
Diversity of Macrolichens of Wayanad district, Kerala, India with some New Records

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ABSTRACT

The present paper deals with the enumeration of macrolichens of Wayanad district, Kerala, India. More than 500 lichen specimens were studied and analysed which resulted in 97 species of macrolichens in the study area. Of the 97 species, fifteen were found to be new to Kerala state, and among them, two species were new to the Indian Peninsula..

INTRODUCTION

The symbiotic association between an alga and a fungus resulted in a new life form called lichen. 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, the bark of plants, surface of leaves, metallic surfaces and even on the shells of insects and turtles. The updated status on the world lichens includes 19,387 species in 995 genera, 115 families, 39 orders and eight classes (Lücking et al. 2016).

India having a variety of phytogeographical regions and is rich with mega and microcentres of endemism and several hotspots that holds a rich variety of lichens. India harbours a total of 3,028 taxa of lichen under 469 genera and 88 families. Of these 2,053 were crustose followed by 729 foliose and 224 fruticose lichen forms (Sinha 2021).

Kerala with diverse vegetation such as tropical rain forests, tropical moist deciduous forests, tropical dry deciduous forests, montane wet temperate forests and grasslands, holds a greater number of lichens in its microhabitat. Purushothaman et al. (2021) mentioned the occurrence of 798 species of lichens from Kerala. Later, many species were added to the lichen biota of Kerala; thus, the total lichens of Kerala till date reaches up to 832 species (Biju et al. 2021; Biju and Sabeena 2021; Anilkumar et al. 2022; Sequeira 2022; Sequeira et al. 2022).

Previous studies from the Wayanad district shows that the area is rich in lichen diversity. Kumar et al. (2000), while preparing the macrolichen flora of Kerala, reported 32 species of lichens from the Wayanad district, which were collected from Thirunelly (18 spp.) and Pakshipadalam (14 spp.). Kumar and Sequiera (2003) also reported some lichens from the Chembra and Thirunelly hills of the Wayanad district. Balu et al. (2020) studied the macrolichens of Kalpetta municipality of Wayanad district and reported the occurrence of 21 species. Recently, a new species of parmelioid lichen, *Parmotrema sahyadrica* Sequiera & A. Christy was described from Wayanad district (Sequeira et al. 2022). There are many under explored areas for lichen studies in Wayanad. The present study enumerates the macrolichens from different areas of Wayanad district including forest and cultivated lands.

MATERIALS AND METHODS

Study Area

Wayanad district in Kerala state has an area of 2,132 km² sharing its border with Karnataka (Kodagu and Mysore districts) to the north and north east, Tamil Nadu (Nilgiris district) to the south east, Malappuram to the south, Kozhikode to the south west and Kannur to the north-west. Wayanad forms a major part of Western Ghats in Kerala and have a good forest cover. Chembra peak (2,100 m) and Banasura hills (2,079 m) are the highest peaks in this area.

Macrolichens of Wayanad District

Forest areas like Muthanga Wildlife Sanctuary, Chembra, Aranamla, Periya, Thirunelli, Thariyode, 900 Estate, Begur and Kavumannam and Kurumbalakotta were explored for the lichen inventory (Fig. 1, Plate 1, Figs. A-F). Vegetation type in the study area includes evergreen forests, moist deciduous forest, southern montane subtropical forests, grasslands and cultivated lands.

Collection and Identification

The specimens were collected and numbered from different areas of Wayanad district as mentioned above. The nature of substratum and thallus, vegetation type and elevation of the study areas were noted. The samples were then air dried and herbarium was prepared as per the standard method and are deposited at Maharaja's college herbarium (MCH).

Morphological and anatomical characters of the lichen specimens were examined with a stereo zoom microscope (Labomed CZM6) and trinocular compound microscope (Carl Zeiss Primo star). The spot colour tests were done using different chemicals such as aqueous solution of KOH (K), Calcium hypochlorite (C) and parphenylenediamine (P). The microcrystallography was also done for identification of specific chemical present in the lichen thallus (Nayaka 2014). Thin Layer Chromatography was performed for doubtful specimens following Culberson (1972), Walker and James (1980) and Orange et al. (2001). Solvent system A was used for the TLC experiment and *Parmotrema reticulatum* (Taylor) M. Choisy was used as control. Individual lichen samples were identified with the help of published literatures, keys and monographs (Awasthi 2007; Divakar and Upreti 2005). The classification of lichens was updated following Wijaywardhane et al.

