

**ECOLOGICAL AND TAXONOMIC STUDIES  
ON THE PTERIDOPHYTES OF PERIYAR  
TIGER RESERVE, KERALA, SOUTH INDIA**

*Thesis submitted to the University of Calicut  
in partial fulfilment of the requirements  
for the degree of*

**Doctor of Philosophy**

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University of Calicut  
Kerala, India

2001

*dedicated to*

*my parents*

## DECLARATION

The thesis entitled “**Ecological and Taxonomic studies on the Pteridophytes of Periyar Tiger Reserve, Kerala, South India**” submitted by me for the degree of **Doctor of Philosophy** in Botany of the University of Calicut has not been formed the basis for the award of any degree/ diploma to the best of my knowledge.

Calicut University,  
18 April 2001.

  
**K. P. Rajesh**

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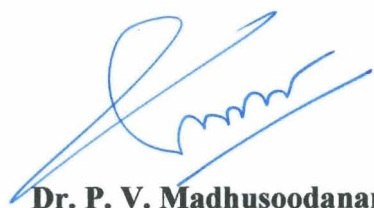
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### CERTIFICATE

Certified that the thesis entitled “**Ecological and Taxonomic studies on the Pteridophytes of Periyar Tiger Reserve, Kerala, South India**” submitted by Mr. K. P. Rajesh for the degree of **Doctor of Philosophy** in Botany of the University of Calicut is a bonafide record of research work done by him in this Department under my supervision. This has not previously been formed the basis for the award of any degree / diploma.

Calicut University,

18 April 2001.



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# INTRODUCTION

K.P. Rajesh “Ecological and taxonomic studies on the pteridophytes of Periyar tiger reserve, Kerala, South india” Thesis. Department of Botany , University of Calicut, 2001



*“Why do we know more about distant celestial objects than we do about the ground beneath our feet? ...”*

Leonardo da Vinci

## **INTRODUCTION**

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# 1. INTRODUCTION

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*Sojourner rover*, the first non-human fellow of the American Geological Society (Mc Sween & Murchie, 1999), has astonished the world by bringing the minutest details of the rocks of the Mars. After the Mars Pathfinder mission, *Barnacle Bill*, *Yogi*, *Scooby Doo* and *Boris*, became more familiar to us than the rocks in our garden or wayside. The recent advances in the field of science and technology could thus bring the details of the martian volcanism (Hartmann et al., 1999) or plate tectonics (Mc Kenzie, 1999), but not a complete list of species of the earth. It is ironical to note that the satellite missions are for searching the possible occurrence of extra terrestrial life, when most species of the earth are becoming extinct (Pimm & Raven, 2000; Mc Cann, 2000; Chapin III et al., 2000) even before they have been properly identified and named. Scientists are looking for habitable locations in the distant planets, while most ecosystems of the earth, which are teeming with life forms, are irreparably damaged.

It is predicted that the advancement in molecular taxonomy integrated with information technology would help us produce taxonomic biosensing equipments that could be used to identify the life forms to ultimate precision. Techniques may even be available to document the finest details of the life forms of the remote ecosystems '*without leaving the comfort of the armchair*'. But all these techniques, which may revolutionise the very practice of taxonomy, are things to happen in the future. The best method available at present is one that has been practised from time immemorial: field checking to explore the area, largely by foot to collect the data on the availability of the life forms. Thus what I present here are the results of an old-fashioned '*down to earth*' field study conducted in the pristine tropical forests of the Periyar Tiger Reserve of the Western Ghats from 1994 to 2000.

The Western Ghats, a 1400 km long chain of mountains stretching between the Tapti river basin in Gujarat State in the north and Kanyakumari of Tamil Nadu at south, runs parallel to the West Coast and is the most notable topographical feature of the Peninsular India. Being a part of the Gondwana land, which passed through different climatic stresses during its drift towards North, it represents unique paleo-flora and fauna. Its rugged terrain and the high peaks acted as habitat islands for a number of relict endemics. The Western Ghats strongly influence the climate and culture of South India. It supports rich biodiversity which is experiencing serious threats of destruction. Hence, it is identified as one among the 25 of global biodiversity hotspots (Myers et al., 2000). Compared to its northern parts, the southern Western Ghats is more species rich (Nair, 1991; Nayar, 1996 & 1997).

The Periyar Tiger Reserve situated in the southern Western Ghats is a part of the Anamalai-High ranges endemic centre identified in Kerala State (Nayar, 1996 & 1997). Eventhough the forest destruction rate is higher in southern Western Ghats, especially in Idukki district (Jha et al., 2000), the Reserve remains comparatively less disturbed due to its exceptionally high protected status as a Tiger Reserve. The biodiversity documentation of a protected area like Periyar Tiger Reserve in the southern Western Ghats is thus of high significance. The species or populations present in the protected areas are supposed to be saved from extinction (Sayers & Whitmore, 1991).

Named after *Periyar* River, the Periyar Tiger Reserve is one of the most popular tourist attractions in South India. The area is well known for its rich wild life and scenic beauty. The unique location of the Periyar Lake, created by building the Mullaperiyar dam in 1895, flanked by grasslands and forests, offers ample chances to observe wild animals in its natural surroundings. The area supports good populations of wild animals like tiger, elephant, gaur, sambar, wild boar, wild dog, nilgiri langur, etc. Large number of birds, butterflies, moths, etc are also seen as a sign of healthy environment. The fine network of hill streams beside the lake, support a rich and diverse fish fauna, including narrow endemics and recent finds. The famous pilgrim centre of South India,

Sabarimala Temple, which is visited by millions of devotees annually, is also situated in this Reserve.

The knowledge on the plant wealth of the Reserve was fragmentary until recently when a research project on the flowering plants of the Reserve was carried out. The project on the flowering plants of the Reserve, in which I also worked as a research fellow, resulted in the recording of ca. 2000 species, including some new taxa and interesting finds (Rajesh et al., 1996 & 1997; Sasidharan et al., 1997; Augustine et al., 1998; Sasidharan, 1998; Sasidharan et al., 1998; Sasidharan & Augustine 1999a & b; Augustine, 2000). Periyar Tiger Reserve is also notable for being the only known locality in Peninsular India for the occurrence of *Ophioglossum pendulum* and *Arthropteris palisotii* (Augustine et al., 1994; Rajesh et al., 1997). The present thesis is the result of the continued explorations done by me from 1994 to 2000. This study illustrates the diversity of pteridophytes of the Reserve, which includes more than 50 percent of the species known from the southern Western Ghats. In addition, the present study analyses the distribution pattern of pteridophytes along the vegetational and altitudinal gradients.

Recent studies reveal that the lower group of organisms play a key role in the ecosystem functions (Francis & Read, 1984; Simrad et al. 1997; Helgason et al., 1998; van der Heijden et al., 1998 a & b; Hartnet & Wilson, 1999; Ohtonen, 1999; Eom, 2000; Moore, 2000). It is found that the biodiversity of an area is determined by the microbes. These findings however, demand change in the manner of looking at the functions of ecosystems. Eventhough all the components of the biodiversity are important, in India lesser attention is paid on the study of pteridophytes. Much emphasis is given to the dominant components of the tropics, the flowering plants. Hence, the knowledge about pteridophytes, which also plays a prominent role in the ecosystem, is fragmentary. In the present 'age of biodiversity', it is unfair to neglect the pteridophytes which constitute a vital component of tropical ecosystem development and maintenance.

Except for a few regional studies (Manickam & Ninan, 1976, 1984; Manickam, 1986; Nair et al., 1988, 1992a & b, 1994; Manickam & Irudayaraj, 1992; Nayar & Geevarghese, 1993; Rajagopal & Bhat, 1998), Beddome's good old works (1863-1893) still remain as the primary source of reference on Indian ferns. The efforts to fill the gap for an updated fern flora of India are yet to be crystallised. From the conservation point of view, both national and regional studies are very significant. Regional studies are very important in planning and formulating suitable conservation strategies at local level (Margules & Pressey, 2000). All the earlier studies on the flora of the Periyar Tiger Reserve deal with flowering plants, except for a few sporadic reports of the occurrence of some pteridophytes. The present study aims to provide comprehensive data on the pteridophytes of the Reserve. Results of this study are presented with the hope that this may serve the purpose for the better management of the protected area.

# THE STUDY AREA

K.P. Rajesh “Ecological and taxonomic studies on the pteridophytes of Periyar tiger reserve, Kerala, South india” Thesis. Department of Botany , University of Calicut, 2001

*“... This is one of the most splendid sanctuaries in India both scenically with its combination of lake, grassland and forest and zoologically as a viable potential of all India’s sanctuaries for a future first class National park ...”*

Waller, R. H.

## **THE STUDY AREA**

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## 2. THE STUDY AREA

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Being the first of its kind in Kerala State, the Periyar Tiger Reserve has a long history. Construction of the Mullaperiyar dam across the Mullaperiyar river in 1895 created the Periyar lake. The dam was constructed subject to the conditions of the Periyar lease signed between the erstwhile Madras and Travancore States in 1886. As per the conditions of this lease, the water of the Periyar River will be diverted to irrigate the arable lands of Madurai of the erstwhile Madras Presidency for a period of 999 years. In 1899 the forest around the lake was declared as reserve forest, the *Periyar Lake Reserve Forest No. 39*, one of the first reserved forests in India. The then Maharaja of erstwhile Travancore State appointed Mr. C. H. Robinson in 1933 as the first game warden to constitute and maintain a sanctuary. As per his recommendation in 1934 the area around the lake was declared as the Nellikkampatty Game Reserve. In 1950, adding more areas, the Periyar Wildlife Sanctuary with an area of 777 km<sup>2</sup> was constituted. The area was brought under Project Tiger in 1978. The Reserve holds the largest stretch of evergreen forest under protection in Kerala State. Eventhough the preliminary notification for declaring it as a National Park was issued in 1982, the second notification elevating it to the status of a National park has not been issued until now (Asari, 1985; Nair, 1991).

Tribes, who practised shifting cultivation have, inhabited the area until it was declared as Game Reserve. There were 5 tribal communities inside the Reserve, viz., Mannan, Paliyan, Urali, Mala Arayan and Malam pandaram. Except for the Malam pandaram, all are now resettled outside the Reserve in settlements. Mannan and Paliyans have been resettled at Mannakkudy and Paliyakkudy respectively near Kumily. Uralis have been resettled in Vanchivayal settlement near Vallakkadavu and Mala Arayans at Moozhikkal and Attathodu settlements near Koruthodu. Cultivation, collection of non-timber forest produces, fishing, etc are the source of income of these tribes. The Malam pandarams, very few in number still follow '*nomadic*' life style and moves



inside the forests and are reluctant to mix with other people. Two groups were reported to live in the rock caves and temporarily built sheds near the hill streams at Arjunankotta and Chenthamara kokka. Four abandoned cardamom plantations inside the Reserve, viz., Lakshmippara, Melappara, Naduthottam and Ummikkuppan have become natural forests. The following description of the study area is prepared based largely on published sources such as Pillai (1940), Gee (1952), Kurup (1971), Waller (1972), Vijayan et al. (1979), Ramachandran et al. (1986 & 1987), Asari (1985), Nair (1991), Sasidharan (1998) and Augustine (2000).

## 2.1. Location

The Periyar Tiger Reserve situated in the southeast corner of the Idukki district of Kerala State lies between  $9^{\circ} 16'$  and  $9^{\circ} 30'$  North latitudes and  $76^{\circ} 57'$  and  $77^{\circ} 25'$  East longitudes (Fig. 2.1). It is bordered by the districts of Tamil Nadu, viz., Theni in the north and north-east, Virudanagar in the east and Thirunelveli in the south-east. Pathanamthitta and Kottayam districts of Kerala State lie in the south and west respectively. It is with an area of  $777 \text{ km}^2$  including  $26 \text{ km}^2$  of water spread of Periyar Lake.

## 2.2. Topography

The terrain of Periyar Tiger Reserve is characteristic of Cardamom hills, consisting of highly undulating chains of hills ranging from 100 m to over 2000 m above sea level (Fig. 2.2 & 2.3). The lowest altitude is at Pambavally area, about 100 m and highest peak is at Kottamala with an altitude of 2016 m. On the northern and eastern sides the crestline drops abruptly into the plains of Tamil Nadu. On the northern side lies the Cumbam valley and on the eastern side lies the Ramanad plains. Extending from the north-east of Kumily, there is a steep, spurhill projecting into the Tamil Nadu, called the High Wavy mountains. The southern part of the Reserve joins with the rugged Pandalam hills which extend up to Shenkotta gap in the southern Western Ghats. On the western part the Reserve continues with the Peermade plateau. There are more than 30 hill peaks having an altitude of 1000 m (Table 2.1). The area is drained by Periyar and its tributaries such as Mullayar.

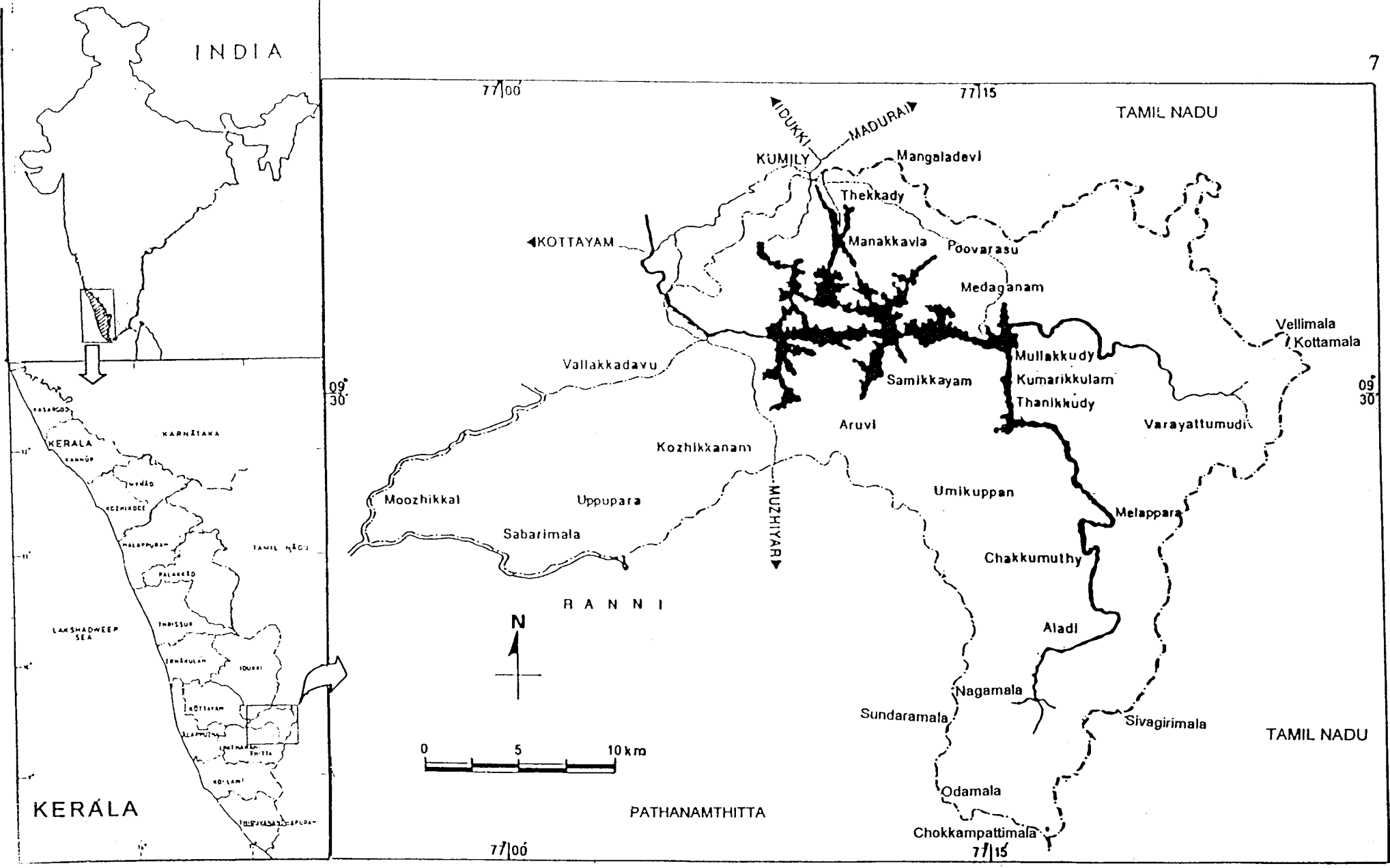


Fig. 2.1. Map of Periyar Tiger Reserve.

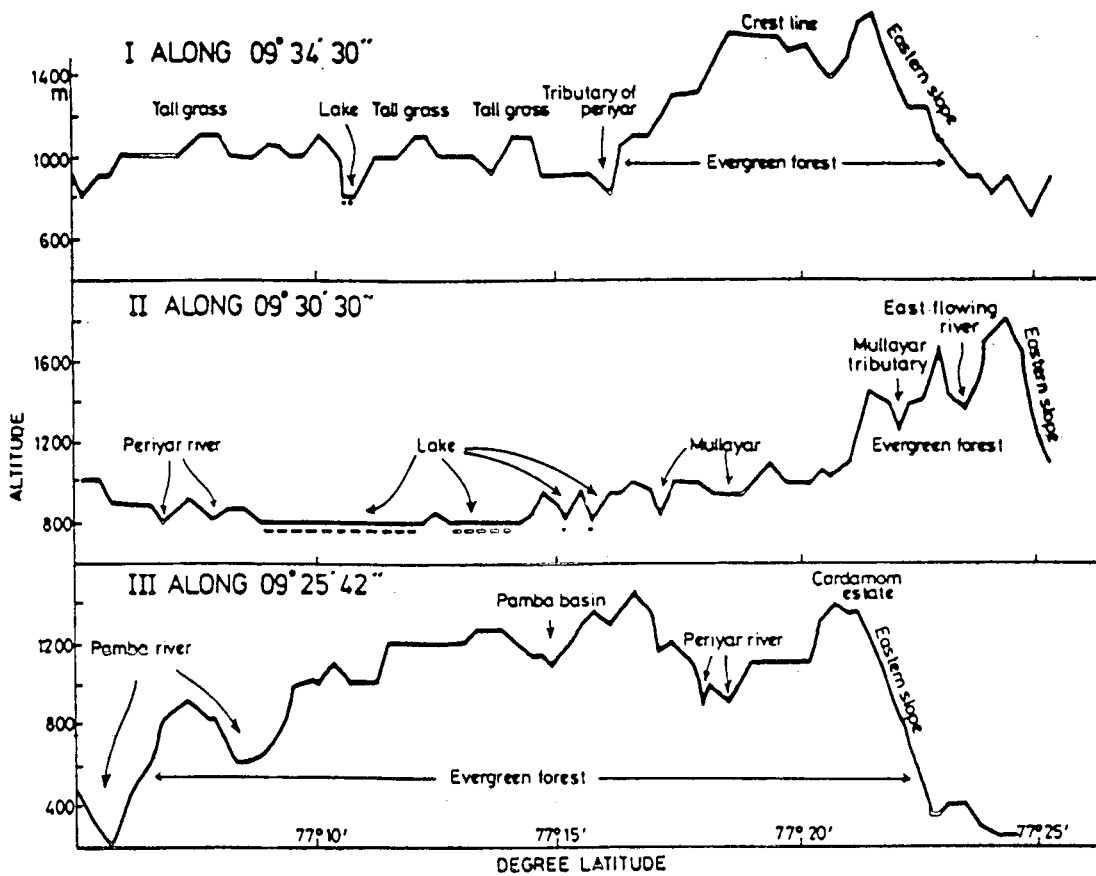


Fig. 2.2. Altitude profiles along three regions of the Periyar Tiger Reserve (Source: Ramachandran et al., 1986).



Fig. 2.3. A view of Periyar Tiger Reserve- vast stretch of evergreen forests, grasslands and lake.

Table 2.1. Prominent hills of Periyar Tiger Reserve.

<b>Name of peak</b>	<b>Altitude (m asl.)</b>
1. Kottamala	2016
2. Brooks peak	1965
3. Nagamala	1890
4. Vellimala	1877
5. Kari mala	1844
6. Chokkampatti mala	1802
7. Melmala	1795
8. Pachimala	1792
9. Aladimala	1756
10. Pachaiar mala	1752
11. Kalvarimala	1749
12. Sivagiri	1746
13. Surulipara	1628
14. Tulukkanpara mala	1619
15. Koyil mala	1606
16. Tottimalai	1597
17. Kovil mala	1573
18. Sangumalai	1557
19. Chavarkuzhi mala	1552
20. Pulamalai	1505
21. Chinnamelmala	1487
22. Varayattumudi	1463
23. Kattanatu mala	1434
24. Palkulam mudi	1371
25. Mangaladevi	1341
26. Swamikayam mala	1306
27. Kulaluti mala	1222
28. Kumarikulam	1204
29. Arjunankotta	1165
30. Brandippara	1139
31. Kottakavala mala	1091
32. Emankramala	1039
33. Mlappara	998
34. Lakshmiippara	976
35. Varayattumudi	904

### 2.3. Geology, Rocks and Soil

Granites, Gneises and Laterite are the main rock formations of the area. According to Murthy et al. (1982), the soil is known as *Thekkady series*, belonging to the red and lateritic regions. It is clayey, well drained and medium to strongly acidic.

### 2.4. Climate

The area receives South-West monsoon from June to September and retreating monsoon from October to November (Fig. 2.4). The average annual rainfall is about 2500 mm (Fig 2.5). The maximum rainfall is obtained during July-August. December to March is the least rainy period. The temperature varies between 15<sup>0</sup> C to 31<sup>0</sup> C. December-January is the coolest period and April-May is the hottest. The area is humid, typical of the southern Western Ghats.

### 2.5. Vegetation

Following the classification of Chandrasekharan (1962) and Champion and Seth (1968); Nair (1991) identified 12 vegetation types in the Reserve including Cane brakes, Wet Bamboo brakes, Reed brakes, Riparian fringing forest and West coast secondary evergreen Dipterocarp forest. Sasidharan (1998) and Augustine (2000) treated 7 types, which is followed in this study also.

1. West coast tropical evergreen forests (evergreen)
2. West coast semi-evergreen forests (semi-evergreen)
3. Southern moist mixed deciduous forests (moist deciduous)
4. Southern hill-top tropical evergreen forests (hill-top evergreen)
5. Southern montane wet temperate forests (shola)
6. South Indian sub-tropical hill savannah (savannah)
7. Southern montane wet grasslands (grassland)

#### 2.5.1. West coast tropical evergreen forests (evergreen)

This forest type is characterised by the presence of tall, clean boled trees of more than 35 m and is found in the Koruthodu-Sabarimala-Poonkavanam

areas. Three associations, viz., *Mesua-Palaquium-Cullenia*, *Hopea-Dipterocarpus-Vateria* and *Polyalthia-Myristica-Calophyllum* associations are seen in this type. The dominant top canopy trees include *Mesua thwaitesii*, *Palaquium ellipticum*, *Cullenia exarillata*, *Hopea parviflora*, *Dipterocarpus indicus*, *D. bourdillonii*, *Vateria indica*, *Polyalthia coffeoides*, *Myristica dactyloides*, *Calophyllum polyanthum*, *Holigarna grahamii*, *Diospyros buxifolia*, *Lophopetalum wightianum*, *Dysoxylum malabaricum*, etc. The middle canopy is composed of *Diospyros bourdillonii*, *D. condolleana*, *D. paniculata*, *Drypetes elata*, *D. malabarica*, *Humboldtia vahliana*, *Knema attenuata*, etc. The lower canopy is composed of *Orophea uniflora*, *O. erythrocarpa*, *Meiogyne ramarowii*, *M. pannosa*, *Goniothalamus rhynchantherus*, etc. The shrubby layer is dominated by *Psychotria* spp., *Glycosmis macrocarpa*, *Strobilanthes warrensis*, *S. heyneanus*, etc. This type of forest is rich in pteridophytes like *Pteris* spp., *Thelypteris* spp., *Angiopteris evecta*, etc (Fig. 2.6a).

### **2.5.2. West coast semi-evergreen forests (semi-evergreen)**

This forest type is found in areas such as Thekkady, Swamikkayam, Vallakkadavu, etc. The top canopy species include *Terminalia bellirica*, *Myristica dactyloides*, *Ficus drupacea*, *F. nervosa*, *F. virens*, *Bischofia javanica*, *Syzygium hemisphericum*, *S. gardneri*, *Mangifera indica*, *Filicium decipiens*, *Tetrameles nudiflora*, etc. The middle canopy is composed of trees like *Syzygium cumini*, *Litsea floribunda*, *L. decanensis*, *Dimocarpus longan*, *Harpullia arborea*, etc. The lower canopy trees include *Clausena indica*, *Aidia gardneri*, *Ixora brachiata*, *Archidendron monadelphum*, etc. The shrub layer is composed of *Cipadessa baccifera*, *Elatostemma lineolatum*, *Aporusa acuminata*, *Turrea villosa*, *Gomphandra coriacea*, *Allophyllus cobbe*, *A. concanicus*, *Strobilanthes anceps*, *S. pulneyensis*, etc. This forest type is also rich in pteridophytes such as species of *Pteris*, *Thelypteris*, *Tectaria*, *Asplenium*, etc.

### **2.5.3. Southern moist mixed deciduous forests (moist deciduous)**

This forest type is found in areas such as Thannikkudy, Mullakkudy, Edapalayam, Pambavalley, Metahaganam, etc, and is characterised by the dominance of deciduous trees. The dominant upper canopy trees include *Xylia*

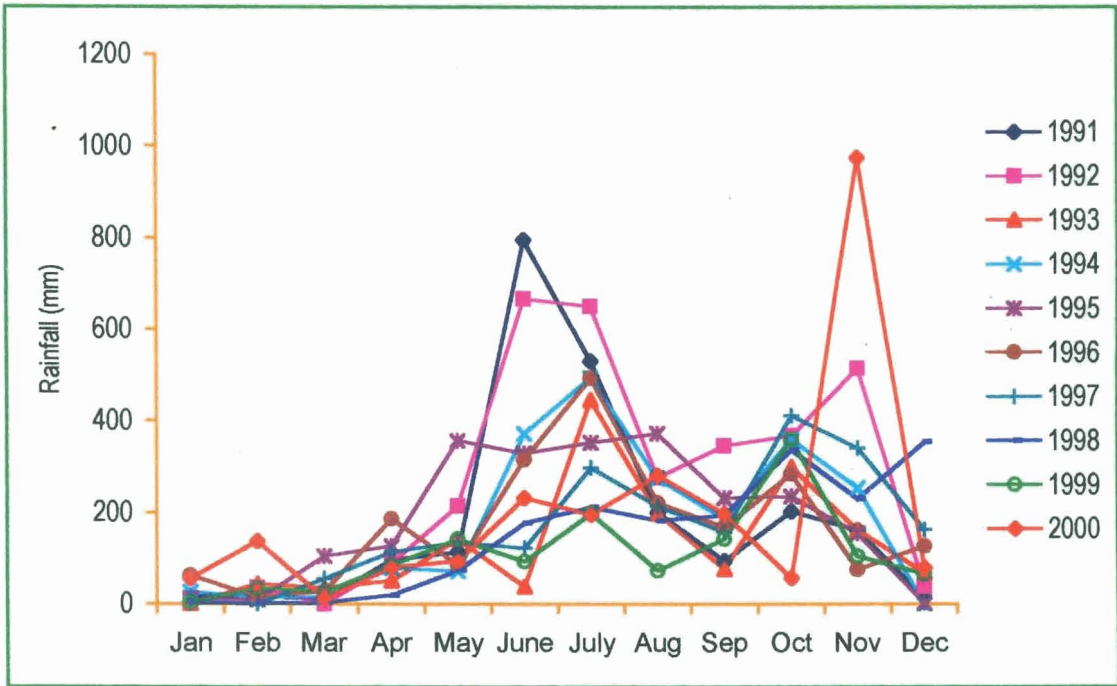


Fig. 2.4. Rainfall pattern of PTR (1991-2000).

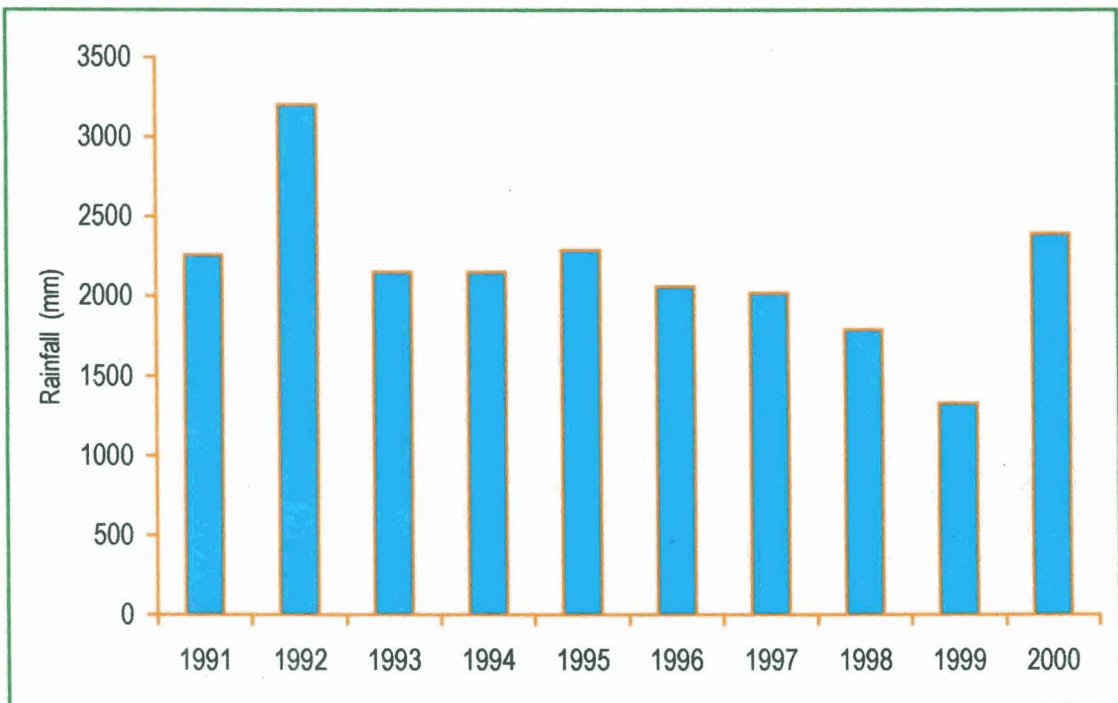


Fig. 2.5. Average annual rainfall of PTR (1991-2000).



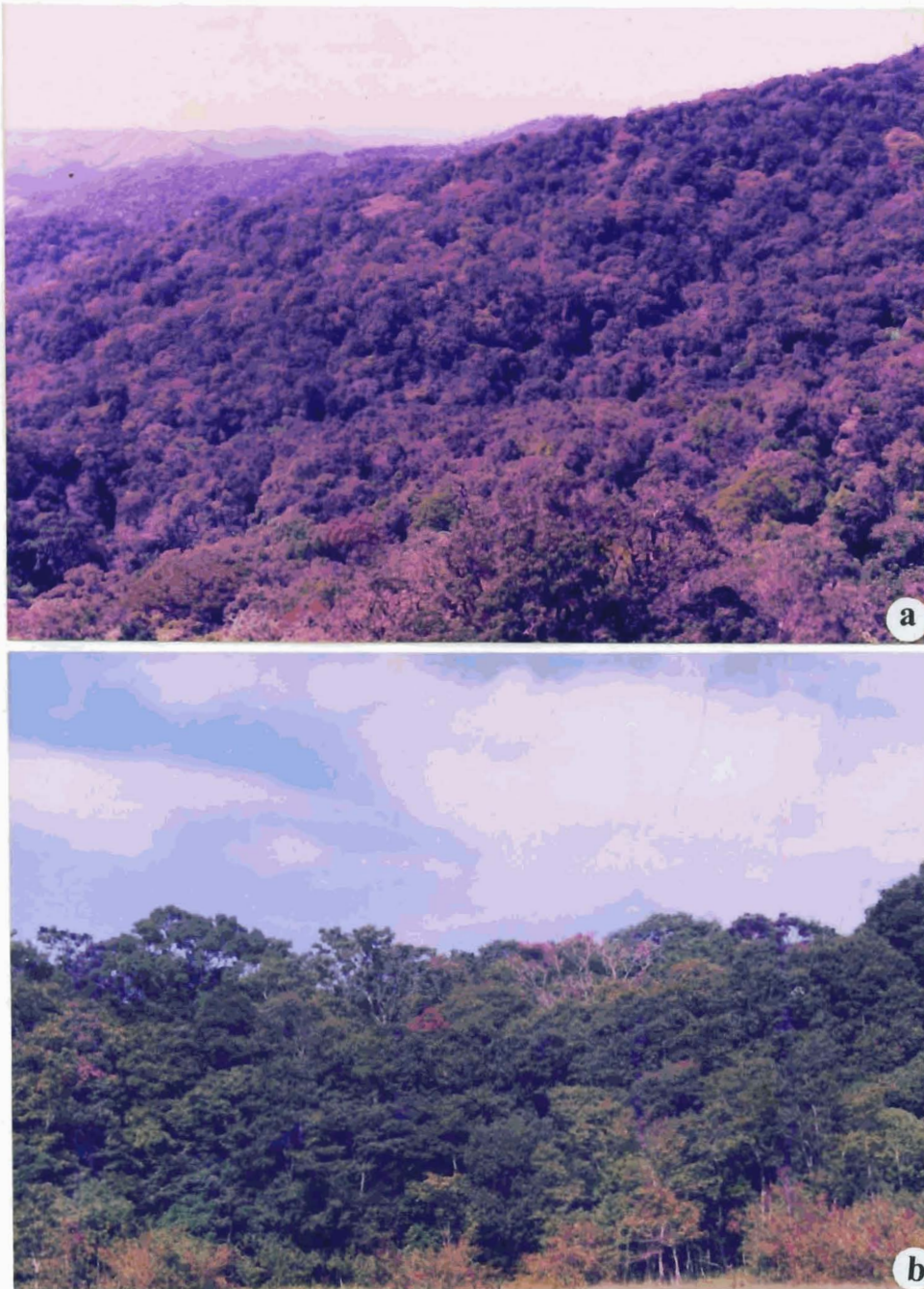


Fig. 2.6. **a.** A view of evergreen forest, **b.** A view of moist deciduous forest.

*xylocarpa*, *Pterocarpus marsupium*, *Tectona grandis*, *Terminalia paniculata*, *T. crenulata*, *Bombax ceiba*, *Tetrameles nudiflora*, *Actinodaphne malabaricum*, *Dalbergia lanceolaria*, *D. sissoides*, *Lagerstroemia microcarpa*, etc. The middle canopy is composed of *Olea dioica*, *Litsea coriacea*, *Careya arborea*, *Dillenia pentagyna*, etc. The lower canopy is composed of *Wrightia tinctoria*, *Catunaregan spinosa*, *Clausena dentata*, etc. The ground is usually overgrown with shrubs like *Mesa indica*, *Solanum torvum*, *S. anguvii*, *Lantana camera*, etc. Pteridophytes are comparatively less in this type of forest, with occasional presence of *Pteris* spp., *Tectaria coandunata*, *Adiantum* spp., etc (Fig. 2.6b).

#### 2.5.4. Southern hill-top tropical evergreen forests (hill-top evergreen)

This forest type is characterised by the dominance of tree species such as *Dysoxylum binecteriferum*, *Palaquium ellipticum*, *Cullenia exarillata*, *Mesua ferrea*, *Acrocarpus fraxinifolius*, etc and is found in places south of Mlappara, east of Mullakkudy and Thannikkudy. Two major subtypes are identified in this type, viz., *Dysoxylum-Palaquium-Cullenia* association and *Cullenia-Mesua-Acrocarpus* association.

The former is found in places south of Mullakkudy and Thannikkudy. In addition to *Dysoxylum*, *Palaquium* and *Cullenia*, other dominant trees of this type are *Acrocarpus fraxinifolius*, *Meliosma pinnata* sub sp. *barbulata*, *Syzygium gardneri*, *Litsea oleoides*, *Cassine paniculata*, etc. The middle canopy of this type is dominated by trees like *Casearia rubescens*, *C. ovata*, *Litsea glabrata*, *L. insigne*, *Hydnocarpus alpina*, *Diospyros* spp., etc. The lower storey is composed of trees such as *Goniothalamus wightii*, *Meiogyne pannosa*, *Microtropis stocksii*, *Aporusa fusiformis*, *Antidesma menasu*, *Glochidion ellipticum*, etc. The undergrowth is dominated by *Strobilanthes* spp., *Lasianthus* spp., *Dendrocide sinuata*, *Psychotria* spp., *Euonymus crenulatus*, *Saprosma foetens*, *Tabernaemontana gamblei*, *Elatostemma lineolatum*, *Pellionia heyneana*, etc.

The latter subtype is found in places south of Mlappara along Aladi-Chokkampatti hills. The dominant top canopy trees of this type are *Cullenia exarillata*, *Mesua ferrea*, *Acrocarpus fraxinifolius*, *Syzygium hemisphericum*, *S. zeylanicum*, *Elaeocarpus tuberculatus*, *Myristica dactyloides*, *Canarium*

*strictum*, *Drypetes oblongifolius*, etc. The middle canopy is composed of trees like *Coffea crassifolia*, *Gordonia obtusa*, *Lepisanthes tetraphylla*, *Dysoxylum beddomei*, etc. The lower canopy is composed of trees like *Aporusa ficiformis*, *Meiogyne pannosa*, *Microtropis stocksii*, *Litsea ligustrina*, etc. The undergrowth of this type also is as that of the former.

The hill-top evergreen forests are rich in pteridophytes. Species such as *Botrychium* spp., *Pteris* spp., *Thelypteris* spp., *Arthropteris palisotii*, *Arachniodes tripinnata*, etc. are commonly grown in the forest floor. Epiphytes like *Ophioglossum pendulum*, *Phymatosorus beddomei*, *Nephrolepis cordifolia*, *Davallia bullata*, *Araiostegia* spp., are common in this type of forest.

#### **2.5.5. Southern montane wet temperate forests (shola)**

This type is characterised by the presence of short-boled, densely branched trees, usually found above 1500 m altitude at places like Vellimala, Kottamala, Uppermanalar, Pachaiarmala, Sundaramala, Chokkampetti mala, etc. The dominant trees of this type are *Garcinia cowa*, *Syzygium parameswaranii*, *S. rubicundum*, *Eugenia discifera*, *Cinnamomum wightii*, *Phoebe wightii*, *Bhesa indica*, etc. The undergrowth is dominated by *Mallotus muricatus*, *Symplocos pulchra*, *S. macrophylla*, *S. monantha*, *Rauvolfia verticillata*, *Strobilanthes anceps*, *S. pulneyensis*, *S. micranthus*, *S. homotropus*, *S. gracilis* etc. This type of forest is notable for the rich growth of epiphytic mosses and orchids. Some species of epiphytic pteridophytes like *Grammitis pilifera*, *Elaphoglossum beddomei*, *Huperzia hilliana*, *H. hamiltonii*, *Phymatopteris montana*, etc., are confined to this type of forest.

#### **2.5.6. South Indian sub-tropical hill savannah (savannah)**

This forest type is found at Thannikkudy, Edapalayam and Kavalappara areas. This is characterised by the occasional growth of trees such as *Terminalia paniculata*, *T. chebula*, *Careya arborea*, *Pterocarpus marsupium*, *Phyllanthus emblica*, etc along with grasses. Shrubs like *Zizyphus rugosa*, *Helicteres isora*, *Desmodium pulchellum*, etc and grasses like *Themeda cymbaria*, *Chrysopogon hackelii*, *Cymbopogon flexuosus*, etc also grow here. Similar to that of the grasslands, savannahs are also poor in pteridophytes.

### 2.5.7. Southern montane wet grass lands (grassland)

Grasslands are found in Arjunankotta, Uppupara, Kavalappara, Mangaladevi, Kumarikulam, Palkulammudi, Kathiranmudi, Swamikkayam mala and Kalvarimala. Augustine (2000) divides the grasslands of the Reserve based on the species composition into three, viz., grasslands of hill top, of hill slopes and of lake shore. The first is composed of short, densely tufted grasses like *Tripogon* spp., *Chrysopogon* spp., *Heteropogon contortus*, *Arundinella* spp., etc. The second type is composed of tall grasses like *Themeda cymbaria*, *Cymbopogon flexuosus*, etc. The third type are with species like *Panicum repens*, *Brachiaria* spp., *Cynadon dactylon*, etc. The grasslands are less diverse as far as the pteridophytes are concerned. Species such as *Pteridium aquilinum*, *Cheilanthes opposita*, *Parahemionitis cordata*, *Actiniopteris radiata*, etc are the common species found. *Selaginella* spp. are found during the rainy periods. *Selaginella wightii* is confined to the rocks in the grasslands.

# REVIEW OF LITERATURE

K.P. Rajesh “Ecological and taxonomic studies on the pteridophytes of Periyar tiger reserve, Kerala, South india” Thesis. Department of Botany , University of Calicut, 2001

*“... Knowledge is of two kinds. We know a subject ourselves, or we know where we can find the information about it...”*

Dr. Samuel Johnson

## **REVIEW OF LITERATURE**

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### 3. REVIEW OF LITERATURE

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The earlier publications on Periyar Tiger Reserve are mainly on its fauna; ecology, behaviour of animals, new descriptions of fishes, etc (Krishnan, 1971; Kurup, 1971 & 1979; Mc Clare, 1972; Varghese, 1975 & 1981; Vijayan et al., 1979; Nair et al., 1985; Ramachandran et al., 1986 & 1987; Robertson & Jackson, 1992; Srivastava et al., 1993; Shaji & Easa, 1995; Arun et al., 1996; Zacharias et al., 1996; Menon & Jacob, 1996; Joseph et al., 1998 & Zacharias & Minimol, 1999).

The studies on the flora of the Reserve were scanty in the past. Ward and Connor (1827) and Bourdillon (1893) mention about the vegetation, tribals who inhabited in forests, their way of living, etc before the construction of the Mullaperiyar dam in 1895 and subsequent declaration of the area around the lake as a reserved forest in 1899. Chandrasekharan (1973) mentions about its forest types and classify it into evergreen, semi-evergreen, moist deciduous and grasslands.

Most of the other reports from the Reserve and surrounding areas are on the flowering plants which include description of new species, new records of occurrence, rediscoveries, etc. The earliest from the state of Travancore and its surroundings of the erstwhile Madras Presidency are those by Rao (1914), Gamble and Fisher (1915-1936), Blatter and Hallberg (1917), Blatter (1928), Fyson (1932), Barnes (1939), Iyappu (1955), etc.

The studies conducted by the Southern Circle of the Botanical Survey of India, resulted in the publication of a series of articles on the flora of the Idukki district, which include novelties such as *Gomphostemma keralensis* and *Cassia intermedia* from the Reserve itself. The important among them are those of Shetty and Vivekananthan (1969-1973), Sebastine and Vivekananthan (1967), Sharma and Rathakrishnan (1978), Sharma et al. (1974), Vivekananthan (1981), Vivekananthan et al. (1984), Mohanan et al. (1984), Pandurangan and Nair (1996).

Srivastava et al. (1994) recorded 64 grasses from the Reserve in a preliminary survey. Another series of publications then came as a result of the angiosperm flora project. These are: Rajesh et al. (1996 & 1997), Sasidharan et al. (1997), Augustine

et al. (1998), Sasidharan, (1998); Sasidharan et al. (1998), Sajeev et al. (1998), Sasidharan and Augustine (1999a & b), Augustine (2000). The project resulted in recording of about 2000 species of angiosperms including novelties such as *Habenaria periyarensis* and *Sysygium periyarensis*; rediscovery of *Taeniophyllum scaberulum*, *Symplocos monantha*, etc and new distribution records like *Rotala ritchie*, *Ficus caulocarpa*, etc. Apart from this, Thothathri and Ravikumar (1997) reported a new variety, *Mucuna pruriens* var. *thekkadiensis* from the Reserve.

D'Almeida (1926a & b), reported 59 pteridophytes including a new species, *Davallia halbergii* from the High Wavy Mountains which is contiguous with the Reserve. Recently Rajasekaran and Santhan (1996) recorded 47 pteridophytes from the same area, but did not give any reference to previous works of D' Almeida.

Occasional explorations made by the scientists of Botanical Survey of India also brought out some interesting pteridophytes from the Reserve and surrounding areas. Subramanyam et al. (1961) reported the occurrence of 50 pteridophytes from the nearby Cumbum valley and Patchakumatchi hills, including *Arthropteris palisotii* as a new record to South India. Nair and Ghosh (1973) reported *Ophioglossum gramineum* as a new record to Kerala from Thekkady. Vivekananthan (1978) gives a brief description of the vegetation and the rare and threatened plants, including some pteridophytes, of the Periyar Wildlife Sanctuary. Ghosh (1985) while describing the new species, *Phymatosorus beddomei*, cites specimens collected from the Reserve. Augustine et al. (1995) reported *Ophioglossum pendulum* and Rajesh et al. (1997) recorded *Arthropteris palisotii* from the Reserve.

The earliest description of the South Indian plants was those in van Rheedé's (1678-1703) monumental work *Hortus Indicus Malabaricus*. Eventhough there are some differences of opinion regarding the identification of some of the 15 pteridophytes illustrated and described in 19 plates, (Nicolson et al., 1988; Datta 1985; Almeida & Almeida, 1993; Madhusoodanan & Rejani, 1994) Rheedé's work is of great historical importance in Indian botany. Linnaeus (1753) largely depended on this work while naming the Indian plants. Other publications of historical importance are those of Hooker (1844-1864), Hooker and Greville (1827-1831), Hooker and Baker (1865-1868), Smith (1866 & 1875), Baynes (1887), Moore (1857-1862), etc.



The most outstanding work on the South Indian pteridology is Col. R. H. Beddome's *Ferns of Southern India*, which recorded 240 species of pteridophytes from the Peninsular India. His other works, *The Ferns of British India* (1866), *Supplement to the Ferns of Southern India and British India* (1876), *Handbook to the Ferns of British India* (1883) and *Supplement to the Ferns of British India* (1892), still continue to be good source books on Indian pteridology. Nayar and Kaur's (1974) 'Companion' and Chandra and Kaur's (1987) 'Nomenclatural Guide', though inadequate in some respects, are helpful in identifying Beddome's ferns.

The works of Holttum (1938-1979) greatly influenced the growth and development of modern pteridology, which were largely used by Indian pteridologists. Slegde's (1956-1982) exhaustive studies on the ferns of Ceylon are also of great importance. The contributions of Walker (1957 & 1960), Fraser-Jenkins (1986 & 1989) are also relevant with respect to South Indian ferns.

Ching (1984) comments that the major problem of Indian pteridology is the lack of access to the authentic specimens lodged in the European Herbaria. Professor S. S. Bir is a colossal figure in Indian pteridology with his outstanding contribution in almost all aspects of pteridology. His excellent reviews on Indian pteridology (Bir, 1977 & 1987) give insights into the depth and breadth of the subject. He also expresses his concern over the decline of active contributors in pteridology due to various reasons. The contributors to South Indian pteridology are not an exception. Active workers are confined to a few centres and their population is fast depleting (Madhusoodanan et al., in press). Major contributions are from Botanical Survey of India, Calicut University, Kerala University, and St. Xaviers College (Playamkottai, Tamil Nadu).

Scientists of Botanical Survey of India; Nair, Shetty, Sharma, Vivekananthan, Sebastine, Bhargavan, Rathakrishnan, S. R. Ghosh, R. K. Ghosh and Dixit, contributed a lot on various aspects of South Indian pteridology. They give a general account of the pteridophyte flora of the area and describe new species like *Cheilanthes keralensis* Nair et Ghosh, *Pteris furunculata* Nair et Ghosh, *P. silentvalliensis* S.K.Ghosh et S.R.Ghosh, *Phymatosorus beddomei* S.R.Ghosh, *Selaginella ganguliana* Dixit, *S. nayarana* Dixit, *S. keralensis* Dixit:- (Ghosh & Ghosh, 1982; Dixit, 1984 & 1985; Ghosh, 1985). They also commented on the nomenclatural problems and reported the occurrence of many species of

phytogeographical importance as new to the area such as *Pityrogramma* spp., *Pteris dactylina* Hook., *P. confusa* T.G.Walker, *P. roseo-lilacina* Hieron., *P. praetermissa* T.G.Walker, *Asplenium greville* Wall. ex Hook. & Grev., *Ophioglossum gramineum* Willd., *Phlebodium aureum* (L.) J.Sm., *Huperzia ceylanica* (Spreng.) Trev., etc:- (Sebastine, & Vivekananthan, 1967; Shetty & Vivekananthan, 1971; Bhargavan, 1973; Nair & Ghosh, 1973, 1974, 1975, 1976a & b, 1978a, b & 1979; Nair & Bhargavan, 1980, 1981a, b & 1985; Bhargavan & Nair, 1981; Nair & Dixit, 1981; Nair et al., 1984, 1988, 1992 a & b & 1994; Bhargavan & Vivekananthan, 1987). Ravi and Joseph (1979) described a new species, *Grammitis pilifera* Ravi et Joseph, from Kerala State.

Nair and Bhargavan (1981a) provide an excellent review on the South Indian pteridology. The review browses through the good old literature on the South Indian ferns like those of Linnaeus, Koeinig, Burman, Swartz, Willdenov, Roth, Wallich, Zenker, Graham, Agardh, Miquel, Gardner, Kunze, Brown, DeVries, etc. Dixit's (1984) *A Census of Indian Pteridophytes* and Dixit and Vohra's (1984) *A Dictionary of the Pteridophytes of India* are useful references on Indian pteridophytes. Dixit's (1988 & 1992 respectively) revisions on the families *Lycopodiaceae* and *Selaginellaceae*, though not comprehensive and perfect, provide insight into the subject. Nair et al., (1988, 1992 a & b & 1994) provide an exhaustive treatment of about 250 pteridophytes of Kerala State. Dixit and Mondal (1993) gives an account of 43 fern-allies of South India.

The pteridologists at Kerala University; Ninan (1955-1966), Abraham (1958-1962), Kuriachan (1963-1976), Bhavanandan (1971-1985) and Ammal (1987-1996); contributed on the cytological aspects, particularly of South Indian pteridophytes.

Another wave of publications on Indian pteridology is due to B. K. Nayar and his group, both at National Botanical Gardens, Lucknow and Calicut University. With Kaur, Devi, Bajpai, P. Chandra, S. Chandra, Raza, Kazmi, Lata, Srivastava and Chopra; all at NBRI contributed on various aspects ranging from anatomy, gametophyte morphology and cytology to phylogeny (Nayar, 1954-1995; Nayar & Srivastava, 1962; Nayar & P. Chandra, 1963-1967; Nayar & Kaur, 1963-1974; Nayar & Bajpai, 1964; Nayar & Devi, 1964-1967; Nayar & Kazmi, 1963, 1964; Nayar & Lata, 1965; Nayar and S. Chandra, 1965, 1966; Nayar et al., 1965-1968).

With his students at Calicut University; namely Gopalakrishnan, Molly, Geevarghese and Madhusoodanan, he contributed much to South Indian pteridology. They described novelties such as *Microlepia manohara*, *Nistarika bahupunctika*, *Adiantum ramyam*, *A. nagnam*, etc and reported many species of phytogeographic importance from the area (Nayar & Madhusoodanan, 1977 & 1984; Nayar et al., 1985; Nayar & Geevarghese, 1986, 1987 & 1993; Nayar & Molly, 1989; Nayar & Gopalakrishnan, 1981; Gopalakrishnan & Nayar, 1990).

Madhusoodanan and his collaborators contributed on the various aspects of South Indian pteridology, ranging from taxonomy, ecology, morphology, anatomy, cytology, palynology, to physiology and economic importance. Various aspects of *Salvinia* (Madhusoodanan, 1989a & b, 1990; Madhusoodanan & Nampy, 1994) and *Azolla* (Madhusoodanan & Sevichan, 1989a & b, 1990, 1991a; Sevichan & Madhusoodana, 1991, 1993, 1995, 1996a & b) were studied in detail. Madhusoodanan et al. (1991) comments on the cytotaxonomy and phylogeny of heterosporous ferns. Taxonomy and distribution of *Adiantaceae* (Madhusoodanan & Sevichan, 1991), *Lycopodiaceae* (Madhusoodanan et al., 1996), *Lomariopsidaceae* (Majeed et al., 1994a, b & c, 1995) and *Aspleniaceae* (Azeez et al., 1996) were studied for Kerala State. The following pteridophyte groups were revised for South India:- Cheilanthoid ferns (Madhusoodanan & Jyothi, 1992a & b, 1993; Jyothi & Madhusoodanan, 1993), *Thelypteridaceae* (Leena & Madhusoodanan, 1992, 1993, 1994a & b, 1996a & b; Madhusoodanan & Leena, 1994); *Polypodiaceae* (Nampy & Madhusoodanan, 1991, 1992a & b, 1993, 1994, 1995 & 1998) and *Hymenophyllaceae* (Madhusoodanan et al., 1996; Madhusoodanan & Hameed, 1997a & b, 1999; Hameed & Madhusoodanan, 1998a, b, c & 1999). Madhusoodanan and Kumar (1986) recorded *Schizaea digitata* from South India. Some novelties like *Selaginella dixitii* Madhus. et Nampy (Madhusoodanan & Nampy, 1994), *Helminthostachys zeylanica* var. *brachyspicae* Nampy et Madhus. also were described. (Nampy & Madhusoodanan, 1994c). Ecology and diversity of aquatic pteridophytes (Madhusoodanan et al., 1992, 1993; Madhusoodanan & Kumar, 1994) and pteridophytes in general for Wyand (Leena & Madhusoodanan, 1998) and Kerala (Madhusoodanan & Nampy, 1998) were also studied.

V. S. Manickam and his group is another prominent contributor to the South Indian pteridology. He and his team had been contributed considerably on varied

aspects of pteridology such as taxonomy, anatomy, conservation, ecology, cytology, phytochemistry, morphology, *in vitro* propagation, etc (Manickam, 1984, 1986, 1988, 1989, 1995; Manickam & Ninan, 1984; Manickam & Irudayaraj, 1988, 1989, 1990a, b & c, 1991, 1992; Irudayaraj & Manickam, 1986, 1987, 1991, 1992, 1995; Irudayaraj & Bir, 1994, 1997; Ramachandran et al., 1991; Antonisamy et al., 1992; De Britto et al., 1992, 1993, 1994 a, b, c & d, 1995, 1996a & b; Irudayaraj et al., 1992, 1993, 1995a & b, 1996; Jesudass et al., 1992, 1995; Raja et al., 1992; Gopalakrishnan et al., 1993a & b; Joseph et al., 1993; Irudayaraj, 1994, 1996, 1998, 1999a, b & c; Bir et al., 1996; Bir et al., 1996; Manickam et al., 1997, 1998; Sara et al., 1998; Irudayaraj & Raja, 1998; Manickam and Rajkumar, 1999; Irudayaraj & Jeyanth, 1999; Irudayaraj & Ganapathi, 2000; Raj & De Britto, 2000.).

Holtum (1976) recorded the occurrence of 10 species of *Thelypteridaceae* in 'Flora of Hassan District, Karnataka'. Pullaiah and Yesoda (1989) record 8 pteridophytes from Anantapur District of Andhra Pradesh. Yoganarasimhan et al. (1981) reported 12 species of ferns in the *Flora of Chikmangalur District, Karnataka*. Rajagopal and Bhat (1998) reported 172 pteridophytes from Karnataka State. Irudayaraj and Bir (1997) recorded 16 pteridophytes from Goa State.

Viswanathan (1989) described a new species, viz., *Asplenium lakshmanii*, from Javad Hills of Tamil Nadu. Some other works relevant to South Indian pteridophytes are Vasudeva and Chhibber (1989), Vasudeva et al. (1991), Panigrahi (1992 & 1994), Antony et al. (1996, 1997, 2000), Kumar (1997), Kumar, et al. (1998a & b), Kumar and Sequira (1998 a & b, 1999), Kumar, et al. (1999), Mitra and Sarkar (2000), etc.

The book by Fraser–Jenkins (1997) critically examines the drawbacks of Indian pteridology and thus emerged as a good source book.

Chandra (1998) makes an updated census of endemic pteridophytes of India. Dixit (1998) by following Pichi-Sermolli (1977) accepts Tryon's (1976) treatment of Cyatheaceae and rearranged the 14 tree ferns of India into *Alsophila* R.Br. and *Sphaeropteris* Bernh. However, he does not make any mention to the widely accepted system of Lellinger (1987) supported by molecular taxonomy (Conant, et al., 1995). Luckily Dixit's (1998) treatment of Indian Cyatheaceae falls within the

above mentioned two genera relevant to India, not creating new nomenclatural problems.

Chandra's (2000) '*The Ferns of India*' enumerates more than 1100 pteridophytes with details on synonyms and distribution. But this book is not without errors, which requires a thorough editing and correction to become a reference book on Indian pteridophytes, as claimed by the author.

Smith (1995) reviews the hypothesis of pteridophyte phylogeny based on non-molecular techniques. The potential use of the most recent and powerful techniques of molecular taxonomy to settle taxonomic problems at various levels have been discussed by many (Wolf, 1995a & b; Ranker, 1995; Hasebe et al., 1995; Manhart, 1995; Raubson & Stein, 1995; Pryer et al., 1995; Crane et al., 1995; Conant et al., 1995; Gastony & Rollo, 1995; Haufler & Ranker, 1995; Hauk, 1995; Murakami et al., 1995; Wolf et al., 1998 & 1999; Sano et al., 2000a & b). Pryer et al. (2001) proves that horse tails and ferns are monophyletic groups and are the closest relatives of seed plants.

Ecological studies on the lower group of plants are comparatively less compared to other aspects. Holttum (1938) provided the first comprehensive treatment on the ecology of tropical pteridophytes. The main reason for the lack of studies is that the pteridophytes are not a dominant component in any vegetation. The branch of ecology of pteridophytes, thus still has not flourished as other branches of pteridology. Except for a few, most of the works contain only scanty information on ecology of the pteridophytes.

In India the earlier studies on ecology of pteridophytes (Mehra, 1939; Stewart, 1945; Kachroo, 1953 & 1975; Schelpe, 1954; Loyal & Verma, 1960; Bir, 1963; Singh, 1963; Mehra & Bir, 1964; Panigrahi & Patnaik, 1968; Mehra & Dhir, 1968; Dhir & Sheera, 1975) are mainly from the Himalayan region. Gopal (1968, 1969a & b) reported the ecology of *Marsilea*. Bir and Vasudeva studied the ecology of the ferns of Kodaikanal (in 1971) and Pachmarhi Hills (in 1972). Sharma and Bohra (1977) describes the year round phenology of pteridophytes of Mt. Abu.

After Holttum (1938), Page (1979a & b) provided an elaborate treatment of the ecology of ferns.

Awasthi and Sharma (1980) made ecological observations on the pteridophytes of Garwal. Dhir and Sood (1981) in '*Ferns of Mussoorie*', Bhaishya and Rao (1982) in '*Ferns of Meghalaya*', Bir et al. (1983) in '*Ferns of Garwal Himalaya*' provided information on the ecology of ferns. Bir et al. (1982) described the ecology of Indian Polypodiaceae members. The book by Manickam and Ninan (1984) is the first elaborate study on the ecology of ferns of South India. Gurung (1985) and Sinha and Gurung (1985) studied the ecology of pteridophytes of Nepal. Sharma and Purohit (1985) and Kaur and Yadav (1985) studied the water deficit, resurrection and drought endurance of Rajasthan ferns. Vasudeva and Bir (1987) commented on the ecology of the ferns of Tamia Hills. Gena et al. (1987) studied the ecology of *Isoetes* of Rajasthan. Dixit (1989) gives an account of ecology of pteridophytes of Madhya Pradesh. Singh and Bir (1989) have commented on the distribution, ecology and phytogeography of the Asplenioid ferns of India.

Maheswaran and Gunatilleke (1988) highlighted the role of pteridophytes as nutrient reserves in disturbed habitats of Sri Lanka. Catling and Lefkovitch (1989) report the epiphytism and host ranges in vascular plants.

Dutta and Sen (1992) comment on the growth and development of some ferns under different environmental conditions. Dixit and Balkrishna (1990, 1993) provide phytogeographical analysis of endemic pteridophytes of India. Gupta (1991) reviews the role of pteridophytes in environment pollution monitoring. Bir et al. (1991) give an account of the ecology, distribution and phytogeography of 596 North-Eastern Indian pteridophytes. Theurkauf (1993) comments on the *ex situ* conservation of South Indian ferns. Nayar and Geevarghese (1993) provide a detailed account of ecology of ferns of Malabar. Vasudeva (1995) examines the ecology and phytogeographical peculiarities of 78 pteridophytes of Pachmarhi Hills. Gurung (1997) gives a detailed description of ecology of pteridophytes of Nepal. Munshi and Kundu (1997) study the epiphytism of *Microsorium punctatum* (L.) Copel. Leena and Madhusoodanan (1998) commented on the ecology of pteridophytes of Wyand District. Madhusoodanan and Nampy (1998) provided an elaborate ecological classification of pteridophytes of Kerala State. Kumar and Sequiera (1998b & 1999) analyse the distribution and ecology of epiphytic pteridophytes of Kerala State and of Silent Valley National Park. Sharma (1999) studies the anatomy and ecology of tree ferns of Himalaya.

Young and Leon (1991), Tuomisto and Paulsen (1996), Porter (1994), Tuomisto and Ruokalainen, (1994), Tuomisto et al. (1995, 1996, 1998), Parris (1996), Paul et al. (1996), Leon and Young (1996), Ruokalainen and Tuomisto (1997), Arens and Baracalado (1998) are some studies dealing with detail of the ecology of pteridophytes. Sharpe (1993) records the demography of *Danaea wedlandii*. Walker (1994), Walker and Aplet (1994), Walker and Boneta (1995) and Walker et al. (1996) deals with various aspects of fern ecology; its role in plant succession, etc. Arens (1997) comments on the leaf anatomy of *Cyathea caracasana* and its ecological significance. Dassler and Farrar (1997) evaluate the form of gametophytes with respect to the ecology. Russel and Vitousek (1997) and Russel et al. (1998, 1999) studied the ecology of *Dicranopteris linearis* in Hawaii. Sheffield (1996) comments on the potentials of soil spore bank. Rumsey and Sheffield (1996) and Moore (1998) comment on the significance of independent gametophyte phenomenon.

# MATERIALS AND METHODS

K.P. Rajesh “Ecological and taxonomic studies on the pteridophytes of Periyar tiger reserve, Kerala, South india” Thesis. Department of Botany , University of Calicut, 2001



*“What we see depends on how we view it...”*

Anonymous

## **MATERIALS AND METHODS**

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## 4. MATERIALS AND METHODS

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### 4.1. Taxonomic studies

Systematic collection of the pteridophytes was done during the field study by camping and trekking through the study area. Data on the habit, habitat and other ecological details were noted down. Herbarium of the collected specimens were prepared following the standard procedures (Bridson & Forman, 1994) and deposited in the Calicut University Herbarium (CALI). The specimens collected during the angiosperm flora project and lodged in the Kerala Forest Research Institute Herbarium (KFRI) are also used for the study. Specimens housed in Madras Herbarium (MH) from the study area and its immediate surroundings such as the High Wavy Mountains of Tamil Nadu also were referred. Identification of the specimens was done using pertinent literature. The spores were studied without any treatment. Doubtful specimens were sent to experts and got it confirmed.

The systematic treatment of the pteridophytes collected from the Reserve starts with a key to families. All the species are provided with correct name and a description with notes on the distribution arranged according to Pichi-Sermolli's (1977) system of classification. The synonyms and citations are limited to those relevant to South India. The updated scheme of Brummit and Powell (1992) and Pichi-Sermolli (1996) are followed in author citations. Relevant notes are provided wherever necessary. Abbreviations used in the thesis are as follows.

CALI- Calicut University Herbarium

JA- Jomy Augustine

KPR- K.P. Rajesh

MH- Madras Herbarium

PTR- Periyar Tiger Reserve

KFRI- Kerala Forest Research Institute Herbarium

TN- Tamil Nadu

#### **4.2. Ecological studies**

The distribution pattern of the pteridophytes was studied by searching the fern habitats thoroughly and by recording the abundance and frequency of the species. A hand-held altimeter was used to measure the altitude. At a particular altitude range the abundance and frequency of each species along a linear transect was measured.

# RESULTS

K.P. Rajesh “Ecological and taxonomic studies on the pteridophytes of Periyar tiger reserve, Kerala, South india” Thesis. Department of Botany , University of Calicut, 2001

*“...When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, your knowledge is of a meagre and unsatisfactory kind; it may be the beginning of knowledge but you have scarcely, in your thoughts, advanced to the stage of science...”*

*William Thompson (Lord Kelvin)*

## **RESULTS**

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## 5. RESULTS

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### 5.1. Systematic treatment of Pteridophytes of Periyar Tiger Reserve

The classification of pteridophytes is a dynamic area of discussion as there still exists differences of opinion (Hennipman, 1996). An agreeable classification is yet to be formed. Kramer (in Kramer & Green, 1990) tries to propose a new scheme after incorporating all recently available data. But some workers still are not to follow the scheme of Kramer as it is not applicable globally (Lellinger, *pers. comm.* 2000). Even though Brummit's (1992) scheme is a plan for herbarium arrangements, some follow this as a classification system of pteridophytes. After discussing with experts, Pichi-Sermolli's (1977) system is followed with some amendments for the present treatment (Table 5.1.1). A comparison of the Kramer's (in Kramer & Green, 1990) and Brummit's (1992) systems for the pteridophytes of the Reserve is also given in Table 5.1.2.

Table 5.1.1. Classification of Pteridophytes of Periyar Tiger Reserve according to Pichi Sermolli's system (1977) incorporating relevant changes.

Class	Order	Family	Genus
Lycopsidea	Lycopodiales	Lycopodiaceae	Huperzia Lycopodiella
	Selaginellales	Selaginellaceae	Selaginella
Equisetopsida	Equisetales	Equisetaceae	Equisetum
Psilotopsida	Psilotales	Psilotaceae	Psilotum
Ophioglossopsida	Ophioglossales	Ophioglossaceae	Botrychium Ophioglossum
Marattiopsida	Marattiales	Marattiaceae	Angiopteris Marattia
Filicopsida	Schizaeales	Lygodiaceae	Lygodium
	Pteridales	Sinopteridaceae	Cheilanthes Doryopteris Pellaea
		Actiniopteridaceae	Actiniopteris
		Pteridaceae	Pteris
		Adiantaceae	Adiantum
		Hemionitidaceae	Parahemionitis Pityrogramma
		Vittariaceae	Antrophyum Vittaria
		Parkeriaceae	Ceratopteris
		Marsileales	Marsileaceae
	Hymenophyllales	Hymenophyllaceae	Cephalomanes Crepidomanes Hymenophyllum Trichomanes
	Dicksoniales	Cyatheaceae	Alsophila Sphaeropteris
	Dennstedtiales	Dennstedtiaceae	Microlepia Pteridium Hypolepis
		Lindsaeaceae	Lindsaea Odontosoria
	Aspleniales	Thelypteridaceae	Macrothelypteris Thelypteris
		Aspleniaceae	Asplenium

Table 5.1.1. (ctd.).

Class	Order	Family	Genus
Filicopsida	Aspleniales	Athyriaceae	Anisocampium Athyrium Deparia Diplazium
		Dryopteridaceae	Arachniodes Dryopteris Polystichum Tectaria
		Lomariopsidaceae	Bolbitis Elaphoglossum
		Nephrolepidaceae	Nephrolepis
		Oleandraceae	Arthropteris Oleandra
		Davalliaceae	Araiostegia Davallia Humata Leucostegia
	Blechnales	Blechnaceae	Blechnum Stenochlaena
	Polypodiales	Grammitidaceae	Grammitis Prosaptia
		Loxogrammaceae	Loxogramme
		Polypodiaceae	Drynaria Lepisorus Leptochilus Microsorium Phymatopteris Phymatosorus Pleopeltis Pyrrosia
	Salviniales	Azollaceae	Azolla



Table 5.1.2. Classification of Pteridophytes of Periyar Tiger Reserve as per different classification systems- a comparison. Pichi Sermolli's (1997) system is followed in the present study incorporating relevant changes. (The family sequence in the classifications is not strictly followed here to effect the comparison).

<b>Pichi Sermolli (1977)</b>	<b>Kramer (in Kramer &amp; Green, 1990)</b>	<b>Brummit (1992)</b>
Class Lycopsidea Order Lycopodiales <b>Lycopodiaceae</b> Huperzia Lycopodiella	Class Lycopodiatae <b>Lycopodiaceae</b> Huperzia Lycopodiella	<b>Lycopodiaceae</b> Huperzia Lycopodiella
Order Selaginellales <b>Selaginellaceae</b> Selaginella	<b>Selaginellaceae</b> Selaginella	<b>Selaginellaceae</b> Selaginella
Class Equisetopsida Order Equisetales <b>Equisetaceae</b> Equisetum	Class Equisetatae <b>Equisetaceae</b> Equisetum	<b>Equisetaceae</b> Equisetum
Class Psilotopsida Order Psilotales <b>Psilotaceae</b> Psilotum	Class Psilotae <b>Psilotaceae</b> Psilotum	<b>Psilotaceae</b> Psilotum
Class Ophioglossopsida Order Ophioglossales <b>Ophioglossaceae</b> Botrychium Ophioglossum	Class Filicatae <b>Ophioglossaceae</b> Botrychium Ophioglossum	<b>Ophioglossaceae</b> Botrychium Ophioglossum
Class Marattiopsida Order Marattiales <b>Marattiaceae</b> Angiopteris Marattia	<b>Marattiaceae</b> Angiopteris Marattia	<b>Marattiaceae</b> Angiopteris Marattia
Class Filicopsida		
Order Schizaeales <b>Lygodiaceae</b> Lygodium	<b>Schizaeaceae</b> Lygodium	<b>Schizaeaceae</b> Lygodium

Table 5.2.1. (ctd.)

