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LICHEN (MACROLICHEN) FLORA OF KERALA PART OF WESTERN GHATS

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Abstract

Lichens are a unique group of plants composed of a photobiont and a mycobiont associated in a symbiotic manner. They form one of the important constituents of the Indian flora. The lichen flora of Kerala part of the Western Ghats is inadequately known as only fragmentary work has been done in the past. A study on the macrolichens flora of Kerala was carried out during 1997 to 2000. Kerala state lying between $8^{\circ} 18'$ and $12^{\circ} 4'$ N latitude and between $74^{\circ} 52'$ and $77^{\circ} 22'$ E longitude covers an area of approximately $38,863 \text{ km}^2$. The present work is the first intensive study of macrolichens from Kerala part of the Western Ghats.

During intensive field explorations, 254 species of macrolichens under 43 genera belonging to 18 families were collected and enumerated. The family Parmeliaceae dominates with 80 species under 14 genera followed by Physciaceae (43 species under 6 genera), Usneaceae (40 species under 1 genus), Collemataceae (29 species under 2 genera), etc. The genus *Usnea* dominates with 40 species followed by *Parmotrema* (26 species), *Heterodermia* (24 species), *Leptogium* (23 species), etc. Among the 43 genera, five genera in fruticose forms and 13 genera in foliose forms are represented by single species each. Nine species viz. *Hypotrachyna* (1 species), *Parmelina* (2 species), *Parmotrema* (2 species), *Ramalina* (1 species), *Stereocaulon* (1 species) and *Usnea* (2 species) are expected to be new taxa. Species like *Cladonia carneola*, *C. foliacea*, *C. glauca*, *Parmelina phlyncina*, *Phaeophyscia nepalensis*, *Ramalina subampliata*, *R. usnea*, *Usnea albopunctata* and *U. vegae* are new records to India and *Parmeliella pannosa* new to the mainland of India. As many as 63 species were found to be new to peninsular India and 109 species new records for Kerala. Species like *Parmotrema praesorediosum* and *Collema tenax* have been record for the first time from southern India.

The occurrence of 254 species in an area of $38,863 \text{ km}^2$ exhibits the richness and diversity of the macrolichen flora in the Kerala part of the Western Ghats. The 253 species recorded from this study area form 36 per cent of the

estimated macrolichens of India. Among the 18 various localities surveyed during the study, some of the areas like Mannavan shola of Idukki district holds highest number of species with 101 macrolichens followed by Siruvani-Muthikulam hills (60 species), Silent Valley National Park (52 species), Nelliampathy hills (47 species), Silent Valley Estate of Munnar (39 species), and Uppupara area of Periyar Tiger Reserve (39 species) possess large number of macrolichens.

Macrohabitats such as evergreen forests, grasslands, subtropical forests, and montane shola forests hold different types of macrolichens in their microhabitats. Among these, evergreen forests show maximum species diversity with 62 species under 24 genera found exclusive to this type of vegetation. Subtropical forests hold six species under five genera, grasslands hold 17 species under 12 genera and shola forests have 43 species under 21 genera found exclusive to these vegetation. Ecotone regions in the evergreen - savannah margin and montane shola - montane grassland in higher altitudes constitute 18 species of macrolichens under 10 genera to their credit. About 109 species of macrolichens are found in more than one vegetation type.

It is evident from the study that macrolichens constitute an important component in the flora of the tropical forest as they play varying role in the pioneer, transition and climax ecosystems.

1. Introduction

Lichens are polyphyletic in origin and are a unique group of non-vascular cryptogams composed of a photobiont and a mycobiont associated in a symbiotic manner. They are the dominant life forms on earth, which constitute over as much as 8% of earth's surface (Ahmadjian, 1995). These little plants are the most successful symbiotic organisms on earth and can grow on anything and anywhere. They are found growing on rocks, boulders, soil, decaying plant material, bark of plants, surface of leaves, metallic surfaces and even on the shells of insects and turtles.

Morphologically the thallus of lichens shows variation in its structure like crustose, squamulose, foliose and fruticose forms. If the thallus is superficial or partially or completely developed within the substrate (bark or rocks), only the fructifications (ascocarps) are either partially or fully visible. Majority of the lichens possess green alga as the photobiont and have various modified asexual or vegetative propagules. The mycobiont is of Ascomycetes fungi. In few lichens, the mycobiont belongs to the Basidiomycetes and Hyphomycetes.

There are two types of photobionts – a blue green alga (cyanobacterium) and a green alga. In most of the lichens the main photobiont is a green alga. In some of the foliose genera like, *Lobaria*, *Sticta*, *Pseudocyphellaria*, have a blue-green alga as the primary photobiont. They are often found in separate delimited areas towards the lower part of the medulla containing a cyanobacteria and these areas are called internal cephalodia. Functionally, the cephalodia supplement the nitrogenous requirements of the lichen and can be compared to the role of the root nodules that play in the leguminous plants. It is believed that in the early stage of lichenization, cyanobacterial photobiont must have evolved due to their primitiveness and there had been a swift from cyanobacteria to green alga, as the latter being more efficient in photosynthesis.

As a primitive colonizer on land, type of substratum is important for the colonization of each lichen species. According to the type of substratum they are classified as Corticolous (on

bark of trees), Saxicolous (on rocks), Terricolous (on soil) and Follicolous (on leaf surfaces). In extreme xeric conditions, lichens can adapt themselves due to quick absorption of moisture from the humid atmosphere or dew at night. Lichens are active in their photosynthetic rate even at very low temperature, below freezing point and can also withstand the cold of arctic regions as well.

Lichens produce over 600 chemicals, which helps them to survive in marginal environments and from attack of bacteria, fungi, and grazing herbivores. These lichen substances include pigments mostly contributed by the fungal component, toxins and antibiotics that are very useful as a source for dyes, perfumeries and medicines. Many species of lichens are valuable sources of food. Litmus is also obtained from lichens that are widely used in chemical laboratories as an acid base indicator.

Recently, throughout the world, studies on lichens as bio-monitoring agents and bio-indicators of environmental contamination have gained importance. When SO_2 concentration goes up in the atmosphere above a particular level, lichens are the first to be affected and therefore, they act as indicators of pollution. Detailed work on these aspects has been carried out in European countries, even though such studies are very meager in India.

There are about 18000 species (both micro and macro forms) of lichens which are distributed throughout the world. They are distributed from hot tropics to frigid high mountains and arctics, from extreme xerophytic areas of the deserts to the very moist conditions, on rocky substrates that are periodically or persistently submerged in water and from sea level to the high mountains.

As a highly diverse group and universally distributed, they play varying roles in the pioneer, transition and climax ecosystems. However, they have received little scientific attention when compared to other groups of plants.

1.1. Reasons for undertaking the present work

As a mega diversity centre with high level of endemism in both flora and fauna, India is unique in its biota and one of the most diverse in the world ranging from the cold arctic zone of the Himalayas to the tropical areas of the southern Western Ghats. The great diversity in this region may be due to the vast geographical area extending over many degrees of latitude, varied topography, climatic zones and position of the country at the junction of many biogeographic regions and subregions (Nair, 1991). There are about 2000 species of lichens so far reported from the temperate and subtemperate regions of Himalayas, regions of Western Ghats and Eastern Himalaya. Among these, Western Ghats hold about 800 species of lichen including both micro and macro forms. Among south Indian states, Tamil Nadu has received better attention for the study of lichens. Lying on the lap of Western Ghats and hottest of 'hotspots' of endemism, Kerala also holds rich lichen in its diverse habitats. Unfortunately, in Kerala, inventory of lichens has not received much attention when compared to other disciplines of botany. Only a fragmentary work has been done from this part of region. Recently, Kumar & Stephen (2000) enumerated 771 lichens from Western Ghats, which include the states of Karnataka, Kerala, Maharashtra and Tamil Nadu based on a survey of all the available literature on the lichens of these areas. From the Kerala part of Western Ghats, the literature survey revealed that only 53 species of macrolichens occur in Kerala. However, the number of species would be definitely more, since only scattered study was made from this region. A detailed inventory of the lichens and their special habitats is inevitable for understanding the lichen flora of the area and their diversity. It is therefore, essential to explore the unexplored and under-explored areas to know the diversity and to develop suitable conservation measures as well as for sustainable management. To fulfill this objective and to fill up the lacunae, intensive study of macrolichens was initiated in the Kerala part of Western Ghats.

The prime objective of the project was to understand the lichen flora of this region and to bring in awareness of these fascinating group of lichens to the people.

2. Study area

2.1. Area - Kerala part of Western Ghats

Kerala is one of the world's outstanding areas of natural beauty, cultural heritage with diversity of ecosystems, species and genetic resources. With an average of 10000 km² patches of original tropical forests, Kerala holds about 10035 species of plants altogether in vascular, non-vascular and lower groups in its pristine habitats (Nayar, 1997). Being situated in a 'hottest' of hotspots of endemism in India, Kerala has three endemic 'hotspots' such as Agasthyamala, Anamalai - Highranges and Silent Valley - Wayanad Plateau. Besides these, Kerala has one Biosphere Reserve, two National Parks and twelve Wildlife Sanctuaries to its credit.

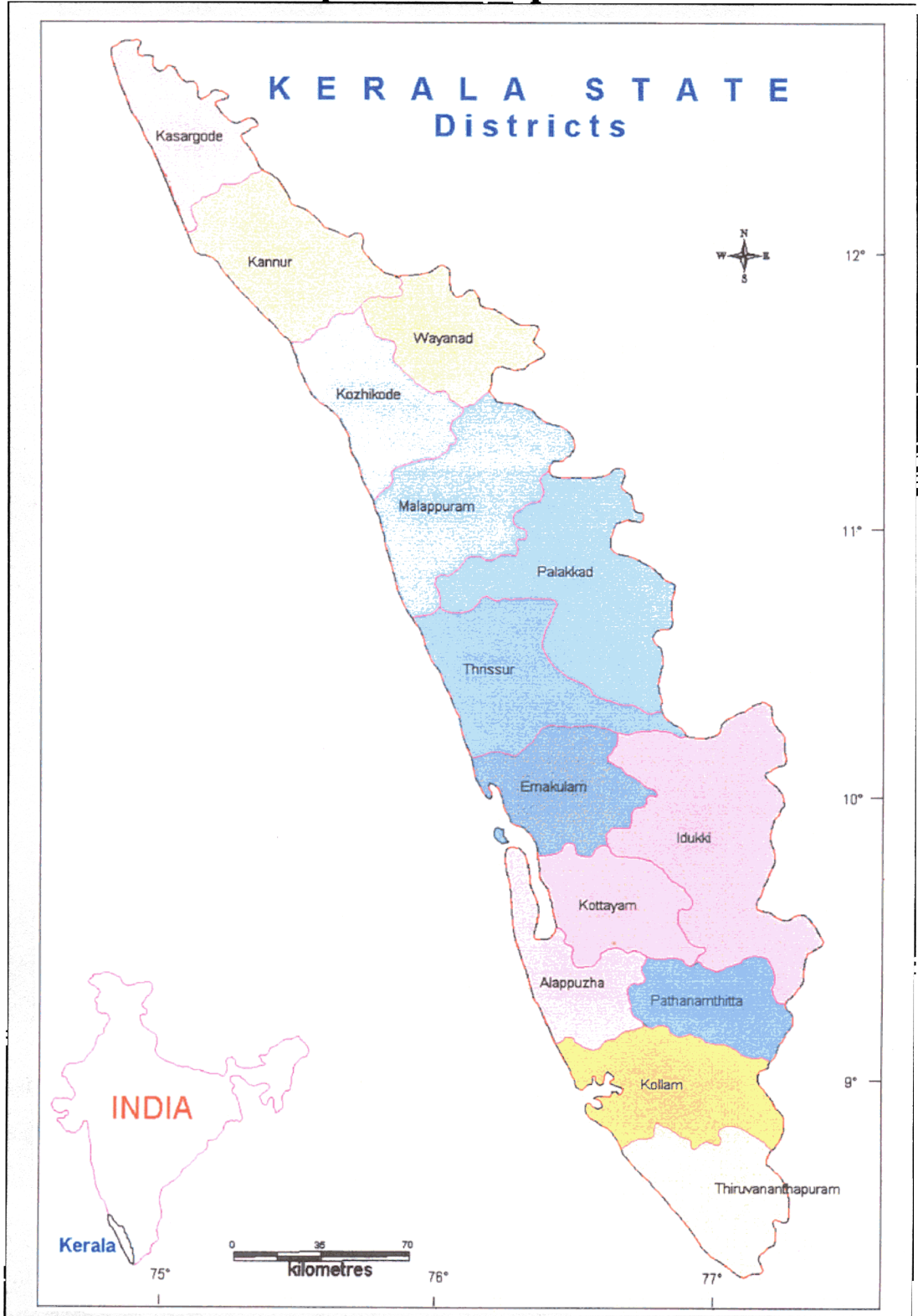
2.1.1. Location and Topography

Situated in the southwest corner of peninsular India, Kerala lies between 8°18' and 12°4' North latitude and between 74°52' and 77°22' East longitudes. The entire region covers an area of approximately 38,863 km² and has 14 political districts (Map I). The state is bounded by the Western Ghat mountains in the east and the Arabian Sea in the west. Altitude of the area ranges from sea level to the highest mountain peak of Anaimudi (2694m) in Idukki District. Besides these, there are series of mountain ranges sloping on the windward side but with abrupt gradients on the leeward side. Physiographically the State is also divisible into 4 zones, viz. coastal belt, the midlands, hilly uplands and the highlands (Map II).

2.1.2. Climate

The tropical humid climate of Kerala with irregular wet and dry periods are closely associated with the high precipitation South West Monsoon and scattered precipitation of North East Monsoon. These two Monsoons together form the State's rainy year in full swing for about six to eight months. Average annual rainfall is about 3000mm. The rainfall sometime extends even up to 7000mm. Highest relative humidity varies from 100% in June to 80% in December and lowest from 78% in July-August to 48% in January. Temperature

Map 1. District map of Kerala



Map 2. Physiographic zones of Kerala State



generally varies from a monthly mean maximum of 33.6°C to 27.7°C and a monthly mean minimum of 26.5°C to 21°C.

2.1.3. Vegetation

The forest areas of Kerala falls under the Hooker's (1907) Malabar Botanical regions classified on the basis of the species content of the families under each botanical province. Different vegetational types are met within Kerala depending on the altitude and rainfall & temperature variations. Thus, the area supports Tropical rain forests, Tropical moist deciduous forests, Tropical dry deciduous forests, Shola forests, Grasslands and Riparian forests.

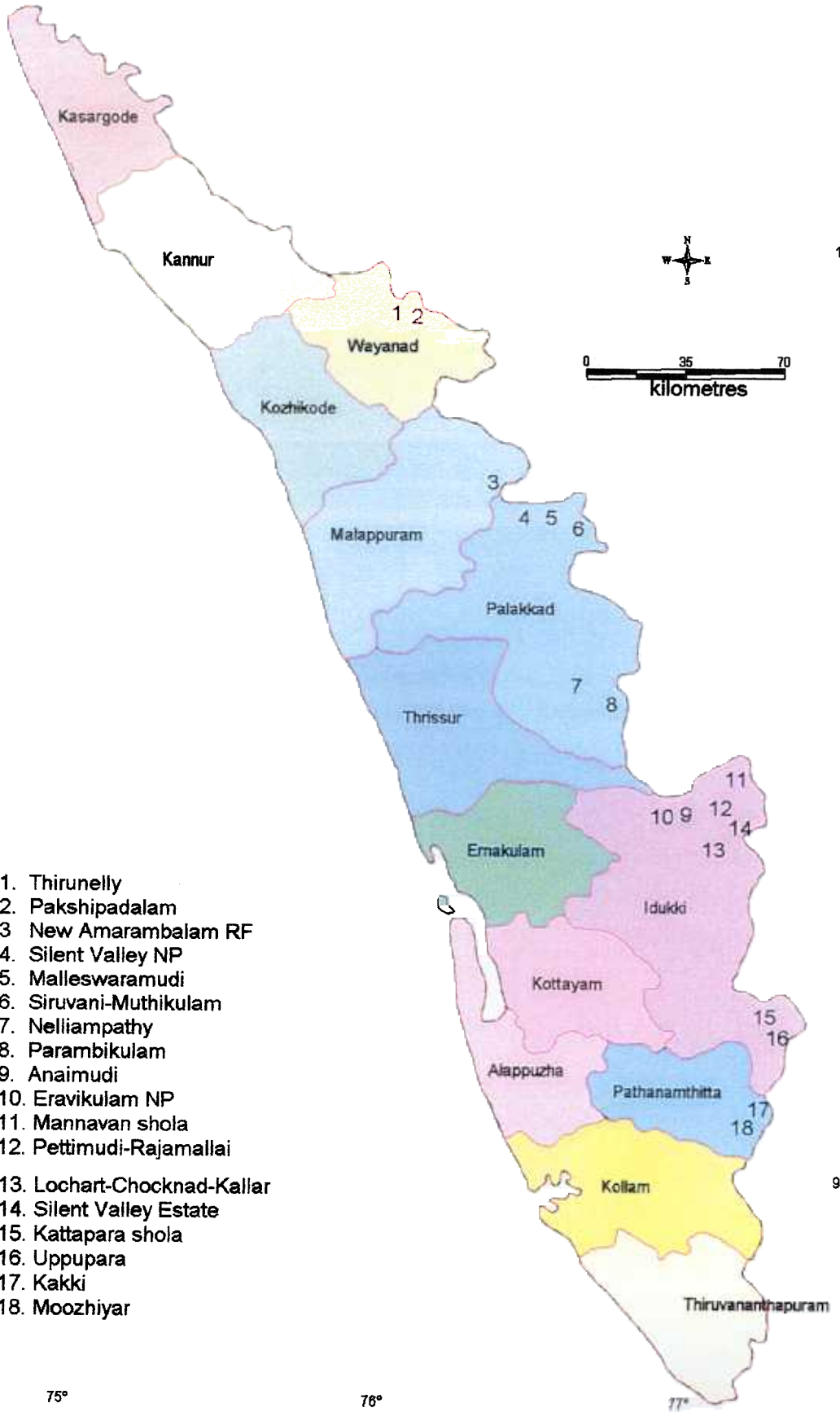
3. Materials and Methods

Field explorations were conducted on the lichen rich areas of Kerala part of Western Ghats for a period of three years. Specimens were collected, numbered and air/sun dried and identified as per the standard methods by examining the thallus morphology, spot colour tests and Thin Layer Chromatography (TLC).

All the species that are described in the systematic part were collected during the period from 1997-2000. The survey and collection of specimens were made periodically during all the seasons of the years. Over 1200 specimens were collected from different localities of Kerala part of Western Ghats (Map III). The materials were collected from the areas with altitude ranging from 700m to the highest point 2696m (Anaimudi). Special attention was paid to record data relating to their habit, habitat, associations with other species, synecological features and their host trees.

All the samples collected were sun dried by changing the papers at suitable intervals. During the rainy season samples were air dried at room temperature. The air/sun dried specimens were mounted on a cardboard paper and covered with thick brown packets, numbered & labeled. These packets were stored in cardboard boxes and kept in suitably sized steel almirahs.

Map 3. Collection localities of Macrolichens



For the identification purpose, apart from examining the morphology of the thallus, micro chemical colour tests were also carried out by the direct application of the reagents on the lichen thallii. An aqueous solution of Potassium Hydroxide (K); Steiner's stable solution of Paraphenyline diamine (P); 1% of Potassium Iodide (I); freshly prepared aqueous solution of Bleaching powder - Calcium hypochlorite (C); were used for cortex and medullary colour tests. Thin Layer Chromatography (TLC) was also carried out for some of the species. The chromatograms were developed in the solvent containing Toluene, Dioxan and Acetic acid (TDA). Merck silica gel pre-coated aluminium plates were used for spotting the lichen fragment. The lichen compounds were identified with the help of tables as per Culberson (1972).

The identification of all the taxa were done by comparing the keys and descriptions available from the literature. Some specimens were also identified by matching with lichen exsiccates available at Lichenological laboratory of the National Botanical Research Institute, Lucknow (LWG).

4. Review of Literature

Theophrastus (371-284 BC), who has been accredited as father of botany, in his book *History of Plants* used the word 'Lichen' for the first time to the extra plant growth on tree barks. Eric Acharious was the first man who described the lichen species growing in India. In his classical work, *Lichenographa Universalis* (1810) he included five species of Indian lichens. Subsequently, in *Synopsis Methodica Lichenium* published in 1814, a few more species of Indian lichens were added.

Besides Acharius several other workers like Montague (1842), Belanger and Bory (1846), Babington (1852); Nylander (1860) and others enumerated many lichens from Western Ghats. Intensive collection of lichens from the Western Ghats was carried out during the middle of nineteenth century.

During the 20th century rapid progress was made in the studies of Indian lichens. Hue (1900), Prain (1905), Zahlbruckener (1911), Jatta (1911), Quraishi (1928), Smith (1926), Choisy (1931), Chopra (1934), Santensson (1952), Moreau & Moreau (1952) and others made

the foundation for the Indian lichenology. It is obvious that, European botanists, naturalists in the British Army personnel and also Jesuit missionaries, collected the lichens from the Indian subcontinent. The European lichenologists and some Indian workers described all those collections and specimens that were lodged in the different European herbaria and were not easily accessible to the Indian workers.

Kerala part of Western Ghats have scarcely been explored for the study of lichens. Only fragmented collection had been made from this region and the details are scattered and given as a part under specimen examined in the published literature. During 1970's several papers were published on the studies of lichens from other parts of Western Ghats region.

Later, Prof. D.D. Awasthi, from Lucknow University, who is presently known as the father of Indian lichenology, started to work on lichens and published initially an account of 14 species of lichens collected from South India which included a new species of *Parmelia* from Kodaikanal (Awasthi, 1957). In the meantime, Ajay Singh (1957) enumerated 974 species of Indian lichens. During 1965 Awasthi in his book, *Catalogue of lichens from India, Nepal, Pakistan and Ceylon*, gave an up to date historical account with collector's name and publications. It was followed by a series of publications pertaining to taxonomic and other related studies (Awasthi, 1975, 1976, 1980, 1981, 1985, 1986, 1988, 1998); Awasthi & Akhtar (1979); Awasthi & Upreti (1985); Patwardhan & Prabhu (1977a, 1977b, 1977c, 1977d); Sharma & Awasthi (1981); Singh & Singh (1976); Singh (1984) and Vohra *et al.* (1982).

During this decade many botanist were interested in the study of lichens of Western Ghats. Kumar & Stephen (1997a) reported 20 species of macro lichens as new record to Kerala and also published an appraisal of lichen flora of Western Ghats (Kumar & Stephen, 1997b). Recently, Mukerji *et. al.*, (1999) published a book on lichens with valuable contributions from different authors on various aspects of lichen taxonomy and ecology of different phytogeographic region of India. Kumar & Stephen (1999) reviewed the work done in Western Ghats region and listed the species occurring in the Western Ghats. The most

recent publications are that of Awasthi (2000a) who has brought out a *Handbook on lichens* and another book on *Lichenology in Indian subcontinent* (Awasthi, 2000b). In these books he has listed out the lichens occurring in India and keyed out the common Indian species. In addition, during the present decade, Negi & Gadgil (1996); Negi & Upreti (2000) have tried to investigate certain ecological aspects of lichens occurring in the Himalayan regions.

5. Results

5.1 Analysis of the lichen flora

During the tenure of the study over 1200 lichen specimens have been collected and identified. The critical study of these specimens revealed that there are 254 species of macrolichens under 43 genera belonging to 18 families in the study area (Table 1).

The family Parmeliaceae dominate with 80 species under 14 genera followed by Physciaceae (43 species under 6 genera), Usneaceae (40 species under 1 genus), Collemataceae (29 species under 2 genera), etc. The genus *Usnea* dominate with 40 species followed by *Parmotrema* (26 species), *Heterodermia* (24 species) *Leptogium* (23 species), etc. Among the 43 genera, 5 genera in fruticose forms and 13 genera in foliose forms are represented by single species each. Nine species viz. *Hypotrachyna* (1 species), *Parmelina* (2 species), *Parmotrema* (2 species), *Ramalina* (1 species), *Stereocaulon* (1 species) and *Usnea* (2 species) are expected to be new taxa. Species like *Cladonia carneola*, *C. foliacea*, *C. glauca*, *Parmelina phlyntina*, *Phaeophyscia nepalensis*, *Ramalina subampliata*, *R. usnea*, *Usnea albopunctata* and *U. vegae* are found to be new record to India and *Parmeliella pannosa* is new to the mainland of India. During the study 63 species are found to be new to peninsular India and 109 species are new records of occurrence in Kerala. Species like *Parmotrema praesorediosum* and *Collema tenax* are new records to south India (Table 2). Macrolichens so far known endemic to other states could be collected from Kerala during the present study (Table 3). Key for the identification of genera and species, description of each species, its ecology and distribution are enumerated under the systematic treatment.

Table 1. Numerical representation of macrolichens collected from the study area

Sl. No.	Family	Genera	No. of species
1	BAEOMYCETACEAE	<i>Baeomyces</i>	1
2	CLADONIACEAE	<i>Cladonia</i>	13
3	COCCOCARPIACEAE	<i>Coccocarpia</i>	3
4	COLLEMATACEAE	<i>Collema</i>	6
		<i>Leptogium</i>	23
5	LECANORACEAE	<i>Lecanora</i>	1
6	LECIDIACEAE	<i>Phyllospora</i>	1
7	LICHEN IMPERFECTI	<i>Leprocaulon</i>	1
8	PANNARIACEAE	<i>Leioderma</i>	1
		<i>Pannaria</i>	4
		<i>Pameliella</i>	3
		<i>Psoroma</i>	1
9	PARMELIACEAE	<i>Bulbothrix</i>	3
		<i>Cetraria</i>	1
		<i>Cetrelia</i>	1
		<i>Everniastrum</i>	3
		<i>Hypogymnia</i>	2
		<i>Hypotrachyna</i>	21
		<i>Melanelia</i>	1
		<i>Menegazzia</i>	1
		<i>Parmelaria</i>	1
		<i>Parmelinopsis</i>	1
		<i>Parmelina</i>	14
		<i>Parmotrema</i>	26
		<i>Pseudoparmelia</i>	4
		<i>Relicina</i>	1
10	PHYLLOSPORACEAE	<i>Psorella</i>	2
11	PHYSICIACEAE	<i>Dirinaria</i>	2
		<i>Heterodermia</i>	24
		<i>Hyperphyscia</i>	3
		<i>Phaeophyscia</i>	3
		<i>Physcia</i>	3
		<i>Pyxine</i>	8
12	RAMALINACEAE	<i>Ramalina</i>	12
13	ROCELLACEAE	<i>Roccella</i>	1
14	STEREOCAULACEAE	<i>Pilophorus</i>	1
		<i>Stereocaulon</i>	2
15	STICTACEAE	<i>Lobaria</i>	1
		<i>Pseudocyphellaria</i>	3
		<i>Sticta</i>	9
16	TELOSCHISTACEAE	<i>Teloschistes</i>	1
17	USNEACEAE	<i>Usnea</i>	40
18	VERRUCARIACEAE	<i>Dermatocarpon</i>	1

Table 2. New records of lichens collected from the study area

Sl. No.	Species
1.	<i>Baeomyces soreidifer</i> *
2.	<i>Bulbothrix bulbochaeta</i> *
3.	<i>Bulbothrix isidiza</i>
4.	<i>Bulbothrix setschwanensis</i>
5.	<i>Cetraria wallichiana</i>
6.	<i>Cladonia carneola</i> ^a
7.	<i>Cladonia cartilaginea</i>
8.	<i>Cladonia ceratophylla</i> *
9.	<i>Cladonia coniocraea</i>
10.	<i>Cladonia decorticata</i>
11.	<i>Cladonia farinacea</i> *
12.	<i>Cladonia fimbriata</i> *
13.	<i>Cladonia foliacea</i> ^a
14.	<i>Cladonia glouca</i> ^a
15.	<i>Cladonia parasitica</i>
16.	<i>Cladonia scabriuscula</i> *
17.	<i>Cladonia uncialis</i>
18.	<i>Collema auriculatum</i> *
19.	<i>Collema conglomeratum</i> var. <i>crassiusculum</i> *
20.	<i>Collema flaccidum</i>
21.	<i>Collema subflaccidum</i> *
22.	<i>Collema tenax</i> [*]
23.	<i>Dermatocarpon vellerium</i> *
24.	<i>Dirinaria consimilis</i> *
25.	<i>Heterodermia angustiloba</i>
26.	<i>Heterodermia dactyliza</i>
27.	<i>Heterodermia dissecta</i> var. <i>koyana</i>
28.	<i>Heterodermia dissecta</i>
29.	<i>Heterodermia flabellata</i> *
30.	<i>Heterodermia hypocaustia</i> *
31.	<i>Heterodermia incana</i> *
32.	<i>Heterodermia indica</i>
33.	<i>Heterodermia microphylla</i>
34.	<i>Heterodermia obscurata</i>
35.	<i>Heterodermia pseudospeciosa</i>
36.	<i>Heterodermia punctifera</i>
37.	<i>Heterodermia speciosa</i> *
38.	<i>Heterodermia togashii</i> *
39.	<i>Hyperphyscia aglutinata</i> *
40.	<i>Hyperphyscia granunala</i> *
41.	<i>Hyperphyscia syncolla</i> *
42.	<i>Hypogymnia pseudobitteriana</i>
43.	<i>Hypogymnia vittata</i>
44.	<i>Hypotrachyna adducta</i>
45.	<i>Hypotrachyna awasthii</i> *
46.	<i>Hypotrachyna brevirhiza</i>
47.	<i>Hypotrachyna coorgiana</i> *

Sl. No.	Species
48.	<i>Hypotrachyna crenata</i> *
49.	<i>Hypotrachyna dactylifera</i>
50.	<i>Hypotrachyna degelii</i> *
51.	<i>Hypotrachyna dodapetta</i> *
52.	<i>Hypotrachyna endochlora</i> *
53.	<i>Hypotrachyna exsecta</i> *
54.	<i>Hypotrachyna flexilis</i>
55.	<i>Hypotrachyna formosana</i> *
56.	<i>Hypotrachyna infirma</i> *
57.	<i>Hypotrachyna masonhalei</i> *
58.	<i>Hypotrachyna orientalis</i> *
59.	<i>Hypotrachyna revoluta</i> *
60.	<i>Hypotrachyna rigidula</i>
61.	<i>Lecanora indica</i> *
62.	<i>Leprocaulon pseudoarbusculum</i>
63.	<i>Leptogium adpressum</i> *
64.	<i>Leptogium azureum</i> *
65.	<i>Leptogium brebissonii</i> *
66.	<i>Leptogium burgessii</i> *
67.	<i>Leptogium burnetiae</i> *
68.	<i>Leptogium cochleatum</i> *
69.	<i>Leptogium corticola</i> *
70.	<i>Leptogium cyanescens</i> *
71.	<i>Leptogium indicum</i> *
72.	<i>Leptogium marginellum</i> *
73.	<i>Leptogium mollucanum</i> *
74.	<i>Leptogium phyllocarpum</i> *
75.	<i>Leptogium pichneum</i> *
76.	<i>Leptogium platynum</i> *
77.	<i>Leptogium subtile</i>
78.	<i>Leptogium tenuissimum</i>
79.	<i>Leptogium ulvaceum</i> *
80.	<i>Lobaria retigera</i> *
81.	<i>Melanelia stygia</i>
82.	<i>Menegazzia terebrata</i>
83.	<i>Pannaria leucophaea</i>
84.	<i>Pannaria leucosticta</i> *
85.	<i>Parmeliella pannosa</i> [#]
86.	<i>Parmeliella plumbea</i> *
87.	<i>Parmeliella tryptophylla</i> *
88.	<i>Parmelina arulenta</i> *
89.	<i>Parmelina expallida</i>
90.	<i>Parmelina horrescens</i> *
91.	<i>Parmelina indica</i> *
92.	<i>Parmelina manipurensis</i>
93.	<i>Parmelina phlyctina</i> ^a
94.	<i>Parmelina spathulata</i>
95.	<i>Parmelina subaurulenta</i> *
96.	<i>Parmelina xantholepis</i> *

Sl. No.	Species
97.	<i>Parmelinopsis microlobulata</i>
98.	<i>Parmotrema abessinicum</i> *
99.	<i>Parmotrema crinitum</i> *
100.	<i>Parmotrema disparale</i> *
101.	<i>Parmotrema eunetum</i> *
102.	<i>Parmotrema grayanum</i> *
103.	<i>Parmotrema indicum</i> *
104.	<i>Parmotrema kamatii</i> *
105.	<i>Parmotrema latissima</i>
106.	<i>Parmotrema mesotropum</i> *
107.	<i>Parmotrema nilgherrense</i> *
108.	<i>Parmotrema praesorediosum</i> *
109.	<i>Parmotrema pseudonilgherrense</i> *
110.	<i>Parmotrema reticulatum</i> *
111.	<i>Parmotrema saccatilobum</i> *
112.	<i>Parmotrema stuppeum</i> *
113.	<i>Parmotrema subarnoldii</i> *
114.	<i>Parmotrema zollingeri</i> *
115.	<i>Phaeophyscia hispidula</i> *
116.	<i>Phaeophyscia nepalensis</i> ^a
117.	<i>Phaeophyscia orbicularis</i>
118.	<i>Phyllospora corralina</i> *
119.	<i>Physcia albinea</i>
120.	<i>Physcia dimidiata</i>
121.	<i>Physcia integrata</i> *
122.	<i>Pilophorus awasthianum</i>
123.	<i>Pseudocyphellaria argyracea</i> *
124.	<i>Pseudocyphellaria aurata</i> *
125.	<i>Pseudocyphellaria crocata</i> *
126.	<i>Pseudoparmelia carneopruinata</i> *
127.	<i>Pseudoparmelia cinearascens</i> *
128.	<i>Pseudoparmelia crozalsiana</i> *
129.	<i>Pseudoparmelia texana</i> *
130.	<i>Psorella isidiophora</i> *
131.	<i>Psorella psorina</i> *
132.	<i>Pyxine meissnerina</i> *
133.	<i>Pyxine minuta</i> *
134.	<i>Pyxine philippina</i>
135.	<i>Ramalina africana</i> *
136.	<i>Ramalina celastri</i> *
137.	<i>Ramalina himalayensis</i>
138.	<i>Ramalina pollinaria</i> *
139.	<i>Ramalina roesleri</i> *
140.	<i>Ramalina sinensis</i>
141.	<i>Ramalina subampliata</i> ^a
142.	<i>Ramalina taitensis</i>
143.	<i>Ramalina usnea</i> ^a
144.	<i>Roccella montagnei</i> *
145.	<i>Stereocaulon austroindicum</i> *
146.	<i>Sticta neocaledonica</i>
147.	<i>Sticta filicina</i> *
148.	<i>Sticta henryana</i>
149.	<i>Sticta limbata</i> *

150.	<i>Sticta praetextata</i>
151.	<i>Teloschistes flavicans</i> *
152.	<i>Usnea albopunctata</i> ^a
153.	<i>Usnea austroindica</i> *
154.	<i>Usnea bimolliuscula</i> *
155.	<i>Usnea bornmuelleri</i>
156.	<i>Usnea cineraria</i>
157.	<i>Usnea complanata</i> *
158.	<i>Usnea eumitrioides</i> *
159.	<i>Usnea fragilis</i> *
160.	<i>Usnea gigas</i> *
161.	<i>Usnea himalayana</i> *
162.	<i>Usnea indica</i>
163.	<i>Usnea maculata</i> *
164.	<i>Usnea misamisensis</i>
165.	<i>Usnea nepalensis</i>
166.	<i>Usnea nilgirica</i> *
167.	<i>Usnea orientalis</i>
168.	<i>Usnea pangiana</i>
169.	<i>Usnea picta</i> *
170.	<i>Usnea pseudosinensis</i>
171.	<i>Usnea rubiconda</i> *
172.	<i>Usnea sordida</i>
173.	<i>Usnea spinosula</i> *
174.	<i>Usnea splendens</i> *
175.	<i>Usnea stigmatoides</i> *
176.	<i>Usnea subchalybeae</i>
177.	<i>Usnea subflorida</i> *
178.	<i>Usnea thomsonii</i>
179.	<i>Usnea vegae</i> ^a

- * Kerala
- ◆ Peninsular India
- # Indian mainland
- ♣ India
- ♣ South India

Table 3. Macrolichens endemic to other states collected from the study area

Sl. No.	Species	Occurrence
1.	<i>Leptogium austro-indicum</i>	Maharashtra
2.	<i>Hypogymnia pseudobitteriana</i>	Tamil Nadu
3.	<i>Hypotrachyna coorgiana</i>	Karnataka
4.	<i>H. dodapetta</i>	Tamil Nadu
5.	<i>Parmelina indica</i>	Tamil Nadu
6.	<i>P. simplicior</i>	Maharashtra
7.	<i>Parmotrema disparale</i>	Tamil Nadu
8.	<i>P. indicum</i>	Tamil Nadu
9.	<i>P. kamatii</i>	Tamil Nadu
10.	<i>Psorella isidiophora</i>	Tamil Nadu
11.	<i>Ramalina himalayensis</i>	West Bengal
12.	<i>Usnea austro-indica</i>	Tamil Nadu
13.	<i>U. indica</i>	N.W. Himalaya
14.	<i>U. nilgirica</i>	Tamil Nadu
15.	<i>U. pictoides</i>	Tamil Nadu
16.	<i>U. spinosula</i>	Tamil Nadu
17.	<i>U. stigmatoides</i>	Tamil Nadu
18.	<i>U. subchalybeae</i>	Bababrodans
19.	<i>U. vegae</i>	Sri Lanka
20.	<i>U. vulneraria</i>	Tamil Nadu

5 . 2 . S y s t e m a t i c T r e a t m e n t

KEY TO FAMILIES OF MACROLICHENS

1a. Thallus fruticose	2
1b. Thallus otherwise	9
2a. Thallus yellow	Teloschistaceae
2b. Thallus otherwise	3
3a. Thallus strap shaped or flattened, compressed, rarely rounded in cross section, hollow	4
3a. Thallus strictly circular or angular in cross section	5
4a. Thallus with an upper and lower surface; spores hyaline, 2-celled, straight or slightly curved	Ramalinaceae
4b. Thallus without a difference between an upper and lower surface; spores brown, 3-septate	Roccellaceae
5a. Thallus dimorphic with crustose, granular, squamulose or verruculose (some times absent) primary thallus and an erect secondary podetia or pseudopodetia	6
5b. Thallus otherwise - erect or pendulous, usually attached by a basal attachment	Usneaceae
6a. Primary thallus crustose, granulose to squamulose	7
6b. Primary thallus verruculose	8
7a. Podetia or pseudopodetia hollow in centre	Cladoniaceae
7b. Podetia or pseudopodetia solid	Baeomycetaceae
8a. Thallus sterile; cephalodia absent	Lichenes Imperfecti
8b. Thallus fertile; cephalodia present	Stereocaulaceae
9a. Photobiont a blue green alga	10
9b. Photobiont a green alga	13
10a. Thallus squamulose to foliose, hypothallus present or rarely absent, corticated on both the surfaces; spores simple, 2-celled	11
10b. Thallus distinctly foliose, hypothallus absent, with or without lower cortex; spores septate	12
11a. Photobiont <i>Scytonema</i> ; thallus lead grey with concentric rings, lacking hypothallus	Coccocarpiaceae
11b. Photobiont <i>Nostoc</i> , thallus without transverse concentric rings, blue-brown or brown- black hypothallus present	Pannariaceae
12a. Thallus with cyphellae or pseudocyphellae	Stictaceae
12b. Thallus lacking cyphellae or pseudocyphellae	Collemataceae
13a. Thallus umblicate	Verrucariaceae
13b. Thallus lacking umblicus	14
14a. Thallus squamulose or placodioid, rarely foliose, corticated on upper surface only	15
14b. Thallus strictly foliose, corticated on both sides, some times lower cortex absent	17

- 15a. Spores hyaline, simple 16
 15b. Spores hyaline, 3-15-septate **Phyllosporaceae**
- 16a. Thallus on hypothallus; apothecia simple, hypothecium hyaline
 or brownish **Lecideaceae**
 16b. Thallus without hypothallus, apothecium lecanorine **Lecanoraceae**
- 17a. Thallus large foliose, apothecia brown, spores simple, hyaline,
 atranorin absent **Parmeliaceae**
 17b. Thallus rossetiform or ribbon like, closely appressed,
 apothecia not brown, spores brown, 2-celled, atranorin present **Physciaceae**

Family Baeomycetaceae

Genus *Baeomyces* Pers.

About 80 species of *Baeomyces* are found distributed all over the world (Zahlbruckner, 1922-40; Lamb, 1963). Out of these only 4 species have been found in India. Among these, 3 species are distributed in the temperate Eastern Himalayas and one in Tamil Nadu. During the present study only one species encountered is described.

1. *Baeomyces soridiifer* Nyl. in Acta. Soc. Sci. Fenn., 26(10): 5. 1900.

Fruticose lichen, thallus white, primary thallus crustose, heteromerous; secondary thallus podetial in nature, 1.5mm long, 1mm in diameter, soresiate, ecorticate; apothecia terminal, up to 0.5mm in diameter, brownish, exciple proper, asci 8-spored; spores hyaline, simple.

Habit: Saxicolous

Habitat: Prefers grassland-shola region particularly near streamside rocks at an altitude of 2100m and above.

Distribution: Tamil Nadu

Specimens examined: Chinnamala, Anaimudi, Munnar, Idukki Dt., *Stephen 22091* (KFRI).

Note: New record to Kerala

Family Cladoniaceae

Genus *Cladonia* (Hill) Weber in Wigg

Thallus dimorphic, primary or vegetative thallus crustose to subfoliose, persistent or disappearing, heteromerous, corticate on upper side; secondary thallus or podetia hollow, usually upright, simple to branched, axils open or closed; cup forming or cupless; apothecia

terminal or marginal of cups or on podetia; asci 6-8-spored, spores colourless, simple, rarely 2-4 celled.

This genus is cosmopolitan in distribution and comprises of 300 species in the world. Upreti (1987) recorded 62 species from India and Nepal. Among these, 51 are from India. During the present study 13 species of *Cladonia* collected from this part of the phytogeographic region is described.

Key to the species

- | | |
|----------------------------------------------------------------------------------------------|------------------------|
| 1a. Podetia with inferior of cups closed, axils closed | 2 |
| 1b. Podetia with inferior of cups open, axils opened | 8 |
| 2a. Primary thallus of tiny squamules, podetia yellow tinged | <i>C. carneola</i> |
| 2b. Primary thallus of large squamules, podetia greyish | 3 |
| 3a. Lower surface of primary squamules yellowish | <i>C. foliacea</i> |
| 3b. Lower surface of primary squamules white | 4 |
| 4a. Podetia without cup | 5 |
| 4b. Podetia with cups | 6 |
| 5a. Podetia P+ Orange-red | <i>C. cartilaginea</i> |
| 5b. Podetia P- | <i>C. decorticata</i> |
| 6a. Podetia with definite and trumpet shaped cups | <i>C. fimbriata</i> |
| 6b. Podetia with irregular cups or lacking cups | 7 |
| 7a. Soredia farinose | <i>C. coniocraea</i> |
| 7b. Soredia granular | <i>C. ramulosa</i> |
| 8a. Base of podetium persistant | 9 |
| 8b. Base of podetium dying | <i>C. uncialis</i> |
| 9a. Primary thallus of large and broad squamules | <i>C. ceratophylla</i> |
| 9b. Primary thallus of narrow crenate squamules | 10 |
| 10a. Podetia P+ deep yellow or red | 11 |
| 10b. Podetia P- | <i>C. glauca</i> |
| 11a. Podetia P+ deep yellow to orange | <i>C. parasitica</i> |
| 11b. Podetia P+ orange red to red | 12 |
| 12a. Primary squamules disappearing, podetial
branch tapering, granulose-sorediate | <i>C. scabriuscula</i> |
| 12b. Primary squamules persistant, podetia
irregularly branched, farinose-sorediate | <i>C. farinacea</i> |

1. *Cladonia carneola* (Fr.) Fr., Lichenogr. EUR. Reforme: 233. 1831.

Plate I. Fig. 1.

Primary squamules 1-2 x 1-3mm in size, upper side brownish grey, lower side white, esoridiate, lobed; podetia simple, 3-9mm long, 1-2mm broad, yellowish, farinose-soeridiate, forming cups; cups broad, oblique, marginally proliferating; apothecia on margin of cups brownish, 1.5mm in diameter.

Podetia and squamules K+ yellow, P+ orange red.

Habit: Terricolous

Habitat: Prefers evergreen shola at an altitude of 2100m and above.

