse at bas, thinly tomentose beneath; petiole to 2 cm long; sheath saccate. Spike to 5 cm long, terminal, one-sided; bracts obovate, 2 cm long, obtuse; bracteoles tubular, deeply cleft to the base. Flowers solitary in each bracts; calyx tube short, truncate; corolla tube 1.5 cm long; lobes equal, oblong, 1 x 0.4 cm; lip obovate, 2 x 1.5 cm, acute, white with red-purple spots; lateral staminodes obovate, 1 x 0.5 cm; filaments 0.2 cm long; anthers parallel, not crested; ovary oblong, 3 -celled; ovules few; style filiform. Fruit an oblong capsule.

Fl. & Fr. : August-September.

Distribution: Endemic to Southern Western Ghats. Evergreen forests. *Amitha Bachan 123402* (Kannankuzhi- Athirappilly, ground vegetation of the riparian evergreen forests, banks of Kannankuzhy-thodu, 90m); *Amitha Bachan 117608* (Vazhachal, ground cover of riparian vegetation, banks of Chalakkudy river, 230 m).

CURCUMA Linnaeus

Sp. Pl. 2. 1753, *nom. cons.*

Curcuma aurantiaca Zijp in Trav. Bot. Neerl. 12: 345. 1915. *Curcuma ecalcarata* Sivar. & Indu, Notes Roy. Bot. Gard. Edinb. 41: 321. 1983; Mangaly & M. Sabu, Rheedea 3:151. 1993; Sasidh. & Sivar., Fl. Pl. Thrissur For. 459. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 498. 2005; M. Sabu, Zingiberaceae & Costaceae of South India 150. 2006.

Plate 40. D

Herbs with tuberous rootstock. Leaves distichous, broadly ovate-oblong, 25 x 12 cm, acute to acuminate at apex, obtuse to emarginate at base; ligule acute. Flowers on dense bracteate spikes ending in a yellow-white coma from the centre of the leaves. Calyx truncate, 1 cm; Corolla 2 cm, dorsal lobe larger, hooded, concave. Staminodes bright yellow; lip 3-lobed, mid lobe larger. Anthers not spurred. Ovary 3-celled; ovules many. Capsule globose.

Fl. & Fr. : August-September.

Distribution: Endemic to the Western Ghats. Ground cover, riparian forest vegetation. *Amitha Bachan 117609* (Vazhachal, ground cover in the riparian vegetation, banks of Chalakkudy river, 230 m).

ELETTARIA Maton

Trans. Linn. Soc. London 10: 250. 1811.

Elettaria cardamomum (L.) Maton, Trans. Linn. Soc. London 10: 250. 1811; Baker in Hook. f., Fl. Brit. India 6: 251. 1892; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1491. 1928; Manilal, Fl. Silent Valley 312. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 460. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 499. 2005; M. Sabu, Zingiberaceae & Costaceae of South India 150. 2006. *Amomum cardamomum* L., Sp. Pl. 1: 1. 1753. *Alpinia cardamomum* (L.) Roxb., Asiat. Res. 11: 356. 1810 & Pl. Coromandel Coast 3: 19. t. 226. 1819. *Elettaria cardamomum* (L.) Maton var. *minus* Watt, Econ. Prodr. India 512. 1908. *Elettaria cardamomum* (L.) Maton var. *minuscula* Burkill, Bull. Misc. Inform. Kew 1930:35.1930. **Elam**.

Perennial rhizomatous herbs to 1.5-3 m high. Rhizome branched, thick. Leafy shoots to 2m high, tufted. Leaves bifarious, elliptic-lanceolate, to 60 x 10 cm, acute. Panicle arising from the rhizome, 25-50

cm long, prostrate or erect; bracts scarius, 3-4 cm long, carrying 2-7 flowers; calyx tubular, 1 cm long, split on 1 side; corolla white, tube equal to the calyx, lobes unequal, oblong, to 2 cm long; labellum obovate, 1 x 0.5 cm, white with red lines; stamen 1, filaments short; anther cells parallel, shortly spurred; staminodes short; ovary 3-celled, ovules many, style filiform, stigma funnel-shaped. Capsule ellipsoid, 1.2 x 0.3 cm, striate; seeds many, angular, fragrant.

Fl. & Fr. : August-February.

Distribution: India, Malaysia and China. Evergreen forests. *Amitha Bachan 117650* (Nelliyampathy, riparian forest, banks of Karappara river, 900 m).

GLOBBA Linnaeus

Mantissa Pl. 2: 170. 1771.

Globba marantina L., Mantissa Pl. 2: 170. 1771; Baker in Hook. f., Fl. Brit. India 6: 206. 1890; Sasidh. & Sivar., Fl. Pl. Thrissur For. 462. 1996; M. Sabu, Zingiberaceae & Costaceae of South India 106. 2006. *Globba bulbifera* Roxb., Asiat. Res. 11: 358. 1810; Baker in Hook. f., Fl. Brit. India 6: 206. 1890; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1481. 1928; Manilal, Fl. Silent Valley 312. 1988. *Globba marantinoides* Wight, Icon. Pl. Ind. Orient. t. 2001. 1853. **Plate 40. G**

Erect rhizomatous herbs to 50 cm high, stem usually solitary, slender. Leaves bifarious, oblong-lanceolate, to 20 x 5 cm, acute at apex, sessile, glabrous. Spike terminal, to 10 cm long, often with bulbils towards the base; bracts 1-2 cm long, broadly ovate, greenish; bracteoles ovate, 1 cm long. Flowers solitary in each bracts; calyx 0.5 cm long, funnel-shaped, 3-lobed; corolla 1.4 cm long, tube slender, lobes short, yellow; lip as long as the corolla, deeply 2-lobed, yellow; stamen 1,

anthers broadly winged; lateral staminodes oblong; ovary 1-celled; ovules many on 3-parietal placentae; style 1, slender; stigma turbinate. Capsule oblong, 1 x 6 mm, glabrous, coarsely rugose.

Fl. & Fr. : July-August.

Distribution: Indo-Malaysia. Evergreen riparian forests. *Amitha Bachan 123412* (Vazhachal, ground vegetation of the riparian evergreen forests, banks of Chalakkudy river, 200 m).

HEDYCHIUM Koenig

in Retzius, Observ. Bot. 3: 61. 1783.

Hedychium coronarium Koenig in Retz., Obs. Bot. 3: 73. 1783; Wight, Icon. Pl. Ind. Orient. t. 2010. 1853; Baker in Hook. f., Fl. Brit. India 6: 225. 1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1485. 1928; Manilal, Fl. Silent Valley 313. 1988; M. Sabu, Zingiberaceae & Costaceae of South India 196. 2006. **Kalyana sougandhikam**.

Robust herbs to 1.5 m high; rhizome horizontal. Leaves oblong, to 30 x 10 cm, acuminate, glabrate; ligule 2 cm long, acuminate. Spike ovoid, to 16 x 8 cm; bracts oblong, obtuse, to 6 x 2 cm, glabrous. Flowers 2-4 in each bracts; calyx 4 cm long, not lobed, glabrous; corolla tube narrow, to 8 cm long, glabrous, white, lobes, slender, 3.5 cm long, glabrous; lip 6 x 6 cm; lobes emarginate, white; anthers 1.5 cm long, filaments shorter than lip.

Fl. & Fr. : July-December.

Distribution: Tropics, cultivated. *Amitha Bachan 117680* (Malakkapara, riparian, banks of Sholayar river, 900 m).

115. COSTACEAE Nakai

J. Jap. Bot. 17: 189. 1941.

COSTUS Linnaeus

Sp. Pl. 2. 1753.

Costus speciosus (Koenig) J.E. Smith, Trans. Linn. Soc. London 1: 249. 1791; Wight, Icon. Pl. Ind. Orient. t. 2014. 1853. Baker in Hook. f., Fl. Brit. India 6: 249. 1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1490. 1928; A. S. Rao & D. M. Verma, Bull. Bot. Surv. India14: 138. 1972; Manilal, Fl. Silent Valley 311. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 459. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 708. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 497. 2005; M. Sabu, Zingiberaceae & Costaceae of South India 259. 2006. C. N. Sunil & Sivad., Fl. Alappuzha 682. 2009. *Banksea speciosa* Koenig in Retz., Obs. Bot. 3: 75. 1783. **Channa-kuva, Anakkuva.** **Plate 40. F**

Perennial herbs with creeping rhizome; stem 1-2 m tall, spirally twaining, fleshy; rhizome horizontal, cylindrical, yellowish-green inside, Leaves spirally arranged, oblong to oblong lanceolate, to 24 x 6 cm, abruptly acuminate at apex, acute at base, sessile, glabrous. Spike strobilioid, terminal, to 10 cm long; bracts oblong, 3 cm long, mucronate, brownish-red. Flowers solitary in each bract, calyx 2 cm long, tubular; corolla 3-lobed, pinkish-white; lip obovate, 5 cm across, white, yellowish at centre, entire; staminal filaments petalloid; anthers parallel. Capsule globose, reddish.

Fl. & Fr. : July-October.

Distribution : Indo-Malaysia. Wet areas in the forests. *Amitha Bachan 117669* (Anakkayam, along the riparian forests, banks of Anakkyam-thodu, 600 m).

116. **MARANTACEAE** Petersen in Engler & Prantl

Nat. Pflanzenfam. 2(6): 33. 1888.

SCHUMANNIANTHUS Gagnepain

Bull. Soc. Bot. France 51: 176. 1904.

Schumannianthus virgatus (Roxb.) Rolfe, J. Bot. 14: 244. 1907; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1494. 1928; Manilal, Fl. Silent Valley 315. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 464. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 712. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 501. 2005. *Phrynium virg*atum Roxb., Asiat. Res. 11: 324. 1810. *Maranta virgata* (Roxb.) Wall. ex Wight, Icon. Pl. Ind. Orient. t. 2015. 1853. *Clinogyne virgata* (Roxb.) Benth. in Benth. & Hook. f., Gen. Pl. 3: 651. 1883; Baker in Hook. f., Fl. Brit. India 6: 258. 1892. **Channa.**

Erect leafy subshrubs to 4 m high; stem thickened at nodes, reed like. Leaves bifarious, ovate-oblong, to 38 x 16 cm, cuspidate at apex, rounded at base; petiole to 1 cm long, hairy; sheath to 20 cm long. Flowers in lax panicles; panicle to 50 cm long, branches slender, dichotomous; bracts narrow linear. Flowers paired in each bract; sepals small, ovate lanceolate; corolla white, tube short; stamens 1, outer staminodes petalloid, white, to 1.5 cm long; inner staminodes smaller; ovary villous hairy, 3-celled, solitary in each cell, basal. Berry subpyriform, rugose. Seeds subglobose.

Fl. & Fr. : Throughout the year.

Distribution : Endemic to India and Sri Lanka. Along stream banks in moist forests. *Amitha Bachan 117678* (Malakkapara, banks of Sholayar river, 900 m).

117. HYPOXIDACEAE R. Brown

in Flinders, Voy. Terra. Austr. 2: 576. 1814.

Key to genera

1a. Ovary produced upward into a filamentous rostrum..... **Curculigo**

1b. Ovary not produced into a filamentous rostrum..... **Molineria**

CURCULIGO Gaertner

Fruct. 1: 63, t. 16, f. 11. 1788.

Curculigo orchioides Gaertn., Fruct. 1: 63. t. 16. f.11. 1788; Hook. f., Fl. Brit. India 6: 279. 1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1502. 1928; Sasidh. & Sivar., Fl. Pl. Thrissur For. 467. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 716. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 503. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 689. 2009. *Curculigo malabarica* Wight, Icon. Pl. Ind. Orient. t. 2043A. 1853. **Nilapana.**

Perennial rhizomatous herbs, rhizome elongated, oblong, to 15 cm long. Leaves subsessile, elliptic-lanceolate, to 15 x 1.5 cm, plicate, sheathing at base, pilose; prominently nerved. Flowers solitary or racemed on usually a very short scape among the leaves. Perianth tube 3 cm long, yellow narrow, sparsely pilose, 6 partite. Stamens 6, on the base of the perianth segments; filaments filiform; anthers basifixed; Ovary 3-celled, villous, often subterranean, produced upward into a filamentous rostrum. Fruit succulent; seeds subglobose, black, striate, beaked.

Fl. & Fr. : June – December.

Distribution : Indo-Malaysia. Moist forests to moist localities in the plains. *Amitha Bachan 123316* (Sholayar, riparian evergreen forests, banks of Sholayar river, 700 m).

MOLINERIA Colla

Mem. Reale Acad. Sci. Torino 31 (Hortus Ripul. App. 2): 331. 1826

Molineria trichocarpa (Wight) Balakr., J. Bombay Nat. Hist. Soc. 63: 330. 1966; Manilal, Fl. Silent Valley 316. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 716. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 503. 2005. *Hypoxis trichocarpa* Wight, Icon. Pl. Ind. Orient. t. 2045. 1853. *Hypoxis latifolia* Wight, Icon. Pl. Ind. Orient. t. 2044. 1853. *Hypoxis leptostachya* Wight, Icon. Pl. Ind. Orient. t. 2045. 1853. *Hypoxis pauciflora* Wight, Icon. Pl. Ind. Orient. t. 2046. 1853. *Molineria finlaysoniana* Baker, J. Linn. Soc. Bot. 17: 121. 1878; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1502. 1928. *Curculigo finlaysoniana* (Baker) Wall. ex Hook. f., Fl. Brit. India 6: 279. 1892. *Curculigo trichocarpa* (Wight) Bennet & Raizada, Indian J. For. 4: 61. 1981; Sasidh. & Sivar., Fl. Pl. Thrissur For. 467. 1996.

Herbs with tuberous root stock. Leaves elliptic-lanceolate, to 30 x 5 cm, acuminate at apex, attenuate at base, plicate, glabrous; petiole to 30 cm long. Racemes to 8 cm long; bracts linear-lanceolate, 1 cm long. Flowers yellow, bisexual flowers towards base of racemes; male towards the apex. Perianth yellow, 6-lobed, connate; stamens 6. ovary 3-celled, 1 cm across, ovules numerous, pilose. Fruit a capsule, narrowly oblong, 1.5 x 0.3 cm. Seeds globose.

Fl. & Fr. : August-April.

Distribution : Endemic to Peninsular India and Sri Lanka. Evergreen forests. Moist forest floor in the riparian forests. *Amitha Bachan 123317* (Sholayar, riparian evergreen forest floor, banks of Sholayar river, 700m).

118. DIOSCOREACEAE

R. Brown, Prodr. 294. 1810.

DIOSCOREA Linnaeus

Sp. Pl. 1032. 1753.

Key to Species

1a. Stem twining to right; leaves simple..... **D. oppositifolia**

2a. Stem twining to left; leaves 3-5- foliolate..... **D. pentaphylla**

Dioscorea oppositifolia L., Sp. Pl. 1033. 1753; Wight, Icon Pl. Ind. Orient. t. 813. 1844; Hook. f., Fl. Brit. India 6: 292. 1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1512. 1928; Manilal, Fl. Silent Valley 316. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 469. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 718. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 504. 2005. *Dioscorea oppositifolia* L. var. *linnaei* Prain & Burkill, J. Asiat. Soc. Bengal 10: 30. 1914; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1512. 1928. *Dioscorea oppositifolia* L. var. *dukhunensis* Prain & Burkill, J. Asiat. Soc. Bengal 10: 30. 1914; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1512. 1928; Hook. f., Fl. Brit. India 6: 292. 1892. **Kanjirakizhangu.**

Stem terete, twining to right, unarmed not bulbifereous. Leaves simple, opposite, ovate to elliptic-oblong, 17 x 8.5 cm, rounded or slightly cordate at base, acute to apiculate at apex; 3-5 nerved from base, glabrous; margins cartilaginous or coriaceous; petiole to 4 cm long. Spike 2-6 cm long, slender, 3-6 together along the peduncle; peduncle 15-20 cm long; bracts lanceolate. Male spikes fascicled on a long, slender

rachis, tepals ovate, obtuse; stamens 6. Female flowers distant; tepals orbicular, 1 mm long, glabrous. Capsule 2 x 3 cm, glabrous, winged. Seeds broadly winged all around.

Fl. & Fr. : August-November.

Distribution : Indo-Malaysia and China. Moist forests. *Amitha Bachan 99047* (Vazhachal, evergreen riparian, banks of Chalakkudy river, 220m).

Dioscorea pentaphylla L., Sp. Pl. 1032. 1753; Hook. f., Fl. Brit. India 6: 281. 1892; C. E. C. Fisch.in Gamble, Fl. Pres. Madras 1511. 1928; Manilal, Fl. Silent Valley 317. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 469. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 504. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 690. 2009. *Botryosicyos pentaphyllus* (L.) Hochst., Flora 27: 3. 1844. *Dioscorea pentaphylla* L. var. *communis* Prain & Burkill., J. Asiat. Soc. Bengal 10: 23. 1914; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1512. 1928. *Dioscorea pentaphylla* L. var. *linnaei* Prain & Burkill, J. Asiat. Soc. Bengal 10: 23. 1914; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1511. 1928. *Dioscorea pentaphylla* L. var. *rheedei* Prain & Burkill, J. Asiat. Soc. Bengal 10: 23. 1914; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1511. 1928. **Nootakachil.**

Tuberous climbers; stem twining to left, terete, armed with prickles; tubers oblong or very diverse. Leaves 3-5-foliolate, with bulbils in the axils; leaflets elliptic-ovate, 7 x 4 cm, acute or attenuate at base, acute at apex, glabrous or pubescent below; upper leaves much smaller; petiole to 8 cm long. Male flowers on slender spikes on axillary or terminal panicles, tomentose. Perianth lobes 6, greyish; outer ovate, 1.5 mm long, tomentose, inner lanceolate, 1 mm long, glabrous. Stamens 3, staminodes 3. Female spike solitary, tomentose. Perianth lobes 6,

biseriate, 1 mm long, ovate. Capsule oblong, 2 cm long, glabrescent, 3-winged.

Fl. & Fr. : September-December.

Distribution : Indo-Malaysia and China. Evergreen forests. *Amitha Bachan 99027* (Orukombankutty, riparian evergreen, banks of Chalakkudy river, 450 m).

119. LILIACEAE Juss.

Gen. Pl. 48. 1789.

ASPARAGUS Linnaeus

Sp. Pl. 313. 1753.

Asparagus racemosus Willd., Sp. Pl. 2: 152. 1799; Hook. f., Fl. Brit. India 6: 316. 1892; C. E. C. Fisch. Gamble, Fl. Pres. Madras 1517. 1928; Manilal, Fl. Silent Valley 318. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 470. 1996; Mohanan & Sivad., Fl. Agasthyamala 721. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 505. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 694. 2009. *Protasparagus racemosus* (Willd.) Oberm., S. Afr. J. Bot. 2: 244. 1983. **Schadavari.**

Slender scandent or climbing herbs with tuberous roots; stem green, angled, branchlets reduced to leaf-like green cladodes, acicular; cladodes compressed, curved, 3-angled, 2-7 together, to 1.3 cm long. Leaves reduced to minute spinescent scales. Flowers small, in axillary racemes; racemes 2-4 cm long; bracts minute, ovate; pedicels jointed, 4 mm long; tepals 6, obovate, inserted on the bases of perianth lobes, white; anthers small; ovary 3-celled, ovules 2 or more in each cell; style one, stigmas 3. Berry globose, 0.6 cm across, smooth. 1-6-seeded.

Fl. & Fr. : July-August.

Distribution : Paleotropics. Moist forests to lower plains. *Amitha Bachan 123626* (Sholayar, riparian forests, banks of Sholayar river, 700 m).

120. PONTEDERIACEAE Kunth

in Humboldt *et al.*, Nov. Gen. Sp. 1, ed. 4: 265. 1816.

Key to genera

1a. Petiole swollen to form floats; perianth-lobes connate below.....
.....**Eichhornia**

1b. Petiole not swollen to form floats; perianth-lobes free .....**Monochoria**

EICHHORNIA Kunth

Gen. Nov. 3. 1842; Enum. 4: 129. 1843, *nom. cons.*

Eichhornia crassipes (C. Martins) Solms-laub. in A. DC., Monogr. Phan. 4:527.1883; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1530. 1928; Anil Kumar *et al.*, Fl. Pathanamthitta 508. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 697. 2009. *Pontederia crassipes* Mart., Nov. Gen. Sp. Pl. 1: 9. t. 4. 1823. **Kulavazha.**

Aquatic free-floating herbs. Leaves radical, rosulate, broadly ovate-rhomboid or orbicular, to 12 x 10 cm, cuneate to rounded at base, obtuse at apex, thin-coriaceous; petiole to 30 cm long, spongy, swollen about the middle. Inflorescence of terminal spikes; peduncle to 10 cm long. Flowers dense, irregular, lilac or blue with yellow median blotch. Perianth tube 1-2 cm long; lobes 3+3, 3 cm long, obovate-oblaceolate, unequal. Stamens 3+3, glandular-pubescent; anthers dorsifixed. Ovary to 6 mm long, oblong, 3-celled, ovules many, stigma globose, glandular-pubescent. Capsule ovoid, covered by perianth. Seeds many, ribbed.

Fl. & Fr.: January – May.

Distribution: Native of South America, now naturalized in paleotropics. A fast spreading weed in ponds, streams and other water bodies. *Amitha Bachan 117722* (Kanakkankadavu, near Kanakkankadavu sluice, Chalakkudy river, sea level).

MONOCHORIA K. B. Presl

Rel. Haenk. 1: 127. 1827.

Monochoria vaginalis (Burm. f.) Presl, Reliq. Haenk. 1:128.1827; Hook. f., Fl. Brit. India 6: 363. 1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1529. 1931; N. Mohanan & Sivad., Fl. Agasthyamala 727. 2002; Anil Kumar *et al.,* Fl. Pathanamthitta 508. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 697. 2009. *Pontederia vaginalis* Burm. f., Fl. Ind. 80. 1768. **Karikovalam. Kakapola.**

Erect, semi-aquatic herbs to 40 cm tall. Leaves obvate, 4-9 x 2-4 cm, cordate at base, abruptly acuminate at apex, thinly coriaceous; petiole 6-25 cm long, sheathing at base. Inflorescence a terminal raceme, solitary, to 10 cm long, from upper nodes of emergent stems. Flowers 2 cm across, blue; pedicel to 1.5cm long; bracts membraneous. Perianth campanulate, deeply lobed; lobes 3+3, deep blue, 1.2 cm, oblong-obovate. Stamens 6; filaments subequal. Ovary, 5 cm long, globose, 3-locular; ovules many per locule; style to 5 mm long; stigma 3-lobbed. Capsule oblong, to 1 cm long.

Fl. & Fr. : September-November.

Distribution: Indo-China to Malaysia and Japan. Wetlands and water bodies. *Amitha Bachan 117723* (Kanakkankadavu, near sluice, Chalakkudy river, sea level).

121. COMMELINACEAE R. Br.

Prodr. 268. 1810.

Key to genera

1a. Fruit indehiscent..... **Pollia**

1b. Fruit loculicidally 2-3-valved.....2

2a. Flowers enclosed in spathe or bracteoles.....3

2b. Flowers not enclosed in spathe or bracteoles.....4

3a. Fertile stamens 2 or 3; filaments naked.....**Commelina**

3b. Fertile stamens 6; filaments bearded..... **Cyanotis**

4a. Flowers regular; bracts subulate, deciduous.....**Murdannia**

4b. Flowers irregular; bracts funnel-shaped or leafy, persistent.....5

5a. Cells of the ovary 1- ovuled; capsule 1- seeded..... **Dictyospermum**

5b. Cells of the ovary 2-many ovuled; capsule 1-more seeded....**Aneilema**

COMMELINA Linnaeus

Sp. Pl. 40. 1753.

Commelina benghalensis L., Sp. Pl. 41. 1753; Hook. f., Fl. Brit. India 6: 370. 1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1539. 1931; Sasidh. & Sivar., Fl. Pl. Thrissur For. 473. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 511. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 702. 2009.

Creeping and erect herbs; stem fleshy, pubescent. Leaves ovate, to 4 x 1.5 cm, obtuse to acute at apex, rounded at base; sheath 1 cm long, mouth with red bristles. Flowers enclosed in a spathe; spathe to 1 cm, hairy. Flowers to 1 cm across; sepals obovate, 3 mm long, red-glandular; petals blue, to 5 mm long; stamens 3, filaments glabrous; staminodes 2;

ovary 3 celled, two cells with 2-ovuled and other one-ovuled. Capsule 3-celled; seeds oblong, 4-5, smooth, brown.

Fl. & Fr. : July – November.

Distribution: Africa, India, China, Japan and Malaysia. Wet areas. *Amitha Bachan 98974* (Vazhachal, sandy river beds, banks of Chalakkudy river, 230 m).

CYANOTIS D. Don

Prodr. Fl. Nepal. 45. 1825, *nom. cons.*

Key to Species

1a. Leaves linear-lanceolate, to 20 x 1.5 cm.....**C. arachnoidea**

1b. Leaves ovate, lanceolate, to 4 x 1 cm..... **C. papilionacea**

Cyanotis arachnoidea Clarke in A. & C. DC., Monogr. Phan. 3: 250. 1881; Hook. f., Fl. Brit. India 6: 386. 1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1550. 1931; Sasidh. & Sivar., Fl. Pl. Thrissur For. 475. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 735. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 513. 2005.

Herbs suberect, densely covered with white-cottony hairs. Leaves linear-lanceolate, to 20 x 1.5 cm, upper leaves much smaller, cottony hairy. Cymes terminal; peduncle 4 cm long; bracts ovate, 1.7 x 1 cm, acute, hairy; bracteoles curved, falcate, 10-25 pairs, 6 x 1.5 mm, densely cottony hairy. Flowers densely packed; sepals 6 x 1.5 mm, united at the base, densely long hairy; corolla tube 0.6 cm long; lobes triangular, acute; Stamens 6; staminodes absent; filaments 1.2 cm long, bearded; ovary densely hairy at apex; style bearded. Capsule oblong, 2.5 mm long, hairy; seeds transversally rugose, black.

Fl. & Fr. : August - November.

Distribution: Endemic to Peninsular India and Sri Lanka. Grasslands, stream sides near the grasslands. *Amitha Bachan 99011* (Karimala, stream sides, banks of Karimala stream draining to Sholayar river, 900m).

Cyanotis papilionacea (Burm. f.) Schult. f., Syst. Veg. 7:1151.1830; Hook. f., Fl. Brit. India 6:384.1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1549. 1931; Sasidh. & Sivar., Fl. Pl. Thrissur For. 475. 1996; *Commelina papilionacea* Burm. f., Fl. Ind. 17. 1768.

Procumbent herbs; stem hairy. Leaves ovate, lanceolate, acute, to 4 x 1 cm, sparsely hairy; sheath hairy, to 1 cm long. Cymes solitary or fascicled, peduncled, terminal and upper axillary; bracts broadly ovate, 8 x 4 mm, abruptly acuminate; bracteoles 6-8 pairs in a cyme, 5 x 3 mm, curved, margins ciliate. Flowers few, dense; sepals 4.5 x 1.5 mm, united at the base, ciliate, hairy along the keels; corolla tube 4 mm long; lobes triangular, blue; Fertile stamens 6; staminodes absent; filaments 0.5 cm long, bearded. Capsule globose, 2 mm long, hairy at apex; seeds solitary in a cell, obovate, trigonous.

Fl. & Fr. : August - November.

Distribution: Endemic to Peninsular India. *Amitha Bachan 98723* (Nelliyampathy- Pullala, stream banks, stream draining to Karappara river, 1000 m).

DICTYOSPERMUM Wight

Icon. Pl. Ind. Orient. vi. 29. tt. 2069-71 (1853).

Dictyospermum montanum Wight, Icon. Pl. Ind. Orient. t. 2069. 1853. *Aneilema montanum* (Wight) Thwaites., Enum. Pl. Zeyl. 322. 1864; Hook. f., Fl. Brit. India 6:382.1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1546. 1931; Sasidh. & Sivar., Fl. Pl. Thrissur For. 472. 1996; N.

Mohanan & Sivad., Fl. Agasthyamala 730. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 510. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 700. 2009.

Erect herbs to 25-70 cm; stem glabrous. Leaves elliptic-lanceolate, to 16 x 3 cm, clustered towards the apex, acuminate at apex, cuneate at base, scabrid above; sheath to 2.5 cm long, pubescent on one side; mouth truncate. Panicle very lax, to 25 cm long; branches pubescent. Flowers 0.6 cm across, solitary, pedicelled; sepals oblong, 3 x 2 mm, obtuse, glabrous; petals white, obovate, 5 x 3 mm, obtuse; filaments 4 mm long, glabrous. Capsule 3-4 mm long, globose; seeds planoconvex, rugose, brown.

Fl. & Fr. : July - October.

Distribution: Endemic to Peninsular India. Evergreen forest undergrowth *Amitha Bachan 123411* (Vazhachal, evergreen forests, along Chalakkudy river. 200 m); *Amitha Bachan 117618* (Malakkapara, riparian forest, banks of Sholayar river, 900 m).

MURDANNIA Royle

Illustr. Bot. Himalayan Mts. t. 95. 1839, *nom. cons.*

Key to species

1a. Seeds 1-seriate in each cell.....2

1b. Seeds 2-seriate in each cell..... **M. semiteres**

2a. Cells of the ovary 3-many ovuled.....3

2b. Cells of the ovary 2-ovuled.....**M. nudiflora**

3a. Leaves ovate-lanceolate, to 15 x 5 cm..... **M. japonica**

3b. Leaves narrow, linear, less than 1.5 cm wide..... **M. spirata**

Murdannia japonica (Thunb.) Faden, Taxon 26: 142. 1977; Sasidh. & Sivar., Fl. Pl. Thrissur For. 476. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 739. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 516. 2005. *Commelina japonica* Thunb., Trans. Linn. Soc. London 2: 332. 1794. *Aneilema lineolatum* Kunth, Enum. Pl. 4: 69. 1843; Hook. f., Fl. Brit. India 6: 370. 1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1544. 1931. *Aneilema latifolium* Wight, Icon. Pl. Ind. Orient. t. 2072. 1853. *Murdannia elata* (Vahl) Brueck. in Engl. & Prantl, Naturl. Pflanzenfam. (ed.2) 15a: 173. 1930. *Commelina elata* Vahl, Enum. Pl. 2: 178. 1805.

Erect robust herbs with leafy flowering stem to 1m high; roots tuberous. Leaves ovate-lanceolate to elliptic-oblong, acute to acuminate at apex; rounded to cordate at base, to 15 x 5 cm, margins white, undulate. Flowers blue on stout leafy dichotomous panicles; Sepals 3 free, membranous; Petals 3, free; Stamens 3; staminodes 3. Capsules subglobose; seeds reticulate, glandular pubescent.

Fl. & Fr. : July - September.

Distribution: Indo-Malaysia. Forest under growth. *Amitha Bachan 99015* (Orukombankutty, riparian evergreen forest undergrowth, 470 m).

Murdannia nudiflora (L.) Brenan, Kew Bull. 1952: 189. 1952; Sasidh. & Sivar., Fl. Pl. Thrissur For. 477. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 516. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 706. 2009. *Commelina nudiflora* L., Sp. Pl. 41. 1753. *Aneilema nudiflorum* (L.) R. Br., Prodr. 271. 1810; Hook. f., Fl. Brit. India 6: 378. 1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1545. 1931.

Procumbent herbs; rooting at lower nodes. Leaves sessile, linear or linear-lanceolate, to 11 x 1.2 cm, rounded at base, acute or acuminate at apex; sheath to 1.2 cm long, margin ciliate. Flowers in terminal and

axillary few-flowered, subglobose or subcorymbose panicles. Sepals 3, oblong, 2 mm long, obtuse. Petals 3, oblong, to 2.5 mm long, acute, bluish-purple. Staminal filaments bearded; stamens 3; staminodes 3 with filaments bearded or not. Ovules 2 in each cell. Capsule globose, to 3.5 mm across. Seeds 2- per locule, 1 mm, deeply pitted.

Fl. & Fr. : July - November.

Distribution: Indo-Malaysia and Africa. Grasslands to lower plains. *Amitha Bachan 117800* (Karanthodu, on river bed, along Chalakkudy river, 400 m).

Murdannia semiteres (Dalz.) Sant., Poona Agri. Coll. Mag. 41(4): 15. 1951; Manilal, Fl. Silent Valley 327. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 740. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 517. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 706. 2009. *Aneilema semiteres* Dalz. in Hook.'s, J. Bot. Kew Gard. Misc. 3: 138. 1851. *Aneilema paniculatum* Wall. ex Clarke in A. & C. DC., Monogr. Phan. 3: 215. 1881, nom. illeg.; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1546. 1931. *Dichaespermum juncoides* Wight, Icon. Pl. Ind. Orient. t. 2073. 1853. *Dichaespermum paniculatum* (Wall. ex Clarke) Hook. f. & Thomson in Hook.f., Fl. Brit. India 6: 381. 1892, pro syn. *Murdannia juncoides* (Wight) Rao & Kammathy, Bull. Bot. Surv. India 6: 3. 1964; Sasidh. & Sivar., Fl. Pl. Thrissur For. 477. 1996.

Erect tufted slender herbs. Leaves linear, filiform, to 12 x 0.3 cm, semiterete, acuminate at apex. Flowers blue on terminal lax, panicles, usually longer than leaves, branches capillary; peduncles reddish, 8-20 cm long. Pedicels filiform; bracts minute, ocreate. Sepals obovate, acute. Petals blue, obovate, to 4 mm long, 3-loobed at apex. Staminal filaments not bearded. Ovary glabrous; ovules 2-seriate in each cell.

Capsule subglobose, to 3 mm long, angular. Seeds 2-seriate, 6-8 in each cell, smooth, compressed.

Fl. & Fr. : October - December.

Distribution: Endemic to Peninsular India. *Amitha Bachan 98803* (Vazhachal, rocky streambed, banks of Chalakkudy river, 250 m).

Murdannia spirata (L.) Brueck. in Engl. & Prantl, Naturl. Pflanzenfam. (ed. 2) 15a: 173. 1930; Sasidh. & Sivar., Fl. Pl. Thrissur For. 477. 1996; C. N. Sunil & Sivad., Fl. Alappuzha 708. 2009. *Commelina spirata* L., Mantissa Pl. 2: 176. 1771. *Aneilema spiratum* (L.) Sweet, Hort. Suburb. London 12: 1808; Hook. f., Fl. Brit. India 6: 377. 1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1546. 1931.

Erect or diffuse herbs with fibrous roots. Leaves ovate-lanceolate, 1-4 x 0.5-1.2 cm, cordate and semi-amplexicaul at base, acute at apex; sheath 1 cm long, ciliate at mouth. Flowers to 0.6 cm across, in few-flowered terminal and axillary panicles; bracts ovate, to 2 mm long; pedicel to 5 mm long, filiform. Sepals 3, ovate-oblong, to 3 mm long. Petals 3, bluish or violet, oblong, to 4 mm long. Fertile stamens 3, filaments bearded; staminodes 2. Ovules 3 in each cell. Capsule oblong, 4-5 mm long, trigonous. Seeds 3 in each cell, 1 mm, angular, cuboid, rugose, light brown.

Fl. & Fr. : September- December.

Distribution: Indo-Malaysia. Forests to plains on sand beds. *Amitha Bachan 117702* (Vazhachal, river bed, banks of Chalakkudy river, 240m).

POLLIA Thunb.

Nova Genera Plantarum, 1783.

Pollia secundiflora (Blume) Bakh.f., Blumea 6:399.1950. *Commelina secundiflora* Blume, Enum. Pl. Jav. 1: 3. 1827. *Pollia sorzogonensis* (Mey ex Presl.) Steud., Nomencl. Bot. (ed. 2) 368. 1841; Hook. f., Fl. Brit. India 6: 368. 1892; Manilal, Fl. Silent Valley 328. 1988. *Pollia sorzogonensis* var. *indica* (Wight) Clarke in A. & C. DC., Monogr. Phan. 3: 127. 1881; Hook. f., Fl. Brit. India 6: 368. 1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1533. 1931. *Aclisia indica* Wight, Icon. Pl. Ind. Orient. t. 2068. 1853. *Aclisia secundiflora* (Blume) Bakh.f. in Backer & Bakh.f., Fl. Java 3: 658. 1968; Anil Kumar *et al.*, Fl. Pathanamthitta 509. 2005.

Plate 44. A

Erect branched fleshy herbs; stem viscid. Leaves elliptic – lanceolate, to 16 x 5 cm, acuminate at apex, base narrowed or cuneate. Panicles viscidly pubescent; bracts oblong persistent. Sepals 3, free; Petals 3, free, white to pink; stamens 3 perfect, filaments naked; Ovary, sessile, 3-celled; ovules 2-10 in each cells. Fruit globose, to 3 mm, indehiscent; seeds 2-seriate; cells many seeded.

Fl. & Fr. : November - December.

Distribution: Indo-Malaysia and china. Strictly riparian or streamside in the close vicinity of water front; *Amitha Bachan 99197* (Sholayar-Meenchaliyali, stream bed and streamside, banks of Meenchaliyali stream, 800 m); *Amitha Bachan 123350* (Vazhachal, streamside, banks of Chalakkudy river, 250 m).

122. **ARECACEAE** Schultz Sch.,

Nat. Syst. Pflanzenr. 317. 1832; PALMAE, *nom. alt.*

Key to genera

1a. Scandent shrubs; leaf sheath and rachis armed with spines; fruit scaly ..... **Calamus**

1b. Erect trees; leaf sheath and rachis without spines; fruit not scaly....2

2a. Leaves bipinnate..... **Caryota**

2b. Leaves simple pinnate..... **Arenga**

ARENGA Labillardiere

Mem. Inat. Par. 4: 209. 1801, *nom. cons.*

Arenga wightii Griff., Calcutta J. Nat. Hist. 5: 475.1845; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6:422.1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1588. 1931; Sasidh. & Sivar., Fl. Pl. Thrissur For. 478. 1996; Renuka, Palms Kerala 15. 1999; N. Mohanan & Sivad., Fl. Agasthyamala 742. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 518. 2005. **Kattuthengu.**

Monoecious stout palms with dark green foliage; trunk to 8 m tall, to 30 cm diameter, covered with persistent leaf sheaths, to 10-15 m long. Leaves pinnatisect, to 8 m long; leaflets to 100 x 5 cm, linear, auricled at base, glaucous below. Male flowers and female flowers on separate spadices, to 1 m long. Male flowers: tepals 6, biseriate, outer 3 mm long, orbicular; stamens many, free. Female flowers : tepals 6, biseriate, similar, accrescent; ovary 3-celled. Fruit globose, to 2 cm in diameter, 2 or 3 seeded.

Fl. & Fr.: July – September.

Distribution: Endemic to Western Ghats. Evergreen forests, Riparian forests and streamside. *Amitha Bachan 123619* (Charpa-Vazhachal, riparian forests, banks of Chalakkudy river, 170 m).

CALAMUS Linnaeus

Sp. Pl. 325. 1753.

Calamus thwaitesii Becc. ex Becc. & Hook. f. in in Hook. f., Fl. Brit. India 6: 441. 1892; Sasidh. & Sivar., Fl. Pl. Thrissur For. 480. 1996; Renuka, Palms Kerala 32. 1999; Anil Kumar *et al.*, Fl. Pathanamthitta 520. 2005. *Calamus thwaitesii* Becc. var. *canaranus* Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 138. 1908; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1567. 1931. **Thadiyanchooral.**

High climbing canes. Stems to 20 m or more in length and 6 cm across, with sheaths; sheath armed with spines; spines arising from a raised rim-like surface, flat, black with yellow base. Leaves to 3 m long; leaflets clustered and equidistant, to 50 x 3 cm, spinulate along margins; rachis and sheath armed with stout spines in oblique whorls. Fruit ca. 2 x 1.3 cm, ovoid, scales in 12 vertical rows, Vertically grooved.

Fl. & Fr. : March – January.

Distribution : Endemic to the Western Ghats. Common; in evergreen forests. Riparian forests. *Amitha Bachan 72079* (Sholayar, riparian forests, Sholayar river side, 800 m).

CARYOTA Linnaeus

Sp. Pl. 1189. 1753.

Caryota urens L., Sp. Pl. 1189. 1753; Hook. f., Fl. Brit. India 6: 422. 1892; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1560. 1931; Sasidh. & Sivar., Fl. Pl. Thrissur For. 480. 1996; Renuka, Palms Kerala 35. 1999;

N. Mohanan & Sivad., Fl. Agasthyamala 746. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 520. 2005.

Large stout palms, to 20 m high; stem 30-60 cm diameter, annular; Leaves large, to 4-6 m long, 3 m wide, spiral, bipinnate; leaflets cuneate, to 40 x 20 cm, fan-shaped, serrate on marginal apex. Spadix 3-4 m long, axillary, formed basipetally along the stem, branches many, narrow, pendent. Flowers monoecious, solitary. Flowers 1.5 cm long; sepals 3, orbicular; petals 3, oblong, calycine; stamens many, filaments united at base; ovary 3- celled, 1 ovule per cell. Fruit globose, 1-2-seeded with endosperm ruminate.

Fl & Fr. : January – April.

Distribution: Indo–Malaysia. Plains to evergreen forests. Riparian evergreen forest from lower to medium elevations. *Amitha Bachan 123683* (Sholayar, riparian forests, Anakkayam streamside, 750 m).

123. PANDANACEAE R. Brown

Prodr. 340. 1810.

PANDANUS S. Parkinson

J. Voyage South Seas 46. 1773.

Key to the Species

Key based on vegetative characters

1a. Leaves armed or unarmed, if armed spines 1-3mm, usually erect trees or scandent shrubs cultivated in gardens 2

1b. Leaves all armed, spines >3mm, mostly wild erect trees or scandent shrubs sometimes grown as hedges or along the margins of ponds, streams and paddy fields, not in the gardens 3

2a. Leaves completely armed or unarmed, leaves large, >70 cm long, spines red tipped, not musky scented, tip flagelliferous, acuminate; cultivated in the gardens or wild.....**P. tectorious**

2b. Leaves armed only at the tip and extreme base. Leaves small <70cm long; spines light green, tipped, musky scented, tip sword-shaped, short acute; cultivated shrubs, used as spice.....**P. amaryllifolius**

3a Scandent shrubs, leaf apex with twin lateral pleats prickly; Mostly wild, as evergreen semi-evergreen forest undergrowth in higher elevations.....**P. foetidus**

3b. Mostly erect trees, sometimes scandent; leaf apex not prickly at the twin lateral pleats; wild or sometimes cultivating, usually lining the water bodies and paddy fields; coastal and middle altitudes.....4

4a. Tall trees, up to 8m high or more, unbranched or branched few, only at the tip; trunk straight, glossy shining or dull, well-marked leaf scars (spirals), internodes not very close; prickles greenish white, leaf bases usually reddish purple or bronzy brownish; bracts yellow or straw coloured 6

4b. Small-medium trees, 3-6m high, highly or moderately branched; trunk usually not straight and glossy, internodes very close; prickles pale to white; leaf base never reddish-purple; bracts white to cream..... 5

5a. Stem highly branched, often from the base; main trunk acquire >40cm girth in older trees; prickles white or whitish, markedly paler than the leaf-surfaces, gives a beaded appearance to the leaves; leaf attitude arching and also somewhat twisting, flagelliform apex curving, underside glaucous; pistillate phalanges 5-15-celled; maritime species of the sandy coast .....**P. fascicularis**

5b. Stem not highly branched or branch at 5-6 feet high, branching-pseudo dichotomous; usually straight, sometimes scandent, main trunk less than 30cm; usually with numerous stilt roots; prickles pale greenish but not white; leaf attitude more stiff erect or abruptly bent or decurved towards apex; flagelliform apex straighter; underside not so glaucous; pistillate phalanges 1-4-celled; rare species of the sandy coast.....**P. kaida**

6a. Trees up to 6-9m high, slender, girth of the stem usually <25 cm, seldom branched; trunk smooth glossy shining gray to dark in colour, like the appearance of slender palm; leaves 2 m or more, base reddish purple or bronzy brownish; prickles greenish white, dark tipped <7mm. bracts straw coloured; wild and cultivated; Stigmas in fruit not spinulose; usually in middle and higher altitudes, along streams and river side near forests, near paddy fields .....**P. furcatus**

6b. Trees up to 7-10m high, not slender, girth of the stem usually >25cm, moderately branched usually attaining 6m height; trunk not so glossy; dark green in (younger part) to brownish; leaves <2m and 6-9cm broad, thick; prickles greenish to brownish 7mm long; bracts not straw coloured; Persistent stigma usually 'V'-shaped and spinulose in fruit; usually in the middle and lower altitudes near to coast, along streamside and paddy fields.....**P. unipapillatus**

Key based on staminate inflorescence

1a. Male spikes racemose-spicate, composed of singly attached stamens; filaments very much shorter than the narrow elongated apiculate anthers; wild forest species.....**P. foetidus**

1b. Male spike not as above, the stamens joined in phalanges with a column (stemonophore), filaments not much shorter; wild or cultivated.....2

2a. Stamens umbellate at the apex of the stemonophore; anthers mucronate-apiculate by the extension of the connective.....4

2b. Stamens racemose along the stemonophore; anthers not apiculate...3

3a. Leaves with large white prickles; wild maritime species of the coastal sandy beaches.....**P. fascicularis**

3b. Leaves with small greenish prickles, cultivated.....**P. tectorius**

4a. Bracts and spikes yellow or buffy; tall trees seldom or not branching 5

4b. Bracts and spikes white or cream coloured; small trees, moderately or highly branching; stamens few 5-15 per phalanges; anthers with obvious mucro 0.5mm long, column stout; along the coastal areas .....**P. kaida**

5a. Stamens 8-14 in phalanges; spikes about 15 x 3 cm or larger, bracts larger or stiff; stem girth < 30 cm, glossy grey or black; usually midland to higher altitudes; stream banks along forests...**P. furcatus**

5b. Stamens 17-29 in phalanges; spikes 7-11 x 2.2 cm or larger, lower bract flagelliform; stem >30cm girth, greenish to brown; usually lining the paddy fields of midlands and coasts..... **P. unipapillatus**

Key based on pistillate inflorescence

1a. Carpels simple; ovary 1-celled; syncarp composed of simple drupes..3

1b. Carpels adnate in 2-several celled phalanges; syncarp composed of 2-15 drupes..... 2

2a. Carpels in 2- 4- celled phalanges..... **P. kaida**

2b. Carpels in 5-15- celled phalanges.....**P. fascicularis**

3a. Pistillate heads upto 3 rarely solitary; syncarp globose, small >15cm long.....**P. foetidus**

3b. Pistillate heads solitary; syncarp oblong >15cm long..... 4

4a. Drupes with persistent single style, slightly bend, some times spinulose; bract straw-coloured, spike up to 15cm long; usually mountainous stream or river side, some times near paddy field of middle elevations, not along the coasts.....**P. furcatus**

4b. Drupe with persistent forked 'V'-shaped style, not bend, usually spinulose, sometimes single; bracts not straw-coloured; spike 11 cm long; marshy plants, river side or near paddy fields of lower altitudes up to near coasts..... ..... **P. unipapillatus**

Pandanus amaryllifolius Roxb., Hort. Bengal. 71. 1814, Fl. Ind. 3: 743. 1832; Backer & Bakh. f., Fl. Java, 199. 1968; B. C. Stone in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3: 319 1981. **Rampha, Biriyani Plant.**

Plate 41. G

Unbranched shrubs or small tree, reaching to 1-1.6m tall, slightly leaning or erect stem with aerial root. Leaves light green, linear, sword like with pointed tip, apex abruptly rounded-acute, the lateral pleates obsolete. Juvenile leaves 30-65cm long and 2.5-4cm broad and the adult leaves are up to 115 cm long and 7-8 cm wide. Margins usually unarmed except at the extreme tip, There may be few minute prickles and also on the portion of the midrib. Midrib at base rarely with a few short distant retrose prickles are less than 1mm long. Flowers and fruits were not seen.