<b>Pichi Sermolli (1977)</b>	<b>Kramer (in Kramer &amp; Green, 1990)</b>	<b>Brummit (1992)</b>
Order Pteridales <b>Sinopteridaceae</b> Cheilanthes Pellaea Doryopteris	<b>Pteridaceae</b> <b>Subfam. Cheilanthoideae</b> Cheilanthes Pellaea Doryopteris Parahemionitis <b>Subfam. Taenitidoideae</b> Pityrogramma Actiniopteris	<b>Adiantaceae</b> Doryopteris Parahemionitis Pellaea Pityrogramma
<b>Hemionitidaceae</b> Parahemionitis Pityrogramma		
<b>Actiniopteridaceae</b> Actiniopteris		
<b>Pteridaceae</b> Pteris	<b>Pteridaceae</b> <b>Subfam. Pteridoideae</b> Pteris	<b>Pteridaceae</b> Pteris
<b>Adiantaceae</b> Adiantum	<b>Pteridaceae</b> <b>Subfam. Adiantoideae</b> Adiantum	<b>Adiantaceae</b> Adiantum
<b>Parkeriaceae</b> Ceratopteris	<b>Pteridaceae</b> <b>Subfam. Ceratopteridoideae</b> Ceratopteris	<b>Parkeriaceae</b> Ceratopteris
<b>Vittariaceae</b> Antrophyum Vittaria	<b>Vittariaceae</b> Antrophyum Vittaria	<b>Vittariaceae</b> Antrophyum Vittaria
Order Marsileales <b>Marsileaceae</b> Marsilea	<b>Marsileaceae</b> Marsilea	<b>Marsileaceae</b> Marsilea
Order Hymenophyllales <b>Hymenophyllaceae</b> Cephalomanes Crepidomanes Hymenophyllum Trichomanes	<b>Hymenophyllaceae</b> <b>Subfam.</b> <b>Hymenophylloideae</b> Cephalomanes Crepidomanes Hymenophyllum Trichomanes	<b>Hymenophyllaceae</b> Cephalomanes Crepidomanes Hymenophyllum Trichomanes
Order Dicksoniales <b>Cyatheaceae</b> Alsophila Sphaeropteris	<b>Cyatheaceae</b> Alsophila Sphaeropteris	<b>Cyatheaceae</b> Alsophila Sphaeropteris
Order Dennsteadtiales <b>Dennsteadtiaceae</b> Hypolepis Microlepia Pteridium	<b>Dennsteadtiaceae</b> <b>Subfam. Dennsteadtioideae</b> Hypolepis Microlepia Pteridium	<b>Dennsteadtiaceae</b> Hypolepis Lindsaea Microlepia Odontosoria Pteridium
<b>Lindsaeaceae</b> Lindsaea Odontosoria	<b>Lindsaeaceae</b> <b>Subfam. Lindsaeoideae</b> Lindsaea Odontosoria	

Table 5.1.2. (ctd).

Pichi Sermolli (1977)	Kramer (in Kramer & Green, 1990)	Brummit (1992)
Order Aspleniales <b>Thelypteridaceae</b> Thelypteris Macrothelypteris	<b>Thelypteridaceae</b> Macrothelypteris Thelypteris	<b>Thelypteridaceae</b> Amphineuron Christella Cyclosorus Macrothelypteris Metathelypteris Pneumatopteris Pronephrium Pseudocyclosorus Sphaerostephanos Stegnogramma Thelypteris Trigonospora
<b>Aspleniaceae</b> Asplenium	<b>Aspleniaceae</b> Asplenium	<b>Aspleniaceae</b> Asplenium
<b>Dryopteridaceae</b> Dryopteris Arachniodes Polystichum Tectaria	<b>Dryopteridaceae</b> <b>Subfam. Dryopteridoideae</b> Arachniodes Dryopteris Polystichum Tectaria <b>Subfam. Athyrioideae</b> Anisocampium Athyrium Deparia Diplazium Hypodematium	<b>Dryopteridaceae</b> Arachniodes Dryopteris Polystichum Tectaria
<b>Athyriaceae</b> Anisocampium Athyrium Deparia Diplazium Hypodematium		<b>Woodsiaceae</b> Anisocampium Athyrium Deparia Diplazium Hypodematium
<b>Lomariopsidaceae</b> Bolbitis Elaphoglossum	<b>Lomariopsidaceae</b> Bolbitis Elaphoglossum	<b>Lomariopsidaceae</b> Bolbitis Elaphoglossum
<b>Nephrolepidaceae</b> Nephrolepis	<b>Nephrolepidaceae</b> Nephrolepis	<b>Oleandraceae</b> Arthropteris Nephrolepis Oleandra
<b>Oleandraceae</b> Arthropteris Oleandra	<b>Oleandraceae</b> Oleandra Arthropteris	
<b>Davalliaceae</b> Araiostegia Davallia Humata Leucostegia	<b>Davalliaceae</b> Araiostegia Davallia (including Humata) Leucostegia	<b>Davalliaceae</b> Araiostegia Davallia Humata Leucostegia
Order Blechnales <b>Blechnaceae</b> Blechnum Stenochlaena	<b>Blechnaceae</b> <b>Subfam. Blechnoideae</b> Blechnum <b>Subfam. Blechnoideae</b> Stenochlaena	<b>Blechnaceae</b> Blechnum Stenochlaena

Table 5.1.2. (ctd.).

Pichi Sermolli (1977)	Kramer (in Kramer & Green, 1990)	Brummit (1992)
Order Polypodiales <b>Grammitidaceae</b> Grammitis Prosaptia	<b>Grammitidaceae</b> Grammitis Prosaptia	<b>Grammitidaceae</b> Grammitis Prosaptia
<b>Loxogrammaceae</b> Loxogramme	<b>Polypodiaceae</b> <b>Subfam. Polypodioideae</b> Drynaria Lepisorus Leptochilus Loxogramme Microsorium Phymatopteris Phymatosorus Pleopeltis Pyrrosia	<b>Polypodiaceae</b> Drynaria Lepisorus Leptochilus Loxogramme Microsorium Phymatopteris Phymatosorus Pleopeltis Pyrrosia
<b>Polypodiaceae</b> Drynaria Lepisorus Leptochilus Loxogramme Microsorium Phymatopteris Phymatosorus Pleopeltis Pyrrosia		
Order Salviniiales <b>Azollaceae</b> Azolla	<b>Azollaceae</b> Azolla	<b>Azollaceae</b> Azolla

### Key to the Pteridophyte Families of Periyar Tiger Reserve

1. Aquatic herbs and semi aquatics including rheophytes ..... 2
1. Not aquatics; terrestrials, epiphytes or lithophytes ..... 9
2. Floating herbs ..... **Azollaceae**
2. Rooted herbs ..... 3
3. Rhizome erect ..... 4
3. Rhizome creeping ..... 5
4. Fronds dimorphic or subdimorphic; sori linear, exindusiate ..... **Parkeriaceae**
4. Fronds monomorphic; sori circular, indusiate ..... **Thelypteridaceae p.p.**
5. Fronds quadrifid; sporangia in thick walled sporocarps..... **Marsileaceae**
5. Fronds not quadrifid; sporangia not in sporocarps ..... 6
6. Delicate plants; sori in cupular or bivalved indusia..... **Hymenophyllaceae**
6. Not delicate plants; sori exindusiate, circular or acrostichoid ..... 7
7. Fronds simple; sori circular, distinct.....  
..... **Polypodiaceae p.p. (*Microsorium pteropus*)**
7. Fronds pinnate; sori circular or acrostichoid ..... 8
8. Fronds dimorphic; sori acrostichoid, exindusiate .....  
..... **Lomariopsidaceae p.p. (*Bolbitis*)**
8. Fronds monomorphic; sori circular, indusiate ..... **Thelypteridaceae p.p.**
9. Leaves scaly, not foliaceous ..... 10
9. Leaves foliaceous, not scaly ..... 11
10. Stem anisodichotomously branched; scale leaves arranged in distinct whorls; sporangia on peltate sporophylls, which aggregated into fusiform strobili ..... **Equisetaceae**
10. Stem isodichotomously branched; scale leaves not in whorls; sporangia aggregated into trilocular synangia ..... **Psilotaceae**
11. Strobili heterosporous ..... **Selaginellaceae**
11. Strobili homosporous ..... 12
12. Sporangia single per sporophyll, reniform ..... **Lycopodiaceae**
12. Sporangia numerous per sporophyll, globose or subglobose ..... 13
13. Fronds bipartite into fertile and sterile lamina; fertile lamina simple or tripinnate . ..... **Ophioglossaceae**

13. Fronds not bipartite; some times dimorphic .....	14
14. Sporangia arranged in synangia .....	<b>Marattiaceae p.p.</b>
14. Sporangia distinct, not in synangia .....	15
15. Sori indusiate .....	16
15. Sori exindusiate .....	41
16. Indusia pouched, cupular or bivalved .....	17
16. Indusia circular, reniform, linear or 'J' shaped.....	21
17. Delicate plants; lamina filmy; usually epiphytes or lithophytes; if terrestrial fronds tripinnate .....	<b>Hymenophyllaceae</b>
17. Not delicate plants; lamina subcoriaceous or coriaceous.....	18
18. Pinnae dimidiate .....	<b>Lindsaeaceae p.p. (<i>Lindsaea malabarica</i>)</b>
18. Pinnae not dimidiate .....	19
19. Ultimate lobes of pinnae truncate .....	<b>Lindsaeaceae p.p. (<i>Odontosoria</i>)</b>
19. Ultimate lobes of pinnae not truncate .....	20
20. Epiphytes .....	<b>Davalliaceae</b>
20. Terrestrials .....	<b>Dennstedtiaceae p.p.</b>
21. Fronds dimorphic .....	<b>Dryopteridaceae p.p. (<i>Dryopteris cochleata</i>)</b>
21. Fronds monomorphic .....	22
22. Epiphytes, rarely lithophytes; if lithophytes rhizome tubers present.....	23
22. Terrestrials or lithophytes; rhizome tubers absent.....	25
23. Indusia linear.....	<b>Aspleniaceae p.p.</b>
23. Indusia reniform .....	24
24. Rhizome creeping .....	<b>Oleandraceae</b>
24. Rhizome erect .....	<b>Nephrolepidaceae p.p.</b>
25. Indusia circular or reniform.....	26
25. Indusia linear, elliptic or 'J' shaped .....	31
26. Indusia reniform .....	27
26. Indusia circular .....	28
27. Sori median .....	<b>Nephrolepidaceae p.p.</b>
27. Sori marginal .....	<b>Adiantaceae</b>
28. Rhizome covered with hairs only .....	<b>Dryopteridaceae p.p.</b>
28. Rhizome covered with scales only .....	29

29. Arborescent plants .....	<b>Cyatheaceae</b>
29. Not arborescent plants .....	<b>30</b>
30. Plants glabrous .....	<b>Athyriaceae p.p. (<i>Anisocampium cummingianum</i>)</b>
30. Plants pubescent or strigose hairy .....	<b>Thelypteridaceae p.p.</b>
31. Sori angular to the costa .....	<b>32</b>
31. Sori not angular to costa .....	<b>33</b>
32. Scales clathrate .....	<b>Aspleniaceae</b>
32. Scales not clathrate .....	<b>Athyriaceae p.p.</b>
33. Sori median, parallel, on either side of the costa.....	
.....	<b>Blechnaceae p.p. (<i>Blechnum</i>)</b>
33. Sori marginal .....	<b>34</b>
34. Rhizome covered with hairs only; scales absent .....	<b>35</b>
34. Rhizome covered with hairs and scales .....	<b>36</b>
35. Indusia fimbriate .....	<b>Dennstaedtiaceae p.p. (<i>Pteridium</i>)</b>
35. Indusia entire.....	<b>Lindsaeaceae p.p.</b>
36. Fronds simple .....	<b>37</b>
36. Fronds pinnate .....	<b>38</b>
37. Fronds fan shaped .....	<b>Actiniopteridaceae</b>
37. Fronds deltoid; palmately lobed .....	<b>Sinopteridaceae p.p. (<i>Doryopteris</i>)</b>
38. Pinnules dimidiate .....	<b>Adiantaceae</b>
38. Pinnules not dimidiate .....	<b>39</b>
39. Pinnules hairy, at least along the costa .....	<b>Sinopteridaceae p.p. (<i>Pellaea</i>)</b>
39. Pinnules not hairy; some times spinules present .....	<b>40</b>
40. Ultimate pinnules to 2.5 cm long .....	<b>Sinopteridaceae p.p. (<i>Cheilanthes</i>)</b>
40. Ultimate pinnules more than 3 cm long .....	<b>Pteridaceae</b>
41. Sori acrostichoid or pseudo-acrostichoid .....	<b>42</b>
41. Sori linear, circular or anastomosing .....	<b>48</b>
42. Fronds dimorphic or subdimorphic .....	<b>43</b>
42. Fronds monomorphic .....	<b>47</b>
43. Fertile pinnae or pinnules linear, elliptic or oblong .....	<b>44</b>
43. Fertile pinnae not as above .....	<b>46</b>

44. Fertile pinnae simple ..... **Polypodiaceae p.p.**
44. Fertile pinnae pinnate ..... **45**
45. Rhizome short creeping ..... **Lomariopsidaceae p.p. (*Bolbitis*)**
45. Rhizome long creeping ..... **Blechnaceae p.p. (*Stenochlaena*)**
46. Fertile pinnae triangular or ovate, hastate .....  
..... **Hemionitidaceae p.p. (*Parahemionitis*)**
46. Fertile pinnae linear or oblong, cuneate at base .....  
..... **Lomariopsidaceae p.p. (*Elaphoglossum*)**
47. Terrestrials; fronds pinnate; lower surface of the lamina silvery or yellow  
crusted ..... **Hemionitidaceae p.p. (*Pityrogramma*)**
47. Epiphytes; fronds simple; lower surface not as above .. **Polypodiaceae p.p.**
48. Terrestrials ..... **49**
48. Epiphytes or lithophytes ..... **51**
49. Fronds of unlimited growth, twinning; sporangia aggregated on finger-like  
lobes of the fertile pinnae ..... **Schizaeaceae**
49. Fronds of limited growth, not twining; sori not as above ..... **50**
50. Rhizome erect, massive; sori marginal; sporangia arranged in close double  
rows ..... **Marattiaceae p.p. (*Angiopteris*)**
50. Rhizome creeping, not massive; sori median or dispersed throughout;  
sporangia not in double rows .....  
..... **Thelypteridaceae p.p. (*Thelypteris mollissima* and *T. triphylla*)**
51. Sori linear, elliptic or anastomosing ..... **52**
51. Sori circular ..... **53**
52. Sori linear or elliptic, angular to the costa ..... **Loxogrammaceae**
52. Sori linear, submarginal or anastomosing along the veins ..... **Vittariaceae**
53. Fronds hairy, at least along the stipe and costa ..... **Grammitidaceae**
53. Fronds glabrous ..... **Polypodiaceae p.p.**



## LYCOPODIACEAE

Mirbel in Lamarck & Mirbel, Hist. Nat. Veg. 4: 293. 1802.

### Key to the genera

1. Epiphytes, stem dichotomously branched ..... **Huperzia**
1. Terrestrials, stem anisodichotomously branched ..... **Lycopodiella**

### HUPERZIA J.J. Bernhardt

Schrad. J. Bot. 1800(2): 126. 1802.

Erect or pendant epiphytes, dichotomously branched. Leaves usually thick, coriaceous, mucronate. Sporophylls similar to leaves or dissimilar. When isomorphic, not arranged in to distinct cones. Cones terminal, cylindrical, simple or dichotomously branched. Sporangia yellow, reniform, sessile, opened by a marginal slit. Spores white or yellow, tetrahedral, trilete, smooth or granulose.

### Key to the species.

1. Cones distinct, terminal ..... **2**
1. Cones not distinct, diffused ..... **3**
2. Stem erect, leaves thick, mucronate ..... **H. macrostachys**
2. Stem pendant, leaves thin, not mucronate ..... **H. phlegmaria**
3. Leaves elliptic-oblong, obtuse at apex ..... **H. hamiltonii**
3. Leaves linear, acute ..... **4**
4. Stem 0.5-1 cm, or more thick, sporophylls dissimilar from vegetative leaves .....  
..... **H. squarrosa**
4. Stem 0.5 cm or less thick, sporophylls similar to vegetative leaves ..... **H. hilliana**

**Huperzia hamiltonii** (Spreng) Trevis, Atti. Sci. Ital. Sci. Nat. 17: 248. 1875; R.D.Dixit, Cens. Indian Pterid. 7. 1984 & Lycopod. India 48. f. 4 A-B. 1988; B.Ollg., Opera Bot. 92: 165. 1987; N.C.Nair et al., J. Econ. Tax. Bot. 12: 192. 1988; Manickam & Irud., Pterid. Fl. W. Ghats 27. pl. 6. 1992; Madhus. et al., Indian Fern J. 13: 69. 1996. **Lycopodium hamiltonii** Spreng., Syst. Veg. 5: 425. 1828. **Phlegmariurus hamiltonii** (Spring) Sen & Sen, Fern Gaz. 11: 419. 1978.

Epiphytes. Rhizome creeping, 5 mm thick. Stem suberect or pendant 10-15 cm long, dichotomously branched. Leaves 10-16 x 3-4 mm, oblong, obtuse or subacute, thick coriaceous. Sporophylls similar to vegetative leaves.

Sporangia 2 x 1 mm, reniform, yellow, open through a median slit. Spores 37.5 x 32.5  $\mu\text{m}$ , yellowish or creamy, tetrahedral, trilete, granulose.

Occasional, in evergreen forests.

Specimen studied: Vellimala, *KPR* 70056 (CALI).

**Huperzia hilliana** (Nessel) Holub, Folia Geobot. Phytotax. 20: 78. 1985; B.Ollg., Opera Bot. 92: 166. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 28. pl. 7. 1992. **Urostachys hillianus** Nessel, Report. Spec. Nov. Regn. Veg. 36: 186. t. 175. 1934.

Epiphytes. Rhizome creeping, 0.8-1 cm in diameter. Stem pendant to 25 cm long. dichotomously branched. Leaves 12 x 2 mm, linear, acute, slightly curved towards apex, coriaceous, vein slightly raised above. Sporophylls 7 x 1.5 mm, lanceolate-linear, acute, aggregated towards apex forming a cone or intermixed. Sporangia reniform 1 x 1.5 mm, opened by marginal slit. Spores 37.5 x 30  $\mu\text{m}$ , whitish, tetrahedral, trilete, granulose. (**Fig. 5.1.1a & b**).

Rare, in evergreen forests.

Specimens studied: Chokkampatti, *KPR* 14625; Pachakkanam, *JA* 12818 (KFRI, CALI); Vellimala, *KPR* 62880 (CALI).

**Huperzia macrostachys** (Hook. ex Spring) Holub, Folia Geobot. Phytotax. 20: 74. 1985; B.Ollg., Opera Bot. 92: 166. 1987; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 148. 1997. **Lycopodium macrostachys** Hook. ex Spring, Monogr. Lycopod. 2: 30. 1849; Subr. et al., Bull. Bot. Surv. India 3: 210. 1961. **Huperzia phyllantha** auct. mult., Manickam & Irud., Pterid. Fl. W. Ghats 25. pl. 4. 1992; Madhus. et al., Indian Fern J. 13: 70. 1996, non. (Hook. & Arn.) Holub, Folia Geobot. Phytotax. 20: 75. 1985. **Phlegmariurus phyllantha** (Hook. & Arn.) R.D.Dixit, J. Bombay. Nat. Hist. Soc. 77: 541. 1981; Cens. Indian Pterid. 9. 1984 & Lycopod. India 73. f. 17 A-B. 1988. **P. macrostachys** (Hook. ex Spring) N.C.Nair & S.R.Ghosh in N.C.Nair et al., J. Econ. Tax. Bot. 12: 194. 1988.

Epiphytes. Stem erect, to 40 cm long, 4 cm wide including leaves. Leaves 1.5-2 x 0.4-0.8 cm, lanceolate or elliptic, mucronate, thick coriaceous, dark green, glabrous, margin slightly revolute, midrib raised below, grooved

above. Cones terminal, 10-15 cm long, simple or forked. Sporophylls 2-3 x 3 mm, ovate or deltoid, entire, opposite decussate. Sporangia 2 x 2.1 mm, reniform, yellow, borne on the axils of sporophylls, sessile, opened by marginal slit. Spores 32.5 x 30 µm, yellowish, trilete, finely granulose.

Occasional, in evergreen forests.

Specimens studied: Vellimala, *KPR* 18326 (KFRI, CALI); *KPR* 70057(CALI); Aruna Estate (Madurai district, TN), *K. Subramanyam* 9522 (MH).

Note: Nair et al., (1988) while proposing the new combination *Phlegmariurus macrostachyus* (Hook. ex Spring) N.C.Nair & S.R.Ghosh, commented that *Lycopodium phyllanthum* Hook. & Arn. [= *Huperzia phyllantha* (Hook. & Arn.) Holub], described from Hawaii is a different species and largely misquoted in many Indian works. Ollgaard (1987) also treated them separately. Ollgaard (1987) has reduced *Phlegmariurus* Holub under *Huperzia* Bern. Fraser-Jenkins (1997) has synonymised *Phlegmariurus macrostachyus* (Hook. ex Spring) N.C.Nair & S.R.Ghosh under *Huperzia* Bern. Above studied collection (*KPR* 70057) is confirmed by Ollgaard (*pers. comm*, 2000).

***Huperzia phlegmaria*** Rothm., Feddes Repert. Sp. Nov. 54: 62. 1944; B.Ollg., Opera Bot. 92: 166. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 24. pl. 3. 1992; Madhus. et al., Indian Fern J. 13: 70. 1996. ***Lycopodium phlegmaria*** L., Sp. Pl. 2: 1101. 1753; Spring, Monogr. Lycop. 1: 63. 1842, 2: 228. 1849; Madhus. & Rejani, Indian Fern J. 11: 15. 1994. ***Phlegmariurus phlegmaria*** (L.) T.Sen & U.Sen, Fern Gaz. 11: 421. 1978; R.D.Dixit, Cens. Indian Pterid. 9. 1984 & Lycopod. India 70. f. 16 A-B. 1988; N.C.Nair et al., J. Econ. Tax. Bot. 12: 195. 1988. ***Tama-Povel-Paatsja-Maravara, Vel Enedi – Kovrengo*** Rheede, Hort. Malab. 12: 27-29. t. 14. 1693.

Epiphytes. Stem pendant 30-60 x 1-1.5 cm, dichotomously branched. Leaves 12-15 x 3-4 mm, lanceolate, acuminate, subcoriaceous. Cones terminal, 15-20 x 0.3-0.5 cm, dichotomously branched. Sporophylls 5 x 2 mm, lanceolate, acuminate. Sporangia 1 x 1.5 mm, reniform. Spores 35 x 32 µm, tetrahedral, granulose. (Fig. 5.1.1c & d).

Occasional, in semi-evergreen and evergreen forests.

Specimens studied: Kozhikkanam, *B.D. Sharma* 41648; Pamba, *D.B. Deb* 30375; A.G. Pandurangan 78001 (MH); Mlappara, *JA* 12889 (KFRI, CALI).



Fig. 5.1.1a. *Huperzia hilliana*- habit, b. Part of strobili, c. *H. phlegmaria*- habit, d. Part of strobili.

**Huperzia squarrosa** (G.Forst.) Trevis, Atti. Soc. Ital. Sci. Nat. 17: 247. 1875; R.D.Dixit, Lycopod. India 65. f. 14A-B. 1988; B.Ollg., Opera Bot. 92: 167. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 26. pl. 5. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 12: 193. 1988; Madhus. et al., Indian Fern J. 13: 70. 1996. **Lycopodium squarrosus** G.Forst., Prod. Fl. Ind. Austr. 479. 1786. **Planthes squarrosa** Pal.-Beuv., Prod. Aeth. 112. 1802. **Phlegmariurus squarrosus** (G.Forst.) Love & Love, Taxon 26: 325. 1918.

Epiphytes. Stem pendant, 50-60 x 1 cm, dichotomously branched. Leaves 10-12 x 2 mm, lanceolate, acuminate, entire, coriaceous. Cones terminal, 5-6 x 0.7 cm, cylindrical; sporophylls 5 x 1-1.1 mm, lanceolate, acuminate. Sporangia 1.5 x 1.5-2 mm, reniform. Spores 37.5 x 35  $\mu\text{m}$ , yellowish, tetrahedral, granulose.

Occasional, in semi-evergreen and evergreen forests.

Specimen studied: Sabarimala thodu, JA 13204 (KFRI, CALI).

#### LYCOPODIELLA Holub

Preslia 36: 20, 22. 1964.

**Lycopodiella cernua** (L.) Pic.Serm., Webbia 23: 166. 1968; B.Ollg., Opera Bot. 92: 175. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 31. pl. 10. 1992; Madhus. et al., Indian Fern J. 13: 73. 1996. **Lycopodium cernuum** L., Sp. Pl. 1103. 1753; Madhus. & Rejani, Indian Fern J. 11: 18. 1994. **Palhinhaea cernua** (L.) Franco & Vasc. in Vasc. & Franco, Bot. Soc. Broter. Ser. 241: 25. 1967; R.D.Dixit, Cens. Indian Pterid. 10. 1984 & Lycopod. India 90. f. 42B, f. 49. 1988; N.C.Nair et al., J. Econ. Tax. Bot. 12: 196. 1988. **Bellan- Patsja** Rheede, Hort. Malab. 12: 73. t. 40. 1693.

Terrestrials. Stem creeping, 0.5 cm thick, branching, rooting at nodes. Erect branches 60-80 cm long, 0.3-0.5 cm thick. Leaves minute, linear, 3-5 x 1 mm, in whorls. Cones terminal 0.5-10 x 2-2.5 mm, cylindrical, pendant on ultimate branches, sporophylls 2 x 1 mm, lanceolate, serrulate, sporangia 0.5 x 1 mm, reniform. Spores 30 x 30  $\mu\text{m}$ , tetrahedral, granulose.

Occasional, in grasslands.

Specimens studied: Kavalappara, JA, 12807(KFRI, CALI); Vallakkadavu, B.D. Sharma 42436 (MH).

## SELAGINELLACEAE

Willkomm in Willkomm & Lange, Prodr. Fl. Hisp. 1: 14. 1861.

### SELAGINELLA Palisot de Beauvois

Mag. Encycl. Paris 9: 478. 1804, *nom. cons.*

Delicate terrestrial or lithophytic herbs. Stem erect or creeping, subscandant. Rooted at base only or throughout the nodes. Rhizophores delicate to thick. Leaves isomorphic or heteromorphic. When heteromorphic 3 types, viz., median, lateral and axillary leaves. Usually heteromorphic throughout, some times isomorphic at the basal portion only. Sporophylls isomorphic or dimorphic, arranged in terminal 2-sided or 4-sided strobili. Heterosporous; larger macrospores, 1-4, white or yellow to black, tetrahedral, trilete, granulate or tuberculate in macrosporangium, arranged towards the basal portion of the strobili; microspores numerous, white, yellow or bright red, tetrahedral, trilete, granulate to verrucate in reniform microsporangia, opened by a marginal slit.

#### Key to the species.

- |   |                          |
|---|--------------------------|
| 1. Xerophytes .....   | 2                        |
| 1. Not xerophytes .....   | 3                        |
| 2. Leaves linear, isomorphic throughout .....                     | <b>S. wightii</b>        |
| 2. Leaves not linear, isomorphic below, heteromorphic above ..... | <b>S. involvens</b>      |
| 3. Sporophylls uniform .....                                      | 4                        |
| 3. Sporophylls dimorphic .....                                    | 6                        |
| 4. Stem erect .....   | <b>S. intermedia</b>     |
| 4. Stem sub scandant or creeping .....                            | 5                        |
| 5. Stem prostrate .....   | <b>S. sp. a</b>          |
| 5. Stem not prostrate, sub scandant .....                         | <b>S. inaequalifolia</b> |
| 6. Stem prostrate .....   | <b>S. minutifolia</b>    |
| 6. Stem erect or sub erect .....                                  | 7                        |
| 7. Lateral and axillary leaves auricled .....                     | <b>S. sp. b</b>          |
| 7. Lateral and axillary leaves not auricled .....                 | 8                        |
| 8. Stem green .....   | <b>S. ciliaris</b>       |
| 8. Stem pinkish .....   | <b>S. tenera</b>         |

**Selaginella ciliaris** (Retz.) Spring, Bull. Acad. Brux. 10: 23. 1843; Alston, Proc. Nat. Inst. Sci. India 11: 227. 1945; N.C.Nair et al., J. Econ. Tax. Bot. 12: 204. 1988; R.D.Dixit, Sela. India 79. f. 41. 1992. **Lycopodium ciliare** Retz., Obs. 5: 32. 1789.

Terrestrials. Stem erect, 15 cm long, rooting at base only. Leaves heteromorphic throughout, ciliolate; median leaves 1.5 x 0.5 mm, lanceolate; lateral leaves 3 x 2 mm, ovate-lanceolate, obtuse; axillary leaves 2.8 x 1.8 mm, elliptic, acute. Strobili 8-10 x 3 mm, 2-sided; sporophylls dimorphic; larger sporophylls 2 x 1 mm, ovate-lanceolate, acute, keeled; smaller sporophylls 1.5 x 1 mm, ovate, acuminate, ciliate. Microspores 30-40 x 30-37.5  $\mu\text{m}$ , bright red, tetrahedral, granulose. Macrospores 312.5 x 312.5  $\mu\text{m}$ , white, tetrahedral, rugose.

Common, in grasslands, moist deciduous, semi evergreen and evergreen forests.

Specimens studied: Vellimala, *KPR* 13293, 13297 (KFRI, CALI).

**Selaginella inaequalifolia** (Hook. & Grev.) Spring, Bull. Acad. Brux. 10: 145. 1843; Alston, Proc. Nat. Inst. Sci. 11: 223. 1945; N.C.Nair et al., J. Econ. Tax. Bot. 12: 204. 1988; R.D.Dixit, Sela. India 66. f. 30. 1992; Manickam & Irud., Pterid. Fl. W. Ghats 37. pl. 15. 1992. **Lycopodium inaequalifolium** Hook. & Grev. in Hook., Bot. Misc. 2: 391. 1831.

Terrestrials. Stem erect, scandent, 30-35 cm long, rooting at the base, rhizophores thick. Leaves heteromorphic throughout; median leaves 4 x 1.5 mm, elliptic, long acuminate; lateral leaves 11 x 2.5 mm, oblong-lanceolate, acute, axillary leaves 4 x 1.5 mm, elliptic, acute. Strobili 20 x 2 mm, cylindrical; sporophylls uniform, 2 x 1 mm, ovate-lanceolate, acuminate. Microspores 25 x 15  $\mu\text{m}$ , white, tetrahedral to planoconvex, tuberculate. Macrospores 375 x 312-375  $\mu\text{m}$ , creamy with anastomosing ridges. (Fig. 5.1.2a).

Occasional, in semi-evergreen and evergreen forests.

Specimens studied: Mlappara, *KPR* 70005 & *KPR* 70011 (CALI); Poongavanam to Sabarimala, *N.C.Nair* 70207; Sabarimalai slopes, *B.D. Sharma* 42056; Pamba, *D.B.Deb* 30445 (MH); Vahalala, *KPR* 14610; Vellimala, *KPR* 13300 (KFRI, CALI).

***Selaginella intermedia*** (Blume) Spring, Bull. Acad. Brux. 10: 144. 1843; Alston, Proc. Nat. Inst. Sci. 11: 218. 1945; N.C.Nair et al., J. Econ. Tax. Bot. 12: 203. 1988; R.D.Dixit, Sela. India 63. f. 28. 1992; Manickam & Irud., Pterid. Fl. W. Ghats 39. pl. 17. 1992. ***Lycopodium intermedium*** Blume, Enum. Pl. Jav. 2: 269. 1830.

Terrestrials. Stem erect, 35-40 cm long, rooting from the base only. Leaves heteromorphic throughout; median leaves 4.8 x 2 mm, elliptic-acuminate, oblique at base, ciliate, auricled on the acroscopic base, ciliate, glabrous along the basispic margin; axillary leaves 3.5 x 2 mm, elliptic, acute, ciliate. Strobili 8-10 x 3 mm, 4-sided, sporophylls isomorphic, 2-2.2 x 1 mm, ovate-lanceolate, ciliate. Microspores 30 x 30  $\mu\text{m}$ , yellowish, tuberculate. Macrospores 400 x 300  $\mu\text{m}$ , white, tetrahedral.

Common, in moist deciduous, semi-evergreen and evergreen forests.

Specimen studied: Arjunankotta, JA 12888 (KFRI, CALI).

***Selaginella involvens*** (Sw.) Spring, Bull. Acad. Brux. 10: 138. 1843; Alston, Proc. Nat. Inst. Sci. 11: 220. 1945; N.C.Nair et al., J. Econ. Tax. Bot. 12: 201. 1988; R.D.Dixit, Sela. India 46. f. 12. 1992; Manickam & Irud., Pterid. Fl. W. Ghats 35. pl. 12. 1992. ***Lycopodium involvens*** Sw., Syn. Fil. 182. 1806.

***Selaginella caulescens*** (Wall. ex Hook. & Grev.) Spring, Bull. Acad. Brux. 10: 137. 1843. ***S. pendula*** Spring, Mem. Acad. Sci. Belg. 24: 160. 1850.

Lithophytes. Stem erect, 30-40 cm long, 5 mm thick, including leaves. Leaves heteromorphic throughout; median leaves 1.8 x 1 mm, ovate-acuminate, ciliate; lateral leaves 2.5 x 1.5 mm, ovate, acute, ciliate; axillary leaves 2 x 1.2 mm, ovate, acute, ciliate. Strobili 5 x 2 mm, quadrangular; sporophylls isomorphic, 1.5-1.8 x 0.5-0.8 mm, ovate, acuminate, denticulate. Microspores 35 x 30  $\mu\text{m}$ , warty with thin perispore. Macrospores 900 x 700  $\mu\text{m}$ , dark brown. (Fig. 5.1.2b).

Common, in semi-evergreen, and evergreen forests on boulders near the streams.

Specimens studied: Chokkampatti, KPR 14691 (KFRI, CALI); Mlappara, C.N.Mohanan 72811 (MH).





Fig. 5.1.2. Habits of *Selaginella* spp. a. *S. inaequalifolia*, b. *S. involvens*, c. *S. tenera*, d. *S. wightii*.

**Selaginella minutifolia** Spring, Mem. Acad. Sci. Bel. 24: 239. 1850; Alston, Proc. Nat. Inst. Sci. 11: 228. 1945; R.D.Dixit, Bull. Bot. Surv. India 26: 127. t. 1. 1984; N.C.Nair et al., J. Econ. Tax. Bot. 12: 205. 1988; R.D.Dixit, Sela. India 81. f. 42. 1992.

Terrestrials. Stem prostrate, 4-5 cm long, 2.5-3 mm thick, including leaves. Leaves heteromorphic throughout; median leaves 1 x 0.9 mm, elliptic, acute, ciliolate; lateral leaves 1.8 x 1.1 mm, elliptic or oblong, acute, ciliolate; axillary leaves 1.5 x 1 mm, elliptic, acute, ciliate. Strobili 1-1.3 x 3 mm, 2-sided, sporophylls dimorphic; smaller sporophylls 1 x 0.9 mm, ovate, acute, ciliate; larger sporophylls 1.1 x 0.9 mm, ovate, acute, keeled. Microspores 50 x 50 µm, bright red, tetrahedral, granulose. Macrospores 375 x 312.5 µm, white.

Occasional, in grasslands.

Specimen studied: Mangaladevi, *KPR* 62842 (KFRI, CALI).

**Selaginella tenera** (Hook. & Grev.) Spring, Bull. Acad. Brux. 10: 232. 1843; Alston, Proc. Nat. Inst. Sci. 11: 227. 1945; N.C.Nair et al., J. Econ. Tax. Bot. 12: 205. 1988; R.D.Dixit, Sela. India 87. f. 50. 1992; Manickam & Irud., Pterid. Fl. W. Ghats 41. pl. 20. 1992. **Lycopodium tenerum** Hook. & Grev. in Hook., Bot. Misc. 2: 400. 1831. **L. debile** Bory, Bel. Voy. Bot. 2: 8. t. 1. f. 1. 1834. **Selaginella debilis** (Bory) Spring, Bull. Acad. Brux. 10: 143. 1843.

Terrestrials. Stem erect, 15-20 cm long, rooting at the base only. Leaves heteromorphic throughout, distant towards base; median leaves 2 x 0.8 mm, ovate, acuminate, ciliolate; lateral leaves 3.1 x 2 mm, ovate, obtuse; axillary leaves 3 x 2 mm, broadly ovate, obtuse. Strobili 5-8 mm long, 2-sided, sporophylls dimorphic; smaller sporophylls 1.5 x 0.5 mm, ovate, acuminate, ciliolate; larger sporophylls 2 x 0.6 mm, ovate-lanceolate, acute, keeled. Microspores 32 x 30 µm, bright red, granulose. Macrospores 625-750 x 500-750 µm, light red. (**Fig. 5.1.2c**).

Common, in grasslands, moist deciduous, semi-evergreen and evergreen forests.

Specimens studied: Pachakkanam, *JA* 13280 (KFRI, CALI); Pamba to Ayyappan temple, *N.C.Nair* 50800 (MH); Uppuparai, *K. Vivekananthan* 45239 (MH); Vellimala *KPR* 62875, 62884, 62885 (CALI); *KPR* 13294, 13299, 18328, (KFRI, CALI);

**Selaginella wightii** Hieron, Hedwigia 39: 1900; Alston, Proc. Nat. Inst. Sci. 11: 215. 1945; R.D.Dixit, Cens. Indian Pterid. 18. 1984; N.C.Nair et al., J. Econ. Tax. Bot. 12: 201. 1988; R.D.Dixit, Sela. India 33. f. 2. 1992; Manickam & Irud., Pterid. Fl. W. Ghats 34. pl. 11. 1992.

Lithophytes. Stem creeping, 20-30 x 0.10-0.15 cm, much branched. Leaves isomorphic throughout, 2-2.5 x 0.1 mm, linear, fimbriate, stiff, light greenish to silvery. Strobili 4-6 x 1-1.2 mm, cylindrical, sporophylls isomorphic, lanceolate, ciliate. Microspores 40-45 x 40  $\mu\text{m}$ . Megaspores 300-350 x 400  $\mu\text{m}$ . orange brown, reticulate. (**Fig. 5.1.2d**).

Rare, on rocks in grasslands.

Specimen studied: Kottamala, JA 13265 (KFRI, CALI).

### **Selaginella sp. a**

Terrestrials. Stem prostrate, 30-40 cm long, 3 mm thick including leaves. Leaves heteromorphic throughout; median leaves 2 x 1 mm, ovate, acuminate, ciliate; lateral leaves 3 x 2 mm, ovate or ovate-lanceolate, acute, ciliate at base; axillary leaves 1.8 x 1 mm, elliptic-acuminate, ciliate. Strobili 5-8 mm, long, sporophylls uniform, 1.5 x 1 mm, ovate-acuminate, ciliate. Microspores 32 x 32  $\mu\text{m}$ , red, tetrahedral, granulose. Macrospores 500 x 487.5  $\mu\text{m}$ , white, tetrahedral.

Common, in grasslands, moist deciduous, semi-evergreen and evergreen forests.

Specimen studied: Thekkady, KPR 14660 (KFRI, CALI).

### **Selaginella sp. b**

Terrestrials. Stem erect, 25-30 cm long. Leaves heteromorphic throughout; median leaves 1.5 x 1 mm, ovate, acuminate; lateral leaves 5 x 1.5-2.1 mm, ovate-oblong, obtuse, auricled on acroscopic base; axillary leaves 2-2.2 x 3 mm, ovate-lanceolate, obtuse, broad or shallowly auricled at base. Strobili 2-sided, 1-1.5 x 0.2 cm, sporophylls dimorphic; smaller sporophylls 1 x 0.5-0.8 mm, ovate, acuminate; larger sporophylls 1.5 x 0.5 mm, ovate-

lanceolate, obtuse, keeled. Microspores 10 x 10 µm, yellow, tetrahedral, granulose. Macrospores 350 x 300 µm, white, tetrahedral.

Occasional, in evergreen forests.

Specimens studied: Chokkampatti, *KPR* 14686, 14688; Melmala, *KPR* 14612, 14614 (KFRI, CALI).

Note: This species is characterised by the lateral leaves auricled on the acroscopic base and basally broad axillary leaves.

The correct identity of *Selaginella* sp. a and *S. sp. b* could not be confirmed. Dr. B. Verdcourt, after examining the specimens commented that he could not find any matching specimens at Kew and requires further study (*pers. comm.*, 2001).

## EQUISETACEAE

L.C. Richard ex De Candolle in Lamarck & De Candolle,  
Fl. France 2: 580.1805.

### EQUISETUM Linnaeus

Sp. Pl. 1061. 1753.

**Equisetum ramosissimum** Desf., Fl. Atlant. 2: 398. 1800; R.D.Dixit, Cens. Indian Pterid. 24. 1984; Manickam & Irud., Pterid. Fl. W. Ghats 44. pl. 24. 1992; sub sp. **debile** (Roxb. ex Voucher) Hauke, Amer. Fern J. 52: 33. 1962; N.C.Nair et al., J. Econ. Tax. Bot. 12: 19. 1988. **E. debile** Roxb. ex Voucher, Mem. Soc. Phys. Hist. Nat. Grev. 1: 287. 1821.

Terrestrials. Rhizome 5-10 mm thick, long creeping, copiously branched, subterranean, rooting at internodes. Aerial stem 1-1.5 m tall, branched, dark green, polished, glabrous with ridges and furrows. Leaves minute scaly, at the nodes. Cones terminal, 1-2 x 0.5-0.8 cm; sporophylls peltate, closely packed. Spores 28-35 µm, globose smooth with coiled elators. (**Fig. 5.1.3a**).

Common along the sandy banks of streams in evergreen forests.

Specimens studied: Mlappara, *JA* 13242 (KFRI, CALI); *KPR* 70014 (CALI); Mlappara estate, *N.C.Nair* 70135 (MH).



Fig. 5.1.3a. *Equisetum ramosissimum*- habit, b. *Psilotum nudum*- habit, c. *Botrychium daucifolium*- habit, d. *Ophioglossum pendulum* - habit e. *O. pendulum*- an enlarged view of spike.

**PSILOTACEAE**

Kanitz, Noveny. Attek. 43. 1887.

**PSILOTUM** Swartz

Schrad. J. Bot. 1800(2): 8, 109. 1802.

**Psilotum nudum** (L.) Beauv., Prod. Fam, Aetheog. 106, 112. 1805; R.D.Dixit, Cens. Indian Pterid. 20. 1984; N.C.Nair et al., J. Econ. Tax. Bot. 12: 189. 1988; Manickam & Irud., Pterid. Fl. W. Ghats 45. pl. 25. 1992. **Lycopodium nudum** L., Sp. Pl. 2: 1100. 1753. **Psilotum triquetrum** Sw., Syn. Fil. 1137. 1806, *nom. illeg.*

Epiphytes. Rhizome 3 mm in diameter, creeping. Stem 32-40 cm long, erect, tetragonal with grooves and ridges; main stem unbranched to 20 cm long, isodichotomously branched above, up to 5-6 times, forming the characteristic obconical outline of about 12 x 13 cm, ultimate branches 4-5 x 0.5 cm, trigonous, acute, flexuous with scale leaves. Scale leaves 2.5 x 1 mm, lanceolate, acute. Sporangia trilocular, 3 x 2 mm, borne on the axils subtended by scale leaves, dehisced by vertical slits. Spores 66 x 35 µm, monoletic, oblong or ellipsoid, yellowish-hyaline, exine with anastomosing thickening, granulose. (Fig. 5.1.3b).

Occasional, in moist deciduous, semi evergreen and evergreen forests.

Specimens studied: Mlappara, JA 12828 (KFRI, CALI); Way to Mangaladevi temple, K. Vivekananthan 50544; Thannikkudy, B.D. Sharma 42370; Mlappara estate, N.C.Nair 70118 (MH).

**OPHIOGLOSSACEAE**

(R.Brown) Agardh, Aphor. Bot. 8: 113. 1822.

**Key to the genera**

1. Sterile lamina simple, occasionally forked, spike simple ..... **Ophioglossum**
1. Sterile lamina triforked, pinnatisect, spike tripinnate ..... **Botrychium**

## BOTRYCHIUM Swartz

Schrad. J. Bot. 1800(2): 8, 110. 1801.

Terrestrial herbs. Rhizome erect, tuberous with thick fleshy roots. Fronds divided into sterile and fertile lobes. Stipe elongated terete, pubescent or puberulous; sterile lamina triforked, bi or tripinnate, ovate or deltoid in outline; fertile lobe bi or tripinnate, arising from the junction of branching of the sterile lamina or below it. Sporangia globose, opened by a vertical slit. Spores oblongoid or ellipsoid, trilete, granulose or tuberculate.

### Key to the species

1. Fertile stalk arising from 4-6 cm below the branching of sterile blade .... **B. daucifolium**
1. Fertile stalk arising from the point of branching of sterile blade ..... **B. lanuginosum**

**Botrychium daucifolium** Wall. ex Hook. & Grev., Ic. Fil. t. 161. 1829; Bedd., Handb. Ferns Brit. India 469. t. 294. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 107. 1974; R.D.Dixit, Cens. Indian Pterid. 21. 1984; Manickam, Fern Fl. Palni Hills 8. 1986; Subh.Chandra & S.Kaur, Nomen Guide Bedd. 8. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 54. pl. 32. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 68. 1993; Subh.Chandra, Ferns India 4. 2000. **B. subcarnosum** Wall., List. No. 49. 1828; Bedd., Ferns South. India 23. pl. 68. 1983.

Rhizome 4-8 x 2-3 cm, erect. Stem 20-25 x 0.8 cm, forked. Fronds dissimilar. Sterile fronds 25-30- x 30-35 cm, blades ternate with 4-6 cm long petiole; basal pinnae 15-16 x 15-17 cm, triangular ovate, acuminate in outline, with 2-3 cm long stalk; terminal pinna 22 x 22 cm, including 4 cm long stalk, obconical in outline, pinnules 1.5-4.5 x 1-1.5 cm, oblong to oblong-lanceolate, crenate, obtuse, veins forked once or twice. Fertile segment 25-30 cm including 15-18 cm long stalk, arising from 4-6 cm below the branching of the sterile blade; spike 10-12 cm long, ultimate segments with two rows of sporangia, dark pinkish brown, dehisced by median slit reaching the base. Spores 30 x 25 µm, pale yellow, trilete, granulose. (**Fig. 5.1.3c**).

Occasional, in evergreen forests.

Specimens studied: Moolavyka, JA 12846 (KFRI, CALI); Vellimala, KPR 18311 (KFRI, CALI).

**Botrychium lanuginosum** Wall. ex Hook. & Grev., Ic. Fil. t. 79. 1829; B.V.Shetty & Vivek., Bull. Bot. Surv. India 13: 27. 1971; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 108. 1974; R.D.Dixit, Cens. Indian Pterid. 21. 1984; Manickam, Fern Fl. Palni Hills 9. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 8. 1987; N.C.Nair et al., J. Econ. Tax. Bot. 12: 208. 1988; Manickam & Irud., Pterid. Fl. W. Ghats 53. pl. 31. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 69. 1993; Subh.Chandra, Ferns India 4. 2000. ***B. virginianum*** var. ***lanuginosum*** T.Moore, Ind. Fil. 213. 1857-62; Bedd., Ferns South. India 22. pl. 67. 1963 & Handb. Ferns Brit. India 471. t. 295. 1883.

Rhizome erect 1-1.5 x 2 cm, densely hairy. Fronds 30-50 x 25-30 cm, divided into sterile and fertile segments; stipe 18-25 cm long, pubescent. Sterile lamina 25-30 x 25-30 cm, triforked, tripinnate; primary pinnae 20 x 18-20 cm, deltoid in outline; secondary pinnae 12-13 x 3 cm, lanceolate in outline; tertiary pinnae 3.5 x 2 cm, ovate acute, again lobed; veins forked once; fertile lobe 25-30 x 2.5-3 cm, arising from the branching of the sterile lobes, quadripinnate, stalk 15-20 cm long. Sporangia globose, 2 mm in diameter, opened by a vertical slit. Spores 40 x 30 µm, oblongoid or ellipsoid, tuberculate.

Rare, in evergreen forests.

Specimen studied: Kottamala, JA 13273 (KFRI).

### **OPHIOGLOSSUM** Linnaeus

Sp. Pl. 2: 1062. 1753.

Terrestrial or epiphytic herbs. Rhizome short tuberous. fronds simple linear, strap like or cordate, coriaceous, thick, fleshy, sometimes forked. Veins anastomosing. Fertile segment stalked, erect or pendant, bearing sporangia arranged in two rows, embedded on either side of the stalk. Spores numerous, trilete, smooth or reticulate.

#### **Key to the species.**

- |                                  |                     |
|----------------------------------|---------------------|
| 1. Epiphytes .....               | <b>O. pendulum</b>  |
| 1. Terrestrials .....            | <b>2</b>            |
| 2. Leaves oblong or linear ..... | <b>O. gramineum</b> |
| 2. Leaves ovate or cordate ..... | <b>O. vulgatum</b>  |



**Ophioglossum gramineum** Willd., Schrift. Akad. Erfurt 1802: 18. t. 1. f. 1. 1802; Bedd., Handb. Suppl. Ferns Brit. India 108. 1892; Balak. et al., Bull. Bot. Surv. India 2: 337. 1960; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 106. 1974; N.C.Nair & S.R.Ghosh, Bull. Bot. Surv. India 15: 130. 1973 (1979); R.D.Dixit, Cens. Indian Pterid. 23. 1984; N.C.Nair et al., J. Econ. Tax. Bot. 12: 207. 1988; Manickam & Irud., Pterid. Fl. W. Ghats 48. pl. 26. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 75. 1993; Subh.Chandra, Ferns India 8. 2000. ***O. vulgatum*** var. ***gramineum*** (Willd.) Hook.f., Fl. Nov. Zeyl. 2: 50. 1854.

Terrestrial herbs of about 10-12 cm long. Rhizome 0.5 x 0.5 cm, sub-globose. Fronds bipartite; sterile blade 2.5-3.5 x 0.8-1 cm, oblong or elliptic, obtuse or apiculate, subcoriaceous, veins anastomosing, common stalk 4-6 cm long; fertile spike 3-6.5 cm long, arising from the base of the sterile blade; 1.5-2 x 0.4 cm, oblong, acute, flattened, fleshy with wavy margins. Sporangia globose, sunken arranged in a row on either side of the stalk.

Rare, in grasslands.

Specimen studied: Thekkady, K. Vivekananthan 24362 (MH).

Note: This species had been reported as a new record for Kerala from the Reserve (Nair & Ghosh, 1976). I have not collected this species during the present course of study.

**Ophioglossum pendulum** L., Sp. Pl. 2: 1518. 1753; Bedd., Ferns South. India 88. pl. 269. 1884 & Handb. Ferns Brit. India 465. t. 291. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 108. 1974; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 33. 1987; Augustine et al., J. Econ. Tax. Bot. 18: 445. 1994; Subh.Chandra, Ferns India 10. 2000. ***Ophioderma pendulum*** C.Presl., Suppl. Tent. Pterid. 56. 1845. f. ***pendulum*** R.D.Dixit, Cens. Indian Pterid. 22. 1984

Epiphytes. Rhizome erect or suberect, 1-1.5 x 2 cm, cylindrical. Fronds 1.5-2 x 0.01-0.02 m, fleshy, oblong, strap like, occasionally forked. Fertile spike 20-30 x 1-1.5 cm, oblong, dorsi-ventrally flattened, sporangia globose, arranged in a row on either side of the stalk. (Fig. 5.1.3d & e).

Rare, in moist deciduous, semi-evergreen and evergreen forests.

Specimens studied: Mlappara, JA 12832 (KFRI); KPR 70012 (CALI).

Note: Panigrahi and Dixit (1969), following Chakravarty (1951) doubts the occurrence of this species in Assam as recorded by Beddome (1883). Dixit (1984) also mentioned its occurrence in Assam based on Beddome. Augustine *et al.* (1994) recorded this species from the Reserve as a new record to mainland of India. Periyar is the only known place of this species in Southern India.

**Ophioglossum vulgatum** L., Sp. Pl. 2: 1062. 1753; Bedd., Handb. Ferns Brit. India 464. 1883; Suppl. Handb. Ferns Brit. India 109. 1892; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 106. 1974; R.D.Dixit, Cens. Indian Pterid. 24. 1984; Manickam, Fern Fl. Palni Hills 12. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 51. pl. 29. 1992; Subh.Chandra, Ferns India 13. 2000.

Terrestrial herbs. Rhizome 0.5 x 0.8 cm, erect, subglobose or cylindrical. Fronds bipartite; sterile blade 5-6 x 4-5 cm, ovate or elliptic, subcordate, obtuse, subcoriaceous with a common stalk of 10-12 cm long; veins anastomosing; fertile spike 10-15 x 0.3-0.5 cm, arising from the base of the sterile lamina, fertile lamina 3-5 x 0.3-0.5 cm, oblong, acute, margins wavy. Sporangia globose, sunken, arranged in a row on either side of the stalk. Spores 45 x 30 µm, ellipsoid, granulose.

Rare, in grasslands and semi-evergreen forests.

Specimen studied: Komalithuruthu, *KPR* 13286 (KFRI, CALI).

## MARATTIACEAE

Berchfold & J.S. Presl, Prirozen. Rostl. 1: 272. 1820.

### Key to the genera

1. Sporangia distinct ..... **Angiopteris**  
 1. Sporangia coalesced into synangia ..... **Marattia**

## ANGIOPTERIS Hoffman

Commentat. Soc. Regiae Sc. Gott. 12: 29. 1796, *nom. cons.*

**Angiopteris evecta** (G.Forst.) Hoffm., Comm. Soc. Reg. Sc. Gott. 12: 29. t. 5. 1796; Bedd., Ferns South. India 27. pl. 78. 1863 & Handb. Ferns Brit. India 46. 1883; Subr. et al., Bull. Bot. Surv. India 3: 210. 1961; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 105. 1974; R.D.Dixit, Cens. Indian Pterid. 25. 1984;

Manickam, Fern Fl. Palni Hills 15. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 9. 1987; N.C.Nair et al., J. Econ. Tax. Bot. 12: 206. 1988; Manickam & Irud., Pterid. Fl. W. Ghats 56. pl. 34. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 78. 1993; Subh.Chandra, Ferns India 14. 2000. ***Polypodium eVectum*** G.Forst., Prod. 81. 1786.

Terrestrials. Rhizome erect, 25-30 x 20-25 cm, massive, densely dark brown to black hairy. Fronds 3-3.5 x 1-1.5 m, bipinnate; stipe 150-180 cm long, hairy; lamina broadly elliptic acute in outline; pinnae 60-70 x 30-40 cm, oblong-lanceolate, acute in outline; pinnules 12-15 x 1.5-2 cm, oblong, acuminate, serrulate to entire, rounded at base; costa raised above and below, veins indistinct above, prominent below, rarely forked. Sporangia separate in a close double row, along the margins, dark brown. Spores 30 x 25 µm, black, globose, rugulose. (Fig. 5.1.4a).

Occasional, in all forest types along the water courses.

Specimens studied: Mlappara, *KPR* 70039 (CALI); Pamba, *D.B.Deb* 30428 (MH); Uppermanalar, *JA* 12863 (KFRI, CALI); Vazhukkappara, *N.C.Nair* 69881(MH); Besides Vellimala stream (Madurai district, TN), *B.V. Shetty* 10358; High Wavy Mountains (Madurai district, TN), *K.C. Jacob* 17557(MH).

### **MARATTIA** Swartz

Prod. 8: 128. 1788.

***Marattia fraxinea*** Sw., Pl. Ic. 2: t. 48. 1790. Bedd., Ferns South. India 27. pl. 79. 1863; Bedd., Handb. Ferns Brit. India 460. t. 286. 1883; Subr. et al., Bull. Bot. Surv. India 3: 210. 1961; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 107. 1974; R.D.Dixit, Cens. Indian Pterid. 26. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 9. 1987; Manickam, Fern Fl. Palni Hills 16. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 58. pl. 35. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 81. 1993; Subh.Chandra, Ferns India 15. 2000.

Terrestrials. Rhizome 30 x 30 cm, erect, massive. Fronds 120-250 x 130-150 cm, bipinnate, deltoid in outline; stipe 100-130 cm long, thick, scaly and hairy; pinnae 50-60 x 18-22 cm, elliptic-oblong, acuminate; pinnules 9 x 1.5 cm, oblong, acuminate, cuneate at base, serrate along the margins, coriaceous; costa raised above and below, veins indistinct above, distinct below, at right

angle to costa, rarely forked. Synangia 1.5 x 0.5 mm, dark brown, on veins, submarginal. Spores 22-25 µm in diameter, globose, smooth.

Occasional, in evergreen forests.

Specimens studied: Chemmanoda, *JA* 13238; Chokkampatti, *KPR* 14684 (KFRI, CALI). Vellimalai-Pachakumatchi (Madurai district, TN), *K. Subramanyam* 9496 (MH).

## SCHIZAEACEAE

Kaulfuss, Wesen Farrnkr. 119. 1827.

### LYGODIUM Swartz

Schrad. J. Bot. 1800(2): 106. 1802, nom. cons.

**Lygodium microphyllum** (Cav.) R.Br., Prod. Fl. N. Holl. 162. 1810; Bedd., Handb. Ferns Brit. India 455. t. 288. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 104. 1974; R.D.Dixit, Cens. Indian Pterid. 69. 1984; Manickam, Fern Fl. Palni Hills 18. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 7. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 62. pl. 39. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 252. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 94. 1993; Madhus. & Rejani, Indian Fern J. 11: 17. 1994; Subh.Chandra, Ferns India 27. 2000. **Ugenia microphylla** Cav., Ic. Descr. Pl. 6: 76. t. 595. 1801. **Lygodium scandens** (L.) Sw., Schrad. J. Bot. 1800(2): 106. 1801; Bedd., Ferns South. India 21. pl. 61. 1863; **Valli – Panna** Rheede, Hort. Malab. 12: 63. t. 32. 1693. **Tsjuru – valli – panna** Rheede, Hort. Malab. 12: 67. t. 34. 1693.

Terrestrials. Rhizome 5-8 mm thick, long creeping, black hairy, with fibrous roots at base. Fronds 4-5 m long, climbing, bipinnate; pinnae 6-8 x 2.5-3 cm, opposite, elliptic in outline, rachis flexuous; pinnules dimorphic; sterile pinnules 2.5-3 x 1-2 cm, ovate to oblong-lanceolate, obtuse with 3-4 mm stalk, terminal pinnule larger; fertile pinnules to 1.5 x 1.5 cm, ovate to rounded, lacinate, lobes subcordate to truncate at base, costa raised below, indistinct above, veins free forked. Sporangia yellowish-brown, crowded on the lobes of fertile pinnae. Spores 75 x 62.5 µm, black, triangular, reticulate.

Occasional, in moist deciduous and semi-evergreen forests.

Specimen studied: Pachakkanam, *KPR* 14682 (KFRI, CALI).



Fig. 5.1.4. Habits of a. *Angiopteris evecta*, b. *Pellaea falcata* and c. *Cheilanthes opposita*.

## SINOPTERIDACEAE

Koidzumi, Acta. Phytotax. Geobot 3: 50. 1934.

### Key to the genera

- 1. Fronds simple, palmately lobed ..... **Doryopteris**
- 1. Fronds simply pinnate to tripinnate ..... **2**
- 2. Pinnules ovate-lanceolate ..... **Pellaea**
- 2. Pinnules oblong, obtuse ..... **Cheilanthes**

## CHEILANTHES Swartz

Syn. Fil. 5: 126. 1806, *nom. cons.*

Terrestrial herbs. Rhizome erect. Scales lanceolate, acuminate, dark brownish to black. Fronds bipinnate. Sori marginal, indusia reflexed entire or laciniate. Sporangial capsule globose or subglobose, sessile. Spores yellowish, tetrahedral, trilete, granulate or spinulose.

### Key to the species

- 1. Indusia laciniate ..... **C. farinosa**
- 1. Indusia entire ..... **C. opposita**

**Cheilanthes farinosa** (Forssk.) Kaulf., Enum. Fil. 212. 1824; Bedd., Ferns South. India 65. pl. 191. 1864 & Handb. Ferns Brit. India 92. 1883; B.K.Nayar, Bull. Nat. Bot. Gard. Lucknow 68: 23. 1962; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 25. 1974; R.D.Dixit, Cens. Indian Pterid. 64. 1984; Manickam & Irud., Pterid. Fl. W. Ghats 87. pl. 63. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 267. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 120. 1993; Subh.Chandra, Ferns India 53. 2000. **Pteris farinosa** Forssk., Fl. Aegypt. Arab. 187. 1775. **Aleuritopteris farinosa** (Forssk.) Fee, Gen. Fil. 154. t. 12B. f. 1. 1850-52; Jyothi & Madhus., J. Econ. Tax. Bot. 17: 32. 1993; **Cheilanthes pulveraceae** C.Presl, Rel. Haenk. 1: 64. 1825; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 23. 1987.

Terrestrials. Rhizome 2.5 x 2 cm, erect, with fibrous roots at the base and scales above. Scales 5-6 x 1-1.1 mm, lanceolate, acuminate, entire, dark brownish to black in the middle, paler along margins. Fronds 25-45 x 6-8 cm, bipinnate; stipe 10-22 cm long, dark pinkish-brown to black, sparsely scaly above, densely beneath; lamina lanceolate, acuminate in outline; primary

pinnae to 6 x 3 cm, triangularly ovate, acute or obtuse in outline, progressively reduced towards apex; pinnules 1-2.5 x 0.5-0.7 cm, oblong, obtuse, lobed to crenate; lobes to 2 x 2 mm, oblong or ovate, obtuse; acroscopic pinnules smaller; costa and costules raised below, grooved above. Sori linear, marginal, not continuous, indusia laciniate. Sporangial capsule 437.5 x 312.5  $\mu$ m, globose, sessile. Spores 62.5 x 62.5  $\mu$ m, yellowish brown, tetrahedral, spinose.

Common, in grasslands, moist deciduous semi-evergreen and evergreen forests.

Specimens studied: Mangaladevi, JA 12814; Pachakkanam, JA 12840; Vellimala, KPR 13295 (KFRI, CALI).

**Cheilanthes opposita** Kaulf., Enum. Fil. 211. 1824; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 86. 1997; Subh.Chandra, Ferns India 55. 2000. **C. melanocoma** Bory, Bel. Voy. Bot. 2: 71. 1833. **C. swartii** Webb & Berthel., Hist. Nat. Canar. Phyt. 3(3): 458. 1847; R.D.Dixit, Cens. Indian Pterid. 66. 1984; N.C.Nair et al., J. Econ. Tax. Bot. 16: 268. 1992. **C. mysurensis** Wall., List No. 66. 1829, nom. nud.; Hook., Sp. Fil. 2: 94. t. 100A. 1852; Bedd., Ferns South. India 65. pl. 190. 1864 & Handb. Ferns Brit. India 89. pl. 46. 1883; Subr. et al., Bull. Bot. Surv. India 3: 210. 1961; B.K.Nayar, Bull. Nat. Bot. Gard. Lucknow 65: 30. 1962; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 24. 1974; Manickam, Fern Fl. Palni Hills 29. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 23. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 89. pl. 65. 1992; Jyothi & Madhus., J. Econ. Tax. Bot. 17: 34. 1993; B.K.Nayar & Geev., Fern Fl. Malabar 121. 1993.

Terrestrials and lithophytes. Rhizome 1 x 1 cm, erect, with fibrous roots at base and scaly above. Scales 1-2.1 x 0.1 mm, dark brownish to black, subulate. Fronds 10-13 x 2-2.5 cm, oblanceolate or elliptic-lanceolate in outline, bipinnate; stipe 1-1.5 cm long, black polished, sparsely scaly above, densely beneath; pinnae 12-15 pairs, to 1.5 x 1 cm, progressively reduced towards both ends; pinnules to 6 x 3 mm, oblong, obtuse, lobed; lobes 1 x 0.5 mm, obovate or rounded, pinnules progressively reduced towards apex; rachis and costa grooved above, raised below; veins indistinct. Sori distinct, along the margin of

lobes, protected by the reflexed margins. Sporangial capsule 375 x 250 µm, yellow, subglobose, subsessile. Spores 50 x 50 µm, yellowish, tetrahedral, granulose. (Fig. 5.1.4b).

Common, in grasslands and moist deciduous forests.

Specimens studied: Brandippara, JA 12838 (KFRI, CALI); Kuamrikulam malai, N.C.Nair 70164 (MH) Thekkady, KPR 14662 (KFRI, CALI).

### **DORYOPTERIS** J.Smith

Hook. J. Bot. 3: 404. 1841.

**Doryopteris concolor** (Langsd. & Fischer) Kuhn in Decken, Reisen Ostafri. 3(3): 19. 1879; Subr. et al., Bull. Bot. Surv. India 3: 211. 1961; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 28. 1974; R.D.Dixit, Cens. Indian Pterid. 61. 1984; Manickam, Fern Fl. Palni Hills 30. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 4. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 83. pl. 59. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 269. 1992; Jyothi & Madhus., J. Econ. Tax. Bot. 17: 35. 1993; B.K.Nayar & Geev., Fern Fl. Malabar 124. 1993; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 116. 1997; Subh.Chandra, Ferns India 60. 2000. **Pteris concolor** Langsd. & Fischer, Ic. Fil. 19. t. 21. 1810. **Pellaea concolor** Baker, Fl. Bros. 1(2): 396. 1870; Bedd., Handb. Ferns Brit. India 100. 1883. **Allosorus concolor** Kuntze, Rev. Gen. Pl. 2: 806. 1891. **Pteris geranifolia** Raddi, Opusc. Sci. Bol. 3: 293. 1819; Bedd., Ferns South. India 13. pl. 37. 1863. **Cheilanthes concolor** (Langsd. & Fischer) R.M.Tryon & A.F.Tryon, Rhodora 83: 183. 1981. **C. concolor** (Langsd. & Fischer) Schelpe & N.C.Anthony, Contr. Bolus. Herb 155. 1982, *nom. supefl.*

Terrestrials. Rhizome 2-4 x 2 cm, erect. Scales 2-3 x 0.4-0.6 mm, lanceolate-acuminate, dark brown in the middle, paler along margins. Fronds 25-30 x 10-15 cm, simple; stipe 15-25 cm long, dark brown or black polished, sparsely scaly; lamina 10-15 x 10-12 cm, cordately ovate, acuminate in outline, deeply palmately lobed; lobes again divided; lobules to 1 x 0.5 cm, oblong, acute. Sori continuous along the margins of the lobules, brownish. Sporangial capsule 250-312.5 x 187.5 µm, globose, stalk 250-312.5 µm long. Spores 37.5 x 37.5 µm, yellowish, tetrahedral, granulose.

Occasional, in all vegetation types.



Specimens studied: Kumarikulam, JA 12843; Kottamala, JA 13277; Ambari, KPR 14648; High Wavies (TN), KPR 18364 (KFRI, CALI); Thekkady, K. *Vivekananthan* 46703 (MH).

Note: Though Tryon & Tryon, (1981) transferred *Doryopteris concolor* (Langsd. & Fischer) to *Chielanthes* Sw., many authors do not agree with this (Fraser-Jenkins, 1997; Hasebe et al., 1995; Lellinger, pers. comm. 2000).

### PELLAEA Link

Fil. Sp. Cult. 48. 59. 1841, *nom. cons.*

Terrestrial, lithophytic or rarely epiphytic herbs. Rhizome erect or creeping. Scales lanceolate-acuminate, entire to fimbriate. Fronds simply pinnate to tripinnate. Stipe dark brown to black, pubescent to tomentose. Lamina oblong-lanceolate to ovate-acute in outline, ultimate pinnae triangular-ovate to oblong-lanceolate in outline, chartaceous. Sori linear sub-marginal, indusiate. Spores trilete, tetrahedral, granulose to tuberculate.

#### Key to the species

1. Fronds simply pinnate ..... **P. falcata**  
 1. Fronds bi or tripinnate ..... **P. boivini**

**Pellaea boivini** Hook., Sp. Fil. 2: 147. t. 118A. 1858; Bedd., Handb. Ferns Brit. India 102. pl. 53. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 28. 1974; R.D.Dixit, Cens. Indian Pterid. 62. 1984; Subh.Chandra & S.Kaur, Nomen Guide Bedd. 4. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 85. pl. 61. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 269. 1992; Jyothi & Madhus., J. Econ. Tax. Bot. 17: 36. 1993; B.K.Nayar & Geev., Fern Fl. Malabar 127. 1993; Subh.Chandra, Ferns India 63. 2000. *Pteris boivini* Moore ex Bedd., Ferns South. India 12. pl. 36. 1863.

Terrestrials. Rhizome 3-5 x 1.5 cm, erect. Scales 3-6 x 0.5 mm, dark brown, lanceolate, acuminate, sparsely fimbriate. Fronds 25-32 x 12-15 cm, bi or tripinnate; stipe 20-25 cm long, dark brown to black polished, scaly beneath, pubescent above; lamina ovate-acute in outline; primary pinnae 5-6 x 3-4 cm, ovate, acute in outline, 5-6 pairs, progressively reduced towards apex, terminal pinnae single; secondary pinnae 2.5-3 x 3 cm, triangular-ovate in outline, 4-5

pairs; pinnules 2-2.7 x 0.7 cm, shortly stipitate, lanceolate or elliptic-lanceolate, obtuse; terminal pinnae larger; rachis, costa and costules hispid; costa grooved above, raised below. Sori linear along the margins of pinnules, continuous, dark brownish. Sporangial capsule 375 x 250  $\mu\text{m}$ , globose, stalk 250  $\mu\text{m}$  long. Spores 50 x 45  $\mu\text{m}$ , dark brown, trilete, tetrahedral, granulose.

Occasional, in moist deciduous, semi-evergreen and evergreen forests.

Specimen studied: Vellimala, *KPR* 62872 (CALI).

***Pellaea falcata*** (R.Br.) Fee, Gen. Fil. 129. 1852; Bedd., Handb. Ferns Brit. India 103. pl. 54. 1883, non; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 26. 1974; Manickam, Fern Fl. Palni Hills 30. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 3. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 84. pl. 60. 1992; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 190. 1997; Subh.Chandra, Ferns India 64. 2000. ***Pteris falcata*** R.Br., Prod. Fl. N. Holl. 154. 1810. ***P. seticaulis*** Hook., Ic. Pl. 3. t. 207. 1840. ***Pellaea falcata*** (R.Br.) Fee var. ***setosa*** Hook., Sp. Fil. 2: 136. 1858. ***Platyloma falcatum*** var. ***setosum*** Bedd., Ferns South. India 7. pl. 22. 1863. ***P. falcata*** Js.Sm., J. Bot. 4: 160. 1841. ***Allosorus falcata*** Kunze, Linn. 23: 219. 1850. ***Pellaea seticaulis*** (Hook.) S.R.Ghosh, J. Econ. Tax. Bot. 7: 681. 1985; N.C.Nair et al., J. Econ. Tax. Bot. 16: 269. 1992.