Distribution: Nepal

Specimens examined: Anaimudi, Munnar, Idukki Dt., 2100m, *Stephen & Viswam 8940* (KFRI).

Note: New record to India.

2. *Cladonia cartilaginea* Mull. Arg., in Flora 63: 260. 1880.

Plate I. Fig. 2A.

Primary squamules 2-4 x 1-2mm in size, upper side greyish, lower side glaucous white, soeridiate, lobbed and marginally incised; podetia greyish, moderately branched, 5-10mm long, up to 1mm in diameter, decorticate, soeridiate, tapering apically, apothecia on ends of podetia; apothecia and pycnidia brown.

Podetia and squamules P+ orange red, K+ yellow.

Habit: Saxicolous/Terricolous

Habitat: Prefers evergreen forest at an altitude of 850m and above.

Distribution: Eastern and Western Himalayan region.

Specimens examined: Nilikkal, Silent Valley National Park. Palakkad Dt., 900m, *Stephen 20091* (KFRI); Kakki Damsite, Pathanamthitta D., 850m, *Stephen 21933* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21098* (KFRI)

Note: New record to Peninsular India.

3. *Cladonia ceratophylla* (Sw.) Spreng., Catal. Lich. Univ. 4: 461. 1927.

Primary squamules 1-2.5 X 0.5-1mm in size, upper side greyish, lower side white, marginally rolled inwards, lobed; podetia 7-16mm long, 0.5mm broad, greyish, decorticate, granular-sorediate, base of podetium persistent, irregularly branched; apothecia on margin of cups, brownish

Podetia and squamules P+ red, K+ yellow

Habit: Corticolous

Habitat: Prefers evergreen-grassland margin at an altitude of 900m and above on *Syzygium sp.*

Distribution: Tamil Nadu

Specimen examined: Kattapara shola, Idukki Dt., 925m, *Stephen 21825* (KFRI)

Note: New record to Kerala

4. *Cladonia coniocraea* (Floerke) Sprengel., Syst. Veg., Linnd., ed. 16(4): 272. 1827.

Plate I. Fig. 2B.

Primary squamules 1-3 x 0.5-2mm in size, upper side greyish, lower side white, margin sorediate, lobed, flat or involute; podetia 5-10mm long, 1-2mm broad, farinose-sorediate, with cups; cups sorediate; apothecia brownish, sessile.

Podetia and squamules K-, P+ red

Habit: Corticolous

Habitat: Prefers grassland trees at an altitude of 1800m and above on *Rhododendron* tree.

Distribution: Arunachal Pradesh, Jammu & Kashmir, Nagaland and Uttar Pradesh.

Specimens examined: Pettimudi, Rajamalla, Munnar, Idukki Dt., 1800m, *Stephen 20182* (KFRI).

Note: New record to Peninsular India.

1. *Cladonia decorticata* (Floerke) Sprengel., Syst. Veg. 4(1): 271(1-7). 1827.

Plate I. Fig. 2C.

Primary squamules 0.5-2 x 0.5-1mm in size, upper side greyish, lower side white, lobed; podetia 10-20mm long, 1-1.5mm broad, irregularly branched, tapering, decorticate, sorediate, cupless, axils closed, margin entire; cups bearing brown apothecia, pycnidia brown.

Podetia and squamules P-, K-

Habit: Corticolous

Habitat: Prefers evergreen shola margins at an altitude of 1600m and above on *Rhododendron* tree.

Distribution: Western Himalayas

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22046* (KFRI).

Note: New record to Peninsular India.

6. *Cladonia farinacea* (Vainio) A. Evans. in *Rhodora* 52: 95. 10. 1950.

Primary squamules 1-2 x 0.5-1mm in size, upper side greyish, lower side white, esorediate, margin incised and lobed; podetia 10-35mm long, 0.5mm broad, branched, base of podetium persistent, farinose-sorediate, with or without cups, cupless podetia irregularly branched; cups proliferating, brown, 2mm wide; apothecia absent

Podetia and squamules K+ yellow, P+ orange-red

Habit: Terricolous/Corticolous/Saxicolous

Habitat: Prefers evergreen shola-grassland margin on the base of *Rhododendron* tree or on rock or cuttings at an altitude of 1600m and above.

Distribution: Tamil Nadu

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen & Viswam 20114* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 20185* (KFRI); Mannavan Shola, Marayoor, Idukki Dt., 1650m, *Stephen 22059* (KFRI).

Note: New record to Kerala.

7. *Cladonia fimbriata* (L.) Fr., Wain, Monogr. Cladon. Univ. 2. 246. 1894.

Primary squamules 0.5-1.5 x 0.5-1mm in size, upper side greyish, lower side white, lobed; podetia small up to 10mm long, 0.5mm broad, simple, farinose-sorediate, with definite cups; cups trumpet shaped; apothecia and pycnoconidia brown.

Podetia and squamules P+ red, K+ yellow

Habit: Saxicolous

Habitat: Prefers ecotone region of evergreen shola and grass land area at an altitude of 2000m and above.

Distribution: Himalayas and Tamil Nadu.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 21962* (KFRI).

Note: New record to Kerala.

8. *Cladonia foliacea* (Huds.) Willd. Catal. Lich. Univ., 4: 525. 1927.

Plate I. Fig. 3.

Primary squamules 1-2.5 x 0.5-1.5mm in size, upper side greyish-brown, lower side yellowish, crenate with imbricate incurved lobes; podetia small, simple, up to 5mm long, 0.5mm broad, lacking cups; sterile.

Podetia and squamules P+ red, K+ yellow

Habit: Saxicolous

Habitat: Prefers grassland at an altitude of 1200m and above.

Distribution: Nepal

Specimens examined: Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21841* (KFRI).

Note: New record to India.

9. *Cladonia glauca* Floerke, DeCladon: 140 Pasq. 1828.

Primary squamules small, 0.5-2 x 0.5-1mm in size, upper side greyish, lower side white, crenate; podetia branched, persistent, farinose-sorediate, decorticate, with or without cups; cups minute; sterile.

Podetia and squamules K+ yellow, P-

Habit: Saxicolous

Habitat: Prefers grasslands at an altitude of 1100m and above.

Distribution: Nepal

Specimens examined: Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21167* (KFRI).

Note: New record to India.

10. *Cladonia parasitica* (Hoffm.) Hoffm, Dent. Fl. 2: 127. 1796.

Plate I. Fig. 2D.

Primary squamules 1-2.5 x 0.5-1mm in size, upper side greyish, lower side white, marginally sorediate, lobed; podetia 6-15mm long, 1mm broad, greyish, simple to irregularly branched, axils open, cups absent, granular sorediae; apothecia absent.

Podetia and squamules K+ yellow, P+ yellow

Habit: Saxicolous/Corticolous

Habitat: Prefers evergreen and shola or grassland edge at an altitude of 900-2300m.

Distribution: Arunachal Pradesh, Meghalaya and Nagaland.

Specimens examined: Pullukuthimala, New Amarambalam Reserve Forest, Malappuram Dt., 1200m, *Stephen 20017* (KFRI), 900m, *20026* (KFRI); Kallar Estate, Munnar, Idukki Dt., 1500m, *Stephen 20153* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21015* (KFRI).

Note: new record to Peninsular India.

11. *Cladonia ramulosa* (With.) Laundon, Lichenologist 16: 225. 1984.

Primary squamules 2-4 x 1-2mm in size, upper side greyish, lower side white, crenate, lobed; podetia simple or branched, greyish, 15-30mm long, 1mm broad, partly decorticate, granular-sorediate, with small squamules on the branches, with or without cups; cups 1mm broad; apothecia brown.

Podetia and squamules K+ yellow, P+ orange-red

Habit: Corticolous/Saxicolous/Terricolous

Plate-I



Fig. 1. *Cladonia carneola*



Fig. 2. A. *Cladonia cartilaginea* B. *C. coniocraea*
C. *C. decorticata* D. *C. parasitica*
E. *C. uncialis*



Fig. 3. *Cladonia foliacea*

Habitat: Prefers shola or grassland cuttings at an altitude of 1600m and above.

Distribution: Himalayas, Tamil Nadu and Kerala.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22035* (KFRI), 2000m, *21949a* (KFRI); Anaimudi, Munnar, Idukki Dt., 2600m, *Stephen 22111* (KFRI).

12. *Cladonia scabriuscula* (Delise in Duby) Nyl., Flora 58: 447. 1875.

Primary squamules 2-4 x 0.5-2mm in size, upper side greyish, lower side white, irregularly lobed, esorediate or granular soorediate; podetia 15-30mm long, 0.5-1mm broad, dichotomously or irregularly branched, greyish, tapering apically, granular soorediate, axils open; cups absent; apothecia at the tip of podetia.

Podetia and squamules K+ yellow, P+ yellow-orange.

Habit: Corticolous

Habitat: Prefers shola forests at an altitude of 2100m on the base of *Rhododendron* tree.

Distribution : Nagaland, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20116* (KFRI); *20095* (KFRI).

Note: New record to Kerala.

13. *Cladonia uncialis* (L.) Web., Catal. Lich. Univ. 4: 617 1927.

Plate I. Fig. 2E.

Primary squamules rare, if present 1-2 x 0.5-1mm in size, upper side greyish, lower side white; podetia intricately branched, 20-40mm long, 1mm broad, dying at base, axils dilated, perforated with small squamules, with or without cups; podetial tip tapering at apex in cupless podetia; cups 1mm broad; sterile.

Podetia and squamules K-, P+ yellow

Habit: Saxicolous

Habitat: Prefers open exposed area in evergreen forests at an altitude of 800m and above.

Distribution: Temperate Himalayas

Specimens examined: Kakki dam site, Pathanamthitta Dt., 850m, *Stephen 21932* (KFRI); *21934* (KFRI).

Note: New record to Peninsular India.

Family Coccocarpiaceae

Genus *Coccocarpia* Pers.

Thallus squamulose to foliosed, dorsiventral, heteromerous, whitish grey or lead grey to brown grey, upper surface smooth with or without concentric rings; isidia present or absent; lower surface with rhizines, simple, sometimes forming a hypothallus; corticated on upper and lower surfaces; photobiont a blue green alga; apothecia adnate, irregular in outline; asci 8-spored, spores colourless, usually with oil droplets.

Arvidsson (1982) monographed this genus. About 21 species are known from the tropical and subtropical regions of the world. Awasthi (1985) reported 3 species from India. All the 3 species have been collected during this study and described.

Key to the species

- | | |
|--------------------------------------------------------------------------------|-----------------------|
| 1a. Thallus isidiate | 2 |
| 1b. Thallus lacking isidia | <i>C. erythroxyli</i> |
| 2a. Isidia granular to cylindrical, thallus with concentric rings | <i>C. palmicola</i> |
| 2b. Isidia squamulose to microphylline, thallus without concentric rings | <i>C. pellita</i> |

1. *Coccocarpia erythroxyli* (Sprengel) Swinscow & Krog., Norw. J. Bot. 23:256. 1976.

Thallus orbicular or irregular patches, whitish grey-lead grey, broadly flabellate; margin incised or weakly branched, deflexed, lobulate; upper surface glossy with concentric rings; isidia absent; rhizines blackish, apothecia common, scattered to crowded, up to 4mm in diameter, some times irregular; proper exciple euparaplectenchimatous, thalline exciple indistinct; epithecium brownish or blackish.

Habit: Corticolous/Saxicolous

Habitat: Prefers all climatic conditions in moist shady or open places at an altitude of 800m and above.

Distribution: Assam, Karnataka, Kerala, Maharashtra, Manipur, Nagaland, Tamil Nadu and West Bengal.

Specimens examined: Punnamala, Silent Valley National Park, Palakkad Dt., *Stephen 20087* (KFRI); Mannavan shola, Marayoor, Idukki Dt., *Stephen 22058* (KFRI); Pakshipadalam,

Wayanad Dt., *Stephen 21063c* (KFRI); Kattapara shola, Idukki Dt., *Stephen 21810* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., *Stephen 21857* (KFRI).

2. *Coccocarpia palmicola* (Sprengel) Arvidsson & D. Galloway, Bot. Notiser 132: 242. 1979.

Thallus orbicular or irregular patches, lead grey, lobes imbricate, flabellate or rotund at apices, margin incised; upper side glossy, minutely wrinkled, isidiate; isidia laminal, concolourous with the thallus, globular to cylindrical; rhizines blackish, sterile.

Habit: Corticolous/Saxicolous

Habitat: Abundant on trees, rocks and in all types of vegetation at an altitude of 900 - 2100m.

Distribution: Assam, Karnataka, Kerala, Maharashtra, Manipur, Nagaland, Tamil Nadu and Uttar Pradesh.

Specimens examined: Pullukuthimala, New Amarambalam Reserve Forests, Malappuram Dt., *Stephen 20019* (KFRI), *20023* (KFRI); Chinnamala, Anamudi, Munnar, Idukki Dt., *Stephen 22088b* (KFRI); Ranimedu, Nelliampathy, Palakkad Dt., *Stephen 21069* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., *Stephen 21082* (KFRI); Kattapara shola, Idukki Dt., *Stephen 21819* (KFRI), *21825* (KFRI); Muthikulam, Siruvani, Palakkad Dt., *Stephen 21145* (KFRI); Uppupara, Idukki Dt., *Stephen 21859* (KFRI).

3. *Coccocarpia pellita* (Ach.) Mull. Arg. Em R. Sant., Symb. Bot. Upsa. 12(1): 420. 1952.

Thallus in orbicular or irregular patches; lead grey or sometimes brownish, imbricate, flabellate or rounded at apices, margin incised, sometimes lobulate; upper surface glossy, isidiate; isidia laminal to marginal, dense, concolourous with the thallus, microphylline; lower surface brown or blackish, rhizines blackish; sterile.

Habit: Corticolous/Saxicolous

Habitat: Prefers open moist areas in grasslands or evergreen shola on tree and rocks at an altitude of 1500-2100m.

Distribution: Kerala, Manipur, Meghalaya, Nagaland, Tamil Nadu and Uttar Pradesh.

Specimens examined: Eravikulam National Park, Idukki Dt., *Stephen 20106* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., *Stephen 21844* (KFRI)

Family Collemataceae

Key to genera

- 1a. Thallus not corticated on upper and lower surface *Collema*
1b. Thallus corticated on both surfaces or only on the upper surface *Leptogium*

Genus *Collema* Webber in Wiggers

Thallus small to large, usually foliose, sometimes, subcrustose or squamulose, gelatinous, homoiomerous, ecorticated, olivegreen to blackish green, distinctly lobate; isidia or pustules present or absent; photobiont a blue green alga; rhizines absent; apothecia with an outer thalline and inner proper exciple; asci 8-spored; spores colourless, transversely septate to muriform.

There are about 80 species of *Collema* in the world (Degelius, 1954, 1974). Akhtar and Awasthi (1980) studied the Indian species of *Collema* and reported 34 species from India. During the present study 6 species of *Collema* collected are described.

Key to the species

- 1a. Thallus isidiate 2
1b. Thallus lacking isidia 5
- 2a. Isidia squamuliform, rarely globular when young *C. flaccidum*
2b. Isidia otherwise 3
- 3a. Thallus uniformly smooth, lacking ridges and furrows 4
3b. Thallus striate, ridged or pustulate *C. auriculatum*
- 4a. Apices of lobes swollen and plicate, isidia globular *C. tenax*
4b. Apices of lobes uniformly thin; isidia globular to coralloid *C. subflaccidum*
- 5a. Thallus fenestrate, greenish grey to olive green *C. glaucophthalmum*
var. *implicatum*
5b. Thallus not fenestrate, dark olive brown *C. conglomeratum*
var. *crassinsculum*

1. *Collema auriculatum* Hoffm, Deut. Fl. 98. 1976.

Thallus foliose, in small patches, loosely adnate to the substratum, dark olive green to bluish or blackish green; lobes orbicular, irregularly lobulate; margins incised; upper surface rugose, striated, isidiate; isidia dense, globular to clavate, sometimes squamuliform; pseudo cortex absent; sterile.

Habit: Prefers trees with open moist places at an altitude of 800-2000m.

Distribution: Tamil Nadu and Uttar Pradesh

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 22014b* (KFRI), 22018 (KFRI); Shingampara, Siruvani, Palakkad Dt., 900m, *Stephen 21132a* (KFRI).

Note: New record to Kerala.

2. *Collema conglomerata* Hoffm. Dent. Fl. 102. 1976. var. *crassinsculum* (Malme) Degel., Symb. Bot. Upsal. 13(2): 43. 1974.

Thallus foliose, cartilaginous, dark grey to blackish grey; lobes short, rounded; upper surface ridged, crumpled, isidia absent; apothecia laminal, on the ridges, 2mm in diameter, thalline exciple rough, proper exciple euparaplectenchymatous; spores transversely septate, 2 celled.

Habit: Corticolous

Habitat: Prefer open moist places in evergreen forest at an altitude of 800m

Distribution: Maharashtra and Tamil Nadu

Specimens examined: Kakki, Pathanamthitta Dt., 900m. *Stephen 21186* (KFRI).

Note: New record to Kerala.

3. *Collema flaccidum* (Ach.) Ach., Lichenogr. Univ. 647. 1810.

Thallus foliose, bluish grey to brownish grey; lobes orbicular; upper surface smooth, isidiate; isidia squamuliform, young isidia globular; apothecia rare, proper exciple subparaplectenchymatous; spores ellipsoid, 4-5 septate.

Habit: Corticolous

Habitat: Prefers moist shady places in evergreen forests at an altitude of 1500m.

Distribution: Jammu & Kashmir and Temperate Hilmalaya.

Specimens examined: Kallar Estate, Munnar, Idukki Dt., 1500m, *Stephen 20014b* (KFRI), *20146* (KFRI), *20152* (KFRI).

Note: New record to Peninsular India.

4. *Collema glaucophthalmum* Nyl. var. *implicatum* (Nyl.) Degel., Symb. Bot. Upsal., 20(2): 167. 1974.

Thallus foliose, cartilaginous and hard, dark greenish grey to blackish green; lobes rounded or elongated; upper surface rough, ridged and fenestrated, isidia absent; apothecia

crowded, laminal, on the ridges and pustules; thalline exciple smooth; proper exciple euparaplectenchymatous; spores acicular to fusiform, sickle shaped or straight, 4-6 septate.

Habit : Corticolous

Habitat: Prefer moist shady or open places in the evergreen forest at an altitude of 900m.

Distribution : Kerala, Manipur, Nagaland and Tamil Nadu.

Specimens examined: Kakki Damsite, Pathanamthitta Dt., 900m, *Stephen 21922* (KFRI), *21196* (KFRI).

5. *Collema subflaccidum* Degel., Symb. Bot. upsal. 20(2): 140. 1974.

Thallus foliose; dark grey to greyish brown; lobes orbicular; upper surface smooth to rough; isidiate; isidia laminal to marginal, dense, globular to coralloid, rarely squamuliform; apothecia rare; thalline exciple isidiate or non isidiate; proper exciple euparaplectenchymatous, spores ellipsoid, 5-8 septate.

Habit: Corticolous

Habitat: Prefers moist shady places in the evergreen forests at an altitude of 1500m.

Distribution: Jammu & Kashmir, Himachal Pradesh, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Kallar Estate, Munnar, Idukki Dt., 1500m, *Stephen 20147* (KFRI).

Note: New record to Kerala.

6. *Collema tenax* (Sw.) Ach. En. Degel., Ach. Lichenogr. Univ. 635. 1810.

Plate II. Fig.1.

Thallus foliose, dark olivaceous grey to blackish green; lobes orbicular; margins swollen and plicate, entire or lobulate, upper surface rough, isidiate; isidia granular and sparse; apothecia 1mm in diameter; thalline exciple entire; proper exciple subparaplectenchymatous; spores ellipsoid, muriform, 3-5 septate, longitudinally septate.

Habit: Corticolous

Habitat: Prefers dense shady areas in the evergreen forests at an altitude of 900m.

Distribution: Maharashtra and North Western Himalaya

Specimens examined: Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21940* (KFRI).

Note: New record to South India.

Genus *Leptogium* (Ach.) Vainio

Thallus foliose, homoiomerous, paraplectenchymatously corticated; lobate, subgelatinous, lead grey to bluish or greenish; flattened; margin entire to lacerate, crenate or isidiate; upper surface smooth, undulate or wrinkled or lobulate or isidiate; soredia absent, photobiont a blue green alga; lower surface smooth or glabrous or tomentose; apothecia emergent, adnate, sessile or pedicillate; asci 8-spored; spores colourless, transversely septate or musiform.

The genus *Leptogium* is cosmopolitan in origin and there are about 150 species distributed in the tropical regions of the world. Awasthi and Akhtar (1977,1979) studied the Indian species of *Leptogium* and recorded 42 species from India. Among these, 23 species have been collected during the present study and described.

Key to the species

- 1a. Thallus with tomentum of multicellular hyphal hairs 2
- 1b. Thallus lacking tomentum of multicellular hyphal hairs 3

- 2a. Thallus isidiate *L. burnetiae*
- 2b. Thallus isidiate *L. burgessii*

- 3a. Thallus paraplectenchymatous throughout its thickness4
- 3b. Thallus not paraplectenchymatous throughout its thickness5

- 4a. Thallus granular squamulose *L. subtile*
- 4b. Thallus cushion shaped with coralloid out growths *L. tenuisissimum*

- 5a. Spores transversely septate 6
- 5b. Spores musiform 7

- 6a. Lobes crumbled and wrinkled; spores acicular *L. adpressum*
- 6b. Lobes reticularly wrinkled; spores fusiform *L. brebissoni*

- 7a. Thallus or apothecia isidiate 8
- 7b. Thallus and apothecia lacking isidia 13

- 8a. Isidia present only on the thalline exciple *L. marginellum*
- 8b. Isidia on the thalline exciple, as well as on the
lamina and margin of thallus 9

- 9a. Thallus smooth 10
- 9b. Thallus wrinkled 12

10a. Isidia squamuliform, never cylindrical	<i>L. denticulatum</i>
10b. Isidia granular to cylindrical	11
11a. Margin of thallus entire or rarely isidiate, isidia cylindrical, rarely squamuliform, blackish	<i>L. pichneum</i>
11b. Margin of thallus isidiate and lobulate, isidia concolourous with the thallus	<i>L. cyanescens</i>
12a. Isidia branched; wrinkles acutely raised	<i>L. isidiosellum</i>
12b. Isidia simple, wrinkles not acutely raised	<i>L. austro-americanum</i>
13a. Thallus lobes anastomosing	14
13b. Thallus lobes not anastomosing	15
14a. Thalline exciple lobulate	<i>L. phyllocarpum</i>
14b. Thalline exciple not lobulate	<i>L. chloromelum</i>
15a. Thallus wrinkled	16
15b. Thallus not wrinkled	18
16a. Layers of isidiometric cells below the apothecia	17
16b. Only one layer cortical cell below the apothecia	<i>L. platynum</i>
17a. Thallus rugose, dark, thalline exciple rugose-tuberculose	<i>L. fallax</i>
17b. Thallus not rugose, lead grey, thalline exciple smooth	<i>L. corticola</i>
18a. Proper exciple euparaplectenchymatous only in the marginal region .	19
18b. Proper exciple euparaplectenchymatous in the marginal as well as below the hypothecium	21
19a. Apothecia sessile	20
19b. Apothecia stipitate	<i>L. indicum</i>
20a. Lobes 5-10mm wide, lead grey to dark grey-apothecia up to 2.5mm diameter	<i>L. azureum</i>
20b. Lobes up to 3.5mm wide, lead grey, apothecia up to 1.2mm in diameter	<i>L. moluccanum</i>
21a. Thallus lobes erect to semi-erect, bluish grey to dark or olivaceous	<i>L. gelatinosum</i>
21b. Thallus lobes horizontal, ashy grey to lead grey	22
22a. Thalline exciple smooth, ashy grey	<i>L. ulvaceum</i>
22b. Thalline exciple periclinally wrinkled, lead grey	<i>L. cochleatum</i>

1. *Leptogium adpressum* Nyl. Syn. Lich. 1: 131. 1860.

Thallus foliose, 2-4cm in size, closely adnate to the substratum, dark grey when dry, ashy grey when wet; lobes irregularly divided and crumpled, margin entire to wavy; upper and lower surface wrinkled; isidia absent; apothecia marginal, sessile, 1.5mm in diameter, smooth; thalline exciple irregularly to periclinally wrinkled; proper exciple euparaplectenchymatous; spores acicular, transeversally 13-18 septate.

Habit: Corticolous

Habitat: Prefers moist shady region in the evergreen forests at an altitude of 700m.

Distribution: Tamil Nadu

Specimens examined: Thirunelly, Wayanad Dt., 700m, *Stephen 21038* (KFRI); Shingampara, Siruvani, Palakkad Dt., 750m *Stephen 21183* (KFRI).

Note: New record to Kerala

2. *Leptogium austro-americanum* (Malme) Dodge, Ann. Mo. Bot. Gard. 20: 419. 1933.

Thallus foliose, up to 2cm in size, loosely or closely attached to substratum, dark grey; lobes orbicular, discrete, margin entire, plane to wavy; laminal or sometime marginal, simple, globular or rarely squamuliform; sterile.

Habit : Corticolous

Habitat: Prefers base of trees in shady areas in the forests at an altitude of 900-2100m.

Distribution: North Western Himalaya and Kerala.

Specimens examined: Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21883* (KFRI); Eravikulam National Park, Idukki Dt, 2100m, *Stephen 20124a* (KFRI); Kulayalakadavu, New Amarambalam Reserve Forests, Malappuram Dt., 900m, *Stephen 20001* (KFRI); Pakshipadalam, Wayanad Dt., 1500m, *Stephen 21064a* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21902a* (KFRI).

3. *Leptogium azureum* (Sw.) Mont. In Webb. & Berth., Hist. Nat. Iles Canar. 3: 129. 1840.

Thallus foliose, upto 3cm in size, loosely or closely attached, lead grey to dark grey; lobes orbicular to elongate, margin entire, plane to wavy; upper surface smooth; isidia absent; apothecia laminal submarginal, sessile to shortly stipitate 1mm in diameter; thalline exciple entire; proper exciple euparaplectenchymatous at marginal region; spores ellipsoid, muriform.

Habit: Corticolous

Habitat: Prefers open moist areas in evergreen forests at an altitude of 800-1200m.

Distribution: Meghalaya, Nagaland, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Ranimedu, Nelliampathy, Palakkad Dt., 800m, *Stephen 21068* (KFRI);

Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21944* (KFRI), Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21848* (KFRI), *21850* (KFRI).

Note: New record to Kerala.

4. *Leptogium brebissoni* Mont. In Webb., Hist. Nat. Iles Canar. 3: 130. 1840.

Thallus foliose, 2cm in size, closely attached to the substratum, dark grey, margin entire; reticulately wrinkled, thin; isidia absent; apothecia marginal, 1mm in diameter; spores fusiform, ellipsoid.

Habit: Corticolous

Habitat: Prefers moist areas in the forests at an altitude between 1200-2300m.

Distribution: Tamil Nadu

Specimens examined: Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21148* (KFRI); Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20142* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m. *Stephen 21033* (KFRI).

Note: New record to Kerala.

5. *Leptogium burgessii* (L.) Mont. Apud Webb., Hist. Nat. Iles. Canar. 3(2): 129. 1840.

Thallus foliose, loosely attached to the substratum, lead grey to bluish grey; lobes flat, orbicular to sublinear, margin entire, plane to entire; upper surface smooth to rough; lower surface smooth, covered by very short, dense white to pale brown tomentum; isidia absent; apothecia submarginal, sessile to shortly pedicillate; thalline exciple microphylline to lobulate; spores ellipsoid.

Habit: Corticolous

Habitat: Prefers ecotone areas of the evergreen shola forests at an altitude of 2000m.

Distribution: Tamil Nadu

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 22014a* (KFRI).

Note: New record to Kerala.

6. *Leptogium burnetiae* Dodge, Beich. Nova Hedwigia, 12: 120. 1964.

Thallus foliose, loosely or formerly attached to the substratum, grey bluish, deeply to shallowly lobate, lobes orbicular to sublinear; margin entire to dentate; isidiate; upper surface

smooth to slightly rough, isidiate, isidia solid, simple; coralloid branched, concolourous with thallus; lower surface pale with white tomentum; sterile.

Habit: Corticolous

Habitat: Prefers open moist places of evergreen forest at an altitude of 700m and above.

Distribution: Himachal Pradesh, Nagaland, Tamil Nadu, Uttar Pradesh, and West Bengal.

Specimens examined: Siruvani Damsite, Siruvani, Palakkad Dt., 700m. *Stephen 21112b* (KFRI).

Note: New record to Kerala.

7. *Leptogium chloromelum* (Sw.) Nyl., Syn. Meth. Lich. 1: 128. 1860

Thallus foliose, loosely attached, grey to blackish grey; lobes anastomosing, margins flat to wavy, irregular; upper surface rough, wrinkled; isidia absent; lower surface strongly wrinkled, pale; apothecia laminal to submarginal, sessile; thalline exciple concolourous to thallus, periclinally wrinkled proper exciple euparaplectenchymatous; spores muriform, ellipsoid.

Habit: Corticolous

Habitat: Prefers open moist areas between an altitude of 700-2500m.

Distribution: Kerala, Tamil Nadu and Uttar Pradesh.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20124b* (KFRI); Pakshipadalam, Wayanad Dt., 1500m, *Stephen 21064b* (KFRI); Shingampara, Siruvani, Palakkad Dt., *Stephen 21132b* (KFRI).

8. *Leptogium cochleatum* (Dickson) P. Jorg. & James, Lichenologist 15(2): 113. 1983.

Thallus foliose, closely attached to the substratum, lead grey; lower orbicular, margin entire to wrinkled, isidia absent; lower surface smooth, pale; apothecia laminal to submarginal, sessile, receptacle smooth, wrinkled at base; thalline exciple corticated at margin; proper exciple euparaplectenchymatous, spores muriform, ellipsoid.

Habit: Corticolous

Habitat: Prefers open humid place in the evergreen forests at an altitude of 900m.

Distribution: Tamil Nadu and West Bengal.

Specimens examined: Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21897* (KFRI).

Note: New record to Kerala.

9. *Leptogium corticola* (Tayl.) Tusck., Cat. Pl. Cinc. 47. 1849.

Thallus foliose, loosely attached to the substratum, lead grey to dark grey, lobes orbicular, slightly wrinkled; lower side distinctly wrinkled; isidia absent; apothecia laminal to submarginal, sessile, wrinkled below; thalline exciple entire; proper exciple euparaplectenchymatous; spores ellipsoid, muriform.

Habit: Corticolous/Saxicolous

Habitat: Prefers moist humid areas of the evergreen forest between an altitude of 900-1200m.

Distribution: Tamil Nadu

Specimens examined: Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21902b* (KFRI) Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21852* (KFRI).

Note: New record to Kerala.

10. *Leptogium cyanescens* (Rabenh.) Korber, Syst. Lich. Germ.420. 1855.

Thallus foliose, loosely attached to the substratum, lead grey to dark lead grey, glossy; lobes orbicular, margin entire to isidiate, undulate; upper surface smooth to slightly rough, isidiate; isidia sparse to dense, laminal, concolourous with the surface, granular to cylindrical, rarely squamuliform; lower surface pale, sterile.

Habit: Corticolous

Habitat: Prefers moist places in the evergreen/subtropical forests between an altitude of 900-1700m.

Distribution: Himachal Pradesh, Maharashtra, Manipur, Nagaland, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m. *Stephen 22082* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21941* (KFRI); Lockart Gap, Munnar, Idukki Dt., 1800m, *Stephen 22165a* (KFRI).

Note: New record to Kerala.

11. *Leptogium denticulatum* Nyl., Ann. Sci. Nat. Bot. 5 Ser. 7: 302. 1867.

Thallus foliose, loosely or closely attached to the substratum, lead grey to dark grey; lobes slightly sub erect, discrete, margin entire to lobulate; upper surface smooth, isidiate; isidia dense, concolourous with the thallus; lower surface smooth; apothecia rare, laminal, thalline exciple concolourous to thallus, entire; proper exciple euparaplectenchymatous; spores ellipsoid, muriform.

Habit: Corticolous

Habitat: Prefers moist shady areas in the evergreen forest at an altitude of 800m.

Distribution: Kerala, Maharashtra, Tamil Nadu and West Bengal.

Specimens examined: Kakki Damsite, Pathanamthitta Dt., 850m. *Stephen 21926* (KFRI)

12. *Leptogium fallax* Mull. Arg., Flora, 65: 292. 1882.

Thallus foliose, loosely attached to the substratum, dark grey, margin entire; lobes anastomosing undulate; upper surface rugose, dark, wrinkled, isidia absent; lower surface pale; apothecia laminal, sessile; thalline exciple rugose tuberculose to laciniate; proper euparaplectenchymatous; spores muriform.

Habit: Saxicolous

Habitat: Prefers open moist areas in the evergreen forests at an altitude of 800m.

Distribution: Kerala and NorthWestern Himalaya

Specimens examined: Malleswara mudi; Palakkad Dt., 800m. *Stephen 22124b* (KFRI).

13. *Leptogium gelatinosum* (With.) Laundon, Lichenologist 18: 169-177. 1986.

Thallus foliose, loosely attached to the substratum, dark grey to bluish grey; lobes elongate or orbicular, overlapping, discrete; margin entire, slightly folded; upper surface rough, irregularly wrinkled; lower surface rough, isidia absent; apothecia submarginal to laminal, found on both the surface, sessile; thalline exciple entire, periclinally wrinkled; proper exciple euparaplectenchymatous; spores muriform.

Habit: Corticolous

Habitat: Prefers shaded area in the evergreen shola forests at an altitude of 2300m.

Distribution : Kerala, Tamil Nadu and West Bengal.

Specimens examined: Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21013* (KFRI).

14. *Leptogium indicum* Awas. & P. Akhtar, Geophytol. 8(2): 189-204. 1979.

Thallus foliose, loosely or firmly attached to the substratum, dark lead grey; irregularly lobate, lobes orbicular, margin wavy; upper surface smooth to rough; lower surface rough; apothecia dense, laminal, pedicillate; thalline exciple rough, sometimes longitudinally wrinkled, proper exciple euparaplectenchymatous; spores muriform, colourless.

Habit: Corticolous

Habitat: Prefers moist shady places in evergreen forest at an altitude of 1000m.

Distribution: Maharashtra

Specimens examined: Walakkad, Silent Valley National Park, Palakkad Dt., 1050m, *Stephen 20077* (KFRI).

Note: New record to Kerala. Hitherto this endemic species is known only from its type collection (Maharashtra). The present collection confirms its extended distribution.

15. *Leptogium isidiosellum* (Ridd.) Sierk, Bryologist 67: 282. 1964.

Thallus foliose, firmly attached to the substratum, slightly crumpled; grey to greenish grey; lobes irregularly divided, orbicular, margin entire; upper surface wrinkled, wrinkled acutely raised isidiate, isidia dense laminal, simple to coralloid; lower surface wrinkled; sterile.

Habit: Corticolous

Habitat: Prefers open moist places in the evergreen forests at an altitude of 1000m.

Distribution: Tamil Nadu

Specimens examined: Kulayalakadavu, New Amarambalam Reserve Forest, Malappuram Dt., 950m. *Stephen 20004* (KFRI).

Note: New record to Kerala.

16. *Leptogium marginellum* (Sw.) S. Gray, Nat. Amer. Brit. L. 1. 401. 1821.

Thallus foliose, loosely attached, grey to brownish grey, lobes orbicular, discrete, margin undulate; upper surface slightly wrinkled, isidia absent; apothecia marginal; thalline exciple with squamuliform isidia; proper exciple euparaplectenchymatous; spores muriform.

Habit: Corticolous

Habitat: Prefers shady moist areas in the evergreen shola fores at an altitude of 1800m.

Distribution: Tamil Nadu

Specimens examined: Lockart Gap, Munnar, Idukki Dt., 1800m, *Stephen 22165 b* (KFRI).

Note: New record to Kerala.

17. *Leptogium moluccanum* (Pers.) Vain., Etud. Lich. Bresil. 1:223. 1810.

Thallus foliose, loosely attached, grey to lead grey, lobes orbicular, discrete, margin entire; upper and lower surface smooth, pale, isidia absent; apothecia submarginal, sessile, thalline exciple smooth; proper exciple euparaplectenchymatous; spores muriform.

Habit: Corticolous

Habitat: Prefers moist shady slopes in the evergreen forests at an altitude between 1000-1500m.

Distribution : Nagaland, Tamil Nadu and West Bengal.

Specimens examined: Pakshipdalam, Wayanad Dt., 1500m, *Stephen 21064c* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 950m, *Stephen 21845* (KFRI).

Note: New record to Kerala.

18. *Leptogium phyllocarpum* (Pers.) Mont., Ann. Sci. Nat. Bot. 3: 10. 1848.

Thallus foliose, loosely attached, dark grey, lobes elongate, anastomosing, irregularly divided, margin entire, wavy; upper surface wrinkled, wrinkles acute; lower surface, wrinkled, pale, isidia absent; apothecia submarginal to laminal, sessile; thalline exciple lobulate wrinkled; proper exciple euparaplectenchymatous; spores muriform; ellipsoid.

Habit: Corticolous/Saxicolous

Habitat: Prefers open area at an altitude of 1000m.

Distribution: Nagaland and Tamil Nadu

Specimens examined: Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21902c* (KFRI); Shingampara, Siruvani, Palakkad Dt., 800m, *Stephen 21135* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m. *Stephen 21851* (KFRI).

Note: New record to Kerala.

19. *Leptogium pichneum* (Ach.) Malme, Ark. Bot. 19(8): 20. 1924.

Thallus foliose, loosely or closely attached, lead grey to dark grey, lobes discrete, contiguous, margin entire, wavy; upper surface smooth; lower surface pale; isidiate; isidia laminal to marginal, cylindrical or squamuliform; sterile.

Habit: Corticolous

Habitat: Prefers open or shady areas in the evergreen forests at an altitude of 800m.

Distribution: Tamil Nadu

Specimens examined: Punnamala, Silent Valley National Park, Palakkad Dt., 1050m, *Stephen 20085* (KFRI); Kakki Damsite, Pathanamthitta Dt., 900, *Stephen 21801* (KFRI); Kattappara shola, Idukki Dt., 925m, *Stephen 21823* (KFRI); Siruvani- riverine area, Siruvani, Palakkad Dt., 750m, *Stephen 21183* (KFRI).

Note: New record to Kerala.

20. *Leptogium platynum* (Tuck.) Herre, Proc. Wash. Acad. Sci. 12: 144. 1910.

Thallus foliose, flat, loosely attached, dark grey to brownish grey, lobes irregular, margin entire; wavy, flat; upper surface wrinkled; acutely raised; lower surface pale, wrinkled, irregular; apothecia marginal to laminal, sessile; thalline exciple periclinally wrinkled, concolourous to the thallus; proper exciple euparaplectenchymatous; spores muriform, ellipsoid.

Habit: Corticolous

Habitat: Prefers shady humid areas in the evergreen forests at an altitude of 900m.

Distribution: Tamil Nadu

Specimens examined: Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21879* (KFRI).

Note: New record to Kerala.

21. *Leptogium tenuisissimum* (Discson) Korber,

Plate II. Fig. 2A.

Thallus foliose, loosely attached, cushion shaped, with coralloid outgrowths, lobes orbicular, discrete, margin entire, paraplectenchymatous throughout; upper surface plane, lower surface pale; apothecia lobulate, thalline exciple, entire; proper exciple euparaplectenchymatous.

Habit: Corticolous

Habitat: Prefers moist shady place at an altitude of 1200m.

Distribution: North Western Himalaya

Specimens examined: Muthikulam, Siruvani, Palakkad Dt., 1200m, *Stephen 21143* (KFRI).

Note: New record to Peninsular India.

22. *Leptogium subtile* Torss.

Plate II. Fig. 2B.

Thallus foliose, loosely or firmly attached, dark grey, lobes orbicular granular squamulose, paraplectenchymatous throughout; upper surface wrinkled, lower surface pale, isidia absent; apothecia laminal, margin thick, thalline exciple entire, proper exciple euparaplectenchymatous; spores simple.

Habit: Saxicolous

Habitat: Prefer open area at an altitude of 850m.

Distribution: North Western Himalaya

Specimens examined: Kulayalakadavu, New Amarambalam Reserve Forest, Malappuram Dt., 850, *Stephen 8999* (KFRI).

Note: New record to Kerala.

23. *Leptogium ulvaceum* (Pers.) Vainio, Ann. Acad. Sci. Fenn. Ser. A, 15(6): 38. 1921.

Thallus foliose, loosely attached, cushion shaped, lead grey to dark green, lobes overlapping; margin entire, wavy; upper surface rough, isidia absent; lower surface smooth, pale; apothecia laminal to submarginal, sessile proper exciple euparaplectenchymatous; thalline exciple entire; spores muriform, ellipsoid.

Habit: Corticolous

Habitat: Prefers open place at altitudes ranging from 800-2300m.

Distribution: Nagaland and Tamil Nadu.

Specimens examined: Malleswaramudi, Palakkad Dt., 1800m, *Stephen 22177* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21008* (KFRI); Kakki Damsite, Pathanamthitta Dt., 850m, *Stephen 21915* (KFRI).

Note: New record to Kerala.

Family Lecanoraceae

Genus *Lecanora* Ach. Ex Luyken.

The genus *Lecanora* comprises of 400 species in the world. Indian taxa belong to the subg. *Placodium* (Pers.) Poelt consists of about 15 species in India (Awasthi, 1988). During this study only one species has been collected and described.

1. *Lecanora indica* Zahlbr. Cat. Lich. Univ. 5: 626. 1928.

Thallus placodioid, corticate only on upper surface, monophyllous, 0.5mm in diameter, yellowish grey; apothecia blackish, lecanorine, asci-8-spored; spores hyaline, simple.

Thallus K+ yellow, P-.

Habit: Saxicolous

Habitat: Prefers exposed rocks in the grasslands at an altitude of 1800m. and above.

Distribution: Tamil Nadu

Specimens examined: Chockanad Estate, Munnar, Idukki Dt., 1800m, *Stephen 22173* (KFRI).

Note: New record to Kerala.

Family Lecidiaceae

Genus *Phyllospora* Mull. Arg.

Awasthi (1988) reported 2 species of *Phyllospora* from India. During the present study only one species collected is described.

1. *Phyllospora corallina* (Eschw.) Mull. Arg., Jb. 20: 264. 1894.

Thallus foliose, corticated on upper surface only, heteromerous, laciniate, corraline branched; hypothallus brown-black apothecium sessile, hypothecium hyaline; asci 8-spored; spores simple, hyaline.

Thallus K+ yellow, P+ light yellow.

Habit: Corticolous

Habitat: Prefers trees in the shady places at an altitude between 900-2000m.

Distribution: Tamil Nadu

Specimens examined: Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20160* (KFRI); Kakki, Pathanamthitta Dt., 900m, *Stephen 21200* (KFRI).

Note: New record to Kerala.

Lichen Imperfecti

Genus *Leprocaulon* Nyl.

Awasthi (1988) reported 2 species of *Leprocaulon* from India. Both the species were reported from the state of Sikkim. During the present study one species is collected from this phytogeographic region is described.

1. *Leprocaulon pseudoarbuscula* (Asah.) Lamb & Ward., J. Hattori Bot. Lab. 38: 499-553. 1974.

Plate II. Fig. 3.

Primary thallus verruculose; pseudopodetia cartilaginous terete, simple or branched, leprose-sorediate; photobiont, a green alga, thallus in tufts, dendroid, branches soft fragile; apothecia and pycnidia absent.

Thallus K+ yellow, C-, P+ orange red.

Habit: Terricolous/Corticolous

Habitat: Prefers humid areas in the forests at an altitude of 1000m and above.

