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STUDIES ON THE EPIPHYTIC FLORA IN THE TROPICAL FOREST ECOSYSTEM OF WESTERN GHATS WITH SPECIAL REFERENCE TO NILGIRI BIOSPHERE RESERV

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ABSTRACT

The epiphytic flora of tropical forests of Western Ghats is inadequately known. The present work is the first attempt to compile the epiphytic flora of Western Ghats. The information presented here is based on intensive botanical explorations in the Nilgiri Biosphere Reserve areas of the Kerala part of Western Ghats for a period of three years.

In the present study, 225 species of vascular epiphytes have been enumerated. Among them 159 species belonging to 54 genera representing 12 families are angiosperms and 66 species belonging to 29 genera representing 12 families are pteridophytes. Among the angiosperms the family Orchidaceae includes the highest number of epiphytic taxa with 129 species under 39 genera. In pteridophytes the family Polypodiaceae includes maximum number of epiphytes with 18 species under 10 genera .

From the critical studies on the collections made the following 8 angiosperm taxa viz., *Bulbophyllum* (1 sp.), *Elastostemma* (1 sp.), *Impatiens* (3 spp.), *Oberonia* (2 spp.), *Schoenorchis* (1 sp.) were found to be new and hence, an addition to the flora of India from this part of the phytogeographic region. Species like *Eria polystachya, Gastrochilus flabelliformis, Impatiens lawsonii* and *Oberonia josephii* are found to be new records to Kerala. Two species of orchids, *Oberonia forcipata* and *Vanda thwaitesii* are new records to India which were earlier known only from Sri Lanka. *Eria muscicola* var. *brevilinguis* has been found to have a wider range of distribution and extending up to the northern part of Kerala.

Among the pteridophytes, *Ctenopteris subfalcata and Vittaria montana* are found to be new records to Kerala. Three species of *Asplenium* viz., *A. auritum, A. laciniatum, A. tenuifolium* have been collected from Kerala forests after a lapse of over a hundred years.

Apart from the vascular epiphytes, a few lower groups of plants like mosses (10 spp.) and lichens (54 spp.) were also collected during the study. It is interesting to note that among the macrolichens 17 species were found to be new records to Kerala and two species were new records to South India. Different types of epiphytes and host-epiphyte relationship have been discussed. All the epiphytes occurring in the NBR have been described and relevant keys are provided.

It is evident from the study that epiphytes constitute an important component in the ecology of the tropical forests due to their diverse habits and habitats. However, to develop a meaningful conservation strategy for the preservation of biological diversity, detailed information on thise group of plants is essential.

1. INTRODUCTION

1.1 GENERAL

Tropical forests are known to harbour the greatest wealth of biological and genetic diversity. In India tropical forests hold about 9000 species, representing 52% of the country's flowering plants. Of the 1500 threatened species in India 80% of species occur in the tropical forests. The main constituents of tropical forests are straight boled canopy trees, buttressed trees, cauliflorous trees, second storey trees and shrubs, shade tolerant herbaceous ground layer of aroides, zingibers, grasses, mosses and bryophytes, epiphytes, parasites, saprophytes and lianas occupy different ecological space having sunlight and nutrients (Nayar, 1997).

Western Ghats, to which the forests of Kerala belong, is highly significant in view of biodiversity. It is one of the 18 'Hot Spots' identified all over world and one among the two identified within the country harbouring about 4000 flowering plants and 250 pteridophytes. Southern Western Ghats have forest areas in patches covering 12000 km^2 having 3900 species of flowering plants of which 1286 species are endemic (Nayar, 1996).

A thorough knowledge of biodiversity, its species components, distribution pattern, abundance, dynamics etc., is essentially needed for the formulation of any biodiversity conservation strategies. At present owing to different interferences, the forest area has been considerably depleted all over the world and due to extensive and unabated destruction of forests many valuable plants are getting extinct.

Though considerable work has been done on the floristic survey of this region, so far no substantial studies have been taken up on the epiphytic flora of the tropical forests of Western Ghats. Studies on the tropical forest ecosystem will be incomplete until the vascular epiphytes are given due importance. Most often, while studying the various aspects of forest ecology/floristics the studies on epiphytic flora are either ignored or are poorly dealt with. And hence, this study was undertaken.

1.2 EPIPHYTES

Epiphytes generally grow attached to the trunk and branches of trees and shrubs.. The mode of life of epiphytes is highly specialised which differs widely in physiogonomy and physiology from that of the herbaceous ground flora. Schimper (1888) regarded tropical epiphytes in general as having evolved from terrestrial plants growing in wet shady places. This was later refuted and considered that the tropical American epiphytes, mainly Bromeliads are derived from terrestrial ancestors of semi - desert plants (Pittendrigh, 1948). Many epiphytes can grow successfully in suitable open habitats (bare rocks, sea

shores, savannas, etc.) but in the forests they are entirely dependent on their hosts for mechanical support. Typical epiphytes do not depend on organic food from other plants. Only the Loranthaceae (mistletoes) are semi-parasite as well as epiphytic. The distribution and occurrence of epiphytes depend on the microclimate, nature of the substratum and specialized morphological adaptations.

The epiphytes according to the type of dependance on the phorophytes are of two types 1)Autotrophs which depend on trees for support only and 2) Heterotrophs where plants depend on their nutrition and get a substantial part of their carbon supply from the host .

Autotrophs are of four types *viz.*,(a) Accidental, (b) Facultative, (c) Hemi-epiphytes, (Primary- straggling, non straggling; secondary) and (d) True epiphytes.

Accidental epiphytes possess no modifications.These plants colonize wherever moist cavities exist, whether in the tree crowns or in rock crevices as a result of the seed dispersal by wind or by birds .

Facultative epiphytes inhabit forest canopies and the ground interchangeably. These plants are found growing on humid sites where bark supports moisture-retaining masses of bryophytes, lichens, vascular plants and associated litter.

Primary hemiepiphytes are those plants which do not have any access to soil, but later, develop feeder roots towards the ground and become enmeshed in anastomosing roots which may eventually kill the host plant as a result of girdling (eg. species of *Ficus*). Secondary hemiepiphytes are climbers which begin their life in the soil near a phorophyte and when it gets attached to the tree their older stems and roots get decayed and ultimately become epiphytic.

True epiphytes are those plants which do not have any contact with the forest floor nor they depend on the host plants for their survival and growth. However, they are the most specialised group having special adaptations of their specific habit and habitats.

The structural specialization and morphological adaptations of epiphytes are obviously connected with their mode of life and habitats. The seeds and seedlings of epiphytes show many characteristic features depending upon the nature of dispersal and establishment. The spores of ferns, seeds of *Aeschynanthus* and the members of the Orchidaceae and Gesneriaceae are adapted to wind dispersal. In *Aeschynanthus* and in the semiparasitic *Loranthus*, part of the young seedlings forms a flattened disc, with numerous root hairs, which assist in its establishment. Most of the epiphytes anchor themselves by very efficient root systems. In the family Orchidaceae the root system is differentiated into nutritive and anchoring roots with specialised morphological and anatomical structure.

Schimper (1888) distinguished four classes of epiphytes based on their ecological morphology as proto-epiphytes, nest and bracket epiphytes, tank epiphytes and hemi-epiphytes. Proto-epiphytes are the least specialised group. Many of the proto- epiphytes have a xeromorphic structure and have water storing organs of various types such as succulent leaves, pseudobulbs or root tubers.

In nest and bracket epiphytes the plant accumulates humus and debris, from which the roots derive water and mineral substances as in some ferns (*Asplenium*) and a few aroids and orchids. The roots in these plants form a dense interwoven mass, resembling a bird's nest. In bracket epiphytes all the leaves or some of them, are bracket like. Ecologically similar to the bracket epiphytes there are myrmicophytes. In these plants the stem develops a large tuber with honeycomb-type cavities which are invariably inhabited by ants.

The tank or cistern epiphytes are represented only by one family Bromeliaceae. They are abundant throughout the tropical american forests. In these plants the leaves are narrow and stiff, and form a rosette. Their sheathing bases overlap so as to act as a reservoir which may hold as much as five litres of water.

The hemiepiphytes, develop long aerial roots which reach the ground. Once the connection with the ground is established these plants become independent as in *Ficus*.

The epiphytic flowering plants belong to a very limited number of families.Schimper (1888) enumerated about 33 families and 232 genera of epiphytes including hemi-epiphytes of which majority are found in the tropics. In the Western Ghats, the families of flowering plants containing larger number of genera and species of epiphytes are: Orchidaceae, Melastomataceae, Gesneriaceae, Asclepiadaceae, Balsaminaceae and Piperaceae. Among the Pteridophytes families like Polypodiaceae, Aspleniaceae, Hymenophyllaceae, Lycopodiaceae and Davalliaceae are well represented.

2. STUDY AREA

Epiphytic plants were collected from all the NBR areas of Kerala part of Western Ghats. Almost all the areas in the Silent Valley NP have been covered. Part of Wayanad, Nilambur and New Amarambalam have also been covered.

Apart from the NBR areas, epiphytes were collected from Nelliampathy forests which comes under Nemmara Forest Division, Sholayar forest under Trichur Forest Division, Munnar and adjoining areas in the high ranges.

The NBR is located in the south - west portion of Western Ghats (north of Palghat gap between 10° 45' and 12° 5' N lat. and between 76° 10' and 77° 10' E long and is about 5500 km^2 in extent (Figs. 1 & 2).

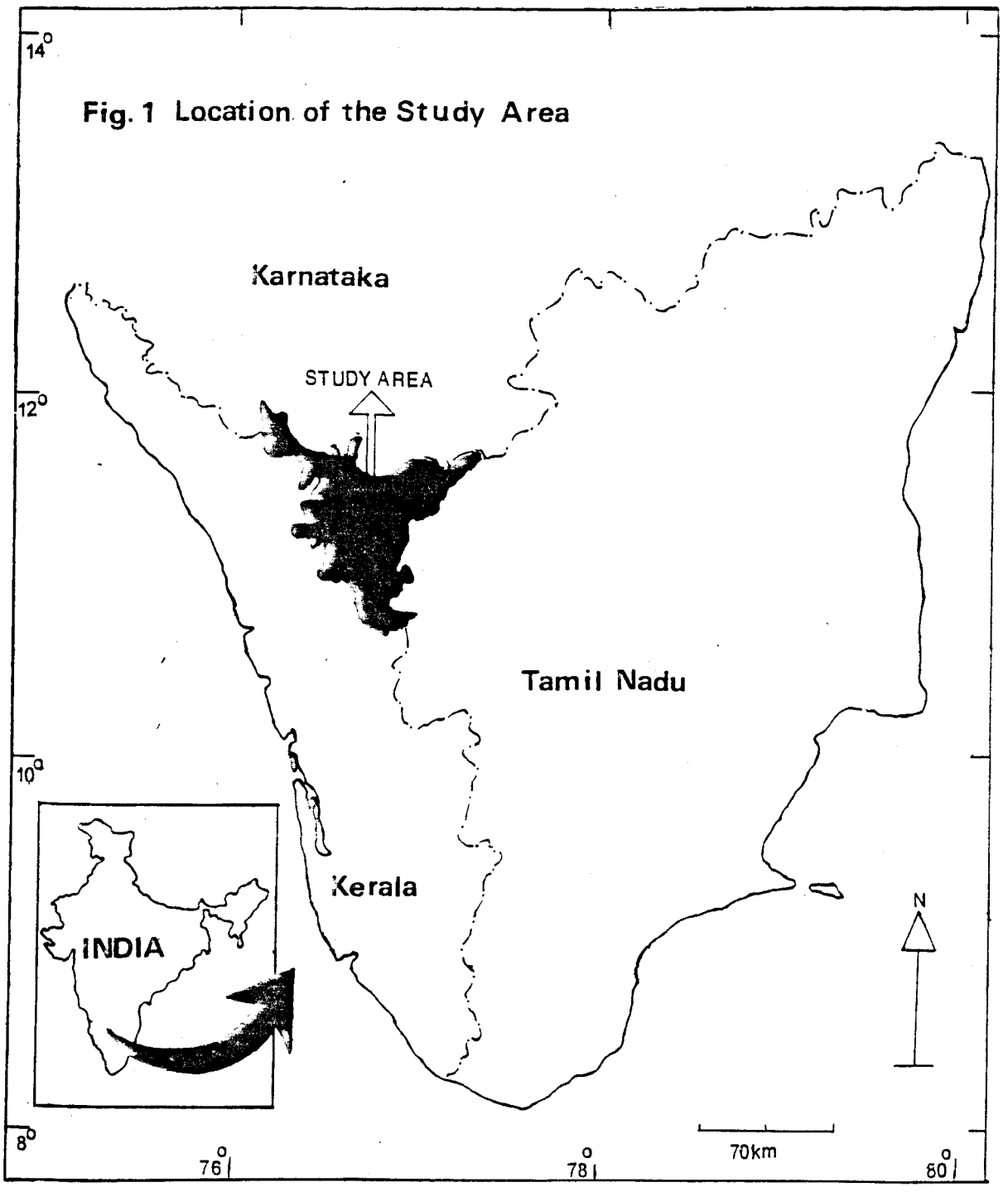


Fig. 1 Location of the Study Area

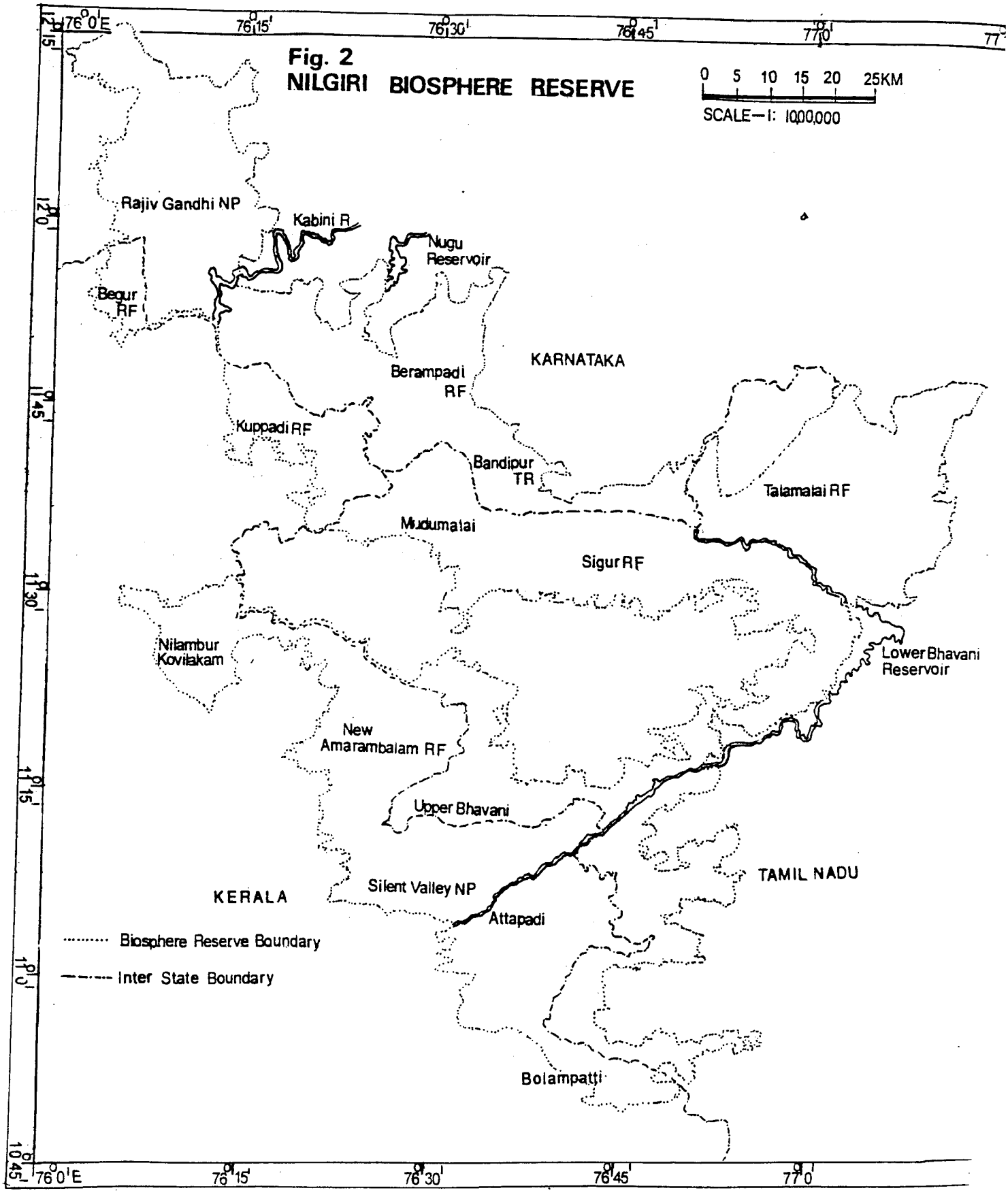


Fig. 2
NILGIRI BIOSPHERE RESERVE
0 5 10 15 20 25KM
SCALE—1: 1000,000
76°0'E
76°15'
76°30'
76°45'
77°0'
12°15'
12°0'
11°45'
11°30'
11°15'
11°0'
10°45'
Rajiv Gandhi NP
Kabini R.
Nugu Reservoir
Begur RF
KARNATAKA
Berampadi RF
Kuppadi RF
Bandipur TR
Talamalai RF
Mudumalai
Sigur RF
Nilambur Kovilakam
Lower Bhavani Reservoir
New Amarambalam RF
Upper Bhavani
TAMIL NADU
KERALA
Silent Valley NP
Attapadi
Bolampatti
Biosphere Reserve Boundary
Inter State Boundary

The Kerala part of NBR extends over an area of 1455 km^2 encompassing Wayanad Wildlife Division, Silent Valley National Park, Mannarghat, Nilambur North and South divisions (Fig. 3). The core zone is about 240 km^2, the forestry zone 870 km^2, the tourism zone 100 km^2 and the restoration zone 245 km^2. Vegetation types observed in the NBR of Kerala part are tropical wet evergreen forests, tropical montane shola and grassland, tropical semievergreen forests, tropical dry deciduous forests and tropical dry thorn forests.

The northern part of the NBR is formed by the Wayanad, Mysore, Sigur and Talamalai Plateau with associated hills at a general elevation of 700 - 1000 m. On the west, the slopes constituting Nilambur, New Amarambalam and Silent Valley Reserve descend to 250 m in Calicut plains. To the south, the Attapadi Plateau, Siruvani and Bolampatti hills show diverse topography with the elevation ranging from 1800-150 m in the Palghat Gap. On the east, the Nilgiri hills slope down to 250 m in the Coimbatore plains.

2.1 Wayanad

Wayanad is contiguous with Bandipur Tiger Reserve and Rajiv Gandhi National Park of Karnataka and Mudumalai of Tamil Nadu. The total extent is about 1200 km^2 of which 344 km^2 form the Wayanad Wildlife Sanctuary. The eastern and western slopes of Wayanad Plateau differ in topography and climate. The Wayanad Plateau is at an elevation of 700 - 1600 m. The northern part has an elevation of 700 - 2000 m. The vegetation types include evergreen forests confined to the northern parts and deciduous forests in the areas bordering adjacent states. The natural forests are interspersed with bamboo thickets and teak andeucalyptus.plantations.

2.2 Nilambur

Nilambur Reserve Forests is located in Malappuram district of Kerala between 11° 16' and 11° 34' N lat. and between 76° 31' and 76° 31' E long. The reserve consists of evergreen and moist deciduous forests with intervening bamboo thickets.

New Amarambalam R.F. located in the Nilambur south Forest Division. This forms the core area of the NBR. This forest covers an area of 265.72 km^2 and is sitauted at latitude 11° 14' and 11° 24N and longitude 76° 19' and 76° 33'. The study area is adjacent to the north west of Silent Valley National Park. The lower and outer foot hills, which were once clothed by moist deciduous forests have been converted into teak plantations and the evergreen and semi-evergreen forests are virtually untouched.

2.3 Silent Valley National Park

Silent Valley National Park, with an extent of 89 km^2 is located in the Palghat district of Kerala between 11° 04' and between 11° 13' N lat. and between 76° 24' and 76° 29' E long. It is bound by the Nilgiris and forests of Nilambur along the north and Attapadi reserve forests along the south. Forests of Nilambur and Attappadi form the western and the eastern boundaries respectively. Major vegetation types consist of wet evergreen forests, montane grasslands and shola forests.

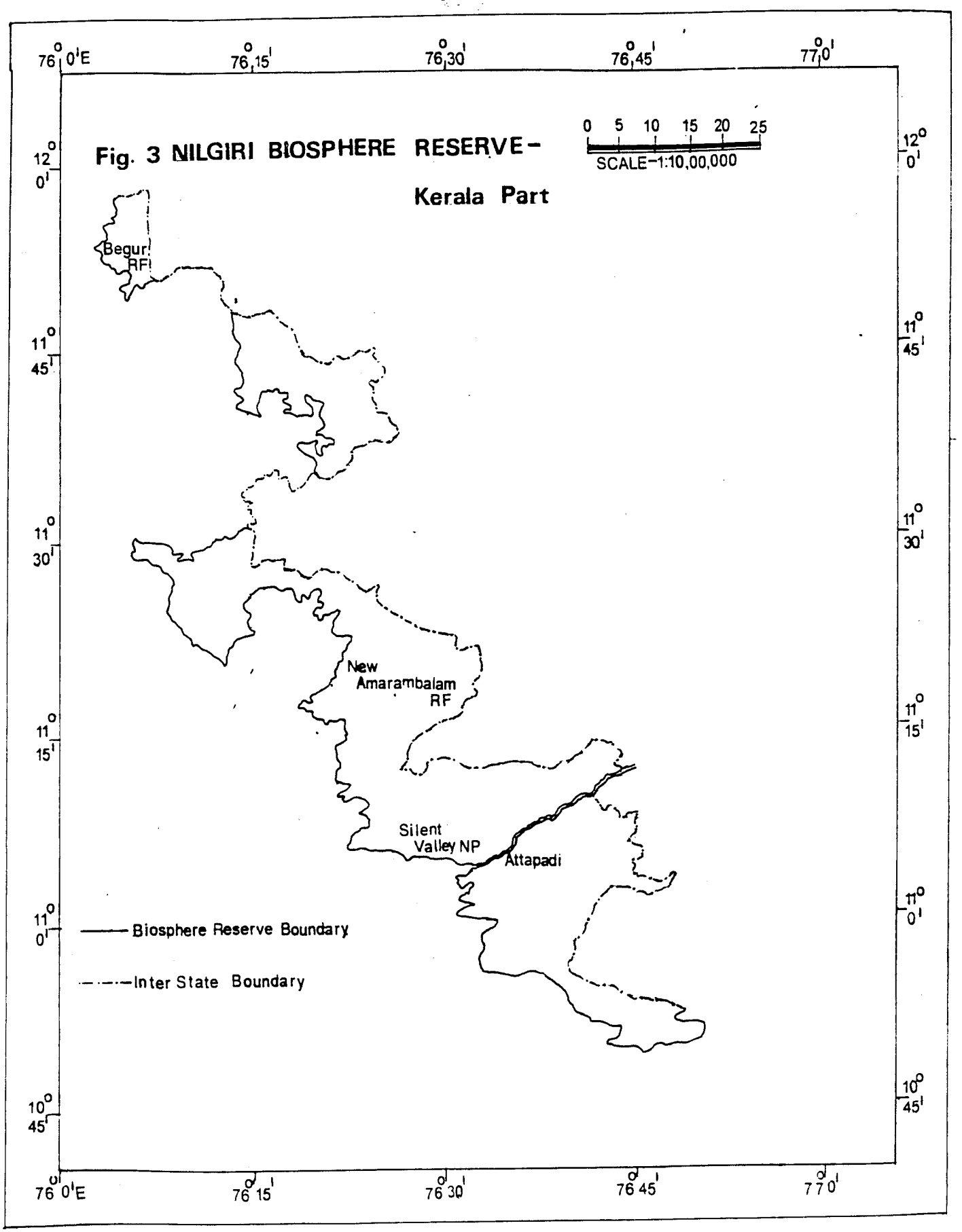


Fig. 3 NILGIRI BIOSPHERE RESERVE -
Kerala Part
0 5 10 15 20 25
SCALE-1:10,00,000
76° 0'E
76°15'
76°30'
76°45'
77°0'
12° 0'
11° 45'
11° 30'
11° 15'
11° 0'
10° 45'
Begur RF
New Amarambalam RF
Silent Valley NP
Attapadi
Biosphere Reserve Boundary
Inter State Boundary

2.4 Attappadi

Attapadi valley is located in the Palghat District of Kerala between 10° 55' to 11° 14' N lat. and between 76° 27' to 76° 48' E long. The area is bordered in the north by Nilgiri District of Tamil Nadu, in the west by Malappuram District, in the south by Palghat District and in the east by Coimbatore District of Tamil Nadu. The area is about 765 km^2 with a rugged terrain and having a range of elevation from about 250 - 1700m.

2.5 Muthikulam - Siruvani

Muthikulam reserve is situated in the Siruvani plateau of Palghat District of Kerala between 10° 55' to 11° 03' N lat. and between 76° 36' to 76° 41' E long. and covers an area of about 64 km^2. This reserve is almost cut-off from north, east and west. Elevation ranges from about 600 - 2065m.

3. MATERIALS & METHODS

Collection of epiphytic plants was carried out for 3 years during different seasons from the Kerala part of Western Ghats with special emphasis on the NBR areas. Bimonthly expeditions each lasting for 7-10 days were organised for the first two and half years after a reconnaissance study. The herbarium specimens were prepared as per the standard specification (Fosberg & Sachet 1965; Bridson & Forman 1991). The specimens were identified with the help of relevant literature and authentic specimens. For lower groups such as lichens, chemical coulour test and thin layer chromatography (TLC) were adopted. Apart from the plants collected during the survey, those specimens collected earlier from the Kerala part of Western Ghats and maintained at KFRI, CALI, MH &TBGT herbaria were also consulted for the study. Data pertaining to their taxonomy, distribution, ecology and conservation of the indigenous and endemic plants of the NBR area were gathered from all the available sources.

Quantitative analysis has not been carried out during the present study. The study is based on a preliminary survey on the vascular epiphytic flora of Western Ghats. The classification of Bentham & Hooker (1862-83) has been followed for angiosperm systematics and for pteridophytes the genera are arranged according to Holttum (1949) and the families as per Pichi-Sermolli (1958). An artificial key to the families for both angiosperms and pteridophytes has been provided. In the enumeration, key to the genera under each family and species under each genus has been given in alphabetical order.

Illustrations are provided for only those specimens that are found to be either new records, new species or rare. All the specimens collected during the study have been deposited at KFRI herbarium as voucher specimens. The live collections are also being maintained in the green house.

4. REVIEW OF LITERATURE

The epiphytic flora is, no doubt, an important component of the tropical as well as temperate forest ecosystems. From the world literature some of the important earlier works on various aspects of epiphytes are those of Dixon (1882); Wiesner (1907); Miehe (1911); Kamerling (1912); Spanner (1939) and Went (1940, 1944). Grubb & Whitemore (1966) have noted the distribution of epiphytes in the lowland as well as in the submontane forests of Asia. Madison (1977) carried out investigations on the epiphytic flora in the palaeotropics and published the most comprehensive compilation of vascular epiphytes since the work of Schimper (1888) and Richards (1952). Since the publication of Madison's list, many additional records of epiphytic species have been published (Kress, 1986, 1989). Gentry & Dodson (1987) studied the diversity and biogeography of Neotropical vascular epiphytes and discussed the species diversity in the Neotropics. A bibliographic list of 571 citations dealing with the biology of vascular and nonvascular epiphytes that updates the list compiled by Watson *et al.* (1987) has been published by Nadkarni & Ingram (1992). However, they have not included pure taxonomic and floristic accounts in their list.

Though a large number of floras have been published from different phytogeographic regions of India which includes epiphytes as a part of the enumeration of the floras of those regions. Studies exclusively on the epiphytic flora are very meagre. Sen (1963) studied the epiphytic flowering plants other than orchids from Darjeeling hills and recorded 34 species belonging to 22 genera under 15 families. Ecology of vascular epiphytes from the forest of Sikkim has been studied by Rai *et al.*, (1988). Sathish Kumar & Manilal (1992) published a list of epiphytic orchids occurring in the Indian phytogeographic region. While studying the systematic distribution of the epiphytic ferns of Kumaon Hills, Pande & Pande (1993) recorded 80 species of epiphytic pteridophytes. Chettri & Rai (1996) studied the distribution of epiphytes with special reference to host specificity from the forest of Sikkim.

While scanning the literature, exclusively on the epiphytes in the region of Western Ghats, it was noted that no substancial work has been undertaken on this fascinating and complex group of plants other than that of Kumar & Stephen (1997), who attempted to compile and enumerate the vascular epiphytes in the Western Ghats region.

5. ANALYSIS OF THE EPIPHYTIC FLORA

Compared to the non-epiphytic genre the occurence of vascular epiphytes is less in the study area. Among 225 vascular epiphytes known to occur in Kerala. 180 species were collected and studied. However, all the 225 species of vascular epiphytes that occur in Kerala are included in the systematic part. For which various herbaria like MH. TBGT CALI and KFRI were consulted.

The distribution of the families, genera and species with respect to angiosperms and pteridophytes are as follows.

Taxa	Families	Genera	Species
Angiosperms	12	54	159
Pteridophytes	12	29	66
Total	**24**	**83**	**225**

From the total number of vascular plants occurring in the Kerala part of Western Ghats it is estimated that only 7% are epiphytes and only 6% of the genera include epiphytic species. It has been observed that orchids have major share (57.33%), other angiosperms (13.33%), ferns (25.33%) and fern allies (4%) (Fig. A).

Families of vascular plants having 3 or more epiphytic species are follows:

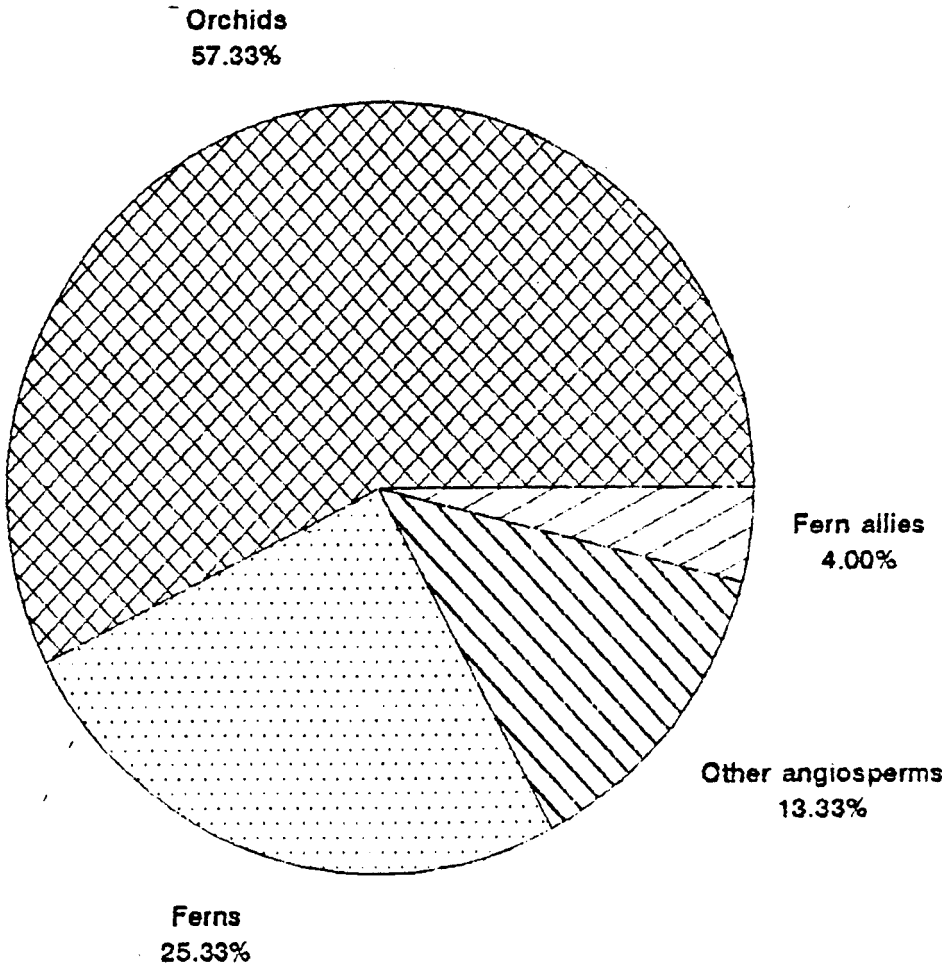
Sl. No.	Family	Epiphytic	Total	Percentage
1.	Orchidaceae	129	220	58
2.	Balsaminaceae	10	70	14
3.	Piperaceae	4	21	19
4.	Asclepiadaceae	3	92	03
5.	Lycopodiaceae	7	9	77
6.	Vittariaceae	4	4	100
7.	Davalliaceae	4	4	100
8.	Hymenophyllaceae	8	9	88
9.	Aspleniaceae	14	23	65
10.	Polypodiaceae	18	19	94
11.	Grammitidaceae	3	5	60

Among angiosperms the family Orchidaceae constitute the highest number of epiphytic taxa with 129 species belonging to 39 genera. In pteridophytes the family Polypodiaceae has the highest number of epiphytes with 18 species under 10 genera.

Vascular plants having 5 or more species in each genus have been enumerated as follows:

Genus	Family	Epiphytic	Total	Percentage
Oberonia	Orchidaceae	24	24	100
Dendrobium	Orchidaceae	15	16	93
Bulbophyllum	Orchidaceae	12	12	100
Eria	Orchidaceae	12	12	100
Luisia	Orchidaceae	05	05	100
Impatiens	Balsaminaceae	10	70	14
Asplenium	Aspleniaceae	15	23	65
Huperzia	Lycopodiaceae	07	07	100

Fig. A. Diversity of vascular epiphytes in the study area



Fern allies - Lycopodiaceae, Selaginellaceae and Psilotaceae.
Other angiosperms - Melastomataceae, Asclepiadaceae, Lentibulariaceae, Gesneriaceae, Piperaceae, Urticaceae, Commelinaceae and Araceae.

5.1 MAJOR FINDINGS

The following are the important findings of the present study.

5.1.1 Higher Groups

A total of 225 species belonging to 83 genera under 24 families of both angiosperms and pteridophytes have been studied. When compared to non-epiphytic vascular plants the percentage of epiphytic vascular plants is lower. However, evergreen forests and high altitude shola forests form a good habitat for the epiphytes. Compared to other NBR areas selected for the study purposes, low and mid altitude evergreen and high altitude evergreen shola forests of Silent Valley National Park hold a good number of endemic epiphytes.

Impatiens denisonii, a common lithophytic balsam showed a tendency to inhabit the trunks of trees in high altitudes. Many species of *Ficus* actually start as epiphytes and on maturity they become self dependent trees and harbour many epiphytic herbaceous plants including ferns and angiosperms. *Habenaria crinifera*, a common lithophytic orchid was found to be growing on the trunks of *Lagerstroemia sp.* in Thirumelly area of Wayanad. The members of the family Araliaceae and Loganiaceae viz., *Polysctas acuminata*, *Shefflera venulosa* and *Fagraea ceylanica* are found to be growing as true epiphytes in riverine areas of Silent Valley National Park, though these plants are known to be hemi-epiphytes.

Hymenophyllaceous ferns like *Hymenophyllum, Microgonium, Trichomanes* occur only on the lower side of the tree trunk and are abundant in the riverine area. *Nistarika bahupunctika*, a rare fern recently reported from Silent Valley National Park was found to grow only on small herbaceous plants. The genus *Leptochilus* prefers lower part of the tree trunks and exposed tree roots for their attachment. Likewise *Bolbitis sp., Egenolfia sp.* start their life on soil or rock and climb on the lower of trees. Ferns like *Selaginella involvens, Leucostegia immersa, Asplenium formosum, A. erectum, A. polyodon* var. *bipinnatum* were reported earlier to be lithophytic or terrestrial were found as epiphytic in various localities.

From the critical studies on the collections made during the explorations 8 new species of vascular plants have been added to the Indian flora and 12 species are found to be new records including the report of extended distribution and rediscoveries.

New species

1. *Imaptiens* (3 spp.)
2. *Elastostemma* (1 sp.)
3. *Oberonia* (2 spp.)
4. *Bulbophyllum* (1 sp.)
5. *Schoenorchis* (1 sp.)

New records

Angiosperms

1. *Impatiens lawsonii* Hook.f. (Balsaminaceae), is reported earlier from Chikmangalure and Nilgiri hills only. The present collection from Pakshipadalam of Wayanad is a new record to Kerala.

2. *Eria polystachya* A. Rich. (Orchidaceae), is known only from Nilgiri hills of Tamil Nadu. The present collection from Thirunelly area of Wayanad is a new record to Kerala.

3. *Gastrochilus flabelliformis* (Blatt. & McCann) Saldanha (Orchidaceae), hitherto known only from North Kanara and Hassan districts of Karnataka. The collection from Nilambur is a new record to Kerala.

4. *Oberonia forcipata* Lindl. (Orchidaceae), hitherto known only from Sri Lanka . The present collection from Tholpatty of Wayanad is a new record to India.

5. *Oberonia josephii* Saldanha (Orchidaceae), is known only from Hassan district of Karnataka and the present collection from Thirunelly of Wayanad is a new record to Kerala.

6. *Vanda thwaitesii* Hook. f. (Orchidaceae), hitherto known only from Sri Lanka. The present collection from Silent Valley National Park is a new record to India.

7. *Eria muscicola* var. *brevilinguis* Joseph & Chandrasek. (Orchidaceae), is known only from Agastyamala hills and the present collection from Silent Valley National Park denotes its distributional range to the northern part of the State.

Pteridophytes

1. *Asplenium laciniatum* Don. (Aspleniaceae) - During the survey of pteridophytes of Western Ghats, Manickam and Irudayaraj (1992) recorded this species from Tamil Nadu. Azeez, et al., (1996) revised Aspleniaceae of Kerala have not recorded this species. The present collection from Devicolam of Munnar is a new record to Kerala.

2. *Ctenopteris subfalcata* (Bl.) Knze. (Grammitidaceae) - Manickam and Irudayaraj (1992) reported its distribution in South India is from Tamil Nadu. The present collection from Mannavan Shola of Kanthallore is a new record to Kerala.

3. *Vittaria montana* Manickam (Vittariaceae), hitherto known only from Palni hills. The present collection from Thirunelly of Wayanad is new record to Kerala.

Rediscovery

. *Asplenium auritum* Sw. and *Asplenium tenuifolium* D. Don. (Aspleniaceae) - Manickam & Irudayaraj (1992) recorded these species from Palni hills, South India. However, Nair, et al., (1992) reported the occurrence of these species in Travancore hills based on the collections made by Levinge (1883). During the revisionary studies on Aspleniaceae of Kerala Azeez, et al., (1996) could not locate these species. These specimens have been relocated adn collected after a lapse of over 110 years from Munnar, Kerala.

5.1.2 Endemics

In all the epiphytic vascular plants occurring in the study area a total of 66 species under 20 genera are endemic to Western Ghats. The family Orchidaceae has the highest number of endemics with 53 species under 14 genera. Among these the genus *Oberonia* has 13 species endemic to Western Ghats. *Oberonia agastyamalayana, O. wynadensis* are endemic to Kerala. The genera such as Eria (11 species), *Dendrobium* (9 species), *Bulbophyllum* (6 species) are endemic to Western Ghats.

The angiosperms other than orchids have 10 endemic species in Western Ghats. Among these the genus *Impatiens* has 6 endemic species to this region. The genus *Medinilla* with two species endemic to Western Ghats has been collected from the study area.

Among pteridophytes the species like *Vittaria montana, Elaphoglossum beddomei, E. nilgiricum* are known to be endemic to South India.

5.1.3 Lower Groups

Lower groups such as mosses and lichens were also collected and studied during this period.

Mosses

Mosses are abundant in evergreen forest and evergreen shola forests. From the study area 10 species of epiphytic mosses that are commonly found have been collected and identified.

1. *Barbella determessi*
2. *B. pendula*
3. *Fissidens schmidii*
4. *Hypnum cupressiforme*
5. *Papilaria crocea*
6. *Pleuropus nilghirense*
7. *Pterobryopsis orientalis*
8. *Rhegmatodon orthostegium*
9. *Trachypus humilis*
10. *Sematophyllum subhumile*

Among these, *Papilaria crocea* and *Pterobryopsis orientalis* are commonly found to cover the branches of the trees heavily and as a result of the weight of the mosses the branches get broken.

Lichens

Several species of corticolous lichens - both micro and macrolichens were collected and identified with the help of Chemical Colour Test and Thin Layer Chromatography. Macrolichens are more profuse in evergreen shola patches, at an altitude of 1500m and above in sheltered folds of the mauntains. Foliose and fruiticose lichen genera like *Parmelia, Heterodermia, Leptogium, Lobaria, Sticta, Usnea, Ramalina* and crustose forms of the families Graphidaceae, Thelotramataceae, etc., predominate in this high altitude sholas. The arboreal elements of the shola provide suitable habitat for these lichens to grow. *Parmelia nepalense, P. tinctorum, Heterodermia comosa, H. isidiophora, Usnea sp.* grow on trunks of the trees of these sholas. *Parmelia nepalense* and *Usnea sp.* are fairly common at the altitude above 1800m. They are found in almost all trees. The tree trunks of *Rhododendron nilagiricum* var. *arboreum, Syzygium sp., Elaeocarpus sp., Litsea sp., Vaccinium sp.*, etc., are inhabited by lichens such as *Parmelia sp, Heterodermia boryi, Usnea sp., and Ramalina sp.* The trunks of the low altitude (800-1500m) evergreen trees are often covered with crustose forms which belong to the family Graphidaceae, Thelotremataceae, etc,. and foliose forms like *Parmelia sp.*, and *Heterodermia sp.* The density of lichen growth increases with the altitude of the area. The deciduous forests have comparatively poor lichen growth. The list of lichens collected from the study area is given as Appendix I.

6. HOST-EPIPHYTE RELATIONSHIP

The habitat of epiphytes differs in various respects from that of the terrestrial plants. Different species of epiphytes differ widely in their microclimatic requirement. Some species are restricted to a very well-illuminated habitat and some species to very shady habitat while, others are tolerant to a wide range of conditions. These specific differences or tolerances are mainly responsible for the marked variations in the composition of the epiphytic vegetation in relation to altitude and from tree to tree. The microclimatic gradients vary from place to place owing to the irregular stratification of the trees and to the specific and individual differences in the density of their crowns.

The interaction between the microclimate and the substratum gives rise to a very great complexity in the distribution of epiphytes in the forest and they form a well-defined superposed community. These were recognised by Schimper (1888) as 'estages' (storey). Richards (1952) regarded them as synusiae and distinguished three types: (a) shade epiphytes, (b) sun epiphytes and (c) extreme xeromorphic epiphytes.

The shade epiphytes are found mainly in the II- storey of the forests, on the tree trunks and branches. On very large trees of the I- storey with dense foliage they appear above the first fork in the centre of the crown. The shade epiphytes commonly consist of filmy ferns like *Hymenophyllum* and a few orchids and other flowering plants like *Medinilla*.

Sun epiphytes are usually the richest of the epiphytic community in both number of species and individuals. They occur chiefly in the centre of the crowns and along the larger branches of I- and II- storey trees. On very large trees, sun epiphytes spread over the trunk below the first fork. Many ferns and a very large number of species of orchids and other flowering plants come under this category.

Extreme xeromorphic epiphytes live on the topmost branches and twigs of the taller trees. They are almost fully exposed to sun and wind. This community mainly consists of members of the Gesneriaceae and Orchidaceae

The growth of epiphytes depend mainly on the bark charecteristics of the host plant, light and humus, precipitation, altitude and humidity of the forest strata. It is often found that epiphytes grow on rocks when trees are absent. Although epiphytes occupy a host tree, the availability of a suitable substratum is a common problem in most of the epiphytic communities. Some trees are found to harbour a large number of epiphytes. In Silent Valley, evergreen tree species *Mesua nagassarium* alone harbours 14 species of vascular epiphytes. They include *Oleandra muscifolia, Asplenium indicum, A. phyllitidis, Selaginella involvens, Pyrrossia porosa* var. *porosa, Lepisorus nidus, Huperzia phlegmaria, Vittaria elongata, Bulbophyllum tremulum, Oberonia sp., Hoya pauciflora, Aeschynanthus perottettii and Peperomia tetraphylla*. Some other trees are occupied by 5 or 6 species on an average. The diversity of epiphytes is affected by the climatic imbalances and impermanence of the epiphytic substrata.

The following parameters are found to be responsible to determine the diversity of epiphytes.

6.1 BARK

Bark characteristics are important in determining the suitability of a host species. Some of the tree species where the bark is easily shed from branches and trunks do not provide a permanent substratum for the epiphytes. Moist bark with adequate supply of water and nutrients provides a suitable substratum for epiphytes. Epiphytic species of *Utricularia* is found only on tree trunks with dripping water. Fungi, bryophytes and mosses establish more easily due to the presence of epiphytes which maintain the bark in a moist condition. Some species like *Grammitis sp., Elaphoglossum sp., Impatiens sp., Coelogyne sp., Dendrobium sp., etc.* are restricted to the trunk with mossy mats which are found only in the higher canopy. Such substrata with a high water holding capacity supply moisture to the epiphytes even during drier periods. These mossy, bryophyte mats act as a chemical buffer against bark toxins (Steege and Cornelissen, 1989). According to Sanford (1968) and Johanson (1974), trees with relatively rough bark carry large number of epiphytes than trees having smooth bark. Many epiphytes are found only on living trees except *Belosynapsis vivipara* which occurs on the decayed wood as well. As the rough barks can hold high moisture, mosses and bryophytic mass in the tree species like *Antidesma menasu, Elaeocarpus sp. Calophyllum polyanthum, Olea dioica* and high altitude shola plants like members of Lauraceae and Myrtaceae hold large of epiphytes.

6.2 LIGHT AND HUMUS

Epiphytes depend on the availability of light for their growth. Some of the epiphytes inhabit upper canopy trees. Based on light requirement there are two types of epiphytes. 1) *Shade loving epiphytes* - which are mostly ferns and some orchids which occur mainly on the lower side of the tree trunk 2) *Sun loving epiphytes* - which mostly prefer upper part of the crown of the trees where they are found almost up to the tip of the branches. Minature orchids are found here. The vertical distribution of epiphytes is mainly determined by the fluctuations in photon flux density (PFD) in the forest strata. In the tree foot zone, relative PFD varies due to the shade caused by the undershrubs. Species like *Hymenophyllum, Trichomanes, Microgonim, Eria, Leptochilus*, etc. prefer mostly lower part of the tree trunk. In the upper part of the tree trunk PFD increases gradually. In the lower canopy though the PFD increases it varies considerably due to the shade caused by the large branches. Some ferns like *Asplenium* and *Microsorium* occupy this zone. Therefore, epiphytism is higher in the lower canopy and upper part of the tree trunk. Few species are exclusive to the lower canopy and it is in these tree zones epiphytic diversity is found to be maximum. In the forks of branches, moss and bryophyte mass provide better habitats for epiphytes to grow. These forks provide support to the epiphytes by accumulating liter and humus. Genera like *Asplenium, Microsorium, Remusatia* etc. form this type of association. Those species occurring in upper canopy are prone to frequent droughts. These plants are small in size, succulent and some of them have terete leaves. Their roots are specially adapted for this

condition and provide firm attachment. *Tainiophyllum, Chiloschista* and species of *Dendrobium* are upper canopy occupants and they do not occur elsewhere in the tree. The trees of the upper canopy with larger branches are highly suitable for colonization of epiphytes and for the accumulation of humus. Nest leaves of some ferns accumulate dead leaves organic matter on the branches of trees, and thereby making their own humus soil. This humus formation is enhanced by ants, which supply nitrogen and other nutrients. This type of association can be seen in the species like *Diplocentrum, Asplenium*, etc.

6.3 RAIN & ALTITUDE

Precipitation does not directly determine the distribution and diversity of epiphytes in the tropics. But it is by the frequency of wetting from the precipitation in the form of dew or mist that plays an important role. In the epiphytes, intake of water takes place only in the form of fine droplets. As a result, they undergo many interesting structural adaptations like velamen tissues as in the roots of orchids, xerophytic condition as in the ferns, and succulent nature of other epiphytic plants. Although low land rain forests have a higher rainfall than the mountain slopes, with relatively few heavy downpours, on the windward high altitude mountain slopes, by contrast, the ascending air masses give rise to frequent drizzle or dripping fog, which makes the the montane forests, very rich in epiphytic density, particularly in the high altitude belt of the fog forest.

These forests differ from low land forests in the presence of stunted trees, less crown stratification, reduced buttresses, crooked stems, small and coriaceous leaves, persistant foliage and less cauliflory, which provide a suitable substratum for the growth of epiphytes. Due to the high humidity in these forests mosses and lichens are commonly found. Although high altitude forests are rich in density of epipinytes, maximum species diversity is seen in lowland evergreen forests.

6.4. HOST TREES IN DIFFERENT TYPES OF FORESTS

6.4.1 Low Altitude Evergreen (700 - 1500 m.)

In the evergreen forest over 20 species of trees are found to harbour epiphytes. They are *Semecarpus anacardium, Litsea floribunda, Dimocarpus longan, Heritiera papilio, Calophyllum polyanthum, Biscofia javanica, Terminalia sp., Persia macrantha, Syzygium leatum, S. cumini, Antidesma menasu, Elaeocarpus tuberculatus, E. munronii, E. glandulosus, Olea dioica, Holigarna nigra, Mesua nagassarium, Artocarpus integrifolia, Canarium strictum, Dysoxylum malabaricum, Cullinia exarillata, Debregeasia longifolia* and *Laportia sp.* At the same altitude some *Ficus sp.* also holds certain epiphytes. In *Syzygium sp., Mesua nagassarium, Olea dioica, Eleocarpus sp., Biscofia javanica* etc. most of the epiphytes are seen. The frequency of occurrence of epiphytes is high in *Biscofia javanica* in the range of 6 to 7 species. While, in all the other host trees on an average 4 epiphytic species are seen. In some areas of Silent Valley species of *Antidesma menasu. Turpinia malabarica, Litsea floribunda, Aglaia lavii. Garzinia sp., Gomphandra sp., Elaeocarpus sp.* harbour some mosses (*Papilaria crocea & Pterobryopsis orientalis*),

and these mosses have a festoonaceous appearance. Trees like *Syzygium sp., Dimocarpus longan, Olea dioica*, etc. found in the riverine area are inhabited by *Selaginella involvens, Vittaria elongata, Asplenium decrescens*, etc.

6.4..2 High altitude evergreen shola forest (1000m. & above).

Shola forests form an important habitat for the epiphytes. High humidity, suitable light intensity, fog etc. play an important role in the distribution of epiphytes in the evergreen shola forests. Some of the major tree species which harbour the epiphytes are:- *Elaeocarpus recurvatus, Syzygium sp., Neolitsea sp., Calophyllum sp., Ligustrum decaisnei, Turpinia sp., Gnidia glauca, Rhododendron arborea* var. *nilgirica, Actinodaphne sp.*, and *Litsea sp.* Orchids are the main occupants in these forests. Some species of the genus *Seidenfadeniella, Coelogyne sp., Dendrobium sp., Eria, Aerides*, etc. and ferns like *Grammitis, Crypsinus*, etc.are found only in these forests. Most of the arboreal elements have rough bark and are covered with mossess and lichens. These trees serve as a suitable substratum for the abundant growth of epiphytes. Here the epiphytic density is found to be high.

6.4.3 Grassland

Some grassland trees also hold certain number of orchids and ferns. Among these *Emblica officianalis* holds large number of epiphytic species, such as *Luisia zeylanica, Dendrobium sp. Trias stocksii, Coelogyne sp., Bulbophyllum fischerii, Vanda sp. and Oberonia sp.* Ecotone tree species *Glochidion arboreum, G. neilgherrense, Wendlandia sp., Gnidia glauca, Rhododendron arboreum* var. *nilagirica* also are found to hold large number of epiphytes. It was interesting to note that *Wendlandia sp.* inhabit only ferns like *Araiostegia pulchra, Elaphoglossum nilgiricum, Crypsinus montanus*, etc.

6.4.4 Drier regions

In drier regions only lower groups of plants, particularly lichens (Microlichens) inhabit the trees. Moist deciduous tree species such as *Tectona grandis, Dalbergia sp. Lagerstroemia paniculata, L. lanceolata* also hold some species of epiphytes. Orchids such as *Acampe, Aerides, Rhyncostylis, Vanda* etc. and ferns like *Drynaria quercifolia, Pyrrossia lanceolata* etc. are found in these forests.

7. DISCUSSION

Western Ghats is one of the floristically richest area harbouring about 4000 flowering plants and 255 species of pteridophytes. Southern Western Ghats with forest patches covering an area of 12000 km^2 is reported to hold 3900 species of flowering plants of which 1286 species are endemic (Nayar, 1997). During the recent enumeration of vascular epiphytes of Western Ghats, it has been estimated that of the total vascular plant species occurring in the Western Ghats about 7% are epiphytic. Among the angiosperms the family Orchidaceae contributes a

is also found in the interior forest, at an altitude of above 700m. Trunks of ecotone tree species are inhabited by the only epiphytic member of the family Lentibulariaceae(*Utricularia striatula*). With regard to the genus *Medinilla* (Fam. Melastomataceae), *M. malabarica* is more common in the evergreen forests ranging from 700-900m in altitude. However, *M. beddomei* is rather rare and occurs only in the high altitude shola forests. The epiphytic Asclepiad. *Hoya pauciflora* is commonly found above 700m altitude, while, *Hoya wightii* is rare and seen only above 1000m. It prefers both ecotone area and interior forest. The genus *Impatiens* (Balsaminaceae) is shade loving and prefers mostly shola forests. Among this *I. parasitica* and *I. jerdoniae* are most common. During the present study 3 new species of *Impatiens* have been recorded.

Some members of the family Loganiaceae, Araliaceae and Moraceae show epiphytic tendencies in their juvenile life. *Fagraea ceylanica* (Fam. Loganiaceae) shows epiphytism in evergreen forests, however, it grows as an independant tree in higher altitude. *Schefflera venulosa* and *Polyscias accuminata* (Fam. Araliaceae) are also found growing as epiphytic on large trees. Species of the genus *Ficus* start their life as epiphytes and subsequently become estblished as independant trees.

In pteridophytes Polypodiaceae has the highest number (18 spp.) of epiphytic species under 10 genera. The family Vittariaceae and Davalliaceae have all epiphytic species though a few members of these groups are occassionally lithophytic. The genus *Asplenium* (Fam. Aspleniaceae) has the highest number of epiphytes (14 spp.). *Drynaria quercifolia*, a nest forming fern, is more common in low altitudes. Other nest forming ferns like *Asplenium* and *Microsorium* are found in evergreen forests. Xeromorphic ferns like *Pyrossia spp.*, *Drymoglossum heterophyllum*, *Lepisorus spp.*, *Vittaria spp.*, etc. are sun exposed and are anchored on the bark by their long trailing rhizome.