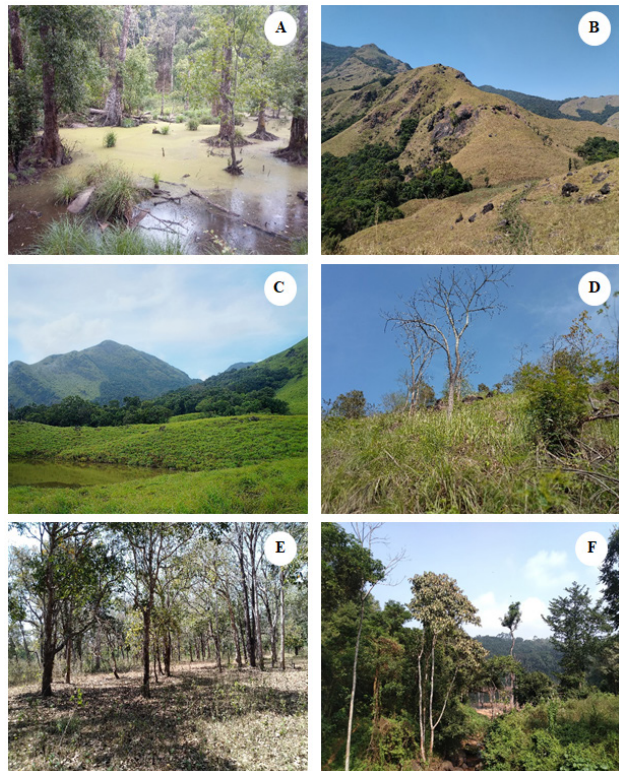


Plate-1. Study Area; A. 900 Estate, B. Aranamala, C. Chembra, D. Kurumbalakotta, E. Muthanga WLS, F. Thariyode

(2020, 2021).

RESULTS AND DISCUSSION

The diversity of lichens in Wayanad districts of Kerala is relatively rich when compared the other districts of Kerala. Kumar (2000) reported the occurrence of 32 macro lichens from the collections made from Thirunelly and Pakshipadalam belt. Studies by others (Kumar and Sequiera