Distribution: Sikkim

Plate-II



Fig.1. *Collema tenax*

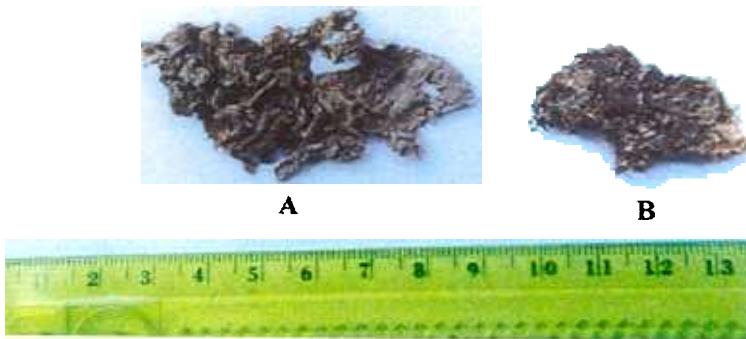


Fig.2. A. *Leptogium tenuisissimum* B. *Leptogium subtil*

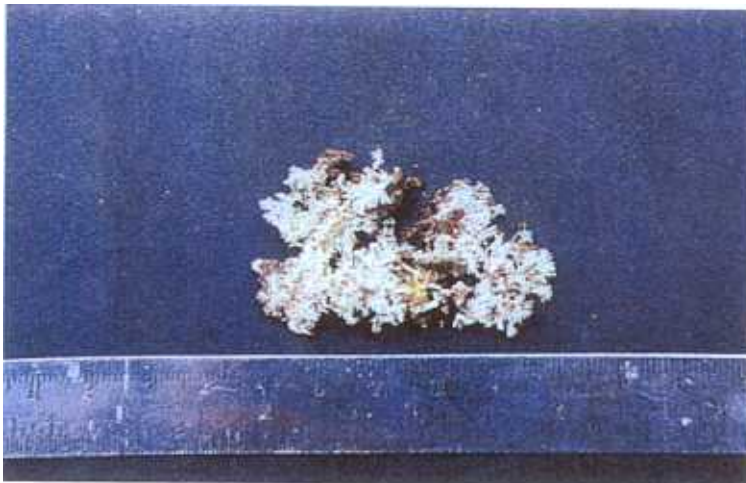


Fig.3. *Leprocaulon pseudoarbuscula*

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20112* (KFRI); Mannavan Shola, Marayoor, Idukki Dt., 1650m, *Stephen 22072* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21104* (KFRI).

Note: New record to Peninsular India.

Family Pannariaceae

Key to genera

- 1a. Thallus corticated on both surfaces..... 2
- 1b. Thallus corticated on upper surface only 3

- 2a. Upper surface with white hispid hairs, hypothallus black *Psoroma*
- 2b. Upper surface without white hispid hairs, hypothallus
blue-brown to brown-black *Pannaria*

- 3a. Upper surface uniformly arachnioid tomentose,
spores thick walled *Leioderma*
- 3b. Upper surface lacking tomentum, spores thin walled *Parmeliella*

Genus *Leioderma* Nyl.

Only a single species of *Leioderma* has been reported from India (Awasthi, 1988). During this study this species has been collected and described here.

1. *Leioderma solediatum* G. Galloway & P.M. Jorge; Lichenologist 19: 390. 1987.

Thallus foliose, corticated on upper surface only; upper surface uniformly arachnioid tomentose, margin solediatum, photobiont a blue green alga; sterile.

Habit: Corticolous

Habitat: Prefers open areas of evergreen forests at an altitude between 900-1500m.

Distribution: Tamil Nadu and Kerala

Specimens examined: Pakshipadalam, Wayanad Dt., 1500m, *Stephen 21063* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21875b* (KFRI).

Genus *Pannaria* Delise in Bory

Thallus squamulose to foliose, appressed, corticated on both surfaces, heteromerous, photobiont a blue green alga, hypothallus present, isidiate or non isidiate, non solediate,;

apothecia present, laminal adnate; hypothecium hyaline to brown; asci 8-spored; spores simple, hyaline.

The genus *Pannaria* is distributed Pantropical temperate subarctic regions of the Northern and Southern Hemisphere of the world (Jorgensen, 1978, 1994). Awasthi (1988) recorded 6 species from India. Among these 3 species are collected during the present study.

Key to the species

- 1a. Thallus isidiate *P. stylophora*
1b. Thallus lacking isidia 2
- 2a. Spores with episporium 3
2b. Spores lacking episporium *P. leucophaea*
- 3a. Thallus squamulose-foliose with enlarged radiating lobes *P. rubiginosa*
3b. Thallus squamulose-crustose, without enlarging radiating lobes *P. leucosticta*

1. *Pannaria leucophaea* (Vahl.) P.M. Jorg., Oper. Bot. 45: 1-124. 1978.

Plate III. Fig. 1.

Thallus squamulose-crustose, grey brown to black squamules discrete; hypothallus blue-black; apothecia up to 1mm in diameter, discs brown-black, with or without thalline margin; hymenium blue black in the upper part, I+ blue green, turning red-brown; spores colourless, lacking episporium.

Habit: Corticolous

Habitat: Prefers base of trees in the shola slopes at an altitude of 1600m.

Distribution: Himalaya

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22081* (KFRI).

Note: New record to Peninsular India.

2. *Pannaria leucosticta* (Tuck. In Darl.) Nyl., Ann. Sci. Nat. Bot. Ser. 4.12: 294. 1859.

Thallus squamulose, brown, marginal squamules elongated, lobe ends white belted tomentose, hypothallus blue-black; apothecia frequent; disc brown; thalline margin white belted tomentose, upper part of hymenium brown, remaining part colourless, I+ blue-green, turning red-brown; spores colourless; ellipsoid, episporium present; episporium broadly acuminate, present at both apices.

Habit: Corticolous

Habitat: Mostly prefers barks of *Rhododendron* in the shola forest at an altitude of 2000m.

Distribution: Tamil Nadu

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 22016* (KFRI).

Note: New record to Kerala.

3. *Pannaria rubiginosa* (Ach.) Bory, Dict. Class. Hist. Nat. 13: 20. 1828.

Thallus foliose, rosette forming, upper surface whitish-blue to fawn, scabrid or slightly pruinose, lobes deeply incised; hypothallus blue-black; apothecia frequent, thalline margin prominent, silvery white and crenulate; disc red brown; upper part of hymenium brown remaining colourless, I+ persistent by deep blue; spores ellipsoid, colourless; epispore distinctly uneven, acuminate at apices.

Habit: Corticolous

Habitat: Prefers exposed areas in the shola forests at an altitude between 1000-2000m.

Distribution: Widely distributed

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 22032* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150, *Stephen 21849* (KFRI).

4. *Pannaria stylophora* Vainio

Thallus foliose, upper surface greyish-blue; isidiate, lobes pale grey, narrow radiating, branched, isidia dark brown; lower surface rhizino-se; hypothallus blue black; sterile.

Habit: Corticolous

Habitat: Prefer exposed areas in the Savannah at an altitude of 950m,

Distribution: Tamil Nadu

Specimens examined: Kulayalakadavu, New Amarambalam Reserve Forests, Malappuram Dt., 950m, *Stephen 20005* (KFRI).

Note: New record to Kerala.

Genus *Parmeliella* Mull. Arg.

Thallus crustose to squamulose or squamulose foliose, irregularly lobes; corticated only on upper surface, heteromerous, photobiont a blue green alga; hypothallus present; apothecia sessile; hypothecium hyaline to brownish; asci-8-spored; spores hyaline, simple.

Key to the species

- 1a. Thallus isidiate *P. triptophylla*
1b. Thallus lacking isidia 2
- 2a. Thallus placodioid-minophyllous, shell like ridges on upper surface *P. plumbea*
2b. Thallus rosette forming, upper surface without shell-like ridges *P. pannosa*

1. *Parmeliella pannosa* (Sw.) Mull. Arg., Malpighia 19: 179. 1905.

Plate III. Fig. 2.

Thallus foliose, stellate, lobes contiguous, denticulate, isidia absent; hypothallus yellowish black to black, apothecia adnate, up to 1mm in diameter, hypothecium hyaline; spores simple.

Thallus K-, P-.

Habit: Corticolous

Habitat: Prefers solitary trees in the grass land at an altitude of 900m.

Distribution: Andaman Islands

Specimens examined: Kattappara shola, Idukki Dt., 925m, *Stephen 21820* (KFRI).

Note: New record to the mainland of India.

2. *Parmeliella plumbea* (Lightf.) Vainio, Acta Fl. Fauna Fenn. 7: 206. 1890.

Thallus foliose, placodioid-monophyllous, upper surface blue-grey with shell like ridges; isidia absent; hypothallus beard like, apothecia present, up to 1mm broad; spores colourless, ellipsoid.

Thallus K-, P-.

Habit: Saxicolous/Corticolous

Habitat: Prefers exposed areas at an altitude between 1000-2100m.

Distribution: Tamil Nadu

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20109* (KFRI); Pakshipadalam, Wayanad Dt., 1500m, *Stephen 21063b* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21838* (KFRI).

Note: New record to Kerala.

3. *Parmeliella tryptophylla* (Ach.) Mull. Arg., Soc. Phys. Hist. Genere 16: 376. 1862.

Thallus squamulose, grey brown, lobes enlarged, isidiate, hypothallus brown; apothecium up to 1mm wide, hypothecium brownish, asci 8-spored, simple.

Habit: Corticolous/ Saxicolous

Habitat: Prefers exposed area between an altitude of 1000-2300m.

Distribution: Tamil Nadu

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 22027* (KFRI); *21960* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21021* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21850* (KFRI).

Note: New record to Kerala.

Genus *Psoroma* Nyl.

The genus *Psoroma* is distributed in tropical to subtropical regions of the world. Awasthi (1988) reported only a single species from Malabar regions of India. In the present study this species have been recollected and enumerated here.

1. *Psoroma hispidulum* Nyl., Catal. Lich. Uni. 3: 269. 1925.

Thallus squamulose, heteromerous, corticated on both the surfaces, photobiont a green alga; upper surface with white hispid hairs; apothecia brown; thalline margin with squamules; upper part of hymenium brown, remaining colourless I+ blue; asci 8-spored; spores hyaline, simple.

Habit: Corticolous

Habitat: Prefers trees having mosses in the evergreen forests at an altitude of 1000m.

Distribution: Kerala.

Specimens examined: Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21070* (KFRI); *21102* (KFRI); i(KFRI).

Family Parmeliaceae

Key to genera

- | | |
|---------------------------------------------------------------------------------------------------------------------|-----------------------|
| 1a. Thallus hollow in medulla | 2 |
| 1b. Thallus not hollow in medulla | 3 |
| 2a. Upper cortex of thallus perforated by round holes | <i>Menegazzia</i> |
| 2b. Lower cortex generally perforated by round holes
on lamina or at apices | <i>Hypogymnia</i> |
| 3a. Pycnidia marginal | 4 |
| 3b. Pycnidia laminal or unknown | 5 |
| 4a. Apothecia marginal, pseudocyphellae on one or both surfaces,
spores thin walled, apothecia imperforate | <i>Cetraria</i> |
| 4b. Apothecia laminal, pseudocyphellae absent,
spores thick walled, apothecia perforate | <i>Parmelaria</i> |
| 5a. Thallus punctate on lower surface | <i>Cetrelia</i> |
| 5b. Thallus not punctate | 6 |
| 6a. Thallus with bulbate cilia along the margin of lobes | 7 |
| 6b. Thallus lacking bulbate cilia, simple cilia present or absent | 8 |
| 7a. Thallus yellow green to yellow, usnic acid present | <i>Relicina</i> |
| 7b. Thallus grey to grey-brown, usnic acid absent | <i>Bulbothrix</i> |
| 8a. Rhizinae present throughout the lower surface | 9 |
| 8b. Rhizinae restricted in central part,
marginal area lacking rhizines | <i>Parmotrema</i> |
| 9a. Lobes linear, involute, canaliculate | <i>Everniastrum</i> |
| 9b. Lobes otherwise, plane | 10 |
| 10a. Thallus grey or greyish, rarely yellow-grey | 11 |
| 10b. Thallus otherwise, brown or brownish | <i>Melanelia</i> |
| 11a. All or most of the rhizinae dichotomously branched | <i>Hypotrachyna</i> |
| 11b. All rhizinae simple or squarrosely branched | 12 |
| 12a. Upper surface of the thallus cracked | <i>Pseudoparmelia</i> |
| 12b. Upper surface not cracked, sometimes reticulate | 13 |
| 13a. Isidia lobulate, apothecia absent, sometime marginal area
of lower surface lacking rhizines | <i>Parmelinopsis</i> |
| 13b. Isidia otherwise, apothecia present, imperforate,
rhizines throughout the lower surface | <i>Parmelina</i> |

Genus *Bulbothrix* Hale

Thallus foliose, dorsiventral, heteromerous, corticolous or saxicolous; whitish grey; lobes sub linear; margin crenate with bulbate cilia; upper surface smooth to rugose; soredia, isidia present or absent; medulla white; lower surface with moderately to densely rhizines; apothecia adnate, imperforate; asci 8-spored; spores simple.

Hale (1976b) recorded 30 species of *Bulbothrix* around the world. Among these, Awasthi (1998) described 7 species from India. During the present study 3 species of *Bulbothrix* have been collected and described.

Key to the species

- 1a. Thallus isidiate *B. isidiza*
1b. Thallus lacking isidia 2
- 2a. Medulla K+ red, lower surface pale brown *B. setschwanensis*
2b. Medulla K-, lower surface dark *B. bulbochaeta*

1. *Bulbothrix bulbochaeta* (Hale) Hale, Smithson. Contr. Bot. 32: 1-29. 1976.

Thallus foliose, adnate, greyish, lobes linear, sinuate, 1.5-2mm wide, margin entire, bulbate cilia thick at base, upper surface smooth, slightly cracked, isidia absent, lower surface with rhizines; rhizinae dichotomously branched; apothecia adnate, margins entire, up to 2mm. Wide spores 12-16 x 6-10mm.

Medulla K-, C-, KC-, P+ orange.

Habit: Saxicolous

Habitat: Prefers open rocks in the ecotone regions at an altitude of 1500m.

Distribution: Tamil Nadu

Specimens examined: Pakshipadalam, Wayanad Dt., 1500m, *Stephen 21047* (KFRI).

Note: New record to Kerala.

2. *Bulbothrix isidiza* (Nyl.) Hale, Phytologia 28: 480. 1974.

Plate III. Fig. 3A.

Thallus foliose, loosely or firmly attached, grey-yellowish, lobes 2-6mm wide, truncate at apices; margin ciliate; cilia inflated; upper surface smooth; isidiate, isidia laminal, simple to coralloid, tips black; lower surface brown; apothecia upto 3mm in diameter; margin entire, spores 9-13 x 5-8mm.

Medulla K+ yellow turning red, C-, KC-, P+ orange.

Habit: Saxicolous/Corticolous

Habitat: Prefers exposed areas in the evergreen forests at an altitude of 750-1000m.

Distribution: Manipur, Meghalaya, Uttar Pradesh and West Bengal.

Specimens examined: Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21075* (KFRI); Kakki Damsite, Pathanamthitta Dt., 850m, *Stephen 21916b* (KFRI), *21924* (KFRI); 900m, *21803a* (KFRI); Poovanchola, Silent Valley National Park, Palakkad Dt., 1000m, *Stephen 22162* (KFRI); Siruvani Damsite, Siruvani, Palakkad Dt., 750m, *Stephen 21120b* (KFRI).

Note: New record to Peninsular India.

3. *Bulbothrix setschwanensis* (Zahlbr.) Hale, *Phytologia* 28: 481. 1974.

Plate III. Fig. 3B.

Thallus foliose, closely attached, greyish-yellowish; lobes 2-5mm wide; margin dissected, ciliate, cilia bulbate; upper surface smooth, slightly cracked, isidia absent; lower surface pale brown, moderately rhizinate; rhizines simple; apothecia adnate, margin entire; thalline exciple ecoronate; spores 12-18 x 7-8mm.

Medulla K+ red, C-, KC-, P+ orange.

Habit: Corticolous

Habitat: Prefers fringes of evergreen shola forests at an altitude of 1900m.

Distribution: Arunachal Pradesh, Manipur, Nagaland, Uttar Pradesh and West Bengal.

Specimens examined: Sispara, Silent Valley National Park, Palakkad Dt., 1950m, *Stephen 22129c* (KFRI).

Genus *Cetraria* Ach.

The genus *Cetraria* is cosmopolitan in distribution and about 40 species are found distributed in temperate, alpine, arctic and antarctic region. Awasthi (1982) studied the Indian and Nepal species of *Cetraria* and published an account of 22 species of cetraria from the area. Recently, on merging with various other genera, Awasthi (1988), recorded only 11 species of *Cetraria* from Indian subcontinent. Among these only one species is identified here.

Plate-III

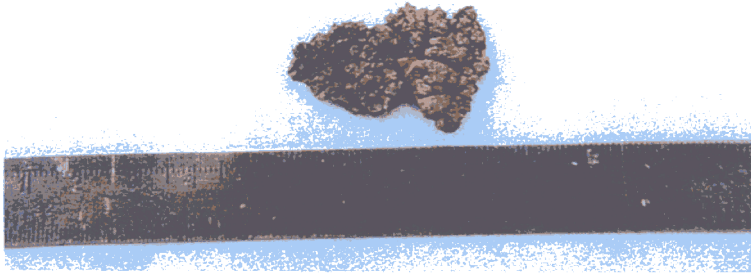


Fig.1. *Pannaria leucophaea*



Fig.2. *Parmeliella pannosa*



Fig.3. A. *Bulbothrix isidiza*

B. *Bulbothrix setschwanensis*

1. *Cetraria wallichiana* (Tayl.) Mull. Arg., Flora 71: 139. 1888.

Thallus foliose, horizontally spreading, light brownish; thick coriaceous; irregularly convolute; lobes imbricate up to 2cm wide; upper side smooth lacking black fibrils; medulla white; lower side yellow to brownish yellow, pseudocyphellate, rhizinate, rhizines sparse; apothecia laminal, disc pale brown to dark brown, spores ellipsoid.

Medulla K-, C-, KC+ red, P-

Habit: Saxicolous

Habitat: Prefers shaded areas near streams in the evergreen forests at an altitude of 1200m.

Distribution: Arunachal Pradesh, Manipur, Sikkim, Uttar Pradesh and West Bengal.

Specimens examined: Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21152a* (KFRI); *21161a* (KFRI).

Note: New record to Peninsular India.

Genus *Cetrelia* Culb. & Culb.

The genus has about 14 species in the world (Culberson & Culberson, 1968). Awasthi (1988) reported 6 species in India and they are all from temperate Himalayan regions. During the present study one specimen was collected and the critical examination revealed that this specimen is closely allied to *Cetrelia*, but not agree with any of the specimens described by Awasthi. This could be a new species. This specimen has been described.

1. *Cetrelia* sp.

Thallus closely or loosely attached, dorsiventral, heteromerous, grey to dark brown, up to 5mm wide, undulate, crenate; upper surface, smooth to rugose, pseudocyphellate, punctiform, isidiate; isidia turning into dorsiventral lobules; medulla white; lower surface black, rhizinate.

Medulla K+ purple, C-, P+ orange red.

Habit: Corticolous

Habitat: Prefers small branches of trees in the evergreen forests at an altitude of 900m.

Specimens examined: Kakki Dam site, Kakki, Pathanamthitta Dt., 900m, *Stephen 21190* (KFRI).

Note: The specimen is closely allied to *C. pseudolivetorum* (Asah.) Culb. & C. Culb. but differs in the chemical test.

Genus *Everniastrum* Hale

Thallus foliose dorsiventral, corticated on both surface, heteromerous, lobes long, linear, with or without marginal cilia; upper surface convex, isidia present or absent, photobiont a green alga; lower surface black, canaliculate, rhizinate or erhizinate; asci-8-spored, spores colourless, simple.

There are about 27 species of *Everniastrum* found in the world. Among these, 4 species are distributed in India (Awasthi, 1998). During the present study 3 species have been collected and described.

Key to the species

- | | |
|------------------------------------------------------------------|---------------------|
| 1a. Thallus isidiate | <i>E. vexans</i> |
| 1b. Thallus lacking isidia | 2 |
| 2a. Lower surface uniformly rhizinate, rhizine short | <i>E. nepalense</i> |
| 2b. Lower surface lacking rhizinae; if present it is short | <i>E. cirrhatum</i> |

1. *Everniastrum cirrhatum* (Fr.) Hale, Mycotaxon 3: 345-353. 1976.

Thallus foliose, dichotomously laminate, lobate, grey, tapering apically, lobes linear elongate; upper surface smooth to rugose, margin ciliate, simple or branched; isidia and soredia absent; lower side black, pale brown to dark brown at apices; canaliculate; rhizine absent, rarely present, sparse; apothecia laminal, upto 5mm in diameter; asci-8-spored; spores colourless, simple.

Medulla K+ red, C-, P+ orange red.

Habit: Corticolous

Habitat: Prefers exposed areas in ecotone areas at an altitude of 1800m and above.

Distribution: Himachal Pradesh, Manipur, Nagaland, Sikkim, Uttar Pradesh and West Bengal.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20134* (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 1850m, *Stephen 20070m* (KFRI); 1800m, *Stephen 20058a* (KFRI); 1900m, *Stephen 22143* (KFRI); 1950m, *Stephen 22139* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 1800m, *Stephen 22119* (KFRI); 2000m, *Stephen*

21991 (KFRI); Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20169* (KFRI); Anaimudi slope, Munnar, Idukki Dt., 2300m, *Stephen 22117* (KFRI).

Note: New record to Peninsular India.

2. *Everniastrum nepalense* (Tayl.) Hale, Mycotaxon 3: 345-353. 1976.

Thallus foliose, grey, dichotomously laciniate, lobate, lobes linear, elongate, variable in width, tapering apically; upper surface glaucous grey smooth, margin ciliate; cilia simple to branched; isidia and soredia absent; lower side black, pale brown near apices, canaliculate, densely rhizinate, rhizinae short, simple; apothecia laminal; up to 7mm in diameter, asci-8-spored, spores colourless, simple, reniform.

Medulla K+ red, C-, P+ orange red.

Habit: Corticolous/Terricolous

Habitat: Prefers exposed areas in shola forests at an altitude of 1500m and above.

Distribution: Arunachal Pradesh, Himachal Pradesh, Manipur, Nagaland, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Sispara, Silent Valley National Park, Palakkad Dt., 1800m, *Stephen 20058b* (KFRI); Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20100* (KFRI); Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20178* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 20189* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 1800m, *Stephen 22120* (KFRI); Pakshipadalam, Wayanad Dt., 1500m, *Stephen 21066a* (KFRI).

Note: New record to Kerala.

3. *Everniastrum vexans* (Zahlbr.) Hale, Mycotaxon 3: 345-353. 1976.

Thallus foliose, loosely adnate, ashy grey, laciniate lobate, laciniae divaricately divided linear, tapering, margin ciliate; cilia black, simple to dichotomously branched; upper surface smooth, densely isidiate; isidia becoming elongate laciniate; lower side black, concave canaliculate, rhizinate; rhizinae dichotomously branched; sterile.

Medulla K+ yellow, C-, P+ orange red.

Habit: Corticolous/Saxicolous

Habitat: Prefers exposed areas at an altitude of 1000m and above

Distribution: Himalayas, Manipur, Nagaland, Tamil Nadu and West Bengal.

Specimens examined: Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20159* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 20188* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21077* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21153* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21872* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21900* (KFRI).

Note: New record to Kerala.

Genus *Hypogymnia* (Nyl.) Nyl.

Thallus foliose, appressed or suberect, heteromerous, corticated on both surfaces, photobiont a green alga, medulla hollow, lower surface lacking rhizines; apothecia lecanorine, asci 8-6 spored; spores hyaline, simple.

There are about 45 species widely distributed in northern and southern hemisphere of the world. Among these, 14 species have been found distributed in India (Awasthi, 1984). During the present study 2 species of *Hypogymnia* have been collected from this area and described.

Key to the species

- 1a. Thallus sorediate *H. pseudobitteriana*
1b. Thallus lacking soredia *H. vittata*

1. *Hypogymnia pseudobitteriana* (Awasthi) Awasthi, Kavaka 12: 87. 1984.

Plate IV. Fig. 1A.

Thallus foliose, ashy white, suborbicular, lacinae up to 2cm long, some what convex, apex rounded; lacinae sorediate; lower side without rhizinae, shining, minutely wrinkled, perforated; medulla hollow; apothecia up to 2mm in diameter, cup shaped, margin incurved; hypothecium colourless; asci 8-spored; spores colourless, oval-ellipsoid.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers open trees in the grasslands at an altitude of 1600 and above.

Distribution: Tamil Nadu

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 1650m, *Stephen 22048* (KFRI); *22049b* (KFRI).

Note: New record to Kerala. Hitherto this endemic taxa was reported from its type locality (Tamil Nadu) only.

2. *Hypogymnia vittata* (Ach.) Parr, Acta. Soc. Linn. Bordeaux 53: 66. 1898.

Plate IV. Fig. 1B.

Thallus foliose, ashy grey, lacineae up to 1mm long, dichotomous, irregularly branched; upper surface slightly convex, soredia absent; medulla white, hollow; lower surface black, pale brown at apices with round perforations at tips and axils, sterile.

Medulla K-, C-, KC+ red, P-

Habit: Corticolous

Habitat: Prefers open areas in the grasslands at an altitude of 1600m and above.

Distribution: Himachal Pradesh, Nagaland and West Bengal.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22070b* (KFRI).

Note: New record to Peninsular India.

Genus *Hypotrachyna* (Vainio) Hale

Thallus foliose, dorsiventral, corticated on both surfaces, heteromerous; lobes sublinear, apically truncate; margins crenate, ciliate, pseudocyphellae absent; photobiont a green alga; medulla white, rarely pigmented, lower surface black, rhizinae up to margins; rhizinae black, dichotomously branched; apothecia lecanorine, adnate; asci-8-spored, spores colourless, simple, oval ellipsoid; pycnidia immersed.

The genus *Hypotrachyna* is distributed in the tropical montane regions of the world comprising over 100 species. Indian species were dealt by Awasthi (1988, 1998) and recorded 33 species from India. Among these, 21 species are recorded from this phytogeographic area during the study period and described.

Key to the species

- 1a. Thallus isidiate or sorediate or pustulate or pustulate sorediate 2
- 1b. Thallus lacking isidia, soredia and pustules 18

- 2a. Thallus isidiate only 3
- 2b. Thallus lacking isidia 8

- 3a. Isidia cylindrical sometimes lobulate or crenulate 4
- 3b. Isidia inflated, breaking open and pustulate *H. dactylifera*

4a. Medulla K+ red or yellow	5
4b. Medulla K-	6
5a. Medulla K+ yellow	<i>H. crenata</i>
5b. Medulla K+ red	<i>H. awasthii</i>
6a. Medulla KC+ rose or red	<i>H. orientalis</i>
6b. Medulla KC-	7
7a. Thallus lobe imbricate, black rimmed	<i>H. infirma</i>
7b. Thallus lobes maculate, without black rim	<i>H. costaricensis</i>
8a. Medulla white	9
8b. Medulla yellow or yellow ochraceous	16
9a. Medulla K+ red	10
9b. Medulla K- or K+ yellow	12
10a. Lobes up to 5mm wide, soredia capitate towards lobe tips	11
10b. Lobes 5-10mm, pustulate-sorediate	<i>H. dodapetta</i>
11a. Lobes 3-5mm wide, soredia not pustulate	<i>H. brevirhiza</i>
11b. Lobes upto 2mm wide, soredia pustulate	<i>Hypotrachyna sp.</i>
12a. Medulla P+ orange red	<i>H. thryptica</i>
12b. Medulla P-	13
13a. Medulla C+ red	<i>H. revoluta</i>
13b. Medulla C-	14
14a. Pustules present with soredia	15
14b. Pustules absent	<i>H. immaculata</i>
15a. Thallus UV+ yellow, lobes 1-3mm wide	<i>H. formosana</i>
15b. thallus UV-, lobes 2-5mm wide	<i>H. exsecta</i>
16a. Medulla uniformly yellow ochraceous, pustules subterminal, granular-sorediate	<i>H. endochlora</i>
16b. Medulla partly yellow ochraceous only	17
17a. Soralia normal	<i>H. immaculata</i>
17b. Soralia from pustules	<i>H. formosana</i>
18a. Medulla K+ red	19
18b. Medulla K- or K+ faint brown	20
19a. Lobes up to 3mm wide, involute, salazinic acid only	<i>H. coorgiana</i>
19b. Lobes up to 2mm, linear, not involute, Salazinic acid and Norstictic acid	<i>H. masonhalei</i>
20a. Medulla white	21
20b. Medulla yellow ochraceous	<i>H. rigidula</i>
21a. Medulla P+ orange	<i>H. adducta</i>
21b. Medulla P-	22

- 22a. Upper surface maculate, medulla KC+ orange or red *H. degelii*
22b. Upper surface lacking maculae, medulla KC- *H. flexilis*

1. *Hypotrachyna adducta* (Nyl.) Hale, Phytologia 28: 340. 1974.

Plate IV. Fig. 2A.

Thallus foliose, coriaceous, loosely attached, grey; lobes irregularly sinuate lobate, 2-4mm wide; upper surface smooth, emaculate, isidia and soredia absent; medulla white; lower surface brown near margin, densely rhizinate; apothecia sessile; thalline exciple smooth, epithecium brown; pycnidia absent.

Medulla K-, C-, KC-, P+ orange-red.

Habit: Corticolous

Habitat: Prefers shola forests at an altitude of 2300m.

Distribution: Arunachal Pradesh, Manipur, Nagaland and West Bengal.

Specimens examined: Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21030* (KFRI).

Note: New record to Peninsular India.

2. *Hypotrachyna awasthii* Hale & Patw., Bryologist, 77: 637. 1974.

Thallus foliose, greyish white, up to 7cm across, irregularly sinuate lobate; lobes imbricate, 3-8mm wide, notched, ciliate in notches; cilia short; upper surface smooth dull, cracked, emaculate, isidiate; isidia laminal, cylindrical to filiform, simple to branched, medulla white, lower surface black, rhizinate, rhizines black; sterile.

Medulla K+ red, C-, KC-, P+ orange.

Habit: Mostly corticolous, rarely saxicolous

Habitat: Prefers open moist areas in the forests at an altitude between 800-2300m.

Distribution: Maharashtra, Nagaland and Tamil Nadu.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20123* (KFRI); *Stephen 20137* (KFRI); *20099a* (KFRI); Nilikkal, Silent Valley National Park, Palakkad Dt., 850m, *Stephen 20046* (KFRI); Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20158* (KFRI); *20176a* (KFRI); Anaimudi, Munnar, Idukki Dt., 2300m, *Stephen 22098* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21024b* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21905* (KFRI); *21908c* (KFRI); Uppupara, Periyar Tiger

Reserve, Idukki Dt., 1150m, *Stephen 21936* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21101c* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21147* (KFRI).

Note: New record to Kerala.

3. *Hypotrachyna brevirhiza* (Kurok.) Hale, *Smithson. Contrib. Bot.* 25: 6. 1975.

Plate IV. Fig. 2B.

Thallus foliose, closely adnate, greyish white; lobes short; upper surface plane to rugose, pruinose at tips, sorediate; soredia at the lobe ends, capitate, sometimes laminal; lower surface densely rhizinate, rhizines long; sterile.

Medulla K+ yellow-red, C-, KC-, P+ orange.

Habit: Corticolous

Habitat: Prefer open dry areas in the grassland trees at an altitude between 900-1600m.

Distribution: Manipur and Nagaland.

Specimens examined: Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21908b* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22061* (KFRI); Kattapara shola, Idukki Dt., 925m, *Stephen 21816b* (KFRI).

Note: New record to Peninsular India.

4. *Hypotrachyna coorgiana* Patw. & Prabhu, *Bryologist* 80: 348. fig. 2. 1977.

Thallus foliose, loosely or firmly attached, whitish grey, lobes short, up to 3mm wide; upper surface smooth, involute, lacking soredia and isidia; lower surface rhizinate; rhizines short or long, apothecia common, up to 8mm in diameter; margin entire; thalline exciple smooth; spores 10-15 x 5-6mm.

Medulla K+ red, C-, KC-, P+ orange.

Habit: Corticolous

Habitat: Prefers open dry areas in the grassland at an altitude of 1200m.

Distribution: Karnataka.

Specimens examined: Pullukuthimala, New Amarambalam Reserve Forests, Malappuram Dt., 1200m, *Stephen 20020* (KFRI).

Note: New record to India. Hitherto this endemic species is known from its type locality (Karnakata) only. Present collection reveals its extended distributional range.

5. *Hypotrachyna costaricensis* (Nyl.) Hale, Phytologia 28: 340-342. 1974.

Thallus foliose, closely or loosely attached lobes; lobes small, sublinear; upper surface smooth, maculate; isidiate; isidia laminal cylindrical to lacinulate; lower surface with rhizines; rhizinae long, forming a thick mat; apothecia common, up to 7mm wide; margin entire, thalline exciple smooth; spores 8-10 x 4-6mm.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers open moist area in the evergreen forests at an altitude of 900m.

Distribution: Kerala and Tamil Nadu

Specimens examined: Pothumala, Nelliampathy, Palakkad Dt., 700m, *Stephen 21074b* (KFRI); Kakki Damsite, Pathanamthitta Dt., 850m, *Stephen 21929*(KFRI).

6. *Hypotrachyna crenata* (Kurok.) Hale, Smithson. Contr.Bot. 25: 26. 1975.

Thallus foliose, loosely attached, lobes sub linear to sub truncate; up to 5mm wide;; margin crenate; upper surface smooth, isidiate; isidia cylindrical, lower surface black, rhizinate; rhizine long; sterile.

Medulla K+ yellow, C-, KC-, P-

Habit: Corticolous/Saxicolous

Habitat: Prefers shady areas in the evergreen forests between an altitude of 900-1250m.

Distribution: North Western Himalaya and Peninsular India.

Specimens examined: Punnamala, Silent Valley National Park, Palakkad Dt., 1250m, *Stephen 20089* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21074c* (KFRI); Kattapara shola, Idukki Dt., 925m, *Stephen 21811* (KFRI); Pullukuthimala, New Amarambalam Reserve Forests, Malappuram Dt., 950m, *Stephen 20034b* (KFRI); Muthikulam, Siruvani, Palakkad 1225m, *Stephen 21146* (KFRI).

Note: New record to Kerala.

7. *Hypotrachyna dactylifera* (Vainio) Hale, Smithson. Contr. Bot. 25: 30. 1975.

Plate IV. Fig. 3.

Thallus foliose, closely adnate, mineral grey, sinuate lobate; lobes sublinear, 1-3mm wide, margin eciliate; upper surface smooth, isidiate; isidia dense, inflated, breaking at top; lower surface black, moderately rhizinate; rhizine short; apothecia 3mm in diameter; spores colourless, simple.

Medulla K-, C-, KC+ red, P-.

Habit: Corticolous

Habitat: Prefers shaded areas in the forests between an altitude of 1000-1800m.

Distribution: Meghalaya

Specimens examined: Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20154* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21070* (KFRI).

Note: New record to Peninsular India.

8. *Hypotrachyna degelii* (Hale) Hale, Smithson. Contr. Bot. 25: 31. 1975.

Thallus foliose, closely adnate, olivaceous grey, sinuate lobate; lobes short, sublinear; upper surface plane, smooth, faintly maculate, isidia and soredia absent; lower side black, rhizinate; apothecia up to 3mm in diameter; margin crenate; spores colourless, simple.

Medulla K-, C-, KC+ red, P-.

Habit: Corticolous

Habitat: Prefers open areas in the evergreen forests between an altitude of 900-1650m.

Distribution: Tamil Nadu

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22049a* (KFRI); Kattappara shola, Idukki Dt., 925m, *Stephen 21816a* (KFRI).

Note: New record to Kerala.

Plate-IV



Fig.1. A. *Hypogymnia pseudobitteriana* B. *Hypogymnia vittata*



Fig.2. A. *Hypotrachyna adducta* B. *Hypotrachyna brevirhiza*



Fig.3. *Hypotrachyna dactylifera*

9. *Hypotrachyna dodapetta* Hale & Patwa., Bryologist, 77: 637. 1974.

Thallus foliose, closely adnate, grey, lobes 5-10mm wide; upper surface pustulate; pustules fragile; lower side black, rhizinate, marginal zone brown, medulla white; sterile.

Medulla K+ red, C-, P+ orange red.

Habit: Corticolous

Habitat: Prefers shola forests at an altitude between 1800-2000m.

Distribution: Tamil Nadu

Specimens examined: Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20155* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 21964c* (KFRI).

Note: New record to Kerala. Hitherto this endemic species is known from its type locality (Karnakata) only. Present collection reveals its extended distributional range.

10. *Hypotrachyna endochlora* (Leight.) Hale, Smithson. Contr. Bot. 25: 34. 1975.

Thallus foliose, loosely adnate, irregularly sinuate lobate, grey to dark grey, lobes 1-3mm wide, much imbricated, ciliate; upper surface plane, smooth, sorediate; soredia submarginal, granular; lower side black, sparsely rhizinate; medulla yellow; sterile.

Medulla K-, C-, KC+ red, P-.

Habit: Corticolous

Habitat: Prefers shola forests at an altitude of 2000m.

Distribution: Tamil Nadu

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 21971* (KFRI).

Note: New record to Kerala.

11. *Hypotrachyna exsecta* (Taylor) Hale, Phytologia 28: 341. 1974.

Thallus foliose, loosely adnate, mineral grey, sinuate lobate; lobes 1-4mm wide, apex dentate; upper surface smooth, emaculate, pustulate, sorediate; pustules subapical, also in lobules; lower surface densely rhizinate; rhizines projecting beyond margins; sterile.

Medulla K-, C-, KC+ red, P-.

Habit: Corticolous

Habitat: Prefers dense moist forest between an altitude of 1000-2300m.

Distribution: Arunachal Pradesh, Nagaland, Tamil Nadu and West Bengal.

Specimens examined: Pullukuthimala, New Amarambalam Reserve Forests, Malappuram Dt., 950m, *Stephen 20037a* (KFRI); Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20156* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 20200* (KFRI); *21006* (KFRI); *21007* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22054a* (KFRI); *22070a* (KFRI); 2000m, *Stephen 21967* (KFRI).

Note: New record to Kerala.

12. *Hypotrachyna flexilis* (Kurok.) Hale, *Phytologia* 28: 341. 1974.

Plate V. Fig. 1A.

Thallus foliose, loosely attached, whitish grey, sinuate lobate, lobes 2-5mm wide, margins crenate; upper surface smooth, emaculate, isidia and soredia absent; lower surface rhizinate; rhizinae dense; apothecia laminal, 2mm in diameter, margin entire; asci clavate.

Medulla K-, C-, KC-, P-.

Habit: Corticolous

Habitat: Prefers open moist places in the evergreen forests at an altitude of 925 m.

Distribution: Arunachal Pradesh, Manipur, Nagaland and West Bengal

Specimens examined: Kattappara shola, Idukki Dt., 925m, *Stephen 21815* (KFRI).

Note: New record to Peninsular India.

13. *Hypotrachyna formosana* (Zahlbr.) Hale, *Smithson. Cont. Bot.* 25: 38. 1975.

Thallus foliose, closely adnate, glaucous grey, sinuate lobate; lobes 1-3mm wide, eciliate; upper surface smooth, emaculate, pustulate; pustules breaking apically; lower side black, rhizinate; rhizinae projecting beyond the margins, medulla white to ochraceous; sterile.

Medulla K-, C-, KC+ red, P-.

Habit: Corticolous

Habitat: Prefers open or shady places in the forests between an altitude of 900-2100m.

Distribution: Meghalaya, Tamil Nadu and West Bengal.

Specimens examined: Eravikulam National Park, Idukki 2100m, *Stephen 20144* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 21964d* (KFRI); 21966 (KFRI).

Note: New record to Kerala.

14. *Hypotrachyna imaculata* (Kurok.) Hale, *Smithson. Contr. Bot.* 25: 41. 1975.

Thallus foliose, closely adnate, fragile, whitish grey, lobes contiguous in central part, margins crenate; upper surface plane, smooth, slightly cracked, sorediate; soredia capitate, granular; lower surface dark; pale near margin, rhizinate; apothecia rare.

Medulla K+ red, C-, KC-, P+ red.

Habit: Corticolous

Habitat: Prefers open grass land trees at an altitude of 950m.

Distribution: Kerala, Nagaland and Tamil Nadu.

Specimens examined: Pullukuthimala, New Amarambalam Reserve Forests, Malappuram Dt., 950m, *Stephen 20037b* (KFRI).

15. *Hypotrachyna infirma* (Kurok.) Hale, *Phytologia* 28: 341. 1974.

Thallus foliose, loosely attached, whitish grey, sinuate lobate; lobes imbricate, 2-3mm wide, dentate; upper surface smooth, emaculate, isidiate; isidia laminal, dense filiform; lower surface rhizinate, marginal zone brown; apothecia substipulate, up to 2mm in diameter; margin entire; thalline exciple sometimes isidiate.

Medulla K-, C-, KC-, P-.

Habit: Corticolous

Habitat: Prefers open dry areas in the forests up to an altitude of 1500m.

Distribution: Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Tamil Nadu and West Bengal.

Specimens examined: Kallar Estate, Munnar, Idukki Dt., 1500m, *Stephen 20149* (KFRI); Pullukuthimala, New Amarambalam Reserve Forests, Malappuram Dt., 950m, *Stephen 20034* (KFRI); *20039*(KFRI); Ranimedu, Nelliampathy, Palakkad Dt., 950m, *Stephen 8925a* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21908a* (KFRI); Kattappara shola, Idukki Dt., 925m, *Stephen 21822* (KFRI); *21809b* (KFRI); Muthikulam, Siruvani; Palakkad Dt., 1200m, *Stephen 21144* (KFRI); Kakki, Pathanamthitta Dt., 900m, *Stephen 21192* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21861*(KFRI); *21863* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21885* (KFRI).

Note: New record to Kerala

16. *Hypotrachyna masonhalei* Patw. & Prabhu, Bryologist 80: 348. Fig. 1. 1977.

Thallus foliose, loosely attached, lobes sinuate lobate, linear, up to 2mm wide; upper surface smooth to rugose, isidia and soredia absent; medulla white; lower surface black, rhizinate; sterile.

Medulla K+ red, C-, KC-, P-.

Habit: Corticolous

Habitat: Prefers open areas in the forests at an altitude of 1650m.

Distribution: Karnataka and Maharashtra.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22071* (KFRI).

Note: New record to Kerala.

17. *Hypotrachyna orientalis* (Hale) Hale, Phytologia 28: 341. 1974.

Thallus foliose, closely adnate, ashy grey, irregularly sinuate lobate; lobes 1-3mm wide, sub linear to linear; upper surface smooth, densely isidiate; isidia filiform; lower surface black, rhizinate; rhizines short; apothecia up to 2mm in diameter, disc light brown; margin isidiate.

Medulla K-, C-, KC+ red, P-.

Habit: Corticolous

Habitat: Prefers open moist areas in the forests between an altitude of 900-1700m.

Distribution: Tamil Nadu

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22037a* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21948* (KFRI).

Note: New record to Kerala.

18. *Hypotrachyna revoluta* (Floerke) Hale, *Smithson. Contr. Bot.* 25: 60. 1975.

Thallus foliose, closely adnate, thin delicate, glaucous grey; sinuate lobate, lobes 1-3mm wide; upper surface smooth; faintly pruinose in young lobes, lobe tips pustulate soerediate; pustules small; soredia granular; lower side black rhizinate, marginal zone brown with papillate; sterile.

Medulla K-, C+ rose-red, KC+ red, P-.

Habit: Corticolous

Habitat: Prefers moist shady places in the sub tropical forest slopes at an altitude of 1650m.

Distribution: Tamil Nadu

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22033* (KFRI).

Note: New record to Kerala.

19. *Hypotrachyna rigidula* (Kurok.) Hale, *Phytologia* 28: 341. 1974.

Plate V. Fig. 1B.

Thallus foliose, closely adnate, coriaceous, irregularly lobate, dark grey, lobes up to 7mm wide; upper side smooth, emaculate with black dots of pycnidia; isidia and soredia absent; lower surface black, densely rhizinate, marginal zone erhizinate; medulla yellow; apothecia up to 7mm in diameter, laminal, disc dark brown.

Medulla K-, C-, KC-, P-.

Habit: Corticolous

Habitat: Prefers open areas in the fringes of forests at an altitude of 1150m.

Distribution: Nagaland, Sikkim and West Bengal.

Specimens examined: Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21854* (KFRI).

Note: New record to Kerala.

20. *Hypotrachyna thryptica* (Hale) Hale, Phytologia 28: 342. 1974.

Thallus foliose, closely adnate, olive white, lobes subirregular, sinuate lobate, up to 3mm wide, eciliate; upper surface cracked; soredia and isidia absent; lowerside black, rhizinate; medulla white; sterile.

Medulla K+ yellow, C-, P+ orange.

Habit: Corticolous

Habitat: Prefers exposed area in the shola forests at an altitude of 1650m.

Distribution: Kerala.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22034* (KFRI).

21. *Hypotrachyna sp.*

Thallus foliose, closely or loosely attached to the substratum glaucous grey, 4cm in diameter, older part brownish, sinuate lobate, lobes up to 2mm wide, crenate, ciliate; upper surface smooth, slightly convex; pustulate-sorediate, pustules on the apex of the lobules, breaking at top, small; isidia absent; lower surface black, rhizinate, margins of lobes brownish; sterile.

Medulla K+ red, C-, KC-, P-.