Fern allies like *Huperzia spp.* are seen only above 900m altitude and along shaded stream banks. Among this only *H. phyllantha* is erect and the rest have pendent habit. *Selaginella involvens*, the only epiphytic member of the genus *Selaginella* is common throughout. It has been observed that *Psilotum nudum* is very rare though it is common in low altitudes. Some of the relatively ferns that are seen only above 700m altitude are *Lepisorus nudus*. *Pyrrosia spp.*, *Nephrolepis auriculata*, *Araiostegia pulchra*, *Vittaria elongata*, *Hymenophyllum spp.*, *Asplenium formosum*, *A. phyllitidis*, *Microsrium punctatum* . Among these *Lepisorus nudus* and *Pyrrosia spp.*, are widespread. *Drynaria quercifolia*, *Pyrrosia lanceolata* and *Vittaria elongata* occur mostly in plains. Some species like *Asplenium serricula*, *Antrophyum plantagenium*, *Davallia bullata*, *Crypsinus montanus*, *Microgonium bimarginatum* and *Hymenophyllum spp.*, prefer deeply shaded localities of the evergreen forests. Hymenophyllaceous ferns are restricted to deeply shaded localities associated with streams. Most of the epiphytic members of the family Polypodiaceae are restricted to higher altitudes. Only *Drymoglossum heterophyllum*, *Drynaria quercifolia* and *Pyrrosia lanceolata* prefer low altitude. *Crypsinus montanus*, *Phymatosorus spp.*, *Laxogramme spp.*, *Microsorium membranaceum* and *Elaphoglossum spp.*, mostly prefer an altitude above 900m . Polypodiaceous fern *Nistarika bahupunctika* is rare in study area. It has been located only

in Silent Valley National Park. Some of the epiphytic ferns like *Vittaria elongata, Oleandra muscifolia, Lepisorus nudus, Nephrolepis auriculata* and some species of the genera *Asplenium* are sun lovers and they occur in semi-shaded open localities of the evergreen forests. Species like *Leucostegia immersa, Humata repens, Crypsinus montanus, Elaphoglossum nilgiricum, Pyrrosia porosa* var. *porosa, Asplenium crinicaule* prefer upper canopy of the trees while species such as *Microgonium bimarginatum, Hymenophyllum gardenerii, Asplenium formosum. Antrophyum plantagenium, Elaphoglossum beddomei.* etc. are mostly seen in the lower part of the tree trunk. Some species like *Drynaria quercifolia, Pyrrosia lanceolata* and *Drymoglossum heterophyllum* spread all over the trees.

During the present study it was found that there are over 40 species of host trees distributed at different altitudinal ranges holding a large number of epiphytes and with the maximum species diversity at an altitude of 500m - 1000m and 1000m - 1500m. The density of epiphytes is found to be high at an altitude of 1500m and above but species diversity is comparatively less (Figs. B & C).

These observations are based on the data generated from arbitarily selected areas covering the localities where the trees showed maximum epiphytic growth and therefore may not be enough to make any generalisation on vegetational diversity considering the areas that have been covered during the study. However, it definitly gives an indication of the vegetational diversity. Except Silent Valley National Park the other NBR areas were not completely covered due to various reasons, however, representative collections could be made from these localities.

8. CONCLUSION

It is evident that epiphytes constitute an important component in the ecology of the tropical forests due to their diverse habits and habitats. However, to develop a meaningful conservation strategy for the preservation of biological diversity detailed and accurate information on the species that exist in the region is essential. The knowledge of the epiphytic flora of our tropical forests is still inadequate. Further detailed studies on various aspects on this diverse group is an urgent need. This is the first attempt to study the epiphytic flora of Western Ghats. It is hoped that the study will accelerate further studies on this fascinating group and a detailed study on impact assessment on biodiversity, during the working of forests during the various forestry programmes will help to adopt appropriate conservation strategies.

Fig. B Occurrence of vascular epiphytes per host tree at different altitudes

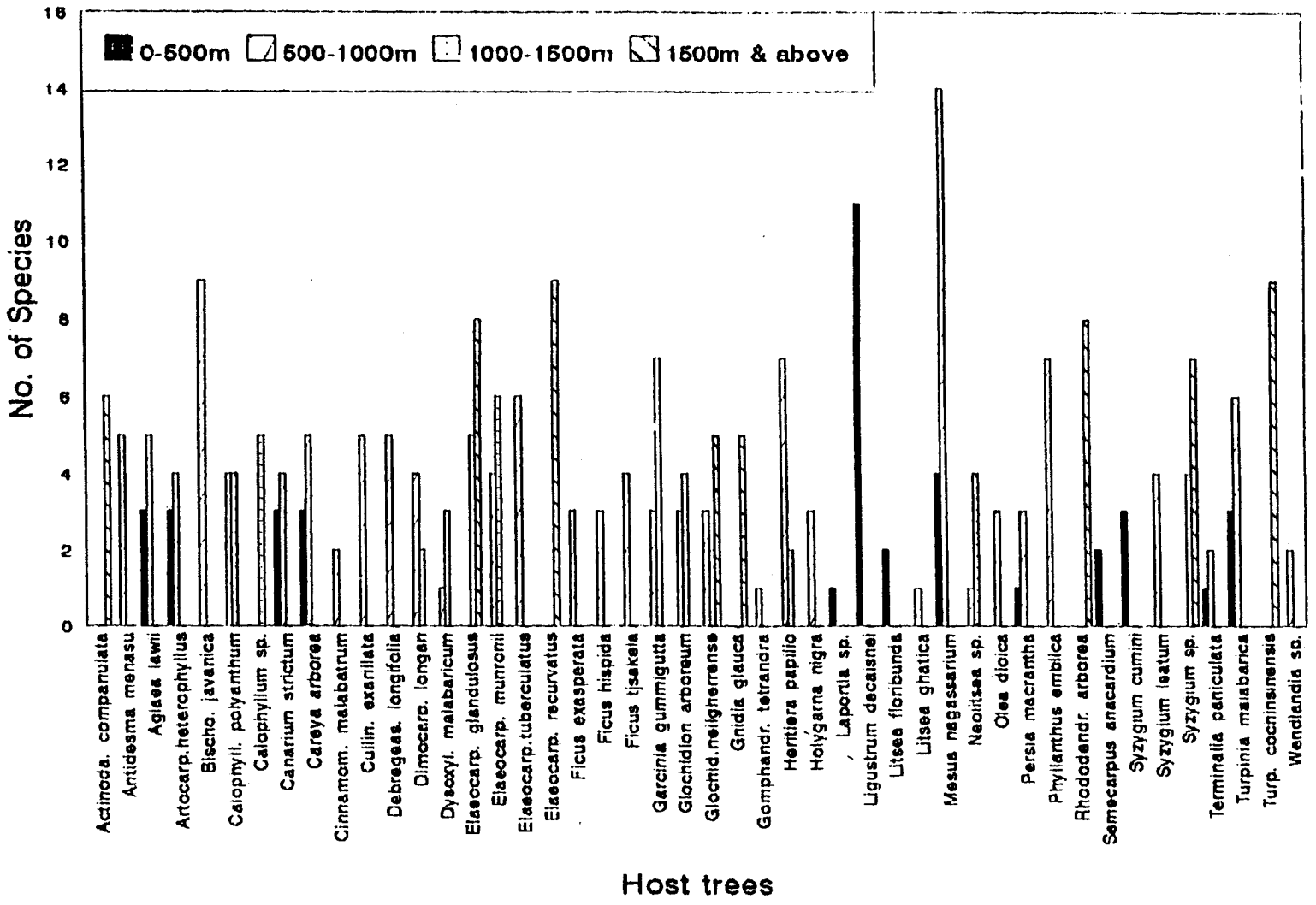
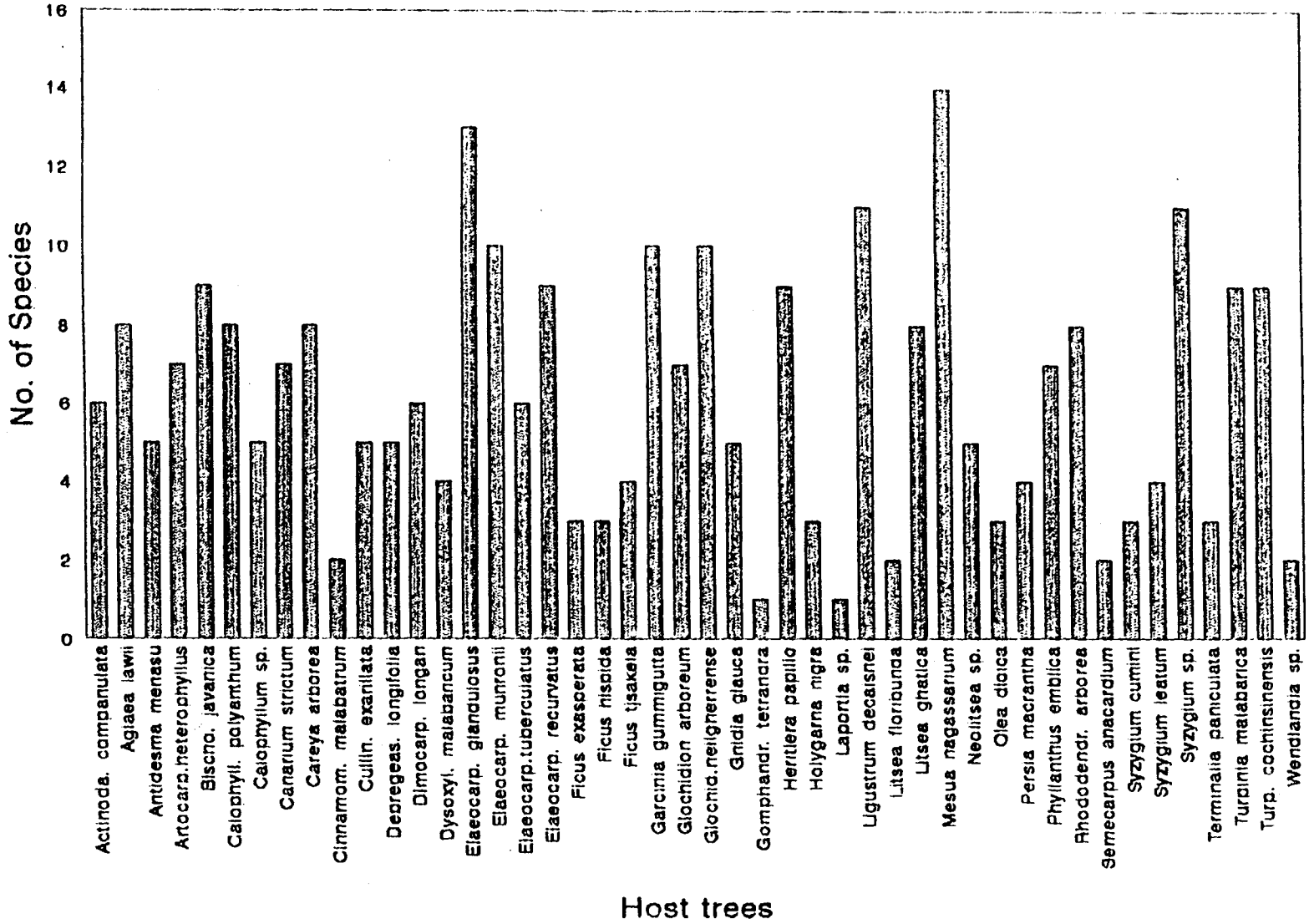


Fig. C. Incidence of vascular epiphytes per host tree



9. SYSTEMATICS

Key for the identification of Vascular Epiphytes

1. Plants without flowers ..... Pteridophyta
2. Plants with flowers ..... Angiosperms

9.1 PTERIDOPHYTA

Key to the families

1a. Plants bearing cones 2
1b. Plants otherwise 3

2a. Cones heterosporous ..... Selaginellaceae
2b. Cones homosporous ..... Lycopodiaceae

3a. Plants without leaves and roots, sporangia trilocular ..... Psilotaceae
3b. Plants with leaves and roots; sporangia unilocular 4

4a. Sporangia borne on spikes or panicles ..... Ophioglossaceae
4b. Sporangia borne on back of the blade or on modified fronds or part of fronds 5

5a. Sporangia borne on modified or separate fronds or part of fronds 6
5b. Sporangia borne on back of the blade 7

6a. Margin of the lamina with a narrow cartilaginous border;
veins simple or forked, free ..... Lomariopsidaceae
6b. Margin of the lamina without cartilaginousborder; veinlets simple
and branched ending in hydathodes ..... Polypodiaceae *(Leptochilus)*

7a. Fronds pinnatifid 8
7b. Fronds otherwise 11

8a. Receptacle present ..... Hymenophyllaceae
8b. Receptacle absent 9

9a. Sori submarginal on the vein end, elongated; indusia orbicular
to suborbicular some times semicircular, pale brown ..... Davalliaceae
9b. Sori and indusia otherwise 10

10a. Sori linear along the veins protected by glabrous, entire or fimbricate indusia ..... Aspleniaceae
10b. Sori and indusia reniform ..... Oleandraceae

11a. Plants always pendulous; sori marginal or on the longitudinal
groove along the netted veins of the frond ..... Vittariaceae
11b. Plants otherwise 12

12a. Veinlets anastomosing ..... Polypodiaceae
12b. Veinlets free ..... Grammitidaceae

LYCOPODIACEACE

The systematic status of this family is still controversial. Some workers have recently split this family into 2 or 3 distinct families. However, Ollgaard (1987) based on the revisionary studies included four genera, viz. *Huperzia, Phylloglossum, Lycopodium and Lycopodiella* under this family. Ollgaard's system has been followed here.

In South India the family Lycopodiaceae, is represented by only one epiphytic genus *Huperzia*, which is described here.

HUPERZIA Bernh.

Epiphytic herbs; stem erect or pendent; leaves small, spiral or decussate, with a single median vein; sporophylls arranged in distinct cone or loosely placed in the stem; sporophylls similar to vegetative leaves or dissimilar.

Seven species of this genus have been collected during the present study.

Key to the species

1a. Plant erect or suberect 2
1b. Plant pendent 3

2a. Plants with distinct cone ..... *H. phyllantha*
2b. Cone indistinct ..... *H. ceylanica*

3a. Sporongia borne on distinct cone ..... *H. phlegmaria*
3b. Sporangia not borne on distinct cone 4

4a. Leaves curved upward 5
4b. Leaves not curved upward 6

5a. Leaves crowded near the apex of stem, leaves acute, acuminate at apex ..... *H. hamiltonii*
5b. Leave not crowded near the apex of stem, leaves acute at apex ..... *H. nilagirica*

6a. Leaves oblanceolate, progressively narrowed towards the base, acuminate and stiff ..... *H.squarrosa*
6b. Leaves oblong slightly narrowed towards base acute and not stiff ..... *H.hilliana*

Huperzia ceylanica (Spring) Trev., Atti. Soc. Ital. Sci. nat. 17:248 (1875).
Lycopodium ceylanicum Spring, Men. Lycop. 138 (1842).

Small erect herbs, about 7 cm long; dichotomously 1 or 2 times branched; leaves spreading, glossy, ovate, apex obtuse; sporophylls similar to vegetative leaves; sporangia reniform.

Distribution & Ecology: Very rare, collected only from Aruvanpara slope of Silent Valley National Park. Prefers an altitude of 1000m and above, in shaded localities of evergreen forests.

Specimens examined: Stephen 007502 KFRI (Aruvanpara, SVNP).

Huperzia hamiltonii (Spreng) Trev., Atti. Sci. Ital. Sci. nat. 17: 248(1875); Nair et.al, J. Econ. Tax. Bot. 12(1):192(1988); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 27. pl. 6 (1992).

Small pendent herbs, about 20 cm long; stem tufted, dichotomously 2-3 times branched; leaves spreading, spirally arranged, curved upward, oblong, apex acute, glossy and firm; sporophylls similar to vegetative leaves and aggregated at the apical part of the main branches; sporangia reniform.

Distribution & Ecology: Rare, collected only from Punnamala area of Silent Valley National Park and Rajamallay of Munnar. Prefers shaded trees at an altitude of 800m - 1500m.

Specimens examined: Stephen & Joy 007257 KFRI (Punnamala);Stephen 7240 KFRI (Rajamallay, Munnar).

Huperzia hilliana (Nessel) Holub, Folia Geobot. Phytotax. 20 : 73 (1985); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 28. pl. 7 (1992).

Urostachys hillianus Nessel, Repert. Spec. Nov. Regn. Veg. 36: 186, t. 175 (1934).

Small pendant herbs about 15cm long, very thin, dichotomously branched into 2-3 times; leaves numerous, ascending, oblong slightly narrowed towards the base, acute; sporophylls similar to vegetative leaves; sporangia borne on the distal part of the main branches, reniform (Fig. 4A).

Distribution & Ecology: Rare, collected from Parathode and Panchalithode areas of Silent Valley National Park. Also collected from Mannavan Shola, Idukki Dt. Mostly prefers evergreen shola forests and stream side trees at an altitude of 850 - 1800m.

Specimens examined: Stephen 007274 KFRI (Parathode); Stephen 007672 KFRI (Panchalithode); Stephen 007257 KFRI (Punnamala); Stephen 007892 KFRI (Mannavan Shola); Stephen 007240 KFRI (Rajamallay).

Huperzia nilagirica (Spring) Dixit, J. Bombay Nat. Hist. Soc. 77(3) : 541 (1981).

Lycopodium nilagiricum Spring Bull. Acad. Sci. Belg. 15(1) : 58 (1842).

Pendent herbs, about 15 cm long; dichotomously branched into 3-4 times; leaves ascending, obovate, apex acute, leathery; sporophylls similar to vegetative leaves; sporangia reniform (Fig. 4B).

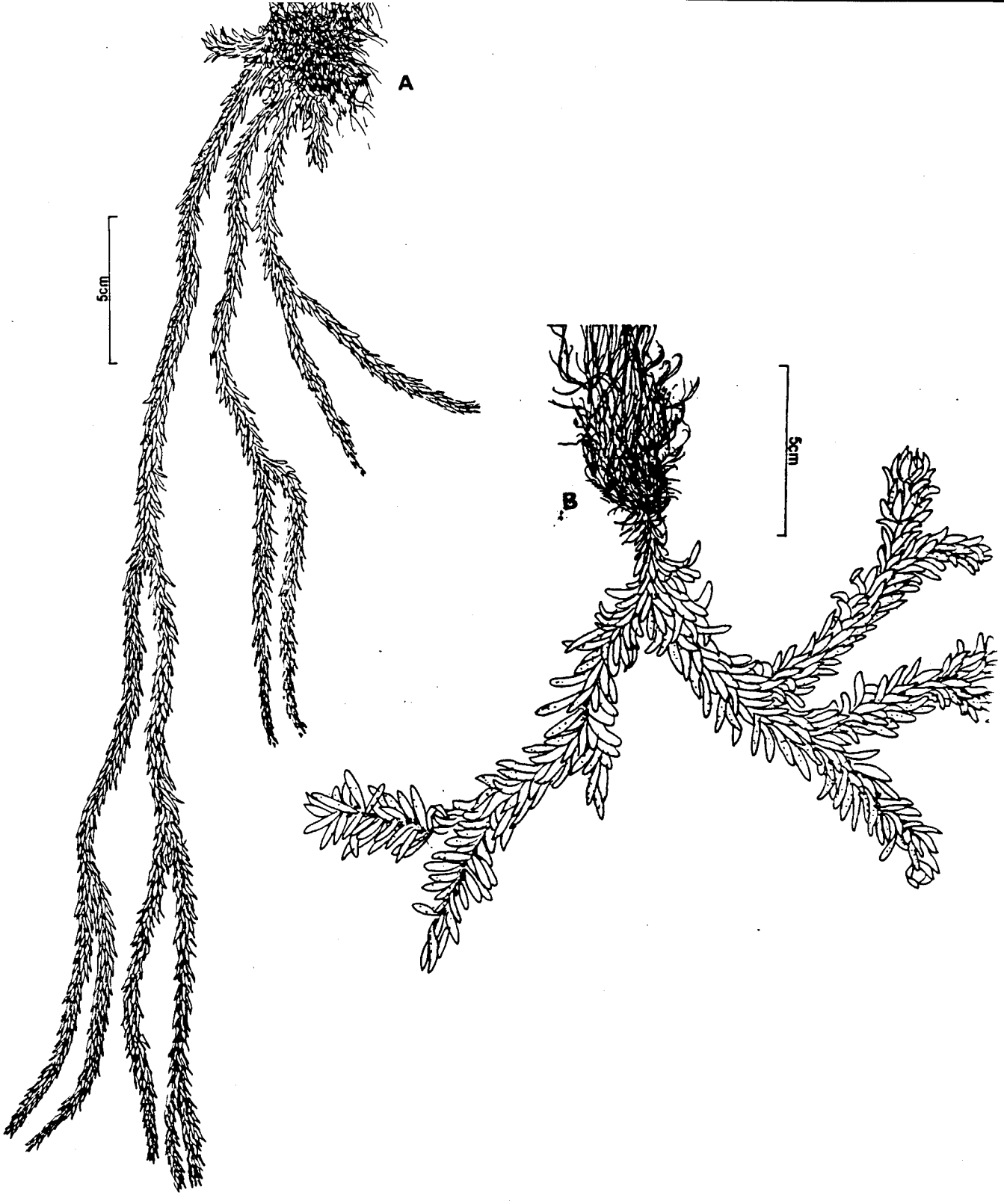


Fig. 4. A- Habit of *Huperzia hilliana* (Nessel) Holub; B- Habit of *H. nilagirica* (Spring) Dixit

Distribution & Ecology: Collected once from Punnamala area of Silent Valley National Park. Prefers shaded localities in the evergreen forests at an altitude of 800m - 1000m.

Specimens examined: Stephen & Joy 7255 KFRI (Punnamala, SVNP).

Huperzia phlegmaria Rothmaler in Feddes Repert. Sp. Nov. 54:62(1944);Ollgaard, Opera Botanica, 166(1987); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 24. pl. 3.(1992).

Lycopodium phlegmaria L., Sp. Pl. 2: 1101 (1753).

Phlegmariurus phlegmaria (L.) Holub in Preslia, 36: 21 (1964); Dixit, Cens. Ind. Pterid. 9 (1984); Lycop. India, 70, fig. 16 A-B (1988); Nair et.al, J. Econ. Tax. Bot. 12(1) :195 (1988).

Pendent epiphytic herb, about 1m long, stem isodichotomously forked upto 4 to 5 times; leaves laxly arranged, ovate, lanceolate, midrib prominent, cone terminal on the ultimate branches 1 or 2 times dichotomously branched; sporophylls distinct from vegetative leaves. sporophylls opposite, decussate; sporangia borne on the axil of the sporophyll, reniform. yellow coloured.

Distribution & Ecology: Very rare, collected from Silent Valley National Park, it is localised in distribution and shows variation in the size of entire plant and cone. Prefers mostly stream sided trees at an altitude of 800m - 950m.

Note: Plants collected from Panthenthode area have upto 1 m in length and 25 cm long cone, plants collected from Panchalithode area shows upto 50 cm in length and 10 cm long cone, where as the plants collected from Parathode area is much smaller than the above 2 localities, which is 20 cm long and cone upto 4 cm long.

Specimens examined: Stephen & Joy 007300 KFRI (Panthenthode); Stephen & Joy 007273 KFRI (Parathode); Stephen 007674 KFRI (Panchalithode).

Huperzia phyllantha (Hook.& Arnott) Holub. Ollgaard, Opera Botanica, 92 : 166 (1987); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 25. pl. 4 (1992).

Lycopodium phyllanthum Hook. & Arn., Bot. Capt. Belg. Voy. 102 (1841); Sledge, Bot. J. Linn. Soc. 84 :8 (1982).

Stem erect, about 50cm long, 1 or 2 times forked; leaves arranged in vertical rows, sessile, ovate, acute, midrib raised below grooved above, texture stiff, tip spiny like. cone terminal on the ultimate branches, dichotomously forked; sporophylls opposite, decussate, sessile, broadly triangular, acute, midrib prominent; sporangia borne on the axil of the sporophyll that covers the sporangia, reniform, yellow coloured (Fig. 5A).

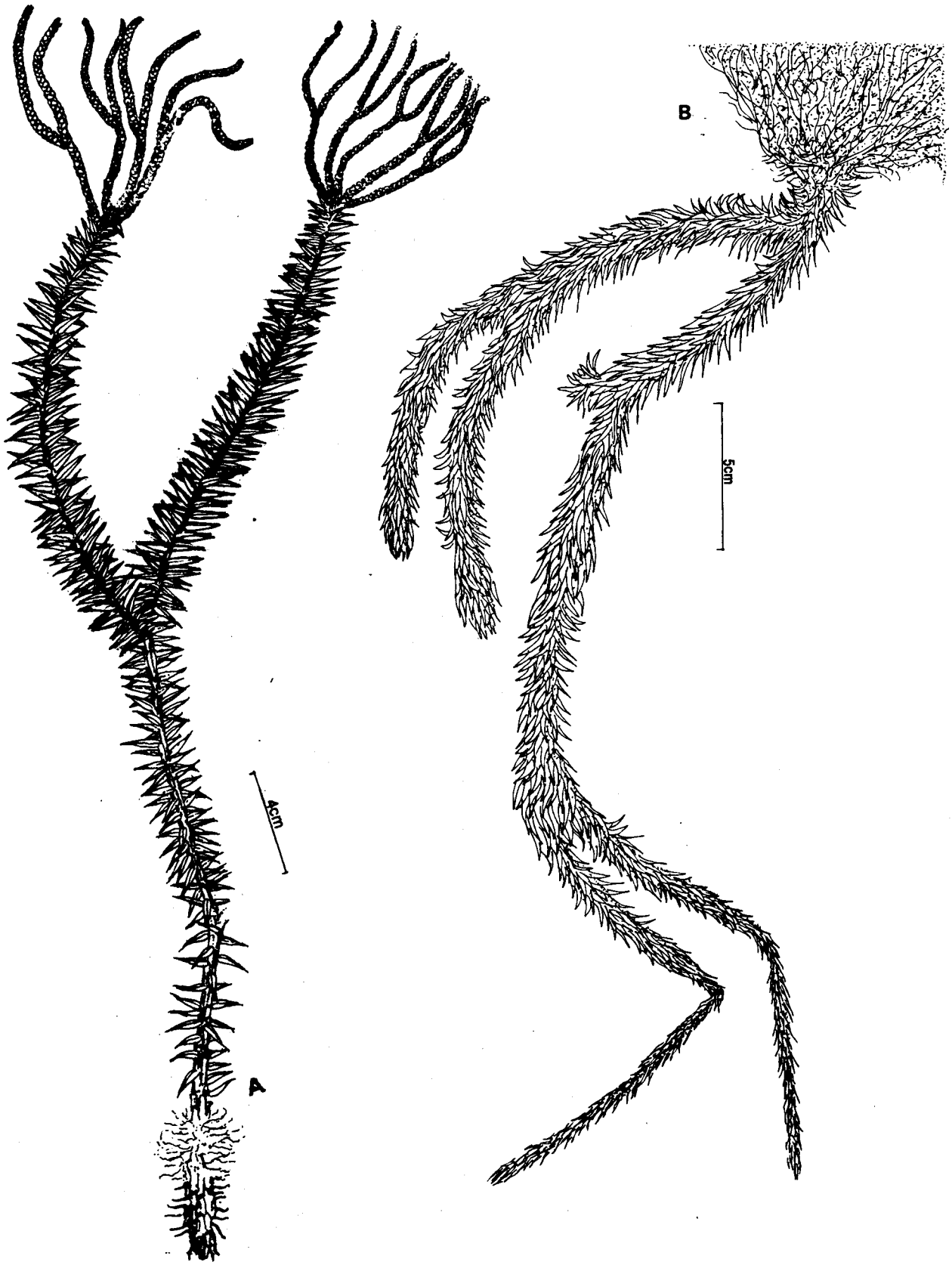


Fig. 5. A- Habit of *Huperzia phyllantha* (Hook. & Arnott.) Holub;
B- Habit of *H. squarrosa* (Forst.) Trev.

Distribution & Ecology: Collected from Chandanathode and Chembra Peak of Wayanad and Pothupara of Nelliampathy. It is a widely distributed species throughout the Southern Western Ghats. Prefers shaded stream side trees at an altitude of 700m - 1500m.

Specimens examined: Muktesh Kumar & Stephen 006747 KFRI (Chandanathode); Joy & Stephen 007217 KFRI (Pothupara).

Huperzia squarrosa (Forst.) Trev., Atti, Soc. Ital. Sci. nat. 17: 247 (1875); Dixit, Cens. Ind. Pterid. (1984); Ollgaard, Opera Botanica, 167 (1987); Nair et al., J. Econ. Tax. Bot. 12(1): 193 (1988); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 26. pl. 5 (1992).

Pendulous, about 40 cm long; stem dichotomously 2-3 times branched; leaves crowded, arranged in close spirals; oblanceolate, base progressively narrowed, apex acute or acuminate, stiff; sporophylls slightly smaller than the vegetative leaves, lanceolate acuminate; sporangia reniform, yellowish (Fig. 5B).

Distribution & Ecology: Very rare, collected from two different localities, viz. Meenmutty area New Amarambalam and Kungilliapadi of Muthikulam area (Palghat Dt.) Mostly prefer fully shaded trees at an altitude of 700m - 900m.

Specimens examined: Stephen 8103 KFRI (Meenmutty); Stephen & Michael 008813 KFRI (Kungilliapadi).

SELAGINELLACEAE

SELAGINELLA Palisot de Beauvois.

Selaginella involvens (Sw.) Spring in Bull. Ac. Brux. 10(6) :136 (1843) emend Hieron. in Hedwigia 50(1): 2 (1910); Bir et.al., Ind. Fern J. 6(1-2) :35 (1989); Nair et.al, J. Econ. Tax. Bot. 12(1) : 190 (1988); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 35. pl. 12 (1992).

Lycopodium involvens Sw., Syn. Fil. 182 (1806).

Stem erect, rooting only at the base; lower part of stem simple, copiously branched above, quadripinnate; lateral branches alternate, lanceolate, bearing secondary and tertiary branches; leaves on main stem scattered, broadly ovate, acute; lateral leaves ovate-lanceolate, acute; cones terminal on the branches, quadrangular, sporophylls ovate and acuminate (Fig. 6).

Distribution & Ecology: Common throughout the study area. It is also found growing as lithophytes and as terrestrial plants. It is luxuriant in the riparian area. Prefers an altitude of 800m - 1200m.

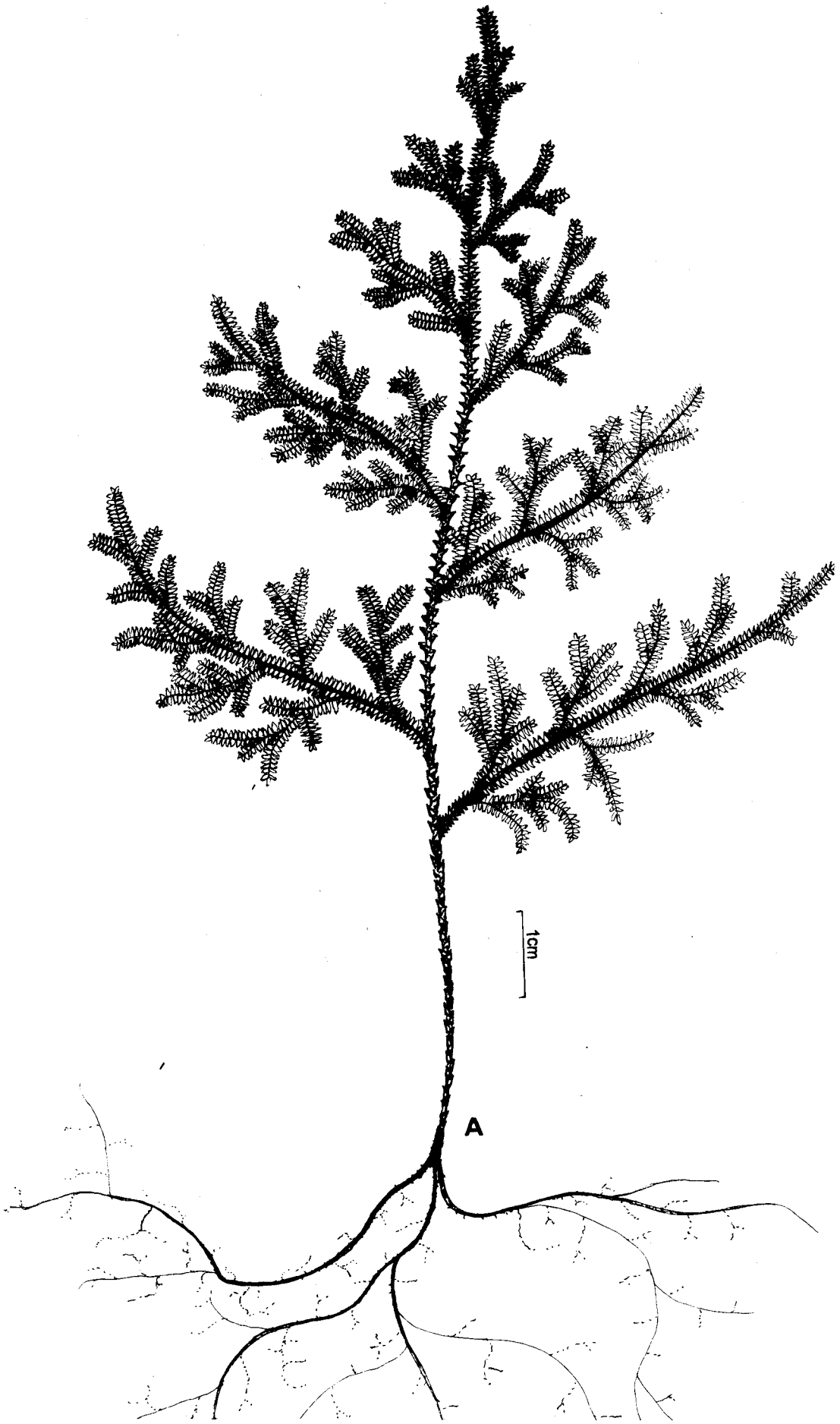


Fig. 6. A- Habit of *Selaginella involvens* (Sw.) Spring

Specimens examined: Stephen & Joy 007280 KFRI (Chembotti River Bank, Silent Valley National Park).

Note: Locally known as 'Garudapacha', is used for various medicinal purposes. It is used against various poisons. The dried plants become fresh green again when kept in water for some times.

PSILOTACEAE

PSILOTUM Swartz

Psilotum nudum (L.) P. Beauv., Prod. Fam. Aetheog. 106, 112 (1805); Sledge, Bot. J. Linn. Soc. 84 : 8 (1982); Dixit & Vohra, Dict. Pterid India, 39 (1984); Nair et.al, J. Econ. Tax. Bot. 12(1) : 190 (1988); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats. 45. pl. 25 (1992).

Lycopodium nudum L., Sp. Pl. 2: 1100 (1753).

Erect plant with creeping rhizome; roots absent; stem tetragonal with a few grooves and ridges, dichotomously branched; true leaf absent, scale leaves arranged in alternate pairs throughout the branches; sporangia borne at the axis of scale leaves, sessile; synangia trilocular.

Distribution & Ecology: Very rare, it is a low altitude fern but also found in some shola forests. Epiphytic on tree bases or on the adventitious roots of coconut palms. Collected from Mannavan Shola & Peechi.

Specimens examined: Muktesh Kumar & Stephen 006797 KFRI (Mannavan Shola); Stephen 008831 (Peechi).

OPHIOGLOSSACEAE

The family Ophioglossaceae is represented by 4 genera in India. Among these, only one genera *Ophioglossum* with a single species is known to be epiphytic.

OPHIOGLOSSUM L.

Ophioglossum pendulum L. Sp. Pl. (ed. 2) 1518. (1763); Bedd., Handb. Ferns Brit. India, Ceylon and Malay Peninsula 465. (1893); *f. pendulum* : Weiffering Blumea 12: 332. (1964).

Pendulous epiphytes with creeping rhizome; fronds ribbon like, apex obtuse, base tapering and terete, upto 30 cm long; spikes solitary from the fronds, unbranched, upto 15 cm long.

Distribution & Ecology: Very rare, grows on *Toona cilita* and *Cullinia exarillata* in Ever Green Forests(1000 m). In association with *Nephrolepis* species.

Specimens examined: Jomy 12832 KFRI.

Note: Augustine et al, (1994) recorded its occurrence in Indian main land from Periyar Tiger Reserve in the Idukki District of Kerala.

VITTARIACEAE

The family Vittariaceae include 2 genera viz. *Vittaria* and *Antrophyum*. Two species of *Vittaria* and two species of *Antrophyum* have been collected during the present study. Rhizome creeping or descending, fronds simple linear lanceolate or obovate. Veins reticulate except when the blade is extensively narrow. Sporangia spread all over the veins or restricted to the submerged veins.

Key to the genera

1a. Fronds linear; sori marginal or submarginal; mid vein distinct ..... *Vittaria*
1b. Fronds falcate, elliptic; sori on the longitudinal groove along the netted veins; mid vein indistinct ..... *Antrophyum*

ANTROPHYUM Kaulf.

Small epiphytes; rhizomes clothed by clathrate scales, margin dentate, apex gland tipped; fertile fronds similar to sterile fronds, falcate elliptic; midrib indistinct but with several longitudinal veins which are reticulate; sori spreading all over the veins

Key to the species

1a. Fronds sessile or subsessile; paraphyses thread like, unbranched ..... *A. reticulatum*
1b. Fronds with distinct stipe; paraphyses club shaped, branched ..... *A. plantagenium*

Antrophyum plantagenium (Cav.) Kaulf., Enum. 197 (1824); Beddome, Handb. Ferns British India, 403 (1883); Dixit & Nair, J. Ind. Bot. Soc. 53: 287 (1974); Manickam, Fern Fl. Palni Hills, 45 (1986); Nair et.al, J. Econ. Tax. Bot. 16(2) : 277 (1992); Nayar & Geevargheese Fern Fl. Malabar, 148 (1993); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 107. pl. 85 (1992).

Hemionitis plantagenia Cav., Descr. 260 (1802)

Antrophyum reticulatum sensu Beddome, Ferns S. India, t. 52 (1864).

Rhizome short creeping, soft and covered by clathrate scales; ovate, lanceolate, margin toothed, acuminate; fronds tufted, falcate, acuminate at apex, 15 cm long and 3 cm broad; margin entire; sori borne on the reticulate veins; paraphyses clavate or club shaped (Fig. 7).

Distribution & Ecology: Very rare, collected only from Walakkad area of Silent Valley National Park. Seen as isolated patches on the bases of tree trunks in the deeply shaded localities of Evergreen forest. Prefers mostly at an altitude of 1000 m and above.

Specimens examined: Stephen 007576 KFRI (Kozhipara).

Antrophyum reticulatum (Forst.) Kaulf., Enum. Fil. 198 (1824); Dixit & Nair, J. Ind. Bot. Soc. 53: 282 (1974)

Hemonitis reticulata Forst; Prodr. 79 (1786).

Rhizome creeping, scales clathrate, linear, lanceolate, margin toothed, apex acuminate; fronds thin, linear, lanceolate; paraphyses thread like.

Distribution & Ecology: Collected only from Chandanathode, Wayanad. Growing on bases of riparian tree trunks in evergreen forests. Prefers mostly ecotone area at an altitude ranging from 700-1000 m.

Specimens examined: Muktesh Kumar & Stephen 006752 KFRI (Chandanathode).

VITTARIA J. Sm.

Rhizome densely clothed by dark clathrate scales. Fronds simple and linear, apex acute, margin entire; sori linear, extra or intra marginal.

Key to the species

1a. Apex of the rhizome scale long acuminate, gland tipped ..... *V. elongata*
1b. Apex of the rhizome scale short but acuminate, without gland tipped ..... *V. montana*

Vittaria elongata Sw., Syn. Fil. 109, 302 (1806); Beddome, Ferns South India, t. 22 (1864), Handb. Ferns British India t. 238 (1883); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 107. pl. 84. (1992); Nair et.al, J. Econ. Tax. Bot. 16(2) :277 (1992); Nayar & Geevarghese Fern Fl. Malabar, 148 (1993).

Fronds simple, dark green , linear- oblong, lanceolate, 30-40 x 0.7-1 cm, apex acuminate, margin entire, midrib distinct, texture chartaceous; sori marginal.

Fig. 7. A- Habit of *Antrophyum plantagenium* (Cav.) Kaulf.

Distribution & Ecology: Very common, epiphytic on *Ficus sp.* and *Syzygium sp.* mostly prefers riverine trees. In Silent Valley it is associated with *Selaginella involvens*. This species is found growing at different altitudes ranging from 100-1000m.

Specimens examined: Stephen 007647 KFRI (Parathode); Stephen & Joy 007518 KFRI (Parathode); Stephen & Joy 007282 KFRI (Chembotti); Stephen 007633 KFRI (Kuruva Island, Wayanad);

Vittaria montana Manickam, Ind. Fern J. 5(1-2): 180 (1988); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 106. pl. 82 (1992).

Fronds simple, dark green , oblong linear, lanceolate 30 x 0.5 cm, apex acute, margin entire, midrib distinct, texture chartaceous; sori marginal (Fig. 8).

Distribution & Ecology: Manickam & Irudayaraj (1992) recorded this species from Palni Hills. This plant has been collected from Thirunelly of Wayanad at an altitude of 1000m.

Specimens examined: Stephen & Michael 008119 KFRI (Chemmatti, Thirunelly).

Note: Hitherto this species is known only from Palni hills of Tamil Nadu. Present collection of the species from Tirunelly makes this taxa new record to Kerala. According to Manickam & Irudayaraj (1992) this is a typical high altitude fern ranging from 1500m - 1700m. But the present collection has been made from Wayanad at an altitude of 1000m.

DAVALLIACEAE

Small to medium sized ferns with long creeping rhizome covered with peltate scales; lamina simple or pinnately compound; sori terminal in the veins, submarginal and protected by indusia.

Key to the genera

1a. Margin of the pinnule deeply lobed into 2 or 3 unequal lobes; rhizome bearing hairs ..... *Leucostegia*
1b. Margin of the pinnule not deeply lobed; rhizome not bearing hairs 2

2a. Rhizome scale with peltate base and long acuminate apex, margin ciliate; indusium united at the base and sides ..... *Davallia*
2b. Rhizome scale otherwise; indusium attached at base and free at sides 3

3a. Lamina 3-4, pinnatifid; sori with ultimate forking point of each lobe; scale entire ..... *Araiostegia*
3b. Lamina bipinnatifid; sori submarginal; rhizome scale fimbricate ..... *Humata*

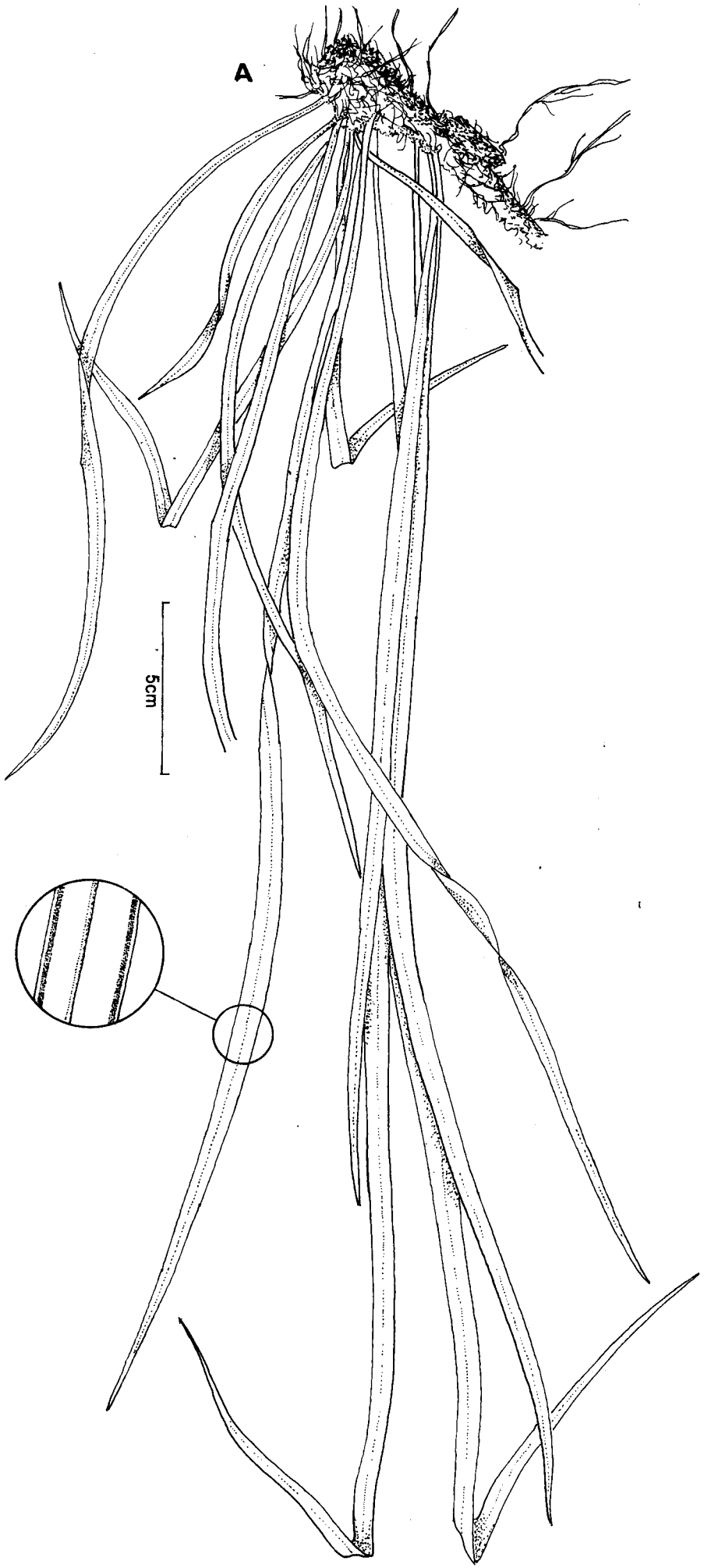


Fig. 8. A- Habit of *Vittaria montana* Manickam

ARAIOSTEGIA Copel.

Araiostegia pulchra (Don) Copel., Philipp. J. Sci. 31: 241 (1927); Mehra & Bir, Res. Bull. Panjab Univ. (n.s.), 15. 119 (1964); Manickam, Fern Fl. Palni Hills, 55 (1986); Nair et.al, J. Econ. Tax. Bot. 16(3): 524 (1992); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 135. pl. 104 (1992); Nayar & Geevarghese, Fern Fl. Malabar, 262 (1993).

Davallia pulchra Don, Prod. Fl. Nep. 11 : 402 (1825); Clarke in Trans. Linn. Soc. II. 144 (1880).

Rhizome creeping, branched, scales ovate; stipes abaxially rounded, adaxially grooved, scaly at very base, glabrous above; lamina lanceolate, deltoid, 3-4 pinnatifid, indusia semicircular.

Distribution & Ecology: Very common in evergreen forests and rare in semievergreen forests like Moolampady, Wayanad. In Silent Valley it is commonlly found in the densely shaded regions at an altitude of 800m - 1000m. Epiphytic on *Calophyllum sp., Persia macrantha & Dalbergia sp.*

Specimens examined: Stephen 007671 KFRI (Poochipara, SVNP); Stephen & Michael 008126, 008137 KFRI (Pakshipadalam); Stephen & Michaell 008121 KFRI (Molampadi); Stephen 007636 KFRI (Vazhachal); Stephen & Joy 007537 KFRI (Munnar).

DAVALLIA Sm.

Davallia bullata Wall. ex Hook., Sp. Fil. 1:169, f. 50 B. (1864); Beddome, Ferns. South India, t. 17 (1864), Handb. Ferns British India 61, t. 31 (1883); Nayar & Kaur, Comp. Beddome Handb. 18 (1974); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 132. pl. 103 (1992).

Davallia trichomanoids Bl. Enum. Pl. Jav. 283 (1828); Holttum Fl. Malaya 2: 361 (1968); Nair et.al, J. Econ. Tax. Bot. 16(3): 525 (1992); Nayar & Geevarghese, Fern Fl. Malabar, 263 (1993).

Rhizome creeping, branched; scales acuminate with peltate base; stipes abaxially rounded, adaxially flattered, glabrous; lamina triangular, 3-4 pinnatifid; indusia elongate or oblong.

Distribution & Ecology: Rare, occuring on small colonies in localised areas of the Silent Valley National Park. In Parathode area it is epiphytic on *Glochidion sp.* in association with *Elaphoglossum nilgiricum*. Mostly prefers edge trees as host species and occur at an altitude of 900m - 1500m. Also collected from Nelliampathy and Munnar.

Specimens examined: Stephen 007644 KFRI (Parathode); Muktesh et al., 007208 KFRI (Ranimedu); Joy & Stephen 007221 KFRI (Victoria); Stephen & Joy 007635 KFRI (Munnar).

HUMATA Cav.

Humata repens (L.f.) Diels, nat. pf. 1(4) :209 (1899); Holttum Fl. Mal 2: 371 (1954); Nayar & Kaur, Comp. Beddome Handb. 15 (1974); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 137. pl. 106 (1992); Nayar & Geevarghese, Fern Fl. Malabar, 265 (1993).

Rhizome creeping, branched; scales lanceolate margin fimbriate; stipes abaxially rounded, adaxially grooved, glabrous; lamina cordate, broadly ovate or deltoid, 2-3 pinnatifid; sori submarginal; indusia sub-orbicular to semi-orbicular.

Distribution & Ecology: Very rare. Nayar & Geevarghese reported this species from Peria of Wayanad. Manickam & Irudayaraj from Pamba Hills. THis species prefers an altitude of 700m - 1200m.

LEUCOSTEGIA Presl

Leucostegia immersa (Wall.) Presl, Tent. Pterid. 95. t. 4, (1936); Beddome, Handb. Ferns British India 51 (1883); Manickam, Fern Fl. Palni Hills, 56 (1986); Nair et.al, J. Econ. Tax. Bot. 16(3): 525 (1992); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 131. pl. 102 (1992); Nayar & Geevarghese, Fern Fl. Malabar, 268 (1993).

Davallia immersa Wall.. Cat. No. 256 (1928); Hook.. Sp. Fil. 1:156 (1846); Hope in J. Bombay Nat. Hist. Soc. 13 : 29 (1990).

Rhizome creeping, covered by scales and hairs; scales lanceolate; stipes glabrous, abaxially rounded, adaxially grooved; lamina 2-3 pinnatifid, pinnules deeply lobed into 2-3 unequal segments; sori sub-marginal; indusia orbicular.

Distribution & Ecology: Very rare, collected from Parathode, Silent Valley National Park. Occupying large trees at an altitude of 800-1000m. Prefers deeply shaded localities of evergreen forests.

Specimens examined: Stephen 008832 KFRI (Parathode).

OLEANDRACEAE

Rhizome erect or creeping; scales appressed; lamina simple or pinnate; veins forked; sori superficial in one row on either side of the midrib, circular and protected by basally attached reniform indusium.

There are two genera under this family - *Oleandra* and *Nephrolepis*

Key to the genera

1a. Lamina simple; rhizome creeping; scales with dark brown spot at the basal region ..... *Oleandra*
1b. Lamina pinnate; rhizome erect; scales without dark spot at the basal region ..... *Nephrolepis*

1. NEPHROLEPIS Schott,

Nephrolepis auriculata (L.) Trimen, Journ. Linn. Soc. London Bot. 24: 152 (1887); Sledge, Bot. J. Linn. Soc. 84: 20 (1982); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats. 140. pl. 108 (1992).

Polypodium auriculatum L., Sp. Pl. 1088 (1753).

Rhizome erect; scales lanceolate, pale brown, acuminate, margin fimbricate; roots bearing spherical, scaly tubers; lamina lanceolate, 50 cm - 1 m long, pinnae sessile, alternate, apex subacute or rounded; sori submarginal in two rows, reniform; indusia reniform.

Distribution & Ecology: Very common, at an altitude from 700m - 1500m. Found to be growing as lithophytic also.

Specimens examined: Stephen & Joy 007286 KFRI (Chembotti); Stephen 007676 KFRI (Panchalithode); Stephen 008810 KFRI (Muthikulam); Stephen 007606 KFRI (Kottavasal, Kollam); Muktesh et al., 007206 KFRI (Ranimedu, Nelliampathy).

OLEANDRA Cav.

Oleandra musifolia (Bl.) Presl, Epim, Bot. 42 (1849); Beddome, Handb. Ferns British India, 287 (1883); Nayar & Kaur, Comp. Beddome, Handb. 70 (1974); Nair et.al, J. Econ. Tax. Bot. 16(3): 521 (1992); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats. 139. pl. 107 (1992); Nayar & Geevarghese, Fern Fl. Malabar. 258 (1993).

Aspidium musaefolium Bl.,Enum. Pl. Jav. 141 (1828).

Rhizome creeping, densely covered by golden coloured scales all over; scales with dark spot at the sub basal region; apex acuminate base cuneate; fronds simple; stipes articulate, phyllopodium extending as midrib, sparsely covered by smaller scales; lamina 20- 30cm long and 2 - 3.5 cm broad, oblong lanceolate, straight or slightly falcate; veins distinct, forked one or twice; Sori in two rows along the midrib, sori reniform; indusia reniform (Fig. 9).

Distribution & Ecology: Rare, collected only from Parathode, Silent Valley National Park, where it is seen epiphytic on *Cullinia exarillata*. Prefers deeply shaded localities of evergreen forests at an altitude of 800m - 1500m.

Specimens examined: Stephen & Joy 007267 KFRI, Stephen 007642 KFRI (Parathode).

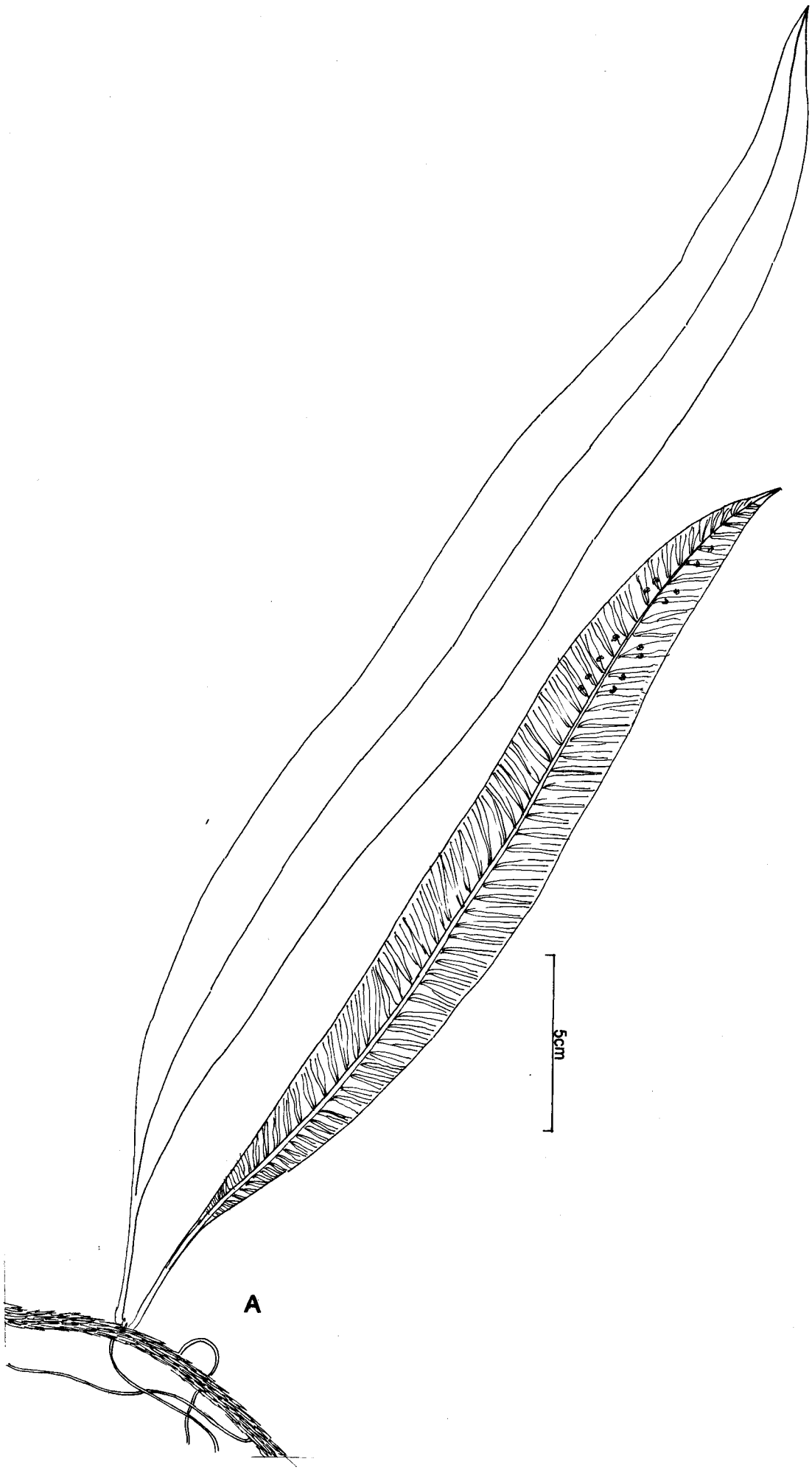


Fig. 9..A- Habit of *Olendra muscifolia* (Bl.) Presl

HYMENOPHYLLACEAE

This family is characterized by very thin delicate fronds. Rhizome short erect or creeping; fronds simple or variously divided; vein free, sori marginal or extra marginal. Sporangia borne in an elongated receptacle within a tubular bivalved indusium.