Fl.& Fr.: Not seen, not reported from anywhere else.

Distribution: West and South India, Wide spread in Asia, South East Asia, eastward Western Malaysia to central Moluccas . Probable origin Moluccas. Cultivated in gardens for its scented leaves. *Amitha Bachan 98790* (Chalakkudy, escape from cultivation, banks of Chalakkudy river, 7m).

Note: Flowering in this specimen has not so far been reported. Consequently it can not be assigned to a subgenera or section of the genus. Leaves are used in different culinary preparations. Juice extracts from fresh leaves are used for flavoring various preparations.

Pandanus fascicularis Lam., Encycl. 1: 372. 1783; Hook. f., Fl. Brit. India 6: 495. 1872; B. C. Stone in C. J. Saldanha & Nicolson, Fl. Hassan Dist. 780. 1976; Nicolson, *et. al* An Inte. Hort. Malab. 304. 1988; K. G. Bhat, Fl. Udupi, 673. 2003; C. N. Sunil & Sivad., Fl. Alappuzha 718. 2009. *Pandanus odoratissimus sensu. auct. non* L. f., Suppl. Pl. 424. 1782 *nom. Illeg.* (incl. Type of *Keura odorifera* Forcsh. 1725): B.C. Stone in Dassan. & Fosberg Rev. Handb. Fl. Ceylon 3; 311. 1981. *Pandanus tectorious* Soland. ex Parkinson, J. Voy. H.M.S. End. 46. 1773; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 3: 1570.1931. **Kaida, Pookaida, Kadathazha.** **Plate 41. A & B; Plate 42. A-C.**

Branched shrubs or small trees, trunk grayish brown, ringed by leaf scars and with basal prop roots. Main stem up to 20 cm thick, erect or more or less decumbent; later branches usually same or lesser diameter. Adult plant seldom over 10 m tall. Occurrence in groves due to profuse lateral branching. Leaf spiraled in three rows, up to 1-2.5 m long and 4-8cm broad, linear-ensiform, apex gradually narrowed in to an triquete flagella, the margins and dorsal mid rib armed with white prickles, glaucous beneath. Male inflorescence pedunculate, fragrant, bracteate, brats yellowish or cream coloured., young bracts white, linear-

lanceolate or lanceolate lower ones flagelliferous. Stemonophore 12mm long, bearing about 19-23 racemosely disposed stamens on short filaments., anthers 2-3.5m long, cuspidate. cephalia solitary, globose to ellipsoid., carpals usually in phalanges of 5-15, each carpal terminating in a single U or V- shaped stigma. syncarp up to 25 cm long., Phalanges 5-8 x 6.5-4.5 cm terbinate, pentagonal or hexogonal, young phalanges greenish, later orange or reddish.

Fl.& Fr.: July- September.

Distribution: Throughout Peninsular India especially along the coasts and hot areas of other parts of India including North east India, Sri Lanka, eastwards through western Malaysia, and South America. *Amitha Bachan 99177* (Veli-Thiruvananthapuram, costal sandy beaches, sea level); *Amitha Bachan 98789* (Mathilakam-Kodungallur, streamside vegetation, near costs, sea level).

Note. As Stone (1976) pointed out, *P. odoratissimus* is an illegitimate name because Linnaeus f. (1782) cited "Keyra (*Keura odorifera*) Forsk. Aegypt. p.172 (1775). According to Art. 63.1 "A name (*P. odoratissimus*) is illegitimate and is to be rejected if it was nomenclaturally superfluous when published. As Stone (1976) pointed out, *Keura odorifera* Forssk has not been identified with certainty. It as well as *P. odoratissimus* may or may not actually be a synonym of *P. fascicularis. Keura odorifera* (1775), a name based on a staminate inflorescence purchased in an arabian shop by Forskal. This early name must be *nomina dubia* until this type is studied and compared with known taxa. Dr. Anne For Mauls (in litt.) reported there is no type of *Keura odorifera* in the Forsskal Herbarium. (Nicols et al, 1988,& Manilal, 2003).

All agrees that the Thumberg material (from Ceylon) that Linnaeus. f. cited is identifiable with *P. fascicularis.* However, this material cannot be

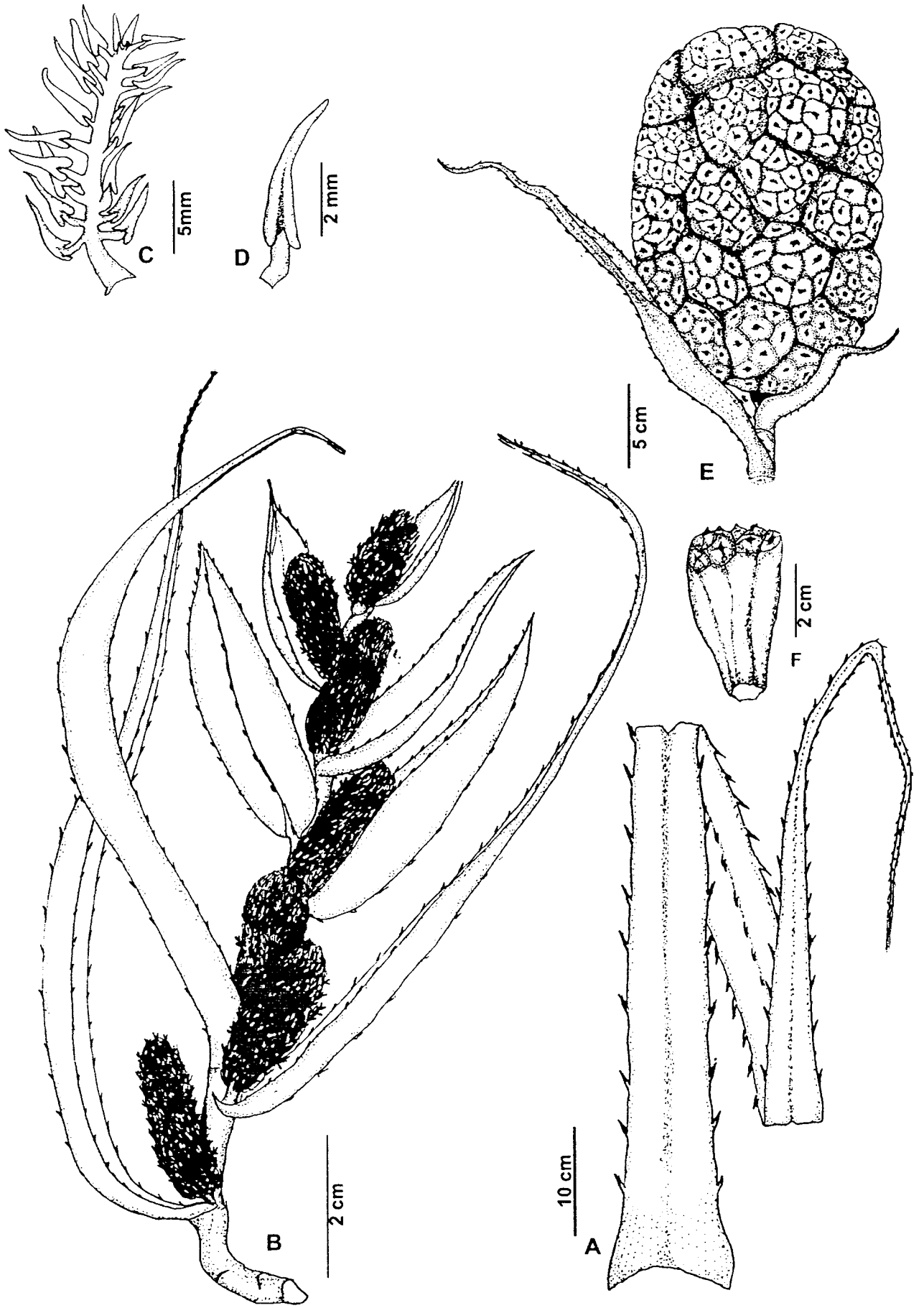


Fig. 2.9. *Pandanus fascicularis* Lam. A. Leaf; B. Male inflorescence; C. Stamens (racemose) on stemanophore; D. Single stamen; E. Syncarp (Fruit); F. Single phalange (aggregate of 7 drupes).

the type of *P. odoratissimus* L.f. Under this automatic typification imposed by Art. 7.11. The Thumberg specimen is simply one of many elements included and does not satisfy the definition of a holotype (Art.7.3.). " A holotype is the one specimen or other element used by the author or designated by him as the holotype". The Thumberg specimens is only a syntype (Manilal, 2003). Stone (1983) gave arguments in favour of accepting *P. odoratissimus* L.f. (1782).

Pandanus furcatus Roxb., Hort. Beng. 71.1814; Fl. Ind. 3: 744.1832; Hook. f., Fl. Brit. India 6: 484. 1872; C. E. C. Fischer in Gamble, Fl. Pres. Madras 3: 1570. 1935; H. St. John, Bot. Mag. Tokyo 85: 248. 1972; B.C. Stone in Dassan. Fosberg, Rev. Handb. Fl. Ceylon 3: 304. 1981; Nicolson *et. al* Interprt. Hort. Malab. 305. 1988; Manilal, Van Rheede, Hort. Malab (Eng. Ed). 2: 12. 2003. *Rykia furcata* (Roxb.) de Vriese, Hooker's J. Bot. Kew Gard. Misc. 6: 268 .1854. **Attukaitha.** **Plate 41. E; Plate 42. M**

Arborescent, trees up to 6- 9m tall; not or scarcely branched; stem green (younger portion) turning gray brown, leaf scars distinct, a palm like general appearances; leaves large; linear, apex gradually attenuate; lamina coriaceous, 2 m long or more to 6-8.5 cm wide; margins and midrib (beneath) armed with sharp prickles, prickles 1.5- 3 mm long, 3-17 mm apart, ventral pleats smooth unarmed. Margins, towards the base with small antrorse prickles, towards apex prickles more crowded 1-3 mm apart; reticulations not evident or visible; staminate inflorescence terminal, racemose- spicate at first sub erect, later drooping and pendulous , The main rachis firm, fleshy, yellow bearing about 9-11 spathacious bract; basal ones with green leaf like apices, The terminal ones slightly ovate, navicular 16-20 x 3-5 cm, staminate spikes 7-9, sessile or slightly pedicellate about 15x 3 cm, trigonous, Pistillate inflorescence terminal, bracteate, the peduncle bearing a solitary, ovoid, ellipsoid head, surrounded by pale yellow spathes, spathes similar to

those of staminate inflorescence; but turning green, and comparatively longer (30-45 cm). Fruiting head oblong, solitary, carpels simple, ovary one celled, syncarp composed of simple drupes with persistent single style, slightly bend, some times spinulose, single bend some terms spinulose, give the appearance of the real Jack fruit. Seed single, 14 mm long, oblong, slightly narrower towards base, usually with a long hardy style, mesocarp fibrous, albumen white.

Fl. & Fr : October- December.

Distribution: Indo-Malaysia, seen along sides of streams midland to higher elevations. *Amitha Bachan 99184* (Chalakkudy, riparian, banks of Chalakkudy river, 20 m).

Note. Many authors (Manilal & Suresh, 1984, Nicols *et al* 1988 and Manilal 2003 reported that they were not able to collect the live specimens of *P. furcatus* from Malabar region after a long period of intensive search since 1974. This species has not been reported from Kerala after Gamble's (1935) collection from Cochin area. The auther collected pistillate specimens from Chalakkudy areas of Thrissur district, very near to Cochin area.

Pandanus kaida Kurz., J. Asiat. Soc. Bengal, 38: 148, 1869; B. C. Stone in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3: 308. 1981; Manilal & Suresh, New Botanist 11: 123. 1984; K. G. Bhat, Ind. J. For. 15: 360. 1992 & Fl. Udupi, 673, 2003; C. N. Sunil & Sivad., Fl. Alappuzha 718. 2009. **Kaida** Rheede, Hort. Malab. 2:1-2, t.-5. 1679. **Kaida, Thazha.**

Plate 41. C; Plate 42. G-J.

Branched shrubs or small tree, height up to 25 ft, stem erect, cylindrical and grayish brown, ringed by leaf scars with basal prop roots. Leaves spiraled in 3 rows, up to 3-4m long and 5- 8, rarely 9cm broad,

simple, linear ensiform, apex acuminate and narrowed in to and elongated triquete flagella, coriaceous, green above and below, not or scarcely glaucous, erect ascending, rather stiff, the tips of the older leaves abruptly down turned. The margins and dorsal mid rib armed with spines which are white or pale yellow coloured The spines in the margins forwardly curved. On the midrib teeth nearer the leaf blade blunt stout and reflexed; from the middle of the leaf and beyond all forwardly curved. Male inflorescence terminal raceme or spike. Each lateral raceme 8-11cm long, 2.5-3cm thick, subsessile, one side flat (towards the peduncle) and other side round convex; each subtended by a white spathe, the lower ones flagelliferous and upper ones acute at the tips and smaller in size. Stemonophore 7-8mm long up to 25 erect stamens, stamens umbellate, crowded and erect, filaments 0.5-2mm long., anther linear or slightly curved, 3–4mm long, appiculate. All filaments closely crowded at the apex of the stemonophore. Female inflorescence terminal, pedunculate, peduncle upto 40-50cm long, trigonal bearing several(3-5) foliacious bracts. Cepahlia solitary or sometimes 2,3, borne together spicately, each subtended by one or several bracts (Spathes), are green to whitish with leaf like tips (lower bracts) or white apices (upper brcts). Carpels in phalanges of 1-4. syncarp up to 30 x 15 cm, oblong-ellipsoid or rounded trigonal, finally pendulous on an elongated peduncle. Phalanges cuneate, 4-5 x 1-2 cm, usually 5-7- angled, apex low pyramidal centrally produced in to 1-4 short styles.

Fl.& Fr. July -October

Distribution: Endemic to India and Sri Lanka. This species is common in the coastal areas It is planted as a hedge plant and also on bunds of paddy fields to mark borders and also around ponds and streams of the coastal areas. Ensures soil protection, prevent bank erosion. *Amitha*

Bachan 98788 (Mathilakam, streamside vegetation, sea level); *Amitha Bachan 98786* (Kodungallur, stream banks, coastal areas, sea level).

Notes: Stone denotes the absence of wild specimens, and its original home never is known in detail. He admits its presence in India Ceylon, Malaya to South China. This species is more concentrates in the Coasts of central Kerala. Also seen in wild thickets. Stone (1983) denotes that this species may be indigenous to Ceylon it is very much similar to *P. ceylanicus* in vegetative structures.

Pandanus foetidus Roxb., Fl. Ind. 3: 742. 1832; Hook f., Fl. Brit. India 6. 483. 1893; K.G. Bhat, Ind. J. For. 15: 359. 1992. *Pandanus thwaitesii sensu* C. E. C. Fisch. in Gamble, Fl. Pres. Madras 3: 1570 1935; B. C. Stone in C. J. Saldanha & Nicolson, Fl. Hassan Dist. 780. 1976; Manilal, Fl. Silent Valley 330. 1988; Sasidh.& Sivar. Fl. Pl. Thrissur 481.1996; N. Mohanan & Sivad., Fl. Agasthyamala 748. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 521. 2005. *non* Mart. 1904. *Pandanus foetidus* var. *racemosus* Trimen, Handb. Fl. Ceyl. 4: 340 1898. **Kattukaitha.**

Plate 41. D; Plate 42. L.

Shrub, under shrub supported by stilt root. The stems erect or deumbent-ascending (usually), sparsely branched, if dichotomous, 2-6 m long and 4-8 cm diam.; prop roots few, basal rather short. Leaves linear, lanceolate, acuminate up to 2-2.8 m long 3-4.5 cm broad spiny along margins and keel (some times two keeled) beneath., Apical twin pleats denticulate along distal one-fifth of the blade. Midrib prickly along its whole length, retrose on the proximal two-thirds, antrorse on the distal third of the blade at the base. Staminate inflorescence terminal spicate; bracts yellow, lower ones rather abruptly acuminate at apex, distal ones acute, fragrant; spikes sessile, to 10 cm long; stamens not on stemenophore, attachd disrectly to the rachis; filaments short; anthers

apiculate. Pistillate inflorescence terminal spicate, on an erect peduncle; bracts similar to male inflorescence. Cephalia 1-4, well spaced, in flower composed of numerous simple crowded carpals. Fruiting heads on an erect peduncle, sessile, globose, 9-12 cm across, green. Syncarp globose, up to 12 cm across, drupes oblanceolate, narrowed to the base, 2.5-3.5 x 0.6-0.8 cm, 5-6 angled connate basally, free apex pentagonal-pyramidal, terminated by the entire subspinescent style.

Fl. & Fr.: September-March

Distribution: Endemic to North East, Central, South India and Burma. Fairly common in evergreen forests of Kerala, Karnataka and Kanyakumari Dt. of Tamil Nadu. *Amitha Bachan 98727* (Nelliyampathy, riparian forest undergrowth, banks of Karappara river, 800 m). *Amitha Bachan 99176* (Sholayar, stream bank vegetation in the evergreen forests, stream draining to Sholayar reservoir, 850 m).

Note: This species is treated as *P. thwaitesii* Mart. by several authors Fischer (1935), Manilal (1988), Sasidharan and Sivarajan (1996); Mohanan and Sivadasan (2002) and Anil Kumar *et al.* (2005) from south India because of its similarity in having prickles on the upper twin apical pleats and reduced subsessile few-stamened male flowers, and free, one-seeded, oblanceolate drupes with subspinescent style. It differs from *P. thwaitesii* Mart. by its 1-4 fruit heads on an erect peduncle. In *P. thwaitesii* Mart. the fruit heads are 5-7 on a pendulous peduncle (Bhat, 1992 & 2003). J. D. Hooker (1894) reported its occurrence from Konkan. The specimens and photographs from Nelliyampathy and Sholayar were identified as *P. foetidus* Roxb. K.G. Bhat (pers. comm.). Careful examination of the collected specimens from the Western Ghats region, indicate the occurrence of *P. foetidus* in this region as well. Its identification as *P. thwaitesii* Mart. is erroneous. It is certain that, *P.*

thwaitesii Mart. is endemic to Sri Lanka as was indicated by B. C. Stone and *P. foetidus* Roxb. has its distribution along the Western Ghats, North East India upto Burma (Karthikeyan *et al.* 1989, Hooker 1897 and Mitra 1958).

Pandanus unipapillatus Dennst., Schleuss., 15, 23, 27. 1818; Nicolson *et al.* Interprt. Hort. Malab. 306. 1988. *Pandanus canaranus* Warb. in Engl., Pflanzenr. IV. 9: 75. 1900; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 3: 1570. 1935. **Thazhakaida, Anakaida. Plate 41.F; Plate 42. K**

Shrubs or small trees., 8-10m tall, stem more or stout erect, branching near top, dichotomous and few; grayish brown, ringed by distinct leafs scars., prop root stout. Leaves up to 180 cm long and 9.2 cm broad, linear oblong, very thick, apex acuminate, prickly along margins and dorsal mid rib, prickles very sharp greenish to brownish 5-7 mm long, antrorse, mostly 5-18mm apart; when dry very slightly copper-bronzy-purplish. Male inflorescence terminal, bracteate, bracts yellowish linear lanceolate or lanceolate, the lower ones flagelliferous., stamens 17-27 together, filaments 1 mm long., anthers apiculate, 2.5-3.5 mm long. Female inflorescence terminal, bracteate, pedunculate, infructescence solitary, 20-24 cm long oblong ovoid, slightly trigonous composed of many simple drupes., peduncle pendulous. Drupes 3.5-4 cm long, 5-7 angled, orange yellow when ripe, narrowly clavate, the pileus steeply pyramidal and slightly curved, about 5-7mm long, prolonged into the central antrorse to erect, corneous, glossy brown style usually simple sometimes forked. The stigmas ventral ovate black.

Fl.& Fr: July-September

Distribution: Endemic to Peninsular India. Common along the banks of streams, canals, rice fields and bunds. *Amitha Bachan 98791* (Puthenvelikkara, riparian, banks of Chalakkudy river, near sea level);

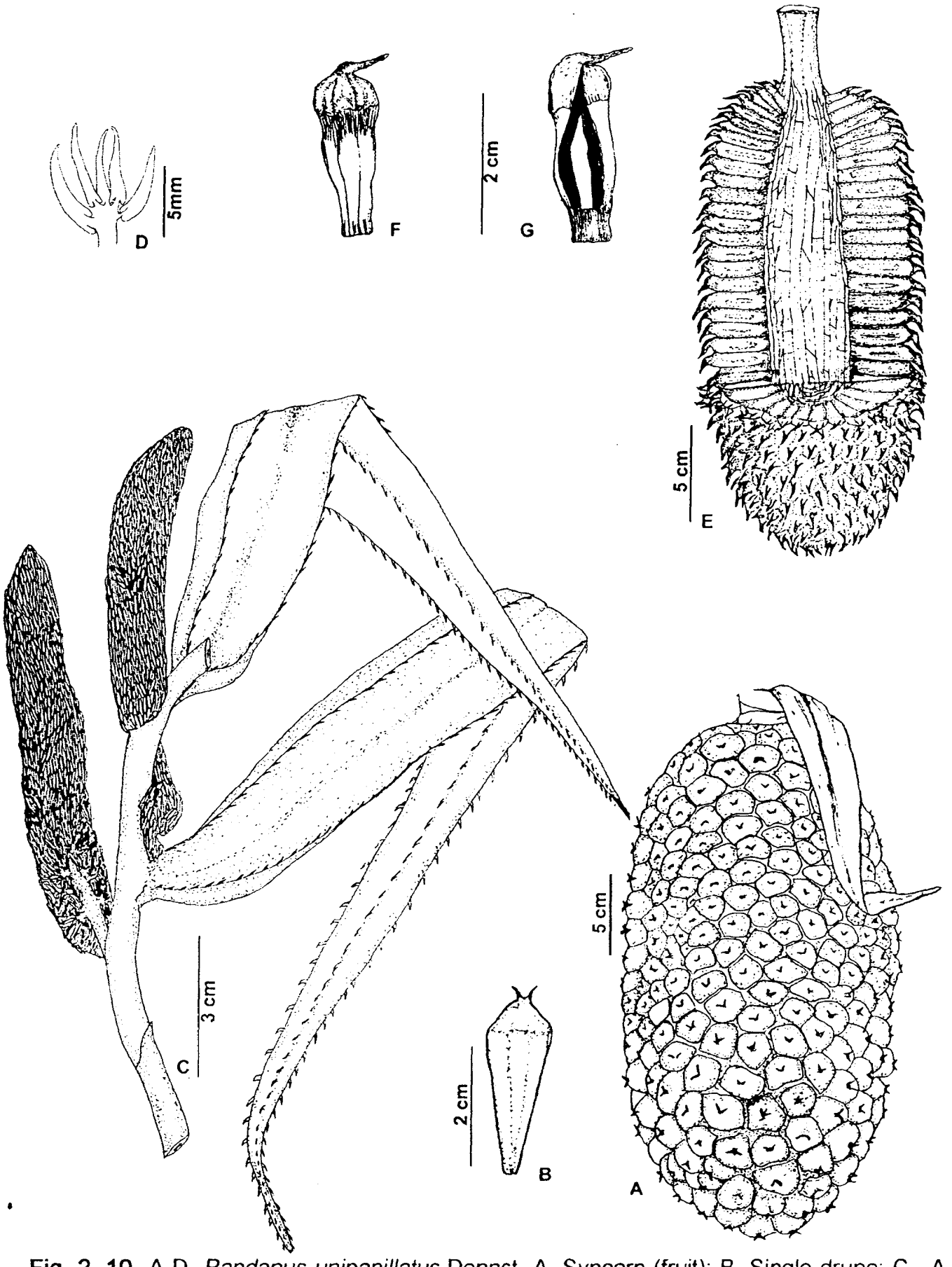


Fig. 2. 10 A-D. *Pandanus unipapillatus* Dennst. A. Syncarp (fruit); B. Single drupe; C. A portion of male inflorescence; D. Stamens (umbellate) on stemanophore. E-G. *Pandanus furcatus* Roxb. E. Syncarp (Fruit) with a portion removed; F. Single drupe; G. Drupe L.S.

Amitha Bachan 98787 (Irinjalakkuda, streamside vegetation, near sea level).

Notes. Dennstedt's name is solely based on Rheede's plate (Hort. Malab. 2: 5, t. 7. 1679). Many authors including Warburg (1900) noted that *P. canaranus* may be this species. A recent pistillate collection from by Kerala (Nicolson *et. al,* 1988) confirmed Rheede's illustration of the type *P. unipapillatus* Dennist. with *P. canaranus* and Dennisted's earlier name applies (Nicolson *et. al,* 1988, Manilal, 2003). On examination of specimens and photographs collected during this study also corroborate this view.

Pandanus tectorius Parkinson ex Z. in Der. Naturforscher, 4: 220- 258. 1774; St. John, Bid. J. Linn. Soc. 4 (4) : 305- 310. 1972.

Branched trees up to 10 m tall or above, stem grey ringed by sharp spiral leafscars. Main stem >15cm in mature trees; profusely branching. Leaves 1-2m long, armed, linear apex gradually narrowed into triquete flagella. spines small, usually red tipped. Male inflorescence bracteate, pedunculate yellowish or cream coloured. Stamens racemosely arranged on the stemonophore. Phalanges 5-15, upper part of the phalanges are raised conically.

Key to varieties

1a. Leaves entirely unarmed..... var. **laevis**

1b. Leaves armed.....2

2a. Leaves (variegated) striped green and yellow or green and white, rarely completely albino; cultivated, usually in gardens...var. **sanderi**

2b. Leaves light green, not variegated or striped, cultivated in gardens..... var. **tectorius**

var. **tectorius** **Plate 41. H**

This can be identified by the completely armed large green leaves with tip acute flagelliferous, and 1-3 mm long red-tipped older leaves.

Fl. & Fr.: Not known.

Amitha Bachan 98923 (Puthenvelikkara, banks of Chalakkudy river, escape from cultivation, sea level).

Note: This species is named as *Pandanus tectorius* Park. ex Z., Stone (1981) has treated the other two varieties (var. *laevis* Warb. and var. *sanderi* (Hort.) Stone) under this species, reference to electronic plant diversity data base, there are 12 other varieties for *P. tectorius.* Many have confused that the typical variety of *Pandanus tectorius* Park with *P. fascicularis* Lam, but it can be distinguished by small spines, usually red tipped and raised conical upper part of the phalanges.

var**. laevis** Warb. In Pfklanzer. 3 (IV.9) : 48, 1900. *Pandanus laevis* Kunth, Enum. Pl. 3: 100. 1841. *Pandanus moschatus* Miq., Fl. Ind. Bat. 3: 165. 1855. *Pandanus spurious* Miq., CV 'Putat' in St. John, Pac. Sci. 19(2); 232, fig. 223. 1965.

This is seen cultivated in gardens. This can be recognized by its completely unarmed leaves, unless it resembles *P. fascicularis.* Its males have been collected in Sri Lanka (Stone, 1981).

Fl.& Fr. : Not seen.

Amitha Bachan 98924 ((Puthenvelikkara, banks of Chalakkudy river, escape from cultivation, sea level).

var. sanderi (Hort.) B. C. Stone in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3. 320. 1981; *Pandanus sanderi* Hort. In Gard. Chron. 3 Ser. 23, 243. f. 93. 1898; Warb., in Pflanzenr. 3 (IV.9): 87. 1900. *P. variegates* Miq. Anal. Bot. 28. 1851. *P. baptistii* Hort. Belg. 19: 166 f. 35. 1893. *P. veitchii* Hort. In Dalliere, Pl. Orn. In Gard. Chron. 2: 249. 1868.

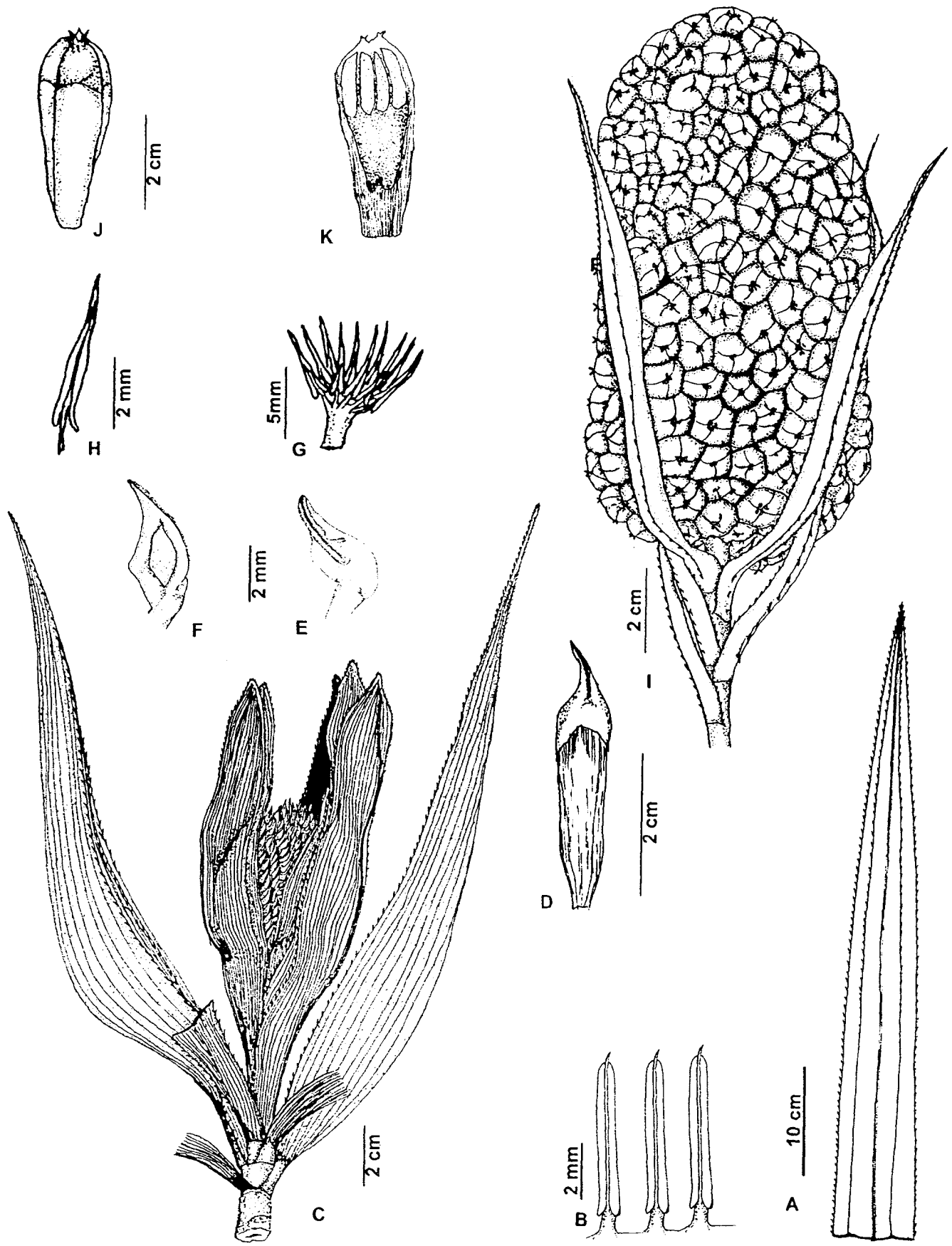


Fig. 2.11. A-F. *Pandanus foetidus* Roxb., A. Leaf tip showing armed ventral pleats; B. Stamens (singly arising from rachilla); C. Syncarp; D. Single drupe; E. Drupe apical portion; F. Drupe L.S. G-K. *Pandanus kaida* Kurz., G. Stamens (umbellate) on stemanophore; H. Single stamen; I. Syncarp; J. Single phalange (aggregate of 3 drupes); K. Single phalange L.S.

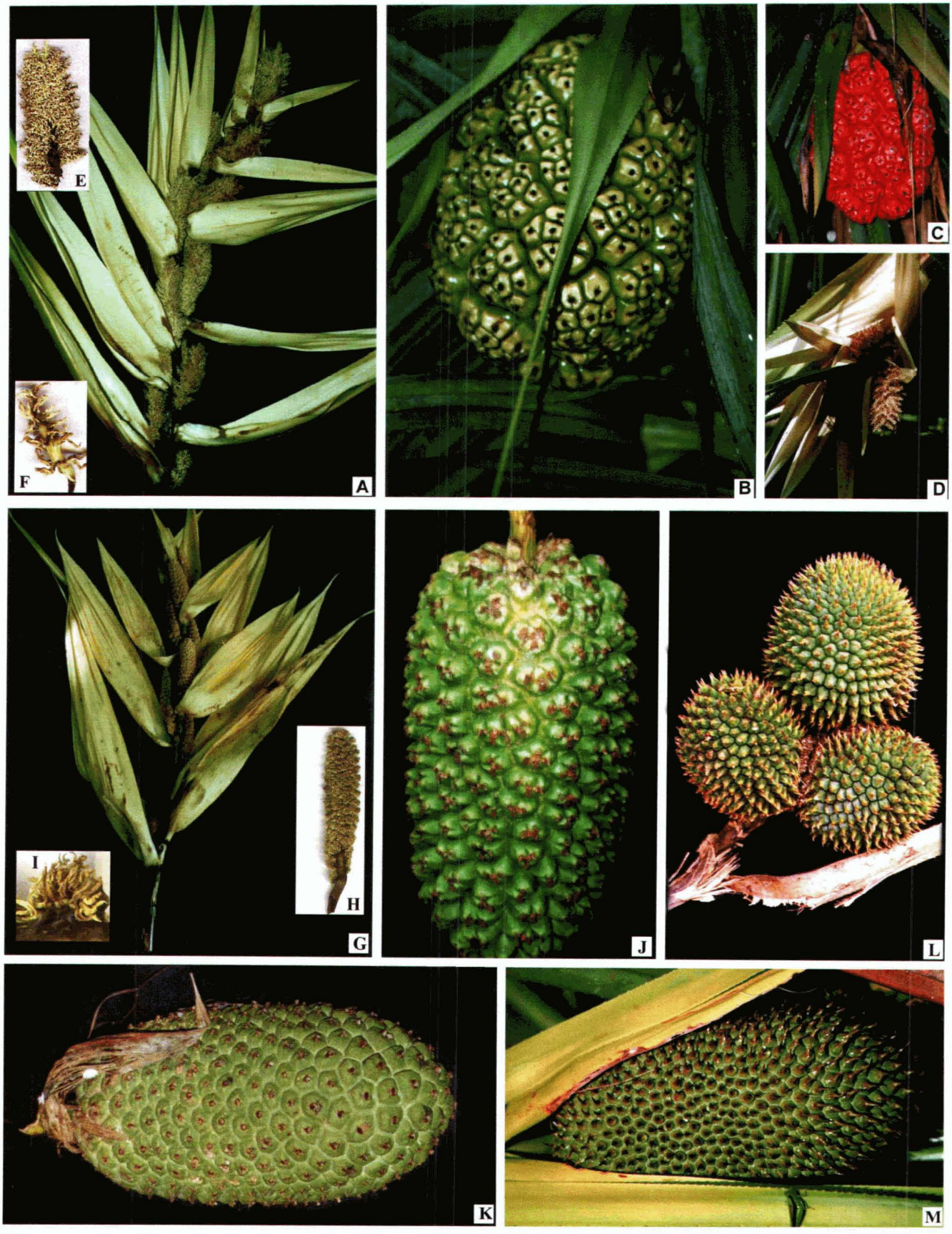


Plate 42. A-D. *Pandanus fascicularis* Lam. A. Male inflorescence; B. Mature fruit; C. Ripened fruit; D & E. Male spike; F. Stamens (racemose) on stemanophore. G-J. *Pandanus kaida* Kurz. G. Male inflorescence; H. Single spike; I. Stamens (umbellate) on stemanophore; J. Mature fruit. K. *Pandanus unipapillatus* Dennst., mature fruit. L. *Pandanus foetidus* Roxb., Infructescence. M. *Pandanus furcatus Roxb.*, fruit.

Plate 41. I

This is seen in cultivation only. It grows in gardens for its showy variegated leaves with yellow and green, sometimes complete albinos were seen.

It is usually found in gardens, throughout Kerala.

Fl.& Fr.: Not seen.

Amitha Bachan 98925 (Puthenvelikkara, banks of Chalakkudy river, escape from cultivation, sea level).

124. TYPHACEAE Juss.

Gen. Pl. 25. 1789.

TYPHA Linnaeus

Sp. Pl. 971. 7153.

Typha angustifolia L., Sp. Pl. 971. 1753; Guha & Mondal, J. Econ. Tax. Bot. 22: 519. 1998. *Typha domingensis* Pers., Syn. Pl. 2: 532. 1807. *Typha angustata* Bory & Chaub., Exped. Sci. Moree Bot. 1: 338. 1832; Hook. f., Fl. Brit. India 6: 489. 1893; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1571. 1931; C. N. Sunil & Sivad., Fl. Alappuzha 719. 2009.

Robust perennial semi-aquatic or marshy herbs to 2.5 m tall; rhizome creeping, clothed with distichous scales; stem terrete, basally submerged. Leaves distichous, linear, to 2 m long and 1-2.5 cm wide, sheathing below, subterete above the sheath, flattened towards apex, thick, spongy; sheaths 40-50 cm long, auricled. Flowers unisexual in cylindrical spikes; the male spikes above the female ones. Male spike 8-18 cm long; male flowers slender and paler than the female ones, densely packed in the spike and mixed with simple, linear spathulate hairs; stamens 2 or 3; anthers 2 mm long, linear. Female spikes to 20 cm long, 1-1.5 cm across, terete; female flowers on compound stalks mixed with

Plate 41. A & B. *Pandanus fascicularis* Lam. A. Habit; B. Main trunk showing branching. C & D. *Pandanus kaida* Kurz. C. Stem base showing stilt roots; D. Habit. E. *Pandanus furcatus* Roxb., habit. F. *Pandanus unipapillatus* Dennst., habit. G. *Pandanus amaryllifolius* Roxb., habit. H. *Pandanus tectorius* var. *tectorius* (Park. ex Z.), habit. I. *Pandanus tectorius* var. *sanderi* (Hort.) Stone, habit.

bracts and sterile flowers; ovary linear, 1 mm long; style to 3 mm long; stigma flattened. Fruit minute, fusiform, to 2 mm long.

Fl. & Fr. : December – February.

Distribution: Cosmopolitan. Semi-aquatic in moist localities and swamps in moist forests. *Amitha Bachan 117778* (Valparai, riparian marshes, banks of Sholayar river, 1200 m).

125. ARACEAE Juss.

Gen. Pl. 23. 1789.

Key to genera

1a. Climbers..... **Pothos**

1b. Erect herbs or shrubs.....2

2a. Aquatic free-floating herb.....**Pistia**

2b. Terrestrial, epiphytic or marshy rooted herbs or shrubs.....3

3a. Leaves peltate.....4

3b. Leaves not peltate.....6

4a. Leaves orbicular, not cordate at base.....**Ariopsis**

4b. Leaves ovate, cordate at base.....5

5a. Leafless during flowering; produce bulbils on bulbiferous stalks.....
.....**Remusatia**

5b. Leafy during flowering; do not produce bulbils.....**Colocasia**

6a. Leaves entire.....7

6b. Leaves divided or deeply lobed 8

7a. Leaves linear, grass-like.....**Cryptocoryne**

7b. Leaves broad, not grass-like.....**Lagenandra**

8a. Spadix and leaves seen together.....**Arisaema**

8b. Spadix and leaves not seen together..... .....**Amorphophallus**

AMORPHOPHALLUS Blume ex Decaisne

Nouv. Ann. Mus. Hist. Nat. 3: 366. 1834 , *nom. cons.*

Amorphophallus commutatus (Schott) Engl. in A. & C. DC., Monogr. Phan. 2: 319. 1879, *var.* **commutatus**; Hook. f., Fl. Brit. India 6: 515. 1893; Sasidh. & Sivar., Fl. Pl. Thrissur For. 483. 1996. *Conophalus commutatus* Schott, Bonplandia 7: 28. 1859 & Prodr. Syst. Aroid. 128. 1860. *Amorphophallus commutatus* (Schott) Engl. var. *wayanadensis* Sivad. & Jaleel, Rheedea 12: 163. 2002. **Kattuchena.**

Herbs with tuberous corms; leafless during flowering, corms depressed globose, to 5-7 cm across. Leaves tripartitely compound, lamina 50 cm long, leaflets decurrent at base, elliptic, caudate-acuminate, acute at base, glabrous, membranous; petiole stout, as long as the lamina , terete. Spadix monoacious with female flowers at base, male flowers above. Peduncle up to 1.5m tall; spathe 40 x 15 cm, ovate–lanceolate; Spadix and sterile appendages terete, narrowed towards apex, as long as the spathe. Anthers truncate, dense, dehiscing by apical pores. Ovary 1 celled; ovule 1 in each cell; Berry 1-3 seeded.

Fl & Fr. : July - September

Distribution : Endemic to the Western Ghats. Evergreen forests, riparian zone. *Amitha Bachan 99052* (Orukombankutty, riparian forests, banks of Chalakkudy river, 400 m).

ARIOPSIS Nimmo

in J. Graham, Cat. Pl. Bombay 252. 1839.