Habit: Corticolous

Habitat: Prefers ecotone regions of shola grass land at an altitude of 1650m.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22052b* (KFRI).

Genus *Melanelia* Essl.

The genus *Melanelia* is distributed from temperate to subtemperate regions of the world. Awasthi (1998), enumerated 14 species from India. Among these only one species could be collected and described.

1. *Melanelia stygia* (L.) Essl., Mycotaxon, 7: 46. 1978.

Thallus foliose, loosely or closely attached, greyish brown to dark brown; lobes up to 8mm wide; upper surface smooth, soredia and isidia absent; lower black, rhizinate; rhizinae simple, present throughout the lower surface; sterile.

Medulla K-, C-, KC-, P+ orange.

Habit: Saxicolous/Corticolous

Habitat: Prefers open exposed area at an altitude of 900m.

Distribution: Temperate Himalaya

Specimens examined: Kakki Damsite, Pathanamthitta Dt., 900m, *Stephen*, 21803b (KFRI).

Note: New record to Peninsular India.

Genus *Menegazzia* Massal

The genus *Menegazzia* is distributed in the Southern Hemisphere of the world represented by about 45 species in the world. Awasthi (1984, 1988) recorded only a single species from India and this species has been collected during the present study and described.

1. *Menegazzia terebrata* (Hiffim.) Massal., Naeg. Lich. 3. 1854.

Plate V. Fig. 2.

Thallus foliose, closely appressed, radiating lobes; lobes subirregularly to dichotomously branched, imbricate centrally, discrete at periphery; margin brown to dark brown; upper surface yellowish grey, smooth, slightly convex, perforate at axils; apically sorediate; medulla hollow; lower surface black, brown near margin, wrinkled; sterile.

Medulla K+ yellow, C-, KC- P+ orange.

Habit: Corticolous

Habitat: Prefers open exposed areas in the shola forests at an altitude of 1650m.

Distribution: Arunachal Pradesh, Himachal Pradesh and Uttar Pradesh.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen* 22052a (KFRI).

Note: New record to Peninsular India.

Genus *Parmelaria* Awas.

The genus *Parmelaria* is temperate in origin and consists of 2 species in India (Awasthi, 1987). During the present study only one species has been collected from this region and described.

1. *Parmelaria thomsonii* (Striton) Awas., J. Hattori Bot. Lab. 63: 368. 1987.

Thallus foliose, loosely attached, mineral grey, up to 10cm across, irregularly lobate; lobes up to 10mm wide, margin entire; medulla white, lower surface rugose, rhizinate; rhizines sparse, up to 3mm long; apothecia submarginal to laminal, entire to crenate; inflexed, perforated; thalline exciple smooth to rugose; hymenium colourless; pycnidia filiform, ostiole wide.

Medulla K-, C-, KC+ red, P-.

Habit: Corticolous

Habitat: Prefers mostly trees in open areas in the shola forests at an altitude of 1800 and above.

Distribution: Kerala, Manipur, Sikkim, Uttar Pradesh and West Bengal.

Specimens examined: Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21024a* (KFRI); *21026* (KFRI); Mannavan shola, Marayoor, Idukki Dt., *Stephen 22118* (KFRI); Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20164* (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 1800m, *Stephen 20041* (KFRI); *20054* (KFRI); *20059* (KFRI).

Genus *Parmelinopsis* Eliz & Hale

The genus *Parmelinopsis* is distributed in the tropical temperate areas of the world. Awasthi (1998) enumerated 8 species from India. Among these one species is enumerated from this region.

1. *Parmelinopsis microlobulata* (Awas.) Elix & Hale, Mycotaxon 29: 242. 1987.

Plate V. Fig. 3.

Thallus foliose, closely adnate, pale grey, irregularly lobate; lobes short, sub linear, dissected; margin brown rimmed, sparsely ciliate; upper surface smooth, isidiate; isidia cylindrical to flattened; lower side black, marginal zone dark brown, rhizinate; rhizinae simple; sterile.

Medulla K-, C-, KC-. P-.

Plate-V

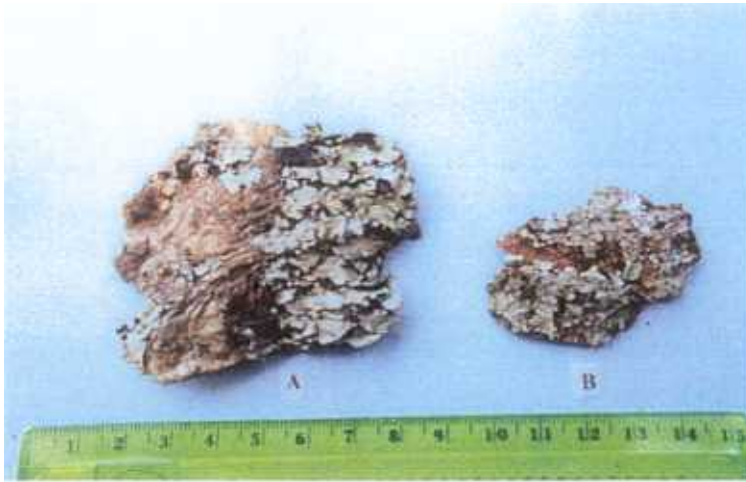


Fig.1. A. *Hypotrachyna flexilis* B. *Hypotrachyna rigidula*



Fig.2. *Menegazzia terebrata*



Fig.3. *Parmelinopsis microlobulata*

Habit: Corticolous

Habitat: Prefers shaded areas in the lower trunk of trees in the evergreen forests at an altitude of 925 m.

Distribution: West Bengal

Specimens examined: Kattappara shola, Idukki Dt., 925m, *Stephen 21809a* (KFRI).

Note: New record to Peninsular India.

Genus *Parmelina* Hale

Thallus foliose, dorsiventral, heteromerous, lobate, corticolous or saxicolous, lobes narrow or broad, margin sub rotund or crenate, ciliate, cilia sparse or only on the axils; upper surface smooth to rugose; isidia, soredia, maculae or pustules present or absent; photobiont a green alga; medulla white or yellow; lower surface black, rhizinate; rhizinae simple or squarrosly branched; apothecia sessile, laminal, imperforate; asci 8-spored; spores colourless, simple.

About 57 species are distributed in the tropical and the temperate regions of the world. Awasthi (1976) dealt Indian species under the genus *Parmelia* sub genus *Parmelia*. Recently, 5 new genera viz., *Canomaculina*, *Myelochroa*, *Parmelinella*, *Parmelinopsis* and *Parmotremopsis* were segregated (Elix and Hale, 1987) from *Parmelina sensu lato*. Thus the genus *Parmelina sensu str.* comprises now only a small group of 8 species (Awasthi, 1998). Here the *sensu lato* concept (Hale, 1974a) is followed. During the present study 14 species of *Parmelina* are collected and enumerated here.

Key to the species

- 1a. Thallus isidiate or sorediate or pustulate 2
- 1b. Thallus lacking isidia soredia and pustules 10

- 2a. Thallus isidiate only 3
- 2b. Thallus sorediate or pustulate-sorediate 7

- 3a. Isidia lobulate or peltate or inflated 4
- 3b. Isidia persistently cylindrical 5

- 4a. Medulla C+ rose or red, lobes 1-3mm *P. spathulata*
- 4b. Medulla C-; lobes upto 2mm wide *P. horrescens*

- 5a. Medulla K+ red *P. wallichiana*
- 5b. Medulla K- 6

- 6a. Ciliate in margin or in axils *P. expallida*
- 6b. Cilia absent *P. indica*

7a. Medulla yellow or yellow ochraceous	8
7b. Medulla white	9
8a. Thallus reticulately cracked, lobules involute K+ red, P+ orange	<i>Parmeliana sp.1</i>
8b. Thallus plane, lobules not involute, K-, P-	<i>P. aurulenta</i>
9a. Lobes emaculate, upto 9mm wide, cilia along margin, thallus reticulate.....	<i>Parmelina sp.2</i>
9b. Lobes emaculate, upto 3mm wide, cilia in axils only, thallus not reticulate	<i>P. muelleri</i>
10a. Medulla white, K+ red	11
10b. Medulla yellow, K-	13
11a. Upper cortex flaking off	<i>P. phlyctina</i>
11b. Upper cortex firm, continous	12
12a. Lobes small, 3-5mm, involute	<i>P. simplicior</i>
12b. Lobes large 6-15mm,	<i>P. manipurensis</i>
13a. Thallus with dimorphic lobes	<i>P. xantholepis</i>
13b. Thallus with uniform sized lobes	<i>P. subaurulenta</i>

1. *Parmelina aurulenta* (Tuck.) Hale, Phylologia 28:482. 1974

Thallus foliose, closely adnate; yellowish grey; lobes imbricate, subrotund upto 5mm wide, notched, ciliate; cilia short, on the axils; upper surface smooth, emaculate; pustulate-sorediate; soralia marginal to submarginal, soredia granular; medulla yellow; lower surface rhizinate; apothecia rare; thalline exciple sorediate pustulate.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers open areas in the evergreen forests at an altitude of + 800 m.

Distribution: Himachal Pradesh, Manipur, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Kakki Dam site, Pathanamthitta, 800m, *Stephen 21916a* (KFRI); Siruvani Dam site, Siruvani, Palakkad Dt., 750m, *Stephen 21109a* (KFRI).

Note: New record to Kerala.

2. *Parmelina expallida* (Kurok.) Hale, Phytologia 28: 482. 1974.

Plate VI. Fig. 1.

Thallus foliose, loosely attached, greenish grey; lobes imbricate, margins rounded, weakly notched, ciliate; cilia sparse; upper surface smooth, plane, emaculate, isidiate; isidia

laminal, cylindrical, simple or branched; medulla white; lower surface brown to black; margin pale brown; sterile.

Medulla K-, C-, KC-, P-

Substratum: Corticolous

Habitat: Prefers open areas in the forests at an altitude of 900-1800m.

Distribution: Nagaland and West Bengal.

Specimens examined: Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20168* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 1650m. *Stephen 22049c* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21901* (KFRI); 21882 (KFRI); Kakki Dam site, Pathanamthitta Dt., 850m, *Stephen 21920* (KFRI); 900m, *Stephen 21198* (KFRI); 21199 (KFRI); Kattapara shola, Idukki Dt., 925m, *Stephen 21830* (KFRI).

Note: New record to Peninsular India.

3. *Parmelina horrescens* (Taylor) Hale, Phytologia 28:482. 1974.

Thallus foliose, closely adnate, whitish grey, lobes imbricate, sublinear, margins crenate, becoming lobulate, ciliate; cilia simple, dispersed; upper surface shiny, emaculate, isidiate; isidia cylindrical; medulla white; lower surface black; apothecia rare; thalline exciple isidiate.

Medulla K-, C-, KC + rose or red, P-

Habit: Saxicolous/Corticolous.

Habitat: Prefers shaded or open areas in the shola forests at an altitude of 1200-2000m.

Distribution: Tamil Nadu

Specimens examined: Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20176b* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 21957d* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21151a* (KFRI); 21154a (KFRI).

Note: New record to Kerala.

4. *Parmelina indica* Hale, Smithson. Contrib. Bot. 33:34. 1976.

Thallus foliose, loosely attached, dark grey; lobes sublinear, contiguous, upto 2mm wide, ciliate; cilia irregularly dispersed; simple; upper surface plane, isidiate; isidia dense,

cylindrical; medulla white; lower surface black; rhizinate, rhizinae dense, simple; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous.

Habitat: Prefers exposed areas in the forests at an altitude between 900-1650m.

Distribution: Tamil Nadu

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22049 d* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21946* (KFRI).

Note: New record to Kerala. Hitherto this endemic taxa is known from its type locality (Tamil Nadu) only.

5. *Parmelina manipurensis* K. Singh, Bryologist 83(4): 533.1980.

Plate VI. Fig. 2.

Thallus foliose, loosely attached, whitish grey; lobes subirregular to subrotund, upto 10mm wide; margins undulate, ciliate; cilia on the axils only; upper surface smooth, emaculate, cracked in older parts; isidia and soredia absent; medulla white; lower surface dark brown to black, marginal zone shining brown, rhizinate; apothecia adnate; margin entire to cracked; thalline exciple smooth.

Medulla K+ yellow - red, C-, KC-, P+ orange-red.

Habit: Saxicolous.

Habitat: Prefers open areas on the roadsides at an altitude of 750m.

Distribution: Manipur and Nagaland.

Specimens examined: Siruvani Dam site, Siruvani, Palakkad Dt., 750m, *Stephen 21120a* (KFRI).

Note: New record to Peninsular India.

6. *Parmelina muelleri* (Vainio) Hale, Phytologia 28:483. 1974.

Thallus foliose, closely adnate, yellowish grey; lobes, irregularly branched, rounded at apices, upto 3mm wide, ciliate; cilia simple to branched; upper surface white-maculate, irregularly cracked, sorediate; soredia laminal, granular; medulla white, lower surface black, rhizinate; apothecia rare, sessile, thalline exciple sorediate.

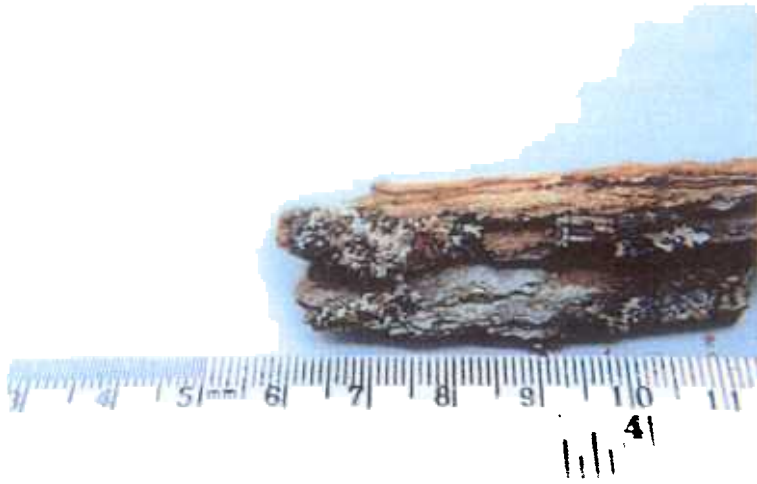


Fig.1. *Parmelina expallida*



Fig.2. *Parmelina manipurensis*



Fig.3. *Parmelina phlyctina*

Medulla K+ Yellow, C-, KC-, P+ Orange.

Habit: Corticolous.

Habitat: Prefers moist humid regions in the evergreen forests at an altitude of 750-1000m.

Distribution: North Western Himalaya

Specimens examined: Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21101 d* (KFRI); Siruvani riverine area, Siruvani, Palakkad Dt., 750m, *Stephen 21181b* (KFRI).

Note: New record to Peninsular India

7. *Parmelina phlyctina* (Hale) Hale, *Phytologia* 28. 483. 1974.

Plate VI. Fig. 3.

Thallus foliose, loosely or closely attached, membranous, mineral grey, lobes sub irregular, apically rotund, upto 10mm wide, margin entire to lobulate, ciliate; cilia sparse, in the axils only; upper surface plane, cortex flaking off, isidia and soredia absent; medulla white; lower surface black, margin brownish, rhizinate; sterile.

Medulla K+ yellow turning red, C-, KC-, P+ orang red.

Habit: Corticolous

Habitat: Prefers shaded areas in the branches of *Rhododendron nilagiricum*, var. *arboreum* in the shola forests at an altitude of 2000m.

Distribution: Mexico and West Indies.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 21964a* (KFRI).

Note: New record to India.

8. *Parmelina simplicior* (Hale) Hale, *Phytologia* 28:483. 1974.

Thallus foliose, closely attached, whitish grey; lobes elongate, sub irregular, imbricate, upto 5mm wide, axils ciliate; upper surface plane, emaculate, isidia and soredia absent; medulla white; lower surface blade, rhizinate; apothecia sessile, up to 6mm in diameter.

Medulla K+ yellow turning red, C-, KC-, P+ Orange

Habit: Corticolous

Habitat: Prefers open moist areas in the forests between an altitude of 850-2100m.

Distribution: Maharashtra

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22070 d* (KFRI); 2000M, *Stephen 21960* (KFRI); Kakki Dam site, Pathanamthitta 850m, *Stephen 21912 a* (KFRI); Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20108* (KFRI); Karimala Gopuram, Parambikulam, Palakkad Dt., 1400m, *Stephen 22169 b* (KFRI).

Note: New record to Kerala. Hitherto this endemic taxa is known from its type locality (Maharashtra) only.

9. *Parmelina spathulata* (Kurok.) Hale, Phytologia 28: 483. 1974.

Plate VII. Fig. 1.

Thallus foliose, closely attached, glaucous grey, fragile; lobes sublinear, crowded, upto 3mm wide, ciliate; cilia evenly dispersed; upper surface plane, isidiate; isidia cylindrical to flattened; lower surface black, rhizinate; rhizinae simple to furcate; sterile.

Medulla K-, C+ red, KC+ rose or red, P-

Habit: Corticolous/Saxicolous.

Habitat: Prefers shaded humid areas in the evergreen and subtropical forests at an altitude of 1000-1250m.

Distribution: Arunachal Pradesh

Specimens examined: Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21101b* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21150b* (KFRI); *21151b* (KFRI); *21154b* (KFRI); *21159b* (KFRI); *21165* (KFRI).

Note: New record to Peninsular India.

10. *Parmelina subaurulenta* (Nyl.) Hale, Phytologia, 28: 483. 1974.

Thallus foliose, closely attached, greenish grey; lobes subintricate, upto 4mm wide, ciliate; cilia in axils only; uppersurface plane, rugose centrally, faintly maculate, sometimes lobulate centrally, isidia and soredia absent; medulla pale, yellow; lower surface black, rhizinate; apothecia adnate, lancelinal, margin entire to crenulate; thalline exciple smooth.

Medulla K+ yellow, C+ pale Yellow, KC+ pale yellow, P+ yellow.

Habit: Corticolous.

Habitat: Prefers open areas in the evergreen/subtropical/shola forests between an altitude of 900-2000m.

Distribution: Manipur, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Kulayalakadavu, New Amarambalam RF, 950m, *Stephen 20007* (KFRI); Mannavan shola, Marayoor, Idukki, Dt., *Stephen 22004* (KFRI).

Note: New record to Kerala.

11. *Parmelina wallichiana* (Tayl.) Hale, Phytologia 28: 483. 1974.

Thallus foliose, closely or loosely attached, mineral grey; lobes sub diohotomonsly sinuate, upto 15mm wide, apices rotund to subrotund; margin crenate, notched, ciliate; upper surface smoothly cracked, emaculate, isidiate; isidia laminal, cylindrical; medulla white; lower surface brown to black; rhizinate papillate at marginal zone; apothecia upto 10mm in diam. Margins entire, thalline exciple smooth.

Medulla K+ red, C-, KC-, P+ orange.

Habit: Corticolous/Saxicolous.

Habitat: Prefers open areas at an altitude of 900-2100m.

Distribution: Assam, Kerala, Manipur, Meghalaya, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Kulayalakadavu, New Amarambalam Reserve Forests, Malappuram Dt., 950m, *Stephen 20013* (KFRI); Pullukuthimala, New Amarambalam Reserve Forests, Malappuram Dt., 1200m, *Stephen 20021* (KFRI); *20038* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22047* (KFRI); *22052* (KFRI); Pakshipathalam, Wayanad Dt., 1500m, *Stephen 21050* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21085* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21909c* (KFRI); *21942* (KFRI); *21945* (KFRI); Kattapara Shola, Idukki Dt., 925m, *Stephen 21827* (KFRI); *21829* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21835* (KFRI); Anguinda, Silent Valley National Park, Pallakad Dt., 2100m, *Stephen 22147* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21107* (KFRI); Muthikulam Siruvani, Palakkad Dt., 1125m, *Stephen 21149* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21835* (KFRI); *21843b* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21899* (KFRI).

Note: New record to Kerala.

12. *Parmelina xantholepis* (Mont. et v.d. Bosch) Hale, Phytologia 28: 483. 1974.

Thallus foliose, fragile, closely attached, grey; lobes dimorphic; primary lobes up to 5mm wide, sparsely ciliate; secondary lobules develop on primary lobes; crowded, imbricate, dichotomously divided; upper surface plane, rugulose, maculate, isidia and soredia absent; medulla yellow; lower surface black, rhizinate; sterile.

Medulla K+ Yellow, C+. Pale yellow, KC+ yellow, P+ yellow.

Habit: Corticolous

Habitat: Prefers open shady riverine areas in the evergreen forests at an altitude of 950m.

Distribution: Manipur, Tamil Nadu and West Bengal

Specimens examined: Kulayalakadavu, New Amarambalam Reserve Forests, Malappuram Dt., 950m, *Stephen 20006* (KFRI).

Note: New record to Kerala.

13. *Parmelina* sp. 1.

Thallus foliose, loosely or closely attached, glaucous grey, upto 15mm across, lobes sub imbricate, upto 10mm wide, ciliate; cilia black, simple, sparse to dense, upto 2mm long; upper surface smooth, brittle, dark, centrally rugose, central part dark grey to black, reticulately cracked; isidia absent, sorediate; soralia at the lobe tips, blackish, granular; medulla white; lower side black, marginal zone dark brown, rhizinate; sterile.

Medulla K+ pale yellow, C-, KC+ yellow, P-

Habit: Saxicolous.

Habitat: Prefers open areas in the shola forests at an altitude of 1650m.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m *Stephen 22067* (KFRI).

14. *Parmelina* sp. 2.

Thallus foliose, closely or loosely attached, yellowish grey upto 12cm across; lobes 3-10mm wide, sinuate, lobate, notched; ciliate, cilia sparse to dense upper surface plane, rugose, reticulately cracked at centre, isidia absent, sorediate; soralia on the apex of lobules; rounded; medulla yellow or rarely white; lower surface black, margin pale to dark brown, shining; rhizinate; rhizinae sparse; sterile.

Medulla K+ red, C-, KC-, P+ orange.

Habit : Corticolous/Saxicolous.

Habitat: Prefers open areas in the shola forests at an altitude between 1600-2000m.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 21968* (KFRI); *21958* (KFRI); *21970* (KFRI); *21964b* (KFRI); *22041* (KFRI).

Genus *Parmotrema* Massal.

Thallus foliose, dorsiventral, heteromerous, loosely or closely attached; lobate; lobes broad rotund, margins entire or crenate, ciliate or eciliate; upper surface smooth to rugose, wrinkled, isidia, soredia, maculae present or absent; lower surface black or brown with a pale brown or white mottled erhizinate marginal zone; photobiont green; medulla white or yellow; apothecia substipitate or stalked, disc perforate or imperforate; thalline exciple smooth or rugose; asci 8-spored; spores colourless, simple.

A genus of about 110 species, mostly distributed in the tropical regions of the world. Hale (1965) completed a world monograph of the genus under the name *Parmelia* subgenus *Amphigymnia*. Later, Awasthi (1976) also studied Indian taxa under the same title. In India there are 43 species of *Parmotrema* has been reported (Awasthi, 1988, 1998). Among these, 26 species of *Parmotrema* are collected and enumerated here.

Key to the Species

- 1a. Thallus isidiate or sorediate or pustulate-sorediate 2
- 1b. Thallus lacking isidia, soredia or pustules 20

- 2a. Thallus isidiate 3
- 2b. Thallus sorediate or pustulate-sorediate 7

- 3a. Margin of lobes ciliate 4
- 3b. Margin of lobes lacking cilia 5

- 4a. Medulla P+ orange red *P. crinitum*
- 4b. Medulla P- *P. xanthina*

- 5a. Isidia cylindrical, filiform, medulla C+ red or C- 6
- 5b. Isidia coralloid branched medulla C+ rose *Parmotrema* sp. 1

- 6a. Medulla C+ red *P. tinctorum*
- 6b. Medulla C- *P. saccatilobum*

- 7a. Thallus pustulate *P. kamatii*
- 7b. Thallus sorediate 8

- 8a. Margin of lobes ciliate 9
- 8b. Margin of lobes lacking cilia 18

9a. Medulla K+ red	10
9b. Medulla K- or K+ pale yellow	11
10a. Upper surface of thallus white maculate, cortex, reticulately cracked	<i>P. reticulatum</i>
10b. Upper surface of thallus not white maculate, cortex not reticulately cracked	<i>P. stuppeum</i>
11a. Medulla K+ pale yellow, P+ orange	<i>Parmotrema sp. 2</i>
11b. Medulla K-, P+ red or P-	12
12a. Medulla P+ red	<i>P. subarnoldii</i>
12b. Medulla P-	13
13a. Medulla C+ rose or red	14
13b. Medulla C-	16
14a. Lobes maculate, reticulately cracked	<i>P. cooperi</i>
14b. Lobes emaculate, not reticulately cracked	15
15a. Soraliolate lobes involute, marginal area of lower surface white to pale brown, medulla yellow	<i>P. sanctae - angelii</i>
15b. Soraliolate lobes not involute, marginal area of lower surface dark brown, shining, medulla white	<i>P. indicum</i>
16a. Medulla K+ pink or red	17
16b. Medulla KC-	<i>P. grayanum</i>
17a. Marginal area of the lower surface dark brown	<i>P. pseudonilgherrense</i>
17b. Marginal area of the lower surface ivory to grey	<i>P. hababianum</i>
18a. Medulla P+ red	<i>P. dilatatum</i>
18b. Medulla P-	19
19a. Medulla C+ red, KC+ red	<i>P. austrosinensis</i>
19b. Medulla C-, KC-	<i>P. praesorediosum</i>
20a. Lobes ciliate	21
20b. Lobes eciliate	24
21a. Medulla P+ orange-red	<i>P. zollingeri</i>
21b. Medulla P-	22
22a. Medulla C+ rose-red	<i>P. eunetum</i>
22b. Medulla C-	23
23a. Lobes maculate, 10-20mm wide	<i>P. nilgherrense</i>
23b. Lobes emaculate, 4-10mm wide	<i>P. abessinicum</i>
24a. Medulla K+ red	<i>P. latissimum</i>
24b. Medulla K-	25
25a. Medulla P+ orange-red	<i>P. disparale</i>
25b. Medulla P-	<i>P. mesotropum</i>

1. *Parmotrema abessinicum* (Krempelh.) Hale, Pytologia 28: 334. 1974.

Thallus foliose, loosely attached, dark-grey; lobes rotund, upto 7mm wide, margin crenate, ciliate; cilia simple, upper surface smooth, faintly maculate; isidia and soredia absent; medulla white; lowerside minutely wrinkled, brown black, rhizinate, marginal zone light brown to mottled pale brown; apothecia upto 5mm in diameter, perforated.

Medulla K-, C-, KC+ red, P-

Habit: Corticolous

Habitat: Prefers fringes of shola forests at an altitude between 1800-2300m.

Distribution: Tamil Nadu.

Specimens examined: Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 201662* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21032* (KFRI).

Note: New record to Kerala.

2. *Parmotrema austrosinensis* (Zahlbr.) Hale, Phytologia 28: 335. 1974.

Thallus foliose, loosely attached; glaucous white to grey; lobes rotund, up to 10mm wide, imbricate, eciliate; soredia surface smooth; emaculate, sorediate; soredia marginal, linear, sinuous, wavy; farinose; medulla white; lower side reticulately wrinkled, black; marginal zone mottled; sterile.

Medulla K-, C+ rose-red, KC+ red, P-

Habit: Corticolous

Habitat: Prefers evergreen slopes at an altitude of 1000m.

Distribution: Himachal Pradesh, Karnataka and Tamil Nadu,.

Specimens examined: Chembra hill, Waynad Dt., 1000m, *Stephen 8918* (KFRI).

Note: New record to Kerala.

3. *Parmotrema cooperi* (Steiner & Zahlbr.) Hale, Phytologia 28: 335. 1974.

Thallus foliose, loosely attached, grey, lobes dimorphic, rotund, some flabellate rotund, margins irregularly convolute, ciliate; upper surface smooth; maculate, reticulately cracked in older parts; sorediate; soralia marginal, linear, sinuous; sorediate lobes involute; lower surface black, rhizinate; sterile.

Medulla K-, C+ red, KC+ red, P-

Habit: Corticolous

Habitat: Prefers shaded areas in the evergreen forests at an altitude between 700-900m.

Distribution: Tamil Nadu

Specimens examined: Ranimedu, Nelliampathy, Palakkad Dt., 950m, *Stephen 8932b* (KFRI); Siruvani riverine area, Siruvani, Palakkad Dt., 750m, *Stephen 21181a* (KFRI).

Note: New record to Kerala.

4. *Parmotrema crinitum* (Ach.) Hale, Phytologia 28: 335. 1974.

Thallus foliose, loosely attached, dark grey; lobes rotund, upto 8mm wide, crenate, ciliate; upper surface smooth, emaculate, isidiate; isidia laminal, simple to coralloid, ciliate; medulla white; lower side slightly rugose, black; marginal zone shining; sterile.

Medulla K-, C-, KC-, P+ orange.

Habit: Corticolous

Habitat: Prefers shaded areas in the evergreen to shola slopes at an altitude of 1100-1800m.

Distribution: Tamil Nadu.

Specimens examined: Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20180* (KFRI); *20181* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21866* (KFRI).

Note: New record to Kerala.

5. *Parmotrema dilatatum* (Vainio) Hale, Phytologia 28: 335. 1974.

Thallus foliose, loosely attached, darker grey; lobes rotund, imbricate and divided, crenate and sparsely ciliate; cilia on the axils only; upper surface smooth, dull, emaculate, sorediate; soralia marginal, globular or confluent, linear; medulla white; lower surface minutely wrinkled, black, rhizinate, marginal zone yellowish brown to white mottled, rhizinate; sterile.

Medulla K-, C-, KC+ red, P+ red.

Habit: Corticolous

Habitat: Prefers open trees in the ecotone regions at an altitude of 1650m.

Distribution: Kerala, NorthWest Himalaya and Tamil Nadu.

Specimen examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22069a* (KFRI).

6. *Parmotrema disparale* (Nyl.) Hale, *Phytologia*, 28: 335. 1974.

Thallus foliose, loosely attached, mineral grey; lobes rotund, laciniate; upper surface smooth, white maculate, reticulately cracked, isidia and soredia absent; medulla white, lower side black, rhizinate, marginal zone brown to ivory mottled; apothecia pedicillate, thalline exciple rugose.

Medulla K-, C-, KC+ red, P+ orange-red.

Habit: Corticolous

Habitat: Prefers open humid areas near the streams in the evergreen forests at an altitude of 950m.

Distribution: Tamil Nadu

Specimens examined: Pullukuthimala, New Amarambalam Reserve Forests, Malappuram Dt., 950m, *Stephen 20031* (KFRI).

Note: New record to Kerala. This endemic taxa is hitherto known only from its type locality (Tamil Nadu).

7. *Parmotrema eunetum* (Stirt.) Hale, *Phytologia* 28: 336. 1974.

Thallus foliose, loosely attached, glaucous grey; lobes rotund, upto 10mm wide, crenate to entire ciliate; upper surface smooth, faintly maculate; isidia and soredia absent; medulla white; lower surface black, rhizinate, marginal zone tan; sterile.

Medulla K-, C+ red, KC+ red, P-

Habit: Corticolous

Habitat: Prefers moist humid areas in the evergreen forests at an altitude of 800m.

Distribution: Tamil Nadu

Specimens examined: Punnamala, Silent Valley National Park, Palakkad Dt., 850m, *Stephen 20086b* (KFRI); Thirunelly, Wayanad Dt., 700m, *Stephen 21034* (KFRI); Kakki, Pathanamthitta Dt., 900m, *Stephen 20173* (KFRI).

Note: New record to Kerala.

8. *Parmotrema grayanum* (Hue) Hale, Phytologia 28: 336. 1974.

Thallus foliose, loosely attached, ashy grey; lobes short rotund; sub imbricate, crenate dentate, ciliate; upper surface smooth, pruinose emaculate; sorediate; soralia marginal; medulla white, lower surface slightly wrinkled; rhizinate, marginal zone brown to dark brown, sterile.

Medulla K-, C-, KC-, P-

Habit: Saxicolous, rarely corticolous

Habitat: Prefers open dry areas with high wind between an altitude at 800-2300m.

Distribution: Tamil Nadu

Specimens examined: Pettimudi, Munnar, Idukki Dt., 2300m, *Stephen 20173* (KFRI); Malleswaramudi, Palakkad Dt., 800m, *Stephen 22124c* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21842* (KFRI); *21843a* (KFRI).

Note: New record to Kerala.

9. *Parmotrema hababiana* (Hale) Hale, Phytologia 28: 336. 1974.

Thallus foliose, loosely attached, pale grey; lobes rotund, upto 10mm wide, ciliate; upper surface smooth, faintly maculate, rugose, sorediate; soralia marginal to sub marginal, linear to capitate, granular; medulla white; lower surface black, wrinkled, marginal area brown to white mottled; sterile.

Medulla K-, C-, KC+ red, P-

Habit: Corticolous

Habitat: Prefers open dry or moist areas in the evergreen forests at an altitude of 1000m.

Distribution: Andhra Pradesh, Kerala, Manipur, Tamil Nadu and Uttar Pradesh.

Specimens examined: Ranimedu, Nelliampathy, Palakkad Dt., 950m, *Stephen 8932c* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., *Stephen 21101a* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21874* (KFRI).

10. *Parmotrema indicum* Hale, Mycotaxon 5: 432-448. 1979.

Thallus foliose, loosely attached, dark grey; lobes rotund; ciliate, upto 10mm wide; upper surface non maculate, reticulately cracked, isidia absent, sorediate; soredia laminal, marginal; medulla white; lower surface black, rhizinate; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers open areas in the evergreen forests between an altitude of 900-1200m.

Distribution: Tamil Nadu

Specimens examined: Dam site, Silent Valley National Park, Palakkad Dt., 900m, *Stephen 20092* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21086a* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21939a* (KFRI).

Note: New record to Kerala. This endemic taxa is hitherto known only from its type locality (Tamil Nadu).

11. *Parmotrema kamatii* Patw. & Prabhu Bryologist 80: 348. Fig. 3. 1977.

Thallus foliose, loosely attached; lobes subrotund, upto 7mm wide, sparsely ciliate, revolute, divided into lobules; upper surface plane, rugose, soredia and isidia absent, pustulate; pustules submarginal; medulla white; lower surface black marginal zone, mottled, rhizinate; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers open areas in the forests between an altitude of 1000-2100m.

Distribution: Tamil Nadu

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20222a* (KFRI); Pullukuthimala, New Amarambalam Reserve Forests, Malappuram, 1200m, *Stephen 20025* (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 1800m, *Stephen 20052* (KFRI).

Note: New record to Kerala. This endemic taxa is hitherto known only from its type locality (Tamil Nadu).

12. *Parmotrema latissimum* (Fee) Hale, Phytologia 28: 337. 1974.

Plate VII. Fig. 2.

Thallus foliose, loosely attached, pale grey; lobes rotund, entire, eciliate; upper surface plane, smooth, emaculate, rugose; isidia and soredia absent; medulla white, lower side black, sparsely rhizinate, marginal zone dark tan; apothecia imperforate, thalline exciple maculate.

Medulla K+ red, C-, P+ orange-red.

Habit: Corticolous

Habitat: Prefers open areas at an altitude of 900m.

Distribution: West Bengal

Specimens examined: Kakki Dam site, Pathanamthitta Dt., 850m, *Stephen 21912b* (KFRI); *21197* (KFRI).

Note: New record to Peninsular India.

13. *Parmotrema mesotropum* (Mull. Arg.) Hale, Phytologia 28: 337. 1974.

Thallus foliose, loosely attached, pale grey; lobes upto 8mm wide, eciliate; upper surface pale, smooth, rugose, lacking isidia and soredia, medulla white, lower surface black, rhizinate; apothecia upto 5mm in diameter.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers shaded areas in the forests between an altitude of 1200-1800m.

Distribution: Karnataka

Specimens examined: Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20183* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21166* (KFRI).

Note: New record to Kerala.

14. *Parmotrema nilgherrense* (Nyl.) Hale, Phytologia 28: 338. 1974.

Thallus foliose, loosely attached, ashy grey; lobes plane to involute, imbricate, ciliate; upper surface maculate, smooth, rugose, isidia and soredia absent; medulla white; lower surface black, minutely wrinkled, rhizinate; apothecia large, upto 15mm, involute, thalline exciple rugose.

Medulla K-, C-, KC+ pink, P-

Habit: Corticolous/Saxicolous

Habitat: Prefers ecotone regions of shola forests at an altitude of 2000m.

Distribution: Himachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Chinnamala, Anaimudi, Munnar, Idukki Dt., 2100m, *Stephen 22094* (KFRI); Anaimudi, Munnar, Idukki Dt., 2400m, *Stephen 22105* (KFRI); Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 21957b* (KFRI).

Note: New record to Kerala.

15. *Parmotrema praesorediosum* (Nyl.) Hale, *Phytologia* 28: 338. 1974.

Plate VII. Fig. 3.

Thallus foliose, closely attached, pale grey; lobes upto 9mm wide, sinuate, imbricate, eciliate; upper surface smooth, emaculate, rugose, cracked; sorediate; soralia marginal, linear, capitate, granular; medulla white, lower surface black, wrinkled, rhizinate, marginal zone brown to white mottled; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers open riverine areas in the evergreen forests at an altitude of 750m.

Distribution: Madhya Pradesh, Maharashtra, Manipur, Uttar Pradesh and West Bengal.

Specimens examined: Siruvani Dam site, Siruvani, Palakkad Dt., 750m, *Stephen 21179* (KFRI).

Note: New record to Kerala.

16. *Parmotrema pseudonilgherrense* (Asah.) Hale, *Phytologia* 28: 338. 1974.

Thallus foliose, loosely attached, grey; lobes rotund, imbricate, sinuous, ciliate; upper surface smooth, maculate, sorediate; soralia on tip of lobes, sorediate lobes involute, soredia granular; medulla white; lower side smooth, rhizinate, marginal zone tan to dark brown; apothecia sessile, thalline exciple rough maculated.

Plate-VII



Fig.1. *Parmelina spathulata*



Fig.2. *Parmotrema latissimum*



Fig.3. *Parmotrema praesorediosum*

Medulla K-, C-, KC+ red, P-

Habit: Corticolous

Habitat: Prefers fringes of shola forests at an altitude of 2300m.

Distribution: Himachal Pradesh, Maharashtra, Tamil Nadu and Uttar Pradesh.

Specimens examined: Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21002* (KFRI).

Note: New record to Kerala.

17. *Parmotrema reticulatum* (Tayl.) M. Choisy, Bull. Mens. Soc. Linn. Lyon 21: 175. 1952.

Thallus foliose, loosely attached, pale grey; lobes upto 10mm wide, crenate or irregularly incised, ciliate; upper surface reticulately cracked, maculate, sorediate; sorediate lobes involute; soralia marginal; medulla white; lower surface black, rhizinate, marginal area brown; apothecia upto 10mm in diameter; thalline exciple sorediate.

Medulla K+ yellow-red, C-, KC-, P+ orange-red.

Habit: Corticolous

Habitat: Prefers open areas in the shola-grassland margin at an altitude of 2000m.

Distribution: Assam, Himachal Pradesh, Madhya Pradesh, Manipur, Meghalaya, Nagaland, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 22030* (KFRI).

Note: New record to Kerala.

18. *Parmotrema saccatilobum* (Tayl.) Hale, Phytologia 28: 339. 1974.

Thallus foliose, loosely attached, dark grey; lobes lacinate, lobes rotund to subrotund, discrete, upto 10mm wide, ciliate; upper surface dull, smooth, maculate, maculae reticulate, reticulately cracked, sorediate, sorediate lobes involute; medulla white, lower surface black, rhizinate, marginal area brown to yellow brown; sterile.

Medulla K+ yellow-red, C-, P+ orange-red

Habit: Corticolous

Habitat: Prefers shaded trunks in the evergreen forests at an altitude of 750m.

Distribution: Assam, Himachal Pradesh, Meghalaya, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Siruvani Dam site, Siruvani, Palakkad Dt., *Stephen 21112c* (KFRI).

Note: New record to Kerala.

19. *Parmotrema sanctae - angeli* (Lynge) Hale, Phytologia 28: 339. 1974.

Thallus foliose, loosely attached, glaucous white to grey; lobes upto 10mm wide; margins ascending, imbricate, ciliate; upper surface plane, emaculate, cracked in centre, sorediate; soralia marginal, farinose to granulose; medulla white; lower surface brown, white mottled at marginal area, rhizinate; rhizines simple; sterile.

Medulla K-, C + rose, P-

Habit: Corticolous

Habitat: Prefers semishaded areas in the evergreen forests at an altitude of 900m

Specimens examined: Dam site, Silent Valley National Park, Palakkad Dt., *Stephn 008915* (KFRI).

20. *Parmotrema stuppeum* (Tayl.) Hale, Phytologia 28: 339. 1974.

Thallus foliose, loosely attached, dark grey; lobes upto 10mm wide, rotund, crenate-dentate, ciliate; upper surface dull smooth, emaculate, reticulately cracked, sorediate; soralia marginal to submarginal, farinose; sorediate lobes involute, lower side smooth, black, rhizinate, marginal zone dark brown to tan, papillate; sterile.

Medulla K+ yellow-red, C-, P+ yellow.

Habit: Corticolous

Habitat: Prefers moist humid areas in the evergreen slopes at an altitude of 700m.

Distribution: Tamil Nadu

Specimens examined: Thirunelly, Wayanad Dt., 700m, *Stephen 21042* (KFRI).

Note: New record to Kerala.

21. *Parmotrema subarnoldii* (des Abb.) Hale, Phytologia 28: 339. 1974.

Thallus foliose, loosely attached, grey; lobes upto 15mm wide, imbricate, margin undulate, ciliate; upper surface plane, dull, emaculate, sorediate, sorediate lobes sinuous; medulla white; lower surface smooth, rhizinate, marginal zone light to dark brown; sterile.

Medulla K-, C-, KC+ red, P+ red.

Habit: Corticolous

Habitat: Prefers exposed trees in the shola margin at an altitude of 1650m.

Distribution: Nagaland and Tamil Nadu.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 1650m, *Stephen 22041a* (KFRI).

Note: New record to Kerala.

22. *Parmotrema tinctorum* (Despr. ex Nyl.) Hale, Phytologia 28: 339. 1974.

Thallus foliose, loosely attached, glaucous grey; lobes rotund, upto 20mm wide, margin entire, eciliate; upper surface smooth, shining, emaculate, sometime cracked; isidiate; isidia laminal, sparse to dense, cylindrical; medulla white, lower surface black, rhizines sparse, marginal area brown, erhizinate, sterile.

Medulla K-, C+ red, KC+ red, P-

Habit: Mostly Corticolous, rarely Saxicolous.

Habitat: Prefers moist or shady places in the evergreen/subtropical/shola forests between an altitude of 750-2300m.

Distribution: Assam, Bihar, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Kulayalakadavu, New Amarambalam Reserve Forests, Malappuram Dt., 950m, *Stephen 20010* (KFRI); Punnamala, Silent Valley National Park, Palakkad Dt., 850m, *Stephen 20086a* (KFRI); Malleswaramudi, Palakkad Dt., 800m, *Stephen 22124d* (KFRI); *22125* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21023* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21023* (KFRI); Ranimedu, Nelliampathy, Palakkad Dt., 950m, *Stephen 8931* (KFRI); *8933* (KFRI); Karappara, Nelliampathy, Palakkad Dt., 950m, *Stephen 8935* (KFRI); Kakki Dam site, Pathanamthitta Dt., 850m, *Stephen 21914* (KFRI); *21802* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21939b* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m,

Stephen 21106 (KFRI); Siruvani, Palakkad Dt., 1000m, *Stephen 21106* (KFRI); Siruvani, Palakkad Dt., 750m, *Stephen 21117* (KFRI); *21124* (KFRI); *21173* (KFRI); *21174* (KFRI); Kakki, Pathanamthitta Dt., 900m, *Stephen 21188* (KFRI); 925m, *Stephen 21802* (KFRI); Karimala, Parambikulam, Palakkad Dt., 1400m, *Stephen 22169a* (KFRI).

Note: New record to Kerala.

23. *Parmotrema xanthinum* (Mull. Arg.) Hale, Phytologia 28: 339. 1974.

Thallus foliose, loosely or closely attached, yellowish grey; lobes rotund, upto 12mm wide, ciliate; upper surface dull, plane, reticulately cracked, isidiate; isidia marginal to sub marginal; simple to coralloid; medulla white; lower surface, black, rhizinate, marginal area dark brown, shining; sterile.

Medulla K-, C-, KC+ red, P-

Habit: Corticolous

Habitat: Prefers shaded areas in the base of tree trunks in the evergreen forests at an altitude of 1000m.

Distribution: Tamil Nadu

Specimens examined: Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21074a* (KFRI).

Note: New record to Kerala.