Terrestrials, lithophytes or rarely epiphytes. Rhizome 2 mm thick, creeping. Scales 2 x 0.5 mm, linear or ovate, acuminate, dark brownish or black in the middle, pale brown along the margins. Fronds 25-40 x 5-6.5 cm, simply pinnate; stipe 14-20 cm long, densely brownish tomentose; lamina oblong-lanceolate in outline, dark green; pinnae 3.5-5 x 0.8-1.5 cm, oblong or elliptic-lanceolate, subobtuse to acute, subcordate to truncate at base, shortly stipitate, subopposite to alternate, margins wavy; progressively reduced towards apex, terminal pinnae larger, rhomboid, acuminate; costa slightly raised above and below, hairy; veins close, forked. Sori dark brown, linear continuous submarginally. Sporangial capsule 250 x 187.5  $\mu\text{m}$ , globose, stalk 250  $\mu\text{m}$  long. Spores 37.5 x 32.5  $\mu\text{m}$ , dark brownish, tuberculate. (**Fig. 5.1.4c**).

Occasional, in evergreen forests.

Specimens studied: Mlappara, *KPR* 70020 (CALI); Mlappara estate area, *N.C.Nair* 70117 (MH); Naduthottam, *JA* 12891; Vellimala, *KPR* 18334 (KFRI, CALI).

### ACTINIOPTERIDACEAE

Pichi Sermolli, *Webbia* 17: 5. 1962.

#### ACTINIOPTERIS Link

Fil. Sp. Herb. 79. 1841.

**Actiniopteris radiata** (Sw.) Link, Fil. Sp. Horto. Res. Bot. Ber. Cult. 80. 1841; Bedd., Ferns South. India 43. pl. 124. 1863; Nayar & Kaur, Comp. Bedd. Handb. 47. 1974; Dixit, Cens. Indian Pterid. 68. 1984; Manickam., Fern Fl. Palni Hills 27. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 15. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 81. pl. 58. 1992; Nair et al., J. Econ. Tax. Bot. 16: 255. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 97. 1993; Subh.Chandra, Ferns India 28. 2000. **Asplenium radiatum** Sw., Schrad. J. Bot. 1800(2): 50. 1801. **Actiniopteris australis** (L.f.) Link, Fil. Sp. Horto. Reg. Bot. Ber. Cult. 80. 1841; B.K.Nayar, Bull. Nat. Bot. Gard. Lucknow 75: 11. 1962; **Actiniopteris dichotoma** Kuhn, Bot. Zeit. 504. 1871; Bedd., Handb. Ferns Brit. India 197. pl. 98. 1883; Subr. et al., Bull. Bot. Surv. India 3: 210. 1961.

Terrestrials. Rhizome 2 x 2.5 cm, erect or suberect, densely scaly. Scales 2-4 x 0.1-0.5 mm, linear-lanceolate, dark brown in the middle, paler along margin, entire. Fronds 3-4 x 3-4.5 cm, simple, flabellate; stipe 8-10 cm long; lamina dichotomously lobed, lobes linear, 2-4 x 0.1-0.15 mm, lobed; fertile lamina narrower. Sori linear, marginal, covered by the reflexed margins of the pinnae lobes. Sporangial capsule 250 x 225 µm, subglobose, stalk 375 µm. Spores 62.5 x 50 µm, trilete, tetrahedral, rugulose to verrucate.

Rare, in grasslands.

Specimen studied: Mlappara, *JA* 12825 (KFRI, CALI).

**PTERIDACEAE**

Reichenbach, Handb. Nat. Pflanz. 138. 1837.

**PTERIS** Linnaeus

Sp. Pl. 1073. 1753.

Terrestrial herbs. Rhizome erect, scales linear, dark in the middle. Fronds simply pinnate or bipinnate or ternately divided and bipinnate; basal pinnae usually bipartite in bipinnate fronds. Stipe dark green, brownish or carmine red. Spinules present or absent along the costa and costules. Veins forked freely, sometimes forming net work at the base of pinnules. Sori marginal, linear, dark brown, some times continuous, indusiate. Sporangial capsule subglobose, with many celled stalk, longer than capsule. Spores tetrahedral trilete, triangular, rugose to reticulate.

**Key to the species**

- 1. Fronds simply pinnate ..... 2
- 1. Fronds bipinnate or ternately divided ..... 3
- 2. Pinnae 1-2 pairs, 4 cm or more broad ..... **P. pellucida**
- 2. Pinnae more than 4 pairs, 1-2 cm broad ..... **P. cretica**
- 3. Fronds ternately divided ..... **P. longipes**
- 3. Fronds not divided ..... 4
- 4. Basal veins anastomosing, forming series of areoles ..... 5
- 4. Basal veins not anastomosing ..... 6
- 5. Pinnules entire ..... **P. biaurita**
- 5. Pinnules crenate ..... **P. kleiniana**
- 6. Stipe and rachis carmine red ..... **P. aspericaulis**
- 6. Stipe and rachis dark green or brownish ..... 7
- 7. Pinnae with white band along the costa ..... **P. argyraea**
- 7. Pinnae without such white bands ..... 8
- 8. Pinnules below 2 cm long ..... **P. quadriaurita**
- 8. Pinnules more than 2 cm long ..... **P. confusa**

**Pteris argyraea** T.Moore, Gard. Chron. 671. 1859; R.D.Dixit, Cens. Indian Pterid. 68. 1984; Manickam, Fern Fl. Palni Hills 23. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 78. pl. 54. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 262. 1992; Subh.Chandra, Ferns India 33. 2000. **P. quadriaurita** Retz. var.

**argentea** Bedd., Handb. Ferns Brit. India 111. 1883; Subr. et al., Bull. Bot. Surv. India 3: 211. 1961; B.K.Nayar & Geev., Fern Fl. Malabar 114. 1993.

Terrestrials. Rhizome 1.5-2 x 2-3 cm, erect. Scales 0.4 x 0.5 mm, linear-lanceolate, dark in the middle, pale brown along the margin, fimbriate. Fronds 4-50 x 20-30 cm; stipe 20-30 cm long, scaly below, glabrous, glossy above; lamina 25-30 x 20-30 cm, bipinnate, 3-5 pairs, lanceolate in outline, 10-15 x 3-4 cm, with a prominent white band along the costa on the upper side, margins deeply lobed; lobes 0.5-2.8 x 0.5-0.8 cm, oblong, sub curved to apex, obtuse, veins free; basal pinnae bipartite, terminal pinnae single, 1-2 x 0.2-0.4 cm, lanceolate acuminate. Sporangial capsule 350-400 x 375  $\mu$ m, capsule subglobose or globose with stalk of 375  $\mu$ m long. Spores 40 x 38  $\mu$ m, dark brown, triangular in outline, thickly reticulate. (**Fig.5.1.5a**).

Common, in evergreen forests.

Specimens studied: Vellimala, *KPR* 18331 (KFRI, CALI); beside the stream-Vellimalai (Madurai district, TN), *B.V. Shetty* 10316 (MH).

**Pteris aspericaulis** Wall. ex Agardh, Rec. Sp. Gen. Pteridis 22. 1839; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 30. 1974; Manickam & Irud., Pterid. Fl. W. Ghats 75. pl. 51. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 102. 1993; Subh.Chandra, Ferns India 286. 2000. ***P. quadriaurita* var. *aspericaulis*** Bedd., Handb. Ferns Brit. India 111. 1883.

Terrestrials. Rhizome 2-3 x 2 cm, erect. Scales 2-5 x 0.1-0.3 mm, linear, dark brown in the middle, hyaline along margins, fimbriate. Fronds 50-70 x 20-30 cm; stipe 25-30 cm long, scaly beneath, glabrous, pinkish-red, polished above; lamina 25-30 x 20-30 cm, bipinnate, elliptic-oblong in outline; pinnae 10-13 x 2-3 cm, lanceolate, acuminate in outline, opposite, except terminal one, 4 or 5 pairs, basal pinnae bipartite, basispic half smaller, pinnae deeply lobed almost to the costa; lobes to 2 x 0.5 cm, oblong, rounded, entire, spinules present along the costa and costules, veins free forked. Sori linear, 0.5-1 cm long, along the margins of the lobes in the middle. Sporangial capsule 350 x 250  $\mu$ m, stalk 375  $\mu$ m long. Spores 50 x 50  $\mu$ m, dark brown triangular in outline.

Common, in evergreen forests.

Specimens studied: Deviarmettu, *JA* 13251 (KFRI, CALI); Poongavanam-Sabarimala, *N.C.Nair* 70201; Sabarimala slopes, *B.D. Sharma* 24062 (MH); Vellimala, *KPR* 18331 (KFRI, CALI); Uppuparai to Sabarimala, *K. Vivekananthan* 45366 (MH);

**Pteris biaurita** L., Sp. Pl. 2: 1076. 1753; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 31. 1974; R.D.Dixit, Cens. Indian Pterid. 69. 1984; Manickam, Fern Fl. Palni Hills 21. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 5. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 73. pl. 49. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 263. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 104. 1993; Subh.Chandra, Ferns India 286. 2000. **Campteria biaurita** Hook., Gen. Fil. t. 65A. 1841; Bedd., Ferns South. India 14. pl. 44. 1863; Handb. Ferns Brit. India 116. 1883.

Terrestrials. Rhizome 5 x 2.5-5 cm, erect. Scales 4-5 x 0.8-1.1 mm, lanceolate, long acuminate, dark brown in the middle, translucent along margins, fimbriate. Fronds 50-80 x 20-50 cm; stipe 20-30 cm long, scaly beneath, polished, glabrous above; lamina deltoid in outline, basal pinnae bipartite; pinnae 14-28 x 3-8.5 cm, lanceolate, acuminate in outline, lobed up to 4 mm to the costa, 1-2.5 x 0.5-0.8 mm, falcately oblong, lanceolate, acute, progressively reducing, terminal lobe linear, acuminate, 3-7 cm long, rachis and costa grooved above, rounded and raised beneath, costal veins anastomosing, veins forked, prominent above and below. Sori linear, continuous up to the apex, joined at base along the margin of sinus, dark brownish to black. Sporangial capsule 250 x 187.5 µm, stalk 375 µm long. Spores 50 x 50 µm, deep pinkish brown, trilete, tuberculate or verrucose. (**Fig. 5.1.5b**).

Common, in moist deciduous, semi-evergreen and evergreen forests.

Specimens studied: Thekkady, *KPR* 18348; Upper Manalar, *JA* 12863 (KFRI, CALI).

**Pteris confusa** T.G.Walker, Kew Bull. 14: 329. f. 5. t. 5B. 1960; N.C.Nair & S.R.Ghosh, J. Bombay Nat. Hist. Soc. 73: 441. 1976; Manickam & Irud., Pterid. Fl. W. Ghats 80. pl. 57. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 262. 1992; Subh.Chandra, Ferns India 35. 2000.

Terrestrial herbs. Rhizome 2-3.5 x 5-6 cm, erect. Scales 2-5.5 x 0.1-1.2 mm, lanceolate, acuminate, cordate at base, dark brown along the middle, paler along the margins. Fronds 50-100 x 20-30 cm, bipinnate; stipe 30-50 cm long, scaly below, glabrous, polished above; lamina 30-50 x 25-30 cm, oblong-lanceolate, acuminate in outline; pinnae 11-18 x 2.5-5 cm, opposite or sub opposite, deeply lobed, 5-6 pairs; pinnules 1.5-3 x 0.3-0.7 cm, oblong, obtuse, terminal lobe 4-5 x 0.5 cm, linear-acuminate; basal pinnae bipartite, basiscopic half smaller; terminal pinnae single, larger than others, lobes of sporophylls narrower than vegetative pinnae. Spinules present on the upper side along the costa and at the junction of the pinnules; veins dichotomously branched from the base. Sori linear along the margins, sometimes on both sides. Sporangial capsule 250 x 125  $\mu\text{m}$ , stalk 437-500  $\mu\text{m}$  long. Spores 42.5 x 40  $\mu\text{m}$ , dark brown, tetrahedral, trilete.

Common, in semi-evergreen and evergreen forests.

Specimens studied: Karadikkavala, *KPR* 70124; Mlappara, *KPR* 70030, 70031, 70055 (CALI).

**Pteris cretica** L., Mantissa Pl. 130. 1767; Bedd., Ferns South. India 13. pl. 39. 1863 & Handb. Ferns Brit. India 106. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 29. 1974; R.D.Dixit, Cens. Indian Pterid. 69. 1984; Manickam, Fern Fl. Palni Hills 20. 1986; Subh.Chandra & S.Kaur, Nomen Guide Bedd. 5. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 70. pl. 45. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 105. 1993; Subh.Chandra, Ferns India 35. 2000.

Terrestrials. Rhizome 1-2 x 2.5 cm, erect. Scales 4-6 x 0.4-0.6 mm, dark brown, lanceolate. Fronds 40-60 x 20-30 cm, simply pinnate; stipe 25-30 cm long, glabrous, yellow polished above; lamina 30 x 20-30 cm, 5-6 pairs, basal pair bipinnate; pinnae oblong-lanceolate, acuminate, cuneate at base, entire, except the non soral distal part; serrate or serrulate. Veins indistinct above, free or once forked, costa indistinct above, raised below. Sori linear 13-14 cm long, greyish. Sporangial capsule 312 x 250  $\mu\text{m}$ , stalk 312  $\mu\text{m}$  long. Spores 45 x 37.5  $\mu\text{m}$ , dark brown, verrucose.

Occasional, in evergreen forests.

Specimens studied: Arjunankotta, *JA* 12887; Ezhanakkuzhi, *JA* 12897 (KFRI, CALI).



Fig. 5.1.5. Habits of *Pteris* spp. a. *P. argyrea*, b. *P. biaurita*, c. *P. longipes* and d. *P. pellucida*.



**Pteris geminata** Wall. ex Agardh, Rec. Sp. Gen. Pteridis 31. 1839; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 31. 1974; R.D.Dixit, Cens. Indian Pterid. 70. 1984; N.C.Nair & Bhargavan, J. Econ. Tax. Bot. 6: 268. 1965; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 5. 1987; N.C.Nair et al., J. Econ. Tax. Bot. 16: 264. 1992; Subh.Chandra, Ferns India 37. 2000. **Campteria kleiniana** C.Presl, Tent. Pterid. 147. 5. f. 19. 1836; Bedd., Handb. Ferns Brit. India 116. t. 60. 1883. **Campteria anamallyensis** Bedd., Ferns South. India 14. pl. 45. 1863. **Pteris kleiniana** H.Christ, Bull. Boiss. 4: 666. 1896; Manickam & Irud., Pterid. Fl. W. Ghats 74. pl. 50. 1992.

Terrestrials. Rhizome 4 x 5 cm, erect. Scales 8-10 x 1-1.2 mm, linear-lanceolate, pale brown. Fronds to 90-120 x 40-60 cm, bipinnate; stipe 50-55 x 0.4-0.6 cm, scaly beneath, glabrous, dark brownish, polished above; lamina 45 x 40 cm, deltoid in outline; pinnae 6 pairs, except terminal one, 23-25 x 5-6 cm; basal pinnae bipartite, stipitate 1.5-4 cm, lanceolate, acuminate in outline, deeply lobed, up to 3-5 mm to costa; lobes 3.5-4 x 0.8-1 cm, oblong or elliptic lanceolate, acuminate, crenate. Veins in the lobes forked once, not reaching the margin, basal veins anastomosing. Sori linear, 0.5-2 cm long, dark brown, marginal, along the middle of the lobes, indusia dark brown. Sporangial capsule 312 x 150 µm, ellipsoid, stalk 250 µm long. Spores 30 x 25 µm, trilete, dark pinkish-brown, reticulate.

Common, in evergreen forests.

Specimens studied: Upper Manalar, JA 12854, 13228; Vellimala, KPR 18322 (KFRI, CALI); KPR 62892 (CALI).

**Pteris longipes** D.Don, Prod. Fl. Nepal. 15. 1825; Bedd., Handb. Ferns Brit. India 115. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 31. 1974; R.D.Dixit, Cens. Indian Pterid. 70. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 4. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 72. pl. 47 & 48. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 263. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 109. 1993; Subh.Chandra, Ferns India 39. 2000. **P. pelluscens** Agardh, Rec. Sp. Gen. Pteridis 43. 1839; Bedd., Ferns South. India 11. pl. 32. 1863; Handb. Ferns Brit. India 115. 1883.

Terrestrials. Rhizome 8 x 4 cm, erect. Scales 5-6 x 1-2 mm, lanceolate or linear, dark brown. Fronds 110-125 x 20-40 cm; stipe 58-70 cm, scaly at base, yellowish; lamina bi or tripartite; basal primary pinnae 20 x 10 cm, bipartite, elliptic-acuminate in outline, pinnules 11-12 pairs; basiscopic pinnule longer than acroscopic, upper pinnae opposite or alternate, 14-15 pairs; oblong-lanceolate, acuminate in outline, deeply lobed almost to the costa, angular, lobes to 1 x 0.4 cm, oblong, rounded, crenate towards distal half. Spinules present at the junction of costa and costules, and costules and veins. Veins rarely forked. Sori linear, 0.3-0.7 mm long, marginal, in the middle of lobes, indusia dark brownish. Sporangial capsule 350 x 250  $\mu\text{m}$ , yellow, ellipsoid, stalk 375  $\mu\text{m}$  long. Spores 50 x 37.5  $\mu\text{m}$ , yellowish-brown, triangular with projections. (Fig. 5.1.5c).

Occasional, in semi-evergreen and evergreen forests.

Specimens studied: Anjuruli, *KPR* 70116 (CALI); Ayyappan temple to Uppuparai, *N.C.Nair* 70199 (MH); Palkulam mudi, *JA* 12855 (KFRI, CALI).

***Pteris pellucida*** C.Presl, Rel. Haenk. 1: 55. 1825; Bedd., Ferns South. India 13. pl. 38. 1863; Handb. Ferns Brit. India 106. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 29. 1974; R.D.Dixit, Cens. Indian Pterid. 71. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 5. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 69. pl. 44. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 259. 1992; Subh.Chandra, Ferns India 41. 2000. ***P. venulosa*** Blume, Enum. Pl. Jav. 209. 1828; B.K.Nayar & Geev., Fern Fl. Malabar 115. 1993. ***P. venusta*** Kuntze, Bot. Ziet. 195. 1848.

Terrestrials. Rhizome 2.5-4 x 1.5-2 cm, erect. Scales 2-3 x 0.1-0.4 mm, linear or lanceolate-acuminate, pale brown, margins fimbriate. Fronds 40-45 x 15-20 cm, simply pinnate; stipe 18-30 cm long, brownish, polished, glabrous; lamina 10-22 x 15-20 cm. Pinnae 1-2 pairs, 10-18 x 2.5-5 cm, oblong acuminate, terminal pinna single, larger. Veins forked, almost perpendicular to the costa. Sori linear along the margin of the pinnae except at base and apex. Sporangial capsule 375 x 250  $\mu\text{m}$ , subglobose, stalk 375-400  $\mu\text{m}$  long. Spores 62.5 x 50  $\mu\text{m}$ , dark brown, verrucate with thick hyaline perispore. (Fig. 5.1.5d).

Occasional, in moist deciduous and semi evergreen forests.

Specimens studied: Pachakkanam, *JA* 12813; Thekkady, *KPR* 18346 (KFRI, CALI).

**Pteris quadriaurita** Retz., Obs. Bot. 6: 38. 1791; Bedd., Ferns South. India 11. pl. 31. 1863; Handb. Ferns Brit. India 110. 1883; Subr. et al., Bull. Bot. Surv. India 3: 211. 1961; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 29. 1974; R.D.Dixit, Cens. Indian Pterid. 71. 1984; Manickam, Fern Fl. Palni Hills 23. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 4,5. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 79. pl. 55. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 112. 1993; Subh.Chandra, Ferns India 43. 2000.

Terrestrials. Rhizome 2 x 2.5 cm, erect. Scales 4-4.5 x 0.2-0.5 mm, linear acuminate, dark brownish to black along the middle, pale brownish, translucent, fimbriate along margins. Fronds 80-110 x 25 cm, simply pinnate; stipe 30-35 cm long, scaly beneath, glabrous, polished above, greyish; pinnae 15 x 4 cm, lanceolate, acuminate, deeply divided; basal pinnae unequally bipartite; pinnules 1.5-2.2 x 0.3-0.4 cm, lobed up to costa, oblong, rounded to acute, entire. Veins divided, prominent above and below; spinules present on the costa and costules above. Sori 1-1.5 cm long, yellowish or brown, along the basal margins except at the apex and base. Sporangial capsule 400 x 375 µm, ellipsoid, stalk 450 µm long. Spores 40 x 35 µm, yellowish brown, reticulate.

Common, in moist deciduous, semi evergreen and evergreen forests.

Specimens studied: Melmala, *KPR* 14416 (KFRI, CALI); way to Mlappara, *N.C.Nair* 69896; Vallakkadavu, *N.C.Nair* 74238 (MH).

## ADIANTACEAE

(C.Presl) Ching, Sunyatsenia 5: 229. 1940, *nom. cons.*

### ADIANTUM Linnaeus

Sp. Pl. 1094. 1753.

Terrestrial herbs. Rhizome erect or creeping. Scales lanceolate or linear-acuminate, dark brown to black. Fronds simply pinnate or bipinnate or divided at times bulbiferous. Pinnules dimidiate, hairy or glabrous. Veins forking. Sori linear or reniform, brown at maturity. Sporangial capsule subglobose or globose with stalk equal or longer than the capsule. Spores brownish, trilete, triangular, smooth or granulose.

**Key to the species**

- 1. Fronds simply pinnate ..... 2
- 1. Fronds branched ..... 4
- 2. Fronds hairy ..... **A. caudatum**
- 2. Fronds glabrous ..... 3
- 3. Pinnae deeply lobed, stipe and rachis hairy ..... **A. zollingeri**
- 3. Pinnae shallowly lobed or not, stipe and rachis glabrous .... **A. philippense**
- 4. Fronds hispid ..... **A. hispidulum**
- 4. Fronds glabrous ..... 5
- 5. Pinnules obovate, sori reniform ..... **A. raddianum**
- 5. Pinnules trapeziform, sori linear ..... **A. latifolium**

**Adiantum caudatum** L., Mant. Pl. Act. 308. 1771; Bedd., Handb. Ferns Brit. India 83. pl. 44. 1883; B.K.Nayar, Nat. Bot. Gard. Lucknow 52: 6. 1961; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 23. 1974; R.D.Dixit, Cens. Indian Pterid. 74. 1984; N.C.Nair et al., J. Econ. Tax. Bot. 16: 274. 1992; Manickam & Irud., Pterid. Fl. W. Ghats 96. pl. 71. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 144. 1993; Subh.Chandra, Ferns India 67. 2000.

Terrestrials. Rhizome 1-2 x 1 cm, erect. Scales 4-5 x 1-0.5 mm, linear, dark brown in the middle, paler along the margins. Fronds 30-45 x 2.5-3 cm, simply pinnate with long cirrhose, bulbiferous apex; stipe 5-10 cm long, scaly at the base, densely hairy above; pinnae 1.5 x 0.5 cm, dimidiate, oblong in outline, lobed, brown hispid; veins distinct above and below. Sori 0.5 x 0.4 mm, dark brown, reniform; indusia dark brown, hispid. Sporangial capsule 250 x 125 µm, subglobose, dark brown, stalk 125 µm long. Spores 45-50 x 25 µm, dark brown, tetrahedral, tuberculate. (**Fig. 5.1.6a**).

Occasional, in moist deciduous and semi-evergreen forests.

Specimens studied: Bank of Thannithode, *N.C.Nair* 70172 (MH); Thekkady, *KPR* 70101 (CALI).



Fig. 5.1.6. Habits of Adiantum spp. a. *A. caudatum*, b. *A. latifolium*, c. *A. raddianum*.

**Adiantum hispidulum** Sw., Schrad. J. Bot. 1800: 82. 1801; Bedd., Ferns South. India 1. pl. 3. 1863 & Handb. Ferns Brit. India 86. 1883; B.K.Nayar, Nat. Bot. Gard. Lucknow 52: 10. 1961; Subr. et al., Bull. Bot. Surv. India 3: 210. 1961; R.D.Dixit, Cens. Indian Pterid. 75. 1984; Manickam, Fern Fl. Palni Hills 37. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 99. pl. 75. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 275. 1992; Subh.Chandra, Ferns India 69. 2000. **A. pubescens** Schkuhr, Kryp. Gew. 1: 141. t. 116. 1809; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 24. 1974; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 1. 1987; Vasudeva et al., Indian Fern J. 8: 170. 1991; B.K.Nayar & Geev., Fern Fl. Malabar 144. 1993. **A. rigidum** Fourn, Ann. Sci. Nat. 5. 18: 329. 1873.

Terrestrials. Rhizome 2-3 x 2-2.5 cm, erect. Scales 2.5-3 x 0.5 mm, lanceolate, acuminate, pale brown. Fronds 20-30 x 10-15 cm, dichotomously branched, 4 or 5 times; stipe 10-15 cm long, dark brown to black, hispid; pinnae 2-10 cm long, pinnules 1 x 0.6-0.8 cm, dimidiate, obovate, elliptic or rhomboid, shortly stipitate, truncate to cuneate at base; sterile pinnae serrate, fertile pinnae serrate to lobed; hispid coriaceous. Sori along the reflexed margins, reniform, 1 x 1 mm, dark brown to black. Sporangial capsule 250 x 125 µm, subglobose, stalk 125 µm long. Spores 37.5 x 37.5 µm, yellow, trilete, tetrahedral.

Common, in moist deciduous, semi-evergreen and evergreen forests.

Specimens studied: Mlappara estate, *N.C.Nair* 70123; Mlappara, *C.N.Mohanan* 78810 (MH); Mlappara, *JA* 12821 (KFRI, CALI); Thekkady, *B.D. Sharma* 43840; Vazhukkappara to Mlappara, *N.C.Nair* 69883; Aruna estate (Madurai district, TN), *K. Subramanyam* 9485 (MH).

**Adiantum latifolium** Lam., Encl. 1: 43. 1783; Manickam & Irud., Pterid. Fl. W. Ghats 103. pl. 80. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 275. 1992; Subh.Chandra, Ferns India 70. 2000. **A. denticulatum** Sw., Prod. 135. 1788, non Burm.f., Fl. Ind. 236. 1768.

Terrestrials. Rhizome 3-4 mm thick, long creeping, densely scaly. Scales 2-3 x 0.1 mm, lanceolate or linear, very narrow pointed at apex, dark reddish brown, clathrate, entire or with few outgrowths. Fronds 40-55 x 20-28 cm; stipe 25-36 cm long, black polished, scaly beneath, hairy above; lamina deltoid in

outline, bipinnate; primary pinnae 12-13 x 4.5-6 cm, oblong, lanceolate in outline, 5-6, alternate, largest in middle; pinnules to 3.5 x 1 cm, trapeziform, obtuse to rounded at apex, serrate; sessile or subsessile, acroscopic base truncate, basispic base cuneate, excised, coriaceous; veins very close, repeatedly forking, anastomosing, largest pinnae in the middle, terminal pinnae rhomboid, larger. Sori 2-4 mm, oblong or elliptic, yellowish brown. Sporangial capsule 250 x 125  $\mu$ m, subglobose, stalk 250  $\mu$ m long. Spores 37.5 x 35  $\mu$ m, triangular, yellowish, verrucoid. (**Fig. 5.1.6b**).

Occasional, in moist deciduous, semi-evergreen and evergreen forests.

Specimen studied: Thannikkudy, *KPR* 70053 (CALI).

**Adiantum philippense** L., Sp. Pl. 2: 1004. 1753; B.K.Nayar, Nat. Bot. Gard. Lucknow 52: 5. 1961; Subr. et al., Bull. Bot. Surv. India 3: 210. 1961; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 23. 1974; R.D.Dixit, Cens. Indian Pterid. 75. 1984. **A. lunulatum** Burm.f., Fl. Ind. 235. 1768; Bedd., Ferns South. India 1. pl. 1. 1863 & Handb. Ferns Brit. India 82. 1883; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 1. 1987; Vasudeva et al., Indian Fern J. 8: 172. 1991; Manickam & Irud., Pterid. Fl. W. Ghats 98. pl. 73. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 271. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 142. 1993; Madhus. & Rejani, Indian Fern J. 11: 17. 1994; Subh.Chandra, Ferns India 71. 2000. **Pteris lunulata** Retz., Obs. 2: t. 4. 1781. **Avenka** Rheede, Hort. Malab. 12: 72. t. 39. 1693.

Terrestrials. Rhizome 1 x 1.5 cm, erect. Scales 2-3 x 0.1 mm, linear or lanceolate, acuminate, dark brown to black, clathrate, entire. Fronds 40-47 x 8-10 cm, simply pinnate; stipe 17-23 cm long, scaly at base, pinkish-brown polished above, lamina 30 x 8-10 cm, lanceolate in outline; pinnae to 2.5 x 4.5 cm, semicircular, acroscopic margin shallowly lobed, basispic base entire, coriaceous or subcoriaceous; veins forked to anastomosing. Sori linear 0.6-2 cm, dark brown, indusia brownish. Sporangial capsule 250-312.5 x 125  $\mu$ m, subglobose, stalk 250  $\mu$ m long. Spores 37.5 x 37.5  $\mu$ m, brownish yellow, planoconvex, thinly granulose.

Common, in moist areas of all vegetation types.

Specimens studied: Anjuruli, *KPR* 62831 (CALI); Pamba to Ayyappan temple, *N.C.Nair* 50835; Thekkady, *B.D. Sharma* 42070 (MH).

***Adiantum raddianum*** C.Presl, Tent. Pterid. 158. 1836; R.D.Dixit, Cens. Indian Pterid. 76. 1984; Manickam, Fern Fl. Palni Hills 40. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 102. pl. 78. 1992; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 31. 1997; Subh.Chandra, Ferns India 73. 2000. ***A. cuneatum*** Langsd. & Fisch., Ic. Fil. 23. t. 26. 1810, non Forst., 1786; Subr. et al., Bull. Bot. Surv. India 3: 210. 1961. ***A. cuneipinnulum*** N.C.Nair & S.R.Ghosh, Acta Bot. India 2: 78. 1974; Vasudeva et al., Indian Fern J. 8: 177. 1991; N.C.Nair et al., J. Econ. Tax. Bot. 16: 274. 1992.

Terrestrials. Rhizome 4-5 cm long, creeping. Scales 1.5-2 x 0.5 mm, lanceolate, acuminate, cordate at base, dark brown. Fronds 10-25 x 5-10 cm, branched; stipe 5-10 cm long, dark brown, glabrous, polished; lamina 10-15 x 5-10 cm, light green, tripinnate, pinnules 0.5-0.8 cm, obovate, cuneate or acute at base with a short stalk, terminal pinnules larger, obovate in outline, lobed once or twice, veins free. Sori marginal 2-4, on lower side of pinnule, borne at the semicircular or circular notches. Sporangial capsule 250 x 225  $\mu\text{m}$ , subglobose, stalk 250-275  $\mu\text{m}$  long. Spores 50 x 37.5  $\mu\text{m}$ , yellow, tetrahedral, trilete, tuberculate. (**Fig. 5.1.6c**).

Common, in evergreen forest.

Specimens studied: Mlappara, *JA* 12808 (KFRI, CALI); Thekkady, *B.D. Sharma* 42067, *K. Vivekananthan* 45391 (MH); Thekkady, *KPR* 14663; Vellimala, *KPR* 18342 (KFRI, CALI); High Wavy Mountains (Theni district, TN), *KPR* 18362 (KFRI, CALI);

***Adiantum zollingeri*** Mett. ex Kuhn, Ann. Lugd. Bot. 4: 280. 1869, J.Ghatak, Bull. Bot. Surv. India 5: 75. 1963; R.D.Dixit, Cens. Indian Pterid. 78. 1984; Manickam, Fern Fl. Palni Hills 37. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 99. pl. 74. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 271. 1992; Subh.Chandra, Ferns India 75. 2000.



Terrestrials. Rhizome 4 x 1.5 cm, erect. Scales 4-6 x 0.1 mm, reddish-brown, hyaline along the margins, linear, sharply pointed at apex. Fronds 40-50 x 3.5 cm, oblong-lanceolate; tufted, simply pinnate; stipe 12-15 cm long, deep brown to black, scaly beneath, hairy above; lamina to 40 cm long; pinnae to 2.5 x 0.8 cm, trapeziform, dimidiate, acroscopic margins deeply lobed; lobes to 5 x 3 mm, oblong, truncate at acroscopic base, sessile, coriaceous. Veins very close, free forking. Sori 2 mm long, ob-reniform, near the margins of lobes of pinnae. Sporangial capsule 125-250 x 125, subglobose, stalk 125 µm long. Spores 25 x 25 µm, reddish brown, triangular, granulose or spinulose.

Occasional, in moist deciduous, semi-evergreen and evergreen forests.

Specimens studied: Kottamala, JA 13274 (KFRI, CALI); Mlappara, KPR 70029 (CALI); Thekkady, KPR 14661.

### HEMIONITIDACEAE

Pichi Sermolli, Webbia 21: 478. 1966.

#### Key to the genera

1. Fronds simple, cordate at base, dimorphic ..... **Parahemionitis**  
 1. Fronds bipinnate, not cordate, not dimorphic ..... **Pityrogramma**

#### PARAHEMIONITIS Panigrahi

Amer. Fern J. 83: 90. 1993.

**Parahemionitis cordata** (Roxb. ex Hook. & Grev.) Fraser-Jenk., New Sp. Syndr. Indian Pterid. 187. 1997. **Hemionitis cordata** Roxb. ex Hook. & Grev., Ic. Fil. t. 64. 1828; Bedd., Ferns South. India 18. pl. 53. 1863. **H. cordifolia** Roxb. ex Wall., List No. 44. 1828. **H. arifolia** (Burm.f.) T.Moore, Ind. Fil. 114. 1859; Bedd., Handb. Ferns Brit. India 431. pl. 245. 1883; Subr. et al., Bull. Bot. Surv. India 3: 211. 1961; B.K.Nayar, Bull. Nat. Bot. Gard. Lucknow 67: 11. 1962; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 97. 1974; R.D.Dixit, Cens. Indian Pterid. 75. 1984; Manickam, Fern Fl. Palni Hills 37. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 6. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 93. pl. 68. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 266. 1992; Jyothi & Madhus., J. Econ. Tax. Bot. 17: 35. 1993; B.K.Nayar & Geev., Fern Fl. Malabar 125. 1993; Madhus. & Rejani, Indian Fern J. 11: 15. 1994; Subh.Chandra,

Ferns India 61.2000. *Asplenium arifolium* Burm.f., Fl. Ind. 231. 1768. *Parahemionitis arifolia* (Burm.f.) Panigrahi, Amer. Fern J. 83: 90. 1993. *nom. inval.* *Patitsjivi Maravara* Rheede, Hort. Malab. 12: 21. t. 10. 1693.

Terrestrials or lithophytes. Rhizome 2 x 1.5-2 cm, erect or short creeping. Scales 2-3 x 0.1-0.2 mm, lanceolate, entire, darker in the middle. Fronds 20-25 x 3-5 cm, simple; stipe 15-17 cm long, dark brown to black, scaly at the very base, polished, pubescent above; lamina cordate or deltoid, chartaceous, densely scaly below, costa grooved above, raised below; veins copiously anastomosing, obscure. Sori dark brown, continuous along the veins, acrostichoid at maturity. Sporangial capsule 250-275 x 187-225  $\mu\text{m}$ , globose, stalk 250  $\mu\text{m}$  long. Spores 50 x 37.5  $\mu\text{m}$ , dark brown, tetrahedral, trilete, reticulate.

Occasional, in all vegetation types.

Specimens studied: Kozhikkanam, *B.D. Sharma* 41644 (MH); Vellimala, *KPR* 62888 (CALI).

Note: Panigrahi (*l.c.*) separated *Hemionitis arifolia* (Burm.f.) T.Moore, into a new genus, but not following the rules of ICBN. So Fraser-Jenkins (1997) made the correct combination as *Parahemionitis cordata* (Roxb. ex Hook. & Grev) Fraser-Jenk.

### **PITYROGRAMMA** Link

Handb. d Gew. 3: 19. 1833.

Terrestrial herbs. Rhizome erect. Scales pale brown to dark brown, linear to lanceolate, entire. Fronds bipinnate. Stipe grooved scaly beneath, polished, dark brownish to black above. Lamina triangular to ovate in outline; pinnules lanceolate to rhomboidal, coriaceous, silvery or yellowish beneath. Sori acrostichoid. Sporangial capsule globose, stalked. Spores tetrahedral, trilete, granulate or with thickenings.

#### **Key to the species:**

- 1. Fronds silvery beneath ..... **P. calomelanos**
- 1. Fronds golden yellow beneath ..... **P. austro-americana**

**Pityrogramma calomelanos** (L.) Link, Handb. Gew. 3: 20. 1833; Subr. et al., Bull. Bot. Surv. India 3: 211. 1961; N.C.Nair & S.R.Ghosh, J. Indian Bot. Soc. 54: 104. 1975; Manickam, Fern Fl. Palni Hills 33. 1986; N.C.Nair et al., J. Econ. Tax. Bot. 16: 254. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 99. 1993; Subh.Chandra, Ferns India 32. 2000. **Acrostichum calomelanos** L., Sp. Pl. 2: 1072. 1753. **Pityrogramma calomelanos** (L.) Link var. **calomelanos**: Manickam & Irud., Pterid. Fl. W. Ghats 94. pl. 69. 1992

Terrestrials. Rhizome 4 x 2 cm, erect, densely scaly. Scales 2-6 x 0.2-0.5 mm, brownish, linear, entire. Fronds 80-100 x 20-22 cm, bipinnate; stipe 40-50 cm, dark-pinkish brown, polished; lamina triangular in outline; pinnae 11 x 2.5 cm, lanceolate, acuminate in outline, pinnules 1.5 x 0.7 cm, rhomboidal to lanceolate, acute, lobed to serrate, pinnae and pinnules progressively reduced to apex, rachis and costa grooved above, raised below; lower surface of pinnules white crusted. Sori acrostichoid. Sporangial capsule 275-312.5 x 250 µm, globose, stalk 250 µm long. Spores 50 x 50 µm, triangular in outline, yellowish with pinkish thickenings.

Common, in moist deciduous and semi-evergreen forests.

Specimens studied: Kumily, *K. Vivekananthan* 45701; Mlappara estate, *N.C.Nair* 70122; Pamba, *D.B.Deb* 30303 (MH); Thekkady, *KPR* 13288 (KFRI, CALI).

**Pityrogramma austro-americana** Domin, Spisy Prirod. Fak. Karlovy Univ. 88: 7. 1928; Panigrahi, Kew Bull. 30: 663. 1975; R.D.Dixit, Cens. Indian Pterid. 79. 1984; N.C.Nair et al., J. Econ. Tax. Bot. 16: 254. 1992; Subh.Chandra, Ferns India 32. 2000. **Acrostichum chrysophyllum** Sw., Schrad. J. Bot. 1800(2): 12. 1801. **Gymnogramma calomelanos** var. **aureoflava** Hook., Gard. Ferns t. 50. 1822. **G. calomelanos** var. **chrysophylla** (Sw.) Blatt. & d'Almeida, Ferns Bombay 177. 1922. **Pityrogramma calomelanos** var. **austro-americana** (Domin) Farwell, Amer. Midl. Nat. 12: 280. 1931. **P. chrysophylla** (Sw.) Link, Handb. Erken. Gew. 3: 19. 1833; R.D.Dixit, Cens. Indian Pterid. 79. 1984; N.C.Nair et al., J. Econ. Tax. Bot. 16: 254. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 100. 1993. **P. calomelanos** var. **aureoflava** (Hook.) Weath. ex

F.M.Bailey, Man. Cult. P. 64. 1924; Manickam, Fern Fl. Palni Hills 33. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 95. pl. 70. 1992.

Terrestrials. Rhizome 3-5 x 2-3 cm, erect. Scales 4-6 x 0.5-0.9 mm, lanceolate, long acuminate, pale brown. Fronds 20-30 x 5-10 cm, bipinnate; stipe 8-10 cm long, scaly beneath, dark brown polished, grooved above; lamina ovate in outline; pinnae 3-7 x 0.8-1.8 cm, lanceolate, acuminate in outline, progressively reduced towards apex; pinnules 5-10 x 2-3 cm, lanceolate, acute, margins serrate, basal pinnules auricled, progressively reduced towards apex, glabrous above, covered by yellow powder below. Sori acrostichoid when mature. Sporangial capsule 250 x 250  $\mu\text{m}$ , globose, stalk 250  $\mu\text{m}$  long. Spores 50 x 50  $\mu\text{m}$ , dark brown, tetrahedral, trilete, granulose.

Occasional, in grasslands and evergreen forests along earth cuttings.

Specimens studied: Mangaladevi, *KPR* 70109 (CALI); way to Mangaladevi temple, *N.C.Nair* 70229 (MH); Vellimala, *JA* 13271 (KFRI, CALI).

## VITTARIACEAE

(C.Presl) Ching, *Sunyatsenia* 5: 232. 1940.

### Key to the genera

1. Lamina oblong, sori marginal or submarginal ..... **Vittaria**  
 1. Lamina elliptic, sori along the veins, anastomosing..... **Antrophyum**

## ANTROPHYUM Kaulfuss

Enum. Fil. 197. 1824.

Epiphytic and lithophytic herbs. Rhizome erect. Scales lanceolate-acuminate, clathrate, fimbriate. Fronds dark green, coriaceous, elliptic or linear-acuminate, entire or some times lobed. Veins anastomosing. Sori linear, dark brown along veins, forming a net work. Sporangial capsule subglobose with stalk equal or longer than the capsule. Paraphyses dark brown, club-shaped or taeniform. Spores globose or tetrahedral, granulose.

### Key to the species

1. Paraphyses club shaped ..... **A. plantagineum**  
 1. Paraphyses taeniform ..... **A. reticulatum**



Fig. 5.1.7a. *Antrophyum plantagineum*- an enlarged view of the fertile frond, b. *Vittaria microlepis*- habit.

**Antrophyum plantagineum** (Cav.) Kaulf., Enum. Fil. 197. 1824; Bedd., Handb. Ferns Brit. India 403. 1883; Subr. et al., Bull. Bot. Surv. India 3: 213. 1961; R.D.Dixit & N.C.Nair, J. Indian Bot. Soc. 53: 287. 1974; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 96. 1974; R.D.Dixit, Cens. Indian Pterid. 80. 1984; Manickam, Fern Fl. Palni Hills 45. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 6. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 107. pl. 85. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 277. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 148. 1993; Subh.Chandra, Ferns India 83. 2000. ***Hemionitis plantaginea*** Cav., Descr. 260. 1802. ***Antrophyum reticulatum*** sensu Bedd., Ferns South. India 18. pl. 52. 1863, non (G.Forst.) Kaulf., Enum. Fil. 198. 1824.

Rhizome 1-1.5 x 0.5-1 cm, erect, with brownish, fibrous roots and scales. Scales 4-6 x 2 mm, lanceolate, acuminate, fimbriate, clathrate. Fronds 3-17 x 1.5-4 cm, simple, fleshy, dark green, elliptic, acuminate, cuneate at base with 1-4.5 cm long stipe, densely scaly at base. Veins anastomosing, with large areoles. Sori linear, dark brownish, along the veins forms a net work. Sporangial capsule 375 x 250 µm, subglobose, stalk 375 µm long, paraphyses 275 µm long, clavate, dark brown. Spores 75 x 62.5 µm, yellowish, globose or tetrahedral, granulose. (**Fig. 5.1.7a**).

Occasional, in evergreen forests.

Specimens studied: Vellimala, *KPR* 70058 (CALI); Vellimalai-Pachakumatchi (Madurai district, TN), *K. Subramanyam* 9494 (MH).

**Antrophyum reticulatum** (G.Forst.) Kaulf., Enum. 198. 1824; Bedd., Ferns South. India 76. pl. 231. 1864; Handb. Ferns Brit. India 401. t. 235. 1883 & Suppl. Handb. Ferns Brit. India 102. 1892; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 95. 1974; R.D.Dixit & N.C.Nair, J. Indian Bot. Soc. 53: 282. 1974; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 28. 1987; N.C.Nair et al., J. Econ. Tax. Bot. 16: 276. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 149. 1993; Subh.Chandra, Ferns India 83. 2000. ***Hemionitis reticulata*** G.Forst., Prodr. 79. 1786.

Rhizome erect 1.5 x 1 cm, with brownish fibrous roots and scales. Scales 4-6 x 1 mm, lanceolate, acuminate, fimbriate, clathrate, dark brownish to black. Fronds 18-25 x 3 cm, dark green, coriaceous, linear, lanceolate, acuminate,

entire, attenuate at base, densely scaly, with 2-3 cm long stipe. Veins anastomosing with large areoles, grooved above, raised below. Sori dark brownish, linear, along the veins. Sporangial capsule 375 x 250  $\mu\text{m}$ , subglobose, stalk 250  $\mu\text{m}$  long; paraphyses 550-750  $\mu\text{m}$  long, dark brown, taeniform. Spores 45 x 37.5  $\mu\text{m}$ , yellowish, tetrahedral, granulose.

Occasional, in evergreen forest.

Specimen studied: Sabarimala, JA 12811 (KFRI, CALI).

### **VITTARIA** J.E.Smith

Mem. Acad. Turin 5: 413. 1793.

**Vittaria microlepis** Hieron, Hedw. 57. 202. 1916; Manickam & Ninan, Bot. Rec. Monogr. 1: 10. 1976; R.D.Dixit, Cens. Indian Pterid. 82. 1984; Manickam, Fern Fl. Palni Hills 44. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 106. pl. 83. 1992; Subh.Chandra, Ferns India 81. 2000.

Epiphytes. Rhizome 3 x 1 cm, short creeping, densely scaly. Scales 0.5-0.7 x 0.2-0.8 mm, linear, black. Fronds 10-20 x 0.3-0.4 cm, oblong, acute, thick coriaceous, dark green, shining; veins indistinct. Sori linear, submarginal, dark brown. Sporangial capsule 275-312.5 x 225-250  $\mu\text{m}$ , subglobose, stalk 250  $\mu\text{m}$  long; paraphyses 375  $\mu\text{m}$  long, dark brown, club-shaped. Spores 75 x 37.5-45  $\mu\text{m}$ , ellipsoid, yellowish, smooth. (**Fig. 5.1.7.b**).

Occasional, in evergreen forests.

Specimen studied: Vellimala, KPR 62893 (CALI).

### **PARKERIACEAE**

Hook., Exot. Fl. 2: t. 147. 1825.

### **CERATOPTERIS** Brongniart

Bull. Sci. Soc. Philom. Paris 8: 186. 1821.

**Ceratopteris thalictroides** (L.) Brong., Bull. Sci. Soc. Philom. 186. t. 186. 1821; Bedd., Ferns South. India 26. pl. 75. 1863 & Handb. Ferns Brit. India 123. pl. 63. 1883; N.C.Nair, Bull. Bot. Surv. India 11: 186. 1969; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 32. 1974; R.D.Dixit, Cens. Indian Pterid. 84. 1984; Manickam, Fern Fl. Palni Hills 31. 1986; Subh.Chandra & S.Kaur, Nomen.

Guide Bedd. 9. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 91. pl. 67. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 251. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 89. 1993; Subh.Chandra, Ferns India 24. 2000. **Acrostichum thalictroides** L., Sp. Pl. 2: 1070. 1753.

Aquatic or semi aquatic herbs. Rhizome 4 x 2-3 cm, erect, with thick long, fibrous, fleshy roots. Scales 5-7 x 4-5 mm, pale brown, membranous, ovate or elliptic, acute, entire. Fronds 30-50 x 3-15 cm, dimorphic; stipe 15-20 cm long; sterile lamina 7-15 x 4-6 cm, simply pinnate; pinnae 2-5 x 2-4, ovate or deltoid in outline, variously lobed, coriaceous, fleshy, glabrous, veins anastomosing, indistinct; fertile lamina 30-40 x 15 cm, simply pinnate, pinnae tripinnatifid, lobes linear, fleshy. Sporangial capsule 500 x 437.5 µm, sessile. Spores 100 x 100 µm, trilete with thickly folded ridges.

Occasional, in marshy areas in moist deciduous and semi-evergreen forests.

Specimen studied: Anjuruli, *KPR* 70133 (CALI).

### MARSILEACEAE

Mirbel, Hist. Nat. Veg. 5: 126. 1802.

#### MARSILEA Linnaeus

Sp. Pl. 2: 1099. 1753.

**Marsilea minuta** L., Mant. Pl. 308. 1771; R.D.Dixit, Cens. Indian Pterid. 85. 1984; Manickam & Irud., Pterid. Fl. W. Ghats 342. pl. 259. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 18: 470. 1994; Subh.Chandra, Ferns India 423. 2000. **M. crenulata** Desv., Prodr. 179. 1827.

Terrestrial or aquatic herbs. Rhizome 1-1.5 mm thick, long creeping. Fronds 8-10 x 1-2 cm, simple; stipe 6-8 cm long, slender, glabrous or softly pubescent; lamina quadrifid; each lobe 0.8-1 x 0.6-1 cm, obovate or obtriangular, lobed to serrate along the outer margins. Sporocarps 3 x 2.5 mm, oblongoid, hispid when young, less hairy at maturity, with 4-5 mm long stalk, produced in clusters.

Occasional, in marshy places.

Specimens studied: Anjuruli, *KPR* 13285; Thekkady, *KPR* 14628 (KFRI, CALI).



## HYMENOPHYLLACEAE

Link, Handb. Z. Erk. D. Gew. 3: 36. 1883.

### Key to the genera

1. Terrestrials; rhizome erect or suberect; fronds tripinnate or tripinnatifid ..... **Cephalomanes**
1. Lithophytes or epiphytes; rhizome long creeping; fronds simple, simply pinnate or pinnatifid... 2
2. Fronds simple ..... **Trichomanes**
2. Fronds pinnate, pinnatifid or flabellate ..... 3
3. Indusia bivalvate ..... **Hymenophyllum**
3. Indusia not bivalvate, mouth dilated or not ..... **Crepidomanes**

### CEPHALOMANES C.Presl

Abh. Bohm. Ges. V. 3: 17. 1843.

**Cephalomanes obscurum** (Blume) K.Iwats., J. Fac. Sci. Univ. Tokyo III 13: 547. 1985. **Trichomanes obscurum** Blume, Enum. Pl. Jav. 227. 1828; Manickam & Irud., Pterid. Fl. W. Ghats 148. pl. 113. 1992. **T. rigidum** Bedd., Ferns South. India 3. pl. 8. 1863 & Handb. Ferns Brit. India 33. 1883. **Selenodesmium obscurum** (Blume) Copel., Phil. J. Sci. 67: 81. 1938; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 14. 1974; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 2. 1987; B.K.Nayar & Geev., Fern Fl. Malabar 363. 1993; N.C.Nair et al., J. Econ. Tax. Bot. 18: 450. 1994; Subh.Chandra, Ferns India 348. 2000.

Terrestrials. Rhizome 4-6 x 1 cm, erect or short creeping, dark or reddish brown, stiff hairy. Fronds 20-25 x 8-10 cm, tripinnate, dark bluish green; stipe 10-15 cm long, hairy; lamina ovate-acuminate in outline; primary pinnae 7 x 2 cm, elliptic in outline; secondary pinnae 3 x 1 cm, lanceolate in outline; pinnules 5 x 1 mm, linear, dissected, acute; veins indistinct. Sori 2 x 1 mm, dark brown, confined to basal acroscopic segments of pinnules; indusia 1 x 0.5 mm, cup-shaped, narrowly winged; truncate at apex, receptacles exserted. Sporangial capsule 187.5 x 187.5 µm, subglobose. Spores 40 µm in diameter, globose, trilete, finely granulose. (**Fig. 5.1.8a**).

Rare, in earth cuttings along streams in evergreen forest.

Specimens studied: Kundankallu, JA 12896 (KFRI, CALI); Mlappara, KPR 70049 (CALI); Mlappara-Maddalamkotti, C.N.Mohanan 72812 (MH).

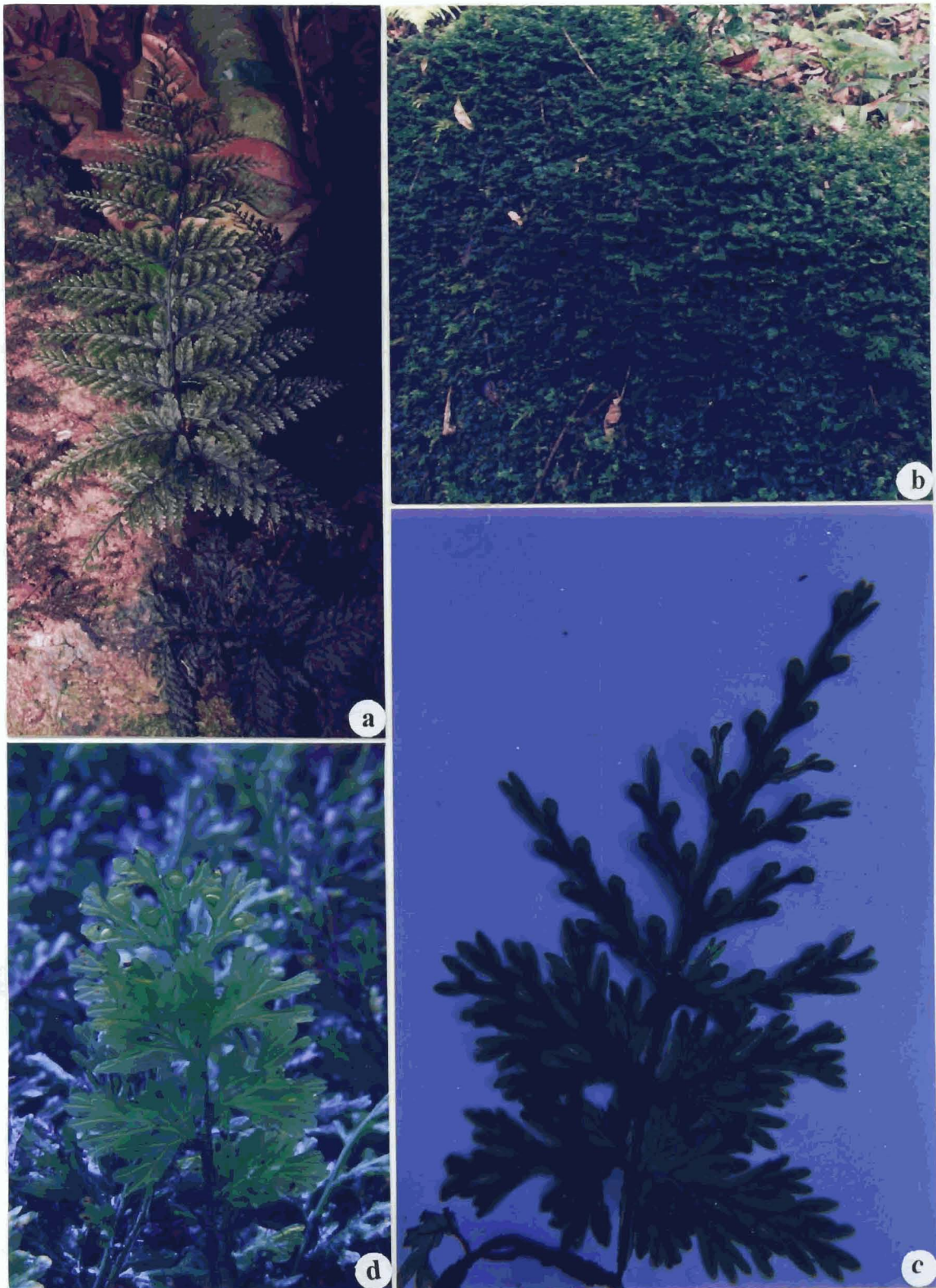


Fig. 5.1.8a. *Cephalomanes obscurum*- habit, b. *C. plicatum*- habit, c. *C. plicatum*- an enlarged view of fertile frond, d. *C. bilabiatum*- an enlarged view of fertile frond.



Fig. 5.1.9 a. *Cephalomanes saxifragoides*- an enlarged view, b. *Hymenophyllum denticulatum*- an enlarged view, c. *Alsophila nilgirensis*- habit.

**CREPIDOMANES (C.Presl) C.Presl**

Epim. Bot. 258. 1851.

Delicate epiphytes or lithophytes. Rhizome long-creeping, filiform, dark brown to black hairy. Fronds simple, pinnatifid to simply pinnate. Stipe distinct, short or long, some times narrowly winged above. Lamina semicircular, flabellate or oblong-lanceolate, pinnatifid. True veins free often with adpressed hairs. False veinlets continuous or not or absent. Sori cupular or campanulate with dilated mouth; receptacles usually long exerted or included. Sporangial capsule sessile or subsessile, subglobose with many celled annulus. Spores globose, trilete, spinulose to tuberculate.

**Key to the species**

- 1. Fronds flabellate ..... **C. saxifragoides**
- 1. Fronds not flabellate ..... **2**
- 2. Fronds simple, digitate or pinnatifid ..... **3**
- 2. Fronds simply pinnate to bi or tripinnatifid ..... **4**
- 3. Involucral mouth winged ..... **C. agasthianum**
- 3. Involucral mouth not winged ..... **C. intramarginale**
- 4. Submarginal false veinlets present ..... **C. bilabiatum**
- 4. Submarginal false veinlets absent ..... **C. plicatum**

**Crepidomanes agasthianum** Madhus. & C.A.Hameed, Nord. J. Bot. 18: 169. 1998.

Lithophytes. Rhizome about 1mm thick, long creeping, filiform, densely dark brown hairy. Fronds 2-12 x 5 mm, simple; stipe 1-4 mm long, hairy; lamina membranous, obovate or obtriangular in outline, digitate or pinnatifid, lobes linear obtuse, undulate; submarginal false veinlets continuous, separated from the margins by a single row of cells, veins distinct, bearing minute clavate hairs. Sori 1 x 1 mm, 1-3 on a frond, subterminal, cupular, winged, involucral mouth narrow. Sporangial capsule 225-275 x 150-225  $\mu$ m, subglobose, sessile. Spores about 15  $\mu$ m in diameter, trilete, globose, sparsely tuberculate, exine with closely adpressed perine.

Rare, on wet rocks in streams, in evergreen forests.

Specimen studied: Mlappara, JA 12848 (KFRI, CALI).

Note: A recently described endemic species with narrow distribution range.

**Crepidomanes bilabiatum** (Nees & Blume) Copel., Phil. J. Sci. 68: 59. 1938; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 13. 1974. *Trichomanes bilabiatum* Nees & Blume, Nova Acta 11: 123. pl. 13. f. 2. 1823. *T. bipunctatum* sensu Bedd., Handb. Ferns Brit. India 41. 1883, p.p., non Poir., 1808.

Lithophytes. Rhizome about 0.8 mm thick, long creeping, with dense black hairs. Fronds 15-20 x 5-6 cm, simple, dark green, pinnate to bipinnatifid; stipe 2-4 cm long, narrowly winged, except at base; lamina ovate to elliptic in outline; pinnae 3.5 x 1.5 cm, ovate or elliptic in outline, pinnatifid; lobes about 1-2 x 0.5 mm, linear, obtuse or round; submarginal false veinlets interrupted, irregular. Sori 2 x 1 mm, confined to upper part of pinnae, 4-8 per pinnae; indusia bilipped, involucre obtuse or round, receptacles exserted. Sporangial capsule 250 x 250 µm, subglobose, sessile. Spores 35-40 µm in diameter, globose, trilete, spinulose. (Fig. 5.1.3.8d).

Rare, as low epiphytes in evergreen forests.

Specimens studied: Kottamala, KPR 14654 (KFRI, CALI); Mlappara, KPR 62858 (CALI).

**Crepidomanes intramarginale** (Hook. & Grev.) C.Presl, Epim. Bot. 258. 1849; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 77. 1974; K.Iwats., J. Fac. Sci. Univ. Tokyo III 13: 533. 1985; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 25. 1987; Subh.Chandra, Ferns India 340. 2000. *Trichomanes intramarginale* Hook. & Grev., Ic. Fil. pl. 211. 1831; Bedd., Ferns South. India 70. pl. 208. 1864 & Handb. Ferns Brit. India 41. 1883.

Lithophytes. Rhizome 1 mm thick, long creeping, densely brownish hairy. Fronds simple, pinnatifid; stipes very short, about 5 mm long, hairy at base, winged above; lamina obovate in outline, pinnatifid, cuneate at base; ultimate segments 5 x 2 mm, linear, round or obtuse, margins irregular; submarginal false veinlets broad, continuous; true veins prominent, ends at margins, bearing short, brown, clavate trichomes. Sori 1 x 1 mm, terminal; indusia obconical, winged throughout, mouth bivalvate, lips rounded with submarginal false veinlets, round the orifice. Sporangial capsule 250 x 225-250 µm, subglobose. Spores about 45 µm in diameter, globose, trilete, sparsely tuberculate.

Rare, on boulders along the streams in evergreen forests.

Specimen studied: Vellimala, KPR 62856 (CALI).

**Crepidomanes plicatum** (Bosch) R.C.Ching, Fl. Reip. Pop. Sin. 2: 171. 1959; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 13. 1974; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 71. 1987. **Didymoglossum plicatum** Bosch, Ned. Kruid. Arch. 5: 139. 1863. **Trichomanes filicula** sensu Bedd., Ferns South. India 2. pl. 7. 1863 & Ferns Brit. India pl. 283. 1868, non Bory, 1849. **Didymoglossum latealatum** Bosch, Ned. Kruid. Arch. 5: 138. 1863; N.C.Nair & R.D.Dixit, J. Bombay Nat. Hist. Soc. 78: 462. 1981. **Trichomanes plicatum** (Bosch) Bedd., Ferns Brit. India 285. 1868; Manickam, Fern Fl. Palni Hills 62. 1986. **T. pusillum** sensu Bedd., Ferns Brit. India pl. 302. 1869, non Sw., 1788. **T. latealatum** H.Christ, Verh. Nat. Ges. Basel 11: 424. 1896; Subh.Chandra, Ferns India 350. 2000. **Crepidomanes latealatum** (Bosch) Copel., Phil. J. Sci. 67: 60. 1938; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 74. 1974; N.C.Nair & R.D.Dixit, J. Bombay Nat. Hist. Soc. 78: 462. 1981; R.D.Dixit, Cens. Indian Pterid. 91. 1984; N.C.Nair et al., J. Econ. Tax. Bot. 18: 453. 1994; K.Iwats., J. Fac. Sci. Univ. Tokyo III 13: 537. 1985; K.Iwats., J. Fac. Sci. Univ. Tokyo III 14: 14. 1985.

Epiphytes or lithophytes. Rhizome about 1 mm thick, long creeping, much branched, covered with short black hairs. Fronds 7 x 3 cm, simply pinnate; stipe about 3 cm long, narrowly winged; lamina elliptic to elliptic-oblong in outline; pinnae to 4 x 3 cm, ovate or obovate in outline, pinnatifid, segments linear acute or obtuse; midrib distinct above and below, pinnate; veins end submarginal to apex, false veins numerous, scattered, oblique to true veins. Sori 2-2.1 x 1 mm, indusia bi-lipped, obconical, narrowly winged at base, involucrel valves triangular, obtuse, receptacles exserted. Sporangial capsule 250-275 x 250 µm, subglobose. Spores about 47 µm in diameter, globose, trilete, spinulose. (Fig. 5.1.8 b & c).

Occasional, in evergreen forests on moist rocks or as low epiphytes.

Specimens studied: Maddalamkotti, C.N.Mohanan 72803 (MH); Pachakkanam, JA 12812; Parayadi, JA 12894; Sabarimalathodu, JA 13203 (KFRI, CALI); Thannikkudithode, N.C.Nair 70175 (MH); Uppermanalar, JA 13226 (KFRI, CALI); Vellimala, KPR 62857 (CALI).

**Crepidomanes saxifragoides** (C.Presl) C.A.Hameed, *inedit.* **Trichomanes saxifragoides** C.Presl, Hymen. 39. 131. 1843; Subh.Chandra, Ferns India 353. 2000. **T. parvulum** sensu Blume, Enum. Pl. Jav. 223. 1828, p.p.; Bedd., Ferns Brit. India pl. 179. 1866 & Handb. Ferns Brit. India 39. pl. 18. 1883. **Gonocormus saxifragoides** (C.Presl) Bosch, Hymen. Jav. 9. 1861; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 13. 1974; R.D.Dixit, Cens. Indian Pterid. 85. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 56. 1987; N.C.Nair et al., J. Econ. Tax. Bot. 18: 451. 1994.

Epiphytes. Rhizome about 1 mm thick, long-creeping, much branched, densely brown hairy. Fronds 0.5-1.5 x 0.5-1 cm, pale green, simple; stipe 3-8 mm, long, brownish hairy below, slightly winged above; lamina flabellate, lobes oblong, truncate, divided at apex, obtuse; veins flabellate, dichotomously branched, bearing small trichomes; false veins absent. Sori 1.5-1.8 x 0.7-1 mm, immersed in the apex of the segments, indusia turbinate to cylindrical, narrowly winged, dilated above, receptacles exerted. Sporangial capsule 312.5 x 312.5 subglobose, sessile. Spores about 25-36  $\mu\text{m}$  in diameter, globose, tetrahedral, verrucate. (**Fig. 5.1.9 a**).

Rare, in evergreen forests as low epiphytes.

Specimens studied: Mlappara, *KPR* 70054 (CALI); Mlappara estate slopes, *N.C.Nair* 70133 (MH).

Note: Hameed (2000) treats *Trichomanes saxifragoides* under *Crepidomanes*, which is followed here.

#### **HYMENOPHYLLUM** J.E.Smith,

Mem. Acad. Turin 5: 418. 1793.

Delicate epiphytes or lithophytes. Rhizome long creeping, wiry, profusely branched, dark brown hairy. Fronds simply pinnate or bipinnatifid, stipitate. Stipe winged or not. Lamina oblong or elliptic in outline, entire or denticulate. Sori terminal or subterminal, indusia bivalvate, crenate, hairy at base. Sporangial capsule subglobose, sessile or subsessile. Spores globose, trilete, spinulose or tuberculate.

### Key to the species

1. Ultimate lobes denticulate ..... **H. denticulatum**  
 1. Ultimate lobes entire ..... **H. exsertum**

**Hymenophyllum denticulatum** Sw., Schrad. J. Bot. 1800: 100. 1801; Bedd., Ferns Brit. India pl. 278. 1868 & Handb. Ferns Brit. India 34. 1883; K.Iwats., J. Fac. Sci. Univ. Tokyo III 13: 511. 1985; Manickam & Irud., Pterid. Fl. W. Ghats 144. pl. 110. 1992. **Leptocionium denticulatum** (Sw.) Bosch, Ned. Kruid. Arch. 4: 328. 1859. **Hymenophyllum acanthoides** sensu Nakai, Bot. Mag. Tokyo 40: 58. 1926, non (Bosch) Rosenst., 1911. **Meringium denticulatum** (Sw.) Copel., Phil. J. Sci. 67: 42. 1938; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 11. 1974; R.D.Dixit, Cens. Indian Pterid. 88. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 70. 1987; Subh.Chandra, Ferns India 345. 2000.

Lithophytes. Rhizome about 1 mm thick, long creeping, irregularly branched, pale brownish hairy when young, glabrous at maturity. Fronds 2.5-9 x 2-3 cm, simply pinnate; stipe 0.5-2.5 cm long, narrowly winged, dentate; lamina elliptic or oblong in outline, cuneate at base, rachis winged, margins toothed; pinnae ovate or deltoid in outline, pinnatifid, segments linear or oblong, denticulate, obtuse; veins distinct, ends submarginally to apex of segments, glandular hairy. Sori 2-2.5 x 1 mm, many confined to upper part of the fronds, indusia bilipped, involucre elliptic or obovate, serrate, spinulose at the base, receptacle exserted. Sporangial capsule 375 x 312.5 µm, subglobose. Spores about 46-51 µm in diameter, globose, tuberculate. (**Fig. 5.1.9 b**).

Rare, growing on boulders in streams in evergreen forests.

Specimen studied: Parayadi, JA 12893 (KFRI, CALI).

Note: The above studied specimen is the variety '*denticulatum*' characterized by fronds more than 5 cm long with crisped margins and involucre spinulose at base only.

**Hymenophyllum exsertum** Wall. ex Hook., Sp. Fil. 1: 109. pl. 38A. 1844; Bedd., Ferns South. India 3. pl. 9. 1863 & Handb. Ferns Brit. India 30. pl. 16. 1883; Manickam, Fern Fl. Palni Hills 61. 1986; K.Iwats., J. Fac. Sci. Univ. Tokyo III 13: 513. 1985; K.Iwats., J. Fac. Sci. Univ. Tokyo III 14: 14. 1985. **H. gardneri** Bosch, Ned. Kruid. Arch. 4: 417. 1859; Manickam & Irud., Pterid. Fl. W. Ghats 145. pl. 111. 1992. **Mecodium exsertum** (Wall. ex Hook.) Copel., Phil. J. Sci. 67: 23. 1938; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 10. 1974; R.D.Dixit,



Cens. Indian Pterid. 86. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 2. 1987; B.K.Nayar & Geev., Fern Fl. Malabar 360. 1993; N.C.Nair et al., J. Econ. Tax. Bot. 18: 450. 1994; Subh.Chandra, Ferns India 343. 2000.

Epiphytes or lithophytes. Rhizome about 0.3 mm thick, long creeping, highly branched, dark brown hairy. Fronds 13 x 4 cm, simply pinnate; stipe 1-5 cm long, lamina oblong-lanceolate in outline, bipinnatifid, rachis winged, midrib distinct, hairy, costa and veins distinct; pinnae 2.5 x 1 cm, oblong-lanceolate in outline, deeply lobed, lobes oblong, obtuse. Sori 2 x 1-1.5 mm, indusia bilabiate, free to base, lips irregular or inciso-crenate, receptacles included. Sporangial capsule 312.5-375 x 250-375  $\mu$ m. Spores about 52  $\mu$ m in diameter, globose, papillate.

Rare, on wet rocks and tree trunks in evergreen forests.

Specimens studied: Vellimala, *KPR* 14603 (KFRI, CALI); *KPR* 62859 (CALI).

### TRICHOMANES Linnaeus

Sp. Pl. 1097. 1753 & Gen. Pl. 5: 485. 1754.

**Trichomanes bimarginatum** (Bosch) Bosch, Ned. Kruid. Arch. 5: 143. 1863; K.Iwats., J. Fac. Sci. Univ. Tokyo III 13: 543. 1985. **Microgonium bimarginatum** Bosch, Hymen. Jav. 7. 1861; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 77. 1974; R.D.Dixit, Cens. Indian Pterid. 88. 1984; B.K.Nayar & Geev., Fern Fl. Malabar 361. 1993; N.C.Nair et al., J. Econ. Tax. Bot. 18: 453. 1994; Subh.Chandra, Ferns India 346. 2000. **Trichomanes muscoides** sensu Bedd., Ferns Brit. India 304. 1869 & Handb. Ferns Brit. India 38. 1883, non Sw., 1801.