Ariopsis peltata Nimmo in Graham, Cat. Pl. Bombay 252. 1839; Hook. f., Fl. Brit. India 6: 519. 1893; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1580. 1931; Manilal, Fl. Silent Valley 331. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 755. 2002. **Plate 43. F & G.**

Small tuberous herbs; corm 1-2 cm across, globose; Leaves solitary, entire peltate, appear along with inflorescence; petiole to 20 cm long, smooth, base sheathing. Lamina suborbicular, sometimes broader than long, 2-15 cm, rounded, emarginated or cordate at bas, acute to apiculate at apex . Peduncle slender, 3-10 cm long; spathe 1.5-4 cm long, tube 1-1.5 cm broad, purple with white lines and a green dorsal ridge, glabrous; limb ovate, finely caudate-acuminate, horizontal, green with white lines. Spadix 6 cm long, straight, narrowed at apex into a short tail. Male flowers dark purple; female green, stigma yellow. Ovary few, 1-celled. Seeds longitudinally furrowed.

Fl. & Fr. : June-August.

Distribution: India and Western Malaysia. On wet rocks in evergreen forests. *Amitha Bachan 117667* (Sholayar-Anakkayam, on wet rocks along the river side, Anakkayam streamside, 650 m).

ARISAEMA Martius

Flora 14: 459. 1831.

1a. Spathe limb broadly ovate, acute, tube green.....**A. murrayi**

1b. Spathe limb ovate, caudate acuminate, tube purple.....**A. barnesii**

Arisaema barnesii C. E. C. Fisch., Bull. Misc. Inform. Kew 1933: 342. 1933 & C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1891. 1936;

Chatterjee, Bull. Bot. Soc. Bengal 8: 121. 1959; Manilal, Fl. Silent Valley 331. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 484. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 756. 2002. **Plate 44. B.**

Tuberous herbs; inflorescence appear with leaves. Corms globose, 2cm across. Leaflets 7 or 5 foliolate, elliptic-lanceolate, 15 x 5 cm, caudate-acuminate, base acute, glabrous; entire; petiole to 18 cm long. Spathe 12-15 cm long, tube 5 x 1.5 cm, vertically striped with dark purple streaks; limb horizontal, ovate, finely caudate-acuminate, green with white bands inside and purplish outside; Spadix straight, tapering into a short tail terminated by a minutely warted small knob. Staminate flowers 0f 2-8 anthers grouped on a short stalk or sessile. Pistillate flowers with 1-locular ovary; stigma discoid; ovules many.

Fl & Fr. : March - May

Distribution: Endemic to Southern Western Ghats, Threatened. Evergreen and streamside vegetation medium to high elevations. *Amitha Bachan 99065* (Karimalathodu-Sholayar, streamside evergreen forests, Karimalathodu, 1100 m).

Arisaema murrayi (Graham) Hook., Bot. Mag. t. 4388. 1848; Hook. f., Fl. Brit. India 6: 507. 1893; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1585. 1931; Manilal, Fl. Silent Valley 332. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 485. 1996. *Arum murrayi* Graham, Cat. Pl. Bombay 229. 1839.

Tuberous herbs; inflorescence appear with leaves. Corm globose, to 2.5 cm across. Leaf shortly pedatisect, lobes 5-9, elliptic or elliptic-lanceolate, acute, shortly acuminate, cuneate at base, to 17 x 6 cm, membranous; petiole slender, sheathing, to 20-40 cm long. Peduncles as long as the petiole, stout, green mottled with red-brown; spathe greenish, to 10 cm long, base tubular, to 3 x 1.5 cm; limb 6 x 5 cm, green with

white streaks, reddish along margins; spadix 5-7 cm long; sterile appendages as long as spathe or shortly exserted. Berry obovoid, 3 or 4-angled at apex, 6 x 5 mm.

Fl. & Fr. : April-July.

Distribution: Endemic to Western Ghats. Moist forests. *Amitha Bachan 117666* (Sholayar-Anakkyam, riparian forest, banks of Anakkyam thodu).

COLOCASIA Schott

in Scott et Endlicher Melet. Bot. 18. 1832, *nom. cons.*

Colocasia esculenta (L.) Schott in Schott & Endl., Melet. Bot. 1: 18. 1832; Sasidh. & Sivar., Fl. Pl. Thrissur For. 485. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 524. 2005. *Arum esculentum* L., Sp. Pl. 965. 1753. *Arum colocasia* L., Sp. Pl. 965. 1753. *Colocasia antiquorum* Schott in Schott & Endl., Melet. Bot. 1: 18. 1832; Hook. f., Fl. Brit. India 6: 523. 1893; C. E. C. Fisch.in Gamble, Fl. Pres. Madras 1580. 1931. **Chembu.**

Tuberous rhizomatous herb; tubers to 15 cm across. Leaves many, peltate, ovate to sub-orbicular cordate, to 70 x 30 cm, cordate at base, glabrous and glossy; petiole to 1.5 m, sheathing at base. Peduncle to 30cm long; spathe to 25 cm long, base tube to 20 cm, green, limb yellow, narrowly lanceolate; spadix 15 cm long. Perinath 0; anthers 3-6, connate, opening by short slits. Ovaries obovoid, 1 celled.

Fl & Fr. : May –August.

Distribution : Pantropical, Common along the streamside and marshy areas *Amitha Bachan 123635* (Vazhachal, riparian forests, banks of Chalakkudy river, 230 m).

CRYPTOCORYNE C.E.C. Fisch. ex Wydler

Linnaea 5: 428. 1830.

Cryptocoryne retrospiralis (Roxb.) Kunth, Enum. Pl. 3: 12. 1841; Hook. f., Fl. Brit. India 6: 493. 1893; C. E. C. Fisch. In Gamble Fl. Pres. Madras 1575. 1931; Anil Kumar *et al.*, Fl. Pathanamthitta 525. 2005. *Ambrosinia retrospiralis* Roxb., Fl. Ind. 3: 492. 1832. *Ambrosinia unilocularis* Roxb., Fl. Ind. 3: 493. 1832. *Cryptocoryne unilocularis* (Roxb.) Kunth, Enum. Pl. 3: 13. 1841. *Ambrosinia roxburghiana* Voigt, Hort. Suburb. Calcutt. 685. 1845. *Cryptocoryne dalzellii* Schott, Bonplandia 5: 221. 1857. *Cryptocoryne roxburghii* Schott, Prodr. Syst. Aroid. 18. 1860; Hook. f., Fl. Brit. India 6: 494. 1893. *Lagenandra dalzellii* (Schott) Rataj, Studie CSAV 3: 101. 1975.

Stoloniferous marshy herbs. Leaves many, linear-oblong, to 15 x 0.6 cm, acute or acuminate, glabrous. Peduncle 2-3 cm long, slender, solitary; spathe 8-12 cm long, partitioned by a transverse diaphrum above the spadix; limb 3 cm long, spirally twisted, acuminate, pale brown with deep brown spots; spadix 14 mm long, included in the chamber, slender at middle. Female flowers 4 or 5, one-whorled at the base; ovaries connate, l-celled, ovules many, placentation parietal. Neutral flowers 4-6, above the female flowers as a whorl of appendages. Male flowers many, in terminal globose clusters; stamens 1 or 2.

Fl. & Fr. : December-March

Distribution : Northeast and South India; along river banks and stream beds. *Amitha Bachan 99101* (Orukombankutty, river bed, along Chalakkudy river, 460 m).

LAGENANDRA Dalzell

Hooker's J. Bot. Kew Gard. Misc. 4: 289. 1852.

Key to species

1a. Leaf base usually cordate, sub cordate or rounded; rhizome <1 cm across 2

1b. Leaf base usually acute, never cordate; rhizomes 1-5 cm across.....3

2a. Leaf base rounded to subcordate; rhizome slender elongated; spathe limb terminating into subulate curved tail; berry smooth..... .....**L. meeboldii**

2b. Leaf base cordate; petiole shorter than lamina; rhizome stout short; spathe limb without a subulate tail; berry spinulose.....**L. nairii**

3a. Leaves to 20 cm long; spathe pale-purple or violet, limb smooth..... .....**L. toxicaria**

4a. Leaves to 50 cm long; spathe dark-purplish, limb warty.....**L. ovata**

Lagenandra meeboldii (Engl.) C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1576. 1931; Manilal, Fl. Silent Valley 333. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 486. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 525. 2005. *Cryptocoryne meeboldii* Engl., Pflanzenr. Arac.-Aroid. & Pistioid. 234. 1920. **Plate 43. D.**

Rhizomatous marshy rheophytic herbs, rhizome to 1 cm thick, slender, creeping. Leaves clustered; lamina ovate, 4-9 x 2-4 cm, acute, rounded at base; nerves numerous, regularly arching, reddish-purple below; petiole nearly as long or greater than the lamina. Peduncle to 2.5 cm long, concealed in the leaf sheath. Spathe to 10 x 1.5 cm, ellipsoidal, long-acuminate at apex, twisted once or twice; limb warty, purple, thick to 6 cm long. Male and female flowers in separate clusters, stamens 1-2.

Fl & Fr. : January - March

Distribution : Endemic to the Western Ghats. Marshy riversides, streamside in evergreen forests. *Amitha Bachan 98949* (Karapara-Nelliyampathy, rocky-marshy river bed, along Karappara river, 918 m).

Lagenandra nairii Ramamurthy & Rajan, J. Bombay Nat. Hist. Soc. 80: 613. 1983 (1984); Sasidh. & Sivar., Fl. Pl. Thrissur For. 486. 1996.

Plate 43. A-C.

Rhizomatous, perennial herbs. Rhizomes short, stout, <1cm, firmly attached to cervices of rocks or roots o f riparian trees along the river bed. Leaves simple alternate, clustered; lamina ovate-elliptic, oblong, to 5-8 x 1.5-6 cm, acute to obtuse at tip, cordate or emarginated at base, shortly tomentose along the nerves beneath; petiole 2-6 cm. Peduncle 1-1.5 cm long. Spathe up to 4 cm, basal tubular portion white, limb ovate acuminate, dark; spadix with an ovate sterile appendage. Berry ovoid, 4 angled, spinous or warty along the walls.

Fl & Fr. : January - March

Distribution : Endemic to South India, Stream sides associated with low-elevation Riparian forests. *Amitha Bachan 72059 & 117627* (Vazhachal, reheophytic on rocky-marshy river beds, right bank of Chalakkudy river at Athirappilly dam site, 220 m).

Note. Known only from the type locality. The present collection is from Athirapilly (120 m) and Vazhachal (225 m).

Lagenandra ovata (L.) Thwaites, Enum. Pl. Zeyl. 334. 1864; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1576. 1931; N. Mohanan & Sivad., Fl. Agasthyamala 757. 2002; Anil Kumar *et al.,* Fl. Pathanamthitta 526. 2005. *Arum ovatum* L., Sp. Pl. 967. 1753. *Lagenandra insignis* Trimen, J. Bot. 23: 269. 1885; Hook. f., Fl. Brit. India 6: 496. 1893.

Perennial marshy herbs; rhizome creeping, 2-4 cm diameter, cylindrical. Lamiana elliptic-ovate, ovate-oblong, to 20-40 x 6-12 cm, acute, at both ends, entire; nerves many, erose; petiole 20-70 cm long. Peduncle axillary, erect, 15-20 cm long; spathe 15-20 x 5-10 cm, broadly ellipsoid, closed, coarsely warted on both surface, dark purplish, twisted and acuminate at apex; spadix 3-5 cm long, included in the chamber. Male flowers many, in terminal globose head; stamens 1 or 2; female flowers many, basal, subglobose; ovary obovoid; ovule 1.

Fl. & Fr. : July-February.

Distribution: Endemic to India & Sri Lanka. Marshy river beds and streams in forest areas. *Amitha Bachan 99079* (Sholayar, along the stream sides, Meenchaliyali streamside, 900 m).

Lagenandra toxicaria Dalz. in Hooker's J. Bot. Kew. Gard. Misc. 4:289.1852 & 5: t. 4.1853, var. **toxicaria**; Hook. f., Fl. Brit. India 6:495.1893, *p.p.*; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1889. 1936; Sasidh. & Sivar., Fl. Pl. Thrissur For. 486. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 526. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 723. 2009.

Marshy herbs; rhizome 2-4.5 cm diameter, horizontal, stout. Leaves, elliptic-oblong, acute at apex, cuneate, acute at base, to 12-25 x 3-8 cm, veins close, undulate, crispate; petiole 12-35 cm long, sheathing at base, base brownish. Inflorescence with short peduncle; spathe 8-15 cm long, pale brown or purple; basal tube 1-2 cm long, purplish outside, dark brown with ridges within; limb 5 x 3 cm, ovate, light purplish outside and dark purplish within with irregular fimbriate lamellae, smooth; caudate tip 8-12 cm long. Spadix to 2-2.5 cm long. Female flowers 50, in close spirals; Staminate portion yellow. Ovary unilocular; ovule 3-7; stigma sessile with a central pit.

Fl. & Fr.: July-October.

Distribution: Endemic to Southern Western Ghats. Common along fresh water streams *Amitha Bachan 123631* (Vazhachal, streamside, stream draining to Chalakkudy river, 230 m)

POTHOS Linnaeus

Sp. Pl. 968. 1753.

Key to species

1a. Petiole winged; spadix globose.....**P. scanens**

1b. Petiole not winged; spadix slender or elongate.....2

2a. Plants armed with prickles modified from adventitious roots; spadix slender; flowers in groups.....**P. armatus**

2b. Plant unarmed; spadix elongate; flowers compacted.....
.....**P. crassipedunculatus**

Pothos armatus C. E. C. Fisch., Bull. Misc. Inform. Kew 1929:126.1929 & C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1592.1931; Sasidh. & Sivar., Fl. Pl. Thrissur For. 487. 1996. N. Mohanan & Sivad., Fl. Agasthyamala 759. 2002.

Evergreen climbers with thin woody stems and many adventitious roots from nodes. Adventitious roots turns spinous. Leaves simple, entire, shortly petioled, round and cordate when young, elliptic lanceolate, to 8-14 x 2-3 cm. Inflorescence solitary, axillary, peduncled; spathe open, spadix globose, 3-5 cm, densely flowered. Flowers bisexual, trimerous; tepals 6, subequal; stamens 6, equal; pistil trilocular, with one sub-basal ovule in each locule. Berries ovoid 0.6 mm.

Fl & Fr. : December- March

Distribution : Endemic to Southern Western Ghats endemic. *Amitha Bachan 99185* (Vazhachal, riparian evergreen forests, banks of Chalakkudy river, 220 m); *Amitha Bachan* 99078 (Sholayar, Evergreen riparian forests, banks of Sholayar river, 700 m).

Pothos crassipedunculatus Sivad. & N. Mohanan, Pl. Syst. Evol. 168: 221. 1989; Gopalan & Henry, Endemic Pl. Agasthiyamala 351. 2000; N. Mohanan & Sivad., Fl. Agasthyamala 759. 2002.

Climber, stem thin and woody, terete. Leaves oblong-lanceolate to elliptic, to 8-18 x 2-4.5 cm. acuminate at tip, attenuate at base; veins pinnate, looping at margin to form intramarginal veins. Inflorescence on short lateral shoots. Peduncles thickened towards tip. Spathe up to 2 x 1 cm, broadly ovate, longer than spadix. Berry to 5 mm long, 4-6 angled.

Fl & Fr. : December - May

Distribution : Endemic to Southern Western Ghats. Evergreen forests, stream-bank vegetation. *Amitha Bachan 99072* (Sholayar, Evergreen riparian forests, banks of Sholayar river, 700 m).

Pothos scandens L., Sp. Pl. 968. 1753; Hook. f., Fl. Brit. India 6: 551. 1893; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1592. 1931; Manilal, Fl. Silent Valley 334. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 487. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 761. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 526. 2005. **Paruvakodi.**

Large climbers; stem angled, 0.5cm thick. Leaf, lanceolate, acuminate at apex, cordate at base, to 10 x 3 cm; nerves many, united to form 2-3 narrow ribs, glabrous; petiole to 5 cm long, broadly winged, wing to 5 mm broaden above. Spadix axillary, globose; peduncle to 0.5 cm long, spathe 5 mm across, orbicular, obtuse, concave, brown; spadix 3-5 mm across, globose. Flowers densely packed; bracts 3-5, orbicular;

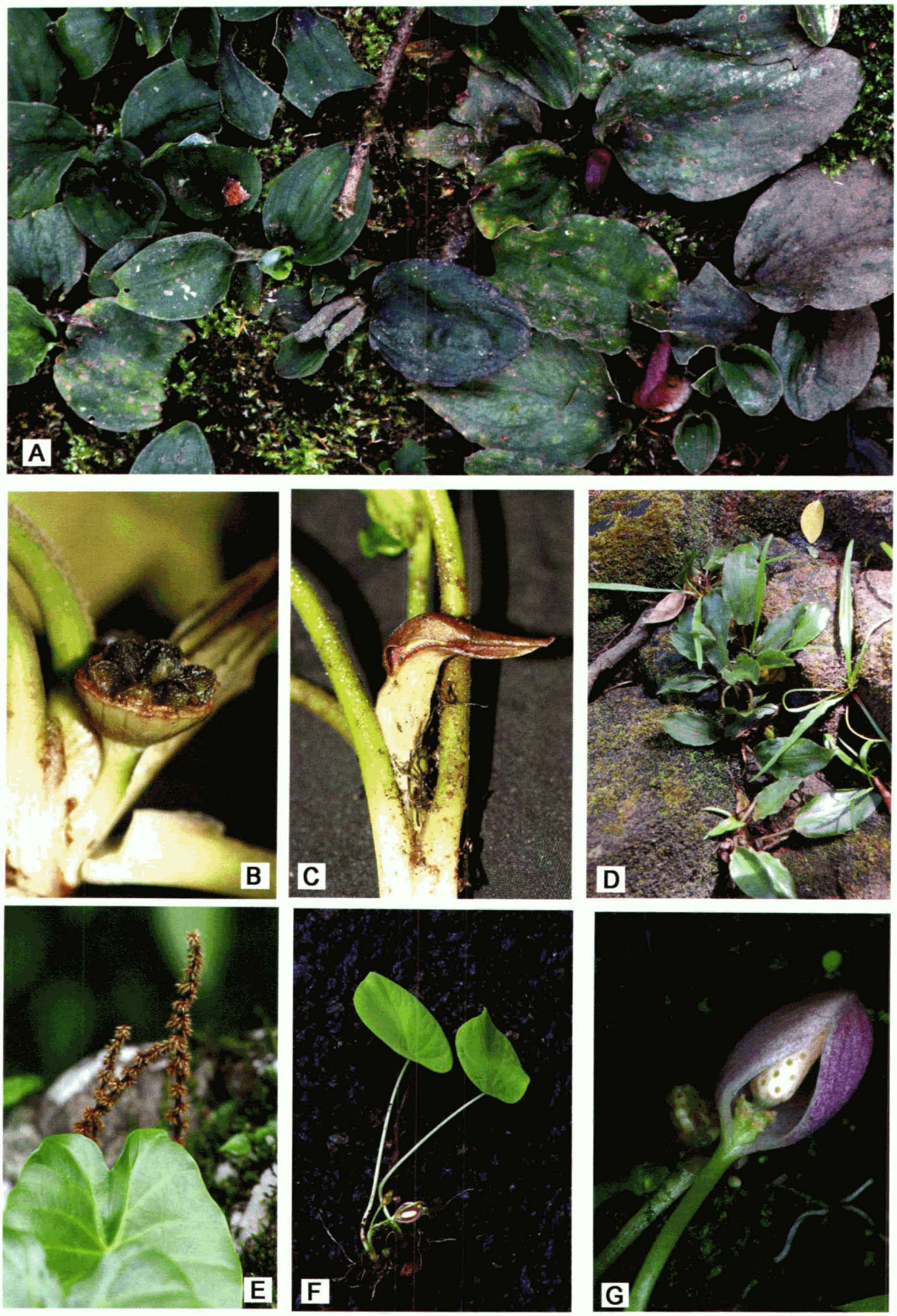


Plate 43. A. – C. *Lagenandra nairii* Ramamurthy & Rajan, A. Habit, B. Infructescence; C. Inflorescence; D. *Lagenandra meeboldii* (Engl.) C. E. C. Fisch.; E. *Remusatia vivipara* (Roxb.) Schott; F. & G. *Ariopsis peltata* Nimmo, F. Plant, G. Inflorescence.

stamens 6, free; ovary obovoid, stigma 3-toothed. Berries oblong 1.6 cm, red on ripening.

Fl & Fr. : October - November

Distribution : India to Malaysia and Madagascar. Climbing on large trees along the evergreen and riparian forests, also in the plains *Amitha Bachan 99143* (Vazhachal, riparian evergreen, banks of Chalakkudy river, 200m).

REMUSATIA Schott

in Schott et Endlicher, Melet. Bot. 18. 1832.

Remusatia vivipara (Roxb.) Schott in Schott & Endl., Melet. Bot. 18.1832; Hook. f., Fl. Brit. India 6:521.1893; C .E. C. Fisch. in Gamble, Fl. Pres. Madras 1583. 1931; Manilal, Fl. Silent Valley 334. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 487. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 761. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 527. 2005. *Arum viviparum* Roxb., Hort. Bengal 65. 1814. **Plate 43. E.**

Epiphytic or lithophytic herbs with erect bulbiferous slender shoots. Leaves ovate, acute at apex, cordate at base, 20-30 cm across, glossy above; nerves prominent; petiole to 40 cm long; spadix solitary, on erect, terminal peduncle, covered with large cataphylls; spathes obovate to rhomboid, spreading, yellowish white; tube short, 5 cm long, ellipsoid, limb to 10 x 6 cm, acute; spadix 5 cm long. Female flowers many, ovary globose, 1-celled; ovules many, parietal, stigma 3-lobed, globose. Male flowers many, on clavate above part of the spadix; stamens 6, united.

Fl. & Fr. : April-June.

Distribution: Paleotropics. Evergreen riparian forests. *Amitha Bachan 123406* (Vazhachal, riparian forests, banks of Chalakkudy river, 220 m).

126. **BUTOMACEAE** L.C. Richard

Mem. Mus. Hist. Nat. 1: 366. 1815.

LIMNOCHARIS Humb. & Bonpl.

Pl. Aequin. 1: 116. 1807.

Limnocharis flava (L.) Buch., Abh. Naturw. Ver. Bremen 2: 2. 1868; Kammat. & Subram., J. Bombay Nat. Hist. Soc. 64: 389. 1967; C. N. Sunil & Sivad., Fl. Alappuzha 732. 2009. *Alisma flavum* L., Sp. Pl. 343. 1753. *Damasonium flavum* (L.) Mill., Gard. Dict. ed. 8: 2. 1768. *Limnocharis emarginata* Humb. & Bonpl., Pl. Aequinoct. 1: 116. 1808.

Perennial rhizomatous herbs; rhizome stout. Leaves ovate, broadly ovate-elliptic or suborbicular, to 28 x 22 cm, cordate to round at base, obtuse or emarignate at apex; nerves numerous, parallel; petiole triangular, spongy, to 50 cm long. Inflorescence umbel-like, 2-15-flowered, axillary; peduncles triangular, to 60 cm long, flattended at the base. Bracts broadly elliptic to rounded, to 2.5 x 2 cm. Sepals 3, broadly ovate, obtuse, 2.5 x 1.5 cm, green, persistent. Petals broadly ovate to orbicular, 3 x 2 cm, rounded at apex, pale yellow. Stamens numerous, surrounded by a whorl of staminodes. Ovary syncarpous, carpels 15-20, laterally compressed; stigma sessile, capitate. Fruits subglobose, to 1.5 cm across, Seeds numerous, ovate, 1 mm long, brown.

Fl. & Fr.: Throughout the year.

Distribution: Native of Tropical America; introduced into S.E. Asia. Wet lands in the lower planes. *Amitha Bachan 117730* (Elanthikkara, riparian marshes in the lower planes, banks of Chalakkudy river, sea level).

127. ERIOCAULACEAE P. Beauv. ex Desv.

in Ann. Sci. Nat. (Paris) 13: 47. 1828.

ERIOCAULON Linnaeus

Sp. Pl. 87. 1753.

Key to species

1a. Floral bracts glabrous..... **E. truncatum**

1b. Floral bracts hoary.....2

2a. Involucral bracts much shorter than floral bracts.....**E. thwaitesii**

2b. Involucral bracts larger than floral bracts.....3

3a. Involucral bracts reflexed, oblong, obovate obtuse; floral bracts black, acute at apex.....**E. ritchieanum**

3b. Involucral bracts oblanceolate, acuminate or cuspidate; floral bracts straw-coloured, truncate at apex.....**E. xeranthemum**

Eriocaulon ritchieanum Ruhland., Ansari & N. P. Balakr., Eriocaulaceae India 161. 2009.

Acaulescent herbs. Rootstock absent. Leaves rosulate, linear–ensiform, acuminate, up to 3.5 x 0.3 cm, glabrous. Peduncles few or many, up to 23 cm long, virgate, glabrous. Sheaths up to 5 cm long, glabrous; limb incised. Heads spherical or hemispherical, 6 mm across, grey or black. Receptacle cylindric, glabrous. Involucral bracts reflexed, oblong, obovate obtuse, 1.25 x 0.75 mm, chartaceous, black. Floral bracts oblanceolate, acute, chartaceous, hoary towards apex, black. Male flowers: pedicels 0.5 mm long. Sepals obovate, connate into a spathe of 1.25 x 1 mm, 3-lobed with obtuse lobes, hoary towards apex, black. Petals 3, subequal, oblong, obtuse, 5 mm long, hoary with a black gland in each. Anthers 6, sub globose, white. Female flowers: pedicels 2.5 mm

long, Sepals 3, free, oblong or oblanceolate, obtuse or acute, 1.25 mm long, hyaline, sparsely hoary towards apex, black. Petals 3, free, spathulate, not clawed, obtuse, 1.25 mm long, hyaline, hoary towards apex, with a black gland in each, stipitate between sepals and petals. Ovary subsessile, globose; style 3-fid; seeds oblong-ellipsoid, acute or obtuse, 0.45 x 0.3mm, pale purple; cells of seed coat transversely elongated, aligned in vertical rows; appendages absent.

Fl & Fr. : August - October.

Distribution: Endemic to Peninsular India. Frequent in waterlogged open lands of high altitude. *Amitha Bachan 117764* (Karimala, streamside vegetation, along Karimala stream draining to Sholayar river, 1100 m).

Eriocaulon thwaitesii Koernicke, Linnaea 27: 627. 1854; Hook. f., Fl. Brit. India 583. 1893; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1620. 1931; Sasidh. & Sivar., Fl. Pl. Thrissur For. 490. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 766. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 530. 2005; Ansari & N. P. Balakr., Eriocaulaceae India 60. 2009; *Eriocaulon mariae* Fyson, Bull. Misc. Inform. Kew 1914: 331. 1914. *Eriocaulon gamblei* C.E.C. Fisch., Bull. Misc. Inform. Kew 1930: 160. 1930 & in Gamble, Fl. Pres. Madras 1618. 1931. **Plate 44. D.**

Acaulescent herbs to 20 cm tall. Leaves linear, ensiform, to 8 cm long, acute at apex, 5-vained, faint. Peduncle many, to 20 cm, ribbed; Involucral bracts obovate, rounded or sub-truncate at apex, yellowish brown, glabrous; heads hemispherical, to 6mm across, white; receptacle flat or shortly conical, pilose; floral bracts obovate-spathulate, concave, rounded or shortly cuspidate at apex, blackish. Male flowers: sepals 3, free, unequal, concave, hoary at apex. Female flowers: sepals 2 or 3, keel-shaped; petals 3, minute, filiform or deeply segmented, white hoary

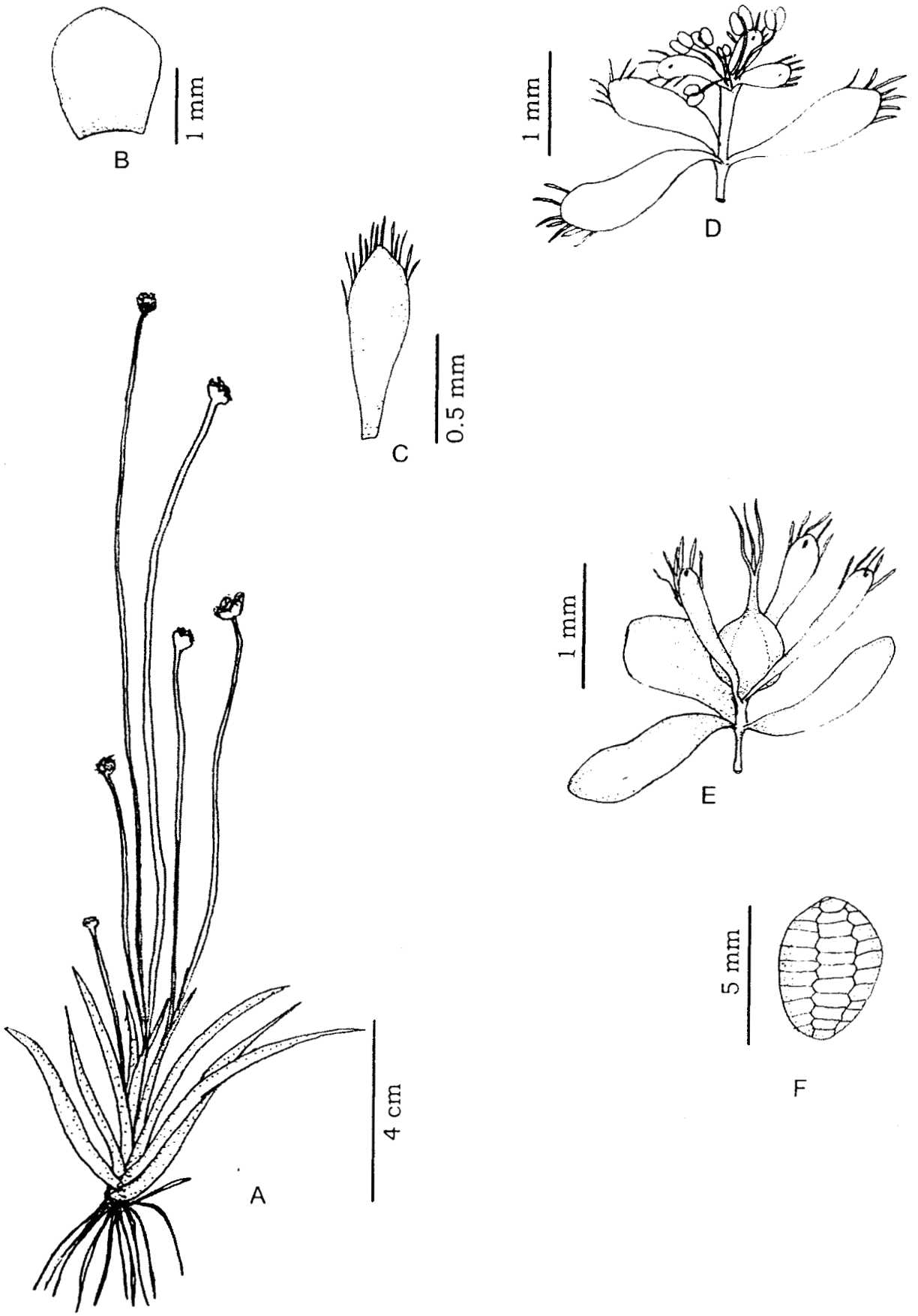


Fig. 2.12. *Eriocaulon ritchieanum* Ruhland A. Habit, B. Involucral bract, C. Floral bract, D. Male flower, E. Female flower, F. Seed.

at apex, eglandular; stamens 6. Ovary sessile, ovoid; style 3-fid; seeds ovoid, reddish-brown.

Fl & Fr. : July – September.

Distribution: Endemic to Peninsular India and Sri Lanka. Evergreen-pseudoshola margin. *Amitha Bachan 98940* (Pullala-Nelliyampathy, streamside vegetation, along stream draiing to Karappara river, 1000 m).

Eriocaulon truncatum Buch.-Ham. in Wall., Pl. Asiat. Rar. 3: 29. 1832; Hook. f., Fl. Brit. India 6: 578. 1893; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1619. 1931; Mani., Fl. Silent Valley 336. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 767. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 530. 2005; Ansari & N. P. Balakr., Eriocaulaceae India 110. 2009; C. N. Sunil & Sivad. Fl. Alappuzha Dist. 742. 2009. *Eriocaulon truncatum var. malaccense* Hook.f., Fl. Brit. India 6: 578. 1893.

Acaulescent herbs. Leaves rosulate, oblong-lanceolate, upto 5 x 0.6 cm, apex acuminate. Peduncles many, upto 12 cm long, virgate; sheaths upto 3 cm long. Heads 4 mm across, hemispherical, white or straw-coloured; receptacles convex, glabrous or pilose; involucral bracts spreading or erect, 2 mm long, oblong-obovate, obtuse, hyaline; floral bracts 1.5 mm long, obovate-cuneate, obtuse or acute, hyaline. Male flowers: sepals connate into a spathe to 1.5 mm long, obovate, 2-lobed, hoary towards apex, black; petals 3, subequal, ovate, hairy, with a black gland in each; anthers 6, oblong, black. Female flowers: sepals 2 or 3, free, to 1.5 mm long, oblong or linear; the middle one smaller lacking, black; petals 3, free, subequal, 1 mm long, spathulate, hyaline, sparsely hoary, with a black gland in each. Ovary sessile, ovoid; style 3-fid. Seeds 0.5 mm long, oblong or ovoid, obtuse, pale yellow; cells of seed coat rectangular, vertically elongated; appendages ribbon-like bands.

Fl & Fr. : July-September

Distribution : Indo-Malaysia. Grasslands and wet rocky streamsides in evergreen forests, riparian evergreen forests. *Amitha Bachan 72024* (Vazhachal, river side, along Chalakkudy river, 200 m).

Eriocaulon xeranthemum Mart. in Wall., Pl. Asiat. Rar. 3: 29. 1832; Hook. f., Fl. Brit. India 584. 1893; Fyson, J. Ind. Bot. Soc. 2: 200. 1921; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1619. 1931; Sasidh. & Sivar., Fl. Pl. Thrissur For. 490. 1996; Anil Kumar *et al.,* Fl. Pathanamthitta 531. 2005; Ansari & Balakr., Eriocaulaceae India 54. 2009; C. N. Sunil & Sivad. Fl. Alappuzha Dist. 744. 2009. *Eriocaulon pygmaeum* Dalz. in Hooker's J. Bot. Kew Gard. Misc. 3: 281. 1851, *nom. illeg.* **Plate 44. C.**

Acaulescent herbs. Leaves rosulate, linear, upto 3 x 0.3 cm, apex acute or subacuminate. Peduncles few, upto 4 cm long, virgate; sheaths upto 2 cm long. Heads hemispherical or cuneate, 4 mm across, straw-coloured; receptacles convex, glabrous; involucral bracts erect or spreading, linear-oblong, or oblanceolate, 2 x 0.5 mm, acuminate, chartaceous, glabrous, straw-coloured; floral bracts. 1 x 0.5 mm, cuneate, truncate, hyaline, hoary at apex. Male flowers: pedicels minute, sepals cuneate, connate into a spathe of 1 x 0.5 mm, 3-lobed with truncate lobes, black, hoary at apex; petals 3, subequal, minute, with a black gland in each; anthers 6, globose, black. Female flowers: sessile, sepals 3, free, unequal, 1 mm long; the two lateral ones oblanceolate, obtuse, hoary at apex; the middle one linear, much narrower than the lateral ones; petals 3, subequal, 0.5-1 mm long, spathulate, obtuse, hyaline, barbate, with a black gland in each. Ovary ovoid; style 3-fid. Seeds to 0.5 mm long, oblong or ellipsoid; cells of seed-coat transversely elongated; appendages setiform, 2-4 from the transverse radial walls.

Fl & Fr. : July - September

Distribution : Tropical Africa and India. wet rocky areas in evergreen forests. *Amitha Bachan 117690* (Medamchal-Orukombankutty, wet rocky riparian vegetation, along Kuriyarkutty river, 450 m).

128. CYPERACEAE Juss.

Gen. Pl. 26. 1789.

Key to genera

1a. Flowers unisexual.....**Scleria**

1b. Flowers bisexual.....2

2a. Glumes on spikelets spiral.....6

2b. Glumes on spikelets distichous.....3

3a. Style-base dilated and constricted or articulated above the nut ....**Fimbristylis**

3b. Style-base not dilated, continuous with the nut.....4

4a. Rhachilla not articulated, persistent, hence glumes falling apart from rhachilla. 5

4b. Rhachilla articulated, hence spikelets falling entirely ..... **Kyllinga**

5a. Nut triangular or dorsiventrally flattened, one side facing rhachilla ..... **Cyperus**

5b. Nut bilaterally flattened with one angle facing rhachilla .....**Pycreus**

6a. Style-base dilated and constricted or articulated above the nut ....**Fimbristylis** *(p.p)*

6b. Style-base not dilated, continuous with the nut.....7

7a. Hypogynous scales or bristles present (except in *Schoenoplectus articulatus)* 9

7b. Hypogynous scales or bristles absent.....8

8a. Style-base caducous, falling apart from nut..... **Fimbristylis**

8b. Style-base persistent on the mature nut, hence nut crowned by a bulbous style base. .....**Bulbostylis**

9a. Style-base dilated which is persistent at apex of nut 10

9b. Style-base not dilated, continuous with the ovary, hence nut neither crowned by nor jointed with the style base.....12

10a. Leaves reduced to sheaths; spikelet solitary ..... **Eleocharis**

10b. Leaves with well-developed blades; spikelets many.....11

11a. Spikelets uniformly compound; hypogynous scales 2; hypogynous bristles absent..... **Hypolytrum**

11b. Spikelets simple; hypogynous scales absent; hypogynous bristles 5-6 ..... **Rhynchospora**

12a. Culms nodose and leafy throughout; glumes aristate..... **Fuirena**

12b. Culms not nodose and leaved only at base or leaves reduced to sheaths; glumes not aristate.....13

13a. Hypogynous bristles 0-6; hypogynous scales none; inflorescence pseudolateral, if terminal then erect; perennial, rhizomatous herbs upto 150 cm height ..... **Schoenoplectiella**

13b.Hypogynous bristles none; hypogynous scales 2; inflorescence terminal; annual non-rhizomatous herbs upto 23 cm height ..... **Lipocarpha**

BULBOSTYLIS Kunth

Enum. Pl. 2: 205. 1837, *nom. cons.*

Bulbostylis barbata (Rottb.) Kunth *ex* Clarke in Hook. f., Fl. Brit. India 6: 651. 1893, subsp. **barbata** C.E.C. Fisch., Fl. Pres. Madras 1662. 1931;

N. Mohanan & Sivad., Fl. Agasthyamala 769. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 532. 2005. *Scirpus barbatus* Rottb., Desc. Nov. Pl. 52. 1773. *Isolepis barbata* (Rottb.) R. Br., Prodr. 222. 1810. *Isolepis barbata* (Rottb.) R. Br. var. *capillaris* Nees in Wight, Contrib. 109. 1834. *Stenophyllus barbatus* (Rottb.) Cooke., Fl. Pres. Bombay 2: 887. 1908.

Densely tufted annuals without rhizome; culms erect, slender, 8-22 cm tall. Leaves only at the base, capillary to filiform, acuminate, 3-8 cm long, scabrid towards apex; sheaths 0.5-1.5 cm long, brownish, with white long hairs at mouth. Inflorescence a terminal head, 6-12 mm across, brownish; bracts 1-3, setaceous, 0.5-1.5 cm long. Spikelets sessile, ovate-lanceolate, apex subacute, 3-7 x 1.5-2.5 mm. Glumes spiral, 2-4 x 1-2 mm, ovate-acute, strongly keeled, mucronate, keel scabrid, margins ciliolate, 1-2 basal ones empty. Stamen 1-3. Style linear, broader at base; stigmas 3. Nut upto 1 x 0.5 mm, obovate, triquetrous, stamineous.

Fl. & Fr. : August – December

Distribution: Paleotropics and southern USA; near streams and sandy open areas. *Amitha Bachan 123420* (Elanthikkara, banks of Chalakkudy river, sea level).

CYPERUS Linnaeus

Sp. Pl. 44. 1753.

Key to species

1a. Spikelets digitately arranged or inflorescence capitate.....2

1b. Spikelets spicately arranged on an elongated rhachis, thus forming spikes.....4

2a. Large-sized perennials with very short rhizome, stolons absent; culms 30-90 cm tall; atleast some leaves and bracts more than 1 cm wide. .....**C. diffusus**

2b. Small to medium-sized tufted annuals or short-lived perennials with stoloniferous rhizome; culms upto 40 cm tall; leaves and bracts upto 5 mm wide.....3

3a. Glumes closely imbricate; rhizome conspicuous..... **C. haspan**

3b. Glumes spaced; rhizome absent .....**C. tenuispica**

4a. Rhachilla of spikelets winged with base of glumes.....5

4b. Rhachilla of spikelets not or hardly winged.....6

5a. Rhizome very short or absent..... **C. distans**

5b. Rhizome horizontally creeping or stoloniferous.....7

7a. Rhizome creeping, stout, woody.....**C. corymbosus**

7b. Rhizome stoloniferous, non tufted, soft.....**C. rotundus**

6a. Rhachis of spike hispidulous on the angles..... **C. pilosus**

6b. Rhachis of spike glabrous. .....**C. procerus**

Cyperus corymbosus Rottb., Desc. Nov. Pl. 42. t.7, f.4. 1773; C. B. Clarke in Hook. f., Fl. Brit. India 6: 612. 1893; C.E.C. Fisch., Fl. Pres. Madras 1641. 1931; Anil Kumar *et al.,* Fl. Pathanamthitta 534. 2005. *Cyperus tagetiformis* Roxb. ex Kunth, Enum. Pl. 2: 56. 1837; C. B. Clarke in Hook. f., Fl. Brit. India 6: 612. 1893. *Cyperus enodis* var. *longispiculatus* Kuntze. Rev. Gen. 2: 749. 1891. *Cyperus corymbosus* Rottb. var. *longispiculatus* (Kuntze.) Kukenth. in Engler's Das Pflanzenr. Heft 101, 82. 1936. **Plate 44. E & F.**

Annual herbs to 1m high; stem trigonous. Rhizome creeping, stout, woody. Leaves basal, reduced to sheaths. Inflorescence anthelate; anthela compound; bracts 3-5, linear-ensiform, shorter than the inflorescence. Umbel compound; primary rays 6-15, slender, to 15 cm long; secondary rays terminated by corymbs of 4-16 spikelets. Spikelets clustered, sub erect or horizontal to rachis, linear, to 3 cm long; Glumes ovate-oblong, obtuse or acute; rachilla distinctly 2-winged opposite the seeds, persistent. Nut obovoid, trigonous, to 1.5 mm long.

Fl. & Fr. : September-January.

Distribution: Pantropical. Along banks of streams. *Amitha Bachan 98946* (Karappara, rocky river banks, Karappara river, 910 m).

Cyperus diffusus Vahl, Enum. Pl. 2: 321. 1805; C. B. Clarke in Hook. f., Fl. Brit. India 6: 603. 1894; C. E. C. Fisch., Fl. Pres. Madras 1639. 1931; subsp. **diffusus** Koyama in Dassan. & Fosb., Rev. Handb. Fl. Ceylon 5: 197. 1985; Anil Kumar *et al.*, Fl. Pathanamthitta 535. 2005. *Cyperus pubisquama* Steud., Syn. Pl. Glum. 2: 20. 1855; C. B. Clarke in Hook. f., Fl. Brit. India 6: 604. 1893; C. E. C. Fisch., Fl. Pres. Madras 1639. 1931. *Cyperus diffusus* Vahl var. *macrostachyus* Boeck., Linnaea 35: 534. 1868. *Cyperus diffusus* Vahl subsp. *macrostachyus* (Boeck.) Koyama, Gard. Bull. Singapore 30. 139. 1977 ; C. N. Sunil & Sivad., Fl. Alappuzha 754. 2009.

Erect, single or tufted, perennials; rhizome short, corm-like, covered with brown scales; culms 40-110 cm tall, trigonous. Leaves several, basal, 35-90 x 1-2 cm, linear, abruptly acute at apex, flattish margins scabrous, prominently 3-nerved; sheaths upto 10 cm long, purple-brown. Inflorescence compound to decompound, 20-35 cm across, diffuse; primary rays many; leafy bracts 4-10, as long as the leaves. Spikelets sessile, 3-9 together, linear-oblong, flattened, acute, 8-

12 x 1.5-2 mm, 25-30-flowered. Glumes ovate-obtuse, 1.5 x 1 mm, closely imbricating, strongly keeled, keel excurrent into a mucro, margins white-hyaline. Stamens 2-3. Rachilla narrowly winged; Stigmas 3. Nut ellipsoid, 1.5 mm long, triquetrous, dark brown to black.

Fl. & Fr. : February-April.

Distribution: Indo-Malaysia to Pacific Islands and East Asia. Evergreen forests, along banks of streams. *Amitha Bachan 98808* (Vazhachal, riparian forest, banks of Chalakkudy river, 230 m).