24. *Parmotrema zollingeri* (Hepp.) Hale, Phytologia 28: 339. 1974.

Thallus foliose, loosely or closely attached, pale grey; lobes sub rotund, up to 15mm wide, margin lobulate, ciliate; cilia in axils only; upper surface dull, plane, isidia and soredia absent; medulla white, lower side black; rhizinate, marginal area lacking rizines; apothecia up to 10mm in diameter; spores 18-22 x 7-10mm.

Medulla K-, C-, KC-, P+ orange-red.

Habit: Saxicolous

Habitat: Prefers exposed rocks in the sloppy grasslands at an altitude of 800m.

Distribution: Eastern Himalayas.

Specimens examined: Malleswaramudi, Palakkad Dt., 800m, *Stephen 22124a* (KFRI).

Note: New record to Kerala.

25. *Parmotrema* sp. 1

Thallus foliose, loosely attached, dull greenish grey to pale grey; lobes rotund, sparsely ciliate, sinuate, crenate, minutely lobulate, up to 10mm wide, upper surface plane to rugose, isidate, isidia simple to coralloid, sub marginal to marginal, concolourous to the thallus; medulla white; lower surface black, rhizinate, marginal area lacking rhizines, ivory to brown mottled; sterile.

Medulla K-, C+ rose, KC-, P-

Habit: Corticolous

Habitat: Prefers shaded areas in the evergreen forests at an altitude of 750m.

Specimens examined: Dam site, Siruvani, Palakkad Dt., 750m, *Stephen 21125* (KFRI).

26. *Parmotrema* sp. 2

Thallus foliose, loosely to closely attached; glaucous grey; lobes sinuate, sparsely ciliate, crenate, slight black rimmed; up to 8mm wide, upper surface plane, slightly maculate, sorediate; soralia on the margin of lobes, soraliolate lobes slightly involute; medulla white; lower surface black; rhizinate, marginal area pale brown to brown, shining; sterile.

Medulla K+ pale yellow, C-, KC-, P+ orange.

Habit: Corticolous

Habitat: Prefers open trees in the grasslands at an altitude of 2000m.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 21963* (KFRI).

Genus *Pseudoparmelia* Lynge

Thallus foliose, corticolous or saxicolous, dorsiventral, heteromerous, closely or loosely adnate to the substratum, lobate; lobes subirregular or sublinear, rotund or sub rotund, margins sometimes broadly crenate or black rimmed; upper surface smooth or rugose; pseudocyphellae and maculae absent; isidia, soredia, pustules present or absent; photobiont a green alga; medulla white or yellow; lower surface black, rhizinate; apothecia laminal, lecanorine; asci 8-spored; spores colourless, simple.

Hale, (1976) completed a worldwide monograph of this genus. Later this genus was segregated into 4 new genera viz. *Flavoparmelia*, *Canoparmelia*, *Paraparmelia* and *Relicinopsis* by Hale (1986), Elix, Johnstan & Ver don (1986) on the basis of the chemistry of

cortex and medulla, centres of distribution, habitats and size of pycnoconidia and spores. Recently, Awasthi (1998) published 204 taxa of parmeliaceae in the Indian subcontinent on the basis of the work done by Elix (1993). He reported 9 species of *Pseudoparmelia sensu lato* (Hale, 1976) under 3 different genera viz. *Flavoparmelia*, *Canoparmelia* and *Relicinopsis*. However, the *sensu lato* concept (Hale, 1974b, 1976a) of *Pseudoparmelia* has been followed. There are about 76 species of *Pseudoparmelia* occurring in dry subtemperate to tropical areas of the world. Awasthi (1988) reported 11 species from India. Among these, 4 species have been collected during the study and enumerated.

Key to the species

- 1a. Medulla K+ yellow or red 2
 1b. Medulla K-, KC+ red *P. texana*
- 2a. Medulla K+ yellow, thallus sorediate 3
 2b. Medulla K+ red, thallus isidiate *P. cinearascens*
- 3a. Thallus lobes up to 5mm, subrotund; soredia farinose *P. crozalziana*
 3b. Thallus lobes up to 3mm, rotund; soredia granular *P. carneopruinata*

1. *Pseudoparmelia carneopruinata* (Zahlbr.) Hale, Phytologia 28: 189. 1974.

Thallus foliose, closely attached dark grey; lobes irregular, sublinear, up to 3mm wide, margin slightly black rimmed, eciliate; upper surface reticulately wrinkled; cracked, sorediate; soralia laminal, dense in central part, soredia granular, medulla white; lower side black, sparsely rhizinate; sterile.

Medulla K+ yellow, C-, KC-, P+ red.

Habit: Corticolous

Habitat: Prefers shaded areas of the evergreen forests between an altitude of 900-1650m.

Distribution: Tamil Nadu

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22069b* (KFRI); Kakki, Pathanamthitta Dt., 900m, *Stephen 21187* (KFRI).

Note: New record to Kerala.

2. *Pseudoparmelia cinearascens* (Lynge) Hale, Phytologia 28: 189. 1974.

Thallus foliose, loosely attached, glaucous grey; lobes sub linear; up to 3mm wide, eciliate; upper surface plane, cracked, isidiate; isidia cylindrical; medulla white; lower surface black, rhizinate; sterile.

Medulla K+ red, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers moist or dry areas near streams in the evergreen forests at an altitude of 1200m.

Distribution: Tamil Nadu

Specimens examined: Pullukuthimala, New Amarambalam Reserve Forests, Malappuram Dt., 1200m, *Stephen 20024* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21159a* (KFRI).

Note: New record to Kerala.

3. *Pseudoparmelia crozalziana* (B. de Lesd.) Hale, Phytologia 28: 189. 1974.

Thallus foliose, closely attached, ashy grey; lobes irregular, up to 5mm wide, subrotund, incised, eciliate; upper surface reticulately wrinkled, cracked in central part, sorediate; soralia laminal, generally in ridges, soredia farinose; medulla white; lower surface black, rhizinate; sterile.

Medulla K+ yellow, C-, KC-, P+ orange red.

Habit: Corticolous

Habitat: Prefers open dry or moist places in the evergreen/shola forests between an altitude of 1200-2100m.

Distribution: Nagaland and Tamil Nadu.

Specimens examined: Chinnamala, Anaimudi, Munnar, Idukki Dt., 2100m, *Stephen 22097* (KFRI); Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20166* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1200m, *Stephen 21138* (KFRI); *21139* (KFRI); *21142* (KFRI).

Note: New record to Kerala.

4. *Pseudoparmelia texana* (Tuck.) Hale, Phytologia, 28: 191. 1974.

Thallus foliose, loosley or closely attached, ashy grey; lobes imbricate, crenate; up to 4mm wide; upper surface reticulately cracked, sorediate; soralia laminal, soredia granular; medulla white; lower surface dark brown, rhizinate, marginal area erhizinate, sterile.

Medulla K-, C-, KC+ red, P-

Habit: Corticolous

Habitat: Prefers open or ecotone regions of shola forests at an altitude of 2000m.

Distribution: Manipur, Meghalaya, Nagaland and Tamil Nadu.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 21957c* (KFRI); 21996 (KFRI); Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20103* (KFRI).

Note: New record to Kerala.

Genus *Relicina* (Hale & Kurok.) Hale

Hale, (1975) has monographed the genus *Relicina* on world level. He include 24 species, all most all of which occur in tropical South East Asia. In India Patwardhan & Prabhu (1977) recorded 2 species of *Relicina* from Kerala forests. In the present investigation only one species is encountered.

1. *Relicina abstrusa* (Vain.) Hale, Phytologia 28: 484. 1974.

Thallus foliose, closely attached, pale yellowish green; lobes sub linear to linear, up to 2mm wide, ciliate; cilia bulbate, slightly inflated; upper surface smooth, plane; isidiate, isidia short, simply, cylindrical; medulla white; lower surface black up to the margin, rhizinate; rhizines simple; sterile.

Medulla K+ yellow turning red, C-, KC-, P+ orange.

Habit: Corticolous

Habitat: Prefers shady moist areas or riverine areas in the evergreen forests between an altitude of 750-1000m.

Distribution: Kerala

Specimens examined: Punnamala, Silent Valley National Park, Palakkad Dt., 800m, *Stephen 20084* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21080* (KFRI); Riverine area, Siruvani, Palakkad Dt., 750m, *Stephen 21182* (KFRI).

Family Phyllosporaceae

Genus *Psorella* Mull. Arg.

Thallus squamulose to foliose, heteromerous, corticated in upper surface only; photobiont a green alga; apothecia sessile, hypothecium hyaline or coloured, asci 8-spored; spores hyaline, transversely 3-15-septate.

The genus *Psorella* is distributed in tropical to subtropical regions of the world. Awasthi (1988) reported 2 species in India both collected from Nilgiri & Palni hills of Tamil Nadu. During the present study, one species of *Psorella* could be collected from this part of the phytogeographic region.

Key to the species

- 1a. Thallus isidiate *P. isidiophora*
1b. Thallus lacking isidia *P. psorina*

1. *Psorella isidiophora* Awas. & K. Singh, Geophytology 5 (1): 40. 1975.

Thallus squamulose, squamules up to 1mm long; corticated only on upper surface; glaucous grey; upper surface plane, isidiate; isidia simple to branched; lower surface glaucous white, erhizinate, apothecia laminal, up to 2mm in diameter, disc reddish brown to black.

Medulla K-, C-, KC-, PB-

Habit: Corticolous

Habitat: Prefers partially shaded areas in the evergreen as well as shola forests between an altitude of 900-2000m.

Distribution: Tamil Nadu

Specimens examined: Kattapara Shola, Idukki Dt., 925m, *Stephen 21813* (KFRI); 1200m, *Stephen 22013* (KFRI).

Note: New record to Kerala. Hitherto this endemic species was known only from its type locality (Tamil Nadu).

2. *Psorella psorina* (Nyl.) Zahlbr., Cat. Lich. Univ. 4: 403. 1927.

Thallus squamulose-foliose, up to 1.5mm long; corticated on upper surface only, squamules yellow ochraceous; upper surface plane, ochraceous, isidia, soredia, pseudocyphellae absent; lower surface yellowish, erhizinate; apothecia up to 2mm in size, dark brown, spores 15-septate.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers partially shaded areas in the evergreen forests between an altitude of 900-1000m.

Distribution: Tamil Nadu

Specimens examined: Walakkad, Silent Valley National Park, Palakkad Dt., 1050m, *Stephen 20066* (KFRI); *8906* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21884* (KFRI).

Note: New record to Kerala.

Family Physciaceae

- 1a. Thallus corticated on upper surface only *Heterodermia*
- 1b. Thallus corticated on both the surfaces 2
- 2a. Hypothecium brown to dark brown 3
- 2b. Hypothecium colourless to yellowish 4
- 3a. Epithecium K+ purple violet, thallus rhizinate, pseudocyphellate *Pyxine*
- 3b. Epithecium K-, thallus erhizinate, pseudocyphellae absent *Dirinaria*
- 4a. Thallus agglutinated *Hyperphyscia*
- 4b. Thallus appressed but not agglutinated 5
- 5a. Thallus K+ yellow 6
- 5b. Thallus K- *Phaeophyscia*
- 6a. Upper cortex paraplectenchymatous *Physcia*
- 6b. Upper cortex prosoplectenchymatous *Heterodermia*

Genus *Dirinaria* (Tuck.) Clem.

Thallus foliose, dorsiventral, heteromerous, glaucous-grey to grey, closely appressed to the substratum; lobes agglutinated and confluent centrally; upper surface plane subverrucose; thallus corticated on both sides; photobiont a green alga; medulla colourless to pale; lower surface brownish; rhizines lacking or small black precursor of rhizines sparsely present; apothecia lecanorine; epithecium brown to dark brown; hymenium colourless; asci 8-spored; spores brownish black, transversely 2-celled.

About 26 species of *Dirinaria* are distributed in tropical and subtropical regions of the world; Awasthi, (1975) reported 6 species in India. During the present study 2 species were collected from this region and have been enumerated.

Key to the species

- 1a. Thallus sorediate *D. consimilis*
- 1b. Thallus lacking soredia *D. confluens*

1. *Dirinaria confluens* (Fr.) Awasthi, Bibliotheca Lichenol. 2: 28. 1975.

Thallus foliose, grey to glaucous-grey, closely adnate, lobes radiating, up to 3mm wide at apices; upper surface pruinose, isidia and soredia absent; medulla white; lower surface dark

brown, apices pale brown; apothecia laminal; epithecium dark brown; hymenium colourless; hypothecium dark brown.

Medulla K-, C-, KC-, P-.

Habit: Corticolous

Habitat: Prefers marginal trees in the shola forests at an altitude of 1800m.

Distribution: Maharashtra, Nagaland, Orissa and Tamil Nadu.

Specimens examined: Sispara, Silent Valley National Park, Palakkad Dt., 1800m, *Stephen 22175* (KFRI).

2. *Dirinaria consimilis* (Stirt.) Awas. in Awasthi & Agarwal, J. Indian Bot. Soc. 49: 135. 1975.

Thallus foliose, whitish grey to ashy grey, closely adnate, lobes radiating, subdichotomously branched at periphery, up to 2 mm wide; upper surface pruinose, sorediate; soralia capitate, soredia farinose; medulla white; lower surface brown, margin pale; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous/Saxicolous

Habitat: Prefers open areas between an altitude of 700-1000m.

Distribution: Himachal Pradesh, Manipur, Nagaland, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Thirunelly, Wayanad Dt., 700m, *Stephen 21037b* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21081* (KFRI); Kakki Damsite, Kakki, Pathanamthitta Dt., 900m, *Stephen 21806* (KFRI); Siruvani, Palakkad Dt., 750m, *Stephen 21122a* (KFRI); *21177b* (KFRI).

Note: New record to Kerala.

Genus *Heterodermia* Trevis.

Thallus foliose, dorsiventrally, heteromerous, whitish grey to greenish grey, lobate; lobes linear elongate, linear or spatulate, lobulate or with air lobes; upper surface plane to convex, pruinose or epruinose, cilia, isidia, sordia present or absent; photobiont a green alga; medulla white or pigmented; lower surface corticate or ecorticate, white or ochraceous, rhizinate or erhizinate; apothecia present or absent, adnate or stipulate; hymenium colourless; spores brown, 2-celled, thick walled.

A cosmopolitan genus with about 40 species in the world. Awasthi (1988) recorded 35 species in India. Among these, 24 species have been collected from this study area and enumerated.

Key to the species

1a. Lobes rosulate, suberect or ribbon like, lower surface ecorticate	2	
1b. Lobes suborbicular, lower surface corticate or ecorticate	8	
2a. Thallus ribbon like, linear	3	
2b. Thallus rosulate, suberect	4	
3a. Lower surface P+ yellow-orange		<i>H. leucomela</i>
3b. Lower surface P-		<i>H. leucomela</i> subsp. <i>boriyii</i>
4a. Lobes with whitish laminal cilia		<i>H. comosa</i>
4b. Lobes lacking laminal cilia	5	
5a. Thalline exciple black ciliate		<i>H. indica</i>
5b. Thalline exciple lobulate	6	
6a. Lower surface K+ yellow-red, P+ yellow orange		<i>H. podocarpa</i>
6b. Lower surface K+ yellow, P-	7	
7a. Thalline exciple lobules ciliate		<i>H. incana</i>
7b. Thalline exciple lobules lacking cilia		<i>H. pellucida</i>
8a. Lower surface corticate	9	
8b. Lower surface ecorticate	15	
9a. Lobes isidiate or sorediate	10	
9b. Lobes lacking isidia or soredia	14	
10a. Lobes isidiate		<i>H. isidiophora</i>
10b. Lobes sorediate	11	
11a. Medulla K+ reddish	12	
11b. Medulla K+ yellow	13	
12a. Soralia capitate, thalline exciple sorediate		<i>H. pseudospeciosa</i>
12b. Subisidial marginal squamules sorediate, thalline exciple smooth		<i>H. dissecta</i>
13a. Soralia capitate		<i>H. speciosa</i>
13b. Soredia on apices of subisidial marginal squamules		<i>H. dissecta</i> var. <i>koyana</i>
14a. Medulla K+ yellow-red, P+ yellow-red		<i>H. angustiloba</i>
14b. Medulla K-, P-		<i>H. diademata</i>
15a. Lobes sorediate	16	
15b. Lobes lacking soredia	18	
16a. Lower surface pigmented in apical region	17	
16b. Lower surface lacking pigmentation		<i>H. japonica</i>

17a. Lower surface K+ purple	<i>H. obscurata</i>
17b. Lower surface K+ yellow	<i>H. hypocaesia</i>
18a. Spores with polyblastidia	19
18b. Spores lacking polyblastidia	23
19a. Lower surface P+ orange.....	20
19b. Lower surface P-	21
20a. Lower surface pigmented at apice	<i>H. dendritica</i>
20b. Lower surface not pigmented	<i>H. coronata</i>
21a. Lower surface pigmented at apice	<i>H. flabellata</i>
21b. Lower surface not pigmented	22
22a. Thallus delicate, glaucous white	<i>H. togashii</i>
22b. Thallus rigid, brownish grey	<i>H. dactyliza</i>
23a. Lower surface K+ red, P+ yellow apothecia punctiform	<i>H. punctifera</i>
23b. Lower surface K-, P-, apothecia not punctiform	<i>H. microphylla</i>

1. *Heterodermia angustiloba* (Mull. Arg.) Awas., Geophytology 3: 113. 1973.

Plate VIII. Fig. 1.

Thallus foliose, grey-white, loosely attached; lobes linear elongate, irregularly branched, up to 1.5 mm wide; upper surface smooth, convex, isidia and soredia absent; medulla white; lower surface corticate, white to pale brown, rhizinate, rhizine sparse, simple; sterile.

Medulla K+ red, C-, KC-, P+ red.

Habit: Corticolous

Habitat: Prefers partly shaded areas in the evergreen forests at an altitude of 950 m.

Distribution: Temperate Himalaya.

Specimens examined: Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21890* (KFRI).

Note: New record to Peninsular India.

2. *Heterodermia comosa* (E. Schw.) Follmann & Redon, Willdenowia 6: 446. 1973.

Thallus foliose, lacinate, grey, laciniae basally narrow, affixed to the substratum, lobes spatulate, ascending, suberect, 2-4mm wide; upper surface uneven, convex, sparsely ciliate; cilia white, simple, laminal and marginal; medulla white; lower surface ecorticate, white; sterile.

Medulla K+ yellow, C-, KC-, P-.

Habit: Corticolous

Habitat: Prefers small twigs in shady places in the evergreen /subtropical forests between an altitude of 700-1650m.

Distribution: Nagaland, West Bengal, Kerala and Temperate Himalaya.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22039* (KFRI); Thirunelly, Wayanad Dt., 700m, *Stephen 21043c* (KFRI); Riverine area, Siruvani, Palakkad Dt., 750m, *Stephen 21178* (KFRI).

3. *Heterodermia coronata* (Kurok.) Awas., Geophytology 3: 113. 1973.

Thallus foliose, whitish grey, lacinate, lobes small, up to 2mm wide; upper surface smooth, slightly convex, isidia and soredia absent; medulla white; lower surface ecorticate, white; apothecia sparse, up to 3mm in diameter, polyblastidia present in the spores.

Medulla K+ red, C-, KC-. P+ yellow orange.

Habit: Corticolous

Habitat: Prefers moist humid areas in the evergreen forests at an altitude of 900m.

Distribution: Eastern Himalaya.

Specimens examined: Punnamala, Silent Valley National Park, Palakkad Dt., 850 m, *Stephen 20088* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950 m, *Stephen 21893* (KFRI).

Note: New record to Peninsular India.

4. *Heterodermia dactyliza* (Nyl.) Swisc. & Krog, Lichenol. 8: 117.1976.

Thallus foliose, brownish grey, lacinate; lobes up to 1.5mm wide, margin rhizinate; rhizinae densely branched; upper surface smooth; isidia and soredia absent; medulla white; lower surface ecorticate, white, apothecia up to 4mm diameter, margin crenulate-lacinate; spores with polyblastidia.

Medulla K+ yellow-red, C-, KC-, P+ yellow - orange.

Substrum: Corticolous

Habitat: Prefers shaded areas in the shola forests at an altitude of 1800-2400.

Distribution: Eastern Himalaya.

Specimens examined: Sispara, Silent Valley National Park, Palakkad Dt., 1800m, *Stephen 20063* (KFRI); Eravikulam National Park, Idukki Dt., 2100m; *Stephen 21102a* (KFRI); *20104* (KFRI); *20125* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 20187* (KFRI); *21022* (KFRI); Anaimudi slope, Munnar, Idukki Dt., 2400m, *Stephen 22102* (KFRI).

Note: New record to Peninsular India.

5. *Heterodermia dendritica* (Pers.) Poelt, Nova Hedwigia 9: 31. 1965.

Thallus foliose, loosely attached, greenish white; lobes up to 4mm wide, slightly notched, marginally lobulate; upper surface plane, pruinose near apices, isidia and soredia absent; medulla white to yellowish; lower surface ecorticate, white to light yellowish, pigmented near tips, purplish in the middle part; apothecia scattered, laminal, margin lobulate; spores constricted in the middle.

Medulla K+ yellow-red, C-, KC-, P+ yellow.

Habit: Corticolous

Habitat: Prefers shaded areas in the evergreen forests at an altitude of 950m.

Distribution: Arunachal Pradesh, Manipur, Nagaland and West Bengal.

Specimens examined: Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21891* (KFRI).

Note: New record to Peninsular India.

6. *Heterodermia diademata* (Taylor) Awas., Geophytology 3: 113. 1973.

Thallus foliose, loosely attached; greyish white; lobes dichotomously to irregularly branched, minutely notched, up to 2mm wide; upper surface plane, isidia and soredia absent; medulla white; lower surface corticate, white to pale brown; apothecia scattered, laminal, crenulate-lobulate; spores constricted in the middle.

Medulla K+ yellow, C-, KC-, P+ pale yellow.

Habit: Corticolous

Habitat: Prefers branches of trees in moist areas of the evergreen/shola forests between an altitude of 750-2100m.

Distribution: Manipur, Meghalaya, Nagaland, Sikkim, Uttar Pradesh and West Bengal.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20122b* (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 1950m, *Stephen 22130* (KFRI); Siruvani, Palakkad Dt., 750m, *Stephen 21113* (KFRI).

Note: New record to Peninsular India.

7. *Heterodermia dissecta* (Kurok.) Awas., Geophytology 3: 113. 1973.

Plate VIII. Fig. 2A.

Thallus foliose, closely attached, mineral grey; lobes irregularly branched, minutely notched, lobulate, imbricate; upper surface smooth, epruinose; isidiate, isidia marginal, rarely submarginal; medulla white; lower surface corticate, greyish-brown, rhizinate; rhizines sparse; sterile.

Medulla K+ yellow-red, C-, KC-, P+ yellow.

Habit: Corticolous/Saxicolous

Habitat: Prefers trees or rocks in the grassland/evergreen/subtropical forests between an altitude of 750-1200m.

Distribution: Manipur, Nagaland, Tropical temperate Himalaya and West Bengal.

Specimens examined: Pullukuthimala, New Amarambalam Reserve Forests, Malappuram Dt., 1200m, *Stephen 20018* (KFRI); Walakkad, Silent Valley National Park, Palakkad Dt., 1050m, *Stephen 20080* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21911a* (KFRI); 21898 (KFRI); Kakki Damsite, Kakki, Pathanamthitta Dt., 850m, *Stephen 21925* (KFRI); 21805 (KFRI); Kattapara shola, Idukki Dt., 925m, *Stephen 21812* (KFRI); Siruvani, Palakkad Dt., 750m, *Stephen 21115* (KFRI); Muthikulam, Siruvani Palakkad Dt., 1225m, *Stephen 21155* (KFRI); Riverine area, Siruvani, Palakkad Dt., *Stephen 21170* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21867* (KFRI).

Note: New record to Peninsular India.

8. *Heterodermia dissecta* var. *koyana* (Kurok.) Awas., Geophytology 3: 113. 1973.

Plate VIII. Fig. 2B.

Thallus foliose, closely or loosely attached, grey; lobes dichotomously or irregularly branched, lobed; upper surface smooth, epruinose, lobulate; isidiate; isidia on the apices of marginal lobules; medulla white; lower surface corticate, grey-pale brown, rhizinate; rhizines white to pale brown; sterile.

Medulla K+ yellow, C-, KC-, P+ yellow.

Habit: Saxicolous/Corticolous

Habitat: Prefers open areas in the evergreen shola forests between an altitude of 750-2300m.

Distribution: Eastern Himalaya.

Specimens examined: Pullukuthimala, New Amarambalam Reserve Forest, Malappuram Dt., 1000m, *Stephen 20032* (KFRI); 20033 (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21009* (KFRI); Siruvani, Palakkad Dt., 750m, *Stephen 21110c* (KFRI); 21122b (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21876* (KFRI); 21894 (KFRI).

Note: New record to Peninsular India.

9. *Heterodermia flabellata* (Fee) Awas., Geophytology 3: 113. 1973.

Thallus foliose, loosely attached, greyish; lobes dichotomously to irregularly branched, margins entire, minutely notched at apices; upper surface plane; soredia and isidia absent; medulla white; lower surface ecorticate, ochraceous pigmented, rhizinate; apothecia laminal, up to 4mm in diameter, crenulate-lobulate; spored constricted in the middle.

Medulla K+ yellow, C-, KC-, P-.

Habit: Corticolous/Saxicolous

Habitat: Prefers shaded or streamside trees or rocks in the evergreen forests between an altitude of 750-1200m.

Distribution: Manipur, Nagaland, Tamil Nadu and Uttar Pradesh.

Specimens examined: Nilikkal, Silent Valley National Park, Palakkad Dt., 850m, *Stephen 20045* (KFRI); Thirunelly, Wayanad Dt., 700m, *Stephen 21039* (KFRI); Kattapara shola, Idukki Dt., 925m, *Stephen 21826* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21156* (KFRI); Riverine area, Siruvani, Palakkad Dt., 750m, *Stephen 21180* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 925m, *Stephen 21826* (KFRI).

Note: New record to Kerala.

10. *Heterodermia hypocaesia* (Yasuda) Awas., Geophytology 3: 113. 1973.

Thallus foliose, loosely attached, greyish white, subdigitately branched; lobes slightly ascending towards apices, minutely notched at tips, up to 2mm wide; upper surface plane,

pruinose, soreciate; soredia on short lateral lobes, granular; medulla white; lower surface ecorticate, arachnioid, rhizinate; sterile.

Medulla K+ yellow-red, C-, KC-, P+ yellow.

Habit: Corticolous/Saxicolous

Habitat: Prefers moist trees or rocks in the evergreen/subtropical/shola forests between an altitude of 700-2000m.

Distribution: Manipur, Nagaland, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 21958* (KFRI); Kulayalakkadavu, New Amarambalam Reserve Forest, Malappuram Dt., 950m, *Stephen 20014a* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22054b* (KFRI); 22056 (KFRI); Thirunelly, Wayanad Dt., 700m, *Stephen 21044* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21073* (KFRI); *21083b* (KFRI); Ranimedu, Nelliampathy, Palakkad Dt., 950m, *Stephen 8926b* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., Dt., 950m, *Stephen 21903* (KFRI); *21906b* (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 1950m, *Stephen 22128* (KFRI); Damsite, Siruvani, Palakkad Dt., 750m, *Stephen 21123* (KFRI), *21126* (KFRI); *21127* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21157* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21865a* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21892* (KFRI).

11. *Heterodermia incana* (Stirton) Awas. Geophytology 3: 113. 1973.

Thallus foliose, attached by central part of thallus. Whitish grey; lobes dichotomously to irregularly branched, suberect, ascending, up to 3mm wide; upper surface smooth, soredia and isidia absent; medulla white; lower surface ecorticate, concave, white, rhizinae marginal; apothecia subterminal, crenate to lobulate, lobule margin ciliate; spores constricted in the middle; polyblastidia present.

Medulla K+ yellow, C-, KC-, P+ pale yellow.

Habit: Corticolous

Habitat: Prefers twigs of shrubs or bark trees in shaded places in the evergreen shola forests between an altitude of 700-2300m.

Distribution: Nagaland, Sikkim, Tamil Nadu and West Bengal.

Specimens examined: Pullukuthimala, New Amarambalam Reserve Forest, Malappuram Dt., 1000m, *Stephen 20036* (KFRI); Punnamala, Silent Valley National Park, Palakkad Dt., 850m, *Stephen 20090* (KFRI); Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20174* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21005* (KFRI); *21011a* (KFRI); *21014* (KFRI); *21016* (KFRI); Thirunelly, Wayanad Dt., 700m, *Stephen 21043a* (KFRI); Pothumala,

Nelliampathy, Palakkad Dt., 1000m, *Stephen 21078* (KFRI); *21079* (KFRI) *21100* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21904* (KFRI); Kakki Damsite, Pathanamthitta Dt., 850m, *21930* (KFRI), Kattapara shola Idukki Dt., 925 (KFRI); Poovanchola, Silent Valley National Park, Palakkad Dt., 1000m, *Stephen 22164* (KFRI); Karimala, Parambikulam, Palakkad Dt., 1000m, *Stephen 22170* (KFRI); Shingampara, Siruvani, Palakkad Dt., 750m, *Stephen 21129* (KFRI); *21134* (KFRI); Kakki Dam site, Kakki, Pathanamthitta Dt., 900m, *Stephen 21193* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950 m, *Stephen 21875a* (KFRI); *21886* (KFRI).

Note: New record to Kerala.

12. *Heterodermia indica* (H. Magn.) Awas., Geophytology 3: 113. 1973.

Plate VIII. Fig. 3.

Thallus foliose, attached by the central part of thallus; lobes ascending, suberect, irregularly branched, upto 3mm wide; upper surface smooth, soredia and isidia absent; medulla white; lower surface ecorticate, white, concave, rhizinate; rhizines marginal, dense; apothecia subterminal to terminal, ciliate; spores with polyblastidia.

Medulla K+ yellow, C-, KC-, P+ yellowish.

Habit: Corticolous

Habitat: Prefers shaded areas in the shola forests at an altitude of 2300m.

Distribution: West Bengal.

Specimens examined: Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 20191* (KFRI).

Note: New record to Peninsula India.

13. *Heterodermia isidiophora* (Nyl.) Awas., Geophytology 3: 114. 1973.

Thallus foliose, loosely appressed, lobes dichotomously or irregularly branched; minutely notched at apex, up to 2 mm wide; upper surface plane, dull, epruinose, isidiate; isidia marginal to laminal, cylindrical-coralloid; medulla white to pale yellow; lower surface corticated; pale brown, rhizinate; sterile.

Medulla K+ yellow, C-, KC-, P+ yellow.

Habit: Corticolous

Habitat: Prefers exposed areas between an altitude of 750-2300m.

Plate-VIII



Fig.1. *Heterodermia angustiloba*



Fig.2. A. *Heterodermia dissecta* B. *Heterodermia dissecta* var. *koyana*



Fig.3. *Heterodermia indica*

Distribution: Tamil Nadu, Nagaland and West Bengal.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20107* (KFRI); 20097 (KFRI); 20099b (KFRI); Punnamala, Silent Valley National Park, Palakkad Dt., 800m, *Stephen 20044* (KFRI); Sispara, Silent Valley National Park Palakkad Dt., 1500m, *Stephen 20051* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21011b* (KFRI); Pakshipadalam, Wayanad Dt., 1500m, *Stephen 21056* (KFRI); 21057 (KFRI); 21067 (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 219434a* (KFRI); Siruvani, Palakkad St., 750m, *Stephen 21109b* (KFRI); 21110a (KFRI); Shingampara, Siruvani, Palakkad Dt., 1750m, *Stephen 21130* (KFRI).

Note: New record to Kerala.

14. *Heterodermia japonica* (M. Sato) Swinsc. & Krog., Lichenol. 81: 122. 1962.

Thallus foliose, loosely attached, greyish white; lobes irregularly branched, up to 3 mm wide; upper surface plane, sorediate; medulla white; lower surface ecorticate, rhizinate on margins, black to purple black in older part; apothecia laminal, up to 8mm in diameter; laciniate; spores with polyblastidia.

Medulla K+ yellow, C-, KC-, P-.

Habit: Corticolous/Saxicolous

Habitat: Prefers trees or rock in open or shaded areas in the evergreen/subtropical/ shola forests between an altitude of 700-2300m.

Distribution: Temperate Himalaya.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20128* (KFRI); Pullukuthimala, New Amarambalam Reserve Forest, Malappuram Dt., 1200m, *Stephen 20022* (KFRI); 950m, *Stephen 20035* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 20190* (KFRI); 21004 (KFRI); Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 22026* (KFRI); Thirunelly, Wayanad Dt., 700m, *Stephen 21037a* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21083a* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21909b* (KFRI).

Note: New record to Kerala.

15. *Heterodermia leucomela* (L.) Poelt, Nova Hedwigia 9: 31. 1965.

Thallus foliose, loosely attached, whitish grey; lobes dichotomously branched, ascending, revolute, up to 2.5mm wide; upper surface uneven; medulla white, thin; lower surface ecorticate, canaliculate, arachnioid, white; rhizines marginal; sterile.

Medulla K+ yellow-red, C-, KC-, P+ yellow.

Habit: Corticolous

Habitat: Prefers open places in the evergreen to shola forests between an altitude of 1000-2100m.

Distribution: Karnataka, Kerala, Nagaland, Tamil Nadu and Temperate Himalaya.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 21127* (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 1800m, *Stephen 20042* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22038* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21084* (KFRI).

16. *Heterodermia leucomela* subsp. *boriyii* (Fee) Swinsc. & Krog, Lichenologist 8: 124. 1976.

Thallus foliose, loosely spreading, mineral grey; lobes dichotomously branched, ascending, narrower towards apices, up to 1.5mm wide; circinately revolute; upper surface smooth; medulla white, thin; lower surface ecorticate, white, narrow, canaliculate; rhizines marginal; apothecia sub terminal; lobulate or ciliate; spores constricted in the middle, polyblastidia present.

Medulla K+ yellow, C-, KC-, P+ pale

Habit: Corticolous/Saxicolous/Terricolous

Habitat: Prefers trees, rocks or boulders in open moist places between an altitude of 1500-2400m.

Distribution: Kerala, Tamil Nadu and Temperate Himalaya.

Specimens examined: Sispara, Silent Valley National Park, Palakkad Dt., 1950m, *Stephen 22131* (KFRI); Pakshipadalam, Wayanad Dt., 1500m, *Stephen 21066* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 21955a* (KFRI); 1650m, *Stephen 22084* (KFRI); 2100m, *Stephen 22079* (KFRI); 1650m, *Stephen 22060* (KFRI); 22068 (KFRI); 22053 (KFRI); 2000m, *Stephen 22019* (KFRI); 22015 (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 850m, *Stephen 20068* (KFRI); 20067 (KFRI); 20057 (KFRI); Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20141* (KFRI).

17. *Heterodermia microphylla* (Kurok.) Skorepa, Bryologist 75: 490. 1972.

Plate IX. Fig. 1A.

Thallus foliose, loosely attached, occurring as small patches; mineral grey; lobes dichotomously or irregularly branched, up to 1.5mm wide, producing short lateral lobules; upper surface plane, soredia and isidia absent; medulla white; lower surface ecorticate, white, slightly canaliculate, margin rhizinate; apothecia submarginal, up to 4mm in diameter; spores lacking polyblastidia.

Medulla K-, C-, KC-, P-.

Substrum: Corticolous

Habitat: Prefers humid areas of ecotone regions in the evergreen shola forests between an altitude of 1500-2600m.

Distribution: Eastern Himalayas.

Specimens examined: Anaimudi, Munnar, Idukki Dt., 2600m, *Stephen 22109* (KFRI); Pakshipadalam, Wayanad Dt., 1500m, *Stephen 21055* (KFRI).

Note: New record to Peninsular India.

18. *Heterodermia obscurata* (Nyl.) Trevisan, Nnov. Giorn. Bot. Ital. 1:114. 1869.

Plate IX. Fig. 1B.

Thallus foliose, loosely attached; lobes dichotomously to irregularly branched, minutely notched at apice; discrete at periphery, up to 2.5mm wide; upper surface plane, smooth, epuriose, sorediate; soralia labriform, on the tips of lateral recurved branchlets; medulla white; lower surface ecorticate, ochraceous in the centre and brownish yellow in the preiphery, rhizinate; rhizines marginal; sterile.

Medulla K+ yellow, C-, KC-, P+ pale yellow.

Habit: Corticolous

Habitat: Prefers trees in shaded areas in the evergreen/shola forests between an altitude of 750-2000m.

Distribution: Himachal Pradesh, Manipur, Nagaland and Uttar Pradesh.

Specimens examined: Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 22052c* (KFRI); *21907* (KFRI); *21878* (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 1950m,

Stephen 22129b (KFRI); Siruvani, Palakkad Dt., 750m, *Stephen 21111* (KFRI); Kakki Damsite, Kakki, Pathanamthitta Dt., 900m, *Stephen 21185* (KFRI).

Note: New record to Peninsular India.

19. *Heterodermia pellucida* (Awas.) Awas., Geophytology 3: 114. 1973.

Thallus foliose, attached centrally to the substratum, grey to brownish grey; lobes dichotomously to irregularly branched; suberect, ascending; eciliate, up to 5mm wide; upper surface smooth, epruinose; soredia and isidia absent; medulla white; lower surface ecorticate, concave, white, rhizinate.

Medulla K+ yellow, C-, KC-, P-.

Habit: Corticolous

Habitat: Prefers twigs of shrubs and branches of trees in shaded areas in the evergreen/shola forests between an altitude of 700-2000m.

Distribution: Eastern Himalaya.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 21102b* (KFRI); *20105* (KFRI); Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20165* (KFRI); Thirunelly, Wayanad Dt., 700m, *Stephen 21043b* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 21975b* (KFRI); Kattapara shola, Idukki Dt., 925m, *Stephen 21817b* (KFRI).

Note: New record to Peninsular India.

20. *Heterodermia podocarpa* (Bel.) Awas., Geophytology 3: 114. 1973.

Thallus foliose, attached centrally to the substratum, dark grey, lobes dichotomously to irregularly branched, suberect, ascending, margins of lobes with fibrils, fibrils irregularly branched; up to 3mm wide; medulla thick; upper surface, convex, smooth, subtubular; lower surface concave, white farinose; apothecia subterminal, up to 5mm wide, margin crenate-laciniate; spores brown to dark brown, 2 celled, ellipsoid to oval ellipsoid.

Medulla K+ yellow-red, C-, KC-, P+ yellow orange.

Habit: Corticolous

Habitat: Prefers twigs of shrubs and small branches of trees in the evergreen forests between an altitude of 700-1000m.

Distribution: Tamil Nadu.

Specimens examined: Walakkad, Silent Valley National Park, Palakkad Dt., 1050m, *Stephen 20081* (KFRI); Dam site, Silent Valley National Park; Palakkad Dt., 900m, *Stephen 20094* (KFRI); Thirunelly Wayanad Dt., 700m, *Stephen 21036* (KFRI); Kattapara shola, Idukki Dt., 925m, *Stephen 21821* (KFRI).

Note: New record to Kerala.

21. *Heterodermia pseudospeciosa* (Kurok.) Culb., Bryologist 69: 484. 1966.

Plate IX. Fig. 2A.

Thallus foliose, loosely attached, glaucous grey; lobes dichotomously branched, imbricate centrally, discrete peripherally; lobulate, minutely notched, up to 2mm wide; upper surfaces plane, sorediate; soralia capitate to linear, apically on lobes, soredia granular medulla white; lower surface corticate, white, brownish towards the centre, sparsely rhizinate; sterile.

Medulla K+ yellow to red, C-, KC-, P+ yellow.

Habit: Corticolous/Saxicolous

Habitat: Prefers open areas on trees and rocks between an altitude of 750-2100m.

Distribution: Himalayas, Manipur, Nagaland, Uttar Pradesh and West Bengal.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20119* (KFRI); Pullukuthimala, New Amarambalam Reserve Forest, Malappuram Dt., 20015 (KFRI); 20018 (KFRI); Ranimedu, Nelliampathy, Palakkad Dt., 950m, 8926a (KFRI); Kakki Dam site, Kakki, Pathanamthitta Dt., 850m, 21919 (KFRI); 21927 (KFRI); 21807 (KFRI); Kattapara shola, Idukki Dt., 925m, *Stephen 21818* (KFRI); 21834a (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 1950m, *Stephen 22129a* (KFRI); Siruvani, Palakkad Dt., *Stephen 21116* (KFRI); 21119 (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, 21880 (KFRI); 21881 (KFRI).

Note: New record to Peninsular India.

22. *Heterodermia punctifera* (Kurok.) Awas., Geophytology 3: 114. 1973.

Plate IX. Fig. 2B.

Thallus foliose, closely attached, whitish grey; lobes irregularly branched, discrete, margins notched, up to 1mm wide upper surface smooth, epruinose, soredia and isidia absent; medulla white, lower surface ecorticate, white, rhizinate; sterile.

Medulla K+ yellow-red, C-, KC-, P+ pale yellow.

Habit: Corticolous

Habitat: Open areas in the evergreen forests at an altitude of 750m.

Distribution: Himalayas.

Specimens examined: Siruvani, Palakkad Dt., 750m, *Stephen 21110 b* (KFRI).

Note: This species was so far known to be endemic to Himalayas. New record to Peninsular India.

23. *Hetrodermia speciosa* (Wulf.) Trevis., Atti Soc. Ital. Sci. Nat. Milano 11: 614. 1868.

Thallus foliose, closely attached; glaucous grey; lobes dichotomously to irregularly branched; contiguous, marginally imbricate, peripherally discrete up to 1.5mm wide; upper surface plane, smooth or striated, sorediate; soralia capitate, mostly restricted in the central part; medulla white; lower surface corticate, whitish to pale grey, rhizinate; sterile.

Medulla K+ yellow, C-, KC-, P-

Habit: Corticolous / Saxicolous.

Habitat: Prefers partly shaded ecotone regions of the evergreen forests between an altitude of 900-1500m.

Distribution: Himalayas and Tamil Nadu.

Specimens examined: Pakshipadalam, Thirunelly, Wayanad Dt., 1500m, *Stephen 21049* (KFRI); Kattapara Shola, Idukki Dt., 925m, *Stephen 21834 b* (KFRI).

Note: New record to Kerala.

24. *Heterodermia togashii* (Kurok.) Awas., Geophytology 3: 114. 1973.

Thallus foliose, loosely attached, glaucous white to grey; lobes dichotomously to irregularly branched, delicate, up to 2mm wide; upper surface plane, smooth, soredia and isidia absent; medulla white; lower surface ecorticate, marginally ciliate; rhizinae branched forming a mat; sterile.

Medulla K+ yellow, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers ecotone regions of the evergreen/shola forests between an altitude of 950-2300m.

Distribution: Eastern Himalayas.

Specimens examined: Sispara, Silent Valley National Park, Palakkad Dt., 1800m, *Stephen 20063* (KFRI); Kozhipara, Silent Valley National Park, Palakkad Dt., 1050m, *Stephen 20082* (KFRI); Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20096* (KFRI); Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20163* (KFRI); *20167* (KFRI); *20175* (KFRI); Chinnamala, Anamudi, Munnar, Idukki Dt., 2100m, *Stephen 22095* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21019* (KFRI); Pakshipadalam, Thirunelly, Wayanad Dt., 1500m, *Stephen 21052* (KFRI); *21053* (KFRI); *21054* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21910* (KFRI); *21911b* (KFRI); *21947* (KFRI); Kattapara Shola, Idukki Dt., 925m, *Stephen 21817a* (KFRI); Anguinda, Silent Valley National Park, Palakkad Dt., 2100m, *Stephen 22148* (KFRI).

Note: New record to Kerala.

Genus *Hyperphyscia* Mull. Arg.

Thallus foliose, closely adnate, heteromerous; photobiont a green alga; upper cortex distinct; lower cortex poorly differentiated, black or brownish, with or without isidia and soredia; medulla white or red; apothecia lecanorine; hypothecium colourless, asci-8-spored, spores brown, 2-celled, pycnoconidia more than 10mm long.

The genus *Hyperphyscia* is subtropical in origin and widely distributed. Awasthi (1988) reported 4 species from India. Among these, 3 species could be collected during the present study from this region.

Key to the Species

- | | |
|----------------------------------------------|----------------------|
| 1a. Thallus isidiate or sorediate | 2 |
| 1b. Thallus lacking isidia and soredia | <i>H. syncolla</i> |
| | |
| 2a. Thallus isidiate | <i>H. granulata</i> |
| 2b. Thallus sorediate | <i>H. aglutinata</i> |

1. *Hyperphyscia aglutinata* (Florke) Mayrn. & Poelt, Herzogia 5: 62. 1979.