Epiphytes or lithophytes. Rhizome long creeping, branched, about 0.2 mm thick, densely dark brownish hairy. Fronds 0.5-2 x 0.2-0.7 cm, simple; stipe to 8 mm long, reddish-brown hairy; lamina variable; ovate, obovate, sub-orbicular to elliptic-oblong, base rounded or cuneate, apex obtuse or truncate; submarginal false veinlets continuous; true veins distinct, veinlets joined with submarginal false veinlets. Sori 1-2.5 x 0.5-1.5 mm, trumpet shaped, indusia tubular, dilated above, receptacles exserted. Sporangial capsule 375 x 250  $\mu$ m subglobose. Spores about 40  $\mu$ m in diameter, globose, trilete, tuberculate.

Occasional, in evergreen forests on moist rocks and also as low epiphytes.

Specimen studied: Chokkampatti, *KPR* 14694 (KFRI, CALI).

## CYATHEACEAE

Kaulfuss, Wasen. Farranker. 119. 1827.

### Key to the genera (after Dixit, 1998).

1. Stipe scales flabelloid and setose at apex, comprised of a median band of elongated thick walled cells and fragile margins of shorter, thin walled, pale cells spreading fan wise outwards ..... **Alsophila**
1. Stipe scales setiform, comprised of uniform, elongate cells and marginal, regular, short, oblique dark or concolorous setae ..... **Sphaeropteris**

### ALSOPHILA R. Brown

Prod. Fl. Nov. Holl. 158. 1810.

Terrestrials. Trunk woody, 3-8 cm long, covered with remnants of frond base. Fronds tripinnate; stipe muricate. Sori round arranged in a 'V' shape or along the sides of the costule; indusiate or not. Sporangial capsule subglobose, stalk equal or longer than capsule. Spores yellow or dark brown, globose or tetrahedral, granulose or tuberculate.

#### Key to the species

1. Sori submarginal, exindusiate, arranged along the arms of 'V' ..... **A. gigantea**
1. Sori median, indusiate, arranged along both sides of the costule .... **A. nilgirensis**

**Alsophila gigantea** Wall. ex Hook., Syn. Fil. 1: 53. 1844; R.D.Dixit, Indian Fern J. 15: 35. 1998. **A. glabra** sensu Bedd., Ferns South. India 20. pl. 60. 1863; Handb. Ferns Brit. India 14. 1883, non (Blume) Hook. 1844. **Cyathea gigantea** (Wall. ex Hook.) Holttum, Gard. Bull. Str. Settl. 8: 318. 1935; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 7. 1974; R.D.Dixit, Cens. Indian Pterid. 93. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 7. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 162. pl. 126. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 278. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 153. 1993; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 94. 1997; Subh.Chandra, Ferns India 92. 2000. **C. balakrishnanii** Dixit & Tripathi, Bull. Bot. Surv. India 26: 170. 1984. 1986. **Alsophila balakrishnanii** (Dixit & Tripathi) Dixit, Indian Envir., 275. 1991 & Indian Fern J., 15: 33. 1998.

Tree ferns. Trunk 1-2 m long. Scales 5-7 x 1-1.5 mm, lanceolate, acuminate, dark brown. Fronds 150-220 x 90-110 cm, tripinnate; stipe 60-80 cm long; lamina broadly elliptic in outline; pinnae 40-50 x 17-20 cm, elliptic-acuminate in outline; pinnules to 9 x 1.7 cm, oblong-lanceolate, acuminate, lobed; lobes to 5 x 5 mm, acute, obtuse, serrate, terminal pinnules variously lobed, linear-acuminate; rachis and costa grooved, hispid above, raised below; veins indistinct above, raised below, free, ending in swollen tips. Pinnae, pinnules and lobes progressively reduced towards apex. Sori rounded, dark brownish, at vein endings, arranged along the arms of 'V' on each lobe. Sporangial capsule 225-312.5 x 225  $\mu$ m, subglobose, stalk 250  $\mu$ m long. Spores 55-62.5 x 45  $\mu$ m, dark brownish, globose, tuberculate.

Occasional, in evergreen forests.

Specimen studied: Arjunankotta, JA 12884 (KFRI, CALI).

Note: Eventhough Dixit (1998) retained *Alsophila balakrishnani*, the concept of Fraser-Jenkins (1997) is followed here.

***Alsophila nilgirensis*** (Holttum) R.M.Tryon, Contr. Gray Herb. 200: 32. 1970; R.D.Dixit, Indian Fern J. 15: 36. 1998. ***Cyathea nilgirensis*** Holttum, Kew Bull. 19: 468. 1965; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 6. 1974; R.D.Dixit, Cens. Indian Pterid. 94. 1984; Manickam, Fern Fl. Palni Hills 68. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 7. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 160. pl. 123. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 279. 1992; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 93. 1997; Subh.Chandra, Ferns India 94. 2000. ***Alsophila latebrosa*** Hook., Sp. Fil. 1: 37. 1844. p.p. quod Bedd., Handb. Ferns Brit. India 11. 1883; ***A. latebrosa*** Hook. var. ***schmidiana*** Kunze, Linnaea 24: 294. 1851. ***Cyathea latebrosa*** (Wall. ex Hook.) Copel., Philipp. J. Sci. 4C: 52. 1909; Subr. et al., Bull. Bot. Surv. India 3: 211. 1961. ***Cyathea nilgirensis*** Holttum var. ***lobatum*** Manickam & Irud., Pterid. Fl. W. Ghats 161. pl. 124 & 125. 1992.

Tree ferns. Trunk 2-5 m long, bearing crown of fronds at apex. Scales 3-4 x 1-1.2 mm, dark brown, ovate, acuminate, setose. Fronds 1.5-2.2 x 1-1.2 m, tripinnate; stipe 50-60 cm long, densely scaly at base, spinous or muricate; lamina broadly elliptic in outline, pinnae 50-60 x 30-40 cm, elliptic, acuminate in outline; secondary pinnae to 15 x 2.5 cm, lanceolate, acuminate in outline

25-30 pairs; pinnules to 16 x 4 mm, oblong, acute, crenate, serrulate towards apex, subfalcate; costa raised above and below, hispid above, pubescent beneath, costules raised above and below; pinnae and pinnule progressively reduced towards apex; terminal pinnule linear, acuminate. Sori 0.5-0.8 mm in diameter, brownish on both sides of costule, up to the middle. Sporangial capsule 250 x 187.5 µm, subglobose, stalk 312.5 µm long. Spores 37.5 x 37.5 µm, yellow, trilete, tetrahedral, granulose. (Fig. 5.1.9 c).

Rare, in evergreen forests.

Specimens studied: Maddalamkottithodu, JA 13233; Uppermanalar, JA 12880 (KFRI, CALI).

### **SPHAEROPTERIS** J.J.Bernhardi

Schrad. J. Bot. 1800: 122. 1801, non Wall. 1830.

**Sphaeropteris crinita** (Hook.) R.M.Tryon, Contr. Gray Herb. 200: 21. 1970; R.D.Dixit, Indian Fern J. 15: 41. 1998. **Alsophila crinita** Hook., Ic. Pl. 7. t. 671. 1844 & Sp. Fil. 1: 54. 1844; Bedd., Ferns South. India 20. pl. 59. 1863 & Handb. Ferns Brit. India 16. pl. 6. 1883. **Cyathea crinita** (Hook.) Copel., Philipp. J. Sci. Ser. C (Bot.) 4: 40. 1909; R.D.Dixit, Indian Pterid. 93. 1984; Manickam, Fern Fl. Palni Hills 70. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 7. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 163. pl. 127. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 279. 1992; Subh.Chandra, Ferns India 92. 2000.

Tree ferns. Trunk 3-5 m high, bearing closely set leaf bases; apex with a crown of fronds, densely scaly. Scales 3 x 0.15-0.2 cm, golden-yellow or brownish yellow, linear, cells uniformly elongated, margins with short dark brown setae. Fronds 1.8-2 x 1.5 m, bipinnate; stipe 80-110 cm; long, grooved, rounded below, swollen at base, dark pinkish brown, densely scaly, muricate or spinulose; lamina elliptic in outline, pinnae 50-70 x 10-15 cm, elliptic-lanceolate in outline; pinnules 2-8 x 0.8-1 cm, oblong, acute or obtuse, lobed or serrate to the middle of the costule; lobes ovate obtuse; costules pubescent; veins pinnate free. Sori 1-1.3 mm in diameter. Sporangial capsule 250-312.5 x 187.5-225 µm, subglobose, stalk 250 µm long. Spores 40 x 40 µm, tetrahedral, granulose.

Rare, in evergreen forests.

Specimen studied: Vellimala, KPR 18313 (KFRI, CALI).

## DENNSTAEDTIACEAE

Pichi Sermolli, *Webbia* 94: 704. 1970.

### Key to the genera

- 1. Sori linear ..... **Pteridium**
- 1. Sori circular or pouch like ..... **2**
- 2. Sori circular ..... **Hypolepis**
- 2. Sori cup shaped ..... **Microlepia**

### **HYPOLEPIS** J.J. Barnhardi

Schrad. *J. Bot.* 1: 34. 1806.

**Hypolepis glandulifera** Brownsey & Chinnock, *J. Adelaide Bot. Gard.* 10: 16. f. 2, 8. 1987; Manickam & Irud., *Pterid. Fl. W. Ghats* 113. pl. 88. 1992; Subh.Chandra, *Ferns India* 107. 2000. ***Polypodium rugulosum*** Labil, *N. Holl. Pl. Spec.* 2: 92. t. 241. 1806; Bedd., *Ferns South. India* 56. pl. 170. 1864. ***P. punctatum*** Thunb., *Fl. Japan* 337. 1784. ***Phegopteris punctata*** Mett., *Ann. Lagd. Bot.* 1: 222. 1862. Bedd., *Handb. Ferns Brit. India* 295. 1883. ***Dryopteris punctata*** C.Chr., *Ind. Fil.* 287. 1905. ***Hypolepis punctata*** (Thunb.) Mett. ex Kuhn, *Fil. Afr.* 120. 1868; B.K.Nayar & S.Kaur, *Comp. Bedd. Handb.* 27. 1974; R.D.Dixit, *Cens. Indian Pterid.* 97. 1984; Manickam, *Fern Fl. Palni Hills* 48. 1986; Subh.Chandra & S.Kaur, *Nomen Guide Bedd.* 20. 1987; N.C.Nair et al., *J. Econ. Tax. Bot.* 16: 282. 1992; B.K.Nayar & Geev., *Fern Fl. Malabar* 168. 1993.

Terrestrials. Rhizome 1-2.5 cm thick, long creeping. Fronds 150 x 70-120 cm, tripinnate; stipe 80-95 cm long, hispid, grooved; lamina deltoid in outline; primary pinnae 35 x 10 cm, elliptic-acuminate in outline; secondary pinnae 9 x 3 cm, elliptic-lanceolate, acuminate; pinnules 1.5 x 0.6 cm, oblong, obtuse at apex, truncate to rounded at base, lobed nearly to the costa; lobes oblong, truncate, serrulate, hispid; rachis and costa grooved above, pubescent, costules grooved above, raised below, pubescent; veins indistinct above, slightly raised below, pinnate. Sori 1 mm in diameter, yellow, circular. Sporangial capsule 250 x 225, subglobose, stalk 250-312.5 µm long. Spores 35 x 30 µm, yellow, ellipsoid, spinose.

Occasional, in evergreen forests.

Specimens studied: Arjunankotta JA 12885; Uppermanalar, JA 13216 (KFRI, CALI).

**MICROLEPIA** C.Presl

Tent. Pterid 124. 1836.

Terrestrial herbs. Rhizome creeping, covered with brown or pinkish uniseriate hairs. Fronds bi or tripinnate, glabrous or strigose hairy. Pinnules thick coriaceous to thin membranous. Veins pinnate, forked, ending submarginally with swollen tips. Sori cup-shaped, at vein endings, opening towards the margins of the pinnule. Sporangial capsule subglobose with stalk shorter or longer than capsule. Spores yellowish to dark brown, tetrahedral, trilete, smooth or granulose.

**Key to the species**

1. Fronds bipinnate, strigose hairy ..... **M. strigosa**
1. Fronds tripinnate, not strigose hairy, soft pubescent only ..... **2**
2. Pinnae thick coriaceous, glabrous ..... **M. platyphylla**
2. Pinnae thin membranous, hairy at least along the veins ..... **3**
3. Pinnules 3-6 x 1-1.5 cm..... **M. majuscula**
3. Pinnules 1-2 x 0.5-1 cm..... **4**
4. Ultimate segments deeply lobed..... **M. speluncae**
4. Ultimate segments gently crenate or entire..... **M. rhomboidea**

**Microlepia majuscula** (Lowe) T.Moore, Ind. Fil. 297. 1861; Bedd., Handb. Ferns Brit. India 66. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 19. 1974; Manickam, Fern Fl. Palni Hills 50. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 31. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 117. pl. 91. 1992; Subh.Chandra, Ferns India 100. 2000. **Davallia majuscula** Lowe, Ferns Exotic b. 8: f. 33. 1859. **Microlepia proxima** Bedd., Ferns South. India 84. pl. 254. 1864, non (Blume) C.Presl, 1849. **Davallia thwaitesii** Baker, Syn. Fil. 1: 99. 1867.

Terrestrials. Rhizome 15-25 x 0.5-1 cm, creeping, branched, covered with dark brown uniseriate hairs, 1 x 0.1 mm. Fronds 70-120 x 30-50 cm, tripinnate; stipe 50-70 x 0.5-0.8 cm, densely covered with short brown hairs; lamina 50-60 x 30-50 cm, dark green; pinnae 20-25 x 7-9 cm, ovate-lanceolate in outline; pinnules 3-6 x 1-1.5 cm, lanceolate in outline, lobed; lobes 0.7-1.5 x 0.5-1 cm, obovate or oblanceolate, margins entire or wavy, acroscopic basal

lobes larger, again lobed; pinnae, pinnules and lobes progressively reduced towards apex; hairy along the costa below; veins freely branched or not. Sori circular, 1-3 at vein endings in the acroscopic half of the lobes. Sporangial capsule 375 x 250  $\mu\text{m}$ , subglobose, stalk 250  $\mu\text{m}$  long. Spores 50 x 50  $\mu\text{m}$ , dark brown to black, trilete, smooth.

Occasional, in evergreen forests.

Specimen studied: Vellimala, *KPR* 18343 (KFRI, CALI).

***Microlepia platyphylla*** (D.Don) Js.Sm., London J. Bot. 1: 427. 1842; Bedd., Ferns South. India 5. pl. 13. 1863 & Handb. Ferns Brit. India 66. pl. 33. 1883; B.K.Nayar & S.Kaur, Bull. Nat. Bot. Gard. Lucknow 79: 12. 1963 & Comp. Bedd. Handb. 79. 1974; R.D.Dixit, Cens. Indian Pterid. 69. 1984; Manickam, Fern Fl. Palni Hills 49. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 2. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 115. pl. 89. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 281. 1992; Subh.Chandra, Ferns India 101. 2000. ***Davallia platyphylla*** D.Don, Prod. Fl. Nepal. 10. 1825.

Terrestrials. Rhizome creeping, covered with brown hairs. Fronds 2-2.8 x 0.6-0.8 m; stipe 80-90 cm long; lamina tripinnate to bipinnatifid; primary pinnae 30-50 x 30-35 cm, triangular in outline; secondary pinnae to 23 x 6 cm, lanceolate-acuminate in outline; rachis grooved above, raised below; pinnules 6 x 2 cm, lanceolate-acuminate, serrate, cuneate at base, acroscopic base rounded, coriaceous; costa grooved above, hispid, raised below, glabrous, flexuous; costules indistinct above, raised below; veins pinnate, forked ending submarginally in swollen tips, 1 or 2 each in serrate lobes of pinnule, indistinct above, raised below. Sori dark brown, marginal at vein endings; indusia cup-shaped, opening towards the margins of the pinnules. Sporangial capsule 312.5 x 225  $\mu\text{m}$ , subglobose, stalk 375  $\mu\text{m}$  long. Spores 37.5 x 37.5  $\mu\text{m}$ , yellowish, tetrahedral, triangular in outline.

Rare, in evergreen forests.

Specimens studied: Vellimala, *KPR* 13299 (KFRI, CALI); Aruna estate (Madurai district, TN) *B.V. Shetty* 10326 (MH).

**Microlepia rhomboidea** Prantl, Arb. Bot. Cart. Breslau 1: 31. 1892; Manickam & Irud., Pterid. Fl. W. Ghats 118. pl. 92. 1992; Subh.Chandra, Ferns India 102. 2000. **Davallia rhomboidea** Wall., List No. 257. 1829, nom. nud.; Kunze, Bot. Zeit. 158. 1850. **Microlepia polypodioides** Bedd., Ferns South. India 5. pl. 15. 1863. **M. speluncae** Bedd., Handb. Ferns Brit. India 68. 1883. **M. trapeziformis** (Roxb.) Kuhn, Chaetopt. 347. 1882; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 19. 1974; R.D.Dixit, Cens. Indian Pterid. 97. 1984; Manickam, Fern Fl. Palni Hills 51. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 2. 1987.

Terrestrials. Rhizome 5-7 mm thick, long creeping, branched, covered with brown hairs. Fronds 150-180 x 40-50 cm. tripinnate; stipe 45-50 cm long; lamina elliptic-acuminate in outline; rachis grooved above, hispid; primary pinnae 23 x 9 cm, ovate-lanceolate, acuminate in outline, 25 pairs, alternate, stipitate; costa grooved above, hispid, raised below; secondary pinnae 6 x 1.7 cm, lanceolate-acuminate in outline, 18-20 pairs, shortly stipitate to sessile, costules raised above and below, hispid; pinnules to 17 x 9 mm, elliptic to obovate or spatulate, rounded at apex, cuneate at base; basal acroscopic pinnule of each secondary pinna larger, lobed; veins indistinct, forked, ending submarginally in swollen tips; pinnules hispid above, sparsely below; pinnae and pinnules reduced towards apex; pinnae bipinnatifid towards apex. Sori dark brown, at vein endings; indusia cup-shaped, opening towards the margin of pinnule. Sporangial capsule 312.5-350 x 250 µm, subglobose, stalk 312 µm long. Spores 50 x 45 µm, yellowish, tetrahedral, trilete, smooth.

Occasional, in evergreen forests.

Specimen studied: Mlappara, JA 12822 (KFRI, CALI).

**Microlepia speluncae** (L.) T.Moore, Ind. Fil. 93. 1857; Bedd., Handb. Ferns Brit. India 67. 1883; Sledge, Kew Bull. 3: 524. 1956; B.K.Nayar & S.Kaur, Bull. Nat. Bot. Gard. Lucknow 79: 22. 1963 & Comp. Bedd. Handb. 19. 1974; R.D.Dixit, Cens. Indian Pterid. 96. 1984; Manickam, Fern Fl. Palni Hills 52. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 119. pl. 93, 94. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 280. 1992; Subh.Chandra, Ferns India 103. 2000. **Polypodium speluncae** L., Sp. Pl. 2: 1093. 1753. **Microlepia polypodioides**



C.Presl, Tent. Pterid. 125. 1825, non Bedd., 1863. *M. polpodioides* var. *pubscens* Hook., Sp. Fil. 1: 182. 1846. *M. speluncae* var. *speluncae*: Sledge, Kew Bull. 3: 525. 1956. *M. speluncae* var. *pubescens* (Hook) Sledge, Kew Bull. 3: 525. 1956.

Terrestrials. Rhizome 2-2.5 cm thick, creeping, covered with short, dark brown hairs. Fronds 150-180 x 60-110 cm, tripinnate; stipe 50-100 cm long, grooved, strigose; lamina ovate to rhomboidal in outline; primary pinnae 25-50 x 9-15 cm, ovate-lanceolate in outline; secondary pinnae 5-10 x 1.5-2 cm lanceolate-acuminate in outline, 26 pairs; pinnules 1-1.5 x 0.5 cm, oblong to oblong-lanceolate, obtuse to retuse, lobed to serrate, subcoriaceous, glabrous to pubescent; costa grooved above, raised below, veins free, indistinct. Sori 0.5-2.2 mm in diameter, yellowish brown to orange-brown, at vein endings; indusia pouch-like. Sporangial capsule 187.5-250 x 187.5-225  $\mu\text{m}$  globose to ellipsoid, stalk 375  $\mu\text{m}$  long. Spores 26-37.5 x 26-37.5  $\mu\text{m}$ , tetrahedral, triangular in distal view, granulose. (**Fig. 5.1.10 b**).

Occasional, in moist deciduous, semi-evergreen and evergreen forests.

Specimens studied: Anjuruli, *KPR* 70118 (CALI); Deviarmettu, *JA* 13252; Thannikkudy, *JA* 12860 (KFRI, CALI); Thekkady, *B.D. Sharma* 42072, *K. Vivekananthan* 45675 (MH); Uppermanalar, *JA* 12878 (KFRI, CALI); way to Mlappara, *N.C.Nair* 69894 (MH);

Note: Sledge (1956) described varieties in this variable taxon based on the hairiness. Manickam and Irudayaraj (1992) and Nair et al., (1992) mentioned about these varieties, but which is not followed here.

**Microlepia strigosa** (Thunb.) C.Presl., Epim. Bot. 95. 1849; Bedd., Ferns South. India 85. pl. 225. 1864 & Handb. Ferns Brit. India 67. 1883; B.K.Nayar & S.Kaur, Bull. Nat. Bot. Gard. Lucknow 79: 16. 1963; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 19. 1974; R.D.Dixit, Cens. Indian Pterid. 96. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 31. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 116. pl. 90. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 280. 1992; Subh.Chandra, Ferns India 104. 2000. *Trichomanes strigosum* Thunb., Fl. Jap. 339. 1784.



Fig. 5.1.10. Habits of a. *Pteridium aquilinum*, b. *Microlepia speluncae*, c. *M. strigosa*, d. *Lindsaea malabarica*.

Terrestrials. Rhizome 5 mm thick, long creeping, densely covered with pinkish hairs. Fronds 50-90 x 24-30 cm, bipinnate; stipe 35-40 cm long, densely hairy below, sparsely above; lamina elliptic-acuminate in outline; pinnae to 13 x 3 cm, lanceolate-acuminate in outline, stipitate, 20-25 pairs; pinnules 16 x 7 mm, sessile, elliptic or oblong, serrate to lobed, rounded at apex, obliquely cuneate at base; progressively reduced towards apex; rachis, costa, costules and veins hairy; costules and veins indistinct above, raised below, veins pinnate, branched once or twice. Sori dark brown at vein endings in sinus of pinnules; indusia cup-shaped, opening towards the margins of pinnule. Sporangial capsule 312.5 x 250 µm, subglobose, stalk 375 µm long. Spores 50 x 45 µm, yellow, tetrahedral, trilete. (Fig. 5.1.10 c).

Rare, in evergreen forests.

Specimens studied: Mlappara, *KPR* 70051 (CALI); Uppermanalar, *JA* 13222 (KFRI, CALI).

### PTERIDIUM Scopoli

Fl. Carniol. 169. 1760.

**Pteridium aquilinum** (L.) Kuhn in Decken, Reis. Ostafr. 3: 11. 1879; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 31. 1974; R.D.Dixit, Cens. Indian Pterid. 98. 1984; Manickam, Fern Fl. Palni Hills 47. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 5. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 109. pl. 86. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 501. 1992; Subh.Chandra, Ferns India 108. 2000. *Pteris aquilina* L., Sp. Pl. 2: 1075. 1753. *P. aquilina* var. *lanuginosa* L., Sp. Pl. 2: 1075. 1753; Bedd., Ferns South. India 14. pl. 42. 1863. *Pteridium aquilinum* (L.) Kuhn, subsp. *aquilinum* var. *wightianum* Tryon, Rhodora 43: 1, 37. 1941; B.K.Nayar & Geev., Fern Fl. Malabar 169. 1993.

Terrestrials. Rhizome 1-2.5 cm thick, long creeping, densely covered with dark brown hairs. Fronds 1.5-2 x 1 m, tripinnate; stipe 30-100 cm long, densely hairy at base; lamina deltoid or rhomboid in outline; primary pinnae 30-60 x 15-25 cm elliptic, acute in outline; secondary pinnae 10-20 x 2-4 cm, lanceolate-long in outline; tertiary pinnae 1-1.5 x 0.2-0.4 cm, ovate or linear subfalcate, acute; pinnae and pinnules progressively reduced towards apex,

rachis, costa and costules grooved, hispid above, raised below; pinnules and costa hispid below; veins forked, distinct above. Sori linear, covered by the reflexed margin of pinnules. Sporangial capsule 250 x 200 µm, subglobose, with longer stalk. Spores 35 x 42.5 µm, planoconvex, rugulose. (**Fig. 5.1.10 a**).

Common in grasslands.

Specimen studied: Mangaladevi, KPR 70108 (CALI).

## LINDSAEACEAE

Pichi Sermolli, *Webbia* 24: 707. 1970.

### Key to the genera

1. Fronds simple or bipinnate ..... **Lindsaea**  
 1. Fronds tri or quadripinnate ..... **Odontosoria**

## LINDSAEA Dryander

in J.E.Smith, *Mem. Acad. Turin* 5: 401. 1793.

Terrestrial herbs. Rhizome creeping. Scales linear or subulate, hair-like. Fronds simply pinnate or bipinnate; when simply pinnate sometimes triforked. Stipe quadrangular. Pinnae dimidiate or not. Veins free forked or anastomosing. Sori linear continuous or confined to the lobes of pinnae. Sporangial capsule subglobose with stalk equal to or longer than capsule. Spores yellowish to brown, trilete, granulose, rugulose or baculate.

### Key to the species

1. Fronds bipinnate ..... **L. heterophylla**  
 1. Fronds simply pinnate ..... **2**  
 2. Fronds triforked, pinnae dimidiate ..... **L. malabarica**  
 2. Fronds not forked, pinnae oblong not dimidiate ..... **L. ensifolia**

**Lindsaea ensifolia** Sw., *Schrad. J. Bot.* 1800(2): 77. 1801; R.D.Dixit, *Cens. Indian Pterid.* 99. 1984; Subh.Chandra & S.Kaur, *Nomen. Guide Bedd.* 3, 37. 1987; Manickam & Irud., *Pterid. Fl. W. Ghats* 125. pl. 98. 1992; N.C.Nair et al., *J. Econ. Tax. Bot.* 16: 503. 1992; B.K.Nayar & Geev., *Fern Fl. Malabar* 172. 1993; Subh.Chandra, *Ferns India* 110. 2000. ***Schizoloma ensifolium*** (Sw.) Js.Sm. in Hook., *J. Bot.* 3: 414. 1841; Bedd., *Ferns South. India* 9. pl. 25. 1863 & *Handb. Ferns Brit. India* 80. pl. 41. 1883; B.K.Nayar & S.Kaur, *Comp. Bedd.*

Handb. 22. 1974. *S. griffithianum* Fee, Gen. Fil. 108. 1850-52; Bedd., Ferns Brit. India t. 29. 1865.

Terrestrials. Rhizome 2 mm thick, creeping. Scales 1.5 x 0.1-0.2 mm, linear, entire, acuminate, dark brown uniformly thickened. Fronds 40 x 10-15 cm, simply pinnate; stipe 18-20 x 0.2-0.25 cm, glabrous, dark brown to pink, polished; pinnae 10-12 x 0.7-1.2 cm, oblong-acuminate, subsessile, obliquely cuneate at base, serrate at distal non soral part, alternate, except the basal pinna; veins anastomosing, costa prominently raised beneath. Sori linear, 8-9.5 cm long, yellowish brown; indusia translucent. Sporangial capsule 250 x 150  $\mu$ m subglobose, stalk 250  $\mu$ m long. Spores 37.5 x 25  $\mu$ m, trilete, yellowish, granulose.

Occasional, in semi-evergreen and evergreen forests.

Specimen studied: Pachakkanam, JA 13279 (KFRI, CALI).

**Lindsaea heterophylla** Dryand., Trans. Linn. Soc. 3: 41. t. 8. f. 1. 1797; Kramer, Fl. Mal. Ser 2, 3: 210. 1971 & Gard. Bull. Singapore 26: 31. 1972; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 4. 1987; N.C.Nair et al., J. Econ. Tax. Bot. 16: 503. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 175. excl. f. 59. 1993; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 172. 1997; Subh.Chandra, Ferns India 112. 2000. **Schizoloma heterophyllum** (Dryand.) Js.Sm. in Hook., J. Bot. 3: 414. 1841; Bedd., Ferns South. India 9. pl. 26. 1863 & Handb. Ferns Brit. India 80. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 21, 22. 1974. **Lindsaea heterophylla** Bedd., Ferns South. India 70. pl. 206. 1864 & Handb. Ferns Brit. India 77. 1883; Manickam & Irud., Pterid. Fl. W. Ghats 129. pl. 101. 1992. **L. beddomea** R.D.Dixit & S.R.Ghosh, Proc. Indian Acad. Sci. 89: 181. 1980.

Terrestrials. Rhizome creeping. Scales to 2 x 1 mm, triangular-acuminate to subulate. Fronds 106-120 x 36-40 cm, bipinnate; stipe 77-80 cm long, pinkish to yellow, scaly beneath, polished, grooved above; lamina rhomboid in outline, bipinnate at base, simple towards apex; primary pinnae to 21-26 x 15-18 cm, elliptic, lanceolate in outline; pinnules to 11 x 2 cm, lanceolate-acuminate, oblique at base; upper pinnae and pinnules variously lobed; costa grooved

above, raised below; veins forked, rarely anastomosing. Sori linear, submarginal, indusia translucent. Sporangial capsule 187.5 x 125  $\mu\text{m}$ , subglobose, stalk 250  $\mu\text{m}$  long. Spores 37.5 x 37.5  $\mu\text{m}$ , dark brown, triangular in distal view, baculate.

Occasional, in evergreen forests.

Specimen studied: Pachan pallam, JA 13209 (KFRI, CALI).

**Lindsaea malabarica** (Bedd.) Baker in Hook. & Baker, Syn. Fil. 545. 1874; Kramer, Gard. Bull Singapore 26: 33. 1972; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 22. 1974; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 68. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 127. pl. 99. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 504. 1992; Subh.Chandra, Ferns India 114. 2000. **Schizoloma malabaricum** Bedd., Ferns Brit. India t. 268. 1868. **S. lobata** (Poir.) Bedd. var. **malabaricum** Bedd., Handb. Ferns Brit. India 79. pl. 39. 1883.

Terrestrials. Rhizome 2 mm thick, creeping, covered with short brownish hairs. Fronds 50-65 x 18-25 cm, stipe 35-40 cm, quadrangular, hairy at the very base, polished, glabrous above. Lamina rhomboidal in outline, bipinnate; primary pinnae 18-20 x 3 cm; pinnules 2-2.5 x 0.5 cm, dimidiate, parallelogram like, cuneate at base, rounded or obtuse at apex, lobed along the margins; progressively reduced towards apex, veins anastomosing. Sori along the margins, oblong, not continuous. Sporangial capsule 187.5 x 125  $\mu\text{m}$ , subglobose, stalk 275  $\mu\text{m}$  long. Spores 25 x 25  $\mu\text{m}$ , yellowish brown, triangular, trilete, densely rugulose. (**Fig. 5.1.10 d**).

Occasional, in evergreen forests.

Specimens studied: Pamba-Periyar ridge, C.N.Mohanan 72877 (MH); Mlappara, KPR 70009, 70050 (CALI).

### ODONTOSORIA Fee

Mem. Foug. 5: 325. 1852.

**Odontosoria chinensis** (L.) Js.Sm., Bot. Voy. Herald 430. 1857; Manickam & Irud., Pterid. Fl. W. Ghats 121. pl. 95. 1992. **Trichomanes chinensis** L., Sp. Pl. 2: 1099. 1753. **Adiantum chinense** Burm.f., Fl. Ind. 236. 1768. **Davallia chinensis** J.E.Smith, Mem. Ar. Turin 5: 417. 1793. **Stenoloma chinensis** Bedd., Handb. Ferns Brit. India 341. pl. 191. 1883. **Davallia tenuifolia** Sw., Schrad. J. Bot. 1800(2): 88. 1801; Bedd., Ferns South. India 6. pl. 16. 1863. **Sphaenomeris chinensis** (L.) Maxon, J. Washington Acad. Sci. 3: 144. 1913; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 19. 1974; R.D.Dixit, Cens. Indian Pterid. 102. 1984; Manickam, Fern Fl. Palni Hills 54. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 3. 1987; N.C.Nair et al., J. Econ. Tax. Bot. 16: 502. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 179. 1993; Subh.Chandra, Ferns India 118. 2000.

Terrestrials. Rhizome 8 mm thick, creeping, branched, densely covered with dark brown hairs. Fronds 25-50 x 5-15 cm, quadripinnate, finely dissected; stipe 10-15 cm long, yellow, hairy at the very base, polished above; lamina 6-40 x 5-15 cm, oblong or elliptic-lanceolate in outline; primary pinnae to 8 x 3 cm, triangular or ovate-acuminate in outline, 12-25 pairs, alternate, 5 mm stalked; secondary pinnae to 2 x 1.5 cm, rhomboid or elliptic in outline, 10-15 pairs, alternate; tertiary pinnae to 1 x 0.8 cm, obovate or obtriangular in outline, 4-8 per pinnae; quaternary pinnae to 5 x 2 mm, obtriangular, truncate at apex, cuneate at base, entire, coriaceous; pinnae and pinnules progressively reduced towards apex; veins free. Sori 1.5-2 x 0.5 mm, elliptic, 1 or 2 at the apex of the quaternary pinnae, dark brown, indusia paler, attached by base and sides, free at apex only. Sporangial capsule 350 x 250 µm, subglobose, stalk 250 µm. Spores 50 x 35 µm, yellow, hyaline, smooth.

Occasional, on earth cuttings in evergreen forests.

Specimens studied: Mlappara, JA 12831; Vellimala, KPR 18355 (KFRI, CALI).

## THELYPTERIDACEAE

Pichi-Sermolli, Webbia 24: 709. 1970.

The generic delimitation of *Thelypteridaceae* is still a controversy among the pteridologists. Many genera proposed by Holttum (1971, 1973 & 1982) are now treated as subgenera. Smith (in Kramer & Green, 1990) accepted 5 genera. Now it is generally agreed the family consist of 4 genera viz., *Macrothelypteris*, *Phegopteris*, *Pseudophegopteris* and *Thelypteris* (including *Cyclosorus*) (Smith, pers. comm., 2000). Eventhough Fraser Jenkins (1997) treated *Cyclosorus* as a subgenus of *Thelypteris*, he maintained *Stegnogramma* as a distinct genus. Here I prefer to follow the concept of Smith. The placement of the species within the genera is shown in table 5.1.3.

### Key to the genera

- 1. Fronds tripinnate ..... **Macrothelypteris**
- 1. Fronds simple or bipinnate ..... **Thelypteris**

### MACROTHELYPTERIS (H.Ito) Ching

Acta Phytotax. Sin. 8: 308. 1963.

**Macrothelypteris torresiana** (Gaudich.) Ching, Acta Phytotax. Sin. 8: 310. 1963; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 64, 205. 1974; R.D.Dixit, Cens. Indian Pterid. 109. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 12. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 172. pl. 131. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 536. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 317. 1993; Leena & Madhus., J. Econ. Tax. Bot. 20: 426. 1996. **Polystichum torresianum** Gaudich. in Freyc., Voy. Bot. 333. 1824. **Aspidium uliginosum** Kunze in Linnaea 20: 6. 1847. **Lastrea setigera** sensu Bedd., Ferns South. India correct p. i. 1864, p.p. errore '**Lastrea flaccida**' 35, pl. 99. 1863, non **Cheilanthes setigera** Blume, 1828. **Thelypteris uliginosa** (Kunze) Ching, Bull. Fam. Mem. Inst. Biol. Bot. 6: 342. 1936; Subr. et al., Bull. Bot. Surv. India 3: 212. 1961.



Terrestrials. Rhizome 1-2 cm thick, creeping, densely scaly. Scales 11 x 1 mm, dark brown, linear, densely acicular hairy. Fronds 60-80 x 40-50 cm, bipinnate; stipe 40-50 cm long, scaly at base, polished, glabrous above, grooved; lamina ovate-lanceolate in outline, rachis grooved above, hispid; pinnae 24 x 10 cm, elliptic-lanceolate, acuminate; pinnules 5 x 1.1 cm, alternate, 20-24 pairs, lanceolate, acuminate, cuneate to decurrent at base, thin membranous, progressively reduced to both ends, deeply lobed to costa; lobes 8 x 2 mm, oblong, serrate, obtuse to rounded, falcate; costules grooved above, raised below, hispid on both sides, veins pinnate, forked free, not anastomosing. Sori circular, 1 mm in diameter, yellow, median on veins. Sporangial capsule 250 x 225  $\mu$ m, subglobose, stalk 250  $\mu$ m long. Spores 50 x 35  $\mu$ m, ellipsoid, with thinly folded perine, granulose. (**Fig. 5.1.11a**).

Occasional, in evergreen forests.

Specimens studied: Mlappara, *KPR* 70018, 70026, 70027(CALI); Uppermanalar, *JA* 13219 (KFRI, CALI).

### **THELYPTERIS** Schmidel

Icon. Pl. ed. J.C.Keller 45. t. 11. 13. 1767.

Terrestrial herbs. Rhizome erect to creeping. Scales dark brown to black, lanceolate, acuminate, ciliate to hispid. Fronds simple pinnate or bipinnate. Stipe scaly below, grooved. Lamina ovate to elliptic in outline; pinnae ovate to oblong-lanceolate in outline; basal pinnae usually reduced gradually or abruptly. Sori circular to reniform, indusiate; indusia reniform, hairy. Sporangial capsule with acicular hairs or not; stalk usually glandular. Spores planoconvex to reniform, spinulose.



Fig. 5.1.11 a. *Macrothelypteris torresiana*-habit, b. *Thelypteris arbuscula*-habit, c-e. *T. parasitica*, c. habit, d and e. abnormally branched fronds.

Table 5.1.3. Infrageneric arrangement of *Thelypteridaceae* in Periyar Tiger Reserve.

Genus	Subgenus	Species
<b>Macrothelypteris</b> (H.Ito) Ching	—	<b>torresiana</b> (Gaudich.) Ching
<b>Thelypteris</b> Schmidel	<b>Abacopteris</b> (Fee) K.Iwats.	<b>triphylla</b> (Sw.) K.Iwats.
	<b>Amphineuron</b> (Holttum) Fraser-Jenk.	<b>terminans</b> (J.Sm.ex Hook.) Tagawa & K.Iwats.
	<b>Cyclosoriopsis</b> K.Iwats.	<b>dentata</b> (Forrsk.) E.P.St.John <b>meeboldii</b> (Rosenst.) C.F.Reed <b>papilio</b> (Hope) K.Iwats <b>parasitica</b> (L.) Tardieu-Blot
	<b>Cyclosorus</b> (Link) Morton	<b>interrupta</b> (Willd.) K.Iwats.
	<b>Metathelypteris</b> (Ito) A.R.Sm.	<b>flaccida</b> (Blume) Ching
	<b>Pneumatopteris</b> (Nakai) K.Iwats.	<b>truncata</b> (Poir) K.Iwats.
	<b>Pseudocyclosorus</b> (Ching) Fraser-Jenk.	<b>tylodes</b> (Kunze) Ching
	<b>Sphaerostephanos</b> (J.Sm. ex Hook.) K. Iwats.	<b>arbuscula</b> (Willd.) K. Iwats.
	<b>Stegnogramma</b> (Blume) C.F.Reed	<b>mollissima</b> (Kunze) Rajesh <i>inedit.</i>
	<b>Trigonospora</b> (Holttum) Fraser-Jenk.	<b>caudipinna</b> Ching

**Key to the species**

1. Fronds bipinnate ..... T. (Subgen. *Metathelypteris*) *flaccida*
1. Fronds simple ..... 2
2. Veins free ..... 3
2. Veins anastomosing ..... 5
3. Sori linear, exindusiate ..... T. (Subgen. *Stegnogramma*) *mollissima*
3. Sori circular, indusiate ..... 4
4. Basal pinnae not abruptly reduced ..... T. (Subgen. *Trigonospora*) *caudipinna*
4. Basal pinnae abruptly reduced in to tubercles ..... T. (Subgen. *Pseudocyclosorus*) *tylodes*
5. Lamina trifoliolate ..... T. (Subgen. *Abacopteris*) *triphylla*
5. Lamina not trifoliolate ..... 6
6. Basal pinnae not reduced ..... 7
6. Basal pinnae reduced ..... 9
7. Pinnae lobes oblong, obtuse; sori median, both on lobed and unlobed parts .....  
..... T. (Subgen. *Cyclosoriopsis p.p.*) *parasitica*
7. Pinnae lobes ovate, subacute or acute; sori marginal, confined to the lobes ..... 8
8. Scales present on the lower side of the pinnae; pinnae lobes ovate, subacute .....  
..... T. (Subgen. *Cyclosorus*) *interruptus*
8. Scales absent on pinnae; lobes ovate, acute, falcate ... T. (Subgen. *Amphineuron*) *terminans*
9. Basal pinnae abruptly reduced; more than one to one and half pairs of veins united to form the  
excurrent vein ..... 10
9. Basal pinnae gradually reduced; one to one and half pairs of veins united to form the excurrent  
vein ..... 11 (Subgen. *Cyclosoriopsis p.p.*)
10. Sessile yellowish to white, spherical glands present on the pinnae .....  
..... T. (Subgen. *Sphaerostephanos*) *arbuscula*
10. Sessile spherical glands absent on the lamina ..... T. (Subgen. *Pneumatopteris*) *truncata*
11. Rhizome erect or suberect ..... T. (Subgen. *Cyclosoriopsis*) *papilio*
11. Rhizome creeping ..... 12
12. Orange-yellow glands present on the pinnae ..... T. (Subgen. *Cyclosoriopsis*) *meeboldii*
12. Glands absent ..... T. (Subgen. *Cyclosoriopsis*) *dentata*

Subgenus **ABACOPTERIS** (Fee) K.Iwatsuki

Mem. Col. Sci. Univ. Kyoto B. Biol. 31: 34. 1964.

**Pronephrium** C.Presl, Epim. Bot. 258. 1851,

excl. *P. lastreoides* C.Presl, 1849.

**Thelypteris triphylla** (Sw.) K.Iwats., Mem. Coll. Sci. Univ. Kyoto, B. Biol. 31: 190. 1965; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 252. 1997. **Meniscium triphyllum** Sw., Schrad. J. Bot. 1800(2): 16. 1801; Bedd., Ferns South. India 19. pl. 56. 1863 & Handb. Ferns Brit. India 397. pl. 231. 1883. **Abacopteris triphylla** (Sw.) Ching, Bull. Fam. Mem. Inst. Bio. (Bot.). 8: 241. 1938. **Pronephrium triphyllum** (Sw.) Holttum, Blumea 20: 122. 1972; R.D.Dixit, Cens. Indian Pterid. 111. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 7. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 185. pl. 140. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 541. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 329. 1993; Subh.Chandra, Ferns India 312. 2000.

Terrestrials. Rhizome 5 mm thick, creeping. Scales 5 x 0.3-1 mm, dark brown, linear with acicular hairs. Fronds 56 x 12 cm, simply pinnate; stipe 28-40 cm long, scaly beneath, puberulous above, grooved; lamina ovate, acuminate in outline; pinnae to 19 x 3 cm, oblong to elliptic or oblong-lanceolate, acuminate, entire to wavy, rounded to cuneate at base, basal pairs sessile or shortly stipitate, odd pinna stipitate; costa grooved above, hispid, raised below, pubescent; veins pinnate; inter costular veins anastomosing. Sori oblong, 1-1.5 mm in diameter, yellow. Sporangial capsule 250 x 187.5 µm, subglobose, acicular, stalk 250 µm long. Spores 40 x 30 µm, yellow, ellipsoid, spinose.

Rare, in evergreen forests.

Specimen studied: Arjunankotta, JA 12886 (KFRI, CALI).

Subgenus **AMPHINEURON** (Holttum) Fraser-Jenkins

New Sp. Syndr. Indian Pterid. 255. 1997.

**Amphineuron** Holttum, Blumea 19: 45. 1971.

**Thelypteris terminans** (J.Sm. ex Hook.) Tagawa & K.Iwats., Acta. Phytotax. Geobot. 26: 169. 1975; Panigrahi, Phytologia 30: 410. 1975; Fraser-Jenk., New

Sp. Syndr. Indian Pterid. 255. 1997. ***Nephrodium terminans*** J.Sm. ex Hook., Sp. Fil. 4: 73. 1862; Bedd., Ferns South. India 32. pl. 90. 1863. ***N. pteroides*** sensu J.Sm., Cat. Cult. Ferns 54. 1857; Bedd., Handb. Ferns Brit. India 269. 1883, non ***Polypodium pteroides*** Retz., 1791. ***Cyclosorus interruptus*** sensu Ching, Bull. Fan Mem. Inst. Biol. 8: 184. 1938, non Willd., 1794. ***Amphineuron terminans*** (Hook.) Holttum, Amer. Fern J. 63: 82. 1973; B.K.Nayar & S.Kaur, Comp. Bedd. 205. 1974; R.D.Dixit, Cens. Indian Pterid. 103. 1984; Manickam, Fern Fl. Palni Hills 77. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 11. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 189. pl. 143. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 538. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 300. 1993; Subh.Chandra, Ferns India 286. 2000.

Terrestrials. Rhizome 0.5-0.8 cm thick, creeping. Scales 8 x 1-1.5 mm, lanceolate, acuminate, brown. Fronds 77 x 50 cm, simply pinnate, rhomboid in outline; stipe 35 cm long, scaly beneath, grooved; pinnae to 25 x 2 cm, oblong-lanceolate in outline, lobed; lobes 0.5 x 0.5-0.8 mm, ovate, obtuse or truncate; base of pinnae truncate, acuminate at apex, progressively reduced towards apex, except the terminal pinna, which is larger. Rachis grooved above, rounded beneath, pubescent, costa raised above and below, pubescent, veins prominent below, faint above, basal one to two and half pairs uniting. Scales and sessile yellow glands present beneath. Sori reniform, 1 mm in diameter, confined to the lobes, indusia dark brown. Sporangial capsule 187.5 x 187.5 µm, reddish brown, globose, stalk biseriate, longer than capsule with an yellow gland. Spores 37.5 X 25 µm, planoconvex, monolete with raised thickenings.

Occasional, in semi-evergreen forests along stream sides and marshy openings.

Specimens studied: Karadikkavala, *KPR* 70125 (CALI); Mullakkudy, *B.D. Sharma* 43855.

Subgenus **CYCLOSORIOPSIS** K.Iwatsuki

Mem. Col. Sci. Univ. Kyoto B. Biol. 31: 28. 1964.

***Christella*** H.Lev., Fl. Kouy-Tcheou, 472. 1915.

***Thelypteris dentata*** (Forssk.) E.P.St.John, Amer. Fern J. 26: 44. 1936; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 259. 1997. ***Polypodium dentatum*** Forssk., Fl. Aegypt. Arab. 185. 1773. ***Aspidium molle*** Sw., J. Bot. Gottinge

1800: 34. 1801. *Nephrodium molle* (Sw.) R.Br., Prodr. Fl. Nov. Holl. 149. 1810; Bedd., Handb. Ferns Brit. India 277. 1883, p.p. & Handb. Ferns Brit. India Suppl. 76. 1892, p.p. *Cyclosorus dentatus* (Forssk.) Ching, Bull. Fan. Mem. Inst. Biol. 8: 206. 1938; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 67. 1974. *Christella dentata* (Forssk.) Brownsey & Jermy, Fern Gaz. 10: 338. 1973; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 207. 1974; R.D.Dixit, Cens. Indian Pterid. 104. 1984; Manickam, Fern Fl. Palni Hills 83. 1986; Madhus. & Leena, J. Econ. Tax. Bot. 15: 619. 1991; Manickam & Irud., Pterid. Fl. W. Ghats 198. pl. 149. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 543. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 304. 1993; Subh.Chandra, Ferns India 289. 2000.

Terrestrials. Rhizome 10-12 x 2 cm, creeping. Scales 8-14 x 1-2 mm, dark brown, lanceolate, acuminate, entire, hairy. Fronds 60-130 x 26-30 cm, simply pinnate; stipe 45-50 cm long, glabrous, polished, grooved; lamina oblong-lanceolate in outline, rachis grooved, pubescent; pinnae 12-14 x 1.5-2 cm, oblong-lanceolate, acuminate, lobed half way to costa or serrate; lobes 6 x 3 mm, ovate, obtuse, subfalcate, pinnae cuneate at base; costa grooved above, hispid, raised below, glabrous, veins pinnate, free, except basal pairs uniting to form an excurrent vein at the base of sinus, not reaching the margin. Sori 2 mm in diameter, dark brownish, indusia dark brown, hairy reniform. Sporangial capsule 187.5 x 187.5 µm globose, stalk 187.5 µm long. Spores 37.5-40 x 25 µm, blackish, ellipsoid to reniform with thick ridges.

Common, in all vegetation types.

Specimens studied: Anjuruli, *B.D. Sharma* 42416 (MH); *KPR* 70115 (CALI); Mlappara estate, *N.C.Nair* 70128 (MH); Mlappara, *KPR* 70004 (CALI); Uppermanalar, *JA* 13221(KFRI, CALI); Vellimala, *KPR* 18358; *KPR* 62867; 62897(CALI).

*Thelypteris meeboldii* (Rosenst.) C.F.Reed, Phytologia 17: 291. 1968; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 264. 1997. *Dryopteris meeboldii* Rosenst., Feddes Repert 12: 247. 1913. *Nephrodium malabariense* Fee, Mem. Soc. Strasbourg. 6: 43. 1865. *Christella meeboldii* (Rosenst.) Holttum in B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 208. 1974 & in C.J.Saldanha &

Nicolson, Fl. Hassan Dist. 860. 1976; Madhus. & Leena, J. Econ. Tax. Bot. 15: 619. 1991; Manickam & Irud., Pterid. Fl. W. Ghats 197. pl. 148. 1992; Subh.Chandra, Ferns India 286. 2000. ***Thelypteris malabariensis*** (Fee) Panigrahi, Notes Roy. Bot. Gard. Edin. 33: 497. 1975. ***Christella malabariensis*** (Fee) Holttum, Kew Bull. 31: 317. 1976; R.D.Dixit, Cens. Indian Pterid. 105. 1984; Manickam, Fern Fl. Palni Hills 84. 1986; N.C.Nair et al., J. Econ. Tax. Bot. 16: 543. 1992.

Terrestrials. Rhizome 30-40 x 0.5-1 cm, creeping. Scales 5-8 x 0.5-10 mm, lanceolate, entire. Fronds 85-160 x 19-35 cm, simply pinnate; stipe 30-70 cm long, scaly at base, glabrous polished above, grooved; lamina lanceolate, acuminate in outline; pinnae 9.5-12 x 1.4-2.2 cm, oblong-lanceolate, acuminate, auricled at base, cuneate, lobed less than half way to costa or serrate; costa raised and grooved above, hispid, raised below, pubescent; veins pinnate, 5-6 pairs, slightly raised above and below, basal two to two and half pairs uniting; pinnae progressively reduced to both ends. Sori circular 1 mm in diameter, dark brown, median on veins, indusia dark brown, hairy. Sporangial capsule 312.5 x 250  $\mu$ m, globose, stalk 250  $\mu$ m long. Spores 40 x 20  $\mu$ m, ellipsoid to reniform, smooth or granulose.

Occasional, in evergreen forests.

Specimens studied: Uppermanalar, JA 12869 (KFRI, CALI); Vellimala, KPR 62897 (CALI).

***Thelypteris papilio*** (Hope) K.Iwats., Mem. Coll. Sci. Univ. Kyoto, B. Biol. 31: 175. 1964; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 266. 1997. ***Nephrodium papilio*** C.Hope, J. Bombay Nat. Hist. Soc. 12: 625. t. 12. 1899. ***N. molle*** var. ***major*** Bedd., Handb. Ferns Brit. India Suppl. 76. 1892, p.p. ***Dryopteris papilio*** (Hope) C.Chr., Ind. Fil. 282. 1905. ***Cyclosorus papilio*** (Hope) Ching, Bull. Fan Mem. Inst. Biol. Bot. 8: 214. 1938. ***Christella papilio*** (C.Hope) Holttum in B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 208. 1974; R.D.Dixit, Cens. Indian Pterid. 105. 1984; Manickam, Fern Fl. Palni Hills 82. 1986; Madhus. & Leena, J. Econ. Tax. Bot. 15: 623. 1991; Manickam & Irud.,



Pterid. Fl. W. Ghats 200. pl. 151. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 544. 1992; Subh.Chandra, Ferns India 293. 2000.

Terrestrial herbs. Rhizome erect, 3-20 x 3-4 cm. Scales 5-8 x 1.5-2.5 mm. Fronds 120-150 x 35-42 cm; stipe 18-26 cm long, scaly below, glabrous, polished above, grooved; lamina elliptic-lanceolate in outline; pinnae to 19 x 2 cm, oblong, or ovate, acuminate, cuneate at base; progressively reduced to both ends; basal most pairs triangular-ovate, acuminate in outline; costa grooved, pubescent above, glabrous, raised below; veins pinnate, slightly raised above and below, basal one and half pairs uniting at the base of sinus. Sori 1 mm in diameter, reddish-brown, indusia hairy. Sporangial capsule 250 x 250  $\mu$ m, globose, stalk 250  $\mu$ m long. Spores 35 x 25  $\mu$ m, black, ellipsoid, spinose.

Occasional, in evergreen forests.

Specimens studied: Vellimala, KPR 62865, 62866 (CALI).

**Thelypteris parasitica** (L.) Tardieu., Notul. Syst. 7: 75. 1938; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 266. 1997. **Polypodium parasiticum** L., Sp. Pl. 1090. 1753. **Nephrodium didymosarum** Parish ex Bedd., Ferns Brit. India 200. 1866. **N. procurrens** (Mett.) Baker, Syn. Fil. 290. 1867; Bedd., Handb. Ferns Brit. India Suppl. 67. 1892, p.p. **Christella parasitica** (L.) H.Lev., Fl. Kovy-Tcheou 475. 1915; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 208. 1974; R.D.Dixit, Cens. Indian Pterid. 106. 1984; Manickam, Fern Fl. Palni Hills 80. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 195. pl. 147. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 542. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 307. 1993; Subh.Chandra, Ferns India 294. 2000. **Cyclosorus didymosorus** (Parish) B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 68. 1974.

Terrestrials. Rhizome 15-20 x 0.5 mm, creeping. Scales 8-10 x 1-2 mm, lanceolate, acuminate, dark brown. Fronds 80-90 x 25-30 cm, simply pinnate; stipe 3-35 cm long, scaly at the very base grooved, glabrous, polished above; lamina triangular-ovate in outline; pinnae 14-18 x 2-2.5 cm, oblong, acuminate, truncate at base, deeply lobed nearly to the costa; lobes oblong, acute, subfalcate; strigose hairy above, tomentose, orange-red, sessile glandular beneath; costa grooved, hispid above, raised below, veins indistinct above,

distinct below, basal one pair united. Sori reniform, 1 mm in diameter, median, reddish brown, indusia 0.5 mm, dark brown, hairy above. Sporangial capsule 250 x 125 µm, subglobose, stalk 250 µm long with a clavate gland. Spores 37.5 x 25 µm, dark brown to black, planoconvex with folded perine. (Fig. 5.1.11 c-e).

Occasional, in semi-evergreen and evergreen forests.

Specimens studied: Mlappara, KPR 70021, 70022; Karadikkavala, KPR 70123 (CALI).

Note: The above studied collection (KPR 70022) is interesting with its branched fronds. One specimen is with divided frond, each branch simply pinnate. Another specimen is with simple pinna, but some pinnae branched (Fig.5.1.11d & e).

#### Subgenus **CYCLOSORUS** (Link) Morton

Amer. Fern J. 53: 153. 1963.

**Cyclosorus** Link, Hort. Reg. Bot. Berol 2: 128. 1833.

**Thelypteris interrupta** (Willd.) K.Iwats., J. Jap. Bot. 38: 314. 1963; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 272. 1997. **Pteris interrupta** Willd., Phytographia 13. t. 10. f. 1. 1794. **Aspidium gongyloides** Schkuhr, Krypt. Gew. 1: 193. t. 33C. 1809. **Nephrodium propinquum** R.Br., Prod. Fl. Nov. Holl. 148. 1810. **Cyclosorus gongyloides** (Schkuhr) Link, Hort. Reg. Bot. Berol. 2: 128. 1833. **Nephrodium pteroides** Hook. & Baker, Syn., Fil. 289. 1867; Bedd., Handb. Ferns Brit. India 269. 1883. **Cyclosorus interruptus** (Willd.) H.Ito, Bot. Mag. Tokyo 51: 714. f. 9. 1937; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 65. 1974; R.D.Dixit, Cens. Indian Pterid. 108. 1984; Manickam, Fern Fl. Palni Hills 74. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 187. pl. 142. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 537. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 309. 1993; Subh.Chandra, Ferns India 300. 2000.

Terrestrials. Rhizome 0.5 cm thick, creeping. Scales 2-2.5 x 1-1.5 mm, ovate, acute, dark brown. Fronds 100-120 x 15-20 cm, simply pinnate; stipe 50-65 cm long, grooved, scaly at the very base, glabrous, polished above; lamina oblong-lanceolate in outline; pinnae 10-15 x 1-1.2 cm, linear acuminate, deeply lobed; lobes ovate, acuminate, progressively reduced towards apex, except terminal larger pinnae, glabrous above, pubescent beneath, costa grooved

above, raised below, veins indistinct above, distinct below, lower one pair united. Sori 1 mm in diameter, circular, confined to the lobes of the pinnae. Sporangial capsule 312.5 x 225 µm, subglobose, stalk 250 µm long, biseriate, longer, bearing a uniseriate hair with reddish gland. Spores 50 x 30 µm, yellowish brown, planoconvex, thinly muricate.

Common, forming colonies in open marshy places in all forest types.

Specimens studied: Edapalayam, *B.D. Sharma* 41655 (MH); Mlappara, *KPR* 70052 (CALI); Nellippara slopes-way to Mlappara, *N.C.Nair* 70112 (MH).

Subgenus **METATHELYPTERIS** (H.Ito) A.R.Sm. ex Fraser-Jenkins

New Sp. Syndr. Indian Pterid. 274. 1997.

***Metathelypteris*** (H.Ito) Ching, Acta Phytotax. Sin. 8: 306. 1963.

***Thelypteris flaccida*** (Blume) Ching, Bull. Fam. Mem. Inst. Biol. Bot. 6: 336. 1936; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 59. 1974. Fraser-Jenk., New Sp. Syndr. Indian Pterid. 274. 1997. ***Aspidium flaccidum*** Blume, Enum. Pl. Jav. 2: 161. 1828. ***Lastrea flaccida*** (Blume) T.Moore, Ind. Fil. 92. 1858; Bedd., Ferns South. India 83. pl. 250. 1864; Handb. Ferns Brit. India 244. pl. 191. 1883. ***Nephrodium flaccidum*** (Blume) Hook., Sp. Fil. 4: 133. t. 263. 1862 & Syn. Fil. 274. 1867. ***Dryopteris flaccida*** (Blume) Kuntze, Rev. Gen. Pl. 2: 812. 1891. ***Metathelypteris flaccida*** (Blume) Ching, Acta Phytotax. Sin. 8: 306. 1963; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 59, 205. 1974; R.D.Dixit, Cens. Indian Pterid. 109. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 30. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 169. pl. 129. 1992; Subh.Chandra, Ferns India 303. 2000.

Terrestrials. Rhizome 3-5 x 1-3 cm, erect. Scales 5-8 x 1-1.5 mm, ovate-lanceolate, acuminate, ciliate. Fronds 90-100 x 15-25 cm; stipe 30 cm long, densely scaly beneath, sparsely above, grooved; lamina elliptic-lanceolate, acuminate in outline, simply pinnate; pinnae 9 x 2.5 cm, lanceolate, acuminate in outline, progressively reduced to both ends, basal pinnae reduced, deeply lobed; lobes 1 x 0.4-0.5 cm, oblong, obtuse, serrate up to costa; rachis grooved above, densely hispid; costa raised, hispid above, pubescent below; costules raised above and below, short stiff hairy above, pubescent beneath; veins

pinnate, indistinct above, raised beneath, reaching up to margins. Sori yellow, submarginal. Sporangial capsule 250 x 250 µm, globose, stalk 312.5 µm long. Spores 37.5 x 35 µm, yellow, ellipsoid to reniform, granulose.

Occasional, in evergreen forests.

Specimen studied: Uppermanalar, JA 13215 (KFRI, CALI).

Subgenus **PNEUMATOPTERIS** (Nakai) K.Iwatsuki

Mem. Col. Sci. Univ. Kyoto B. Biol. 31: 33. 1964.

***Pneumatopteris*** Nakai, Bot. Mag. Tokyo 47: 179. 1933.

***Thelypteris truncata*** (Poir.) K.Iwats., Mem. Coll. Ser. Univ. Kyoto, B. Biol. 31: 33. 1964; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 275. 1997. ***Polypodium truncatum*** Poir., Encycl. Meth. 5: 534. 1804. ***Nephrodium truncatum*** sensu Bedd., Handb. Ferns Brit. India 280. 1883, non (Gaudich.) C.Presl., 1836. ***Dryopteris truncata*** (Poir.) C.Chr., Ind. Fil. 299. 1905. ***Pneumatopteris truncata*** (Poir.) Holttum, Blumea 21: 314. 1973 & in B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 207, 208. 1974; R.D.Dixit, Cens. Indian Pterid. 110. 1984; Manickam & Irud., Pterid. Fl. W. Ghats 202. pl. 152. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 547. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 320. 1993; Subh.Chandra, Ferns India 307. 2000.

Terrestrials. Rhizome 19 x 2-4 cm, erect or suberect. Scales 1-1.5 x 0.2 cm, dark brown, lanceolate-linear, acuminate, entire, except for few outgrowths. Fronds 150-160 x 44-54 cm, simply pinnate; stipe 50-60 cm long, densely scaly, grooved above; lamina oblong-lanceolate in outline; rachis grooved above, raised below; pinnae 27-30 x 3 cm, thin, oblong-lanceolate, acuminate, lobed half way to costa; lobes 8-10 x 5 mm, oblong, retuse or rounded, serrulate at apex; lobes progressively reduced, serrulate towards apex; base of pinnae truncate at basisopic base, cuneate at acroscopic base; costa grooved above, pubescent, raised below, glabrous; costules raised above and below, veins pinnate raised above and below, free, except basal 2 or 3 pairs uniting at the sinus of lobes. Sori circular, 1 mm in diameter, yellow, median, indusia brownish, peltate. Sporangial capsule 225 x 187.5 µm, subglobose, stalk 375 µm long. Spores 37.5 x 30 µm, hyaline, ellipsoid to reniform, exine smooth with spinulose perine.

Occasional, in evergreen forests near streamlets.

Specimens studied: Mlappara, *KPR* 70041 (CALI); Vellimala, *KPR* 18323 (KFRI, CALI).

Subgenus **PSEUDOCYCLOSORUS** (Ching) Fraser-Jenkins

New Sp. Syndr. Indian Pterid. 276. 1997.

***Pseudocyclosorus*** Ching, Acta Phytotax. Sin. 8: 322. 1963.

***Thelypteris tylodes*** (Kunze) Ching, Bull. Fam. Mem. Inst. Biol. Bot. 6: 286. 1936; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 278. 1997. ***Aspidium tylodes*** Kunze in Linnaea 24: 244, 283. 1851, 'xylodes' err. Type 281. ***Lastrea osthodes*** (Kunze) T.Moore, Ind. Fil. 107. 1858; Bedd., Ferns South. India 37. pl. 106. 1863. ***L. osthodes*** var. ***tylodes*** (Kunze) Bedd., Ferns South. India 37. pl. 107. 1863; Handb. Ferns Brit. India 240. 1883. ***Pseudocyclosorus tylodes*** (Kunze) Ching, Acta Phytotax. Sin. 8: 324. 1963; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 204. 1974; R.D.Dixit, Cens. Indian Pterid. 112. 1984; Manickam, Fern Fl. Palni Hills 90. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 13. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 175. pl. 133. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 546. 1992; Leena & Madhus., J. Econ. Tax. Bot. 17: 648. 1993; Subh.Chandra, Ferns India 315. 2000.

Terrestrials. Rhizome 50 cm long, suberect, thick massive. Scales 5-7 x 2-3 mm, ovate, acuminate, dark brown. Fronds 150 x 36 cm, simply pinnate; stipe 25-30 cm, grooved, glabrous, polished, scaly at the very base; lamina elliptic-lanceolate in outline, basal pinnae reduced to auricles, larger ones in the middle, 16-18 x 1.5 cm, linear, acuminate, deeply lobed; lobes linear, falcate, acute, glabrous above, pubescent beneath; costa grooved above, hirsute, raised below; veins distinct above, free. Sori 0.5 mm in diameter, yellowish when young, dark brownish to black when mature; indusia hairy. Sporangial capsule 250 x 225 µm, globose, stalk 250 µm long with a gland. Spores 45 x 37.5 µm, monolete, planoconvex, thickly spinous.

Rare, in evergreen forests.

Specimens studied: Deviar mettu, *JA* 13248 (KFRI, CALI); Mlappara, *KPR* 70017 (CALI); Uppermanalar, *JA* 12875 (KFRI, CALI).

Subgenus **SPHAEROSTEPHANOS** (J.Smith ex Hook.) K.Iwatsuki  
 Mem. Col. Sci. Univ. Kyoto B. Biol. 31: 32. 1964.

**Sphaerostephanos** J.Smith ex Hook., Gen. Fil. t. 24. 1839.

**Thelypteris arbuscula** (Willd.) K.Iwats., Acta Phytotax Geobot. 21: 170. 1968; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 279. 1997. **Aspidium arbuscula** Willd., Sp. Pl. ed. 4, 5: 233. 1810. **Nephrodium arbuscula** (Willd.) Desv., Mem. Soc. Paris 6: 253. 1927; Bedd., Ferns South. India 31. pl. 87. 1863 & Bedd., Handb. Ferns Brit. India 276. 1883. **Cyclosorus arbusculus** (Willd.) Ching, Bull. Fan Mem. Inst. Biol. Bot. 8: 194. 1938; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 66. 1974. **Sphaerostephanos arbuscula** (Willd.) Holttum, J. South Afr. Bot. 40: 164. 1974, in B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 207. 1974; R.D.Dixit, Cens. Indian Pterid. 114. 1984; Manickam, Fern Fl. Palni Hills 87. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 10. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 192. pl. 145. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 546. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 338. 1993; Subh.Chandra, Ferns India 320. 2000.

Terrestrials. Rhizome 15-30 x 4-10 cm, erect. Scales 5-7 x 0.5-1.1 mm, lanceolate, acuminate, hispid above, dark brown. Fronds simply pinnate, 70-90 x 12-15 cm; stipe 3-10 cm long; lamina elliptic-lanceolate in outline; pinnae 6-12 x 1-1.5 cm, oblong-lanceolate, acuminate truncate at base, serrate to shallowly lobed along the margins; larger pinnae in the middle, progressively reduced towards apex, abruptly reduced towards base, lower pinnae auricled; costa grooved above, raised below, hispid on both sides, veins distinct above and below, pubescent above, hispid beneath, white sessile glands present all over above and below. Sori 1 mm in diameter, dark brown, circular. Sporangial capsule 312.5 x 250 µm, subglobose with a stalk of about 325 µm long. Spores 40 x 32.5 µm, ellipsoid, spinulose, dark brown. (**Fig. 5.1.11b**).

Occasional, along streams in the evergreen forests.

Specimen studied: Vellimala, KPR 62895 (CALI).

Subgenus **STEGNOGRAMMA** (Blume) C.F.Reed

Phytologia 17: 254. 1968.

**Stegnogramma** Blume, Enum. Pl. Jav. 172. 1928.

**Thelypteris mollissima** (Kunze) Rajesh **comb nov. inedit.** **Gymnogramma totta** Schltld. var. **mollissima** Kunze, Linnaea 24: 249. 1851. **Stegnogramma mollissima** (Kunze) Fraser-Jenk., New Sp. Syndr. Indian Pterid. 237. 1997. **Leptogramma totta** (Schltld.) Js.Sm., J. Bot. 4: 52. 1814; Bedd., Handb. Ferns Brit. India 377. pl. 215. 1883. **Grammitis totta** C.Presl, Tent. Pterid. 209. t. 9. f. 4. 1836; Bedd., Ferns South. India 17. pl. 49. 1863. **Stegnogramma pozoi** sensu auct., Holttum, J. S. Afr. Bot. 40: 149. 1974; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 211. 1974; Manickam, Fern Fl. Palni Hills 77. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 6. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 173. pl. 132. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 539. 1992, non (Lag.) K.Iwats., 1963.

Terrestrials. Rhizome 0.8-1 cm thick, creeping. Scales 5-6 x 2 mm, yellowish-brown, lanceolate-acuminate, with acicular hairs. Frond 30 x 6.5 cm, simply pinnate; stipe 8-10 cm, densely scaly at base, hispid above, grooved; lamina elliptic-lanceolate, acuminate in outline, rachis hispid; pinnae to 3.8 x 1.2 cm, thin in texture, oblong, obtuse, lobed half way to costa, lobes ovate, rounded or oblong, truncate or apiculate, base of pinnae truncate, hispid above, puberulous beneath; costa raised above and below, hispid, veins pinnate, indistinct above, raised below, free, pinnae progressively reduced towards both ends, terminal pinnae linear. Sori 2-2.5 mm long, linear, on basal one or two pairs of veins. Sporangial capsule 250 x 225 µm, acicular, stalk 250 µm long. Spores 35 x 25 µm, black, ellipsoid to reniform, spinose.

Common, in evergreen forests.

Specimen studied: Mlappara, KPR 70061 (CALI).

Note: Though Smith (in Kramer & Green, 1990) treated *Stegnogramma* as a subgenus of *Cyclosorus*, which is now in turn a subgenus of *Thelypteris*, Fraser-Jenkins (1997) treated it as a separate genus. I prefer to follow the recent scheme of four genera in *Thelypteridaceae* (Smith, 2000, *pers. comm*) in which *Cyclosorus* including *Stegnogramma* is treated under *Thelypteris*.