Cyperus distans L. f., Suppl. Pl. 103. 1781; C. B. Clarke in Hook. f., Fl. Brit. India 6: 607. 1894; C. E. C. Fisch., Fl. Pres. Madras 1640. 1931; Manilal, Fl. Silent Valley 338. 1988; Anil Kumar *et al.*, Fl. Pathanamthitta 535. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 755. 2009. *Cyperus nutans* sensu C. B. Clarke in Hook.f., Fl. Brit. India 6: 607. 1893, *p.p., non* Vahl 1805. *Cyperus distans* L.f. var. *pseudonutans* Kukenth. in Engler's Das Pflanzenr. Heft 101, 140. 1936; Manilal, Fl. Silent Valley 339. 1988; Anil Kumar *et al.*, Fl. Pathanamthitta 537. 2005.

Erect perennial herbs; rhizome short, knotty, stoloniferous; culms solitary or few together, 15-70 cm tall, triquetrous, thickened at base. Leaves few, basal, linear, narrow, acuminate at apex, 10-45 x 0.4-0.6 cm, scabrid on margins; sheaths 6-12 cm long, purple-brown. Inflorescence compound to decompound; leafy bracts 4-6, the lowest upto 40 cm long; rays 5-12, very unequal. Spike loose, broadly ovate, distantly bearing 10 to 20 spikelets. Spikelets linear, to 1.6 cm long, spreading even in fruit; rachilla flexuous, winged. Glumes ovate-oblong, obtuse, distantly disposed on weakly zig-zag rachilla, red-brown, margins white-hyaline. Stamens 3; anthers oblong. Stigmas 3. Nut to 1.5 mm long, oblong, trigonous, dark brown.

Fl. & Fr. : September – December.

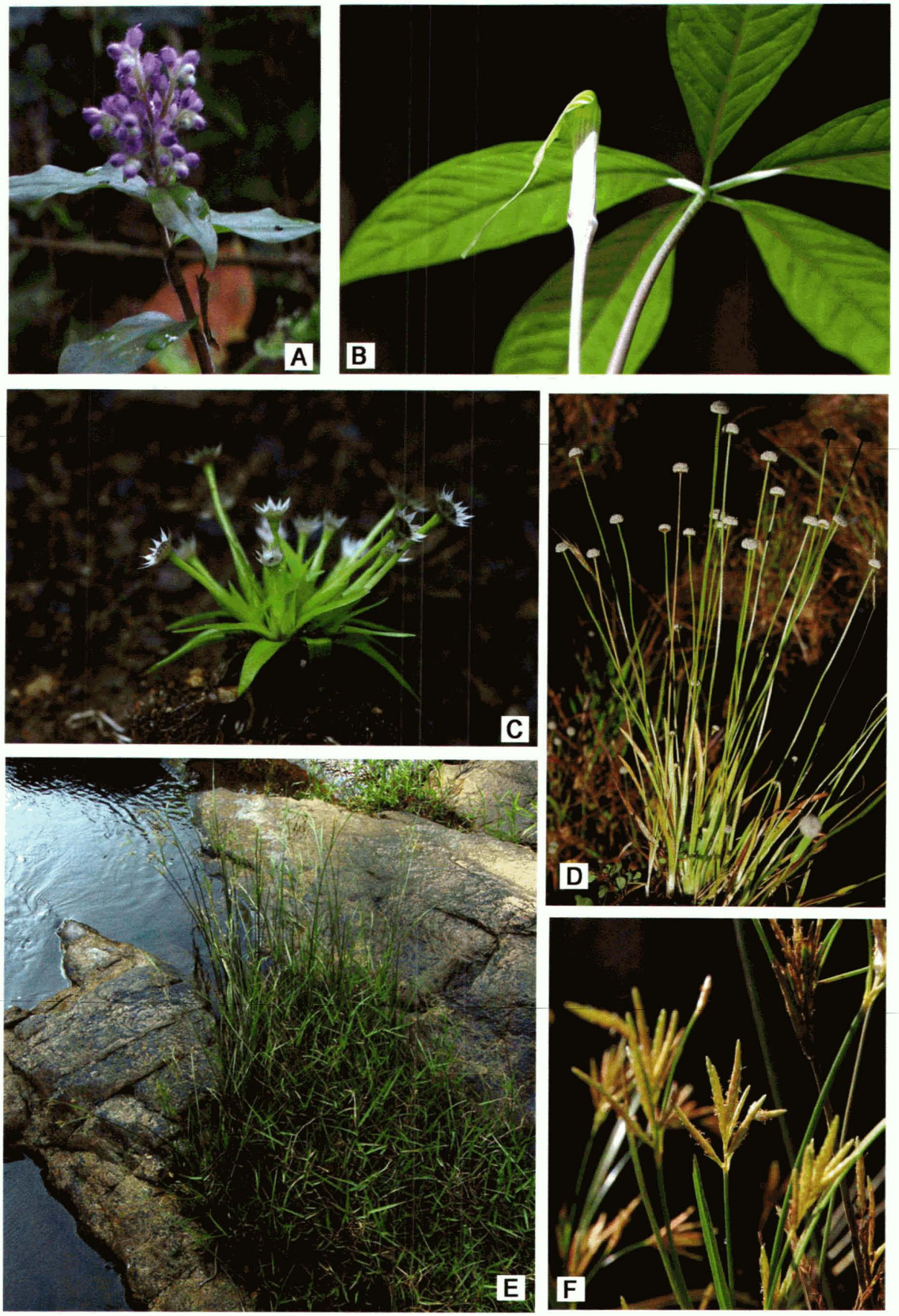


Plate 44. A. *Pollia secundiflora* (Blume) Bakh.f.; B. *Arisaema barnesii* C. E. C. Fisch.; C. *Eriocaulon xeranthemum* Mart.; D. *Eriocaulon thwaitesii* Koernicke; E. & F. *Cyperus corymbosus* Rottb., E. Habit, F. Inflorescence.

Distribution : Pantropics. Common moist localities and waste places. *Amitha Bachan 123421* (Chalakkudy, banks of Chalakkudy river, 10 m).

Cyperus haspan L., Sp. Pl. 45. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 6: 600. 1893; C. E. C. Fisch., Fl. Pres. Madras 1640. 1931; Sasidh. & Sivar., Fl. Pl. Thrissur For. 492. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 774. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 537. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 756. 2009. *Cyperus juncoides* Lam., Illustr. Gen. 1: 147. 1791. *Cyperus haspan* L. var. *flaccidissimus* Kukenth. in Engl., Pflanzenr. 4, Fam. 20: 248. 1936. *Cyperus haspan* L. subsp. *juncoides* (Lam.) Kukenth., Fedde Report. 23: 184. 1926.

Erect rhizomatous perennials; rhizome slender, creeping; roots red-purple; culms 15-30 cm tall, triquetrous. Leaves few, basal, linear, apex acute, 2-10 x 0.2-0.5 cm, sometimes reduced to an appendage of sheaths; sheaths upto 5 cm long, reddish brown. Inflorescence compound, many-rayed, 4-9 cm across, ultimate branches ending in digitately arranged clusters of spikelets; leafy bracts 2-3, the longest upto 6 cm long. Spikelets linear-lanceolate, compressed, 5-10 x 1-2 mm. Glumes oblong-ovate, mucronulate, to 2 mm long, keeled, chestnut-brown. Stamens 2-3; connective bristly at top. Stigmas 3. Nut obovoid, trigonous, 0.5 mm, broadly stipitate, cream-yellow, verruculose.

Fl. & Fr. : Throughout the year

Distribution : Pantropical. Moist localities and banks of streams, *Amitha Bachan 99152* (Poringal, banks of Chalakkudy river, 350m); *Amitha Bachan 99186* (Vazhachal, Chalakkudy riverside, 220m); *Amitha Bachan 72048* (Nelliyampathy, Karappara riverside, 900m); *Amitha Bachan 123308* (Sholayar, Sholayar riverside, 800 m).

Cyperus pilosus Vahl, Enum. Pl. 2: 354. 1805; C. B. Clarke in Hook. f., Fl. Brit. India 6: 609. 1893; C. E. C. Fisch., Fl. Pres. Madras 1641. 1931;

Sasidh. & Sivar., Fl. Pl. Thrissur For. 493. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 774. 2002. *Cyperus marginellus* Nees in Wight, Contrib. 83. 1834. *Cyperus obliquus* Nees in Wight, Contrib. 86. 1834. *Cyperus pilosus* Vahl var. *obliquus* (Nees) C. B. Clarke, J. Linn. Soc. Bot. 21: 151 & in Hook. f., Fl. Brit. India 6: 610. 1893. *Cyperus pilosus* Vahl var. *polyanthus* C. B. Clarke, J. Linn. Soc. Bot. 21: 148. 1884 & in Hook. f., Fl. Brit. India 6: 610. 1893.

Herbs up to 1m high; rootstock small, stoloniferous. Leaves linear-oblong, broad, keeled to 80 x 1.5 cm; bracts 3-5, 60 x 1.2 cm; Umbel compound. Primary rays 2-10, to 18 cm long, bearing pedicelled spikes. Rachis of spikes hispid on the angles. Spikelets linear or linear lanceolate, to 1.2 cm, horizontal. Glumes broadly ovate-oblong, obtuse, to 1.2-2cm, reddish brown, margins hyalin; Rachilla not winged. Nut trigonous, obovate-subglobose, black.

Fl. & Fr. : February-May.

Distribution : Tropical Asia, Australia and Tropical West Africa. River banks and marshy areas. *Amitha Bachan 99151* (Poringalkuthu, riparian forest, banks of Chalakkudy river, 350 m).

Cyperus procerus Rottb., Desc. Nov. Pl. 29. t. 5, f. 3. 1773; C. B. Clarke in Hook. f., Fl. Brit. India 6: 610. 1893; C. E. C. Fisch., Fl. Pres. Madras 1641. 1931; Anil Kumar *et al.*, Fl. Pathanamthitta 538. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 760. 2009.

Erect, non-tufted, shortly rhizomatous perennials, to 1.2 m; rhizome stoloniferous, the stolons slender, long, distantly covered with scales; culms solitary or few together, triquetrous. Leaves few, basal, linear, gardually acuminate, canaliculate, to 75 x 1.2 cm, spongy or coriaceous; sheaths purplish, to 30 cm long. Inflorescence compound, 15 cm; leafy bracts 3-4, the longest upto 55 cm long; primary rays 3-7,

very unequal. Spikelets oblong to linear-lanceolate, 0.8-3 x 0.2-0.35 cm, compressed, pale coloured, tinged with red-brown. Glumes ovate-obtuse, 2-3 x 1.5-2 mm, pale brownish and stained with reddish-brown, margins hyaline. Stamens 3. Stigmas 3. Nut 1.5 mm, obovoid, triquetrous, apiculate, brown.

Fl. & Fr. : February – April.

Distribution : South and Southeast Asia and Australia. Marshy areas. *Amitha Bachan 99083* (Sholayar, riparian forest, banks of Sholayar river, 900 m).

Cyperus rotundus L., Sp. Pl. 45. 1753, subsp. **rotundus** C. B. Clarke in Hook. f., Fl. Brit. India 6: 614. 1893; C. E. C. Fisch., Fl. Pres. Madras 1641. 1931; N. Mohanan & Sivad., Fl. Agasthyamala 775. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 538. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 761. 2009. **Muthanga.**

Erect, non-tufted, rhizomatous perennials; rhizome stoloniferous, stolons terminated by an ellipsoidal or globose-ovoid tuber; culms bearing a corm-like enlargement at base, 12-45 cm tall, triquetrous. Leaves few, basal, linear, gradually acuminate, to 6-20 x 0.2-0.5 cm; sheaths 1-7 cm long, light brownish. Inflorescence simple or compound; primary rays 1-8; leafy bracts 2-4, usually shorter, but in some the lowest one exceeding the inflorescence. Spikelets linear, acute at apex, to 2 x 3 cm, compressed, brown. Glumes ovate-elliptic, to 3 x 2 mm, keeled, compressed, ferrugineous brown with pale narrow hyaline margins; keels 5-7- nerved. Stamens 3. Stigmas 3. Nut 1.5 mm long, obovate-oblong, greyish black.

Fl. & Fr. August – December.

Distribution : Pantropical. Moist localities and banks of streams. *Amitha Bachan 123422* (Chalakkudy, banks of Chalakkudy river, 20 m).

Cyperus tenuispica Steud., Syn. Pl. Glum. 2: 11. 1855; C. E. C. Fisch., Fl. Pres. Madras 1640. 1931; N. Mohanan & Sivad., Fl. Agasthyamala 776. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 538. 2005. *Cyperus flavidus* C. B. Clarke, J. Linn. Soc. Bot. 21: 22. 1884 & in Hook. f., Fl. Brit. India 6: 600. 1893, *non* Retz. 1789.

Small, erect, tufted, annual herbs; rhizomes absent, roots reddish-purple; culms 10-30 cm tall, triquetrous. Leaves few, basal, linear, gradually acuminate, to 5-18 x 0.2-0.3 cm, scabrid on upper margins; sheaths up to 5 cm long, reddish-brown. Inflorescence compound to 5-12 cm long; leafy bracts 1-3, the longest upto 12 cm long; primary rays 5-12. Spikelets digitate in clusters of 3-9, linear-oblong, flattened, to 7 x 1.5 mm. Glumes ovate-oblong, obtuse, mucronate, to 1 mm, straw-coloured. Stamens 1 or 2. Stigmas 3. Nut obovate, trigonous, to 0.5 mm long, minutely tuberculate, white.

Fl. & Fr. : Throughout the year

Distribution : Tropical and subtropical Africa and Asia. Along streams and paddy fields. *Amitha Bachan 123423* (Chalakkudy, banks of Chalakkudy river, 20 m).

ELEOCHARIS R. Brown

Prodr. 224. 1810.

Key to species

1a. Floral glumes spiral, style 2-fid; nut biconvex.....**E. atropurpurea**

1b. Floral glumes distichous; style 3-fid; nut trignous .....**E. retroflexa**

Eleocharis atropurpurea (Retz.) Presl, Rel. Haenk. 1: 196. 1928; C. B. Clarke in Hook. f., Fl. Brit. India 6: 627. 1893; C. E. C. Fisch., Fl. Pres.

Madras 1648. 1931; C. N. Sunil & Sivad., Fl. Alappuzha 765. 2009. *Scirpus atropurpureus* Retz., Obs. Bot. 5:14.1789. *Eleogenus atropurpureus* (Retz.) Nees in Wight, Contrib. 113. 1834.

Erect, non-rhizomatous tufted herbs; culms slender, to 12 cm tall, terete. Leaves reduced to bladeless sheaths; sheaths 0.5-1.5 cm long, membranous, purple, mouth oblique. Inflorescence with a single, terminal spikelet. Spikelets ovoid or subglobose, obtuse, to 3-5 x 2-3 mm, densely many-flowered, wider than culm. Glumes spiral, imbricate, ovate, obtuse, to 1-2 x 0.5 mm, keeled, pale brown-purplish. Stamens 1-2. Style short, 2-fid; stigmas 2. Hypogynous bristles 4, white, shorter to or as long as the nut, minutely retrorsely scabrous. Nut obovoid, biconvex, to 1 mm long, smooth, shining, dark brown or black.

Fl. & Fr. : November-December.

Distribution: Pantropical. Wet fileds and marshes. *Amitha Bachan 117727* (Kanakkankadavu, wet areas along river banks, banks of Chalakkudy river, sea level).

Eleocharis retroflexa (Poir.) Urban subsp. **chaetaria** (Roem. & Schult.) Koyama, Bull. Nat. Sci. Mus. Tokyo 17: 68. 1974; N. Mohanan & Sivad., Fl. Agasthyamala 777. 2002; Anil Kumar *et al.,* Fl. Pathanamthitta 540. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 767. 2009. *Scirpus retroflexus* Poir. in Lam., Encycl. 6: 753. 1805. *Eleocharis chaetaria* Roem. & Schult., Syst. Veg. 2: 154. 1817; C. B. Clarke in Hook. f., Fl. Brit. India 6: 629. 1893; C. E. C. Fisch., Fl. Pres. Madras 1648. 1931.

Erect, tufted, non-rhizomatous annual herbs with pale brown fibrous roots; culms 5-14 cm long, filiform, mostly curved, 4-5-ribbed. Leaves reduced to bladeless sheaths; sheaths 1-2 cm long, membranous, reddish-brown, mouth acute, white-scarious. Inflorescence with a single terminal spikelet. Spikelets broadly ovate-obtuse, compressed, to 4 x 2

mm. Glumes distichous, ovate-elliptic, 2.5-3 x 1.5-2 mm, keeled, subacute, sides purplish, margins hyaline. Stamens 2 or 3. Style 1 mm long, style-base conical, 3-fid; stigmas 3. Hypogynous bristles 6, as long as or slightly exceeding the style base, scabrous. Nut 1 mm long, broadly obovate, trigonous with ribbed edges, trabeculate, straw coloured.

Fl. & Fr. : November-December.

Distribution: Paleotropics. Marshy areas in grasslands and river banks. *Amitha Bachan 99183* (Chalakkudy, marshy areas in river banks, banks of Chalakkudy river, 10 m).

FIMBRISTYLIS M. Vahl

Enum. Pl. 2: 285. 1805-1806, *nom. cons.*

Key to species

1a. Glumes spirally imbricated; stigmas 3 or 2.....2

1b. Glumes distichous; stigmas 3..... **F. narayanii**

2a. Stigmas 2; nuts biconvex or oblong-cylindrical 3

2b. Stigmas 3; nuts triquetrous or trigonous.....**F. miliacea**

3a. Spikelets squarrose; nuts oblong-cylindrical, with clavate outgrowths .....**F. dipsacea**

3b. Spikelets not squarrose; nuts biconvex, without clavate outgrowths 4

4a. Culms 6-16 cm tall; leaves acuminate at apex; spikelets 1-1.5 mm wide; nuts nearly smooth .....**F. aestivalis**

4b. Culms 15-64 cm tall; leaves obtuse at apex; spikelets 2-4 mm wide; nuts strongly trabeculate .....**F. dichotoma**

Fimbristylis aestivalis Vahl, Enum. Pl. 2: 288. 1805, subsp. **aestivalis** C. B. Clarke in Hook. f., Fl. Brit. India 6: 637. 1893; N. Mohanan & Sivad., Fl. Agasthyamala 778. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 541. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 770. 2009. *Scirpus aestivalis* (Vahl) Retz., Observ. Bot. 4: 12. 1786. *Fimbristylis trimeni* Hook. f. in Trimen, Handb. Fl. Ceylon 5 (Suppl.): 52. 1900. *Fimbristylis aestivalis* (Retz.) Vahl subsp. *major* (Trimen) Koyama, Bot. Mag. (Tokyo) 87: 325. 1974 & in Dassan. & Fosb., Rev. Handb. Fl. Ceylon 5: 313. 1985.

Non-rhizomatous tufted annuals; culms 6-16 cm tall, trigonous. Leaves few, basal, 3-7 cm long, 0.5-1 mm wide, acuminate at apex, pilose, margins incurved; sheaths 5-15 mm long, compressed, keeled, light brown, densely pubescent. Inflorescence laxly corymbose, 2-4 cm across; leafy bracts 2-4 filiform, the longest up to 7 cm long. Spikelets solitary, oblong, acute, greenish-brown, 2-6 x 1-1.5 mm. Glumes spiral, ovate, yellow-brownish, to 1 mm, keeled, keel green, excurrent to straight or recurved. Stamen 1; anther oblong. Style linear, flat, pyramidally thickened at base; stigmas 2. Nut 0.5 mm long, obovate, yellowish, smooth.

Fl. & Fr. : January-April.

Distribution : Asia and Australia. Moist localities of forest areas and plains. *Amitha Bachan 98921* (Karanthodu-Vazhachal, riparian forests, banks of Chalakkudy river, 400 m).

Fimbristylis dichotoma (L.) Vahl, Enum. Pl. 2: 287. 1805, subsp. **dichotoma** C. E. C. Fisch., Fl. Pres. Madras 1658. 1931; Manilal, Fl. Silent Valley 342. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 780. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 544. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 772. 2009. *Scirpus dichotomous* L., Sp. Pl. 50.

1753. *Scirpus diphyllus* Retz., Obs. Bot. 5: 15. 1788. *Fimbristylis diphylla* (Retz.) Vahl, Enum. Pl. 2: 289. 1805; C. B. Clarke in Hook. f., Fl. Brit. India 6: 636. 1823.

Shortly rhizomatous tufted annuals or short-lived perennials; culms 25-60 cm tall, trigonous, compressed. Leaves basal, linear, flat, apex obtuse, 10-30 x 0.2-0.4 cm, margins minutely scabrid on upper part; sheaths 3-5 cm long, brownish; ligule a dense fringe of short hairs. Inflorescence compound, 6-11 cm long, 8-15 cm wide; rays 3-11. Spikelets solitary or clustered, ovoid-ellipsoid, terete, subacute at apex, 5-8 x 2-3 mm, brown. Glumes spiral, broadly ovate, boat-shaped, apex subacute and mucronate, 1.5-2.5 x 1.5-2 mm, pale brown. Stamens usually 2. Style linear, flat, ciliate at top; stigmas 2. Nut 1 mm long, obovoid, biconvex, yellow, distinctly trabeculate.

Fl. & Fr. : September – November.

Distribution : Pantropical. Cultivated lands, forest areas and riverbanks. *Amitha Bachan 991531* (Poringalkuthu, riparian forest, banks of Chalakkudy river, 300 m); *Amitha Bachan 98706* (Elanthikkara, banks of Chalakkudy river, sea level).

Fimbristylis dipsacea (Rottb.) C. B. Clarke in Hook. f., Fl. Brit. India 6: 635. 1893; C. E. C. Fisch., Fl. Pres. Madras 1658. 1931; C. N. Sunil & Sivad., Fl. Alappuzha 775. 2009. *Scirpus dipsaceus* Rottb., Desc. Nov. Pl. 56. t. 12, f. 1. 1773. *Echinolytrum dipsaceum* (Rottb.) Desv., J. Bot. 1: 21. t. 1. 1808. *Isolepis dipsacea* (Rottb.) Roem. & Schult., Syst. Veg. 2: 119. 1817.

Non-rhizomatous, small, tufted annuals; culms 2-8 cm tall, trigonous, glabrous. Leaves few, narrowly linear to setaceous, sub-acute at apex, 1-3.5 cm long; sheath 6-8 mm long, compressed, keeled on back, mouth truncate; ligule absent. Inflorescence umbelliform, lax, rays

ending in solitary subglobose or oblong spikelets; bracts 4-5, erect, unequal. Spikelets squarrose, 4-7 x 3-3.5 mm; rachilla narrowly winged. Glumes spiral, 2 mm long, oblong, strongly keeled, keel 3-nerved, projecting beyond the glume-apex forming 1 mm long awn, margins scarious. Stamen 1; anthers 0.5 mm long. Style linear, slightly thickened at base; stigmas 2, longer than style. Nuts 0.5 mm long, oblong-obtuse, biconvex, with clavate out growths.

Fl. & Fr. : March-May.

Distribution: Tropical Africa and Asia. Sandy riverbeds. *Amitha Bachan 123425* (Karanthodu-Vazhachal, streambeds of Chalakkudy river, 400 m).

Fimbristylis miliacea (L.) Vahl, Enum. Pl. 2: 287. 1806; C. B. Clarke in Hook. f., Fl. Brit. India 6: 644. 1893; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1660. 1931; N. Mohanan & Sivad., Fl. Agasthyamala 781. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 544. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 780. 2009. *Scirpus miliaceus* L., Syst. ed. 10, 868. 1759. *Fmbristylis littoralis* Gaud. in Freycinet, Voy. Bot. 413. 1826; Blake, J. Arnold Arb. 35: 127. 1954. *Trichelostylis miliacea* (L.) Nees in Wight, Contr. Bot. India 104. 1834.

Non-rhizomatous erect, tufted, annuals, 15-25 cm tall; culms compressed, 4-sided with 2 sharp edges, glabrous. Leaves basal, equitant, linear, laterally flattened, 7-20 cm long, scabrid on margins; sheaths laterally compressed, sharply keeled, 2-6 cm long, lower sheaths bladeless; ligule absent. Inflorescence compound, 4-15 cm long and wide, loose, rays cymose; bracts 2-4, 1 cm long, setaceous. Spikelets solitary, globose, 1.5-2.5 x 1.5-2 mm, obtuse, rusty-brown; rachilla wingless. Glumes spiral, ovate, obtuse, 1.2-1.5 x 1 mm, scarcely keeled, 3-nerved, margins narrowly hyaline. Stamens 1-2; anthers 0.3 mm long.

Style linear, triquetrous, ciliate at the base of stigmas; stigmas 3-fid, as long as the style. Nuts 0.5 mm, obovoid, trigonous.

Fl. & Fr. : November – March.

Distribution : Tropical and Subtropical. Common weed in marshy areas and stream sides. *Amitha Bachan 98920* (Karanthodu-Vazhachal, Streambeds of Chalakkudy river, 400 m); *Amitha Bachan 99117* (Orukombankutty, riverbeds, Chalakkudy river, 420 m).

Fimbristylis narayanii C.E.C. Fisch., Bull. Misc. Inform. Kew 1931: 46. 1931 & in Gamble, Fl. Pres. Madras 1660. 1931; Manilal, Fl. Silent Valley 343. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 782. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 544. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 785. 2009. *Abildgaardia narayanii* (C. E. C. Fisch.) Rejani, Taxon. Cyperaceae Kerala 74. 1991.

Erect, tufted, non-rhizomatous annuals; culms 7-15 cm long, compressed, quadrangular. Leaves basal, linear, acute, to 7 x 0.2 cm, scabrid on margins in the upper part; sheaths 0.5-1.5 cm long, compressed, stramineous. Inflorescence simple bearing 2-5 spikelets, 1-2 cm long and wide; bracts upto 5 mm long. Spikelets solitary, oblong, acute, 6-10 x 1.5-3 mm, brown, flat. Glumes distichous, ovate, acute, 2-2.5 x 1-1.5 mm, sides yellow-brown, basal 1-2 glumes empty. Stamens 2; connective shortly produced. Style-base caducous. Stigmas 3. Nuts 1 mm long, obovoid, trigonous, white tubercled, whitish to yellow.

Fl. & Fr. : November-February.

Distribution : Endemic to south India (Kerala). Along river banks. *Amitha Bachan 117788* (Vazhachal, on rocks and river beds in the riparian forests, banks of Chalakkudy river, 220 m).

FUIRENA Rottboell

Descript. Icon. Nov. 70. 1773.

Fuirena ciliaris (L.) Roxb., Fl. Ind. 1: 184. 1820; Anil Kumar *et al.*, Fl. Pathanamthitta 547. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 786. 2009. *Scirpus ciliaris* L., Mantissa Pl. 2: 182. 1771. *Fuirena glomerata* Lam., Tabl. Encycl. 1: 150. 1791; C. B. Clarke in Hook. f., Fl. Brit. India 6: 666. 1893; C.E.C. Fisch., Fl. Pres. Madras 1669. 1931. *Scirpus pilosus* Retz., Obs. Bot. 6: 19. 1791.

Non-rhizomatous, erect, aquatic or semiaquatic annual herbs; culms 16-35 cm tall, slender, 3-4-noded, pubescent. Leaves linear or linear-lanceolate, rounded at base, acute at apex, 8 x 0.5 cm, wholly pubescent, 3-5-nerved, basal leaves reduced to bladless sheaths; sheaths to 3.5 cm long; ligules 1-2 mm long, hairy. Inflorescence with 1 to 3 glomerulous clusters of spikelets; bearing 4-10 spikelets, 1-2 cm across; bracts leaf-like. Spikelets ovate or oblong-elliptic, 5-10 x 2.5 - 3.5 mm, squarrose, pubescent. Glumes spiral, oblong-obovate, 1.5-2 x 1 mm, pubescent, 3-nerved; awn 1 mm long, recurved. Hypogynous bristles 3, scabrid. Hypogynous scales 3, 1 x 0.5 mm, longitudinally rectangular with 3-denticulate apex, base long-stipitate. Stamens 3. Stigmas 3, papillose. Nuts obovate to elliptic, to 1mm, triquetrous.

Fl. & Fr. : September – March.

Distribution : Pantropical. Marshy areas and streamsides. *Amitha Bachan 98989* (Kundoor, riparian, banks of Chalakkudy river, 10 m).

HYPOLYTRUM Persoon

Syn. Pl. 1:70. 1805.

Hypolytrum nemorum (Vahl) Spreng., Syst. Veg. 1:233.1825. subsp. **nemorum** Koyama in Dassan & Fosb., 5: 138. 1985; Manilal, Fl. Silent

Valley 343. 1988; Sasidh. & Sivar., Fl. Pl. Thrissur For. 495. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 784. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 547. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 787. 2009. *Schoenus nemorum* Vahl, Symb. Bot. 3: 8. 1794. *Hypolytrum latifolium* L.C. Rich. in Pers., Syn. Pl. 1: 70. 1805; C. B. Clarke in Hook. f., Fl. Brit. India 6: 678. 1893; C. E. C. Fisch., Fl. Pres. Madras 1673. 1931.

Rhizomatous, erect, perennials to 150 cm tall; rhizome short, woody; culms triquetrous. Leaves basal and 1-3 upper on the culm, broadly linear, 60-90 x 1-1.5 cm, margins scabrid, apex acute, subcoriaceous, midnerve scabrid beneath; sheaths to 6 cm long, mouth truncate. Inflorescence terminal corymbose-panicle, compound to 5 cm tall, 4-7 cm across; bracts 2-3, leaf-like, lowest much exceeding the inflorescence, to 10 cm. Spikelets globose to ellipsoidal, 4-6 x 3-4 mm. Glumes spiral, ovate-orbicular, 2.5 mm, obtuse, membranous, light brown. Hypogynous scales 2, hyaline, 1 mm long. Stamens 2. Style short; stigmas 2. Nuts broadly ovate, to 3 mm, broadest at slightly below the middle, yellowish-brown.

Fl. & Fr. : Throughout the year.

Distribution : Indo-Malaysia to Fiji and China. Forests in moist localities. *Amitha Bachan 98859* (Anakkayam - Sholayar, Evergreen riparian, banks of Anakkayam-thodu, 700 m).

KYLLINGA Rottboell

Descrpt. Icon. Rar. Pl. 12. 1773, *nom. cons.*

Key to species

1a. Rhizome absent, stem close.....**K. bulbosa**

1b. Rhizome present, stem spaced.....**K. brevifolia**

Kyllinga brevifolia Rottb., Desc. Nov. Pl. 13. t. 4, f. 3. 1773, var. **brevifolia** C. B. Clarke in Hook. f., Fl. Brit. India 6: 588. 1893; C. E. C. Fisch., Fl. Pres. Madras 1624. 1931; N. Mohanan & Sivad., Fl. Agasthyamala 785. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 549. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 788. 2009. *Cyperus brevifolius* (Rottb.) Hassk., Cat. Hort. Bogor. 24. 1844.

Rhizomatous erect, perennials; rhizome slender, creeping, covered with brownish scales; culms arranged in a single row along the rhizome, 10-25 cm long, triquetrous. Leaves basal, narrowly linear, acuminate, 1.5-17 x 0.1-0.3 cm; sheaths membranous, 1.5-5 cm long, purplish-brown, lower ones bladeless. Inflorescence a terminal single globose head, 5-10 mm long and wide, greenish; leafy bracts 3-4, very unequal in length, the lowest upto 9 cm long. Spikelets 3 x 1 mm, oblong. Glumes 4, distichous, basal 2 sterile, small, 3rd glume fertile, 2.5 x 1 mm, ovate-mucronate, 4th glume sterile, 3 mm long, keeled. Stamens 1 or 2. stigmas 2. Nut oblong, apiculate, 1-1.5 cm, biconvex, brown.

Fl. & Fr. : July – November.

Distribution : Pantropical. Marshy and moist areas. *Amitha Bachan 123330* (Sholayar, Evergreen riparian, banks of Sholayar river, 600 m).

Kyllinga bulbosa P. Beauv., Fl. Oware 1: 11. 1805; N. Mohanan & Sivad., Fl. Agasthyamala 785. 2002; C. N. Sunil & Sivad., Fl. Alappuzha 789. 2009. *Kyllinga triceps* Rottb., Desc. Nov. Pl. 14. t. 4, f.6. 1773, nom. illeg.; C. B. Clarke in Hook. f., Fl. Brit. India 6: 587. 1893; C. E. C. Fisch., Fl. Pres. Madras 1623. 1931; Sasidh. & Sivar., Fl. Pl. Thrissur For. 496. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 550. 2005. *Cyperus triceps* (Rottb.) Endl., Cat. Hort. Acad. Uindb. 1: 94. 1842; Manilal, Fl. Silent Valley 341. 1988. *Kyllinga tenuifolia* Steud., Syn. Pl. Glum. 2: 69. 1855.

Small erect herbs; rhizome practically nil, not stolonifersou; culms 6-20 cm tall, slender, trigonous. Leaves few, linear, 6-15 x 0.1-0.2 cm, apex acuminate; sheaths 1-1.5 cm long, light brown. Inflorescence a head with usually 3, rarely one sessile, white spikes, central spike 5-8 mm long, ovoid-globose; bracts 3 or 4, linear, much exceeding the inflorescence. Spikelets oblong, 2 x 0.5 mm, 1-flowered. Glumes 4, distichous, ovate-oblong, acute, plicate on a smooth keel, 2 upper glumes narrow. Stamens 2. Stigmas 2. Nuts oblong, to 1mm, apiculate, yellow-brown.

Fl. & Fr.: October-December.

Distribution: Paleotropics. Marshy areas. *Amitha Bachan 117701* (Vazhachal, riparian forest openings, banks of Chalakkudy river, 240 m).

LIPOCARPHA R. Brown

in Tuckey, Narr. Exped. Zaire 5:459. 1818, *nom. cons.*

Lipocarpha chinensis (Osbeck) Kern, Blumea, Suppl. 4: 167. 1958; Manilal, Fl. Silent Valley 343. 1988; N. Mohanan & Sivad., Fl. Agasthyamala 788. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 550. 2005. *Scirpus chinensis* Osbeck, Dago. Ostind. Resa. 220. 1757. *Lipocarpha argentea* (Vahl) R. Br., Narr. Exp. Congo Appen. 477. 1818; C. B. Clarke in Hook. f., Fl. Brit. India 6: 667. 1893; C. E. C. Fisch., Fl. Pres. Madras 1670. 1931. *Hypaelytrum argenteum* Vahl, Enum. Pl. 2: 283. 1805.

Glabrous, erect, herbs to 10-40 cm high; rhizome absent or short, vertical; stems rigid, tufted. Leaves linear, basal, to 8 cm long. Inflorescence terminal. Spikelets broadly ovoid; 3-10, 0.5-1 cm long; aggregated in heads; heads usually 3. Glumes spirally imbricate, 1-2, lowest empty, pale, margins hyaline; streaked with red brown, oblanceolate, acute, triangular at apex, 1.2 mm long. Hypogynous

bristles replaced by scale; scale narrowly lanceolate, as long as glumes, longitudinally veined, splitting into linear segments. Stamen 2; style short, slender; stigmas 2. Nut sessile, obovate-oblong, biconvex.

Fl. & Fr. : October-November.

Distribution: Pantropical. Marshy areas in grasslands and pools. *Amitha Bachan 117745* (Nelliyampathy, wet areas near stream sides, stream draining to Karappara river, 1100 m).

PYCREUS Palisot de Beauvois

Fl. Oware 2:48. 1816.

Key to the species

1a. Glumes truncate to emarginate at apex, the midvein excurrent beyond the glume apex into a recurved mucro..... **P. pumilus**

1b. Glumes acute to subobtuse at apex, never emarginate nor cuspidate.....**P. polystachyos**

Pycreus polystachyos (Rottb.) P. Beauv., Pl. Oware Beinn. 2: 48. t.86. f.2. 1807, *var.* **polystachyos** C. B. Clarke in Hook. f., Fl. Brit. India 6: 592. 1893; Sasidh. & Sivar., Fl. Pl. Thrissur For. 498. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 790. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 553. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 798. 2009. *Cyperus polystachyos* Rottb., Desc. Nov. Pl. 39. t. 11, f. 1. 1773; Manilal, Fl. Silent Valley 340. 1988. *Pycreus odoratus* Urban, Symb. Antill. 2: 164. 1900; C. E. C. Fisch., Fl. Pres. Madras 1627. 1931.

Erect, tufted, annual herbs; culms 17-30 cm tall, trigonous. Leaves few, 3-15 x 0.2-0.4 cm, linear, flat, gradually acuminate; sheaths 1.5-3.5 cm long, purple brown. Inflorescence compound with well developed rays, but often contracted in a subglobose or irregularly lobed head-like cluster of spikelets without rays; leafy bracts 3 to 5, upto 11

cm long. Spikelets 1-2 x 0.15-0.2 cm, linear or linear-lanceolate, strongly compressed, yellow to straw-coloured. Glumes 1.5-2 x 1 mm, ovate, acute, distichous, keeled. Stamens 2, rarely 1. Stigmas 2. Nut 1 mm, oblong, biconvex, dark brown.

Fl. & Fr. : Throughout the year.

Distribution: Widely distributed in Tropical and subtropical regions. Marshy areas, stream sides. *Amitha Bachan 99055* (Vazhachal, riparian, banks of Chalakkudy river, 220 m).

Pycreus pumilus (L.) Nees, Linnaea 9: 283. 1835; C. B. Clarke in Hook. f., Fl. Brit. India 6: 591. 1893; C. E. C. Fisch., Fl. Pres. Madras 1627. 1931; N. Mohanan & Sivad., Fl. Agasthyamala 791. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 553. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 799. 2009. *Cyperus pumilus* L., Cent. Pl. 2: 6. 1756. *Pycreus nitens* (Retz.) Nees, Nov. Acta Phys. Med. Acad. Caes. Leop. Carol. Nat. Cur.19, Suppl 1: 53. 1843; C. B. Clarke in Hook. f., Fl. Brit. India 6: 591. 1893.

Non-rhizomatous, erect, tufted, annual herbs; culms 8-12 cm tall, triquetrous. Leaves few, basal, linear, flat, acuminate apex, 4-8 x 0.1-0.2 cm; sheaths 1.5-2 cm long, purplish-brown. Inflorescence simple or subcompound, 1-3 cm long and as wide; primary rays 1-5, upto 3 cm long; bracts 3-5, the longest 7-12 cm long. Spikelets oblong, subacute, 5-12 x 2-2.5 mm, flattened, pale green. Glumes distichous, closely imbricate, ovate-obtuse, 1-1.5 x 1 mm, the midnerve excurrent into a distinct mucro, sharply keeled, 1-2 basal ones empty. Stamens 2. Stigmas 2; longer than the style. Nut upto 1 mm long, ellipsoid, biconvex, distinctly apiculate, brown, distinctly puncticulate.

Fl. & Fr. : Throughout the year.

Distribution : South and Southeast Asia. Marshy areas and wetlands. *Amitha Bachan 72031* (Vazhachal, riparian, banks of Chalakkudy river, 220 m).

RHYNCHOSPORA Vahl

Enum. 2:229. 1805 ("*Rynchospora*") *nom. cons.*

Rhynchospora corymbosa (L.) Brit., Trans. New York Acad. Sci. 11: 84. 1892; C.E.C. Fisch., Fl. Pres. Madras 1672. 1931; N. Mohanan & Sivad., Fl. Agasthyamala 791. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 554. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 801. 2009. *Scirpus corymbosus* L., Cent. Pl. 2: 7. 1756. *Rhynchospora aurea* Vahl, Enum. Pl. 2: 229. 1805; C. B. Clarke in Hook. f., Fl. Brit. India 6: 670. 1893.

Rhizomatous erect, tufted, perennial herbs; rhizome short, thick, withut stolons; culms triquetrous, 80-120 cm tall, nodes several. Leaves basal and cauline, many, 30-80 x 1-2 cm, linear, flat, margins scabrid, apex long-acuminate, keeled, thinly coriaceous; sheaths to 10 cm long. Panicles corymbose, terminal, 15-30 cm long; rays c. 10, upto 10 cm long; leafy bracts 10-28 cm long. Spikelets 6-10 x 1-2 mm, lanceolate, subterete, acute, chestnut-brown, 2-3-flowered, lowest flower bisexual, upper one male. Glumes 5-7, subdistichous; lower ones smaller, ovate, upper ones 3-5 x 1.5-2 mm, oblong-ovate, light brown. Hypogynous bristles 6, in bisexual flowers and 1-3 in male flowers. Stamens 3. Style-base conical, compressed, grooved on both sides. Nuts 2-3 x 1.5-2 mm, oblong-obovate, irregularly rugose, brown.

Fl & Fr. : August – January.

Distribution : Pantropical. Wetlands, Marshy areas and wet streamsides. *Amitha Bachan 123331* (Vazhachal, riparian, banks of Chalakkudy river, 220 m).

SCHOENOPLECTIELLA Lye

Lidia 6(1): 20. 2003.

Schoenoplectiella articulata (L.) Lye, Lidia 6: 20. 2003. *Scirpus articulatus* L., Sp. Pl. 47. 1753; C. B. Clarke in Hook. f., Fl. Brit. India 6: 655. 1893; C.E.C. Fisch., Fl. Pres. Madras 1666. 1931. *Isolepis articulata* (L.) Nees in Wight, Contrib. 108. 1834. *Schoenoplectus articulatus* (L.) Palla in Engl., Bot. Jahrb. Syst. 10: 299. 1889; C. N. Sunil & Sivad., Fl. Alappuzha 804. 2009. *Scirpus subarticulatus* Roxb., Fl. Ind. 1: 217. 1820.

Erect, tufted, non-rhizomatous perennials, 25-50 cm tall; stem terete, transversely septate, hollow, glabrous, green. Leaves well developed in young plants; when mature leaves are not seen and base of the stem covered with 2-3 bladeless sheaths only; sheaths 5-10 cm long, cylindrical, mouth truncate. Inflorescence a pseudolateral head, seen below the middle of the stem, (1-3 cm long and wide). Bract 1, erect, continuous with the stem, much longer thanthe stem. Spikelets 8-15 x 3-4 mm, cylindrical, oblong-acute, sessile, rachilla wingless, persistent. Glumes spiral, 4-5 x 3-4 mm, ovate-acute, many-nerved, shortly keeled, margins hyaline. Hypogynous bristles absent. Stamens 3; anthers 1 mm long, oblong. Style long; stigma 3. Nuts 1.5-2 x 1-1.3 mm, obovate, acutely triquetrous, apiculate, dark brown, inconspicuously wavy ridged.

Fl. & Fr. : August-December.

Distribution : Indo-Malaysia. Wet marshes and along the river banks. *Amitha Bachan 117720* (Kottat-Chalakkudy, river banks, Chalakkudy river, 7 m).

SCLERIA P. Bergius

Kongl. Vetensk. Acad. Handl. 26: 142. 1765.

Scleria lithosperma (L.) Sw., Prodr. 18. 1788, var. **lithosperma** C. B. Clarke in Hook. f., Fl. Brit. India 6: 685. 1894; C. E. C. Fisch., Fl. Pres. Madras 1677. 1934; N. Mohanan & Sivad., Fl. Agasthyamala 793. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 555. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 808. 2009. *Scirpus lithosperma* L., Sp. Pl. 51. 1753.

Rhizomatous erect, tufted, perennials, to 60 cm tall; rhizome woody, short; culms trigonous. Leaves scattered all along the stem, dense at the middle part, 10-30 x 0.2-0.4 cm, linear, margins scabrous, apex obtuse; sheaths narrow, 4-6 cm long, not winged, 3-sided; contraligule short, 1-2 mm long, obtuse, ciliate. Inflorescence narrow, loose, terminal panicle and 2-3 distant lateral ones. Primary bracts leaf-like, much longer than the inflorescence; secondary bracts setaceous. Spikelets few, bisexual, flowers unisexual, with one female flower and few male ones, 3-5 mm long. Glumes 3-4 mm long, ovate, acute, brown. Stamen 1; anthers 1-1.5 mm. Nut 2-3 x 2 mm, ovoid, obtusely trigonous, smooth, shining white.

Fl. & Fr. : Throughout the year.

Distribution : Pantropical. Wet areas of riparian forests also other moist localities of forests. *Amitha Bachan 99030* (Orukombankutty, riparian, banks of Kuriyarkutty river, 450 m).

129. POACEAE (R. Br.) Barnhart Bull.

Torrey Bot. Club 22: 7. 1895.