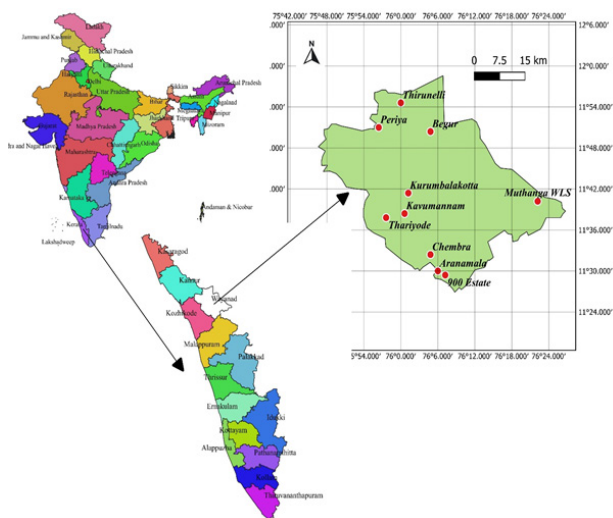


Fig. 1: Location map of the study area

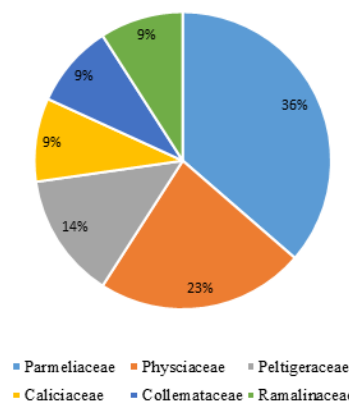


Fig. 2. Dominant families of lichens in Wayanad

Macrolichens of Wayanad District

Table 1: The lichens and their distribution in Wayanad District

Sl. No.	Species	Family	Growth Form	Substratum	Collection Localities										Elevation (m)	Vegetation Types	
					1	2	3	4	5	6	7	8	9	10			
1	<i>Bulbothrix isidiza</i> (Nyl.) Hale	Parmeliaceae	Fo	C	-	-	-	-	-	-	-	-	+	-	-	800	EV
2	<i>B. tabacina</i> (Mont. & Bosch) Hale	Parmeliaceae	Fo	C	-	-	-	-	-	-	-	+	-	-	-	790	MDF
3	<i>Cladonia fruticulosa</i> Kremp	Cladoniaceae	Fr	T	-	-	-	-	-	-	-	-	+	-	-	800	EV
4	<i>C. macilenta</i> Hoffm.	Cladoniaceae	Fr	T	-	-	-	-	-	-	-	-	+	-	-	800	EV
5	<i>Coccocarpia glaucina</i> Kremp	Coccocarpiaceae	Fo	C	-	-	-	-	-	-	-	-	-	+	-	750	EV
6	<i>C. palmicola</i> (Spreng.) Arv. & D.J. Galloway	Coccocarpiaceae	Fo	C	-	-	-	-	+	-	-	-	+	-	-	750-800	CL, EV
7	<i>C. pellita</i> (Ach) Müll. Arg. Em. R. Sant.	Coccocarpiaceae	Fo	C	-	+	-	-	-	-	-	-	-	-	+	900-1400	EV
8	<i>Collema furfuraceum</i> (Arn.) Du Rietz	Collemataceae	Fo	C	-	+	-	-	-	-	-	-	-	-	-	1400	EV
9	<i>C. nigrescens</i> (Huds.) DC.	Collemataceae	Fo	C	-	-	-	-	+	-	-	-	-	-	-	750	CL
10	<i>Dirinaria aegialita</i> (Afzel. ex Ach.) B.J. Moore	Caliciaceae	Fo	C	-	-	-	+	-	-	+	-	-	-	-	790-1400	MDF, SMSF, GR
11	<i>D. applanata</i> (Fée) D.D. Awasthi	Caliciaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	-	790	MDF
12	<i>D. consimilis</i> (Stirt.) D.D. Awasthi	Caliciaceae	Fo	C	-	-	-	-	+	-	+	-	-	-	-	750-790	CL, MDF
13	<i>D. picta</i> (Sw.) Clem. & Shear	Caliciaceae	Fo	C	-	-	-	-	-	+	+	-	-	-	-	790-1000	GR, MDF
14	<i>Heterodermia albicans</i> (Pers.) Swinscow & Krog	Physciaceae	Fo	C/S	-	-	-	-	-	+	+	-	-	-	-	790-1000	GR, MDF
15	<i>H. antillarum</i> (Vain.) Swinscow & Krog	Physciaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	-	790	MDF
16	<i>H. comosa</i> (Eschw.) Follman & Redon	Physciaceae	Fo	C	-	-	-	-	+	-	-	-	-	-	-	750	CL
17	<i>H. diademata</i> (Taylor) D. D. Awasthi	Physciaceae	Fo	C	-	-	-	-	-	+	-	+	-	-	-	800-1000	EV, GR
18	<i>H. dissecta</i> (Kurok.) D.D. Awasthi	Physciaceae	Fo	C	-	-	-	-	+	+	-	-	-	-	-	750-1000	CL, GR
19	<i>H. galactophylla</i> (Tuck.) W. L. Culb.	Physciaceae	Fo	C	-	-	-	-	+	-	-	-	-	-	-	750	CL
20	<i>H. incana</i> (Stirt.) D. D. Awasthi	Physciaceae	Fo	C	-	-	-	+	-	-	-	+	-	+	-	800-1400	EV, SMSF
21	<i>H. isidiophora</i> (Nyl.) D.D. Awasthi	Physciaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	-	790	MDF
22	<i>H. obscurata</i> (Nyl.) Trevis.	Physciaceae	Fo	C	-	+	-	-	+	+	+	+	+	-	-	750-1400	CL, EV, GR, MDF
23	<i>H. podocarpa</i> (Bél.) D.D. Awasthi	Physciaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	-	790	MDF
24	<i>H. speciosa</i> (Wulf.) Trevis	Physciaceae	Fo	C	-	-	-	-	+	+	+	-	+	-	-	750-1000	CL, EV, GR, MDF
25	<i>Hypotrachyna boquetensis</i> (Hale) Hale	Parmeliaceae	Fo	C	-	-	-	-	-	-	-	+	-	-	-	800	EV
26	<i>H. costaricensis</i> (Nyl.) Hale	Parmeliaceae	Fo	C	-	+	-	-	-	-	-	+	-	-	-	800-1400	EV, GR
27	<i>H. crenata</i> (Kurok.) Hale	Parmeliaceae	Fo	C	-	+	-	-	-	-	-	+	-	-	-	800-1200	EV
28	<i>H. degelii</i> (Hale) Hale	Parmeliaceae	Fo	C	-	-	-	-	-	-	-	-	+	-	-	750	EV
29	<i>H. infirma</i> (Kurok.) Hale	Parmeliaceae	Fo	C	-	-	-	+	-	-	-	-	-	-	-	1400	SMSF
30	<i>H. masonhalei</i> Patw. & A. V. Prabhu	Parmeliaceae	Fo	C	-	-	-	-	-	-	-	+	-	-	-	800	EV
31	<i>H. microlobulata</i> (D.D. Awasthi) Divakar, A. Crespo, Sipman, Elix & Lumbsch	Parmeliaceae	Fo	C	-	+	-	-	-	-	-	-	-	-	-	1400	EV