Fraser-Jenkins (1997) states that, *Stegnogramma pozoi* (Lag.) K.Iwats., does not occur in India. The plant known earlier by that name from South India is a distinct and separate taxon, which is named by him as *S. mollissima* (Kunze) Fraser-Jenk. It is now brought to *Thelypteris*.

Subgenus **TRIGONOSPORA** (Holttum) Fraser-Jenkins

New Sp. Syndr. Indian Pterid. 281. 1997

***Trigonospora*** Holttum, Blumea 12: 29. 1971.

***Thelypteris caudipinna*** Ching, Bull. Fam. Mem. Inst. Biol. Bot. 6: 288. 1936; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 281. 1997. ***Lastrea falciloba*** sensu Bedd., Ferns South. India 37. pl. 105. 1863, non ***Nephrodium falcilobum*** Hook., 1862. ***Lastrea sergiana*** sensu Bedd., Suppl. Ferns South. India & Handb. Ferns Brit. India 370. 1876. ***L. calcarata*** var. ***ciliata*** Bedd., Handb. Ferns Brit. India 235. pl. 121. 1883. ***Trigonospora ciliata*** (Benth.) Holttum var. ***angustiloba*** Holttum in C.J.Saldanha & Nicolson, Fl. Hassan Dist. 866. 1976; N.C.Nair et al., J. Econ. Tax. Bot. 16: 540. 1992. ***T. caudipinna*** (Ching) Sledge, Bull. Brit. Mus. Nat. Hist. Bot. 8: 15. f. 2A. 1981; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 13. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 182. pl. 138. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 344. 1993; Subh.Chandra, Ferns India 328. 2000.

Terrestrials. Rhizome 2 x 2 cm, erect. Scales 2-3 x 1-2 mm, ovate-lanceolate, acuminate, fimbriate, sparsely hairy above and below. Fronds 60-80 x 15-25 cm; stipe 23-32 cm long, scaly below, polished above, hispid along the groove, pubescent; lamina elliptic, acuminate in outline, simply pinnate; pinnae 9 x 2.5 cm, elliptic-lanceolate, acuminate, deeply lobed; lobes 1.6 x 0.3 cm, linear, falcate, obtuse to truncate, nearly to costa, margins scarious; rachis pubescent, costa raised above and below, sparsely hairy above and below; base of pinnae truncate. Sori 1 mm in diameter, circular, dark brown, on veins near costules; indusia dark brown, peltate, hairy. Sporangial capsule 312.5 x 250, subglobose, stalk 250 µm long. Spores 37.5 x 37.5 µm, yellowish-brown, globose, trilete, spinulose.

Common, in evergreen forests.

Specimens studied: Chokkampatti, KPR 14621 & 14693; Vahalala, JA 14607 (KFRI, CALI).



**ASPLENIACEAE**

Frank in Leunis, Syn. Pflanzenkd. 2, 3: 1465. 1877.

**ASPLENIUM** Linnaeus

Sp. Pl. 2: 1078. 1753.

Epiphytic, lithophytic or terrestrial herbs. Rhizome erect to creeping. Scales linear to linear-lanceolate, entire to fimbriate, clathrate. Fronds simple to bipinnate. Stipe polished, grooved. Lamina oblong-lanceolate to ovate in outline, subcoriaceous to coriaceous. Ultimate pinnae linear to ovate or elliptic, entire to serrate or lobed. Veins free, forked once or twice, ends submarginally. Sori elliptic to linear, orange red to dark brown, one or two indusiate. Spores dark brown to black, rounded to planoconvex with thin or thickly folded, granulose or smooth perine.

**Key to the species**

- |  |                       |
|--|-----------------------|
| 1. Fronds simple .....   | 2                     |
| 1. Fronds pinnate .....  | 4                     |
| 2. Fronds less than 2 cm broad; veins free .....                                 | <b>A. ensiforme</b>   |
| 2. Fronds more than 3 cm broad; veins uniting close to margins .....             | 3                     |
| 3. Fronds 50-60 cm long and 6-8 cm broad .....                                   | <b>A. phyllitidis</b> |
| 3. Fronds more than 65 cm long and more than 8 cm broad .....                    | <b>A. nidus</b>       |
| 4. Fronds simply pinnate .....   | 5                     |
| 4. Fronds bipinnate .....  | 16                    |
| 5. Rhizome creeping .....  | 6                     |
| 5. Rhizome erect .....   | 9                     |
| 6. Fronds more than 60 cm long, gemmiparous; pinnae 10-15 cm or long .....       | <b>A. zenkeranum</b>  |
| 6. Fronds less than 60 cm long, not gemmiparous; pinnae less than 10 cm long ... | 7                     |
| 7. Pinnae thick, coriaceous .....  | <b>A. decrescens</b>  |
| 7. Pinnae thin membranous .....  | 8                     |
| 8. Pinnae lobed; sori confined to lobes .....                                    | <b>A. cheilosorum</b> |
| 8. Pinnae serrulate or serrate; not lobed, sori median .....                     | <b>A. unilaterale</b> |
| 9. Stipe hairy .....   | 10                    |
| 9. Stipe glabrous .....  | 11                    |

10. Scales bicoloured, thicker in the middle, paler along the margins, glandular hairy ..... **A. crinicaule**
10. Scales uniform, entire ..... **A. yoshinagae** subsp. **indicum**
11. Pinnae thick, coriaceous, terminal pinnae similar ..... **A. serricula**
11. Pinnae thin, membranous, terminal pinnae dissimilar ..... **12**
12. Pinnae more than 4 cm long ..... **A. inaequilaterale**
12. Pinnae less than 4 cm long, about 1-3 cm long ..... **13**
13. Pinnae thick, coriaceous ..... **A. tenerum**
13. Pinnae membranous or chartaceous ..... **14**
14. Pinnae chartaceous ..... **A. normale**
14. Pinnae membranous ..... **15**
15. Sori confined to lower part of pinnae ..... **A. formosum**
15. Sori on both half of the pinnae ..... **A. erectum**
16. Fronds tri or quadripinnate ..... **A. tenuifolium**
16. Fronds bipinnate ..... **17**
17. Fronds delicate, to 15 cm long ..... **A. laciniatum**
17. Fronds not delicate, more than 20 cm long ..... **18**
18. Primary pinnae more than 6 cm long ..... **A. polyodon**
18. Primary pinnae less than 6 cm long ..... **19**
19. Pinnae shallowly lobed ..... **A. auritum**
19. Pinnae deeply lobed, almost to costa ..... **A. nitidum**

**Asplenium auritum** Sw., Schrad. J. Bot. 1800: 52. 1801; Bedd., Ferns South. India 47. pl. 137. 1864 & Handb. Ferns Brit. India 149. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 36. 1974; R.D.Dixit, Cens. Indian Pterid. 116. 1984; Manickam, Fern Fl. Palni Hills 99. 1986; Subh.Chandra & S.Kaur, Nomen Guide Bedd. 17. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 227. pl. 174. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 528. 1992; Subh.Chandra, Ferns India 258. 2000.

Lithophytes. Rhizome 3 x 1-1.5 cm, erect. Scales 3 x 3 mm, pale brown, clathrate, lanceolate, acuminate, entire. Fronds 30-40 x 3-10 cm, bipinnate or bipinnatifid; stipe 3-13 cm long, scaly at the very base, glabrous, polished above, greenish to dark brown, rounded beneath, grooved above; lamina 12-26

x 3-10 cm, lanceolate in outline; pinnae 2-6 x 1-2 cm, lanceolate or oblong-lanceolate in outline, simply pinnate, pinnatifid or bipinnate, lobed, distinctly stalked, firm, thick, coriaceous, progressively reduced towards apex; pinnules 1 x 0.6 cm, ovate, rounded, serrulate; veins forked once, not reaching the margin. Sori 2-3 mm long, orange to brownish, linear or semi-lunar, indusia greenish. Sporangial capsule 312.5 x 225  $\mu$ m, ellipsoid, stalk 375  $\mu$ m long. Spores 45 x 32.5  $\mu$ m, planoconvex with narrowly winged perispore.

Rare, in evergreen forests.

Specimen studied: Mlappara, *KPR* 70024 (CALI).

**Asplenium cheilosorum** Kunze ex Mett. in Abhandl. Seckeb. Naturforsch. Ges. 3: 177. t. 5. f. 12, 13. 1859; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 37. 1974; R.D.Dixit, Cens. Indian Pterid. 116. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 16. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 211. pl. 159. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 530. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 274. 1993; Azeez et al., J. Econ. Tax. Bot. 20: 441. 1996; Subh.Chandra, Ferns India 260. 2000. **A. heterocarpum** Wall., List. no. 218. 1828; Hook., Sp. Fil. 132. t. 175. 1860; Bedd., Ferns South. India 44. pl. 131. 1864; Bedd., Handb. Ferns Brit. India 153. 1883.

Terrestrials. Rhizome 5-7 mm thick, creeping. Scales 3 x 0.8 mm, brownish, ovate, acuminate, cordate at base, clathrate, entire. Fronds simply pinnate, 45-50 x 4-6 cm; stipe 20 cm long, pinkish brown, glabrous, polished; lamina oblong-lanceolate in outline; pinnae 4-5 x 1-2 cm, dimidiate, lanceolate-linear in outline, deeply lobed; lobes incised, cuneate at base, progressively reduced towards apex, terminal pinnae smaller, dissimilarly lobed; veins forked once. Sori 1-2 mm long, brownish, elliptic to oblong, confined to the lobes. Sporangial capsule 250 x 225  $\mu$ m, subglobose, stalk 500  $\mu$ m long. Spores 50-57 x 30-40  $\mu$ m, dark brown to black, ovoid to planoconvex or reniform with reticulately folded perine.

Rare, in evergreen forest along stream sides.

Specimens studied: Uppermanalar, *JA* 12873 (KFRI, CALI); beside the stream-Vellimalai (Madurai district, TN), *B.V. Shetty* 10359 (MH).

**Asplenium crinicaule** Hance, Ann. Sci. Nat. Ser. v. 5. 254. 1886; Bedd., Handb. Ferns Brit. India 150. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 36. 1974; R.D.Dixit, Cens. Indian Pterid. 117. 1984; Manickam, Fern Fl. Palni Hills 103. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 17. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 216. pl. 164. 1992; Azeez et al., J. Econ. Tax. Bot. 20: 442. 1996; Subh.Chandra, Ferns India 260. 2000. **A. falcatum** sensu Bedd., Ferns South. India 47. pl. 141. 1864, non Lam., 1786.

Terrestrials. Rhizome 2.5 x 1 cm, erect. Scales 2-3 x 0.5 mm, linear or lanceolate, clathrate, dark brown in middle, paler along margins. Fronds 15-22 x 3-4 cm, simply pinnate; stipe 3-6 cm long, brownish, hairy; lamina lanceolate, acuminate in outline; pinnae 1.5-2.4 x 0.7 cm, rhomboidal in outline, serrate, acute, truncate at apiscopic base, excised at basisopic base, shortly stalked; pinnae gradually reduced towards apex, terminal pinna dissimilar, ovate-lanceolate, acuminate, lobed to serrate, obtuse; veins forking once or twice. Sori 2-3 x 1.5 mm, orange-red or brownish. Sporangial capsule 312.5 x 250 µm, subglobose, stalk 375 µm long. Spores 250 x 125 µm, black, planoconvex with thick perine.

Occasional in evergreen forests near stream sides.

Specimens studied: Mangaladevi, JA 12816; Uppermanalar, JA 12867; Vellimala, JA 13254 (KFRI, CALI); KPR 62899 (CALI).

**Asplenium decrescens** Kunze, Linnaea 24: 261. 1851; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 36. 1974; R.D.Dixit, Cens. Indian Pterid. 117. 1984; Manickam, Fern Fl. Palni Hills 100. 1986; Subh.Chandra & S.Kaur, Nomen Guide Bedd. 17. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 210. pl. 151. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 531. 1992; Azeez et al., J. Econ. Tax. Bot. 20: 442. 1996; Subh.Chandra, Ferns India 261. 2000. **A. contiguum** sensu Bedd., Ferns South. India 47. pl. 140. 1864, non Kaulf., 1824. **A. caudatum** sensu Hook., Sp. Fil. 3: 152. 1880: quod specim., Zeyl p.p. non Forster, 1786; Bedd., Handb. Ferns Brit. India 151. 1883; B.K.Nayar & Geev., Fern Fl. Malabar 273. 1993.

Epiphytes or terrestrials. Rhizome 2 x 2 cm, erect. Scales 6-7 x 0.8-0.9 mm, lanceolate, linear, dark brown, clathrate, rounded to cordate at base, long acuminate, gland tipped at apex. Fronds 30-35 x 10 cm, simply pinnate; stipe 10-15 cm long, dark brownish to black, scaly and hairy; pinnae 5-6 x 1.5-2 cm, rhomboidal in outline, deeply lobed, lobes incised, coriaceous, larger pinnae in the middle, terminal pinnae dissimilar, smaller; veins forked. Sori 5-10 mm long, linear, yellowish to brown, along the costa, indusia linear, yellowish translucent. Sporangial capsule 187.5 x 150  $\mu\text{m}$ , subglobose, stalk 375-500  $\mu\text{m}$  long. Spores 45 x 25  $\mu\text{m}$ , yellowish, elliptic or planoconvex to reniform with thickly folded perine. (**Fig. 5.1.12 a**).

Occasional, in evergreen forests.

Specimen studied: Vellimala, *KPR* 18335 (KFRI, CALI).

**Asplenium ensiforme** Wall. ex Hook. & Grev., Ic. Fil. t. 71. 1829; Bedd., Ferns South. India 43. pl. 125. 1864; Ferns Brit, India t.147.1866 & Handb. Ferns Brit. India 141. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 34. 1974; R.D.Dixit, Cens. Indian Pterid. 117. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 15. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 207. pl. 154. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 528. 1992; Azeez et al., J. Econ. Tax. Bot. 20: 444. 1996; Subh.Chandra, Ferns India 262. 2000.

Epiphytes or lithophytes. Rhizome 0.5-0.8 x 0.5 cm, erect. Scales 4 x 1 mm, lanceolate, acuminate, entire, clathrate, dark brown. Fronds 7-9 x 0.8-1 cm, simple; stipe to 1 cm long, densely scaly below, sparsely above; lamina linear-lanceolate, acute at both ends, coriaceous, costa faint above, raised below, veins forked. Sori 5 mm long, brown, linear on the acroscopic branch of the vein. Sporangial capsule 312.5 x 250  $\mu\text{m}$ , subglobose, stalk 375  $\mu\text{m}$  long. Spores 125 x 100  $\mu\text{m}$ , dark brown to black, ellipsoid with thickly folded, lacinate perine. (**Fig. 5.1.12 c**).

Rare, in evergreen forests.

Specimens studied: Vellimala, *JA* 13358 (KFRI, CALI); *KPR* 62876 (CALI).



Fig. 5.1.12. Habits of *Asplenium* spp. **a.** *A. decrescens*, **b.** *A. erectum*, **c.** *A. ensiforme*, **d.** *A. normale*, **e.** *A. phyllitidis*, **f.** *A. polyodon*.

**Asplenium erectum** Bory ex Willd. in L., Sp. Pl. 5: 338. 1810; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 36. 1974; R.D.Dixit, Cens. Indian Pterid. 117. 1984; Manickam, Fern Fl. Palni Hills 106. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 16. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 209. pl. 156. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 534. 1992; Subh.Chandra, Ferns India 262. 2000. **A. brasiliense** sensu Bedd., Ferns South. India 45. pl. 135. 1864, non Raddi, 1825. **A. lunulatum** var. **camptorachis** (Kunze) Bedd., Handb. Ferns Brit. India 148. 1883.

Terrestrials and lithophytes. Rhizome 3-4 x 1-1.5 cm, erect. Scales 1-1.5 x 0.5-0.8 mm, ovate, acuminate or lanceolate, dark brown, entire or with few bulbous tipped hairs. Fronds 15-22 x 2-2.5 cm, simply pinnate; stipe 3-4 cm long, dark brown to black, glabrous, polished. Lamina 12-15 x 2-2.5 cm, lanceolate in outline, acute at both ends; pinnae to 1.5 x 0.5 cm, trapezoid-lanceolate, acute, serrate, basiscopic base excised, cuneate, acroscopic base truncate, auricled, shortly stipitate; larger pinnae in the middle, progressively reduced towards both ends, terminal pinnae linear, lobed. Veins in the basal lobe only forked. Sori 1-1.5 mm, elliptic, dark brown, indusia reddish-brown. Sporangial capsule 250 x 185.5  $\mu\text{m}$ , subglobose, stalk 375-437.5  $\mu\text{m}$  long. Spores 35 x 25  $\mu\text{m}$ , yellowish, planoconvex with thin, folded perine. (Fig. 5.1.12 b).

Occasional, on earth cuttings in semi-evergreen and evergreen forests.

Specimen studied: Vellimala, *KPR* 18357 (KFRI, CALI).

**Asplenium formosum** Willd. in L., Sp. Pl. 5: 329. 1810; Bedd., Ferns South. India 46. pl. 136. 1864 & Handb. Ferns Brit. India 152. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 37. 1974; R.D.Dixit, Cens. Indian Pterid. 118. 1984; Manickam, Fern Fl. Palni Hills 105. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 17. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 208. pl. 155. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 530. 1992; Azeez et al., J. Econ. Tax. Bot. 20: 445. 1996; Subh.Chandra, Ferns India 265. 2000.

Terrestrials and lithophytes. Rhizome 1-2 cm long, erect. Scales 2-2.5 x 0.5 mm, ovate-lanceolate, brownish to black, thick in the middle. Fronds 20-40 x

3-4 cm long, simply pinnate; stipe 2-3 cm long, glabrous, polished; lamina elliptic-linear in outline; pinnae 1-1.3 x 0.4-0.5 cm, subopposite to alternate, lanceolate in outline, deeply lobed or incised, cuneate at base; larger pinnae in the middle, progressively reduced to both ends, terminal pinnae dissimilar; veins forked. Sori 2 mm long, elliptic to linear, confined to basiscopic half; indusia linear. Sporangial capsule 250 x 187.5  $\mu$ m, subglobose, stalk 625-875  $\mu$ m long. Spores 50 x 30  $\mu$ m, dark brown to black, planoconvex with thickly folded perine.

Occasional, in evergreen forests.

Specimens studied: Medaganam, *KPR* 70104 (CALI); Pachakkanam, *JA* 12804; Vellimala, *JA* 13255; *KPR* 18339 (KFRI, CALI).

**Asplenium inaequilaterale** Willd. in L., Sp. Pl. 5: 322. 1810; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 36. 1974; R.D.Dixit, Cens. Indian Pterid. 118. 1984; Manickam, Fern Fl. Palni Hills 107. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 16. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 220. pl. 167. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 534. 1992; Subh.Chandra, Ferns India 267. 2000. **A. trapeziforme** sensu Bedd., Ferns South. India 45. pl. 134. 1864. **A. lunulatum** var. **trapeziforme** Bedd., Handb. Ferns Brit. India 148. 1883, p.p. non **A. trapeziforme** Roxb. 1844.

Terrestrials. Rhizome 1-1.5 x 0.8-1.5 cm, erect. Scales 2-3 x 0.2-0.8 mm, dark brown to black, clathrate, lanceolate, acuminate, entire. Fronds 20-32 x 3-8 cm, lanceolate, acuminate in outline, simply pinnate; stipe 6-15 cm, long, dark brown to black, grooved, pubescent; lamina 9-17 x 38 cm, oblong-lanceolate in outline; pinnae 4.8 x 1.3 cm, oblong-lanceolate, acute in outline, serrate, basiscopic base cuneate, acroscopic base truncate; pinnae progressively reduced towards apex, terminal pinna dissimilar, linear, lobed; veins forked, costa prominent. Sori 3-6 mm, elliptic to linear, reddish-brown; indusia pale brownish. Sporangial capsule 250 x 187.5  $\mu$ m, globose, stalk 375  $\mu$ m long. Spores 37.5 x 25  $\mu$ m, yellowish-brown with thick reticulately folded, lacinate perine.

Occasional, in evergreen forests.



Specimens studied: Mangaladevi, *JA* 12816 (KFRI, CALI); Mlappara, *KPR* 70043 (CALI); Uppermanalar, *JA* 12867; Vellimala, *KPR* 13254, 13300 (KFRI, CALI); Aruna estate (Madurai district, TN), *K. Subramanyam* 9480 (MH); Metla-High Wavies (TN), *KPR* 18360 & 18366 (KFRI, CALI).

**Asplenium laciniatum** D.Don, *Prod. Fl. Nepal.* 8. 1825; Manickam & Irud., *Pterid. Fl. W. Ghats* 224. pl. 172. 1992; Fraser-Jenk., *New Sp. Syndr. Indian Pterid.* 54. 1997. **A. varians** Wall. ex Hook. & Grev., *lc. Fil.* 2: t. 172. 1829; Bedd., *Ferns South. India* 44. pl. 129. 1864 & *Handb. Ferns Brit. India* 158. 1883; B.K.Nayar & S.Kaur, *Comp. Bedd. Handb.* 38. 1974; R.D.Dixit, *Cens. Indian Pterid.* 122. 1984; Manickam, *Fern Fl. Palni Hills* 96. 1986; Subh.Chandra & S.Kaur, *Nomen. Guide Bedd.* 16. 1987; Singh & Bir, *Indian Fern J.* 6: 272. 1989; N.C.Nair et al., *J. Econ. Tax. Bot.* 16: 529. 1992. **A. gueinzianum** Mett. ex Kuhn, *Fil. Afr.* 103. 1868; Subh.Chandra, *Ferns India* 266. 2000.

Terrestrials. Rhizome 1 x 0.8 cm, erect. Scales 3-4 x 0.3 mm, clathrate, deep reddish brown to black, lanceolate-acuminate, entire. Fronds 9-12 x 2 cm, bipinnate; stipe 0.5-2 cm, scaly and sparsely hairy when young; lamina elliptic-lanceolate, narrowed to both ends; primary pinnae to 1.5 x 1 cm, ovate, acute in outline, subcoriaceous; secondary pinnae to 8 x 6 mm, ovate or elliptic, serrate, rounded to retuse at apex, cuneate at base; veins forked once or twice, not reaching the margin. Sori 1-2 mm long, elliptic to linear, dark brownish, indusia translucent. Sporangial capsule 225 x 187.5 µm, ellipsoid, stalk 187.5 µm long. Spores 37.5 x 25 µm, black, rounded to planoconvex with thickly folded perine.

Rare, in evergreen forests.

Specimens studied: Pachakkanam, *JA* 12802 (KFRI, CALI); Vellimala, *KPR* 62849 (CALI).

**Asplenium nidus** L., *Sp. Pl.* 2: 1079. 1753; B.K.Nayar & S.Kaur, *Comp. Bedd. Handb.* 34. 1974; R.D.Dixit, *Cens. Indian Pterid.* 119. 1984; Subh.Chandra & S.Kaur, *Nomen. Guide Bedd.* 58. 1987; N.C.Nair et al., *J. Econ. Tax. Bot.* 18: 450. 1994; Subh.Chandra, *Ferns India* 269. 2000. **Thamnopteris nidus** C.Presl, *Epim. Bot.* 68. 1849; Bedd., *Handb. Ferns Brit. India* 137. 1883.

Epiphytes. Rhizome erect, stout. Scales lanceolate, dark brown, fimbriate. Fronds simple, 60-70 x 10 cm, subcoriaceous, oblong-lanceolate, acute, costa raised above, forked once, endings uniting along the margins to form a continuous intramarginal vein. Sori 4-4.5 x 0.2 cm, linear, dark brown, indusia translucent.

Occasional in semi-evergreen and evergreen forests.

Specimens studied: way to Mangaladevi temple, *K. Vivekananthan* 48667; Poongavanam-Sabarimalai, *N.C.Nair* 70218 (MH).

Note: This species is included here on the basis of specimens lodged in the Madras Herbarium. I have not collected this during the present study.

**Asplenium nitidum** Sw., Syn. Fil. 84: 280. 1806; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 38. 1974; R.D.Dixit, Cens. Indian Pterid. 119. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 18. 1987; Vasudeva et al., Indian Fern J. 7: 67. 1990; Manickam & Irud., Pterid. Fl. W. Ghats 227. pl. 175. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 528. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 281. 1993; Azeez et al., J. Econ. Tax. Bot. 20: 446. 1996; Subh.Chandra, Ferns India 270. 2000. **A. nitidum** var. **obtusum** Sw., Bedd., Ferns South. India 50. pl. 149. 1864. **A. insigne** Blume, Enum. Pl. Jav. 2: 188. 1828. **A. spathulinum** Kunze, Bot. Zeit. 6: 524. 1848.

Terrestrials. Rhizome 1.5-2 x 1.5 cm, erect. Scales 2-3 x 0.2-0.3 mm, brown, clathrate, linear, entire, dark. Fronds 25-38 x 8 cm, bipinnate; stipe 10-22 cm, dark brown, scaly at the base polished, glabrous above; lamina ovate or deltoid in outline; pinnae 5-6 x 2 cm, sub opposite, 10-12 pairs, oblong-acute in outline; pinnules 1-1.8 x 0.5-0.8 cm, ovate-lanceolate, acute, lobed to serrate, shortly stipitate, cuneate at base; veins free forked. Sori linear, 3-5 mm, dark brown, indusia brownish. Sporangial capsule 250 x 187.5 µm, subglobose, stalk 375 µm long. Spores 50 x 30 µm, black, planoconvex with thickly reticulate perine.

Occasional in evergreen forests.

Specimens studied: Chemmanoda, *JA* 13241; Vellimala, *KPR* 18341 (KFRI, CALI).

**Asplenium normale** D.Don, Prodr. Fl. Nepal. 7. 1825; Bedd., Ferns Brit. India t. 144. 1883; Manickam & Irud., Pterid. Fl. W. Ghats 217. pl. 105. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 539. 1992; Subh.Chandra, Ferns India 270. 2000. **A. multijugum** Wall., List. no. 207. 1828, nom. nud; Bedd., Ferns South. India 45. pl. 133. 1864.

Terrestrials. Rhizome 2-2.5 x 2 cm, erect. Scales 2-3 x 0.2-0.5 mm, dark brown to black, lanceolate, thick in the middle. Fronds 30-45 x 3.5-4 cm, simply pinnate, very close; stipe 10-12 cm long, dark brown to black, polished, glabrous; lamina oblong-lanceolate in outline; pinnae 1.5-2 x 0.5-1.5 cm, ovate-lanceolate or oblong, obtuse to rounded, crenate or serrate, truncate at base, sessile or sub sessile, reduced towards apex, terminal pinnae bulbiferous; veins forked twice or more. Sori 2-4 cm long, brown, linear, indusia translucent. Sporangial capsule 312.5 x 250 µm, subglobose, stalk 625 µm long. Spores 50 x 37.5 µm, brownish, planoconvex with thickly folded perine, spinulose. (**Fig. 5.1.12d**).

Occasional, in evergreen forests.

Specimens studied: Deviarmettu, JA 13249 (KFRI, CALI); Mlappara, KPR 70046 (CALI); Vellimala, KPR 18309 (KFRI, CALI); KPR 62868, 62878 (CALI); Vellimala, K. Subramanyam 9498 (MH).

**Asplenium phyllitidis** D.Don, Prodr. Fl. Nepal. 7. 1825; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 34. 1974; Subh.Chandra & S.Kaur, Nomen Guide Bedd. 15. 1987; N.C.Nair et al., J. Econ. Tax. Bot. 16: 527. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 284. 1993; Azeez et al., J. Econ. Tax. Bot. 20: 447. 1996; Subh.Chandra, Ferns India 272. 2000. **Thamnopteris phyllitidis** D.Don sensu Bedd., Ferns South. India 42. pl. 123. 1863. **T. nidus** var. **phyllitidis** D.Don in Bedd., Handb. Ferns Brit. India 139. 1883. **Asplenium nidus** var. **phyllitidis** (D.Don) Bir, J. Indian Bot. Soc. 43: 567. 1964. **A. nidus** sensu Manickam & Irud., Pterid. Fl. W. Ghats 206. pl. 153. 1992, non L., 1753.

Epiphytes. Rhizome 6 x 5 cm, erect. Scales 8-12 x 2-4 mm, lanceolate, acuminate, fimbriate. Fronds 50-60 x 6-8 cm, simple; stipe 4-5 cm, stout; lamina

dark green, coriaceous, narrowly oblanceolate, acute, midrib indistinct above, raised below; veins usually forked once near the mid rib, straight, slightly ascending, uniting close to the margin. Sori 2-2.5 cm long, on alternative veinlets. Sporangial capsule 337.5 x 287.5  $\mu\text{m}$ , subglobose, stalk 625  $\mu\text{m}$  long. Spores 50 x 40  $\mu\text{m}$ , black, planoconvex, monolete, with thickly folded lacinate perispore. (Fig. 5.1.12e).

Occasional, in evergreen forests.

Specimens studied: Karadikkavala, JA 12817 (KFRI, CALI); Uppuparai to Sabarimala, K. Vivekananthan 45364 (MH).

**Asplenium polyodon** G.Forst., Fl. Ins. Austral Prod. 80. 1786; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 51. 1997; Subh.Chandra, Ferns India 273. 2000. **A. falcatum** Lam., Encl. 2: 300. 1786; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 36. 1974; R.D.Dixit, Cens. Indian Pterid. 117. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 17. 1987. **A. mysoreense** Roth, Nov. Pl. Sp. 395. 1821, p.p. **Tarachia furcata** var. **platyphylla** C.Presl, Abhandl. K. Bohm. Ges. Wiss. Folge 6: 440. 1851, p.p. **Asplenium praemorsum** var. **latum** T.Moore, Ind. Fl. 156. 1859, p.p., non Desv. **A. spathulinum** sensu Bedd., Ferns South. India 75. pl. 226. 1864, non Js.Sm. ex Hook. **A. falcatum** var. **bipinnatum** Sledge, Bull. Brit. Mus. Nat. Hist. 3: 262. 1965; R.D.Dixit, Cens. Indian Pterid. 118. 1984; Manickam, Fern Fl. Palni Hills 98. 1986. **A. polyodon** G.Forster var. **bipinnatum** (Sledge) Sledge, Bot. J. Linn. Soc. 84: 6. 1982; Manickam & Irud., Pterid. Fl. W. Ghats 219. pl. 167. 1992; Subh.Chandra, Ferns India 273. 2000.

Lithophytes or terrestrials. Rhizome 10 x 4 cm, erect, densely scaly. Scales 10-12 x 1.5-2 mm, lanceolate, acuminate, dark brown, smooth or minutely toothed. Fronds 30-80 x 10-20 cm, bipinnate; stipe 20-35 cm, densely scaly, dark brownish to black; lamina oblong-acuminate in outline; pinnae 6-10 x 2-3.5 cm, lanceolate in outline, progressively reduced towards apex; pinnules 2.5-3 x 1.5 cm, ovate or rhomboid in outline, lobed to serrate, glabrous, coriaceous, progressively reduced towards apex, terminal pinnules irregularly lobed; veins forked, distinct above. Sori 10-12 mm long, linear, dark brown, indusia translucent. Sporangial capsule 312.5 x 312.5  $\mu\text{m}$ , globose, stalk 375

µm long. Spores 50 x 40 µm, dark brown to black, with thickly folded perine.

(Fig. 5.1.12f).

Occasional, in evergreen forests.

Specimens studied: Chemmanoda, JA 13246 (KFRI, CALI); Paloda- way to Mlappara, N.C.Nair 70101 (MH); Mlappara, KPR 70003 (CALI).

**Asplenium serricula** Fee, Mem. Fam. Fough. 5: 196. 1852; Sledge, Bull. Bot. Mus. Nat. Hist. Bot. 3: 225. 1965; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 35. 1974; R.D.Dixit, Cens. Indian Pterid. 121. 1984; Manickam, Fern Fl. Palni Hills 102. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 16. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 222. pl. 169. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 532. 1992; Azeez et al., J. Econ. Tax. Bot. 20: 449. 1996; Subh.Chandra, Ferns India 276. 2000. **A. wightianum** Wall., List. No. 2215. 1830, nom. nud; Hook., Sp. Fil. 3: 105. t. 167. 1860; Bedd., Ferns South. India 43. pl. 126. 1864 & Handb. Ferns Brit. India 146. 1883.

Epiphytes, lithophytes or terrestrials. Rhizome 2 x 1 cm, erect. Scales 2-3.5 x 0.5-1.1 mm, brownish, clathrate, ovate, acuminate, rounded at base, margins fimbriate with club shaped glands. Fronds 25-30 x 5-12 cm, simply pinnate; stipe 10-15 cm, scaly at base, glabrous, polished above; lamina lanceolate in outline; pinnae 4-6 x 0.5-1.5 cm, coriaceous, lanceolate, sub acuminate to acute, crenate, serrate or lobed, cuneate at base, shortly stalked, terminal pinnae similar or sub similar. Sori 3-6 mm long, oblong, yellowish brown, indusia linear, translucent. Sporangial capsule 312.5 x 275 µm, subglobose, stalk 0.8-1 mm long. Spores 75 x 45 µm, yellowish, planoconvex or oblongoid with thickly folded perine, spinulose.

Occasional, in semi-evergreen and evergreen forests.

Specimens studied: Arjunankotta, JA 12887 (KFRI, CALI); Chavarkuzhi medu, near Thannikkudy, N.C.Nair 70184 (MH); Vellimala, KPR 18316 (KFRI, CALI); beside a stream- Vellimalai (Madurai district, TN), B.V. Shetty 10315 (MH).

**Asplenium tenerum** Forster f., Florul. Ins. Prodr. 80. 1786; Bedd., Handb. Ferns Brit. India 147. t. 74. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 36. 1974; R.D.Dixit, Cens. Indian Pterid. 121. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 16, 27. 1987; Manickam & Irud. Pterid. Fl. W. Ghats 222. pl. 170. 1992; Azeez et al., J. Econ. Tax. Bot. 20: 449. 1996; Subh.Chandra, Ferns India 277. 2000. **A. elongatum** Sw., Syn. Fil. 79. 1806; Bedd., Ferns South. India 75. pl. 224. 1864. **A. tenerum** var. **terminans** Mett., Abhandl. Seckemb. Naturforsch. Ges. 3: 113. 1859. **A. wightianum** var. **microphyllum** Bedd., Ferns South. India 44. pl. 127. 1864.

Terrestrials. Rhizome 2-3 x 1 cm, erect. Scales 2-2.5 x 0.5-1 mm, brownish-black, lanceolate, acuminate, clathrate, dark brown to black in the middle, paler along margins, entire. Fronds 15-20 x 2-4 cm, simply pinnate; stipe 6-10 cm long, scaly at the base, glabrous above; lamina elliptic-lanceolate in outline; pinnae 2-3 x 0.5-0.8 cm, oblong or lanceolate, acute in outline, serrate, unequally cuneate at base; terminal pinnae dissimilar, linear-long, lobed; veins forked in acroscopic lobe only, not reaching the margins. Sori 1.5-2 mm long, elliptic to linear on both halves, indusia linear translucent. Sporangial capsule 312.5 x 250 µm, subglobose, stalk 500 µm long. Spores 50 x 30 µm, yellowish, planoconvex with thick perine.

Occasional, in evergreen forests.

Specimen studied: Sabarimalathodu, JA 13206 (KFRI, CALI)

**Asplenium tenuifolium** D.Don, Prodr. Fl. Nepal. 8. 1825; Bedd., Ferns South. India 44. pl. 130. 1864 & Handb. Ferns Brit. India 159. t. 78. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 38. 1974; R.D.Dixit, Cens. Indian Pterid. 121. 1984; Manickam, Fern Fl. Palni Hills 94. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 16. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 223. pl. 171. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 529. 1992; Subh.Chandra, Ferns India 278. 2000.

Epiphytes or lithophytes. Rhizome 0.7-1 x 0.7-0.9 cm, erect. Scales 3-4 x 0.5-1 mm, dark brown, clathrate, ovate or linear-lanceolate, acuminate, basifixed, cordate at base, entire. Fronds 11 x 3.5 cm, bipinnate; stipe 3 cm long, glabrous; lamina 8 x 3 cm, lanceolate-acuminate in outline; primary pinnae

1.5 x 0.8 cm, alternate, ovate-acute or acuminate in outline; pinnules 5-6 x 2-3 mm, obovate or lanceolate in outline, deeply 2-4 lobed, lobes 4 x 1 mm, linear, acute, subfalcate, veins free, indistinct. Sori 1-2 x 0.2 mm, linear, indusia translucent, entire. Sporangial capsule 312.5 x 250 µm, subglobose, stalk 375 µm long. Spores 50 x 35 µm, black with laciniate perispore.

Occasional, in evergreen forests.

Specimens studied: Chemmanoda, *JA* 13244; Pachan pallam, *JA* 13211; Uppermanalar, *JA* 13225 & 13232; Vellimala, *KPR* 14602 (KFRI, CALI).

***Asplenium unilaterale*** Lam., *Encycl. Menth. Bot.* 2: 305. 1786; Bedd., *Handb. Ferns Brit. India* 152. 1883; B.K.Nayar & S.Kaur, *Comp. Bedd. Handb.* 37. 1974; Subh.Chandra, *Ferns India* 279. 2000. Manickam & Irud., *Pterid. Fl. W. Ghats* 212. pl. 160. 1992; B.K.Nayar & Geev., *Fern Fl. Malabar* 288. 1993; Azeez et al., 20: 450. 1996. ***A. resectum*** Sm., *Pl. Ic.* 3: t. 72. 1791. ***A. erythrocaulon*** Blume, *Enum. Pl. Jav.* 183. 1828.

Note: Fraser-Jenkins (1997) does not agree with any of the varieties of *A. unilaterale*. I prefer to treat them as separate varieties as keyed out below.

#### Key to the varieties

- 1. Indusia two ..... var. **bivalvatum**
- 1. Indusia single..... **2**
- 2. Pinnae acute or acuminate at apex ..... var. **majus**
- 2. Pinnae obtuse at apex..... var. **unilaterale**

***Asplenium unilaterale*** var. ***bivalvatum*** B.K.Nayar & Geev., *Fern Fl. Malabar* 292. 1993; Azeez et al., *J. Econ. Tax. Bot.* 20: 453. 1996; Subh.Chandra, *Ferns India* 279. 2000.

Terrestrials. Rhizome 10 cm long, creeping. Scales 2.5-3 x 0.9 mm, dark brown, ovate-lanceolate, acuminate, entire, cordate at base. Fronds 60-70 x 6-7 cm, simply pinnate; stipe 20-30 cm long, scaly at the very base, glabrous above; pinnae 4-5 x 1-1.3 cm, dimidiate, rhomboidal or oblong acute, crenate, progressively reduced, terminal pinnae irregularly lobed; veins forked. Sori 5-6 mm long, linear, yellowish brown, indusia two, linear, translucent. Sporangial

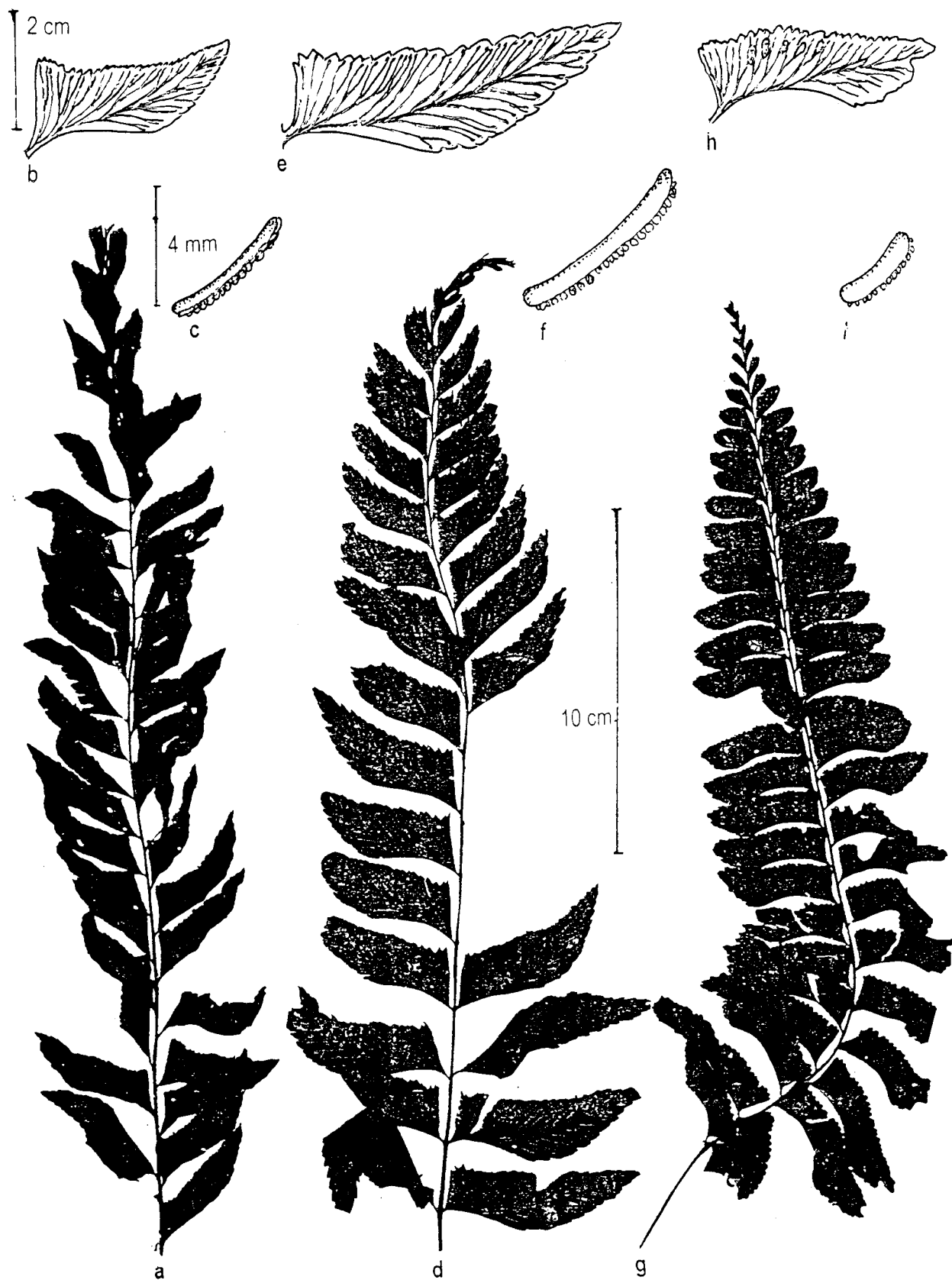


Fig. 5.1.13. *Asplenium unilaterale* a-c. var. *bivalvatum*: a. Habit, b. Pinna, c. Sorus, d-f. var. *majus*: d. Habit, b. Pinna, c. Sorus, g-i. var. *unilaterale*: g. Habit, h. Pinna, i. Sorus.



capsule 250 x 225  $\mu\text{m}$ , subglobose, stalk 250  $\mu\text{m}$  long. Spores 50 x 45  $\mu\text{m}$ , dark brown, ovoid to planoconvex with thick folded perine. (**Fig. 5.1.13a-c**).

Rare, in evergreen forests.

Specimen studied: Pachakkanam, JA 13284 (KFRI, CALI).

**Asplenium unilaterale** var. **majus** (C.Chr.) Sledge, Bull. Brit. Mus. Nat. Hist. Bot. 3: 246. 1965; R.D.Dixit, Cens. Indian Pterid. 122. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 17. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 213. pl. 161. 1992. **A. unilaterale** f. **majus** C.Chr., Bernice P. Bishop Mus. Bull. 177: 67. 1943. **A. resectum** Sm., Pl. Ic. 3: t. 72. 1791; Bedd., Ferns South. India 45. pl. 132. 1864. **A. unilaterale** Lam., *sensu* Bedd., Handb. Ferns Brit. India 152. 1883, p.p.

Terrestrials. Rhizome 15-20 x 0.7 cm, creeping. Scales 2.5 x 1 mm, ovate, acuminate, dark brown, entire. Fronds 30-77 x 10-13 cm, simply pinnate; stipe 10-25 cm long, dark brown to black, glossy, glabrous; lamina ovate-lanceolate in outline; pinnae 4-8 x 1.5 cm, coriaceous, parallelogram like in outline, acroscopic base truncate, basisopic base excised to one third, rest cuneate, margins serrate, apex acute or acuminate; veins indistinct above, distinct below, forked. Sori 5-7 mm, linear, dark brown, indusia single, translucent. Sporangial capsule 275 x 187.5  $\mu\text{m}$ , subglobose, stalk 375  $\mu\text{m}$  long. Spores 55 x 40  $\mu\text{m}$ , black, planoconvex with thickly folded perine. (**Fig. 5.1.13d-f**).

Occasional in densely shaded evergreen forests.

Specimens studied: Mlappara, KPR 70040 (CALI); Mlappara-Maddalamkotti, C.N.Mohanan 72809; Pamba to Ayyappan temple, N.C.Nair 50834; Poongavanam-Sabarimalai, N.C.Nair 70205 (MH).

**Asplenium unilaterale** var. **unilaterale**: Bedd., Handb. Ferns Brit. India 152. 1883; Manickam & Irud., Pterid. Fl. W. Ghats 212. pl. 160. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 531. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 288. 1993; Azeez et al., 20: 450. 1996.

Terrestrials. Rhizome 3-6 mm thick, creeping. Scales 2 x 0.5 mm, dark brown, lanceolate, acuminate. Fronds 20-45 x 7.5-8 cm, simply pinnate; stipe 9-15 x 0.2 cm long, dark brownish to black, hairy at the very base, polished, glabrous above; lamina lanceolate in outline; pinnae to 4 x 1.3 cm, subdimidiate, oblong, rounded in outline, serrate, truncate at apiscopic base, basiscopic half excised, coriaceous or subcoriaceous; veins forked once or twice. Sori 2-3 mm long, elliptic or oblong, dark brown; indusia single, translucent. Sporangial capsule 250 x 187.5  $\mu$ m, subglobose, stalk 500-625  $\mu$ m long. Spores 50 x 37.5  $\mu$ m, dark brown to black, planoconvex to reniform with thickly folded perine, spinulose. (**Fig. 5.1.13 g-i**)

Rare, in semi-evergreen and evergreen forests.

Specimens studied: Karadikkavala, *KPR* 70120 (CALI); Sabarimalai slopes, *B.D. Sharma* 42058 (MH); Ummikkuppan, *JA* 12820; Vellimala, *KPR* 18312 (KFRI, CALI).

***Asplenium yoshinagae*** Makino subsp. ***indicum*** (Sledge) Fraser-Jenk., Bot. Helvetica 102: 155. 1992 & New Sp. Syndr. Indian Pterid. 48. 1997. ***A. indicum*** Sledge, Bull. Brit. Mus. Nat. Hist. Bot. 3: 264. 1965; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 37. 1974; Manickam, Fern Fl. Palni Hills 101. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 17. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 215. pl. 163. 1992; Azeez et al., J. Econ. Tax. Bot. 20: 445. 1996. ***A. planicaule*** Wall. ex Mett., Abhandl. Sencker. Naturforsch Gen. 3: 201. 1859; Bedd., Ferns South. India 47. pl. 139. 1864, non Lowe, 1858. ***A. laciniatum*** sensu Bedd., Handb. Ferns Brit. India 154. 1883, p.p., non D.Don, 1825. ***A. yoshinagae*** Makino, Phan. Pterid. Jap. Ic. 111: pl. 64. 1960; N.C.Nair et al., J. Econ. Tax. Bot. 16: 533. 1992. ***A. yoshinagae*** Makino var. ***planicaule*** (Wall. ex Mett.) Morton, Contr. U.S. Nat. Herb. 38: 227. 1973; Subh.Chandra, Ferns India 281. 2000. ***Asplenium yoshinagae*** Makino var. ***indicum*** (Sledge) Ching & S.K.Wu in S.K.Wu, Fl. Xizangica 1: 182. 1983.

Terrestrials. Rhizome 1.5 x 1.5 cm, erect. Scales 4-6 x 0.5 mm, dark brown, lanceolate-acuminate, basifixed, clathrate, entire. Fronds 12-40 x 3.5-5 cm, simply pinnate; stipe 3-6 cm long, scaly; lamina lanceolate-acuminate in outline; pinnae 2-3 x 0.5-1 cm, lanceolate-acute or rhomboidal, lobed and

serrated, coriaceous, cuneate at base, shortly stipitate; veins free forking. Sori linear, 4-7 mm, dark brown, indusia paler. Sporangial capsule 250 x 250  $\mu\text{m}$ , globose, stalk 300  $\mu\text{m}$  long. Spores 55 x 37.5  $\mu\text{m}$ , black, planoconvex with thickly folded perine.

Occasional, in evergreen forests.

Specimens studied: Pachakkanam, JA 12803 (KFRI, CALI); Maddalamkotti, C.N.Mohanan 72802 (MH); Vellimala, KPR 62894 (CALI).

**Asplenium zenkeranum** Kunze, Linnaea 24: 259. 1851; Bedd., Handb. Ferns Brit. India 148. t. 75. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 36. 1974; R.D.Dixit, Cens. Indian Pterid. 122. 1984; Manickam, Fern Fl. Palni Hills 95. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 16. 1987; Singh & Bir, Indian Fern J. 6: 273. 1989; Manickam & Irud., Pterid. Fl. W. Ghats 214. pl. 162. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 532. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 295. 1993; Azeez et al., J. Econ. Tax. Bot. 20: 454. 1996; Subh.Chandra, Ferns India 282. 2000. **A. persicifolium** Hook., Sp. Fil. 3: 109. 1860; Bedd., Ferns South. India 44. pl. 128. 1864.

Terrestrials. Rhizome 4 x 1.5 cm, creeping. Scales 3-4 x 1 mm, brownish, clathrate, lanceolate, margins fimbriate with glandular hairs. Fronds 85-90 x 30-32 cm, simply pinnate; stipe 37-40 cm long, scaly beneath, sparsely above; lamina lanceolate in outline; pinnae 15 x 2.8 cm, lanceolate, long-acuminate, crenulate, coriaceous, veins forked near the costa, veinlets again forked, not reaching the margin; terminal pinna smaller, gemmiparous. Sori 5-7 mm long, linear, reddish brown; indusia linear, paler. Sporangial capsule 250 x 250  $\mu\text{m}$ , globose, stalk 625-750  $\mu\text{m}$  long. Spores 55 x 50  $\mu\text{m}$ , yellowish, elliptic or planoconvex with thickly folded perine.

Rare in evergreen forests.

Specimens studied: Kalvarithodu, JA 13208 (KFRI, CALI); Vellimalai-Pachakumatchi (Madurai district, TN), K. Subramanyam 9492 (MH).

## ATHYRIACEAE

Alston, Taxon 5: 25. 1956.

### Key to the genera

1. Sori circular, indusia fugacious ..... 2
1. Sori linear or reniform indusia persistent ..... 3
2. Lamina simply pinnate; veins anastomosing... **Anisocampium**
2. Lamina bipinnate; veins free ..... **Deparia p.p.**
3. Sori hooked ..... **Athyrium**
3. Sori linear ..... 4
4. Fronds pubescent, atleast along the veins ..... **Deparia p.p.**
4. Fronds glabrous ..... **Diplazium**

### ANISOCAMPIUM C.Presl

Epim. Bot. 58. 1851.

**Anisocampium cummingianum** C.Presl, Epim. Bot. 59. 1849; R.D.Dixit, Cens. Indian Pterid. 125. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 10. 1987; Manickam & Irud. Pterid. Fl. W. Ghats 231. pl. 178. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 516. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 185. 1993; Subh.Chandra, Ferns India 121. 2000. **Pleocnemia aristata** Bedd., Ferns South. India 284. pl. 83. 1863, nom. illeg. **Nephrodium otaria** (Kunze ex Mett.) Baker in Hook. & Baker, Syn. Fil. 288. 1867; Bedd., Handb. Ferns Brit. India 267. t. 137. 1883. **Athyrium cummingianum** (C.Presl) Milde, Bot. Zeit. 353. 1870.

Terrestrials. Rhizome 7 x 0.5 cm, creeping. Scales 4-5 x 1-1.2 mm, lanceolate, acuminate, entire, pale brown. Fronds 30-40 x 20-24 cm, simply pinnate; stipe 20-25 cm long, scaly beneath, glabrous, polished above, grooved; lamina elliptic, acuminate in outline; pinnae 10-12.5 x 2-3 cm, shortly stalked, coriaceous, elliptic-lanceolate, acuminate, lobed to serrate; lobes serrulate; costa grooved above, bi-grooved below; veins indistinct above, raised below, parallel with occasionally uniting veinlets. Sori 0.5-1 mm in diameter, dark-brown. Sporangial capsule 250 x 187.5 µm, subglobose, stalk 375 µm long. Spores 50 x 37.5 µm, dark brown, ellipsoid with thickly folded perine.

Occasional, in semi-evergreen and evergreen forests.

Specimens studied: Karadikkavala, *KPR* 70126 (CALI); Pamba to Ayyappan temple, *N.C.Nair* 56833 (MH).

Note: Kato and Kramer (in Kramer & Green, 1990) included *Anisocampium* in *Athyrium*. But many later workers do not agree with this (Hasebe, *pers. Comm.*, 2000; Lellinger, *pers. comm.*, 2000; Sano *et al.*, 2000).

### ATHYRIUM Roth

Tent. Fl. Germ. 3: 58. 1799.

Terrestrial herbs. Rhizome erect. Scales yellowish-brown, non-clathrate, lanceolate, entire. Fronds simply pinnate or bipinnatifid, subcoriaceous or membranous; veins free. Sori linear-hooked, indusia entire. Sporangial capsule subglobose, stalk longer than capsule. Spores yellowish-brown, planoconvex to reniform with thickly folded perine.

#### Key to the species

1. Pinnae auricled at base ..... **A. falcatum**
1. Pinnae not auricled ..... **2**
2. Lower pairs of pinnae reduced ..... **A. hohenackerianum**
2. Lower pair of pinnae not reduced ..... **A. lanceum**

**Athyrium falcatum** Bedd., Ferns South. India 51. pl. 151. 1864 & Handb. Ferns Brit. India 164. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 40. 1974; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 18. 1987; N.C.Nair et al., J. Econ. Tax. Bot. 16: 509. 1992; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 58. 1997; Subh.Chandra, Ferns India 126. 2000. **A. drepanophyllum** Bedd., Suppl. Handb. Ferns Brit. India 32. 1892. **Athyrium x keralensis** Manickam & Irud., Pterid. Fl. W. Ghats 238. pl. 185. 1992. **A. puncticaule** sensu Manickam & Irud. Pterid. Fl. W. Ghats 234. pl. 180. 1992, non T.Moore, 1860.

Terrestrials. Rhizome 2.5 x 3 cm, erect. Scales 4 x 1 mm, lanceolate, acuminate, yellowish brown, non-clathrate, entire. Fronds 15-20 x 3-4 cm, simply pinnate; stipe 3-7 cm, long, scaly beneath; lamina lanceolate in outline, narrowed at both ends; pinnae to 1.5 x 1 cm, ovate, lanceolate, lobed, acute, lobes crenate, subcordate at base, auricled, veins forked once or twice. Sori 1.5-2 mm, linear, reddish brown, indusia, entire, confluent at maturity.

Sporangial capsule 375 x 250  $\mu\text{m}$ , subglobose, stalk 375  $\mu\text{m}$  long. Spores 50 x 37.5  $\mu\text{m}$ , yellowish to black, planoconvex with thickly folded perine.

Occasional, in grasslands on wet cuttings.

Specimens studied: Mangaladevi, JA 12816; Pachakkanam, JA 13281 (KFRI, CALI).

**Athyrium hohenackerianum** (Kunze) T.Moore, Ind. Fil. 49. 1857; Bedd., Ferns South. India 50. pl. 150. 1864 & Handb. Ferns Brit. India 163. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 40. 1974; R.D.Dixit, Cens. Indian Pterid. 127. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 18. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 233. pl. 179. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 310. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 187. 1993; Subh.Chandra, Ferns India 128. 2000. **Asplenium hohenackerianum** Kunze, Bot. Zeit. 771. 1849. **Allantodia hohenackeriana** Kunze, Farnkr. 2: 63. t. 126. 1850.

Terrestrials. Rhizome 3 x 1.5 cm, erect. Scales 6-8 x 0.5-1 mm, dark brown, lanceolate, linear, yellowish. Fronds 12-32 x 3.5-4 cm, simply pinnate, stipe 2-12 cm long, densely scaly; lamina elliptic-lanceolate in outline; pinnae 2.5-3 x 0.7-1 cm, linear lanceolate, lobed to serrate, cuneate at base, acute to sub acuminate at apex, subcoriaceous, progressively reduced to both ends, veins forking once or twice. Sori linear 1-1.5 mm long, linear, reddish brown. Sporangial capsule 312.5 x 250  $\mu\text{m}$ , subglobose, stalk 375  $\mu\text{m}$  long. Spores 50 x 45  $\mu\text{m}$ , yellow, planoconvex to reniform with thickly folded perine.

Common, in moist deciduous, semi-evergreen and evergreen forests.

Specimens studied: Kottamala, JA 13275; Vellimala, JA 12847 (KFRI, CALI).

**Athyrium lanceum** (Kunze) T.Moore, Ind. Fil. 185. 1860; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 18. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 238. pl. 184. 1992; Subh.Chandra, Ferns India 129. 2000. **Aspidium lanceum** Kunze, Bot. Zeit. 1846: 473. 1846. **Athyrium macrocarpum** (Blume) Bedd., Ferns South. India 51. pl. 153. 1864, excl. pl. 152. **A. anisopterum** C.Chr., Bull. Herb. Boiss. 6: 962. 1898; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 40. 1974; R.D.Dixit, Cens. Indian Pterid. 127. 1984.

Terrestrials. Rhizome 3 x 1.5 cm, short creeping, densely scaly. Scales 6 x 1 mm, pale brown, lanceolate, entire. Fronds 19 x 4 cm, simply pinnate; stipe 7-8 cm long, densely scaly beneath, sparsely above, grooved; lamina ovate-lanceolate in outline; pinnae 2.3 x 1.5 cm, membranous, ovate or elliptic, obtuse, deeply lobed nearly to costa, lobes to 6 x 6 mm, ovate or oblong, crenulate; pinnae cuneate at base, basiscopic base unequal; costa slightly grooved above, raised below, veins free, pinnate, forked, distinct below. Sori 1.5-2 mm long, linear or reniform, dark brown on veins. Sporangial capsule 312.5 x 250  $\mu$ m, subglobose, stalk 375  $\mu$ m long. Spores 52.5 x 45  $\mu$ m, planoconvex with thickly folded perine.

Rare, in evergreen forests.

Specimen studied: Vellimala, JA 13267 (KFRI, CALI).

### DEPARIA Hooker & Greville

lc. Fil. Pl. 154. 1829.

Terrestrial herbs with long creeping rhizome, densely covered with brown, lanceolate, acuminate scales. Fronds uni or bipinnate, elliptic or rhomboidal in outline, hairy. Sori circular or linear with persistent or fugacious indusia. Sporangial capsule subglobose with long stalk. Spores planoconvex, dark brown to black.

#### Key to the species

1. Fronds bipinnate; sori circular, indusia fugacious ..... **D. boryana**

1. Fronds simply pinnate; sori linear, indusia persistent ... **D. petersenii**

**Deparia boryana** (Willd.) M.Kato, Bot. Mag. Tokyo 90: 36. 1977; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 102.1997; Subh.Chandra, Ferns India 145. 2000. **Aspidium boryanum** Willd. in L., Sp. Pl. ed. 4, 5: 285. 1810. **A. divisum** Wall., List. No. 393. 1829. **Lastrea boryana** (Willd.) T.Moore, Ind. Fil. 86. 1858; Bedd., Handb. Ferns Brit. India 266. 1883. **L. divisa** (Wall.) Bedd., Ferns South. India 35. pl. 97. 1863. **Phegopteris kingii** Bedd., Suppl. Ferns Brit. India 84. 1892. **Athyrium boryanum** (Willd.) Tagawa, Acta Phytotax. Geobot. 4: 144. 1935; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 64, 73. 1974; Subh.Chandra & S.Kaur, Nomen Guide Bedd. 12. 1987. **Dryothyrium boryanum** (Willd.)

Ching, Bull. Fan Mem. Inst. Biol. Bot. 11: 81. 1941; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 64, 74. 1974; R.D.Dixit, Cens. Indian Pterid. 135. 1984; Manickam, Fern Fl. Palni Hills 108. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 230. pl. 177. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 516. 1992.

Terrestrials. Rhizome 2 cm thick, creeping. Scales 8-9 x 2-3 mm, oblong-lanceolate, acuminate, entire. Fronds 60-75 x 30-36 cm; stipe 30-35 cm, scaly at the base, smooth above; lamina rhomboid in outline, bipinnate; primary pinnae 13-17 x 5-6 cm, elliptic-lanceolate in outline, larger pinnae in the middle, reduced towards apex; secondary pinnae 3-3.5 x 1-1.5 cm, elliptic-oblong, rounded in outline, deeply lobed; lobes oblong-truncate, serrulate, base of pinnae winged, veins indistinct, free. Sori circular, dark brown, 0.5 mm in diameter, indusia caducous. Sporangial capsule 250 x 187.5  $\mu$ m, subglobose, stalk 250  $\mu$ m long. Spores 50 x 37.5  $\mu$ m, dark brown to black, ellipsoid, thickly tubercled.

Occasional, in semi-evergreen and evergreen forests.

Specimens studied: Mlappara, *KPR* 70019 & 70025 (CALI); Mlappara estate slopes, *N.C.Nair* 70125; Aruna estate (Madurai district, TN), *K. Subramanyam* 9476 (MH).

Note: Many authors (Kato, 1990; Fraser-Jenkins, 1997, etc) did not recognise *Dryoathyrium* as a separate genus, but is placed under *Deparia*. Molecular data analyses (Hasebe *et al.*, 1995; Sano *et al.*, 2000) also support Kato's (1990) concept of placing it under *Deparia*, which is followed in this treatment.

***Deparia petersenii*** (Kunze) M.Kato, Bot. Mag. Tokyo 96. 1977; Manickam & Irud., Pterid. Fl. W. Ghats 239. pl. 186. 1992; Subh.Chandra, Ferns India 147. 2000. ***Asplenium petersenii*** Kunze, Anal. 24. 1837. ***Asplenium japonicum*** Thunb., Fl. Jap. 334. 1784. ***Diplazium japonicum*** (Thunb.) Bedd., Ferns Brit. India Suppl. 12. 1876 & Handb. Ferns Brit. India 180. 1883; B.K.Nayar & Geev., Fern Fl. Malabar 198. 1993. ***D. lasiopteris*** Kunze, Linnaea 17: 565. 1843; Bedd., Ferns South. India 53. pl. 160. 1864; N.C.Nair et al., J. Econ. Tax. Bot. 16: 507. 1992. ***D. thwaitesii*** (A.Br. & Mett.) Klotzsch ex T.Moore, Ind. Fil. 339. 1862; Bedd., Ferns Brit. India t. 291. 1868. ***D. decussatum*** Bedd., Ferns Brit. India t. 292. 1868. ***Athyrium japonicum*** (Thunb.) Copel., Philip. J. Sci. 3: 290.



1908; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 44. 1974; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 19. 72. 1987. *Lunathyrium japonicum* (Thunb.) Sa.Kurata, J. Geobot. 9: 99. 1961; R.D.Dixit, Cens. Indian Pterid. 136. 1984; Manickam, Fern Fl. Palni Hills 109. 1986.

Terrestrials. Rhizome 6-8 mm thick, creeping. Scales 6-8 x 1.5-2 mm, deep brown, lanceolate, acuminate, entire. Fronds 60-70 x 25-28 cm, elliptic in outline, simply pinnate; stipe 25-28 cm long, densely scaly beneath, sparsely above; rachis and pinnae sparsely hairy; lamina elliptic in outline; pinnae 12-13 x 2.5-3 cm, elliptic or oblong, lanceolate, acuminate, deeply lobed nearly to costa, lobes 1-1.5 x 0.5-0.6 cm, obliquely oblong, rounded, serrulate, larger lobes in the middle; pinnae sparsely stiff hairy above; veins free. Sori 2-3 mm, linear, reddish brown, indusia brownish, laciniate. Sporangial capsule 187.5 x 125 µm, subglobose, stalk 125 µm long. Spores 50 x 37.5 µm, dark brown, planoconvex with thickly folded perine.

Common, in evergreen forests.

Specimen studied: Maddalamkottithodu, JA 13231 (KFRI, CALI).

### DIPLAZIUM Swartz

Schrad. J. Bot. 1800: 61. 1801.

Terrestrial herbs. Rhizome erect or creeping. Scales linear-lanceolate, non-clathrate, entire or fimbriate. Fronds simple, bi or tripinnate. Stipe smooth or muricate. Lamina elliptic acuminate to rhomboidal or deltoid in outline. Veins usually free, at times anastomosing. Sori linear, along the veins, indusia translucent. Sporangial capsule subglobose, stalk equals or longer than capsule. Spores yellowish to brown, planoconvex to reniform with thick or thin perine, spinulose or not.

#### Key to the species

1. Veins anastomosing ..... **D. esculentum**
1. Veins free ..... **2**
2. Fronds simply pinnate ..... **D. sylvaticum**
2. Fronds bi or tripinnate ..... **3**
3. Rhizome creeping..... **D. cognatum**
3. Rhizome erect..... **4**
4. Pinnules oblong-lanceolate..... **D. brachylobum**
4. Pinnules elliptic-acuminate ..... **D. travancoricum**

**Diplazium brachylobum** (Sledge) Manickam & Irud., Indian Fern J. 7: 54. 1990; Pterid. Fl. W. Ghats 252. pl. 196. 1992; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 115. 1997; Subh.Chandra, Ferns India 149. 2000. **D. polypodioides** Blume var. **brachylobum** Sledge, Bull. Brit. Mus. Nat. Hist. Bot. 2: 307. 1962 & Bot. J. Linn. Soc. 84: 17. 1982. **D. sp. b** Manickam, Fern Fl. Palni Hills 119. 1986.

Terrestrials. Rhizome 6-15 x 4 cm, erect. Scales 10-20 x 2-3 mm, yellowish to deep brown, lanceolate, acuminate, toothed. Fronds 150-200 x 40-65 cm, bipinnate; stipe 55-150 cm long, scaly beneath, polished above, muricate; lamina deltoid in outline; primary pinnae 30-40 x 15-20 cm, elliptic-lanceolate, acuminate in outline; pinnules 8-10 x 2-2.4 cm, coriaceous, oblong-lanceolate, acuminate, lobed to the middle, lobes to 8 x 7 mm, oblong, rounded, crenulate, reducing towards apex; veins free. Sori 3-4 mm, linear, reddish brown, indusia brownish entire. Sporangial capsule 250 x 225 µm, subglobose, stalk 250 µm long. Spores 150 x 150 µm including thickly folded perine, yellowish, planoconvex to reniform.

Rare, in evergreen forests.

Specimens studied: Mlappara, KPR 70016 (CALI); Sabarimalai slopes, B.D. Sharma 42025 (MH); Vellimala, KPR 18344 (KFRI, CALI).

**Diplazium cognatum** (Hieron.) Sledge, Bull. Brit. Mus. Nat. Hist. Bot. 2: 308. t. 31. f. 18. 1962; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 72. 1987; Manickam & Irud., Indian Fern J. 7: 54. 1990; Pterid. Fl. W. Ghats 246. pl. 170. 1992; Subh.Chandra, Ferns India 149. 2000. **Athyrium cognatum** Hieron., Hedwigia 59: 321. 1917. **Diplazium assimile** Bedd., Ferns Brit. India pl. 294. 1860, p.p., non **Asplenium assimile** Endl., 1833. **A. umbrosum** var. **assimile** Baker in Hook. & Baker, Syn. Fil. 2: 489. 1874, p.p. quoad ref. Bedd. et specim. ex Sri Lanka; non **A. assimile** Endl. **Athyrium assimile** sensu Bedd., Suppl. Ferns S. India 12. 1876, non C.Presl. **Diplazium umbrosum** var. **assimile** Bedd., Handb. Ferns Brit. India 190. 1883, p.p., non **Asplenium assimile** Endl.

Terrestrials. Rhizome 4-6 x 3 cm, short creeping. Scales 10-12 x 1-1.2 mm, dark brown to black, linear acuminate, entire. Fronds 90-130 x 65-70 cm, bipinnate; stipe 30-50 cm long, densely scaly below, polished, glabrous above;

lamina deltoid in outline; primary pinnae 34 x 5-8 cm, alternate, elliptic-lanceolate, acuminate, deeply lobed, lobes to 1.5 x 0.8 cm, oblong, rounded, serrate towards the distal half; costa prominent, raised above and below, veins simple. Sori to 9 mm long, deep brown, linear, indusia entire, translucent. Sporangial capsule 250 x 187.5  $\mu\text{m}$ , subglobose, stalk 250  $\mu\text{m}$  long. Spores 45 x 30  $\mu\text{m}$ , dark brown, planoconvex to reniform, densely spinous.

Common, in evergreen forests.

Specimens studied: Mlappara, *KPR* 70028 (CALI); Vellimala, *KPR* 18318 (KFRI, CALI); *KPR* 62896.

**Diplazium esculentum** (Retz.) Sw., Schrad. J. Bot. 1800(2): 312. 1803; Bedd., Handb. Ferns Brit. India 192. t. 94. 1883; Subr. et al., Bull. Bot. Surv. India 3: 212. 1961; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 46. 1974; R.D.Dixit, Cens. Indian Pterid. 132. 1984; Manickam & Irud., Pterid. Fl. W. Ghats 242. pl. 187. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 506. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 195. 1993; Madhus. & Rejani, Indian Fern J. 11: 15. 1994; Subh.Chandra, Ferns India 151. 2000. **Hemionitis esculenta** Retz., Obs. Bot. 6: 38. 1791. **Anisogonium esculentum** C.Presl, Tent. Pterid. 116. 1836; Bedd., Handb. Ferns Brit. India 192. t. 94. 1883. **Callipteris esculenta** Js.Sm. in T.Moore & Houlston, Gard. Mag. Bot 3: 265. 1851; Bedd., Ferns South. India 54. pl. 164. 1863. **Para Panna Maravara** Rheede, Hort. Malab. 12: 31. t. 15. 1693. **Kari-Welli-Panna-Parvara** Rheede, Hort. Malab. 12: 35. t. 17. 1693.