Three genera viz. *Microgonium*, *Hymenophyllum* and *Trichomanes* were collected during this study.

Key to the genera

1a. Fronds minute, simple; sori restricted to the apex of the lamina ..... *Microgonium*
1b Fronds otherwise; sori borne on the lateral lobe 2

2a. Receptacle included ..... *Hymenophyllum*
2b. Receptacle extruded ..... *Trichomanes*

1. HYMENOPHYLLUM J. Smith

Rhizome long creeping, slender, densely covered by short unicellular hairs; lamina bipinnate fronds hairy or glabrous; sori terminal on the segment, involucre bilabiate, receptacle included.

Key to the species

1a. Margin of the frond wavy ..... *H. javanicum*
1b. Margin of the frond otherwise 2

2a. Margin of the frond entire; veins hairy, involucre margin entire ..... *H. gardeneri*

2b. Margin of the frond denticulate; veins glabrous, involucre margin toothed ..... *H. denticulatum*

Hymenophyllum denticulatum Sw., Schrad. J. Bot. 1800(2): 100 (1801); Beddome. Ferns British India, 278 (1868), Handb. Ferns British India, 34 (1883); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 144. pl. 110 (1992).

Rhizome creeping, covered by pale brown hairs; lamina ovate, bipinnate, acute, cuneate, rachis winged; fronds glabrous, margin denticulate; sori in the tip of the basal acroscopic segment; obovate, involucre two lipped, apex rounded, margin toothed.

Distribution & Ecology: Very rare, epiphytic on bases of tree trunks at an altitude of 800m - 1500m along stream banks.

Specimens examined: Stephen 007611 KFRI (Chandanathode, Wayanad).

Hymenophyllum gardnerii v.d.B., Ned. Kruid. Arch. 4: 417 (1859); Sledge, J. Linn. Soc. Bot. 60: 293 (1968); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats. 145. pl. 111 (1992).

Rhizome creeping, sparsely covered by pale brown slender septate hairs; lamina ovate or oblong, bipinnate, apex sub-acute or rounded, margin entire; vein hairy; sori in the end of the vein, involucre bilabiate, apex rounded, margin entire.

Distribution & Ecology: Common, prefers moist areas of evergreen forests. Epiphytic on bases of tree trunks along stream side at an altitude of 800m - 1500m.

Specimens examined: Stephen & Joy 007285 KFRI (Chembotti); Stephen & Joy 007520 KFRI (Kattivaramudi slope); Stephen & Joy 007552 KFRI (Devicolam. Munnar).

Hymenophyllum javanicum Spr., Syst. Veg. 4: 132 (1827); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 146. pl. 112 (1992).

Rhizome creeping, sparsely covered by pale brown hairs; lamina oblong, bipinnate, apex obtuse or rounded, margin indulate, glabrous; sori terminal on the ultimate segment, involucre bivalved, free upto the base, acute, entire.

Distribution & Ecology: Rare, prefers evergreen shola forests at an altitude of 1200m - 1500m. Epiphytic on bases of tree trunks along stream banks.

Specimens examined: Stephen 007612 KFRI (Chandanathode, Wayanad).

MICROGONIUM Presl

Microgonium bimarginatum v.d.B., Hymen, Jav. 7 (1861); Nayar & Kaur Comp. 12; Nair et.al, J. Econ. Tax. Bot. 18(2): 453 (1994).

Rhizome long creeping , filiform, densely covered by brownish hairs; lamina simple, variable in shape; ovate or oblong, rounded to obtuse at apex, margin more or less crisped; lateral veins few to many; oblique, false veinlets many; sori 1 to many on the apical part of the frond, involucre tubular with dialated mouth.

Distribution & Ecology: Very rare, colllected only from Panchalithode of Silent Valley National Park. Where it is abundant on bases of tree trunks near stream. Prefers shaded moist evergreen forests of 1000m. altitude.

Specimens examined: Stephen 007680 KFRI (Panchalithode).

TRICHOMANES L.

Rhizome long creeping, covered by short hairs; fronds simple, bipinnate or trifoliate; lamina pale or dark green, glabrous or with short blunt trichomanes or veins; sori terminal in the segments, involucre more or less completely immersed tubular mouth usually truncate, receptacle extruded.

Key to the species

1a. False veins present ..... *T. plicatum*
1b. False veins absent 2

2a. Stipe and rachis proliferous ..... *T. proliferum*
2b. Stipe and rachis not proliferous 3

3a Lamina bipinnatifid; sori axillary with truncate mouth ..... *T. schmidianum*
3b. Lamina pinnatifid or sub pinnatifid; sori terminal on the segments shortly bilabiate with rounded mouth ..... *T. intramarginale*

Trichomanes intramarginale Hook. *et* Grev., Icon. Fil. t. 211 (1831); Beddome, Ferns South India,t. 208 (1864), Handb Ferns British India, 41 (1883); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 156. pl. 119 (1992).

Small plants; rhizome slender, creeping; lamina digitatly or pinnately divided, margin entire; veins distinct above and below, trichomes sparsely above and below, false veins absent; sori terminal on the segments with shortly bilabiate mouth in the rounded tips.

Distribution & Ecology: Rare, collected from Devicolam. Prefers dense shade forest.

Specimens examined: Stephen 008859 KFRI (Devicolam).

Trichomanes plicatum (v.d.B.) Beddome, Ferns British India, t. 285 (1868); Manickam, Fern Fl. Palni Hills, 62 (1986); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 152. pl. 117 (1992).

Rhizome creeping; stipes upto 3 cm long bearing short hairs along the margins at the basal part; lamina oblong or ovate, tripinnatifid; veins distinct above and below, reaching the margin, free, numerous false veins scattered on either side of the true veins; sori terminal on each lobe, Involucre bluntly triangular, receptacle extruded.

Distribution & Ecology: Common, epiphytic on bases of tree trunks, also seen as lithophytes along stream sides. Prefers dense shady moist areas of evergreen forests at an altitude of 700m - 1000m.

Specimens examined: Joy & Stephen 007509 KFRI (Pathrakadavu, SVNP).

Trichomanes proliferum Blume, Enum. Pl. Jav. 224 (1828); Beddome, Handb. Ferns British India, 39 (1883); Manickam, Fern Fl. Palni Hills, 6 (1986); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 150. pl. 115 (1992).

Rhizome creeping, slender, sparsely covered with dark hairs; stipes upto 1-3 cm long, wingless; lamina ovate, oblong, usually pinnate to decompound; veins slightly distinct above and below, false veins absent; rachis proliferous; sori terminal on the apices of the segments, involucre tubular, mouth truncate, receptacle extruded.

Distribution & Ecology: Common in the evergreen forests. Prefers stream side trees and rocks.

Specimens examined: Joy & Stephen 007505 KFRI (Pathrakadavu, SVNP).

Trichomanes schmidianum Zenker ex Taschn., Dissert. 34, Pl. f. 1, 3, 5 (1843); Manickam, Fern Fl. Palni Hills, 63 (1986); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 154. pl. 118 (1992).

Rhizome creeping; stipes 1 to 2 long, flattened, narrowly winged. lamina ovate, oblong, 4-6 cm long, bipinnatifid; veins distinct above and below, false veins absent; sori supra axillary, obconical with truncate mouth, receptacle extruded.

Distribution & Ecology: Rare; collected from Poovanchola of Silent Vallley. Prefers dense shaded areas of evergreen forests at an altitude of 1000m and above.

Specimens examined: Stephen 007669 KFRI (Poovanchola).

ASPLENIACEAE

ASPLENIUM L.

Rhizome erect, suberect or creeping, covered by narrow, dark brown, clathrate, entire or toothed scales; fronds simple or pinnate; veins forked or free or very rarely united just within the margin; sori along the veins, protected by indusium, indusia attached laterally along the vein.

Key to the species

1a. Fronds simple 2
1b. Fronds pinnate 3

2a. veins free ..... *A. ensiforme*
2b. Veins united by a marginal strand ..... *A. phyllitidis*

3a. Fronds bipinnate or tripinnate 4
3b. Fronds simply pinnate 8

4a. Fronds tripinnate ..... *A. tenuifolium*
4b. Fronds bipinnate 5

5a. Rhizome suberect 6
5b. Rhizome erect 7

6a. Lamina lanceolate or oblong-lanceolate; stipe scaly at the very base, glabrous above ..... *A. polyodon* var. *bipinnatum*
6b. Lamina ovate to ovate-lanceolate; stipe glabrous on entire part ..... *A. auritum*

7a. Stipes densely clothed by scale and hairs all over, pinnae and rachis are covered by long, slender, soft hairs,pinnules upto 12 pairs ..... *A. aethiopicum*
7b. Stipe scaly near base only, glabrous above, pinnae and rachis glabrous, pinnules upto 5 pairs ..... *A. lacinlatum*

8a. Rhizome creeping or suberect 9
8b. Rhizome strictly erect 10

9a. Rhizome long, creeping, margin of the pinnae irregularly lobed; sori imbricate along the costa ..... *A. decrescens*
9b. Rhizome suberect; lamina imparipinnate, margin of the pinnae serrate; sori borne just above the costa ..... *A. serricula*

10a. Stipe strictly glabrous 11
10b. Stipe densely or sparsely scaly or scaly near the base only 12

11a. Lower margin of the pinnae unexcised; sori strictly 2 or 3 per pinnae, median along the veinlets on the lower unexcised part of the pinnae ..... *A. formosum*
11b. Lower and upper margin of the pinnae crenate or shallowly incised; sori four pairs per pinna median on the veins rarely on auricles ..... *A. erectum*

12a. Stipe scaly near the base only ..... *A. polyodon*
12b. Stipes densely scaly all over 13

13a. Margin of the pinnae irregularly lobed half way to the centre, lobes serrate, margin of the rhizome scale entire, apex long acuminate ..... *A. indicum*
13b. Margin of the pinnae crenate, margin of the rhizome scale with filamentous glandular multicellular hairs, apex gland tipped ..... *A. crinicaule*

Asplenium aethiopicum (Burm. f.) Becherer in Candollea, 6: 23, Fig. 1 (1935); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 228 pl. 176 (1992). Nair et.al, J. Econ. Tax. Bot. 16(3): 529 (1992); Azeez *et. al.*, J. Econ. Tax. Bot 20(2): 447 (1996).

Trichomanes aethiopicum Burm. f., Ind. Fl. Cap. Prodr. 32 (1768).

Rhizome erect or suberect, densely clothed by scales all over; scales linear-lanceolate, margin slightly toothed; stipes tufted, dark brown, abaxially rounded, deeply grooved above, densely clothed by scales all over; lamina ovate-lanceolate, bipinnate, upto 35

Fig. 10. *Asplenium aethioipicum* (Burm.f.) Becherer A- Habit; B- Pinna enlarged

cm long, primary pinnae upto 15-20 pairs, 4-5 cm long, pinnules 5 or 6 pairs with serrated margin, pinnae and rachis densely covered by long, slender, soft, scales; sori 5 mm long, formed only in acroscopic veins (Fig. 10).

Distribution & Ecology: Rare, collected from Devicolam & Chinnakanal of Munnar. Prefers evergreen shola forests at an altitude of 1300m. and above.

Specimens examined: Stephen & Joy 007554 KFRI, Stephen 007557 KFRI (Devicolam); Stephen & Joy 007550 KFRI, 007545 KFRI (Chinnakanal).

Asplenium auritum Sw., Schrad, Journ. Bot. 1800(2): 52 (1801); Beddome, Ferns South India, t. 137 (1864), Handb. Ferns British India, 149 (1883); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 227 pl. 174 (1992); Nair et.al, J. Econ. Tax. Bot. 16(3): 528 (1992).

Rhizome suberect, densely scaly; scales lanceolate; stipes glabrous; lamina ovate to ovate-lanceolate, 20-30 cm long, bipinnate, pinnae upto 20 pairs, lanceolate, apex acute or acuminate, pinnules upto 8 pairs, ovate or oblong, margin crenate; sori in two oblique rows, linear along the veins (Fig. 11).

Distribution & Ecology: Rare, collected from Edamalakudy of Munnar. Prefers dense evergreen shola forests atan altitude of 1500m. and above.

Specimens examined: Stephen 008853 KFRI (Edamalakudy, Munnar)

Asplenium crinicaule Hance in Annal. Sci. nat. Ser. V. 5: 259 (1866); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 216. pl. 164 (1992); Nair et. al, J. Econ. Tax. Bot. 16(3) : 533 (1992).Azeez *et. al.*,J. Econ. Tax. Bot 20(2): 442 (1996).

Rhizome erect, densely clothed by scales all over; scales lanceolate, apex gland tipped, margin entire with a few filamentous hairs; stipes abaxially rounded, adaxially grooved, densely covered by hair like scales; lamina oblong-lanceolate, unipinnate, 20-23 cm long, pinnae upto 20 pairs, ovate-lanceolate, margin deeply incised; sori linear, in two oblique rows along acroscopic veinlets.

Distribution & Ecology: Common, epiphytic on various trees like *Calophyllum polyanthum, Ficus sp.* , *Syzygium sp.* etc. Seen as lithophytic also. Prefers an altitude of 800m and above.

Specimens examined: Stephen 007683 KFRI (Panchalithode); Stephen 007637 KFRI (Parathode); Stephen & Joy 007281 KFRI (Chembotti); Stephen 007630 KFRI (Kalarimotta, Wayanad); Stephen & Joy 007517 KFRI (Parathode); Joy & Stephen 007230 KFRI (Ranimedu, Nelliampathy); Stephen 008808, 008812 KFRI (Muthikulam).

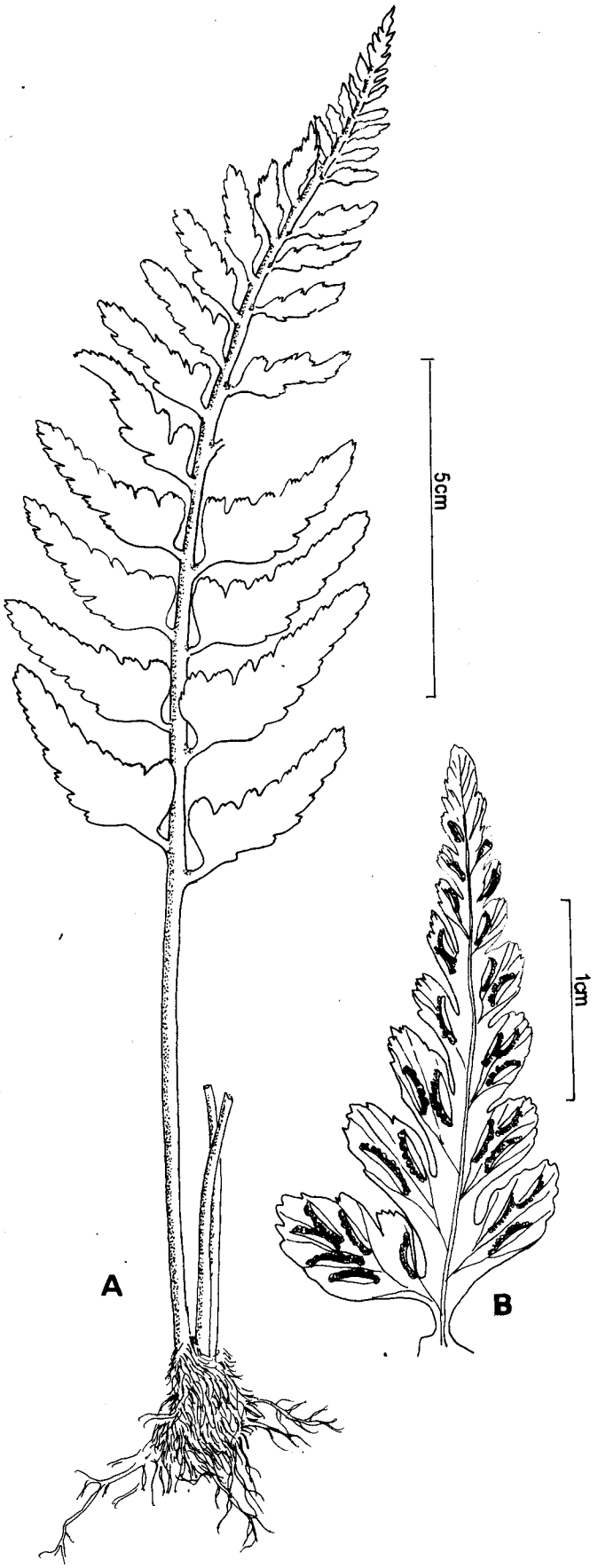


Fig. 11. *Asplenium auritum* Sw. A- Habit; B- Pinna enlarged

Asplenium decrescens Kunze in Linnaea, 24 (1881); Manickam, Fern Fl. Palni Hills, 100 (1986); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 210. pl. 157 (1992); Nair et. al, J. Econ. Tax. Bot. 16(3): 531 (1992);Azeez *et. al.*, J. Econ. Tax. Bot 20(2): 442 (1996);

Rhizome long, creeping, densely covered by scales; scales ovate-lanceolate, clathrate, margin slightly toothed, apex long acuminate; stipes dark brown, abaxially rounded, adaxially grooved, glabrous; lamina upto 40 cm long, unipinnate, oblong-lanceolate, pinnae upto 25 pairs, falcate, lanceolate, acuminate at apex, margin irreguiarly lobed, apices serrate; sori on the branch of the vein nearest to the costa.

Distribution & Ecology: Rare, collected from Silent Valley National Park (Poovanchola) and Wayanad (Pakshipadalam). Mostly prefer high altitude, evergreen shola forests of 1000m - 2300m altitude.

Specimens examined: Stephen 007664 KFRI (Poovanchola); Stephen & Michael 008124 KFRI (Pakshipadalam); Stephen & Joy 007539 KFRI (Lockart gap, Munnar); 007555 KFRI, 007558 (Devicolam, Munnar); Muktesh Kumar & Stpehen 007243 KFRI (Rajamallay, Munnar).

Note: This species shows considerable variations in the size and degree of dissection in the pinna.

Asplenium ensiforme Wall. ex Hook., Ic. Fil. t. 71 (1829); Beddome, Ferns South India, t. 125 (1864); Handb. Ferns British India, 141, t. 71 (1883); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 207. pl. 154 (1992); Nair et. al, J. Econ. Tax. Bot. 16(3): 528 (1992); Azeez et. al., J. Econ. Tax. Bot 20(2): 444 (1996).

Rhizome suberect, short, clothed with ovate-lanceolate scales; scales acuminate and entire; lamina simple, lanceolate or linear-lanceolate, 20-25 cm long; stipe reduced, apex acuminate, margin entire or slightly wavy; sori arranged in two rows on either side of the midrib, sori produced from extreme base to the tip of the lamina.

Distribution & Ecology: Rare, collected from Munnar. Prefers moist shady localities of high altitude, evergreen shola forests of 1500m altitude and above. Epiphytic on the vertical trunks of trees.

Specimens examined: Stephen 008860 KFRI (Devicolam).

Asplenium erectum Bory ex Willd. in L. Sp. Pl. ed. 5: 328 (1810); Manickam, Fern Fl. Palni Hills, 106 (1986); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 209. pl. 156 (1992). Nair et. al, J. Econ. Tax. Bot. 16(3): 534 (1992).

Rhizome erect, scaly; scales ovate-lanceolate, acute, margin entire; stipe tufted, glabrous; lamina upto 30 cm long linear-elliptic, unipinnate, serrate, pinnae upto 40 pairs, oblong,

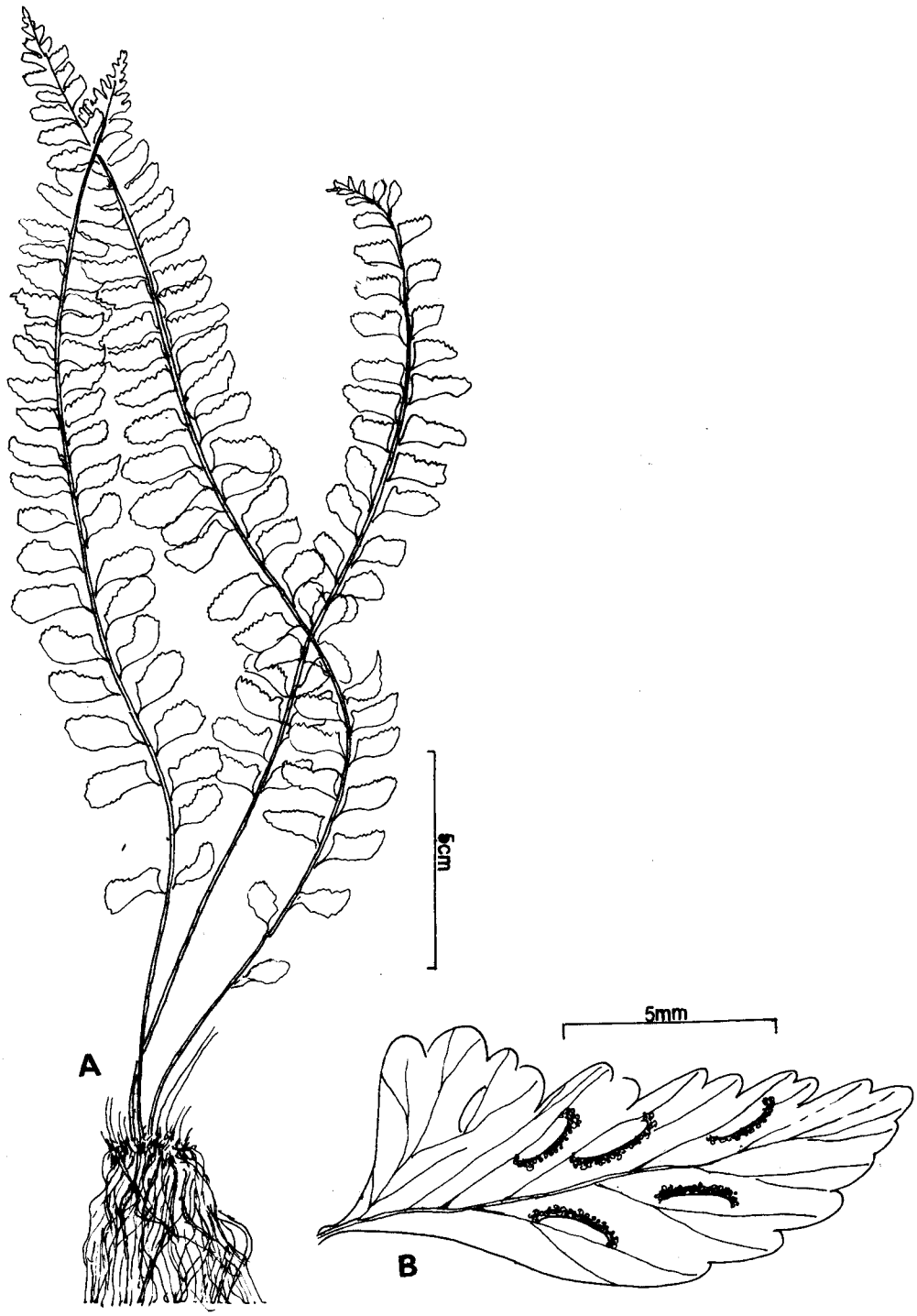


Fig.12. *Asplenium erectum* Bory ex Willd. A- Habit; B- Pinna enlarged

apex rounded, margin crenate, basal pinnae progressively reduced, glabrous; sori median more or less on the vein not reaching margin or costa (Fig. 12).

Distribution & Ecology: Very rare, collected from Silent Valley National Park & Munnar. Epiphytic or lithophytic along stream banks of evergreen shola forests. Prefers an altitude of 2000m. and above.

Specimens examined: Stephen & Joy 007562 KFRI (Silent Vallley).

Asplenium formosum Willd. in L., Sp. Pl. Ed. 4, 5: 329 (1810); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 208. pl. 155 (1992); Nair et. al, J. Econ. Tax. Bot. 16(3): 530 (1992); Azeez et. al., J. Econ. Tax. Bot 20(2): 444 (1996).

Rhizome erect, densely scaly at apex; scales oblong-lanceolate, acute, entire; stipes tufted, glabrous and glossy; lamina oblong-lanceolate, unipinnate, upto 25 cm long, pinnae upto 40 pairs, sessile, apex acute, upper margin deeply incised, apex rounded, lower margin unexcised, basal pinnae progressively reduced; sori two or three along the veinlet on the lower unexcised part (Fig. 13).

Distribution & Ecology: Very common, epiphytic on bases of tree trunk and also as lithophytes. Occuring in large colonies along stream sides. Prefers an altitude of 750m - 1000m.

Specimens examined: Joy & Stephen 007504 KFRI (Pathrakadavu); 007272 KFRI (Parathode); Stephen 007659 KFRI (Thondakulam); Stephen 007614 KFRI (Chandanathode, Wayanad); Stephen & Michael 008120 KFRI (Thirunelly, Wayanad); Joy & Stephen 007229 KFRI (Nelliampathy).

Asplenium indicum Sledge in Bull. Brit. Mus. nat. Hist. Bot. 3: 264 (1965); Manickam et Irudayaraj, Pterid. Fl. W. Ghats, 215. pl. 163 (1992); Azeez *et. al.*, J. Econ. Tax. Bot 20(2): 445 (1996).

Rhizome erect, densely covered by ovate-lanceolate scales; scales dark brown, tip acute, entire; stipes tufted, rounded below, grooved above, sparsely covered by scales all over; lamina linear-lanceolate, unipinnate, upto 25 cm long, pinnae upto 20 pairs, dimidiate-ovate, base truncate, apex obtuse, margin irregularly lobed, basal pinnae reduced; sori spreading along the veins from near the costa.

Distribution & Ecology: Not common, collected from Silent Valley National Park and Wayanad. Seen as small patches on the tree trunks in shaded and semiexposed areas at an altitude of 800m. and above.

Specimens examined: Stephen & Joy 007567 KFRI (Parathode) 007258 KFRI (Punnamala); Stephen 007684 KFRI (Panchalithode); 007641 KFRI (Parathode); 007670 KFRI (Poovanchola); Stephen & Michael 008113 KFRI, 008122 KFRI (Thirunelly, Wayanad).

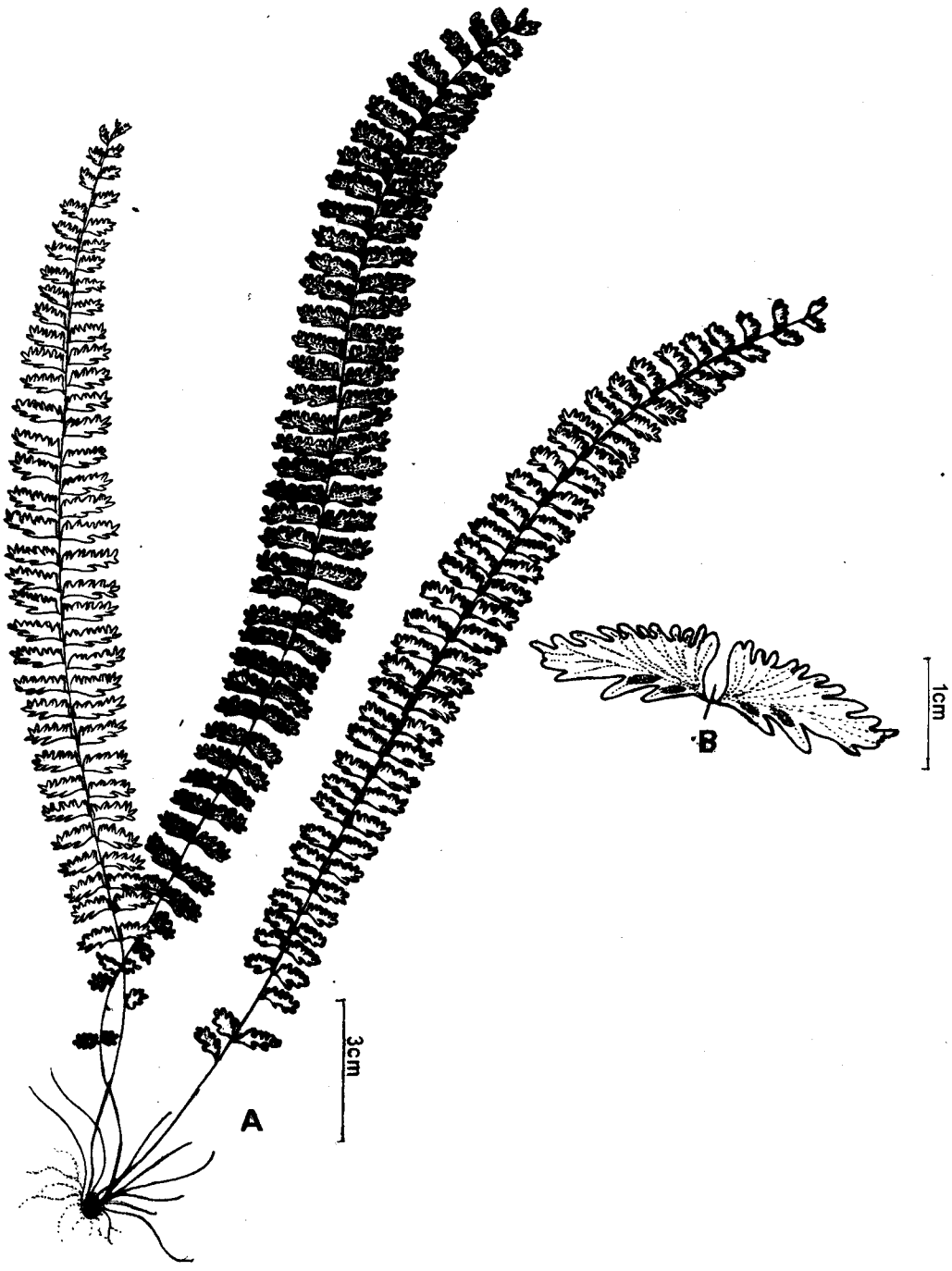


Fig. 13. *Asplenium formosum* Willd. A- Habit; B- Pinna enlarged

Asplenium laciniatum Don, Prodr. Fl. Nepal. 8 (1825); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 224 pl. 172 (1992).

Rhizome erect, scaly; scales ovate-lanceolate, apex long acuminate, margin slightly toothed; stipes tufted, scaly near base, glabrous above; lamina ovate-lanceolate, upto 15 cm long, bipinnate, pinnae upto 10 pairs, pinnules upto 5 pairs, obovate base, toothed above; sori long, 3 to 4 per pinnule (Fig. 14).

Distribution & Ecology: Very rare, collected from Devicolam. Epiphytic in the evergreen shola forests near small streams. Prefers an altitude above 1300m.

Specimens examined: Stephen & Joy 007556 KFRI (Devicolam).

Note: Manickam & Irudayaraj (1992) recorded this species only from Tamil Nadu during their survey. The present collection is an addition to the fern flora of Kerala.

Asplenium phyllitidis Don, Prodr. Fl. Nepal & (1825); Azeez *et. al.*, J. Econ. Tax. Bot 20(2): 447 (1996).

Rhizome erect, densely scaly all over; scales broad, apex acuminate, gland tipped, margin entire; lamina simple tufted giving nest habit, upto 65 cm long, middle portion broad, gradually narrowing towards the tip and base, tip acuminate, margin entire, wavy, midrib prominent below, almost flattened above; veins forked showing intramarginal fusion; sori elongated, linear, arranged in close oblique rows on either sides of the costa (Fig. 15).

Distribution & Ecology: Common, epiphytic on vertical trunks of trees in exposed and semiexposed areas of evergreen forests. Prefers an altitude of 700m. to 1000m.

Specimens examined: Muktesh Kumar & Stephen 006748 KFRI (Chandanathode, Wayanad); Stephen & Joy 007283 KFRI (Chembotti); Stephen & Michael 008149 KFRI (Thirunelly, Wayanad).

Asplenium polyodon G. Forster, Prod. 80 (1786); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 218. pl. 166 (1992); Azeez *et. al.*, J. Econ. Tax. Bot 20(2): 447 (1996).

Rhizome erect, densely scaly; scales lanceolate, long acuminate, entire; stipes tufted, rounded below, grooved above, scaly near base, glabrous above; lamina ovate-lanceolate, upto 40 cm long, simple pinnate, apex of the lamina bilobbed or trilobbed pinna, pinnae upto 7 pairs, lower base slightly excised, upper base cuneate, pinna acuminate; sori linear median or sub median along the vein, parallel (Fig. 16).

Distribution & Ecology: Not common, collected from Silent Valley National Park, epiphytic on *Calophyllum polyanthum*. Prefers semiexposed areas of evergreen forests at an altitude of 800m - 1000m.

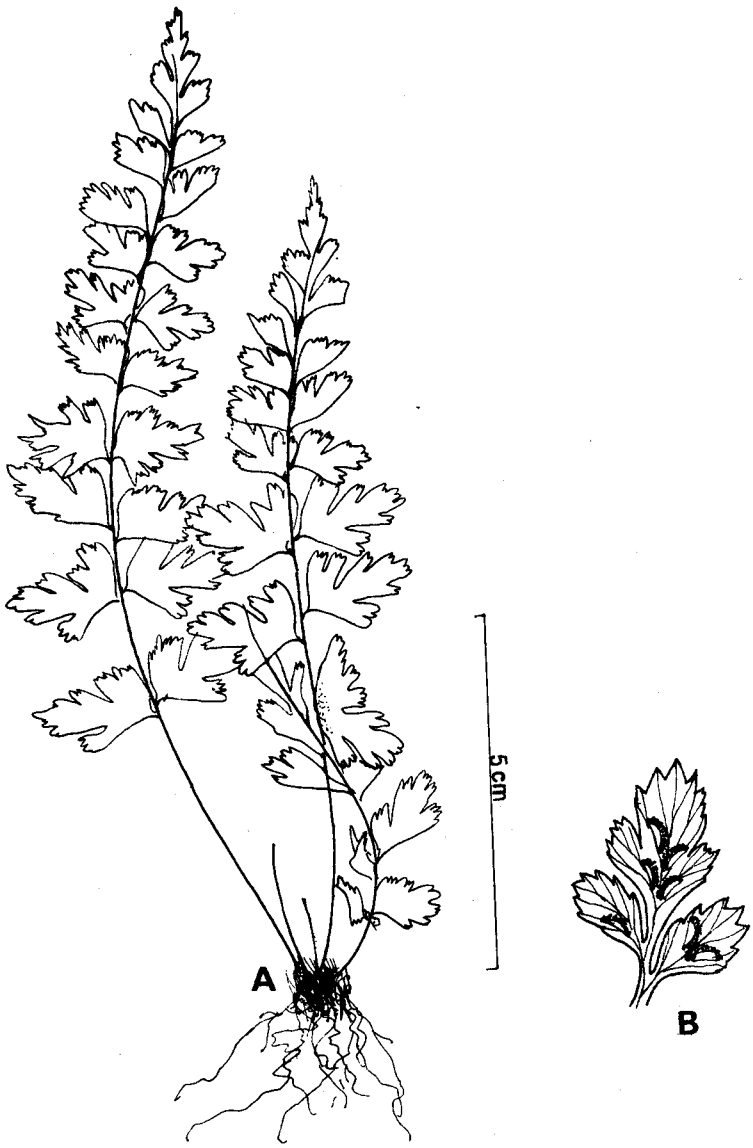


Fig. 14. *Asplenium laciniatum* D.Don. A- Habit; B- Pinna enlarged

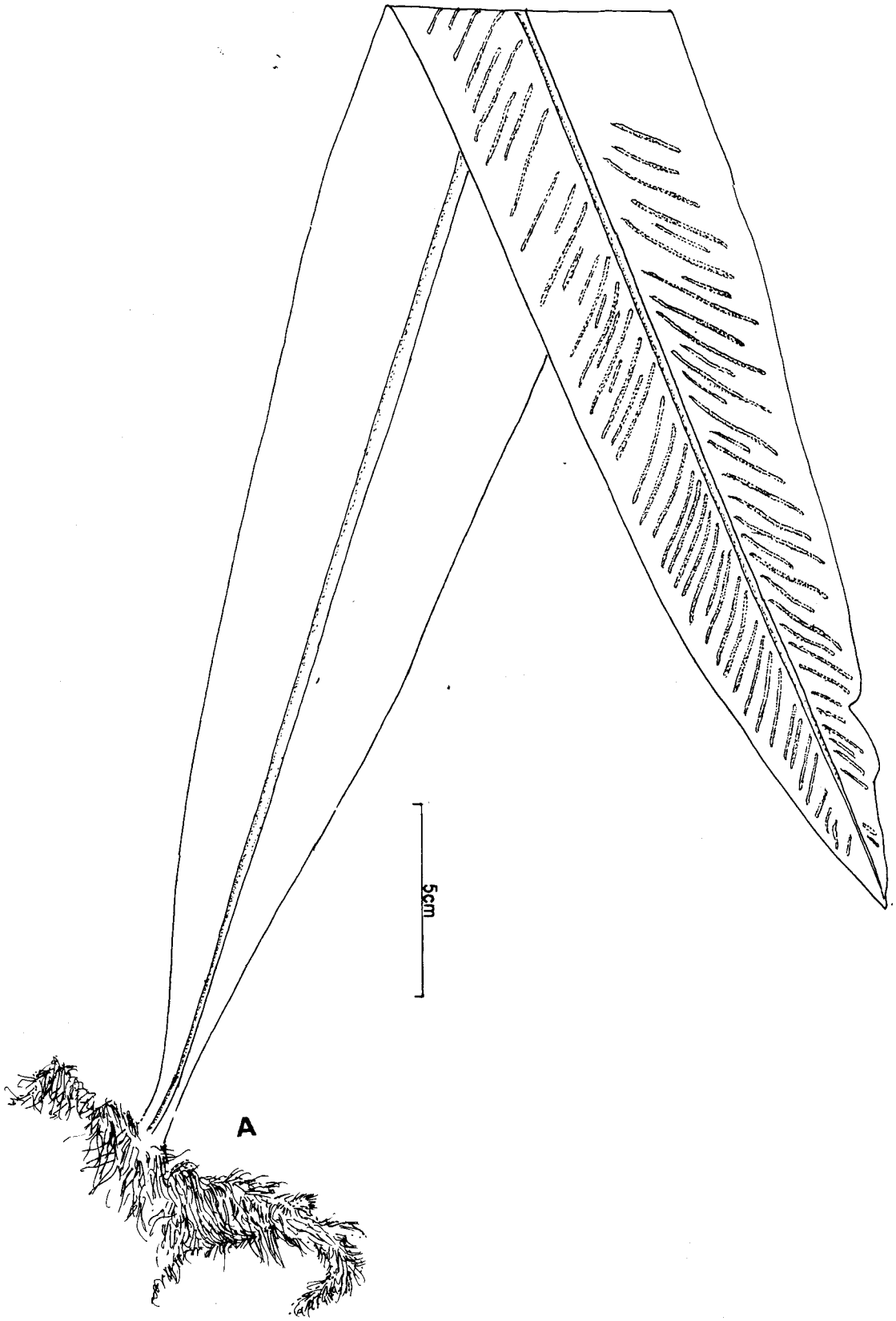


Fig. 15. A- Habit of *Asplenium phyllitidis* Don.

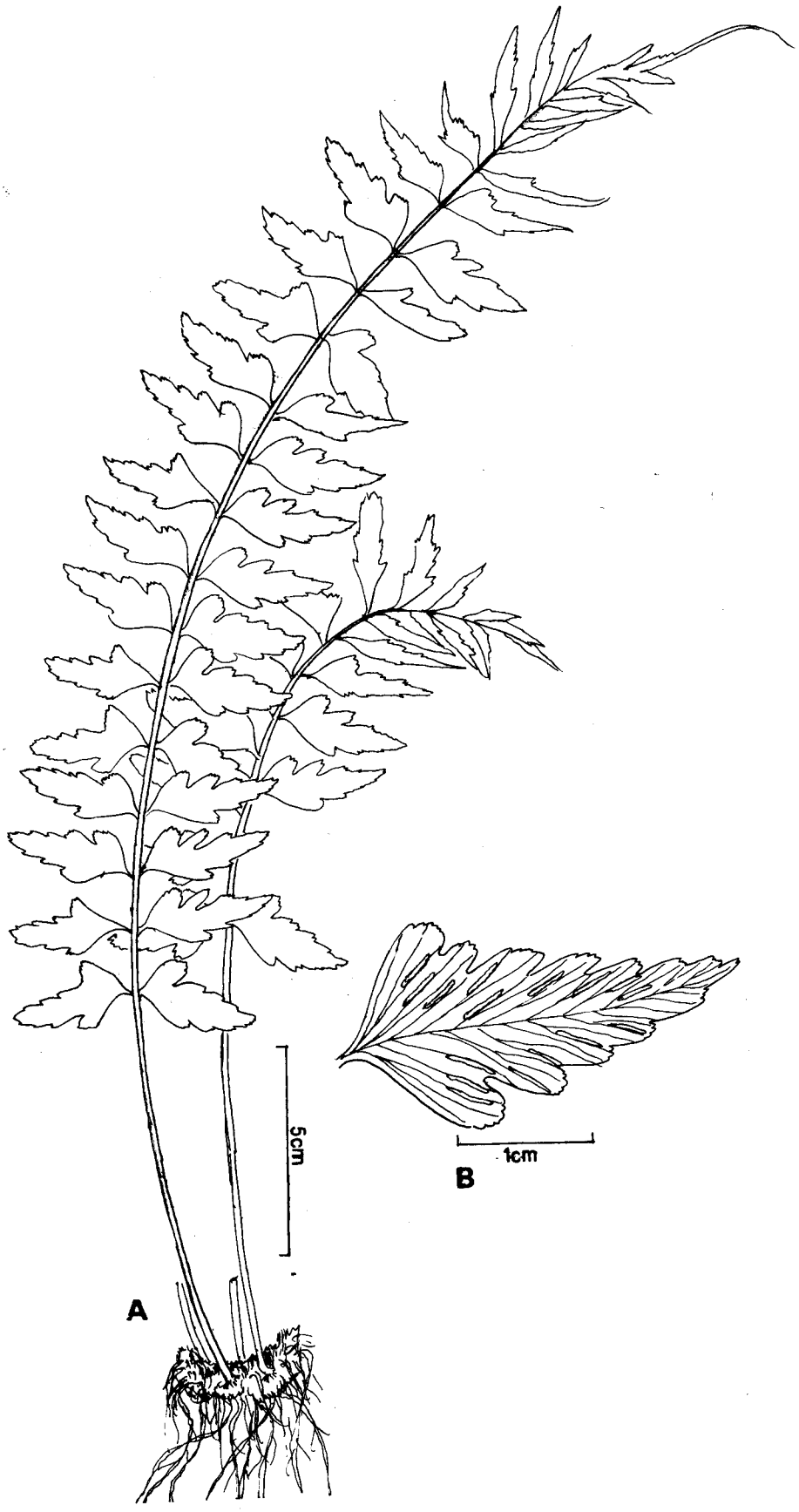


Fig. 16. *Asplenium polyodon* G. Forster. A- Habit; B- Pinna enlarged

Specimens examined: Stephen 007664 KFRI (Poovanchola) and 007683 KFRI (Panchalithode).

Asplenium polyodon G. Forster var. **bipinnatum** (Sledge) Sledge, Bot. J. Linn. Soc. 34: 6 (1982); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 219. pl. 167 (1992).

Asplenium falcatum var. *bipinnatum* Sledge, Bull. Brit. Mus. Nat. Hist. Bot. 3(6): 262 (1965);

Rhizome suberect, densely linear-lanceolate scales all over; stipes tufted, rounded below, grooved above, scaly near the base, glabrous above; lamina oblong-lanceolate, upto 40 cm long, acuminate, bipinnate; pinnae upto 10 pairs, lanceolate, acuminate crenate, one third to half distal part of the primary pinna shallowly lobed without bearing distinct pinnules; sori numerous, all along the veins except the extreme apex.

Distribution & Ecology: Very rare, collected from Silent Valley area of Munnar. Epiphytic in the shola forests near small streams. Prefers an altitude of 2000m and above.

Specimens examined: Stephen 008854 KFRI (Silent Valley Estate, Munnar).

Asplenium serricula Fee, Mem. Fam. Fough. 5: 196 (1952); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 221. pl. 169 (1992); Azeez *et. al.*, J. Econ. Tax. Bot 20(2): 449 (1996).

Rhizome suberect, scaly at apex; scales lanceolate, apex acuminate, margin fimbricate; stipes tufted, glabrous; lamina ovate upto 30 cm long, unipinnate, ending in a terminal pinnae, pinnae upto 7 pairs, lanceolate, apex acuminate, margin serrate; sori many on each pinna, arising just above the costa.

Distribution & Ecology: Rare, collected from New Amarambalam and Edamalakkudy of Munnar. Found in large colonies along stream side trees. Prefers well shaded moss covered tree trunks at an altitude ranging from 750 - 900 m.

Specimens examined: Stephen 008855 KFRI (New Amarambalam).

Asplenium tenuifolium D. Don, Prodr. Fl. Nepal, 8 (1825); Beddome Ferns South India, 44, t. 130 (1864); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 223 pl. 171 (1992); Nair et.al, J. Econ. Tax. Bot. 16(3): 529 (1992).

Rhizome erect, scaly at apex; scales ovate-lanceolate, margin entire; stipes tufted, scaly at base, glabrous above; lamina ovate,upto 30 cm, tripinnate, primary pinnae upto 20 pairs, ovate-lanceolate, secondary pinnae upto 8 pairs, immediately in bilobbed or trilobbed pinnule, pinnule obovate, bilobed or trilobed, apex of the lobes rounded or subacute; sori 1 or 2 per pinnule (Fig. 17).

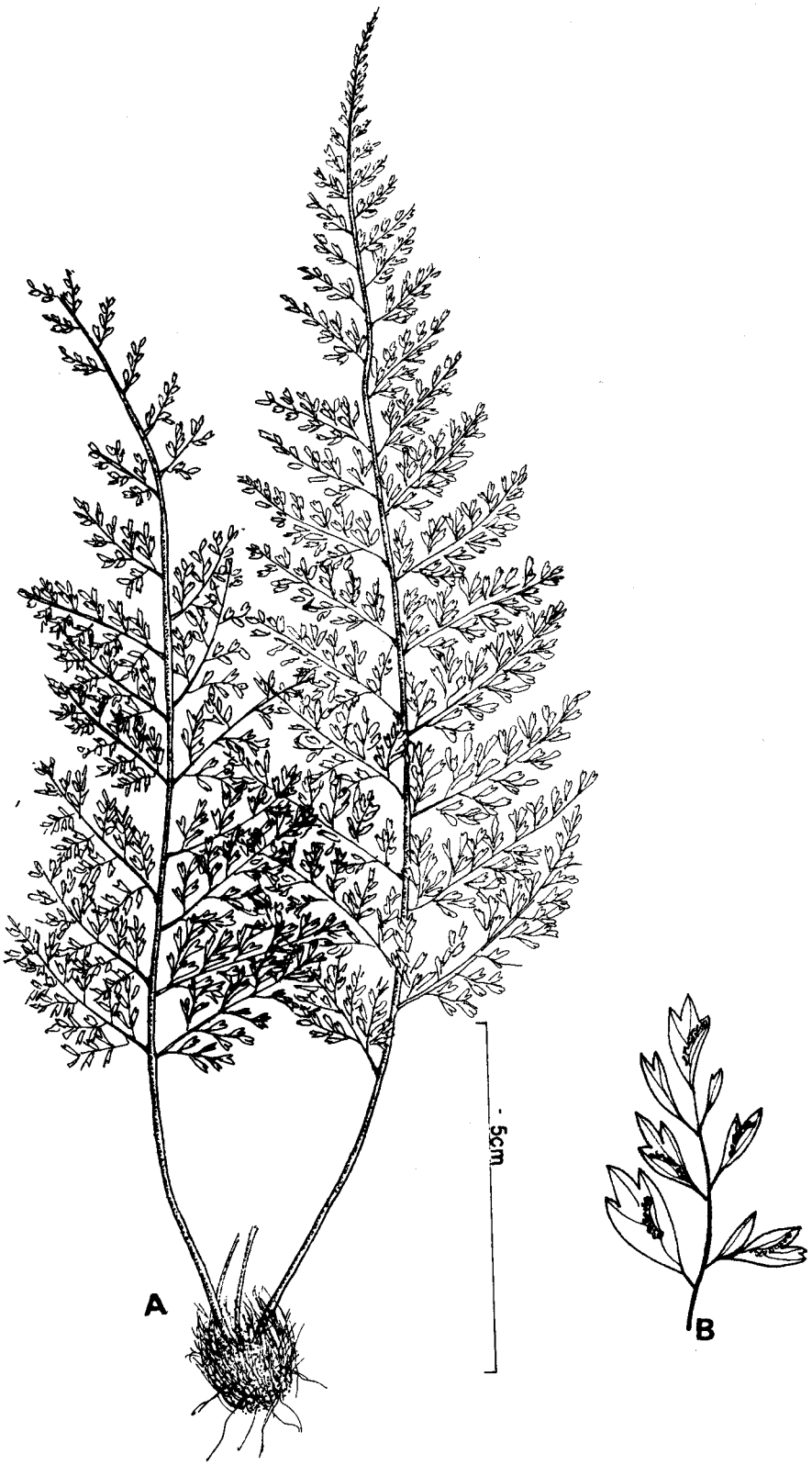


Fig. 17. *Asplenium tenuifolium* D. Don. A- Habit; B- Pinna enlarged

Distribution & Ecology: Very rare, collected from Silent Valley of Munnar. Prefers well shaded stream side on the bases of tree trunks . Occur at an altitude of 1500m. and above.

Specimens examined: Stephen 008856 KFRI (Silent Valley, Munnar).

Note: Manickam & Irudayaraj (1992) recorded this species from Palni & Anamallais. Nair et al., (1992) recorded this species from Travancore Hills based on Levinge's (1883) collection. After Levinge's collection, this species has been collected after a lapse of over 115 years from Kerala hills.

LOMARIOPSIDACEAE

Rhizome with gland bearing and thick walled scales; fronds two or more rows on the dorsal surface of the rhizome; stipe scaly; lamina simple, veins distinct, subglabrous or copiously scaly; fertile fronds slightly dimorphous or not.

Only the genus *Elaphoglssum* is found to be epiphytic in this family.

ELAPHOGLOSSUM Schott ex. Smith

Rhizome creeping, vegetative fronds larger than fertile fronds, lower surface of sterile frond covered with small scales.

Key to the species

1a. Midvein and veinlets distinct in sterile frond; margin entire with cartilaginous border; scales sparsely on the lamina ..... *E. beddomei*

1b. Midvein and vein lets indistinct, margin entire without cartilaginous border, toothed scales, densely clothed both upper and lower surfaces of the frond ..... *E. neilgiricum*

Elaphoglossum beddomei Sledge, Bull. British Mus. Nat. Hist. Bot. 4: 88 (1967); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 288 pl. 221 (1992); Nair et.al, J. Econ. Tax. Bot. 16(3): 518 (1992); Nayar & Geevarghese, Fern Fl. Malabar, 246 (1993).

Rhizome short creeping, linear scales on the rhizome; fertile stipe larger than the sterile stipe; lamina simple, upto 30 cm long and 3.5 cm wide, coriaceous, entire with cartilagenous border, sparsely covered by fimbriate scales; sori achrostichoid (Fig. 18A).

Distribution & Ecology: Very rare, collected from Walakkad of Silent Valley National Park. Epiphytic on stream side trees and prefers dense shaded area at an altitude of 1000m and above.

Specimens examined: Stephen 007871 KFRI (Walakkad).

Note: This species is endemic to South India.

Fig. 18. A- Habit of *Elaphoglossum beddomei* Sledge; B- Habit of *E. neilgiricum* Krajina ex Sledge

Elaphoglossum nilgiricum Krajina ex Sledge, Bull. Bristish Mus. nat. Hist. Bot. 4: 94 (1967); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 290 pl. 223 (1992); Nayar & Geevarghese , Fern Fl. Malabar, 247 (1993).

Rhizome short creeping, scaly; scales ovate-lanceolate with long marginal teeth, fronds caespitose with a short stipe; fertile stipe is longer than the sterile, fronds lanceolate to oblong-lanceolate, upto 30 cm long and 3 cm wide, apex acute, margin entire without cartilagenous border, densely clothed by toothed scales; sori achrostichoid (Fig. 18B).

Distribution & Ecology: Very rare, collected from Parathode of Silent Valley and Rajamallay Hills of Munnar. Prefers moss covered tree trunks of evergreen forests with heavily shaded localities at an altitude of 800m and above.

Specimens examined: Stephen 007650 KFRI (Parathode); Stephen 008182 KFRI (Sispara); Muktesh Kumar & Stephen 007242 KFRI (Rajamallay).

Note: This species is endemic to South India.

POLYPODIACEAE

Rhizome usually creeping, rarely suberect, or climbing, scaly; fronds usually simple; pinnatifid or digitatly lobed; veins anastomosing; sori round, elongate, achrostichoid.

Key to the genera

1a. Sterile or fertile frond simple 2
1b. Sterile or fertile frond pinnate 9

2a. Sporangia borne on separate frond 3
2b. Sporangia not borne on separate frond 5

3a. Sterile fronds orbicular, ovate, succulent; fertile frond oblong; fronds with stellate hairs ..... *Drymoglossum*
3b. Sterile frond, lanceolate, herbaceous, fertile frond narrow, long linear oblong, fronds without stellate hairs 4

4a. Fronds borne in more than two rows on rhizome, fertile fronds clustered, filiform ..... *Nistarika*
4b. Fronds strictly on two rows on rhizome, fertile fronds not clustered, linear or linear-oblong ..... *Leptochilus*

5a. Sori linear ..... *Loxogramme*
5b. Sori otherwise 6

6a. Fronds densly or sparsely covered by hairs ..... *Pyrossia*
6b. Fronds glabrous 7

7a. Sori scattered ..... *Microsorium*
7b. Sori arranged in two rows ..... *Lepisorus*

8a. Nest leaves present ..... *Drynaria*
8b. Nest leaves absent 9

9a. Plants upto 30 cm in length, margin of the pinna broadly notched; rhizome scales, ovate lanceolate, apex acuminate, margin dentate ..... *Crypsinus*
9b. Plants more than 30 cm long, margin of the pinna not notched; rhizome scales broadly ovate or deltoid or suborbicular, apex acute or sub acute, margin entire ..... *Phymstosorus*

CRYPSINUS Presl

Crypsinus montanus Sledge in Bull. Mus. nat. Hist. Bot. 2(5): 145 (1960); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 318 pl. 243 (1992); Nayar & Geevarghese, Fern Fl. Malabar, 377 (1993).