Macrolichens of Wayanad District

32	<i>H. vexans</i> (Zahlbr. ex W.L. Culb. & C.F. Culb.) Divakar, A. Crespo, Sipman, Elix & Lumbsch	Parmeliaceae	Fo	C	-	-	-	+	-	-	-	-	-	-	1400	SMSF
33	<i>Leptogium austroamericanum</i> (Malme) C.W. Dodge	Collemtaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	790	MDF
34	<i>L. cochleatum</i> (Dicks.) P. M. Jorg. & P. James	Collemtaceae	Fo	C	-	+	-	-	-	-	-	-	-	-	1400	EV
35	<i>L. coralloideum</i> (Meyen & Flot.) Vain.	Collemtaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	790	MDF
36	<i>L. cyanescens</i> (Ach.) Körb.	Collemtaceae	Fo	C/S	-	+	-	+	+	+	-	-	-	+	750-1400	CL, EV, GR, SMSF
37	<i>L. denticulatum</i> Nyl.	Collemtaceae	Fo	C/S	-	+	-	-	+	+	-	-	+	+	750-1400	CL, EV, GR
38	<i>L. indicum</i> D. D. Awasthi & Akhtar	Collemtaceae	Fo	C	-	+	-	-	-	-	-	-	-	-	1400	EV
39	<i>L. javanicum</i> Mont.	Collemtaceae	Fo	C	-	-	-	-	-	+	-	-	-	-	1000	GR
40	<i>L. pichneum</i> (Ach.) Malme	Collemtaceae	Fo	C	-	-	-	+	-	-	-	-	-	-	1400	SMSF
41	<i>L. ulvaceum</i> (Pers.) Vain.	Collemtaceae	Fo	C	-	-	-	+	-	+	-	+	+	-	750-1400	EV, GR, SMSF
42	<i>Leucoderma leucomelos</i> (L.) Kalb	Physciaceae	Fo	C	-	-	-	-	-	-	+	+	-	-	790-800	EV, MDF
43	<i>Lobaria discolor</i> (Bory ex Delise) Hue	Peltigeraceae	Fo	C	-	-	-	-	-	-	+	-	-	-	790	MDF
44	<i>Myelochroa xantholepis</i> (Mont. & Bosch) Elix & Hale	Parmeliaceae	Fo	C	+	+	-	+	-	-	-	-	-	-	1000-1400	EV, SMSF
45	<i>Pannaria nilgherriensis</i> P.M. Jorg. & Upreti	Pannariaceae	Sq	C	-	-	-	-	-	+	-	-	-	-	1000	GR
46	<i>Parmelinella wallichiana</i> (Taylor) Elix & Hale	Parmeliaceae	Fo	C	-	+	-	+	-	-	-	-	-	-	1400	EV, SMSF
47	<i>Parmelinopsis expallida</i> (Kurok.) Elix & Hale	Parmeliaceae	Fo	C	-	-	-	-	-	+	+	-	-	-	790-1000	GR, MDF
48	<i>P. horrescens</i> (Taylor) Elix & Hale	Parmeliaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	790	MDF
49	<i>Parmotrema austrosiuiense</i> (Zahlbr.) Hale	Parmeliaceae	Fo	C	-	-	-	-	-	-	-	+	-	-	790	MDF
50	<i>P. cetratum</i> (Ach.) Hale	Parmeliaceae	Fo	C	-	-	-	-	-	+	+	-	-	-	790-1000	GR, MDF
51	<i>P. cooperi</i> (J. Steiner & Zahlbr) Sérus	Parmeliaceae	Fo	C	-	-	+	-	-	-	-	-	-	-	840	EV
52	<i>P. crinitoides</i> J.C. Wei	Parmeliaceae	Fo	C	-	+	-	-	-	-	-	-	-	-	1200	EV
53	<i>P. crinitum</i> (Ach.) Choisy	Parmeliaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	790	MDF
54	<i>P. cristiferum</i> (Taylor) Hale	Parmeliaceae	Fo	C	-	-	+	-	+	-	+	+	-	-	750-840	CL, EV, MDF
55	<i>P. grayanum</i> (Hue) Hale	Parmeliaceae	Fo	S	-	-	-	-	-	+	-	-	-	-	1000	GR
56	<i>P. hababianum</i> (Gyeln.) Hale	Parmeliaceae	Fo	C	-	-	+	-	-	-	+	+	-	-	790-840	EV, MDF
57	<i>P. indicum</i> Hale	Parmeliaceae	Fo	C	-	-	+	-	+	-	-	-	-	-	750-840	CL, EV
58	<i>P. kamatii</i> Patw. & Prabhu	Parmeliaceae	Fo	S	-	-	-	-	-	+	-	-	-	-	1000	GR
59	<i>P. mesotropum</i> (Müll. Arg.) Hale	Parmeliaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	790	MDF
60	<i>P. planatlobatum</i> (Hale) Hale	Parmeliaceae	Fo	C	+	-	-	-	-	-	-	-	+	-	750-1000	EV
61	<i>P. praesorediosum</i> (Nyl.) Hale	Parmeliaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	790	MDF
62	<i>P. pseudocrinitum</i> (Abbayes) Hale	Parmeliaceae	Fo	C	-	-	-	-	+	-	+	-	-	-	750-790	CL, MDF
63	<i>P. ravum</i> (Krog & Swinscow) Sérus.	Parmeliaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	790	MDF
64	<i>P. reticulatum</i> (Taylor) Choisy	Parmeliaceae	Fo	C	-	-	+	-	+	-	+	+	+	-	750-840	CL, EV, MDF