Thallus foliose, closely adnate, laciniate; lobes small, up to 0.5mm wide; upper cortex distinct, upper surface plane, isidia absent; sorediate; soralia laminal, soredia granular; medulla white; lower surface pale brown; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers exposed regions in the evergreen shola forests between an altitude of 750-2000m.

Distribution: Subtropical regions.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 21965* (KFRI); Siruvani, Palakkad Dt., 750m, *Stephen 21122c* (KFRI).

Note: New record to Kerala.

2. *Hyperphyscia granulata* (Poelt) Moberg. Nord. J. Bot. 7: 721. 1987.

Thallus foliose, closely adnate, laciniate, lobes radiating, irregularly branched, margins entire; upper surface plane; isidiate; isidia laminal, short, cylindrical; soredia absent; medulla colourless; lower surface dark; prothallus present, sterile.

Medulla K-, C-, KC-, P-

Substratum: Corticolous

Habitat: Prefers ecotone region of the shola forests at an altitude of 2000m.

Distribution: Subtropical regions.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 22028* (KFRI).

Note: New record to Kerala.

3. *Hyperphyscia syncolla* (Nyl.) Kalb, Lichenes neotropici 6: 201-250. 1983.

Thallus foliose, closely adnate, glaucous grey to grey brown; lobes irregularly branched, margin entire; upper surface plane, slightly convex, isidia and soredia absent, medulla white, lower surface pale brown; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers partially shaded trees in the shola forests at an altitude of 2300m.

Distribution: Subtropical regions.

Specimens examined: Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21020* (KFRI).

Note: New record to Kerala.

Genus *Phaeophyscia* Moberg.

Thallus foliose, lobate, dorsiventral, greyish-brown, loosely attached; upper surface epruinose, emaculate; medulla white; lower surface black, rhizinate; photobiont a green alga; apothecia lecanorine, laminal; disc brown to black; hypothecium colourless to pale; asci 8-spored; spores brown.

The genus *Phaeophyscia* is tropical to subtropical in origin and comprises about 22 species in the world (Moberg, 1977; Esslinger, 1978). Awasthi (1988) recorded 14 species from India. Among these, 3 species could be collected during this study from Kerala part of Western Ghats.

Key to the species

- 1a. Thallus sorediate *P. orbicularis*
1b. Thallus lacking soredia 2
- 2a. Lower surface black *P. hispidula*
2b. Lower surface otherwise *P. nepalensis*

1. *Phaeophyscia hispidula* (Ach.) Moberg, Bot. Notiser 131: 260. 1978.

Thallus foliose, greyish brown, loosely attached; lobes irregularly branched, discrete or imbricate up to 2mm wide; upper surface dull, epruinose, sorediate; soralia laminal, pustulate to capitate; medulla white; lower surface black, rhizinate; sterile.

Medulla K-, C-, KC-, P-

Habit: Saxicolous/Corticolous

Habitat: Prefers exposed areas in the evergreen forests at an altitude of 900m.

Distribution: Manipur, Nagaland, Tamil Nadu and Uttar Pradesh.

Specimens examined: Kakki Dam site, Kakki, Pathanamthitta Dt., 900m, *Stephen 21808* (KFRI); *21194* (KFRI).

Note: New record to Kerala.

2. *Phaeophyscia nepalensis* (Poelt.) Awasthi.,

Plate IX. Fig. 3.

Thallus foliose, greenish grey; loosely attached; lobes branched, appressed; up to 2mm wide; upper surface dull, epruinose, soredia and isidia absent; medulla white; lower surface pale brown, sterile.

Plate-IX



Fig.1. A. *Heterodermia microphylla* B. *Heterodermia obscurata*



Fig.2. A. *Heterodermia pseudospeciosa* B. *Heterodermia punctifera*



Fig.3. *Phaeophyscia nepalensis*

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers humid areas in the shola forests at an altitude of 2300m.

Distribution: Nepal

Specimens examined: Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21010* (KFRI).

Note: New record to India.

3. *Phaeophyscia orbicularis* (Neck.) Moberg, Symb. Bot. Upsal. 22 (1): 44. 1977.

Plate X. Fig. 1.

Thallus foliose, brownish; loosely attached; lobes dichotomously to irregularly branched, up to 1mm wide; margin entire; upper surface plane, epruinose, emaculate; sorediate; soralia laminal to submarginal, soredia granular, medulla white; lower surface pale at margin; apothecia up to 2mm in diameter; disc brown black; thalline exciple smooth, epithecium brownish.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers partly shaded areas near small streams in the evergreen forests at an altitude of 1150m.

Distribution: Jammu & Kashmir, Manipur, Nagaland and Uttar Pradesh.

Specimens examined: Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21937* (KFRI).

Note: New record to Peninsular India.

Genus *Physcia* (Schreber) Michaux.

Thallus foliose, corticated on both surfaces, heteromerous; photobiont a green alga; lower surface rhizinate; apothecium lecanorine; hypothecium hyaline, asci 8-spored, spores brown, 2-celled, thick walled; atranorin present.

The genus *Physcia* is cosmopolitan in distribution and consists of about 175 species from all over the world (Awasthi, 1960). Awasthi (1988) reported 19 species from India.

Among these, 3 species of *Physcia* have been collected during the present study from this part of the phytogeographic region.

Key to the Species

- 1a. Thallus sorediate *P. dimidiata*
1b. Thallus lacking soredia 2
- 2a. Thallus saxicolous *P. albinea*
2b. Thallus corticolous *P. integrata*

1. *Physcia albinea* (Ach.) Nyl.,

Plate X. Fig. 2A.

Thallus foliose, suborbicular, appressed, laciniate, confluent in the central part, discrete in the peripheral part; surface plane, greyish brown, smooth, soredia and isidia absent, emaculate; lower surface brown-black, rhizinate; medulla white, apothecia sessile, hypothecium pale.

Medulla K+ yellow, C-, KC-, P-

Habit: Saxicolous

Habitat: Prefers highly exposed ecotone regions in the shola forests at an altitude of 2000m.

Distribution: North West Himalaya.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 21951* (KFRI).

Note: New record to Peninsular India.

Physcia dimidiata (Arn.) Nyl., *Addenda mpva ad Lichenographica europeam*. 38 Flora 64: 537. 1881.

Plate X. Fig. 2B.

Thallus foliose, orbicular to suborbicular; laciniate; confluent in the central part, discrete in the peripheral part; lobes some what convex, up to 1mm in wide, incised, brittle, lobe ends pruinose; surface plane, isidia absent; sorediate; soralia marginal or apical; medulla white, lower surface brown black; sterile.

Medulla K+ yellow, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers marginal area of branches of trees in the shola forests at an altitude of 1800m.

Distribution: Western Himalaya.

Specimens examined: Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20157* (KFRI).

Note: New record to Peninsular India.

2. *Pyxicia integrata* Nyl., in synops. Meth. Lich. 424. 1860.

Thallus foliose, sub orbicular, appressed, lacinate; confluent in the central part; peripheral part discrete; surface plane, glaucous white, smooth; lower surface black, rhizinate; soredia and isidia absent; medulla white; apothecia sessile, margin lacinate; hypothecium pale; asci 8-spored; spores brown, 2-celled.

Thallus K+ yellow, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers ecotone region in the shola forests at an altitude of 2000m.

Distribution: Tamil Nadu

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 22029* (KFRI).

Note: New record to Kerala.

Genus *Pyxine* Fr.

Thallus foliose, appressed, corticated on both surfaces, heteromerous, photobiont a green alga; thallus glaucous white to dark grey, smooth or rugose; maculate or emaculate, pruinose or epruinose; isidia, soredia present or absent; lower surface brown black, rhizinate; apothecia laminal with or without thalline margin, epithecium K+ purple; hypothecium brown to dark brown, asci 8-spored; spores brown, 2-celled, thick walled.

The genus *Pyxine* is widely distributed in the tropical and subtropical regions of the world, comprising of about 35 species in the world. Awasthi (1980) studied the Indian species of *Pyxine* and reported 21 species from India. He reported 7 species from Kerala. Most of the *Pyxine* occurring in this region are from the plains or coastal areas. However, during the present study which was mainly in the forest areas, many of the species collected by Awasthi could not be located. However, 8 species of *Pyxine* were encountered during this study, which are enumerated.

Key to the Species

1a. Thallus isidiate	2
1b. Thallus lacking isidia	3
2a. Medulla K+ yellow-red	<i>P. cylindrica</i>
2b. Medulla K-	<i>P. corraligera</i>
3a. Thallus sorediate	4
3b. Thallus lacking soredia	6
4a. Soralia laminal, orbicularr capitate	<i>P. asiatica</i>
4b. Soralia marginal, linear	5
5a. Internal stipe of apothecia K+ violet-purple	<i>P. sorediata</i>
5b. Internal stipe of apothecia K+ yellow-brown	<i>P. meissnerina</i>
6a. Thallus UV+ yellow	7
6b. Thallus UV-	<i>P. philippina</i>
7a. Thallus corticolous, apothecia with algal cells in exciple	<i>P. petricola</i>
7b. Thallus saxicolous, apothecia lacking algal cells in exciple	<i>P. minuta</i>

1. *Pyxine asiatica* Vain., Hedwigia., 46: 171. 1907.

Thallus foliose, gloucos white to grey, closely appressed to substratum; lobes discrete at periphery; pruinose, maculate; maculae laminal, linear, sorediate; soralia laminar, orbicular, soredia farinose; medulla white; sterile.

Medulla K+ yellow, C-, KC-, P+ yellow-orange.

Habit: Saxicolous

Habitat: Prefers open exposed rocks in the grasslands at an altitude of 1100m.

Distribution: Kerala

Specimens examined: Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21836* (KFRI).

2. *Pyxine corraligera* Malme, Bihang K. svenska Vetensk Akad. Handl. 23 afd. 3: 40. 1897.

Thallus foliose, grey to ashy grey, closely appressed to substratum; lobes compact, periphery discrete; diffused pruinose; maculate, maculae laminal, linear, fissured; isidiate; isidia laminal and marginal, cylindrical, apically crateriform to produce granular soredia; medulla yellow in the upper; white below; sterile.

Medulla K-, C-, KC-, P+ yellow to orange.

Habit: Corticolous

Habitat: Prefers marginal trees in the evergreen forests at an altitude of 1000m.

Distribution: Andaman Islands and Kerala.

Specimens examined: Kakki Dam site, Kakki, Pathanamthitta Dt., 850m, *Stephen 21931* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21943 b* (KFRI).

3. *Pyxine cylindrica* Kashiw., Bull. Natn. Sci. Mus. Ser. B (Bot.) 3(2): 66. 1977.

Thallus foliose, glaucous grey to grey, closely appressed; lobes compact, plane, faintly pruinose; maculate; maculae laminal; linear, fissured, pseudocyphellate in older parts; isidiate; isidia laminal dense; soredia absent; medulla white to yellow, lower side black; sterile.

Medulla K+ yellow-red, C-, KC-, P+ orange-red.

Habit: Corticolous

Habitat: Prefers upper canopy branches of trees in the evergreen shola forests between an altitude of 2100-2300m.

Distribution: Kerala.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20133* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21003* (KFRI).

4. *Pyxine meissnerina* Nyl., Bull. Soc. Linn. Normandie, Ser. 2, 7: 164. 1973.

Thallus foliose, glaucous white to pale grey, closely appressed; lobes compact to imbricate, plane; pruinose up to the margin; maculae scarce, marginal; sorediate; soralia marginal to sub marginal; orbicular to linear; soredia yellowish grey; isidia absent; medulla yellow to white; lower surface black; apothecia sessile, slightly caespruinose; hypothecium dark brown; internal stipe red brown, K+ yellowish brown.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers riverine trees in the evergreen forests at an altitude of 1650m.

Distribution: Manipur, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 1650m, *Stephen 22080* (KFRI).

Note: New record to Kerala.

5. *Pyxine minuta* Vain., Acta. Soc. Faun. Fl. Fenn. 7(1): 156.

Thallus foliose, agglutinated, pale grey; lobes evanescent, centrifugally confluent to discrete plicate, diffused pruinose; maculae scarce, linear fissured, soredia and isidia absent; medulla white; lower side brown black; apothecia sessile, dense, algal cells absent in exciple; hypothecium light brown.

Medulla K-, C-, KC-, P+ yellow.

Habit: Saxicolous

Habitat: Prefers highly exposed riverine trees in the evergreen forests at an altitude of 1200m.

Distribution: Karnataka and Uttar Pradesh.

Specimens examined: Pullukuthimala, New Amarambalam Reserve Forests, Malappuram Dt., 1200m, *Stephen 20016* (KFRI).

Note: New record to Kerala.

6. *Pyxine petricola* Nyl., J. Bot. Land. 14: 263. 1876.

Thallus foliose, white to glaucous grey; closely appressed; lobes linear, marginally imbricate, plane; pruinose; pruina agglutinated in plaques extending to the lateral margin, maculae indistinct; isidia and soredia absent medulla white; lower surface black; apothecia sessile; plane, algal cells present in exciple; internal stipe of hypothecia red brown, K+ red-violet.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers riverine trees in the evergreen forests between an altitude of 750-900m.

Distribution: Karnataka and Madhya Pradesh.

Specimens examined: Siruvani riverine area, Siruvani, Palakkad Dt., 750m, *Stephen 21175* (KFRI); Kakki Dam site, Kakki, Pathanamthitta Dt., 900m, *Stephen 21191* (KFRI).

Note: New record to Kerala.

7. *Pyxine philippina* Vain., Philipp. J. Sci. Sect. C, 8(2): 110. 1913.

Plate X. Fig. 3.

Thallus foliose, glaucous white, loosely to closely attached; lobes compact to confluent in centrally attached; lobes compact to confluent in central part, discrete at periphery, plane or rugose; secondary lobules sometimes present at the central part of thallus, apices of lobes bluish black, slightly diffused pruinose; maculae sparse, linear; medulla white to stramineous, lower black; apothecia sessile, epruinose, algal cells absent in the exciple; hypothecium dark brown, K-.

Medulla K+ yellow-red, C-, KC-, P+ orange-red.

Habit: Corticolous

Habitat: Prefers fringes of evergreen forests at an altitude of 925m.

Distribution: Manipur, Uttar Pradesh and West Bengal.

Specimens examined: Kattapara Shola, Idukki Dt., 925m, *Stephen 21824* (KFRI).

Note: New record to Peninsular India.

8. *Pyxine sorediata* (Ach.) Mont., Hist. Cuba Bot. 9: 188. 1842.

Thallus foliose, glaucous grey, firmly appressed; lobes linear, compact, imbricate to discrete, plane; surface smooth, diffused pruinose, margin of lobes white pseudocyphellate; pseudocyphellae absent on lamina; sorediate, soralia marginal, linear, soredia grey, powdery to granular; isidia absent; medulla yellow, lower side black; rhizinate; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous/Saxicolous

Habitat: Prefers marginal trees in the evergreen forests or exposed rocks in the grassland at an altitude of 900-1650m.

Distribution: Manipur, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 1650m, *Stephen 22057 a* (KFRI); Kakki Dam site, Kakki, Pathanamthitta Dt., 900m, *Stephen 21195* (KFRI).

Note: New record to Kerala.

Plate-X



Fig.1. *Phaeophyscia orbicularis*

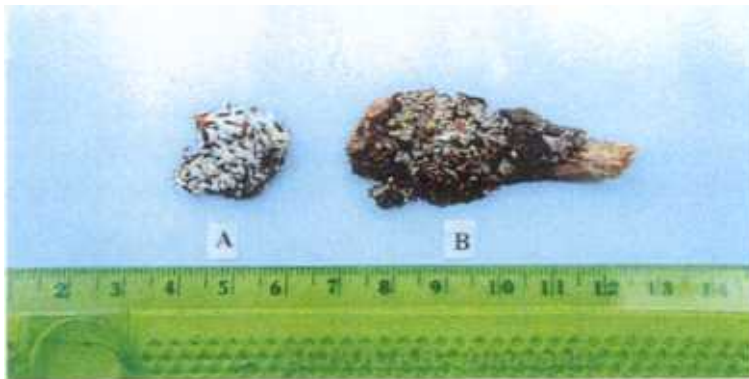


Fig.2. A. *Physcia albinea*

B. *Physcia dimidiata*



Fig.3. *Pyxine philippina*

Family Ramalinaceae

Genus *Ramalina* Ach. ex Luykew.

Thallus fruticose, heteromerous, erect to subpendulous, stramineous to pale grey, branching dichotomous or irregular, branches inflated, canaliculate, channeled or strap shaped; upper surface and lower surface distinct or indistinct; cortex uneven; medulla solid or hollow; photobiont, a green alga; pseudocyphellae and soralia present or absent; apothecia lecanorine; asci 8-spores; spored colourless; ellipsoid; septate.

The genus *Ramalina* is distributed mostly in the temperate and subtropical regions comprising about 200 species in the world. Awasthi (1988) recorded 23 species from India. Among these, 4 taxa are considered as *nomen dubium*. During the present study 11 species of *Ramalina* are encountered.

Key to the Species

1a. Medulla solid	3
1b. Medulla hollow	2
2a. Thallus saxicolous	<i>R. himalayensis</i>
2b. Thallus corticolous	<i>R. inflata</i>
3a. Thallus sorediate	4
3b. Thallus lacking soredia	7
4a. Thallus dichotomously divided	5
4b. Thallus otherwise	<i>R. polliaria</i>
5a. Soralia marginal or laminal	6
5b. Soralia capitate on apices	<i>R. roesleri</i>
6a. Thallus nervose	<i>R. taitensis</i>
6b. Thallus striate	<i>R. pacifica</i>
7a. Thallus strap shaped	8
7b. Thallus otherwise	10
8a. Thallus nervose	9
8b. Thallus lacking nerves or not prominent	<i>R. subamplificata</i>
9a. Branches laceolate, reticulately ridged and rugose	<i>R. celastri</i>
9b. Branches palmately lobed, perforated	<i>R. sinensis</i>
10a. Thallus strap shaped	11
10b. Thallus otherwise	<i>R. usnea</i>
11a. Thallus K+ red, P+ red	<i>R. africana</i>
11b. Thallus K-, P-	<i>Ramalina</i> sp.

1. *Ramalina africana* (Stein.) Dodge, Nova Hedwigia 38: 56. 1971.

Thallus fruticose, suberect, grey to stramineous, up to 4cm long; branching dichotmous to irregular; branches up to 2mm wide; upper surface flat to canaliculate; pseudocyphellate; pseudocyphellae laminal to marginal, punctiform; medulla loose; apothecia marginal or lateral, receptacle wrinkled, caesiopruinose.

Medulla K+ red, KC-, P+ red.

Habit: Corticolous

Habitat: Prefers upper canopy branches of trees in the evergreen forest at an altitude of 700m.

Distribution: Himalayas, Manipur, Nagaland and Tamil Nadu.

Specimens examined: Thirunelly, Wayanad Dt., 700m, *Stephen 21040b* (KFRI).

Note: New record to Kerala.

2. *Ramalina celastri* (Spreng.) Krog & Swensc., Norw. J. Bot. 23: 159. 1976.

Thallus fruticose, erect to sub pendulous, grey to stramineous, up to 5 cm long, branches flattened, lanceolate, up to 3mm wide; upper surface smooth, reticulately ridged with small laminal lobules; soredia and isidia absent; pseudocyphellate; pseudocyphellae common, irregular; lower surface reticulately ridged; medulla dense; apothecia laminal on both surfaces, receptacle ridged, pruinose.

Medulla K-, C-, KC-, P-.

Habit: Corticolous.

Habitat: Prefers upper canopy branches of trees or open places in the evergreen as well as subtropical forests between an altitude of 750-1500m.

Distribution: Manipur, Nagaland and Tamil Nadu.

Specimens examined: Sispara, Silent Valley National Park, Palakkad Dt., 1500m, *Stephen 20056* (KFRI); Walakkad, Silent Valley National Park, Palakkad Dt., 1300m, *Stephen 20064* (KFRI); *22157* (KFRI); *22158* (KFRI); *22159* (KFRI); *22161* (KFRI); 1000m, *Stephen 22152* (KFRI); *22153* (KFRI); *22155* (KFRI); Riverine area, Siruvani, Palakkad Dt., 750m, *Stephen 21172a* (KFRI).

Note: New record to Kerala.

3. *Ramalina himalayensis* Ras., Arch., Soc. 2001. Bot. 'Vahamo' 5(1): 26. 1950.

Plate XI. Fig. 1.

Thallus fruticose, suberect to erect, yellowish grey; fronds imbricate, irregularly inflated, cylindrical, imperforate; smooth, pseudocyphellae sparse; isidia and soredia absent; medulla yellowish white; apothecia lateral to subterminal, plane to convex; disc pruinose.

Thallus K-, C-, KC-, P-.

Habit: Saxicolous

Habitat: Prefers open areas in the evergreen forests at an altitude of 950m.

Distribution: West Bengal

Specimens examined: Mukurti Peak, New Amarambalam Reserve Forest, Malappuram Dt., 2450m, *Stephen 20030* (KFRI).

Note: New record to Peninsular India. So far this Eastern Himalayan endemic taxon was known only from its type locality.

4. *Ramalina inflata* (Hook.f. & Tayl.) Hook.f. & Tayl. apud Hook., Flora Antarct. 1: 194. Tab. 79. Fig. 1, 1844.

Thallus fruticose, suberect to erect, yellow to brownish yellow, up to 4 cm in size; dichotomously branched, subcylindrical, partially pitted; surface perforated, pseudocyphellae, soredia and isidia absent; medulla hollow; apothecia lateral to terminal, disc plane to convex, pruinose.

Medulla K-, C-, KC-, P-.

Habit: Corticolous

Habitat: Prefers exposed areas in the margin or upper canopy branches of trees in the shola forests between an altitude of 1800-2300m.

Distribution: Kerala and Tamil Nadu

Specimens examined: Sispara, Silent Valley National Park, Palakkad Dt., 1800m, *Stephen 20055* (KFRI); *20069* (KFRI); 1950m, *Stephen 22134* (KFRI); *22136* (KFRI); Anaimudi slope, Munnar, Idukki Dt., 2300m, *Stephen 22114* (KFRI); *22115* (KFRI).

5. *Ramalina pacifica* Asah., J. Jap. Bot. 15: 213. 1939.

Thallus fruticose, pendulous, up to 10 cm long; branching dichotomous; branches anastomosing, up to 2mm wide, compressed, flat, apices attenuate; surface dull, striate; canaliculate, sparsely perforated, pseudocyphellate; pseudocyphellae marginal, linear; sorediate; soralia laminal to marginal; medulla loose; sterile.

Medulla K-, C-, KC-, P-.

Habit: Corticolous

Habitat: Prefers upper canopy branches of trees in the evergreen forests or ecotone regions of the shola forests between an altitude of 950-2000m.

Distribution: Karnataka, Kerala and Nagaland.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 22001* (KFRI); *22017* (KFRI); Ranimedu, Nelliampathy, Palakkad Dt., 950m, *Stephen 8928* (KFRI); *8930* (KFRI).

6. *Ramalina pollinaria* (Westr.) Ach., Lich. Univ., 608. 1810.

Thallus fruticose, subpendulous; greyish white; up to 4cm tall, branchlets broad, palmately lobed; lobes up to 3mm wide; surface white, pseudocyphellae absent, sorediate, soralia irregular, linear to orbicular; medulla loose; sterile.

Medulla K-, C-, KC-, P-.

Habit: Corticolous.

Habitat: Prefers ecotone regions of the shola forests at an altitude of 1650m.

Distribution: Andhra Pradesh.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22039a* (KFRI).

Note: New record to Kerala.

7. *Ramalina roesleri* (Hochst. Ex Schaer.) Hane, Rev. Bot. 6: 151. 1887.

Thallus fruticose, subpendulous, glaucous white, branching dichotomous; branches flat, up to 2mm in wide; secondary branches repeatedly branched, surface striated, sparsely fenestrated, sorediate; soralia terminal to subterminal, punctiform; medulla arachnioid; sterile.

Medulla K-, C-, KC-, P-.

Habit: Corticolous.

Habitat: Prefers open areas in the shola forests at an altitude of 1600m.

Distribution: Himachal Pradesh, Nagaland and Tamil Nadu,.

Specimens examined: Lockart Gap, Munnar, Idukki Dt., 1600m, *Stephen 8970* (KFRI); *8971* (KFRI).

Note: New record to Kerala.

8. *Ramalina sinensis* Jatta, Nuov. Giorn. Bot. Ital. 9: 462. 1902.

Plate XI. Fig. 2.

Thallus fruticose, subpendulous, pale grey; branching lateral; main branches strap shaped to palmate; secondary branches variable, elongate; upper surface uneven, wrinkled, faveolate, fenestrated; isidia, soredia and pseudocyphellae absent; lower surface pale; medulla loose; sterile.

Medulla K-, C-, KC-, P-.

Habit: Corticolous

Habitat: Prefers upper canopy branches or riverine trees in the evergreen forests between an altitude of 700-900m.

Distribution: Arunachal Pradesh, Punjab and Uttar Pradesh.

Specimens examined: Marapallipara, Parambikulam, Palakkad Dt., 900m, *Stephen 22167* (KFRI); Riverine area, Siruvani, Palakkad Dt., 750m, *Stephen 21172b* (KFRI).

Note: New record to Peninsular India.

9. *Ramalina subampliata* (Nyl.) Fink,

Plate XI. Fig. 3.

Thallus fruticose, subpendulous, pale grey up to 4 cm tall, branching dichotomous; branches up to 5mm in wide, tapering; surface flat, strap shaped, sparsely fenestrated; pseudocyphellae, soredia and isidia absent; medulla loose; sterile.

Medulla K-, C-, KC-, P-.

Habit: Corticolous

Plate-XI



Fig.1. *Ramalina himalayensis*



Fig.2. *Ramalina sinensis*

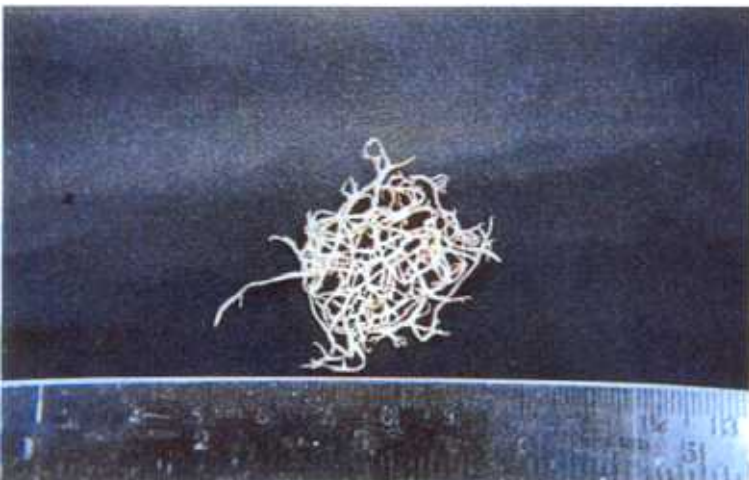


Fig.3. *Ramalina subampliata*

Habitat: Prefers ectone regions of shola forests at an altitude of 1650m.

Distribution: Nepal.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22036a* (KFRI).

Note: New record to India.

10. *Ramalina taitensis* Nyl.,

Plate XII. Fig. 1.

Thallus fruticose; subpendulous; pale grey; up to 4cm tall, branching dichotomous to irregular; branches linear, narrow, tapering apically; apical lobes finely divided; surface nervose, pseudocyphellae absent; sorediate; soralia marginal to laminal; round to oblong, soredia farinose to granular; medulla loose; sterile.

Medulla K-, C-, KC-, P-.

Habit: Corticolous.

Habitat: Prefers marginal trees in the shola forests between an altitude of 1600-2000m.

Distribution: Eastern Himalaya.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22066* (KFRI); 2000m, *Stephen 21989* (KFRI).

Note: New record to Peninsular India.

11. *Ramalina usnea* (L.) R. Howe,

Plate XII. Fig. 2.

Thallus fruticose, erect to subpendulous; glaucous grey; branching dichotomously to irregular, ribbon like, branches narrow, spirally twisted; up to 1.5mm wide, surface plane, canaliculate, sparsely nerved; soredia absent; pseudocyphellate; pseudocyphellae strap like; running parallel to the branches; medulla loose; sterile.

Medulla K-, C-, KC-, P-.

Habit: Corticolous

Habitat: Prefers upper canopy branches of trees or ecotone regions in the evergreen shola forests between an altitude of 1600-1800m.

Distribution: Nepal.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22039c* (KFRI); 1800m, *Stephen 22122* (KFRI).

Note: New record to India.

12. *Ramalina* sp.

Thallus fruticose, pendulous greenish grey; up to 8cm long; branching dichotomous to irregular; branches up to 5 mm wide, irregular in width; slightly twisted; surface flat to canaliculate, strap shaped; tuberculate; soredia and isidia absent; pseudocyphellate; pseudocyphellae raised on tubercle; white; medulla dense; sterile.

Medulla K-, C-, KC-, P-.

Substratum: Corticolous

Habitat: Prefers trees in the grassland and evergreen shola forests at an altitude of 1650m.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22036b* (KFRI).

Note: This taxon is closely allied to *R. africana* but differs in colour reactions. Awasthi (1988) also mentioned this unidentified taxon as *nomen dubium*.

Family Roccellaceae

Genus *Roccella* DC.

Awasthi (1988) reported 2 species of *Roccella* from India. Both these species were reported from the coastal regions of India. During the present investigation one species of *Roccella* were collected from montane forests.

1. *Roccella montagnei* Bel. emend. Awas., Bryologist 84: 216-219. 1981.

Thallus fruticose, pendulous, up to 15cm long; grey coloured, branching dichotomous; branches strap shaped or irregularly flattened, tapering; photobiont a green alga; upper surface plane, sorediate; soralia laminal; medulla loose.

Cortex K-, C+ red, KC-, P-

Habit: Corticolous

Habitat: Prefers open areas in the montane shola forests at an altitude of 2000m.

Distribution: Karnataka

Specimens examined: Top Station, Munnar, Idukki Dt., 2000m, *Stephen 22173* (KFRI).

Note: New record to Kerala.

Family Stereocaulaceae

Key to genera

- 1a. Spores transversely septate, pseudopodetia well branched *Stereocaulon*
- 1b. Spores simple, pseudopodetia little branched *Pilophorus*

Genus *Pilophorus* (Tuck.) Th. Fr.

The genus *Pilophorus* is temperate in origin. In India only a single species of *Pilophorus* is known to occur. During the present study, this species was encountered from the study area.

1. *Pilophorus awasthianum* Ras. Arch. Soc. Zool. Bot. 'Vanamo' 5(1): 28. 1950.

Plate XII. Fig. 3.

Thallus fruticose; grey white, primary thallus verruculose, secondary thallus podetial in nature; pseudopodetia 5-8mm long, simple; apothecia terminal, simple to aggregated; spores simple, fusiform; photobiont a green agla.

Habit: Saxicolous

Habitat: Prefers exposed rocks in the grasslands at an altitude of 2650m.

Distribution: Eastern Himalayas

Specimens examined: Anaimudi top, Munnar, Idukki Dt., 2650m, *Stephen 22112* (KFRI).

Note: New record to Peninsular India.

Genus *Stereocaulon* (Schreber) Hoffm.

Thallus dimorphic, primary thallus crustose, granular, verrucose or squamulose; secondary thallus podetial in nature; pseudopodetia erect, simple or branched; phyllocladia

Plate-XII



Fig.1. *Ramalina taitensis*



Fig.2. *Ramalina usnea*



Fig.3. *Pilophorus awasthianum*

cylindrical, terete or verrucose; surface covered with phyllocladia, cortex present or absent, photobiont a green alga; medulla loosely interwoven; apothecia terminal or lateral.

The genus *Stereocaulon* is widely distributed in the temperate to subtropical regions of the world. The genus was first monographed by Th. Fries (1957, 1958) and enumerated 23 species. Nylander (1960) dealt 39 taxa of *Stereocaulon*. About 123 species are now known to occur in the world. Pant and Upreti (1999) studied the species of *Stereocaulon* from India and Nepal and reported altogether 13 species from these regions. During the present study 2 species of *Stereocaulon* were collected. One is expected to be new to science.

Key to the species

- 1a. Phyllocladia cylindrical but not branched at apices *Stereocaulon* sp.
1b. Phyllocladia granular to coralloid *S. austroindicum*

1. *Stereocaulon austroindicum* Lamb, J. Hattori Bot. Lab.43: 205. 1977.

Primary thallus persistent, granulose, pseudopodetia erect; simple to branched up to 1mm wide; apices white, efflorescent pseudosorediate; phyllocladia granular to coralloid; cephalodia lateral on pseudopodetia, sessile, yellow to brown, verrucose, apothecia terminal, brown-black, convex; exciple brown; hypothecium yellow pigmented.

Phyllocladia K+ yellow, PD+ pale yellow.

Habit: Corticolous / Saxicolous

Habitat: Prefers well exposed boulders or rocks in the grasslands between an altitude of 1150-2000m.

Distribution: Kerala and Tamil Nadu.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 21949b* (KFRI); *21950* (KFRI); *21959* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21837* (KFRI).

Note: Endemic to South India.

2. *Stereocaulon* sp.

Primary thallus persistent; crustose; pseudopodetia erect, up to 2cm tall, glaucous grey to greyish white, slightly branched, up to 1mm wide, phyllocladia cylindrical, up to 2mm long, some times branched; cephalodia lateral, verrucose, yellow-brown; apothecia terminal on branches; brownish, exciple yellow-brown.

Phyllocladia K+ yellow, P+ yellow

Habit: Saxicolous

Habitat: Prefers partly shaded rocks near streams in the subtropical forests at an altitude of 1050m.

Specimens examined: Walakkad, Silent Valley National Park, Palakkad Dt., 1050m, *Stephen 8909* (KFRI); *20079* (KFRI).

Note: It is allied to *S. glareosum* but differs in the nature of phyllocladia and cephalodia. Only one species of *Stereocaulon* ie., *Stereocaulon austroindicum* is known from South India. According to D.D. Awasthi (pers. comm.) if any *Stereocaulon* other than *S. austroindicum* occurs in South India, it could be a new species.

Family Stictaceae

Key to genera

- 1a. Thallus cyphellate on lower surface *Sticta*
1b. Thallus lacking cyphellae on lower surface 2
- 2a. Thallus pseudocyphellate on lower surface *Pseudocyphellaria*
2b. Thallus lacking pseudocyphellae on lower surface,
 bullate on lower surface *Lobaria*

Genus *Lobaria* (Schreber) Hoffm.

The genus *Lobaria* is distributed in the tropical and temperate regions both in northern and southern hemispheres and about 80 species in the world. Joshi and Awasthi (1982) recorded 11 species of *Lobaria* from India. Most of their collections are from the temperate Himalayas and only 3 species from Nilgiri and Palni hills of Tamil Nadu. During the present study only one species of *Lobaria* could be collected from this part of phytogeographic region.

1. *Lobaria retigera* (Bory) Trev., Lichenotheca veneta: 75. 1869.

Thallus foliose; lobes up to 3cm wide; upper surface pale brown to dark brown; scrobiculate, isidiate; isidia on ridges or on margin of lobes, granular to cylindrical, simple to coralloid; lower surface dark brown to black; photobiont a blue-green alga.

Medulla K-, C-, KC-, P-

Habit: Mostly corticolous, rarely saxicolous.

Habitat: Prefers moist, shaded regions in the shola forests between an altitude of 1400-2100m.

Distribution: Arunachal Pradesh, Assam, Himachal Pradesh, Meghalaya, Nagaland, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 1650m, *Stephen 22073 c* (KFRI); Anamudi, Munnar, Idukki Dt., 2100m, *Stephen 8938* (KFRI); Chockanad Estate, Munnar, Idukki Dt., 1400m, *Stephen 22166* (KFRI).

Note: New record to Kerala.

Genus *Pseudocyphellaria* Vain.

Thallus foliose, pale brown to reddish brown or greyish brown; heteromerous; corticated on both surfaces; photobiont blue-green or green alga; medulla yellow or white; lower surface densely tomentose; pale brown to reddish brown; pseudocyphellate; apothecia marginal to laminal with proper or thalline exciple; spores colourless to brown, fusiform, transversely septate.

The genus *Pseudocyphellaria* is distributed in the tropical to temperate regions of the world comprising about 200 species. Joshi and Awasthi (1982) recorded 4 species from India. Among these, 3 species are from South India only. During the present study 3 species of *Pseudocyphellaria* have been collected.

Key to the species

- 1a. Thallus reddish brown, photobiont a green alga *P. aurata*
- 1b. Thallus pale brown or grey brown, photobiont a blue-green alga 2
- 2a. Thallus isidiate, soredia absent *P. argyracea*
- 2b. Thallus soredia, isidia absent *P. crocata*

1. *Pseudocyphellaria aurata* (Ach.) Vainio., Etud. Lich. Bresil. 1: 183. 1890.

Thallus foliose, lobes up to 2cm wide; upper surface reddish brown, smooth, lightly scrobiculate; sorediate, soralia marginal, linear, yellow; soredia granular; medulla yellow; pseudocyphellae yellow; photobiont a green alga; lower surface densely tomentose; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers exposed trees in the evergreen forests at an altitude of 750m.

Distribution: Manipur and Tamil Nadu.

Specimens examined: Siruvani Dam area, Siruvani, Palakkad Dt., 750m, *Stephen 21121* (KFRI).

Note: New record to Kerala.

2. *Pseudocyphellaria argyracea* (Bory.) Vainio., Hedwigia 8: 34. 1898.

Thallus foliose, lobes up to 2.5cm wide; upper surface brown to dark brown, smooth, marginally tomentose, isidiate; isidia marginal to laminal, granular to cylindrical or squamuliform; medulla white; photobiont a blue-green alga; pseudocyphellae white, lower surface brown, tomentose; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous, rarely saxicolous.

Habitat: Prefers moist, shady areas in all type of vegetation between an altitude of 900-2400m.

Distribution: Tamil Nadu.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20120* (KFRI); *20126b* (KFRI); Kallar Estate, Munnar, Idukki Dt., 1500m, *Stephen 20148c* (KFRI); Mannavan Shola, Marayoor, Idukki Dt., 1650m, *Stephen 22073b* (KFRI); *22087* (KFRI); Anaimudi, Munnar, Idukki Dt., 2400m, *Stephen 22101* (KFRI); *22103* (KFRI); 2100m, *Stephen 8937* (KFRI); Pakshipadalam, Wayanad Dt., 1500m, *Stephen 21058* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1200m, *Stephen 21139* (KFRI); 1225m, *Stephen 21152b* (KFRI); *21161b* (KFRI); *21164* (KFRI); Kakki Dam area, Kakki, Pathanamthitta Dt., 900m, *Stephen 21184* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21887* (KFRI); *21889* (KFRI).

Note: New record to Kerala.

3. *Pseudocyphellaria crocata* (L.) Vainio., Hedwigia 35: 34. 1898.

Thallus foliose, lobes up to 1cm wide; upper surface pale brown or greyish brown; sorediate; soralia marginal, linear, soredia granular; medulla white; pseudocyphellae yellow; photobiont a blue-green alga; lower surface brown; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers moist areas of the evergreen forests at an altitude of 700m.

Distribution: Arunachal Pradesh, Tamil Nadu and Uttar Pradesh.

Specimens examined: Thirunelly, Wayanad Dt., 700m, *Stephen 21041* (KFRI).

Note: New record to Kerala.

Genus *Sticta* Schreber.

Thallus foliose, pale brown to dark brown; stipitate or non stipitate, heteromerous, corticated on both thallus; photobiont a green or blue green alga; upper surface smooth or rugose, isidia, soredia present or absent; lower surface brownish, cyphellate, tomentose; apothecia laminal, with or without alga in exciple; spores hyaline, transversely septate, acicular to fusiform.

The genus *Sticta* is cosmopolitan in origin and distributed in the tropical, subtropical and temperate regions of the world comprising about 200 species (Joshi & Awasthi, 1982). Awasthi (1988) studied the Indian species of *Sticta* and recorded 13 species from India. Among these, 9 species have been collected during the present study.

Key to the species

- | | |
|----------------------------------------------|-------------------------|
| 1a. Photobiont a green alga | 2 |
| 1b. Photobiont a blue-green alga | 3 |
| 2a. Thallus isidiate | <i>S. praetextata</i> |
| 2b. Thallus lacking isidia | <i>S. henryana</i> |
| 3a. Thallus adnate | 4 |
| 3b. Thallus stipitate | 6 |
| 4a. Thallus isidiate | 5 |
| 4b. Thallus sorediate | <i>S. limbata</i> |
| 5a. Upper surface scrobiculate | <i>S. sylvatica</i> |
| 5b. Upper surface smooth | <i>S. weigeli</i> |
| 6a. Thallus isidiate | 7 |
| 6b. Thallus lacking isidia | <i>S. neocaledonica</i> |
| 7a. Lobes linear; isidia marginal | <i>S. cyphellulata</i> |
| 7b. Lobes rounded, isidia laminal | 8 |
| 8a. Isidia granular to coralloid | <i>S. filicina</i> |
| 8b. Isidia teretiform to glomuliferous | <i>S. orbicularis</i> |

1. *Sticta cyphellulata* (Mull. Arg.) Hue., Nouv. Archs. Mus. Ser. 4,3: 99. 1901.

Thallus foliose; stipitate, dichotomously branched; lobes up to 2cm wide; upper surface pale brown or greyish brown, smooth; isidiate; isidia marginal; simple, granular to cylindrical;

lower surface brown, tomentose; cyphellate, cyphellae flask shaped; photobiont a blue-green alga; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers base of tree trunks in all type of forests between an altitude of 950-2400m.

Distribution: Kerala and Tamil Nadu.

Specimens examined: Earavikulam National Park, Idukki Dt., 2100m, *Stephen 20121* (KFRI); Anaimudi, Munnar, Idukki Dt., 2400m, *Stephen 22100* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen21031c* (KFRI); Pakshipadalam, Wayanad Dt., 1500m, *Stephen 21061* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21088b* (KFRI); Anguinda, Silent Valley National Park, Palakkad Dt., 2100m, *Stephen 22145* (KFRI); Shingampara, Siruvani, Palakkad Dt., 950m, *Stephen 21136* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21152d* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21855b* (KFRI); Upper Moozhiyar, Pathanamthitta Dt., 950m, *Stephen 21888* (KFRI).

2. *Sticta filicina* Ach., Meth. Lich. 275. 1803.

Thallus foliose, stipitate, expanded, fan-like; lobes up to 2cm wide; upper surface pale brown to dark brown, smooth, isidiate; isidia marginal, granular to coralloid; lower surface shortly rhizinate; cyphellate; cyphellae urceolate; photobiont a blue green alga; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous/Saxicolous

Habitat: Prefers partly shaded areas in the subtropical/shola forests between an altitude of 1100-2300m.

Distribution: Tamil Nadu

Specimens examined: Kallar Estate, Munnar, Idukki Dt., 1500m, *Stephen 20150* (KFRI); Mannavan Shola, Marayoor, Idukki Dt., 1650m, *Stephen 22073a* (KFRI); Chinnamala, Anaimudi, Munnar, Idukki Dt., 2100m, *Stephen 22096* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21025* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21150a* (KFRI); *21160* (KFRI).

Note: New record to Kerala.

3. *Sticta henryana* Mull. Arg., Flora 74: 374. 1891.

Plate XIII. Fig. 1A.

Thallus foliose, sinuate lobate; up to 1.5cm wide; upper surface yellowish grey, smooth, tomentose; isidia and soredia absent; lower surface yellowish brown, sparsely rhizinate, cyphellate, cyphellae saucer shaped; photobiont a green alga; apothecia absent.

Medulla K-, C-, KC-, P-

Habit: Corticolous / Saxicolous.

Habitat: Prefers marginal area of subtropical forests as well as evergreen shola forests between an altitude of 1200-1800m.

Distribution: Arunachal Pradesh and Uttar Pradesh.

Specimens examined: Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20184* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21158* (KFRI).

Note: New record to Peninsular India.

4. *Sticta limbata* (Sm.) Ach., Meth. Lich.: 280. 1803.

Thallus foliose, sinuate lobate; lobes up to 2cm wide; upper surface brownish yellow, smooth sorediate; soralia marginal, soredia granular, isidia like; lower surface yellow-brown; tomentose; photobiont a blue green alga; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous, rarely saxicolous.

Habitat: Prefers shaded areas in the evergreen/subtropical/shola forests between an altitude of 1000-2300m.

Distribution: Manipur, Meghalaya, Tamil Nadu and Uttar Pradesh.

Specimens examined: Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21031a* (KFRI); Pakshipadalam, Wayanad Dt., 1500m, *Stephen 21046* (KFRI); *21059* (KFRI); *21062* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21076* (KFRI); *21088a* (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 2100m, *Stephen 22144* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21152a* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21855a* (KFRI); *21868* (KFRI).