GRAMINEAE, *nom. alt.*

Key to genera

1a. Culms woody, with culm sheaths; petiolate.....40

1b. Culms not woody without culm sheaths; blade-base not disarticulating from the sheath, not petiolate.....2

2a. Spikelets unisexual, male and female spikelets in different positions of the single inflorescence.....**Coix**

2b. Spikelets bisexual, or with male or barren and bisexual spikelets mixed in the same inflorescence.....3

3a. Spikelets 1-many-flowered, breaking up at maturity above the glumes, or if falling entire then not 2-flowered with the lower floret male or sterile and the upper bisexual; spikelets usually laterally compressed or terete.....4

3b. Spikelets 2-flowered, falling entirely at maturity, with the upper floret bisexual and the lower male or sterile; spikelets usually dorsually compressed.....15

4a. Stamens 6..... **Leersia**

4b. Stamens 1-3.....5

5a. Leaf-blade usually transversely veined between main veins ....**Centotheca**

5b. Leaf-blade without transverse nerves.....6

6a. Spikelets with 1 fertile floret, with or without additional staminate or barren florets.....7

6b. Spikelets with 2 or more fertile florets.....12

7a. Spikelets awned.....8

7b. Spikelets not awned.....9

8a. Lemma of the upper floret with a stout, twisted, flattened, geniculate awn from between the setaceous lobes of a bifid apex .....**Jansenella**

8b. Lemma of the upper floret not awned as above..... **Chloris**

9a. Inflorescence a solitary raceme or spike ..... **Zoysia**

9b. Inflorescence of several digitate racemes or a panicle either open or contracted.....10

10a. Inflorescence a panicle, either open or contracted.....11

10b. Inflorescence of several digitate racemes ..... **Cynodon**

11a. Glumes unequal in size; second lemma with a bristle; panicles 5-25 cm long; ligules membranous .....**Arundinella**

11b. Glumes almost equal in size; second lemma not awned; panicles 1-10 cm long; ligules row of hairs ..... **Isachne**

12a. Rhachilla joints with long silky hairs enveloping the lemmas; tall reed-like grasses 1-4 m tall with large plumose panicles .....**Phragmites**

12b. Rhachilla usually glabrous, rarely shortly hairy but then the hairs not enveloping the lemmas; slender grasses upto 1 m tall; panicles not plumose.....13

13a. Spikelets loosely to densley imbricate in digitate or sub-digitately arranged spikes. 14

13b. Spikelets in open, contracted, or spike-like panicles..... **Eragrostis**

14a. Lemmas aristate or awned; axis of the spikes ending in a sharp point ..... **Dactyloctenium**

14b. Lemmas not aristate; axis of the spikes ending in a spikelet..... ..... **Eleusine**

15a. Spikelets dissimilar, often in pairs or in threes, one sessile and the other pedicelled, rarely solitary but then the upper lemma awned;

glumes as long as the spikelets and enclosing the florets, more or less rigid; lower lemma not similar to upper glume in texture; upper lemma usually awned.....16

15b. Spikelets similar, solitary or paired; glumes usually membranous, the lower often smaller or suppressed; lower lemma more or less similar to upper glume in texture; upper lemma usually without awns.....25

16a. Spikelets solitary, usually sessile and awned..... **Dimeria**

16b. Spikelets paired or rarely in threes, both sessile and pedicelled spikelets present or rarely the pedicelled spikelet reduced.....17

17a. Pedicelled spikelet similar to the sessile, both fertile.....18

17b. Pedicelled spikelet differing from the sessile in shape, both not fertile.....19

18a. Inflorescence a silky villous panicle, with an elongated central axis..... **Saccharum**

18b. Inflorescence not silky; of single raceme ..... **Pogonatherum**

19a. Inflorescence a true or false panicle.....21

19b. Inflorescence a solitary, digitate or subdigitate raceme.....24

21a. Racemes paired, usually one sessile and the other peduncled, collected into a much branched panicle; aromatic grasses ....**Cymbopogon**

21b. Racemes fascicled; grasses not aromatic.....22

22a. Basal joints of racemes bulbous; spikelets in threes, one sessile and the other two pedicelled ..... **Apluda**

22b. Basal joints of racemes not bulbous; spikelets not as above 23

23a. Racemes with 2 pairs of sessile involucral spikelets at base; awnless spikelets either sessile or pedicelled..... **Themeda**

23b. Racemes without 2 pairs of sessile involucral spikelets at base; awnless spikelets always pedicelled ..... **Chrysopogon**

24a. Racemes solitary ..... **Heteropogon**

24b. Racemes two to many.....25

25a. Upper lemma of the sessile spikelet reduced to a hyaline base of the awn.....**Bothriochloa**

25b. Upper lemma of the sessile spikelet well developed, often cleft at apex into two lobes, awned in the sinus.....**Ischaemum**

26a. Spikelets subtended by an involucre of bristles.....27

26b. Spikelets not supported by bristles.....28

27a. Inflorescence spiciform; second lemma more or less smooth; bristle falling with the spikelets. .....**Pennisetum**

27b. Inflorescence paniculate; second lemma transversely rugose; bristles persistent after the spikelets have fallen ..... **Setaria**

28a. Upper glume and first lemma 2-lobed or emarginate at their tips, awned or mucronate from the sinus of the lobes; spikelets silky-villous .....**Rhynchelytrum**

28b. Upper glume and first lemma entire at their tips, awnless or awned from the tips; spikelets not silky-villous.....29

29a. Spikelets in more or less open panicles or panicles contracted and spike-like.....30

29b. Spikelets in one-sided spikes or spike-like racemes; spikes or racemes usually digitate or somewhat distant along an axis, rarely solitary. 32

30a. Panicles contracted, cylindrical or spiciform..... **Sacciolepis**

30b. Panicles open, lax, never spiciform.....31

31a. Spikelets gibbous..... **Cyrtococcum**

31b. Spikelets not gibbous.....**Panicum**

32a. Spikelets awned.....33

32b. Spikelets awnless.....34

33a. Leaf-blades ovate-elliptic or elliptic-lanceolate; lower glume awned; culms creeping or geniculate ..... **Oplismenus**

33b. Leaf-blades linear; lower glume not awned; culms erect or suberect .....**Echinochloa** p.p.

34a. Lower glume well-developed.....35

34b. Lower glume usually absent or reduced to minute scale or rim.....37

35a. Dorsal surface of the second lemma facing towards the rhachis of the raceme.....36

35b. Dorsal surface of the second lemma facing away from the rhachis of the raceme or spike ..... **Brachiaria**

36a. Glumes acuminate or awned, rarely acute; spikelets crowded, often in 3-4 rows; racemes spreading much longer than internode ..... **Echinochloa** p.p.

36b. Glumes awnless; spikelets not crowded; often in 2 rows; racemes appressed to the common axis, shorter than or slightly longer than internode .... **Paspalidium**

37a. Second lemma thin, cartilaginous with flat hyaline margins; spikelets binate or ternate, rarely solitary, but then lemmas with verrucose hairs ..... **Digitaria**

37b. Second lemma more or less crustaceous, usually with narrow inrolled margins; spikelets usually solitary.....38

38a. Dorsal surface of the second lemma facing away from the rhachis of the raceme; lower glume strictly absent; peduncles of inflorescence often 2-3..... **Axonopus**

38b. Dorsal surface of the second lemma facing towards the rhachis of the raceme; lower glume reduced to minute scale or absent, if absent then the spikelets orbicular; peduncles of inflorescence solitary ..... **Paspalum**

40a. Culms 1-5 cm across, to 10m high; reeds 41

40b. Culms >5cm across, 15-35m high; bamboos..... **Bambusa**

41a. Culm-sheaths with small limb.....**Ochlandra**

41b. Culm-sheaths without limb..... **Oxytenanthera**

APLUDA Linnaeus

Sp. Pl. 82. 1753.

Apluda mutica L., Sp. Pl. 82. 1753; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1750. 1934; Manilal, Fl. Silent Valley 346. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 32. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 502. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 800. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 560. 2005; C. N. Sunil & Sivad., Fl.

Alappuzha 817. 2009. *Apluda mutica* var. *aristata* (L.) Hack. ex Backer, Handb., Fl. Java 2: 54. 1928. *Apluda varia* Hack. ssp. *aristata* (L.) Hack. in A. & C. DC., Monogr. Phan. 6: 196. 1889; Hook. f., Fl. Brit. India 7: 151. 1896. *Apluda aristata* L., Amoen. Acad. 4: 303. 1759; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1950. 1934. *Apluda varia* Hack. in A. & C. DC., Monogr. Phan. 6: 196. 1889; Hook. f., Fl. Brit. India 7: 150. 1896.

Annual or perennial herbs, 30-130 m high; nodes glabrous. Leaves elliptic-lanceolate or linear-lanceolate, 5-22 x 1 cm, attenuate at base, setaceous at apex; ligule membranous. Inflorescence a false interrupted panicle, 5-40 cm long; racemes solitary. Spikelets 3-per raceme, 1 sessile, 2 pedicelled. Sessile spikelets to 7 mm long, awned; lower male, upper bisexual; lower glume 4-7 x 1-2 mm, lanceolate, shortly bifid, margins narrowly winged in the upper half; upper glume 3-6 x 1-2 mm, boat-shaped, beaked, keeled. First lemma 3-4.5 x 0.5-1 mm, oblong-lanceolate, faintly 3-5-nerved. Palea equal to lemma, 2-keeled, 2-nerved. Stamens 3, anthers 1.5 mm long, cream in colour with violet margins. Ovary to 1 mm, oblong; style c. 1.5 mm; stigmas 1.5-2.5 mm, pink, feathery. Caryopsis ellipsoid.

Fl. & Fr.: October – November.

Distribution : Tropical Asia and Australia. Moist forests and waste lands. *Amitha Bachan 123397* (Upper Sholayar, wet rocky places in the riverbanks, 1400 m).

ARUNDINELLA Raddi

Agrost. Brasil. 36, t. 1, f. 3. 1823.

Arundinella ciliata (Roxb.) Nees ex Miq. in Verh., Kon. Nederl. Inst. 3: 30. 1851; Manilal, Fl. Silent Valley 348. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 335. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 504.

1996; N. Mohanan & Sivad., Fl. Agasthyamala 803. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 562. 2005. *Holcus ciliatus* Roxb., Fl. Ind. 1: 321. 1820. *Arundinella holcoides* sensu Gamble, Fl. Pres. Madras 1801(1247). 1934, non Trin. 1836. *Arundinella agrostoides* sensu Hook. f., Fl. Brit. India 7: 71. 1896, non Trin. 1836.

Densely tufted annuals; culms 15-60 cm high; nodes bearded. Leaves ovate-lanceolate, 5-16 x 0.5-1 cm, rounded at base, glabrous; sheath rounded, covered with bulbous based hairs; ligule a fimbriate membrane. Panicle 5-25 cm long, congested; rachis and axis covered with bulbous based hairs. Spikelets lanceolate, 4 x 1 mm, pedicelled; glumes similar, 4 mm long, ovate, acuminate, 5-nerved; first lemma 2.5 x 1 mm, lanceolate, 3-nerved, empty; second lemma 1 x 0.5 mm, hyaline; awn 5 mm long.

Fl. & Fr. : November-May.

Distribution : Peninsular India endemic. Common in wet open grasslands and on hilltops. *Amitha Bachan 98795* (Nelliyampathy, wet rocky streamsides, 1200 m); *Amitha Bachan 123396* (Upper Sholayar, wet rocky areas in river side, 1400 m).

AXONOPUS. P. de Beauvois

Essai Agrost. 12: 154. 1812.

Axonopus compressus (Sw.) P. Beauv., Ess. Agrost. 12: 154. 1812; Sreek. & V.J. Nair, Fl. Kerala Grasses 216. 1991; N. Mohanan & Sivad., Fl. Agasthyamala 805. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 563. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 820. 2009. *Milium compressum* Sw., Prodr. 24. 1788.

Slender perennials herbs to 1m long, creeping or stoloniferous, rooting at nodes; nodes bearded. Leaves oblong to linear-lanceolate, to

3-10 x 0.3-1.5 cm, rounded or shallowly cordate at base, margins ciliate, acute at apex; sheaths keeled; ligules membranous, fimbriate. Racemes 2-6, binate, digitate or alternate on stalk, 2-10 cm long; rhachis trigonous. Spikelets oblong-elliptic or elliptic-lanceolate, to 2.5 x 1 mm, sessile or shortly pedicelled, green or straw colored. Floret bisexual. Lower glume absent. Upper glume ovate or elliptic-lanceolate, 2.5 x 1 mm, 5-7-nerved. First lemma ovate, elliptic or elliptic-lanceolate, 2.5 x 1 mm, membranous, 5-nerved, epaleate. Second lemma ovate-oblong, crustaceous, 1.5-2 x 1 mm, faintly 3-5-nerved, bearded at apex. Palea oblong, 1.5-2 x 1 mm. Stamens 3; anthers 0.5 mm long. Ovary oblong 0.5 mm; styles 0.5 mm; stigmas white.

Fl. & Fr. : Throughout the year.

Distribution : Tropics and sub-tropics. Moist forests, open areas and planes along banks of streams, ditches and ponds. A good sand binder. *Amitha Bachan 123430* (Vazhachal, sandy river banks, banks of Chalakkudy river, 220 m).

BAMBUSA Schreber

Gen. 236. 1789; 828. 1791, *nom. cons.*

Bambusa bambos (L.) Voss in Vilmorin, Blumengartn. 1:1189.1896; Sasidh. & Sivar., Fl. Pl. Thrissur For. 505. 1996; Sreek. & V.J. Nair, Fl. Kerala Grasses 335; N. Mohanan & Sivad., Fl. Agasthyamala 805. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 564. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 821. 2009. *Arundo bambos* L., Sp. Pl. 81. 1753. *Bambusa bambos* (L.) var. *gigantea* (Bahadur & Jain) Bennet & Gaur, Thirty Seven Bamboos India 21. 1990. *Bambusa arundinacea* (Retz.) Willd., Sp. Pl. 2: 245. 1799; Hook. f., Fl. Brit. India 7: 395. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1859. 1934. *Bambusa arundinacea* (Retz.) Willd. var. *gigantea* Bahadur & Jain, Indian J. For. 4: 283. 1981.

Gregarious perennials to 30m high. Culms from a thick stoloniferous rhizome, erect, 10-20 cm across; culm sheaths broadly triangular, densely brownish-hairy within, and scattered hairy without. Leaves lanceolate, cordate or obtuse at base, acuminate at apex; to 20 cm long; sheaths linear, to 12 x .2 cm, glabrous; ligule short, entire; petiole short. Inflorescence a compound panicle with the spikelets in heads. Spikelets 1-many-flowered, 0.8-2 cm long, oblong, terete. Bracts glume-like. Glumes 1-3, to 5.5 mm, broadly ovate, mucronate. Lemmas to 6.5 mm, lanceolate, mucronate, coriaceous, glabrous. Paleas to 7 mm, 2-keeled, ciliate. Stamens 6. Style 1; stigmas 3. Caryopsis linearly cylindric, to 0.5 cm long.

Fl. & Fr. : February-July; synchronized, once in 6-12 years.

Distribution : India and Sri Lanka. Riverbanks and streambanks in moist forests. Also grown in plains. *Amitha Bachan 123363* (Athirappilly, riparian forest, banks of Chalakkudy river, 120 m).

BOTHRIOCHLOA O. Kuntze

Rev. Gen. Pl. 2: 762. 1891.

Bothriochloa insculpta (Hochst. ex A. Rich.) A. Camus, Ann. Soc. Linn. Lyon 76:165. 1931; Sreek. & V.J. Nair, Fl. Kerala Grasses 51. 1991. *Andropogon insculptus* Hochst. ex A. Rich., Tent. Fl. Abyss. 2: 458. 1851. *Andropogon pertusus* (L.) Willd. var. insculptus (Hochst. ex A. Rich.) Hack. in A. & C. DC., Monogr. Phan. 6: 482. 1889; Hook. f., Fl. Brit. India 7: 174. 1896. *Amphilophis insculpta* (Hochst. ex A. Rich.) Stapf in Prain, Fl. Trop. Africa 9: 176. 1917; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1732. 1934. *Dichanthium insculptum* (Hochst. ex A. Rich.) Clayton, Kew Bull. 32: 3. 1977.

Stoloniferous perennials; culms tufted, to 1m tall; nodes bearded. Leaves linear-lanceolate, 5-12 x 0.2-0.4 cm, glabrous; sheath keeled, ligule membranous. Raceme digitate, 2-12, on a peduncle, ech 3-5 cm long. Sessile spikelets 3.5 x 1 mm; callus hairy; lower glume equaling the spikelets, glabrous, 1-4 pitted; upper glume hyaline, margin villous in the upper half; first lemma 2 x 1 mm, ovate-oblong, awn 1.5 cm long; palea absent; stamens 3, anthers 2 mm long. Pedicelled spikelets elliptic, 5 x 2 mm; pedicells linear, 1.5-2 mm long, margins ciliate. lower glume ovate-oblong, to 4.5 mm long, chartacious, 1-3 pitted. Upper glume and lower floret similar to that of sessile spikelet.

Fl. & Fr. : December-February.

Distribution: Tropical Asia, Africa and Australia. Grasslands. *Amitha Bachan 111775* (Valparai, rocky streamsides, along upper Sholayar river, 1200 m).

BRACHIARIA (Trinius) Grisebach

In Ledebour, Fl. Rossica 4: 469. 1853.

Brachiaria miliiformis (J. Presl ex C. Presl) A. Chase, Contrib. U.S. Nat. Herb. 22: 35. 1920; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1769. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 220. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 505. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 806. 2002; C. N. Sunil & Sivad., Fl. Alappuzha 824. 2009. *Panicum miliforme* J. Presl ex C. Presl, Reliq. Haenk. 1: 300. 1830; Hook. f., Fl. Brit. India 7: 37. 1896.

Creeping annuals or perennials to 1m long; rooting from lower nodes; nodes glabrous. Leaves lanceolate or linear-lanceolate to 3-18 x 0.3-1.2 cm, rounded or shallowly cordate at base; sheaths glabrous or tubercled hairy; ligules fimbriate. Racemes 3-7, 2.5-6 cm long; rachis flat. Spikelets 3.5-4 mm, elliptic or obovate, tapering and narrowed at

base. Lower glume broadly ovate or obovate, to 2 x 2 mm, 9-11-nerved. Upper glume ovate, acute, to 3 x 2 mm, 7-9-nerved. Lower floret empty. Upper floret bisexual. First lemma ovate, acute, 5-7-nerved. Second lemma elliptic or elliptic-oblong, acute, to 2.5 x 1 mm, crustaceous; 3-5-nerved, faint, rugulose. Palea elliptic or elliptic-oblong, 3 x 1.5 mm, crustaceous, 2-keeled, 2-nerved, rugulose. Stamens 3; anthers to 1 mm, orange-red. Ovary elliptic, to 0.5 mm; stigmas violet or dark-brown.

Fl. & Fr. : July – October.

Distribution : Indo-Malaysia. Moist forests to plains. Open wet areas. *Amtiha Bachan 99004* (Orukombankutty, riparian forest, banks of Chalakkudy river, 450 m).

CENTOTHECA Desvaux

in Nouv. Bull. Sci. Soc. Philom. Paris 2: 189. 1810.

Centotheca lappacea (L.) Desv., Nouv. Bull. Soc. Philom. 2: 189. 1810; Hook. f., Fl. Brit. India 7: 332. 1896; Gamble, Fl. Pres. Madras 1848. 1934; Manilal, Fl. Silent Valley 349. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 354. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 507. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 807. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 565. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 825. 2009. *Cenchrus lappaceus* L., Sp. Pl. (ed. 2) 1488. 1763. *Holcus latifolius* Osbeck, Dagb. Ostind. Resa 247. 1757. *Centotheca latifolia* (Osbeck) Trin., Fund. Agrost. 141. 1820.

Erect tufted perennials to 75 cm high; nodes glabrous. Leaves elliptic-lanceolate 6-18 x 1.3-3.2 cm, oblique at base, acute or acuminate at apex, with prominent transverse veins; sheaths to 6-9 cm long, ciliate along the margins; ligules membranous. Panicles pyramidal, lax, to 8-20 cm. Spikelets elliptic-oblong, 5-8 mm long, 2-3-flowered. Lower glume ovate-lanceolate, to 3 x 1.5 mm, 5-nerved. Upper glume lanceolate to 3.5

mm long. oblong, Lemmas 3-4 x 1-2 mm, 5-7-nerved, glabrous or the upper ones with reflexed, tubercle-based bristles along the margins. Paleas elliptic, 2-keeled, 3 x 1 mm. Stamens 2-3. Stigmas pink. Grains obovoid to 1.5 mm long.

Fl. & Fr. : October – February.

Distribution : Asia and Africa. Moist forests to the plains. *Amitha Bachan 99008* (Vazhachal, riparian forest undergrowth, banks of Chalakkudy river, 250 m).

COIX Linnaeus

Sp. Pl. 972. 1753.

Coix lacryma-jobi L., Sp. Pl. 972. 1753; Hook. f., Fl. Brit. India 7: 100. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1705. 1934; Manilal, Fl. Silent Valley 350. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 207. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 508. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 567. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 830. 2009. **Poochakai.**

Robust annual herbs to 1.2 m high; culms tufted; nodes glabrous. Leaves linear-oblong cordate at base, acuminate at apex, to 10-40 x 1-2.5 cm, margin scaberulous; sheaths to 6 cm long, glabrous; ligules ovate, membranous. Inflorescence terminal and axillary peduncled, false spikes, 3-8 cm long, consisting of one female spikelet completely enclosed in a globose or ovoid basal cupule like bract. Male spikelets 2 or 3, exerted from the mouth of cupule, 5-12 x 2-4 mm, elliptic or elliptic-lanceolate. Lower glume ovate-elliptic, 4-8 x 2-4 mm, 2-keeled, winged on keels. Upper glume elliptic-lanceolate, 3-7 x 2-3 mm, acuminate. Lower floret male. Upper floret male or barren. First lemma oblong-lanceolate, 7 x 2 mm, acuminate, hyaline. Palea elliptic-lanceolate or lanceolate, 7 x 2 mm, 2-keeled. Stamens 3, anthers 4 mm

long. Second lemma elliptic or elliptic-lanceolate, to 7 x 2 mm; hyaline. Palea elliptic-lanceolate, to 7 x 1.5 mm, hyaline. Female spikelets globose or ovoid, 4-14 mm long, bony, shining white or grey. Lower glume ovate-oblong, acute. Upper glume ovate. Lower floret female or barren. Upper floret female. Caryopsis subglobose, to 7 mm, furrowed in the middle.

Fl. & Fr. : October- March.

Distribution : Tropical Africa; introduced in other areas of tropics. Marshy and wet areas in forests to plains. *Amitha Bachan 99054* (Vazhachal, riparian marshes, banks of Chalakkudy river, 250 m).

CHRYSOPOGON Trinius

Fund. Agrost. 187. 1820, *nom.cons.*

Key to species

1a. Pedicells half as long as the sessile spikelets or longer; glumes of the pedicellate spikelets with an arista or awned.....**C. nodulibarbis**

1b. Pedicells less than half as long as the sessile spikelets; glumes of the pedicellate spikelets with an arisa or awned.....**C. fulvus**

Chrysopogon fulvus (Spreng.) Chiov., Fl. Somal. 1: 327. 1929; Sasidh. & Sivar., Fl. Pl. Thrissur For. 508. 1996. *Pollinia fulva* Spreng., Pl. Min. Cogn. Pug. 2: 10. 1815. *Chrysopogon montanus* Trin. ex Spreng., Neua Entd. 2: 93. 1821; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1739. 1934. *Andropogon monticola* Schult., Mantissa 3: 665. 1827; Hook. f., Fl. Brit. India 7: 192. 1896.

Perennials herbs to 1m high; culms erect or rarely decumbent; rootstock often creeping; nodes glabrous. Leaves lanceolate to linear-lanceolate, 5-20 x 2-0.5 cm, glabrous ; sheath keeled, usually glabrous. Panicle spreading with whorled branches, 2-8 cm; callus hairy. Spikelets

in groups of 3. Sessile spikelets oblong, acute; lower glumes oblong-lanceolate, rounded or flat on dorsal surface, usually aristate and coriaceous; upper glume linear-oblong, 2-4mm, coriaceous, ciliate, rufous-hairy in the keel; lower floret empty; upper bisexual; first lemma oblong, hyaline, epaleate; second lemma oblong-lanceolate, awned, awn to 2mm; palea usually absent; stamens 3, free; ovary oblong; styles 2, free; stigmas 2, plumose. Pedicelled spikelets lanceolate; glumes subequal, lanceolate, acute or awned, lower floret empty upper male.

Fl. & Fr. : October- December.

Distribution: Tropical Asia and East Africa. Moist forests. *Amitha Bachan 117789* (Orukombankutty, riparian forest, banks of Kuriyarkutty river, 450 m).

Chrysopogon nodulibarbis (Steud.) Henrard, Blumea 4: 543. 1941. *Andropogon nodulibarbis* Steud., Syn. Pl. Glum. 1: 396. 1854. *Andropogon zeylanicus* Nees ex Steud., Syn. Pl. Glum. 1: 397. 1854; Hook. f., Fl. Brit. India 7: 192. 1896. *Chrysopogon zeylanicus* (Nees ex Steud.) Thw., Enum. Pl. Zeyl. 366. 1864; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1739. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 65. 1991; Anil Kumar *et al.*, Fl. Pathanamthitta 567. 2005.

Perennial erect tufted herbs to 1 m tall. Leaves linear-oblong, 18-30 x 8-1.2 cm, coriaceous, folded, imbricate towards base; ligule a fimbriate rim. Panicles terminal, lax, branches whorled, to 8-15cm, erect; terminal spikelets with 1 sessile and 2 pedicellate spikelets. Sessile spikelet: laterally compressed; glumes sub equal, lower cartilaginous, rounded; upeer aristate, awn to 3 cm long, 1-keeled; leammas lower empty, upper one awned; lower empty. Palea small or 0. Stamens 3. Glumes of the pedicellate spikelet acuminate; pedicel shorter or half as long as sessile spikelets, dorsally compressed, not awned.

Fl. & Fr. : December-March.

Distribution: Endemic to South India and Sri Lanka. Grasslands, rocky cuttings at streamside of high elevation grasslands. *Amitha Bachan 117767* (Valparai, stramside rocky cuttings, banks of upper Sholayar river, 1100 m).

CYMBOPOGON Sprengel

Pl. Pugill. 2: 14. 1815.

Cymbopogon martinii (Roxb.) Wats. in Atkins., Gaz. N.W. Prov. Ind. 392. 1882; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1756. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 72. 1991. *Andropogon martinii* Roxb., Fl. Ind. 1: 280. 1820. *Andropogon schoenanthus* L. var. *martinii* (Roxb.) Hook.f., Fl. Brit. India 7: 204. 1896.

Aromatic perennial herbs to 2.5m high; culms tufted; nodes glabrous. Leaves lanceolate acuminate, to 10-36 x 0.5-1.5 cm, cordate at base, aromatic. Ligules membranous. Panicle contracted, to 50 cm long. Racemes to 1.5 cm long, joints densely villous. Sessile spiklets oblong or elliptic, 3 x 1 mm; lower glume oblong, to 3.5 x 1 with a slit like grove in the upper half. Upper glume winged in the upper half, hyaline, ciliate. First lemma delicate; second lemma notched, awned. Stamens 3; Pedicellate spikelets as long as sessile spikelet; glumes 3.5-4 mm long; lower 11-13 nerved; upper 3-nerved; lower floret empty, upper floret male.

Fl. & Fr. : November-March.

Distribution: Endemic to Peninsular India. Grasslands. *Amitha Bachan 117796* (Orukombankutty, rocky cutting along the river margin, banks of Kuriyarkutty river, 450 m).

CYNODON L.C. Richard

In Persoon, Syn. Pl. 1: 85. 1805.

Cynodon dactylon (L.) Pers., Syn. Pl. 1: 85. 1805; Hook. f., Fl. Brit. India 7: 288. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1835. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 360. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 510. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 810. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 569. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 831. 2009. *Panicum dactylon* L., Sp. Pl. 58. 1753.

Small creeping perennial herbs, stem stoloniferous, slender, creeping. Leaves linear-lanceolate 2-10 x 0.1-0.5 cm, acuminate, glaucous; sheaths keeled; ligules fimbriate, membranous. Inflorescence of terminal, digitate 3-4 spikes; spikes 1-sided, oblong to 5 cm long. Spikelets sessile, single flowered, oblong-lanceolate, to 2-3 mm long, laterally compressed. Lower glume lanceolate, to 2 x 5mm, chartaceous, 1-nerved. Upper glume lanceolate, to 2 x 0.5 mm, chartaceous, 1-nerved. Lemma boat-shaped, ovate-oblong when spread, to 3 x 1.5 mm. Palea boat-shaped; oblong when spread, 2-2.5 x 0.5-1 mm, chartaceous. Stamens 3; anthers 1-1.5 mm long. Ovary oblong, 0.5 mm long; stigmas 0.5-1 mm long, pink. Caryopsis linear, 1 mm.

Fl. & Fr. : September – March.

Distribution : Tropical and warm temperate regions of the world. Moist localities near streams from forest areas to plains. *Amitha Bachan 98709* (Elanthikkara, moist areas in the riverside, banks of Chalakkudy River, sea level).

CYRTOCOCCUM Stapf

In D. Prain, Fl. Trop. Africa 9: 15. 1917 & 9: 745. 1920.

Key to species

1a. Pedicels short, rarely as long as the spikelets..... **C. oxyphyllum**

2a. Pedicels long, usually longer than the spikelets..... **C. longipes**

Cyrtococcum longipes (Wight & Arn. ex Hook.f.) A. Camus, Bull. Mus. Hist. Nat. Paris 27: 118. 1921; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1786. 1934; Manilal, Fl. Silent Valley 351. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 229. 1991; N. Mohanan & Sivad., Fl. Agasthyamala 811. 2002. *Panicum longipes* Wight & Arn. ex Hook. f., Fl. Brit. India 7: 58. 1896.

Perennials herbs to 120 cm high, tall, erect, trailing or willowy; nodes glabrous or sparsely bearded. Leaves elliptic lanceolate or linear lanceolate, 6-25 x 0.5-2 cm, not cuneate at base. Sheaths glabrous or covered with sparse hairs; ligule membranous, ovate. Panicle lax, consisting of 4-8 alternate flabelliform branches. Spikelets 1.5 -2 mm, with longer pedicels; glumes sub-equal, lower ovate-lanceolate, 3 nerved; upper larger boat shaped; Lower floret empty ; upper bisexual; first lemma ovate, obtuse 1.5-2 x 1-1.5 mm; second lemma deltoid, 5-7 nerved; palea 1-1.5 x 0.5 mm, 2 keeled, 2-nerved. Stamens 3, Pistil 1 mm long.

Fl. & Fr. : November - March.

Distribution : Endemic to Western Ghats. Riparian evergreen forests *Amitha Bachan 123369* (Orukombankutty, riparian forests, along Chalakkudy river, 450 m).

Cyrtococcum oxyphyllum (Steud.) Stapf in Hook., Ic. Pl. t. 3096. 1922; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1786. 1934; Manilal, Fl.

Silent Valley 351. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 231. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 510. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 569. 2005. *Panicum oxyphyllum* Steud., Syn. Pl. Glum. 1: 65. 1854. *Panicum pilipes* Nees & Arn. *ex* Buese in Miq., Pl. Jungh. 3: 376. 1854; Hook. f., Fl. Brit. India 7: 57. 1896.

Perennials or annuals; culms 20-50 cm high, slender, trailing or erect, rooting from lower nodes; nodes glabrous. Leaves lanceolate, cuneate at base, 5-15 x 0.2-1.5 cm, hairy along the margins; sheath keeled, margin ciliate; ligule membranous, truncate. Panicle contracted, erect. Spikelets 1.5 x 1 mm, with smaller pedicels; glumes sub-equal, lower one 1 x 1 mm, ovate, glabrous, upper larger; first lemma 1.5 x 1 mm, epaleate; second lemma 1 x 1 mm, 3-nerved; palea 1 x 0.5 mm, 2-nerved.

Fl. & Fr. : Throughout the year.

Distribution : Indo–Malaysia and China. Moist forests, usually shaded areas. *Amitha Bachan 123364* (Athirappilly, undergrowth of riparian forests, banks of Chalakkudy river, 120 m); *Amitha Bachan 99039* (Kuriyarkutty, riparian forests, banks of Kuriyarkuttiyar, 500 m); *Amitha Bachan 99142* (Vazhachal, riparian forests along Chalakkudy river, 220 m).

DACTYLOCTENIUM Willdenow

Enum. Pl. Hort. Berol. 1029. 1809.

Dactyloctenium aegyptium (L.) P. Beauv., Ess. Agrost. 10. 1812; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1840. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 367. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 511. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 570. 2005; C. N. Sunil &

Sivad., Fl. Alappuzha 834. 2009. *Cynosurus aegyptius* L., Sp. Pl. 72. 1753.

Tufted annuals. culms 10-60 cm high, suberect or decumbent; nodes glabrous; rooting at lower nodes. Leaves oblong-lanceolate to 5-20 x 0.5-0.7 cm, rounded at base, glabrous; ligule a fimbriate membrane. Racemes 3-6, digitate, each 1-3 cm long; rachis flat, scabrid, ends in a sharp point. Spikelets similar, 3-4 flowered, ovate, acute, to 4 x 2.5 mm,; sessile; lower glume ovate, 3 x 1.5 mm, 1-nerved; upper glume ovate, 2.5 x 1.5 mm, aristate, 1-nerved, keeled; florets 3-4; lemmas 3-nerved, keeled, 3 x 1.5 mm, mucronate; palea ovate, 2-nerved, 2-keeled; stamens 3, free; ovary oblong; styles 2, free; stigmas plumose. Grain obovate, triangular.

Fl. & Fr. : Throughout the year.

Distribution : Native of South America, naturalized in Paleotropics. Marshy and open areas. *Amitha Bachan 123365* (Athirappilly, marshy open riparian areas, 120 m).

DIGITARIA Heister ex Fabricus

Enum. ed. 1, 207. 1759, *typ. cons.*

Digitaria longiflora (Retz.) Pers., Syn. Pl. 1: 85. 1805; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1765. 1934; Manilal, Fl. Silent Valley 351. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 239. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 512. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 813. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 571. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 837. 2009. *Paspalum longiflorum* Retz., Obs. Bot. 4: 15. 1786; Hook. f., Fl. Brit. India 7: 17. 1896.

Slender annuals; culms 20-30 cm high, creeping and geniculate, rooting from nodes. Leaves ovate-lanceolate, 1.5-7 x 0.4-0.7 cm, cordate

at base, glabrous; sheath rounded. Racemes paired, to 5 cm long, slender, on erect axis. Spikelets solitary, ovate-elliptic, 1.5 x 0.5 mm; lower glume absent; upper glume ovate, 1.5 x 5 mm, glabrous; first lemma elliptic, 1.5 x 0.5 mm, 9-nerved, epaleate. Second lemma and palea similar, ovate, 1.5 x 0.5 mm, coriaceous. Stamens 3, anthers 0.5 mm.

Fl. & Fr. : Throughout the year.

Distribution : Paleotropics. Grasslands and open areas. *Amitha Bachan 123466* (Vazhachal, open areas near riverside, banks of Chalakkudy river, 250 m).

ECHINOCHLOA P. de Beauvois

Essai Agrost. 53: 161. 1812.

Echinochloa colona (L.) Link, Enum. Hort. Berol., 2: 209. 1833; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1776. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 245. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 513. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 817. 2002. C. N. Sunil & Sivad., Fl. Alappuzha 843. 2009. *Panicum colonum* L., Syst. Nat. (ed. 10) 870. 1759; Hook. f., Fl. Brit. India 7: 32. 1896.

Erect annual herbs to 80 cm high; nodes glabrous. Leaves linear-lanceolate, 4-20 x 0.2-0.7 cm, rounded or cordate at base, acuminate at apex; sheaths keeled; ligules absent. Panicles 3-15 cm long, spiciform; racemes 4-10, each 1-3 cm long, straight. Spikelets awnless, 2-4 mm long, ovate-lanceolate, greenish-yellow or purplish, 4 rowed. Lower glume ovate, acuminate, to 2 x 1.5 mm, chartaceous, 5-nerved, hispid. Upper glume ovate or boat-shaped, acuminate, 4 x 1.5 mm, chartaceous, hispid. Lower floret barren. Upper floret bisexual. First lemma ovate, 2-4 x 1.5-2 mm, 7-nerved. Palea 2 x 1 mm, ovate-oblong, hyaline, 2-keeled. Second lemma 3 x 1 mm, ovate-elliptic. Palea ovate-oblong, 2 x

1 mm, mucronate, 2-keeled. Stamens 3; anthers 0.5 mm long, violet. Ovary 0.5 mm, oblong; stigmas pink.

Fl. & Fr. : September-March.

Distribution : Tropical Asia and Africa. Moist and marshy areas near water bodies and paddy fields. *Amitha Bachan 99003* (Orukombankutty, moist riparian areas, along Chalakkudy river, 450 m).

ELEUSINE Gaertner

Fruct. Sem. Pl. 1: 7. 1788.

Eleusine indica (L.) Gaertn., Fruct. 1: 8. 1789; Hook. f., Fl. Brit. India 7: 293. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1839. 1934; Manilal, Fl. Silent Valley 353. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 371. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 513. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 817. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 575; 2005; C. N. Sunil & Sivad., Fl. Alappuzha 846. 2009. *Cynosurus indicus* L., Sp. Pl. 72. 1753.

Annuals or perennials. Culms erect, tufted, to 60 cm high; nodes glabrous. Leaves linear, 10-60 x 0.3-1 cm, cordate at base, acuminate at apex; sheaths keeled, softly pilose, compressed; ligule a row of hairs. Spikes digitate, 3-18 in number, 2-8 cm long, compact. Spikelets 4-6 mm long, ovate, 4-6-flowered. Lower glume ovate-oblong, 2-3 x 1.5-2.5 mm, 3-nerved, keeled. Upper glume ovate-lanceolate, 3-4 x 1.5-3 mm, 5-nerved, keeled. Lemmas ovate, acute, 2-4 x 2-3 mm, 3-nerved. Paleas 2-3 x 1-2 mm, ovate-oblong, 2-keeled, keels winged, scabrid. Stamens 3; anthers c. 1 mm long. Grain orbicular or globose, deeply grooved on one side, dark-brown.

Fl. & Fr. : Throughout the year.

Distribution : Pantropical. Open wet areas. *Amitha Bachan 99005* (Orukombankutty, riparian open areas, banks of Kuriyarkuttyar, 450 m).

ERAGROSTIS N.M. Wolf

Gen. Pl. 23. 1776; Gen.Sp. 63, 65. 1781.

Key to species

1a. Spikelets breaking up from the apex downwards..... 2

1b. Spikelets breaking up from the base upwards.... 4

2a. Panicles >20 cm long; keels of the paleas smooth or scabrid, but never ciliate ..... **E. japonica**

2b. Panicles upto 15 cm long; keels of the paleas ciliate.....3

3a. Panicles contracted, spiciform, 3-6 cm long ..... **E. riparia**

3b. Panicles effuse, 6-15 cm long ..... **E. tenella**

4a. Spikelets leaden grey or black.....**E. nigra**

4b. Spikelets purplish..... ..... **E. unioloides**

Eragrostis japonica (Thunb.) Trin., Mem. Acad. Sci. Petersb. ser. 6, 1: 405. 1830; Gamble, Fl. Pres. Madras 1820. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 382. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 514. 1996; C. N. Sunil & Sivad., Fl. Alappuzha 850. 2009. *Poa jap*onica Thunb., Fl. Jap. 51. 1784. *Eragrostis interrupta* Lam., Encycl. Tabl. 1: 185. 1791; Hook. f., Fl. Brit. India 7: 316. 1896. *Poa diarrhena* Schult., Mantissa 2: 616. 1824. *Eragrostis diarrhena* (Schult.) Steud., Syn. Pl. Glum. 1: 266. 1854; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1820. 1934. *Diandrochloa diarrhena* (Schult.) Henry, Bull. Bot. Surv. India 9: 290. 1967. *Diandrochloa japonica* (Thunb.) Henry, Bull. Bot. Surv. India 9: 290. 1967.

Tufted annuals or perennials to 1m high; nodes glabrous. Leaves linear or linear-lanceolate, 8-30 x 0.3-0.5 cm, rounded or shallowly cordate at base, flat, glaucous; sheaths to 14 cm long, keeled; ligules truncate, membranous. Panicles 20-40 cm long or more, interrupted, spiciform, branches often verticillate. Spikelets ovate-oblong, 1.5-3 x 1 mm, 6-10-flowered, pale yellow. Lower glume 0.5 mm long, ovate, 1-nerved. Upper glume ovate-acute, 0.5-1 x 0.5 mm, 1-nerved. Lemmas broadly ovate1 x 0.5 mm,, 3-nerved. Paleas oblong-lanceolate, 0.5-1 x 0.5 mm, 2-keeled, 2-nerved; keels scabrid. Stamens 2. Grains 0.5 mm long, ellipsoid.

Fl. & Fr. : February – May.

Distribution: Pantropical. Along banks of streams. *Amitha Bachan 99116* (Orukombankutty, river beds and banks of Chalakkudy river, 450 m).

Eragrostis nigra Nees ex Steud., Syn. Pl. Glum. 1: 267. 1854; Hook. f., Fl. Brit. India 7: 324. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1827. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 384. 1991.

Tufted perennials; culms 30-50 cm high, erect; nodes glabrous. Leaves linear, 15-25 x 0.2-0.6 cm, rounded at base with a tuft of long hairs; sheath slightly keeled, ciliate towards the mouth; ligule a fimbriate membrane. Panicle lax, 15-30 cm long, branches and pedicels smooth. Spikelets many, pedicelled, to 6 x 3 mm, oblong, black, breaking up from below upwards; glumes similar, 2.2 mm long, 1-nerved, keeled; florets 5-8, bisexual; lemma 2.2 x 1 mm, ovate, acute, 3-nerved; palea 2 x 1 mm, oblong, curved, keels smooth. Stamens 3; anthers cream or violet; stigmas cream; ovary oblong-elliptic, 0.25 mm.

Fl. & Fr. : July-October.

Distribution: Sri Lanka, India to China. Evergreen forests and grasslands. *Amitha Bachan 117613* (Karanthodu, riparian forest openings, banks of Chalakkudy river, 400 m).

Eragrostis riparia (Willd.) Nees, Agrost. Brass. 512. 1829; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1825. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 386. 1991; C. N. Sunil & Sivad., Fl. Alappuzha 851. 2009. *Poa riparia* Willd., Ges. Natur. Freunde Berlin Neue Schrifften 4: 185. 1803. *Eragrostis tenella* (L.) P. Beauv. *var. riparia* (Willd.) Stapf in Hook.f., Fl. Brit. India 7: 315. 1896.

Densely tufted perennials herbs; culms to 30 cm long, geniculate; nodes glabrous. Leaves linear-lanceolate, 3-8 x 0.2-0.4 cm, rounded at base, acuminate at apex; sheaths to 3 cm long, slightly keeled; ligule a row of hairs. Panicles 3-6 cm long, contracted, spiciform. Sikelets oblong, 1.5-3 x 1-2 mm, 5-10-flowered, pale yellow, breaking from the apex downwards. Lower glume ovate-lanceolate, 1 x 0.5 mm, 1-nerved. Upper glume ovate-lanceolate, 1 mm long, 1-nerved. Lemmas ovate-oblong, 1-1.5 x 0.5-1 mm, apex rounded, 3-nerved. Paleas obovate or oblanceolate, 1-1.5 x 0.5 mm, 2-keeled, ciliate along the keels. Stamens 3. Ovary 0.5 mm long; stigma c.0.5 mm long. Grains 0.5 mm long, linear.

Fl. & Fr. : December – June.

Distribution : Endemic to Peninsular India. Usually along backwaters. *Amitha Bachan 123419* (Elanthikkara, river banks, Chalakkudy river, sea level).

Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult., Syst. Veg. 2: 576. 1817; var. *tenella* Sreek. & V.J. Nair, Fl. Kerala Grasses 390. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 514. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 819. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 576.

2005; C. N. Sunil & Sivad., Fl. Alappuzha 852. 2009. *Poa tenella* L., Sp. Pl. 69. 1753 p.p. *Poa plumosa* Retz., Obs. Bot. 4: 20. 1786. *Eragrostis plumosa* (Retz.) Link, Enum. Hort. Berol. 1: 192. 1827; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1826. 1934. *Eragrostis tenella* (L.) P. Beauv. var. *plumosa* (Retz.) Stapf in Hook.f., Fl. Brit. India 7: 315. 1896.