Macrolichens of Wayanad District

65	<i>P. sahyadrica</i> Sequiera & A. Christy	Parmeliaceae	Fo	C	-	-	-	-	+	-	-	-	-	-	750	CL
66	<i>P. stuppeum</i> (Taylor) Hale	Parmeliaceae	Fo	C	-	-	+	-	+	-	-	+	-	-	750-840	CL, EV
67	<i>P. tinctorum</i> (Despr. ex Nyl.) Hale	Parmeliaceae	Fo	C/S	-	-	+	-	+	+	+	-	-	-	750-1000	CL, EV, GR, MDF
68	<i>Phaeophyscia ciliata</i> (Hoffm.) Moberg	Physciaceae	Fo	S	-	-	-	-	-	+	-	-	-	-	1000	GR
69	<i>P. hispidula</i> var. <i>exornatula</i> (Zahlbr.) Moberg	Physciaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	790	MDF
70	<i>P. orbicularis</i> (Neck.) Moberg	Physciaceae	Fo	C	-	-	-	+	-	-	+	-	-	-	790-1000	MDF, SMSF, GR
71	<i>Phyllopsora corallina</i> (Eschw.) Müll. Arg.	Ramalinaceae	Sq	C	-	-	-	-	+	-	-	-	-	-	750	CL
72	<i>Physcia aipolia</i> (Ehrh. ex Humb.) Fühnr.	Physciaceae	Fo	C	-	-	-	-	-	-	-	-	+	-	750	EV
73	<i>P. integrata</i> (Nyl.) Arnold	Physciaceae	Fo	C	-	-	-	-	+	+	-	-	-	-	750-1000	CL, GR
74	<i>P. sorediosa</i> (Vain.) Lynge	Physciaceae	Fo	C	-	-	-	-	-	-	+	-	+	-	750-1000	EV, GR
75	<i>P. tribacoides</i> Nyl.	Physciaceae	Fo	C	-	-	-	-	+	-	+	+	-	-	750-800	CL, EV, MDF
76	<i>Polyblastidium hypocaustum</i> (Yasuda ex Räsänen) Kalb	Physciaceae	Fo	C	+	-	-	+	+	-	+	+	-	-	750-1400	CL, EV, GR, SMSF, MDF
77	<i>P. japonicum</i> (M. Satô) Kalb	Physciaceae	Fo	C	-	+	-	+	-	-	+	+	+	+	750-1400	EV, MDF, SMSF
78	<i>P. microphyllum</i> (Kurok.) Kalb	Physciaceae	Fo	C	-	-	-	-	-	-	-	+	-	-	800	EV
79	<i>P. togashii</i> (Kurok.) Kalb	Physciaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	790	MDF
80	<i>Pseudocyphellaria argyrea</i> (Delise) Vain.	Peltigeraceae	Fo	C	-	+	-	+	-	-	-	+	+	-	750-1400	EV, SMSF
81	<i>P. aurata</i> (Ach.) Vain	Peltigeraceae	Fo	C	-	-	-	-	-	-	-	+	-	-	800	EV
82	<i>P. crocata</i> (L.) Vain.	Peltigeraceae	Fo	C	-	-	-	-	-	-	+	-	-	-	790	MDF
83	<i>P. intricata</i> (Delise) Vain.	Peltigeraceae	Fo	C	-	-	-	+	-	-	-	-	-	-	1400	SMSF
84	<i>Pseudoparmelia usambarensis</i> (J. Steiner & Zahlbr.) Krog & Swinscow	Parmeliaceae	Fo	C	+	-	-	-	-	-	-	-	-	-	1000	EV
85	<i>Pyxine austroindica</i> D.D. Awasthi	Caliciaceae	Fo	C	-	-	-	-	-	-	+	-	-	-	790	MDF
86	<i>P. cocoes</i> (Sw.) Nyl.	Caliciaceae	Fo	C	-	-	-	-	-	+	-	-	-	-	1000	GR
87	<i>P. farinosa</i> Kashiw.	Caliciaceae	Fo	C	-	-	-	-	-	+	-	-	-	-	790	MDF
88	<i>P. sorediata</i> (Ach.) Mont.	Caliciaceae	Fo	C	-	-	-	-	-	+	-	-	-	-	1000	GR
89	<i>Ramalina conduplicans</i> Vain.	Ramalinaceae	Fr	C	-	-	-	+	-	-	-	-	-	-	1400	SMSF
90	<i>R. hossei</i> Vain.	Ramalinaceae	Fr	C	-	-	-	-	-	-	+	-	-	-	800	MDF
91	<i>R. nervulosa</i> (Müll. Arg.) Abbayes	Ramalinaceae	Fr	C	-	-	-	-	-	-	+	-	-	-	790	MDF
92	<i>R. pacifica</i> Asahina	Ramalinaceae	Fr	C	-	-	-	-	-	-	+	-	-	-	790	MDF
93	<i>Sticta orbicularis</i> (R. Br.) Hue	Peltigeraceae	Fo	C	-	+	-	+	-	-	-	+	-	-	800-1400	EV, SMSF
94	<i>S. weigelii</i> (Ach.) Vain.	Peltigeraceae	Fo	C	+	+	-	-	-	-	-	-	-	-	1000-1400	EV
95	<i>Teloschistes flavicans</i> (Sw.) Norman	Teloschistaceae	Fr	C	-	-	-	-	-	-	+	-	-	-	790	MDF
96	<i>Usnea bismolliuscula</i> Zahlbr.	Parmeliaceae	Fr	C	-	-	-	-	-	-	+	-	-	-	790	MDF
97	<i>U. nipparensis</i> Asahina	Parmeliaceae	Fr	C	-	-	-	-	-	-	+	-	-	-	790	MDF

(Abbreviations: Fo-Foliose; Fr-Fruticose; Sq-Squamulose; C-Corticolous; S-Saxicolous; T-Terricolous; 1 = 900 Estate; 2 = Aranamala; 3 = Begur; 4 = Chembra; 5 = Kavumannam; 6 = Kurumbalakotta; 7 = Muthanga WLS; 8= Periya; 9 = Thariyodu; 10 = Thirunelli; CL = Cultivated Land; EV= Evergreen forests; GR = Grasslands; MDF = Moist Deciduous Forest; SMSF = Southern Montane Subtropical Forests)