Rhizome long creeping, densely scaly; scales ovate-lanceolate, abruptly narrowed to a long acuminate apex, margin slightly dentate; stipes abaxially rounded, adaxially grooved, scaly at base, glabrous and glossy; lamina broadly ovate, pinnatifid, pinnae upto 5 pairs, oblong-lanceolate, apex acuminate, margin broadly notched; sori median along the pinnae per areole (Fig. 19).

Distribution & Ecology: Common in the higher altitude. Abundant in shola forests. Prefers ecotone area having semishaded localities and species like *Glochidion sp.* as their host. Found above 800m altitude.

Specimens examined: Stephen 007646 KFRI (Parathode), 007673 KFRI (Panchalithode); Stephen & Michael 008125 KFRI (Pakshipadalam, Wayanad); Stephen & Joy 007553 KFRI (Devicolam, Munnar).

DRYMOGLOSSUM Presl.

Drymoglossum heterophyllum (L.) Trimen, J. Linn. Soc. Bot. 24: 152 (1887); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 310. pl. 237 (1992).

Rhizome widely creeping, scaly; scales adpressed, peltate, margin entire; fronds dimorphic, sterile ovate elliptic, narrowed or cuneate at base, broadly rounded at apex, fertile fronds oblong to elongate 5-8 cm long, narrowed to the base, acuminate at apex; sori linear.

Distribution & Ecology: Not common, though many authors recorded this species to be common from sea level to higher altitudes, during the present survey this species could be collected only from Siruvani area of Palghat district. Prefers semishaded localities of evergreen forests near stream side trees at an altitude of 850m.

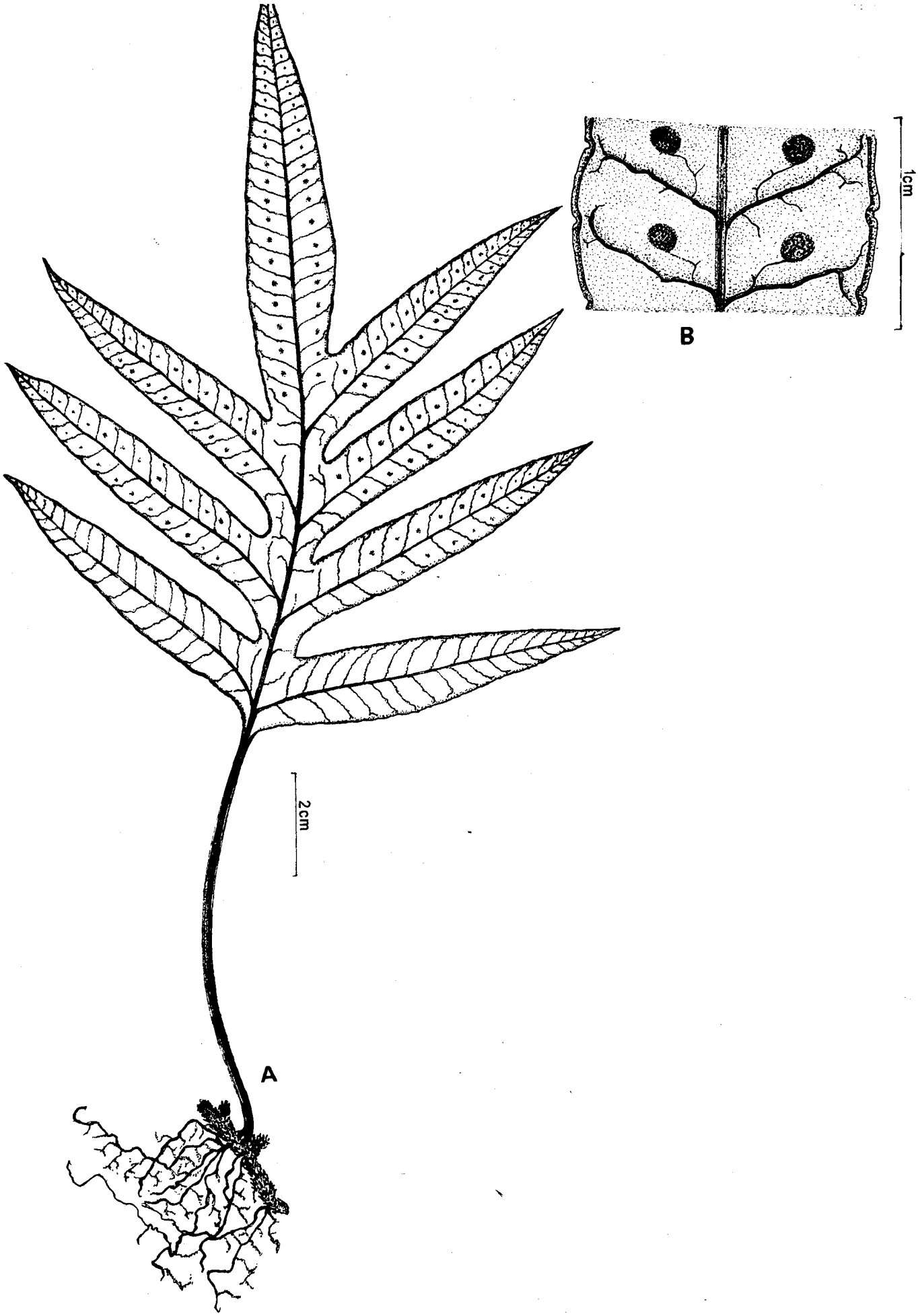


Fig.19. *Crypsinus montanus* Sledge A- Habit; B- Portion of pinna enlarged

Specimens examined: Stephen & Michael 008805 KFRI (Siruvani).

DRYNARIA (Bory)

Drynaria quercifolia (L.) J. Smith, in Hook. J. Bot. 3: 398 (1841); Beddome, Ferns South India, t. 186 (1864); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 312 pl. 238 (1992); Nayar & Geevarghese, Ferns Fl. Malabar, 382 (1993); Nair et.al, J. Econ. Tax. Bot. 18(2): 456 (1994).

Rhizome short creeping, scaly; scales linear-lanceolate, apex long acuminate, margin dentate-ciliate, nest leaves ovate; frond oblong upto 1 m long, pinnately lobed, lobes upto 15 pairs, oblong lanceolate, apex acute, margin entire; sori borne on juncture of veins, in two rows along each pinnae.

Distribution & Ecology: Very common, mainly distributed in the lower elevation. Prefers exposed dry area.

Specimens examined: Muktesh Kumar et al. 007209 KFRI (Ranimedu, Nelliampathy).

LEPTOCHILUS Kaulf.

Rhizome wide creeping, climbing, scaly; scales clathrate; frond dimorphic, sterile frond, ovate-lanceolate, long acuminate at apex, fertile fronds linear; sori achrostichoid.

Key to the species

1a. Base of the sterile frond abruptly decurrent; veins distinct ..... *L. decurrens*
1b. Base of the sterile frond not abruptly decurrent; veins indistinct 2

2a. Fertile fronds oblong base cuneate; sori distributed all over the lower surface leaving a narrow border along the margin; rhizome scales ovate-lanceolate ..... *L. thwaitesianus*
2b. Fertile frond linear-oblong; sori leaving any border along the margin; rhizome scales more or less orbicular ..... *L. decurrens* f. *lanceolatus*

Leptochilus decurrens Bl.,Enum. Pl. Jav. 206 (1828); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 307 pl. 234 (1992); Nayar & Geevarghese , Fern Fl. Malabar, 389 (1993); Nair et.al, Econ. Tax. Bot. 18(2): 462 (1994).

Rhizome creeping, scaly; scales clathrate, margin toothed; sterile fronds ovate-lanceolate upto 40 cm long and 8 cm wide, base abruptly decurrent, fertile fronds upto 30 cm only.

Distribution & Ecology: Common in the low altitude. Epiphytic on bases of tree trunks and exposed roots of trees. Growing as large colonies near moist shaded stream sides at an altitude of 150m - 900m.

Specimens examined: Stephen & Joy 007291 KFRI (Pathrakadavu, SVNP); Muktesh Kumar & Stephen 007692 KFRI (Sasthanada, Kollam).

Leptochilus decurrens f. lanceolatus Manickam et Irudayaraj, Pterid. Fl. W. Ghats. 308 t. 235 pl. 235 (1992).

Rhizome creeping, scaly; scales orbicular, acuminate, margin subentire, base rounded; sterile frond elliptic-lanceolate upto 25 cm long, apex acuminate, base narrowly cuneate, margin entire, fertile frond linear-oblong upto 30 cm long.

Distribution & Ecology: Not common, collected from Silent Valley National Park. Epiphytic on bases of tree trunks. Prefer shaded area at an altitude of 1000m - 1400m.

Specimens examined: Stephen 007875 KFRI (Upper Walakkad).

Leptochilus thwaitesianus Fee, Mem. Fam. Fouger. 10: 7, Pl. 24 (1865); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 309 pl. 236 (1992); Nayar & Geevarghese, Fern Fl. Malabar, 393 (1993).

Rhizome creeping, scaly; scales ovate-lanceolate, apex acuminate, margin entire or subentire; sterile frond lanceolate, upto 20 cm long, apex blunt, fertile frond oblong, upto 25 cm long, margin entire, base cuneate

Distribution & Ecology: Common, epiphpytic on bases of tree trunks on stream side trees. Prefers 600m - 1500m altitude.

Specimens examined: Stephen & Joy 007511 KFRI (Pathrakadavu); Muktesh Kumar & Stephen 007239 KFRI (Rajamallay, Munnar); Stephen & Joy 007546 KFRI (Chinnakanal, Munnar).

MICROSORIUM Link

Rhizome creeping, scaly; scales clathrate, gland tipped; fronds simple elliptic or lanceolate, both surfaces glabrous; sori numerous, scattered.

Key to the species

1a. Fronds thick fleshy; veins indistinct ..... *M. punctatum*
1b. Fronds thin; veins distinct 2

2a. Frond, membranaceous, lanceolate, apex blunt, margin wavy or undulate; lateral veins distinct and raised on the lower side ..... *M. membranaceum*
2b. Frond coriaceous, apex acuminate, base attenuate, margin smooth; lateral veins distinct and externally visible ..... *M. linguaforme*

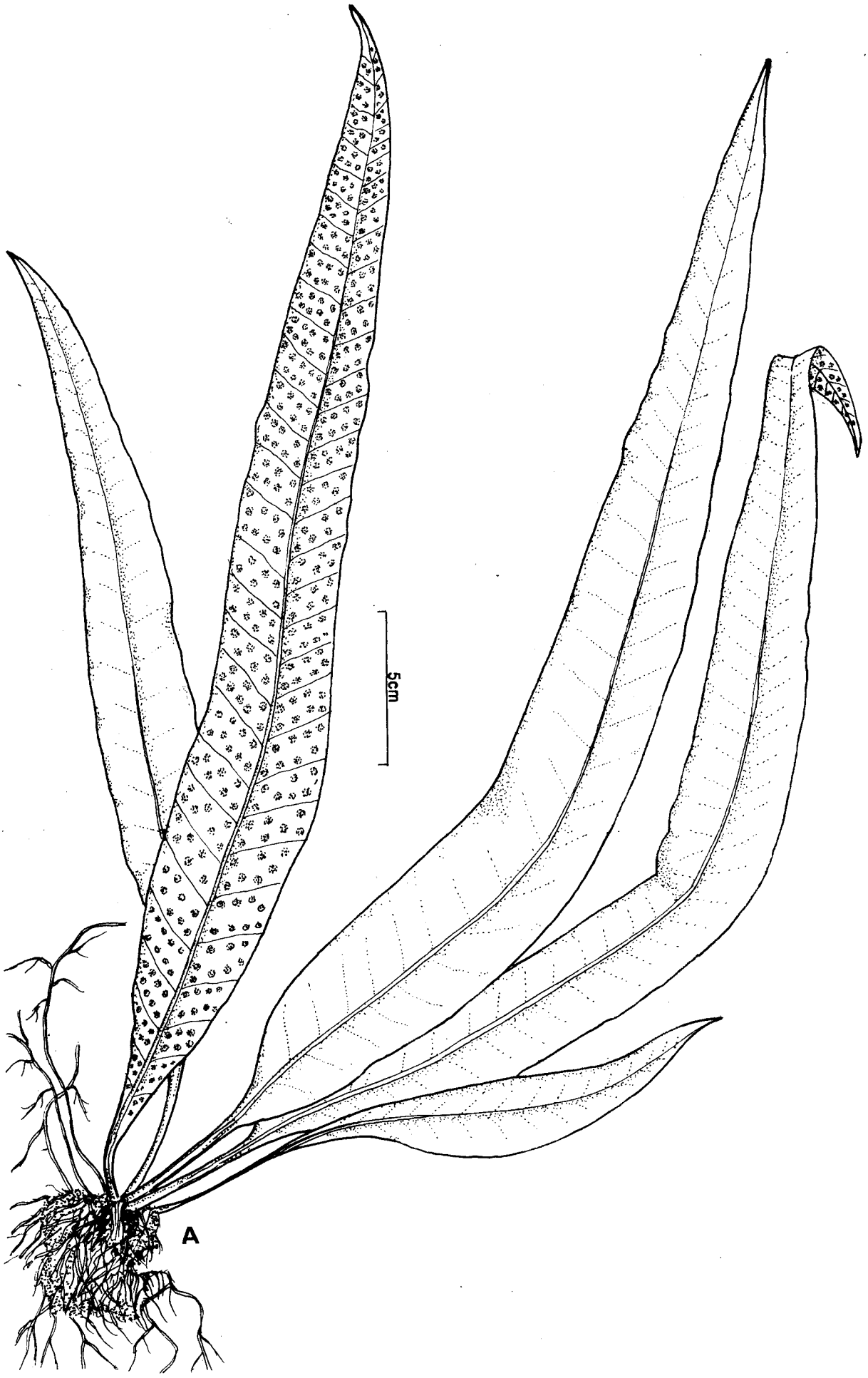


Fig. 20. A- Habit of *Microsorium membranaceum* (D.Don.) Ching

Microsorium linguaforme (Mett.) Copel. Gen. Fil. 196 (1947); Nayar & Madhusoodhan, Bot. J. Linn. Soc. 75: 283 (1977); Madhusoodhan & Nampy, J. Econ. Tax. Bot. 17(1): 43-47 (1993);

Phymatodes linguaforme Mett., Copel. Ferns Fiji 59: 92 (1929).

Rhizome long creeping, scaly; scales peltate, ovate-lanceolate, apex and margin glandular, margin slightly toothed; fronds upto 40 cm long and 8 cm wide, base attenuate, tip acuminate, very broad, margin smooth, venation reticulate, central vein externally visible, midrib raised on both anterior 2/3rd, attached to tertiary veinlets.

Distribution & Ecology: It is a cultivated species. Nayar & Madhusoodanan (1977) reported this species from Nelliampathy forest in wild condition. Collected from Calicut University Botanical Garden.

Specimens examined: Muktesh Kumar 008857 KFRI (Calicut University).

Microsorium membranaceum (D.Don) Ching, Bull. Fan. Mem. Inst. Biol. 4: 309 (1933), Ic. Fil. Sin. 2: Pl. 88 (1934); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 327 pl. 248 (1992); Nayar & Geevarghese, Ferns Fl. Malabar, 401 (1993); Nair et.al, J. Econ. Tax. bot. 18(2): 466 (1994).

Polypodium membranaceum D.Don, Prodr. Fl. Nepal, 2 (1925);

Rhizome short creeping, scaly; scales ovate, clathrate, apex and margin glandular; fronds upto 40 cm long and 5 cm wide, membranaceous, thin lanceolate with blunt apex, margin wavy or undulate, venation reticulate, lateral vein distinct and, flattered between lateral veins (Fig. 20).

Distribution & Ecology: Not common, forming small colonies in deeply shaded, humid localities of evergreen forests and on the fringes of semi - evergreen forests at an altitude of 750m - 1600m.

Specimens examined: Stephen 007658 KFRI (Thondakulam, SVNP); 007665 KFRI (Poovanchola, SVNP); Stephen 007615 KFRI (Chandanathode, Wayanad); Stephen & Michael 008146 KFRI (Thirunelly, Wayanad); Stephen & Joy 007540 KFRI (Lockart Gap, Munnar).

Microsorium punctatum (L.) Copel. in Univ. Calif. Publ. Bot. 16 : 111 (1929); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 328 pl. 249 (1992); Nayar & Geevarghese, Fern Fl. Malabar, 403 (1993); Nair et.al, J. Econ. Tax. Bot. 18(2): 467 (1994).

Acrostichum punctatum L., Sp. Pl. ed. 2: 1524 (1763).

Rhizome creeping, scaly; scales ovate-lanceolate, clathrate, apex and margin glandular, margin sparsely toothed; fronds upto 50 cm long and 8 cm wide, oblanceolate, elongated base, attenuate; apex blunt; venation reticulate, lateral vein slightly distinct, widely separated, midvein raised in both surface; sori rounded, scattered on 2 or 3 part of the anterior area.

Distribution & Ecology: Common, prefers well shaded localities near stream side trees and semi exposed forest fringes at an altitude of 700m and above.

Specimens examined: Joy & Stephen 007251 KFRI (Punnamala); Muktesh Kumar & Stephen 006749 KFRI (Chandanathode, Wayanad); Stephen & Michael 008118 KFRI (Thirunelly, Wayanad).

NISTARIKA Nayar, Madhusoodan et Molly

Nistarika bahupunctika Nayar, Madhusoodan et Molly, Brit. Fern Gaz. 13: 3342 (1985).

Rhizome elongated dorsi-ventrally compressed, scaly; scales clathrate, sub triangular; fronds dimorphic, sterile frond, glossy and glabrous, lanceolate, entire, apex acuminate, margin entire with a narrow cartilaginous edge; venation reticulate, midrib prominent and raised on both surfaces, fertile frond filiform; sori on extending all along the frond (Fig. 21).

Distribution & Ecology: Very rare, collected from Silent Valley National Park. Epiphytic on small shrubs and small trees i on deeply shaded localities of evergreen forests at an altitude of 800m - 900m.

Specimens examined: Stephen & Joy 007298 KFRI (Panthenthode); Stephen 008193 KFRI (Poovanchola).

Note: Nistarika is a monotypic genus and is endemic to Kerala.

LOXOGRAMME (Bl.) Presl.

Rhizome creeping, scaly, hairy; fronds simple, fleshy, linear-lanceolate acute or acuminate at apex; sori elongate, naked, oblique to the costa.

Key to the species

1a. Fronds upto 40 cm long, 3 cm wide; sori 2.5 cm long, upto 15 pairs; rhizome scale entire ..... *L. involuta*

1b. Fronds upto 20 cm long and 1 cm wide; sori 1cm long, upto 10 pairs; rhyzome scale slightly toothed ..... *L. parallela*

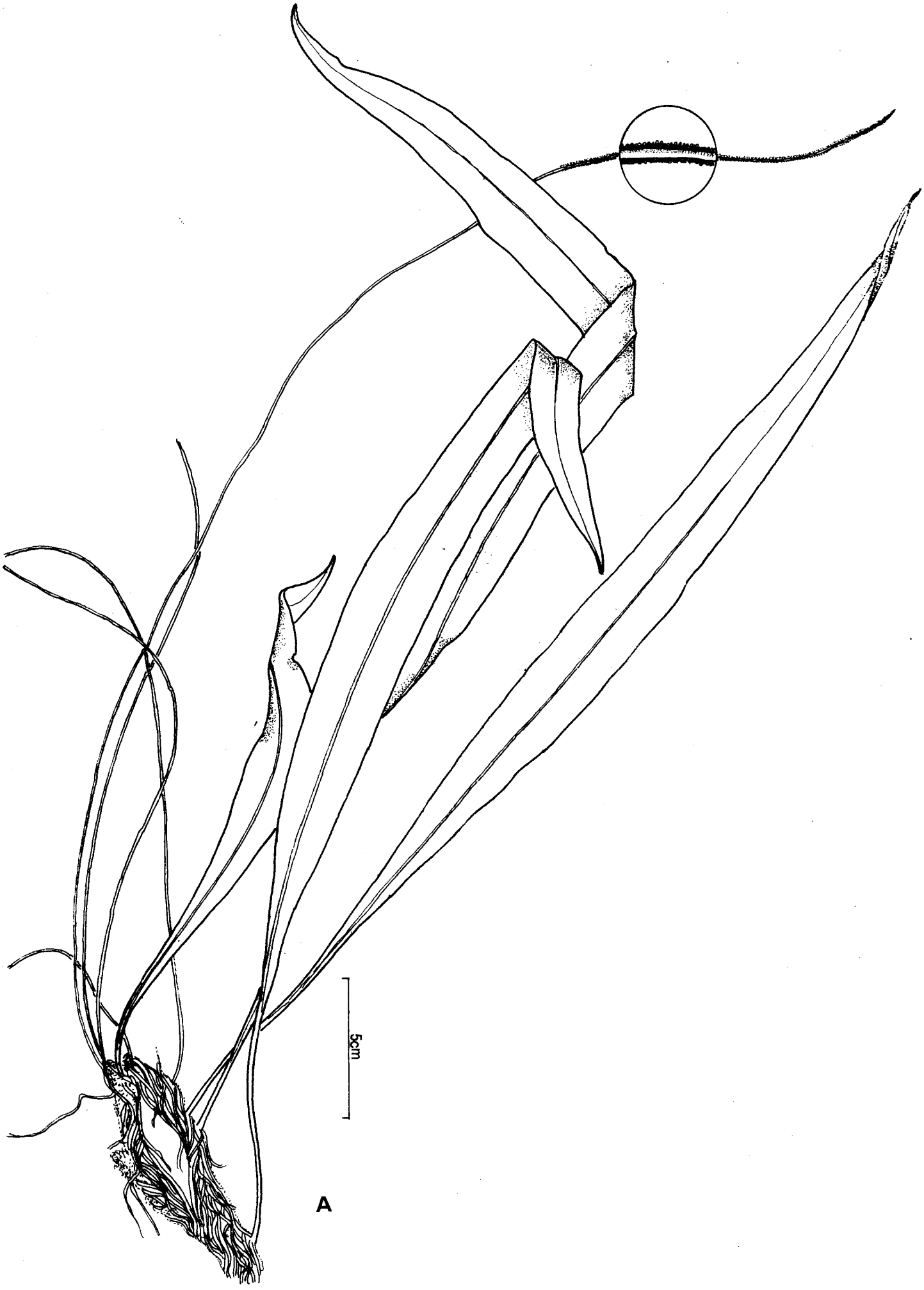


Fig.21. A- Habit of *Nistarika bahupunctika* Nayar, Madhusoodanan et Molly

Loxogramme involuta (D.Don) C. Presl. Tent. Pterid. 215 (1836); Beddome, Ferns South India, 17, t. 50 (1864);Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 314 pl. 239 (1992); Nair et. al, J. Econ. Tax. Bot. 18(2): 449 (1994).

Grammitis involuta D.Don, Prodr. Fl. Nepal, 14 (1825).

Rhizome short creeping, scaly; scales broad lanceolate; fronds simple, lanceolate, attenuate at both ends, margin entire, glabrous; veins obscure; sori linear, oblique (Fig. 22).

Distribution & Ecology: Rare, collected from Sispara of Silent Valley National Park and Munnar. Prefers high altitude shola forests at an altitude of 1500m and above.

Specimens examined: Stephen 007874 KFRI (Sispara); Stephen & Michael 008168 KFRI (Lockart Gap, Munnar).

Loxogramme parallela Copel. in Perkins Fragm. Fl. Philipp. 3: 182 (1905); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 315 pl. 240 (1992).

Rhizome creeping, scaly; scales lanceolate margin slightly toothed, fronds linear-lanceolate, apex acuminate, base narrowly cuneate and becoming wing of the stipe, margin entire, glabrous, veins indistinct; sori linear, almost parallel to the midrib.

Distribution & Ecology: Very rare, collected from Chembra Peak of Wayanad . Prefers high humid shaded evergreen shola forests at an altitude of 1100m and above.

Specimens examined: Stephen & Michael 008159 (Poovanchola, Chembra Peak, Wayanad).

LEPISORUS (J.Smith)

Rhizome creeping, scaly; scales clathrate; fronds simple, linear, lanceolate to elliptic, glabrous or scaly, margin entire; veins usually hidden; sori round or oval in a single row on either side of costa, covered with peltate, clathrate paraphyses.

Key to the species

1a. Fronds linear-elliptic to linear-lanceolate upto 35 cm long, acuminate; sori arranged in the distal half of the fronds; rhizome scale entire ..... *L. nudus*

1b. Fronds elliptic lanceolate upto 20 cm long, apex acute arranged either side of the midrib and almost to the base; rhizome scale dentate ..... *L. amaurolepidus*

Lepisorus amaurolepidus (Sledge) Bir & Trikha in Vasudeva, J. Bombay Nat. Hist. Soc. 68: 192 (1971); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 334 pl. 253 (1992); Nayar & Geevarghese, Fern Fl. Malabar, 387 (1993); Nair et.al, J. Econ. Tax. Bot. 18(2) : 463 (1994).

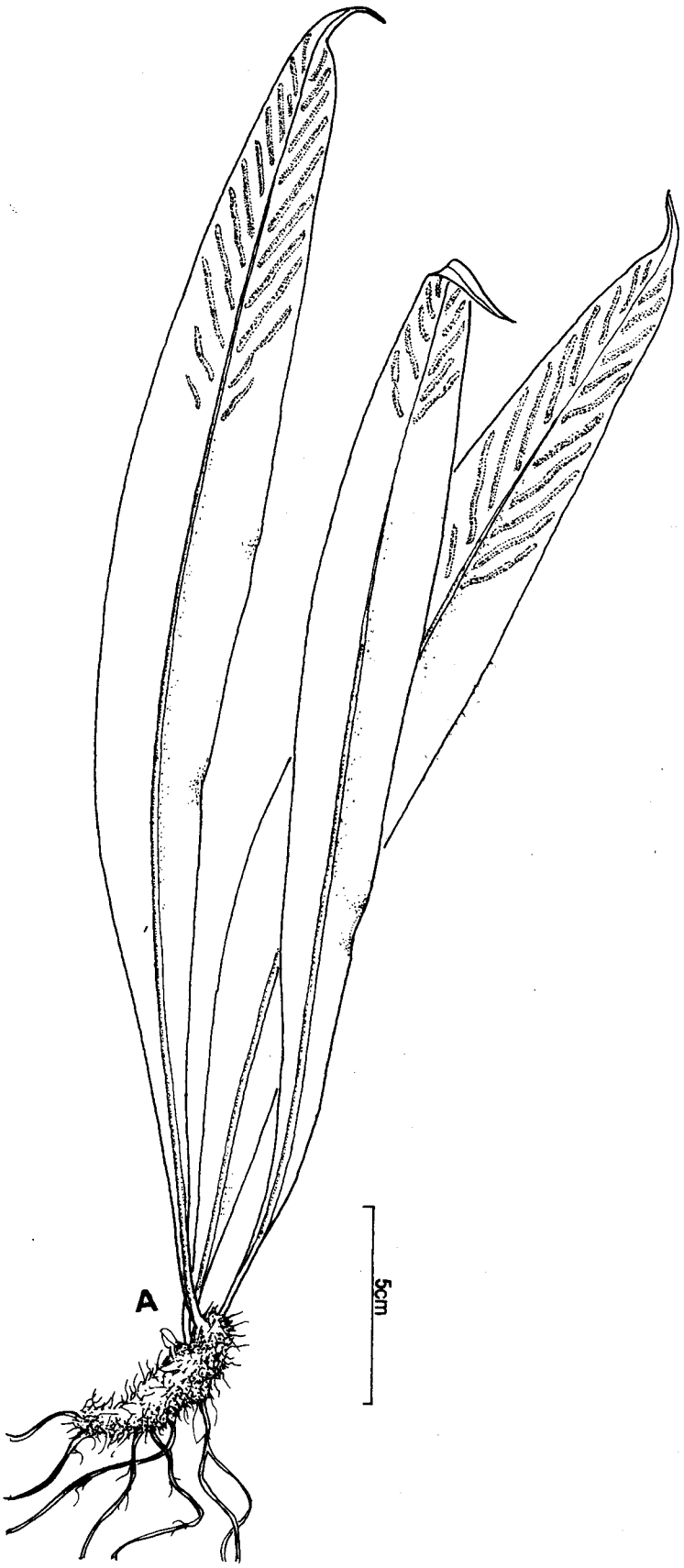


Fig. 22. A- Habit of *Loxogramme involuta* (D.Don.) C. Presl

Pleopeltis amaurolepida Sledge, Bull. British Mus. Nat. Hist. Bot. 2: 136, fig. 2a,b (1960).

Rhizome long creeping scaly; scales peltate, clathrate, ovate-lanceolate, margin dentate; lamina elliptic lanceolate, base decurrent on stipes, apex acute rarely subacute, glabrous, margin entire, midrib slightly raised; sori globose, medianly on either side of the midrib.

Distribution & Ecology: Not common, collected from Silent Vallley National Park, Nelliampathy and Wayanad. Epiphytic on shaded stream side trees at an altitude of 850m - 1600m.

Specimens examined: Stephen 007624 KFRI (Chandanathode, Wayanad); Stephen 007598 KFRI (Sairandhry, SVNP); Stephen & Joy 007223 KFRI (Neiliampathy); 007541 KFRI (Lockart Gap, Munnar).

Lepisorus nudus (Hook.) Ching, Bull. Fan. Mem. Inst. Biol. 4: 83 (1933); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 332 pl. 252 (1992); Nayar & Geevarghese, Ferns Fl. Malabar, 388 (1993); Nair et.al, J. Econ. Tax. Bot. 18(2) : 463 (1994).

Pleopeltis nuda Hook., Exot. Fl. 1 : 63 (1823.

Rhizome long creeping, scaly; scales ovate-lanceolate, acuminate, margin entire; fronds linear-elliptic to linear-lanceolate, tapering at base, margin entire, apex acuminate, glabrous, midrib slightly raised; veins indistinct; sori on either side of the costa and generally in the upper half of the lamina.

Distribution & Ecology: Very common, in shaded and semishaded localities of evergreen forests.

Specimens examined: Stephen 007639 KFRI (Parathode, SVNP); Stephen & Joy 007254 KFRI (Sairandhry); Stephen & Michael 008117 KFRI (Thirumelly, Wayanad); Stephen & Michael 008158 KFRI (Chembra Peak, Wayanad); Stephen 007623 KFRI, 007619 KFRI (Chandanathode, Wayanad); Stephen & Joy 007541 KFRI (Lockart Gap, Munnar).

PHYMATOSORUS Pic.

Rhizome thick, fleshy, creeping, scaly; scales sparsely; lamina pinnatifid, pinnae oblanceolate; veins distinct or indistinct, herbaceous to chartaceous, glabrous; sori superficial or immersed in cavities.

Key to the species

1a. Fronds upto 1 m in length; veins and areols well distinct and slightly raised above and below; sori extruded above by raised cavity ..... *P. nigrescens*

1b. Fronds upto 60 cm long; veins and aerols indistinct; sori sunken ..... *P. lucidus*

Phymatosorus lucidus (Roxb. ex Griff.) Pic. Ser., Webbia, 28: 459 (1973); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 316 pl. 241 (1992).

Polypodium lucidum Roxb. ex Griff., Calc. Journ. nat. Hist. 4: 486 (1844).

Rhizome long creeping, fleshy, greenish, sparsely scaly; scales broadly ovate; stipes scattered, abaxially rounded, grooved adaxially; lamina about 50 cm long, pinnate, pinnae about 8 pairs, oblong-lanceolate, apex acuminate, glabrous, margin entire; midvein raised both above and below, veins indistinct; sori median between the margin of the pinnae and costa, superficial, sunken (Fig. 23).

Distribution & Ecology: Common, seen as lithophyte also. Prefers well shaded riverine areas of evergreen forests at an altitude of 500m - 900m.

Specimens examined: Stephen & Joy 007516 KFRI (Parathode); 007297 KFRI (Panthenthode); Stephen 008102 KFRI (Meenmutty, New Amarambalam); Muktesh Kumar & Stephen 006743 KFRI (Chandanathode, Wayanad); Stephen & Michael 008811 KFRI (Siruvani).

Phymatosorus nigrescens (Bl.) Pic. Ser., Webbia, 28 : 159 (1973); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 317 pl. 242 (1992); Nair et.al, J. Econ. Tax. Bot. 18(2): 465 (1994).

Polypodium nigrescens Bl., Enum. Pl. Jav. 2: 126 (1828).

Rhizome creeping fleshy, greenish, sparsely scaly; scales broadly ovate; stipes scattered, more or less terete, glabrous, glossy; lamina about 90 cm long, pinnate, pinnae about 12 pairs, oblong-lanceolate, glabrous, margin entire; midvein slightly raised above and below, veins indistinct; sori rounded, superficial, extruded above by raised cavity.

Distribution & Ecology: Rare, collected from Munnar. Prefers dense shaded evergreen shola forests at an altitude of 1300m - 1800m.

Specimens examined: Stephen & Joy 007551 KFRI (Chinnakanal, Munnar); Stephen & Michael 008172 KFRI (Lockart Gap, Munnar).

Note: Manickam & Irudayaraj reported this species to be common in Kerala and occurring from 50m - 1000m. But during the present exploration it is found that the species has wide range of distribution between 1300m - 1800m altitude.

PYRROSIA Mirbel

Rhizome slender, short or long creeping, scaly; scales peltate, entire or fringed; fronds simple, elliptic-lanceolate matted with woolly sometimes on lower surface and stellate hairs in upper surface; sori usually confined to the apical half of the frond, globose, scattered.

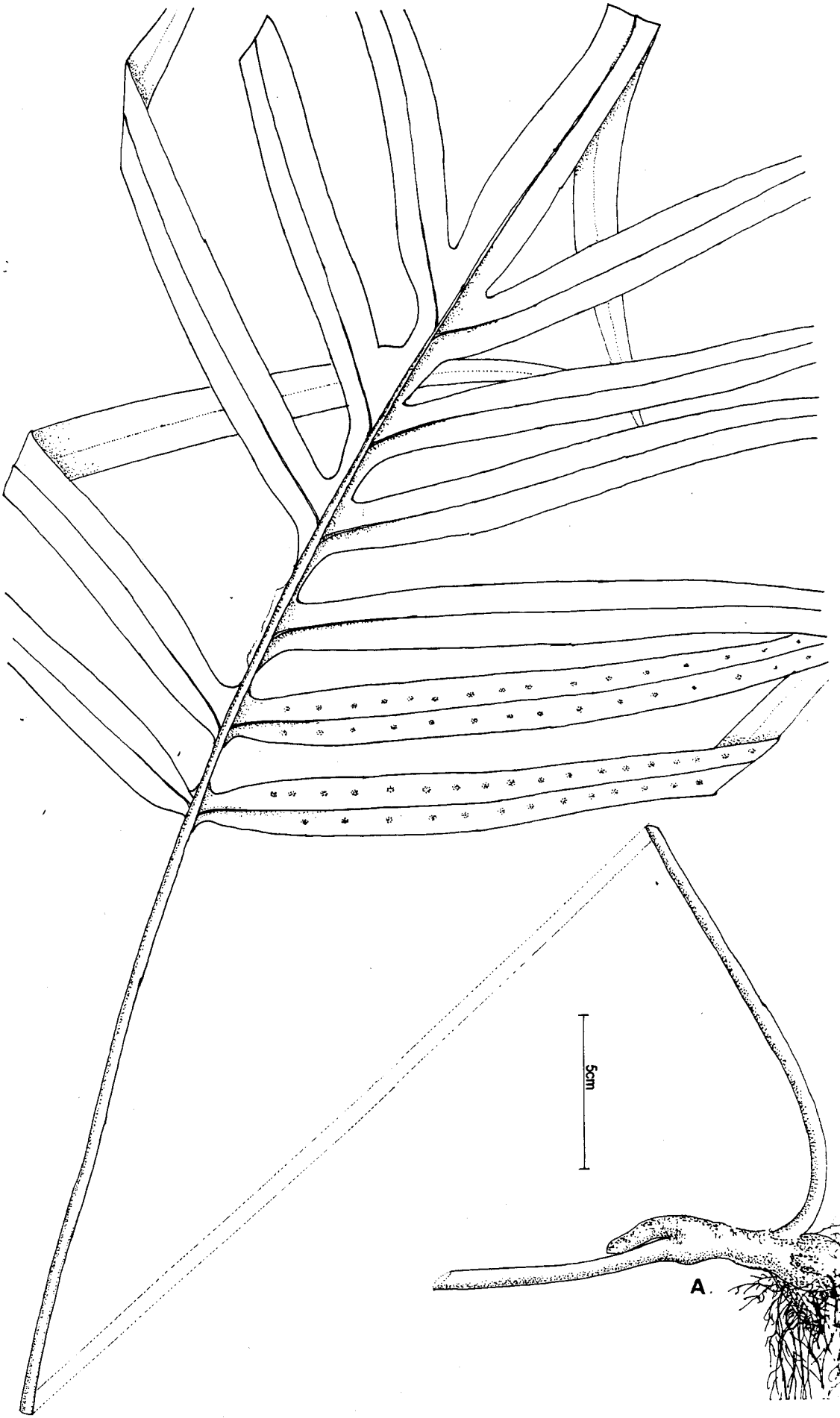


Fig. 23. A- Habit of *Phymatosorus lucidus* (Roxb. ex Griff.) Pic.

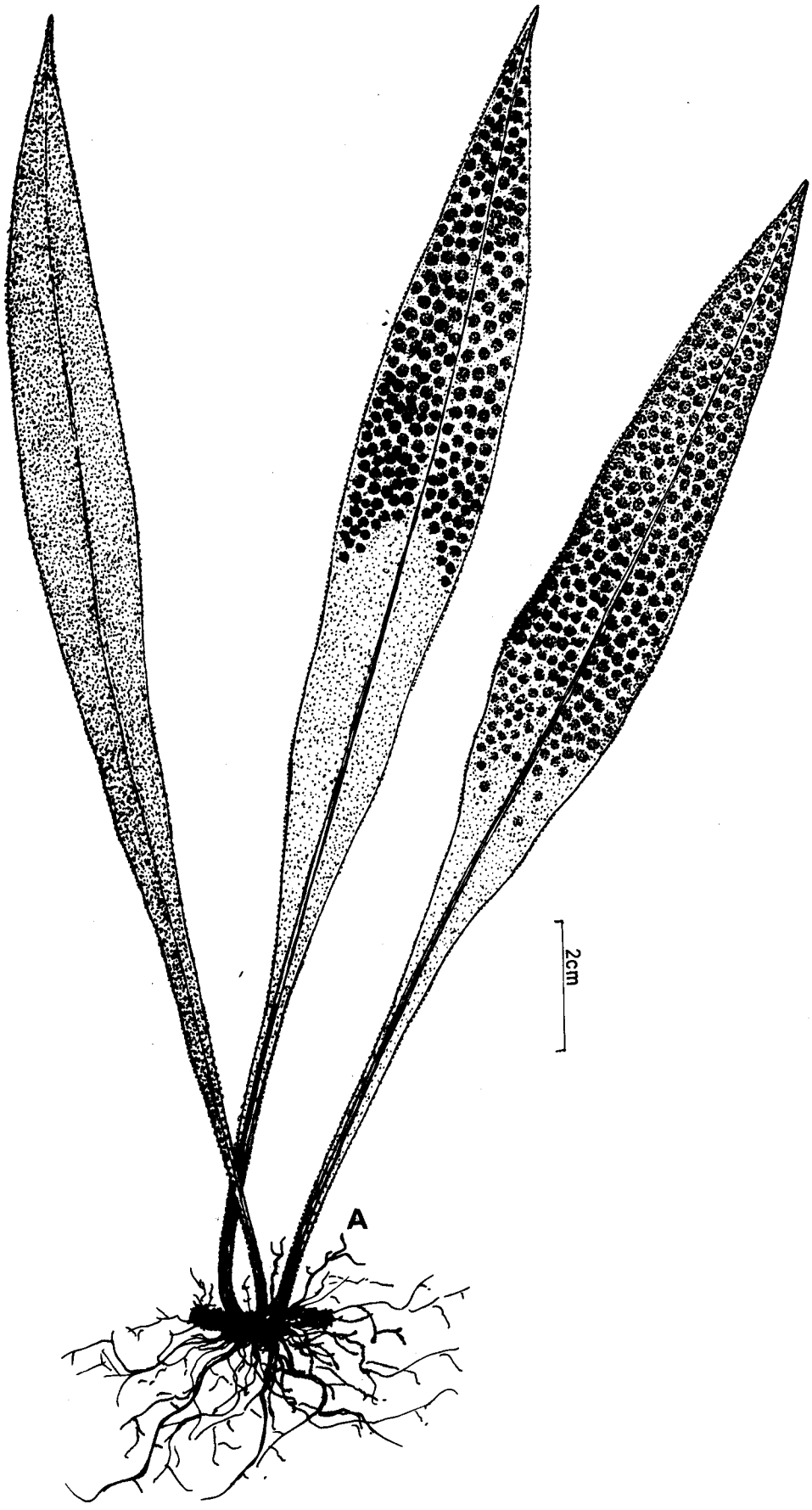


Fig. 24. A- Habit of *Pyrrosia porosa* var. *porosa* Hovenkamp

Key to the species

1a. Stellate hairs of two types ..... *P. porosa* var *porosa*
1b. Only one type of stellate hairs ..... *P. lanceolata*

Pyrrosia lanceolata Farewel, Amer. Middl. Nat. 12 : 245 (1930); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 322 pl. 245 (1992); Nayar & Geevarghese, Fern Fl. Malabar, 408 (1993); Nair et.al, J. Econ. Tax. Bot. 18(2): 459 (1994).

Rhizome long creeping, slender, scaly; scales lanceolate, apex acuminate, margin entire; stipes scattered, flattered, winged along the margin, densely scaly at base, sparsely covered by stellate hairs above; fronds simple lanceolate, elliptic or linear-lanceolate upto 15 cm long, apex acute, base decurrent upto the winged stipe, margin entire or wavy; midvein, marked by a shallow groove above, veins immersed, lower surface of the frond densely covered by stellate hairs; sori irregularly distributed mainly in the distal part of the pinnae.

Distribution & Ecology: Common, distributed from low altitude to high altitude forests. Prefers exposed or semiexposed moist shady area in evergreen forest.

Specimens examined: Stephen & Joy 007507 KFRI (Pathrakadavu, SVNP); Muktesh Kumar et al. 007210 KFRI (Ranimedu, Nelliampathy); 007222 KFRI (Victoria, Nelliampathy) Stephen 007649 KFRI (Parathode); Muktesh Kumar & Joy 006734 KFRI (Pattakarimba, Nilambur); Stephen & Michael 008806 KFRI, 008815 KFRI (Siruvani).

Pyrrosia porosa var. **porosa** Hovenkamp, Blumea, 30 : 208 (1984); Manickam et. Irudayaraj, Pterid. Fl. W.Ghats, 323 pl. 246 (1992).

Rhizome short creeping, densely covered by scales; scales appressed, lanceolate, apex acuminate, margin fimbricate; stipe indistinct; lamina linear, elliptic to lanceolate, margin entire, midrib slightly distinct, lower surface of the frond densely clothed by stellate hairs of two types; sori numerous, towards the distal half of the frond, protected by stellate hairs (Fig. 24).

Distribution & Ecology: Common, usually prefer exposed and semiexposed humid areas near fringes of evergreen forests at an altitude of 900m - 1100m.

Specimens examined: Joy & Stephen 007253 KFRI (Sairandhry, SVNP); Stephen & Michael 008116 KFRI, 008114 KFRI (Thirunelly, Wayanad); Stephen 007592 KFRI (Seethaguindy, Nelliampathy); Joy & Stephen 007224 KFRI (Victoria, Nelliampathy).

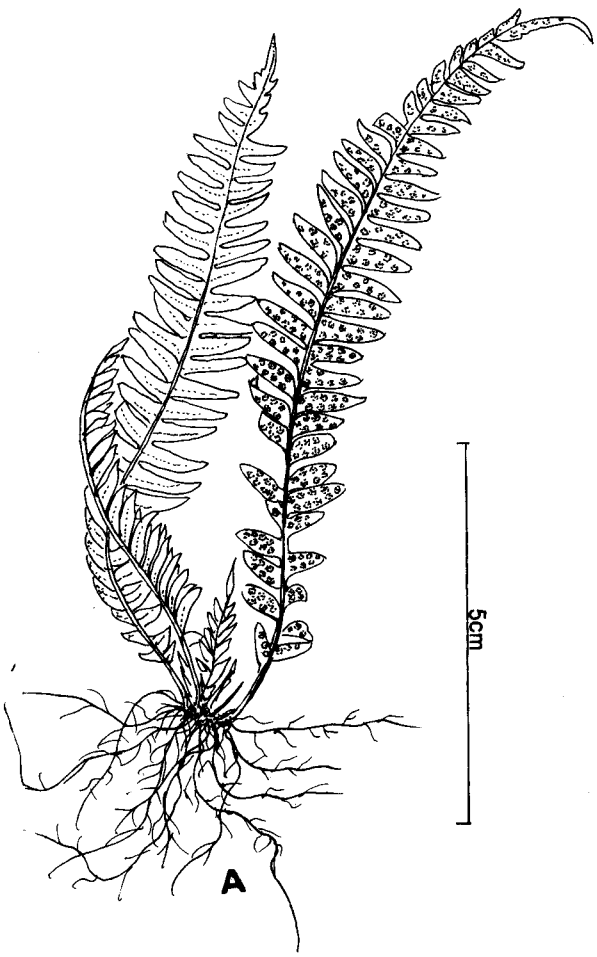


Fig. 25. A- Habit of *Ctenopteris subfalcata* (Bl.) Kunze

GRAMMITIDACEAE

Rhizome creeping or erect, covered with ovate to lanceolate scales bearing unicellular stiff hairs; lamina simple or pinnate; stipe hairy or without hairs; vein forked; sori naked, round mixed with hairs.

Key to the species

1a. Fronds pinnatifid ..... *Ctenopteris*
1b. Fronds simple ..... *Grammitis*

CTENOPTERIS Bl. ex Kunze.

Ctenopteris subfalcata (Bl.) Knze, Bot. Zeit. 6: 120 (1848); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats 338 Pl. 256 (1992).

Polypodium subfalcatum Bl. Enum. Pl. Jav. 2: 130 (1828).

Rhizome erect, densely scaly; scales ovate lanceolate, apex with one or two cilia, margin entire; lamina elliptic to oblanceolate, margin pinnatifid; veins indistinct; midrib scaly below; pinnules herbaceous; pale brown slender hairs distributed densely all over the surface; sori median between the margin and costules of the pinnule, seated at the end of the veins (Fig. 25).

Distribution & Ecology: Very rare, collected from Mannavan shola of Idukki District. Prefers deeply shaded localities of evergreen shola forests at an altitude of 1800m and above.

Specimens examined: Stephen 007891 KFRI (Mannavan shola).

Note: Manickam & Irudayaraj (1992) recorded this from Kothayar Hills during their survey and noted it as a very rare species. The present collection is a new record to Kerala. In Mannavan shola it is abundant. Seen as lithophytic also.

GRAMMITIS Sw.

Rhizome short creeping; lamina simple, elliptic; sori median between the costa and margin of the frond.

Key to the species

1a. Rhizome scale septate with subbasal attachment; upper surface of the frond bristly hairy; lower surface glabrous ..... *G. pilifera*
1b. Rhizome scales basifixed, slender; upper and lower surface of the lamina sparsely hairy 2

2a. Sori linear to elliptic; sporangia non setose; frond clothed with hairs ..... *G. attenuata*
2b. Sori round usually setose; frond glabrous or sparsely hairy ..... *G. medialis*

Grammitis attenuata Kunze in Linnaea, 34: 251, fig. 3 (1851); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 336 pl. 254 (1992); Nayar & Geevarghese, Fern Fl. Malabar, 348 (1993).

Rhizome short creeping, scaly; scales ovate-lanceolate, apex acute, frond tufted, elliptic or linear or oblong-elliptic, apex acute, margin entire, hairy in both surfaces; sori median in position between costa and margin, sori linear or oblong, oblique to the midrib, non setose.

Distribution & Ecology: Rare, only seen in high altitude, evergreen shola forests, collected from Sispara of Silent Valley. Prefers well shaded humid montane forests at an altitude of 1800m and above.

Specimens examined: Stephen 007880 KFRI (Sispara).

Grammitis medialis (Bak.) Sledge, Bull. British Mus. Nat. Hist. Bot. 2(5): 149, fig. 4A-E (1960); Manickam et. Irudayaraj, Pterid. Fl. W. Ghats, 337 pl. 255 (1992); Nair et.al, J. Econ. Tax. Bot. 16(3) : 548 (1992).

Polypodium mediale Bak. in Hook. & Bak. Syn. Fil. ed. 2, 507 (1874).

Rhizome suberect or short creeping, scaly; scales ovate-lanceolate; fronds tufted elliptic to linear, apex acute, margin entire, glabrous above or with few short hairs on midrib; sori circular median between midrib, usually setose .

Distribution & Ecology: Not common, collected from Silent Valley National Park. Prefers shaded stream side trees at an altitude of 800m and above.

Specimens examined: Stephen 007682 KFRI, 007597 KFRI (Panchalithode); Stephen 007855 KFRI (Sispara); Stephen 007697 KFRI (Sairandhry).

Grammitis pilifera Ravi et Joseph in Journ. Bombay Nat. Hist. Soc. 76: 348 (1979); Nair et al., Journ. Econ. Tax. Bot. 16(3): 548. (1992).

Rhizome short erect, scaly; scales ovate-lanceolate, septate with subbasal attachment; fronds, oblong, obtuse or subacute, narrowed into a short stalk at base, upper surface bristly hairy, lower surface glabrous; sori circular; sporangia setose, single.

Distribution & Ecology: So far known only from Ponmudi Hills of Kerala. Prefers shady medium sized tree trunks at an altitude of 800m and above. Also seen as lithophytes.

Specimens examined: Pradeep 43702 CALI (Ponmudi).

9.2 ANGIOSPERMS

Key to the families

1a. Leaves having reticulate venation 2
1b. Leaves having parallel venation 10

2a. Sepals and petals distinct; free or united 3

2b. Sepals and petals indistinct; perianth parts present 9

3a. Petals free 4
3b. Petals united 6

4a. Flowers in panicles or umbels or compound racemes, leaves pinnate or digitate ..... Araliaceae
4b. Flowers otherwise, leaves simple opposite or whorled 5

5a. Sepals tubular; petals ovate, obovate, acute, fleshy;spur absent; leaves 3-5 ribbed ..... Melastomataceae
5b. Sepals free; petals 3, dissimilar, standards and wing petal present;
spur present; leaves otherwise ..... Balsaminaceae

6a. Leaves opposite; spur absent 7
6b. Leaves otherwise; spur present ..... Lentibulariaceae

7a. Corolla lobes often convex and spreading, reflexed; corona present ..... Asclepiadaceae
7b. Corolla lobes, tubular or funnel shaped; corona absent 8

8a. Corolla lobes 5, bilabiate, 2 small upper lip and 3 large lower lobe; stamen 4 ..... Gesneriaceae
8b. Corolla lobes 5, equal; stamens 5 ..... Loganiaceae

9a. Flowers capitate cymes or spikes or aggregated on a fleshy receptacle ..... Urticaceae
9b. Flowers in axillary or terminal catkin like spikes ..... Piperaceae

10a. Flowers on a spadix which is enclosed in a spathe ..... Araceae
10b. Flowers other wise 11

11a. Petals 3, one of them modified into a lip ..... Orchidaceae
11b. Petals 3, sub equal, free or united below ..... Commelinaceae

BALSAMINACEAE

IMPATIENS L.

Scapigerous or perreneal herbs; leaves simple, radical or alternate, usually fascicled; flowers in simple or branching few flowered peduncles or scapes; sepals 3, dissimilar, posterior one formed into lip; petals 3, dissimilar, wing entire or 2-3 lobed; stamens 5; stigma 5-toothed; seeds smooth or tubercled.

Key to the species

1a. Plants scapigerous 2
1b. Plants non scapigerous 6

2a. Spur short, upto 2cm, or spur less 3
2b. Spur long upto 5 cm ..... *I. acaulis*

3a. Lip spur less ..... *I. stocksii*
3b. Spur upto 2 cm. 4

4a. Wings without dorsal auricle ..... *I. sivarajanii*
4b. Wings having dorsal auricle 5

5a. Dorsal auricle spiniform ..... *I. lawsonii*
5b. Dorsal auricle filiform ..... *I. denisonii*

6a. Stem short, stoloniferous ..... *I. kulamavuensis*
6b. Stem long, not stoloniferous 7

7a. Sepals pendulous, acute, exceeding the wings ..... *I. auriculata*
7b. Sepals not pendulous, acuminate, not exceeding the wings 8

8a. Lip red or scarlet green 9
8b. Lip and sepals green ..... *I. viridiflora*

9a. Stem moniliform ..... *I. parasitica*
9b. Stem not moniliform ..... *I. jerdoniae*

Impatiens acaulis Arn. in Hook., Campanion Bot. Maf. 1: 325 (1836); Hook. f., Fl. British India 1: 443 (1879); Gamble, Fl. Pres. Madras 138 (1915); Manilal, Fl. Silent Valley 39 (1988); Vajravelu, Fl. Palghat 99 (1990).

Scapigerous herbs with tuberous rootstocks; leaves orbicular- ovate, palmately veined, glabrous with long petiole; flowers pink in racemes; spur saccate, long upto 5 cm long, wings 2 lobed; seeds minute, clothed with spiral hairs.

Distribution & Ecology: Common in the moist places, collected from Silent Valley National Park. In lower altitude it is growing as lithophytic but this species is found attached on the tree trunk at higher altitudes. Found to be growing at an altitude of 800-1800 m.

Specimens examined: Stephen 007864 KFRI (Sispara).

Impatiens auriculata Wt. in Madras J. L. Sci. Ser. 1. 5: 8 (1837); Hook. f., Fl. British India 1: 460 (1874); Gamble, Fl. Pres. Madras 139 (1915); Moh. & Henr., Fl. Thiruvananthapuram 97 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 77 (1995).

Stem short, prostrate, internode much swollen; leaves petiolate, elliptic, acute, obscurely crenulate; flowers red; sepals pendulous, acute, red, standard dark green, wings dark purple; lip large, laterally compressed; saccate; wrinkled, red; spur short.

Distribution Ecology: Very rare species, prefer high altitude shola forests.

Specimens examined: Nambiar 00105 KFRI (Sholayar).

Note: This species is endemic to Peninsular India.

Impatiens denisonii Bedd., Madras., J. Lit. Sci. Ser. 3. 1: 41 (1864); Ic. t. 151 (1868-1874); Hook. f., Fl. British India 1: 444 (1879); Gamble, Fl. Pres. Madras 139 (1915); Manilal, Fl. Silent Valley 40 (1988).

Scapigerous herbs; leaves ovate, cordate at base, crenate; flowers pink, in terminal racemes; wings 3 lobed, bearded, dorsal auricle filiform, included in the spur; seeds minute with spiral hairs.

Distribution & Ecology: Not common, collected from Silent Valley National Park. Epiphytic on bases of tree trunks. Prefers well shaded stream side, at an altitude of 850 m.

Specimens examined: Stephen 007675 KFRI (Panchalithode, SVNP).

Note: This species is endemic to South India and is considered as an endangered species.

Impatiens jerdoniae Wt., Ic. t. 1602 (1850); Hook. f., Fl. British India 1: 460 (1874); Gamble, Fl. Pres. Madras 139 (1915); Manilal, Fl. Silent Valley 40 (1988).