Note: New record to Kerala.

5. *Sticta neocaledonica* (Mull. Arg.) Hue, Nouv. Archs. Mus. Ser. 4,3: 101. 1901.

Plate XIII. Fig. 1C.

Thallus foliose, stipitate, dichotomously branched; lobes up to 1.5cm wide; upper surface greyish brown to pale brown, smooth; isidia and soredia absent; lower surface brown, rhizinate; cyphellate; cyphellae cup shaped; photobiont a blue-green alga; apothecia marginal; exciple proper; hymenium I+blue; spores fusiform.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers moist areas of the evergreen forests at an altitude of 2300m.

Distribution: Uttar Pradesh and West Bengal.

Specimens examined: Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21031b* (KFRI).

Note: New record to Peninsular India.

6. *Sticta orbicularis* (A. Br.) Hue, Annls. Jard. Bot. Buitenz. 17: 193. 1901.

Thallus foliose, stipitate; lobes up to 1.5cm wide; upper surface pale brown to dark brown, smooth, cracked, isidiate, isidia marginal to sub marginal, branched, teretiform to glomuliferous; lower surface brown, sparsely rhizinate, cyphellate, cyphellae cup shaped; sterile.

Medulla K-, C-, KC-, P-

Habit: Mostly corticolous, rarely saxicolous

Habitat: Prefers riverine areas of the subtropical/shola forests between an altitude of 1100-2100m.

Distribution: Kerala and Tamil Nadu.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20126a* (KFRI); Mannavan Shola, Marayoor, Idukki Dt., 1650m, *Stephen 22086* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21150b* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21860* (KFRI).

7. *Sticta praetextata* (Ras.) Awas., Biol. Mem, 7(2): 185. 1982.

Plate XIII. Fig. 1B.

Thallus foliose, coriaceous; sinuate lobate; lobes up to 3cm wide; margin with simple to repeatedly branched, laciniate; isidiate; isidia squamuliform; soredia absent; lower side brown, cyphellate, cyphellae saucer shaped; photobiont a green alga; sterile.

Medulla K-, C-, KC+ pink, P-

Habit: Saxicolous

Habitat: Prefers moist, shaded areas in the evergreen forests at an altitude of 950m.

Distribution: Arunachal Pradesh, Himachal Pradesh and Uttar Pradesh.

Specimens examined: Kulayalakadavu, New Amarambalam Reserve Forests, Malappuram Dt., 950m, *Stephen 20011* (KFRI).

Note: New record to Peninsular India.

8. *Sticta sylvatica* (Huds.) Ach., Meth. Lich.: 231. 1803.

Thallus foliose, appressed, lobes up to 2cm wide; upper surface yellowish grey to brownish grey; smooth to scrobiculate, irregularly cracked, isidiate; isidia laminal, granular to cylindrical, simple to dichotomously branched; lower surface brown; rhizinae absent; cyphellate; cyphellae cap-shaped; photobiont a blue-green alga; apothecia laminal, exciple thalline; hymenium hyaline, I+blue; spores fusiform.

Medulla K-, C-, KC-, P-

Habit: Corticolous

Habitat: Prefers partly exposed edges of evergreen forests as well as evergreen shola forests between an altitude of 1000-2400m.

Distribution: Kerala and Tamil Nadu.

Specimens examined: Anaimudi, Munnar, Idukki Dt., 2400m, *Stephen 22104* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21099a* (KFRI).

9. *Sticta weigeli* (Ach.) Vain., Lich. Univ.: 446. 1810.

Thallus foliose, appressed; lobes up to 1.5cm wide; upper surface pale brown or greyish brown; smooth to irregularly cracked, isidiate; isidia marginal to sub marginal or in cracks of

thallus, granular to cylindrical, simple to coralloid, branched; lower surface pale brown, rhizines rare, cyphellate; cyphellae cup-shaped; photobiont a blue green alga; sterile.

Medulla K-, C-, KC-, P-

Habit: Corticolous, rarely saxicolous.

Habitat: Prefers shaded or partly exposed regions in the evergreen/subtropical/shola forests between an altitude of 900-2000m.

Distribution: Assam, Kerala, Manipur, Meghalaya, Tamil Nadu and Uttar Pradesh.

Specimens examined: Kattapara Shola, Idukki Dt., 925m, *Stephen 21832* (KFRI); Kallar Estate, Munnar, Idukki Dt., 1500m, *Stephen 20151* (KFRI); Kulayalakadavu, New Amarambalam Reserve Forests, Malappuram Dt., 950m, *Stephen 20002* (KFRI); *20003* (KFRI); Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 22025* (KFRI); Pakshipadalam, Wayanad Dt., 1500m, *Stephen 21060* (KFRI); *21065* (KFRI); Uppupara, Periyar Tiger Reserve, Idukki Dt., 1150m, *Stephen 21846* (KFRI); *21847* (KFRI); *21858* (KFRI); *21871* (KFRI).

Family Teloschistaceae

Genus *Teloschistes* Norm.

The genus *Teloschistes* is distributed in the tropical to subtropical region of the world. A single species of *Teloschistes* is known from India. During the present study this species is encountered.

1. *Teloschistes flavicans* (Sw.) Norm, Nyl. Magaz. Naturv. 7: 229. 1853.

Thallus fruticose, erect to procumbent or subpendulous, yellowish orange to pale yellow; branching dichotomous or trichotomous or irregular; branches imbricate, sinuate, tapering; surface smooth to scabrid; sorediate; soralia elongate-orbicular, white, soredia granular; medulla subfistulose; sterile.

Thallus K+ violet, C-, KC-, P-

Habit: Corticolous, rarely saxicolous.

Habitat: Prefers open humid areas with trees or cuttings in the ecotone regions at an altitude of 2000m.

Distribution: Tamil Nadu

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 22074* (KFRI); 21952 (KFRI); Top Station, Munnar, Idukki Dt., 2000m, *Stephen 22174* (KFRI).

Note: New record to Kerala.

Family Usneaceae

Genus *Usnea* P. Browne ex Adans.

Thallus fruticose, erect or pendulous, branched, corticated, photobiont a green alga, medulla lax, enclosing a central chondrioid axis, central axis solid or dilacerated or hollow, surface papillate or without papillae, isidiate or without isidia, sorediate or without soredia, pseudocyphellate or without pseudocyphellae; apothecia lecanorine, asci 8-spored, spores simple, hyaline.

The genus *Usnea* is tropical in origin and about 600 species in the world. G. Awasthi (1986) studied the Indian species of *Usnea* and thus recorded 55 species from India under subgenera *Eumitria* and *Euusnea* (= *Usnea*). Among these, 39 species are collected during this study.

1a. Central axis solid	2
1b. Central axis hollow	<i>U. baileyi</i>
2a. Thallus dichotomously branched	3
2b. Thallus sympodially or filamentously branched	8
3a. Thallus isidiate	4
3b. Thallus lacking isidia	5
4a. Thallus inflated	<i>U. nilgirica</i>
4b. Thallus not inflated	<i>U. stigmatoides</i>
5a. Thallus erect	6
5b. Thallus pendulous	7
6a. Thallus inflated	<i>U. himalayana</i>
6b. Thallus not inflated	<i>U. rigidula</i>
7a. Thallus papillate	<i>U. vegae</i>
7b. Thallus not papillate	<i>U. corallina</i>
8a. Branching filamentous	9
8b. Branching sympodial	12
9a. Filamentous branches angular	<i>U. gigas</i>
9b. Filamentous branches circular	10
10a. Cortex persistent, axis brown.....	11
10b. Cortex evanescent, axis colourless	<i>U. pectinata</i>
11a. Lateral branchlets sparse	<i>U. indica</i>
11b. Lateral branchlets dense	<i>U. misamisensis</i>

12a. Thallus red pigmented	13
12b. Thallus non pigmented	20
13a. Pigment in cortex	14
13b. Pigment in medulla	17
14a. Thallus branching subsympodial	<i>U. pangiana</i>
14b. Thallus branching sympodial	15
15a. Thallus isidiate	16
15b. Thallus lacking isidia	<i>U. subflorida</i>
16a. Lateral branchlets absent	<i>U. maculata</i>
16b. Lateral branchlets present	<i>U. rubiunda</i>
17a. Thallus isidiate or sorediate	18
17b. Thallus lacking isidia and soredia	<i>U. austro-indica</i>
18a. Thallus rigid, dark brown	<i>U. vulneraria</i>
18b. Thallus fragile, greenish grey	19
19a. Axis lacerate; upper surface not annularly cracked	<i>Usnea sp. 1</i>
19b. Axis solid, upper surface cracked	<i>U. fragilis</i>
20a. Thallus pseudocyphellate	21
20b. Thallus lacking pseudocyphellae	28
21a. Thallus isidiate	22
21b. Thallus lacking isidia	24
22a. Cortex single layered	23
22b. Cortex double layered	<i>U. bornmuelleri</i>
23a. Thallus surface papillate	<i>U. nepalensis</i>
23b. Thallus lacking papillae	<i>U. undulata</i>
24a. Cortex single layered	25
24b. Cortex double layered	<i>U. thomsonii</i>
25a. Thallus tuberculate	26
25b. Thallus lacking tubercles	27
26a. Thallus branches inflated	<i>U. picta</i>
26b. Thallus branches not inflated	<i>U. pictoides</i>
27a. Thallus braches inflated	<i>U. sordida</i>
27b. Thallus branches not inflated	<i>U. splendens</i>
28a. Thallus isidiate or sorediate	29
28b. Thallus lacking isidia and soredia	34
29a. Medulla K+ red, P+ yellow	30
29b. Medulla K-, P-	32
30a. Branches sorediate	<i>U. subfloridana</i>
30b. Branches isidiate	31

31a. Thallus inflated	<i>U. bimolliuscula</i>
31b. Thallus not inflated	<i>U. eumitrioides</i>
32a. Thallus brown to dark brown	33
32b. Thallus yellow brown to brown black	<i>U. subchalybeae</i>
33a. Branches inflated	<i>Usnea sp. 2</i>
33b. Branches not inflated	<i>U. albopunctata</i>
34a. Cortex double-layered	<i>U. pseudosinensis</i>
34b. Cortex single layered	35
35a. Thallus papillate	36
35a. Thallus lacking papillae	39
36a. Branches with tufts of spinules	<i>U. spinosula</i>
36b. Branches without tufts of spinules	37
37a. Branches inflated	<i>U. orientalis</i>
37b. Branches not inflated	38
38a. Papillae concolorous to cortex surface	<i>U. cineraria</i>
38b. Papillae with pale apices	<i>U. dentritica</i>
39a. Axis angular in cross section	<i>U. fischeri</i>
39b. Axis rounded in cross section	<i>U. complanata</i>

1. *Usnea albopunctata* Nyl. apud. Crombie, J. Linn. Soc. London Bot. 17: 554. 1890.

Plate XIII. Fig. 2.

Thallus fruticose; erect; greenish brown; branching sympodial; basal disc absent; unbranched up to about 1.5 cm length, primary branches polychotomous; secondary branches bifurcated, up to 1.5 mm in diameter, terete, tapering; lateral branchlets absent, cortex cracked, pseudocyphellate, isidiate; isidia dense towards apical part, white, singly or in groups; soredia absent; cortex palisade like; medulla dense; axis solid; sterile.

Usnic acid present

Habit: Corticolous

Habitat: Prefers branches of trees in moist areas of the evergreen forests at an altitude of 1100m.

Distribution: Ceylon

Specimens examined: Walakkad, Silent Valley National Park, Palakkad Dt., 1100 m, *Stephen 22151* (KFRI).

Note: This species is so far known only from Ceylon. The present collection from Kerala, is therefore, new record to India.

2. *Usnea austro-indica* G. Awas., J. Hattori Bot. Lab. 61: 333-421. 1986.

Thallus fruticose, erect, brown to dark brown; basal disc flattened, black; branching sympodial; branches articulate and inflated, terete; lateral branchlets dense, simple to branched, sparsely tuberculate; pseudocyphellate; soredia and isidia absent; cortex yellow, red pigmented, pigments near outer region; axis solid, pale yellowish; apothecia terminal, disc concave to plane, margin ciliate; receptacle reticulately scrobiculate, ciliate.

Usnic and Barbatic acids present.

Habit: Corticolous

Habitat: Prefers well-exposed windward area in the shola forests at an altitude of 2000m.

Distribution: Tamil Nadu

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 21977c* (KFRI).

Note: This taxon is so far known from the type collection from Tamil Nadu. The present collection from this area shows its extended distribution to this region.

3. *Usnea baileyi* (Stirt.) Zahlbr., Denkschr. Akad. Wiss. Wien, math.-naturw. Cl. 83: 182 1909.

Thallus fruticose, suberect to pendulous, greenish or brownish grey; disc black; branching subsympodial; main branches dichotomous, tapering; lateral branchlets sparse to dense; surface smooth, transversely cracked; pseudocyphellate; pseudocyphellae white, slightly raised; isidiate; isidia dense, simple or branched; soredia absent; medulla dense, red pigmented; axis hollow; sterile.

Usnic acid and Norstictic acid present

Habit: Corticolous

Habitat: Prefers shaded or open areas in the evergreen or shola forests between an altitude of 1000-1650 m.

Distribution: Arunachal Pradesh, Assam, Kerala, Manipur, Meghalaya, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 1650m, *Stephen 22044* (KFRI); *22045* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21090* (KFRI).

4. *Usnea bimolliuscula* Zahlbr., Cat. Lich. Univ. 6: 542. 1930.

Thallus fruticose; pendulous; grey-green to brown; basal disc blackish; branching sympodial; branches terete, tapering, articulate, inflated; lateral branchlets absent; surface smooth, pseudocyphellae absent; isidiate; isidia dense, white, filiform, occurring in groups, rarely develops into lateral elongate branchlets; cortex palisade; medulla arachnioid; axis solid; sterile.

Usnic acid and Stictic acid complex present.

Habit: Corticolous

Habitat: Prefers shaded or open areas in the evergreen and shola forests between an altitude of 1000–2000m.

Distribution: Arunachal Pradesh, Assam, Manipur, Meghalaya, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 22024* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21091b* (KFRI); *21093* (KFRI).

Note: New record to Kerala.

5. *Usnea bornmuelleri* Steiner, Verh. Zool.-bot. Ges. Wein 53: 227. 1903.

Plate XIII. Fig. 3.

Thallus fruticose; erect; grey green; basal disc black; branching sympodial; branches laxly spreading, inflated, tapering, terete; lateral branchlets absent, rarely few; surface papillate; papillae concolorous to thallus, dense, round; pseudocyphellate; pseudocyphellae white, dense on secondary branches, raised; isidiate, isidia, black tipped; soredia absent; cortex double layered; medulla lax; axis solid, white; sterile.

Usnic acid and Psoromic acids present.

Habit: Corticolous

Habitat: Prefers exposed areas in the shola forests between an altitude of 2000-2600m.

Distribution: Arunachal Pradesh

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 22006a* (KFRI); *22009a* (KFRI); *22010a* (KFRI); *22075a* (KFRI); Anaimudi, Munnar, Idukki Dt., 2600m, *Stephen 22107* (KFRI).

Plate-XIII



Fig.1. A. *Sticta henryana*. B. *Sticta praetextata*
C. *Sticta neocaledonica*



Fig.2. *Usnea albopunctata*

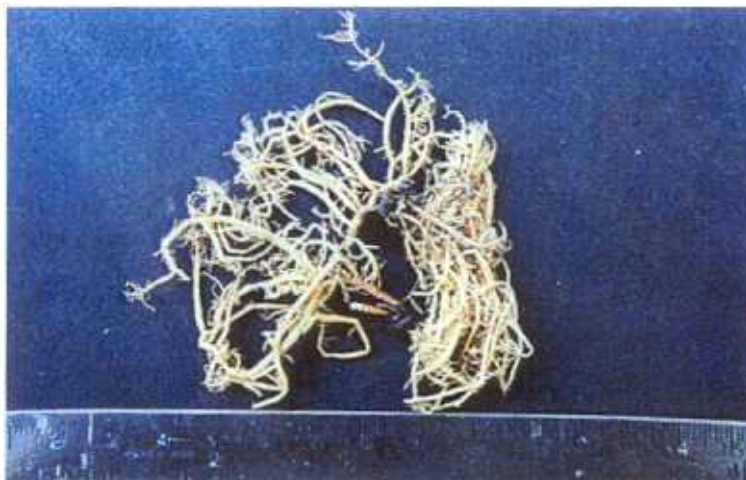


Fig.3. *Usnea bornmuelleri*

Note: New record to Peninsular India.

6. *Usnea cineraria* Mot., Lich. Gen. *Usnea* Stud. Monogr. Pars Syst.: 618. 1936-38.

Plate XIV. Fig. 1.

Thallus fruticose; erect; pale brown to dark brown; basal disc blackish; braching sympodial; branches divergent, flexuose; lateral branchlets dense towards apical region, more or less perpendicular, simple to branched; surface dull to shiny, densely papillate; papillae concolorous to thallus; pseudocyphellae, isidia and soredia absent; cortex palisade like; medulla lax; axis solid; apothecia caesiopruinose, margin ciliate; receptacle reticulately rugose and papillate.

Usnic acid, Norstictic acid and Salacinic acid present.

Habit: Corticolous

Habitat: Prefers ecotone regions in the shola forests at an altitude of 2000m.

Distribution: Arunachal Pradesh, Assam, Sikkim and West Bengal.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 22006c* (KFRI).

Note: New record to Peninsular India.

7. *Usnea complanata* (Mull. Arg.) Mot., Lich. Gen. *Usnea* Stud. Monogr. Pars Syst.: 108. 1936-38.

Thallus fruticose; subpendulous; yellowish brown to dark brown; basal disc black; branching sympodial; branches terete, lax, tapering; lateral branchlets sparse near base, dense upwards, simple to branched; surface epapillate, annularly cracked, pseudocyphellae, isidia and soredia absent; cortex palisade like; medulla lax; axis solid; apothecia scrobiculate, caesiopruinose, margin ciliate; receptacle smooth.

Usnic acid, Galbinic acid, Norstictic acid and Salacinic acids present.

Habit: Corticolous

Habitat: Prefers ecotone regions in the shola forests between an altitude of 1800-2300m.

Distribution: Tamil Nadu

Specimens examined: Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20170* (KFRI); Silent Valley National Park, Munnar, Idukki Dt., 2300m *Stephen 20195* (KFRI).

Note: New record to Kerala.

8. *Usnea corallina* Mot., Lich. Gen. *Usnea* Stud. Monogr. Pars Syst.: 635. 1936-38.

Thallus fruticose; erect, bushy, stiff; pale yellow to yellow-brown; basal disc absent; branching dichotomous; branches tapering, coralloid; lateral branchlets absent; surface annularly cracked, rugose; pseudocyphellae, isidia and soredia absent; cortex semi-prosoplectenchymatous; medulla dense; axis solid, orange yellow; apothecia epruinose to faintly pruinose; margin eciliate; receptacle smooth.

Usnic acid, Galbinic acid, Norstictic acid and Salacinic acid present.

Habit: Terricolous

Habitat: Prefers ecotone regions of the evergreen forests at an altitude of 2000m.

Distribution: Kerala

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 21955b* (KFRI).

Note: Endemic species

9. *Usnea dentritica* Stirt., Scott. Natur. 6: 296. 1882.

Thallus fruticose; erect; greenish brown to brown; basal disc black; branching sympodial; branches tapering, irregularly flexuose; lateral branchlets sparse or absent near base, dense upwards, more or less perpendicular, flexuose; surface annularly cracked, dull, papillate; papillae tubercle like on maturity; pseudocyphellae, isidia and soredia absent; cortex palisade like; medulla dense; axis solid, brownish; apothecia caesiopruinose; margin ciliate; receptacle smooth or papillate or ciliate.

Usnic acid, Alectoric acid, Barbatic acid and Salacinic acid present.

Habit: Corticolous

Habitat: Prefers open areas in the evergreen shola forests and upper canopies in the subtropical forests. Seen between an altitude of 1300-2100m.

Distribution: Arunachal Pradesh, Assam, Meghalaya and West Bengal.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20110* (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 1500m, *Stephen 20053b* (KFRI); 1800m, *Stephen 20060* (KFRI); 1850, *Stephen 20071* (KFRI); Walakkad, Silent Valley National Park, Palakkad Dt., 1300m, *Stephen 20060* (KFRI); 20065 (KFRI); Chinnamala, Anaimudi, Munnar, Idukki Dt., 2100m, *Stephen 22089* (KFRI).

Note: New record to Peninsular India.

10. *Usnea eumitrioides* Mot., Lich. Gen. *Usnea* Stud. Monogr. Pars. Syst.: 322. 1936-38.

Thallus fruticose; erect; yellow brown; basal disc black; branching sympodial; branches divergent, flexuose, tapering; lateral brachlets dense toward basal region, sparse or absent towards apex; isidiate; isidia white, filiform, singly or in groups, dense upwards, often detached leaving white scars; cortex palisade like; medulla more or less dense; axis solid, pale ochraceous; sterile.

Usnic acid and Stictic acid present.

Habit: Corticolous

Habitat: Prefers ecotone region in the shola forests at an altitude of 2000m.

Distribution: Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 21983* (KFRI).

Note: New record to Kerala.

11. *Usnea fischeri* G. Awas., J. Hattori Bot. Lab. 61: 333-421.

Thallus fruticose; erect; yellowish brown to brown; basal disc black; initial branching subdichotomous, bushy; main branches rigid; lateral branches dense, thick, simple to forked; surface cracked, pseudocyphellae and isidia and soredia absent; cortex yellowish, semi-prosenchymatous; medulla compact, dense; axis irregularly angular in cross-section, solid; apothecia terminal; disc concave to plane, caespruinose, margin wavy, ciliate, simple; receptacle smooth.

Usnic acid and Stictic acid present.

Habit: Corticolous

Habitat: Prefers ecotone regions of the shola forests between an altitude of 1800-2300m.

Distribution: Kerala

Specimens examined: Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20177* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 20193* (KFRI); Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 21977b* (KFRI).

Note: Endemic species

12. *Usnea fragilis* Stirt., Scott. Nature. 6: 297. 1882.

Thallus fruticose; erect to pendulous, fragile to elastic or cartilaginous; yellowish green to brown; basal disc black; branching sympodial; branches tapering; surface of basal part irregularly to longitudinally fissured, rugose, annularly cracked, pseudocyphellae and soredia absent; surface of apical parts smooth to rough, minutely tubercled, pseudocyphellate; pseudocyphellae dense becoming sorediate or rarely pseudoisidiate; lateral branches sparse to dense; medulla dense, red pigmented in outer region; axis solid, sterile.

Usnic and Barbatic acid present.

Habit: Corticolous

Habitat: Prefers mostly open ecotone regions in the shola forests or upper canopy of the evergreen forests. Seen between an altitude of 900-2300m.

Distribution: Arunachal Pradesh, Assam, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 1650m, *Stephen 22043* (KFRI); 22050a (KFRI); 2000m, *Stephen 21981a* (KFRI); *21995b* (KFRI); 22000 (KFRI); Anaimudi slope, Munnar, Idukki Dt., 2300m *Stephen 22116a* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21094* (KFRI); *21097* (KFRI); Ranimedu, Nelliampathy, Palakkad Dt., 950m, *Stephen 8927* (KFRI); Karimala, Parambikulam, Palakkad Dt., 1400m, *Stephen 22168* (KFRI).

Note: New record to Kerala

13. *Usnea gigas* Mot., Lich. Gen. *Usnea* Stud. Monogr. Pars Syst.: 400. 1936-38.

Thallus fruticose; pendulous; grey-green, basal disc absent; branching filamentous; branches angular in base, rounded apically, tapering; lateral branchlets dense, perpendicular; surface ridged, transversely cracked, papillate; papillae raised minute, white, pseudocyphellae and isidia rarely present; soredia absent; cortex palisade like; medulla dense; axis centrally dilacerate, inner part pigmented; sterile.

Usnic acid and Stictic acid complex present.

Habit: Corticolous

Habitat: Prefers ecotone trees in the shola forests at an altitude of 2000m.

Distribution: Arunachal Pradesh and Tamil Nadu.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, Stephen 21995a (KFRI).

Note: New record to Kerala. All the specimens so far collected from India are reported to be saxicolous in nature, but the specimen presently collected is found to be corticolous in nature.

14. *Usnea himalayana* Bab., Hook. J. Bot. 4: 243. 1852.

Thallus fruticose; pendulous; greyish green to yellow-brown; basal disc black; branching dichotomous; branches articulate, inflated, tapering; lateral branchlets absent; surface annularly cracked, pseudocyphellate; pseudocyphellae orbicular to linear elongate, plane; soredia and isidia absent; medulla arachnioid; axis solid; apothecia rare, caespruinose, margin ciliate.

Usnic and Salacinic acid present.

Habit: Corticolous, very rarely saxicolous.

Habitat: Mostly prefers ecotone trees in the shola forests or upper canopy branches of trees in the evergreen forests. Seen between an altitude of 1000- 2300m.

Distribution: Himachal Pradesh, Manipur, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20111* (KFRI); Chinnamala, Anaimudi, Munnar, Idukki Dt., 2100m, *Stephen 22093* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21027* (KFRI); *21028* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21089b* (KFRI); Manavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 21972* (KFRI); *21976* (KFRI); *21978* (KFRI); *21980b* (KFRI); *21994b* (KFRI).

Note: New record to Kerala.

15. *Usnea indica* Mot., Lich. Gen. *Usnea* Stud. Monogr. Pars Syst., 380. 1936-38.

Plate XIV. Fig. 2.

Thallus fruticose; pendulous, rigid; greyish green; basal disc absent; branching filamentous; main branches terete, usually broader at dichotomy, tapering; lateral branchlets perpendicular, flexuose, broken, delicate; surface annularly or irregularly cracked; dull or shiny; pseudocyphellate; pseudocyphellae minute, papiliform; soredia and isidia absent; cortex semi-prosoplectenchymatous; medulla dense; axis solid, brown pigmented; sterile.

Plate-XIV



Fig.1. *Usnea cineraria*

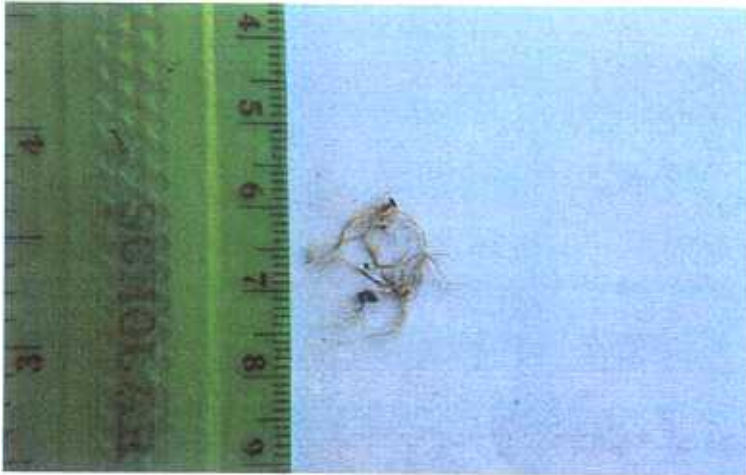


Fig.2. *Usnea indica*



Fig.3. *Usnea misamisensis*

Usnic and Stictic acid complex present.

Habit: Corticolous

Habitat: Prefers open trees in ecotone regions in the shola forests at an altitude of 2000m.

Distribution: North West Himalaya

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 21954b* (KFRI).

Note: New record to Peninsular India. This taxon has been hitherto known only from its type locality (N.W. Himalaya).

16. *Usnea maculata* Stirt., Scott. Natur. 6:293. 1882.

Thallus fruticose; erect; yellow to brown; basal disc black; branching sympodial; branches terete, tapering; lateral branchlets sparse in basal region, absent towards apical region; surface annularly cracked, isidiate; isidia white, filiform, single or in groups; soredia absent; cortex red pigmented; medulla dense; axis solid, white; apothecia caespruinose, margin ciliate; receptacle smooth.

Usnic acid and Protocetraric acid present.

Habit: Corticolous

Habitat: Prefers shaded areas in the subtropical/shola forests at an altitude between 1200-1700m.

Distribution: Tamil Nadu

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 1650m, *Stephen 22040* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21169* (KFRI).

Note: New record to Kerala.

17. *Usnea misamisensis* (Vain.) Mot., Lich. Gen. *Usnea* Stud. Monogr. Pars Syst.: 418. 1936-38.

Plate XIV. Fig. 3.

Thallus fruticose; pendulous; pale green to grayish green; basal disc absent; branching filamentous; branches intertwined; cortex annularly cracked to areolate; lateral branchlets sparse to dense; surface annularly cracked; minute verrucose, soralia sparsely distributed; pseudocyphellae and isidia absent; medulla dense; axis solid, reddish brown; sterile.

Usnic and Stictic acid complex present.

Habit: Corticolous

Habitat: Prefers ecotone trees in the evergreen shola forests or upper canopy branches of trees in the subtropical / shola forests. Seen between an altitude of 1000-2000m.

Distribution: Arunachal Pradesh, Assam and Bihar.

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 22020b* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21091a* (KFRI); Muthikulam, Siruvani, Palakkad Dt., 1225m, *Stephen 21168* (KFRI).

Note: New record to Peninsular India.

18. *Usnea nepalensis* Awas., J. Hattori Bot. Lab. 61: 333-421.

Plate XV. Fig. 1.

Thallus fruitcose; procumbent to pendulous; yellowish brown to brown; basal disk black; branching sympodial to subsympodial; branches terete; secondary branches tapering; lateral branchlets dense near basal region, sparse in apical region; surface cracked, papillate; papillae minute; verrucose-tuberculate, pseudocyphellate; pseudocyphellae white, round, dense in younger branches; isidiate; isidia white, elongate; soredia absent; cortex prosoplectenchymatous; medulla dense; axis white, solid; apothecia caespruinose; disc concave to plane; margin ciliate; receptacle smooth to pseudocyphellate.

Usnic acid present

Habit: Corticolous

Habitat: Prefers ecotone trees in the shola forests at an altitude of 2000m.

Distribution: Sikkim and Uttar Pradesh

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 22002* (KRI); *22005* (KFRI) *22006b* (KFRI); *22010c* (KFRI); *22075b* (KFRI); *21973* (KFR); *21977d* (KFRI); Sispara, Silent Valley, Palakkad Dt., 1900m *Stephen 22172* (KFRI); *22173* (KFRI).

Note: New record to Peninsular India.

19. *Usnea nilgirica* G. Awas., J. Hattori Bot. Lab. 16: 333-423.

Thallus fruticose; pendulous; red brown to brown; soft; basal disc brown black; branching dichotomous; primary axis constricted at base, inflated, smooth to faveolate, pseudocyphellate; secondary branches simple or dichotomously branched, articulate and inflated; papillate; papillae minute, dense; pseudocyphellate and isidiate; soredia absent; cortex yellow; medulla wide, arachnioid; axis solid; sterile.

Usnic acid, Barbatic acid and Fumaroprotocetraric acid present.

Habit: Corticolous

Habitat: Prefers ecotone and shola forests or riverine areas in the evergreen forests between an altitude of 750-2300m.

Distribution: Tamil Nadu

Specimens examined: Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 20192* (KFRI); Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 21988* (KFRI); *21999* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21105* (KFRI); Riverine area, Siruvani, Palakkad Dt., 750m, *Stephen 21176a* (KFRI).

Note: New record to Kerala. Hitherto this species has been known from its type collection from Nilgiri Hills, Tamil Nadu.

20. *Usnea orientalis* Mot., Lich. Gen. *Usnea* Stud. Monogr. Pars Syst.: 547. 1936-38.

Plate XV. Fig. 2.

Thallus fruticose; erect; greenish grey; basal disk black; branching sympodial; branches irregularly swollen, annularly cracked, tapering; lateral branchlets sparse to dense; surface waxy in appearance, papillate; papillae minute, dense, elongate, concolorous to thallus; pseudocyphellae, isidia and soredia absent; medulla arachnioid; axis solid; apothecia caespruinose, margin ciliate; receptacle rugose, papillate and ciliate.

Usnic acid and Salacinic acid present.

Habit: Corticolous

Habitat: Prefers evergreen shola trees or isolated trees of the grasslands between an altitude of 2000-2300m.

Distribution: Arunachal Pradesh, Manipur and Uttar Pradesh.

Plate-XV



Fig.1. *Usnea nepalensis*



Fig.2. *Usnea orientalis*



Fig.3. *Usnea pangiana*

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20101* (KFRI); *20131* (KFRI); *20132* (KFRI); *20135* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 20194* (KFRI); Anaimudi slope, Munnar, Idukki Dt., 2300m, *Stephen 22114a* (KFRI); Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 21990* (KFRI).

Note: New record to Peninsular India.

21. *Usnea pangiana* Stirt., Scott. Natur. 7:77. 1883.

Plate XV. Fig. 3.

Thallus fruticose, pendulous, rigid; pale yellowish brown; basal disc black; branching subsympodial; branches convergent or slightly divergent, tapering, undulate-flexuose; lateral branchlets sparse to dense, simple or branched; surface annularly cracked, densely verruculose, pseudocyphellate; pseudocyphellae white, producing isidia; cortex palisade like; medulla dense; axis solid; sterile.

Usnic acid, Barbatic acid, Diffractaic acid and Salacinic acid present.

Habit: Corticolous

Habitat: Prefers mostly ecotone regions in the shola forests at an altitude of 2000m.

Distribution: Assam, Sikkim, Meghalaya, Uttar Pradesh and West Bengal

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2100m, *Stephen 22075c* (KFRI); *22076* (KFRI); *22077* (KFRI); *22078b* (KFRI); *21984* (KFRI); *21992* (KFRI).

Note: New record to Peninsular India.

22. *Usnea pectinata* Tayl., Hook. London J. Bot. 6:191. 1847.

Thallus fruticose, pendulous; pale yellow to yellowish grey; basal disc black; branching filamentous; branches terete, slightly tapering, with or without cortex, cortex when present smooth, annularly cracked, some time cortex evanescent; lateral branchlets dense, perpendicular, flexuose, simple or dichotomously branched; surface epapillate, verrucae, soredia and isidia absent; medulla dense; axis solid; sterile.

Usnic acid and Stictic acid complex present.

Habit: Corticolous

Habitat: Prefers trees of the grassland at an altitude of 2000m.

Distribution: Arunachal Pradesh

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 22006d* (KFRI); 2100m, *Stephen 22078a* (KFRI).

Note: New record to Peninsular India.

23. *Usnea picta* (Steiner) Mot., Lich. Gen. *Usnea* Stud. Monogr. Pars Syst.: 325. 1936-38.

Thallus fruticose; erect; yellowish brown; branching sympodial; main branches terete, divergent, rigid, slightly inflated, articulate, tapering; lateral branchlets sparse to dense; surface shiny, annularly cracked, papillate-tuberculate; papillae minute; tubercles pseudocyphellate; soredia and isidia absent; medulla dense; axis solid; apothecia caesiopruinose, margin densely ciliate, receptacle smooth.

Usnic acid and Stictic acid complex present.

Habit: Corticolous

Habitat: Prefers ecotone regions in the shola forests between an altitude of 1800- 2300m.

Distribution: Tamil Nadu

Specimens examined: Anaimudi slope, Munnar, Idukki Dt., 2300m, *Stephen 22113* (KFRI); Mannavan Shola, Marayoor, Idukki Dt., 1800m, *Stephen 22121b* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21012* (KFRI); Pettimudi, Munnar, Idukki Dt., 1800m, *Stephen 20171* (KFRI); *20172* (KFRI).

Note: New record to Kerala.

24. *Usnea pictoides* G. Awas., J. Hattori Bot Lab. 61: 333-423. 1986.

Thallus fruticose; erect, rigid; dark brown; basal disc black; branching sympodial; branches divergent; narrower toward basal and apical region; lateral branchlets sparse to dense; surface annularly cracked, densely tuberculate, soredia and isidia absent; cortex palisade like; medulla lax; axis solid, yellowish; apothecia caespruinose, margin ciliate, receptacle smooth to reticulately tubercled, pseudocyphellate.

Usnic acid present

Habit: Corticolous

Habitat: Prefers trees near the margin of shola forests between an altitude of 1800-2300m.

Distribution: Tamil Nadu

Specimens examined: Sispara, Silent Valley National Park, Palakkad Dt., 1850m, *Stephen 20074* (KFRI); Anaimudi slopes, Munnar, Idukki Dt., 2300m, *Stephen 22116b* (KFRI).

Note: New record to Kerala. Hitherto this species is so far known from its type locality (Tamil Nadu).

25. *Usnea pseudosinensis* Asah. in Hara, Fl. Eastern Himalaya, Lichenes: 600. 1966.

Plate XVI. Fig. 1.

Thallus fruticose; erect; yellow brown; basal disc black; branching sympodial; main branches irregularly inflated and articulate, tapering, cortex annularly cracked; lateral branchlets dense; surface papillate; papillae irregular to round, concolorous to thallus, pseudocyphellae, soredia and isidia absent; medulla arachnoid; axis solid; apothecia caespruinose, margin ciliate; receptacle smooth to papillate.

Usnic acid, Barbatic acid and Psoromic acid present.

Habit: Corticolous

Habitat: Prefers ecotone regions of the shola forests at an altitude of 2000m.

Distribution: West Bengal

Specimens examined: Mannavan Shola, Marayoor, Idukki Dt., 2000m, *Stephen 22009b* (KFRI).

Note: New record to Peninsular India.

26. *Usnea rigidula* (Stirt.) G. Awas., Curr. Sci. 54(7): 353. 1985.

Thallus fruticose, pendulous, rigid, pale brown to dark brown; branching dichotomous; branches flexuose or curved, divergent, slightly thickened, tapering; lateral branchlets absent; surface shining, with annular longitudinal, irregular reticulate cracks, pseudocyphellate; pseudocyphellae white, dot-like to linear, plane; soredia and isidia absent; cortex palisade-like; medulla dense; axis solid or lacerate; apothecia caesiopruinose, margin ciliate; receptacle smooth.

Usnic acid and Salacinic acid present.

Habit: Corticolous, rarely saxicolous.

Habitat: Prefers moist areas in the evergreen/subtropical/shola forests between an altitude of 1000-2300m.

Distribution: Tamil Nadu and Kerala.

Specimens examined: Sispara, Silent Valley National Park, Palakkad Dt., 1500m, *Stephen 20053a* (KFRI); Walakkad, Silent Valley National Park, Palakkad Dt., 1050m, *Stephen 20078* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 20197* (KFRI); Mannavan Shola, Maryoor, Idukki Dt., 2000m, *Stephen 22008* (KFRI); *21953* (KFRI); *21980a* (KFRI); *21981b* (KFRI); *21994a* (KFRI); *21997* (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 1950m, *Stephen 2235* (KFRI); *22137* (KFRI).

27. *Usnea rubicunda* Stirt., Scott. Natur. 6: 102. 1881

Thallus fruticose, erect, procumbent to pendulous, red to reddish brown near base, greenish, yellowish to brownish red upwards, basal disc black, branching sub sympodial to sympodial, dense, bushy; branches tapering, with densely dichotomously divided apices; cortex orange red pigmented; lateral branchlets sparse to dense, surface densely pseudocyphellate; pseudocyphellae white, producing isidia; isidia white, singly or in groups; soredia absent; medulla dense; axis solid, with scattered brownish pigmentation; sterile.

Usnic acid and Stictic acid present.

Habit: Corticolous

Habitat: Prefer ecotone regions of the shola forests between an altitude of 1600-2300m.

Distribution: Arunachal Pradesh, Assam, Manipur, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20118* (KFRI); Mannavan shola, Marayoor, Idukki Dt, 2000 m, *Stephen 22010b* (KFRI); 1650m, *Stephen 22063* (KFRI); *22065* (KFRI); Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 21001* (KFRI).

Note: New record to Kerala.

28. *Usnea sordida* Mot., Lich. Gen. *Usnea* Stud. Monogr. Pars Syst.: 619. 1936-38.

Plate. XVI. Fig. 2A.

Thallus fruticose, erect, greenish brown to brown; basal disc black; branching sympodial; branches articulate, inflated, tapering; lateral branchlets sparse; surface waxy in appearance, papillate, pseudocyphellate; pseudocyphellae white, slightly raised, round,

oblong effigurate; soredia and isidia absent; cortex annularly cracked; medulla lax; axis solid; apothecia caesiopruinose, margin ciliate; receptacle slightly rugose.

Usnic acid and Salacinic acid present.

Habit: Corticolous

Habitat: Prefers shola forest at an altitude of 1850 m.

Distribution: North Western Himalaya, Sikkim and West Bengal.

Specimens examined: Sispara, Silent Valley National Park, Palakkad Dt., 1850 m, *Stephen 20075* (KFRI).

Note: New record to Penninsular India.

29. *Usnea spinosula* Stirt., Scott. Natur. 6: 107. 1881.

Thallus fruticose, erect, brown; basal disk black; branching sympodial; main branches terete; lateral branchlets and spinules present; spinules in tufts or solitary; surface papillate; papillae initially minute, concolorous to thallus; pseudocyphellae, soredia and isidia absent; cortex annularly cracked; medulla dense; arachnioid; axis solid; apothecia caespruinose, margin and receptacle ciliate.

Usnic and Stictic acid complex present.

Habit: Corticolous

Habitat: Prefers moist shady regions in the ecotone areas or between an altitude of 1800-2100m.

Distribution: Tamil Nadu

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20138* (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 1800m, *Stephen 20061* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 21998* (KFRI).

Note: New record to Kerala. Hitherto this endemic species is so far known from its type locality (Tamil Nadu).

30. *Usnea splendens* Stirt., Scott. Natur. 6: 296.1882.

Thallus fruticose, erect, bushy, brown to brown black; basal disc black; branching sympodial; major branches tapering; lateral branchlets sparse to dense; surface papillate; papillae minute; pseudocyphellate; pseudocyphellae white, minute, round, irregularly distributed; soredia and isidia absent; cortex annularly cracked at intervals; medulla

arachnoid; axis solid; apothecia caespruinose, margin ciliate; receptacle smooth to papillate and ciliate.

Usnic acid and Salacinic acid present.

Habit: Corticolous

Habitat: Prefers moist humid areas in the evergreen as well as in the shola forests between an altitude of 1100-1800m.

Distribution: Himachal Pradesh, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 22123* (KFRI); Walakkad, Silent Valley National Park, Palakkad Dt., 1100m, *Stephen 22156* (KFRI).

Note: New record to Kerala.

31. *Usnea stigmatoides* G. Awas., J. Hattori Bot. Lab. 61: 333-423. 1986.

Thallud fruticose, procumbent to pendulous, yellowish brown, basal disc black; branching dichotomous; branches terete, tapering; lateral branchlets absent; surface annularly cracked; pseudocyphellae sparse to dense, round, with or without isidia; isidia white, filiform, elongate, in groups; soredia absent; cortex palisade like; medulla dense; axis solid, white; sterile.

Usnic acid and Stictic acid complex present.

Habit: Corticolous

Habitat: Prefers ecotone regions and upper canopy branches of trees in the shola forests/evergreen forests between an altitude of 900-2000m.

Distribution: Tamil Nadu

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 22003* (KFRI); *21974* (KFRI); *21985*(KFRI); 1650m, *Stephen 22062* (KFRI); *22064* (KFRI); Kattapara shola, Idukki Dt., 925m, *Stephen 21831* (KFRI).

Note: New record to Kerala. Hitherto this endemic species is so far known from its type locality (Tamil Nadu).

32. *Usnea subchalybeae* Zahlbr., Annal. Mycolog. 7: 475. 1909.

Plate XVI. Fig. 2B.

Thallus fruticose; erect, pale yellow to light brown; branching sympodial; main branches terete, more or less flexuose, inflated in the middle, tapering; lateral branchlets sometimes present; surface annularly cracked, densely isidiate; isidia minute, solitary, filiform, black tipped; pseudocyphellae and soredia absent; cortex semiprosoplectenchymatous; medulla dense; axis solid, white; sterile.

Usnic acid present.

Habit: Corticolous

Habitat: Prefers trees in the ecotone region between an altitude of 2000-2600m.

Distribution: Bababrodans

Specimens examined: Anaimudi, Munnar, Idukki Dt., 2600m, *Stephen 22108* (KFRI); Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 22001c* (KFRI).

Note: New record to Peninsular India. Hitherto this endemic species is so far known from its type locality (Baba brodans).

33. *Usnea subflorida* (Zahlbr.) Mot., Lich. Gen. *Usnea* Stud. Monogr. Pars Syst.: 335. 1936-38.