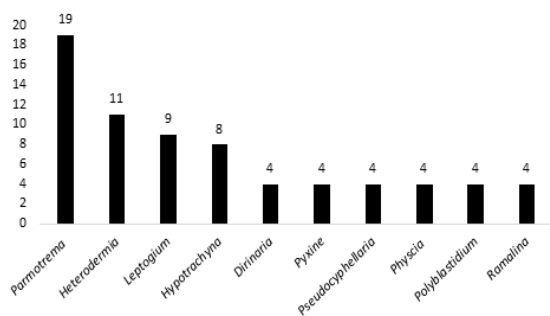


Fig. 3: Dominant genera of lichens in Wayanad

2001; Balu et al. 2020; Sequeira et al. 2022) also revealed that the entire stretch of Wayanad hills irrespective of vegetations are rich in lichens. The present study resulted in the enumeration of 97 species of macro lichens under 26 genera and 10 families from Wayanad district. Of the 97 species, 86 were foliose, 9 species were fruticose and 2 were squamulose forms. Corticolous forms were dominated in the study area with 87 species, 4 species were found to prefer both corticolous and saxicolous substratum, 3 species were exclusively on saxicolous and 2 species on terricolous substratum (Table 1). Also, the critical analysis of the lichen species shows that the family Parmeliaceae is dominant with 8 species followed by Physciaceae with 5 species and Peltigeraceae with 3 species. The genus *Parmotrema* is dominant in the area with 19 species followed by *Heterodermia* (11 species), *Leptogium* (9 species), *Hypotrachyna* (8 species) etc. (Figs. 2 & 3).

Information on the district wise status of lichens from Kerala were done by some researchers. Kumar and Sequeira (2001) enumerated 112 species belonging to 30 genera and 12 families of lichens from Palakkad district. Biju et al. (2014) recorded the occurrence of 136 species of lichens belonging to 45 genera and 24 families from Idukki district. Another important study by Zachariah et al. (2018) reported 85 species belonging to 18 genera and 14 families from Pathanamthitta district. According to the current status, Kerala comprises about 832 species which constitute 28 percentage of total lichen flora of India. In the present study, 97 species were recorded from Wayanad district which include 15 species new to Kerala. These new reports increased the total lichen flora in Kerala to 847 species.

Among the 10 different localities surveyed during the study, Muthanga Wildlife Sanctuary holds maximum number of lichen species (42 spp.) followed by Periya (25 spp.), Kavumannam (21 spp.), Kurumbalakotta (21 spp.), Aranamala (17 spp.), Chembra (16 spp.), Thariyode (12 spp.), Begur (7 spp.), 900 Estate and Thirunelli each with 5 species. Area wise distribution of the individual species

is provided in Table 1.

Lichens and vegetation

Physiographically the study area has different type of vegetations such as Moist deciduous forests (Muthanga Wildlife Sanctuary), Evergreen forests (900 Estate, Aranamala, Begur, Periya, Thariyode and Thirunelli), Southern montane subtemperate forests (Chembra), Grasslands (Kurumbalakotta and Chembra) and some cultivated lands (Kavumannam). Most of the lichen species were found to be distributed in evergreen forests and moist deciduous forests.

Moist Deciduous Forests

Moist deciduous forests are not commonly found in Wayanad district. In the present study, lichens collected from Muthanga Wildlife Sanctuary which is characterised by moist deciduous forest having an elevation from 750 m to 800 m. About 40 species of lichens were identified from this vegetation. Caliciaceae, Physciaceae, Parmeliaceae, *Ramalinaceae* and *Teloschistaceae* were dominant families found here. At generic level, *Dirinaria*, *Heterodermia*, *Parmotrema*, *Ramalina*, *Teloschistes* and *Usnea* possess maximum species. Common species include *Bulbothrix tabacina*, *Dirinaria aegialita*, *Heterodermia antillarum*, *Heterodermia obscurata*, *Heterodermia speciosa*, *Leucodermia leucomelos*, *Parmotrema cristiferum*, *Parmotrema hababianum*, *Parmotrema pseudocritinum*, *Parmotrema reticulatum*, *Parmotrema tinctorum*, *Pyxine austroindica*, *Ramalina nervulosa*, *Ramalina pacifica*, *Ramalina hossei*, *Teloschistes flavicans* and *Usnea bismolliuscula*.

Evergreen Forests

Evergreen forests were distributed in 900 Estate, Aranamala, Begur, Periya, Thariyode and Thirunelli between an elevational range of 750 to 1400 m. Forty one macro lichen species were found distributed in these areas. Dominant families include Parmeliaceae, Physciaceae, Collemataceae and Peltigeraceae and dominant genera were *Heterodermia*, *Hypotrachyna*, *Leptogium*, *Parmotrema*, *Physcia*, *Polyblastidium*, *Pseudocyphellaria* and *Sticta*. Macro lichens such as *Bulbothrix isidiza*, *Coccocarpia pellita*, *Heterodermia incana*, *Heterodermia obscurata*, *Heterodermia speciosa*, *Hypotrachyna crenata*, *Leptogium cyanescens*, *Leptogium denticulatum*, *Myelochroa xantholepis*, *Parmotrema cristiferum*, *Parmotrema planatilibatum*, *Parmotrema reticulatum*, *Polyblastidium hypocaesium*, *Polyblastidium japonicum*, *Polyblastidium*

microphyllum, *Pseudocyphellaria argyraceae* and *Sticta weigeli* were commonly distributed in these vegetations.

Southern montane subtropical forests (associated with grasslands)

Grassland – subtropical forests were located in high elevated areas (1400 m) to above of Wayanad district. Macro lichens collected from Chembra peak/hills resulted in the occurrence of 15 species of lichens. Species includes *Heterodermia incana*, *Parmelinella wallichiana*, *Pseudocyphellaria argyracea* and *Sticta orbicularis* were common here.