Slender annuals to 50 cm; culms slender, tufted; nodes glabrous. Leaves linear-lanceolate, 4-12 x 0.2-0.4 cm, rounded at base, acuminate at apex, flat; sheaths to 4 cm long, with tuft of hairs at mouth; ligules membranous, fimbriate. Panicles 6-15 cm long, pyramidal, contracted. Spikelets ovate or oblong-ovate, 1-3 x 1-1.5 mm, pale yellow, 4-8 or more flowered. Lower glume oblong-lanceolate, 0.5-1 x 0.5 mm, 1-nerved. Upper glume oblong-lanceolate, 1.5 x 0.5 mm, 1-nerved. Lemmas ovate-oblong, 1-1.5 x 0.5 mm, 3-nerved. Paleas oblong-lanceolate, 1 x 0.5 mm, 2-keeled, keels ciliate. Stamens 3; anthers 0.1 – 0.25 mm. Stigmas cream in colour. Grains 0.5 mm long, elliptic.

Fl. & Fr. : July – December.

Distribution : Paleotropics. Degraded open moist areas from forests to plains. *Amitha Bachan 123431* (Elanthikkara, along river sides, banks of Chalakkudy river, sea level).

Eragrostis unioloides (Retz.) Nees ex Steud., Syn. Pl. Glum. 1:264.1854; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1826. 1934; Hook. f., Fl. Brit. India 7: 317.1896; Manilal, Fl. Silent Valley 354. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 392. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 514. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 820. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 576. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 853. 2009. *Poa unioloides* Retz., Obs. Bot. 5: 19. 1788. *Eragrostis amabilis* sensu Stapf in Hook.f., Fl. Brit. India 7: 317. 1896, non Wight & Arn. ex Nees 1838.

Tufted annuals to 60 cm high, usually erect or geniculate; nodes glabrous. Leaves linear-lanceolate or lanceolate, 4-20 x 0.2-0.5 cm, rounded or shallowly cordate at base, acuminate at apex; sheaths to 5 cm long; ligules membranous. Panicles to 15 cm long, lax, purplish. Spikelets 10-30-flowered, broadly ovate or ovate-oblong, 4-6 x 2-4 mm, purplish. Lower glume lanceolate, 1-nerved, 1.5 x 0.5 mm. Upper glume ovate-lanceolate, 1-2 x 0.5-1 mm. Lemmas broadly ovate, 1.5-2.5 x 1-1.5 mm, 3-nerved. Paleas elliptic, 2-keeled, 1-2 x 1 mm. Stamens 3, violet. Stigmas white. Grains 1 mm long, ellipsoid, reddish-brown.

Fl. & Fr. : Throughout the year.

Distribution : South East Asia, India and Africa. A common weedy plant. *Amitha Bachan 98705* (Elanthikkara, riverside, banks of Chalakkudy river, sea level); *Amitha Bachan* 123366 (Vazhachal, riparian vegetation, banks of Chalakkudy river, 220m).

ISCHAEMUM Linnaeus

Sp. Pl. 1049. 1753.

Ischaemum nilagiricum Hack., Oesterr. Bot. 51: 150. 1901; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1722. 1934; Manilal, Fl. Silent Valley 357. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 153. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 517. 1996; *Ischaemum hirtum* sensu Hook. f., Fl. Brit. India 7: 135. 1896, non Hack. 1889.

Densely tufted perennials; culms 30-100 cm tall, rigid; nodes glabrous. Leaves linear, 10-20 x 1 cm, pubescent; sheath keeled; ligule a narrow membrane with a tuft of hairs. Racemes 9-12 cm long, densely hairy. Sessile spikelet 4.5 x 2 mm; lower glume 3.5 x 1.5 mm, bifid at apex, hairy; upper glume 4.5 x 1.5 mm, aristate; lower floret male, upper bisexual; first lemma 3-nerved, paleate; second lemma bifid and awned

in the sinus; palea nerveless, hyaline. Pedicelled spikelets similar to sessile spikelets.

Fl. & Fr. : December – March.

Distribution : Endemic to Southern Western Ghats. Along banks of streams. *Amitha Bachan 98781* (Vazhachal, along rocky riverbed, banks of Chalakkudy river, 220 m).

Ischaemum zeylanicolum (Hack.) Bor, Grass. Bur. Cey. Ind. Pak. 186. 1960; Sreek. & V.J. Nair, Fl. Kerala Grasses 169. 1991; C. N. Sunil & Sivad., Fl. Alappuzha 864. 2009. *Ischaemum timorense* Kunth var. *zeylanicolum* Hack. in A. & C. DC., Monogr. Phan. 6: 230. 1889; Hook. f., Fl. Brit. India 7: 136. 1896. **Plate 45. A.**

Annual or perennial trailing herbs. Culms 30-90 cm long. Leaves elliptic-lanceolate, 3-14 x 0.5-1 cm, base tapering and narrowed into petiole, 0.2-4 cm long, acuminate at apex; sheaths keeled; ligules ovate, membranous. Racemes 2, 2.5-6 cm long, hairy; joints 3-4 mm long, turbinate, densely long ciliate; with a tooth like projection on inner side towards base. Sessile spikelets 4-5 mm long, ovate-lanceolate, awned; lower glume ovate-lanceolate, 4 x 2 mm, not winged towards apex; upper glume boat-shaped, 4-5 x 1.5-2 mm, aristate, hyaline, not winged at apex; lower floret male; upper floret bisexual; first lemma 3-4 mm long, oblanceolate; palea 3-4 mm long, elliptic-lanceolate, 2-keeled; second lemma 3-4 mm long, notched, awned; awn 1-1.5 cm long; palea oblong-lanceolate, hyaline; stamens 3; stigmas violet. Pedicelled spikelets similar to the sessile spikelets.

Fl. & Fr. : September – February.

Distribution : South India and Sri Lanka. Wet areas in margins of forests and streamsides. *Amitha Bachan 123313* (Sholayar - Vavalala, riverside, banks of Sholayar river, 600 m).

JANSENELLA Bor

Kew Bull. 1955 : 96. 1955.

Jansenella griffithiana (C. Muell.) Bor, Kew Bull. 1955: 98. 1955; Manilal, Fl. Silent Valley 357. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 348. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 518. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 830. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 579. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 865. 2009. *Danthonia griffithiana* C. Muell., Bot. 2. 14. 347. 1856. *Arundinella avenacea* Munro ex Thwaites, Enum. Pl. Zeyl. 362. 1864; Hook. f., Fl. Brit. India 7: 69. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1801. 1934.

Small annuals, herbs. Culms to 20cm long, creeping and geniculate. Leaves elliptic-lanceolate, 0.7-3.5 x 0.5-1 cm, base amplexicaulii, acuminate at apex; sheaths slightly keeled; ligules ovate, membranous. Panicles densely compact, capitate, to 3.5 cm long. Spikelets 5-8 mm long, elliptic-lanceolate. Lower glume 4-5 mm long, lanceolate, acuminate. Upper glume lanceolate, 5-8 x 1.5 mm, caudate-acuminate, 3-5-nerved. Lower floret male. Upper floret bisexual. First lemma 4-5 x 1-2 mm, oblong-lanceolate, acuminate. Palea oblong, 3 x 1 mm, notched, hyaline, 2-keeled. Stamens 3. Second lemma oblong, 3-4 x 1-1.5 mm, notched, 2-aristate, with tufted hairs on either side, awned, median awn twisted and geniculate; awn to 1 cm long. Palea linear-oblong, 2-3 mm long, notched, 2-keeled, hairy on dorsal side. Stamens 3. Stigmas 1 mm long.

Fl. & Fr. : October - January.

Distribution : India and Sri Lanka. Moist rocky areas in the forests. *Amitha Bachan 98794* (Nelliyampathy, moist rocks along the stream sides, 1000 m).

LEERSIA O.Swartz

Prodr. 1, 21. 1788 (*nom. cons.).*

Leersia hexandra Sw., Prodr. 21. 1788; Hook. f., Fl. Brit. India 7: 94. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1845. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 430. 1991; Anil Kumar *et al.*, Fl. Pathanamthitta 580. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 866. 2009.

Erect or trailing perennial herbs. Culms to 1.5m long; bearded at nodes. Leaves linear-lanceolate, 4-17 x 0.4-1 cm, rounded at base, acuminate at apex, scaberulous; sheaths to 13 cm long; ligules membranous. Panicles 4-12 cm long, lax; branches to 5 cm long. Spikelets 4-5 mm long, oblong, compressed, 1-flowered, cream-yellow. Glumes reduced to a rim. Lemma oblong, 4 x 1.5 mm, coriaceous, 5-nerved, laterally compressed, keeled, scabrid along the nerves. Palea linear-oblong, 2-3 x 1 mm, coriaceous, 3-nerved, ciliate along the keels. Stamens 6; anthers 2 mm long, yellow. Ovary elliptic; stigmas cream.

Fl. & Fr. : August – February.

Distribution: Pantropical. Wetlands. *Amitha Bachan 98712* (Elanthikkara, wet areas near riverside, banks of Chalakkudy river, sea level).

OCHLANDRA Thwaites

Enum. Pl. Zeyl. 376. 1864.

Key to species

1a. Small reed with culms 2-8m high and 1-3cm across; leaves 2cm broad; usually seen along river banks.....**O. scriptoria**

1b. Tall reeds with culms upt to 10m high and 2-4.5 cm across; Leaves 5-10 cm broad; moist forests.....**O. travancorica**

Ochlandra scriptoria (Dennst.) C.E.C. Fisch. in Gamble, Fl. Pres. Madras 1863. 1934; Sasidh. & Sivar., Fl. Pl. Thrissur For. 519. 1996; Anil Kumar *et al.*, Fl. Pathanamthitta 581. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 867. 2009. *Bambusa scriptoria* Dennst., Schluss. Hort. Malab. 31. 1818. *Bheesha rheedei* Kunth, Enum. Pl. 1: 434. 1833. 'rheedii'.*Ochlandra rheedei* (Kunth) Benth. & Hook.f. ex Gamble, Ann. Roy. Bot. Gard. (Calcutta) 7: 121, t.107. 1896; Hook. f., Fl. Brit. India 7: 418. 1896. **Plate 45. B.**

Small bamboo-like reeds with culms up to 2-8m high, 1-3 cm across. Culm sheaths thin, ligule trigonous, auricled at base, hairy within. Leaves lanceolate, to 16 x 2 cm, acuminate. Sheaths ciliate along margins; ligule with bristles. Spikelets to 2 cm long clustered at nodes. Fertile glumes oblong, mucronate; palea convolute. Stamen to 16, anthers 1.5 cm long; filaments 0.5 cm long free. Lodicules 6-8, linear oblong, 7 x 1.5 mm. Ovary and style glabrous, stigma 6, unequal, plumose.

Fl. & Fr. : July – February.

Distribution : Endemic to the Western Ghats. Usually along the banks of streams. *Amitha Bachan 72040* (Vazhachal, riverside vegetation, banks of Chalakkudy river, 220m); *Amitha Bachan 98929* (Nelliyampathy, banks of hill streams in the evergreen forests, 1100m).

Ochlandra travancorica (Bedd.) Benth. ex Gamble, Ann. Roy. Bot. Gard. (Calcutta) 7: 125. t.111. 1896 & Hook. f., Fl. Brit. India 7: 419. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1863. 1934; N. Mohanan & Sivad., Fl. Agasthyamala 831. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 580. 2005. *Bheesha travancorica* Bedd., Fl. Sylv. t.324.

1891. *Ochlandra travancorica* Benth. ex Gamble var. *hirsuta* Gamble, Ann. Roy. Bot. Gard. (Calcutta) 7: 126. 1896 & C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1863. 1934. *Ochlandra sivagiriana* (Gamble) Camus, Les Bambusees 181. 1913. *Ochlandra soderstromiana* Muktesh & Stephen, Rheedea 9: 33. 1999.

Tall reed-like grasses; rootstock rhizomatous, branched; culms to 10 m tall, densely clumped, hollow, covered with culm sheaths; culm sheaths with small limbs. Leaves oblong-lanceolate, 20-40 x 5-10 cm, scattered, truncate or cuneate at base, glabrous; sheaths tubular, mouth with stiff bristles; ligule short. Panicles large, spicate. Spikelets in verticils, 3-9 together, sessile, 5-6 cm long; glumes 2-5, unequal, to 5 cm long, lanceolate, mucronate, smooth; florets one, bisexual; lemmas 5 cm long, elliptic-oblong, muticous; palea membranous, stamens 20-40, filaments monadelphous; style long; stigma 4-6; fruit ovoid, 2-3 x 1.5 cm, smooth, beaked.

Fl. & Fr. : November – May.

Distribution : Endemic to Southern Western Ghats. Along banks of streams and moist forests. *Amitha Bachan* (Vazhachal, riparian forests, banks of Chalakkudy river, 300m).

OPLISMENUS Palisot de Beauvois

Fl. Oware 2: 14. 1810 ("1807").

Key to the species

1a. Racemes <2.5 cm long; lower floret epaleate, awns pale yellow, flexuous; lower lemma aristate .....**O. burmannii**

1b. Racemes 2-11 cm long; lower floret paleate, awns purple, stiff; lower lemma acute, not aristate ..... **O. compositus**

Oplismenus burmannii (Retz.) P. Beauv., Ess. Agrost. 54. 168. 1812; Hook. f., Fl. Brit. India 7: 68. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1778. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 256. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 519. 1996; Anil Kumar *et al.,* Fl. Pathanamthitta 581. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 867. 2009. *Panicum burmannii* Retz., Obs. Bot. 3: 10. 1783.

Creeping or trailing annuals to 20-50 cm long, rooting at nodes; nodes hairy. Leaves elliptic or elliptic-lanceolate, 1-5 x 0.5-1.3 cm, base oblique, margins undulate, apex acuminate, glabrescent; sheaths to 4 cm long, softly hairy; ligule a row of hairs. Inflorescence to 10 cm long; racemes 2-7, each 1-2.5 cm long; rachis triquetrous, densely villous. Spikelets 2-3 mm long, elliptic; pedicels bristly. Lower glume ovate-lanceolate, 1.5-2 x 1 mm, softly hairy, awned; awn 6-8 mm long, pale yellow, scabrid. Upper glume pale yellow, 1.5-2 x 1 mm. Lower floret barren. Upper floret bisexual. First lemma elliptic, 2-3 x 1-1.5 mm aristate. Palea absent. Second lemma ovate-elliptic, 1.5-2 x 1 mm, subcoriaceous. Palea elliptic, 1.5-2x1 mm, subcoriaceous, 2-keeled. Stamens 3, pale yellow. Stigma 1 mm long, cream coloured. Grain oblong, 3 mm long.

Fl. & Fr.: November- February.

Distribution: Pantropical. Evergreen forests. *Amitha Bachan 117753* (Odankuzhal-Sholayar, riparian forest undergrowth, banks of Sholayar river, 650 m)

Oplismenus compositus (L.) P. Beauv., Ess. Agrost. 54. 168. 1812; Hook. f., Fl. Brit. India 7: 66. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1778. 1934; Manilal, Fl. Silent Valley 358. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 257. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 520. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 832. 2002; Anil

Kumar *et al.*, Fl. Pathanamthitta 581. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 868. 2009. *Panicum compositum* L., Sp. Pl. 57. 1753.

Trailing or creeping annual herbs to 80 cm long; rooting at the lower nodes; nodes softly hairy. Leaves elliptic-lanceolate or ovate-lanceolate, 1.5-7 x 0.8 - 2 cm, oblique at base, margins wavy, apex acuminate, hispid; sheaths to 6 cm long; ligule a row of hairs. Inflorescence to 20 cm long, lax; racemes 4-8, each 2-11 cm long; rachis triquetrous, pilose. Spikelets paired, 3-4 mm long, elliptic, distant, subsessile. Lower glume lanceolate, 2-3 x 1 mm , awned; awn 4-6 mm long. Upper glume ovate-elliptic, 2-3 x 1 mm, aristate. Lower floret barren. Upper floret bisexual. First lemma, ovate, 3-4 x 1-2 mm. Palea 1-2 mm long, lanceolate. Second lemma elliptic, 2-3 x 1 mm, subcoriaceous. Palea 2-3 x 1 mm, elliptic, subcoriaceous, 2-keeled. Stamens 3; anthers 1 mm long, purple. Stigma 1 mm long, reddish. Grains ellipsoid 1mm long.

Fl. & Fr. : Throughout the year.

Distribution : Pantropical. Moist and shady places in degrades forest margins and plains. *Amitha Bachan 117629* (Vazhachal, riparian forests, banks of Chalakkudy river. 240 m).

OXYTENANTHERA Munro

Trans. Linn. Soc. London 26(1): 126. 1868.

Oxytenanthera bourdillonii Gamble, Ann. Roy. Bot. Gard. (Calcutta) 7: 76,t.67. 1896; Hook. f., Fl. Brit. India 7: 403. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1861. 1934. *Pseudoxytenanthera bourdillonii* (Gamble) Naithani, Journ. Bombay Nat. Hist. Soc. 87: 440. 1990; Sasidh. & Sivar., Fl. Pl. Thrissur For. 524. 1996. *Pseudotenanthera bourdillonii* (Gamble) R.B. Majumdar in Karthik. *et al.*, Fl. Ind. Enum. 280. 1989.

Robust perennials; culms 3-5 m high, smooth; culm sheath blade to 15 cm long, glabrous. Leaves ovate-lanceolate, 15-35 x 2-5 cm, sessile, acute at base, glabrous; margin entire; sheath keeled, glabrous. Spikelets 2.5 cm long, glabrous; lower glume 3.5 x 2.5 mm, acute; upper glume 10-11 x 6-7 mm, glabrous; florets 3-5, all bisexual; lemmas 20 x 6 mm, glabrous; palea 10-13 x 4 mm, hairy along the keels; staminal tube short; anthers 6-7 mm long, apiculate; styles 2, linear, hairy; stigmas 2, filiform, hairy.

Fl. & Fr.: October – February.

Distribution : Endemic to Southern Western Ghats. Rare. Evergreen forests at medium and higher elevations, near streamsides. *Amitha Bachan 123627* (Sholayar, evergreen forests near streamsides, 800 m).

PANICUM Linnaeus

Sp. Pl. 55. 1753

Panicum repens L., Sp. Pl. (ed. 2) 87. 1762; Hook. f., Fl. Brit. India 7: 49. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1783. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 271. 1991; N. Mohanan & Sivad., Fl. Agasthyamala 835. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 582. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 874. 2009.

Perennials with branching rhizome; culms 10-60 cm high, erect; nodes glabrous. Leaves linear-oblong, 5-20 x 0.4-0.8 cm, bifarious, distichous hairy below; sheath rounded, ciliate along margins. Panicle 5-20 x 5-15 cm, effuse; branches and pedicels scabrid. Spikelets lanceolate 3 mm; lower glume distinct, broadly ovate, 1 x 1.5 mm, 5-nerved; upper glume lanceolate, 2.5-3 x 1.5 mm, 13-nerved; first lemma similar to upper glume, paleate, empty; second lemma 2 x 1 mm, ovate, concave;

palea 2 x 1 mm, oblong. Stamens 3; style 2, free. Grains tightly enclosed in hardened lemma and palea.

Fl. & Fr. : Throughout the year.

Distribution: Tropics and subtropics. Wetlands and marshy areas. *Amitha bachan 123606* (Vazhachal, riparian vegetation, banks of Chalakkudy river, 220 m).

PASPALUM Linnaeus

Syst. Nat. ed. 10, 2: 855. 1759.

Key to species

1a. Spikelets 1-2 mm; upper glume white ciliate along margins.....
.....**P. conjugatum**

1b. Spikelet 2-4mm long; upper glume not ciliate along margins.....
.....**P. scrobiculatum**

Paspalum conjugatum Berg., Act. Helv. Phys. Math. 7: 129. 1772; Hook. f., Fl. Brit. India 7: 11. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1772. 1934; Manilal, Fl. Silent Valley 359. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 285. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 522. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 837. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 583. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 878. 2009.

Tufted annuals or perennials to 60cm high, tufted; nodes glabrous. Leaves lanceolate, 5-12 x 0.5-1.2 cm, ciliate along the margins; sheath keeled, glabrous; ligule a membrane. Racemes 2, paired, 10-12 cm long. Spikelets short, broadly ovate, 1.5-2 x 1.2 mm, acute, in two rows along the raceme, plano-convex, compressed; upper glume 1.5 x 1.2 mm, 2-nerved; lower florets empty; first lemma similar to upper glume, ovate, epaleate, hairy along the margins; second lemma 1.5 x 1.2 mm, obtuse,

1-nerved, coriaceous, glabrous; palea similar to lemma, 2-nerved; stamens 3; styles 2, free. Grain biconvex, 1.5 mm.

Fl. & Fr. : Throughout the year.

Distribution : Pantropical, banks of rivers. *Amitha Bachan 99002* (Orukombankutty, riparian forest openings, banks of Chalakkudy river, 450 m).

Paspalum scrobiculatum L., Mantissa Pl. 1: 29. 1767; Hook. f., Fl. Brit. India 7: 10. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1772. 1934; Manilal, Fl. Silent Valley 360. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 287. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 522. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 838. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 583. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 879. 2009. *Paspalum orbiculare* Forst., Fl. Ins. Aust. Prodr. 7. 1786; Gamble, Fl. Pres. Madras 1772. 1934.

Erect or creeping annuals; culms 30-50 cm high, tufted; rhizome short. Leaves lanceolate, 10-25 x 0.5-0.8 cm, glabrous; sheath keeled; ligule membranous. Racemes 2-5 together, 2-8 cm long; rhachis flat, smooth. Spikelets 2.5 x 2 mm, obtuse; upper glume 2.5 x 2 mm, orbicular, 3-nerved; lower floret empty; first lemma similar to upper glume, epaleate; second lemma 2.5 x 1.5 mm, 3-nerved, crustaceous; palea 1.5 x 1.5 mm, with wide auricles at the base. Stamens 3, Style 2, free. Grains biconvex, 2-3 mm.

Fl. & Fr. : Throughout the year.

Distribution : India and Pakistan, wet lands and marshes. Along riparian wetlands. *Amitha Bachan 123607* (Vazhachal, riparian marshes and wetlands, banks of Chalakkudy river, 240 m).

PENNISETUM L.C. Richard ex Persoon

Syn. Pl. 1: 72. 1805.

Key to species

1a. Inner bristles densly villous; pedicellate; lower glume similar to upper, 2 x 1 mm..... .....**P. pedicellatum**

2a. Inner bristles laxly ciliate; sessile; lower glume minute or suppressed .....**P. polystachyon**

Pennisetum pedicellatum Trin., Mem. Acad. Sci. Petersb. ser. 6, 3: 184. 1834; Hook. f., Fl. Brit. India 7: 86. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1792. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 290. 1991; C. N. Sunil & Sivad., Fl. Alappuzha 880. 2009.

Erect tufted annuals to 1.2 m high; nodes glabrous. Leaves linear-lanceolate, 7-20 x 0.4-1 cm, rounded at base, acuminate at apex; sheaths to 12 cm long; ligules membranous, fimbriate. Panicles 6-16 cm long, spiciform, interrupted, purplish; rhachis puberulous. Involucre enclosing 1-5 spikelets, at least one of them pedicelled; bristles densely woolly plumose. Spikelets 4-6 mm long, lanceolate. Lower glume ovate-lanceolate, 2 x 1 mm, villous. Upper glume 3 x 1.5 mm, ovate-lanceolate, villous. Lower floret male or barren. Upper floret bisexual. First lemma ovate, 3-4 x 1-1.5 mm, apex 3-lobed. Palea minute. Stamens 3. Second lemma elliptic, 2.5 x 1.5 mm, coriaceous, 2-keeled. Ovary oblong; stigmas cream-yellow.

Fl. & Fr. : September – December.

Distribution : West Africa and India. Waste lands and marshes. *Amitha Bachan 99053* (Vazhachal, degraded riverbank vegetation, 250 m).

Pennisetum polystachyon (L.) Schult., Syst. Veg. 2: 146. 1824; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1792. 1934; Manilal, Fl. Silent Valley

360. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 291. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 522. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 838. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 584. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 880. 2009. *Panicum polystachyon* L., Syst. Nat. (ed. 10) 2: 870. 1759. *Cenchrus setosus* Sw., Prodr. 26. 1788.*Pennisetum setosum* (Sw.) L.C. Rich. in Pers., Syn. Pl. 1: 72. 1805; Hook. f., Fl. Brit. India 7: 87. 1896.

Densely tufted perennials; culms 50-200 cm high, stout, nodes thickened. Leaves linear, 20-60 x 0.6-1.5 cm, shallowly channelled, densely hairy. Raceme 10-20 cm long; rachis angular, glabrous; bristles laxly ciliate, equal. Spikelets 5 mm long, solitary in the involucre, sessile; lower glume minute; upper glume ovate, 3-4 x 1.5 mm, acute, 5-nerved, puberulus; lower floret barren; lower glume minute or suppressed; first lemma 3 x 1.5 mm, 3-nerved, puberulus, epaleate; second lemma 2 x 1 mm, 3-5-nerved, glabrous; palea 2 x 1 mm, 2-nerved; anthers 2 mm long.

Fl. & Fr. : November-January

Distribution: Paleotropics. Degraded moist forests and waste places. *Amitha Bachan 99032* (Orukombankutty, riparian forest, banks of Chalakkudy river, 450 m).

PHRAGMITES Adanson

Fam. 2: 34. 1763.

Phragmites karka (Retz.) Trin. ex Steud., Nomencl. Bot. (ed.2) 2: 324. 1841; Hook. f., Fl. Brit. India 7: 304. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1807. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 331. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 523. 1996; C. N. Sunil & Sivad., Fl. Alappuzha 883. 2009. *Arundo karka* Retz., Obs. Bot. 4: 21. 1786. **Plate 45. A.**

Reed like robust, perennial grass to 1-4m tall. Culms erect, 0.2-1cm across, hollow; rhizome creeping; nodes glabrous. Leaves linear to narrowly lanceolate, 12-40 x 0.6-2 cm, rounded at base, long acuminate at apex, margins scabrid, semi erect; sheaths to 10 cm long; ligule a narrow rim of hairs. Panicles 15-40 cm long, pyramidal, lax, silkly hairy. Spikelets 8-14 mm long, linear-lanceolate, 3-6-flowered. Lower glume ovate-lanceolate, 3-4 x 1 mm. Upper glume elliptic-lanceolate, 4-6 x 1-1.5 mm. Lowest lemma barren, 0.8-1 cm long, narrowly elliptic. Fertile lemmas 8-12 x 0.5-1 mm, linear-lanceolate. Paleas oblong-lanceolate, 2-4 x 0.5 - 1mm, hyaline, 2-keeled. Stamens 3; style 2, free. Ovary linear; grain oblong.

Fl. & Fr.: Throughout the year.

Distribution: Paleotropics. Marshy areas. *Amitha Bachan 99191* (Vazhachal, on the rocks on riverbed, along Chalakkudy river, 220 m).

POGONATHERUM P. Beauvois

Ess. Agrost. 56. 1812.

Pogonatherum crinitum (Thunb.) Kunth, Enum. Pl. 1: 476. 1833; Hook. f., Fl. Brit. India 7: 141. 1896; Manilal, Fl. Silent Valley 360. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 176. 1991; N. Mohanan & Sivad., Fl. Agasthyamala 840. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 584. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 884. 2009. *Andropogon crinitum* Thunb., Fl. Jap. 40. 1784. *Pogonatherum paniceum* sensu Gamble, Fl. Pres. Madras 1714. 1934, non (Lam.) Hack. 1906.

Dense tufted annuals to 20 cm high, erect, short; nodes glabrous. Leaves elliptic-lanceolate acute at both ends, 5 x 0.4 cm, glabrous; sheath keeled, hairy at the mouth; ligule a fimbriate membrane. Raceme solitary, 2-3 cm long; rachis with long hairs. Spikelets paired; one sessile

and one pedicelled. Sessile spikelets 1.5 mm long; glumes awned; awn 2-3 mm long; florets 2; lower empty; upper bisexual; first lemma oblong, obtuse, epaleate; second lemma ovate, acuminate, awned; palea oblong, truncate at apex; stamen one; ovary elliptic; style 2, connate at base; stigmas 2, plumose, cream coloured.

Fl. & Fr. : November-May.

Distribution : Indian subcontinent and Japan. Streamside wet rocks and wet grasslands. *Amitha Bachan 72008* (Vazhachal, among rocks on the stream sides, along Chalakkudy river, 220 m).

RHYNCHELYTRUM C.G.D. Nees in Lindley
Nat. Syst. ed. 2, 378, 446. 1836.

Rhynchelytrum repens (Willd.) C.E. Hubb., Bull. Misc. Inform. Kew 1934:110.1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 297. 1991; N. Mohanan & Sivad., Fl. Agasthyamala 841. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 585. 2005; C. N. Sunil & Sivad., Fl. Alappuzha 887. 2009. *Saccharum repens* Willd., Sp. Pl. (ed. 4) 322. 1798. *Monachyron villosum* Parl. in Hook., Niger Fl. 191. 1849. *Tricholaena wightii* Nees & Arn. ex Steud., Syn. Pl. Glum. 1: 93. 1854 pro syn; Hook. f., Fl. Brit. India 7: 65. 1896. *Rhynchelytrum villosum* (Parl) Chisu in Annuar R. Inst. Bot. Roma 8: 310. 1908; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1791. 1934.

Tufted annuals to 60 cm high; attractive with pink inged spikelets; nodes softly villous. Leaves, linear-lanceolate, 5-15 x 0.2 - 0.5 cm, apex acuminate; sheaths to 15 cm long; ligule a row of hairs. Panicles 6-14 cm long, pyramidal, reddish-brown. Spikelets 4-7 mm long, ovate, villous; pedicels 2-4 mm long, pilose at the tip. Lower glume long, oblong, 1-1.5 mm, emarginate. Upper glume boat-shaped, 3-5 x 1.5-2.5 mm, gibbous, mucronate or aristate, 5-nerved, densely villous. Lower

floret male or barren. Upper floret bisexual. First lemma ovate-lanceolate, 3-5 x 1.5-2.5 mm, aristate. Palea elliptic, 3-5 x 1-1.5 mm, hyaline, 2-keeled. Second lemma ovate-oblong, 2-3 x 1.5-2 mm, coriaceous. Palea elliptic, 2 x 1 mm, coriaceous. Stamens 3; anthers to 2 mm long, yellow. Stigmas brownish.

Fl. & Fr.: January-March.

Distribution: Africa and drier part of India. Rocky cuttings and opening in the moist forests. *Amitha Bachan 117777* (Valparai, rocky cuttings, along Sholayar river, 1200 m).

SACCHARUM Linnaeus

Sp. Pl. 54. 1753.

Key to species

1a. Culms semi-erect to 5 m long, 2-3 cm across.....**S. arundiaceum**

1b. Culms erect, tufted to 3m long, <1cm across.....**S. spontaneum**

Saccharum arundinaceum Retz., Obs. Bot. 4: 14. 1786; Hook. f., Fl. Brit. India 7: 119. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1709. 1934; C. N. Sunil & Sivad., Fl. Alappuzha 887. 2009. *Erianthus arundinaceum* (Retz.) Jesw., Suikerind. Ned.-Ind. 33: 399. 1925. **Njangana.** **Plate 45. E.**

Reed like semierect, perennial grass to 5 m tall, 2-3 cm in diameter, nodes glabrous. Leaves linear, 75-150 x 2-3 cm, acuminate, margins scabrous; sheaths pubescent; ligule ciliolate. Panicle 30-70 cm long; pedicels shorter than the internode; internodes 4-7 mm long, long-pilose. Spikelets 2.5 - 4 mm long, lanceolate; callus short pilose, the hairs shorter than the spikelet. Lower glume lanceolate, 3-4 mm long, long-pilose on the back. Upper glume lanceolate, 3-4 mm long, 3-nerved, pilose on the back in the pedicelled spikelet. Lower lemma 1-nerved, 2-3

mm long, ciliate. Upper floret with the lemma 2-3 mm long, awned, ciliate, cuspidate. Stamens 3. Style 2, free or shortly connate. Stigmas purple.

Fl. & Fr. : December – April.

Distribution : India, Sri Lanka and Malaysia. Banks of rivers at lower elevations. *Amitha bachan 123495* (Kundoor, banks of Chalakkudy River, 3 m).

Saccharum spontaneum L., Mantissa Pl. 2: 183. 1771; Hook. f., Fl. Brit. India 7: 118. 1896; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1709. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 185. 1991; C. N. Sunil & Sivad., Fl. Alappuzha 889. 2009. **Attuvanchi.** **Plate 45. A.**

Tufted erennials grasses to 1-3 m high, culms slender, erect, tufted; nodes glabrous. Leaves linear-lanceolate 30-100 x 1 cm, rounded at base, acuminate at apex, glabrous; sheath rounded; ligule membranous, 3-6 mm long. Panicle to 30 cm long, densely silky hairy. Spikelets similar, paired, covered with white hairs; lower glume oblong, chartaceous; upper glume ovate-lanceolate, chartaceous, keeled, 1-nerved; florets 2; lower empty; upper bisexual; first lemma 2.5 x 1 mm, 3-nerved, epaleate; second lemma linear-lanceolate; palea membranous; stamens 3, free; style basely connated; stigmas 2, white, plumose.

Fl. & Fr. : November-May

Distribution : Paleotropics. River and stream margins, on rocky riverbeds. *Amitha Bachan 123367* (Vazhachal, on rocky river beds, along Chalakkudy river, 220m).

SACCIOLEPIS Nash

in Britton, Man. Fl. N. States ed. 1, 89. 1901.

Key to Species

1a. Panicles 1-8 cm long; lower glume half the spikelet..... **S. indica**

1b. Panicles 5-25 cm long; lower glume one third the spikelet.....

.....**S. nterrupta**

Sacciolepis indica (L.) A. Chase, Proc. Biol. Soc. Wash. 21: 8. 1908; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1787. 1934; Manilal, Fl. Silent Valley 362. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 298. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 525. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 843. 2002; C. N. Sunil & Sivad., Fl. Alappuzha 891. 2009. *Aira indica* L., Sp. Pl. 1753. *Panicum indicum* L., Mantissa Pl. 2: 184. 1771; Hook. f., Fl. Brit. India 7: 41. 1896.

Slender erect annuals to 12-30 cm high, loosely tufted; nodes glabrous. Leaves linear, 5-15 x 0.2-0.5 cm, sparsely hairy; sheath compressed; ligule a membrane. Panicle 1-8 x 0.5-0.7 cm, cylindrical. Spikelets densely packed, 1.5-3 mm long, ovoid, compressed, glabrous or hispid; lower glume 1.5 x 0.5 mm, acute, 5-nerved; upper glume 2 x 1 mm, 9-nerved; lower floret barren; first lemma 1.5 x 1 mm, thinly hairy; second lemma 1.5-2 x 1 mm; palea similar to lemma; anthers 1 mm long.

Fl. & Fr. : Throughout the year.

Distribution : Tropical Asia and Australia. Introduced elseware. Wet areas and degraded forests openings. *Amitha Bachan 123328* (Sholayar, banks of Sholayar river, 700 m).

Sacciolepis interrupta (Willd.) Stapf in Prain, Fl. Trop. Africa 9:757.1920; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1787. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 299. 1991. C. N. Sunil & Sivad.,

Fl. Alappuzha 892. 2009. *Panicum interruptum* Willd., Sp. Pl. (ed. 4) 341. 1798; Hook. f., Fl. Brit. India 7: 40. 1896.

Erect tall annual grasses with cylindrical spike. Culms 25-100 cm long, usually erect, creeping or geniculate, spongy and floating, rooting at the nodes below; nodes glabrous. Leaves lanceolate or linear, 5-28 x 0.3-1 cm, rounded at base, acuminate or acute; sheaths to 16 cm long; ligules ovate, membranous. Panicles 5-25cm long, spiciform, interrupted. Spikelets 3-5 mm long, ovate-lanceolate. Lower glume ovate-oblong, 1-1.5 x 1 mm. Upper glume ovate-lanceolate, 3-5 x 1-2 mm. Lower floret male or barren. Upper floret bisexual. First lemma similar to the upper glume. Palea 2-3 mm olong, oblong, hyaline. Second lemma ovate-oblong, 2-3 x 1-1.5 mm, subcoriaceous. Palea 2-3 mm long, elliptic, 2-keeled, hyaline. Stamens 3; anthers violet. Stigmas pink. Grains ovoid 2 mm long.

Fl & Fr. : Throughout the year.

Distribution: Tropics of South East Asia and Africa. Wetlands. *Amitha Bachan* 117719 (Kottat-Chalakkudy, riverside, along Chalakkudy river, 7 m).

SETARIA P. Beauvois

Ess. Agrost. 51, 178, t. 13, f. 3. 1812.

Setaria palmifolia (Koenig) Stapf, J. Linn. Soc. Bot. 42. 186. 1914; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1789. 1936; Manilal, Fl. Silent Valley 362. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 307. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 525. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 844. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 587. 2005. *Panicum palmaefolium* Koenig, Naturf. 23:208.1788. *Panicum*

plicatum Willd., Enum. Pl. 1033. 1809; Hook. f., Fl. Brit. India 7: 55. 1896, p.p. non Lam. 1791.

Robust perennials; culms densly tufted, 50-130 cm high; nodes glabrous or sparsely bearded. Leaves elliptic, 20-50 x 2-5 cm, erect, plicately folded, narrowed to the base, thinly pubescent, scabrid along the nerves. Ligules row of hairs or fimbriate membrane. Panicle 16-40 cm long, narrow, lax. Spikelets elliptic, 3 mm long, shortly pedicelled, crowded on small branches; lower glume 1.5 mm across, orbicular, obtuse, 5-nerved; upper glume 2.5 x 1.5 mm, 7-nerved; lower floret barren; first lemma 3 x 1.5 mm; palea oblong; second lemma acute, 2.5 x 1.5 mm; palea ovate, acute. Stamens 3; anthers 1.5 mm long. Ovary oblong, 0.5 mm long.

Fl. & Fr. : August-December.

Distribution: Paleotropics, introduced in America. Evergreen forests along river margins. *Amitha Bachan 117628* (Vazhachal, riparian forest, banks of Chalakkudy river, 240 m).

THEMEDA Forsskal

Fl. Aegypt.- Arab. 178. 1775.

1a. Lower glume of the sessile awned spikelet with a longitudinal slit-like groove on the dorsal side; sessile spikelet 2 in a raceme...**T. tremula**

1b. Lower glume of the sessile spikelet without a longitudinal groove; sessile spikelet solitary in a raceme.....**T. triandra**

Themeda triandra Forssk., Fl. Aeg.-Arab. 178. 1775; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1746. 1934; Manilal, Fl. Silent Valley 366. 1988; Sreek. & V.J. Nair, Fl. Kerala Grasses 202. 1991; Sasidh. & Sivar., Fl. Pl. Thrissur For. 527. 1996; N. Mohanan & Sivad., Fl. Agasthyamala 848. 2002; Anil Kumar *et al.*, Fl. Pathanamthitta 589. 2005; C. N. Sunil

& Sivad., Fl. Alappuzha 897. 2009. *Anthistiria imberbis* Retz., Obs. Bot. 3: 11. 1783; Hook. f., Fl. Brit. India 7: 211. 1896.

Densely tufted perennials; culms 30-200 cm high, white or yellowish white. Leaves lanceolate, 20-50 x 0.4-1 cm, rounded at base, margins rarely ciliate; sheath sharply keeled, mouth with long bulbous based hairs; ligule 5-8 mm long, coriaceous. Panicle 20-50 cm long; racemes in dense clusters. Involucral spikelets paired in same or different levels, 7-10 mm long; lower glume 8 mm long, winged along one side; upper glume oblong, 3-nerved. Bisexual spikelets, 6-10 mm long, solitary in a raceme, callus with brown hairs; lower glume 5-9 mm, brown, thinly pubescent; upper glume 6-8 mm long, hirtus; first lemma 3 mm long, oblong, brown; second lemma stipitate, awn 5-9 cm long. Stamens 3.

Fl. & Fr. : November-February.

Distribution : Paleotropics. Degraded forests. *Amitha Bachan 123395* (Sholayar, degraded rocky areas in the riparian forests, banks of Sholayar river, 700 m).

Themeda tremula (Nees ex Steud.) Hack. in A. & C. DC., Monogr. Phan. 6: 667. 1889; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1746. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 198. 1991; Anil Kumar *et al.*, Fl. Pathanamthitta 588. 2005. *Anthistiria tremula* Nees ex Steud., Syn. Pl. Glum. 1:401.1855; Hook. f., Fl. Brit. India 7:214.1896.

Densely tufted perennials; culms 30-120 cm high, leafy, not clothed at base with leaf sheaths. Leaves lanceolate, 10-50 x 0.4-1 cm, rounded at base, margins rarely ciliate; sheath keeled, mouth with long bulbous based hairs; ligule 3-5 mm long, ovate, acute, coriaceous. Panicle 10-40 cm long; racemes in dense clusters. Involucral spikelets in superposed pairs, 2 pairs; lower glume 4-8 mm long, setose from minute

tubercles; upper glume oblong, 3-nerved. Sessile spikelets, 3-4 mm long, 2 in a raceme, awned; lower glume 3-4 mm, brown, densly hairy with a deep slit like grove in the middle; upper glume 3-4 mm long, coriaceous, margins two keeled, keels rounded softly hairy; lower floret empty, upper floret bisexual. first lemma 3 mm long, oblong, brown; second lemma stipitate, awn 2-4 cm long. Stamens 3.

Fl. & Fr. : Throughout the year.

Distribution: Endemic to South India and Sri Lanka. *Amitha Bachan 117776* (Valparai, rocky cuttings near stream banks, Sholayar river, 1200 m).

ZOYSIA Willdenow

Ges. Naturf. Fr. Berlin Neue Schriften 3: 440. 1801.

Zoysia matrella (L.) Merr., Philipp. J. Sci. 7: 230. 1912; C. E. C. Fisch. in Gamble, Fl. Pres. Madras 1815. 1934; Sreek. & V.J. Nair, Fl. Kerala Grasses 445. 1991; C. N. Sunil & Sivad., Fl. Alappuzha 899. 2009. *Agrostis matrella* L., Mantissa Pl. 2: 185. 1771. *Zoysia pungens* Willd. in Gest, Naturf. Freunde Berlin Neue Schr. 3: 441. 1801; Hook. f., Fl. Brit. India 7: 99. 1896.

Small rigid perennial herbs to 20 cm high, Stems stoloniferous, tuft, forming mats; nodes glabrous. Leaves very narrow, convolute, linear or lanceolate, 2-6 x 0.2-0.3 cm, rigid; sheaths to 2.5 cm long; ligules, membranous, fimbriate. Racemes terminal, 2-4 cm long, spiciform, solitary, purplish. Spikelets oblong-lanceolate, 2-3 mm long, 1-flowered. Lower glume absent. Upper glume oblong or ovate-lanceolate, 2-3 mm long,. Lemma ovate-lanceolate, 2-2.5 x 1 mm,. Palea 2 mm long, oblong-lanceolate, 2-keeled. Stamens 3; anthers yellow. Style 2, very long, connate below. Stigmas cream coloured. Grains to 1.5 mm long, oblong-ovoid, free within the lemma and glume.

Fl. & Fr. : November-March.

Distribution: Indo-Malaysia, Australia and Mauritius. Banks of back waters, mangrove forests. *Amitha Bachan 117728* (Chouka-kadavu, riparian sand beds, banks of Chalakkudy river, sea level).