Thallus fruticose, erect, reddish brown; basal disc black; branching sympodial; branches terete; tapering; lateral branchlets sparse to dense; surface papillate and tuberculate, annularly cracked, tubercles pseudocyphellate; soredia and isidia absent; subcortical part of medulla red pigmented; axis solid, white; apothecia caespruinose, margin ciliate; receptacle smooth to papillate and ciliate.

Usnic acid, Protocetraric acid and Barbatic acid present.

Habit: Corticolous

Habitat: Prefers margin of the shola forests between an altitude of 1900-2100m.

Distribution: Tamil Nadu

Specimens examined: Eravikulam National Park, Idukki Dt., 2100m, *Stephen 20130* (KFRI); Mannavan Shola, Idukki Dt., 2000m, *Stephen 21977a* (KFRI); Sispara, Silent Valley National Park, Palakkad Dt., 1950m, *Stephen 22132* (KFRI); *22140* (KFRI).

Note: New record to Kerala.

Plate-XVI

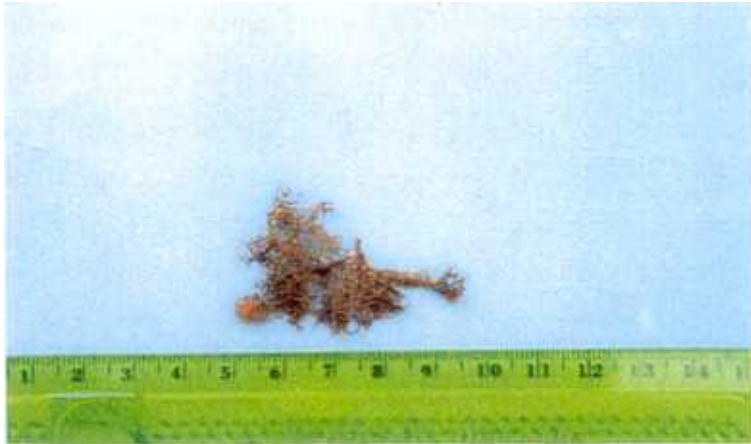


Fig.1. *Usnea pseudosinensis*



Fig.2. A. *Usnea sordida*

B. *Usnea subchalybeae*



Fig.3. *Usnea thomsonii*

34. *Usnea subfloridana* Stirt., Scott. Natur. 6: 294. 1882.

Thallus fruticose; erect, brown, basal disc black; branching sympodial; main branches terete; lateral branchlets divergent in lower part, convergent in upper part, dense, simple to branched; surface cracked, papillate; papillae minute, numerous, concolorous to thallus; sorediate; soralia excavate, soredia granular; isidiate, isidia on soralia; medulla arachnioid; axis solid; sterile.

Usnic acid and Norstictic acid present

Habit: Corticolous

Habitat: Prefers ecotone regions in the shola forests at an altitude of 2000m.

Distribution: Himachal Pradesh, North Western Himalaya and Uttar Pradesh.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 21979* (KFRI).

Note: New record to Peninsular India.

35. *Usnea thomsonii* Stirt., Scott. Natur. 6: 107. 1882.

Plate XVI. Fig. 3.

Thallus fruticose; erect, yellowish brown; basal disc black; branching sympodial; main branches terete, stiff and divergent, articulate and inflated; cortex smooth; lateral branchlets dense, papillate; papillae round to slightly elongate; pseudocyphellate; pseudocyphellae white, raised; soredia and isidia absent; cortex double layered; medulla arachnioid; axis solid; apothecia caespruinose, margin ciliate; receptacle smooth to densely papillate-rugose.

Usnic acid present

Habit: Corticolous

Habitat: Prefers moist areas in the shola forests at an altitude of 2300m.

Distribution: Arunachal Pradesh, Uttar Pradesh and West Bengal.

Specimens examined: Silent Valley Estate, Munnar, Idukki Dt., 2300m, *Stephen 20199* (KFRI).

Note: New record to Peninsular India.

36. *Usnea undulata* Stirt., Scott. Natur. 6: 104. 1882.

Thallus fruticose, erect, procumbent to pendulous; greyish brown; basal disk black; branching sympodial to subsympodial; branches tapering; lateral branchlets sparse to dense; surface pseudocyphellate; pseudocyphellae white; isidiate; isidia filiform, single or in groups; epillate, tubercles absent; soredia absent; medulla lax; axis solid, white; sterile.

Usnic acid, Galbinic acid, Norstictic acid and Salacinic acid present.

Habit: Corticolous

Habitat: Prefers moist areas in margin or upper canopy of the evergreen as well as the shola forests between an altitude of 1000-2000m.

Distribution: Karnataka, Kerala, Meghalaya, Tamil Nadu, Uttar Pradesh and West Bengal.

Specimens examined: Mannavan shola, Marayoor, Idukki Dt., 2000m, *Stephen 22001a* (KFRI); 1650m, *Stephen 22050b* (KFRI); Pothumala, Nelliampathy, Palakkad Dt., 1000m, *Stephen 21089a* (KFRI).

37. *Usnea vegae* Mot., Lich. Gen. *Usnea* Stud. Monogr. Pars Syst.: 636. 1936-

Thallus fruticose; erect or pendulous; more or less rigid pale brown; basal disc black; branching dichotomous; gradually tapering; lateral branchlets absent; surface annularly or irregularly cracked, sparsely papillate; papillae dense in younger branches; pseudocyphellae, isidia and soredia absent; cortex palisade like; medulla dense; axis solid; sterile.

Usnic acid and Norstictic acid present

Habit: Corticolous

Habitat: Prefers upper canopy branches of trees in the evergreen/shola forests between an altitude of 1000-2300m.

Distribution: Sri Lanka

Specimens examined: Sispara, Silent valley National Park, Palakkad, Dt., 1850m, *Stephen 20073* (KFRI); Silent Valley Estate Munnar, Idukki Dt., 2300m, *Stephen 20198* (KFRI); Walakkad, Silent valley National park, Palakkad, Dt., 1100m, *Stephen 8906* (KFRI).

Note: New record to India. So far, this species is known from Sri Lanka. However, G. Awasthi includes this species in her enumeration of Indian *Usnea* on the assumption that this species could possibly occur in south India. Though, she herself had not collected this species. The present collection confirms her assumption and supports her view.

38. *Usnea vulneraria* Mot., Lich. Gen. Usnea Stud. Monogr. Pars. Syst., 308. 1936-1938.

Thallus fruticose, erect, brown; basal disc blackish; thallus dichotomously branched, branches short, divergent, upto 2mm in diameter, slightly inflated; lateral branchlets tapering, branched; isidiate; isidia white, raised; cortex semi-prosoplectenchymatous; medulla red; axis solid; apothecia caesiopruinose; margin ciliate.

Usnic acid, norstictic acid and salacinic acid present.

Habit: Corticolous

Habitat: Prefers semi shaded areas of the evergreen forests at an altitude of 1000m.

Distribution: Tamil Nadu

Specimen examined: Pothumala, Nelliampathy, Palakkad Dt., 1000m, Stephen & Viswam 008921 (KFRI).

Note: New record to Kerala. Hither to this endemic species is so far known from its type locality (Tamil Nadu).

39. *Usnea sp.* 1

Thallus fruticose, greenish grey, up to 6.5cm long, branching sympodial; main branches terete, flexuose, tapering; lateral branchlets present; surface plane, pseudocyphellate; pseudocyphellae linear; isidiate; isidia simple; soredia absent; papillate; tubercled; medulla red pigmented in the upper region; axis lacerate, white; sterile.

Habit: Corticolous

Habitat: Prefers exposed regions in the evergreen forests at an altitude of 750m.

Specimens examined: Riverine area, Siruvani, Palakkad Dt., 750m, Stephen 21176b (KFRI).

Note: Allied to *Usnea fragilis* but differs in having lacerate axis and plane thallus.

40. *Usnea sp.* 2

Thallus fruticose, yellowish grey to yellowish brown; up to 4.5cm long; branching sympodial; main branches tapering, inflated centrally; lateral branchlets lax; surface plane, pseudocyphellate, isidiate; isidia simple; papillae and tubercles absent; medulla lax; axis solid; colourless; sterile.

Habit: Corticolous

Habitat: Prefers upper canopy branches of trees in the evergreen forests at an altitude of 950m.

Specimens examined: Ranimedu, Nelliampathy, Palakkad Dt., 950m, *Stephen* 8929 (KFRI).

Note: This taxon is closely allied to *Usnea albopunctata* but differs in having the inflated branches.

Family Verrucariaceae

Genus *Dermatocarpon* (Eschw.) Th. Er.

The genus *Dermatocarpon* is distributed in dry temperate regions of the world. Awasthi (1965) included 5 species of *Dermatocarpon* from India in his catalogue. Awasthi and Upreti (1985) studied the Indian species of *Dermatocarpon* and recorded 4 species and 2 varieties on delimitation of varietal status of some species earlier recorded. Later, Awasthi (1988) keyed out 4 species of *Dermatocarpon* from India. During the present study one species was collected from Kerala region.

1. *Dermatocarpon vellereum* Zschacke, Rabenh. Krypto Flora 9(1): 638. 1934.

Thallus foliose, monophyllous, with several lobes, irregularly expanding sometimes minute secondary lobes present at the margin of lobes; upper surface rough, plane; lower side black, densely rhizinate, rhizines thick.

Habit: Saxicolous

Habitat: Prefers exposed water-dripping rocks at an altitude of 1800m.

Distribution: Himachal Pradesh, Jammu & Kashmir, Rajasthan, Tamil Nadu and Uttar Pradesh.

Specimens examined: Rajamalai, Munnar, Idukki Dt., 1800m, *Stephen* 22171 (KFRI).

Note: New record to Kerala.

5.3 . Species Composition

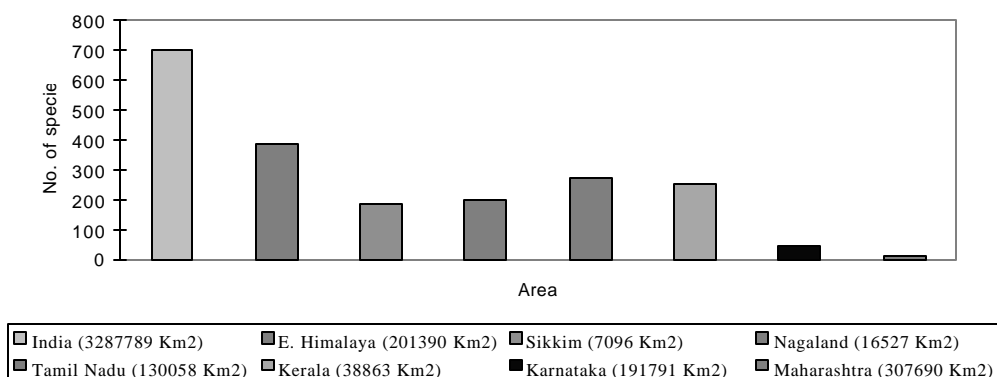
Field explorations were conducted during 1997-2000. Eighteen different sites across Kerala were surveyed during this period. The areas include different types of vegetation and different altitudes. Major habitat level, type of substratum, altitudinal gradients were noted for each specimen. Corticolous species were sampled only up to 3 meter from ground level. Many canopy species were encountered through collection of fallen branches and twigs on the ground.

During the present study, 18 different localities such as Thirunelly, Pakshipadalam, part of Silent Valley National park, part of Parambikulam Wildlife Sanctuary, Nelliampathy hills, Malleswaramudi, Siruvani hills, New Amarambalam Reserve Forests, Kakki, Moozhiyar, part of Eravikulam National Park, Anaimudi hills, Mannavan shola, Pettimudi-Rajamallai area, Lochart-Chochanad-Kallar Estate, Silent Valley Estate, Kattapara shola, Uppupara (Periyar Tiger Reserve) were surveyed for the macrolichens.

5.3.1. *Richness of species*

Since many of the Indian phytogeographic regions so far under explored for the lichen inventory, details regarding the lichens of some areas are available. Lichens of Eastern Himalayan region, Lichens of Sikkim, Nagaland, Tamil Nadu, Karnataka and Maharashtra are now known (Singh & Sinha, 1994; Singh, 1999; Sinha, 1999; Kumar & Stephen, 1999). Evidently, the present sampling has yielded a higher level of species diversity in relation to the area sampled compared to the reports from other areas from India. Thus, the 253 species recorded from this study area form 36 per cent of the estimated macrolichens of India. Fig. 1 shows the level of species richness of macrolichens in the present study area along with different part of the country where studies on macrolichens have been undertaken.

Fig.1. Levels of species richness in different parts of the country



Regarding the 18 various localities surveyed during the study, Mannavan shola of Idukki district holds large number of lichens in its montane shola and grassland vegetation (Fig. 2). Evergreen and subtropical forests of Siruvani-Muthikulam hills inhabits over 60 lichen species followed by Sient Valley National Park (52 species), Nelliampathy hills (47 species), Silent Valley Estate (39 species), Uppupara area of Periyar Tiger Reserve (39 species), Eravikulam National Park (34 species), New Amarambalam Reserve Forests (32 species), etc. Table 3 shows the numerical representation of macro lichens in each locality.

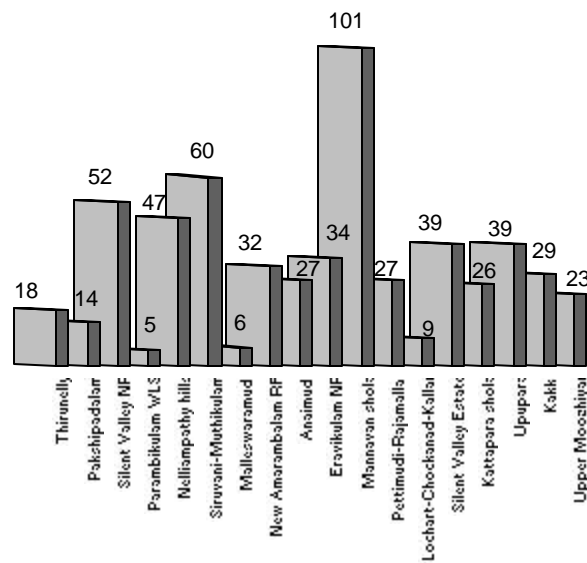
Table 4. No. of macrolichens species selected in each locality

Locality	District	No. of Species
Thirunelly	Wayanad	18
Pakshipadalam	Wayanad	14
Silent Valley NP	Palakkad	52
Parambikulam WLS	Palakkad	5
Nelliampathy hills	Palakkad	47
Siruvani-Muthikulam	Palakkad	60
Malleswaramudi	Palakkad	6
New Amarambalam RF	Malappuaram	32
Anaimudi	Idukki	27
Eravikulam NP	Idukki	34
Mannavan shola	Idukki	101
Pettimudi-Rajamallai	Idukki	27
Lochart-Chockanad-Kallar	Idukki	9
Silent Valley Estate	Idukki	39
Kattapara shola	Idukki	26

UpPupara	Idukki	39
Kakki	Pathanamthitta	29
Upper Moozhiyar	Pathanamthitta	23

In all the above localities majority of lichens are corticolous. Only few species are exclusively saxicolous or terricolous. Most of the species are found in more than one substratum.

Fig. 2. Pattern of abundance of species in each locality in the study area



During the study macrolichens were observed in different macrohabitats such as evergreen forests, grasslands, subtropical forests and montane shola forests. Dry deciduous forests, moist deciduous forests, semi-evergreen forests were excluded as they inhabit very little macrolichens or they are absent. Based on the field observations each type of vegetation and its lichens are discussed here.

5.3.1.1. Evergreen forests

These types of forests are seen between 750-1200m altitude. About 386 specimens were collected from this macrohabitat. The study revealed that there are 133 macrolichen species under 32 genera belonging to 13 families in these forests. Most of the species are found to be corticolous in nature and saxicolous/terricolous species are very little. Species like *Bulbothrix isidiza*, *Cladonia uncialis*, *Dirinaria consimilis*, *Heterodermia speciosa*, *Lobaria retigera*, *Parmelina manipurensis*, *Phaeophyscia hispidula* possess saxicolous substratum. Corticolous species are found attached with the arboreal elements like *Palaquim ellipticum*, *Cinnamomum sp.*, *Olea dioica*, *Elaeocarpus sp.*, *Myristica dactyloides*, *Heritiera papilio*, *Ficus sp.*, *Syzygium sp.*, *Persea macrantha*, *Mallotus sp.*, etc. Genera like *Heterodermia*, *Hypotrachyna*, *Leptogium*, *Parmelina*, *Parmotrema*, *Sticta* are found to be dominant genera and species like *Heterodermia incana*, *Heterodermia hypocaustia*, *Heterodermia pseudospeciosa*, *Heterodermia dissecta*, *Heterodermia togashii*, *Hypotrachyna awasthii*, *Hypotrachyna infirma*, *Parmelina wallichiana*, *Parmotrema tinctorum* are found to be in common occurrence. Riverine trees inhabit large number of *Usnea* in its upper canopy branches. Species like *Leprocaulon pseudoarbuscula*, *Stereocaulon austroindicum*, *Pseudocyphellaria aurata*, *Pseudocyphellaria crocata* are found to be in rare occurrence.

About 62 species of macrolichens are found exclusive to this vegetation. Table 4 gives the species, which are found exclusive to evergreen forests.

Table 5. Macrolichen species found exclusive to evergreen forests in the study area

Sl. No	Species	Family
1.	<i>Bulbothrix bulbochaeta</i>	Parmeliaceae
2.	<i>Bulbothrix isidiza</i>	Parmeliaceae
3.	<i>Cladonia cartilaginea</i>	Cladoniaceae
4.	<i>Cladonia farinosa</i>	Cladoniaceae
5.	<i>Cladonia uncialis</i>	Cladoniaceae
6.	<i>Coccocarpia palmicola</i>	Coccocarpiaceae
7.	<i>Collema coglomerata var. crassiusculum</i>	Collemataceae
8.	<i>Collema glaucophthalmum</i>	Collemataceae
9.	<i>Collema tenax</i>	Collemataceae
10.	<i>Dirinaria consimilis</i>	Physciaceae
11.	<i>Heterodermia aglutinata</i>	Physciaceae

12.	<i>Heterodermia coronata</i>	Physciaceae
13.	<i>Heterodermia dentritica</i>	Physciaceae
14.	<i>Heterodermia podocarpa</i>	Physciaceae
15.	<i>Heterodermia punctifera</i>	Physciaceae
16.	<i>Hypotrachyna costaricensis</i>	Parmeliaceae
17.	<i>Hypotrachyna flexilis</i>	Parmeliaceae
18.	<i>Leptogium adpressum</i>	Collemataceae
19.	<i>Leptogium austroamericanum</i>	Collemataceae
20.	<i>Leptogium burnetiae</i>	Collemataceae
21.	<i>Leptogium cochleatum</i>	Collemataceae
22.	<i>Leptogium denticulatum</i>	Collemataceae
23.	<i>Leptogium indicum</i>	Collemataceae
24.	<i>Leptogium isidiosellum</i>	Collemataceae
25.	<i>Leptogium pichneum</i>	Collemataceae
26.	<i>Leptogium platynum</i>	Collemataceae
27.	<i>Melanelia stygia</i>	Parmeliaceae
28.	<i>Pannaria stylophora</i>	Pannaraiceae
29.	<i>Parmelinopsis microlobulata</i>	Parmeliaceae
30.	<i>Parmeliella pannosa</i>	Pannaraiceae
31.	<i>Parmelina aurulenta</i>	Parmeliaceae
32.	<i>Parmelina kamatii</i>	Parmeliaceae
33.	<i>Parmelina manipurensis</i>	Parmeliaceae
34.	<i>Parmelina muelleri</i>	Parmeliaceae
35.	<i>Parmelina xantholepis</i>	Parmeliaceae
36.	<i>Parmotrema cooperi</i>	Parmeliaceae
37.	<i>Parmotrema disparale</i>	Parmeliaceae
38.	<i>Parmotrema eunetum</i>	Parmeliaceae
39.	<i>Parmotrema hababianum</i>	Parmeliaceae
40.	<i>Parmotrema indicum</i>	Parmeliaceae
41.	<i>Parmotrema latissimum</i>	Parmeliaceae
42.	<i>Parmotrema praesorediosum</i>	Parmeliaceae
43.	<i>Parmotrema saccatilobum</i>	Parmeliaceae
44.	<i>Parmotrema stuppeum</i>	Parmeliaceae
45.	<i>Parmotrema tinctourm</i>	Parmeliaceae
46.	<i>Parmotrema xanthinum</i>	Ramalinaceae
47.	<i>Phaeophyscia hispidula</i>	Physciaceae
48.	<i>Phaeophyscia orbicularis</i>	Physciaceae
49.	<i>Phyllospora corallina</i>	Lecideaceae
50.	<i>Pseudocyphellaria aurata</i>	Stictaceae
51.	<i>Pseudocyphellaria crocata</i>	Stictaceae
52.	<i>Psorella psorina</i>	Phyllosporaceae

53.	<i>Psoroma hispidulum</i>	Pannariaceae
54.	<i>Pyxine corraligera</i>	Physciaceae
55.	<i>Pyxine petricola</i>	Physciaceae
56.	<i>Pyxine philippina</i>	Physciaceae
57.	<i>Ramalina africana</i>	Ramalinaceae
58.	<i>Ramalina sinensis</i>	Ramalinaceae
59.	<i>Relicina abstrusa</i>	Ramalinaceae
60.	<i>Sticta praetextata</i>	Stictaceae
61.	<i>Usnea albopunctata</i>	Usneaceae
62.	<i>Usnea bismolliuscula</i>	Usneaceae

Trees like *Wendlandia thyrsoides*, *Glochidion neilgherrense*, etc. in the evergreen margin or savannahs also inhabit some lichen. Here genera like *Hypotrachyna* and *Heterodermia* is dominant and species like *Hypotrachyna infirma* and *Heterodermia dissecta* are commonly distributed in this region. Riverine areas in the evergreen-savannah margin inhabit genera like *Coccocarpia*, *Heterodermia*, *Parmelia spp.* Most of the species were found here as saxicolous in nature.

5.3.1.2. Subtropical forests

This type of forests occurs in between 1200-1800m altitude. Of the 84 samples collected from here, about 46 species under 18 genera belonging to 9 families of macrolichens have been observed. Most of them are anchored on trees. Arboreal elements like *Ficus sp.*, *Syzygium sp.*, *Mesua ferrea*, *Macaranga sp.*, *Calophyllum sp.*, etc. are the major substrates. Saxicolous species are found only near streams. Species like, *Everniastrum vexans*, *Heterodermia dissecta*, *Hypotrachyna hypocaesia*, *Leptogium phyllocarpum*, *Parmelina horrescens*, *Parmelina spathulata*, *Parmelina wallichiana*, *Pseudocyphellaria argyracea*,

Pseudoparmelia cinearascens, *Sticta cyphellulata*, *Sticta filicina*, *Sticta limbata*, etc. are found near streams. Dominant genera here are *Sticta*, *Heterodermia*, *Leptogium*, *Parmelina*, *Hypotrachyna*, etc. and species like, *Ramalina celastri*, *Hypotrachyna infirma*, *Heterodermia dissecta*, *Parmelina spathulata*, *Pseudocyphellaria argyracea*, *Sticta cyphellulata*, *Sticta weigellii*, etc. are found to be in common occurrence. Six species of macrolichens found exclusive in this vegetation is given as Table 5.

Table 6. Macrolichens found exclusive to subtropical forests in the study area.

Sl. No.	Species	Family
1.	<i>Cetraria hypotrachyna</i>	Parmeliaceae
2.	<i>Hypotrachyna rigidula</i>	Parmeliaceae
3.	<i>Leptogium brebissoni</i>	Collemataceae
4.	<i>Leptogium tenuissimum</i>	Collemataceae
5.	<i>Parmotrema mesotropum</i>	Parmeliaceae
6.	<i>Pseudoparmelia cineaescens</i>	Parmeliaceae

5.3.1.3. Montane shola forests

Apart from the specimens of lichens collected from ecotone and grasslands, 227 specimens were collected from the montane shola forests. These types of forests are seen above 1800m altitudes and distributed in northern region of Silent Valley National Park, Eravikulam National Park, Mannavan Shola and Silent Valley Estate of Munnar. About 99 species under 27 genera belonging to 13 families were found in this vegetation. Parmeliaceae, Physciaceae, Usneaceae and Stictaceae are the dominant families. Genera like, *Everniastrum*, *Heterodermia*, *Hypotrachyna*, *Usnea* and *Sticta* are fairly common and well distributed in this vegetation. Most of the species encountered are corticolous. Arboreal elements like *Ilex wightiana*, *Photinia integrifolia*, *Litsea wightiana*, *Turpinia nepalensis*, *Syzygium densiflorum*, *Pittosporum sp.*, *Cinnamomum wightii*, *Syzygium caryophyllatum*, *Ligustrum decasneii*, *Glochidion neilgherrense*, *Microtropis ramiflora*, etc. play an important role in the distribution of corticolous lichens. Species like *Everniastrum cirrhatum*, *E. nepalense*, *Heterodermia leucomela* subsp. *boriyii.*, *H. togashii*, *H. isidiophora*, *Hypotrachyna awasthii*,

Pseudocyphellaria argyracea, *Usnea rigidula*, *Usnea orientalis*, etc. dominate in the area. Species like *Ramalina inflata*, *Sticta cyphellulata*, *Usnea himalayana* etc. are also fairly distributed in this vegetation. Species like *Leioderma soorediatum* and *Leprocaulon pseudoarbuscula* are found to be very rare. There are 43 species of macrolichens found exclusive to this region (Table 6).

Table 7. Macrolichens found exclusive to montane shola forests

Sl No.	Species	Family
1.	<i>Bulbothrix setschwanensis</i>	Parmeliaceae
2.	<i>Cladonia carneola</i>	Cladoniaceae
3.	<i>Cladonia decorticata</i>	Cladoniaceae
4.	<i>Cladonia scabriuscula</i>	Cladoniaceae
5.	<i>Collema flaccidum</i>	Collemataceae
6.	<i>Collema subflaccidum</i>	Collemataceae
7.	<i>Dermatocarpon vellereum</i>	Verrucariaceae
8.	<i>Everniastrum nepalense</i>	Parmeliaceae
9.	<i>Heterodermia dactylyza</i>	Physciaceae
10.	<i>Heterodermia indica</i>	Physciaceae
11.	<i>Heterodermia microphylla</i>	Physciaceae
12.	<i>Hyperphyscia syncolla</i>	Physciaceae
13.	<i>Hypogymnia pseudobitteriana</i>	Parmeliaceae
14.	<i>Hypogymnia vittata</i>	Parmeliaceae
15.	<i>Hypotrachyna abducta</i>	Parmeliaceae
16.	<i>Leptogium brebissoni</i>	Collemataceae
17.	<i>Leptogium gelatinosum</i>	Collemataceae
18.	<i>Leptogium marginellum</i>	Collemataceae
19.	<i>Pannaria leucophaea</i>	Pannariaceae
20.	<i>Pannaria leucosticta</i>	Pannariaceae
21.	<i>Parmeleria thomsonii</i>	Parmeliaceae
22.	<i>Parmelina simplicolor</i>	Parmeliaceae
23.	<i>Parmotrema abessinicum</i>	Parmeliaceae
24.	<i>Parmotrema pseudonilgherrensis</i>	Parmeliaceae
25.	<i>Parmotrema subarnoldii</i>	Parmeliaceae
26.	<i>Phaeophyscia nepalensis</i>	Physciaceae
27.	<i>Phyllospora corralina</i>	Lecideaceae
28.	<i>Physcia dimidiata</i>	Physciaceae
29.	<i>Physcia integrata</i>	Physciaceae
30.	<i>Pseudoparmelia crozalsiana</i>	Parmeliaceae
31.	<i>Pyxine cylindrica</i>	Physciaceae
32.	<i>Pyxine meisneriana</i>	Physciaceae
33.	<i>Ramalina pollinaria</i>	Ramalinaceae
34.	<i>Ramalina subampliata</i>	Ramalinaceae
35.	<i>Ramalina usnea</i>	Ramalinaceae
36.	<i>Usnea bornmuelleri</i>	Usneaeceae

37.	<i>Usnea complanata</i>	Usneaeceae
38.	<i>Usnea dendritika</i>	Usneaeceae
39.	<i>Usnea indica</i>	Usneaeceae
40.	<i>Usnea picta</i>	Usneaeceae
41.	<i>Usnea pictoides</i>	Usneaeceae
42.	<i>Usnea sordida</i>	Usneaeceae
43.	<i>Usnea thomsonii</i>	Usneaeceae

Small shola patches with small streams possess different types of lichens in their habitats. Species like *Sticta filicina*, *Sticta orbicularis*, *Heterodermia togashii*, *Hypotrachyna exsecta*, *Leptogium cyanescens*, *Pseudocyphellaria argyraceum*, *Parmotrema nilgherense*, *Pseudoparmelia crozalziana*, etc. are fairly well distributed in this habitat.

5.3.1.4. Ecotone region

Ecotone regions of Montane shola and grassland possess several species of lichens. Factors like Wind, humidity, and availability of sunlight are optimal for the lichens. There are about 65 species under 20 genera belonging to 11 families of lichens enumerated from this habitat. Most of the species are corticolous and the trees like *Rhododendron arboreum* var. *nilagiricum*, *Vaccinium leshnaultii* and *Gaultheria fragrantissima*, provide suitable microhabitat for the lichens to grow. Species like *Cladonia ramulosa*, *Stereocaulon austroindicum*, *Teloschistes flavicans* and some *Usnea* sp. also inhabit rocks or soil cuttings in the montane shola forests.

Genera like *Usnea*, *Hypotrachyna*, *Heterodermia*, *Parmelina*, etc. are dominated and are well distributed in this type of habitat. Fruticose lichens like, *Usnea bornmuelleri*, *U. nepalensis*, *U. himalayana*, *U. rigidula*, *U. fragilis*, and foliose forms like *Heterodermia leucomela* subsp. *boriyii*, *Hypotrachyna formosana*, *Pseudocyphellaria argyracea*, *Parmelina* spp. are found to be dominant in this type of habitat. Among these, *Usnea* spp. are most common and well distributed. There are 18 species of macrolichens found exclusive to this type of habitat (Table 7).

Table 8. Macrolichens found exclusive to the ecotone regions

Sl.No.	Species	Family
1.	<i>Cladonia fimbriata</i>	Cladoniaceae
2.	<i>Heterodermia hipocaesia</i>	Physciaceae
3.	<i>Hypotrachyna endochlora</i>	Parmeliaceae
4.	<i>Leptogium burgessii</i>	Collembataceae
5.	<i>Pannaria leucosticta</i>	Pannariaceae
6.	<i>Parmelina phlyctina</i>	Parmeliaceae
7.	<i>Parmotrema dilatatum</i>	Parmeliaceae
8.	<i>Physcia albinea</i>	Physciaceae
9.	<i>Pseudoparmelia texana</i>	Parmeliaceae
10.	<i>Usnea austroindica</i>	Usneaceae
11.	<i>Usnea cineraria</i>	Usneaceae
12.	<i>Usnea corralina</i>	Usneaceae
13.	<i>Usnea eumitrioides</i>	Usneaceae
14.	<i>Usnea gigas</i>	Usneaceae
15.	<i>Usnea misamisensis</i>	Usneaceae
16.	<i>Usnea pseudosinensis</i>	Usneaceae
17.	<i>Usnea subchalybeae</i>	Usneaceae
18.	<i>Usnea subfloridana</i>	Usneaceae

5.3.1.5. Grassland vegetation

Rocks and trees of grasslands hold much lichen. Sampling from 950m to 2694m altitudes of grasslands revealed 56 species of macrolichens under 25 genera belonging to 11 families from this vegetation. Many of the species are saxicolous in nature. Trees like *Rhododendron arboreum* var. *nilagiricum*, *Symplocose cochinchinensis*, *Gnidia glauca*, etc. are the main host trees for the successful attachment of macrolichens. Genera like *Heterodermia*, *Hypotrachyna*, *Parmelina*, *Usnea*, etc. are found to dominate in the area and species like *Heterodermia leucomela* subsp. *boriyii*, *Parmelina wallichiana*, *Pseudocyphellaria argyracea*, *Usnea pangiana*, etc. are found commonly distributed in the grasslands. In some rocky grassland species like *Lecanora indica*, *Parmotrema tinctorum* and *Usnea spp.* are abundant. Species of macrolichens found exclusive to grassland vegetation and are enumerated as Table 8.

Table 9. Macrolichens found exclusive to grasslands

Sl. No.	Species	Family
1.	<i>Baeomyces soređiifer</i>	Baeomycetaceae
2.	<i>Cladonia coniocraea</i>	Cladoniaceae
3.	<i>Cladonia foliacea</i>	Cladoniaceae
4.	<i>Cladonia glauca</i>	Cladoniaceae
5.	<i>Hyperphyscia granulata</i>	Physciaceae
6.	<i>Hypogymnia vittata</i>	Parmeliaceae
7.	<i>Hypotrachyna masonhalei</i>	Parmeliaceae
8.	<i>Hypotrachyna revoluta</i>	Parmeliaceae
9.	<i>Menegazzia terebrata</i>	Parmeliaceae
10.	<i>Parmeliella plumbea</i>	Pannariaceae
11.	<i>Parmotrema mesotropa</i>	Parmeliaceae
12.	<i>Parmotrema reticulatum</i>	Parmeliaceae
13.	<i>Phaeophyscia hispidula</i>	Physciaceae
14.	<i>Pilophorus awasthianum</i>	Stereocaulaceae
15.	<i>Pyxine asiatica</i>	Physciaceae
16.	<i>Ramalina pollinaria</i>	Ramalinaceae
17.	<i>Ramalina subampliata</i>	Ramalinaceae

5.3.1.6. Vegetation overlapping species

Many species are found exclusive to particular type of vegetation but some are seen in more than one vegetation type. During the present study, about 109 species are found in more than one vegetation type. Table 9 shows the distribution of overlapping species according to their vegetation type.

Table 10. Distribution of overlapping species according to the type of vegetation

Sl. No.	Species	Habitat
1.	<i>Cladonia farinacea</i>	S, G
2.	<i>C.parasitica</i>	S, E, G
3.	<i>C. ramulosa</i>	G, Ec
4.	<i>Coccocarpia erythroxyli</i>	S, G, E, Su
5.	<i>C. palmicola</i>	G, E, S, Su
6.	<i>C. pellita</i>	E, G
7.	<i>Collema auriforme</i>	Ec, E
8.	<i>Everniastrum cirrhatum</i>	S, G, Ec
9.	<i>E. vexans</i>	S, E, Su
10.	<i>Heterodermia comosa</i>	G, E
11.	<i>H. diademata</i>	S, E
12.	<i>H. dissecta</i>	G, E, Su
13.	<i>H. dissecta</i> var. <i>koyana</i>	S, E
14.	<i>H. flabellata</i>	E, Su
15.	<i>H. hypocaesia</i>	Ec, S, G, E, Su
16.	<i>H. incana</i>	S, E, G
17.	<i>H. isidiophora</i>	S, E, Su
18.	<i>H. japonica</i>	S, G, E
19.	<i>H. leucomela</i>	G, E
20.	<i>H. leucomela</i> subsp. <i>boriyii</i>	S, Ec, G, Su
21.	<i>H. obscurata</i>	S, G, E
22.	<i>H. pellucida</i>	S, Ec, E
23.	<i>H. pseudospeciosa</i>	S, E, G
24.	<i>H. speciosa</i>	S, E
25.	<i>H. togashii</i>	S, E, G
26.	<i>Hyperphyscia aglutinata</i>	Ec, E
27.	<i>Hypotrachyna awasthii</i>	S, E, G, Su
28.	<i>H. brevirhiza</i>	S, E
29.	<i>H. crenata</i>	G, Su
30.	<i>H. dactylifera</i>	Ec, E
31.	<i>H. degelii</i>	Ec, E
32.	<i>H. dodapetta</i>	S, Ec
33.	<i>H. exsecta</i>	S, Ec, G
34.	<i>H. formosana</i>	S, Ec
35.	<i>H. infirme</i>	S, G, E, Su
36.	<i>H. orientalis</i>	G, E
37.	<i>Leioderma solediatum</i>	S, E
38.	<i>Leprocaulon pseudoarbuscula</i>	S, G, E
39.	<i>Leptogium austro-americanum</i>	S, E
40.	<i>L. azureum</i>	E, Su
41.	<i>L. brebisonii</i>	Su, S
42.	<i>L. chloromelum</i>	S, E
43.	<i>L. corticola</i>	E, Su

44.	<i>L. cyanescens</i>	S, E
45.	<i>L. moluccanum</i>	S, Su
46.	<i>L. phyllocarpum</i>	E, Su
47.	<i>L. ulvaceum</i>	S, E
48.	<i>Lobaria retigera</i>	E, S, G
49.	<i>Pannaria rubiginosa</i>	G, Su
50.	<i>Parmelaria thomsonii</i>	S, E, Su
51.	<i>Parmeliella plumbea</i>	S, G
52.	<i>P. tryptophylla</i>	S, G, Ec, Su
53.	<i>Parmelina expallida</i>	S, Ec, E, G
54.	<i>P. horrescens</i>	S, Ec, Su
55.	<i>P. indica</i>	S, E
56.	<i>P. simplicior</i>	S, Ec, E, G
57.	<i>P. spathulata</i>	E, Su
58.	<i>P. subaurulenta</i>	Ec, E
59.	<i>P. wallichiana</i>	S, Ec, G, E, Su
60.	<i>Parmotrema crinitum</i>	G, Su
61.	<i>P. grayanum</i>	G, S
62.	<i>P. kamatii</i>	S, G, E, Su
63.	<i>P. mesotropum</i>	G, Su
64.	<i>P. nilgherrens</i>	S, Ec
65.	<i>P. tinctorum</i>	G, S, E
66.	<i>Phaeophyscia hispidula</i>	E, G
67.	<i>Phyllospora coralina</i>	E, S
68.	<i>Pseudocyphellaria argyracea</i>	S, G, Ec, E, Su
69.	<i>Pseudoparmelia carneo-pruinata</i>	G, E
70.	<i>P. cinearescens</i>	G, Su
71.	<i>P. crozalziana</i>	S, E, Su
72.	<i>P. texana</i>	Ec, S
73.	<i>Psorella isidiophora</i>	Ec, S, E
74.	<i>Pyxine solediatum</i>	G, E
75.	<i>Ramalina celastri</i>	S, E, Su
76.	<i>R. inflata</i>	S, G, E, Su
77.	<i>R. pacifica</i>	Ec, E
78.	<i>Stereocaulon austroindicum</i>	Ec, G
79.	<i>Sticta cyphellulata</i>	S, Ec, E, Su
80.	<i>S. filicina</i>	S, G, Su
81.	<i>S. henryana</i>	S, Su
82.	<i>S. limbata</i>	S, E, Su
83.	<i>S. neocaledonica</i>	S, Su
84.	<i>S. orbicularis</i>	S, Su
85.	<i>S. sylvatica</i>	S, E
86.	<i>S. weigeli</i>	S, Ec, E, Su
87.	<i>Teloschistes flavicans</i>	G, Ec
88.	<i>Usnea baileyi</i>	G, E
89.	<i>U. bimolliuscula</i>	Ec, E
90.	<i>U. bornmuelleri</i>	Ec, G

91.	<i>U. dendritica</i>	S, G, Su
92.	<i>U. fischeri</i>	S, Ec
93.	<i>U. fragilis</i>	G, Ec, E
94.	<i>U. himalayana</i>	S, Ec, E
95.	<i>U. maculata</i>	S, Su
96.	<i>U. misamisensis</i>	Ec, E, Su
97.	<i>U. nepalensis</i>	S, Ec
98.	<i>U. nilgirica</i>	S, Ec, E
99.	<i>U. orientalis</i>	S, Ec, E, G
100.	<i>U. pangiana</i>	G, Ec, E
101.	<i>U. pectinata</i>	S, Ec, G, Su
102.	<i>U. rigidula</i>	S, Ec, E, G, Su
103.	<i>U. rubicondja</i>	S, Ec, G
104.	<i>U. spinosula</i>	S, Ec
105.	<i>U. splendens</i>	S, E
106.	<i>U. stigmatoides</i>	Ec, G, E
107.	<i>U. subflorida</i>	S, Ec
108.	<i>U. undulata</i>	S, Ec, E
109.	<i>U. vegae</i>	E, S

S - Shola Forests; E - Evergreen Forests; Su - Subtropical Forests; Ec - Ecotone Area; G - Grassland

5.4. Ecology of Lichens

Climatic conditions play an important role in the ecology of lichens. Availability of water, sunlight, moderate to cold climate, unpolluted atmosphere, wind condition and the type of substratum are the major factors responsible for the optimal growth of lichens.

5.4.1. Water

Requirements of water vary considerably in the different species of lichens. Frequent rains are of great advantage for their good growth as the metabolic activities are dependent mainly on moisture content in the thallus. In the absence of rain, dew and humid atmosphere can partially fulfill the moisture requirements as many lichens have the capacity to absorb moisture from humid atmosphere. Evergreen forests and montane forests with an average rain fall of 3000 mm per annum, Kerala with two strong monsoons and about eight months rainy season play an important role in the distribution of lichens. In non-rainy season relative humidity is very high, which fulfill the moisture requirements of lichens. Majority of species absorb water from rain and atmospheric moisture. However, species like *Dermatocarpon vellereum* frequently seen along the water logged rocks in the evergreen forests and absorb moisture from dripping water.

5.4.2. Sunlight

The requirement of sunlight is an important factor for the distribution of lichens. Sunlight requirement is much variable in different species of lichens. Most of the grey coloured foliose taxa and *Usnea spp.* grow in bright sunlight in highly exposed places. Dark coloured taxa like *Sticta*, *Pseudocyphellaria*, *Lobaria*, *Collema*, *Leptogium*, etc. are adapted to grow on shady or subshady areas of forests. Majority of lichens, however, occurs in intermediate situations of moderate exposure between the two extremes. So trees in the ecotone regions, grassland, upper canopy of trees in the evergreen as well as in the montane

shola forests possess a large number of lichens. It is interesting to note that trees facing and midday afternoon sun have a large number of lichens in their upper canopy branches.

5.4.3. Temperature

Temperature is an essential factor for the growth of lichens. A moderate to cold climate with an average temperature of 20°-25°C is favourable for the growth of lichens. Montane shola forests of Silent Valley National Park, Eravikulam National Park, Mannavan shola and Silent Valley Estate of Munnar with an average temperature of 21°C possess a large number of macrolichens in their habitat. About 100 different species of macrolichens are observed in these forests. Species like *Everniastrum cirrhatum*, *Heterodermia leucomela* subsp. *boriyii*, *Usnea spp.*, are abundantly seen along these forests.

5.4.4. Wind

Normal wind currents are essential for proper lichen growth. Trees in the open grasslands inhabit a large number of lichens. Grass lands with rocky areas also possess many foliose and some fruticose forms. Cool winds with additional factors are responsible for the growth of lichens.

5.4.5. Substratum

For the purpose of anchoring, the lichen thallus needs a substratum for its successful growth. The texture and the chemistry of the substratum play an important role in the type of lichen that is supported. In all the areas surveyed, most of the lichens are found to prefer corticolous substratum. Species like *Baeomyces soridiifer*, *Dermatocarpon vellereum*, *Lecanora indica*, *Cladonia parasitica*, *Heterodermia dissecta*, *Phaeophyscia hispidula*, *Pseudoparmelina cinereaescens*, *Stereocaulon austroindicum*, *Pilophorus awasthianum*, etc. are confined to saxicolous substratum. It is interesting to note that exclusive terricolous species are not present in the study area, however, many corticolous species like *Everniastrum*

nepalense, *Heterodermia leucomela* subsp. *boriyii*, *Cladonia ramulosa*, *Leprocaulon pseudoarbuscula*, etc. possesses terricolous nature.

5.5. Development of a Lichen herbarium

A total of 1200 macrolichen specimens including squamulose, foliose and fruticose forms were collected from 18 different localities of Kerala. The identified specimens are arranged according to the classification of Poelt (1973).

5. Conclusion

Though considerable work has been under taken on the floristic survey of Western Ghats, so far, no significant studies have been undertaken on the lichen flora of Kerala part of Western Ghats. From the present study, it has become evident that Kerala abodes a good number of macrolichens in its rich habitats which are getting depleted due to various factors. Microlichens need further investigations . Only fragmentary work has been done on microlichens from this papart of region. Kumar and Stephen(199) reported 153 microlichens from Kerala. However, the number of species would be definitely more, since only scattered study was made from this region. Study of lichens will be complete until the microlichens are also given due importance. Therfor, it is essential to explore the microlichens of Kerala.

Since this is the first study of microlichens from this part of the region there is ample scope for furter studies on the microlichens of Kerala region. The study will help to understand the diversity of lichens better and give the correct status of the biodiversity of the state.

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