Succulent herb with swollen internodes; leaves fascicled, elliptic acute, cuneate at base, serrate; flowers in axillary racemes; sepals acuminate, green; standard yellow, orbicular, narrowly winged at the back, wings yellow; lip red, laterally compressed; spur large, saccate.

Distribution & Ecology: Very rare, collected from Thondakulam of Silent Valley National Park. Associated with *Bulbophyllum sp.* Prefers well shaded riverine area and also found in well exposed area at an altitude of 900m - 1000m.

Specimens examined: Stephen 007660 KFRI (Thondakulam, SVNP).

Note: Endemic to Western Ghats.

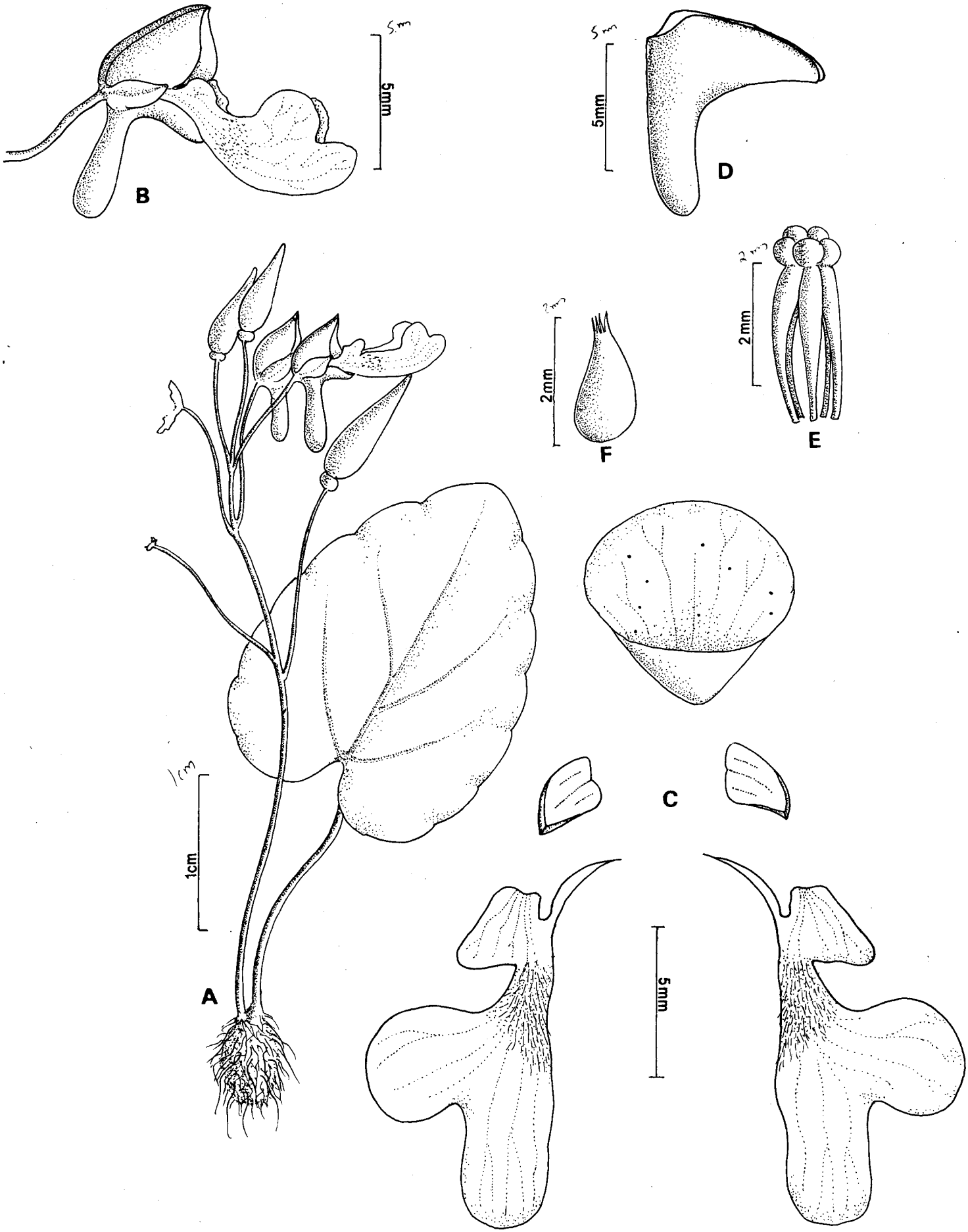


Fig. 26. *Impatiens lawsonii* Hook.f. A- Habit; B- Flower; C- Floral parts; D- Lip with spur; E- Androecium; F- Gynoecium.

Impatiens kulamavuensis Pandurangan & Nair, Novon 5: 57. 58 (1995).

Stoloniferous herbs; stem short, fleshy; leaves alternate, ovate-lanceolate, apex acuminate, base cuneate, margin crenulate-serrate; flowers in racemes, greenish yellow; lower sepal saccate; spur curved with obtuse tip; standard orbicular ovate; hairy at base; wings 3 lobed; seeds pear shaped, smooth.

Distribution & Ecology: Very rare. So far known only from Kulamavu of Idukki district. Growing on moss clad tree trunks at an altitude of 600-700 m.

Specimens examined: Pandurangan 62585 MH (Meenmutty).

Note: This species is endemic to Kerala.

Impatiens lawsonii Hook. f. in Rec. Bot. Sw. India 4: 45 (1906); Gamble, Fl. Pres. Madras 139 (1915); Yoganarasimhan *et. al.*, Fl. Chickmangalure Dist. 59 (1981).

Scapigerous tuberous herbs; leaves radical, ovate, crenate, obtuse; flowers in scapes, white; sepals ovate, acuminate, tip funnel shaped, spur conical; wings 3-lobed, dorsal auricle spiniform, seeds hairy (Fig. 26).

Distribution & Ecology: Very rare, collected from a single locality at Pakshipadalam, Wayanad. Epiphytic on moss clad moist tree trunks on shola forests at an altitude of 1500m and above.

Specimens examined: Stephen & Michael 008142 KFRI (Pakshipadalam).

Note: It is considered as an endangered species. Nayar (1996) reported this species to be confined to Karnataka and Tamil Nadu. The present collection from the Kerala part of Western Ghats shows the extended range of distribution and a new record to Kerala.

Impatiens parasitica Bedd., Ic. t. 140; Gamble Fl. Pres. Madras 139 (1915).

Impatiens jerdoniae var. *parasitica* Hook. f., Fl. British India 1: 460 (1874).

Succulent herbs; stems 10-12 cm long; leaves elliptic acute, serrate, glabrous on both surfaces; flowers in racemes; sepals green, linear, acute; standard green, orbicular; wings green; lip laterally compressed.

Distribution & Ecology: Rare, collected from Eravikulam Hills of Munnar. Prefers high altitude shola forests, occur at an altitude of 1500m and above.

Specimens examined: Stephen 0077852 KFRI (Eravikulam National Park).

Note: This species is endemic to Southern Western Ghats.

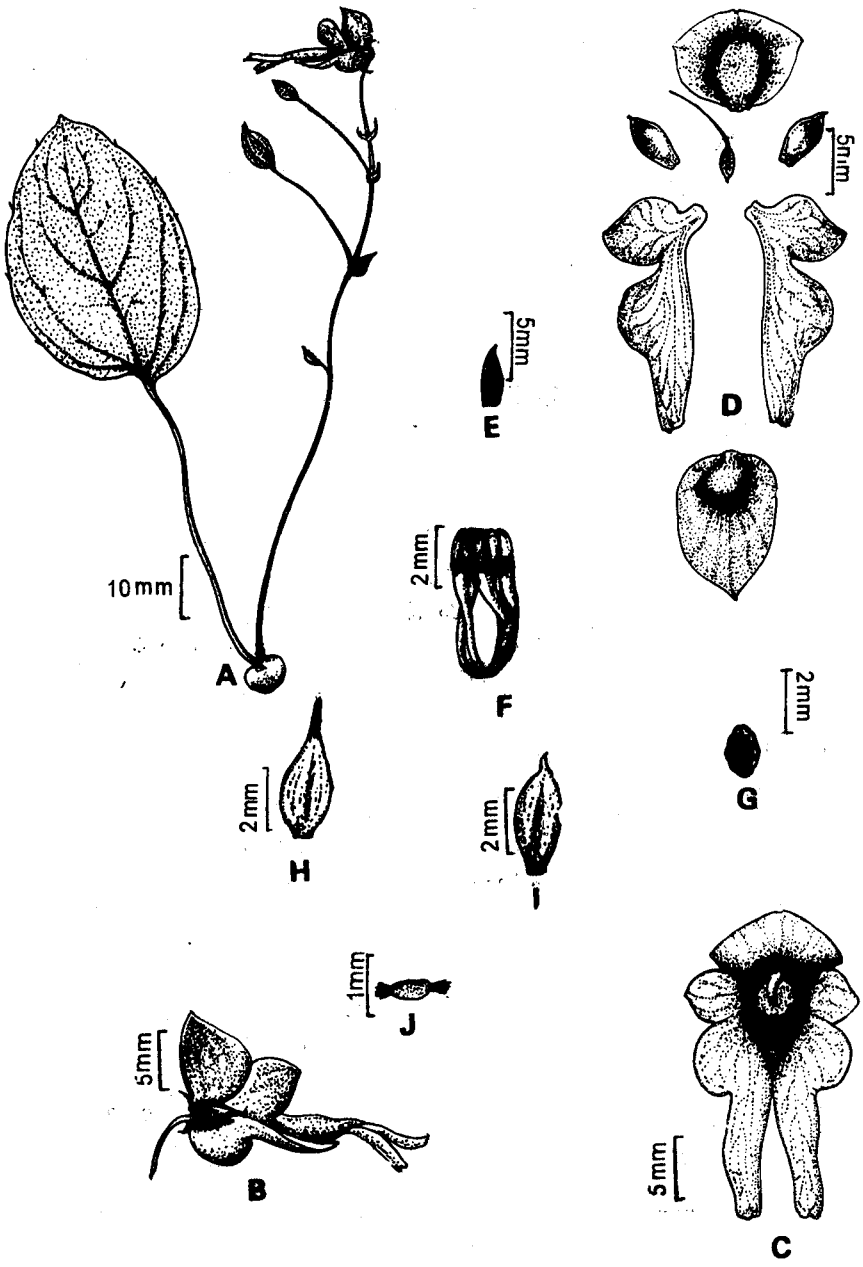


Fig. 27. *Impatiens sivarajanii* Muktesh *et* Stephen. A. Habit; B. Flower; C. Flower front view; D. Floral parts; E. Bract; F. Androecium; G. Anther - top view; H. Gynoecium; I. Capsule; J. Seed.

Impatiens sivarajanii Muktesh *et* Stephen, Rheedea 6(2): 51-54 (1996).

Epiphytic scapigerous perennial tuberous herb, ca. 10 cm high; tubers white with light violet tinge on the upper side. Leaves 1-2, radical, petiole 4-5 cm long, filiform. lamina ovate, 4.5-5 x2.4-2.7 cm, apex acute or acuminate, base subcordate, oblique, margins distantly subcrenate, glabrous except the nerves, crenules minutely apiculate; venation reticulate. Inflorescence 1-3 flowered raceme, peduncle/scape ca. 10 cm long, slender; bracts linear lanceolate, 4.5-4.9 x 1.4- 1.9 mm, acuminate, glabrous; pedicels 1.4-1.8 cm long; filiform, glabrous. Flowers ca. 2x 1.25 cm, creamy white; lateral sepals ovate-elliptic, 0.5x 2.5 mm, acute or acuminate, glabrous, green. Lip widely obovate, acuminate, concave, 1.2 x 0.75 mm, glabrous; spur very short, ca. 2mm, tip rounded. Dorsal petal widely depressed obovate, concave, 0.75 x 1cm, glabrous; lateral petals 3-lobed, 1.75 x 0.9 cm, basal lobe ovate-oblong, obtuse at apex; middle lobe more or less confluent with distal one; venation open, dichotomous. Stamens 5, united, ca. 4 mm long; anther 1 mm long. Ovary ovate-elliptic, 3 x 1 mm, apex acute, glabrous; stigma sessile, toothed, capsule oblong- ovate, 3 x 1 mm apex beaked, glabrous, many-seeded. Seeds narrowly elliptic, 0.8 x 0.3 mm, orange, glabrous except the tips, not banded, tips tufted ciliate (Fig 27).

Distribution & Ecology: Endemic to Silent Valley National Park, growing on moss clad tree trunks at an altitude of 1750m - 1800m.

Specimens examined: Stephen 007885 KFRI (Sispara).

Impatiens stocksii Hook. f. & Th. in J. Linn. Soc. Bot. London, 4: 119 (1860); Drury, Handb. Indian Fl. 1: 191 (1864); Hook. f., Fl. British India 1: 442 (1874); Fischer in Gamble Fl. Pres. Madras 1870 (1928); Ramamoorthy Fl. Hassan Dist. 404 (1976); Yoganarasimhan *et. al.*, Fl. Chickmangalore Dist. 59 (1981).

Scapigerous herbs; leaves radical, orbicular or broadly ovate crenate; flowers white in scapes; spur absent; seeds linear oblong.

Distribution & Ecology: Rare, prefers moss covered branches of trees in evergreen shola forests at an altitude of 2000m.

Impatiens viridiflora Wt. in Hook. f., Fl. Brit. India, 1: 460 (1874); Bedd. Ic. t. 141.

Erect herbs; stem thick, leaves elliptic acute, crenate, serrate; flowers green; sepals linear oblong, acuminate; standard green, orbicular, deeply hooded; wings 2 lobed; lip green, wrinkled, laterally compressed.

Distribution & Ecology: Very rare, preferably a shade loving plant in the shola forests.

Specimens examined: N. Sasidharan 005649 KFRI (Karimala Hills).

Note: This species comes under the endangered category and is endemic to Southern Western Ghats.

MELASTOMATACEAE

Key to the Genera

1a. Flowers large, red; leaves with two pairs of nerves ..... *Kendrickia*
1b. Flowers small, white to pink; leaves with one pair of nerve ..... *Medinilla*

KENDRICKIA Hook. f.

Kendrickia walkeri Hook. f., Clarke in Fl. British India 2: 526 (1879); Bedd. Ic. t. 271 (1868- 1879) Gamble, Fl. Pres. Madras 495 (1919).

Climbing shrub; leaves opposite, fleshy; flowers large red, in terminal umbels, peduncles with 2 bracteols.

Note: This species has not been encountered during the present study. Beddome, reports the occurrence of this rare species in Western Ghats, but no one could collect this plant from the area so far.

MEDINILLA Gaud.

Erect or scandent shrubs, leaves opposite or whorled, ribbed from the base of the blade, flowers pink or white.

Key to the species

1a. Leaves elliptic-lanceolate, large, upto 7 cm long, 35 cm broad, lower side of the leaves purple coloured; plant erect ..... *M. malabarica*
1b. Leaves simple orbicular, 2.5 cm long and 2 cm broad, lower side of the leaves have no colouration; plant climbing ..... *M. beddomei*

Medinilla beddomei Clarke in Hook. f. Fl. Brit. India, 2: 548 (1879); Gamble, Fl. Pres. Madras, 496 (1919); Manilal, Fl. Silent Valley 108 (1988); Vajravelu, Fl. Palghat 202 (1995).

A fleshy, climbing shrub, rooting at nodes; leaves orbicular, 2.5 x2cm, fleshy, 3 ribbed; flowers pink , solitary, axillary, stamens with long, curved, acuminate anthers, spur and tubercles prominent.

Distribution & Ecology: Widely distributed, common in shady areas. This is a typical evergreen species found on many trees at an altitude of 800m - 1000 m. Mostly this species prefer ecotone area.

Specimens examined: Stephen & Michael 008164 KFRI (NarangaKolli, Wayanad).

Note: This species is endemic to Southern Western Ghats.

Medinilla malabarica Beddome, Ic. t. 157 (1868-1874); Clarke in Hook. f. Fl. British India 2: 548 (1879); Gamble, Fl. Pres. Madras, 496 (1919); Manilal, Fl. Silent Valley 109 (1988).

Erect shrub, leaves elliptic-lanceolate, upto 7 cm long and 3 cm wide, 3 nerved; lower side of the leaf purple coloured; anthers short, spur and tubercles much reduced.

Distribution & Ecology: Very rare, collected from Muthikulam Hills near Siruvani Dam. It appears to be a shade loving plant occuring at higher altitude.

Specimens examined: Stephen & Michael, 008820 KFRI, (Muthikulam, Siruvani, Palghat (Dt.)).

Note: This is endemic to Southern Western Ghats and comes under the category of vulnerable species.

ARALIACEAE

Leaves alternate, rarely opposite usually compound; flowers in umbels, racemes or panicled heads.

Key to the genera

1a. Leaves alternate pinnate ..... *Polyscias*
1b. Leaves alternate, digitate, rarely compound digitate ..... *Schefflera*

POLYSCIAS J. & G. Forster

Polyscias acuminata (Wt.) Seem., J. Bot. 3: 181 (1865); Clarke in Hook. f. Fl. British India 2: 727 (1879); Gamble, Fl. Pres. Madras, 568 (1919); Manilal, Fl. Silent Valley, 127 (1988); Vajravelu, Fl. Palghat, 223 (1990); Moh. & Henr., Fl. Thiruvananthapuram, 215 (1994).

Hedra acuminata Wt., Ic. t. 1062 (1846).

Straggling epiphytes, upto 3 m tall; leaves alternate, pinnate leaflets oblong lanceolate, acuminate, entire; flowers greenish yellow in axillary or terminal panicles, berry subglobose.

Distribution & Ecology: Common in the evergreen forests, occur near stream sides at an altitude of 800m - 1100 m.

Specimens examined: Stephen 007643 KFRI (Parathode SVNP); Stephen & Michael 008196 KFRI (Poovanchola).

Distribution & Ecology: Common in the lower elevations. Prefers exposed dry area of moist deciduous forests at an altitude of 250 m.

Specimens examined: Stephen & Michael 008833 KFRI (Punchakolli, Nilambur).

Hoya pauciflora Wt., Ic. t. 1269, (1848); Hook. f. Fl. British India, 4: 56 (1883); Gamble, Fl. Pres. Madras 849 (1923); Sald. & Nicols., Fl. Hassan Dist. 449 (1976); Manilal, Fl. Silent Valley 179 (1988); Moh. & Henr. Fl. Thiruvananthapuram. 299 (1994).

Slender climbing shrub; Leaves linear lanceolate, fleshy, obtuse at apex, narrowed at base, 2.5 - 5 x 0.5 - 0.8 cm; flowers in umbels, white.

Distribution & Ecology: Very common, in Silent Valley this speceis is abundant. Almost all trees from 800m - 1100 m. altitude are covered by this species.

Specimens examined: Stephen & Michael 008147 KFRI (Thirunelly, Wayanad).

Hoya wightii Hook. f., Fl. British India, 4: 59. (1883); Gamble, Fl. Pres. Madras 849 (1923); Sald. & Nicols., Fl. Hassan Dist. 450 (1976); Manilal, Fl. Silent Valley 179 (1988); Moh. & Henr. Fl. Thiruvananthapuram 299 (1994).

Climbing shrubs; leaves elliptic, acute or acuminate at apex, base attenuate or rounded or subacute; flowers in umbels, yellow.

Distribution & Ecology: Very rare, collected from Aruvanpara slopes of Silent Valley, epiphytic on *Syzygium sp.* Prefers high altitude and well exposed forest fringes.

Specimens examined: Stephen 007689 KFRI (Aruvanpara, SVNP).

Note: This species is endemic to Southern Western Ghats.

LOGANIACEAE

FAGRAEA Thunberg

Fagraea ceilanica Thumb., Kongl. Vetensk. Acad. Nya Handl. 3: 132 (1782); Clarke in Hook. f., Fl. British India 4: 83 (1883); *'Zeylanica'*; Gamble, Fl. Pres. Madras, 863 (1923); Sald. & Nicols., Fl. Hassan Dist. 418 (1976); Mani. & Sivaraj., Fl. Calicut 172 (1982); Manilal, Fl. Silent Valley, 180 (1988); Vajravelu, 294 (1990); Moh. & Henr. Fl. Thiruvananthapuram, 302 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur, For. 295 (1995).

Shrubs to trees; leaves upto 15 cm long and 8 cm wide, fleshy, obovate, obtuse or rounded

at apex, base acute, margins recurved; flower large, pale yellow in terminal corymbose cymes; corolla tube long; lobes rounded, berries ellipsoid- globose.

Distribution Ecology: Common in evergreen forests, found in Silent Valley. Frequent near streams and rivers.

Specimens examined: Stephen 008834 KFRI (Poovanchola).

LENTIBULARACEAE

UTRICULARIA Linnaeus

Utricularia striatula J. E. Sm. in Rees, Ceyclop. 37: no. 17. (1819); Gamble, Fl. Pres. Madras 983 (1924); Taylor in Kew Bull. 18: 91 (1964).

Small herbs, stolons filiform with trap and leaves; leaves orbicular, reniform,long petiolated; upper lip of traps with 2 appendages, covered with glandular hairs; flowers 1-5 pink, filiform , erect scapes; calyx lobe unequal; lower lip of corolla suborbicular; throat yellow; spur curved under lower lip of corolla.

Distribution & Ecology: Common, growing on moist bark of trees in evergreen forests. Collected from Silent Valley where it is abundunt in the Walakkad area. Found epiphytic on *Glochidion sp.* at an altitude of 1100 m.

Specimens examined: Stephen 007605 KFRI (Walakkad).

GESNERIACEAE

AESCHYNANTHUS Jack. nom. cons.

Aeschynanthus perrottettii A. Dc. in Dc. Prodr. 9: 261 (1845); Hook. f. Fl. British India 4: 339 (1884); Gamble, Fl. Pres. Madras, 985 (1924); Vajravelu, Fl. Palghat 332 (1990); Mohn. & Henr. Fl. Thiruvananthapuram 337 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 329 (1995).

Succulent herbs; rooting at nodes, leaves upto 7 cm long and 3 cm wide, elliptic lanceolate, glabrous, fleshy, apex acuminate; flowers in fascicles on terminal or axillary peduncles; corolla scarlet, glabrous or pubescent, lobes round.

Distribution & Ecology: Very common, prefers semishaded areas of forest fringes at an altitude of 800m - 1000 m.

Specimens examined: Stephen 007616 KFRI (Chandanathode, Wayanad); Stephen 007638 KFRI (Parathode); Joy & Stephen 007269 KFRI (Parathode); Stephen & Michael 008145 KFRI (Thirunelly, Wayanad).

PIPERACEAE

PEPEROMIA Ruiz & Pav.

Succulent herbs; leaves alternate, opposite or whorled; flowers minute, hermaphrodite, erect in terminal or leaf opposed, panicles, rarely axillary spike.

Key to the species

1a. Leaves 4, whorled at node ..... *P. tetraphylla*
1b. Leaves otherwise 2

2a. Leaves and stems glabrous, upper leaves whorled or mostly opposite 3
2b. Leaves and stem pubescent, leaves usually opposite ..... *P. dindigulensis*

3a. Nut lets rugose ..... *P. wightiana*
3b. Nut lets scaly ..... *P. portulacoides*

Peperomia dindigulensis Miq. Syst. Piperac. 122 (1848); Wt., Ic. t. 1921 (1853); Hook. f. Fl. British India 5: 98 (1886); Gamble, Fl. Pres. Madras 1210 (1925); Vajravelu, Fl. Palghat, 396 (1990); Mohn. & Henr. Fl. Thiruvananthapuram 383 (1994).

Erect; some what large herbs; stem pubescent; leaves elliptic ovate or obovate, acute, pubescent beneath; flowers greenish; stamens 2.

Distribution & Ecology: Not common.

Peperomia portulacoides (Lam.) A. Dietr. Sp. Pl. 1: 172 (1831); Wt., Ic. t. 1922 (1853); Hook. f., Fl. British India 5: 98 (1886); Gamble, Fl. Pres. Madras, 1211 (1925); Vajravelu, Fl. Palghat 396 (1990); Moh. & Henr. Fl. Thiruvananthapuram, 383 (1994); Sasi. & Sivaraj. Fl. Pl. Thrissur For., 375 (1995).

Piper portulacoides Lam. Encycl. 1: 82 (1791).

Erect; succulent herb, glabrous; leaves petiolate; opposite and whorled, obovate, obtuse, emignent, cuneate at base; flowers greenish, in single spike.

Distribution & Ecology: Common, epiphytic on shaded trees near stream side and forest fringes at an altitude of 800m - 1100 m.

Specimens examined: Stephen 007622 KFRI (Chandanathode, Wayanad); Stephen

0077648 KFRI (Parathode, SVNP); Stephen & Michael 008156 KFRI (Chembra Peak, Wayanad); Joy & Stephen 007226 KFRI (Victoria, Nelliampathy).

Peperomia tetraphylla (Forst. f.)Hook. & Arn., Bot. Beechey Voy. 97 (1832); Matthew Fl. Tam. Carnatic 3: 1348 (1983); Saldanha, Fl. Karnataka 1: 77 (1984); Manilal, Fl. Silent Valley 230 (1988); Vajravelu, Fl. Palghat 397 (1990).

Piper tetraphylla Forst. f., Fl. Ins. Austr. 5. (1786).

Succulent slender herbs; leaves four, whorled, coriaceous, at a node, orbicular or ovate, glabrous; flowers in terminal spikes; berry obovoid.

Distribution & Ecology: Common, prefers forest fringes and semi exposed area. Occur at an altitude of 900m - 2000 m.

Specimens examined: Stephen & Michael 008157 KFRI (Chembra Peak, Wayanad); Stephen & Michael 008814 KFRI (Siruvani); Stephen & Joy 007227 KFRI (Victoria, Nelliampathy).

Peperomia wightiana Miq. in Hook., Lord. J. Bot. 5: 548 (1846); Wt., Ic. t. 1924 (1853); Hook. f., Fl. British India 5: 98 (1886); Gamble, Fl. Pres. Madras 1210 (1925); Matthew, Fl. Tam. Carnatic 3: 1350 (1983); Saldanha, Fl. Karnataka 1: 78 (1984); Manilal, Fl. Silent Valley 230 (1988).

Succulent epiphytes; upper leaves opposite, basal alternate, obovate, obtuse, rounded at base, shortly petiolated; flowers in terminal spikes; berry globose.

Distribution & Ecology: Not common, prefers well shaded areas at an altitude of 800-1000 m.

Specimens examined: Stephen & Joy 007260 KFRI (Punnamala, SVNP); 007226 (Victoria, Nelliampathy); Muktesh Kumar & Stephen 006751 KFRI (Chundanathode, Wyanad).

URTICACEAE

Leaves opposite or alternate, entire or lobed; flowers small, greenish, monoecious or dioecious, aggregated on fleshy receptacle, stamens as many on the sepals. Ovary superior, fruit a drupe or achene, seed with a membranous testa.

Key to the genera

1a. Leaves sessile, crenate, serrate at upper half and auricle at base ..... *Elastostemma*
1b. Leaves petioled, serrate on the entire margin of the leaves 2

2a. Receptacle peduncled, leaves opposite, hairy upto 5 cm length ..... *Lecanthus*
2b. Receptacle sessile, leaves alternate, glabrous, upto 12 cm in length ..... *Procris*

ELATOSTEMMA J. & G. Forster *nom. cons*

Elatostemma surculosum Wt., Ic. t. 2091 (1853); Hook. f., Fl. British India 5: 572 (1888); Gamble, Fl. Pres. Madras 1377 (1928); Saldanha, Fl. Karnataka 1: 128 (1984); Manilal, Fl. Silent Valley 262 (1988); Vajravelu, Fl. Palghat 452 (1990).

Succulent herbs; stem fleshy; leaves sessile, linear lanceolate, crenate, serrate on the upper half, apex acuminate, base obliquely auricles, glabrous, cystolith abundant; flowers in axillary fascicles; male receptacle peduncled, achenes ellipsoid.

Distribution & Ecology: Rare, collected from Pakshipadalam, Wayanad. Prefers high altitude deeply shaded area of evergreen shola forests at an altitude of 1500 m. and above.

Specimens examined: Stephen 008135 KFRI (Pakshipadalam, Wayanad).

LECANTHUS Weddell

Lecanthus peduncularis (Wall. ex Royle) Wedd. in Dc. Prodr. 16: 164 (1869); Sald. & Nicols., Fl. Hassan Dist. 89 (1976); Saldanha, Fl. Karnataka 1: 129 (1984); Manilal, Fl. Silent Valley 263 (1988); Vajravelu, Fl. Palghat 454 (1990).

Procris pedunćularis Wall. ex Royle, Illust. Himalaya. t. 53, f. 2. (1839).

Slender, succulent herbs; leaves opposite, obliquely ovate to elliptic, apex acute, serrate, pubescent, trinerved; flowers in peduncled heads; achenes ovoid.

Distribution & Ecology: Rare, collected from Thirunelly, Wayanad, seen in moist shady places, at an altitude of 700m - 1000 m.

Specimens examined: Stephen & Michael 008148 KFRI (Narangakolli).

PROCRIS Juss.

Procris wightiana Wall. ex Wedd., Gamble Fl. Pres. Madras 1378 (1928).

Succulent herbs; leaves upto 13 cm long, alternate, shortly petioled, lanceolate or oblanceolate, acuminate at apex, margin crenate-serrate; flowers axillary, aggregated on a fleshy receptacle; achene ovate or ellipsoid.

Distribution & Ecology: Rare, collected from Pakshipadalam, Wayanad Dist. Occurs in deeply shaded evergreen shola forests near streams at an altitude of 1500 m and above.

Specimens examined: Stephen & Michael 008134 KFRI (Pakshipadalam, Wayanad), 008160 KFRI (Chembra Peak, Wayanad).

ORCHIDACEAE

Key to the Genera

1a. Plants with distinct pscudobulbs 2
1b. Plants without pseudobulbs 12

2a. Inflorescence arising from the base of the pseudobulb 3
2b. Inflorescence terminal on the pseudobulb 5

3a. Pollinia 8 ..... *Thelasis*
3b. Pollinia 4 4

4a. Flowers solitary, leaves elliptic, acute, pseudobulb, smooth ..... *Trias*
4b. Flowers many rarely one in racemes or umbels; leaves oblong, oval or lanceolate; pseudobulb wrinkled ..... *Bulbophyllum*

5a. Pollinia 8 6
5b. Pollinia 4 8

6a. Sepals connate to form a tube ..... *Porpax*
6b. Sepals not connate to form a tube 7

7a. Inflorescence single flowered or two flowered or more than 2 flowers, drooping ..... *Eria*
7b. Inflorescence many minute flowered racemes and not drooping ..... *Phreatia*

8a. Pseudobulb with 1 or 2 leaves; pseudobulbs uninodal 9
8b. Plants with more than two leaves; pseudobulbs plurinodal rarely uninodal ..... *Dendrobium*

9a. Pseudobulbs on the terminal internode of each branches; leaf strictly solitary per pseudobulb, flower solitary or in pairs ..... *Flickingeria*
9b. Pseudobulbs on the rhizome; leaves usually 2 per pseudobulb; flowers many in racemes 10

10a. Flowering peduncle covered by distinct imbricating sheaths inflorescence not drooping; flower mostly white, lobes of the lip often papillose, toothed or ridged ..... *Coelogyne*
10b. Flowering peduncle naked inflorescence drooping or slightly drooping, flowers not white, lobes of the lip otherwise 11

11a. Flowers pinkish white, distichous, lateral sepals ridged or keeled dorsally, lip panduriform, midlobe bifid ..... *Pholidota*
11b. Flowers greenish yellow, lateral sepal neither ridged nor keeled, lip trilobed, midlobe not bifid ..... *Liparis*

12a. Plants with leaves 14
12b. Plants without leaves, at least at the time of flowering; wiry roots and inflorescence only 13

13a. Petals longer than sepals; pollinia 2; roots flattened ..... *Chiloschista*
13b. Petals shorter than sepals, pollinia 8; roots terete ..... *Taeniophyllum*

14a. Leaves terete or semiterete 15
14b. Leaves otherwise 20

15a. Leaves strictly terete 16
15b. Leaves strictly semiterete 18

16a. Inflorescence deflexed, flowers small ..... *Seidenfadeniella*
16b. Inflorescence not deflexed, flowers large 17

17a. Lip with conical pointed spur, smallerthan petals,
infundibuliform; leaves fully terete ..... *Papilionanthe*
17b. Lipwithout spur,longer or as long as the petals,
not infundibuliform, leaves grooved on one side ..... *Luisia*

18a. Lip double spured ..... *Diplocentrum*
18b. Lip single spured 19

19a. Tips of sepals and petals recurved, yellow with red bands
near the margin; spur with longitudinal septum ..... *Cleistostoma*
19b. Tips of sepals and petals not recurved, yellow with red scarred;
spur without a longitudinal septum ..... *Shoenorchis*

20a. Stem short thick woody 21
20b. Stem not woody 26

21a. Leaf tip unequally and irregularly lobed; flowers densely arranged
into a cylindric raceme without branching, strictly drooping ..... *Rhyncostylis*
21b. Leaf tip bilobed; flowers not densely arranged not cylindric form, often branching, erect 22

22a. Inflorescence shorter than leaves; leaf opposed,
sepals and petals barred with red colour ..... *Acampe*
22b. Inflorescence longer or as long as the leaves, from the axils
of the leaves, sepals and petals not barred with any colours 23

23a. Peduncles long upto 40 cm long, lip bumble bee shape, deep
valved purple with a lemon yellow pubescent margin ..... *Cottonia*
23b. Peduncle short, lip otherwise 24

24a. Column foot short or absent 25
24b. Column foot long ..... *Aerides*

25a. Inflorescence always pendent, unbranched panicles, flowers small, bluish violet ..... *Xenikophyton*
25b.Inflorescence always erect, simple, few flowered, flowers median to large ..... *Vanda*

26a. Leaves fleshy, laterally compressed, equitant 27
26b. Leaves otherwise 28

27a. Spike short, few flowered; column with a spur like mentum ..... *Podochilus*
27b. Spike long many flowered; column without a spur like mentum ..... *Oberonia*

28a. Plants with indistinct pseudobulbs, mostly covered with sheathing bases of leaves 29
28b. Plant without pseudobulbs 30

29a. Leaves long; tip obtusely 2- lobed; inflorescence always drooping, long; flowers large .... *Cymbidium*
29b. Leaves short; lip minute incurved tooth; inflorescence always erect, short; flowers small ..... *Polystachya*

30a. Pollinia 4 31
30b. Pollinia 2 32

31a. Leaves solitary, large, flowers terminal or sub terminal on the branches, flowers small; lip inserted into the base of the column ..... *Sirhookera*
31b. Leaves scale like; flowers axillary, large, tip not inserted into the column ..... *Vanilla*

32a. Column with a distinct foot 33
32b. Column without foot or inconspicuous 34

33a. Lip clawed; spur pointing forward in line with column foot; leaves subfalcate ..... *Pteroceros*
33b. Lip not clawed; no distinct spur; leaves loriform ..... *Thixspermum*

34a. Pollinia bipartite 35
34b. Pollinia not divided 36

35a. Disc with two sharp pointed awned appendage; column winged ..... *Kingidium*
35b. Disc without awned appendage; column not winged ..... *Smithsonia*

36a. Stem long stout; leaves alternate; inflorescence unbranched 37
36b. Stem short; leaves distichous; inflorescence often branched 38

37a. Inflorescence pendulous; lip without side lobes, midlobe small, spur long and obtuse ..... *Robiquetia*
37b. Inflorescence not pendulous; lip with distinct side lobes and midlobes trilobulate, spur short and blunt ..... *Trichoglottis*

38a. Lip deeply saccate, epichile fan shaped, hypochile cup shaped, spur without ornaments in the backwall ..... *Gastrochilus*
38b. Lip not saccate, epichile and hypochile otherwise, spur with ornaments in the backwall ..... *Pomatocalpa*

ACAMPE Lindley

Stems thick, short, covered with leaf sheaths; leaves distichous, lorate or ligulate, 2 lobed; panicle peduncled, leaf opposed or supra axillary;flowers more or less large; sepals and petals barred; lip spurred or saccate, side lobes small, mid lobes ovate; column short; foot absent; pollinia 2.

Key to the species

1a. Leaves upto 30 cm long and about 4 cm broad, midlobe of the lip channeled ..... *A. rijida*
1b. Leaves small upto 20 cm long and 2.5 cm broad, mid lobe of the lip not channeled 2

2a. Lipspurred, tip of the mid lobe of the lip acute, margin undulate ..... *A. ochracea*

2b. Lip saccate,tip of mid lobe of the lip obtuse, margin irregularly dentate ..... *A. praemorsa*

Acampe ochracea (Lindl.) Hochr., Bull. New York Bot. Gard. 6: 270 (1910); Sant. & Kapad., Orch. Bombay 234-236 (1966); Abraham & Vatsala, Intr. Orchids 452 (1981).

Saccolabium ochraceum Lindl., Bot. Reg. 28: Misc. 2 (1842).

Stems stout; leaves upto 20 cm long and 2.5 cm broad, lorate, thickly coriaceous, apex 2 lobed, rounded, sheathing the internodes above; flowers in racemose panicles, yellow with red bar across the floral parts; sepals 3 veined; petals 3 veined; lip saccate, hairy, lateral lobes short, recurved, mid lobe ovate, acute, undulate; column with two arms at the apex; pollinia 2, unequally biparted.

Distribution Ecology: Not common, prefers exposed area at an altitude of 400m - 800 m. collected from Nelliampathy.

Specimens examined: Stephen 007232 KFRI (Chandramala, Nelliampathy).

Acampe praemorsa (Roxb.) Blatt. & McCann, J. Bombay Nat. Hist. Soc. 35: 495 (1932); Abraham & Vatsala, Intr. Orchids 450 (1981); Vajravelu, Fl. Palghat 465 (1990); Sasi. & Sivaraj., Flow. Pl. Thrissur For. 433 (1995).

Epidendrum praemorsum Roxb. Pl. Cor. t. 43 (1795).

Stems stout, thick; leaves upto 20 cm long and 2.5 cm broad, lorate, unequally bilobed at the apex; flowers in spiciform racemes, yellow, barred with red; sepals and petals fleshy; lip fleshy, saccate, lateral lobes small, blunt, midlobe ovate, thick, obtuse and irregularly dentate; column short; pollinia 2, unequally bipartite.

Distribution & Ecology: Common, distributed throughout the lower elevations. Prefers exposed dry area from Sea level up to an altitude of 1000 m.

Specimens examined: Stephen 008835 KFRI (Peechi).

Acampe rigida (Buch. - Ham. ex J.E Smith) P.F. Hunt, Kew Bull. 24 (1): 98 (1970).

Stem stout; leaves upto 30 cm long and 4 cm broad, lorate, coriaceous, unequally 2-lobed; flowers in panicles, stout, many flowered, yellow, barred with red; sepals oblong

obtuse; petals obovate-oblong; lip saccate, lateral lobe short, mid lobe ovate, channeled in the middle, sac short rounded with a vertical hairy plate; column short; pollinia 2, deeply bipartite.

Distribution & Ecology: Not common, prefers dry area at an altitude of 100m.

Specimens examined: Puri 003615 BSI, Pune (Kanjikode, Palghat).

AERIDES Loureiro

1a. Lip crenulate, serrulate 2
1b. Lip entire ..... *A. ringens*

2a. mid lobe of the lip ovate-deltoid; spur pointing forward ..... *A. crispa*
2b. Mid lobe of the lip broadly ovate; spur pointing backward ..... *A maculosum*

Aerides crispa Lindl., Gen. Sp. Orch. 239. 1833; Hook. f., Fl. British India 6: 45 (1890); Fischer in Gamble, Fl. Pres. Madras 1442 (1928); Manilal, Fl. Silent Valley 268 (1988).

Stem stout, woody; leaves thick, leathery, channeled; flowers in racemes, fragrant; sepals and petals white with a purple tinge; lip 3 lobed, mid lobe deep pink, triangular, crenulate; spurred at base.

Distribution & Ecology: Rare, prefers shaded areas of evergreen forests and occur upper canopy of the trees at an altitude of 1000 m. and above.

Specimens examined: Stephen & Michael 008836 KFRI (Northern slope of Chembra Peak, Wayanad).

Note: This species is endemic to South India.

Aerides maculosa Lindl., Bot. t. 58. 1845; Hook. f., Fl. Brit. India 6: 45 (1890); Fischer in Gamble, Fl. Pres. Madras 3: 1442 (1928); Manilal, Fl. Silent Valley 268 (1988); Vajravelu, Fl. Palghat 466 (1990).

Stem stout, woody; leaves thick, channeled, unequally lobed at the apex; flowers in racemes, pinkish; sepals obovate, petals narrower; lip 3 lobed,side lobes small, rounded, midlobe retuse, margin crenulate.

Distribution & Ecology: Rare, collected from Sispara area of Silent Valley National Park and Silent Valley of Munnar. Prefers high altitude evergreen shola forests with deeply shaded areas at an altitude of 1800m - 2400 m. epiphytic on *Rhododendron sp.*

Specimens examined: Stephen & Michael 008194 KFRI (Sispara, SVNP); Stephen & Joy 007563 KFRI (Silent Valley, Munnar).

Note: This species is endemic to South India.

Aerides ringens (Lindl.) Fischer, Kew Bull 1928: 284. (1928), in Gamble, Fl. Pres Madras 1442 (1928); Manilal, Fl. Silent Valley 269. (1988); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 433 (1995).

Saccolabium ringens Lindl. Gm. Sp. Orch. 221 (1833).

Stem stout, woody; leaves coriaceous; flowers in racemes, sometimes branched; pinkish; lip 3 lobed, side lobes small, mid lobe hastate.

Distribution & Ecology: Very common, prefers exposed dry areas up to an altitude of 50-2000 m.

Specimens examined: Stephen 008837 KFRI (Peechi).

BULBOPHYLLUM Du Petit- Thouars *nom. cons.*

Plants with pseudobulbs, pseudobulbs uninodal; globose or ovoid oblong, naked or clothed with the remains of old sheaths; single leaved, oblong, lanceolate; inflorescence lateral from the side of the pseudobulb, racemed or umbelled; sepals much longer than petals; lip movable, tongue shaped, attached to the column foot; column foot long; pollinia 4 in groups of 2.

Key to the species

1a. Inflorescence racemose 2
1b. inflorescence umbellate or subumbellate 4

2a. Lip with long hairs on the underside ..... *B. tremulum*
2b. Lip glabrous or papillose petals minute 3

3a. Pseudobulbs four angled; inflorescence shorter than the leaves, densely flowered; lip with two auricles, entire ..... *B. neilgherrense*
3b. Petals tipped with a capillary awn, pseudobulbs subglobose; inflorescence longer than the leaves, few flowered; lip with crenulate auricles ..... *B. fuscopurpureum*

4a. Petals and dorsal sepals fimbriate ..... *B. fimbriatum*
4b. Petal and sepals otherwise 5

5a. Flowers small, in globular heads ..... *B. xylophyllum*
5b. Flowers otherwise 6

6a. Flowers 1 or 2 7
6b. Flowers more than 2 9

7a. Leaves linear or linear lanceolate, apex acute or subacute; lip greenish purple ..... *B. elegans*
7b. Leaves oblong- ovate or elliptic, apex bifid; lip yellow 8

8a. Sepals papillate, lip creamy yellow with purple markings ..... *B. rheedei*
8b. Sepals not papillate; lip deep yellow without markings ..... *B. aureum*

9a. Flowers bright yellow with purple striations or markings 10
9b. Flowers white or creamy yellow no such markings ..... *B. acutiflorum*

10a. Lateral Sepals with small papillate projection ..... *B. elegantulum*
10b. Lateral sepals glabrous 11

11a. Leaves short about 3 cm lateral, sepals pubescent towards the basal half ..... *B. fischeri*
11b. Leaves long about 6 cm; lateral sepals glabrous ..... *B. kaitense*

Bulbophyllum acutiflorum A. Rich., in Ann. Sci. nat. Ser. 2, 15: 5-82 (1841); Seidenf., Dansk Bot. Ark. 29 (1) : 191 (1973); Manilal & Sathish. Field Key Orch. Kerala 29 (1993); Sathish & Manilal, Cat. Ind. Orch. 65 (1994).

Cirrhopetalum acutifolium A. Rich., in Ann. Sci. nat. Ser. 2, 15: 18, t. 7 (1841); Hook. f., Fl. Brit. India 5: 779 (1890); Fischer in Gamble, Fl. Pres. Madras 1421 (1928).

Pseudobulbous herbs; pseudobulb ovoid; leaves solitary, oblong, obtuse; scape slender; flowers in short raceme, creamy; dorsal sepal ovate lanceolate, falcate; lateral sepals linear lanceolate, longer than the dorsal sepals; petals broadly oblong, obtuse; lip recurved, stelidia minute.

Distribution & Ecology: Rare.

Note: Endemic to South India.

Bulbophyllum aureum (Hook. f.) Smith, Bull. Buitz. (Z.S.) 8: 22 (1912); Seidenf., Dansk Bot. Ark. 29 (1): 187 (1973); Manilal Fl. Silent Valley 270 (1988).

Cirrhopetalum aureum Hook. f., Fl. British India 5: 717 (1890); Fischer in Gamble, Fl. Pres. Madras 1420 (1928).

Pseudobulbous herbs; pseudobulbs globose ovoid; leaves solitary, oblong, ovate, thick, coriaceous, upto 3 cm long; scape slender; flowers 2, rarely 1, yellow; lateral sepals ovate oblong, cohering; dorsal sepal suborbicular, spathulate; petals oblong, obtuse; lip fleshy, yellow; column winged.

Distribution & Ecology: Rare.

Specimens examined: N. Sasidharan 005534 KFRI (Sholayar, Trichur).

Note: This is endemic to South India. Manilal (1988) reported that this species is common in the damsite of Silent Valley National Park. But during the present investigation this speceis could not be collected.

Bulbophyllum elegans Gard. ex Thw., Enum. Pl. Zeyl. 298 (1861); Sathish & Manilal, Cat. Ind. Orch. 65 (1994).

Pseudobulbous herbs; pseudobulbs ovoid, slightly bent; leaves solitary, linear or linear lanceolate, upto 10 cm long, acute or subacute; slender, scape drooping; flowers solitary or 2, dull purple, lateral sepals lanceolate, acuminate, cohering at centre; dorsal sepal ovate, acuminate; petals small, lanceolate, acuminate; lip fleshy, tip acuminate, greenish, midlobe spotted, grooved in the centre; column with 2 long narrow stelidia.

Distribution & Ecology: Very rare.

Bulbophyllum elegantulum (Rolfe) J.J. Smith, Bull. Buitz. 2. s. 8 : 23 (1912); Sathish & Manilal, Cat. Ind. Orch. 65 (1994).

Cirrhopetalum elegantulum Rolfe, Gard. Chron. 9 : 552 (1891).

Pseudobulbous herbs; pseudobulbs ovoid; leaves solitary, linear-oblong; flowers in umbels, yellow coloured; lateral sepals lanceolate, papillate; dorsal sepals oblong, glabrous; petals oblong, obtuse, glabrous; lip yellow.

Distribution & Ecology: Rare, collected from Munnar . Prefers open exposed fringes of shola forests at an altitude of 1500m and above.

Specimens examined: Stephen 008108 KFRI (Chockanad estate, Munnar)

Bulbophyllum fimbriatum (Lindl.) Reichb. f., Walp. Ann. Bot. Syst. 6: 260 (1861); Seidenf., Dansk Bot. Ark. 29(1): 243 (1973); Sathish & Manilal, Cat. Ind. Orch. 65 (1994).

Cirrhopetalum fimbriatum Lindl., Bot. Reg. Misc. 72 (1839).

Pseudobulbous herb; pseudobulbs angled, crowded; leaves membranous, leafless when in flower; scape slender, 10-12 cm long; flowers in umbels, yellow coloured; lateral sepals united; dorsal sepal lanceolate, fimbriate, awned; petals fimbriate; lip purple, fleshy, column with 2 narrow, curved stelidia.

Distribution & Ecology: Rare, collected from Parathode, of Silent Valley National Park. Prefers well shaded area.

Specimens examined: Stephen & Joy 007276 KFRI (Parathode, SVNP).

Bulbophyllum fischeri Seidenf., Dansk Bot. Ark. 29: 202 (1973); Manilal, Fl. Silent Valley 271 (1988); Vajravelu, Fl. Palghat 468 (1990); Sathish & Manilal, Cat. Ind. Orch. 65 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 435 (1995).

Pseudobulbous herbs; pseudobulbs globose, brownish; leaves solitary, coriaceous, linear-oblong, about 3 cm long; scape slender, longer than leaves; flowers 4-8 in umbels, yellow, heavily streaked with purple; lateral sepals linear, pubescent near base; dorsal sepal small; petals oblong, acute; lip fleshy, dark purple, spathulate; stelidia minute.

Distribution & Ecology: Frequent, prefers riparian and ecotone tree species as their hosts. Found growing at an altitude of 900m - 1100 m.

Specimen examined: Stephen 007661 KFRI (Thondakulam, SVNP); Stephen & Michael 008175 KFRI (Walakkad, SVNP); Stephen & Joy 007521 KFRI (Kattuvaramudi slope, SVNP).

Note: Endemic to South India.

Bulbophyllum fuscopurpureum Wt., Ic. 5(1): 6. 1845, t. 1651 (1851); Hook. f., Fl. British India 5: 760 (1888); Fischer in Gamble, Fl. Pres. Madras 1418 (1928); Sathish & Manilal, Cat. Ind. Orch. 65 (1994).

Large pseudobulbous herb; pseudobulbs green, smooth; leaves solitary, 10-12 cm long, oblong, obtuse; scape longer than leaves; flowers in raceme, deep purple; lateral sepals ovate, oblong, acuminate; dorsal sepals same as lateral sepals, small; petals ovate, tipped with a capillary awn; lip papillose, side lobes recurved.

Distribution & Ecology: Rare.

Bulbophyllum kaitens (Wt.) Reichb. t., Walp. Ann. 6: 262 (1861); Seidenf., Dansk Bot. Ark. 293 (1973); Sathish & Manilal, Cat. Ind. Orch. 65 (1994).

Cirrhopetalum neilgherrense Wt., Ic. t. 1654 (1852); Hook. f., Fl. Brit. India 5: 788 (1888); Fischer in Gamble, Fl. Pres. Madras 1420 (1928).

Small pseudobulbous herbs; pseudobulbs ovoid; leaves solitary, upto 7 cm long, coriaceous, linear oblong, obtuse; scape slender, long; flowers in umbels, yellowish with purple striations; lateral sepals long, linear-lanceolate, acuminate, slightly falcate; dorsal sepal ovate, acute; petals broadly oblong, small; lip fleshy, yellowish red.

Distribution & Ecology: Rare, collected from Walakkad- Sispara path in Silent Valley National Park and Munnar. Prefers dense shade shola forests at an altitude of 1500m - 1800 m.

Specimens examined: Stephen 007878 KFRI (Sispara- Walakkad path, SVNP); Stephen & Joy 007542 KFRI (Lockart gap, Munnar).

Note: Endemic to South India.

Bulbophyllum neilgherrense Wt., Ic. 5(1): 6, t. 1650 (1851); Fischer in Gamble, Fl. Pres. Madras 1418 (1928); Manilal, Fl. Silent Valley 271 (1988); Vajravelu, Fl. Palghat, 468 (1981); Sathish & Manilal, Cat. Ind. Orch. 66 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 435 (1995).

Robust pseudobulbous herbs; pseudobulbs angled, smooth; leaves solitary upto 10 cm long, fleshy, elliptic, oblong; scape slender, shorter than leaves; flowers in raceme, yellowish purple; lateral sepals ovate, acuminate; dorsal sepal half the size of the lateral sepals; petals minute, ovate; lip deep purple with 2 auricles at base.

Distribution & Ecology: Common, from low altitude to high altitude. Found growing on exposed trees in fringes of forest.

Specimens examined: Stephen 008104 KFRI (Manjeri, Nilambur).

Note: Endemic to South India.

Bulbophyllum rheedei Manilal & Sathish, Rheedea 1(1&2): 52-56 (1991); Sathish & Manilal, Cat. Ind. Orch. 66 (1994).

Tsjerou Tecka Maravara Rheede, Hort. Malab. 12: 45. t. 2b (1693).

Small pseudobulbous herbs; pseudobulbs ovoid or globular; leaves solitary, oblong-ovate, bifid; scape small; flowers single or 2, creamy white with violet spots; lateral sepals papillate; dorsal sepal boat shaped, papillate; petals oblong; lip creamy yellow with purple markings, thick; column winged.

Distribution & Ecology: Rather common in lower elevations, collected from Vandanam of Alappuzha Dist. Occur at an altitude of below 700 m.

Specimens examined: N. Sasidharan 004916 KFRI (Kuruva island, Wayand).

Note: Endemic to South India.

Bulbophyllum tremulum Wt., Ic. t. 1749 (1851); Hook. f., Fl. Brit. India 5: 763 (1890); Fischer in Gamble, Fl. pres. Madras 1418 (1928); Manilal, Fl. Silent Valley 271 (1988); Vajravelu, Fl. Palghat 467 (1990); Sathish & Manilal, Cat. Ind. Orch. 66 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 435 (1995).

Small pseudobulbous herbs; pseudobulbs ovoid-conical to subglobose, ridged and grooved; leaves solitary, ovate-lanceolate, acute, coriaceous; scape slender, longer than leaves with few flowers; flowers in raceme, purplish brown; lateral sepals twisted, ciliate; dorsal sepals ciliate; petals hairy, small; lip linear oblong, deep purple with long pendulous, mobile hairs on underside.

Distribution & Ecology: Frequent, found growing in the fringes of forest at an altitude of 700m - 1100 m.

Specimens examined: Stephen 007699 KFRI (Thondakulam, SVNP); 007662 KFRI (Punnamala, SVNP); Stephen & Michael 008180 KFRI (Poovanchola, SVNP); Stephen & Joy 007275 KFRI (Parathode, SVNP); Stephen & Joy 006772 KFRI (Nilikal, SVNP); Stephen 007590 KFRI, 007248 KFRI (Nelliampathy).

Bulbophyllum xylophyllum Par. & Reichb. f., Trans. Linn. Soc. 30: 151 (1874); Hook. f., Fl. British India 5: 766 (1890); Seidenf., Dansk Bot. Ark. 33(1): 179 (1979); Sathish & Manilal, Cat. Ind. Orch. 67 (1994).

Pseudobulbs absent; leaves flat, broadly elliptic or orbicular; scape distant from the leaf, slender, shorter than the leaves; flowers in globular heads, greenish; lateral sepals broadly oblong; dorsal sepal ovate, obtuse; petals small, oblong; lip oblong, obtuse, papillate; column with forward pointing stelidia.

Distribution & Ecology: Very rare, prefers dense shaded localities in evergreen forests.

Specimens examined: N. Sasidharan 11371 KFRI (Alvarkurichi, Shenduruny)

CHILOSCHISTA Lindley

Chiloschista glandulosa Blatt. & McCann., Journ. Bombay Nat. Hist. Soc. 35(2): 484-495 (1931); Sathish & Manilal, Cat. Ind. Orch. 67 (1994).

Very small non pseudobulbous herb; plant body consisting of a mass of green fleshy roots; leaves absent at the time of flowering; scape small; flowers yellow coloured with purple dots on the sepals and petals, fragrant; pedicel pubescent; lip movable with epichile and hypochile, hypochile concave; epichile with side lobes and midlobe; pollinia 2, unequally cleft into 4.

Distribution & Ecology: Very rare, collected from two localities- Silent Valley National Park and Siruvani. R.F. Preferably a medium altitude plant occuring in the riverine areas and forest fringes between 700m - 800m.