Terrestrials. Rhizome 5-10 x 2-4 cm, erect. Scales 5-7 x 1-1.2 mm, lanceolate, acuminate, entire or rarely fimbriate, dark brown, membranous. Fronds 1.5-2 x 0.6-0.8 m, bipinnate; stipe 0.8-1 m long, polished above, grooved; lamina rhomboid in outline, rachis grooved; pinnae 22-30 x 10-15 cm, elliptic-lanceolate, acuminate in outline, pinnae towards distal part lanceolate-acuminate, lobed to serrate; costa grooved above, raised below; pinnules 5-8 x 1-2 cm, lanceolate, acuminate, lobed to serrate, lobes oblong, retuse, serrulate, base of pinnules truncate, basal pinnules stipitate, upper sessile, progressively reduced towards apex, terminal pinnae exceptionally larger; costules grooved above, raised below, veins pinnate, indistinct above, raised below, anastomosing. Sori 3.5 mm long, dark brown, linear, along veins, indusia



Fig. 5.1.14. *Diplazium esculentum* a. Habit, b. An enlarged view of part of fertile pinnae, c. Habit of simple pinnate form.

brownish. Sporangial capsule 312.5 x 250 µm, subglobose, stalk 375 µm long. Spores 37.5 x 30 µm, yellowish, ellipsoid, monolete, granulose. (**Fig. 5.1.14a-c**).

Common, along streamlets and marshy places in moist deciduous and semi-evergreen forests.

Specimens studied: Anjuruli-Thekkady, *B.D. Sharma* 42401 (MH); Karadikkavala, *KPR* 70127 (CALI); Thannikkudy, *JA* 12845 (KFRI, CALI).

Note: Plants with simply pinnate fronds were seen when growing under dense shaded condition as described by Irudayaraj (1998).

**Diplazium sylvaticum** (Bory) Sw., Syn. Fil. 92. 1806; Bedd., Ferns South. India 53. pl. 161. 1864 & Handb. Ferns Brit. India 177. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 43. 1974; R.D.Dixit, Cens. Indian Pterid. 135. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 19. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 243. pl. 188, 189. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 507. 1992; Subh.Chandra, Ferns India 158. 2000. ***Callipteris sylvatica*** Bory, Voy. Mers. Alf. 1: 282. 1804.

Terrestrials. Rhizome 2 x 1.5 cm, erect. Scales 5-9 x 1-1.2 mm, reddish-brown to black, linear-lanceolate, toothed along the margins. Fronds 30-50 x 15-30 cm, simply pinnate; stipe 18-21 cm long, scaly when young, glabrous at maturity; lamina ovate, acuminate in outline; pinnae 10-13 x 2-4 cm, coriaceous, oblong-lanceolate, acuminate, serrate to lobed, lobes crenate, unequally sub cordate at base, basiscopic base auricled, acroscopic base truncate, stipitate, terminal pinnae larger; costa prominent above and below, grooved, veins free or forked once. Sori 8-10 mm long. Sporangial capsule 275 x 250 µm, globose, stalk 250 µm long. Spores 45 x 30 µm, planoconvex with lacinate perispore.

Occasional, in evergreen forests.

Specimen studied: Vellimala, *KPR* 18319 (KFRI, CALI).

**Diplazium travancoricum** Bedd., Handb. Ferns Brit. India 188. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 45. 1974; R.D.Dixit, Cens. Indian Pterid. 135. 1984; Manickam, Fern Fl. Palni Hills 117. 1986; Manickam & Irud.,

Pterid. Fl. W. Ghats 249. pl. 194. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 508. 1992; Subh.Chandra, Ferns India 159. 2000. ***Asplenium travancoricum*** (Bedd.) Baker, Ann. Bot. 5: 310. 1891.

Terrestrials. Rhizome 10 x 5 cm, erect. Scales 15-20 x 2-3 mm, dark brown, linear-lanceolate, toothed. Fronds 100-150 x 70-90 cm, bipinnate; stipe 40-50 cm; lamina deltoid in outline; primary pinnae 28 x 8 cm, coriaceous, oblong-lanceolate, acuminate, pinnate to pinnatifid, distal part deeply lobed; pinnules to 5-10 x 2.5-3 cm, elliptic-acuminate, serrulate, base truncate, sessile, joined to the rachis; veins free or forked once. Sori 8-10 mm long, reddish-brown, linear; indusia deep brown. Sporangial capsule 275 x 225 µm, subglobose, stalk 375 µm long. Spores 65 x 50 µm, yellowish, planoconvex to reniform with thin, folded perine.

Rare, in evergreen forests.

Specimens studied: Chokkampatti, *KPR* 14690 & 14863; Vellimala, *KPR* 18324 (KFRI, CALI).

## DRYOPTERIDACEAE

Ching, Acta Phytotax. Sin. 10: 1. 1965.

### Key to the genera

1. Pinnule thick coriaceous, with sharp serration ..... **Arachniodes**
1. Pinnules subcoriaceous, without sharp serration ..... **2**
2. Acroscopic base of pinnae auricled ..... **Polystichum**
2. Acroscopic base of pinnae not auricled ..... **3**
3. Veins anastomosing or at least basal veinlets anastomosing ..... **Tectaria**
3. Veins not anastomosing ..... **Dryopteris**

## ARACHNIODES Blume

Enum. Pl. Jav. 241. 1828.

Terrestrial herbs. Rhizome erect or creeping. Scales golden yellowish to dark brown. Fronds deltoid in outline, bi or tripinnate; pinnules thick coriaceous, serrate. Sori circular on vein endings, dark brown. Sporangial capsule globose or subglobose, dark brown. Spores dark brown, planoconvex with perine.

**Key to the species**

1. Fronds bipinnate ..... **A. aristata**  
 1. Fronds tripinnate ..... **A. tripinnata**

**Arachniodes aristata** (G.Forst.) Tindale, Contr. N. S. Wales Nat. Herb. 3: 89. 1961; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 55. 1974; Sledge, Bot. J. Linn. Soc. 84: 19. 1982; R.D.Dixit, Cens. Indian Pterid. 147. 1984; Manickam, Fern Fl. Palni Hills 134. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 12. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 274. pl. 211. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 511. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 203. 1993; Subh.Chandra, Ferns India 162. 2000. **Polypodium aristatum** G.Forst., Prod. 82. 1786. **Lastrea aristata** T.Moore, Ind. Fil. 85. 1857; Bedd., Ferns South. India 36. pl. 101. excl. f. A. 1863 & Handb. Ferns Brit. India 229. 1883. **Polystichopsis aristata** (G.Forst.) Holttum, Rev. Fl. Malaya 2: 286. 1954; Subr. et al., Bull. Bot. Surv. India 3: 212. 1961.

Terrestrials. Rhizome 4 x 4 cm, erect, densely scaly. Scales 2.5 x 0.2 cm, golden-yellowish to brown, lanceolate-linear, entire. Fronds 77 x 22 mm, triangular in outline, bipinnate; stipe 43 cm long, densely scaly at base, hispid above, grooved; pinnae 12 x 3 cm, elliptic-lanceolate, acuminate in outline, 13–15 pairs, alternate; rachis hispid, costa grooved, sparsely above, pubescent, raised below, hispid; pinnules to 1.5 x 0.7 cm, coriaceous, elliptic, acute, serrate, auricled at basisopic base, cuneate at acroscopic base; costule and veins raised on both sides; veins forking once or twice, ending in a swollen tip; pinnules progressively reduced towards both ends; terminal pinnae linear, acuminate. Sori circular on vein endings, dark brown, indusia 1 x 1 mm, reniform, dark brown, caducous. Sporangial capsule 250 x 250 µm, globose, stalk 437.5 µm long. Spores 45 x 30 µm, dark brown, oblongoid to reniform, spinous or baculate, with thickly folded perine.

Occasional, in semi-evergreen and evergreen forests.

Specimens studied: Anjuruli, *KPR* 70119 (CALI); Kumarikulam, *N.C.Nair* 70167 (MH).

**Arachniodes tripinnata** (Goldm.) Sledge, Bull. Brit. Mus. Nat. Hist. Bot. 5: 41. 1973; R.D.Dixit, Cens. Indian Pterid. 148. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 67. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 273. pl. 210. 1992; Subh.Chandra, Ferns India 166. 2000. **Polystichum tripinnatum** Goldm., Nova Acta Acad. Caesar Leop. Carol 19. Suppl. 1: 463. 1843. **Lastrea conifolia** T.Moore, Ind. Fil. 88. 1857; Bedd., Ferns Brit. India t. 261, excl. f. sinist. Sup. 1866, *p.p.* & Handb. Ferns Brit. India 230. pl. 118. 1883, non **Aspidium conifolium** Wall., List No. 341. 1829, nom. nud. **Arachniodes conifolia** (T.Moore) Ching, Acta. Bot. Sin. 10: 257. 1962; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 55. 1974; N.C.Nair et al., J. Econ. Tax. Bot. 16: 310. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 204. 1993.

Terrestrials. Rhizome 4-6 x 4 cm, erect, densely scaly. Scales 20-25 x 2-2.5 mm, dark brown, glossy, lanceolate, acuminate, entire. Fronds 70-90 x 30-50 cm; stipe 35-45 cm long, densely scaly at base, polished above, grooved; lamina deltoid in outline, tripinnate; primary pinnae to 20 x 14 cm, rhomboid in outline, 15 pairs, stipitate, hairy at the junction to rachis; secondary pinnae to 11 x 2.5 cm, lanceolate-acuminate in outline, 15-18 pairs; hairy at the base; tertiary pinnae to 2.5 x 1 cm, lanceolate, acuminate in outline 15-18 pairs, pinnules to 1 x 0.5 cm, elliptic, rounded to acute, lobed, serrate, cuneate at base, coriaceous; pinnae and pinnules progressively reduced towards apex, terminal pinnules linear lobed; rachis, costa and costules grooved above, raised below, veins indistinct. Sori dark brown, indusia reniform. Sporangial capsule 312.5 x 250  $\mu\text{m}$ , subglobose, stalk 437.5  $\mu\text{m}$  long. Spores 50 x 37.5  $\mu\text{m}$ , brownish, ellipsoid or planoconvex with thinly folded perine.

Common, in evergreen forests.

Specimens studied: Mlappara, JA 12829 (KFRI, CALI); KPR 70001 (CALI); Vellimala, KPR 13298 & 18321 (KFRI, CALI).



**DRYOPTERIS** Adanson

Fam. Plants 2: 20. 551. 1763.

Terrestrial herbs. Rhizome erect or creeping. Scales brown, ovate or linear-lanceolate, entire. Fronds simple or bipinnate, dimorphic or similar. Sori circular or reniform, yellowish brown to dark brown, indusia reniform, peltate. Sporangial capsule globose or subglobose, yellowish or brown. Spores yellowish to dark brown, planoconvex.

**Key to the species**

- 1. Fronds simply pinnate ..... **D. hirtipes**
- 1. Fronds bipinnate ..... **2**
- 2. Rhizome short creeping; fronds dimorphic ..... **D. cochleata**
- 2. Rhizome erect; fronds not dimorphic ..... **D. sparsa**

**Dryopteris cochleata** (D. Don) C. Chr., Ind. Fil. 258. 1905; Subr. et al., Bull. Bot. Surv. India 3: 212. 1961; B.K. Nayar & S. Kaur, Comp. Bedd. Handb. 60. 1974; R.D. Dixit, Cens. Indian Pterid. 150. 1984; Manickam, Fern Fl. Palni Hills 137. 1986; Subh. Chandra & S. Kaur, Nomen. Guide Bedd. 14. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 279. pl. 215. 1992; N.C. Nair et al., J. Econ. Tax. Bot. 16: 513. 1992; B.K. Nayar & Geev., Fern Fl. Malabar 207. 1993; Subh. Chandra, Ferns India 173. 2000. **Nephrodium cochleatum** D. Don., Prod. Fl. Nepal. 6. 1825. **Lastrea cochleata** (D. Don) T. Moore, Ind. Fil. 88. 1858; Bedd., Ferns South. India 39. pl. 115. 1863. **Lastrea filix-mas** var. **cochleatum** (D. Don) Bedd., Handb. Ferns Brit. India 250. pl. 130. 1883.

Terrestrials. Rhizome 12-15 x 3-4 cm, creeping. Scales 1-1.5 x 0.3 cm, lanceolate-acuminate, entire, pale brown. Fronds 90-100 x 30-40 cm, bipinnate; stipe 40-50 cm, long, scaly towards base, glabrous, polished above, yellowish or pale brown, dimorphic; lamina rhomboid or ovate in outline; primary pinnae 16-18 x 4-5 cm, lanceolate-acuminate in outline, progressively reduced towards apex, costa grooved and winged above, raised below; secondary pinnae 0.5- 3 x 0.4-1.5 cm, lanceolate-acuminate, sessile, cuneate at base, lobed to serrate along margins, progressively reduced, ending in a linear, lobed terminal segment; veins indistinct above, distinct below, forked; fertile fronds dissimilar; pinnae and pinnules smaller and lobed; primary fertile pinnae 40-10 x 1-2.5 cm; pinnules 0.5-1.5 x 0.5 cm, oblong, rounded, shallowly lobed or serrate. Sori 2

mm in diameter, circular, yellowish-brown in two rows, completely covering the entire lower side; indusia brown, reniform, peltate. Sporangial capsule 312.5 x 250  $\mu\text{m}$  subglobose, stalk 375  $\mu\text{m}$  long. Spores 60 x 40  $\mu\text{m}$ , planoconvex, dark brown with thick anastomosing perispore.

Occasional, in grasslands, moist deciduous and semi-evergreen forests.

Specimens studied: Mangaladevi, *KPR* 70107 (CALI); Mlappara, *KPR* 70017 (CALI); bank of Thannithode, *N.C.Nair* 70180 (MH); Thannikkudy, *JA* 12858 (KFRI, CALI).

***Dryopteris hirtipes*** (Blume) Kuntze, *Rev. Gen. Pl.* 2: 813. 1891; B.K.Nayar & S.Kaur, *Comp. Bedd. Handb.* 55. 1974; Manickam, *Fern Fl. Palni Hills* 135. 1986; Subh.Chandra & S.Kaur, *Nomen. Guide Bedd.* 11. 1987; Manickam & Irud., *Pterid. Fl. W. Ghats* 277. pl. 213. 1992; N.C.Nair et al., *J. Econ. Tax. Bot.* 16: 512. 1992; B.K.Nayar & Geev., *Fern Fl. Malabar* 209. 1993; Subh.Chandra, *Ferns India* 179. 2000. ***Aspidium hirtipes*** Blume, *Enum. Pl. Jav.* 148. 1828. ***Lastrea hirtipes*** (Blume) T.Moore, *Ind. Fil.* 94. 1856; Bedd., *Ferns South. India* 34. pl. 96. 1863 & *Handb. Ferns Brit. India* 232. pl. 120. 1883.

Terrestrials. Rhizome 10 x 8 cm, erect, densely scaly. Scales 20-30 x 2 mm, lanceolate, linear-acuminate, entire, dark brown. Fronds 100-130 x 26-40 cm; stipe 35-45 cm long, densely scaly beneath, hairy above, grooved; lamina elliptic-acuminate in outline, simply pinnate; pinnae to 13-22 x 2 cm, oblong-acuminate, truncate to rounded at base, lobed to serrate along margins; lobes ovate or elliptic, obtuse, serrulate half way to costa; costa grooved above, raised, hairy below, costules indistinct above, raised below, veins pinnate. Sori 1 mm in diameter, dark brown, circular, indusia reniform, brownish. Sporangial capsule 275 x 225  $\mu\text{m}$  subglobose, stalk 250  $\mu\text{m}$  long. Spores 45 x 30  $\mu\text{m}$ , brownish, ellipsoid or reniform, tuberculate with thickly folded perine.

Common, in moist deciduous, semi-evergreen and evergreen forests.

Specimens studied: Anjuruli, *KPR* 70117 (CALI); Anjuruli-Thekkady, *B.D. Sharma* 42411; Kumarikulam sholai, *N.C.Nair* 70170; Ummikkuppanthode, *N.C.Nair* 70141 (MH); Uppermanalar, *JA* 12881; Varayattumudi, *JA* 12844; Vellimala, *KPR* 18354 (KFRI, CALI).

**Dryopteris sparsa** (Buch.-Ham. ex D.Don) Kuntze, Rev. Gen. Pl. 2: 813. 1891; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 61. 1974; R.D.Dixit, Cens. Indian Pterid. 154. 1984; Manickam, Fern Fl. Palni Hills 138. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 12. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 281. pl. 216. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 513. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 210. 1993; Subh.Chandra, Ferns India 187. 2000. **Nephrodium sparsum** Buch.-Ham. ex D.Don, Prodr. Fl. Nepal. 6. 1825. **Lastrea sparsa** (Buch.-Ham. ex D.Don) T.Moore, Ind. Fil. 87. 1858; Bedd., Ferns South. India 36. pl. 103. 1863 & Handb. Ferns Brit. India 252. 1883.

Terrestrials. Rhizome erect. Scales 11 x 3-5 mm, yellowish brown, ovate or elliptic-acuminate, entire. Fronds 60-100 x 20-32 cm, bipinnate; stipe 30-56 cm long, yellowish-pink, densely scaly beneath, glabrous, polished above, grooved; lamina elliptic-acuminate in outline; pinnae 16 x 3 cm, lanceolate-acuminate in outline, rachis grooved above, raised below; basal most pinnule bipinnate or pinnatifid, to 7 x 1.7 cm, lanceolate, acuminate in outline; pinnules to 2.5 x 1 cm, lanceolate, obtuse, cuneate at base, shortly stipitate, lobed; lobes to 4 x 2 mm, ovate-oblong, obtuse, apiculate; costules grooved above, raised below; veins indistinct above, raised below, branched. Sori circular, yellowish-brown, at vein endings, each on the basiscopic base of lobes; indusia dark brown, reniform. Sporangial capsule 312.5 x 250 µm, subglobose, stalk 375 µm long. Spores 50 x 40 µm, yellowish-hyaline, oblongoid to reniform, granulose with folded perine.

Occasional, in evergreen forests.

Specimens studied: Mlappara, *KPR* 70002 & 70010 (CALI); Thannikkudy, *JA* 12858; Vellimala, *JA* 13256 (KFRI, CALI).

### **POLYSTICHUM** Rothmaler

Tent. Fl. Germ. 3: 31, 69. 1799.

Terrestrial herbs. Rhizome erect, densely scaly. Scales dark brown to black, linear to linear lanceolate, usually reduced to hair like. Fronds simply pinnate to bipinnate. Stipe densely scaly, grooved. Lamina lanceolate to ovate

in outline. Pinnules coriaceous, serrate to lobed. Sori dark brown, circular; indusia caducous. Spores planoconvex, granulose to sub-spinulose.

#### Key to the species

1. Fronds simply pinnate ..... **P. harpophyllum**  
 1. Fronds bipinnate ..... **P. kunthianum**

**Polystichum harpophyllum** (Zenker ex Kunze) Sledge, Bot. J. Linn. Soc. 84: 7. 1982; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 15. 1987; Fraser-Jenk. in Bharadwaja & Gena, Asp. Plant Sci. 13: 255. 1990; Manickam & Irud., Pterid. Fl. W. Ghats 265. pl. 203. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 512. 1992; Subh.Chandra, Ferns India 201. 2000. **Polypodium harpophyllum** Zenker ex Kunze, Linnaea 24: 256. 1851. **Polystichum auriculatum** sensu Bedd., Ferns South. India 41. pl. 120. 1863 & Handb. Ferns Brit. India 203. pl. 102., excl. vars. 1883; R.D.Dixit, Cens. Indian Pterid. 156. 1984; Manickam, Fern Fl. Palni Hills 130. 1986, non (L.) C.Presl, Tent. Pterid. 83. 1836.

Terrestrials. Rhizome 2-5 x 2-4 cm, erect. Scales 4-6 x 1-1.9 mm, pale brown, lanceolate-acuminate, fimbriate. Fronds 20-50 x 5-6 cm, dark green, coriaceous, simply pinnate; stipe 15-30 cm, scaly beneath, sparsely hairy above, grooved; pinnae 3-6.5 x 0.8-1.5 cm, alternate, trapeziform, serrate, acute, acroscopic half truncate, basisopic half cuneate; veins dichotomously branching. Sori along the vein endings, 3-4 mm from the margins. Sporangial capsule 225 x 187.5 µm, subglobose, stalk 250-375 µm long. Spores 50 x 37.5 µm, yellowish, ellipsoid to reniform with thickly folded perine.

Occasional, in evergreen forests.

Specimens studied: Uppermanalar, JA 13234; Vellimala, KPR 18363 (KFRI, CALI); KPR 62889 (CALI).

**Polystichum kunthianum** Nayar & Geev., Fern Fl. Malabar 215. 1993; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 54. 1997. **P. molluccense** sensu Fraser-Jenk., Asp. Pl. Sci. 13: 267. 1991; Manickam & Irud., Pterid. Fl. W. Ghats 268. pl. 206. 1992, non (Blume)T.Moore, 1858.

Terrestrials. Rhizome 5-6 x 3-4 cm, erect, densely scaly. Scales 15-20 x 0.5-1 mm, linear, reduced to hair like at above all over. Fronds 40-50 x 15-30

cm, bipinnate; stipe 20-30 cm long, densely scaly, grooved; lamina ovate to elliptic in outline; primary pinnae 7-15 x 2-3.5 cm, lanceolate in outline; pinnules to 3 x 1 cm, shortly stalked, coriaceous, rhomboidal in outline, serrate to lobed, progressively reduced towards apex. Sori 1-1.5 mm, dark brown, circular; indusia caducous. Spores 55 x 45  $\mu$ m, dark brown, planoconvex, sub-spinulose. (Fig. 5.1.15a & b).

Rare in evergreen forests.

Specimen studied: Vellimala, KPR 62869 (CALI).

Note: A South Indian endemic species. Chandra (2000), but given it as a synonym of *P. molluccense* (Blume) T.Moore.

### TECTARIA Cavanilles

Anal. Hist. Nat. 1: 115. 1799.

Terrestrial herbs. Rhizome erect or creeping. Scales dark brown, lanceolate, entire or fimbriate. Fronds simple or bipinnate or pinnatifid; lamina elliptic or oblong acuminate to deltoid in outline; veins pinnate, anastomosing with included veinlets. Sori circular at vein endings. Sporangial capsule globose. Spores yellowish to dark brown, monoletic, reniform with spinulose or smooth perine.

#### Key to the species

- 1. Rhizome erect ..... **T. paradoxa**
- 1. Rhizome creeping ..... **2**
- 2. Fronds simply pinnate ..... **T. wightii**
- 2. Fronds bipinnate ..... **T. coadunata**

**Tectaria coadunata** (Js.Sm.) C.Chr., Contr. U.S. Nat. Herb. 26: 331. 1931; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 52. 1974; R.D.Dixit, Cens. Indian Pterid. 142. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 9, 55. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 260. pl. 200. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 515. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 144. 1993; Subh.Chandra, Ferns India 222. 2000. **Sagenia coadunata** Js.Sm. in Hook., J. Bot. 4: 184. 1841; Bedd., Ferns South. India 28. pl. 81. 1863. **Aspidium cicutarium** sensu Hook., Sp. Fil. 4: 61. 1862, p.p.; Bedd., Handb. Ferns Brit.



Fig. 5.1.15 *Polystichum kunthianum* a. Silhouette of habit, b. pinnule.

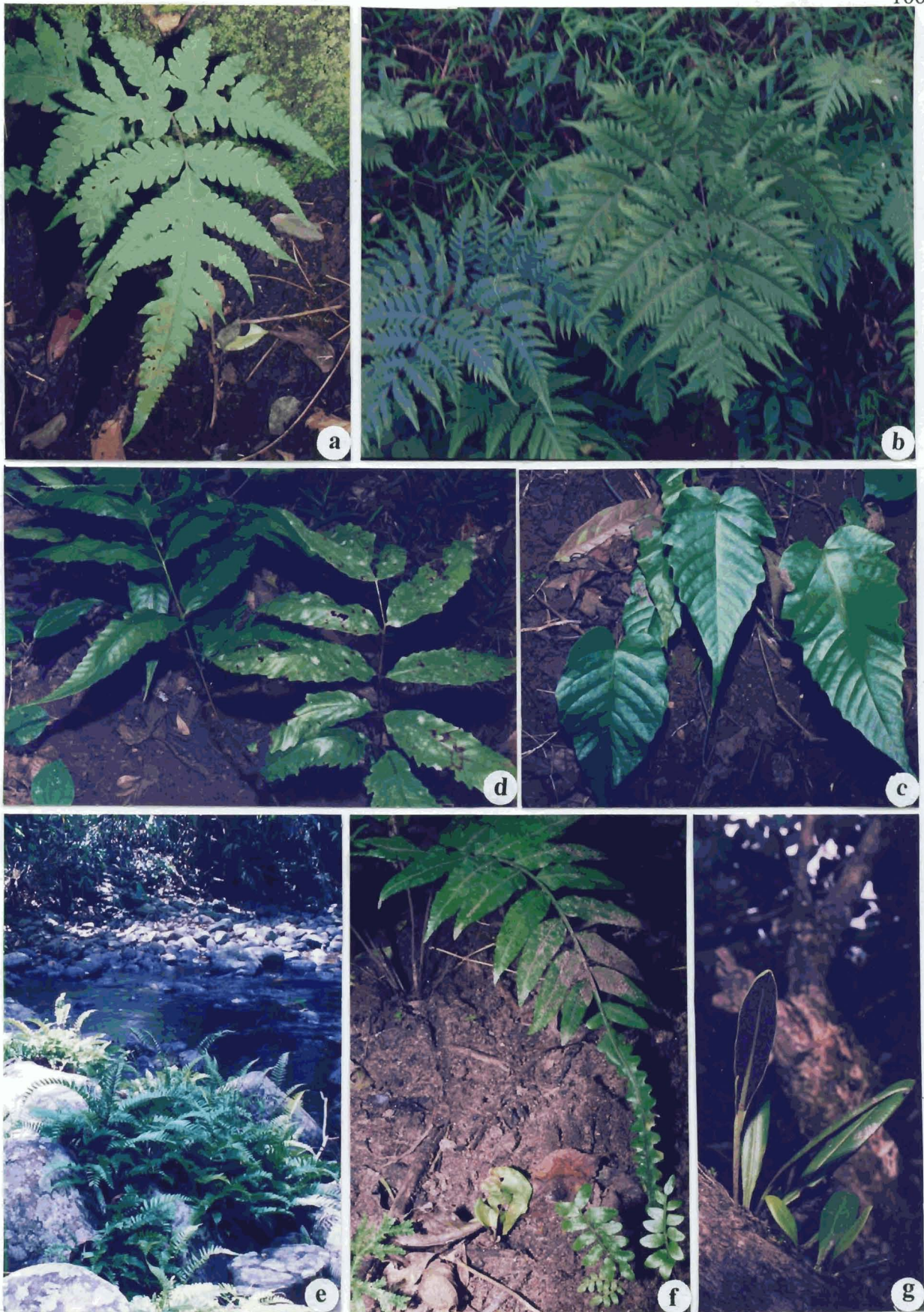


Fig. 5.1.16. Habits of **a.** *Tectaria coadunata*, **b.** *T. paradoxa*, **c.** *T. wightii*- young plants, **d.** *T. wightii*- mature plants, **e.** *Bolbitis appendiculata*, **f.** *B. prolifera*, **g.** *Elaphoglossum beddomei*.

India t. 220. 1883, p.p., non (L.) Sw., 1801, non Willd. 1810. **Sagenia variolosa** Bedd., Ferns Brit. India t. 170. 1866.

Terrestrials. Rhizome 1.5 cm thick, creeping. Scales 4-5 x 1-1.5 mm, lanceolate, acuminate, entire, dark brown. Fronds 40-80 x 20-40 cm, bipinnate; stipe 15-50 cm long, grooved above, rounded below; lamina broadly ovate in outline; pinnae 37-40 x 20-28 cm, elliptic-lanceolate in outline, pinnate to pinnatifid, rachis grooved above, hispid, raised below, glabrous; pinnules 12 x 4 cm, lanceolate-acuminate, lobed; lobes elliptic-oblong, obtuse or rounded; basiscopic lobes larger, again lobed, subcordate to rounded at base; costa raised above and below; veins pinnate, anastomosing, slightly raised above and below; veins copiously anastomosing with included veinlets, pubescent along the costa and costules on both sides. Sori circular, 2 mm in diameter, on the tip of included veinlets, marked with a depression above, arranged on both sides of the costule, more towards margins; indusia dark brown, peltate. Sporangial capsule 250 x 250  $\mu\text{m}$ , globose, stalk 375  $\mu\text{m}$  long. Spores 45 x 37.5  $\mu\text{m}$ , yellowish brown, oblongoid or reniform with thickly folded perine. (Fig. 5.1.16a).

Occasional in grasslands and moist deciduous forests and common in semi-evergreen and evergreen forests.

Specimen studied: Brandippara, JA 12837 (KFRI, CALI); Poongavanam to Sabarimalai, N.C.Nair 70217; Thekkady, B.D. Sharma 42069; K. Vivekananthan 45390 (MH).

**Tectaria paradoxa** (Fee) Sledge, Kew Bull. 27: 413. 1972; N.C.Nair & Bhargavan, J. Econ. Tax. Bot. 6: 269. 1985; Manickam & Irud., Pterid. Fl. W. Ghats 256. pl. 198. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 515. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 224. 1993; Subh.Chandra, Ferns India 227. 2000. **Aspidium paradoxum** Fee, Gen. Fil. 293. 1852. **Lastrea membranifolia** sensu Bedd., Ferns South. India 36. pl. 102. 1863, non C.Presl, 1836. **L. dissecta** sensu Bedd., Handb. Ferns Brit. India 260. 1883, non (G.Forst.) Carruth., 1873. **Ctenitis dissecta** (Forst.f) H.Ito in Nakai & Honda, Nov. Fl. Jap. 4; 91. 1939; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 12. 1987.



Terrestrials. Rhizome 4-5 x 2-2.5 cm, erect. Scales 6-8 x 1-2 mm, lanceolate, fimbriate. Fronds 55-65 x 45-50 cm, simple or bipinnate; stipe 20-50 cm, scaly beneath, glabrous, polished above, grooved; lamina rhomboidal or deltoid in outline; pinnae to 23 x 7 cm, lanceolate-acuminate, bipinnate to deeply lobed 5-8 mm to costa; lobes to 3.2 x 1 cm, oblong-lanceolate, crenate; largest in the middle; sparsely reddish brown hairy above; pinnules 3 x 1.2 cm, ovate-lanceolate, acute to obtuse; basiscopic pinnule 10 x 2.5 cm, lanceolate, long-acuminate in outline, lobed more than half way to the costa; rachis grooved above, hispid, raised below, glabrous; costa grooved above, hispid, raised below, pubescent; costules raised, hispid above, pubescent or glabrous beneath; veins free, pinnate, forked, distinct above and below. Sori 1.5 mm in diameter, yellowish-brown, at vein endings near margins; indusia reniform, dark brown. Sporangial capsule 250 x 250  $\mu\text{m}$  globose, stalk 375  $\mu\text{m}$  long. Spores 45 x 37.5  $\mu\text{m}$ , dark brown, tetrahedral, oblongoid or globose with thickly folded perine. (Fig. 5.1.16 b).

Occasional, in moist deciduous, semi-evergreen and evergreen forests.

Specimen studied: Karadikkavala, KPR 70128 (CALI).

**Tectaria wightii** (C.B.Clarke) Ching, Sinensia 2: 28. t. 8. 1931; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 51. 1974; Manickam & Irud., Pterid. Fl. W. Ghats 258. pl. 199. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 514. 1992; Subh.Chandra, Ferns India 230. 2000. **Nephrodium wightii** C.B.Clarke, Trans. Linn. Soc. London Bot. 1: 538. 1880. **Aspidium polymorphum** Wall. ex Hook., Sp. Fil. 4: 54. 1862; Bedd., Ferns South. India 40. pl. 116. 1863 & Handb. Ferns Brit. India 218. 1883, p.p. **Tectaria polymorpha** (Wall. ex Hook.) Copel., Philipp. J. Sci. Bot. 2C: 413. 1907; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 14. 1987; **Aspidium polymorphum** var. **macrocarpum** Bedd., Ferns South. India 40. pl. 117. 1863 & Suppl. Handb. Ferns Brit. India 45. 1876. **Tectaria polymorpha** var. **macrocarpa** (Bedd.) Subh.Chandra & S.Kaur, Indian Fern J. 1: 86. 1984; Nomen. Guide Bedd. 14. 1987. **T. macrocarpa** (Bedd.) B.K.Nayar & Geev., Bull. Bot. Surv. India 28: 134. 1986 & Fern Fl. Malabar 222. 1993.

Terrestrials. Rhizome 2 cm thick, creeping, densely scaly at apex. Scales 3 x 1 mm, lanceolate, entire, dark brown. Fronds 60-65 x 30-50 cm, simply pinnate; stipe 30-36 cm long, grooved above, scaly at the very base, glabrous above; lamina ovate-acuminate in outline; pinnae 16-25 x 4-7 cm, elliptic-lanceolate, acuminate, margins wavy, cuneate at base, 4-6 pairs, basal pinnae shortly stipitate, upper sessile, terminal pinnae larger, rachis grooved above, rounded beneath, costa grooved above, raised beneath, veins pinnate, veinlets anastomosing with included veinlets, ending in a swollen tip; raised above and below. Sori circular, dark brown on netted veinlets. Sporangial capsule 250 x 225  $\mu\text{m}$ , subglobose, stalk 375  $\mu\text{m}$  long. Spores 45 x 30  $\mu\text{m}$ , dark brown, ellipsoid to reniform, thickly spinose. (**Fig. 5.1.16c & d**).

Common, in semi-evergreen and evergreen forests.

Specimens studied: Anjuruli, *KPR* 70114 (CALI); Arjunankotta, *JA* 12883 (KFRI, CALI); Poongavanam to Sabarimalai, *N.C.Nair* 70202 (MH).

## LOMARIOPSIDACEAE

Alston, *Taxon* 5: 25. 1956.

### Key to the genera

- 1. Fronds simple..... **Elaphoglossum**
- 1. Fronds pinnate ..... **Bolbitis**

### BOLBITIS Schott

Gen. Fil. 3: 14. 1835.

Terrestrial or lithophytic herbs, usually growing near water courses. Rhizome erect or creeping, covered with dark brown, peltate scales. Fronds dimorphic. Sterile fronds, dark green, simply pinnate, elliptic in outline with coriaceous pinnules; terminal pinnae normal or flagelloid and gemmiparous. Fertile pinnules smaller, linear or oblong with acrostichoid dark brown to black sori. Spores dark brown to black, some times abortive.

Note: Though Iwatsuki (1959) and Hennipman (1977) merged *Egenolfia* Schott under *Bolbitis* Schott, Majeed *et al.* (1994), treated them separately. Here *Egenolfia* is treated under *Bolbitis* Schott.

**Key to the species**

1. Veins free ..... **B. appendiculata**  
 1. Veins anastomosing ..... **B x prolifera**

**Bolbitis appendiculata** (Willd.) K.Iwats., Acta Phytotax. Geobot. 18: 48. 1959; Hennipman, Leiden Bot. Ser. 2: 185. f. 49. 51. 1977; Manickam & Irud., Pterid. Fl. W. Ghats 291. pl. 224. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 233. f. 95, 99. 1993; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 64. 1997; Subh.Chandra, Ferns India 231. 2000. **Acrostichum appendiculatum** Willd., Sp. Pl. 5: 114. 1810. **Polybotrya asplenifolia** C.Presl, Tent. Pterid. 231. 1836; Bedd., Ferns South. India 66. pl. 195. 1864 & Handb. Ferns Brit. India 424. t. 235. 1883. **P. appendiculata** (Willd.) Js.Sm., J. Bot. 4: 150. 1841; Bedd., Handb. Ferns Brit. India 424. 1883. **Egenolfia asplenifolia** (Bory in Bel.) K.Iwats., Acta Phytotax. Geobot. 18: 48. 1959; B.K.Nayar & S.Kaur, Bull. Nat. Bot. Gard. 100: 19. 1964 & Comp. Bedd. Handb. 99. 1974; R.D.Dixit, Cens. Indian Pterid. 163. 1984; N.C.Nair et al., J. Econ. Tax. Bot. 16: 520. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 236. 1993; Majeed et al., J. Econ. Tax. Bot. 18: 744. 1994. **E. appendiculata** (Willd.) Js.Sm., Ferns Br. For. 111. 1866; B.K.Nayar & S.Kaur, Bull. Nat. Bot. Gard. 100: 17. 1964 & Comp. Bedd. Handb. 98. 1974; R.D.Dixit, Cens. Indian Pterid. 163. 1984; Manickam, Fern Fl. Palni Hills 143. 1986; N.C.Nair et al., J. Econ. Tax. Bot. 16: 520. 1992; Majeed et al., J. Econ. Tax. Bot. 18: 742. 1994. **Bolbitis keralensis** B.K.Nayar & Subh.Chandra, Amer. Fern J. 54: 9. 1964. **Egenolfia keralensis** (B.K.Nayar & Subh.Chandra) B.K.Nayar & S.Kaur, Bull. Nat. Bot. Gard. 94: 4. 1964. **Bolbitis appendiculata** var. **asplenifolia** (Bory) Sledge, Bot. J. Linn. Soc. 84: 19. 1982; Manickam & Irud. Pterid. Fl. W. Ghats 293. pl. 225. 1992.

Lithophytes. Rhizome 1.5 x 2 cm, erect. Scales 2-3.5 x 0.6-1 mm, linear to ovate, acuminate, fimbriate, peltate or subpeltate. Fronds dimorphic, 30-40 x 6-7 cm; stipe 7-10 cm long, scaly beneath, hairy above; sterile lamina dark green, 20-30 x 6-7 cm, simply pinnate; pinnae 3.5-4.5 x 1 cm, stalked, oblong, serrate, acute or obtuse, setae present in the sinus of serration; larger pinnae in the middle, reduced towards both ends; terminal pinna lanceolate, long-acuminate, lobed; veins forked once or twice; fertile lamina narrower, 2 cm broad; pinnae 1 x 0.5-0.7 cm, elliptic, obtuse, base unequal. Sori acrostichoid,

dark brown to black. Sporangial capsule 275 x 250 µm subglobose, stalk 500 µm long. Spores 50 x 37.5 µm, dark brown to black with broad and lacinate perispore. (Fig. 5.1.16e).

Common, on the rocks in streams in evergreen forests.

Specimens studied: Poongavanam to Ayyappan temple, *N.C.Nair* 70200 (MH); Uppermanalar, *JA* 12865 (KFRI, CALI); Uppuparai, *K. Vivekananthan* 45339 (MH); Vellimala, *KPR* 18308 (KFRI, CALI); Vellimalai-Pachakumatchi (Madurai district, TN), *K. Subramanyam* 9495 (MH).

***Bolbitis x prolifera*** (Bory) C.Chr. & Tardieu in Tardieu & C.Chr., *Notal. Syst.* 7: 102. 1938, p. spec. quoad nomen solum; Hennipman, *Leiden Bot. Ser.* 2: 295. f. 84 j-m. 1977; Subh.Chandra & S.Kaur, *Nomen. Guide Bedd.* 24. 1987; Manickam & Irud. *Pterid. Fl. W. Ghats* 295. pl. 226. 1992; Subh.Chandra, *Ferns India* 239. 2000. ***Polybotrya prolifera*** Bory, *Bel. Voy. Bot.* 3: 18. 1833, p. spec. non (Hook.) Mett., 1856 (= ***B. subcrenata***). ***Poecilopteris repanda*** auct., *Bedd., Ferns South. India* 68. pl. 202. 1864, non (Blume) C.Presl, 1849. ***Gymnopteris contaminans*** *Bedd., Suppl. Ferns Brit. India* 27. 1876, p.p., nom. superfl. & *Bedd., Handb. Ferns Brit. India* 105. 1883.

Terrestrials. Rhizome 4-6 x 0.5-0.8 cm, creeping. Scales 3 x 1 mm, ovate or lanceolate-acuminate, cordate at base, entire, dark brown. Fronds 50-85 x 20-30 cm; stipe 20-25 cm long, scaly; sterile lamina 25-40 x 20-30 cm, simply pinnate; pinnae opposite, 10-15 x 2-3.5 cm, oblong-lanceolate, long-acuminate, obliquely obtuse at base, serrate, progressively reduced, terminal pinna 18-20 cm long with oblong or elliptic lobes; flagelloid, bulbiferous; veins anastomosing; fertile pinnae linear, 5-7 x 0.3-0.5 cm. Sori acrostichoid, dark brown. Sporangial capsule 250 x 250 µm, globose, stalk 375 µm long. Spores abortive. (Fig. 5.1.16f).

Occasional, in moist habitats of moist deciduous, semi-evergreen and evergreen forests.

Specimens studied: Karadikkavala, *KPR* 70121 (CALI); Mlappara, *KPR* 70030 & 70036 (CALI); Palkulam mudi, *JA* 12875; Vellimala, *KPR* 18320 (KFRI, CALI).

**ELAPHOGLOSSUM** J.Smith

Hook., J. Bot. 4: 148. 1841, nom. cons.

**Elaphoglossum beddomei** Sledge, Bull. Brit. Mus. Nat. Hist. Bot. 4: 88. 1967; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 98. 1974; R.D.Dixit, Cens. Indian Pterid. 164. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 24. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 288. pl. 222. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 518. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 246. 1993; Majeed et al., J. Econ. Tax. Bot. 18: 662. 1994; Subh.Chandra, Ferns India 240. 2000. ***E. stigmatolepis*** sensu Bedd., Ferns South. India 67. pl. 199. 1864 & Handb. Ferns Brit. India 418. 1883, non T.Moore, 1857.

Epiphytes or lithophytes. Rhizome 1-1.5 cm thick, creeping. Scales 6-8.5 x 0.5-1.2 mm, ovate-lanceolate, acuminate, peltate, fimbriate, dark brown, clathrate. Fronds 14-20 x 1.5-2.3 cm, simple; stipe 4-10 cm; longer in fertile fronds, scaly beneath; lamina 11-15 x 1.5-2.3 cm, elliptic-lanceolate, acute, cuneate, decurrent at base, margins entire, cartilaginous, coriaceous; costa grooved above, raised below; fertile fronds narrower with long stipe. Sori acrostichoid, dark brown to black. Sporangial capsule 250 x 225 µm, subglobose, stalk 375 µm long. Spores 50 x 37.5 µm, dark brownish or yellowish brown with thick irregular perine. (**Fig. 5.1.16g**).

Occasional, in evergreen forests above 1200 m.

Specimens studied: Vellimala, *KPR* 14673 (KFRI, CALI); *KPR* 62874 (CALI).

**NEPHROLEPIDACEAE**

Pichi Sermolli, Webbia 29: 8. 1974.

**NEPHROLEPIS** Schott

Gen. Fil. 3. 1834.

Terrestrial or epiphytic herbs. Rhizome erect, with or without globose or ovoid tubers, densely covered with hairs, brown at maturity. Scales linear or lanceolate-acuminate, fimbriate. Fronds simply pinnate. Sori circular or reniform, at vein endings, submarginal, indusia peltate, reniform. Sporangial capsule ellipsoid, stalk equal to or longer than capsule. Spores yellowish, reniform, granulose.

**Key to the species**

1. Rhizome tubers present ..... **N. auriculata**  
 1. Rhizome tubers absent ..... **N. hirsutula**

**Nephrolepis auriculata** (L.) Trimen, J. Linn. Soc. London Bot. 24: 152. 1887; Manickam & Irud., Pterid. Fl. W. Ghats 140. pl. 108. 1992; Subh.Chandra, Ferns India 244. 2000. **Polypodium auriculatum** L., Sp. Pl. 1088. 1753. **Nephrolepis cordifolia** (L.) C.Presl, Tent. Pterid. 79. 1836; Bedd., Handb. Ferns Brit. India 282. t. 144. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 69. 1974; R.D.Dixit, Cens. Indian Pterid. 167. 1984; Manickam, Fern Fl. Palni Hills 58. 1986; N.C.Nair et al., J. Econ. Tax. Bot. 16: 523. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 251. 1993. **Polypodium cordifolium** L., Sp. Pl. 2: 1089. 1753. **Aspidium cordifolium** Sw., Schrad. J. Bot. 1800(2): 32. 1801, non C.Presl, 1849. **A. tuberosum** Bory ex Willd., Sp. Pl. 5: 234. 1810. **Nephrodium tuberosum** Desv., Prod. 252. 1827. **Nephrolepis tuberosa** C.Presl, Tent. Pterid. 79. 1836; Bedd., Ferns South. India 33. pl. 92. 1863; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 11. 1987.

Epiphytes or terrestrials. Rhizome 5 x 3 cm, erect, roots long, with ellipsoid tubers, 2-3 x 1.5-2 cm, greenish-yellow, densely brown hairy. Scales 5-8 x 0.5-1 mm, linear-acuminate, pale brown, margins with few outgrowths. Fronds tufted, 50-60 x 3.5-5 cm; stipe 10-15 cm long, densely scaly when young, glabrous polished at maturity; lamina 40-50 x 3.5-5 cm, light green, simply pinnate; pinnae 1-3 x 0.8-1 cm, elliptic or oblong, serrulate, rounded towards apex, auricled on acroscopic base; veins close, forked once, ending submarginally with swollen tips. Sori semicircular or reniform, at vein endings, in a row, near to margins; indusia reniform, hyaline, opening towards the apex of pinnae. Sporangial capsule 187.5 x 150 µm, ellipsoid, stalk 187.5 µm long. Spores 20 x 25 µm, yellowish, reniform, granulose. (**Fig. 5.1.17a**).

Common, in semi-evergreen and evergreen forests.

Specimens studied: Mangaladevi, *KPR* 70106 (CALI); Mavadi, *JA* 12839(KFRI, CALI); Pamba, *D.B.Deb* 30323(MH); Thannikkudy, *B.D. Sharma* 42366; Thekkady, *B.D. Sharma* 42068 (MH); Vellimala, *KPR* 18329 (KFRI, CALI).

**Nephrolepis hirsutula** (Forster) C.Presl, Tent. Pterid 79. 1836; N.C.Nair et al., J. Econ. Tax. Bot. 16: 522. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 252. 1993; Subh.Chandra, Ferns India 246. 2000. **Polypodium hirsutulum** Forster, Prod. 81. 1786.

Terrestrials. Rhizome 3 x 2 cm, erect, with thick roots from the base, densely scaly above. Scales 3-4 x 1 mm, lanceolate, acuminate, dark yellowish-brown, margins with multicellular hairs. Fronds 95-110 x 7-14 cm, simply pinnate; stipe 20-30 cm, long, yellowish-brown, grooved, densely scaly beneath, sparsely above; lamina elliptic-oblong in outline, pinnae 9.5 x 1-1.8 cm, oblong, obtuse, serrulate, truncate at base, auricled at acroscopic base, sessile; costa raised above and below, veins free, rarely forking, ending submarginally in swollen tips; pinnae progressively reduced towards apex, glabrous above, hispid beneath. Sori dark brown, reniform, submarginal at vein endings; indusia peltate, dark brown, reniform, margins wavy. Sporangial capsule 250 x 187.5 µm ellipsoid, stalk 250 µm long. Spores 37.5 x 25 µm, yellowish, reniform, granulose.

Common, in semi-evergreen and evergreen forests.

Specimens studied: Kottamala, JA 13276 (KFRI, CALI); Kottamala pallam, JA 13235; near Periyar dam, K. Subramanyam 9452 (MH); Vellimala, KPR 70059 (CALI); way to Mangaladevi temple, N.C.Nair 70230(MH); Aruna estate (Madurai district, TN), K. Subramanyam 9503 (MH).

## OLEANDRACEAE

(J.Smith) Ching ex Pichi-Sermolli, Webbia 20: 745. 1965.

### Key to the genera

1. Fronds simple ..... **Oleandra**  
 1. Fronds simply pinnate ..... **Arthropteris**

## ARTHROPTERIS J.Smith

in Hooker f., Fl. New Zeal. 2: 53. 1854.

**Arthropteris palisotii** (Desv.) Alston, Bot. Soc. Broter. Ser. 2. 30: 6. 1956; Subr. et al., Bull. Bot. Surv. India 3: 211. 1961; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 70. 1974; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 30.

1987; Rajesh et al., J. Econ. Tax. Bot. 21: 723. 1997; Subh.Chandra, Ferns India 244. 2000. ***Aspidium palisotii*** Desv., Berlin Mag. 5: 320. 1811. ***Nephrodium oblitteratum*** R.Br., Prod. Fl. N. Holl. 148. 1810. ***Aspidium oblitteratum*** Spreng., Syst. Veget. 4: 99. 1827. ***Arthropteris oblitterata*** (R.Br.) Js.Sm., Cat. Cult. Ferns 62. 1827. ***Nephrolepis oblitterata*** Hook., Sp. Fil. 154. 1862; Bedd., Ferns South. India 83. pl. 251. 1864. ***Nephrolepis ramosa*** T.Moore, Ind. Fil. 102. 1858; Bedd., Handb. Ferns Brit. India 284. t. 145. 1883.

Scandent herbs. Rhizome 2-4 m long, creeping, 1.5-2 mm thick. Scales 0.5-1.5 x 0.5 mm, ovate-lanceolate, clathrate, with few multicellular clavate hairs along margins. Fronds 15-25 x 3-4 cm, bipinnate; stipes 6-8 cm long, articulate to a short phyllopodia of 2-5 mm long; pinnae to 3.2 x 1 cm, sessile, auricled on acroscopic half, margins crenulate, lower pinnae smaller, rachis pubescent; veins free-forking, ending submarginally in swollen tips. Sori reniform at vein endings; indusia reniform. Sporangial capsule 375 x 350 µm, ellipsoid, stalk 350 µm long. Spores 45 x 34.4 µm; exine smooth, perine loose, granulose. (**Fig. 5.1.17b & 5.1.18**).

Rare, in evergreen forests.

Specimens studied: Chemmanoda, JA 13243; Vellimala, KPR 14674 (KFRI, CALI).

Note: In India this species is known to occur in the Periyar Tiger Reserve and its immediate surroundings only (Rajesh et al., 1997).

### **OLEANDRA** Cavanilles

Anal. Hist. Nat. 1: 115. 1799.

***Oleandra musifolia*** (Blume) C.Presl, Epim. Bot. 42. 1849; Bedd., Handb. Ferns Brit. India 287. t. 146. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 70. 1974; R.D.Dixit, Cens. Indian Pterid. 166. 1984; Manickam, Fern Fl. Palni Hills 57. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 11. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 139. pl. 107. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 521. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 258. 1993; Subh.Chandra, Ferns India 247. 2000. ***Aspidium musaefolium*** Blume, Enum. Pl. Jav. 141. 1828. ***Oleandra neriiformis*** sensu Bedd., Ferns South. India 32. pl. 91. 1863, non Cav. 1799.





Fig. 5.1.17. Habits of **a.** *Nephrolepis auriculata*, **b.** *Arthropteris palisotii*, **c.** *Leucostegia alternifrons*, **d.** *Araiostegia hymenophylloides*.

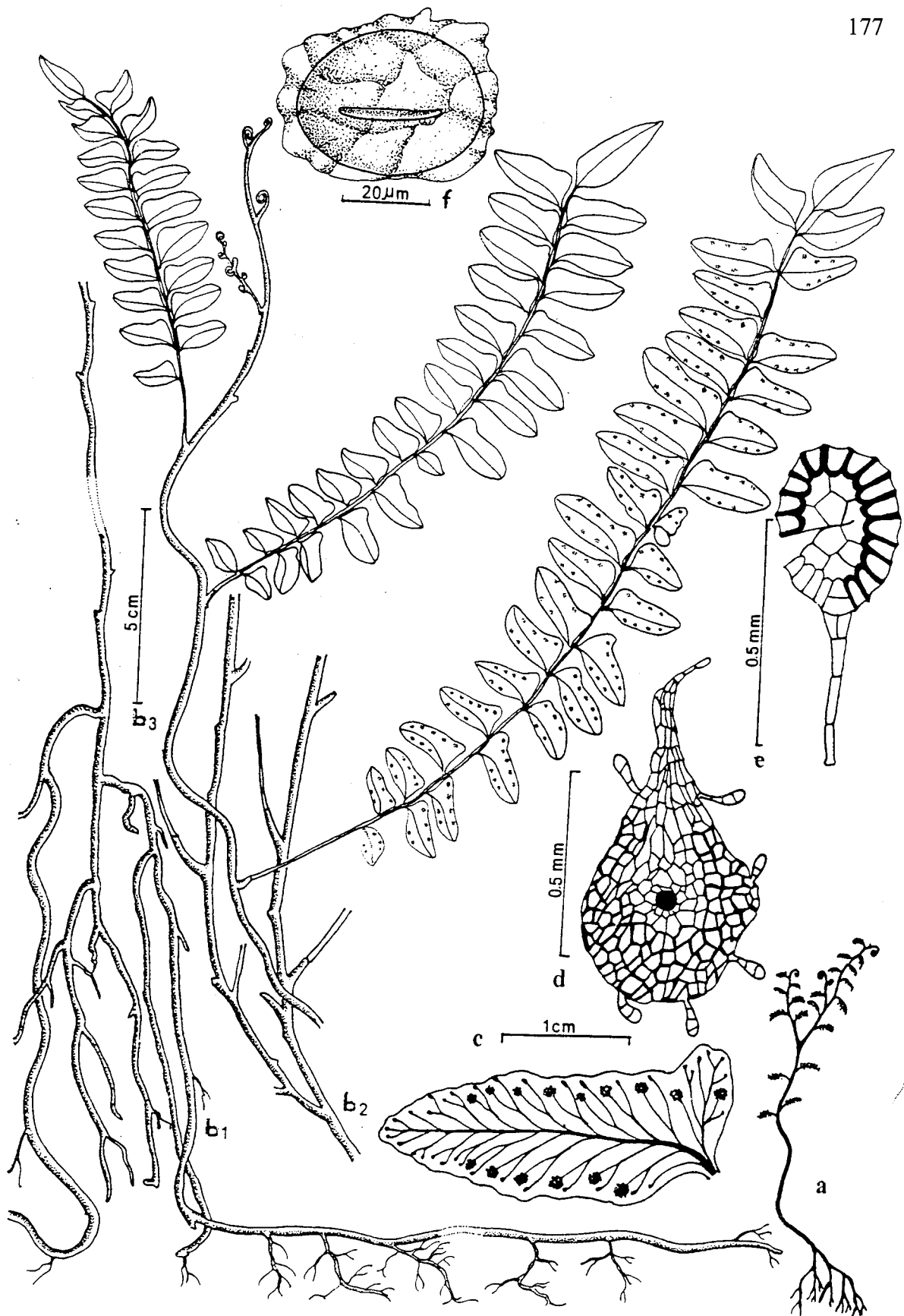


Fig. 5.1.18 *Arthropteris palisotii* a. Habit- schematic representation, b<sub>1</sub>. Rhizome- lower part, b<sub>2</sub>. Rhizome showing branching, b<sub>3</sub>. Rhizome- upper part, c. Pinnule, d. Scale, e. Sporangium, f. Spore.

Epiphytes and lithophytes. Rhizome 0.5-1 cm thick, long creeping, densely covered with scales. Scales 5-8 x 0.5-1.2 mm, lanceolate, acuminate. Fronds 30-40 x 2-3 cm, simple; stipe 1.5-2 cm long; lamina long-linear, acuminate, cuneate at base, margins thickened; costa prominent, grooved above, raised below, scaly; veins close, free, forking alternatively from near to costa, ends submarginally in swollen tips. Sori reniform, dark brown, along both sides of the costa. Sporangial capsule 250 x 225 µm, subglobose, stalk 225 µm long. Spores 50 x 37.5 µm, oblongoid to reniform, with thickly folded perine.

Rare, in evergreen forests.

Specimens studied: Kottamala, *JA* 13260; Pachakkanam, *JA* 12806 (KFRI, CALI); *K. Vivekananthan* 48392 (MH); Vellimala, *KPR* 70060 (CALI);

## DAVALLIACEAE

Mettenius ex Frank in Leunis, *Syn. Pflanzenkd.* 2, 3: 1747. 1877.

### Key to the genera

- 1. Fronds simple ..... **Humata**
- 1. Fronds pinnate ..... **2**
- 2. Indusia campanulate ..... **Davallia**
- 2. Indusia not campanulate, attached at base only ..... **3**
- 3. Rhizome bearing scales and hairs ..... **Leucostegia**
- 3. Rhizome bearing scales only ..... **Araiostegia**

### ARAIOSTEGIA Copeland

*Philipp. J. Sci.* 34: 240. 1927.

Epiphytic herbs with long creeping, branched, densely scaly rhizome. Scales golden yellow or brown, peltate or sub-peltate, ovate or lanceolate-acuminate or rounded. Fronds tripinnate, highly dissected. Veins free. Sori yellowish brown circular or semi-circular, indusia rounded, basally attached. Sporangial capsule subglobose with a stalk equal to or shorter than capsule. Spores planoconvex to reniform, verrucate.

### Key to the species

- 1. Scales acuminate at apex ..... **A. hymenophylloides**
- 1. Scales rounded at apex ..... **A. pulchra**

**Araiostegia hymenophylloides** (Blume) Copel., Philipp. J. Sci. 34: 241. 1927; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 17. 1974; R.D.Dixit, Cens. Indian Pterid. 109. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 31. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 136. pl. 105. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 525. 1992; Subh.Chandra, Ferns India 250. 2000. **Aspidium hymenophylloides** Blume, Enum. Pl. Jav. 172. 1828. **Acrophorus affinis** Moore, Proc. Linn. Soc. 2: 286. 1854; Bedd., Ferns South. India 83. pl. 252. 1864. **Leucostegia hymenophylloides** Bedd., Suppl. Ferns Brit. India 4. 1876; Handb. Ferns Brit. India 54. 1883.

Epiphytes. Rhizome 8 mm thick, creeping, densely scaly. Scales 5-15 x 2-4 mm, peltate, ovate or lanceolate-acuminate, entire, non-clathrate, golden yellowish to brown. Fronds 30-100 x 20-25 cm, tripinnate; stipe 20-48 cm long, glabrous, pinkish-brown, polished; lamina triangularly ovate, acuminate in outline, tripinnate; primary pinnae 8-10 x 2-3 cm, lanceolate, acuminate in outline; secondary pinnae 1.5-2 x 0.8-1 cm, ovate, acuminate in outline; tertiary pinnae to 8 x 4 mm, lanceolate, deeply lobed; lobes 2-2.5 x 1-1.5 mm, oblanceolate, acute, sub-falcate; primary, secondary, tertiary pinnae and lobes progressively reduced towards apex; rachis, costa and costules prominent, veins free. Sori semicircular, yellowish brown at the junction of veinlets of lobes meet the costule in the tertiary pinnae; indusia elliptic or rounded flap, brownish. Sporangial capsule 250 x 225 µm, subglobose, stalk 250 µm long. Spores 50 x 30 µm, yellowish, planoconvex or reniform with thick exine, verrucate. (**Fig. 5.1.17d**).

Rare, in evergreen forests.

Specimens studied: Chemmanoda, JA 13244; Chokkampatti, KPR 14617; Deviarmettu, JA 13247; (KFRI, CALI); Mlappara, KPR 70047 (CALI).

**Araiostegia pulchra** (D.Don) Copel., Philipp. J. Sci. 34: 241. 1927; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 16. 1974; Manickam, Fern Fl. Palni Hills 55. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 2. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 135. pl. 104. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 524. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 262. 1993; Subh.Chandra, Ferns India 252. 2000. **Davallia pulchra** D.Don, Prod. Fl. Nepal. 11. 1825.

***Leucostegia pulchra*** (D.Don) Js.Sm., Lond. J. Bot. 1: 26. 1842; Bedd., Handb. Ferns Brit. India 52. 1883. ***Acrophorus pulcher*** T.Moore, Ind. Fil. 3. 1857; Bedd., Ferns South. India 3. pl. 10. 1863.

Epiphytes. Rhizome 5-7 mm thick, branched, creeping, densely scaly. Scales 1-2 x 1-1.8 cm, broadly ovate or rounded, obtuse or rounded, entire, peltate, yellowish-brown when young, dark brown at maturity. Fronds 25-30 x 10-15 cm, tripinnate; stipe 5-8 cm long, greyish-yellow, scaly beneath, glabrous, polished above; lamina rhomboidal in outline, highly dissected; primary pinnae to 10 x 3.5 cm, lanceolate, acuminate in outline; secondary pinnae to 2 x 1.3 cm, ovate or elliptic-lanceolate in outline; tertiary pinnae to 10 x 3 mm, elliptic to linear-lanceolate in outline, deeply lobed; lobes to 3 x 1 mm, linear, acute, subfalcate; primary, secondary, tertiary pinnae and lobes progressively reduced towards apex, veins free, not reaching the margins. Sori 1 x 1 mm, circular, yellowish brown, ovate or rounded at the junction of vein branching, indusia basally attached. Sporangial capsule 250-375 x 250 µm, subglobose, stalk 250 µm long. Spores 50 x 37.5 µm, yellowish, hyaline, planoconvex to reniform, verrucate.

Rare, in evergreen forests.

Specimens studied: Pachakkanam, JA 12806 (KFRI, CALI); B.D. Sharma 40831 (MH); Vellimala, KPR 62879 (CALI).

#### DAVALLIA J.E.Smith

Mem. Acad. Trurin 5: 414. 1793.

***Davallia bullata*** Wall. ex Hook., Sp. Fil. 1: 169. t. 50B. 1864; Bedd., Ferns South. India 6. pl. 17. 1863 & Handb. Ferns Brit. India 61. pl. 31. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 18. 1974; R.D.Dixit, Cens. Indian Pterid. 170. 1984; Manickam & Irud., Pterid. Fl. W. Ghats 132. pl. 103. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 263. 1993; Subh.Chandra, Ferns India 252. 2000. ***D. trichomanoides*** Blume, Enum. Pl. Jav. 283. 1828; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 3. 1987; N.C.Nair et al., J. Econ. Tax. Bot. 16: 525. 1992.

Epiphytes. Rhizome 3-8 mm thick, long creeping, densely scaly. Scales 3-7 x 1.1 mm, dark brown, peltate, lanceolate, long acuminate, ciliate. Fronds

27-35 x 20-25 cm, tripinnate; stipe 12-15 cm, long, densely scaly at the very base, glabrous, brown, polished above; lamina 16-25 x 20-25 cm, rhomboid or deltoid in outline, tripinnate, coriaceous; primary pinnae to 10 x 6 cm, rhomboidal in outline; secondary pinnae to 3.5 x 1.8 cm, rhomboidal in outline; tertiary pinnae to 1.3 x 0.4 cm, oblanceolate to linear, lobed to serrate; lobes to 5 x 1.5 mm, linear-ovate; pinnae and lobes progressively reduced towards apex. Sori 2 x 0.5 mm, dark brownish, companulate at the junction of vein forkings, just below the base of the lobes. Sporangial capsule 437.5-500 x 225 µm, ellipsoid, stalk 1-1.1mm long. Spores 62.5 x 30 µm, planoconvex to reniform, hyaline-yellowish, verrucate.

Rare, in evergreen forests.

Specimens studied: Pachakkanam, JA 12801 (KFRI, CALI); Pamba, N.C.Nair 50830 (MH).

### HUMATA Cavanilles

Descr. Pl. 1: 272. 1802.

**Humata repens** (L.f.) Diels., Nat. Pflanzen 1: 209. 1899; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 15. 1974; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 2, 31. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 137. pl. 106. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 265. 1993; Subh.Chandra, Ferns India 255. 2000. **Adiantum repens** L.f., Suppl. Plant. Syst. Veg. 446. 1781. **Humata pedata** Js.Sm., J. Bot. 3: 416. 1841; Bedd., Ferns South. India 4. pl. 12. 1863; Handb. Ferns Brit. India 48. 1883. **H. pinnatifida** Bedd., Suppl. Handb. Ferns Brit. India 12. 1892. **H. vestita** (Blume) T.Moore, Ind. Fil. 92. 1857; Bedd., Ferns South. India 84. pl. 253. 1864. **Davallia vestita** Blume, Enum. Pl. Jav. 233. 1828; Hook. & Baker, Syn. Fil. 90. 1874. **Pachypleuria vestita** C.Presl, Epim. Bot. 98. 1849.

Epiphytes. Rhizome 3-4 mm thick, long creeping, branched, densely scaly. Scales 2-7 x 0.5-1 mm, lanceolate, acuminate, peltate, yellowish-brown when young, dark reddish-brown at maturity. Fronds 15-17 x 4-5 cm, simply pinnate, stipe 8-10 cm long, scaly below, sparsely above. Lamina triangular or ovate in outline; coriaceous; pinnae to 2 x 1.5 cm, oblong-lanceolate, lobed to serrate; lower pinnae larger, basispic lobes larger; progressively reduced

towards apex; veins forking. Sori 0.5 x 0.5 mm, dark brownish, semicircular or elliptic, yellowish-brown; indusia rounded or obtuse, entire. Sporangial capsule 250 x 187.5 µm, subglobose, stalk 200 µm long. Spores 50 x 45 µm, yellowish, hyaline, planoconvex to reniform, verrucose.

Occasional, in semi-evergreen and evergreen forests.

Specimens studied: Chokkampatti, *KPR* 14692; Ezhanakkuzhi, *JA* 12892 (KFRI, CALI).

Note: Kramer (in Kramer & Green, 1990) treated *Humata* Cav. under *Davallia* J.E.Smith. But many later workers do not agree with this concept (Lellinger, *pers. comm.*, 2000).

### LEUCOSTEGIA C.Presl

Tent. Pterid. 94. 1836.

**Leucostegia alternifrons** (Dennst.) M.R.Almeida & S.M.Almeida, J. Bombay Nat. Hist. Soc. 90: 423. 1993. **Aspidium alternifrons** Dennst., Schlüssel 11, 19, 39. 1818. **Asplenium alternifrons** (Dennst.) Dillwyn, Ref. Hort. Malab. 64. 1839. **Cheilanthes tenuifolia** sensu Nicolson et al., Interpr. Hort. Malab. 29. 1988; Madhus. & Rejani, Indian Fern J, 11: 16. 1994, non (Burm.f.) Sw., 1806. **Leucostegia immersa** (Wall.) C.Presl, Tent. Pterid. 95. t. 4. f. 11. 1836; Bedd., Handb. Ferns Brit. India 51. 1883; Subr. et al., Bull. Bot. Surv. India 3: 211. 1961; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 161. 1974; R.D.Dixit, Cens. Indian Pterid. 171. 1984; Manickam, Fern Fl. Palni Hills 56. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 2. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 132. pl. 102. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 524. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 268. 1993; Subh.Chandra, Ferns India 256. 2000. **Davallia immersa** Wall., List No. 256. 1828, nom. nud.; Hook., Sp. Fil. 156. 1846. **Acrophorus immersa** T.Moore, Proc. Linn. Soc. 2: 286. 1854; Bedd., Ferns South. India 4. pl. 11. 1863. **Kal – panna – maravara** Rheede, Hort. Malab. 12: 33. t. 16. 1693.

Epiphytes or lithophytes. Rhizome 5 mm thick, creeping. Scales 1.5-2.5 x 0.5-1 mm, ovate or elliptic, acuminate, pale brown, membranous. Dark brown hairs present. Fronds 37-47 x 15-20 cm; stipe 10-18 cm long, yellow, polished; lamina rhomboidal or elliptic in outline, coriaceous; primary pinnae to 15 x 6 cm, elliptic, lanceolate, acuminate to 15 cm long stalked; secondary pinnae to 7 x 2

cm, lanceolate, acuminate, sessile; tertiary pinnae obovate or elliptic in outline, irregularly lobed; lobes crenate, serrate, cuneate at base; terminal pinnules dissimilar, linear, lobed. Pinnae and pinnules progressively reduced towards apex. Veins forked. Sori to 3.5 x 2 mm, cordate to semicircular, reddish-brown, indusia translucent, yellowish, attached at the base only, entire. Sporangial capsule 250 x 150 µm subglobose, stalk 250 µm long. Spores 50 x 30 µm, yellow, hyaline, planoconvex to reniform, verrucate. (**Fig. 5.1.17c**).

Rare, in evergreen forests.

Specimens studied: Kottamala, JA 13262; Pachakkanam, JA 12836; (KFRI, CALI); near Periyar dam, K. Subramanyam 9453 (MH); Vellimala, KPR 62871 (CALI).

Note: The plant illustrated by van Rheedee in *Hortus Malabaricus* as *Kal – panna – maravara* was considered as *Cheilanthes tenuifolia* (Burm.f.) Sw. (Datta, 1985; Nayar & Geevarghese, 1993; Nicolson *et al.*, 1988 & Madhusoodnan & Rejani, 1994). Almeida and Almeida (1993) after a critical examination proves that it is *Leucostegia* hence proposed the new name.

## BLECHNACEAE

(C.Presl) Copeland, Gen. Fil. 155. 1947

*Blechnae* C.Presl, Epim. Bot. 103. 1851.

### Key to the genera

- 1. Rhizome long creeping; scandent ..... **Stenochlaena**
- 1. Rhizome erect; not scandent ..... **Blechnum**

## BLECHNUM Linnaeus

Sp. Pl. 2: 1077. 1753.

**Blechnum orientale** L., Sp. Pl. 2: 1077. 1753; Bedd., Ferns South. India 10. pl. 29. 1863 & Handb. Ferns Brit. India 132. t. 86. 1883; Subr. et al., Bull. Bot. Surv. India 3: 212. 1961; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 33. 1974; R.D.Dixit, Cens. Indian Pterid. 172. 1984; Manickam, Fern Fl. Palni Hills 144. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 4. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 300. pl. 229. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 550. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 349. 1993; Subh.Chandra, Ferns India 335. 2000.



Terrestrials. Rhizome 20-30 x 15-18 cm, erect, thick, massive. Scales 20-28 x 2-3 mm, ovate-lanceolate, brownish. Fronds to 2 x 0.6 m; stipe 65-70 x 1-2 cm, scaly beneath, glabrous above; lamina simply pinnate; pinnae 25-30 x 1.2-1.5 cm, linear-acuminate, sessile, oblique at base; costa prominent, grooved above, rounded below; veins close, forked, almost perpendicular to the costa. Sori linear, beneath, on both sides of the costa, except at the extreme tips; indusia linear, translucent 22-27 x 0.2-0.3 cm. Sporangial capsule 275 x 225  $\mu$ m, subglobose, stalk 500  $\mu$ m long. Spores 37.5-50 x 25  $\mu$ m, yellowish, ellipsoid with thin perine.

Occasional, on earth cuttings of at high altitude.

Specimen studied: Vellimala, KPR 70130 (CALI).

### STENOCHLAENA J. Smith

in Hook., J. Bot. 4: 149. 1841.