Grasslands

Majority of the hilly terrains of Wayanad district were covered by Grasslands. In the present study Kurumbalakotta hills were surveyed for the lichen diversity. The elevation of the area is about 1000 m from sea level. Twenty-one species of lichen were recorded from here. Members of the family Collemataceae, Physciaceae and Parmeliaceae were dominant and genus like *Heterodermia*, *Leptogium*, *Parmotrema* and *Pyxine* were common in this vegetation. Species include *Heterodermia diademata*, *Heterodermia obscurata*, *Heterodermia speciosa*, *Leptogium cyanescens*, *Leptogium denticulatum*, *Parmotrema tinctorum*, *Phaeophyscia ciliata* and *Pyxine sorediata* have wide distributional range in these grasslands.

Cultivated lands

Some of the cultivated land in Kavumannam area (750 m) were also surveyed for the lichen inventory. Twenty species of lichens were found to be distributed here. Common species occur in this area were *Coccocarpia palmicola*, *Collema nigrescens*, *Dirinaria consimilis*, *Heterodermia comosa*, *Heterodermia obscurata*, *Heterodermia speciosa*, *Parmotrema cristiferum*, *Parmotrema indicum*, *Parmotrema reticulatum*, *Parmotrema tinctorum* and *Phyllopsora corallina*.

New records of lichens

Present study resulted in the addition of 15 species of lichens new to the lichen flora of Kerala, among them two species were new to Peninsular India. The new reports of the lichen species from the study area are enumerated below.

1. *Coccocarpia glaucina* Kremp.

(Coccocarpiaceae) (Plate 2, Fig. A)

Specimen examined: Thariyode, Wayanad, Kerala. Arun Christy. 3892 (MCH).

Distribution: New report to Peninsular India. The species

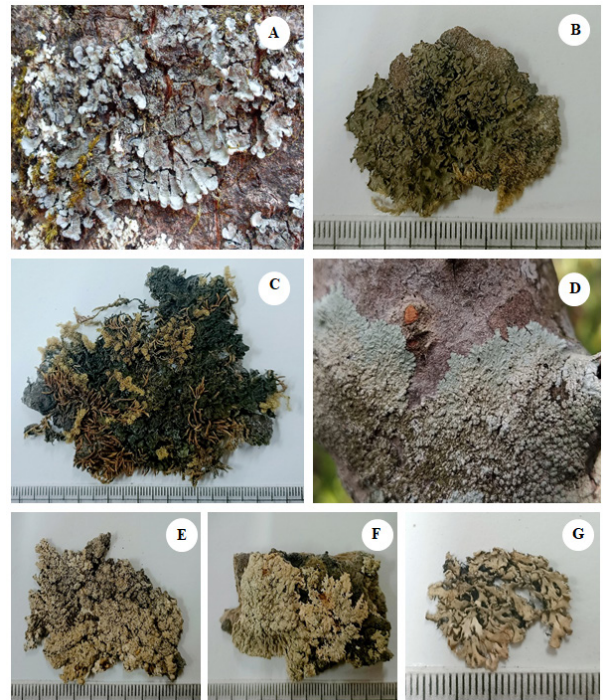


Plate 2: A. *Coccocarpia glaucina*, B. *Collema furfuraceum*, C. *Collema nigrescens*, D. *Dirinaria picta*, E. *Heterodermia albicans*, F. *Heterodermia antillarum*, and G. *Heterodermia galactophylla*

was earlier reported from West Bengal plains (Singh and Sinha 2010).

2. *Collema furfuraceum* (Arn.) Du Rietz em. Degel.

(Collemataceae) (Plate 2, Fig. B)

Specimen examined: Aranamala, Meppadi, Wayanad, Kerala. Arun Christy. 3327 (MCH).

Distribution: New report to Kerala, earlier reported from Tamil Nadu, Sikkim, Jammu & Kashmir, Uttarakhand and West Bengal (Singh and Sinha 2010).

3. *Collema nigrescens* (Huds.) DC.

(Collemataceae) (Plate 2, Fig. C)

Specimens examined: Kavumannam, Wayanad, Kerala. Arun Christy. 2515, 2725, 2728 (MCH).

Distribution: New report to Kerala, earlier reported from Tamil Nadu, Madhya Pradesh and Uttarakhand (Singh and Sinha 2010).

4. *Dirinaria picta* (Sw.) Clem. & Shear

(Caliciaceae) (Plate 2, Fig. D)

Specimens examined: Kurumbalakotta, Wayanad, Kerala.

Arun Christy. 1935 (MCH); Muthanga Wildlife Sanctuary, Wayanad, Kerala. Arun Christy. 3104 (MCH).

Distribution: New report to the lichen biota of Kerala. This species was earlier reported from Arunachal Pradesh, Assam, Tamil Nadu, Uttar Pradesh and West Bengal (Singh and Sinha 2010).

5. *Heterodermia albicans* (Pers.) Swinsc. & Krog

(**Physciaceae**) (Plate 2, Fig. E)

Specimens examined: Muthanga Wildlife Sanctuary, Wayanad, Kerala. Arun Christy. 3006 (MCH); Kurumbalakotta, Wayanad, Kerala. Arun Christy. 1924 (MCH).

Distribution: New report to Kerala. Earlier reported from Tamil Nadu, N.W. Himalayas and Maharashtra (Singh and Sinha 2010).