Specimens examined: Stephen & Joy 007514 KFRI (Damsite, SVNP); Stephen & Michael 008824 KFRI (Kungilliapadi, Siruvani R.F.).

Note: Abraham & Vatsala (1981) misnamed *Chiloschista glandulosa* as *Chiloschista pusilla*. Actually their specimen is *Chiloschista glandulosa* which have purple spots on the sepals and petals. *Chiloschista pusilla* does not have any purple spots. *Chiloschista glandulosa* is endemic to South India.

CLEISTOSTOMA Blume

Cleistostoma tenuifolia (L.) Garay, Bot. Mus. Leafl. Harvard 23: 175 (1972); Seidenf., Dansk Bot. Ark. 29: 30 (1975); Sathish Manilal, Cat. Ind. Orch. 68 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 436 (1995).

Epidendrum tenuifolium L., Sp. pl. 952 (1753).

Pendulous, non pseudobulbous herbs; stem slender; leaves linear, semiterete, acuminate, upto 15 cm long; inflorescence pendant; flowers in racemes, small; sepals and petals yellow with red bands near margin; lip white with purple streaks, three lobed, midlobe tongue shaped, spurred; spur slightly incurved.

Distribution & Ecology: Common, occurs as large colonies on branches of trees in riverine areas at an altitude of 100m - 1000m.

Specimens examined: Muktesh Kumar & Joy 006730 KFRI (Pattakarimba, Nilambur); Stephen 07603 KFRI (Vazhachal, Thrissur Dist.).

COELOGYNE Lindley

Pseudobulbous herbs; leaves 1 or few leaved; leaves coriaceous or membranous and plated; flowers in few flowered racemes, arising from the base or top of the pseudobulb; sepals subequal; petals narrower than the sepals; lip sessile, 3-lobed, lateral lobes widened, midlobe 2 or 3 keeled, often papillose; column winged, long, foot absent; pollinia 4 in pairs of two.

Key to the species

1a. Disk with two ridges; midlobe of the lip orbicular ovate; pseudobulbs ovoid, smooth ..... *C. breviscapa*
1b. Disk with three ridges; midlobe of the lip otherwise; pseudobulbs angled or wrinkled 2

2a. Pseudobulbs deeply rugose, midlobe of the lip triangular, acute ..... *C. nervosa*
2b. Pseudobulbs not rugose; lip otherwise 3

3a. Flowers small; pseudobulb heavily wrinkled; midlobe of the lip orbicular, apiculate .... *C. odoratissima*
3b. Flowers large; pseudobulb smooth and angled; midlobe of the lip elliptic ..... *C. mossiae*

Coelogyne breviscapa Lindl., Orch. *Coelogyne* : 4 (1854); Hook. f., Fl. Brit. India 5: 833 (1890); Fischer in Gamble, Fl. Pres. Madras 1430 (1928); Manilal, Fl. Silent Valley 273 (1988); Vajravelu, Fl. Palghat 470 (1990); Sathish & Manilal, Cat. Ind. Orch. 68 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 437 (1995).

Pseudobulbs green, smooth; leaves two; inflorescence from between the young leaves; flowers in racemes, white, few flowered; petals smaller than sepals; lip 3 lobed, side lobes blunt, midlobe broadly obovate, rounded; lip white with 2 yellow ridges.

Distribution & Ecology: Common, occurs on well exposed isolated trees like *Litsea sp.* at an altitude of 900m - 1100m. Also seen as lithophytic.

Specimens examined: Stephen & Joy 007522 KFRI (Kattuvaramudi slope, SVNP); Stephen & Joy 007294 KFRI, 007501 KFRI (Aruvanpara slope, SVNP).

Coelogyne mossiae Rolfe, Kew Bull. 156 (1894); Fischer in Gamble. Fl. Pres. Madras 1430 (1928); Manilal, Fl. Silent Valley 273 (1988); Sathish & Manilal, Cat. Ind. Orch. 68 (1994).

Large pseudobulbous herb; pseudobulbs lemon-yellow, angled; leaves two, coriaceous; inflorescence from between the leaves, sheathed, flowers in racemes, brownish- white, sepals and petal subsimilar; lip with three crenate ridges, yellow.

Distribution & Ecology: Very rare, collected from Sispara, Silent Valley National Park. Occurs in small colonies in open areas at an altitude of 1800 m. to 2400 m. Also seen as lithophytic.

Specimens examined: Stephen 008837 KFRI (Sispara, SVNP).

Note: Endemic to Southern Western Ghats.

Coelogyne nervosa Rich., Ann. Sci. nat., Ser. 2; 15: 16 (1841); Fischer in Gamble, Fl. Pres. Madras 1430 (1928); Manilal, Fl. Silent Valley 273 (1988); Sathish & Manilal, Cat. Ind. Orch. 68 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 437 (1995).

Pseudobulbs lemon- yellow, deeply rugose; leaves 2, coriaceous; inflorescence from top of the pseudobulb, drooping; flowers 3-4, in racemes, large, white; sepals and petals subsimilar; lip marked with brown coloured veins; disc with three crenulate ridges ending in red points.

Distribution & Ecology: Not common, preferably a high altitude plant found growing at an altitude of 1400m - 2000 m. More common as lithophytic, occurs in small colonies in open semi shade areas.

Specimens examined: Stephen 007859 KFRI (Sispara, SVNP); Muktesh Kumar & Stephen 007238 KFRI (Rajamallai, Munnar).

Note: Endemic to Southern Western Ghats.

Coelogyne odoratissima Lindl., Gen. Sp. Orch. 41. 1830; Hook. f., Fl. Brit. India 5: 834 (1890); Fischer in Gamble, Fl. Pres. Madras 1430 (1928); Manilal, Fl. Silent Valley. 273 (1988); Sathish & Manilal, Cat. Ind. Orch. 68 (1994).

Pseudobulbs crowded, forming large colonies; leaves 1 or 2, pale green, membranous; inflorescence from between the leaves; flowers in racemes, 2-3 flowered, white; sepals long; petals narrower; lip 3-lobed, side lobes falcate, midlobe apiculate, disc with 3-ridges.

Distribution & Ecology: Very rare, located in Sispara ghat of Silent Valley National Park, epiphytic on most of the trees, occur large colonies in evergreen sholas at an altitude of 1800m and above.

Specimens examined: Stephen 007579 KFRI (Sispara, SVNP); Stephen & Michael 008187 KFRI (Anguinda, SVNP).

COTTONIA Wt.

Cottonia peduncularis (Lindl.) Reichb. f., Cat. Orch. Schiller 52. (1857); Manilal, Fl. Silent Valley 274 (1988); Sathish & Manilal, Cat. Ind. Orch. 69 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 437 (1995)

Vanda peduncularis Lindl., Gen. Sp. Orch. 216 (1833).

Non pseudobulbous woody herbs; stems elongate; leaves coriaceous and equally bifid; inflorescence with very long peduncles much longer than the leaves, upto 50 cm long; flowers on apex of the peduncle, pinkish or yellow with maroon shade; sepals dull yellowish-brown, obovate-oblong, inflexed; petals spathulate, inflexed; lip 3-lobed, resembling a bumble bee, mid lobe small, dark purple, side lobes yellow, pubescent.

Distribution & Ecology: Common throughout the lower elevations. In Nilambur it is common in all trees. Preferably a low altitude epiphyte occuring in well exposed openings between 300m-700m altitude.

Specimens examined: Stephen & Michael 008838 KFRI (Punchakolli, Nilambur).

CYMBIDIUM Swartz

Key to the species

1a. Mid lobe of the lip oblong, hairy ..... *C. aloifolium*
1b. Mid lobe of the lip acuminate, wihtout hairs ..... *C. bicolor*

Cymbidium aloifolium (L.) Sw. Nov. Act. Soc. Upsal. 6: 73 (1799); Lindl. Gen. Sp. Orch. 165 (1833); Fischer in Gamble, Fl. Pres. Madras 1436 (1928);Vajravelu, Fl. Palghat 471 (1990); Sathish & Manilal, Cat. Ind. Orch. 69 (1994).

Pseudobulbs indistinct; leaves coriaceous, keeled, linear-lanceolate, distichous; inflorescence drooping. Flowers many, yellow with dark purple tinge, in racemes; sepals

linear oblong; petals lanceolate; lip 3-lobed; side lobes erect, narrow, lanceolate; mid lobe broadly oblong, reflexed, hairy.

Distribution & Ecology: Common, occurs in open exposed areas of semi evergreen and moist deciduous forests between 700m - 1300 m. Common in Tholpetty range of Wayanad and Mancheri of Nilambur.

Specimens examined: Stephen & Joy 007547 KFRI (Chinnakanal, Munnar).

Cymbidium bicolor Lindl., Gen. Sp. Orch. 164 (1833); Sathish & Manilal, Cat. Ind. Orch. 69 (1994).

Pseudobulbs indistinct; leaves thick, linear, drooping; flowers many, yellow with purple striations , in raceme; sepals slightly falcate; petals smaller than the sepals; lip 3- lobed, side lobes erect, mid lobe acuminate, yellow marked with deep purple striations, saccate.

Distribution & Ecology: Common in lower elevations, occurs in open well exposed areas even on road side trees.

Specimens examined: Stephen & Michael 008839 KFRI (Punchakolli, Nilambur).

DENDROBIUM Swartz *nom. cons.*

Stem pseudobulbous or elongate; pseudobulbs plurinodal or uninodal; leaves sessile, coriaceous; flowers solitary or few flowered racemes; leaf opposed or on pseudobulbs; sepals subequal; petals smaller than or larger than the sepals; lip 3-lobed or entire, adnate to the foot of the column, concave or saccate.

Key to the species

1a. Pseudobulb uninodal 2
1b. Pseudobulb plurinodal 5

2a. Mid lobe of the lip rounded 3
2b. Mid lobe of the lip triangular or rhomboid 4

3a. Lip clawed ..... *D. nanum*
3b. Lip not clawed ..... *D. microbulbon*

4a. Mid lobe of the lip rhomboid, serrulate ..... *D. anamalayanum*
4b. Mid lobe of the lip triangular, entire ..... *D. peguanum*

5a. Leafy branch with flowers 6
5b. Leafy branch without flowers 11

6a. Inflorescence terminal 7
6b. Inflorescence from the leaf opposed nodes 8

7a. Flowers pink; lip white with a prominant callus; side lobe of the lip incurved ..... *D. wightii*
7b. Flowers white; lip panduriform, side lobes acute ..... *D. panduratum*

8a. Margin of the mid lobe of lip ciliate or crenulate or crisped 9
8b. Margin of the midlobe of lip entire, tongue shaped ..... *D. haemoglossum*

9a. Flowers white, side lobes of lip incurved or erect 10
9b. Flowers yellow or golden yellow; side lobes rounded ..... *D. jerdonianum*

10a. Lip yellow, pubescent, mid lobe triangular, ciliate ..... *D. aquem*
10b. Lip pink or purple; glabrous, mid lobe crenate ..... *D. heyneanum*

11a. Flowers in racemose 12
11b. Flowers tubercles 13

12a. Flowers upto 2 cm across; lip trilobed, mid lobe hairy ..... *D. ovatum*
12b. Flowers small, upto .75 across; lip not lobed, glabrous ..... *D. herbaceum*

13a. Lip margin fimbriate, disc with 3 raws of hairs ..... *D. macrostachyum*
13b. Lip margin not fimbriate, disc without hairs 14

14a. Flowers pinkish, lip margin slightly crimped ..... *D. crepidatum*
14b. Flowers yelloish, lip entire but hairy ..... *D. heterocarpum*

Dendrobium anamalayanum Chandr. Chandrasek. & Nair, J. Bombay Nat. Hist. Soc. 78(3): 575-576; Sathish & Manilal, Cat. Ind. Orch. 70 (1994).

Pseudobulbous herbs; pseudobulbs uninodal, greenish pink; leaves 2, from top of the pseudobulb; flowers in racemes, pink coloured; dorsal sepal oblong-obovate; lateral sepals falcatly oblong, united to form a small mentum; petal oblanceolate; lip 3 lobed broadly obovate; side lobes look like, midlobe rhomboid- ovate, serrulate; disc toothed at apex.

Distribution & Ecology: Common, collected from Munnar. Preferably a high altitude plant growing well in the dense shaded shola forests and also in the well exposed forest fringes. Mainly epiphytic on *Rhododendron sp.* at an altitude of 1500 m. to 2400 m.

Specimens examined: Stephen & Joy 007543 KFRI (Lockart Gap, Munnar).

Note: Endemic to Anamalai Hills.

Dendrobium aqueum Lindl., Bot. Reg. 6: t. 59 (1843); Hook. f., Fl. Brit. India 5: 739 (1890); Fischer in Gamble, Fl. Pres. Madras 1417 (1928); SManilal Fl. Silent Valley 275 (1988); Vajravelu, Fl. Palghat 473 (1990); Sathish & Manilal, Cat. Ind. Orch. 70 (1994).

Tufted herbs with pendulous or erect branches; leaves membranous, slightly wavy; flowers pinkish white; sepals ovate, apiculate; petals obovate, glabrous; lip 3 lobed, yellow, rhomboid, pubescent; side lobes incurved; midlobe triangular, erose.

Distribution & Ecology: Rare, collected from Silent Valley National Park and Wayanad. Occurs in semi shaded areas in the fringes of forest at an altitude of 850-1100m.

Specimens examined: Stephen 007617 KFRI (Teatunda, Wayanad); Stephen 007631 KFRI (Kalarimotta, Wayanad); Stephen 007651 KFRI (Parathode, SVNP).

Note: Endemic to South India.

Dendrobium crepidatum Lindl., Praxton, Fl. Gard. 1: 63, t. 45 (1850-51); Hook. f., Fl. British India 5:740 (1888); Sathish & Manilal, Cat. Ind. Orch. 70 (1994).

Tufted herbs; stem ribbed with white sheaths; leaves membranous; flowers in pairs from the swollen nodes, white with pinkish tinge; pedicel long; sepals and petals subsimilar; lip 3 lobed, yellow, side lobes incurved, mid lobe slightly crimped.

Distribution & Ecology: Very rare, prefers evergreen forest at an altitude of 800m - 1000m.

Specimens examined: Sasidharan 002922 KFRI (Chandanathode, Wayanad).

Dendrobium haemoglossum Thw., Enum. Pl. Zeyl. 429 (1864); Fischer inGamble, Fl. Pres. Madras 1416 (1928); Manilal, Fl. Silent Valley 276 (1988); Sathish & Manilal, Cat. Ind. Orch. 71 (1994).

Tufted herbs; stem woody, polished yellow; leaves grass like, coriaceous; flowers in pairs, in leaf opposed tubercles, yellow; lip not lobed, tongue like, with deep purple markings.

Distribution & Ecology: Very rare, preferably a high altitude plant growing on branches of tall trees in shaded localities.

Specimens examined: Sathish Kumar 10771 CALI (Silent Valley National Park).

Note: Endemic to South India.

Dendrobium herbaceum Lindl., Bot. Misc. 69. 1840; Hook. f., Fl. British India 5: 719 (1890); Fisher in Gamble, Fl. Pres. Madras 1416 (1928); Manilal, Fl. Silent Valley 276 (1988); Vajravelu, Fl. Palghat 473 (1990); Sathish & Manilal, Cat. Ind. Orch. 71 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 438 (1995).

Profusely branched tufted herbs; stem yellow, shining; leaves linear-lanceolate, leafless when flowering; flowers in short racemes, creamy white; sepals and petals dissimilar; lip yellow; side lobes inconspicous, mid lobe triangular.

Distribution & Ecology: Most widely distributed species. Growing on upper branches of trees in shaded and semishaded open forest fringes of evergreen forests between 300m - 1700 m. altitude.

Specimens examined: Joy & Stephen 007252 KFRI (Punnamala, SVNP); Joy & Stephen 007228 KFRI (Victoria, Nelliampathy); Stephen & Michael 008171 KFRI (Lockart gap, Munnar).

Note: Endemic to Peninsular India.

Dendrobium heterocarpum Wall. ex Lindl., Gen. Sp. Orch. 78. 1830; Hook. f., Fl. British India 5: 737 (1890); Fischer in Gamble, Fl. Pres. Madras 1416 (1928); Manilal, Fl. Silent Valley 276 (1988); Vajravelu, Fl. Palghat 473 (1990); Sathish & Manilal, Cat. Ind. Orch. 71 (1994).

Tufted herbs; stem clavate, brown, with ribbed sheaths; leaves membranous; flowers in pairs yellowish, fragrant; sepals linear-oblong; petals ovate lanceolate; lip 3 lobed, deep red, pubescent, incurved at base.

Distribution & Ecology: Common in Munnar and adjacent areas. Preferably a high altitude plant, collected from Munnar only. Growing on *Eucalyptus sp.* in semi shaded areas between 1500m - 2000m altitude.

Specimens examined: Stephen 007695 KFRI (Chockanad Estate, Munnar); Stephen & Michael 008166 KFRI, 008189 KFRI (Lockart gap, Munnar).

Dendrobium heyneanum Lindl., Gen. Sp. Orch. 78. 1830; Hook. f., Fl. British India 5: 718 (1888); Fischer in Gamble, Fl. Pres. Madras 1415 (1928); Manilal, Fl. Silent Valley 277 (1988); Vajravelu, Fl. Palghat 474 (1990); Sathish & Manilal, Cat. Ind. Orch. 71 (1994). Sasi. & Sivaraj., Fl. Pl. Thrissur For. 438 (1995).

Small tufted herbs; stem slender, clavate; leaves linear-lanceolate; flowers in leaf opposed racemes, many, white; sepals lanceolate; petals spathulate; lip 3 lobed, pink; side lobes erect, mid lobe orbicular-oblong, fimbriate.

Distribution & Ecology: Common, collected from Silent Valley and Wayanad. Occurs in branches of small trees in dense shaded localities in evergreen forests between 750-1100m altitude.

Specimens examined: Stephen 007683 KFRI (Poovanchola, SVNP); Muktesh Kumar & Stephen 006741 KFRI, 006742 KFRI (Chandanathode, Wayanad); Stephen 007627 KFRI (Kalarimotta, Wayanad); Stephen 007613 KFRI (Chandanathoode, Wayanad).

Note: Endemic to South India.

Dendrobium jerdonianum Wt., Ic. t. 1644 (1851); Sathish & Manilal, Cat. Ind. Orch. 71 (1994).

Dendrobium nutans Lindl., Gen. Sp. Orch. 90 (1830); Hook. f., Fl. British India 5: 734 (1988); Fischer in Gamble, Fl. Pres. Madras 1416 (1928); Manilal,Fl. Silent Valley 278 (1988).

Tufted herbs; stem slender; leaves only at the apex of the stem; flowers in leaf opposed tubercles, white; lip pink, 3 lobed, side lobes rounded, mid lobe linear lanceolate, crisped and acute.

Distribution & Ecology: Not common, collected from Thirunelly, Wayanad. Prefers open exposed area between 1200m - 1700m altitude.

Specimens examined: Stephen & Michael 008840 KFRI (Thirunelly, Wayanad).

Note: Endemic to South India.

Dendrobium macrostachyum Lindl., Gen. Sp. Orch. 78 (1830); Wt., Ic,. t. 1647 (1851); Hook. f., Fl. British India 5: 735 (1890); Fischer in Gamble, Fl. Pres. Madras 1416 (1928); Manilal, Fl. Silent Valley 277 (1988); Vajravelu, Fl. Palghat 474 (1990); Sathish & Manilal, Cat. Ind. Orch. 71 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 439 (1995).

Pendulous herbs; stem tufted, brownish; leaves membranous, alternate, ovate lanceolate; flowers in leaf opposed fascicles, yellow with pinkish tinge; sepals lanceolate; petals linear-lanceolate; lip 5 veined, purple, ovate oblong, minutely fimbriate; disc with 3 raws of hairs.

Distribution & Ecology: Common at lower elevations, found abundantly in the planes. Collected from Peechi. Prefers open dry area between 50m - 800m altitude.

Specimens examined: Stephen 008841 KFRI (Peechi).

Dendrobium microbulbon A. Rich., Ann. Sci. nat. Ser. 2. 15: 19, t. 8 (1841); Hook. f., Fl. British India 5: 116 (1888); Fischer in Gamble, Fl. Pres. Madras 1415 (1928); Sathish & Manilal, Cat. Ind. Orch. 71 (1994).

Small pseudobulbous herbs; pseudobulbs uninodal, greenish; leaves membranous; flowers in racemes, white with pinkish tinge; lip 3 lobed, greenish, side lobes incurved, mid lobe orbicular, fimbriate; disc with 2 irregular calii.

Distribution & Ecology: Rare, collected from Kalarimotta, Wayanad. Occurs on isolated trees like *Careya arborea* in grasslands between 900m - 1100m altitude.

Specimens examined: Stephen 007625 KFRI (Kalarimotta, Peria, Wayanad).

Note: Endemic to South India.

Dendrobium nanum Hook. f., Ic. Pl. 19: t. 1853 (1889); Fl. British India 5: 717 (1888); Fischer in Gamble, Fl. Pres. Madras 1415 (1928); Manilal, Fl. Silent Valley 277 (1988); Vajravelu, Fl. Palghat 474 (1990); Sathish & Manilal, Cat. Ind. Orch. 71 (1994).

Small pseudobulbous herbs; leaves elliptic lanceolate; flowers in terminal racemes, white; sepals lanceolate; petals spathulate; lip 3 lobed, side lobes small, incurved, midlobe suborbicular, crenate, green with purple spots; disc 3 ridges.

Distribution & Ecology: Rare, prefers high altitude evergreen shola forests, occuring in dense shade in branches of small trees between 1800m - 2400m altitude.

Specimens examined: Stephen 007862 KFRI (Sispara, SVNP); Stephen 007851 (Eravikulam National Park); Stephen & Joy 007564 KFRI (Silent Valley Estate, Munnar).

Note: Endemic to South India.

Dendrobium ovatum (Willd.) Kranzl., Pflazenf. 45: 71 (1910); Fischer in Gamble, Fl. Pres. Madras 1416 (1928); Vajravelu, Fl. Palghat 474 (1990); Sathish & Manilal, Cat. Ind. Orch. 71 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 439 (1995).

Tufted herbs; stem covered by scaly sheaths; leaves membranous, leafless when flowering, oblong-lanceolate; flowers in raceme, white; lip 3-lobed, side lobes erect, rounded, mid lobes subquadrate, glabrous.

Distribution & Ecology: Common at lower elevations, prefers open area between 50m - 800m altitude.

Specimens examined: Stephen 008841 KFRI (Peechi).

Dendrobium panduratum Lindl., J. Linn. Soc. Bot. 3: 19 (1859); Thw., Enum. Pl. Zeyl. 298 (1861), excl. syn., Hook. f., Fl. British India 5: 717 (1890); Manilal, Fl. Silent Valley 278 (1988); Sathish & Manilal, Cat. Ind. Orch. 71 (1994).

Tufted herbs; leaves linear oblong or lanceolate; flowers in racemes, white; lip panduriform, 3 lobed, side lobes acute, mid lobe broadly ovate or orbicular, crenulate; mentum spur like.

Distribution & Ecology: Very rare, prefers stream side trees between 900m - 1000m.

Specimens examined: Sathish Kumar 10151 CALI (Silient Valley National Park).

Dendrobium peguanum Lindl., Gen. Sp. Orch. 78 (1830); Seidenf.,. Opera. Bot. 83: 1-295 (1985); Sathish. & Manilal, Cat. Ind. Orch. 71 (1994).

Small pseudobulbous herbs; leaves lanceolate; flowers in raceme, white with pink tinge; lip 3 lobed, mid lobe triangular, acute (Fig. 28).

Distribution & Ecology: Very rare, collected from a single locality in Tholpatty range, Wayanad only. Epiphytic on *Dalbergia sp.* occurs in the moist deciduous forests between 650m - 900m.

Specimens examined: Muktesh Kumar & Stephen 006761 KFRI (Tholpatty, Wayanad).

Dendrobium wightii Hawkes & Heller, Orchidea 24: 16 (1962); Abraham & Vatsala, Intr. Orch. 351 (1981); Sathish & Manilal, Cat. Ind. Orch. 72 (1994).

Small herbs; stem reddish; leaves grass like, several from the nodes, membranous with a tinge of red; flowers in raceme, terminal on the shoot; pinkish; sepals wide; petals narrowed; lip 3 lobed, white, side lobes erect, mid lobe triangular, crenate.

Distribution & Ecology: Rare, collected from Poovanchola, Silent Valley National Park. Prefers riverine area between 900m - 1000m altitude.

Specimens examined: Stephen 007656 KFRI (Poovanchola, SVNP).

Note: Endemic to South India.

DIPLOCENTRUM Lindley

Diplocentrum recurvum Lindl., Gen. Sp. Orch. 218 (1833); Wt., Ic. t. 1680-81 (1852); Hook. f., Fl. British India 6: 78 (1890); Fischer in Gamble, Fl. Pres. Madras 1449 (1928); Sathish & Manilal, Cat. Ind. Orch. 72 (1994).

Short, stout herbs; stem woody; leaves linear, recurved, semiterete; flowers in axillary panicles, branched, pinkish; sepals dissimilar; petals smaller than sepals; lip longer than the petals, 2 spurred, entire, lip slightly raised, forked; spurs conical, short, acute, incurved; column thick, stout, clavate.

Distribution & Ecology: Rare, collected from Munnar. Prefers high altitude evergreen shola forests between 1500m - 2000m altitude.

Specimens examined: Stephen 007530 KFRI (Suryanelly, Munnar)

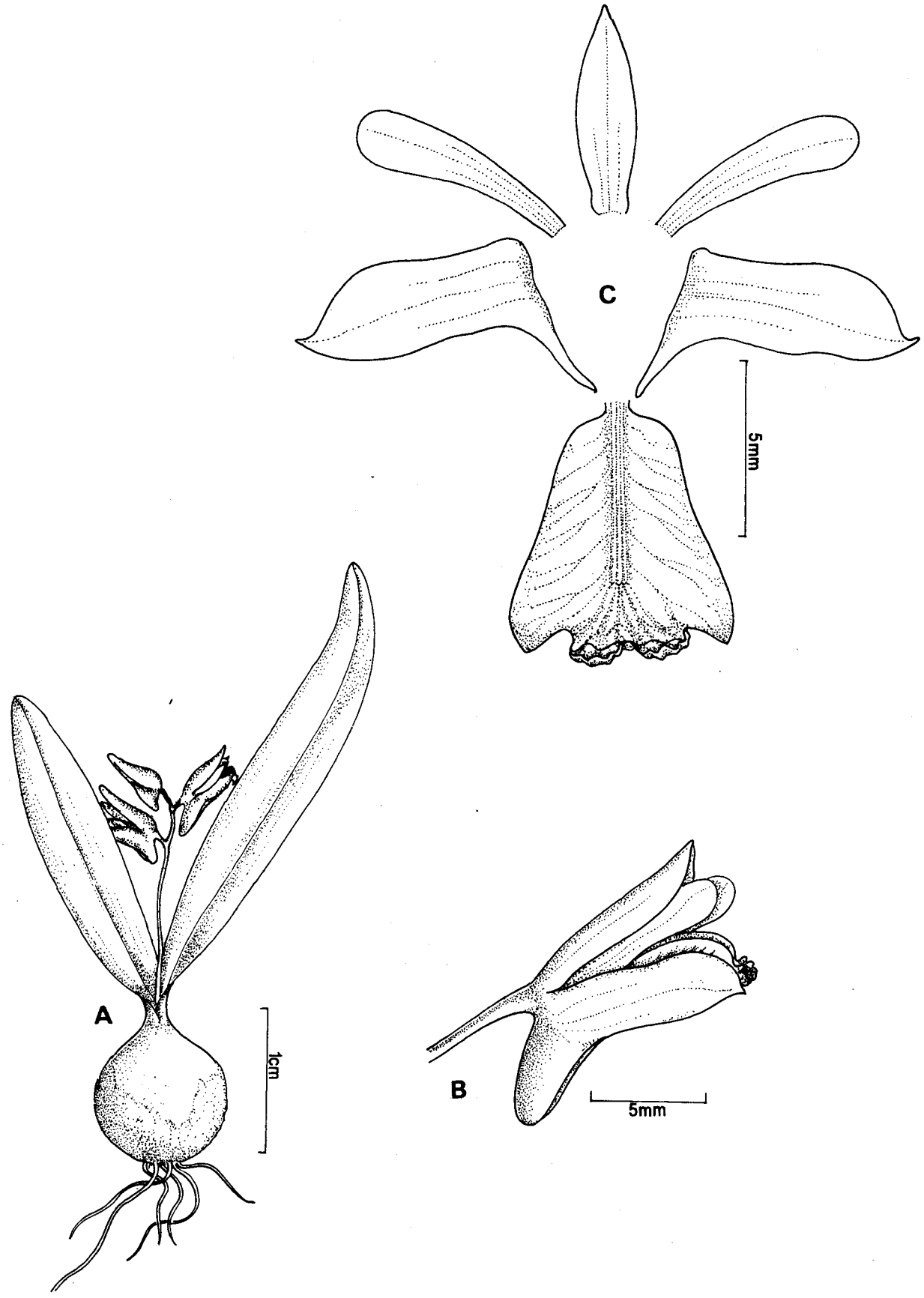


Fig. 28. *Dendrobium peguanum* Lindl. A- Habit; B- Flower; C- Floral parts.

ERIA Lindley

Pseudobulbous or non pseudobulbous herbs; leaves membranous or coriaceous; inflorescence lateral or apparently terminal with one to many flowers; sepals subsimilar; lip sessile on the foot of the column, 3 lobed; pollinia 8.

Key to the species

1a. Pseudobulbs large, elongate or clavate at the top 2
1b. Pseudobulbs small, uninodal 5

2a. Pseudobulbs clavate, flowers solitary or in pairs 3
2b. Pseudobulbs not clavate, flowers many 4

3a. Stem and pseudobulbs glossy; disc with 2 ridges ..... *E. pauciflora*
3b. Stem and pseudobulb folded; disc with single ridge ..... *E. pseudoclavicaulis*

4a. Flowers straw coloured; lip reddish brown; flowers glabrous ..... *E. mysorensis*
4b. Flowers creamy yellow; lip yellow with reddish tinge; flowers pilose ..... *E. polystachya*

5a. Flowers solitary ..... *E. reticosa*
5b. Flowers more than one 6

6a. Pseudobulbs globose or ovoid 7
6b. Pseudobulbs depressed ovoid or otherwise 8

7a. Leafless when in flowers ..... *E. exilis*
7b. Leafy when in flower ..... *E. albiflora*

8a. Flowers secund 9
8b. Flowers not secund 11

9a. Plant 2 flowered; plants 4 cm long 10
9b. Plant many flowered; plant long, upto 8 cm long ..... *E. dalzelli*

10a. Shoots from the lower side of the pseudobulb; lip finely puberulous ..... *E. muscicola* var. *brevilinguis*
10b. Shoots from the top of the pseudobulb; lip glabrous ..... *E. nana*

11a. Lip clawed, tip of the lip acute ..... *E. tiagii*
11b. Lip not clawed, tip of the lip acuminate ..... *E. microchilose*

Eria albiflora Rolfe., in Bull. Misc. Inform. Kew 170 (1893); Fischer in Gamble, Fl. Pres. Madras 1425 (1928); Vajravelu, Fl. Palghat 477 (1990); Sathish & Manilal, Cat. Ind. Orch. 72 (1994).

Small pseudobulbous herbs; pseudobulbs globose or ovoid; leaves oblong-lanceolate; scape slender, pubescent; flowers white; sepals dissimilar; petals linear-lanceolate; lip rhomboid or suborbicular, beaked at tip, sparsely gland dotted, with 2 papillae at base.

Distribution & Ecology: Very rare, collected from Thirunelly, Wayanad. Epiphytic on large tree trunks at an altitude of 800m - 1000m. Prefers deep shady moist localities in the evergreen forests.

Specimens examined: Stephen & Michael 008111 KFRI (Pathipara, Thirunelly, Wayanad).

Note: Threatened, endemic to southern part of Western Ghats.

Eria dalzellii Lindl., J. Linn. Soc. Bot. 3: 47 (1858); Fischer in Gamble, Fl. Pres. Madras 1425 (1928); Manilal, Fl. Silent Valley 279 (1988); Vajravelu, Fl. Palghat 477 (1990); Sathish & Manilal, Cat. Ind. Orch. 73 (1994).

Medium sized pseudobulbous herbs; pseudobulbs depressed ovoid; leaves 2, oblanceolate, oblong; scape upto 6 cm long; flowers secund, yellow; sepals subequal; petal subsimilar; lip small, pandurate with 2 yellow ridges from base.

Distribution & Ecology: Rare, collected from Silent Valley National Park. Prefers shady riverine area between 800m - 1000m altitude.

Specimens examined: Muktesh Kumar 002953 KFRI (Silent Valley National Park).

Note: Endemic to Western Ghats.

Eria exilis Hook. f., Fl. British India 5: 788 (1890); Fischer in Gamble, Fl. Pres. Madras 1425 (1928); Sathish & Manilal, Cat. Ind. Orch. 73 (1994).

Small pseudobulbous herbs; pseudobulbs globose or ovoid; leafless when in flower; scape slender, flexuous; flowers white; lateral sepals decurved, slightly falcate; dorsal sepal oblong; petals linear; lip minute, elliptic-oblong.

Distribution & Ecology: Very rare, collected from Poovanchola, Silent Valley National Park. Prefers semi exposed moist riverine areas between 900m - 1000m altitude. Also seeen as lithophytic.

Specimens examined: Stephen & Michael 008828 KFRI (Poovanchola, SVNP).

Note: Endemic to Western Ghats.

Eria microchilose Lindl., Journ. Linn. Soc. 3: 47 (1858) (nom. et. Syn. tantum, non descr.); Sant. & Kapad., Orch. Bombay 154 (1966); Sathish & Manilal, Cat. Ind. Orch. 73 (1994).

Small pseudobulbous herbs; pseudobulbs discoid; leaves 2-5, oblong-lanceolate or narrowly linear oblong; scape slender often filiform; flowers in racemes, pale yellow;

sepals and petals spreading; lip narrowly oblong, lanceolate, hardly divided, basal half with 2 yellow ridges, apical half tapered to acute apex, crenulate.

Distribution & Ecology: Rare, collected from Pakshipadalam, Wayanad. Prefers high altitude and moist shady areas in evergreen shola forest between 1300m - 1500m altitude.

Specimens examined: Stephen & Michael 008141 KFRI (Pakshipadalam, Wayanad).

Note: This species is endemic to Western Ghats.

Eria muscicola var. **brevilinguis** Joseph & Chandrasek., Bull. Bot. Surv. India 15.(3-4): 267-269 (1973); Sathish & Manilal, Cat. Ind. Orch. 73 (1994).

Small pseudobulbous herbs; pseudobulbs dorsiventrally compressed; leaves 2, ovate acute at apex; scale filiform; flowers secund, greenish yellow; sepals and petals narrowly lanceolate, acuminate; dorsal sepals longer than the lateral sepals; lateral sepals united to form a mentum; lip smaller, induplicate, finely puberulous towards the distal half, rounded and finely crumpled along the apical margin, tip retuse.

Distribution & Ecology: Common in the riverine tree species. Attached on the bases of the tree trunk. Preferably a shade loving plant growing at an altitude between 800m - 900m.

Specimens examined: Stephen 007696 KFRI (Punnamala, SVNP).

Note: Hitherto this taxa is known to occur in Agastyamalai Hills only. The present collection shows the extended range of distribution of this species to the Northern side of Kerala.

Eria mysorensis Lindl., J. Linn. Soc. Bot. 3: 54 (1858); Hook. f., Fl. British India 5: 793 (1890); Manilal, Fl. Silent Valley 279 (1988); Sathish & Manilal, Cat. Ind. Orch. 73 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 440 (1995).

Pseudobulbous herbs; pseudobulbs thick, broad at the base; leaves from the top of the pseudobulb, oblong lanceolate or elliptic lanceolate; flowers fragrant, straw coloured; sepals linear lanceolate, falcate; petals similar, smaller; lip minutely clawed, sub pandurate, finely irregularly crenulate.

Distribution & Ecology: Not common, collected from parathode of Silent Valley National Park, found to be growing near river side trees and fringes of forests between 900m - 1000m altitude.

Specimens examined: Stephen 006798 KFRI (Parathode, SVNP); Stephen & Michael 008843 KFRI (Lockart Gap, Munnar).

Note: Endemic to Western Ghats.

Eria nana A. Rich., Ann. Sci. nat. s.2. 11:19 (1841); Fischer in Gamble, Fl. Pres. Madras 1425 (1928); Sathish & Manilal, Cat. Ind. Orch. 73 (1994).

Small pseudobulbous herbs; pseudobulbs discoid, enclosed in a fibrous sheath; leaves linear lanceolate; flowers 2, secund, cream coloured; sepals and petals linear- lanceolate, falcate; lateral sepals united to form a mentum; lip ligulate.

Distribution & Ecology: Very rare, collected from Pakshipadalam, Wayanad. Prefers a high altitude dense shaded, moist areas in the evergreen shola forests between 1300m - 1600m altitude.

Specimens examined: Stephen & Michael 008141 KFRI (Pakshipadalam, Wayanad).

Note: Endemic to Southern Western Ghats.

Eria pauciflora Wt., Ic. t. 1636 (1851); Hook. f., Fl. British India 5: 799 (1890); Fischer in Gamble, Fl Pres. Madras 1425 (1928); Manilal, Fl. Silent Valley 280 (1988); Sathish & Manilal, Cat. Ind. Orch. 73 (1994).

Creeping rhizomatous herbs; stem tufted, bulbous at apex, brown; leaves 2-3, from the top of the pseudobulb; flowers solitary from between the leaves, white; sepals and petals subequal; lateral sepals slightly falcate; dorsal sepals oblong; petals narrower; lip cuneate with 2 prominent ridges on the disc.

Distribution & Ecology: Common, found to be growing near streams and forest edges, between 900m - 1600m altitude.

Specimens examined: Stephen 006799 KFRI (Parathode, SVNP); Stephen & Michael 008844 KFRI (Lockart Gap, Munnar).

Note: Endemic to Southern Western Ghats.

Eria polystachya A. Rich., Ann. Sci. nat. s.2 11: 20. t. 9 (1841); Wt. Ic. t. 1635 (1852); Hook. f., Fl. British India 5: 792 (1888); Fischer in Gamble, Fl. Pres. Madras 1425 (1928); Sathish & Manilal, Cat. Ind. Orch. 73 (1994).

Medium sized Pseudobulbous herbs; pseudobulbs elongate, thumb shaped; leaves elliptic or oblong-lanceolate; flowers in raceme, creamy yellow, many flowered, faintly pilose; sepals and petals subequal, lanceolate, slightly falcate; lip ovate, constricted at middle with 2 callii in the disc, subpanduriform, bright yellow (Fig. 29).

Distribution & Ecology: Rare, collected Thirunelly, Wayanad. Occurs in isolated trees in forest edges at an altitude of 900m - 1100m.

Specimens examined: Stephen & Michael 008109 KFRI (Pathipara, Thirunelly, Wayanad).

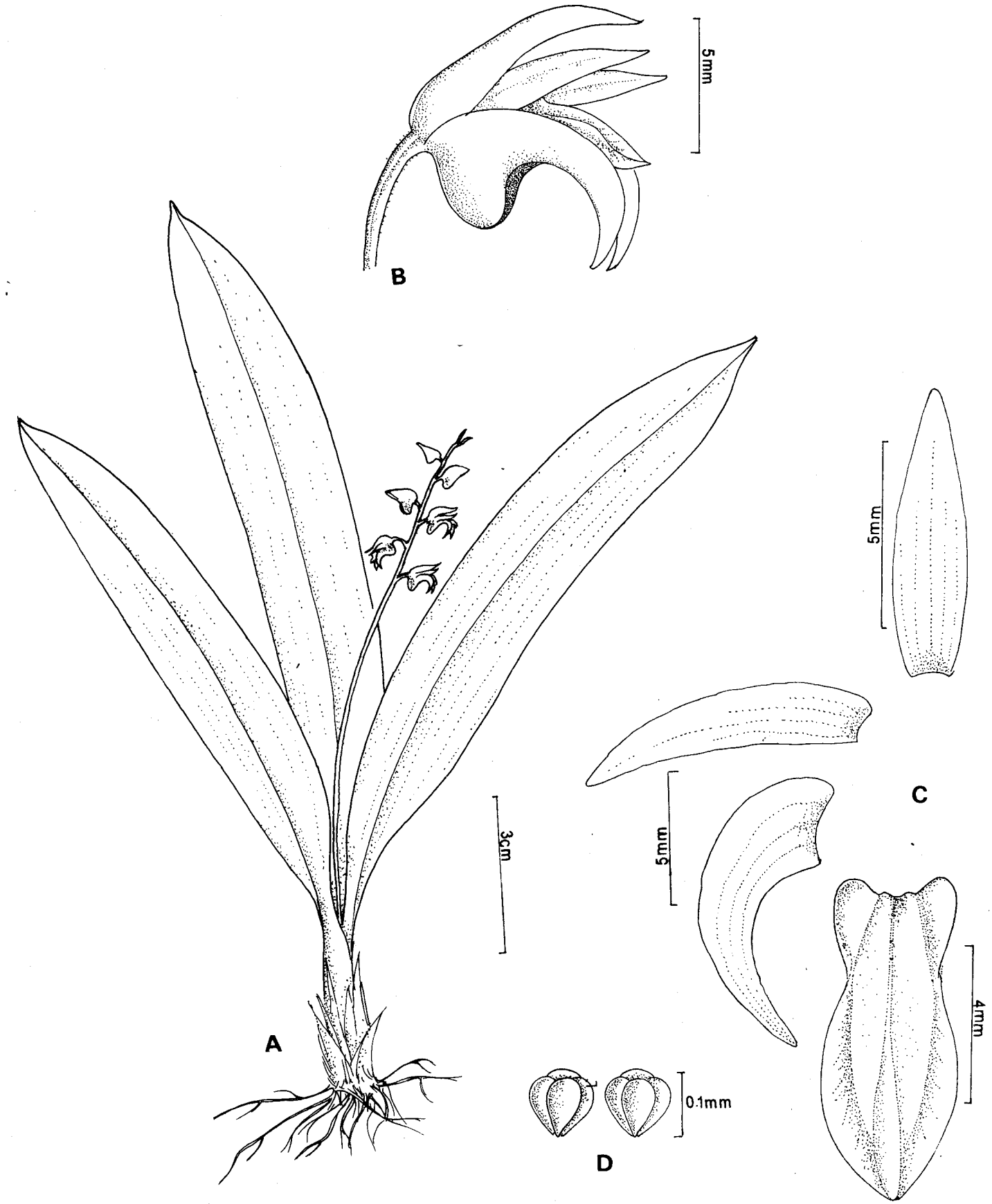


Fig. 29. *Eria polystachya* A. RIch. A- Habit; B- Flower; C- Floral parts.

Note: Hitherto this species is known only from Nilgiri Hills of Tamil Nadu. The present collection makes this a new record to the state.

Eria pseudoclavicaulis Blatt. & McCann., Journ. Bombay Nat. Hist. Soc. 32: 519 (1928); Fischer in Gamble, Fl. Pres. Madras 1426 (1928); Sathish & Manilal, Cat. Ind. Orch. 73 (1994).

Tufted pseudobulbous herbs; pseudobulbs clavate, brownish; leaves 3, on top of the pseudobulb, oblong-lanceolate; flower solitary or in pairs; lateral sepals triangular, falcate; dorsal sepal elliptic oblong; petals oblong, falcate; lip 3 lobed, side lobes slightly crisped, mid lobe minutely puberulous, yellowish.

Distribution & Ecology: Rare, collected from Munnar. Occurs in forest fringes in the evergreen shola forests at an altitude of 1500m - 1700m.

Specimens examined: Muktesh Kumar & Stephen 007570 KFRI (Rajamallay, Munnar).

Eria reticosa Wt., Ic. t. 1637 (1851); Hook. f., Fl. British India 5: 787 (1890); Manilal, Fl. Silent Valley 280 (1988); Vajravelu, Fl. Palghat 477 (1990);Sathish & Manilal, Cat. Ind. Orch. 73 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 440 (1995).

Small pseudobulbous herbs; pseudobulbs discoid, covered with reticulate sheaths; leaves 2, from top of the pseudobulb, oblong or elliptic-lanceolate; flowers solitary, white; sepals and petals subequal; lip 3 lobed, yellow, side lobes auricular, mid lobe ovate, disc with 2 ridges, pubescent.

Distribution & Ecology: Rare, collected from Munnar. Prefers evergreen shola forests between 900m - 1400m. Associated with *Bulbophyllum kaitens*.

Specimens examined: Stephen 008858 KFRI (Lockart Gap, Munnar); Muktesh Kumar 002974 KFRI (Virupara, Munnar); Sasidharan 005198 KFRI & 005654 KFRI (Trichur).

Eria tiagii Manilal, Sathish & Wood, J. Econ. Tax. Bot. 5(2): 483-486 (1984); Manilal, Fl. Silent Valley 280 (1988); Sathish & Manilal, Cat. Ind. Orch. 73 (1994).

Small pseudobulbous herbs; pseudobulbs compressed, sheathed; leaves 2-3, from top of the pseudobulb, oblanceolate; flowers in raceme on the leafy pseudobulbs, white; sepals and petals subsimilar; petals narrow, slightly falcate; lip clawed, constricted at middle, basal region entire, distal region crenulate; disc with 2 callii at base.

Distribution & Ecology: Very rare, collected from Sispara, Silent Valley National Park. Epiphytic on branches of small trees in the evergreen shola forests at an altitude of 1000m - 1800m.

Specimens examined: Stephen 007863 KFRI (Sispara, SVNP).

Note: This species is endemic to Kerala.

FLICKINGERIA Hawkes

Flickingeria nodosa (Dalz.) Seidenf., Dansk Bot. Ark. 34 (1): 41 (1980); Manilal, Fl. Silent Valley 283 (1988); Sathish & Manilal, Cat. Ind. Orch. 74 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 442 (1995).

Dendrobium nodosum Dalz., Hooker's J. Bot. Kew Gard. Misc. 4: 292 (1852).

Medium sized creeping rhizomatous herbs; shoots erect, ending in pseudobulbs; leaves solitary, linear oblong; flowers solitary, white, pink at tip; sepals and petals dissimilar; petal narrower than sepals, slightly falcate; lateral sepals united to form a short mentum; lip 3 lobed; side lobes erect, oblong, midlobe triangular, erose at margin, apex winged.

Distribution & Ecology: Common, occurs near the streams and forest fringes at an altitude of 900m - 1600m.

Specimens examined: Stephen 006800 KFRI (Parathode, SVNP).

Note: Endemic to Western Ghats.

GASTROCHILUS D. Don

Short stemmed, leaves few; flowers fleshy, wide opening; lip basin shaped to semiglobose with its sides firmly attached to the column; mid lobe pointing forward, nearly flat, fringed; column short, without foot; pollinia 2; rostellum short, bifid.

Key to the species

1a. Small plant, leaves with purple tinge and purple spots; mid lobe of the lip finely crenate ..... *G. flabelliformis*
1b. Medium sized; leaves without purple tinge or spots; mid lobe of the lip irregularly fimbriate 2

2a. Mid lobe of the lip white with yellow centre, dotted red; spur sac naked ..... *G. bigibbus*
2b. Mid lobe of the lip white; spur sac with a peg like projection at the bottom ..... *G. acaulis*

Gastrochilus acaulis (Lindl.) Ktze., Rev. Gen. Bot. 2: 661 (1891); Sathish & Manilal, Cat. Ind. Orch. 74 (1994).

Cleisostoma acaule Lindl., Gen. et Sp. Orch. 227 (1833).

Short non pseudobulbous herbs; stem vermiform; leaves linear oblong, subfalcate, unequally bilobed at apex; flowers in racemes, pale green, purple spotted; sepals and petals spathulate, 3 veined; lip conicular saccate; lateral lobes short, mid lobe triangular,

acute, fimbriate; column marginate, bifid or truncate at apex.

Distribution & Ecology: Not common, collected from Silent Valley National Park and Muthikulam. Epiphytic on small trees in the deeply shade evergreen forests between 850m - 1050m altitude. Occuring as small colonies.

Specimens examined: Stephen 007580 KFRI (Walakad, SVNP); Stephen & Michael 008804 KFRI (Siruvani, Damsite).

Gastrochilus bigibbus (Reichb. f. ex J. D. Hook.) Ktze., Rev. Gen. 2: 661 (1891); Sathish & Manilal, Cat. Ind. Orch. 60 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 442 (1995).

Saccolabium bigibbus Reichb. f. ex J.D. Hook., Bot Mag. 95: t. 5767.61 1867-1890.

Short non pseudobulbous herbs; stem short, stout; leaves oblong, slightly falcate, unequally bilobed at apex; flowers in raceme, pale yellow with purple dots; sepals and petals narrowed at base, 3 veined; lip deeply saccate; mid lobe white with yellow centre, dotted red; irregularly fimbriate, spur sac naked; column bifid.

Distribution & Ecology: Rare, collected Panthenthode, Silent Valley National Park. Epiphytic on *Terminalia sp.* Occuring as solitary plants in semi shaded or evergreen forest fringes between 800-900m altitude.

Specimens examined: Stephen & Joy 007296 KFRI,007527 KFRI (Panthenthode, SVNP).

Gastrochilus flabelliformis (Blatt. & McCann) Saldanha &Nicols., Fl. Hassan Dist. 830 (1976); Sathish & Manilal, Cat. Ind. Orch. 75 (1994).

Saccolabium flabelliformis Blatt. & McCann, Rev. Fl. Pres. Bombay 16: 722 (1932).

Small non pseudobulbous herbs; leaves falcate with purple tinge and purple dots; flowers in racemes, yellow with red spot on the margin of the sepals and petals; sepals and petals spathulate; lip 3 lobed, saccate, side lobes obtuse, mid lobe fan shaped, crenate, white; column short, winged, purple coloured; rostellum bifid (Fig. 30).

Distribution & Ecology: Rare, collected from Punchakolli, Nilambur. Found in open area along riverside trees in moist deciduous forests between 250m - 500m altitude.

Specimens examined: Stephen & Michael 008801 KFRI (Punchkolli, Nilambur).

Note:-So far reported only from N. Kanara and Hassan districts of Karnataka. No earlier reports from Kerala. So the present collection is an addition to the orchid flora of Kerala.

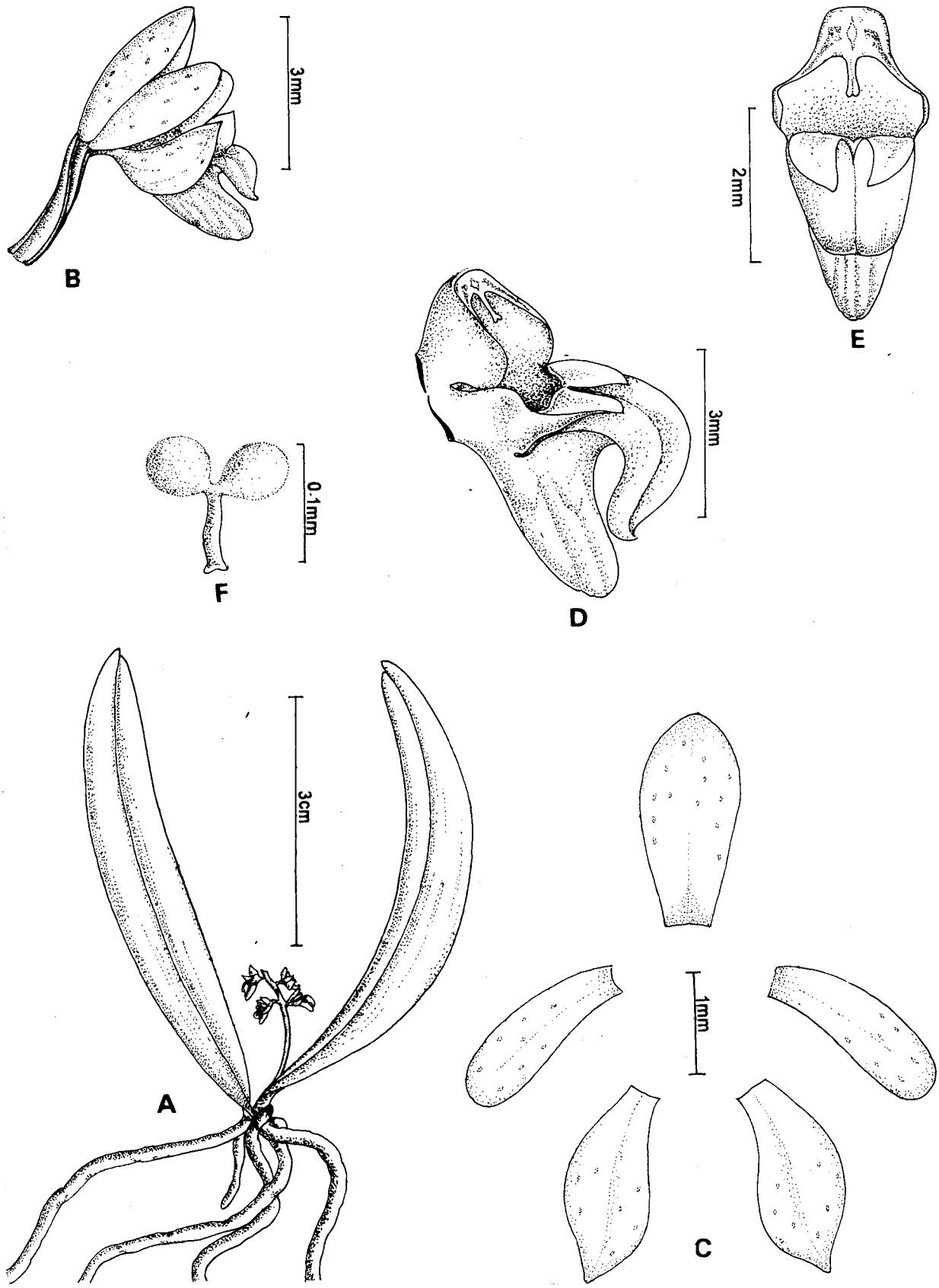


Fig. 30. *Gastrochilus flabelliformis* (Blatt. & McCann) Saldanha
A- Habit; B- FLower; C- Floral parts; D- Column with lip;
E- Column front view; F- Pollinia.

KINGIDIUM D. F. Hunt.

Short stemmed stout herbs; leaves sessile, distichous; peduncle leaf opposed; flowers in raceme; sepals and petals spreading; lateral sepals adnate to the base of the column to form a short mentum; lip 3 lobed, shortly clawed; column short, margins winged.

Key to the species

1a. Apex of the leaf unequally forked; disc with one pair of antennae 2
1b. Apex of the leaf acute; disc with two pairs of antennae ..... *K. niveum*

2a. Margin of the leaves undulate; mid lobe of the lip bifid ..... *K. deliciosum*
2b. Margin of the leaves entire; mid lobe of the lip one fid ..... *K. mysorensis*

Kingidium deliciosum (Reichb. f.) Sweet, Amer. Orch. Soc. Bull. 39: 1095 (1970); Sathish & Manilal, Cat. Ind. Orch. 77 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 445 (1995).

Phalaenopsis deliciosa Reichb. f., Bonpindia 2: 93 (1854).

Stem short; leaves 2-3, oblong-ovate, unequally bifid at apex, margin undulate; flowers in racemes, creamy yellow with purple markings; sepals and petals spathulate, narrower; lip 3 lobed, saccate, side lobes oblong, mid lobe cuneate, bifid; disc with two awned appendage.

Distribution & Ecology: Rare, collected from Silent Valley National Park and Vazhachal forests. Epiphytic on stream side trees on evergreen forests between 350m - 900 m.