**Stenochlaena palustris** (Burm.f.) Bedd., Ferns Brit. India Suppl. 26. 1876 & Handb. Ferns Brit. India 421. t. 253. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 98. 1974; R.D.Dixit, Cens. Indian Pterid. 173. 1984; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 24, 60. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 303. pl. 232. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 549. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 355. 1993; Madhus. & Rejani, Indian Fern J. 11: 17. 1994; Subh.Chandra, Ferns India 337. 2000. **Polypodium palustre** Burm.f., Fl. Ind. 234. 1768. **Stenochlaena scandens** (Sw.) Js.Sm., J. Bot. 3: 401. 1841; Bedd., Ferns South. India 68. pl. 201. 1863. **Davallia ?** sensu Bedd., Ferns Brit. India 209. 1866. **Panna-Valli** Rheede, Hort. Malab. 12: 69. t. 35. 1693.

Scandent herbs. Rhizome 1-1.5 cm thick, long creeping. Scales 2-3.5 x 1-1.5 cm, ovate, acuminate, ciliate, darker in the middle. Fronds dimorphic; sterile fronds 25-50 x 20-40 cm, stipe 10-15 cm long, glabrous; lamina elliptic-oblong, acute in outline, bipinnate; pinnae to 20 x 3 cm, lanceolate-oblong, acuminate, serrate, obliquely attenuate at base, shortly stalked, coriaceous; costa raised above, shallowly grooved below; veins close, parallel to each other; pinnae progressively reduced towards apex; fertile fronds 20-40 x 40-60 cm, pinnae to 30 x 0.3 cm, linear. Sori yellowish brown, acrostichoid. Sporangial

capsule 225 x 187.5  $\mu\text{m}$ , subglobose, stalk 375  $\mu\text{m}$  long. Spores 40 x 25  $\mu\text{m}$ , planoconvex, monoletate, tuberculate.

Occasional, in evergreen forests.

Specimens studied: Kozhikkanam, K. Vivekananthan 46634 (MH); Pachakkanam, JA 13283 (KFRI, CALI).

## GRAMMITIDACEAE

Newman, Hist. Bot. Ferns 1: 7. 1840.

### Key to the genera

1. Sporangia in cavities ..... **Prosaptia**
1. Sporangia not in cavities ..... **Grammitis**

## GRAMMITIS Swartz

Schrad. J. Bot. 1800:17.1801.

**Grammitis pilifera** N.Ravi & J. Joseph, J. Bombay Nat. Hist. Soc. 76: 348. 1979; Nampy & Madhus., Indian Fern J. 9: 206. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 548. 1992; Nampy & Madhus., Fern Fl. South India 22. f. 5. 1998; Subh.Chandra, Ferns India 331. 2000. **Polypodium parasiticum sensu** Bedd., Handb. Ferns Brit. India 302. 1833, p.p., non Mett., 1857. **Grammitis medialis sensu** B.K.Nayar & S.Kaur, Comp. Bedd. Handb. Ferns Brit. India 75.1974; Manickam & Irud., Pterid Fl. W. Ghats 337. pl. 255. 1992, p.p. non **Polypodium mediale** Baker, 1874. **G. attenuata sensu** B.K.Nayar & Geev., Fern Fl. Malabar 348. 1993, p.p., non Kunze, 1851. **G. pilifera** var. **munnaensis** Raju et al., J. Econ. Tax. Bot. 20: 697. 1996.

Epiphytes. Rhizome 1 x 0.2 cm, erect. Scales 1-1.5 x 0.5-1 mm, ovate, acuminate, entire, cordate at base, clathrate, dark brown. Fronds simple, 2-4 x 0.3-0.7 cm, linear or oblong, rounded, entire, cuneate at base; stipe 0.5-0.8 mm, scaly beneath, lamina and stipe stiff hairy; costa raised above and below, veins free, distinct. Sori circular, 1 mm in diameter, dark brown in a row on either side of the costa, towards the distal half. Sporangial capsule 250 x 225  $\mu\text{m}$ , globose, setose, stalk 1-rowed, 250-300  $\mu\text{m}$  long. Spores 45 x 45  $\mu\text{m}$ , yellowish, planoconvex, tuberculate. (**Fig. 5.1.19a**).

Occasional, in evergreen forests.

Specimens studied: Kottamala, JA 13266 & KPR 14652 (KFRI, CALI); Vellimalai-Pachakumatchi (Madurai district, TN), K. Subramanyam 9497 (MH).

### **PROSAPTIA** C.Presl

Tent. Pterid. 165.1836.

**Prosaptia obliquata** (Blume) Mett., Novara Reise Bot. 1: 214. 1879; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. Ferns Brit. India 77. 1974; Satija & Bir, Polyp. Ferns India 5. 1985; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 20. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 340. pl. 257. 1992; Nampy & Madhus., Fern Fl. South India 28. f. 7. 1998; Subh.Chandra, Ferns India 333. 2000. **Polypodium obliquatum** Blume, Enum. Pl. Jav. 2: 128. 1828; Bedd., Ferns South. India 55. pl. 167. 1864 & Handb. Ferns Brit. India 311. 1883.

Epiphytes. Rhizome 1-1.3 cm thick, creeping. Scales 2-4 x 0.2-1 mm, lanceolate or linear, acuminate, fimbriate, dark brown to black, clathrate. Fronds 15-20 x 2-3.5 cm, pinnatifid; stipe 2-4 cm long, scaly beneath, hairy above; lamina deeply lobed up to costa, lobes 0.1-1.8 x 0.3-0.5 cm, triangular to triangular-lanceolate, obtuse, larger lobes in the middle, progressively reduced towards both ends; costules raised below; veins free, indistinct. Sori 1 x 0.5 mm, elliptic, immersed in bilipped cavities, in a row on either side of costule, towards the margins. Sporangial capsule 250 x 250 µm, subglobose, stalk 1-rowed except at apex, 375 µm long. Spores 20 µm in diameter, globose, black, spinulose.

Rare, in evergreen forests.

Specimens studied: Chemmanoda, JA 13245 (KFRI, CALI); Maddalamkotti, C.N.Mohanan 72804 (MH).

### **LOXOGRAMMACEAE**

Ching ex Pichi Sermolli, Webbia 29: 11. 1974.

### **LOXOGRAMME** (Blume) C.Presl

Tent. Pterid. 214. 1836.

**Loxogramme cuspidata** (Zenker) M.G.Price, Amer. Fern J. 74: 61. 1984; Nampy & Madhus., J. Econ. Tax. Bot. 19: 741. 1995 & Fern Fl. South India 37. f. 12, 13. 1998; Subh.Chandra, Ferns India 360. 2000. **Grammitis cuspidata**

Zenker, Pl. Ind. 1: t. 2. 1835. *Loxogramme involuta* sensu Bedd., Ferns South. India 17. pl. 50. 1864 & Handb. Ferns Brit. India 393. 1883; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. Ferns Brit. India 94. 1974; Satija & Bir, Polyp. Ferns India 7. 1985; Manickam, Fern Fl. Palni Hills 150. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 6. 1987; Manickam & Irud., Pterid Fl. W. Ghats 314. pl. 239. 1992; Nampy & Madhus., Indian Fern J. 9: 209. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 16: 449. 1994, non C.Presl, 1836.

Epiphytes. Rhizome 4 mm thick, creeping. Scales 8 x 3 mm, ovate-acuminate, entire, thin membranous, pale brown. Fronds 27-30 x 2-3 cm, simple, linear-lanceolate, acuminate, cuneate to decurrent at base, entire, coriaceous, rolled inwards on drying; costa faintly raised above, grooved below; veins anastomosing. Sori 2-2.5 mm long, linear on either side, angular to costa. Sporangial capsule 312.5 x 250 µm, subglobose, stalk 2-rowed, 375 µm long. Spores 50-60 x 40-45 µm, yellowish, reniform or ellipsoid, granulose.

Rare, in evergreen forests.

Specimen studied: Vellimala, KPR 62896 (CALI).

## POLYPODIACEAE

Berchtold & J.C.Presl, Pirozen. Rostlin. 1: 272. 1820.

### Key to the genera

1. Nest leaves present ..... **Drynaria**
1. Nest leaves absent ..... **2**
2. Fronds simply pinnate ..... **Phymatosorus**
2. Fronds simple ..... **3**
3. Stellate hairs present on the lamina and stipe ..... **Pyrrosia**
3. Stellate hairs absent ..... **4**
4. Fronds dimorphic ..... **Leptochilus**
4. Fronds not dimorphic ..... **5**
5. Fronds pinnatisect ..... **Phymatopteris**
5. Fronds not pinnatisect ..... **6**
6. Sori scattered ..... **Microsorium**
6. Sori in a row on either side of the costa ..... **7**
7. Lamina densely peltate scaly beneath ..... **Pleopeltis**
7. Lamina without scales ..... **Lepisorus**

**DRYNARIA** (Bory) J. Smith,  
J. Bot. 4: 60. 1841, *nom. cons.*

**Drynaria quercifolia** (L.) Js.Sm., J. Bot. 3: 398. 1841; Bedd., Ferns South. India 63. pl. 187. 1864 & Handb. Ferns Brit. India 341. pl. 191. 1883; B.K.Nayar, Bull. Nat. Bot. Gard. Lucknow 56: 11. 1961; Subr. et al., Bull. Bot. Surv. India 3: 213. 1961; Satija & Bir, Polyp. Ferns India 88. 1985; Manickam & Irud., Pterid. Fl. W. Ghats 312. pl. 238. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 382. 1993; N.C.Nair et al., J. Econ. Tax. Bot. 18: 456. 1994; Madhus. & Rejani, Indian Fern J. 11: 15. 1994; Nampy & Madhus., Fern Fl. South India 47. f. 16. 1998; Subh.Chandra, Ferns India 360. 2000. ***Polypodium quercifolium*** L., Sp. Pl. 2: 1087. 1753. ***Panna – kelengo – maravara*** Rheede, Hort. Malab. 12: 23-24. t. 11. 1693. ***Welli-panna-kelengu maravara*** Rheede, Hort. Malab. 12: 25. t. 12, 13. 1693.

Epiphytes or lithophytes. Rhizome 0.5-1.5 m long, 5-10 cm thick, creeping, branched, densely scaly. Scales 10-12 x 1-2 mm, dark brown, linear or lanceolate, acuminate, fimbriate subpeltate. Fronds dimorphic; sterile bracket fronds 30-40 x 25-30 cm, simple; stipe 1-3 cm long, thick; lamina elliptic in outline; cordate at base, lobed; lobes 3-6 x 2-3 cm, ovate to ovate-lanceolate, obtuse or rounded; thick coriaceous; costa and primary veins thick, raised above and below; veinlets copiously anastomosing, raised above and below; fertile fronds 60-80 x 40-50 cm, simply pinnate; stipe 12-15 x 0.5-0.8 cm, grooved above, rounded beneath; lamina broadly elliptic in outline; pinnae 20-25 x 3-4 cm, linear or oblong-lanceolate, acuminate, margins usually wavy; costa, costules and veinlets raised above and below, anastomosing. Sori 1-1.5 mm in diameter, dark brown, many on vein endings. Sporangial capsule 312 x 250 µm, subglobose, stalk 500-625 µm long. Spores 50 x 37.5 µm, brown, ellipsoid with spinous perine. (**Fig. 5.1.19b**).

Common, in all vegetaiontypes.

Specimens studied: Edapalayam, *B.D. Sharma* 41664; way to Mangaladevi temple, *K. Vivekananthan* 50541 (MH); Vallakkadavu, *KPR* 14658 (KFRI, CALI).



Fig. 5.1.19. Habits of a. *Grammitis pilifera*, b. *Drynaria quercifolia*, c. *Leptochilus bahupunctika*, d. *Phymatopteris montana*.



Fig. 5.1.20 **a.** *Microsorium punctatum*- habit, **b.** *Microsorium pteropus*- habit, **c.** *Phymatosorus beddomei*- habit, **d.** part of the fertile pinna, **e.** *Pyrrosia porosa*- habit.

**LEPISORUS** (J.Smith) Ching

Bull. Fam. Mem. Inst. Biol. 4: 47. 1933.

Epiphytes or lithophytes with long creeping, branched rhizome densely covered by dark brown to black, peltate, uniformly or bi coloured scales with entire or dentate margins. Fronds simple, linear or linear-lanceolate, acuminate, coriaceous with prominent costa and indistinct veins. Sori yellow to brown, circular, in a row on either side of the costa. Sporangial capsule ellipsoid or subglobose with long, 2-rowed stalk, intermingled with long stalked, peltate, dark brown paraphyses. Spores planoconvex, granulose to spinulose.

**Key to the species**1. Rhizome scales bicolorous, dentate ..... **L. amaurolepidus**1. Rhizome scales concolorous, entire ..... **L. nudus**

**Lepisorus amaurolepidus** (Sledge) Bir & Trikha in Bir & Vasudeva, J. Bombay Nat. Hist. Soc. 68: 192. 1971; Satija & Bir, Polyp. Ferns India 19. 1985; Manickam & Irud., Pterid. Fl. W. Ghats 334. pl. 253. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 387. 1993; N.C.Nair et al., J. Econ. Tax. Bot. 18: 463. 1994; Nampy & Madhus., Fern Fl. South India 52. f. 18. 1998; Subh.Chandra, Ferns India 337. 2000. **Pleopeltis amaurolepidus** Sledge, Bull. Brit. Mus. Nat. Hist. Bot. 2: 136. 1960; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 85. 1974; Manickam, Fern Fl. Palni Hills 157. 1986. **Polypodium gladiatum** Wall., List No. 279. 1829, nom. nud., non Kunze, 1834. **Lepisorus amaurolepidus** (Sledge) B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 65. 1974.

Epiphytes or lithophytes. Rhizome 2-3 mm thick, creeping. Scales 1.-2 x 0.8-1.2 mm, peltate, ovate, acuminate, margins irregular, ciliate, thick and black in the middle, paler along margins. Fronds 12-14 x 0.8-1.2 cm, simple; stipe 0.5 cm long; lamina linear-lanceolate, acuminate, base cuneate, coriaceous, costa raised above and below, veins indistinct. Sori circular, yellow to yellowish-brown in a row on either side of the costa, more near to margins. Sporangial capsule 312.5 x 250 µm subglobose, stalk 2-rowed, 0.6-0.8 mm long, paraphyses peltate with long stalk. Spores 55 x 37.5 µm, yellow, monoletate, planoconvex or ellipsoid, spinulose.

Rare, in evergreen forests.



Specimens studied: Mangaladevi, *KPR* 62837 (CALI); Sabarimalathodu, *JA* 13205; Vahalala, *KPR* 14606 (KFRI, CALI); Vellimala, *KPR* 62877 & 62891 (CALI).

**Lepisorus nudus** (Hook.) Ching, Bull. Fam. Mem. Inst. Biol. 4: 83. 1933; Subr. et al., Bull. Bot. Surv. India 3: 213. 1961; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 64. 1974; Satija & Bir, Polyp. Ferns India 18. 1985; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 21. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 332. pl. 252. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 388. 1993; N.C.Nair et al., J. Econ. Tax. Bot. 18: 464. 1994; Nampy & Madhus., Fern Fl. South India 54. f. 19. 1998; Subh.Chandra, Ferns India 381. 2000. ***Pleopeltis nuda*** Hook., Exot. Fl. 1: t. 63. 1823; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 84. 1974; Manickam, Fern Fl. Palni Hills 155. 1986. ***Polypodium wightianum*** Thwaites, Enum. Pl. Zeyl. 394. 1864. ***Pleopeltis wightiana*** (Thwaites) Bedd., Ferns South. India 60. pl. 180. 1864. ***P. linearis*** sensu Bedd., Handb. Ferns Brit. India 346. 1883, non ***Polypodium lineare*** Thunb., 1784.

Epiphytes or lithophytes. Rhizome 2 mm thick, long creeping, branched. Scales 3-4 x 1-1.3 mm, lanceolate-acuminate, peltate, dark brown to black. Fronds 10-23 x 0.7-1.8 cm, simple; stipe 1-1.5 cm long; lamina linear-acuminate, acute at base, coriaceous, costa prominent on both sides, veins indistinct. Sori circular, 4 mm in diameter, in two distinct rows, towards distal half. Sporangial capsule 312.5 x 250 µm, ellipsoid, stalk 2-rowed, except at the apex, 375 µm long; paraphyses peltate, long stalked. Spores 50-62.5 x 50 µm, hyaline, yellow, planoconvex, finely granulose.

Rare, in evergreen forests.

Specimens studied: Kottamala, *KPR* 14656; Kumarikulam, *JA* 12834 (KFRI, CALI); Mlappara *KPR* 70035 (CALI); near Periyar Dam, *K. Subramanyam* 9457 (MH); Uppermanalar, *JA* 12864; Vellimala, *KPR* 18333 & 18337 (KFRI, CALI); way to Mlappara, *N.C.Nair* 70102 (MH).

**LEPTOCHILUS** Kaulfuss

Enum. Fil. 147. 1824.

Low epiphytes, lithophytes or terrestrial herbs. Rhizome long creeping, covered with dark brown scales. Fronds simple, dimorphic. Sterile fronds linear-lanceolate or lanceolate, acuminate, cuneate or decurrent at base, coriaceous, dark green. Fertile fronds linear; sori acrostichoid, dark brown to black. Sporangial capsule globose with long stalk. Spores ellipsoid, finely granulose or spinulose.

**Key to the species**

1. Low epiphytes ..... **L. bahupunctika**  
 1. Terrestrials or lithophytes ..... **L. decurrens**

**Leptochilus bahupunctika** (B.K.Nayar et al.) Nampy in Nampy & Madhus., Fern Flora South India 59. 1998. *Nistarika bahupunctika* B.K.Nayar et al., Fern Gaz. 13: 33. 1985; B.K.Nayar & Geev., Fern Fl. Malabar 404. 1993. –**Vallivarakody-maravara** Rheede, Hort. Malab. 12: 59. t. 30. 1693.

Low epiphytes. Rhizome 25-30 x 0.5-0.7 cm, creeping. Scales 1-1.2 x 0.5 mm, lanceolate, acuminate. Fronds 30-38 x 2.5-3.5 cm, simple, linear-lanceolate, acuminate, cuneate at base, some times lobed; stipe 4-6 cm long; costa raised above and below, veins indistinct, anastomosing. Fertile pinnae not seen. (**Fig. 5.1.19c**).

Rare, in evergreen forests.

Specimen studied: Vellimala, KPR 70131 (CALI).

Note: Fraser-Jenkins (p. 171, 1997) comments that *Nistarika bahupunctika* B.K.Nayar et al., may be *Leptochilus thwaitesianus* Fee or *L. decurrens* Blume. Nampy and Madhusoodanan (1998) treated *Nistarika* Nayar et al. and *Leptochilus* Kaulf. as congeneric and transferred *N. bahupunctika* to *Leptochilus*. At the same time they maintained '*bahupunctika*' as a separate species, differing from *Leptochilus thwaitesianus* Fee and *L. ducurrens* Blume, which is followed here.

**Leptochilus decurrens** Blume, Enum. Pl. Jav. 2: 206. 1828; Subr. et al., Bull. Bot. Surv. India 3: 213. 1961; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 100. 1974; Manickam, Fern Fl. Palni Hills 146. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 69. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 307. pl. 234. 1992; Nampy & Madhus., Indian Fern J. 9: 211. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 389. 1993; N.C.Nair et al., J. Econ. Tax. Bot. 18: 462. 1994; Nampy & Madhus., Fern Fl. South India 61. f. 21. 1998; Subh.Chandra, Ferns India 404. 2000. **L. lanceolata** Fee, Acrost. 87. t. 47. f. 1. 1845; Satija & Bir, Polyp. Ferns India 81. 1985; Manickam, Fern Fl. Palni Hills 147. 1986, p.p. **Gymnopteris feei** T.Moore, Ind. Fil. 29. 1857; Bedd., Ferns South. India 15. pl. 48. 1863. **G. feei** var. **trilobata** Bedd., Ferns Brit. India t. 272. 1866 & Handb. Ferns Brit. India 429. 1883. **G. variabilis** (Hook.) Bedd., Ferns Brit. India t. 272. 1866 & Handb. Ferns Brit. India 429. pl. 258. 1883. **G. lanceolata** Bedd., Suppl. Ferns South. India & Ferns Brit. India 26. 1876. **G. variabilis** var. **lanceolata** Bedd., Handb. Ferns Brit. India 429. pl. 191. 1883. **Paraleptochilus decurrens** (Blume) Copel., Gen. Fil. 198. 1947; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 100. 1974; Satija & Bir, Polyp. Ferns India 81. 1985; **Leptochilus decurrens** f. **lanceolatus** (Fee) Sledge, Ann. Mag. Nat. Hist. Ser. 12: 867. pl. 1956; Manickam & Irud., Pterid. Fl. W. Ghats 308. pl. 235. 1992, p.p.; B.K.Nayar & Geev., Fern Fl. Malabar 391. 1993.

Terrestrials or lithophytes. Rhizome 2-3 mm thick, long creeping. Scales 2-3 x 0.5-1 mm, ovate to lanceolate-acuminate, cordate at base, uniformly thickened, brown, fimbriate towards apex. Fronds 25-50 x 0.5-4 cm, dark green, simple, dimorphic; stipe 2-8 cm long, articulated; sterile lamina 25-30 x 3.5-4 cm, linear-acuminate, acute at base, coriaceous, costa distinct on both sides; veins anastomosing; fertile fronds narrower, to 50 x 0.5 cm; sori acrostichoid, orange-brown. Sporangial capsule 225 x 187.5 µm, globose, stalk 373 µm long, 2-rowed, except at the apex. Spores 45 x 30 µm, yellowish, ellipsoid, finely granulose or spinulose.

Common, in moist deciduous, semi-evergreen and evergreen forests.

Specimens studied: Mlappara, *KPR* 70037 (CALI); Uppermanalar, *JA* 12871; Vellimala, *KPR* 18330 (KFRI, CALI); *KPR* 62816.

**MICROSORUM** Link

Hort. Berol. 2: 110. 1833.

Epiphytic or lithophytic herbs. Rhizome erect or creeping, covered with dark brown to black scales. Fronds simple, membranous to coriaceous, with prominent costa and costules. Sori yellow to dark brown or black, circular, scattered. Sporangial capsule subglobose with long stalk. Spores planoconvex, smooth to granulose.

**Key to the species**

- 1. Rheophytes ..... **M. pteropus**
- 1. Epiphytes ..... **2**
- 2. Fronds membranous ..... **M. membranaceum**
- 2. Fronds coriaceous ..... **M. punctatum**

**Microsorium membranaceum** (D. Don) Ching, Bull. Fam. Mem. Inst. Biol. 4: 309. 1933 & Ic. Fil. Sin. 2: 88. 1934; B.K. Nayar, Bull. Nat. Bot. Gard. Lucknow 58: 17. 1961; B.K. Nayar & S. Kaur, Comp. Bedd. Handb. 87. 1974; Satija & Bir, Polyp. Ferns India 75. 1985; Subh. Chandra & S. Kaur, Nomen. Guide Bedd. 21. 1987; Bosman, Leiden Bot. Ser. 12: 91. 1991; Manickam & Irud., Pterid. Fl. W. Ghats 327. pl. 248. 1992; Madhus. & Nampy, J. Econ. Tax. Bot. 17: 45. 1993; B.K. Nayar & Geev., Fern Fl. Malabar 401. 1993; N.C. Nair et al., J. Econ. Tax. Bot. 18: 466. 1994; Nampy & Madhus., Fern Fl. South India 78. f. 30. 1998; Subh. Chandra, Ferns India 406. 2000. *Polypodium membranaceum* D. Don, Prodr. Fl. Nepal. 2. 1825. *Pleopeltis membranacea* T. Moore, Ind. Fil. 191. 1860, nom. inval.; Bedd., Ferns South. India 59. pl. 177. 1864 & Handb. Ferns Brit. India 355. 1883.

Epiphytes. Rhizome 4-7 mm thick, creeping. Scales 1-2 x 0.8 mm, ovate, acuminate, entire, dark brown to black, clathrate. Fronds 15-40 x 1.5-5 cm, articulated, linear-lanceolate, acuminate, base cuneate to decurrent, margins wavy, membranous, costa and costules raised above and below, veins anastomosing; stipe very short or absent. Sori circular, yellowish brown, scattered. Sporangial capsule 250 x 250 µm, subglobose, stalk 375 µm long, 3-seriate at apex, rest biseriate. Spores 62.5 x 37.5 µm, yellow, planoconvex or reniform, granulose.

Occasional, in semi-evergreen and evergreen forests.

Specimen studied: Mlappara, JA 12824 (KFRI, CALI).

**Microsorium pteropus** (Blume) Copel., Univ. Calif. Publ. Bot. 16: 112. 1929; B.K.Nayar, Bull. Nat. Bot. Gard. Lucknow 58: 26. 1961; Satija & Bir, Polyp. Ferns India 78. 1985; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 35. 1987; Manickam & Irud., Pterid. Fl. W. Ghats 326. pl. 247. 1992; Nampy & Madhus., Fern Fl. South India 80. f. 31. 1998. **Polypodium pteropus** Blume, Enum. Pl. Jav. 125. 1828. **Polypodium zosteriforme** Wall., List No. 280. 1829, nom. nud. **Pleopeltis pteropus** (Blume) T.Moore, Ind. Fil. 78. 1857; Bedd., Handb. Ferns Brit. India 359. 1883. **P. tridactyla** (Wall.) T.Moore, Ind. Fil. 78. 1857; Bedd., Ferns South. India 60. pl. 179. 1864. **P. zosteriformis** (Wall.) Bedd., Ferns Brit. India t. 123. 1866. **P. pteropus** var. **zosteriformis** (Wall.) Bedd., Handb. Ferns Brit. India 362. 1883. **P. pteropus** var. **minor** Bedd., Handb. Ferns Brit. India 361. pl. 204. 1883. **Microsorium pteropus** f. **minor** (Bedd.) Ching, Bull. Fam. Mem. Inst. Biol. 4: 312. 1933; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 21. 1987; Madhus. & Nampy, J. Econ. Tax. Bot. 17: 46. 1993. **M. pteropus** var. **minor** (Bedd.) N.P.Balacr., Bull. Bot. Surv. India 22: 137. 1980; N.C.Nair et al., J. Econ. Tax. Bot. 18: 467. 1994. **Kaulinia pteropus** (Blume) B.K.Nayar, Taxon 13: 67. 1964; B.K.Nayar & Geev., Fern Fl. Malabar 385. 1993. **K. zosteriformis** (Wall.) B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 87. 1974. **K. pteropus** var. **minor** (Bedd.) B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 87. 1974. **Colysis pteropus** (Blume) Bosman, Leiden Bot. Ser. 14: 112. 1991; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 89. 1997; Subh.Chandra, Ferns India 400. 2000.

Lithophytes. Rhizome 2-3 mm thick, creeping, branched. Scales 2-2.5 x 0.4-0.8 mm, ovate-lanceolate, acuminate, dark brown to black, entire. Fronds 6-10 x 0.7-1.5 cm, linear or oblong, elliptic-lanceolate, acuminate or obtuse, entire, cuneate at base; stipe 0.5-1 cm long; costa raised below, hairy, indistinct above, glabrous, veins distinct below, anastomosing. Sori brown, circular, scattered. Sporangial capsule 312.5 x 250 µm, subglobose, stalk 375 µm long, biseriate at apex, rest uniseriate. Spores 50 x 37.5 µm, yellow, planoconvex, granulose. (**Fig. 5.1.20b**).

Common, in semi-evergreen and evergreen forests on rocks in the streams.

Specimens studied: Randattinkara, JA 13213; Ummikkuppan, KPR 14637 (KFRI, CALI).

**Microsorium punctatum** (L.) Copel., Univ. Calif. Publ. Bot. 16: 111. 1929; B.K.Nayar, Bull. Nat. Bot. Gard. Lucknow 58: 19. 1961; Bir & Trikha, Bull. Bot. Surv. India 10: 143. 1968; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 87. 1974; Satija & Bir, Polyp. Ferns India 77. 1985; Manickam, Fern Fl. Palni Hills 154. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 21. 1987; Bosman, Leiden Bot. Ser. 14: 97. 1991; Manickam & Irud., Pterid. Fl. W. Ghats 328. pl. 249. 1992; Madhus. & Nampy, J. Econ. Tax. Bot. 17: 46. 1993; B.K.Nayar & Geev., Fern Fl. Malabar 403. 1993; N.C.Nair et al., J. Econ. Tax. Bot. 18: 467. 1994; Nampy & Madhus., Fern Fl. South India 84. f. 32. 1998; Subh.Chandra, Ferns India 407. 2000. **Acrostichum punctatum** L., Sp. Pl. 2: 1524. 1763. **Pleopeltis iriodes** (Poir.) T.Moore, Ind. Fil. 78. 1857; Bedd., Ferns South. India 59. pl. 178. 1864. **P. punctata** Bedd., Suppl. Ferns S. India & Brit. India 22. 1876 & Handb. Ferns Brit. India 357. 1883.

Epiphytes or lithophytes. Rhizome 1.5-5 x 1.5-4 cm, erect. Scales 2-3 x 1 mm, ovate-lanceolate, acuminate, dark brown to black at the centre, paler along margins, irregular to entire. Fronds 18-60 x 1.8-7.5 cm, elliptic or linear-lanceolate, or oblanceolate, acuminate, margins entire, cartilaginous, wavy, coriaceous, cuneate to decurrent at base; stipe 1-1.5 cm long, costa raised above and below; veins indistinct, anastomosing. Sori circular, yellowish to brown, scattered towards the distal half. Sporangial capsule 375 x 312.5 µm, subglobose, stalk 500 µm long, 3-seriate at apex, rest biseriate. Spores 75 x 40 µm, yellowish, ellipsoid, planoconvex or reniform, smooth. (**Fig. 5.1.20a**).

Occasional, in semi-evergreen and evergreen forests.

Specimen studied: Mlappara, *KPR 70062* (CALI).

### **PHYMATOPTERIS** Pichi Sermolli

Webbia 28: 460. 1973.

**Phymatopteris montana** (Sledge) Pic.Serm., Webbia 28: 463. 1973; Satija & Bir, Polyp. Ferns India 63. 1985; N.C.Nair et al., J. Econ. Tax. Bot. 18: 465. 1994; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 193. 1997; Nampy & Madhus., Fern Fl. South India 90. f. 34. 1998; Subh.Chandra, Ferns India 415. 2000. **Crypsinus montanus** Sledge, Bull. Brit. Mus. Nat. Hist. Bot. 2: 145.

1960; Manickam & Irud., Pterid. Fl. W. Ghats 318. pl. 243. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 377. 1993. *Pleopeltis oxyloba* sensu Bedd., Ferns South. India 59. pl. 175. 1864, p.p., non *Polypodium oxylobum* Wall. ex Kunze, 1851. *Phymatodes montana* (Sledge) Bir & Devi, Bull. Bot. Surv. India 10: 209. 1968. *Phymatodes oxyloba* (Wall. ex Kunze) C.Presl, Tent. Pterid. 196. 1836; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 21. 1987.

Epiphytes. Rhizome 4-7 mm thick, creeping, branched. Scales 3-5 x 1-1.5 mm, ovate-lanceolate, entire or rarely ciliate, brownish. Fronds 12-15 x 6-10 cm, simple; stipe 2.5-6 cm long, scaly beneath, glabrous, polished; lamina 7-9 x 6-10 cm, pinnatisect, 5-7-lobed, 4-6 x 1 cm, oblong, rounded, margins wavy or crenate, or crisped; costa raised above and below; veins forked. Sori circular in a row on either side of the costa. Sporangial capsule 312.5 x 250 µm, globose, stalk 500 µm long, 3-seriate at apex, rest biseriate. Spores 75 x 50 µm, yellowish, reniform or planoconvex, monolete, granulose. (Fig. 5.1.19d).

Occasional, in evergreen forests.

Specimens studied: Mlappara, JA 12830; Pamba, D.B.Deb 30358 (MH); Vellimala, JA 13259 (KFRI, CALI); KPR 62883 (CALI).

### PHYMATOSORUS Pichi Sermolli

Webbia 28: 457. 1973.

Epiphytic or lithophytic herbs. Rhizome thick, long creeping, branched, fleshy, covered with peltate scales. Fronds simply pinnate or pinnatisect, broadly elliptic in outline, dark green, coriaceous; lobes linear acute, rachis prominently winged. Sori yellow to brown, circular in a row on either side of the costule, distinctly marked above. Sporangial capsule ellipsoid with long stalk. Spores planoconvex, granulose.

#### Key to the species

1. Wing of the costa narrow, less than 0.5 cm ..... **P. beddomei**
1. Wing of the costa broad, more than 0.5 cm..... **P. nigrescens**

**Phymatosorus beddomei** S.R.Ghosh, J. Econ. Tax. Bot. 6: 433. 1985; N.C.Nair et al., J. Econ. Tax. Bot. 18: 466. 1994; Nampy & Madhus., Fern Fl. South India 95. f. 36. 1998. *Pleopeltis leiorhiza* sensu Bedd., Ferns South.

India 58. pl. 174. 1864 & Handb. Ferns Brit. India 372. 1883, p.p., non T. Moore, 1862. *Microsorium lucidum* sensu B.K. Nayar, Bull. Nat. Bot. Gard. Lucknow 58: 22. 1961; Subr. et al., Bull. Bot. Surv. India 3: 213. 1961; Manickam, Fern Fl. Palni Hills 153. 1986, non Copel., 1947. *Microsorium cuspidatum* sensu B.K. Nayar & S. Kaur, Comp. Bedd. Handb. 89. 1974; B.K. Nayar & Geev., Fern Fl. Malabar 397. 1993, non (D. Don) Tagawa, 1966. *Phymatodes cuspidata* sensu Subh. Chandra & S. Kaur, Nomen. Guide Bedd. 21. 1987, non Js. Sm., 1857. *Phymatosorus cuspidatus* (D. Don) Pic. Serm., Webbia 31: 249. 1977; Satija & Bir, Asp. Plant Sci. 8: 71. 1985; Fraser-Jenk., New Sp. Syndr. Indian Pterid. 198. 1997; Subh. Chandra, Ferns India 419. 2000. *P. lucidus* sensu Manickam & Irud., Pterid. Fl. W. Ghats 316. pl. 241. 1992, non Pic. Serm., 1973.

Epiphytes or lithophytes. Rhizome 2-3 cm thick, creeping, dark green, branched, apex covered with brownish-black scales. Scales 5 x 5 cm, peltate, rounded in outline, irregular along margins. Fronds 60-80 x 30 cm, simple; stipe 30 x 0.5-0.8 cm, thick, polished; lamina 50-60 x 30 cm, pinnatifid, dark green, coriaceous; rachis dark brownish; lobes 25-30 x 1-2 cm, oblong, acuminate, constricted towards base; wings of costa very narrow; veins indistinct. Sori circular 2-4 mm in diameter in distinct rows. Sporangial capsule 312.5 x 250 µm, ellipsoid, stalk 375 µm long, 3-seriate at apex, rest biseriate. Spores 80 x 50 µm, planoconvex, exine granulose. (**Fig. 5.1.20 c & d**).

Rare, in evergreen forests.

Specimens studied: Mlappara, *KPR* 70015 (CALI); Vellimala, *KPR* 13296 (KFRI, CALI); way to Mangaladevi temple, *N.C. Nair* 70228; way to Vazhukkappara, *N.C. Nair* 69879; Aruna estate (Madurai district, TN), *K. Subramanyam* 9483 (MH).

Note: Fraser-Jenkins (*pers. comm.*, 2001) now differs from his earlier (Fraser-Jenkins, 1997) treatment of this species as *Phymatosorus cuspidatus* (D. Don) Pic. Serm.

**Phymatosorus nigrescens** (Blume) Pic. Serm., Webbia, 28: 459. 1973; Satija & Bir, Polyp. Ferns India 68. 1985; Manickam & Irud., Pterid. Fl. W. Ghats 317. pl. 242. 1992; N.C. Nair et al., J. Econ. Tax. Bot. 18: 465. 1994; Nampy & Madhus., Fern Fl. South India 99. f. 38. 1998; Subh. Chandra, Ferns India 421.



2000. *Polypodium nigrescens* Blume, Enum. Pl. Jav. 2: 126. 1828. *Pleopeltis longissima* sensu Bedd., Ferns South. India 59. pl. 176. 1864, non Blume, 1828. *Phymatodes nigrescens* (Blume) J. Sm., Ferns Brit. For. 94. 1866; *Pleopeltis nigrescens* (Blume) Bedd., Handb. Ferns Brit. India 367. 1883. *Microsorium nigrescens* (Blume) Copel., Occas. Pap. Bishop Mus. 14: 74. 1938; B.K.Nayar & Geev., Fern Fl. Malabar 402. 1993. *M. alternifolium* Copel., Gen. Fil. 197. 1947, p.p.; B.K.Nayar, Bull. Nat. Bot. Gard. Lucknow 58: 12. 1961, non Willd., 1810.

Epiphytes or lithophytes. Rhizome 1-2 cm thick, fleshy, long creeping, branched. Scales 4-5 x 3-4.5 mm. Fronds 50-60 x 30-45 cm, simple; stipe 30-40 cm, glabrous below, polished above; lamina pinnatisect, 6-7 lobed, lobes 25-30 x 2.5-4.8 cm, oblong or elliptic-oblong, acuminate, entire, costa and costules raised above and below, veins anastomosing, costal wings 0.5-1.5 cm broad. Sori circular in two distinct rows on either side of costa, raised above. Sporangial capsule 312.5 x 250 µm, ellipsoid, stalk 625 µm long, 3-seriate at apex, rest biseriate. Spores 45 x 30 µm, planoconvex, granulose.

Rare, in evergreen forests.

Specimens studied: Chemmanoda, JA 13240 (KFRI, CALI); Pamba to Ayyappan temple, N.C.Nair 50837 (MH).

#### PLEOPELTIS Humbolt & Bonpland ex Willdnow

Sp. Pl. 5: 211. 1810.

*Pleopeltis macrocarpa* (Bory ex Willd.) Kaulf., Berlin Jahrb. Pharm. 21. 41. 1820; Satija & Bir, Polyp. Ferns India 33. 1985; Manickam & Irud., Pterid. Fl. W. Ghats 330. pl. 251. 1992; Nampy & Madhus., Fern Fl. South India 103. f. 40c & 41. 1998; Subh.Chandra, Ferns India 388. 2000. *Polypodium macrocarpum* Bory ex Willd., Sp. Pl. 5: 147. 1810. *P. lanceolatum* L., Sp. Pl. 2: 1082. 1753. *Pleopeltis lepidota* (Willd. ex Schldt.) C.Presl, Tent. Pterid. 193. 1836; Bedd., Ferns South. India 60. pl. 181. 1864. *Pleopeltis lanceolata* (L.) C.Presl, Tent. Pterid. 193. 1836, non Kaulf., 1824; Bedd., Handb. Ferns Brit. India 351. 1883. *Lepisorus macrocarpus* (Willd.) Ching, Bull. Fam. Mem. Inst. Biol. 4: 80. 1933; N.C.Nair et al., J. Econ. Tax. Bot. 18: 464. 1994.

Epiphytes. Rhizome 1-2 cm thick, creeping, branched. Scales 1-2.2 x 0.2-0.5 mm, peltate, clathrate, margins toothed, yellowish brown, thick along the middle. Fronds 2-4 x 0.4-0.5 cm, simple; stipe 0.5-1 cm long; lamina oblanceolate or linear lanceolate, obtuse, entire, cuneate at base, coriaceous, covered with peltate scales; costa thickened above and below. Sori circular, deep brown, 2 or 3 on either side of the costa in a line near to margins, raised below, depressed above. Sporangial capsule 250 x 250  $\mu\text{m}$ , globose, stalk 375  $\mu\text{m}$  long, 3-seriate at apex, rest biseriate; paraphyses 0.75 x 0.6 mm, peltate. Spores 75 x 50  $\mu\text{m}$ , planoconvex, monolet, granulate, yellowish.

Rare in shola forests.

Specimen studied: Kumarikulam, JA 12833 (KFRI, CALI).

### **PYRROSIA** Mirbel,

Hist. Nat. Gen. 4: 70. 1803.

Epiphytic or lithophytic herbs. Rhizome erect or creeping, densely covered with dark brown subpeltate scales. Fronds simple, some times dimorphic, linear, elliptic to linear-lanceolate, fleshy chartaceous to coriaceous, softly to densely stellate hairy. Sori acrostichoid or pseudo-acrostichoid. Sporangial capsule subglobose with a long stalk. Spores planoconvex, granulate to tuberculate.

#### **Key to the species**

1. Fronds dimorphic, sterile fronds obovate ..... **P. heterophylla**
1. Fronds not dimorphic ..... **2**
2. Fronds hispid ..... **P. porosa**
2. Fronds pubescent ..... **P. lanceolata**

**Pyrrrosia heterophylla** (L.) M.G.Price, Kalikasan 3: 177. 1973; Hovenkamp, Leiden Bot. Ser. 9: 299. 1986; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 22. 1987; Nampy & Madhus., Fern Fl. South India 113. f. 45. 1998; Subh.Chandra, Ferns India 366. 2000. **Acrostichum heterophyllum** L., Sp. Pl. 2: 1067. 1753. **Nipholobus nummularifolius** sensu Bedd., Ferns South. India 62. pl. 186. 1864, p.p., non Js.Sm., J. Bot. 3: 396. 1841. **Drymoglossum beddomei** C.B.Clarke, Trans. L. Soc. London 2: 527. 1880, nom. nud. **D.**

*piloselloides* var. *beddomei* C.B. Clarke: Bedd., Handb. Ferns Brit. India 413. 1883, nom. inval. *D. heterophyllum* (L.) Trimen, J. Linn. Soc. 24: 152. 1887; Satija & Bir, Polyp. Ferns India 54. 1985; Manickam, Fern Fl. Palni Hills 148. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 310. pl. 237. 1992; B.K.Nayar & Geev., Fern Fl. Malabar 380. 1993; N.C.Nair et al., J. Econ. Tax. Bot. 18: 457. 1994. *Pyrrosia piloselloides* sensu Nampy & Madhus., Indian Fern J. 9: 215. 1992, non L., 1753. *Drymoglossum piloselloides* (L.) C.Presl, Tent. Pterid. 227. t. 10. f. 5-6. 1830; Bedd., Ferns South. India 19. pl. 55. 1863 & Handb. Ferns Brit. India 411. 1883; B.K.Nayar & Geev., Fern Fl. Malabar 381. 1993; N.C.Nair et al., J. Econ. Tax. Bot. 18: 457. 1994; Madhus. & Rejani, Indian Fern J. 11: 16. 1994. *Pyrrosia nummularifolia* (Sw.) Ching, Bull. Chinese Bot. Soc. 1: 47. 1935; B.K.Nayar & Subh.Chandra, Bull. Bot. Gard. Lucknow 117: 73. 1965; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 81. 1974; **Marate – Mela – Maravara** Rheede, Hort. Malab. 12: 7. t. 29. 1693.

Epiphytes or lithophytes. Rhizome 1-1.5 mm thick, long creeping. Scales 1-1.5 x 0.1-0.5 mm, peltate, ovate, elliptic, rounded or lanceolate-acuminate, ciliate, golden-brown. Fronds simple, dimorphic; sterile fronds 3-5 x 1.5-2 cm, obovate, rounded, entire, glabrous, coriaceous, cuneate at base; stipe 5-8 mm, scaly beneath; veins anastomosing, indistinct; fertile fronds 5-6.5 x 0.2 cm, linear or oblong-rounded, cuneate at base; stipe 1.5-2.5 cm, glabrous, scaly at base. Sori acrostichoid, reddish brown. Sporangial capsule 375 x 312.5 µm, subglobose, stalk 500 µm long, biseriate. Spores 70 x 45 µm, black, planoconvex, monolete, tuberculate or warty.

Common, in moist deciduous, semi-evergreen and evergreen forests. Specimens studied: Pachanpallam, JA 13210 (KFRI, CALI); way to Mlappara, N.C.Nair 69892; bank of Thannithode, N.C.Nair 70177; Thekkady, K. Vivekananthan 45660 (MH).

***Pyrrosia lanceolata*** (L.) Farw., Amer. Midl. Nat. 12: 245. 1930, as '*Pyrrosia lanceolata*': Ching, Bull. Chinese Bot. Soc. 1: 70. 1935; B.K.Nayar & Subh.Chandra, Bull. Bot. Gard. Lucknow 117: 58. 1965; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 80. 1974; Satija et al., Bull. Bot. Surv. India 25: 69. 1983;

Manickam, Fern Fl. Palni Hills 150. 1986; Manickam & Irud., Pterid. Fl. W. Ghats 322. pl. 245. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 18: 459. 1994; Madhus. & Rejani, Indian Fern J. 11. 18. 1994; Nampy & Madhus., Fern Fl. South India 116. f. 46. 1998; Subh.Chandra, Ferns India 367. 2000. ***Acrostichum lanceolatum*** L., Sp. Pl. 2: 1067. 1753. ***Niphobolus adnascens*** (Sw.) Kaulf., Enum. Fil. 124. 1824; Bedd., Ferns South. India 62. pl. 184. 1864 & Handb. Ferns Brit. India 325. pl. 176. 1883. ***Pyrrosia varia*** (Kaulf.) Farw., Amer. Midl. Nat. 12: 302. 1931; B.K.Nayar & Subh.Chandra, Bull. Bot. Gard. Lucknow 117: 87. 1965; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 80. 1974. ***P. adnascens*** (Sw.) Ching, Bull. Chinese Bot. Soc. 1: 45. 1935; Subr. et al., Bull. Bot. Surv. India 3: 213. 1961; B.K.Nayar & Subh.Chandra, Bull. Bot. Gard. Lucknow 117: 48. 1965; B.K.Nayar & S.Kaur, Comp. Bedd. Handb. 80. 1974; Subh.Chandra & S.Kaur, Nomen. Guide Bedd. 22. 1987. ***Tiri-panna*** Rheede, Hort. Malab. 12: 141. t. 74. 1693.

Epiphytes. Rhizome 1-2 mm thick, creeping. Scales 1-3 x 0.5-0.8 mm, elliptic or linear, pale brown to yellowish, peltate or subpeltate, entire. Fronds simple; stipe 1-1.5 cm long; lamina 10-15 x 0.5-1.5 cm, linear or elliptic-lanceolate, acuminate, entire, base cuneate, coriaceous, densely stellate hairy below; costa raised below, grooved above. Sori 0.8-1 mm in diameter, circular deep brown, scattered, very closely resembles acrostichoid, towards the distal half. Sporangial capsule 350 x 312.5 µm, subglobose, stalk 0.5 mm long. Spores 85 x 62.5 µm, yellowish, planoconvex, tuberculate.

Common, in moist deciduous, semi-evergreen and evergreen forests. Specimens studied: Mlappara, *KPR* 70044 (CALI); *JA* 12890; Moolakkayam, *JA* 12842; Thannikkudy, *KPR* 14647 (KFRI, CALI).

***Pyrrosia porosa*** (C.Presl) Hovenkamp, Blumea 30: 208. 1984 Manickam & Irud., Pterid. Fl. W. Ghats 323. pl. 246. 1992; Nampy & Madhus., Indian Fern J. 9: 214. 1992 & Fern Fl. S. India 119. f. 47. 1998; Subh.Chandra, Ferns India 372. 2000. ***Niphobolus porosus*** C.Presl, Tent. Pterid. 100. 1836; Bedd., Ferns South. India 61. pl. 183. 1864. ***Polypodium porosum*** Wall., List No. 266. 1829, nom. nud. ***Niphobolus fissus*** et syn. homot., auct. non Blume: Bedd., Handb. Ferns Brit. India 330. 1883. ***Niphobolus mollis*** et syn. homot., auct. non

Kunze, *Linnaea* 24: 257. 1851; B.K.Nayar & Subh.Chandra, *Bull. Bot. Gard. Lucknow* 117: 67. 1965; B.K.Nayar & S.Kaur, *Comp. Bedd. Handb.* 814. 1974; Satija & Bir, *Polyp. Ferns India* 41. 1985; Subh.Chandra & S.Kaur, *Nomen. Guide Bedd.* 22. 1987; B.K.Nayar & Geev., *Fern Fl. Malabar* 410. 1993. ***Pyrrrosia nayariana*** Ching & Subh.Chandra, *Amer. Fern J.* 54: 62. t. 1-10. 1964; B.K.Nayar & Subh.Chandra, *Bull. Bot. Gard. Lucknow* 117: 70. 1965; Satija et al., *Bull. Bot. Surv. India* 25: 81. 1983; Satija & Bir, *Polyp. Ferns India* 49. 1985. ***P. stictica*** Holttum, *Nov. Bot. Inst. Bot. Univ. S. Prag.* 31. 1968, nom. superfl., Satija & Bir, *Polyp. Ferns India* 50. 1985; Manickam, *Fern Fl. Palni Hills* 151. 1986. ***P. adnascens*** (Sw.) Ching, *Bull. Chinese Bot. Soc.* 1: 45. 1935; N.C.Nair et al., *J. Econ. Tax. Bot.* 18: 458. 1994. ***P. acrostichoides*** (G.Forst.) Ching, *Bull. Chinese Bot. Soc.* 1: 69. 1935; Subr. et al., *Bull. Bot. Surv. India* 3: 213. 1961.

Epiphytes or lithophytes. Rhizome 2 x 2.5 cm, erect. Scales 2-4 x 1-1.2 mm, peltate, ovate or lanceolate, acuminate, dark brown along the centre, paler, yellowish brown along the margins, ciliate. Fronds 15-20 x 1-2 cm, simple; stipe 2-2.5 densely scaly beneath, densely hispid with stellate hairs; lamina coriaceous, linear-lanceolate, acute or acuminate, cuneate at base, densely covered with stellate hairs; costa raised below, indistinct above; veins anastomosing, indistinct. Sori circular, dark brown, scattered in the distal half, on maturity looks like acrostichoid. Sporangial capsule 437.5 x 375  $\mu$ m, subglobose, stalk 0.5 mm long, biseriate. Spores 100 x 70  $\mu$ m, yellowish, ellipsoid, ovoid or reniform, planoconvex, granulose. (Fig. 5.1.20e).

Occasional, in evergreen forests.

Specimens studied: Kottamala, *KPR* 14655 (KFRI, CALI); Mlappara estate, *N.C.Nair* 70134 (MH); Mlappara, *KPR* 70034 (CALI); bank of Ummikkuppan thode, *N.C.Nair* 70142; Vallakkadavu, *B.D. Sharma* 43825; Vazhukkappara, *N.C.Nair* 69887 (MH); Vellimala, *JA* 13257 (KFRI, CALI).

**AZOLLACEAE**

Wettstein, Handb. Syst. Bot. 2: 77. 1903.

**AZOLLA** Lamarck

Encycl. Meth. Bot. 1: 343. 1783.

**Azolla pinnata** R.Br., Prodr. Fl. Nov. Holl. 167. 1810; R.D.Dixit, Cens. Indian Pterid. 174. 1984; Manickam & Irud., Pterid. Fl. W. Ghats 345. pl. 261. 1992; N.C.Nair et al., J. Econ. Tax. Bot. 18: 469. 1994; Subh.Chandra, Ferns India 425. 2000.

Floating herbs, 6 x 5 mm, triangular in outline. Rhizome slender, branched with 12-15 mm long roots; young roots in fusiform calyptra. Leaves 2-lobed, aerial, dorsal lobe 1 x 0.5 mm, elliptic or rectangular, fleshy, containing mucilaginous cavities filled with blue-green algae; submerged lobes 0.7-0.9 c 0.9 mm, rounded, translucent, entire. Sporocarps not seen.

Occasional, in small ponds.

Specimen studied: Thekkady, *KPR* 70132 (CALI).

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## 5.2. Floristic analysis

Altogether 167 pteridophytes belonging to 68 genera and 32 families have been recorded from the Reserve (Fig. 5.2.1). This forms about 68 % of the total species known from the State of Kerala (Table 5.2.1). This includes 150 ferns and 17 fern allies (Fig. 5.2.2). *Asplenium* with 22 species is the largest genus followed by *Thelypteris* with 13 species. *Selaginella* and *Pteris* are represented with 9 species each. *Adiantum* consists of 6 species. *Crepidomanes*, *Diplazium*, *Huperzia* and *Microlepia* consist of 5 species each (Fig. 5.2.3).

At the family level *Aspleniaceae* with 22 species is the largest family. *Polypodiaceae* with 15, *Thelypteridaceae* with 14 and *Dryopteridaceae* with 10 species are next in the list. *Selaginellaceae*, *Athyriaceae*, *Hymenophyllaceae* and *Pteridaceae* are with 9 or more species (Fig. 5.2.4). Eight genera and families are represented by single species each (Fig. 5.2.5). Out of the 67 South Indian endemic pteridophytes 12 found to occur in the Reserve (Table 5.2.2). Thirty-two species that are reported as rare and endangered in South India (Madhusoodanan, 1991; Manickam, 1995), are also recorded from the Reserve (Table 5.2.3).

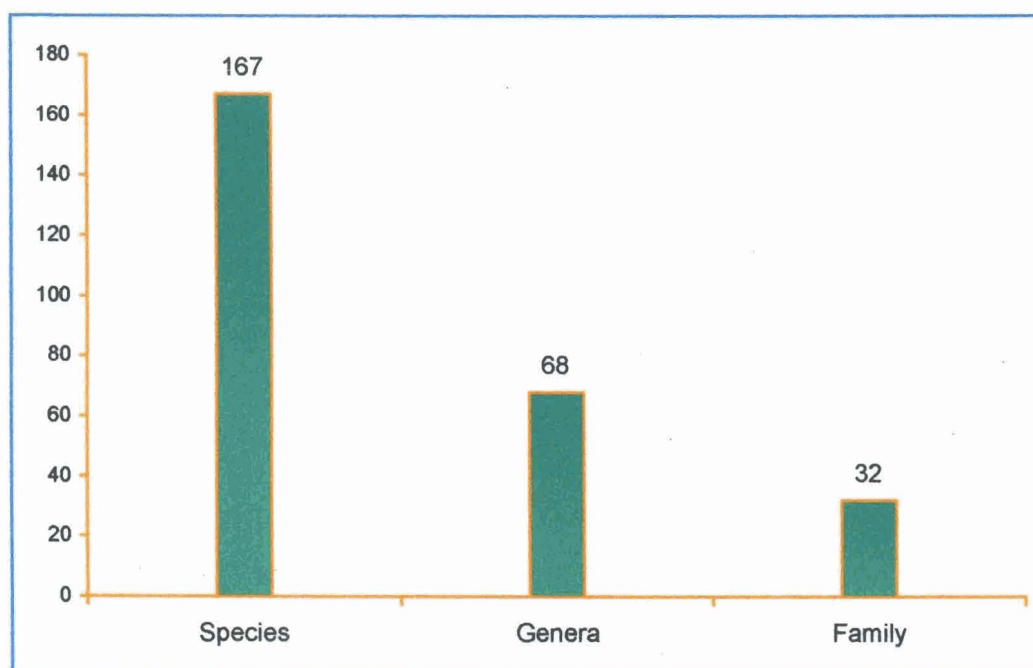


Fig. 5.2.1. Pteridophyte diversity of PTR at species, genera and family levels.

Table 5.2.1. A comparison of species diversity of pteridophytes.

Area	No. of species	Reference
Southern W. Ghats	251	Manickam and Irudayaraj (1992)
Kerala State	246	Nair et al. (1988-1994)
Southern India	240	Beddome (1863-64)
Karnataka State	174	Rajagopal and Bhat (1998)
Malabar	170	Nayar and Geevarghese (1993)
Periyar Tiger Reserve	167	Present study
Palni hills	135	Manickam (1986)
Wynad District	119	Leena and Madhusoodanan (1998)

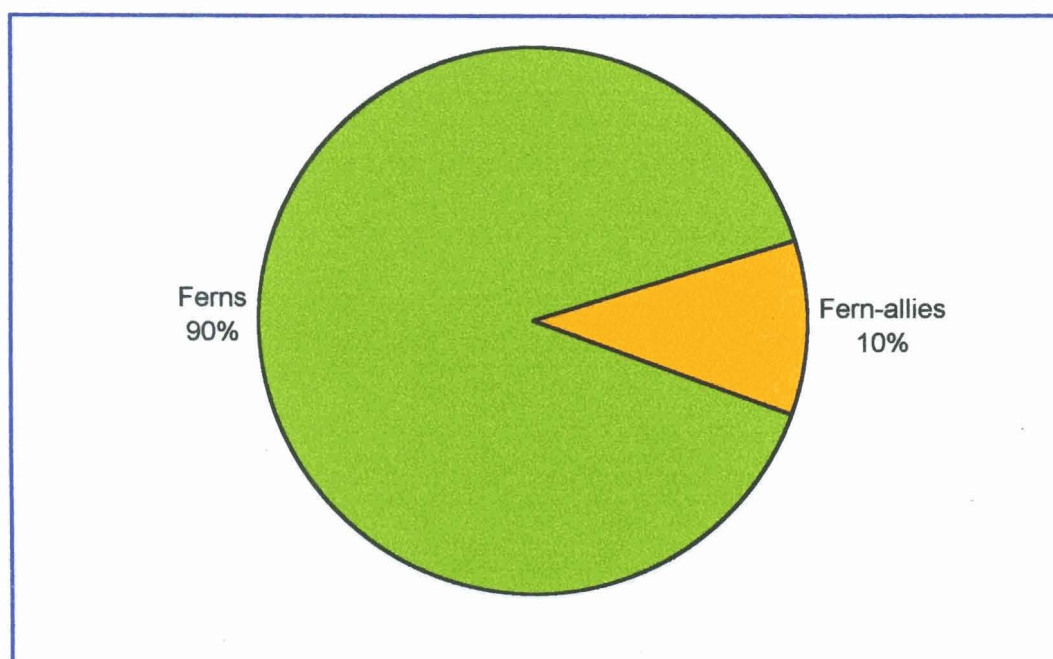


Fig. 5.2.2. Ferns and fern allies of PTR.



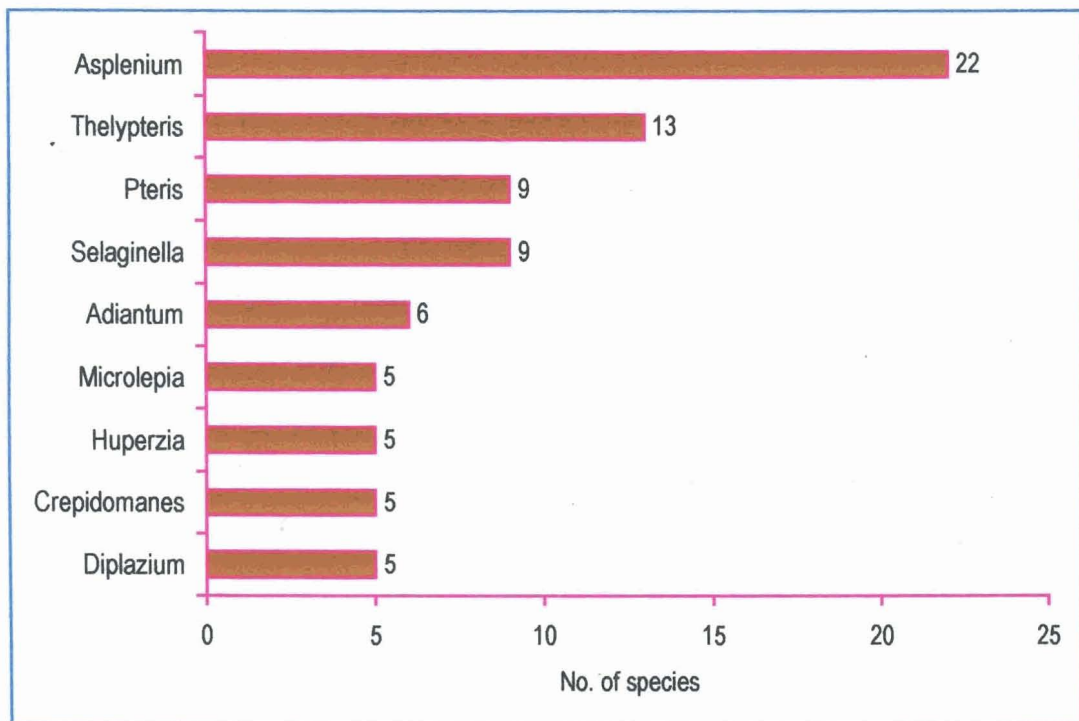


Fig. 5.2.3. Dominant pteridophyte genera of PTR.

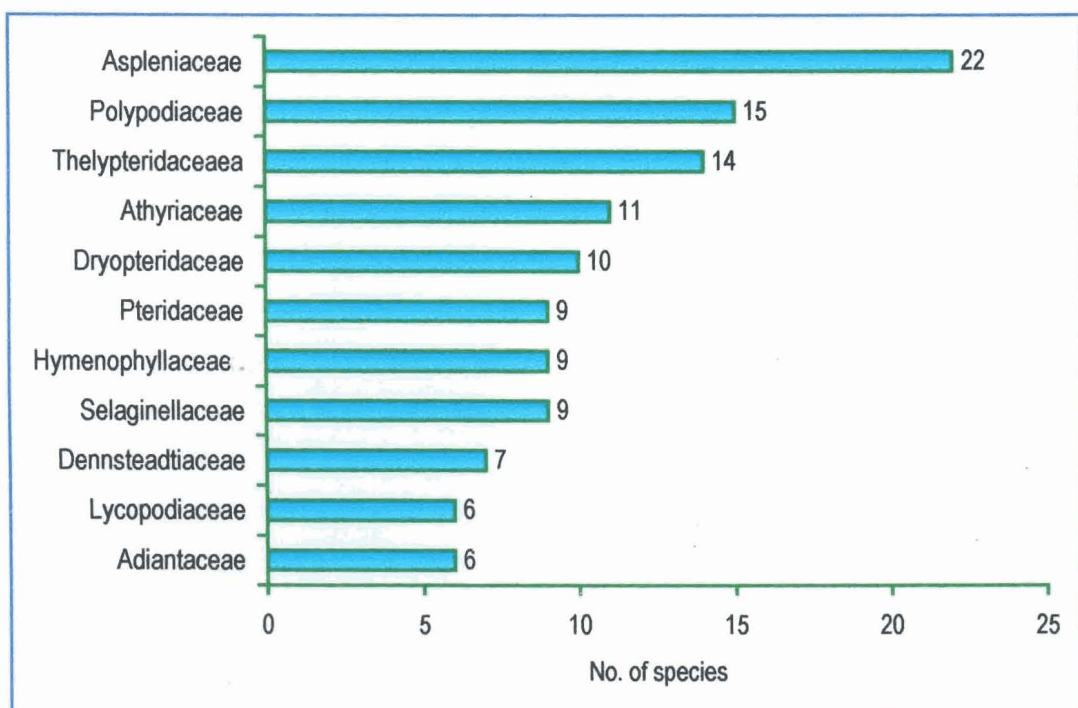


Fig. 5.2.4. Dominant pteridophyte families of PTR.

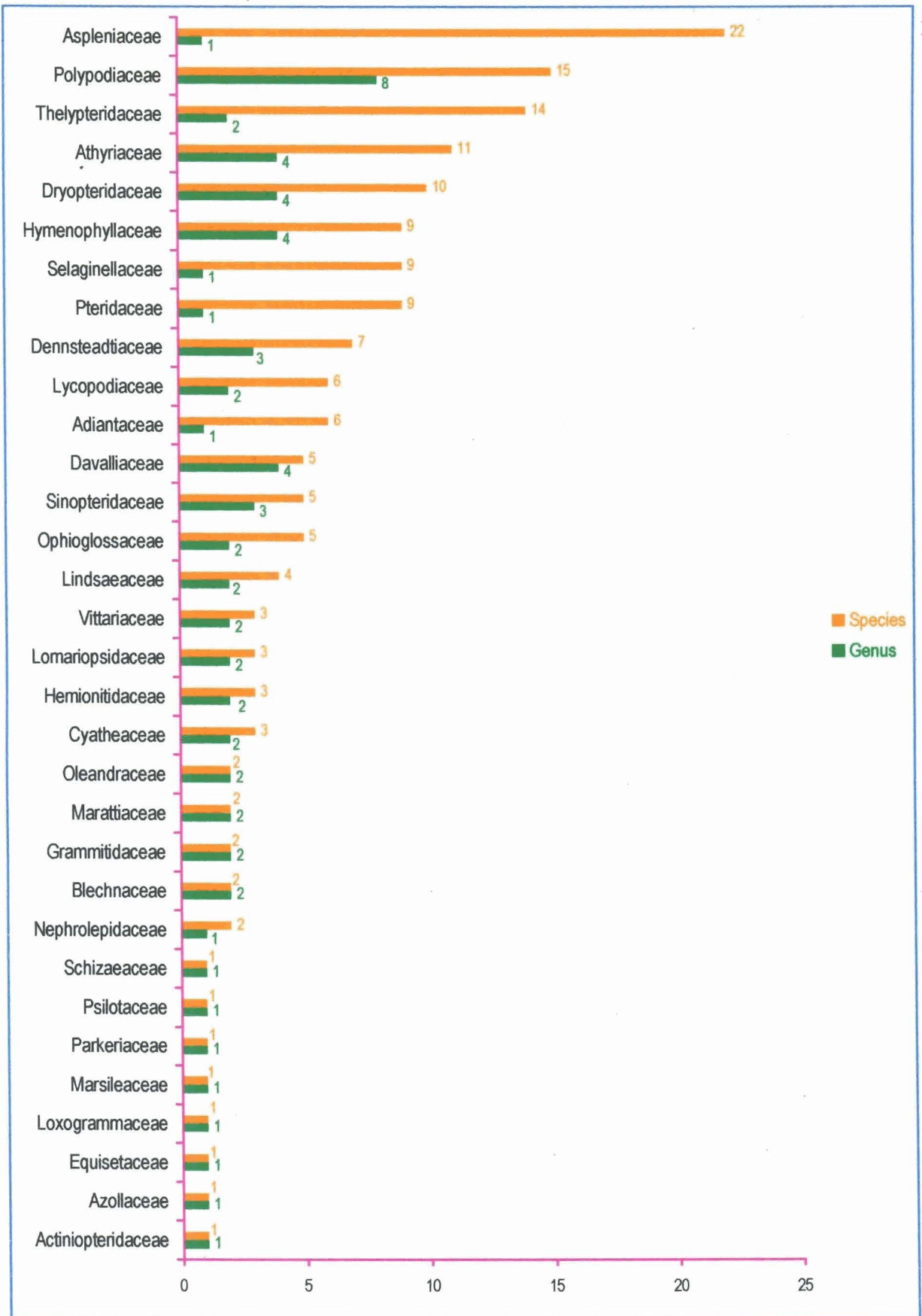


Fig. 5.2.5 Pteridophyte diversity of PTR at generic and species levels.

Table 5.2.2. South Indian endemic pteridophytes recorded PTR (Kar- Karnataka, Ker- Kerala, TN- Tamil Nadu)

Species	Endemic area
1. <i>Alsophila nilgirensis</i> (Holttum) R.M.Tryon	Kar, Ker, TN
2. <i>Asplenium unilaterale</i> var. <i>bivalvatum</i> B.K.Nayar & Geev.	Ker
3. <i>Bolbitis x prolifera</i> (Bory) C.Chr. & Tardieu	Kar, Ker, TN
4. <i>Crepidomanes agasthianum</i> Madhus. & C.A.Hameed	Ker
5. <i>Diplazium travancoricum</i> Bedd.	Ker
6. <i>Elaphoglossum beddomei</i> Sledge	Ker, TN
7. <i>Grammitis pilifera</i> N.Ravi & J.Joseph	Kar, Ker, TN
8. <i>Leptochilus bahupunctika</i> (B.K.Nayar et al.) Nampy	Ker, TN
9. <i>Lindsaea malabarica</i> (Bedd.) Baker	Kar, Ker, TN,
10. <i>Phymatosorus beddomei</i> S.R.Ghosh	Ker, TN
11. <i>Polystichum kunthianum</i> B.K.Nayar & Geev.	Ker
12. <i>Selaginella tenera</i> (Hook. & Grev.) Spring	Kar, Ker,

Table 5.2.3. Pteridophytes reported as rare and endangered in South India recorded from PTR.

Species	Family
1. <i>Alsophila nilgirensis</i> (Holttum) R.M.Tryon	Cyatheaceae
2. <i>Anisocampium cummingianum</i> C.Presl	Athyriaceae
3. <i>Araiostegia hymenophylloides</i> (Blume) Copel.	Davalliaceae
4. <i>Araiostegia pulchra</i> (D.Don)Copel.	Davalliaceae
5. <i>Arthropteris palisotii</i> (Desv.) Alston	Oleandraceae
6. <i>Asplenium crinicaule</i> Hance	Aspleniaceae
7. <i>Asplenium ensiforme</i> Wall. ex Hook. & Grev.	Aspleniaceae
8. <i>Asplenium nidus</i> L.	Aspleniaceae
9. <i>Asplenium phyllitidis</i> D.Don	Aspleniaceae
10. <i>Asplenium polyodon</i> G.Forst.	Aspleniaceae
11. <i>Botrychium daucifolium</i> Wall. ex. Hook. & Grev.	Ophioglossaceae
12. <i>Botrychium lanuginosum</i> Wall. ex. Hook. & Grev.	Ophioglossaceae
13. <i>Crepidomanes agasthianum</i> Madhus. & C.A.Hameed	Hymenophyllaceae
14. <i>Crepidomanes saxifragoides</i> (C.Presl)C.A.Hameed	Hymenophyllaceae
15. <i>Diplazium cognatum</i> (Hieron.) Sledge	Athyriaceae
16. <i>Elaphoglossum beddomei</i> Sledge	Lomariopsidaceae
17. <i>Humata repens</i> (L.f.) Diels.	Davalliaceae
18. <i>Hymenophyllum denticulatum</i> Sw.	Hymenophyllaceae
19. <i>Lindsaea malabarica</i> (Bedd.) Baker	Lindsaeaceae
20. <i>Microlepia majuscula</i> (Lowe) T.Moore	Dennsteadtiaceae
21. <i>Microlepia platyphylla</i> (D.Don) J.Sm.	Dennsteadtiaceae
22. <i>Microlepia strigosa</i> (Thunb.) C.Presl	Dennsteadtiaceae
23. <i>Oleandra musifolia</i> (Blume) C.Presl	Oleandraceae
24. <i>Ophioglossum pendulum</i> L.	Ophioglossaceae
25. <i>Phymatosorus beddomei</i> S.R.Ghosh	Polypodiaceae
26. <i>Phymatosorus nigrescens</i> (Blume) Pic.Serm.	Polypodiaceae
27. <i>Polystichum kunthianum</i> B.K.Nayar & Geev.	Dryopteridaceae
28. <i>Pteris geminata</i> Wall. ex Agardh	Pteridaceae
29. <i>Sphaeropteris crinita</i> (Hook.) R.M.Tryon	Cyatheaceae
30. <i>Thelypteris flaccida</i> (Blume) Ching	Thelypteridaceae
31. <i>Thelypteris triphylla</i> (Sw.) K.Iwats.	Thelypteridaceae
32. <i>Vittaria microlepis</i> Hieron	Vittariaceae

### 5.3. Ecology of Pteridophytes of Periyar Tiger Reserve

#### 5.3.1. Habits and Habitats

The distribution pattern of flora is determined by climate, soil, water, wind and associated organisms. Recent studies proved that the microbes play a key role in determining the vegetation of an area. The pteridophytes are also not an exception. Their distribution is largely influenced by the above mentioned factors. As noted by Holttum (1938) and Page (1979a & b), the pteridophytes depend largely on other dominant vegetation for survival. This group is not a dominant component in any vegetation type. The same time they play their role in disturbed habitats, and pave way to the development of a stabilized climax community (Maheswaran & Gunatilleke, 1988; Gunatilleke & Gunatilleke, 1991; Russel & Vitousek, 1997; Russel et al., 1998, 1999). The pteridophytes occupy all the available habitats in the vegetation types with their wide range of adaptations. Out of the 167 pteridophytes recorded from the Reserve, 104 species are terrestrials, 26 species are epiphytes and 6 species are lithophytes. Two species, viz., *Asplenium serricula* and *A. decrescens*, grow in all the three habitats; while 19 species grow as epiphytes and lithophytes. Seven species grow both as terrestrials and lithophytes. *Azolla pinnata* is free floating aquatic species while *Marsilea minuta* and *Ceratopteris thalictroides* occur both as aquatic and terrestrial. (Fig. 5.3.1).