6. *Heterodermia antillarum* (Vain.) Swinsc. & Krog

(**Physciaceae**) (Plate 2, Fig. F)

Specimens examined: Muthanga Wildlife Sanctuary, Wayanad. Arun Christy. 3100, 3102, 3105, 3115 (MCH).

Distribution: New report to Kerala. Earlier it was reported from Karnataka and Maharashtra (Singh and Sinha 2010).

7. *Heterodermia galactophylla* (Tuck.) W. Culb.

(**Physciaceae**) (Plate 2, Fig. G)

Specimen examined: Kavumannam, Wayanad. Arun Christy. 1726 (MCH).

Distribution: New report to Kerala. Previously reported from Tamil Nadu and Nagaland (Singh and Sinha 2010).

8. *Lobaria discolor* (Bory ex Delise) Hue

(**Peltigeraceae**) (Plate 3, Fig. A)

Specimen examined: Muthanga Wildlife Sanctuary, Wayanad, Kerala. Arun Christy. 3160 (MCH).

Distribution: New report to Kerala. Earlier, it was reported from Tamil Nadu, Uttarakhand, Sikkim, Assam, Arunachal Pradesh and West Bengal. (Singh and Sinha 2010).

9. *Pannaria nilgherriensis* P. M. Jørg. & Upreti

(**Pannariaceae**) (Plate 3, Fig. B)

Specimen examined: Kurumbalakotta, Wayanad, Kerala. Arun Christy. 1938. (MCH).

Distribution: New report to Kerala. Previously reported from Tamil Nadu (Singh and Sinha 2010).



Plate 3. A. *Lobaria discolor*, B. *Pannaria nilgherriensis*, C. *Parmotrema cetratum*, D. *Phaeophyscia hispidula* var. *exornatula*, E. *Physcia aipolia*, F. *Pyxine farinosa*, G. *Ramalina hossei*, and H. *Usnea nipparensis*.

10. *Parmotrema cetratum* (Ach.) Hale

(**Parmeliaceae**) (Plate 3, Fig. C)

Specimens examined: Muthanga Wildlife Sanctuary, Wayanad. Arsha. 3066 (MCH); Kurumbalakotta, Wayanad, Kerala. Arun Christy. 1922 (MCH).

Distribution: New report to Kerala. Earlier, it was reported from Tamil Nadu (Singh and Sinha 2010).

11. *Phaeophyscia hispidula* var. *exornatula* (Zahlbr.)

Moberg,

(**Physciaceae**) (Plate 3, Fig. D)

Specimen examined: Muthanga Wildlife Sanctuary, Wayanad, Kerala. Arun Christy. 3106 (MCH).

Distribution: New report to Kerala. Earlier, it was reported from Tamil Nadu, Himachal Pradesh, Jammu & Kashmir, Nagaland and Uttarakhand (Singh and Sinha 2010).

12. *Physcia aipolia* (Ehrh. ex Humb.) Fűrnr.

(**Physciaceae**) (Plate 3, Fig. E)

Specimen examined: Thariyode, Wayanad, Kerala. Arun Christy. 3864 (MCH).

Distribution: New report to Kerala. Earlier reports were from Tamil Nadu, Himachal Pradesh, Jammu & Kashmir

and Karnataka (Singh and Sinha 2010).

13. *Pyxine farinosa* Kashiw.

(Caliciaceae) (Plate 3, Fig. F)

Specimen examined: Muthanga Wildlife Sanctuary, Wayanad, Kerala. Arun Christy. 3094 (MCH).

Distribution: New report to Kerala. Earlier, it was reported from Andaman & Nicobar Islands (Singh and Sinha 2010).

14. *Ramalina hossei* Vain.

(Ramalinaceae) (Plate 3, Fig. G)

Specimens examined: Muthanga Wildlife Sanctuary, Wayanad, Kerala, India. Arun Christy. 3020, 3043, 3048 (MCH).

Distribution: New report to Kerala. Previously reported from Karnataka (Kumar et al. 2010), Meghalaya, Uttarakhand and West Bengal (Singh and Sinha 2010).

15. *Usnea nipparensis* Asahina

(Parmeliaceae) (Plate 3, Fig. H)

Specimen examined: Muthanga Wildlife Sanctuary, Wayanad, Kerala, India. Arun Christy. 3129 (MCH).

Distribution: New to Peninsular India. This species was reported earlier from Sikkim and West Bengal (Singh and Sinha 2010).

CONCLUSION

The study mainly focused on the enumeration of macro lichen diversity of Wayanad district, Kerala, India. Many areas of the Wayanad serves as an excellent habitat for the lichens. Evergreen forests and Moist deciduous forests have the higher number of lichen species when compared to other vegetations. Even the cultivated lands also possess decent amount of lichen diversity. Exploration of lichens from other unexplored areas of the district will definitely contributes many more species and new records of macro and micro lichens. Available account on the lichen shows that Kerala part of Western Ghats inhabit a good number of lichens and can be compared with any of the lichen rich states of India. However, threats to the lichen community is a serious issue as they are very much sensitive to habitat destruction, encroachment, habitat loss and pollution. Decline of lichens can already be visible in some of the prime localities in Kerala with regard to the heavy inflow of tourism, road construction and encroachment. Atmospheric pollution and different anthropogenic activities are seriously affecting the distribution and diversity of these lichens.

Suitable conservation methods should be adopted for protecting these unique organisms.

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