Specimens examined: Stephen & Joy 007528 KFRI (Panthenthode, SVNP); Muktesh Kumar & Stephen 007604 KFRI (Vazhachal, Thrissur Dt.).

Kingidium mysorensis (Saldanha) Sathish, Cat. Ind. Orch. 95 (1994).

Phalaenopsis mysorensis Saldanha in Indian For. 100: 571. t. 3. (1974); Sald. & Nicols., Fl. Hasssan Dist. 842 (1976); Manilal, Fl. Silent Valley 300 (1988).

Stem short; leaves 2 or 3, elliptic, obovate, unequally forked, margin entire; flowers in racemes, white; lip 3 lobed, mid lobe brimmed; disc with one pair of awned appendage.

Distribution & Ecology: Rare, collected from Peria, Wayanad. Epiphytic on small shola trees between 900m - 1000m altitude. Prefers dense shady evergreen shola forests.

Specimens examined: Stephen 007626 KFRI (Kalarimotta, Wayanad).

Note: Endemic to South India.

Kingidium niveum Sathish, in Sathish & Manilal, Cat. Ind. Orch. 53 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 445 (1995).

Stem short; leaves 2, oblong elliptic, apex acute; flowers in racemes, purplish violet; lateral sepals broadly ovate; dorsal sepals and petals obovate; lip 3 lobed, side lobes erect, deep yellow, slightly toothed margin, mid lobe triangular, yellow, subentire; disc with 2 pairs of unequal antennae; column winged.

Distribution & Ecology: Very rare, collected from Siruvani. Epiphytic on bases of tree trunk in semi openings of the evergreen forests between 750m - 900 m. altitude.

Specimens examined: Stephen & Michael 008816 (Shinkampara, Siruvani).

Note: Endemic to Kerala.

LIPARIS L.C. Richard *nom. cons.*

Pseudobulbous herbs; leaves 2, continuous with the sheath or jointed on the pseudobulb; inflorescence terminal, many flowered; sepals and petals erect or reflexed, 3 lobed, adnate to the base of the column; column slender, incurved.

There are 7 species of *Liparis* occur in Kerala. Among this only 2 species viz. *L. elliptica* and *L. viridiflora* are epiphytic.

Key to the species

1a. Pseudobulbs slender and conical; leaves continuing with pseudobulb, linear lanceolate; petals linear, lip obscurely trilobed ..... *L. viridiflora*

1b. Pseudobulbs laterally compressed; leaves jointed on the pseudobulb; elliptic lanceolate; petals elliptic; lip trilobed ..... *L. elliptica*

Liparis elliptica Wt., Ic. 5(17), t. 1735 (1852); Sathish & Manilal, Cat. Ind. Orch. 78 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 446 (1995).

Delicate pseudobulbous herbs; pseudobulbs laterally compressed; leaves two, elliptic lanceolate; scape from between the leaves; flowers in raceme, greenish white; sepals and petals elliptic lanceolate; petals narrower than sepals; lip 3 lobed, recurved, subacute.

Distribution & Ecology: Not common, collected from Walakkad, Silent Valley National Park. Epiphytic on small trees in evergreen shola forests between 1000m - 1100m altitude. Occuring as small colonies in dense shady areas.

Specimens examined: Stephen 007581 KFRI (Walakkad, SVNP).

Liparis viridiflora (Bl.) Lindl., Gen. Sp. Orch. 31 (1830); Manilal, Fl. Silent Valley 291 (1988); Vajravelu, Fl. Palghat 483 (1990); Sathish & Manilal, Cat. Ind. Orch. 78 (1994).

Malaxis viridiflora Bl., Bijdr. 392. t. 54 (1825).

Tufted pseudobulbous herbs; pseudobulbs slender, ovoid; leaves 2, lanceolate; scape from between the leaves; flowers in raceme, many, pale green; sepals and petals dissimilar; petals linear, lateral sepals oblong; lip obscurely trilobed, recurved; column arched.

Distribution & Ecology: Common, occuring in evergreen as well as semievergreen forests in open or shade areas between 750m - 1300m altitude.

Specimens examined: Stephen 007571 KFRI (Chandanathode, Wayanad); Muktesh Kumar & Stephen 006744 KFRI (Chandanathode, Wayanad).

Note: One of the material (Stephen 007571 KFRI) collected from Chandanathode showed branched inflorescence.

LUISIA Gaudichaud

Fairly long stemmed herbs; leaves slender, terete; flowers on a short axillary peduncle; sepals and petals subequal; lip fleshy, entire or 3 lobed; column short; foot absent; pollinia 2.

Key to the species

1a. Leaf apex with a sharp pointed structure ..... *L. evangelinae*
1b. Leaf apex acute or subacute or blunted 2

2a. Leaf green with purple spots; epichile of the lip not lobed ..... *L. zeylanica*
2b. Leaf green without purple dots; epichile of the lip lobed 3

3a. Leaf tip with a short conical apiculum ..... *L. macrantha*
3b. Leaf tip without conical apiculum 4

4a. Lip white with purple markings, narrowly pandurate ..... *L. birchea*
4b. Lip uniformly reddish purple, uniformly wide ..... *L. abrahami*

Luisia abrahami Vatsala, Intr. Orch. 489 (1981); Sathish & Manilal, Cat. Ind. Orch. 79 (1994).

Scandent herbs, woody; leaves imbricate, terete, apex subacute; flowers in a leaf opposed raceme; sepals and petals pale green, flushed with pale purple, linear oblong; lip 3-lobed, side lobes auricular, mid lobe bilobed at apex, lobes slightly convex and subacute.

Distribution & Ecology: Rare, collected from Sasthanada, Quilon District. Seen between 150m - 600 m. altitude in the moist deciduous forests. Occuring as large colonies in open dry area.

Specimens examined: Stephen 007690 KFRI (Sasthanada, near Shanghly, Quilon Dt.).

Note: Endemic to Peninsular India.

Luisia birchea (A. Rich.) Bl., Rumphia 4:50 (1848); nom nud. Mus. Bot. Lugd. Bot. 1:64 (1849); Seidenf., Dansk Bot. Ark. 27(4): 35-38. 1971; Sathish & Manilal, Cat. Ind. Orch. 79 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 447 (1995).

Luisia tenuifolia auct. non. Bl., Rumphia 4: 50 (1848); nom, nud. Mus. Bot. 1: 63 (1849); Hook. f., Fl. British India 6: 24 (1890); Fischer in Gamble, Fl. Pres. Madras 1438 (1928).

Tufted woody herbs; leaves apex acute; flowers in raceme, greenish white with purple dots; lip 3 lobed, longer than sepals and petals, white with purple markings; hypochile auricled, lobules slightly fimbriate.

Distribution & Ecology: Rare, prefers high altitude evergreen shola forests of 1500m and above. Occurs in large colonies.

Specimens examined: Sasidharan 005457 KFRI (Sholayar, Trichur Dist.).

Luisia evangelinae Blatt. & McCann, Rev. Fl. Pres. Bombay 16: 493 (1932); Sathish & Manilal, Cat. Ind. Orch. 79 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 447 (1995).

Pendent fragile herbs; leaves slender with an awn like structure at the apex; flowers in raceme; sepals and petals white with purple and green tinge; lip pandurate, 3 lobed, without auricles, apex with two lobes; lobes sharp pointed.

Distribution & Ecology: Rare, collected from Silent Valley National Park. Occuring as isolated plants in evergreen forests between 900m - 1000 m. altitude. Prefers semi shaded localities.

Specimens examined: Stephen & Joy 006783 KFRI (Aruvanpara, SVNP); Stephen & Joy 007580 KFRI (Pathrakadavu, SVNP).

Luisia macrantha Blatter & McCann, in J. Bombay Nat. Hist. Soc. 35: 492, t. 10 (1932); Sathish & Manilal, Cat. Ind. Orch. 79 (1994).

Stout herbs; leaves green, apex bluntly rounded with a conical apiculum; flowers in raceme, facing downwards; sepals subequal, greenish yellow speckled with purple; petals

strap shaped; lip 3 lobed, hypochile with 2 rounded ear like lobes; epichile raised upwards ending in 2 lobules; lobules orbicular, obtuse.

Distribution & Ecology: Rare, epiphytic on *Careya arborea* at an altitude of 200 m.

Specimens examined: Chandrasekaran 89365 MH, 96603 MH, 96671 MH (Moozhiyar, Pathanamthitta).

Luisia zeylanica Lindl., Fol. Orch. 3 (1853); Seidenf., Dansk Bot. Ark. 27(4): 62 (1971); Manilal, Fl. Silent Valley 292 (1988); Sathish & Manilal, Cat. Ind. Orch. 79 (1994); Sasi. & Sivaraj., Fl Pl. Thrissur For. 447 (1995).

Erect tufted herbs; leaves with purple dots, apex acute; flowers in raceme, comparatively small, greenish yellow; sepals and petals boat shaped; lip not lobed ; epichile purple, rhomboid.

Distribution & Ecology: Common, prefers well exposed area and evergreen forest fringes between 750m - 1000m altitude.

Specimens examined: Muktesh Kumar & Stephen 006766 KFRI (Begur, Wayanad); Stephen & Joy 006782 KFRI (Nelliampathy).

OBERONIA Lindley *nom. cons.*

Tufted herbs; leaves equitant, laterally compressed, oblong or linear; inflorescence terminal, short or long, usually curved; flowers small, often reflexed; petals usually narrower than sepals; sepals varied; lip superior, sessile on the base of the column, spreading; column very short; pollinia 4.

Key to the species

1a. Lateral lobes of the lip folded upwards and encircling the column 2
1b. Lateral lobes of the lip spreading, if folded, not encircling the column 8

2a. Lip semiorbicular or ovate or reniform in outline 3
2b. Lip quadrate in outline 6

3a. Lip papillose ..... *O. chandrasekharanii*
3b. Lip glabrous 4

4a. petals entire; disc 2 saccate ..... *O. platycaulon*
4b. Petals sub entire; disc 1 saccate or indistinct 5

5a. Lateral lobes of the lip oblong obovate, wing like; disc crescent shaped ..... *O. sebastiana*
5b. Lateral lobes of the lip obliquely cuneate, ear like; disc ovate ..... *O. seidenfadeniana*

6a. Lateral lobes of the lip oblong-ligulate, wing like; apex of the lobules of mid lobe variously toothed, disc indistinct ..... *O. wightiana*
6b. Lateral lobes of the lip oblong elongated; apex of the lobules of mid-lobe entire or crenulate-serrulate 7

7a. Petals crossing each other; lip crenulate-serrulate ..... *O. josephii*
7b. Petals not crossing each other; lip entire ..... *O. wynadensis*

8a. Sepals and petals reflexed 9
8b. Sepals and petals not reflexed 19

9a. Scape terete or indistinct 10
9b. Scape flattened 13

10a. Petals and lip pappillose 11
10b. Petals and lip glabrous 12

11a. Lip with 2 minute calli at base ..... *O. ensiformis*
11b. Lip without calli ..... *O. ferruginea*

12a. Sepals sparsely papillose outside ..... *O. thwaitesii*
12b. Sepals glabrous ..... *O. verticillata*

13a. Lip deeply denticulate along margin 14
13b. Lip subentire or shallowly crenate 15

14a. Rachis densely flowered ..... *O. irtdifolia*
14b. Rachis laxly flowered ..... *O. gammiei*

15a. Spike with a distinct sterile tip 16
15b. Spike without sterile tip 17

16a. petals linear oblong, obtuse-truncate at apex ..... *O. agastyamalayana*
16b. Petals lanceolate, acute at apex ..... *O. brunoniana*

17a.Petals circinate; spike upto 20 cm long 18
17b. Petals not circinated; spike upto 40 cm long; lip reflexed; disc ovate-lanceolate ..... *O. anamalayana*

18a. Plant small; leaves 3-5 cm; disc globular ..... *O. forcipata*
18b. Plants large; leaves upto 7 cm disc ovate ..... *O. santapaui*

19a. Lateral lobes of the lip raised vertically like two horns 20
19b. Lateral lobes of the lip otherwise 21

20a. Mid lobe of the lip 3 fid; lateral lobes sorrounding the column ..... *O. tenuis*
20b. Mid lobe of the lip 2 fid; lateral lobes diverged ..... *O. bicornis*

21a. Lip not lobed ..... *O. proudlockii*
21b. Lip 3 lobed 22

22a. Bracts longer than the pedicel and ovary ..... *O. longibracteata*
22b. Bracts shorter than the pedicel and ovary 23

23a. Lateral lobes and mid lobe of the lip irregularly dentate ..... *O. brachyphylla*
23b. Lateral lobes and mid lobe of the lip subentire ..... *O. recurva*

Oberonia agastyamalayana Sathish, in Sathish & Manilal, Cat. Ind. Orch. 57 (1994).

Tufted pendulous herbs; leaves linear ensiform; flowers in verticels; sepals and petals reflexed, sepals sparsely gland dotted; petals linear oblong, obtuse-truncate at apex; lip 3 lobed, sparsely gland dotted, mid lobe 2 lobulate, lobules orbicular with sinus in between; disc ovate, saccate.

Distribution & Ecology: Rare, reported from Agastyamala Hills, Trivandrum. Occurs between 900m - 1000m altitude.

Specimens examined: Sathish 1398 TBGT (Agastyamala, TVM).

Note: Endemic to Kerala.

Oberonia anamalayana Joseph, J. Indian Bot. Soc. 42 (2): 222 (1963); Abraham & Vatsala, Intr. Orch. 425 (1981); Manilal, Fl. Silent Valley 294 (1988); Ansari & Balak., Orch. Monogr. 4: 19. t. 13 (1990); Sathish & Manilal, Cat. Ind. Orch. 80 (1994).

Large erect herbs; leaves fleshy, oblong, brown; flowers greenish yellow brown, in verticels; sepals and petals reflexed, gland dotted; petals linear, obtuse; lip 3 lobe, ovate, gland dotted, glabrous, shallowly crenate; mid lobe 2 lobuled, lobules orbicular; disc ovate lanceolate.

Distribution & Ecology: Rare, collected from Munnar and Nelliampathy. Occuring as large colonies in evergreen forests betweeen 900m - 1500m altitude.

Specimens examined: Stephen & Joy 007220 KFRI (Victoria, Nellaimpathy); Stephen & Michael 008169 KFRI (Lockart gap, Munnar).

Note: Endemic to Southern Western Ghats.

Oberonia bicornis Lindl., Gen. Sp. Orch. 16 (1830), Fol. Orch. *Oberonia* 4. 1859; Seidenf., Dansk Bot. Ark. 25 (3): 85 (1968); Manilal, Fl. Silent Valley 294 (1988); Ansari & Balak., Orch. Monogr. 4: 31. t. 28 (1990); Sathish & Manilal, Cat. Ind. Orch. 80 (1994).

Malaxis bicornis (Lindl.) Reichb. f., Walp. Ann. 6: 211 (1861); Hook. f., Fl. British India 5: 682 (1888).

Pendulous herbs; leaves linear-oblong; scape indistinct; flowers orange red; in verticels; sepals and petals spreading; gland dotted; petals elliptic or linear, subentire; lip 3 lobed, lateral lobes bend upwards round the column; mid lobe 2 lobuled, gland dotted, lobules ovate-triangular; disc crescent shaped.

Distribution & Ecology: Very rare, collected from Nelliampathy, Palghat. Epiphytic on *Canarium strictum* in the evergreen forests at an altitude of 850m.

Specimens examined: Stephen 008106 KFRI (Ranimedu, Nelliampathy).

Oberonia brachyphylla Blatt. & McCann, J. Bombay Nat. Hist. Soc. 35: 257 (1931); Seidenf., Dansk Bot. Ark. 25.(3): 91 (1968); Ansari & Balak., Orch. Monogr. 4: 38. t. 35 (1990); Sathish & Manilal, Cat. Ind. Orch. 80 (1994).

Erect or pendulous herbs; leaves oblong, ensiform; flowers greenish yellow, scattered in the rachis; sepals and petals reflexed, gland dotted; petals oblong, obtuse, dentate; lip quadrate, 3 lobed, gland dotted; lateral lobes ear like, dentate, mid lobe 2 lobules, lobules oblong, irregularly dentate at apex; disc obovate-orbicular.

Distribution & Ecology: Rare, collected from Sholayar, Thrissur. Epiphytic on *Boemaria malabarica* in association with *Luisia evangilinae*. Prefers an altitude of 500m - 850m.

Specimens examined: Stephen 007894 KFRI (Sholayar, Thrissur Dt.).

Note: Endemic to Western Ghats.

Oberonia brunoniana Wt., Ic. t. 1622 (1851); Hook. f., Fl. British India 5: 681 (1888); Fischer in Gamble, Fl. Pres. Madras 1406 (1928); Seidenf., Dansk Bot. Ark. 25(3): 50 (1968); Manilal, Fl. Silent Valley 296 (1988); Vajravelu, Fl. Palghat 486 (1990); Ansari & Balak., Orch. Monogr. 4: 15. t. 9 (1990); Sathish & Manilal, Cat. Ind. Orch. 81 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 449 (1995).

Erect herbs; leaves oblong-ensiform; flowers brick red, in verticels; sepals and petals reflexed, gland dotted; petals lanceolate, obtuse or acute, subentire; lip ovate, 3 lobed, gland dotted; lateral lobes ear like, mid lobe 2 lobuled, lobules rounded or truncate at apex; disc ovate, saccate.

Distribution & Ecology: Occasional, collected from Silent Valley National Park at an altitude of 1700m and from Wayanad at an altitude of 600m. Prefers open or semi shade areas between 600m - 1800m.

Specimens examined: Stephen 007881 KFRI (Sispara ghat, SVNP); Stephen 007693 KFRI (Kuruva island, Wayanad).

Note: Endemic to Southern Western Ghats.

Oberonia chandrasekharanii Nair, Ramachandran & Ansari, Blumea 28: 361-362 (1983); Manilal, Fl. Silent Valley 296 (1988); Ansari & Balak., Orch. Monogr. 4: 12. t. 5 (1990); Sathish & Manilal, Cat. Ind. Orch. 81 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 450 (1995).

Pendulous herbs; leaves ensiform; flowers greenish yellow, in verticels; sepals and petals reflexed, gland dotted; petals linear, truncate, denticulate; lip semiorbicular or reniform, 3 lobed, gland dotted, papillose; lateral lobes cuneate and auriform, ovate, saccate.

Distribution & Ecology: Rare, collected from Wayanad.

Specimens examined: Stephen 007572 KFRI (Begur R.F, Wayanad); Stephen 008846 KFRI (Chanadanathode, Wayanad).

Note: Endemic to Western Ghats.

Oberonia ensiformis (J.E.Sm.) Lond., Fol. Orch. Oberon. 4 (1859); Hook. f., Fl. British India 5: 679 (1888); Seidenf., Dansk Bot. Ark. 25(3): 53 (1968); Ansari & Balak., Orch. Monogr. 27. t. 22 (1990); Sathish & Manilal, Cat. Ind. Orch. 81 (1994).

Malaxis ensiformis Sm., Rees. Cyclop. 22 (1812).

Pendulous herbs; leaves ensiforme; spike shorter than the leaves; flowers pale yellow, in verticils; sepals and petals reflexed, gland dotted; petals ovate-lanceolate, irregularly dentate; lip quadrate with two minute calli at base, 3 lobed, gland dotted, papillose; lateral lobes wing like; midlobe obreniform, 2 lobuled, lobules rounded; disc concave.

Distribution & Ecology: Rare, collected from Poochipara, Silent Valley National Park. Prefers dense shade area in evergreen forests between 1000m -1100m altitude.

Specimens examined: Stephen 008847 KFRI (Poochipara, SVNP).

Oberonia ferruginea Par. ex. Hook. f., Fl. British India 5:679 (1888); Seidenf., Dansk Bot. Ark. 25 (3): 55 (1968); Sathish & Manilal, Cat. Ind. Orch. 81 (1994).

Pendulous herbs; leaves ensiforme; flowers yellow, in verticils; sepals and petals reflexed; petals linear oblong, fimbriate; lip quadrate, 3-lobed, fimbriate, lateral lobes narrow, short ascending, mid lobe 2 lobuled, lobules rounded, crenate, fimbriate.

Distribution & Ecology: Rare, prefers an altitude of 500m - 2000m.

Oberonia forcipata Lindl., Fol. Orch. Oberonia 2, (1859); Jayaweera in Dassanayake & fosberg (Ed.) Rev. Handb. Fl. Ceylon 2: 12 (1981).

Tufted erect or pendulous herbs; leaves distichous, ensiforme, acute; flowers yellowish brown, sepals and petals dissimilar, reflexed; petals linear, circinate; lip qudrate-ovate, 3 lobed, margin crenulate; midlobe 3 lobuled; disc globular (Fig. 31).

Distribution & Ecology: Very rare, collected from Tholpatty, Wayanad. Epiphytic on *Tectona grandis* in the moist deciduous forests at an altitude of 650m.

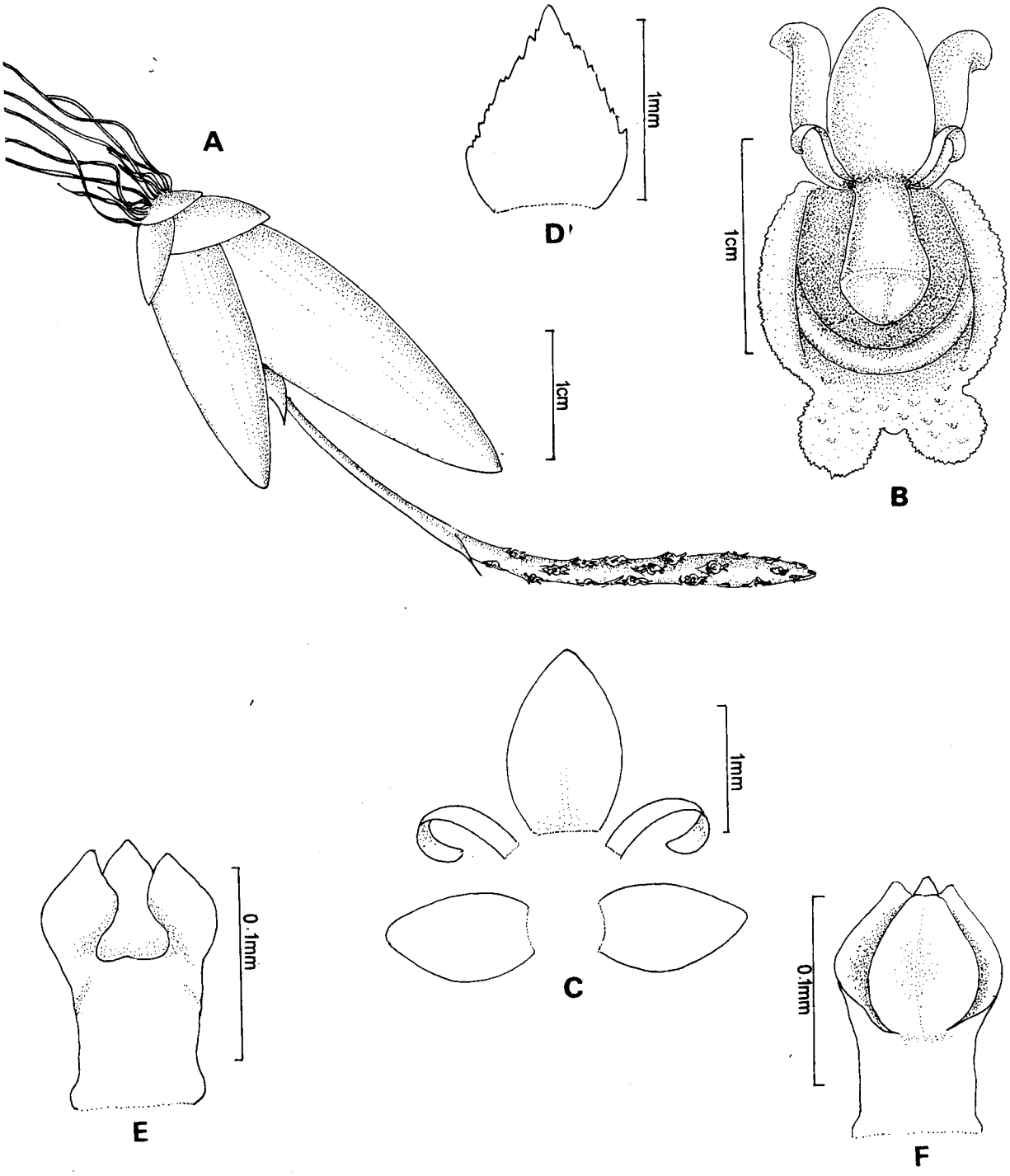


Fig. 31. *Oberonia forcipata* Lindl. A- Habit; B- Flower; C- Floral parts; D- Bract; E- Column ventral side; F- Column dorsal side.

Specimens examined: Muktesh Kumar & Stephen 006762 KFRI (Tholpatty range, Wayanad).

Note: So far reported only from Sri Lanka and hence is a new record to India.

Oberonia gammiei King & Pantl., Journ. As. Soc. Bengal II 66: 578 (1897); Seidenf., Dansk Bot. Ark. 25(3): 45 (1968); Sathish & Manilal, Cat. Ind. Orch. 81 (1994)

Erect herbs; leaves oblong-ensiforme; spike laxly flowered; flowers pale yellow; sepals and petals reflexed, sparsely gland dotted; petals ovate, denticulate; lip quadrate, 3-lobed, sparsely gland dotted. lateral lobes denticulate, midlobe 2-lobuled, lobules triangular, dentate; disc ovate.

Distribution & Ecology: Rare, collected from Kuruva island, Wayanad. Prefers an altitude of 600m - 700m in open or semi shade areas.

Specimens examined: Stephen 008852 KFRI (Kuruva island, Wayanad).

Oberonia iridifolia (Roxb.) Lindl., Wall. Cat. No. 1948; Gen. Sp. Orch. 15 (1830); Hook. f., Fl. British India 5:675 (1888); Ansari & Balak., Orch. Monogr. 4: 38. t. 35 (1990); Seidenf., Dansk Bot. Ark. 25(3): 42 (1968); Sathish & Manilal, Cat. Ind. Orch. 81 (1994).

Cymbidium iridifolium Roxb. 63 (1814).

Pendulous or erect herbs; leaves broadly ensiforme; spike densely flowered; flowers pale yellow, in verticils; sepals and petals reflexed,; petals oblong, denticulate; lip quadrate, 3-lobed, deeply denticulate, lateral lobes indistinct, denticulate, midlobe 2-lobuled, lobules truncate at apex;, denticulate; disc indistinct.

Distribution & Ecology: Common, from low altitude to high altitude. Mostly prefers 50m - 1500m altitude and open exposed areas.

Specimens examined: Stephen 007632 KFRI (Kuruva island, Wayanad).

Oberonia josephii Saldanha, Ind. For. 100: 568 (1974); Ansari & Balak., Orch. Monogr. 4: 14 (1990); Sathish & Manilal, Cat. Ind. Orch. 81 (1994).

Erect or pendulous herbs; leaves ensiform, acute; spike with a definite sterile portion at the apex; flowers orange, in distinct verticils; sepals and petals reflexed; petals oblong-ovate, minutely toothed, crossing each other; lip quadrate, 3 lobed, sparsely gland dotted; lateral lobes oblong, elongate, folded upwards and encircling the column; midlobe 2 lobuled, lobules orbicular, crenulate, serrulate; disc ovate, saccate (Fig. 32).

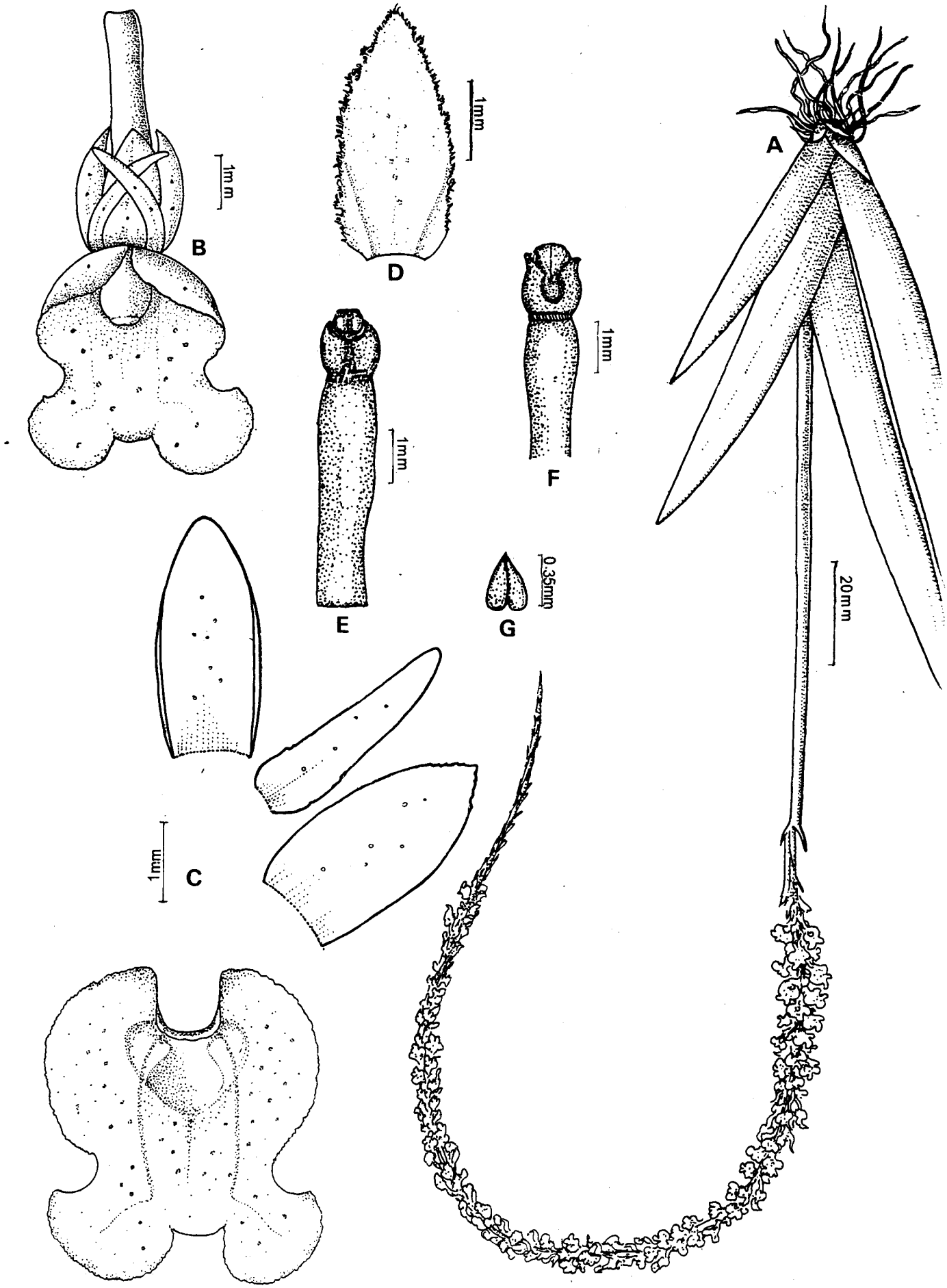


Fig. 32. *Oberonia josephii* Saldanha A- Habit; B- FLower, C- Floral parts; D- Bract; E- Column dorsal side; F- Column ventral side; G- Pollinia.

Distribution & Ecology: Rare, collected from Tirunelly, Wayanad. Epiphytic on branches of trees in the evergreen shola forests between 1000m - 1100m altitude. Associated with *Eria polystachya.*

Specimens examined: Stephen & Michael 008115 KFRI (Vengavalumala, Thirunelly, Wayanad).

Note: This has been earlier reported only from Hassan district of karnataka and hence is a new record to Kerala. According to Ansari & Balakrishnan (1990) the petals of *O. josephii* are not always arching backwards and crossing each other. But the present collection showed the crossing petals and agrees with the Saldanha's original description.

Oberonia longibracteata Lindl., Gen. Sp. Orch. 15 (1830); Fol. Orch. Oberon. 2 (1859); Hook. f., Fl. British India 5: 678 (1888); Seidenf., Dansk Bot. Ark. 25(3): 83 (1968); Ansari & Balak., Orch. Monogr. 4: 39.t. 37 (1990); Sathish & Manilal, Cat. Ind. Orch. 81 (1994).

Erect acaulescent herbs; leaves linear oblong, ensiform; flowers yellowish, scattered; bract longer than the pedicel and ovary linear lanceolate, sepals and petals spreading, gland dotted; petals oblong acute, subentire; lip quadrate, 3 lobed, gland dotted; lateral lobes wing like, subentire; mid lobe obscurely 2 lobuled; disc ovate.

Distribution & Ecology: Rare, prefers high altitude of about 1700m in the evergreen shola forests.

Specimens examined: C.N. Mohanan 0072814 MH (Sivagiri hills, near Elatheri, Idukki Dt.).

Oberonia platycaulon Wt., Ic. t. 1623 (1851); Lind., Fol. Orch. Oberon. 2 (1859); Hook. f., Fl. British India 5: 682 (1888); Seidenf., Dansk Bot. Ark. 25.(3): 51 (1968); Ansari & Balak., Orch. Monogr. 4: 13. t. 6 (1990); Sathish & Manilal, Cat. Ind. Orch. 81 (1994).

Erect caespitose herb; leaves ensiform, acute; flowers orange yellow, scattered on the rachis; sepals and petals reflexed, sparsely gland dotted; petals linear, entire; lip semiorbicular or ovate, 3 lobed, gland dotted; lateral lobes oblong- cuneate, ear like, encircling the column; midlobe 2 lobuled with a distinct lobule like protruberance at the sinus; disc ovate, bisaccate.

Distribution & Ecology: Rare, collected from Sispara, Silent Valley National park. Prefers moist shady areas in evergreen shola forests between 1600m - 1900m altitude. Associated with *Bulbophyllum sp.*

Specimens examined: Stephen 007879 KFRI (Sispara ghat, SVNP).

Note: Lesser known species, endemic to Southern Western Ghats.

Oberonia proudlockii King and Pantl., J. As. Soc. Bengal 66: 580 (1896); Fischer in Gamble, Fl. Pres. Madras 1406 (1928); Seidenf., Dansk Bot. Ark. 25(3) : 22 (1968); Manilal, Fl. Silent Valley 297 (1988); Ansari & Balak., Orch. Monogr. 4: 34. t. 29 (1990); Sathish & Manilal, Cat. Ind. Orch. 81 (1994).

Erect or pendulous herbs; leaves ovate oblong; flowers greenish yellow, scattered; sepals and petals spreading, gland dotted; petals linear or oblong, subentire; lip not lobed, suborbicular with two minute protruberance at apex, irregularly denticulate; disc suborbicular or obovate, cushion like.

Distribution & Ecology: Rare, collected from Punnamala, Silent Valley National Park. Epiphytic on small trees in shady evergreen forests between 850m - 1300m altitude.

Specimens examined: Joy & Stephen 007261 KFRI (Punnamala, SVNP).

Note: Endemic to Western Ghats.

Oberonia recurva Lindl., Bot. Reg. 25: 8 (1839); Fol. Orch. Oberon. 5 (1859); Hook. f., Fl. British India 5: 680 (1888); Ansari & Balak., Orch. Monogr. 4: 38. t. 36 (1990); Sathish & Manilal, Cat. Ind. Orch. 81 (1994).

Erect or pendulous herbs; leaves linear ensiforme; flowers orange yellow, in verticils; sepals and petals spreading, gland dotted; petals oblanceolate, subentire; lip quadrate, 3 lobed, gland dotted; lateral lobes ear like, curved upwards; mid lobe 2 lobuled, lobules ovate; disc obovate.

Distribution & Ecology: Very rare, collected from Poochipara, Silent Valley National Park. Prefers highly shaded areas in the evergreen forests between 900m - 2000m altitude.

Specimens examined: Stephen 008848 KFRI (Poochipara, SVNP).

Oberonia santapaui Kapad., J. Bombay Nat. Hist. Soc. 57: 265. 1960; Seidenf., Dansk Bot. Ark. 25 (3): 50 (1968); Manilal, Fl. Silent Valley 297 (1988); Vajravelu, Fl. Palghat 487 (1990); Ansari & Balak., Orch. Monogr. 4: 18. t. 12 (1990); Sathish & Manilal, Cat. Ind. Orch. 81 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 450 (1995).

Erect or pendulous herbs; leaves oblong; flowers reddish brown, in verticils; sepals and petals gland dotted, reflexed; petals linear, circinate; lip ovate, 3 lobed, gland dotted; lateral lobes longitudinally elongated, shallowly crenate; midlobe two lobuled, lobules oblong, shallowly crenate, rounded at apex; disc ovate.

Distribution & Ecology: Occasional, prefers shaded or semi shaded areas in the evergreen forests between 800m - 1100m altitude.

Specimens examined: Stephen & Joy 007295 KFRI (Aruvanpara, SVNP); Stephen 007578 KFRI (Walakkad, SVNP); Stephen 008849 KFRI (Punnamala, SVNP).

Note: Endemic to Western Ghats.

Oberonia sebastiana Shetty & Vivek., Bull. Bot. Surv. India 17: 157 (1975/1978); Ansari & Balak., Orch. Monogr. 4: 11. t. 4 (1990); Sathish & Manilal, Cat. Ind. Orch. 81 (1994).

Pendulous herbs; leaves ensiforme; flowers yellow; sepals and petals reflexed, glabrous; petals oblong, obtuse, subentire; lip semiorbicular, 3 lobed, gland dotted, glabrous; lateral lobes oblong-ovate, wing like, subentire; midlobe 2 lobuled, lobules obovate, subentire; disc crescent shaped.

Distribution & Ecology: Rare, prefers an altitude of 1500m - 2500m.

Specimens examined: K.M. Sebastine 17517 MH (Idukki); Shetty & Vivekanandan 26480, 33404 MH (Idukki); Rathakrishnan 16238 MH (Munnar).

Note: Endemic to Southern Western Ghats.

Oberonia seidenfadeniana Joseph & Vajravelu, Bull. Bot. Surv. India 13: 344 (1971); Ansari & Balak., Orch. Monogr. 4: 14. t. 7 (1990); Sathish & Manilal, Cat. Ind. Orch. 81 (1994).

Erect or pendulous herbs; leaves ensiforme; spike with a sterile tip; flowers greenish yellow, in verticils; sepals and petals reflexed, glabrous; petals oblong, obtuse, subentire; lip semiorbicular, 3 lobed, sparsely gland dotted, glabrous; lateral lobes broader than midlobe, oblong or obliquely cuneate, ear like; midlobe 2 lobuled; disc ovate, saccate.

Distribution & Ecology: Rare, prefers an altitude of 100m - 1500m.

Specimens examined: J. Joseph 17476 MH (Coimbatore).

Note: Endemic to Southern Western Ghats.

Oberonia tenuis Lindl., Fol. Orch. *Oberonia*, 4 (1859); Hook. f., Fl. British India 5: 682 (1888); Seidenf., Dansk Bot. Ark. 25(3) 86 (1968); Manilal, Fl. Silent Valley 298 (1988); Sathish & Manilal, Cat. Ind. Orch. 81 (1994).

Erect or pendulous herbs; leaves linear oblong, falcate; flowers orange red; sepals and petals spreading; petals narrow, linear, entire; lip 3 lobed; lateral lobes linear, incurved to circle around the column; midlobe obscurely 3 lobed.

Distribution & Ecology: Very rare, prefers shaded areas in the evergreen forest between 800m - 1000m altitude.

Specimens examined: Sathish Kumar 10762 CALI (Dam site, SVNP).

Oberonia thwaitesii Hook. f., Fl. British India 5: 678 (1888); Ansari & Balak., Orch. Monogr. 4: 27. t. 23 (1990); Sathish & Manilal, Cat. Ind. Orch. 81 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 451 (1995).

Erect or pendulous herbs; leaves oblong, ensiforme, slightly falcate; flowers pale yellow, in verticils; sepals and petals reflexed, sparsely gland dotted; sepals sparsely papillose outside; petals ovate, subentire, glabrous; lip obovate, 3 lobed, gland dotted, glabrous; lateral lobes rounded, auricular, folded upwards; midlobe 2 lobuled, lobules oblong or cuneate, toothed; disc indistinct.

Distribution & Ecology: Rare, prefers an altitude of 200m - 1000m.

Specimens examined: Sasidharan 005080 KFRI (Elanad, Trichur Dt.); Sasidharan 003971 KFRI (Peechi, Trichur).

Oberonia verticillata Wt., Ic. 1626 (1851); Lindl., Fol. Orch. Oberon. 3 (1859); (Excel. var. *pubescence khasiana and gigantea*; Hook. f., Fl. British India 5: 677 (1888); Seidenf., Dansk Bot. Ark. 25 (3): 30 (1968); Joseph, Orch. Nilgiris 88 (1982).

Pendulous herbs; leaves oblong ensiforme; flowers pale yellow, in verticils; sepals and petals sparsely gland dotted, reflexed, glabrous; petals oblong or ovate, subentire; lip cuneate-obovate, 3 lobed, gland dotted; lateral lobes auriculate; midlobe 2 lobuled, lobules orbicular, ovate or oblong, distantly serrate; disc indistinct.

Distribution & Ecology: Rare, prefers an altitude of 500m - 2200m.

Specimens examined: J. Joseph 0044615 MH (Trivandrum).

Note: Endemic to Western Ghats.

Oberonia wightiana Lindl., Bot. Reg. Misc. 9 (1839); Wt., Ic. 5(1): 3, t. 1627 (1851); Hook. f., Fl. British India 5: 683 (1890); Fischer in Gamble, Fl. Pres. Madras 1407 (1928); Seidenf., Dansk Bot. Ark. 25(3): 24 (1968); Manilal, Fl. Silent Valley 298 (1988); Ansari & Balak., Orch. Monogr. 4: 24. t. 19 (1990); Sathish & Manilal, Cat. Ind. Orch. 81 (1994);

Malaxis wightiana (Lindl.) Kuntze Rev. Gen. Pl. 3: 669 (1891).

Pendulous herbs; leaves oblong, ensiforme; flowers orange yellow, scattered; sepals and petals glabrous, reflexed; petals linear, entire; lip quadrate, 3 lobed; lateral lobes oblong, ligulate, wing like, folded upwards; midlobe 2 lobuled, lobules ligulate, entire or toothed; disc indistinct.

Distribution & Ecology: Rare, collected from Sispara, Silent Valley. Epiphytic on *Syzygium sp. and Rhododendron sp.* Prefers an altitude of 1800m - 2300m in evergreen sholas.

Specimens examined: Stephen 007884 KFRI (Sispara, SVNP).

Oberonia wynadensis Sivadasan & Bala., Nordic J. Bot. 9(4): 395-397 (1989); Sathish & Manilal, Cat. Ind. Orch. 81 (1994);

Tufted pendulous herbs; leaves ensiforme; flowers yellow; sepals and petals reflexed, glabrous; petals linear-oblong, apex acute, entire; lip quadrate, 3 lobed, glabrous; lateral lobes slightly longer than midlobe, entire; midlobe 2 lobulate, lobules entire.

Distribution & Ecology: Rare, so far reported only from Wayanad.

PAPILIONANTHE Schlechter

Papilionanthe subulata (Koen.) Garay, Bot. Mus. Leafl. Harvard Univ. 23 (10): 372 (1974); Manilal, Fl. Silent Valley 299 (1988); Vajravelu, Fl. Palghat 488 (1990); Sathish & Manilal, Cat. Ind. Orch. 82 (1994).

Epidendrum subulatum Koen. in Retz., Obs. 6: 51 (1791).

Slender elongate herbs; leaves terete; flowers solitary or in pairs, fragrant, pink; sepals ovate oblong; petals broadly lanceolate; lip 3 lobed; side lobes erect; mid lobe fleshy, with ridges; spur conical; throat deep pink with yellow; pollinia 2.

Distribution & Ecology: Occassional, prefers semi exposed riverine areas in the evergreen forests between 900m - 1500m altitude.

Specimens examined: Muktesh Kumar & Stephen 007237 KFRI (Rajamallay, Munnar).

PHOLIDOTA Lindley ex W.J. Hook.

Pholidota pallida Lindl., Bot. Reg. Sub. t. 1777 (1825); Manilal, Fl. Silent Valley 301 (1988); Vajravelu Fl. Palghat 49 (1990); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 452 (1995).

Pholidota imbricata sensu Lindl., Bot. Reg. t. 1213. 1825; non Lindl. in Hook., Exot. Fl. t. 138 (1825); Fischer in Gamble, Fl. Pres. Madras 1431 (1928).

Large pseudobulbous tufted herbs; pseudobulbs angled; leaves solitary, oblong-lanceolate; inflorescence drooping, spike slender; flowers white or pinkish, in two rows of imbricate

bracts; sepals concave; petals linear; lip 3 lobed, saccate, side lobes triangular, erect, mid lobe 2 lobulate; pollinia 4.

Distribution & Ecology: Common in the riverine areas. Found in almost all the tree species in the riparian areas in the evergreen forests between 700m - 1000m altitude.

Specimens examined: Muktesh Kumar & Stephen 006740 KFRI (Chandanathode, Wayanad); Joy & Stephen 007569 KFRI (Kummatanthode, SVNP).

PHRETIA Lindley

Phretia elegans Lindl., Gen. & Sp. Orch. 63., in Journ. Linn. Soc. 361 (1830); Hook. f., Fl. British India 5: 810 (1890); Sathish & Manilal, Cat. Ind. Orch. 83 (1994).

Tufted, pseudobulbous herbs; leaves distichous, equitant; linear; flowers in many flowered racemes, white, minute; sepals, broadly triangular; petals shorter, broadly ovate; lip clawed, obscurely 3 nerved; column short; pollinia 8.

Distribution & Ecology: Very rare, collected from Muthikulam, Siruvani. Occuring as small colonies in evergreen shola forests near streams between 1300m - 1500m altitude.

Specimens examined: Stephen & Michael 008822 KFRI (Muthikulam, Siruvani).

PODOCHILUS Blume

Podochilus malabaricus Wt., Ic. t. 1748 (1851); Hook. f., Fl. British India 6: 80 (1890); Sathish & Manilal, Cat. Ind. Orch. 84 (1994).

Tufted herbs with slender stems; leaves erect, equitant, coriaceous, acute; flowers in raceme, terminal, white; sepals and petals white, tipped with bright violet, sepals lanceolate-ovate; lateral sepals attached to the foot of the column forming a spur like mentum; petals obovate; lip small, tongue shaped, attached to the foot of the column, oblong-lanceolate; column short; pollinia 4.

Distribution & Ecology: Rare, found in Peria of Wayanad and Siruvani of Palghat District. In Wayanad it is found in open areas in isolated trees but in Siruvani it is attached on the upper canopy of the trees in dense shade areas evergreen forests. Prefers an altitude of 750m - 900m.

Specimens examined: Stephen 007629 KFRI (Kalarimotta, Peria, Wayanad).

POLYSTACHYA W.J. Hooker *nom. cons.*

Polystachya concreta (Jacq.) Garay & Sweet, Orchideologia 9(3): 206 (1974); Manilal, Fl. Silent Valley 301 (1988); Sathish & Manilal, Cat. Ind. Orch. 84 (1994).

Pseudobulbous leafy herbs; leaves oblong-lanceolate; flowers in simple or branched racemes, greenish yellow; sepals ovate; petals linear oblong; lip 3 lobed, side lobes erect; mid lobe broadly oblong, deflexed at top.

Distribution & Ecology: Common, occurs from low elevations to 1000m. Epiphytic on *Mesua sp., Emblica officianalis* etc,. Prefers shaded as well as open exposed area.

Specimens examined: Stephen & Joy 007270 KFRI (Parathode, SVNP); Stephen & Joy 007284 KFRI (Chembotti, SVNP).

POMATOCALPA Breda

Pomatocalpa spicata Breda, Gen. & Sp. Orch. et. Asclep. Fasc. 3 t. 15 (1829); Sathish & Manilal, Cat. Ind. Orch. 84 (1994).

Short stemmed herbs; leaves oblong; inflorescence many flowered; flowers small, yellowish; sepals and petals similar; lip 3 lobed, with a saccate spur; lateral lobes triangular; mid lobe curved, ovate; tongue placed deep inside; column short, footless.

Distribution & Ecology: Not common, collected from Meenmutty, New Amarambalam. Epiphytic in semi exposed areas in the evergreen forests at an altitude of 600m.

Specimens examined: Stephen 008101 KFRI (Meenmutty, New Amarambalam); Sasidharan 0759 KFRI (Walayar, Palaghat Dt.).

PORPAX Lindley

Minute pseudobulbous herbs; pseudobulbs flat, discoid, covered with reticulately nerved sheaths; leaves 2; flowers solitary, sessile; sepals connate below into a tube; petals free, more or less included within the tube; lip short somewhat 3 lobed, attached to the foot of the column; column short; pollinia 8.

Key to the species

1a. Flowers pubescent outside glabrous inside ..... *P. jerdoniana*
1b. Flowers glabrous outside, inside papillose ..... *P. reticulata*

Porpax jerdoniana (Wt.) Rolfe, Orch. Rev. 16: 18 (1908); Fischer in Gamble, Fl. Pres. Madras 1422 (1928); Manilal, Fl. Silent Valley 302 (1988); Vajravelu Fl. Palghat 491 (1990); Sathish & Manilal, Cat. Ind. Orch. 84 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 452 (1995).

Pseudobulbs discoid with reticulately veined sheaths; leaves 2, oblong orbicular, ciliate; flowers dirty orange brown, 2 lipped, densely tomentoses; sepals unequal, tomentose; petals parallel, linear-oblong; lip minute, clawed, lobed; side lobes erect, limb oblong, minutely papillate.

Distribution & Ecology: Rare, collected from Sasthanada, Quilon. Epiphytic at the base of the tree trunk in open exposed localities in the moist deciduous forests between 150m - 300m altitude.

Specimens examined: Muktesh Kumar & Stephen 007691 KFRI (Sasthanada, Quilon Dt.)

Note: Endemic to Western Ghats.

Porpax reticulata Lindl., Bot. Reg. Misc. 31 (1845); Fischer in Gamble, Fl. Pres. Madras 1422 (1928); Manilal, Fl. Silent Valley 302 (1988); Vajravelu, Fl. Palghat 492 (1990); Sathish & Manilal, Cat. Ind. Orch. 84 (1994).

Pseudobulbous; Pseudobulbs button like covered with white reticulate sheaths; leaves sessile, broadly oblong; flowers solitary, arising from below the pseudobulb; tubular, deep red brown; sepals united to form a tube like form, saccate at base, 3 lobed at apex, glabrous outside, densely and minutely papillose; lip panduriform, 3 lobed, toothed at the base, clawed; lateral lobe erect; mid lobe suborbicular, irregularly denticulate, densely papillose.

Distribution & Ecology: Common, prefers semishaded areas in the evergreen forests between 300m - 800m altitude.

Specimens examined: Joy & Stephen 007512 KFRI (Pathrakadavu, SVNP); Stephen & Michael 008802 KFRI (Nadugani, Nilambur).

PTEROCERAS Hasskarl

Pteroceras leopardinum (Par. & Reichb. f.) Seidenf. & Smitin., in Oper. Bot. 95: 1-395 (1988); Sathish & Manilal, Cat. Ind. Orch. 84 (1994).

Sarchochilus leopardinus Par. & Reichb. f. in Trans. Linn; Soc. 30. 145. ( ); Hook. f., Fl. British India 6: 38 (1890).

Short stemmed herbs;leaves fleshy, obtuse; flowers in raceme, yellow spotted with purple; sepals broadly oblong; lateral sepal attached to the foot of the column, dorsal smaller; petals small; lip 3 lobed; side lobes wing like, mid lobe small, recurved, ovate, white spotted with purple; spur large, fleshy with a dorsal callus at mouth.

Distribution & Ecology: Rare.

RHYNCOSTYLIS Blume

Rhyncostylis retusa (L.) Bl., Bijdr. 286, t. 49 (1825); Wt., Ic. t. 1745-46 (1852); Hook. f., Fl. British India 6: 32 (1890); Fischer in Gamble, Fl. Pres. Madras 1440 (1928); Sathish & Manilal, Cat. Ind. Orch. 84 (1994).

Epidendrum retusum L., Sp. Pl., 953 (1753).

Woody herbs; stems covered with older leaves; leaves thick, alternate, distichous, keeled, apex unequally and irregularly lobed; flowers in pendulous racemes, upto 30 cm long, pink; sepals ovate; lateral sepals slightly broader than dorsal sepals; petals ovate elliptic; lip continuous with the foot, deeply cleft at apex; hypochile narrow, epichile expanded, spurred; spur saccate; column short.

Distribution & Ecology: Common, prefers exposed dry area.

Specimens examined: Stephen 0088 KFRI.

ROBIQUETIA Gaudichaud

Elongated or pendulous herbs; leaves broadly oblong; inflorescence pendulous or erect, unbranched; sepals and petals spreading; lip 3 lobed, spurred; side lobes short; mid lobe straight; column short; foot absent; pollinia 2.

Key to the species

1a. Flowers pure white, inflorescence pendulous; stem zig-zag ..... *R. gracilis*
1b. Flowers white with pink tinge; inflorescence erect; stem normal ..... *R. josephiana*

Robiquetia gracilis (Lindl.) Garay, Bot. Mus. Leafl. Harvard Univ. 23(4): 197 (1972); Manilal, Fl. Silent Valley 302 (1988); Sathish & Manilal, Cat. Ind. Orch. 84 (1994).

Saccolabium gracile Lindl., Gen. Sp. Orch. 225 (1833).

Pendulous herbs; stems flexuous; leaves elongate, linear-lanceolate, acuminate; flowers in many flowered raceme,pendulous, white; sepals oblong laterals larger; petals narrow, oblong; lip with a spur; lateral lobes obscure; mid lobe acute; mouth of spur very oblique.

Distribution & Ecology: Rare, collected from Silent Valley National Park. Epiphytic on branches of small trees and straglers in dense shady evergreen forests between 900m - 1000m altitude.

Specimens examined: Stephen 007655 KFRI (Poovanchola, SVNP).

Robiquetia josephiana Manilal & Sathish Kumar, Orch. Rev. 92(1091): 293 (1984); Manilal, Fl. Silent Valley 304 (1988); Sathish & Manilal, Cat. Ind. Orch. 84 (1994).

Erect herbs; leaves linear, spotted with purple; flowers in erect raceme, white with purple tinge; sepals oblong; dorsal sepals gland dotted; petals orbicular oblong, gland dotted; lip with a long spur; lateral lobes absent.

Distribution & Ecology: Very rare.

Specimens examined: Manilal & Sathish 10788 CALI (Chembotti, SVNP).

Note: Endemic to Kerala.

SCHOENORCHIS Blume

Erect or pendulous herbs; leaves narrow, semiterete; inflorescence simple or branched racemes; flowers white; sepals and petals dissimilar; lip 3 lobed, spurred, often with a callus; column short, footless; pollinia 4.

Key to the species

1a. Leaves speckled with purple; petals linear ..... *S. jerdonianum*
1b. Leaves green throughout; petals oblong ..... *S. nivea*

Schoenorchis jerdoniana (Wt.) Garay, Bot. Mus. Leafl. Harvard Univ. 23(4): 202 (1972); Manilal, Fl. Silent Valley 304 (1988); Vajravelu, Fl. Palghat 492 (1990); Sathish & Manilal, Cat. Ind. Orch. 84 (1994).

Taeniophyllum jerdonianum Wt., Ic. t. 1756 (1852).

Slender, pendulous herbs; leaves linear, dotted with purple; flowers in branched raceme, white with pinkish tinge; sepals ovate; petals linear; lip spurred; side lobes rounded; mid lobe oblong; spur saccate.

Distribution & Ecology: Rare, collected from Parathode, Silent Valley National Park. Epiphytic on upper canopy of the tree trunks in densely shaded evergreen forests between 800m - 900m altitude.