With its varied topography and vegetation types, the Periyar Tiger Reserve offers a variety of habitats for the pteridophytes. Following Page (1979a), Madhusoodanan and Nampy (1998) classify the pteridophyte habitats of Kerala into 12 types. Of which 7, viz., rain forest floor, rainforest high climbers, rainforest low epiphytes, rain forest high epiphytes, rocks and cliffs, stream banks and earth cuttings occur in the Reserve.

Terrestrial species such as *Pteris* spp., *Arachniodes tripinnata*, *Polystichum harpophyllum*, *P. kunthianum*, *Thelypteris mollissima*, *T. parasitica*, *Microlepia speluncae*, *M. strigosa*, etc grow in humus rich and well drained soils. Species like *Leptochilus decurrens*, *Botrychium daucifolium*,

*B. lanuginosum*, *Asplenium normale*, etc are also confined to well drained soils. *Pteridium aquilinum* grows in the grasslands. *Actiniopteris radiata* is a xerophyte which grows in grasslands.

Out of 69 epiphytic pteridophytes reported from Kerala (Kumar & Sequiera, 1998) 48, including those, which grow as lithophytes, occurs in the Reserve. These epiphytes belong to two categories according to the position of their attachment with the host plants. The low epiphytes are confined to the lower levels; on the base of the trunks of trees, exposed roots, on the lower part of the shrubs, etc. *Leptochilus bahupunctika* grows attached to the stem and lower branches of shrubs. Species of filmy ferns, which grow admixed with the mosses, are also more adapted to this region.

The high epiphytes are canopy specialists, growing on the main stem or branches. Species such as *Drynaria quercifolia*, *Microsorium punctatum*, *M. membranaceum*, *Asplenium phyllitidis*, *A. ensiforme*, etc accumulate humus either by the bracket leaves or by the characteristic bird's nest arrangement of the fronds. *Ophioglossum pendulum* grows in the humus accumulated at the junction of the branches or in association with old colonies of *Nephrolepis auriculata*. *Huperzia* spp., may either grow from the humus accumulations as *O. pendulum* or grow attached to the branches, without much humus accumulation. *Elaphoglossum beddomei*, *Phymatopteris montana*, *Araiostegia hymenophylloides*, *A. pulchra*, etc accumulates humus among their fibrous roots, usually colonised by ants. *Psilotum* is found growing as epiphytes from the holes on the trunk or at the junction of the branches of the trees. *Antrophyum plantagineum*, *A. reticulatum* and *Vittaria microlepis* grow epiphytically on the main trunks. They are also found as lithophytes.

Only three climber pteridophytes are recorded from the Reserve. *Arthropteris palisotii* and *Stenochlaena palustris*, climbs to the upper canopy by the rhizome. The indefinitely growing frond climber, *Lygodium microphyllum* twines itself to the branches and foliage of the shrubs and trees.

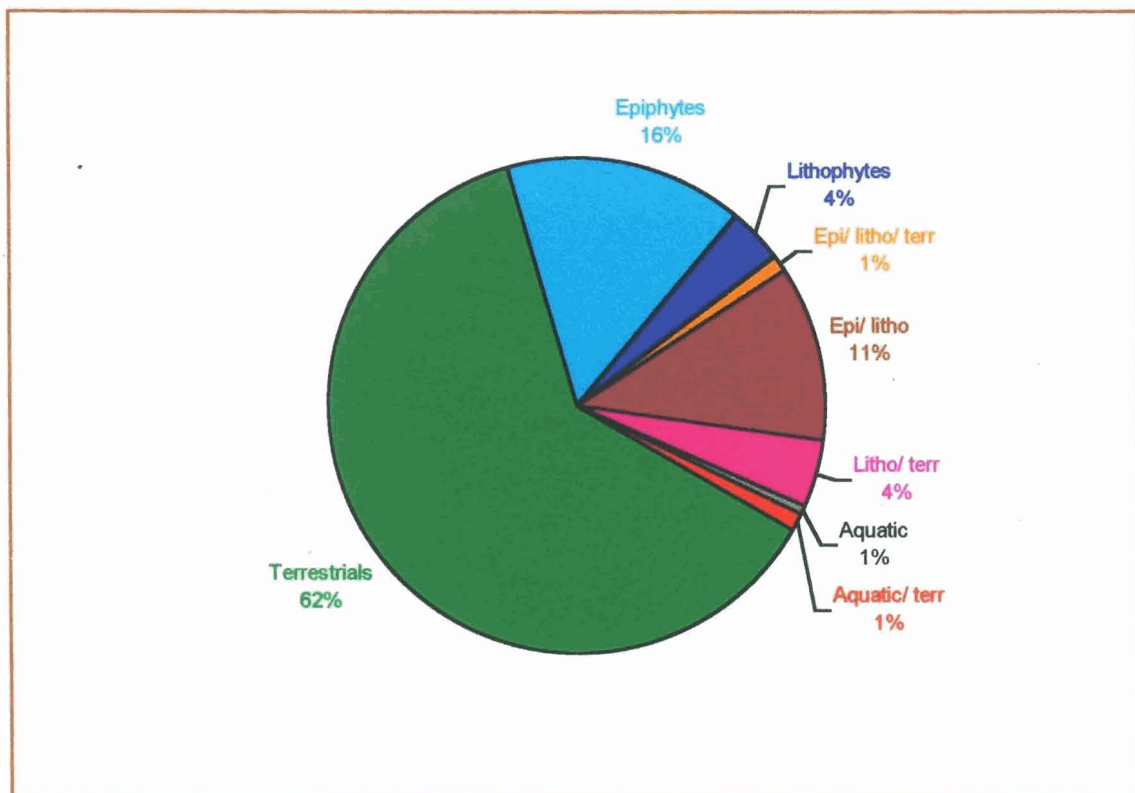


Fig. 5.3.1. Habits of pteridophytes of PTR.

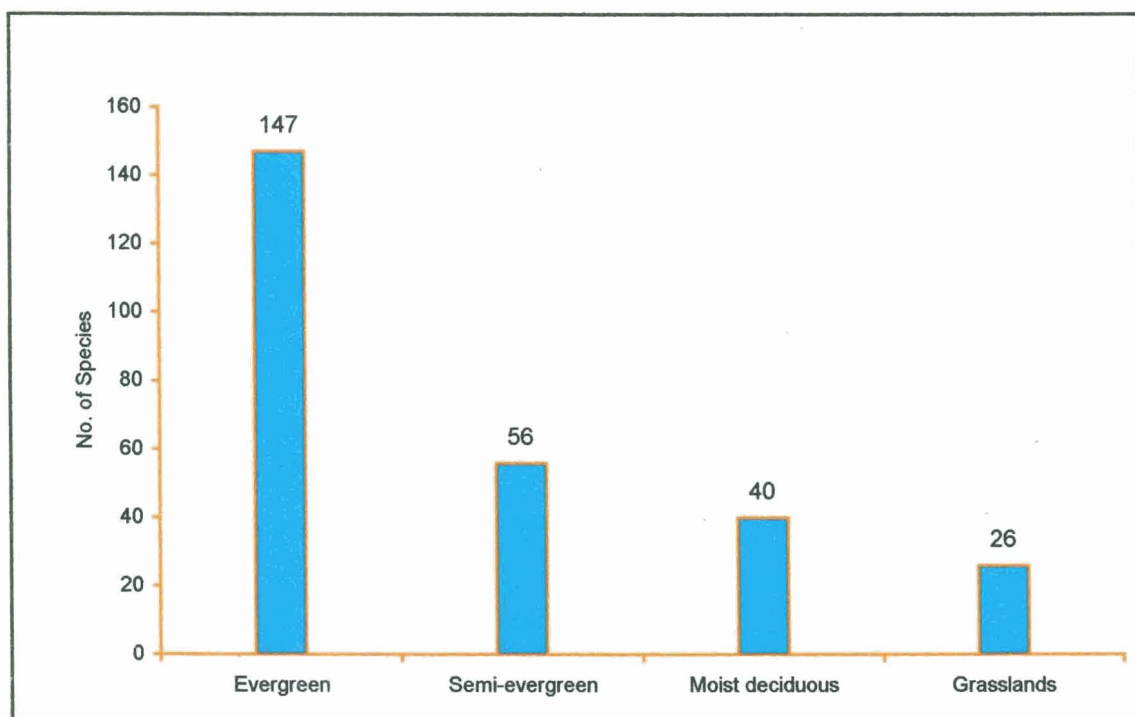


Fig. 5.3.2. Distribution of pteridophytes along vegetation gradient.

The rocks offer microhabitats for species like *Pyrrossia porosa*, *Microsorium punctatum*, *Asplenium* spp., etc. Filmy ferns like *Hymenophyllum denticulatum*, *H. exsertum*, etc are confined to the wet rocks in the densely shaded evergreen forests. *Drynaria quercifolia* is also seen as a lithophyte. Xerophytic species such as *Selaginella wightii* grows on the fully exposed rocks in the grasslands. *S. involvens* is another xerophytic lithophyte, but growing on the partial or fully shaded rocks in the semi-evergreen and evergreen forests.

Pteridophytes are limited by the water availability. Many species are specialised to amphibious habitats. The tree ferns; *Alsophila gigantea*, *A. nilgirensis* and *Sphaeropteris crinita* grow near the streamlets. *Angiopteris evecta* and *Marattia fraxinea* are also streamside ferns. *Thelypteris arbuscula* grow either on the stream banks or on the soil and humus accumulated boulders in the streambed. *Diplazium esculentum* grows usually near the water sources or near the stagnant water swept from the streamlets. The rocks and boulders in the streamside or streambed offer habitat for *Bolbitis appendiculata*, *Microsorium pteropus*, *Hymenophyllum denticulatum* and *H. exsertum*, etc. *Equisetum ramosissimum* is confined to the sandy stream banks.

The earth cuttings near the streamlets offer habitat for still other specialised ferns like *Cephalomanes obscurum*, *Tectaria coadunata*, *T. paradoxa*, *T. wightii*, *Adiantum raddianum*, *Asplenium polyodon*, etc are usually found growing on the earth cuttings.

Most of the *Selaginella* spp. are ephemerals, sprouting out during the rainy season. *Ophioglossum gramineum* grows on marshy lands among the grasses. *O. vulgatum* is found in grasslands as well as moist deciduous forests.

### **5.3.2. Distribution of pteridophytes along vegetation gradient**

An analysis of the pteridophyte distribution along vegetation types shows interesting patterns. Some species show wide range of distribution, occurring in all the vegetation types. Some others are restricted to particular vegetation



types only. Evergreen forests support the maximum species diversity (Fig. 5.3.2). Species such as *Huperzia hamiltonii*, *Grammitis pilifera*, *Prosaptia obliquata*, *Pleopeltis macrocarpa*, etc are confined to the hill top evergreen forests of above 1400 m altitude.

*Phymatosorus beddomei*, *P. nigrescens*, *Polystichum harpophyllum*, *P. kunthianum*, *Huperzia macrostachys*, *H. phlegmaria*, *Microsorium punctatum*, *Botrychium daucifolium* and *B. lanuginosum*, *Alsophila gigantea* and *A. nilgirensis*, *Sphaeropteris crinita*, *Macrothelypteris torresiana*, *Thelypteris mollissima*, *T. triphylla*, *T. truncata*, *Asplenium auritum*, *A. cheilosorum*, *A. unilaterale*, *A. nidus*, etc are evergreen ferns.

Moist deciduous and semievergreen forests are occupied by generalists. Except for a few, most of the species present in this types extend to evergreen forests also.

Grasslands and savannahs are least species rich. The pteridophytes present in these types are either hardy species, or are delicate ephemerals. The former type are xerophytes which can withstand hot and dry conditions either by perennating rhizomes or possess adaptations like curling of the fronds. Low percentage of the species diversity of the grasslands is directly related to the low water availability and lack of shade. The ephemerals like *Selaginella* spp., sprouts out during the rainy periods and completes their life cycle before the grasslands dry up. Species like *Pteridium aquilinum* perennate with the deeply growing subterranean rhizome. *Ophioglossum vulgatum* also perennate with the fleshy rhizome. *Actiniopteris radiata*, *Parahemionitis cordata*, *Cheilanthes opposita*, etc overcome the hot summer by curling their fronds.

### **5.3.3. Distribution of pteridophytes along altitudinal gradient.**

The distribution of the pteridophytes of the Reserve along the altitudinal gradient is shown in the figure 5.3.3. According to the altitudinal specificity 3 categories of species are recognised, viz., Low altitude species (below 800m), Medium altitude species (800-1400m) and High altitude species (above

1400m). Maximum species diversity is seen in the medium altitudinal zone (Fig. 5.3.4.). Species diversity increases with altitude and reaches maximum at 900-1600 m altitude. Seventy-four species are met within the low altitude zone. In the medium altitude zone 149 species are seen and the high altitude zone consist of 112 species. The highest number of species in the medium altitude zone is due to the mixing up of low altitude and high altitude species. Sixteen species such as *Drynaria quercifolia*, *Parahemionitis cordata*, *Selaginella ciliaris*, *S. tenera*, *Leptochilus decurrens*, *Pyrrosia heterophylla*, *P. lanceolata*, *Pteris quadriaurita*, *Nephrolepis auriculata*, etc are of wide range of distribution, occurring in all the three zones.

The ecological features of pteridophytes of the Reserve are summarised in Table 5.3.1.

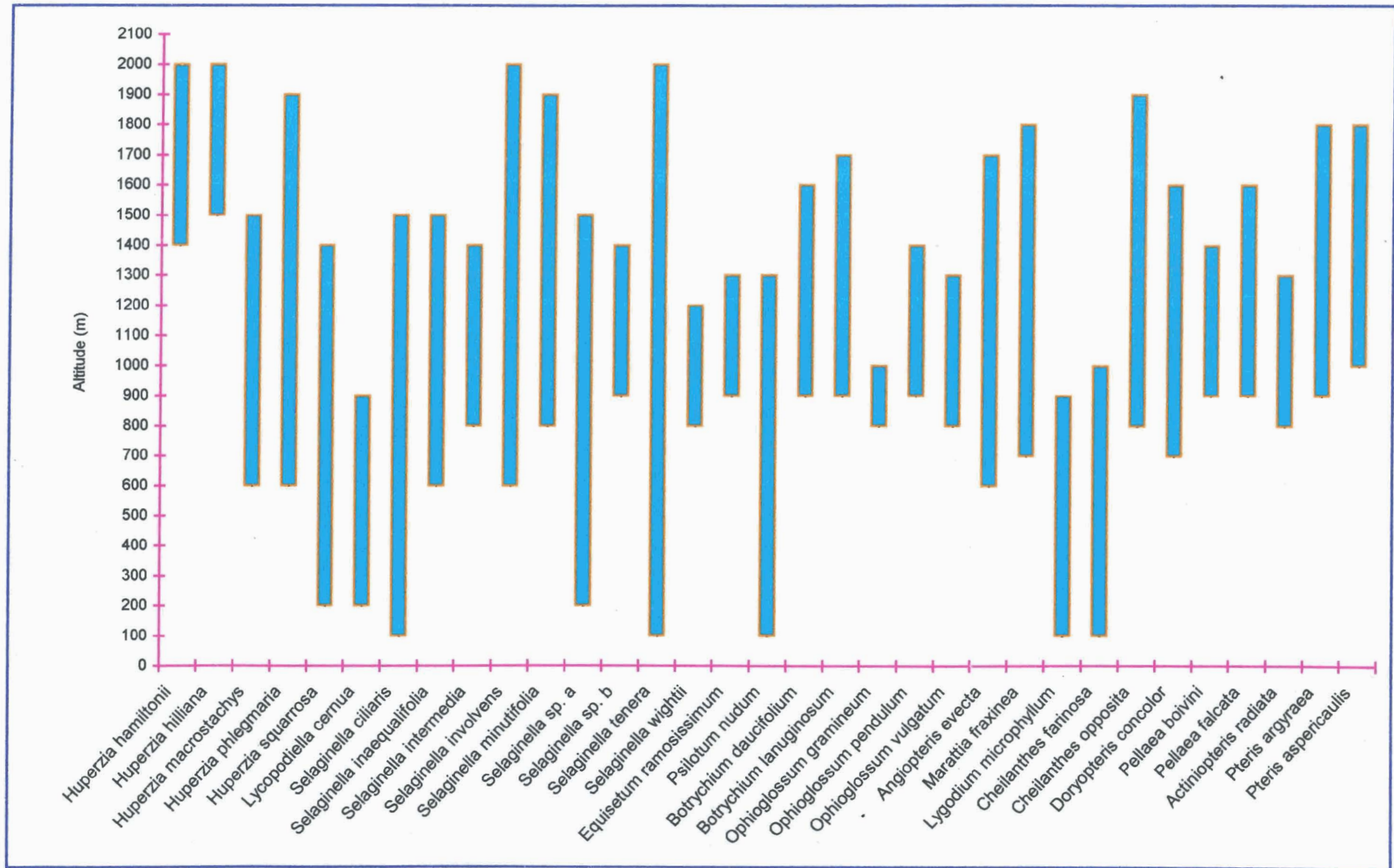


Fig. 5.3.3. Distribution of pteridophytes of PTR along altitudinal gradient.

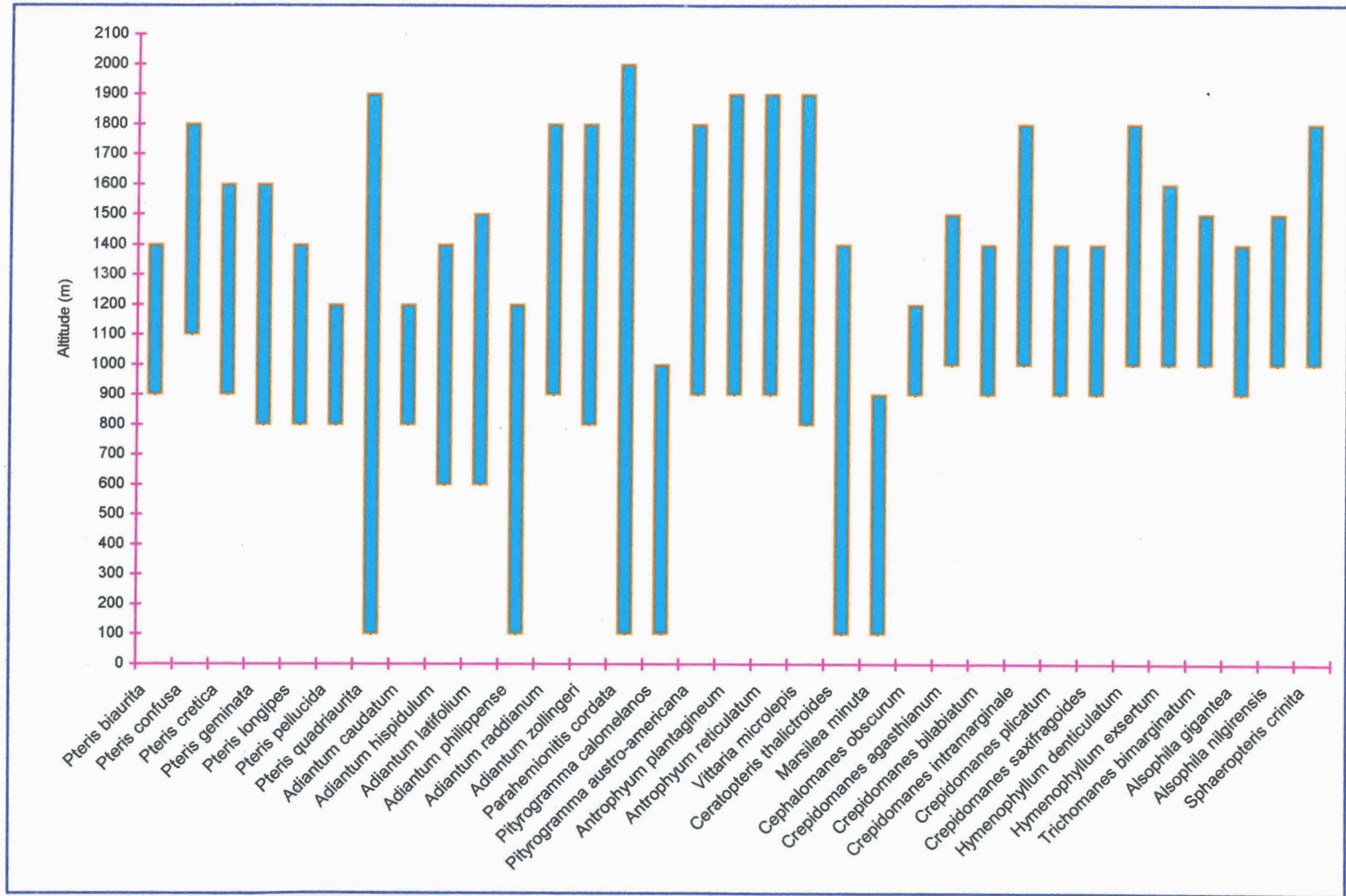


Fig.5.3.3. Distribution of pteridophytes of PTR along altitudinal gradient (ctd.).

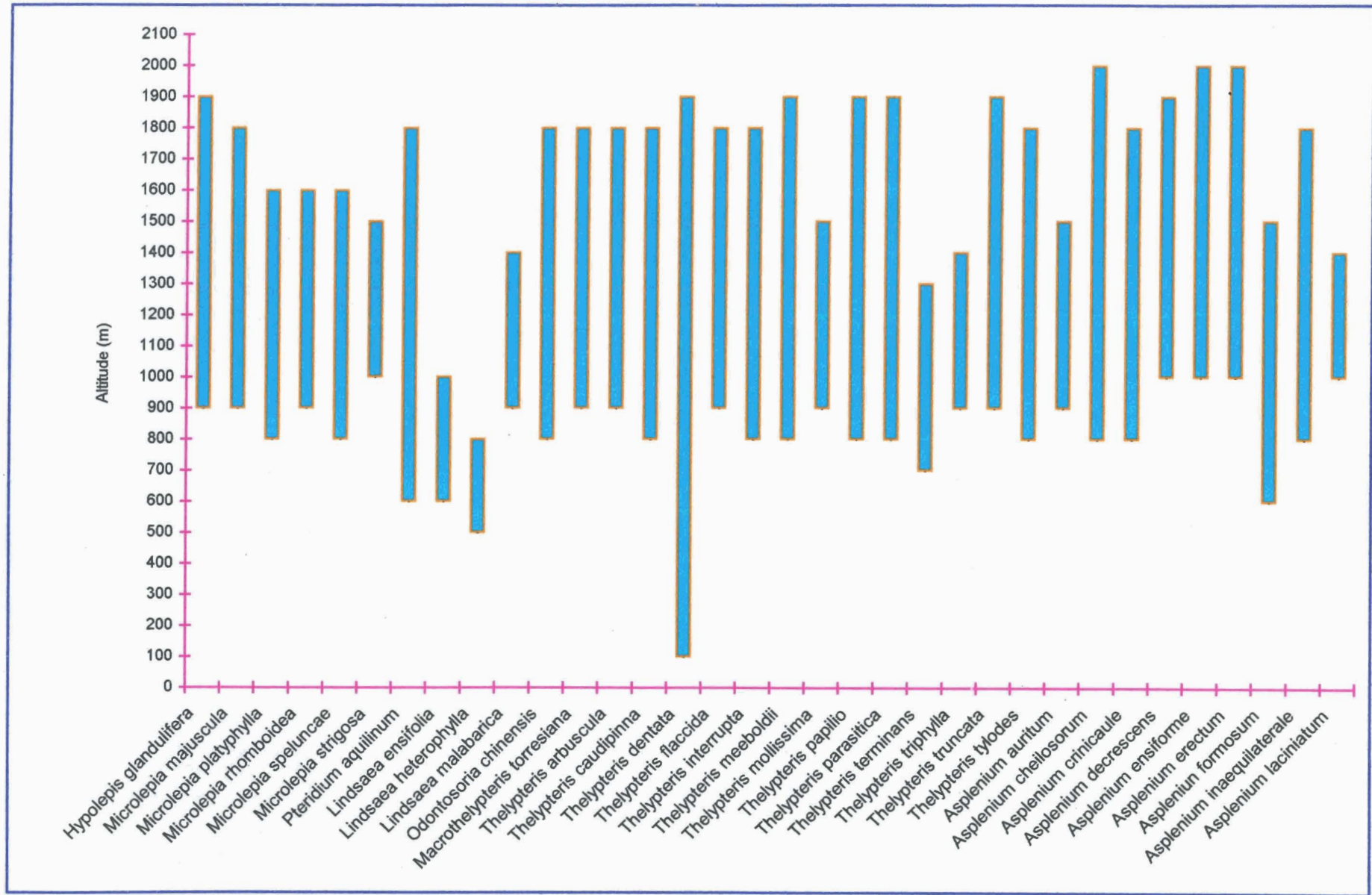


Fig. 5.3.3. Distribution of pteridophytes of PTR along altitudinal gradient (ctd.).

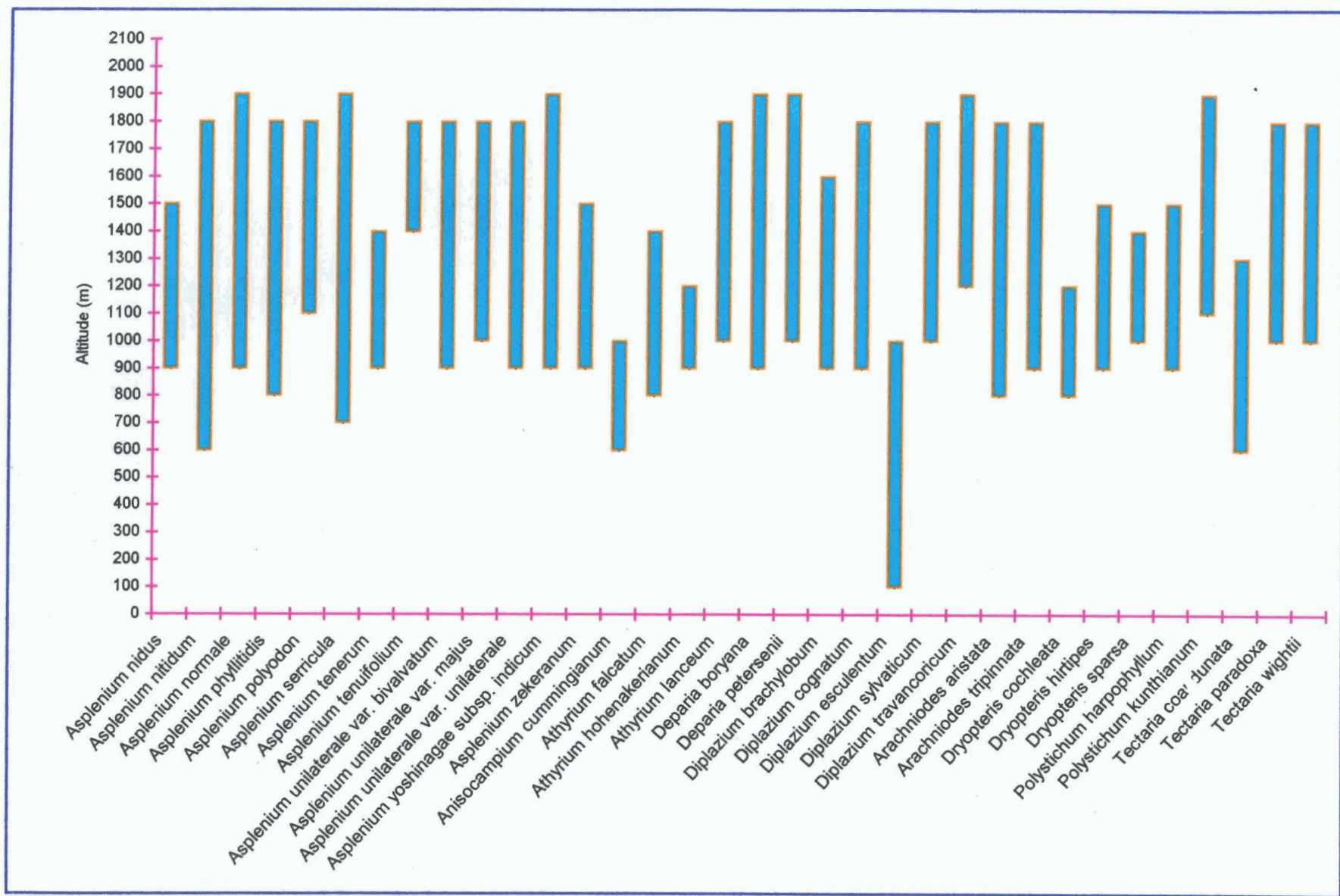


Fig. 5.3.3. Distribution of pteridophytes of PTR along altitudinal gradient (ctd.).

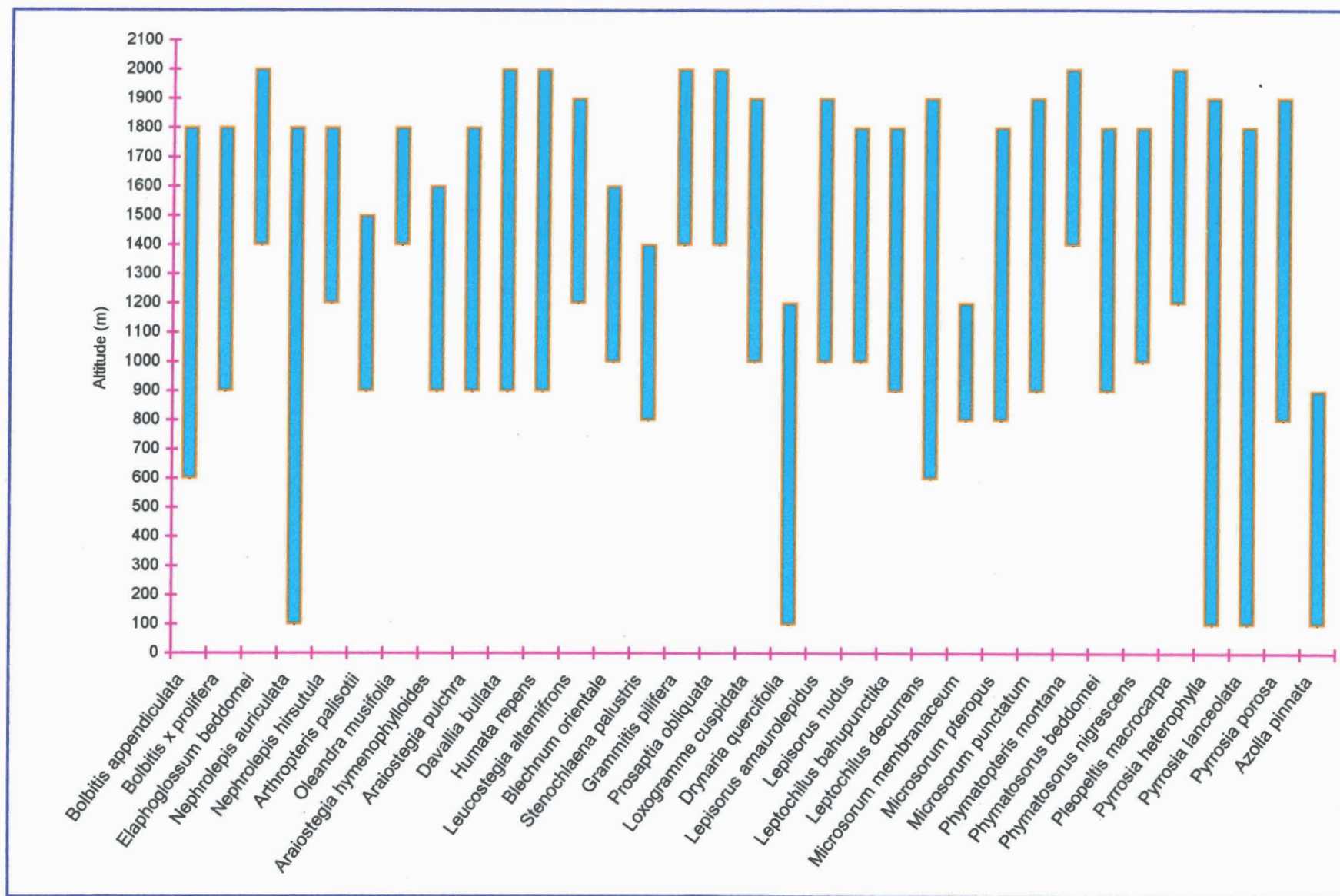


Fig.5.3.3. Distribution of pteridophytes of PTR along altitudinal gradient.

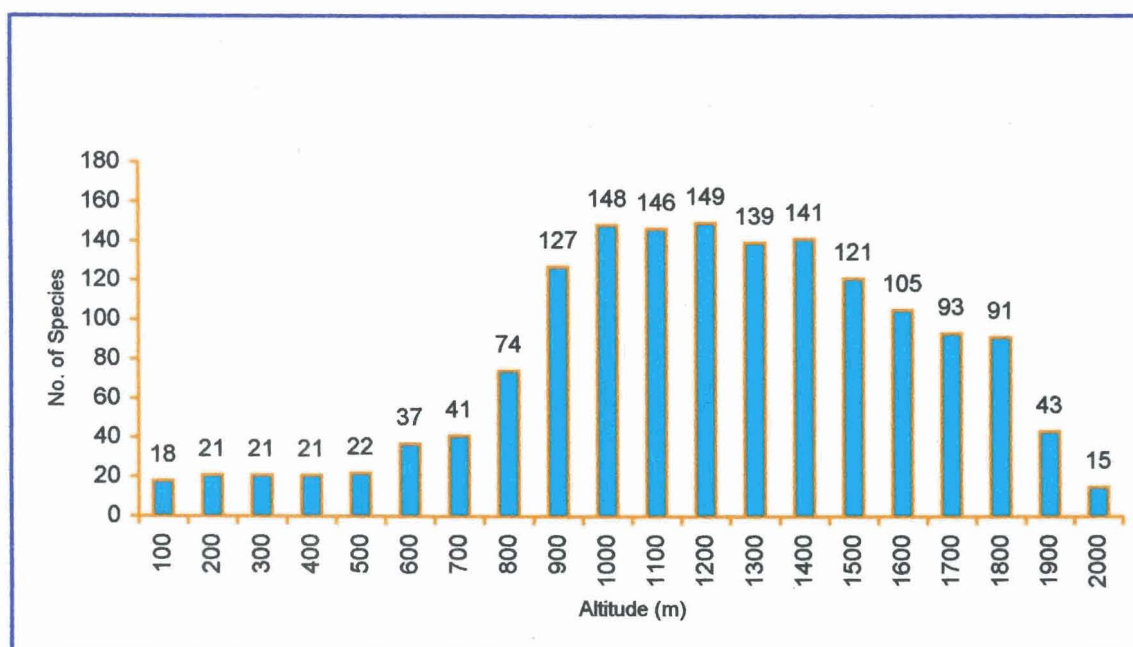


Fig. 5.3.4. Distribution pattern of pteridophytes of PTR along altitudinal gradient.



Table 5.3.1. Ecological data matrix for pteridophytes of PTR.

(a- Aquatic, e-Epiphyte, l-lithophyte, t-terrestrial, EG- Evergreen forest, SEG- Semi-evergreen forest, MD-Moist deciduous forest, GL-Grassland, + present, - absent)

Species	Habit	Vegetation				Altitude (m)	
		EG	SEG	MD	GL	Low	High
<i>Huperzia hamiltonii</i>	e	+	-	-	-	1400	2000
<i>Huperzia hilliana</i>	e	+	-	-	-	1500	2000
<i>Huperzia macrostachys</i>	e	+	-	-	-	600	1500
<i>Huperzia phlegmaria</i>	e	+	+	-	-	600	1900
<i>Huperzia squarrosa</i>	e	+	-	-	-	200	1400
<i>Lycopodiella cernua</i>	t	-	-	-	+	200	900
<i>Selaginella ciliaris</i>	t	+	+	+	+	100	1500
<i>Selaginella inaequalifolia</i>	t	+	+	-	-	600	1500
<i>Selaginella intermedia</i>	t	+	+	+	-	800	1400
<i>Selaginella involvens</i>	l	+	+	-	-	600	2000
<i>Selaginella minutifolia</i>	t	-	-	-	+	800	1900
<i>Selaginella sp. a</i>	t	+	+	+	+	200	1500
<i>Selaginella sp. b</i>	t	+	-	-	-	900	1400
<i>Selaginella tenera</i>	t	+	+	+	+	100	2000
<i>Selaginella wightii</i>	l	-	-	-	+	800	1200
<i>Equisetum ramosissimum</i>	t	+	-	-	-	900	1300
<i>Psilotum nudum</i>	e	+	+	+	-	100	1300
<i>Botrychium daucifolium</i>	t	+	-	-	-	900	1600
<i>Botrychium lanuginosum</i>	t	+	-	-	-	900	1700
<i>Ophioglossum gramineum</i>	t	-	-	-	+	800	1000
<i>Ophioglossum pendulum</i>	e	+	+	+	-	900	1400
<i>Ophioglossum vulgatum</i>	t	-	+	+	+	800	1300
<i>Angiopteris evecta</i>	t	+	+	+	-	600	1700
<i>Marattia fraxinea</i>	t	+	-	-	-	700	1800
<i>Lygodium microphyllum</i>	t	-	+	+	-	100	900
<i>Cheilanthes farinosa</i>	t	-	+	+	+	100	1000
<i>Cheilanthes opposita</i>	l,t	-	-	+	+	800	1900
<i>Doryopteris concolor</i>	t	+	+	+	+	700	1600
<i>Pellaea boivini</i>	t	+	+	+	-	900	1400
<i>Pellaea falcata</i>	t	+	-	-	-	900	1600
<i>Actiniopteris radiata</i>	t	-	-	-	+	800	1300
<i>Pteris argyraea</i>	t	+	-	-	-	900	1800
<i>Pteris aspericaulis</i>	t	+	-	-	-	1000	1800
<i>Pteris biaurita</i>	t	+	+	+	-	900	1400
<i>Pteris confusa</i>	t	+	-	-	-	1100	1800
<i>Pteris cretica</i>	t	+	-	+	-	900	1600
<i>Pteris geminata</i>	t	+	-	-	-	800	1600
<i>Pteris longipes</i>	t	+	+	-	-	800	1400
<i>Pteris pellucida</i>	t	-	+	+	-	800	1200
<i>Pteris quadriaurita</i>	t	+	+	+	-	100	1900
<i>Adiantum caudatum</i>	t	-	+	+	-	800	1200
<i>Adiantum hispidulum</i>	t	+	+	+	-	600	1400

Table 5.3.1. (ctd).

Species	Habit	Vegetation				Altitude (m)	
		EG	SEG	MD	GL	Low	High
<i>Adiantum latifolium</i>	t	+	+	+	-	600	1500
<i>Adiantum philippense</i>	t	+	+	+	+	100	1200
<i>Adiantum raddianum</i>	t	+	-	-	-	900	1800
<i>Adiantum zollingeri</i>	t	+	+	+	-	800	1800
<i>Antrophyum plantagineum</i>	e,l	+	-	-	-	900	1900
<i>Antrophyum reticulatum</i>	e,l	+	-	-	-	900	1900
<i>Vittaria microlepis</i>	e	+	-	-	-	800	1900
<i>Ceratopteris thalictroides</i>	a,t	-	-	+	+	100	1400
<i>Marsilea minuta</i>	a,t	-	-	-	+	100	900
<i>Cephalomanes obscurum</i>	t	+	-	-	-	900	1200
<i>Crepidomanes agasthianum</i>	l	+	-	-	-	1000	1500
<i>Crepidomanes bilabiatum</i>	e	+	-	-	-	900	1400
<i>Crepidomanes intramarginale</i>	l	+	-	-	-	1000	1800
<i>Crepidomanes plicatum</i>	e,l	+	-	-	-	900	1400
<i>Crepidomanes saxifragoides</i>	e	+	-	-	-	900	1400
<i>Hymenophyllum denticulatum</i>	l	+	-	-	-	1000	1800
<i>Hymenophyllum exsertum</i>	e,l	+	-	-	-	1000	1600
<i>Trichomanes bimarginatum</i>	e,l	+	-	-	-	1000	1500
<i>Alsophila gigantea</i>	t	+	-	-	-	900	1400
<i>Alsophila nilgirensis</i>	t	+	-	-	-	1000	1500
<i>Sphaeropteris crinita</i>	t	+	-	-	-	1000	1800
<i>Hypolepis glandulifera</i>	t	+	-	-	-	900	1900
<i>Microlepia majuscula</i>	t	+	+	-	-	900	1800
<i>Microlepia platyphylla</i>	t	+	-	-	-	800	1600
<i>Microlepia rhomboidea</i>	t	+	-	-	-	900	1600
<i>Microlepia speluncae</i>	t	+	+	+	-	800	1600
<i>Microlepia strigosa</i>	t	+	-	-	-	1000	1500
<i>Pteridium aquilinum</i>	t	-	-	-	+	600	1800
<i>Lindsaea ensifolia</i>	t	+	+	-	-	600	1000
<i>Lindsaea heterophylla</i>	t	+	-	-	-	500	800
<i>Lindsaea malabarica</i>	t	+	-	-	-	900	1400
<i>Odontosoria chinensis</i>	t	+	-	-	-	800	1800
<i>Macrothelypteris torresiana</i>	t	+	-	-	-	900	1800
<i>Thelypteris arbuscula</i>	t	+	-	-	-	900	1800
<i>Thelypteris caudipinna</i>	t	+	-	-	-	800	1800
<i>Thelypteris dentata</i>	t	+	+	+	+	100	1900
<i>Thelypteris flaccida</i>	t	+	-	-	-	900	1800
<i>Thelypteris interrupta</i>	t	+	-	+	+	800	1800
<i>Thelypteris meeboldii</i>	t	+	-	-	-	800	1900
<i>Thelypteris mollissima</i>	t	+	-	-	-	900	1500
<i>Thelypteris papilio</i>	t	+	-	-	-	800	1900
<i>Thelypteris parasitica</i>	t	+	-	-	-	800	1900
<i>Thelypteris terminans</i>	t	+	-	-	-	700	1300
<i>Thelypteris triphylla</i>	t	+	-	-	-	900	1400
<i>Thelypteris truncata</i>	t	+	-	-	-	900	1900
<i>Thelypteris tylodes</i>	t	+	-	-	-	800	1800

Table 5.3.1. (ctd).

Species	Habit	Vegetation				Altitude (m)	
		EG	SEG	MD	GL	Low	High
<i>Asplenium auritum</i>	l	+	-	-	-	900	1500
<i>Asplenium cheilosorum</i>	t	+	-	-	-	800	2000
<i>Asplenium crinicaule</i>	t	+	-	-	-	800	1800
<i>Asplenium erectum</i>	l,t	+	+	-	-	1000	2000
<i>Asplenium formosum</i>	l,t	+	+	-	-	600	1500
<i>Asplenium inaequilaterale</i>	t	+	-	-	-	800	1800
<i>Asplenium laciniatum</i>	t	+	-	-	-	1000	1400
<i>Asplenium nidus</i>	e	+	+	-	-	900	1500
<i>Asplenium nitidum</i>	t	+	-	-	-	600	1800
<i>Asplenium normale</i>	t	+	-	-	-	900	1900
<i>Asplenium phyllitidis</i>	e	+	-	-	-	800	1800
<i>Asplenium polyodon</i>	l,t	+	-	-	-	1100	1800
<i>Asplenium serricula</i>	e,l,t	+	+	-	-	700	1900
<i>Asplenium tenerum</i>	t	+	-	-	-	900	1400
<i>Asplenium tenuifolium</i>	e,l	+	-	-	-	1400	1800
<i>Asplenium unilaterale</i> var. <i>bivalvatum</i>	t	+	-	-	-	900	1800
<i>Asplenium unilaterale</i> var. <i>majus</i>	t	+	-	-	-	1000	1800
<i>Asplenium unilaterale</i> var. <i>unilaterale</i>	t	+	+	-	-	900	1800
<i>Asplenium yoshinagae</i> subsp. <i>indicum</i>	t	+	-	-	-	900	1900
<i>Asplenium zekeranum</i>	t	+	-	-	-	900	1500
<i>Anisocampium cummingianum</i>	t	+	-	-	-	600	1000
<i>Athyrium falcatum</i>	t	-	-	-	+	800	1400
<i>Athyrium hohenakerianum</i>	t	+	+	-	-	900	1200
<i>Athyrium lanceum</i>	t	+	-	+	-	1000	1800
<i>Deparia boryana</i>	t	+	+	-	-	900	1900
<i>Deparia petersenii</i>	t	+	-	-	-	1000	1900
<i>Diplazium brachylobum</i>	t	+	-	-	-	900	1600
<i>Diplazium cognatum</i>	t	+	-	-	-	900	1800
<i>Diplazium esculentum</i>	t	-	+	+	-	100	1000
<i>Diplazium sylvaticum</i>	t	+	-	-	-	1000	1800
<i>Diplazium travancoricum</i>	t	+	-	-	-	1200	1900
<i>Arachniodes aristata</i>	t	+	+	-	-	800	1800
<i>Arachniodes tripinnata</i>	t	+	-	-	-	900	1800
<i>Dryopteris cochleata</i>	t	-	+	+	+	800	1200
<i>Dryopteris hirtipes</i>	t	+	+	+	-	900	1500
<i>Dryopteris sparsa</i>	t	+	-	-	-	1000	1400
<i>Polystichum harpophyllum</i>	t	+	-	-	-	900	1500
<i>Polystichum kunthianum</i>	t	+	-	-	-	1100	1900
<i>Tectaria coe. dunata</i>	t	+	+	+	+	600	1300
<i>Tectaria paradoxa</i>	t	+	+	+	-	1000	1800
<i>Tectaria wightii</i>	t	+	+	-	-	1000	1800

Table 5.3.1. (ctd).

Species	Habit	Vegetation				Altitude (m)	
		EG	SEG	MD	GL	Low	High
<i>Bolbitis appendiculata</i>	l,t	+	+	-	-	600	1800
<i>Bolbitis x prolifera</i>	t	+	+	+	-	900	1800
<i>Elaphoglossum beddomei</i>	e	+	-	-	-	1400	2000
<i>Arthropteris palisotii</i>	e	+	-	-	-	900	1500
<i>Oleandra musifolia</i>	e,l	+	-	-	-	1400	1800
<i>Leucostegia alternifrons</i>	e,l	+	-	-	-	1200	1900
<i>Blechnum orientale</i>	t	-	-	-	+	1000	1600
<i>Stenochlaena palustris</i>	t	+	-	-	-	800	1400
<i>Grammitis pilifera</i>	e	+	-	-	-	1400	2000
<i>Prosaptia obliquata</i>	e	+	-	-	-	1400	2000
<i>Loxogramme cuspidata</i>	e	+	-	-	-	1000	1900
<i>Drynaria quercifolia</i>	e,l	+	+	+	+	100	1200
<i>Lepisorus amaurolepidus</i>	e,l	+	-	-	-	1000	1900
<i>Lepisorus nudus</i>	e,l	+	-	-	-	1000	1800
<i>Leptochilus bahupunctika</i>	e	+	-	-	-	900	1800
<i>Leptochilus decurrens</i>	e,l	+	+	-	-	600	1900
<i>Microsorium membranaceum</i>	e	+	+	-	-	800	1200
<i>Microsorium pteropus</i>	l	+	+	-	-	800	1800
<i>Microsorium punctatum</i>	e,l	+	+	-	-	900	1900
<i>Phymatopteris montana</i>	e	+	-	-	-	1400	2000
<i>Phymatosorus beddomei</i>	e,l	+	-	-	-	900	1800
<i>Phymatosorus nigrescens</i>	e,l	+	-	-	-	1000	1800
<i>Pleopeltis macrocarpa</i>	e	+	-	-	-	1200	2000
<i>Pyrrhosia heterophylla</i>	e,l	+	+	+	-	100	1900
<i>Pyrrhosia lanceolata</i>	e	+	+	+	-	100	1800
<i>Pyrrhosia porosa</i>	e,l	+	+	-	-	800	1900
<i>Azolla pinnata</i>	a	-	-	+	-	100	900

# DISCUSSION

K.P. Rajesh “Ecological and taxonomic studies on the pteridophytes of Periyar tiger reserve, Kerala, South india” Thesis. Department of Botany , University of Calicut, 2001

*“...When you know enough about basic biology, then you are ready  
to attack complex systems...”*

E. O. Wilson

## **DISCUSSION**

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## 6. DISCUSSION

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Eventhough we are a part of '*neo-biological civilisation*' and living in the 'age of biodiversity', we know too little about it. The mega project to finalise the list of '*all*' the species of the planet earth within a period of 25 years is just launched (Kelly, 2001). The *all species inventory* and similar programmes (GBIF, 2001) are continuation of the works that were carried out by the natural historians from time immemorial itself. The biodiversity inventories are essential for formulating conservation strategies and also for the better management of the ecosystems.

Red listing and conservation priority setting of many species are controversial (Morsovsky, 1997). This is usually due to the deficiency of local data or not considering it while red listing the species. The rarity of plants is commonly inferred from the herbarium data. For example, in India, if a species has not been collected within the past 50 years, it is considered "*possibly extinct*" (Jain & Sastry, 1981). This concept has resulted in the '*reappearance*' of many '*extinct*' plants. The reappearance of extinct plants raises many logical and ethical issues (Moore, 1983, 1998; Rajesh & Madhusoodanan, 1999). The importance of local data in conservation planning is commented by many (Rodriguez et al., 2000; Hilton-Taylor et al., 2000). The present study is thus highly significant in the conservation point of view, being the result of an intensive exploration in a protected area. All the earlier inventories on the South Indian pteridophytes (Manickam & Ninan, 1984; Manickam, 1986; Manickam & Irudayaraj, 1992; Nayar & Geevarghese, 1993; Rajagopal & Bhat, 1998) were not specific to any protected area.

The study reveals interesting figures on the pteridophyte diversity of the southern Western Ghats. The recording of 167 pteridophytes from an area of 777 km<sup>2</sup> is an immense figure as far as the South Indian pteridophytes are

concerned. It forms about 68 percent of the total pteridophytes known from the Kerala State and which reveals the richness of the study area. The area also supports about 50 percent of the flowering plants known from the State of Kerala.

At the family levels also interesting figures are observed. Out of the 41 species of *Aspleniaceae* and 13 *Lycopodiaceae* members known from South India, 22 and 6 respectively occur in the Reserve. Similarly out of the 25 *Selaginellaceae* members 9 are recorded from the Reserve during the present study (Fig. 6.1).

The area is notable for being the only locality in India for the occurrence of species such as *Ophioglossum pendulum* and *Arthropteris palisotii*. The recording of *Crepidomanes agasthianum* from the Reserve extends the distribution range of this narrow endemic species. This species was earlier reported only from Athirapally forests in the Thrissur District besides its type locality Agasthyamalai forests in the Thiruvananthapuram District, both situated in the southern Western Ghats.

The biodiversity documentation of the protected areas is of great significance. As commented by Sayers and Whitmore (1991) the populations remaining in the protected areas are unlikely to be extinct due to habitat destruction. The occurrence of about 40 percent of the pteridophytes of South India in the Reserve is thus of high significance when formulating conservation strategies. The Reserve support viable populations of pteridophytes, including those, which are reported as rare and endangered in South India. Except for the pilgrimage pressure in Sabarimala area, forest fire, etc, the Periyar Tiger Reserve remains as highly protected. The protection would be maximised if the adjoining areas of the Reserve bordering Tamil Nadu were notified as the Meghamalai Wild Life Sanctuary.

The present study also looks into the distribution pattern of the pteridophytes along vegetation and altitudinal gradients. Examination of the ultimate factors, which determine the distribution of each species, is beyond the scope of this work.



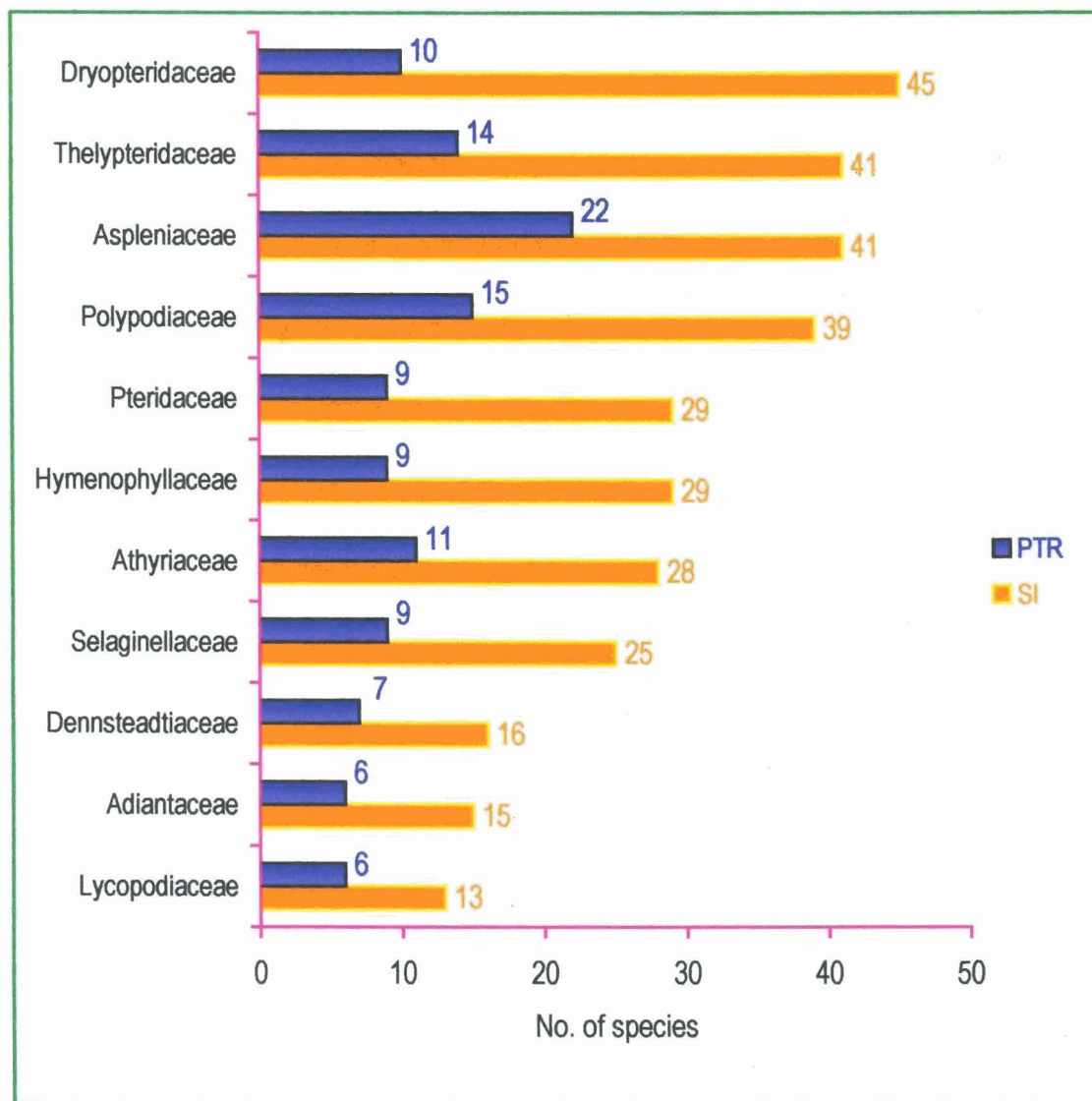


Fig. 6.1. Dominant pteridophyte families of South India compared with PTR (Sources: Dixit, 1988 & 1992; Nampy & Madhusoodanan, 1998; Chandra, 2000; Hameed, 2000).

Evergreen forests are the richest in species diversity. This is due to the availability of maximum suitable and diverse microhabitats, which support a variety of pteridophytes. It is found that the grasslands stand at in species diversity compared to all other vegetation types. Microhabitats are lesser in grasslands. Moreover, the grasslands become dry comparatively earlier to other vegetation types, due to the exposure to wind, lack of shade, moisture and frequent occurrence of fire. Fire, which is a serious limiting factor in the grasslands, often wipes out everything, except those having subterranean branches or rhizome. Gregarious growth of *Pteridium aquilinum*, which perennate by its subterranean rhizome, is seen in the fire prone areas.

The species present in the grasslands are either delicate hygrophilous ephemerals or hardy xerophytes. The former completes the lifecycle before the beginning of the dry season. The latter bypasses the hot and dry condition by the xerophytic adaptations. Except for a few *Selaginella* spp., all other species of grasslands extend to other vegetation types. Majority of them is widely distributed species.

In the present study it is found that maximum species diversity is at medium altitude range of 900-1600 m. This is due to the mixing of low altitude and high altitude species.

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# SUMMARY

K.P. Rajesh “Ecological and taxonomic studies on the pteridophytes of Periyar tiger reserve, Kerala, South india” Thesis. Department of Botany , University of Calicut, 2001

**SUMMARY**

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## 7. SUMMARY

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The present study entitled "Ecological and Taxonomic studies on the pteridophytes of Periyar Tiger Reserve, Kerala, South India", is the result of an intensive study carried out from 1994 to 2000 in the largest protected area of Kerala State. The study has brought out 167 pteridophytes belonging to 68 genera and 32 families. This forms about 68 and 40 percents of the pteridophytes known from the Kerala State and South India respectively. This also includes 12 South Indian endemics and 44 rare and endangered species. Hence the study reveals the floristic richness of the Reserve.

The Reserve is notable being the only locality in India for the occurrence of species like *Arthropteris palisotii* and *Ophioglossum pendulum*. *Asplenium* with 22 species is the largest genus. *Thelypteris* (13 spp.), *Pteris* (9 spp.), *Selaginella* (9 spp.) and *Adiantum* (6 spp.) are the other dominant genera.

The study also reveals the distribution pattern of the pteridophytes along the vegetational and altitudinal gradients. Evergreen forests stands first in the species richness with 147 species, followed by semi-evergreen forests with 56 species. Moist deciduous forests support 40 species. The grasslands are least species richness, with 26 species. The availability of maximum suitable microhabitats that support the pteridophytes is the reason for high species richness in evergreen forests. The grasslands are less diverse as far as these microhabitats are concerned. An analysis of the habit and the lifecycle of the species present in grasslands also prove the importance of soil moisture and other abiotic factors in the distribution of pteridophytes. The grassland species are either delicate, hygrophilous ephemerals which sprouts during the rainy season and completes their lifecycle before the grasslands dry up. The other kind of species present here are hardy xerophytes which can withstand or bypass the hot summer by xerophytic adaptations. Except for a few species most of the species, present in the grasslands, moist deciduous and semi-

evergreen forests extend their distribution ranges to evergreen forests. But majority of the evergreen species is confined to that particular habitat only.

Analysis of the distribution of the pteridophytes along the altitudinal gradients also reveals interesting patterns. The pteridophytes of the Reserve can be grouped in to three categories, viz., low altitude (100-800 m) species, medium altitude (800-1400 m) species and high altitude (above 1400 m) species. Some species are of wide distribution range, occurring in all the three altitudinal zones. Maximum species diversity is seen at an intermediate altitude range of 900-1600 m. This is due to the co-occurrence of low and high altitude species at the intermediate range.

The present study on the pteridophytes of a protected area such as Periyar Tiger Reserve is the first of its kind in South India. The recording of about 40 percent of the South Indian pteridophytes from an area of 777 km<sup>2</sup> is thus of high significance in formulating conservation strategies.

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**APPENDIX**

---

ON THE OCCURRENCE OF *ARTHROPTERIS PALISOTII*  
(DESV.) ALSTON (OLEANDRACEAE), A LITTLE KNOWN  
CLIMBING FERN IN INDIA

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The genus *Arthropteris* consists of about 20 species of scandent epiphytes distributed in Old World tropics, Australia, New Zealand and up to Juan Fernandez Islands of the Pacific Ocean, of which only one species is reported from India (Subramanyam *et al.* 1961, De Vol & Kuo, 1975; Tryon & Tryon, 1982; Dixit & Vohra, 1984). Beddome (1863), described this species as *Nephrolepis obliterated* Hook. citing two specimens, CP 1094 and 1376, from Ceylon, but did not mention South India in the distribution range. Later Beddome (1883) provided an illustrated account of the species under the name *N. ramosum* Beauv., again without mentioning any collection from Southern India. Nayar and Kaur (1974) and Chandra and Kaur (1984) identified *N. obliterated* Hook. and *N. ramosum* Beauv., as *Arthropteris palisotii* (Desv.) Alston. Though, Subramanyam *et al.* (1961) reported this species from South India, later workers (Manickam & Ninan, 1984; Manickam, 1986; Nayar & Geevarghese, 1993) did not mention any recent collection from South India, except Dixit and Vohra

(1984). Manickam and Irudayaraj (1992) expressed doubts about its occurrence in India. This species was also found not included in the list of fern allies and ferns of Kerala prepared by Nair *et al.* (1988, 1992 a & b, 1994), based on the specimens in Botanical Survey of India Herbaria (MH, CAL).

Recently we collected this elegant fern from the Periyar Tiger Reserve, Kerala. A brief account and illustration are provided for easy identification of this little known species in India.

***Arthropteris palisotii*** (Desv.) Alston, Bot. Soc. Broter. ser 2.30:6.1956; Nayar & Kaur, Comp. Bedd. Handb. Ferns Brit. India 70. 1974; Dixit & Vohra, Dict. Pterid. India 4.1984; Chandra & Kaur, Nom. Guide Bedd. Ferns S. India 30.1987. *Aspidium palisotii* Desv., Berlin Mag. 5:1811. *Nephrolepis obliterated* Hook., Sp. Fil. 154. 1862; Bedd., Ferns S. India 83, t.251. 1861. *N. ramosum* Beauv., 1811; Bedd., Handb. Ferns Brit. India 284, t. 145. 1883. *N. ramosa* Moore in part, Luessen, Milt. Bot. 1:200,390. 1874.

[Fig.1].

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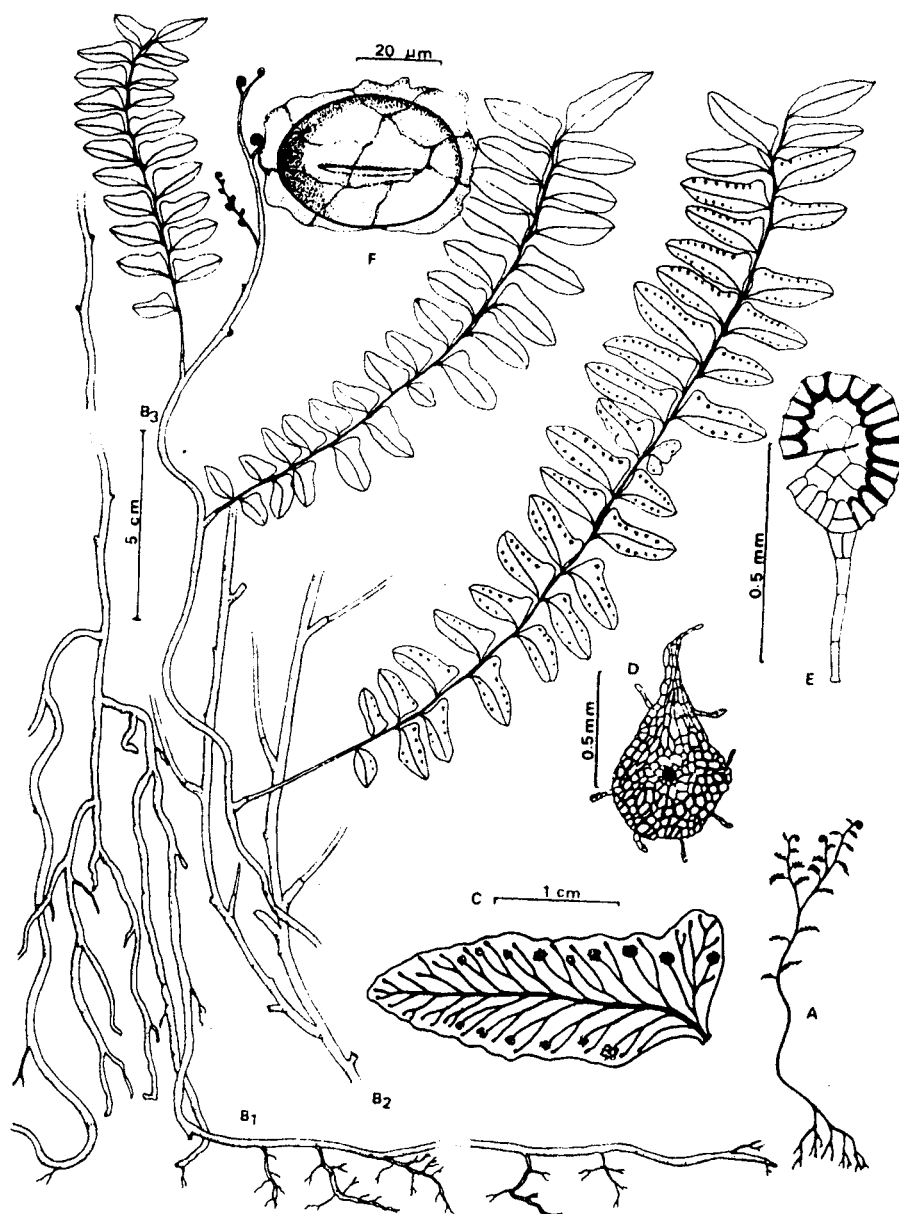


Figure : A. Habit-diagrammatic, B<sub>1</sub>. Rhizome lower part, B<sub>2</sub>, Rhizome showing branching, B<sub>3</sub> Rhizome upper part, C. Pinna of leaf, D. Scale, E. Sporangium, F. Spore

Scandent fern with elongated twining rhizome, to 3 m long and 1.5-2 mm in diameter. Scales brown, ovate-lanceolate, clathrate, 0.5-1.5 x 0.5 mm, with multicellular clavate hairs along the margins. Stipes to 30 cm long, distant, articulate to a short phyllopodia, 2-5 mm long. Fronds pinnate; pinnae to 3.2 x 1 cm, sessile, auricled on acroscopic half, margins crenulate; lower pinnae smaller, rachis pubescent; venation free, dichotomous, ending in hydathodes near to margins. Sori reniform at vein endings, indusiate. Sporangia 3-4 celled, stalked. Spores 45 x 34.4 µm, perinate; exine smooth, perine loose, granulose.

*Specimens studied:* Periyar Tiger Reserve, Idukki District, Kerala, ± 1100 m, 30.05.1994, Jomy Augustine 13243 (KFRI); *Ibid*, ± 1500 m, 30.10.1995, K.P.Rajesh 14674 (KFRI).

*Ecology:* Subramanyam *et al.* (1961) recorded this species common along the road cuttings. We found this species rare in evergreen forests between 1100-1500 m altitude.

*Note :* The relationship of the genus *Arthropteris* was a matter of controversy. It has been placed in the Davallioids near *Nephrolepis*, though there are marked differences. Nayar and Bajpai (1976) after a critical examination of the phylogenetic features of the group, commented that *Arthropteris* represents an independent line of evolution from the immediate ancestors of *Nephrolepis-Oleandra* group. The stele in *Arthropteris* is dorsiventrally compressed and dissected in to two meristeles by a row of closely placed, elongated narrow leaf and branch gaps on either lateral side. The two ranked leaf arrangement, regular alternation of leaves with branches, solitary leaf trace and open channel-like branch trace with independent branch gaps make *Arthropteris* unique among dendroid ferns (Nayar & Bajpai, 1976).

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#### Extinction needn't be for ever

Sir— The questions raised by Peter D. Moore<sup>1</sup> in connection with the discovery<sup>2</sup> of the wild gametophytes of the celebrated British rarity, Killarney fern (*Trichomanes speciosum*) are of great significance. Moore questions the appropriateness of declaring a plant species extinct without being sure that the last individual has been wiped out. We would like to examine these issues in the Indian context, where the appearance

of new taxa, extinction and rediscoveries go hand in hand.

It has been predicted that, in the next few decades, one-third of Indian biodiversity may become extinct or nearly extinct<sup>3</sup>. At present, the rarity of Indian plants is commonly inferred from herbarium data. If a species has not been collected within the past 50 years, it is considered 'possibly extinct'<sup>4</sup>. This highly-biased concept has led to the rediscovery of many 'extinct' plants when they were searched for thoroughly. Nearly 60 Indian endemic species have been rediscovered in this way during 1990–98, for example *Cynometra bourdillonii*, *Dialium travancoricum*, *Humboldtia bourdillonii*, *Inga cynametroides*, *Taeniophyllum scaberulum* and *Aenhenrya rotundifolia*. Some papers report the rediscovery of more than a dozen 'extinct' species.

These rediscoveries are directly related to the amount of collecting effort invested, and we believe that most tropical (rather than temperate) 'extinction' is actually non-availability of data rather than genuine extinction. No Indian biologist has yet questioned the credibility of these reports. We suggest that the Indian plants classified as extinct because they have not been collected recently should instead be termed 'plants to be rediscovered'. This may save the word 'extinction' from constant misuse.

Pointing out examples of plants that have been considered extinct but then re-established from seed banks, Moore suggested<sup>5</sup> that monitoring of the soil seed or spore bank should be mandatory before

designating a plant as extinct. But is this possible in a country such as India, where the search for the mature plant itself is a difficult task; where biodiversity documentation is incomplete; and where taxonomists themselves are 'critically endangered' owing to lack of funding?

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