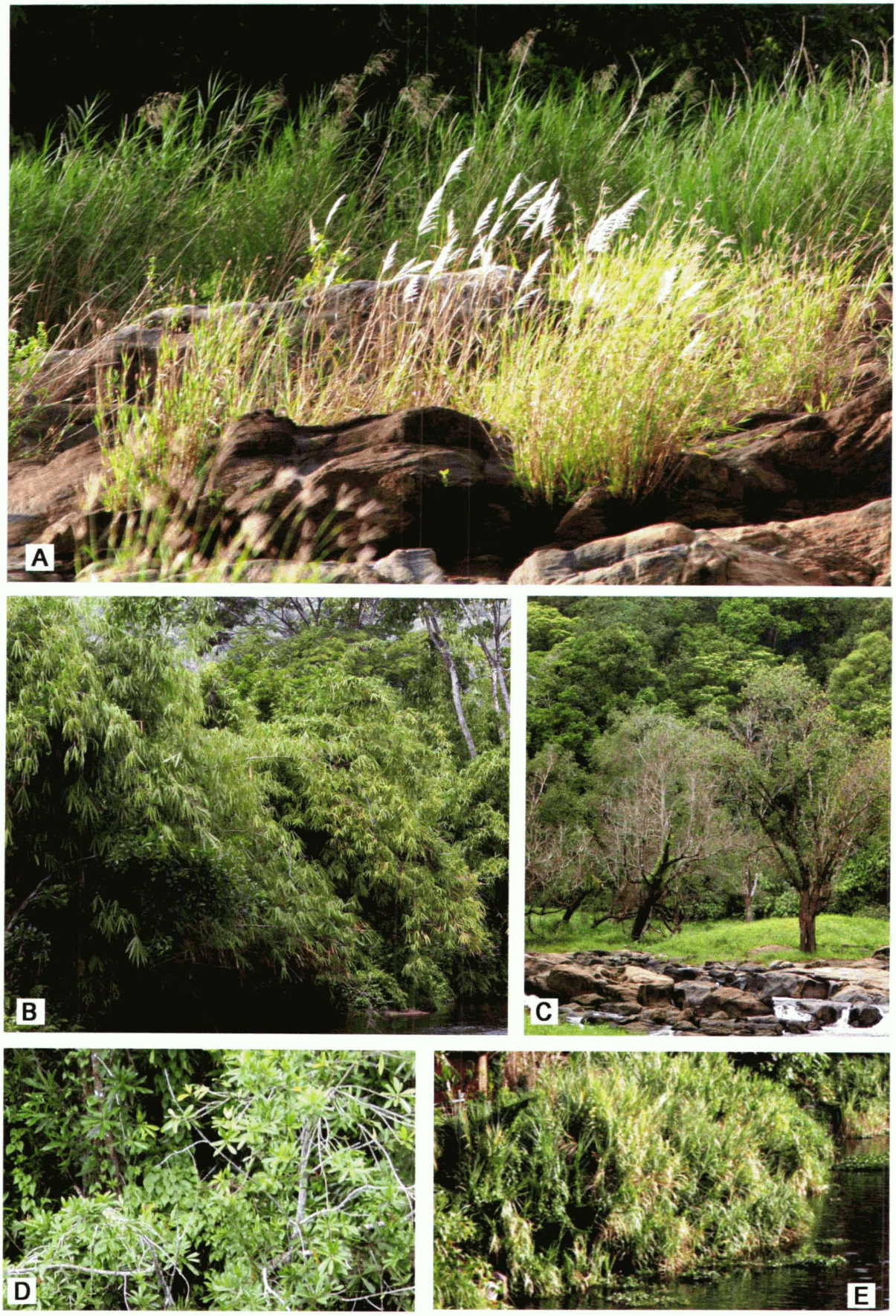


Plate 45. A. Riparian association of *Phragmites karka* (Retz.) Trin. ex Steud., *Saccharum spontaneum* L. & *Ischaemum zeylanicolum* (Hack.) Bor.; B. *Ochlandra scriptoria* (Dennst.) C.E.C. Fisch.; C. *Salix tetrasperma* Roxb.; D. *Madhuca neriifolia* (Moon) H. J. Lam; E. *Saccharum arundinaceum* Retz.

Appendix -1- Tables (Chapter 1)

Chapter 1. Study area

Table 1.1. Physiographic features of the Chalakkudy River basin

	Tributaries / sub-basins					Main river
	Karapara	Kuriyarkutty	Parambikulam	Sholayar	Chalakkudy	Chalakkudy River
Area (Sq. Km)	134.00	233	261.8	261	594.2	1484
Perimeter km	69.42	76.12	93.55	123.8	207.2	271
Total drainage length in km	308.84	533	743.7	694.8	1015	3414
Drainage Density Dd	2.30	2.28	2.84	2.66	1.70	2.30
Length (longest tributary) km	37.20	35.3	43.5	60.95	92.25	145.23
Length km	24.20	18.2	30.5	13.03	17.009	35.39
Breadth km	6.66	13.82	7.94	6.485	11.68	17.21
L/B ratio	3.63	1.31	3.84	2.00	1.45	2.056
Elevation Min in m	480	530	530	460	0	0
Elevation Max in m	1300	1300	1733	2380	1125	2380
Relief in m	820	770	1203	1920	1125	2380
Slope	22.03	21.81	27.65	31.50	12.19	16.38

Table 1. 2. Mean monthly rainfall*, Temperature & Number of Dry Months for all sub-basins of Chalakkudy River

1	**Chalakkudy**												
		Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
	Rainfall	1.733	20.4	6.08	96.24	228.2	713	685	473.3	255.25	411.7	120.77	30.673
	T	23.5	25.2	25.4	26.2	26.5	23.9	23.25	24	23.57	23.2	23.3	23.1
	2T	47	50.4	50.8	52.4	53	47.8	46.5	48	47.14	46.4	46.6	46.2
2	**Vazhachal-Poringal**												
	Rainfall	5.425	13.2	47.18	136.5	190.7	875	922.3	742.4	391.44	338.2	189.8	28.38
	T	23.5	25	25.5	25.8	26.2	23.9	23.25	23.55	23.54	23.05	23.5	23
	2T	47	50	51	51.6	52.4	47.8	46.5	47.1	47.08	46.1	47	46
3	**Nelliyampathy-Karappara**												
	Rainfall	1.465	2.16	25.51	94.65	169.1	844	1011	806.5	289.15	280.3	131.23	39.86
	T	19.2	20.1	23.5	23.8	24	21	20.6	20.8	21	22	22.1	19.8
	2T	38.4	40.2	47	47.6	48	42	41.2	41.6	42	44	44.2	39.6
4	**Kuriyarkutty-Thellikkal**												
	Rainfall	7.73	8.81	22.01	80.73	100.6	282	299.8	263.6	112.6	131.8	113.85	32.995
	T	21	22	25.6	25.5	24.5	23.9	23.25	23.55	23.54	23.05	22.3	21.5
	2T	42	44	51.2	51	49	47.8	46.5	47.1	47.08	46.1	44.6	43
5	**Parambikulam**												
	Rainfall	5.66	4.83	26.83	104.2	139.6	356	402.4	274.5	115.21	152.6	47.675	32.65
	T	20.9	22.7	25.6	25.15	24.5	23.9	23.25	23.55	23.45	23.05	22.1	21.3
	2T	41.8	45.4	51.2	50.3	49	47.8	46.5	47.1	46.9	46.1	44.2	42.6
6	**Sholayar**												
	Rainfall	11.13	16.6	46.18	125.4	197	954	994	897.4	408.64	321.1	185.02	26.787
	T	19.8	23	23.2	24.6	25.1	20	20.3	21	21.2	22	22.1	19
	2T	39.6	46	46.4	49.2	50.2	40	40.6	42	42.4	44	44.2	38
	**based on 20 years of data; rainfall in mm/month; T= temperature in 0C; 2T = Temperature x 2*												

Table 1.3. Average & Mean Probable year Rainfall, No. of Rainy Days and No. of Dry Months

I	Chalakkudy	Rainfall	Rainy days	No of dry months
	Mean	3042	119.8	4.133333333
	SD	500.0366	10.877237	0.743223353
	mean of probable year	2956	119	4
II	Vazhachal-Poringalkuthu			
	Mean	3880.586	133	3.6
	SD	809.7439	20.034181	1.187655807
	mean of probable year	3852	133	3
III	Nelliyampathy-Karappara			
	Mean	3694.92	136.4	3.55
	SD	956.9883	19.754813	0.998683344
	mean of probable year	3716.162	138.38462	3.615384615
IV	Kuriyarkutty-Thellikkal			
	Mean	1456.458	111.05	5.05
	SD	284.6205	15.360493	0.759154655
	mean of probable year	1342	104	5
V	Parambikulam			
	Mean	1661.865	121.35	4.5
	SD	291.866	19.274404	0.76088591
	mean of probable year	1659	119	5
VI	Sholayar -Malakkapara			
	Mean	4183.558	150.73684	3.368421053
	SD	721.4717	43.611724	0.830697586
	mean of probable year	4103	141	3
				*based on 20 years of data; rainfall in mm

Table 1.4 Vegetation of Chalakkudy river basin (an overview)

	Area in Km^2
Primary forests	519.01
Secondary forests	197.46
Forest Plantations	179.61
Other plantations	198.38
Other vegetation (Degraded)	86.93
Total forest area	**1181.42**
Lower plains (agriculture lands)	256.21
Reservoir, streams & rivers	46.56
Non forest area	**302.77**
Total Area of the rive basin	**1484.20**

Table 1.5 Primary Forests types in the basin (Area in Km^2)

Primary Forests	Chalakkudy	Kuriyarkutty	Karappara	Parambikulam	Sholayar	Total
Wet Evergreen Dense	29.35	67.06	48.60	58.55	90.67	294.25
Wet Evergreen degraded	0	22.60	18.61	23.86	1.96	67.04
Evergreen dense (low elevation)	36.19	10.00	17.41	0	12.45	76.07
Evergreen degraded	62.99	11.63	0	0	2.14	76.76
Shola Forest	0	0	0	0	0.09	0.08
Riparian Forest	2.95	0.016	1.16	0.13	0.52	4.79

Table 1.6 Secondary Forests, Plantations & other degraded types in the basin (Area in Km^2)

	Chalakkudy	Kuriyarkutty	Karappara	Parambikulam	Sholayar	Total
Semi evergreen	20.58	0	0	44.88	0.28	65.75
Secondary Moist deciduous	42.74	52.24	0	25.95	0	120.94
Secondary Reed	10.77	0	0	0	0	10.77
Plantations						
Forest Plantation (Teak)	80.89	45.58	1.47	42.35	9.30	179.61
Tea Plantation	0	5.28	33.04	32.10	118.50	188.92
Oil palm Plantation	9.46	0	0	0	0	9.46
Other Vegetation						
Natural grassland (Vayals)	2.02	0	4.94	0.61	3.56	11.15
Open grasslands	28.92	14.03	8.01	14.77	10.04	75.78

Appendix 2 – Tables of Chapter 3. (Phytosociological Analysis)

Table 3.1a Similarity Index between Quadrats

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	*	25	17	26	18	10	22	28	24	14	33	3	2	5	10	7	14	8	8	11	14	7	0	3	0	0	0	4	9	10
2	*	*	34	21	11	42	27	7	32	16	0	20	19	22	19	15	20	5	19	15	11	13	3	3	3	0	0	0	4	3
3	*	*	*	20	19	24	42	21	24	23	4	11	22	5	12	20	20	5	15	17	17	22	3	3	3	0	0	0	0	14
4	*	*	*	*	25	9	15	33	25	21	11	0	0	6	13	6	5	2	6	4	5	9	4	3	4	3	0	0	0	12
5	*	*	*	*	*	21	20	33	35	28	5	0	0	9	19	13	10	1	14	4	6	8	0	3	3	0	0	4	5	18
6	*	*	*	*	*	*	42	17	26	13	3	11	27	16	14	33	20	4	8	15	8	7	4	2	2	0	0	3	0	2
7	*	*	*	*	*	*	*	26	27	19	13	7	31	8	10	21	30	11	9	26	24	10	0	4	4	0	0	4	0	9
8	*	*	*	*	*	*	*	*	25	16	26	6	6	0	6	7	12	7	4	12	17	6	0	3	3	0	0	11	0	12
9	*	*	*	*	*	*	*	*	*	20	8	3	4	10	14	12	14	6	8	5	6	7	0	3	3	0	0	12	8	10
10	*	*	*	*	*	*	*	*	*	*	14	0	4	14	11	13	9	6	18	7	8	15	0	3	3	0	0	4	9	17
11	*	*	*	*	*	*	*	*	*	*	*	16	3	0	0	2	13	7	9	16	22	19	5	0	0	0	0	8	0	6
12	*	*	*	*	*	*	*	*	*	*	*	*	22	6	17	8	12	0	16	18	27	17	7	0	0	3	0	15	0	0
13	*	*	*	*	*	*	*	*	*	*	*	*	*	10	12	33	6	0	8	26	24	12	0	0	0	5	0	8	0	2
14	*	*	*	*	*	*	*	*	*	*	*	*	*	*	10	50	13	2	4	16	2	17	12	3	6	7	0	4	4	6
15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6	9	0	19	4	10	10	0	4	0	0	0	11	26	9
16	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	16	6	16	32	16	16	9	4	4	5	0	0	0	4
17	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	25	11	40	47	16	10	2	5	4	0	0	0	7
18	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	3	29	28	1	0	0	0	0	0	0	0	1
19	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	19	24	26	0	0	0	0	0	0	10	6
20	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	67	11	2	0	0	2	0	2	0	2
21	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	14	4	0	0	5	0	8	0	2
22	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	29	11	12	19	5	6	0	9
23	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	49	53	35	21	0	0	0
24	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	68	40	35	0	5	7
25	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	48	42	0	0	4
26	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	54	3	0	0
27	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0
28	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	17	5
29	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	23
30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
31	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
32	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
33	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
34	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

35	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
36	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
37	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
38	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
39	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
40	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
41	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
42	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
43	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
44	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
46	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
47	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
48	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
49	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
50	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
51	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
52	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
53	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
54	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
55	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
56	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
57	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
58	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
59	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
60	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
61	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
62	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
63	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
64	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
65	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
66	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
67	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
68	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

69	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
70	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
71	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
72	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
73	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
74	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
75	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
76	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
77	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
78	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
79	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
80	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
81	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
82	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
83	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
84	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
85	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
86	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
87	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
88	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
89	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
90	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 3.1b Similarity Index between Quadrats cont.

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
5	0	8	7	16	13	0	18	19	10	0	4	8	7	6	10	7	6	9	0	24	14	8	3	17	6	6	9	7	5
0	10	14	4	11	14	0	0	8	3	0	4	4	0	0	2	31	8	3	0	22	13	0	3	15	15	3	3	6	6
0	7	7	0	4	6	0	3	5	12	4	11	11	16	17	11	25	14	8	6	24	13	4	12	5	9	3	11	0	2
0	10	5	0	11	15	6	9	6	9	5	0	11	9	8	8	3	8	8	13	8	18	5	12	8	5	12	15	4	8
5	9	17	0	14	14	0	4	6	15	9	5	14	20	21	18	14	10	17	4	8	4	9	15	5	12	4	16	4	2
0	5	8	1	3	13	0	0	16	16	0	8	3	0	0	2	24	4	2	5	17	12	0	2	6	5	0	4	0	2
2	2	8	0	0	7	0	10	17	16	2	6	6	6	6	11	28	9	11	6	25	8	2	6	13	14	2	9	0	5

0	7	4	4	7	6	4	16	8	3	7	0	4	10	12	11	8	6	6	6	18	0	11	15	15	6	9	8	0	4
0	4	11	0	8	15	0	7	5	3	4	4	4	7	3	9	18	6	12	3	24	14	0	3	14	10	6	12	6	4
5	8	25	0	13	7	0	4	6	15	4	9	9	15	17	18	12	10	17	14	13	4	9	14	9	8	3	6	4	0
0	0	0	2	0	0	0	32	0	0	0	0	0	0	5	3	0	5	0	6	25	0	8	6	13	0	6	5	0	0
0	10	10	6	0	0	6	0	25	0	10	10	0	0	4	0	13	7	0	4	8	0	5	8	23	23	4	4	0	26
0	5	5	4	0	0	5	0	16	14	0	5	3	0	2	2	26	4	0	0	11	0	3	5	6	7	2	2	0	0
0	11	19	35	4	6	0	0	11	7	0	19	4	0	0	5	13	3	3	0	9	7	0	0	10	9	0	0	6	4
0	0	17	4	6	8	6	0	0	0	0	0	6	5	9	9	16	4	0	0	18	10	0	0	4	2	4	4	9	6
0	4	4	26	2	10	2	0	16	12	0	9	2	0	0	3	18	0	0	2	15	4	0	4	14	8	0	0	0	0
0	2	4	5	0	10	0	9	3	5	2	6	6	3	5	6	9	8	5	2	21	5	2	3	36	5	2	6	5	1
0	0	1	0	0	3	0	6	1	0	0	1	0	0	0	1	2	0	0	0	13	3	0	0	31	0	0	0	0	0
12	0	15	2	9	16	0	6	4	0	0	8	0	0	5	3	13	0	5	0	11	0	0	0	9	0	0	0	6	0
0	4	4	1	0	8	2	11	11	10	0	7	0	0	0	2	17	2	0	2	17	0	0	0	48	5	0	0	0	0
3	0	3	3	3	9	3	12	2	0	0	3	0	0	4	2	22	2	2	2	22	0	3	5	46	3	2	2	0	0
0	0	0	11	0	0	7	5	0	5	6	0	6	5	4	6	8	4	4	0	12	0	6	5	2	2	4	4	0	0
0	0	0	8	0	0	0	0	3	0	5	5	0	0	0	0	0	0	0	4	3	4	0	0	2	2	0	0	0	3
5	4	8	4	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	3	0	0	4	0	0	0	0	0	2
5	4	4	2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	4	0	0	0	0	7	0
0	0	0	5	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0
0	0	7	5	8	0	8	0	4	0	0	0	0	0	10	3	6	10	0	5	3	0	7	11	0	2	5	5	0	3
0	15	16	5	9	11	10	0	0	6	0	0	0	0	0	14	6	0	0	0	0	0	9	0	4	2	0	0	12	3
0	44	20	10	5	8	6	4	3	9	5	5	11	9	8	69	3	11	12	0	3	0	5	12	4	12	4	7	4	3
*	0	10	0	11	0	0	0	5	0	0	0	0	0	6	4	3	0	12	0	0	0	0	0	0	2	0	0	0	0
*	*	32	11	0	9	8	0	4	0	0	7	0	0	0	32	3	9	5	0	0	0	0	15	8	15	0	0	5	0
*	*	*	5	15	0	0	0	4	0	0	7	0	0	5	23	12	9	19	11	3	6	0	5	11	10	0	0	5	3
*	*	*	*	0	0	0	0	0	0	0	0	0	0	2	8	2	6	0	0	3	0	2	6	3	5	2	2	2	2
*	*	*	*	*	5	9	0	8	0	0	0	8	0	11	3	9	5	5	0	0	0	0	0	7	4	5	0	0	0
*	*	*	*	*	*	5	0	9	4	0	15	15	0	4	8	3	11	7	0	3	4	5	8	8	3	12	18	12	3
*	*	*	*	*	*	*	7	0	6	0	0	9	0	0	4	0	0	0	0	4	0	0	0	2	2	11	0	0	0
*	*	*	*	*	*	*	*	0	5	0	0	0	0	0	3	0	4	0	9	15	0	0	0	10	0	4	0	0	0
*	*	*	*	*	*	*	*	*	27	8	24	4	0	0	7	2	6	9	0	0	0	4	0	17	22	3	3	7	23
*	*	*	*	*	*	*	*	*	*	6	11	11	14	17	9	0	20	12	0	0	5	17	9	2	7	13	19	13	0
*	*	*	*	*	*	*	*	*	*	*	15	8	12	10	7	0	5	10	6	0	0	8	5	4	6	5	5	0	6
*	*	*	*	*	*	*	*	*	*	*	*	15	6	0	3	3	0	10	11	3	0	8	11	13	8	0	9	11	6
*	*	*	*	*	*	*	*	*	*	*	*	*	24	21	13	0	10	15	0	7	0	8	16	4	6	16	9	5	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	48	27	3	8	26	14	0	0	12	18	2	7	9	12	9	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	36	5	30	23	4	3	0	10	20	2	9	12	25	8	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	4	11	19	9	2	0	3	11	6	18	6	10	8	2
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	2	5	5	14	8	0	0	11	16	3	2	0	2

·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	33	8	3	4	10	12	2	14	19	31	8	3
·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	16	0	9	5	8	4	12	12	14	12	0
·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	0	0	0	0	0	2	0	0	0	3
·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	25	3	3	18	4	3	3	0	2
·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	0	0	6	0	0	4	0	6
·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	32	2	2	11	23	11	0
·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	0	4	8	30	4	0
·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	28	2	0	6	15
·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	4	8	5	53
·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	18	24	0
·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	37	2
·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	0
·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
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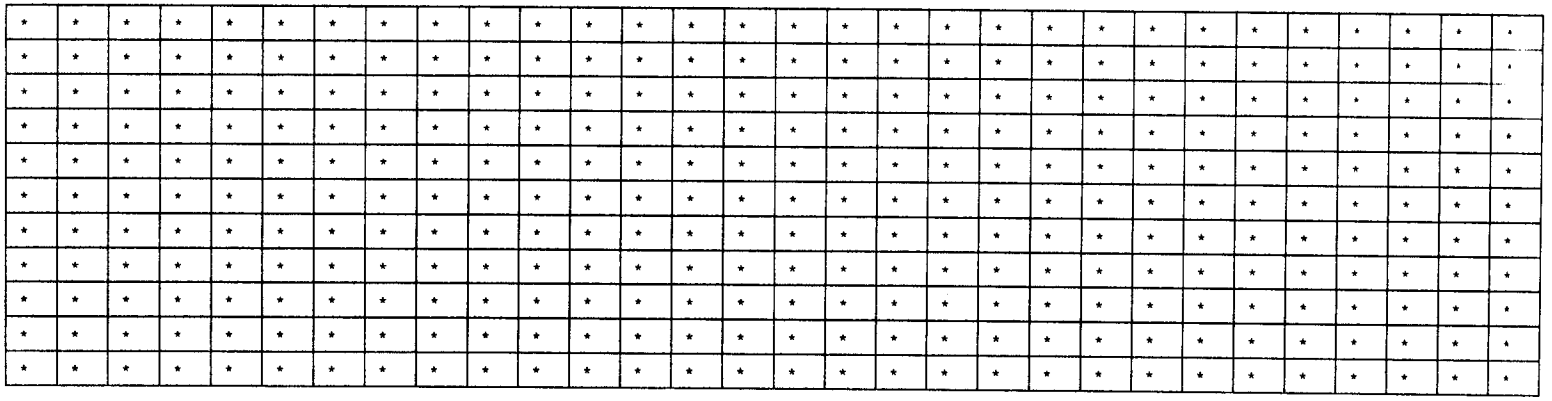

Table 3.1c Similarity Index between Quadrats cont.

61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
5	15	7	8	18	7	6	28	15	27	4	0	4	4	4	4	4	3	10	7	8	4	8	11	18	0	0	0	0	0
5	10	9	5	9	3	43	56	10	12	4	4	4	4	4	3	4	3	3	0	0	1	1	2	0	0	0	4	0	0
3	0	5	7	14	3	31	22	20	12	0	0	0	0	0	0	0	0	0	0	1	1	2	4	3	0	0	4	0	0
6	5	6	19	21	5	4	17	10	32	0	0	6	6	6	5	0	0	0	0	3	1	3	4	7	0	0	0	0	0
6	4	13	14	22	4	7	8	8	14	5	0	5	0	5	4	5	0	0	0	1	1	1	2	3	0	0	0	0	0
3	3	7	4	8	3	24	14	9	4	0	0	0	0	0	5	3	2	2	4	0	0	0	0	0	0	0	0	0	0
5	2	13	10	16	4	22	10	17	17	0	0	0	0	0	0	0	0	0	0	7	5	8	11	13	0	0	2	0	0
2	0	5	13	14	14	3	3	15	28	4	0	8	8	8	10	4	6	3	5	9	5	9	13	19	0	0	0	0	0
3	4	12	13	12	11	18	24	14	8	4	0	4	0	4	7	9	0	0	0	3	2	4	6	6	0	0	5	0	0
4	4	16	14	16	0	13	11	8	8	5	0	5	0	5	4	5	0	0	0	1	1	1	2	3	0	0	0	0	6
0	0	0	4	0	7	0	0	11	24	19	0	10	9	10	20	20	10	12	7	10	4	9	15	29	0	0	0	0	0
19	0	0	3	0	5	15	0	0	0	11	0	6	5	6	18	11	11	8	9	0	0	0	0	0	0	0	0	0	0
0	0	0	2	2	5	16	0	0	0	3	0	3	3	3	15	6	4	7	4	0	1	1	8	0	0	0	3	0	0
3	0	2	0	2	0	9	10	2	8	4	0	4	0	4	3	4	54	45	43	24	12	18	11	41	0	0	0	0	0
6	6	3	7	13	5	17	14	0	14	6	0	13	6	13	25	27	0	9	0	0	0	0	4	0	0	0	0	0	0
1	2	5	0	2	2	21	6	3	2	0	0	0	0	0	2	2	38	30	33	20	12	15	10	26	0	0	2	0	0
3	0	4	6	6	0	15	9	33	33	2	0	2	2	2	4	2	8	8	9	28	16	27	35	26	0	0	0	0	0
0	0	2	0	0	0	1	4	60	19	0	0	0	0	0	0	0	0	0	0	53	71	73	47	13	0	0	0	0	0
2	8	7	0	4	0	16	6	2	4	0	0	0	0	0	0	0	0	0	0	2	1	2	3	5	0	0	0	0	0
0	0	3	0	0	0	12	0	36	34	0	0	0	0	0	2	2	2	2	2	32	18	31	42	23	0	0	0	0	0

0	0	4	2	0	3	16	0	36	38	3	0	3	3	3	10	6	7	5	7	32	17	31	42	26	0	0	0	0	0
2	0	3	3	3	0	21	5	4	7	0	0	0	0	0	0	0	21	23	16	9	4	9	13	24	0	0	0	0	0
2	0	0	0	0	0	4	4	0	3	0	0	0	0	0	9	5	18	20	17	6	3	5	8	14	0	0	0	0	0
0	4	3	0	0	0	3	0	2	3	0	0	0	0	0	0	0	3	4	3	1	1	1	2	3	0	0	0	0	0
0	4	3	0	0	0	3	0	2	0	0	0	0	0	0	0	0	3	4	3	1	1	1	2	3	0	0	0	0	0
0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	8	8	6	4	2	4	5	7	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	7	12	7	13	0	0	0	0	17	0	17	8	17	24	26	10	5	7	0	0	0	0	0	0	0	0	0	0
2	8	0	8	11	0	0	6	0	4	10	0	10	0	20	14	21	0	0	0	0	0	0	0	5	0	0	0	0	17
2	0	3	13	12	10	12	4	7	13	6	0	6	0	6	5	6	0	4	3	1	1	1	2	4	0	0	0	0	0
0	10	4	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	7	0	0	14	5	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	7	8	10	0	10	6	4	11	8	0	8	0	8	6	8	0	0	0	0	0	0	0	0	0	0	0	0	0
1	2	0	2	2	2	4	4	0	2	2	0	2	2	2	4	3	46	34	71	40	11	15	9	28	0	0	0	0	0
7	22	7	12	7	0	5	12	4	8	9	0	18	9	18	13	10	0	0	0	0	0	0	0	0	0	0	0	0	0
4	5	11	18	14	9	7	8	2	6	5	0	0	5	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	4	0	0	0	0	2	4	0	0	10	10	10	14	11	0	6	0	0	0	0	3	0	0	0	0	0	0
0	0	0	0	0	0	0	0	9	17	0	7	7	6	0	0	0	0	0	0	9	4	7	11	20	0	0	0	0	0
16	8	5	8	8	7	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	9	10	12	5	0	5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
7	0	7	8	4	7	0	0	2	4	0	0	0	0	0	0	0	0	0	0	2	1	3	10	9	0	0	0	0	0
9	7	7	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0
9	14	4	12	7	0	0	0	4	4	0	0	0	0	0	6	9	0	6	0	0	0	0	2	0	0	0	0	0	0
2	0	22	10	10	5	0	0	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	26	22	17	14	0	0	8	13	6	0	6	5	6	4	6	4	4	3	0	0	0	0	0	0	0	0	0	0
3	0	18	19	18	13	8	3	7	12	4	0	4	0	4	3	4	0	3	2	1	1	1	2	3	0	0	0	0	0
0	3	6	9	6	0	33	8	3	2	3	0	3	0	3	3	3	0	0	0	0	0	0	0	2	0	0	0	0	0
6	0	33	30	28	18	7	12	7	6	5	6	11	10	5	4	5	4	4	3	1	0	0	0	0	0	0	0	0	0
4	0	28	34	29	14	0	4	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	15	20	12	10	0	0	0	0	0	0	0	0	0	5	6	4	4	3	0	0	0	0	0	0	0	0	0	0
3	0	0	2	0	3	16	21	20	19	14	11	18	18	18	22	15	14	17	4	10	5	10	19	21	0	0	0	8	4
2	0	3	0	6	0	4	20	7	11	0	0	7	7	7	5	7	0	0	0	0	0	0	0	0	0	0	0	9	10
2	0	7	12	4	20	0	0	4	8	9	0	9	8	9	6	9	5	6	4	0	0	0	0	0	0	0	0	0	13
4	5	3	10	6	5	4	0	5	3	6	0	6	6	6	9	6	8	4	6	0	0	0	0	0	0	0	0	7	0
15	4	7	0	3	2	11	8	40	39	0	0	2	2	2	2	0	0	0	0	36	20	35	47	22	0	0	2	0	2
57	2	11	11	12	2	17	7	4	6	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	2	0	0
6	5	23	13	6	14	0	4	3	6	6	0	11	11	11	9	6	4	4	3	1	0	0	0	0	0	0	0	0	0

4	9	11	18	16	13	4	4	5	6	5	0	5	5	5	4	5	3	4	3	0	0	0	0	0	0	0	0	6	0
4	10	9	6	9	10	0	9	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
59	0	0	4	4	0	0	11	1	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*	9	5	9	5	0	0	4	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
*	*	7	4	3	0	5	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0
*	*	*	27	30	16	3	6	9	12	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0
*	*	*	*	37	25	0	3	5	3	8	0	4	4	4	4	4	3	3	2	0	0	0	0	0	0	0	0	0	0
*	*	*	*	*	13	3	13	7	15	4	0	4	0	4	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0
*	*	*	*	*	*	0	5	0	0	7	0	7	7	7	6	8	4	5	3	0	0	0	0	0	0	0	0	0	0
*	*	*	*	*	*	*	25	3	3	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	0	0	6	0	0
*	*	*	*	*	*	*	*	9	17	6	7	6	6	6	5	7	4	5	0	0	0	0	0	0	0	0	0	0	0
*	*	*	*	*	*	*	*	*	39	0	0	2	2	2	2	0	0	0	0	70	40	68	66	19	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	0	0	4	4	4	4	0	0	0	0	26	13	24	36	35	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	*	35	60	57	60	48	32	21	18	4	0	0	0	0	0	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	*	*	59	44	35	15	13	17	13	0	2	0	0	0	0	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	76	70	41	42	21	18	4	2	0	0	0	0	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	67	40	30	21	18	4	2	0	0	0	0	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	48	42	21	18	4	0	0	0	0	0	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	50	21	29	13	0	0	0	9	0	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	22	25	8	0	0	0	3	0	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	71	67	30	13	19	12	48	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	54	21	10	20	17	57	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	46	12	17	11	38	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	49	76	68	38	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	62	37	18	0	0	1	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	67	38	0	0	2	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	40	0	0	3	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	40	29	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	33	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	40

Table 3.2. Similarty coeficent values for Cluster analysis

Step	Clusters	Distance	Similarity	Joined 1	Joined 2
1	105	20.7547169	79.2452831	51	83
2	104	23.8095245	76.1904755	73	74
3	103	24.347826	75.652174	51	81
4	102	26.3157902	73.6842098	86	97
5	101	27.1428566	72.8571434	18	51
6	100	28.695652	71.304348	34	80
7	99	29.2452831	70.7547169	18	82
8	98	29.4117641	70.5882359	78	79
9	97	29.7560978	70.2439022	18	69
10	96	30	70	73	75
11	95	30.2325573	69.7674427	36	99
12	94	30.5555553	69.4444447	30	46
13	93	32.2222214	67.7777786	18	84
14	92	32.3076935	67.6923065	24	25
15	91	33.3333321	66.6666679	34	78
16	90	33.3333321	66.6666679	62	94
17	89	33.3333321	66.6666679	89	91
18	88	34.8837204	65.1162796	20	55
19	87	35.7142868	64.2857132	62	93
20	86	35.8490562	64.1509438	37	100
21	85	36.1702118	63.8297882	35	36
22	84	36.9863014	63.0136986	20	21
23	83	37.0370369	62.9629631	37	101
24	82	37.5	62.5	88	96
25	81	40	60	71	73
26	80	41.0852699	58.9147301	60	61
27	79	41.1764717	58.8235283	71	72

28	78	42.2222214	57.7777786	54	92
29	77	42.8571434	57.1428566	90	95
30	76	43.3734932	56.6265068	56	60
31	75	43.396225	56.603775	34	85
32	74	43.75	56.25	2	68
33	73	45.4545441	54.5454559	12	15
34	72	45.9459457	54.0540543	26	27
35	71	46.2686577	53.7313423	14	34
36	70	46.6666679	53.3333321	23	24
37	69	46.6666679	53.3333321	41	103
38	68	47.2222214	52.7777786	58	59
39	67	50	50	35	98
40	66	50	50	57	58
41	65	50	50	76	77
42	64	50	50	86	88
43	63	50	50	86	89
44	62	50	50	87	90
45	61	50.4273491	49.5726509	14	16
46	60	51.3513527	48.6486473	38	104
47	59	51.7241364	48.2758636	71	76
48	58	52.173912	47.826088	44	45
49	57	52.2012596	47.7987404	17	20
50	56	52.3809509	47.6190491	23	26
51	55	53.5483856	46.4516144	14	18
52	54	54.5454559	45.4545441	39	40
53	53	55.5555573	44.4444427	11	12
54	52	55.5555573	44.4444427	86	87
55	51	55.9748421	44.0251579	14	17
56	50	56.4356422	43.5643578	14	102
57	49	56.7567558	43.2432442	5	10
58	48	56.8627434	43.1372566	50	66

59	47	57.1428566	42.8571434	2	67
60	46	58.3333321	41.6666679	6	7
61	45	58.3333321	41.6666679	31	32
62	44	58.4000015	41.5999985	3	6
63	43	58.4905663	41.5094337	2	3
64	42	60	40	37	38
65	41	60.60606	39.39394	14	70
66	40	60.6557388	39.3442612	14	56
67	39	62.0253181	37.9746819	5	9
68	38	62.31884	37.68116	4	5
69	37	62.9629631	37.0370369	64	65
70	36	64.0449448	35.9550552	14	41
71	35	64.2857132	35.7142868	31	33
72	34	64.7058792	35.2941208	1	11
73	33	65.9574432	34.0425568	22	23
74	32	66.1538467	33.8461533	49	64
75	31	66.6666641	33.3333359	48	63
76	30	66.6666641	33.3333359	105	106
77	29	67.123291	32.876709	30	44
78	28	67.272728	32.727272	48	49
79	27	67.375885	32.624115	2	14
80	26	67.375885	32.624115	2	13
81	25	67.5	32.5	2	47
82	24	67.5675659	32.4324341	2	4
83	23	67.5675659	32.4324341	53	54
84	22	68	32	1	71
85	21	68.1159439	31.8840561	1	2
86	20	68.421051	31.578949	30	31
87	19	68.75	31.25	1	22
88	18	69.0476227	30.9523773	1	8
89	17	69.2307663	30.7692337	1	19

90	16	70.370369	29.629631	30	48
91	15	70.491806	29.508194	30	57
92	14	70.5882339	29.4117661	35	53
93	13	70.5882339	29.4117661	35	42
94	12	71.4285736	28.5714264	1	39
95	11	71.9298248	28.0701752	30	50
96	10	72.8813553	27.1186447	30	35
97	9	73.6842117	26.3157883	1	37
98	8	73.9130402	26.0869598	1	28
99	7	75	25	1	30
100	6	75	25	1	52
101	5	75.757576	24.242424	1	43
102	4	77.1428604	22.8571396	1	29
103	3	79.4871826	20.5128174	1	105
104	2	80	20	1	86
105	1	84.9056625	15.0943375	1	62

Table 3.3 Basal Area, Density, Frequency and IVI of Important Species for the 18 clusters

Cluster -1

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
1	*Aporosa cardiosperma*	2	0.67	33.33	0.12	12.24	7.97	LT
2	*Garcinia gummi-gutta*	11	3.67	33.33	0.16	16.05	10.49	LT
3	*Alstonia scholaris*	1	0.33	66.67	0.72	71.66	18.40	LT
4	*Artocarpus hirsutus*	3	1.00	66.67	0.75	74.55	18.56	LT
5	*Artocarpus heterophyllus*	2	0.67	66.67	1.44	144.49	24.54	MT
6	*Vepris bilocularis*	5	1.67	100.00	3.60	359.54	45.45	MT
7	*Antidesma montanum*	2	0.67	100.00	1.72	172.15	49.60	MT
8	*Elaeocarpus tuberculatus*	5	1.67	100.00	5.52	552.46	55.56	ST
9	*Vernonia arborea*	12	4.00	100.00	5.07	507.01	69.46	ST
			14.33	666.67	19.10	1910.15	300.03	

Cluster -2

Sl. No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
1	*Albizia odoratissima*	3	0.33	22.22	0.43	14.41	25.95	MT
2	*Tabernaemontana alternifolia*	17	0.11	11.11	0.02	0.56	6.25	LT
3	*Melicope lunu-ankenda*	13	0.11	11.11	0.04	1.23	6.84	MT
4	*Olea dioica*	2	0.33	11.11	0.13	4.21	12.98	SH
5	*Elaeocarpus tuberculatus*	14	0.22	22.22	0.51	16.85	26.35	ST
6	*Maesopsis eminii*	3	0.33	22.22	0.47	15.67	27.06	ST
7	*Datura stramonium*	1	1.89	44.44	0.15	5.13	50.35	ST
8	*Ficus hispida*	3	1.56	55.56	0.53	17.80	60.25	ST
9	*Debregeasia longifolia*	1	1.44	77.78	1.13	37.72	84.03	ST
		57	6.33	278	3.408	113.59	300.1	

Cluster -3

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
1	*Canarium strictum*	2	0.67	0.67	0.95	95.32	14.20	LT
2	*Syzygium occidentalis*	1	0.33	0.33	0.13	12.84	5.10	ST
3	*Hopea parviflora*	1	0.33	0.33	0.21	21.15	5.58	LT
4	*Ficus beddomei*	2	0.67	0.33	0.40	40.31	7.91	LT
5	*Mesua ferrea var ferrea*	2	0.67	0.67	0.22	21.68	9.97	LT
6	*Melicope lunu-ankenda*	2	0.67	0.67	0.32	31.85	10.55	ST
7	*Persea macrantha*	6	2.00	0.67	0.08	7.96	14.12	MT
8	*Elaeocarpus tuberculatus*	4	1.33	0.67	0.67	67.42	15.06	LT
9	*Holigarna grahamii*	3	1.00	0.67	0.89	89.35	15.09	MT
10	*Chionanthus mala-elengi*	3	1.00	0.67	0.96	96.42	15.50	ST
11	*Vitex leucoxylon*	3	1.00	0.67	1.40	140.45	18.03	SH
12	*Cullenia exarillata*	3	1.00	0.67	1.78	178.13	20.19	LT
13	*Palaquium ellipticum*	5	1.67	1.00	1.12	111.96	21.98	LT
14	*Madhuca neriifolia*	6	2.00	1.00	1.96	195.87	28.04	ST
15	*Pandanus foetidus*	29	9.67	0.67	1.03	102.61	47.95	SH
16	*Dendrocnide sinuata*	9	3.00	1.00	5.26	526.25	50.74	SH

Cluster -4

Sl. No	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
1	*Xanthophyllum arnottianum*	2	0.5	0.25	0.29	21.56	5.56	ST
2	*Schefflera venulosa*	2	0.5	0.5	0.06	4.52	7.32	LI
3	*Briedelia retusa*	2	0.5	0.5	0.17	12.90	7.57	MT
4	*Garcinia gummi-gutta*	2	0.5	0.5	0.17	13.08	7.58	MT

5	*Ficus rigida*	3	0.75	0.5	0.11	8.31	8.75	ST
6	*Hydnocarpus alpina*	2	0.5	0.5	0.93	69.44	9.30	MT
7	*Mallotus philippensis*	3	0.75	0.5	0.64	47.82	9.95	MT
8	*Diploclisia glaucescens*	3	0.75	0.75	0.17	12.38	11.14	LI
9	*Schleichera oleosa*	3	0.75	0.5	1.38	103.34	11.65	MT
10	*Syzygium laetum*	4	1	0.75	0.65	48.84	13.57	ST
11	*Entada rheedei*	6	1.5	0.75	0.55	40.99	15.96	LI
12	*Cullenia exarillata*	4	1	0.75	3.11	233.26	19.20	LT
13	*Heritiera papilio*	4	1	0.75	3.88	290.93	20.96	MT
14	*Hopea parviflora*	4	1	0.75	5.01	375.51	23.54	LT
15	*Palaquium ellipticum*	5	1.25	0.75	7.07	529.88	29.57	LT
16	*Meliosma simplicifolia*	16	4	1	7.77	582.89	47.94	ST
17	*Madhuca neriifolia*	11	2.75	1	11.73	880.05	50.43	ST
		76	**19**	**11**	**43.68**	**3275.69**	**300.00**	

Cluster -5

Sl No.	**Name of Species**	**Tot**	**D**	**F**	**BA (m2)**	**Dominance**	**IVI**	
1	*Baccaurea courtallensis*	2	1	1	0.05	7.27	10.71	ST
2	*Mycetia acuminata*	1	0.5	0.5	0.01	1.15	5.24	SH
3	*Litsea floribunda*	1	0.5	0.5	0.02	2.75	5.31	MT
4	*Prismatomeris tetrandra*	1	0.5	0.5	0.03	5.20	5.43	SH
5	*Litsea coriacea*	1	0.5	0.5	0.05	8.03	5.56	ST
6	*Macranga peltata*	1	0.5	0.5	0.24	35.74	6.85	MT
7	*Symplocos macrophylla*	3	1.5	0.5	0.04	5.52	9.37	ST
8	*Symplocos cochinchinensis*	4	2	0.5	0.19	29.06	12.42	ST
9	*Carallia brachiata*	2	1	0.5	0.78	116.25	12.57	MT
10	*Cinnamomum sulphuratum*	3	1.5	1	0.11	16.07	13.08	ST
11	*Terminalia paniculata*	2	1	1	0.71	106.06	15.32	MT
12	*Schleichera oleosa*	3	1.5	1	0.49	74.05	15.79	MT

13	*Canarium strictum*	3	1.5	1	0.52	78.27	15.98	LT
14	*Glochidion ellipticum*	3	1.5	0.5	1.13	168.84	16.98	ST
15	*Syzygium cumini*	2	1	1	1.02	153.06	17.51	MT
16	*Gymnacranthera canarica*	2	1	1	1.24	185.39	19.02	MT
17	*Dipterocarpus indicus*	2	1	1	1.49	223.91	20.81	LT
18	*Polyalthia fragrans*	4	2	1	1.11	167.05	22.08	MT
19	*Otonephelium stipulaceum*	5	2.5	1	1.10	164.38	23.92	ST
20	*Diospyros crumenata*	6	3	1	3.98	596.95	46.05	MT
		51	**25.5**	**15.5**	**14.30**	**2145.01**	**300.00**	

Cluster -6

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
1	*Persea macrantha*	1	0.33	0.33	0.02	1.54	2.74	MT
2	*Antidesma montanum*	1	0.33	0.33	0.02	1.54	2.74	ST
3	*Agrostistachys borneensis*	1	0.33	0.33	0.03	2.87	2.80	SH
4	*Hydnocarpus alpina*	1	0.33	0.33	0.03	3.06	2.81	ST
5	*Kattavanakku*	1	0.33	0.33	0.09	9.46	3.09	ST
6	*Myristica beddomei*	1	0.33	0.33	0.13	12.64	3.23	MT
7	*Vernonia arborea*	2	0.67	0.67	0.05	5.48	5.59	MT
8	*Seethali*	3	1.00	0.33	0.29	28.74	5.83	MT
9	*Glochidion zeylanicum var. zeylanicum*	2	0.67	0.67	0.13	13.04	5.92	ST
10	*Spondias pinnata*	2	0.67	0.67	0.16	16.05	6.05	MT
11	*Clerodendrum infortunatum*	3	1.00	0.67	0.04	4.36	6.50	SH
12	*Oreocnide integrifolia*	3	1.00	0.67	0.13	13.04	6.87	SH
13	*Alstonia scholaris*	2	0.67	0.67	0.36	36.12	6.93	LT

14	*Caesalpinia crista*	4	1.33	0.33	0.35	35.11	7.06	LI
15	*Meliosma simplicifolia*	3	1.00	0.67	0.26	25.51	7.42	ST
16	*Polyalthia coffeoides*	3	1.00	0.67	0.26	26.08	7.44	MT
17	*Macranga peltata*	2	0.67	0.67	0.53	53.41	7.68	MT
18	*Clausena anisata*	4	1.33	0.67	0.12	11.85	7.77	SH
19	*Melicope lunu-ankenda*	3	1.00	0.67	0.43	43.22	8.19	ST
20	*Ficus talbotii*	1	0.33	0.33	1.27	127.39	8.23	MT
21	*Aglaia lawii*	3	1.00	0.67	0.59	59.34	8.89	ST
22	*Actinodaphne bourdillonii*	6	2.00	0.67	0.40	39.59	10.89	ST
23	*Elaeocarpus tuberculatus*	3	1.00	1.00	1.07	107.24	12.70	LT
24	*Callicarpa tomentosa*	6	2.00	1.00	0.81	80.51	14.40	SH
25	*Aporosa acuminata*	11	3.67	0.67	0.17	17.20	14.67	ST
26	*Neolitsea cassia*	6	2.00	1.00	1.00	99.77	15.24	MT
27	*Cullenia exarillata*	5	1.67	1.00	1.63	162.66	17.02	LT
28	*Poeciloneuron indicum*	4	1.33	1.00	1.95	195.08	17.48	MT
29	*Schleichera oleosa*	11	3.67	1.00	1.31	131.24	21.37	MT
30	*Vateria indica*	7	2.33	1.00	9.32	932.11	52.45	LT
		105	**35.00**	**19.33**	**22.95**	**2295.29**	**300.03**	