Specimens examined: Stephen & Joy 007277 KFRI (Parathode, SVNP).

Schoenorchis nivea (Lindl.) Schltr., Fedd. Repert. Beich. 1: 986 (1913); Jayaweera in Dassanayake & Fosberg (Ed.) Rev. Handb. Fl. Ceylon 2: 245 (1981); Sathish & Manilal, Cat. Ind. Orch. 84 (1994).

Saccolabium niveum Lindl., Gen. & Sp. Orch. 224 (1833).

Erect, curved herbs; leaves semiterete; flowers in branched raceme, white; sepals oblique, ovate; petals oblong; lip spurred; lateral lobes blunt, curved in wards; mid lobe spathulate; spur cylindric.

Distribution & Ecology: Common, collected from Wayanad and Siruvani. Prefers densely shaded areas in the evergreen forests between 900m - 1500m altitude.

Specimens examined: Stephen & Michael 008155 KFRI (Chembra Peak, Wayanad); Stephen & Michael 008807 KFRI (Vellingirimala, Siruvani); Joy & Stephen 007544 KFRI (Chinnakanal, Munnar).

SEIDENFADENIELLA Sathish.

Pendulous herbs; leaves terete; inflorescence decurved, densely flowered; flowers in raceme, pink or orange yellow; sepal oblong or subspathulate; petals suborbicular, incurved; lip 3 lobed, spurred; pollinia 2, unequally cleft.

Key to the species

1a. Flowers rose; incurved portion of the petals papillate ..... *S. rosea*
1b. Flowers orange-yellow, incurved portion of the petals glabrous ..... *S. chrysantha*

Seidenfadineilla chrysantha (Alston) Sathish, in Sathish & Manilal, Cat. Ind. Orch. 47 (1994).

Saccolabium chrysanthum Alston in Trimen. Hand. Fl. Ceylon 6: 277 (1931).

Pendulous herbs; leaves terete, ventrally grooved; inflorescence deflexed; flowers in extra axillary racemes, orange yellow streaked with crimson brown lines; sepals oblong subspathulate; petals suborbicular; lip 3 lobed, spurred; side lobe erect rounded orbicular; mid lobes fleshy, papillate, deflexed.

Distribution & Ecology: Rare, collected from Eravikulam National Park. Prefers high altitude evergreen shola forests between 2000m - 2500m altitude.

Specimens examined: Stephen 007853 KFRI (Eravikulam National Park).

Seidenfadineilla rosea (Wt.) Sathish, in Sathish & Manilal, Cat. Orch. India 46 (1994).

Pendulous herbs; leaves terete, ventrally grooved; inflorescence decurved; flowers in racemes, purplish- violet, pale pink to rose; sepals oblong triangular; petals suborbicular, incurved at apex, with a dark median band, papillate, lip 3 lobed; spurred, side lobes auricular-ovate, midlobe ovate triangular, papillate; spur with a back wall thickening.

Distribution & Ecology: Rare, collected from Sispara, Silent Valley National Park and Chembra Peak, Wayanad. Prefers high altitude evergreen shola forests at 1100m - 2300m altitude.

Specimens examined: Stephen 007577 KFRI (Sispara, SVNP); Stephen & Michael 008151 KFRI (Chembra Peak, Wayanad).

Note: Sathish & Manilal (1994) reported *S. rosea* has a spur length of 3.5mm and *S. chrysantha* has 3.6-7 mm long. But the collections of *S. rosea* from Chembra Peak has 8 mm long spur.

SIRHOOKERA O. Kuntze

Short stemmed tufted herbs; roots vermiform; leaves solitary, coriaceous; flowers in paniculately branched raceme, flowers small; lip inserted on the base of the column; column erect; pollinia 4.

Key to the species

1a. Leaves purplish violet on the abaxial side ..... *S. latifolia*
1b. Leaves green on the abaxial side ..... *S. lanceolata*

Sirhookera lanceolata (Wt.) Ktze., Rev. Geo. Pl. 681 (1891); Manilal, Fl. Silent Valley 305 (1988); Sathish & Manilal, Cat. Ind. Orch. 84 (1994).

Josephia lanceolata Wt., Ic. t. 1743 (1851); Hook. f., Fl. British India 5: 823 (1890); Fischer in Gamble, Fl. Pres. Madras 1428 (1928).

Leaves solitary or two, lanceolate-oblong, base continuing into the petiolar sheath; flowers in compound racemes, purple coloured; sepals oblong; petals spathulate; lip panduriform; column erect, conical.

Distribution & Ecology: Common. In Silent Valley National Park it is randomly distributed throughout the entire National Park. Prefers shade as well as open areas in the evergreen forests between 800m - 1800m altitude.

Specimens examined: Stephen 007876 KFRI (Sispara slope, SVNP); Muktesh Kumar & Stephen 007241 KFRI (Rajamala, Munnar).

Sirhookera latifolia (Wt.) Ktze., Rev. Gen. Pl. 681 (1891); Manilal. Fl. Silent Valley 305 (1988); Vajravelu, Fl. Palghat 493 (1990); Sathish & Manilal, Cat. Ind. Orch. 84 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 454 (1995).

Josephia latifolia Wt., Ic. t. 1743 (1851); Fischer in Gamble, Fl. Pres. Madras 1428 (1928).

Leaves solitary, oval or oblong, apiculate, deep purplish colour beneath; flowers in panicles, white; sepals orbicular; petals linear-oblong; lip 3 lobed lateral lobes saccate; mid lobe ovate.

Distribution & Ecology: Not common, prefers an altitude of 800m - 1100m in densely shaded areas of the evergreen forests.

Specimens examined: Joy & Stephen 007256 KFRI (Punnamala, SVNP).

SMITHSONIA Saldanha

Short stemmed herbs; leaves 2-4, elliptic oblong or linear oblong, slightly channeled; flowers in racemes; sepals and petals yellow, straw coloured with red spots or without spots, petals obovate; lip immovable, spurred, 3 lobed, side lobes erect; mid lobe more or less covering the spur; spur alternate, non septate; pollinia 2, deeply grooved and unequally lobed.

Key to the species

1a. Plants large; inflorescence longer than the leaves; spur cavity hairy ..... *S. maculata*
1b. Plants small; inflorescence shorter than the leaves; spur cavity glabrous 2

2a. Side lobes of the lip triangular, acute; flowers greenish-white without any spot ..... *S. viridiflora*
2b. Side lobes or the lip short, obtuse; flowers straw coloured with red spots ..... *S. straminea*

Smithsonia maculata (Dalz.) Saldanha, J. Bombay Nat. Hist. Soc. 71(1): 74 (1974); Sathish & Manilal, Cat. Ind. Orch. 84 (1994).

Micropera maculata Dalz., Hooker's J. Bot. 3: 282 (1851).

Short stemmed large herbs; leaves 1 or 2, linear oblong to cuneately oblong, 2 lobed; flowers in long racemes, raceme elongate, much longer than the leaves, yellow; sepals and petals yellow with a purple spot; lip 3 lobed, spurred; side lobes erect, narrow; mid lobe entire; spur obtuse, hairy within.

Distribution & Ecology: Rare, prefers open dry areas between 700m - 900m altitude.

Specimens examined: Muktesh Kumar 002921 KFRI (Nelliampathy).

Smithsonia straminea Saldanha, J. Bombay Nat. Hist. Soc. 71(1); 73 (1974); Vajravelu, Fl. Palghat 493 (1990); Sathish & Manilal, Cat. Ind. Orch. 1994; Sasi. & Sivaraj., Fl. Pl. Thrissur For. 454 (1995).

Stem short; leaves 2-4, elliptic oblong, bilobed; flowers in racemes, straw coloured; sepals obovate; petals slightly smaller and narrower; lip spurred, 3 lobed; lateral lobes erect; mid lobe arching, entire.

Distribution & Ecology: Rare, prefers semi shaded areas in the semievergreen forests between 300m - 400m altitude.

Specimens examined: Sasidharan 003495 KFRI (Vellayanimala, Trichur); Sasidharan 001783 KFRI (Chimmini dam, Trichur).

Smithsonia viridiflora (Dalz.) Saldanha, J. Bombay Nat. Hist. Soc. 71(1): 75 (1974); Sathish & Manilal, Cat. Ind. Orch. 85 (1994).

Small herbs; leaves linear oblong, bilobed; flowers in few flowered racemes, greenish white; sepals obovate, obtuse, laterals slightly spathulate; petals ovate; lip 3 lobed spurred; side lobes erect, triangular, mid lobe membranous, irregularly lobed; spur conical, obtuse, pointing forward.

Distribution & Ecology: Rare, collected from Nilambur forests. Prefers open dry areas on riparian trees in the moist deciduous forests between 250m - 400m altitude.

Specimens examined: Stephen & Michael 008803 KFRI (Punchakolli, Nilambur).

TAINIOPHYLLUM Blume

Tainiophyllum scaberulum Hook. f., Fl. British India 6: 77 (1898); Fischer in Gamble, Fl. Pres. Madras 1449 (1928); Sathish & Manilal, Cat. Ind. Orch. 85 (1994).

Small leafless, filiform rooted herbs; flowers small, in few flowered spikes; peduncle scaberulous; sepals and petals subequal; lip sessile, saccate, 3 lobed, side lobes small; mid lobe fleshy; spur naked; column short, foot absent; pollinia 4.

Distribution & Ecology: Rare, epiphytic on branches of trees in the evergreen forests 800m - 1100m altitude.

Specimens examined: K.P. Rajesh 16214 & 16831 KFRI (Periyar Tiger Reserve).

THELASIS Blume

Thelasis pygmaea Lindl., Journ. Linn. Soc. B. 63.; Hook. f., Fl. British India 6: 86 (1898); Fischer in Gamble, Fl. Pres. Madras 1450 (1928); Sathish & Manilal, Cat. Ind. Orch. 85 (1994).

Small pseudobulbous herbs; pseudobulb globose; leaves solitary, linear; scape longer than the leaf, curved; flowers small, greenish; dorsal sepal ovate-lanceolate; laterals linear oblong; lip ovate, acute contracted towards the tip; rostellum 2 fid; column short; foot absent; pollinia 8 (Fig. 33).

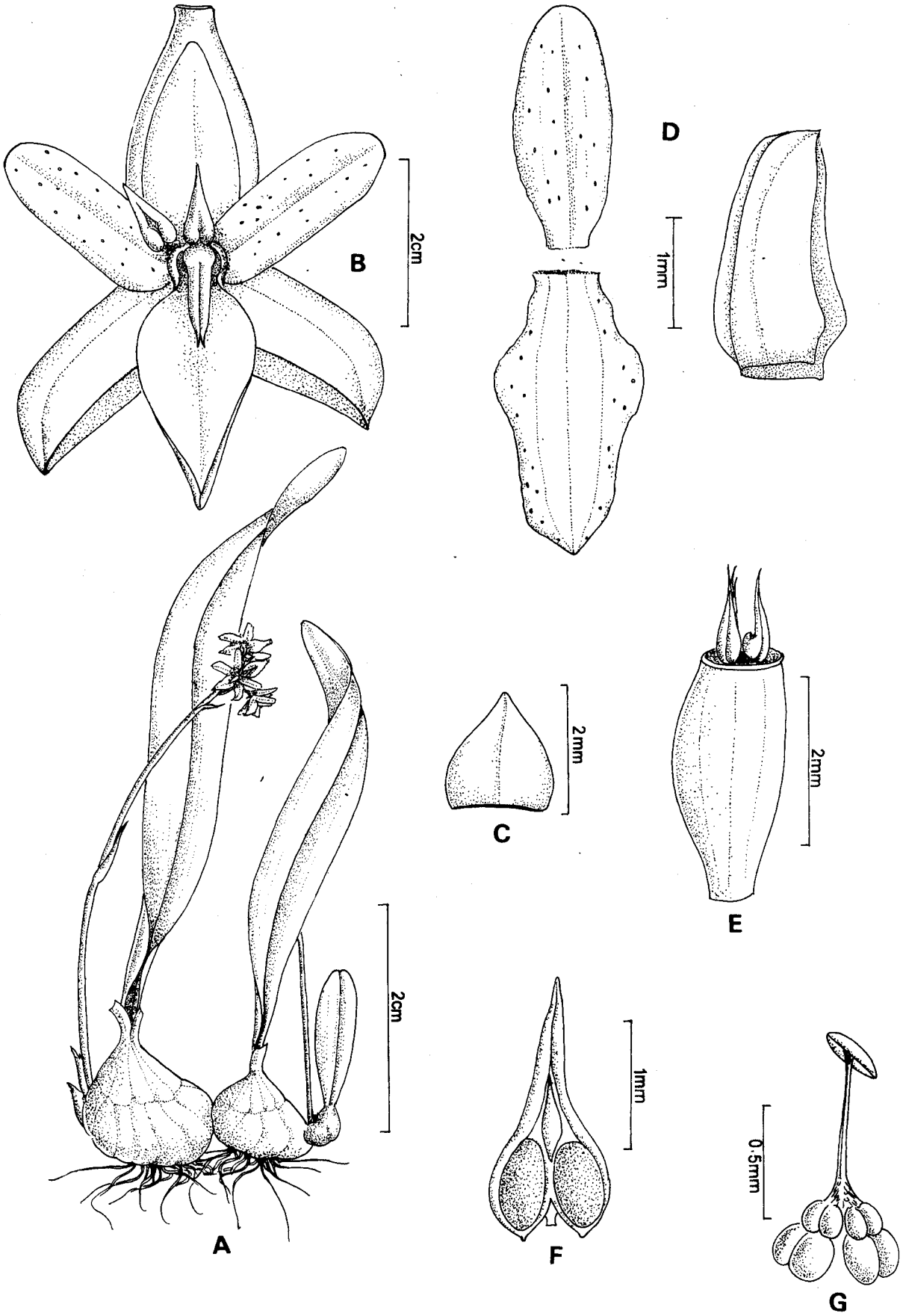


Fig. 33. *Thelasis pygmaea* Lindl. A- Habit; B- Flower front view; C- Bract; D- column; E- operculum; G- Pollinia.

Distribution & Ecology: Very rare, collected from Kungilliapadi, Siruvani. Occuring as small colonies in riverine areas in the evergreen forests between 750m - 900m.

Specimens examined: Stephen & Michael 008823 KFRI (Kungiilliapadi, Siruvani).

THRIXSPERMUM Louriero

Sessile leaved herbs; leaves linear oblong; flowers in laterally compressed racemes or short terminal spikes; sepals lanceolate- oblong or linear subulate; petals lanceolate or linear oblong; lip glandular pubescent, saccate, 3 lobed; column short; pollinia bifid.

Key to the species

1a. Sepals lanceolate oblong; petals lanceolate ..... *T. pulchellum*
1b. Sepals linear subulate; petals linear ..... *T. complanatum*

Thrixspermum complanatum (Koenig) Schltr., Orchis. 5: 55 (1911); Jayaweera in Dassanayake & Fosberg (Ed.) Rev. Handb. Fl. Ceylon 195 (1981); Sathish & Manilal, Cat. Ind. Orch. 61 (1994).

Leaves coriaceous, tip unequally lobed; flowers yellow in laterally compressed pectinate racemes; sepals and petals membranous; sepals linear lanceolate or subulate, acuminate, laterals falcate; petals linear; lip saccate white, blotched with red near apex, adnate to the foot of the column, 3 lobed, lateral lobes obtuse; mid lobe fleshy.

Distribution & Ecology: Very rare.

Thrixspermum pulchellum (Thw.) Schltr. Orchis 5: 57. 1991; Jayaweera in Dassanayake & Fosberg (Ed.) Rev. Handb. Fl. Ceylon 193 (1981); Sathish & Manilal. Cat. Ind. Orch. 86 (1994).

Dendrocolla pulchella Thw., Enum. Pl. Zeyl. 430 (1864); Alston in Trimen, Handb. Fl. Ceylon 6: 276 (1898).

Leaves linear oblong, falcate, 2 lobed at apex; flowers white in terminal spikes; sepals lanceolate-oblong, laterals adnate to the foot of the column; petals lanceolate; lip orbicular ovate, glandular pubescent, 3 lobed, lateral lobes rounded and blunt, mid lobe short with a callus.

Distribution & Ecology: Very rare, epiphytic on *Scleropyrum pentandrum & Tectona grandis*. Prefers an altitude of 150m - 200m.

Specimens examined: Sathish Kumar 36969 CALI (Palode).

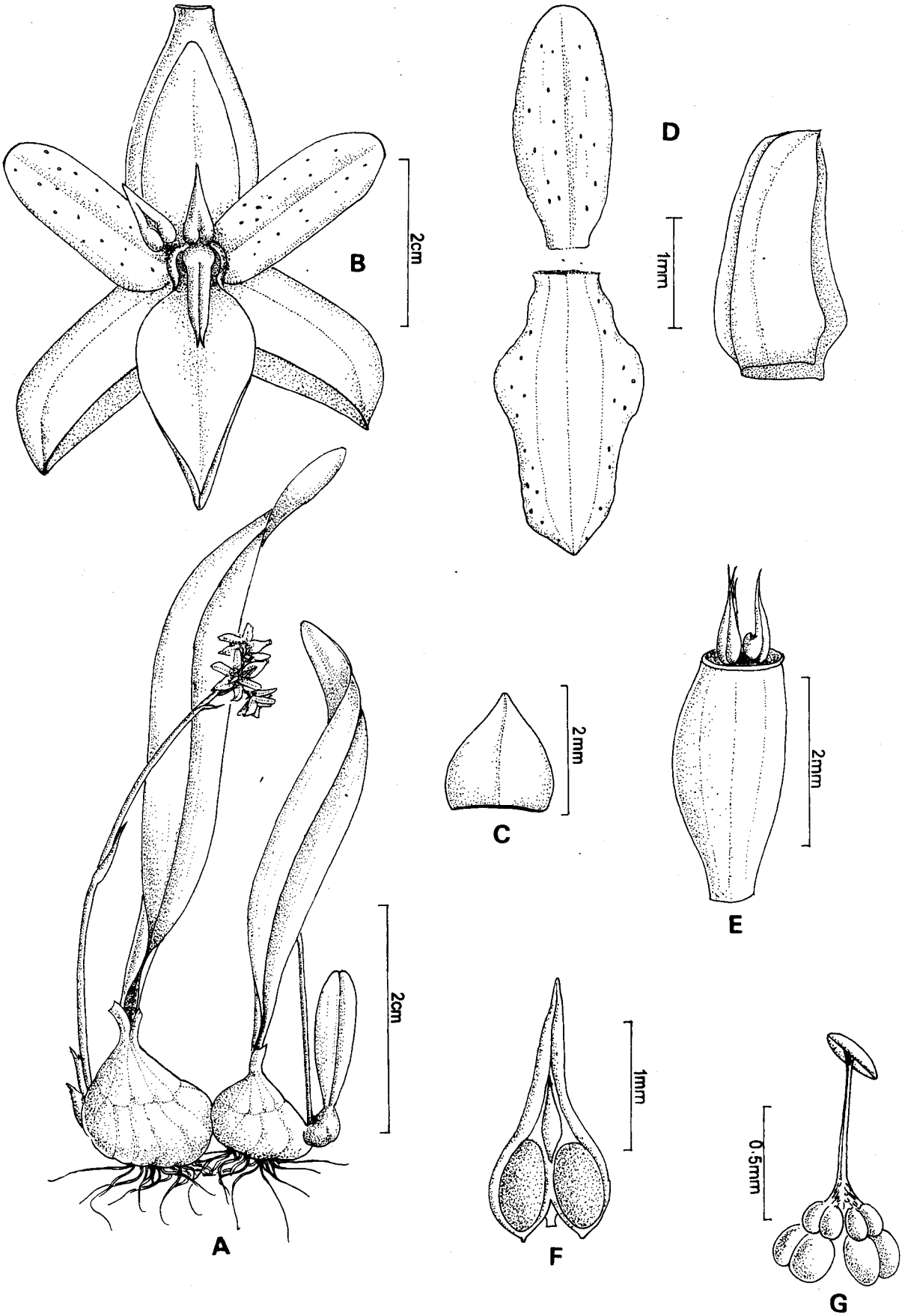


Fig. 33. *Thelasis pygmaea* Lindl. A- Habit; B- Flower front view; C- Bract; D- column; E- operculum; G- Pollinia.

Distribution & Ecology: Very rare, collected from Kungilliapadi, Siruvani. Occuring as small colonies in riverine areas in the evergreen forests between 750m - 900m.

Specimens examined: Stephen & Michael 008823 KFRI (Kungiiliapadi, Siruvani).

THRIXSPERMUM Louriero

Sessile leaved herbs; leaves linear oblong; flowers in laterally compressed racemes or short terminal spikes; sepals lanceolate- oblong or linear subulate; petals lanceolate or linear oblong; lip glandular pubescent, saccate, 3 lobed; column short; pollinia bifid.

Key to the species

1a. Sepals lanceolate oblong; petals lanceolate ..... *T. pulchellum*
1b. Sepals linear subulate; petals linear ..... *T. complanatum*

Thrixspermum complanatum (Koenig) Schltr., Orchis. 5: 55 (1911); Jayaweera in Dassanayake & Fosberg (Ed.) Rev. Handb. Fl. Ceylon 195 (1981); Sathish & Manilal, Cat. Ind. Orch. 61 (1994).

Leaves coriaceous, tip unequally lobed; flowers yellow in laterally compressed pectinate racemes; sepals and petals membranous; sepals linear lanceolate or subulate, acuminate, laterals falcate; petals linear; lip saccate white, blotched with red near apex, adnate to the foot of the column, 3 lobed, lateral lobes obtuse; mid lobe fleshy.

Distribution & Ecology: Very rare.

Thrixspermum pulchellum (Thw.) Schltr. Orchis 5: 57. 1991; Jayaweera in Dassanayake & Fosberg (Ed.) Rev. Handb. Fl. Ceylon 193 (1981); Sathish & Manilal. Cat. Ind. Orch. 86 (1994).

Dendrocolla pulchella Thw., Enum. Pl. Zeyl. 430 (1864); Alston in Trimen, Handb. Fl. Ceylon 6: 276 (1898).

Leaves linear oblong, falcate, 2 lobed at apex; flowers white in terminal spikes; sepals lanceolate-oblong, laterals adnate to the foot of the column; petals lanceolate; lip orbicular ovate, glandular pubescent, 3 lobed, lateral lobes rounded and blunt, mid lobe short with a callus.

Distribution & Ecology: Very rare, epiphytic on *Scleropyrum pentandrum & Tectona grandis*. Prefers an altitude of 150m - 200m.

Specimens examined: Sathish Kumar 36969 CALI (Palode).

TRIAS Lindley

Small pseudobulbous herbs; pseudobulbs brownish grey, conical ovoid; leaves solitary, coriaceous; flowers pinkish; sepals ovate oblong or trianguiar ovate; petals linear oblong, acute or acuminate; lip mobile, yellow with red spots; column oblong; pollinia 4.

Key to the species

1a. Flowers small, epichile of the lip tuberculate ..... *T. stocksii*
1b. Flowers large; epichile of the lip glabrous ..... *T. bonaccordensis*

Trias bonaccordensis Sathish, Blumea 34(1): 103-109 (1989); Sathish & Manilal Cat. Ind. Orch. 86 (1994).

Pseudobulbous herbs; pseudobulbs globose, green yellow often with brown spots; leaves solitary, ovate; flowers solitary, creamy yellow with crimson red spots; sepals triangular ovate, gland dotted; petals with broad base, gland dotted, white; lip creamy yellow in the crimson spots, base of epichile region bended, upper region grooved; side lobes represented by 2 short auricles; column winged.

Distribution & Ecology: Rare, epiphytic on *Garcinia norella, Mesua ferrea, Gluta travancorica & Careya arborea* in the evergreen forests between 950m - 1050m.

Specimens examined: Sathish Kumar 3668 TBGT, (Bonaccord. TVM.).

Note: So far reported only from Bonnaccord, Trivandrum

Trias stocksii Benth. ex Hook. f., Fl. British India 5: 781 (1890); Manilal, Fl. Silent Valley 306 (1988); Vajravelu, Fl. Palghat 494 (1990); Sathis. & Manilal, Cat. Ind. Orch. 86 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 455 (1995).

Small pseudobulbous herb; pseudobulbs conical ovoid; leaves solitary; flowers solitary or 2, white with red spots; sepals ovate oblong, lateral sepals united; petals narrowly linear oblong, gland dotted; lip fleshy, clawed, epichile tuberculate, lateral lobes represented by 2 minute auricles; column winged.

Distribution & Ecology: Common, prefers shaded or semi shaded localities in the evergreen forests between 800m - 900m.

Specimens examined: Joy & Stephen 007266 KFRI (Parathode, SVNP); Joy & Stephen 007262 KFRI (Punnamala, SVNP), Stephen 007698 KFRI (Punnamala, SVNP).

TRICHOGLOTTIS Blume

Trichoglottis tenera (Lindl.) Schltr., Bull. Herb. Boiss. Ser. 2. 6: 471 (1906) Manilal. Fl. Silent Valley 306 (1988); Sathish & Manilal, Cat. Ind. Orch. 86 (1994); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 455 (1995).

Oeceoclades tenera Lindl., Gen. Sp. Orch. 236 (1883).

Scrambling herbs; stem long, green, speckled with red; leaves alternate oblong or linear oblong, recurved; flowers in two flowered racemes, greenish yellow; dorsal sepal oblanceolate; laterals obliquely oblanceolate, decurved; petals oblanceolate; lip 3 lobed, lateral lobes erect, crenulate; mid lobe rhomboid, trilobulate; column broad, foot inconspicuous; pollinia 2.

Distribution & Ecology: Rare, collected from Sispara, Silent Valley. Prefers small trees in deeply shaded evergreen forests between 1100m - 2000m altitude.

Specimens examined: Stephen 007575 KFRI (Walakkad, SVNP); Stephen & Michael 008176 KFRI (Sispara, SVNP).

VANDA Jones ex R. Brown

Stout herbs; leaves flat, recurved thickly coriaceous, bilobed at apex; inflorescence simple, erect; flowers medium sized, various coloured; sepals and petals nearly equal, edges more or less reflexed or crispid; lip sessile, spur short, 3 lobed; column short, foot absent, pollinia 2.

Key to the species

1a. Flowers grey, tesselated with blue ..... *V. tessellata*
1b. Flowers yellowish, not tesselated 2

2a. Leaves and peduncle dotted with purple, scrambling herb ..... *V. spathulata*
2b. Leaves and peduncle greenish only; stout, erect herbs 3

3a. Raceme 2-3 flowered; Flowers golden yellow with greenish tinge ..... *V. thwaitesii*
3b. Raceme many flowerd, flowers creamy yellow with violet flush ..... *V. testacea*

Vanda spathulata (L.) Spreng., Syst. Veg. 3: 719 (1828); Lindl., Gen. Sp. Orch. 216 (1833); Wt., Ic. t. 915 (1844-45); Hook. f., Fl. British India 6: 50 (1890); Fischer in Gamble, Fl. Pres. Madras 1444 (1928); Sathish & Manilal, Cat. Ind. Orch. 86 (1994).

Scrambling herbs; leaves fleshy, keeled, spotted with red; flowers in long peduncled racemes; bright yellow; sepals ovate-oblong; petals obovate; lip 3 lobed, lateral lobes small, erect; mid lobe reniform; spur conical; column small.

Distribution & Ecology: Rare, occur in plains.

Specimens examined: K.M. Sebastine 006251 MH (Chengattupatti, Tiruchirapally Dt.)

Vanda tessellata (Roxb.) Hook. ex D. Don in Loud., Hort. Brit. 372 (1830); Fischer in Gamble, Fl. Pres. Madras 1445 (1928); Manilal, Fl. Silent Valley 307 (1988); Sathish & Manilal, Cat. Ind. Orch. 86 (1994).

Epidendrum tessellatum Roxb., Pl. Cor. t. 42 (1795).

Stout stemmed herbs; leaves recurved, equitant, keeled; flowers in few flowered raceme, grey, tessellated with blue; sepals obovate, wavy; petals obovate, smaller than the sepals, wavy; lip 3 lobed, lateral lobes erect obliquely oblong; mid lobe panduriform; spur conical.

Distribution & Ecology: Common, prefers open dry areas.

Specimens examined: Stephen 008845 KFRI (Chinnar).

Note: Manilal (1988) reported this species to occur in Silent Valley. But in this present study no such material has been located anywhere in the Silent Valley National Park.

Vanda testacea (Lindl.) Reichb. f., Gard. Chron. 2: 166 (1877); Manilal, Fl. Silent Valley 307 (1988); Vajravelu, Fl. Palghat 495 (1990); Manilal & Sathish, Sathish & Manilal, Cat. Ind. Orch. 86 (1994); Sasi. & Sivaraj., & Fl Pl. Thrissur For. 456 (1995).

Aerides testaceum Lindl., Gen. Sp. Orch. 238 (1835).

Stout herbs; leaves channeled, coriaceous; flowers in few flowered racemes, yellow; sepals obovate, oblong; petals spathulate-oblong, narrower; lip yellow with violet flush, 3 lobed; side lobes erect, falcate; mid lobe oblong-ligulate; spur conical.

Distribution & Ecology: Common, collected from Begur, Wayanad. Prefers low elevations to 900m altitude.

Specimens examined: Muktesh Kumar & Stephen 006765 KFRI (Begur, Wayanad).

Vanilla thwaitesii Hook. f., in Trimen, Handb. Fl. Ceylon 4: 193 (1898); Jayaweera in Dassanayake & Fosberg (Ed.) Revd. Handb. Fl. Ceylon 2: 220 (1981).

Stout herbs; leaves coriaceous, falcately recurving, bifid at apex; flowers in 2-3 flowerd raceme; golden yellow with greenish tinge; lateral sepals larger than the dorsal sepals, obtuse; petals obovate-oblong; lip white, infundibuliform, 3 lobed, lateral lobes small, golden yellow, mid lobe broad, yellow with brown spots, spur acute (Fig. 34).

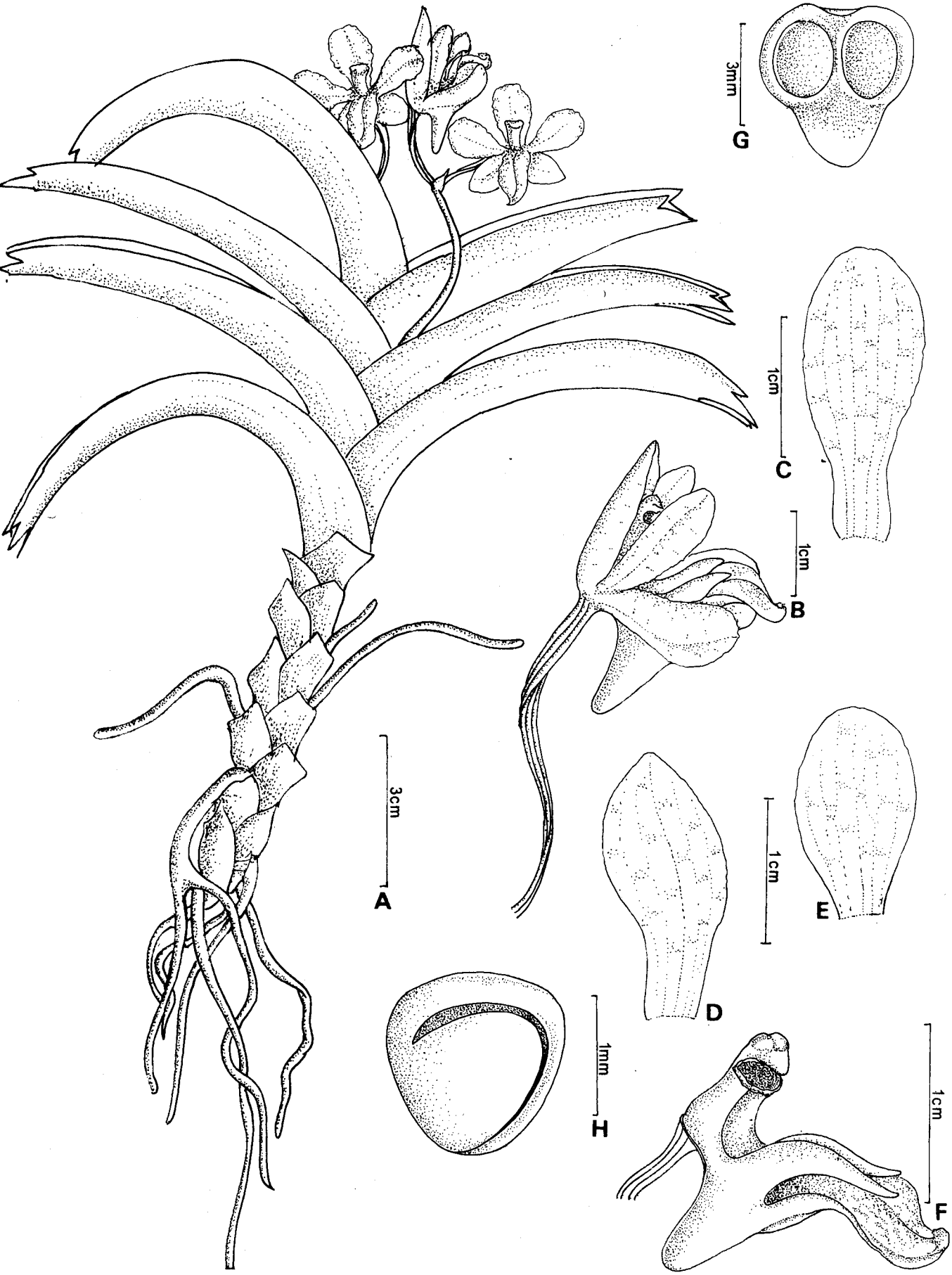


Fig. 34. *Vanda thwaitesii* Hook.f. A- Habit; B- Flower; C- Dorsal sepal; D- Lateral sepal; E- Petal; F- Column with lip; G- Operculum; H- Pollinia

Distribution & Ecology: Very rare, collected from Aruvanpara & Damsite areas of Silent Valley National Park. Prefers an altitude of 850m - 1000m in the evergreen shola forests.

Specimens examined: Stephen & Joy 007513 KFRI (Damsite); Stephen 007595 KFRI (Aruvanpara slope).

Note: Hitherto this species has been reported only from Sri Lanka and hence is a new record for India.

VANILLA Miller.

Tall climbing herbs; stem terete; leaves large, fleshy, some times reduced to small scales; flowers few in axillary raceme; lip jointed, 3 lobed; column elongate, footless; pollinia 4.

Key to the species

1a. Lip tri lobed 2
1b. Lip single lobed ..... *V. walkeriae*

2a. Plant leafless, mid lobe often lip with densely brown hairs ..... *V. aphylla*
2b. Plant with distinct leaves or scale leaves; mid lobe of the lip with 2 barbate crests ..... *V. wightiana*

Vanilla aphylla Bl., Bijdr. 422 (1825); Seidenf., Dansk Bot. Ark. 32: 138 (1978); Sathish & Manilal, Amer. Orch. Soc. Bull. 62. 395 (1993); Sathish & Manilal, Cat. Ind. Orch. 86 (1994);Sasi. & Sivaraj., Fl.Pl. Thrissur For. 456 (1995).

Vanilla parishii Reichb. f., Otia Handb. 1: 39 (1878); Hook. f., Fl. British India 6: 90 (1890).

Climbing herbs; leaves scaly; flowers in racemes, yellowish; sepals elliptic oblong, acute; petals membranous; lip 3 lobed, side lobes small, mid lobe irregularly lobed or fimbriate with violet yellow hairs.

Distribution & Ecology: Rare, epiphytic on *Aprusa lindleyana, Mangifera indica, Strychnos nuxvomica.* Prefers an altitude of 50m - 600m.

Specimens examined: Sasidharan 003914 KFRI (Peringalkuthu, Trichur Dt.).

Vanilla walkeriae Wt., Ic. t. 932 (1845); Hook. fl., Fl. British India6: 90 (1890); Fischer in Gamble, Fl. Pres. Madras 1451 (1928); Sathish & Manilal, Cat. Ind. Orch. 86 (1994).

Stout climbing herbs; stem thick; leaves lanceolate, acuminate; flowers in racemes, white; sepals and petals oblong-lanceolate, undulate; lip entire, ovate oblong, undulate, disk with two median puberulous ridges.

Distribution & Ecology: Rare, prefers low altitude in the semi evergreen forests.

Vanilla wightiana Lindl. ex J.D. Hook., Fl. British India 6: 90 (1890); Fischer in Gamble, Fl. Pres. Madras 1451 (1928); Sathish & Manilal, Cat. Ind. Orch. 87 (1994).

Leafless herb; flowers in racemes; sepals and petals oblong lanceolate, subacute; lip 3 lobed, side lobes broad, rounded with long hairs.

Distribution & Ecology: Rare.

XENIKOPHYTON Garay

Xenikophyton smeanum (Reichb. f.) Garay, Bot. Mus. Leafl. Harvard Univ. 23(10): 374 (1974); Manilal, Fl. Silent Valley 308 (1988); Sathish & Manilal, Cat. Ind. Orch. 87 (1994).

Saccolabium smeeanum Reichb. f., Gard. Chron. Ser. 3, 2: 214 (1887).

Short stemmed woody herbs; leaves coriaceous, channeled, purplish beneath; flowers in branched panicles, pale bluish purple; sepals and petals dissimilar; lip fleshy, reflexed 3 lobed, spurred at base; column short; pollinia 2.

Distribution & Ecology: Rare, collected from Aruvanpara, Silent Valley National Park. Prefers densely shade areas in the evergreen forest between 900m - 1000m.

Specimens examined: Joy & Stephen 007568 KFRI (Aruvanpara, SVNP); Stephen 007688 KFRI (Aruvanpara, SVNP); Stephen & Mathew 007293 KFRI (Aruvanpara, SVNP).

COMMELINACEAE

BELOSYNAPSIS Hasskarl

Belosynapsis vivipara (Dalz.) Fischer ex Sprague & Fischer, Bull. Misc. Inf. 254 (1928); Gamble, Fl. Pres. Madras, 1551 (1931); Manilal, Fl. Silent Valley, 324 (1988); Vajravelu, Fl. Palghat, 515 (1990).

Cyanotis vivipara Dalz. Hooker's J. Bot. Kew Gard. Misc. 3: 226 (1851).

Stem viviparous; leaves radical or caulin, more or less pilose and ciliate hairs: radical leaves linear or lanceolate, acute or acuminate; caulin ones ovate-elliptic, acuminate pubescent; flowers in umbels on capillary pilose peduncles, white, sepals oblong illous petals connate at base.

Distribution & Ecology: Common, collected from Silent Valley, Wayanad and Muthikulam. Epiphytic on base of the tree trunk or decayed fallen logs at an altitude of 900m - 1200m.

Specimens examined: Stephen 007621 KFRI (Chandanathode, Wayanad); Stephen & Joy 007259 KFRI (Punnamala, SVNP); Stephen & Michael 008161 KFRI (Chembra Peak, Wayanad).

Note: This species is endemic to Western Ghats.

ARACEAE

REMUSATIA Schott

Remusatia vivipara (Roxb.) Schott in Schott & Endlicher, Melet. Bot. 18 (1832); Hook. f., Fl. British India 6: 521 (1893); Gamble, Fl. Pres. Madras. 1583 (1931); Manilal, Fl. Silent Valley 334 (1988); Vajravelu, Fl. Palghat, 535 (1990); Sasi. & Sivaraj., Fl. Pl. Thrissur For. 487 (1995).

Arum viviparum Roxb., Hort. Beng. 65 (1814); 'viviparum', Fl. indian 3: 496 (1832); Wt., Ic. 3:6, t. 798 (1844).

Tuberous herb, lateral brownish bulbiferous shoots present; leaf solitary, ovate-cordate, undulate, acute at apex; bulbiferous shoots erect, slender, brown; spathe ovoid or oblong, yellowish, spadix included.

Distribution & Ecology: Common, widely distributed. Prefers densely shaded localities in the evergreen forests at an altitude of 700-1200 m.

Specimens examined: Stephen 007582 KFRI (Walakkad, SVNP); Joy & Stephen 007263 KFRI (Kattuvaramudy, SVNP); Muktesh Kumar & Stephen 006770 (Chandanathode, Wayanad), 007225 KFRI (Victoria, Nelliampathy).

Appendix I. Lichens collected from the study area

Microlichens

1. *Anthracothecium austroindicum* A.Singh - Pyrenulaceae
2. *Buellia isidiophora* Awasthi & Upreti - Physciaceae
3. *B. confusa* Awasthi - Physciacace
4. *Clathroporina duplicascence* (Nyl.) Zahlbr. - Trichotheliaceae
5. *Cryptothecia sp.* - Arthoniaceae
6. *Graphis tritica* Nyl. - Graphidaceae
7. *G. assimilis* Nyl. - Graphidaceae
8. *G. arecae* Vainio - Graphidaceae
9. *Ocellularia arecae* (Vainio) Hale - Thelotremataceae

Macrolichens

1. *Coccocarpia palmicola* (Sprengel) Avid. & D. Galloway - Coccocarpiaceae
2. *Dirinaria confluens* (Fr.) Awasthi - Physciaceae
3. *Heterodermia podocarpa* (Bel.) Awasthi - Physciaceae
4. *H. diademata* (Taylor) Awasthi - Physciaceae
5. *H. comosa* (Eschw) Follm. & Redon - Physciaceae
6. *H. dentritica* (Pers.) Poelt - Physciaceae
7. *H. isidiophora* (Vainio) Awasthi - Physciaceae
8. *H. leucomela* (L.) Poelt - Physciaceae
9. *H. leucomela subsp. boryi* (Fee) Swinsc. & Krog - Physciaceae
10. *H. pellucida* (Awasthi) Awasthi - Physciaceae
11. *H. speciosa* (Wulfen) Trevisan - Physciaceae
12. *Leptogium austroamericanum* (Malme) Dodge - Collemataceae
13. *L. chloromelum* (Swartz ex Ach.) Nyl. - Collemataceae
14. *L. cochleatum* (Dickson) P. Jorg & P. James - Collemataceae
15. *L. isidiosellum* (Riddle) Sierk - Collemataceae
16. *L. denticulatum* Nyl. - Collemataceae
17. *Lobaria discolor* (Bory in Delise) Hue - Sticataceae
18. *L. japonica* (Zahlbr.) Asah. - Stictaceae
19. *Pannaria stylophora* Vainio - Pannariaceae
20. *Parmelaria thomsonii* (Stirton) Awasthi - Parmeliaceae
21. *Parmelia abstrusa* Vainio - Parmeliaceae
22. *P. austroindica* Awasthi - Parmeliaceae
23. *P. austrosinensis* Zahlbr. - Parmeliaceae
24. *P. awasthii* (Hale & Patw.) Awasthi- Parmeliaceae
25. *P. cirrhata* Fr. - Parmeliaceae
26. *P. crenata* Kurok. in Hale & Kurok. - Parmeliaceae
27. *P. dilatata* Vainio - Parmeliaceae
28. *P. formosana* Zahlbr. - Parmeliaceae
29. *P. kamatii* (Patw. & Prabhu) A. Singh - Parmeliaceae

30. *P. nepalensis* Taylor - Parmeliaceae
31. *P. orientalis* Hale - Parmeliaceae
32. *P. sanctae-angelii* Lynge - Parmeliaceae
33. *P. tinctorum* Nyl. - Parmeliaceae
34. *P. wallichiana* Taylor - Parmeliaceae
35. *Pseudocyphellaria argyracea* (Bory) Vainio - Stictaceae
36. *Ramalina inflata* (J.D. Hook. & Taylor) J. D. Hook. & Tayl. in Hook. - Ramalinaceae
37. *R. pacifica* Asah. - Ramalinaceae
38. *Sticta weigelli* (Ach.) Vainio - Stictaceae
39. *Usnea baileyii* (Stirton) Zahlbr. - Usneaceae
40. *U. corralina* Mot. - Usneaceae
41. *U. coralina* Mot. - Usneaceae
42. *U. pictoides* G. Awasthi - Usneaceae
43. *U. rigidula* (Stirton) G. Awasthi - Usneaceae
44. *U. subflorida* (Zahlbr.) Mot. - Usneaceae
45. *U. vegae* Mot. - Usneaceae

APPENDIX II. **ALTITUDINAL RANGE OF EPIPHYTES**

	upto 1000m	1000-1500m	1500 & above
PTERIDOPHYTES			
Lycopodiaceae (7 species)			
1. *Huperzia ceylanica*	+	-	-
2. *H. hamiltonii*	+	+	-
3. *H. hilliana*	+	+	-
4. *H. nilagirica*	+	-	-
5. *H. phlegmaria*	+	-	-
6. *H. phyllantha*	+	+	-
7. *H. squarrosa*	+	-	-
Selaginellaceae (1 species)			
1. *Selaginella involvens*	+	+	-
Psilotaceae (1 species)			
1. *Psilotum nudum*	+	-	+
Vittariaceae (4 species)			
1. *Antrophyum plantagenium*	+	+	-
2. *A. reticulatum*	+	-	-
3. *Vittaria elongata*	+	-	-
4. *V. montana*	+	+	-
Davalliaceae (4 species)			
1. *Araiostegia pulchra*	+	-	-
2. *Davallia bullata*	+	+	-
3. *Humata repens*	+	+	-
4. *Leucostegia immersa*	+	-	-
Oleandraceae (2 species)			
1. *Nephrolepis auriculata*	+	+	-
2. *Oleandra muscifolia*	+	+	-
Hymenophyllaceae (8 species)			
1. *Hymenophyllum denticulatum*	+	+	-
2. *H. gardnerii*	+	+	-

	upto 1000m	1000-1500m	1500 & above
3. *H. javanicum*	+	+	-
4. *Microgonium bimarginatum*	+	-	-
5. *Trichomanes intramarginale*	-	+	-
6. *T. plicatum*	+	-	-
7. *T. proliferum*	+	-	-
8. *T. schmidianum*	-	+	-
Aspleniaceae (14 species)			
1. *Asplenium aethiopium*	-	+	+
2. *A. auritum*	-	+	-
3. *A. crinicaule*	+	+	-
4. *A. decrescens*	+	+	+
5. *A. ensiforme*	-	+	-
6. *A. erectum*	-	-	+
7. *A. formosum*	+	-	+
8. *A. indicum*	+	-	-
9. *A. laciniatum*	-	+	+
10. *A. phyllitidis*	+	-	-
11. *A. polyodon*	+	-	-
12. *A. polyodon* var. *bipinnatum*	-	-	+
13. *A. serricula*	+	-	-
14. *A. tenuifolium*	-	-	+
Lomariopsidaceae (2 species)			
1. *Elaphoglossum beddomei*	-	+	-
2. *E. nilgiricum*	+	-	-
Polypodiaceae (18 species)			
1. *Crypsinus montanus*	+	+	+
2. *Drymoglossum heterophyllum*	+	-	-
3. *Drynaria quercifolia*	+	-	-
4. *Leptochilus decurrens*	+	-	-
5. *L. dcurrens* f. *lanceolatus*	-	+	-
6. *L. thwaiteseanous*	+	+	-
7. *Microsorium linguaforme*	+	-	-
8. *M. membranaceum*	+	+	+
9. *M. punctatum*	+	+	-
10. *Nistarika bahupunctica*	+	-	-
11. *Loxogramme involuta*	-	-	+
12. *L. parellela*	-	+	-

	upto 1000m	1000-1500m	1500 & above
13.*Lepisorus amaurolepidus*	+	+	+
14.*L. nudum*	+	+	+
15.*Phymatosorus lucidus*	+	-	-
16.*P. nigrescens*	-	+	+
17.*Pyrrosia lanceolata*	+	+	-
18.*P. porosa* var. *porosa*	+	+	-
Grammitidaceae (4 species)			
1. *Ctenopteris subfalcata*	-	-	+
2. *Grammitis attenuata*	-	-	+
3. *G. medialis*	+	+	+
4. *G. pilifera*	+	+	-
ANGIOSPERMS			
Balsaminaceae (10 species)			
1. *Impatiens acaulis*	+	+	+
2. *I.auriculata*	+	-	-
3. *I. denisonii*	+	-	-
4. *I. jerdoniae*	+	-	-
5. *I. kulamavuensis*	+	-	-
6. *I. lawsonii*	-	-	+
7. *I. parasitica*	-	-	+
8. *I. sivarajanii*	-	-	+
9. *I. stocksii*	-	-	+
10.*I. viridiflora*	-	-	+
Melastomataceae (3 species)			
1. *Kedrickia walkerii*	-	-	+
2. *Medinilla beddomei*	+	-	-
3. *M. malabarica*	-	-	+
Araliaceae (2 species)			
1. *Poliscias acuminata*	+	+	-
2. *Schefflera venulosa*	+	+	-
Asclepiadaceae (3 species)			
1. *Hoya ovalifolia*	+	-	-
2. *H. pauciflora*	+	+	-

	upto 1000m	1000-1500m	1500 & above
3. *H. wightii*	-	+	-
Loganiaceae (1 species)			
1. *Fagraea ceilanica*	+	+	-
Lentibulariaceae (1 species)			
1. *Utricularia striatula*	-	+	-
Gesneriaceae (1 speices)			
1. *Aeschynanthus perottettii*	+	-	-
Piperaceae (4 species)			
1. *Peperomia dindigulencis*	+	+	-
2. *P. portulacoides*	+	+	-
3. *P. tetraphylla*	+	+	-
4. *P. wightiana*	+	-	-
Urticaceae (3 species)			
1.*Elastostemma surculosum*	-	-	+
2.*Lecanthus peduncularis*	+	-	-
3.*Procris wightiana*	-	-	+
Orchidaceae (129 species)			
1.*Acampe ochracea*	+	-	-
2.*A. pracmorsa*	+	-	-
3.*A. rigida*	+	-	-
4. *Aerides crispa*	-	+	-
5.*A. maculosa*	-	-	+
6.*A. ringens*	+	+	+
7.*Bulbophyllum acutiflorum*	+	-	-
8. *B. aureum*	+	-	-
9. *B. elegans*	+	+	+
10.*B. elegantulum*	-	-	+
11.*B. fimbriatum*	+	-	-
12.*B. fischerii*	+	+	-
13.*B. fuscopurpureum*	-	+	+
14.*B. kaitens*	-	-	+

	upto 1000m	1000-1500m	1500 & above
15.*B. neilgherrens*	+	+	+
16.*B. rheedei*	+	-	-
17.*B. tremulum*	+	+	-
18.*B. Xylophyllum*	+	-	-
19.*Chiloschista glandulosa*	+	-	-
20.*Cleistostoma tenuifolia*	+	-	-
21.*Coelogyne breviscapa*	+	+	-
22.*C. mossiae*	-	-	+
23.*C. nervosa*	-	-	+
24.*C. odoratissima*	-	-	+
25.*Cottonia peduncularis*	+	-	-
26.*Cymbidium aloifolium*	+	+	-
27.*C. bicolor*	+	-	-
28.*Dendrobium anamalayanum*	-	-	+
29.*D. aquem*	+	+	-
30.*D. crepidatum*	+	+	-
31.*D. haemoglossum*	-	-	+
32.*D. herbaceum*	+	+	+
33.*D. heterocarpum*	-	-	+
34.*D. heyneanum*	+	+	-
35.*D. jerdonianum*	-	+	+
36.*D. macrostachyum*	+	-	-
37.*D. microbulbon*	+	+	-
38.*D. nanum*	-	-	+
39.*D. ovatum*	+	-	-
40.*D. panduratum*	+	-	-
41.*D. peguanum*	+	-	-
42.*D. wightii*	+	-	-
43.*Diplocentrum recurvum*	-	-	+
44.*Eria albiflora*	+	-	-
45.*E. dalzelli*	+	-	-
46.*E. exilis*	+	-	-
47.*E. microchilos*	-	+	-
48.*E. muscicola* var. *brevilinguis*	+	-	-
49.*E. mysorensis*	+	+	-
50.*E. nana*	-	+	+
51.*E. pauciflora*	+	+	+
52.*E. polystachya*	+	+	-
53.*E. pseudoclavicaulis*	-	-	+
54.*E. reticosa*	+	+	+
55.*E. tiagii*	-	+	+
56.*Flickingeria nodosa*	+	+	+
57.*Gastrochilus acaulis*	+	+	-

	upto 1000m	1000-1500m	1500 & above
58.*G. bigibbus*	+	-	-
59.*G. flabelliformis*	+	-	-
60.*Kingidium deliciosum*	+	-	-
61.*K. mysorensis*	+	-	-
62.*K. niveum*	+	-	-
63.*Liparis ellipticum*	-	-	+
64.*L. viridiflora*	+	+	-
65.*Luisia abrahami*	+	-	-
66.*L. birchea*	-	-	+
67.*L. evangelinae*	+	+	-
68.*L. macrantha*	+	-	-
69.*L. zeylanica*	+	-	-
70.*Oberonia agastyamalayana*	+	-	-
71.*O. anamalayana*	+	+	+
72.*O. bicornis*	+	-	-
73.*O. brachyphylla*	+	-	-
74.*O. brunoniana*	+	+	+
75.*O. chandrasekharanii*	+	-	-
76.*O. ensiformis*	-	+	-
77.*O. ferruginia*	+	+	+
78.*O. forcipata*	+	-	-
79.*O. gammei*	+	-	-
80.*O. iridifolia*	+	+	+
81.*O. josephii*	-	+	-
82.*O. longibracteata*	-	-	+
83.*O. platycaulon*	-	-	+
84.*O. proudlockii*	+	+	-
85.*O. recurva*	+	+	+
86.*O. santapaui*	+	+	-
87.*O. sebastiana*	-	-	+
88.*O. seidenfadeniana*	+	+	-
89.*O. tenuis*	+	-	-
90.*O. thwaitesii*	+	-	-
91.*O. verticillata*	+	+	+
92.*O. wightiana*	-	-	+
93.*O. wynadensis*	+	+	-
94.*Papilionanthe subulata*	+	+	+
95.*Phollidota pallida*	+	-	-
96.*Phretia elegans*	-	+	+
97.*Podochilus malabaricum*	+	-	-
98.*Polystachya concreta*	+	-	-
99.*Pomatocalpa spicata*	+	-	-
100.*Porpax jerdoniana*	+	-	-

	upto 1000m	1000-1500m	1500 & above
101.*P. reticulata*	+	-	-
102.*Pteroceras leopardinum*	+	-	-
103.*Rhyncostylis retusa*	+	-	-
104.*Robiquetia gracilis*	+	-	-
105.*R. josephiana*	+	+	-
106.*Schoenorchis jerdonianum*	+	-	-
107.*S. nivea*	+	+	-
108.*Seidenfadeniella chrysntha*	-	-	+
109.*S. rosea*	-	+	+
110.*Sirhookera lanceolata*	+	+	+
111.*S. latifolia*	+	+	-
112.*Smithsonia maculata*	+	-	-
113.*S. straminea*	+	-	-
114.*S. viridiflora*	+	-	-
115.*Tainiophyllum scaberulum*	+	+	-
116.*Thelasis pygmea*	+	-	-
117.*Thrixspermum complanatum*	+	-	-
118.*T. pulchellum*	+	-	-
119.*Trias bonaceordensii*	+	-	-
120.*T. stocksii*	+	-	-
121.*Trichoglottis tenera*	-	+	+
122.*Vanda spathulata*	+	-	-
123.*V. tessellata*	+	-	-
124.*V. testaceae*	+	-	-
125.*V. thwaitesii*	+	-	-
126.*Vanilla aphylla*	+	-	-
127.*V. walkeriae*	+	-	-
128.*V.wightiana*	+	+	-
129.*Xenikophyton smeanum*	+	-	-
Commelinaceae (1 species)			
1.*Belosynapsis vivipara*	+	+	-
Araceae (1 species)			
1.*Remusatia vivipara*	+	+	-

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