Cluster -7

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
1	*Acacia sinuata*	1	0.20	0.20	0.01	0.62	1.52	LI
2	*Gnetum edule*	1	0.20	0.20	0.01	0.43	1.51	LI
3	*Memecylon angustifolium*	1	0.20	0.20	0.01	0.46	1.52	SH
4	*Leea asiatica*	1	0.20	0.20	0.01	0.49	1.52	SH

5	*Cinnamomum sulphuratum*	1	0.20	0.20	0.01	0.55	1.52	ST
6	*Mussaenda frondosa*	1	0.20	0.20	0.01	0.65	1.52	LI
7	*Actinodaphne malabarica*	1	0.20	0.20	0.01	0.76	1.52	ST
8	*Caesalpinia mimosoides*	1	0.20	0.20	0.02	1.01	1.52	LI
9	*Garcinia gummi-gutta*	1	0.20	0.20	0.02	1.01	1.52	MT
10	*Gmelina arborea*	1	0.20	0.20	0.02	1.01	1.52	MT
11	*Allophylus cobbe*	1	0.20	0.20	0.02	1.10	1.53	ST
12	*Sarcostigma kleinii*	1	0.20	0.20	0.02	1.10	1.53	ST
13	*Canarium strictum*	1	0.20	0.20	0.03	2.02	1.54	Lt
14	*Garcinia spicata*	1	0.20	0.20	0.03	2.02	1.54	ST
15	*Ixora brachiata*	1	0.20	0.20	0.03	2.08	1.54	ST
16	*Lagerstroemia speciosa*	1	0.20	0.20	0.04	2.34	1.55	MT
17	*Sterculia guttata*	1	0.20	0.20	0.04	2.62	1.55	ST
18	*Syzygium bourdillonii*	1	0.20	0.20	0.04	2.62	1.55	ST
19	*Calophyllum polyanthum*	1	0.20	0.20	0.05	2.76	1.55	LT
20	*Sapindus trifoliatus*	1	0.20	0.20	0.05	2.76	1.55	MT
21	*Otonephelium stipulaceum*	1	0.20	0.20	0.05	3.06	1.56	ST
22	*lagerstroemia microcarpa*	1	0.20	0.20	0.05	3.21	1.56	LT
23	*Carallia brachiata*	1	0.20	0.20	0.05	3.21	1.56	MT
24	*Syzygium chavaran*	1	0.20	0.20	0.06	3.45	1.56	MT
25	*Persea macrantha*	1	0.20	0.20	0.09	5.27	1.59	MT
26	*Terminalia travancorensis*	1	0.20	0.20	0.10	5.78	1.60	LT
27	*Syzygium lanceolatum*	1	0.20	0.20	0.10	5.78	1.60	MT
28	*Stereospermum colais var. colais*	1	0.20	0.20	0.13	7.70	1.63	MT
29	*Mesua ferrea var ferrea*	1	0.20	0.20	0.13	7.95	1.63	LT
30	*Artocarpus hirsutus*	1	0.20	0.20	0.13	8.07	1.64	MT
31	*Pterocarpus marsupium*	1	0.20	0.20	0.30	18.16	1.80	MT

32	*Syzygium cumini*	1	0.20	0.20	0.32	18.92	1.81	MT
33	*Turpinia malabarica*	1	0.20	0.20	0.51	30.82	2.00	MT
34	*Symplocos macrophylla*	2	0.40	0.20	0.02	1.39	2.09	ST
35	*Elaeocarpus serratus var. serratus*	2	0.40	0.20	0.10	5.89	2.16	ST
36	*Mallotus philippensis var. philippensis*	2	0.40	0.20	0.12	7.23	2.18	MT
37	*Madhuca neriifolia*	2	0.40	0.20	0.17	10.46	2.23	ST
38	*Aporosa cardiosperma*	2	0.40	0.20	0.21	12.85	2.27	ST
39	*Calophyllum austroindicum*	2	0.40	0.20	0.28	16.88	2.33	LT
40	*Aglaia lawii*	2	0.40	0.20	0.29	17.25	2.34	ST
41	*Dimocarpus longan*	2	0.40	0.20	0.30	17.98	2.35	MT
42	*Holigarna grahamii*	1	0.20	0.20	1.03	61.91	2.49	MT
43	*Bombax ceiba*	1	0.20	0.20	1.34	80.30	2.78	LT
44	*Seethali*	2	0.40	0.20	0.92	55.22	2.94	MT
45	*Strychnos colubrina*	2	0.40	0.40	0.02	1.50	3.04	LI
46	*Aglaia barberi*	2	0.40	0.40	0.06	3.53	3.07	MT
47	*Cinnamomum malabatrum*	2	0.40	0.40	0.15	9.23	3.16	ST
48	*Gymnacranthera canarica*	2	0.40	0.40	0.21	12.54	3.21	MT
49	*Entada rheedei*	2	0.40	0.40	0.27	16.17	3.27	LI
50	*Xanthophyllum arnottianum*	3	0.60	0.40	0.20	11.78	3.76	ST
51	*Lophopetalum wightianum*	2	0.40	0.20	1.91	114.70	3.88	LT
52	*Macranga peltata*	2	0.40	0.40	0.96	57.52	3.93	MT
53	*Cyathocalyx zeylanica*	3	0.60	0.40	0.46	27.52	4.01	MT
54	*Alstonia scholaris*	2	0.40	0.20	2.36	141.37	4.31	LT
55	*Prismatomeris tetrandra*	4	0.80	0.40	0.23	13.97	4.35	SH
56	*Hydnocarpus alpina*	6	1.20	0.20	0.31	18.35	4.58	ST
57	*Elaeocarpus variabilis*	3	0.60	0.40	1.29	77.20	4.80	MT
58	*Myristica beddomei*	5	1.00	0.40	0.47	28.21	5.13	MT
59	*Polyalthia fragrans*	4	0.80	0.60	2.74	164.60	7.69	MT
60	*Knema attenuata*	5	1.00	0.60	2.32	139.30	7.84	MT

61	*Diospyros crumenata*	4	0.80	0.40	4.89	293.63	8.79	MT
62	*Atuna travancorica*	10	2.00	0.60	5.70	341.90	13.84	ST
63	*Baccaurea courtallensis*	16	3.20	1.00	1.87	112.37	15.43	ST
64	*Schleichera oleosa*	14	2.80	1.00	9.37	562.37	21.46	MT
65	*Vateria indica*	11	2.20	1.00	11.81	708.69	22.12	LT
66	*Dysoxylum malabaricum*	10	2.00	1.00	18.03	1082.02	27.48	LT
67	*Chukrasia tabularis*	13	2.60	1.00	32.13	1928.06	42.57	MT
		180	**36.00**	**21.00**	**105.06**	**6303.68**	**300.00**	

Cluster -8

Sl No.	**Name of Species**	**Tot**	**D**	**F**	**BA (m2)**	**Dominance**	**IVI**	
1	*Palaquium ellipticum*	2	0.29	0.29	0.14	6.13	3.80	LT
2	*Syzygium bourdillonii*	1	0.14	0.14	0.01	0.44	1.82	ST
3	*Chionanthus mala-elengi*	1	0.14	0.14	0.03	1.23	1.85	ST
4	*Holigarna grahamii*	1	0.14	0.14	0.03	1.44	1.85	MT
5	*Actinodaphne malabarica*	1	0.14	0.14	0.03	1.44	1.85	ST
6	*Macranga peltata*	1	0.14	0.14	0.05	2.08	1.87	MT
7	*Sterculia guttata*	1	0.14	0.14	0.06	2.76	1.89	ST
8	*Aglaia perviridis*	1	0.14	0.14	0.09	3.76	1.92	MT
9	*Chukrasia tabularis*	1	0.14	0.14	0.11	4.91	1.95	MT
10	*Seethali*	1	0.14	0.14	0.17	7.17	2.02	MT
11	*Dalbergia lanceolaria*	1	0.14	0.14	0.17	7.27	2.02	MT
12	*Turpinia malabarica*	1	0.14	0.14	0.21	9.18	2.07	MT
13	*Aglaia barberi*	1	0.14	0.14	0.23	9.86	2.09	MT
14	*Paracroton pendulus*	1	0.14	0.14	0.25	10.81	2.12	MT
15	*Humboldtia vahliana*	1	0.14	0.14	0.26	11.06	2.13	ST
16	*Knema attenuata*	1	0.14	0.14	0.26	11.30	2.13	MT
17	*Diospyros candolleana*	1	0.14	0.14	0.29	12.32	2.16	MT
18	*Diospyros assimilis*	1	0.14	0.14	0.39	16.52	2.28	MT

19	*Artocarpus hirsutus*	1	0.14	0.14	0.46	19.65	2.37	MT
20	*Ixora brachiata*	2	0.29	0.14	0.03	1.40	2.50	ST
21	*Ochlandra scriptoria*	2	0.29	0.29	0.01	0.31	3.63	ST
22	*Syzygium cumini*	2	0.29	0.29	0.19	8.20	3.86	MT
23	*Dendrocnide sinuata*	3	0.43	0.29	0.24	10.33	4.57	SH
24	*Calophyllum polyanthum*	2	0.29	0.29	0.92	39.44	4.74	LT
25	*Baccaurea courtallensis*	4	0.57	0.29	0.28	11.80	5.26	ST
26	*Carallia brachiata*	4	0.57	0.29	0.54	23.07	5.58	MT
27	*Myristica malabarica*	4	0.57	0.29	0.63	26.94	5.69	MT
28	*Gmelina arborea*	3	0.43	0.43	0.84	36.04	6.46	MT
29	*Kottapidi maram*	4	0.57	0.43	0.70	30.10	6.94	MT
30	*Hydnocarpus pentandra*	4	0.57	0.43	0.85	36.49	7.12	ST
31	*Polyalthia fragrans*	5	0.71	0.43	1.08	46.21	8.05	MT
32	*Myristica beddomei*	4	0.57	0.43	1.95	83.61	8.46	MT
33	*Tetrameles nudiflora*	4	0.57	0.57	1.33	56.80	8.86	LT
34	*Lagerstroemia microcarpa*	5	0.71	0.43	1.90	81.59	9.05	LT
35	*Aglaia lawii*	7	1.00	0.43	2.94	126.14	11.61	MT
36	*Holigarna arnottiana*	6	0.86	0.71	3.18	136.29	13.58	MT
37	*Polyalthia coffeoides*	10	1.43	0.43	3.19	136.72	13.86	MT
38	*Vateria indica*	9	1.29	0.57	4.75	203.36	16.27	LT
39	*Bombax ceiba*	4	0.57	0.43	9.46	405.40	17.59	LT
40	*Terminalia travancorensis*	4	0.57	0.29	14.62	626.49	22.70	LT
41	*Lagerstroemia speciosa*	10	1.43	0.43	10.64	455.98	22.92	MT
42	*Mallotus philippensis*	24	3.43	0.29	4.21	180.34	23.03	MT
43	*Persea macrantha*	8	1.14	0.57	14.51	621.87	27.49	MT
			22	**12.29**	**82.233**	**3524.3**	**300**	

Cluster -9

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
1	*Rhizophora mucronata*	1	0.2	0.2	0.01	0.49	2.59	MT
2	*Ceiba pentandra*	1	0.2	0.2	0.02	0.92	2.63	MT
3	*Acacia caesia*	2	0.4	0.2	0.01	0.49	3.08	LI
5	*Avicennia officinalis*	2	0.4	0.2	0.01	0.84	3.12	ST
6	*Talipariti tiliaceum*	2	0.4	0.2	0.02	1.50	3.19	SH
7	*Hydnocarpus pentandra*	1	0.2	0.2	0.11	6.88	3.27	ST
9	*Polyalthia longifolia*	2	0.4	0.2	0.05	3.21	3.37	MT
13	*Anacardium occidentale*	2	0.4	0.2	0.07	4.40	3.50	ST
14	*Derris trifoliata*	3	0.6	0.2	0.00	0.15	3.54	LI
15	*Lawsonia inermis*	3	0.6	0.2	0.00	0.15	3.54	SH
16	*Hibiscus rosa-sinensis*	3	0.6	0.2	0.00	0.21	3.55	SH
19	*Caesalpinia crista*	3	0.6	0.2	0.00	0.28	3.56	LI
20	*Terminalia paniculata*	2	0.4	0.2	0.11	6.88	3.77	MT
21	*Acrostichum aurium*	4	0.8	0.2	0.12	7.35	4.81	SH
22	*Caryota urens*	2	0.4	0.4	0.16	9.63	6.10	MT
25	*Holigarna arnottiana*	2	0.4	0.4	0.17	10.46	6.19	MT
26	*Pandanus unipapillatus*	8	1.6	0.2	0.07	4.40	6.47	ST
28	*Pandnaus kaida*	8	1.6	0.2	0.10	5.78	6.62	ST
30	*Calycopteris floribunda*	5	1	0.4	0.06	3.37	6.92	LI
35	*Ailanthus triphysa*	4	0.8	0.4	0.13	8.07	6.92	ST
36	*Artocarpus hirsutus*	3	0.6	0.4	0.55	33.04	9.09	MT
38	*Trema orientalis*	8	1.6	0.6	0.53	31.80	13.48	ST

40	*Thespesia populnea*	7	1.4	0.4	1.00	60.20	13.97	MT
41	*Ficus hispida*	11	2.2	0.6	0.60	35.86	15.40	ST
43	*Ficus racemosa*	3	0.6	0.2	2.83	169.69	21.64	ST
44	*Gliricidia sepium*	20	4	1	0.75	45.02	24.91	ST
45	*Bambusa bambos*	9	1.8	0.8	6.92	414.95	56.91	ST
46	*Saccharum arundinaceum*	81	16.2	1	1.18	70.81	57.86	SH
			40.4	**9.8**	**15.61**	**936.86**	**300.00**	

Cluster -10

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
1	*Callicarpa tomentosa*	1	0.2	0.2	0.01	0.59	3.68	SH
2	*Vernonia arborea*	1	0.2	0.2	0.03	1.66	3.75	MT
3	*Glochidion zeylanicum var. zeylanicum*	1	0.2	0.2	0.05	3.06	3.84	ST
4	*Turpinia cochinchinensis*	2	0.4	0.2	0.11	6.32	4.91	MT
5	*Ochlandra scriptoria*	5	1	0.2	0.05	3.06	7.29	ST
6	*Erythrina indica*	2	0.4	0.4	0.45	27.06	9.04	MT
7	*Vitex leucoxylon*	5	1	0.4	0.26	15.31	10.86	SH
8	*Wendlandia thyrsoidea*	5	1	0.4	0.36	21.67	11.28	ST
9	*Ligustrum robustum*	3	0.6	0.6	0.29	17.43	12.05	ST
10	*Symplocos cochinchinensis*	5	1	0.4	0.70	41.85	12.59	ST
11	*Meliosma pinnata*	3	0.6	0.4	1.19	71.55	12.80	ST
12	*Elettaria cardamomum*	12	2.4	0.4	0.05	3.21	16.11	SH
13	*Syzygium lanceolatum*	6	1.2	0.4	2.36	141.89	19.96	ST
14	*Mallotus philippensis*	5	1	0.6	1.88	112.83	19.98	MT
15	*Cinnamomum macrocarpum*	7	1.4	0.6	5.02	301.16	33.96	LT

16	*Ficus racemosa*	3	0.6	0.6	12.22	733.34	58.63	MT'
17	*Maesa indica*	50	10	1	0.59	35.34	59.29	SH
			23	**7.2**	**25.62**	**1537.33**	**300.01**	

Cluster -11

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
1	*Callicarpa tomentosa*	1	0.5	0.5	0.00	0.69	4.55	SH
2	*Polyalthia coffeoides*	1	0.5	0.5	0.01	1.55	4.57	MT
3	*Melicope lunu-ankenda*	1	0.5	0.5	0.04	6.54	4.73	ST
4	*Calophyllum autroindicuam*	1	0.5	0.5	0.07	10.33	4.84	MT
5	*Persea macrantha*	1	0.5	0.5	0.07	10.33	4.84	MT
6	*Dimocarpus longan*	1	0.5	0.5	0.07	10.78	4.86	MT
7	*Garcinia indica*	1	0.5	0.5	0.28	42.21	5.83	MT
8	*Calamus thwaitesii*	4	2	0.5	0.05	8.03	8.34	LI
9	*Schleichera oleosa*	2	1	1	0.35	52.67	10.67	MT
10	*Otonephelium stipulaceum*	3	1.5	1	0.10	14.45	10.68	ST
11	*Mangifera indica*	3	1.5	1	0.21	32.12	11.23	LT
12	*Bhesa indica*	2	1	0.5	1.35	202.72	11.97	MT
13	*Vateria indica*	3	1.5	0.5	1.16	174.27	12.28	LT
14	*Cinnamomum malabatrum*	4	2	1	0.41	61.54	13.33	ST
15	*Garcinia gummi-gutta*	3	1.5	1	1.05	157.37	15.09	MT
16	*Lophopetalum wightianum*	1	0.5	0.5	2.37	356.03	15.51	LT
17	*Aglaia barberi*	4	2	1	2.30	344.39	22.05	MT
18	*Madhuca neriifolia*	3	1.5	1	2.98	447.31	24.04	ST

19	*Diospyros paniculata*	6	3	1	3.02	453.17	27.79	MT
20	*Syzygium occidentalis*	14	7	1	3.11	466.51	37.73	ST
21	*Ochlandra travancorica*	24	12	0.5	2.59	388.02	43.88	ST
			41.5	**15**	**21.61**	**3241.02**	**298.81**	

Cluster -12

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
1	*Acacia sinuata*	1	0.14	0.14	0.01	0.35	3.47	LI
2	*Ziziphus oenoplia*	1	0.14	0.14	0.01	0.39	3.47	LI
3	*Radermachera xylocarpa*	2	0.29	0.14	0.06	2.64	5.02	ST
4	*Terminalia elliptica*	2	0.29	0.14	0.28	11.93	6.07	LT
5	*Vitex leucoxylon*	5	0.71	0.29	0.10	4.36	11.24	SH
6	*Grewia tiliifolia*	3	0.43	0.43	0.25	10.81	11.50	MT
7	*Terminalia paniculata*	3	0.43	0.29	1.00	42.76	12.96	MT
8	*Lannea coromandelica*	4	0.57	0.29	0.77	33.00	13.16	ST
9	*Syzygium lanceolatum*	3	0.43	0.43	0.90	38.52	14.61	MT
10	*Glochidion zeylanicum*	4	0.57	0.57	0.27	11.43	14.99	ST
11	*Briedelia retusa*	4	0.57	0.57	0.50	21.33	16.11	MT
12	*Pongamia pinnata*	7	1.00	0.71	1.46	62.51	26.76	ST
13	*Gmelina arborea*	7	1.00	0.71	2.67	114.39	32.59	MT
14	*Macranga peltata*	7	1.00	0.86	3.22	138.02	37.37	MT
15	*Trewia nudiflora*	22	3.14	1.00	9.29	398.00	88.19	ST
			10.71	**6.71**	**20.78**	**890.44**	**297.50**	

Cluster -13

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
1	*Calamus thwaitesii*	1	0.25	0.25	0.00	0.37	1.79	ST
2	*Strychnos colubrina*	1	0.25	0.25	0.00	0.37	1.79	MT
3	*Diospyros buxifolia*	1	0.25	0.25	0.01	0.61	1.79	LI
4	*Olea dioica*	1	0.25	0.25	0.01	0.61	1.79	LI
5	*Schefflera venulosa*	1	0.25	0.25	0.01	0.61	1.79	ST
6	*Ailanthus triphysa*	1	0.25	0.25	0.01	0.65	1.79	
7	*Mallotus atrovirens*	1	0.25	0.25	0.01	0.73	1.80	
8	*Hopea ponga*	1	0.25	0.25	0.01	0.77	1.80	
9	*Chonemorpha grandiflora**	1	0.25	0.25	0.02	1.16	1.81	
10	*Mangifera indica*	1	0.25	0.25	0.02	1.32	1.81	
11	*Dalbergia lanceolaria ssp. lanceolaria*	1	0.25	0.25	0.04	3.36	1.85	
12	*Melicope lunu-ankenda*	1	0.25	0.25	0.05	4.02	1.86	
13	*Albizia lebbeck*	1	0.25	0.25	0.07	5.50	1.89	
14	*Kingiodendron pinnatum*	1	0.25	0.25	0.08	5.97	1.90	
15	*Myristica malabarica*	1	0.25	0.25	0.09	6.58	1.92	
16	*Garcinia gummi-gutta*	1	0.25	0.25	0.11	7.90	1.94	
17	*Cinnamomum malabatrum*	1	0.25	0.25	0.11	8.04	1.95	
18	*Flacourtia montana*	1	0.25	0.25	0.11	8.60	1.96	
19	*Pterospermum diversifolium*	1	0.25	0.25	0.16	11.70	2.02	
20	*Glochidion zeylanicum var. zeylanicum*	1	0.25	0.25	0.19	14.35	2.08	
21	*Dipterocarpus indicus*	1	0.25	0.25	0.35	26.33	2.32	
22	*Cinnamomum riparium*	2	0.5	0.25	0.01	1.05	2.50	
23	*Atalantia racemosa var. bourdillonii*	2	0.5	0.25	0.02	1.38	2.50	
24	*Baccaurea courtallensis*	2	0.5	0.25	0.03	2.01	2.52	
25	*Buchanania lanzan*	1	0.25	0.25	0.69	51.97	2.85	
26	*Xylia xylocarpa*	1	0.25	0.5	0.06	4.84	2.97	

27	*Poeciloneuron indicum*	1	0.25	0.25	0.82	61.15	3.04	
28	*Hydnocarpus alpina*	2	0.5	0.25	0.62	46.82	3.44	
29	*Polyalthia fragrans*	2	0.5	0.5	0.32	23.89	4.05	
30	*Syzygium occidentalis*	3	0.75	0.5	0.05	4.11	4.34	
31	*Leea indica*	3	0.75	0.5	0.09	6.96	4.40	
32	*Anamirta cocculus*	3	0.75	0.5	0.14	10.40	4.47	
33	*Bombax ceiba*	2	0.5	0.5	0.79	59.25	4.78	
34	*Vitex altissima*	2	0.5	0.5	0.89	66.61	4.93	
35	*Hopea parviflora*	3	0.75	0.5	0.67	50.57	5.30	
36	*Mycetia acuminata*	6	1.5	0.25	0.10	7.36	5.40	
37	*Madhuca neriifolia*	4	1	0.5	0.41	31.04	5.59	
38	*Sterculia guttata*	4	1	0.5	0.58	43.85	5.85	
39	*Myristica beddomei*	3	0.75	0.5	1.17	87.59	6.06	MT
40	*Ancistrocladus heyneanus*	4	1	0.75	0.06	4.84	6.14	LI
41	*Derris brevipes var. brevipes*	4	1	0.75	0.15	11.04	6.27	LI
42	*Diospyros crumenata*	4	1	0.5	1.56	116.66	7.35	MT
43	*Barringtonia acutangula*	6	1.5	0.75	0.37	27.86	8.00	ST
44	*Garcinia morella*	6	1.5	1	0.23	17.05	8.87	SH
45	*Schleichera oleosa*	3	0.75	0.5	3.10	232.51	9.04	MT
46	*Gmelina arborea*	4	1	0.75	2.48	185.93	9.86	MT
47	*Aporosa cardiosperma*	6	1.5	1	0.91	68.22	9.92	ST
48	*Xanthophyllum arnottianum*	7	1.75	0.75	2.89	217.12	12.59	ST
49	*Humboldtia vahliana*	10	2.5	1	5.34	400.53	19.53	ST
50	*Ochlandra scriptoria*	6	1.5	1	9.22	691.35	22.74	SH
51	*Holigarna arnottiana*	9	2.25	1	9.93	745.04	25.93	MT
52	*Vateria indica*	7	1.75	0.75	19.63	1471.88	38.41	LT

Cluster -14

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI
1	*Meliosma simplicifolia*	1	0.5	1	0.05	8.23	25.35
2	*Polyalthia fragrans*	1	0.5	0.5	0.01	1.30	13.71
3	*Vateria indica*	3	1.5	1	0.64	95.65	36.97
4	*Ochlandra travancorica*	22	11	1	0.81	120.77	86.37
5	*Salix tetrasperma*	13	6.5	1	7.29	1093.77	137.60
					8.80	**1319.71**	**300.00**

Cluster -15

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
1	*Myristica beddomei*	1	0.33	0.33	0.00	0.42	2.75	
2	*Calophyllum calaba*	1	0.33	0.33	0.01	0.77	2.76	
3	*Aglaia barberi*	1	0.33	0.33	0.01	0.87	2.76	
4	*Mallotus philippensis var. philippensis*	1	0.33	0.33	0.01	0.92	2.77	
5	*Olea dioica*	1	0.33	0.33	0.01	0.92	2.77	
6	*Garcinia gummi-gutta*	1	0.33	0.33	0.01	1.09	2.77	
7	*Schleichera oleosa*	1	0.33	0.33	0.01	1.27	2.78	
8	*Antidesma montanum*	1	0.33	0.33	0.02	1.61	2.79	
9	*Hydnocarpus alpina*	1	0.33	0.33	0.02	2.24	2.82	
10	*Alstonia scholaris*	1	0.33	0.33	0.02	2.41	2.82	
11	*Elaeocarpus variabilis*	1	0.33	0.33	0.08	8.28	3.04	
12	*Diospyros assimilis*	1	0.33	0.33	0.11	11.27	3.16	
13	*Spondias pinnata*	1	0.33	0.33	0.14	14.30	3.27	
14	*Persea macrantha*	2	0.67	0.33	0.04	3.57	3.33	
15	*Mallotus atrovirens*	2	0.67	0.33	0.07	7.19	3.47	

16	*Terminalia bellirica*	1	0.33	0.33	0.24	23.83	3.63	
17	*Aporosa cardiosperma*	2	0.67	0.33	0.17	16.97	3.84	
18	*Argyreia hirsuta*	4	1.33	0.33	0.17	16.74	4.75	LI
19	*Hopea parviflora*	2	0.67	0.33	0.24	24.38	4.12	LT
20	*Elaeocarpus tuberculatus*	1	0.33	0.33	0.39	38.54	4.19	LT
21	*Vateria indica*	5	1.67	0.67	0.30	29.96	7.98	LT
22	*lagerstroemia microcarpa*	3	1.00	0.33	1.87	186.51	10.72	LT
23	*Lagerstroemia speciosa*	3	1.00	0.33	0.58	57.61	5.84	MT
24	*Litsea floribunda*	4	1.33	0.67	0.22	22.47	7.24	MT
25	*Knema attenuata*	3	1.00	0.67	0.49	48.97	7.78	MT
26	*Turpinia malabarica*	4	1.33	0.33	1.03	102.61	8.01	MT
27	*Vitex altissima*	3	1.00	0.67	0.73	72.61	8.67	MT
28	*Leea indica*	2	0.67	0.67	0.04	3.90	5.61	SH
29	*Tetracera akara*	4	1.33	0.67	0.29	29.35	7.50	SH
30	*Hydnocarpus pentandra*	1	0.33	0.33	0.61	60.65	5.03	ST
31	*Baccaurea courtallensis*	2	0.67	0.67	0.06	6.45	5.71	ST
32	*Cinnamomum malabatrum*	8	2.67	0.67	0.77	77.01	11.16	ST
33	*Mallotus aureopunctatus*	8	2.67	0.33	2.74	274.34	16.36	ST
34	*Ochlandra travancorica*	34	4.00	1.00	14.90	1489.99	68.80	ST

Cluster -16a

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI
1	*Leea indica*	1	0.2	0.2	0.01	0.49	1.78
2	*Strychnos nux-vomica*	1	0.2	0.2	0.01	0.59	1.79
3	*Melicope lunu-ankenda*	1	0.2	0.2	0.01	0.62	1.79
4	*Bombax ceiba*	1	0.2	0.2	0.02	0.97	1.80

5	*Gnetum edule*	1	0.2	0.2	0.02	1.19	1.80
6	*Dalbergia latifolia*	1	0.2	0.2	0.04	2.21	1.82
7	*Olea dioica*	1	0.2	0.2	0.06	3.45	1.85
8	*Vitex altissima*	1	0.2	0.2	0.09	5.17	1.89
9	*Aporosa cardiosperma*	1	0.2	0.2	0.14	8.58	1.97
10	*Glochidion zeylanicum var. zeylanicum*	1	0.2	0.2	0.15	8.71	1.97
11	*Alstonia scholaris*	1	0.2	0.2	0.16	9.36	1.99
12	*Peltophorum pterocarpum*	2	0.4	0.2	0.03	1.72	2.20
13	*Macranga peltata*	2	0.4	0.2	0.05	3.13	2.23
14	*Dillenia pentgyna*	2	0.4	0.2	0.09	5.57	2.29
15	*Grewia tiliifolia*	2	0.4	0.2	0.16	9.63	2.38
16	*Elaeocarpus serratus var. serratus*	2	0.4	0.2	0.16	9.77	2.38
17	*Cinnamomum riparium*	3	0.6	0.2	0.04	2.41	2.60
18	*Syzygium cumini*	1	0.2	0.2	0.82	48.92	2.90
19	*Hopea ponga*	3	0.6	0.2	0.28	16.88	2.93
20	*Pandanus furcatus*	4	0.8	0.2	0.03	1.96	2.97
21	*Acacia caesia*	4	0.8	0.2	0.07	4.22	3.02
22	*Turpinia malabarica*	1	0.2	0.2	0.91	54.58	3.03
23	*Entada rheedei*	4	0.8	0.2	0.12	6.99	3.09
24	*Crataeva magna*	4	0.8	0.2	0.16	9.63	3.15
25	*Leea guineensis*	5	1	0.2	0.02	1.10	3.34
26	*Homonoia riparia*	6	1.2	0.2	0.14	8.20	3.88
27	*Elaeocarpus variabilis*	3	0.6	0.2	1.15	68.98	4.13
28	*Lophopetalum wightianum*	2	0.4	0.2	2.09	125.23	5.03
29	*Diospyros buxifolia*	4	0.8	0.4	0.58	34.57	5.11
30	*Persea macrantha*	4	0.8	0.4	0.91	54.90	5.58
31	*Helecteres isora*	8	1.6	0.4	0.24	14.46	6.19

32	*Syzygium occidentalis*	9	1.8	0.4	0.36	21.88	6.74
33	*Schefflera venulosa*	10	2	0.4	0.19	11.63	6.89
34	*Humboldtia vahliana*	4	0.8	0.2	2.98	178.92	7.03
35	*Ficus racemosa*	5	1	0.6	0.77	46.20	7.15
36	*Terminalia paniculata*	7	1.4	0.6	1.04	62.60	8.30
37	*Bambusa bambos*	12	2.4	0.4	0.79	47.10	8.47
38	*Mallotus aureopunctatus*	8	1.6	0.6	1.24	74.16	8.95
39	*Ochlandra travancorica*	17	3.4	0.4	0.51	30.34	10.01
40	*lagerstroemia microcarpa*	9	1.8	0.4	4.92	295.13	13.01
41	*Hopea parviflora*	6	1.2	0.6	6.01	360.75	14.76
42	*Ochlandra scriptoria*	12	2.4	1	5.92	354.96	19.71
43	*Barringtonia acutangula*	34	6.8	1	8.50	509.76	31.72
44	*Madhuca neriifolia*	20	4	0.8	14.81	888.77	33.65
45	*Vateria indica*	30	6	0.2	15.83	949.73	34.73
			52	**14.4**	**72.60**	**4356.09**	**300.00**

Cluster -16b

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
2	*Capparis rheedei*	1	0.14	0.14	0.00	0.20	2.66	
3	*Derris eualata*	1	0.14	0.14	0.01	0.35	2.66	
4	*Cyathocalyx zeylanica*	1	0.14	0.14	0.05	2.08	2.67	
5	*Elaeocarpus serratus var. serratus*	1	0.14	0.14	0.07	3.02	2.68	
6	*Pongamia pinnata*	1	0.14	0.14	0.16	6.98	2.72	
7	*Syzygium lanceolatum*	1	0.14	0.14	0.21	9.18	2.73	
8	*Glochidion zeylanicum var. zeylanicum*	1	0.14	0.14	0.23	9.86	2.74	
9	*Macranga peltata*	1	0.14	0.14	0.26	11.06	2.75	
10	*Vitex altissima*	1	0.14	0.14	0.26	11.30	2.75	
11	*Knema attenuata*	1	0.14	0.14	0.30	12.71	2.77	
12	*Holigarna arnottiana*	1	0.14	0.14	0.55	23.78	2.86	

13	*Hydnocarpus alpina*	1	0.14	0.14	0.55	23.78	2.86	
14	*Hopea parviflora*	1	0.14	0.14	1.03	44.22	3.04	
15	*Ficus talbotii*	1	0.14	0.14	1.18	50.58	3.09	
16	*Crataeva magna*	2	0.29	0.14	0.03	1.44	3.36	
17	*Barringtonia acutangula*	2	0.29	0.14	0.04	1.77	3.37	
18	*Hopea ponga*	2	0.29	0.14	0.35	15.05	3.48	
1	*Albizia odoratissima*	2	0.29	0.14	0.66	28.11	3.59	
19	*Mallotus aureopunctatus*	3	0.43	0.14	0.08	3.62	4.08	
20	*Trewia nudiflora*	3	0.43	0.14	0.21	9.07	4.12	
21	*Holigarna grahamii*	2	0.29	0.14	2.36	101.35	4.22	
22	*Vateria indica*	2	0.29	0.14	2.53	108.54	4.29	
23	*Homonoia riparia*	4	0.57	0.14	0.05	2.08	4.76	SH
24	*Madhuca neriifolia*	4	0.57	0.14	2.24	95.85	5.57	ST
25	*Myristica beddomei*	5	0.71	0.14	1.41	60.48	5.96	MT
26	*Cinnamomum riparium*	5	0.71	0.29	0.28	12.06	7.50	SH
27	*Olea dioica*	3	0.43	0.43	0.24	10.33	8.06	MT
28	*Vitex leucoxylon*	7	1.00	0.29	0.41	17.74	8.94	ST
29	*Salix tetrasperma*	8	1.14	0.57	1.39	59.62	13.91	ST
30	*Bambusa bambos*	8	1.14	0.71	28.44	1218.87	25.88	ST
31	*Humboldtia vahliana*	25	3.57	0.43	34.51	1479.09	36.01	MT
32	*Ochlandra scriptoria*	43	6.14	1.00	190.31	8155.93	113.96	SH
			20.57	7.29	270.43	11590.07	300.01	

Cluster -16c

Sl No.	**Name of Species**	**Tot**	**D**	**F**	**BA (m2)**	**Dominance**	**IVI**	
1	*Acacia caesia*	1	0.14	0.14	0.01	0.35	2.67	
2	*Aporosa cardiosperma*	1	0.14	0.14	0.01	0.35	2.67	

3	*Leea indica*	1	0.14	0.14	0.01	0.35	2.67	
4	*Olea dioica*	1	0.14	0.14	0.01	0.49	2.68	
5	*Carallia brachiata*	1	0.14	0.14	0.01	0.60	2.68	
6	*Erythrina indica*	1	0.14	0.14	0.01	0.60	2.68	
7	*Persea macrantha*	1	0.14	0.14	0.02	0.92	2.68	
8	*Gmelina arborea*	1	0.14	0.14	0.03	1.19	2.69	
9	*Arenga wightii*	1	0.14	0.14	0.04	1.58	2.69	
10	*Haldina cordifolia*	1	0.14	0.14	0.06	2.41	2.71	
11	*Vitex altissima*	1	0.14	0.14	0.07	3.02	2.72	
12	*Alstonia scholaris*	1	0.14	0.14	0.07	3.08	2.72	
13	*Ochlandra scriptoria*	1	0.14	0.14	0.07	3.14	2.72	
14	*Terminalia elliptica*	1	0.14	0.14	0.14	5.95	2.77	
15	*Kingiodendron pinnatum*	1	0.14	0.14	0.26	11.06	2.86	
16	*Hydnocarpus pentandra*	1	0.14	0.14	0.36	15.34	2.93	
17	*Derris eualata*	2	0.29	0.14	0.01	0.27	3.45	
18	*Vitex leucoxylon*	2	0.29	0.14	0.02	0.66	3.46	
19	*Schefflera venulosa*	2	0.29	0.14	0.02	0.99	3.47	
20	*Xylia xylocarpa*	2	0.29	0.14	0.16	6.69	3.56	
21	*Hopea parviflora*	2	0.29	0.14	0.58	24.87	3.87	
22	*Barringtonia acutangula*	3	0.43	0.14	0.04	1.77	4.26	ST
23	*Holigarna arnottiana*	3	0.43	0.14	0.06	2.76	4.28	
24	*Mallotus atrovirens*	3	0.43	0.14	0.39	16.82	4.52	
25	*lagerstroemia microcarpa*	3	0.43	0.14	0.85	36.26	4.85	
26	*Humboldtia vahliana*	3	0.43	0.14	0.92	39.44	4.90	
27	*Homonoia riparia*	4	0.57	0.14	0.08	3.28	5.07	SH
28	*Stereospermum colais var. colais*	2	0.29	0.29	0.14	5.95	5.44	
29	*Lagerstroemia speciosa*	4	0.57	0.14	0.66	28.11	5.49	
30	*Mallotus aureopunctatus*	5	0.71	0.14	0.16	6.69	5.91	

31	*Ficus tsjahela*	2	0.29	0.29	0.96	41.32	6.04	
32	*Trewia nudiflora*	5	0.71	0.29	0.25	10.81	7.86	ST
33	*Terminalia paniculata*	5	0.71	0.43	1.20	51.63	10.44	MT
34	*Tetrameles nudiflora*	3	0.43	0.43	3.86	165.29	10.81	LT
35	*Pandanus furcatus*	12	1.71	0.14	0.62	26.56	11.71	ST
36	*Madhuca neriifolia*	9	1.29	0.14	3.90	167.20	11.76	ST
37	*Syzygium occidentalis*	16	2.29	0.14	1.42	60.77	15.42	SH
38	*Macranga peltata*	8	1.14	0.57	3.62	155.01	16.43	MT
39	*Bambusa bambos*	12	1.71	0.71	116.36	4987.03	103.47	ST
			18.29	**7.57**	**137.45**	**5890.60**	**300.01**	

Cluster -17

Sl No.	Name of Species	Tot	D	F	BA (m2)	Dominance	IVI	
1	*Sterculia guttata*	1	0.17	0.17	0.00	0.16	1.97	
2	*Argyreia hirsuta*	1	0.17	0.17	0.01	0.31	1.98	
3	*papi*	1	0.17	0.17	0.01	0.49	1.98	
4	*Turpinia malabarica*	1	0.17	0.17	0.01	0.49	1.98	
5	*Artocarpus hirsutus*	1	0.17	0.17	0.04	2.06	2.00	
6	*Litsea coriacea*	1	0.17	0.17	0.04	2.24	2.00	
7	*Madhuca neriifolia*	1	0.17	0.17	0.05	2.55	2.00	
8	*Garcinia gummi-gutta*	1	0.17	0.17	0.18	8.96	2.08	
9	*Poeciloneuron indicum*	1	0.17	0.17	0.20	9.94	2.09	
10	*Glochidion ellipticum*	1	0.17	0.17	0.23	11.50	2.11	
11	*Knema attenuata*	1	0.17	0.17	0.30	14.83	2.15	
12	*Garcinia imberti*	2	0.33	0.17	0.06	3.15	2.37	
13	*Flacourtia montana*	2	0.33	0.17	0.08	3.82	2.38	
14	*Terminalia paniculata*	2	0.33	0.17	0.24	12.19	2.48	
15	*Elaeocarpus serratus var.*	1	0.17	0.17	0.87	43.35	2.49	

	serratus							
16	*Baccaurea courtallensis*	3	0.50	0.17	0.26	13.19	2.85	
17	*Mallotus aureopunctatus*	4	0.67	0.17	0.77	38.26	3.51	
18	*Cinnamomum malabatrum*	5	0.83	0.17	0.29	14.37	3.58	
19	*Carallia brachiata*	2	0.33	0.33	0.06	2.81	3.98	
20	*Schleichera oleosa*	2	0.33	0.33	0.07	3.52	3.99	
21	*Trewia nudiflora*	2	0.33	0.33	0.26	12.90	4.10	
22	*Hopea ponga*	2	0.33	0.33	0.33	16.73	4.14	
23	*Myristica malabarica*	5	0.83	0.17	1.41	70.56	4.26	
24	*Fagraea ceilanica*	3	0.50	0.33	0.03	1.48	4.32	
25	*Anamirta cocculus*	3	0.50	0.33	0.04	1.79	4.32	
26	*Derris brevipes var. brevipes*	3	0.50	0.33	0.05	2.68	4.33	
27	*Cinnamomum riparium*	3	0.50	0.33	0.20	9.94	4.42	
28	*Alstonia scholaris*	2	0.33	0.33	0.88	43.88	4.47	
29	*Garcinia wightii*	3	0.50	0.33	0.60	29.89	4.66	
30	*Gnetum edule*	4	0.67	0.33	0.06	3.22	4.70	
31	*Leea indica*	4	0.67	0.33	0.17	8.72	4.76	
32	*Dimocarpus longan*	4	0.67	0.33	0.28	14.07	4.83	
33	*Calamus thwaitesii*	5	0.83	0.33	0.04	1.84	5.04	
34	*Artabotrys zeylanicus*	5	0.83	0.33	0.20	9.94	5.14	
35	*Gymnacranthera canarica*	4	0.67	0.33	1.16	57.79	5.36	
36	*Xylia xylocarpa*	4	0.67	0.33	1.21	60.55	5.39	
37	*Vitex altissima*	4	0.67	0.33	1.29	64.33	5.44	
38	*Lagerstroemia speciosa*	3	0.50	0.33	2.64	132.08	5.90	
39	*Capparis rheedei*	3	0.50	0.50	0.05	2.30	5.94	
40	*Xanthophyllum arnottianum*	8	1.33	0.17	2.59	129.34	6.04	
41	*Ochlandra scriptoria*	8	1.33	0.33	0.27	13.33	6.25	SH
42	*Hydnocarpus alpina*	3	0.50	0.50	2.19	109.31	7.23	

43	*Homonoia riparia*	8	1.33	0.50	0.32	15.76	7.90	SH
44	*Aporosa cardiosperma*	5	0.83	0.67	0.14	6.83	8.33	
45	*lagerstroemia microcarpa*	4	0.67	0.33	6.54	326.77	8.61	
46	*Olea dioica*	4	0.67	0.67	1.25	62.43	8.64	
47	*Hopea parviflora*	5	0.83	0.33	6.03	301.31	8.66	LT
48	*Aporosa bourdillonii*	6	1.00	0.67	0.18	8.84	8.71	ST
49	*Syzygium occidentalis*	13	2.17	0.50	1.24	62.11	10.25	SH
50	*Mallotus atrovirens*	20	3.33	0.67	6.17	308.28	17.34	ST
51	*Holigarna arnottiana*	7	1.17	0.83	11.45	572.29	17.48	MT
52	*Entada rheedei*	18	3.00	1.00	2.91	145.71	17.89	LI
53	*Vateria indica*	7	1.17	0.33	25.06	1252.82	20.86	LT
54	*Barringtonia acutangula*	36	6.00	0.83	12.82	641.07	28.71	ST
55	*Humboldtia vahliana*	27	4.50	1.00	71.85	3592.36	62.73	MT
			47	**19.33**	**165.63**	**8281.42**	**387.1**	

Cluster -18

Sl No.	**Name of Species**	**Tot**	**D**	**F**	**BA (m2)**	**Dominance**	**IVI**
1	*Lannea coromandelica*	2	0.67	0.67	0.07	7.34	25.86
2	*Ziziphus rugosa*	3	1.00	0.67	0.02	1.91	27.76
3	*Wrightia tinctoria*	3	1.00	0.67	0.05	5.10	29.44
4	*Ochlandra scriptoria*	6	2.00	0.33	0.01	1.27	35.47
5	*Macranga peltata*	4	1.33	1.00	0.46	45.86	61.94
6	*Terminalia paniculata*	3	1.00	1.00	1.28	128.03	100.54
		21	**7**	**4.333**	**1.895**	**189.5**	**281**

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