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No. 12, Thiruvannamalai Nagar, Saravanampatti - Kalapatti Road, Saravanampatti,
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Ph: +91 9385339863 | www.threatenedtaxa.org

Email: sanjay@threatenedtaxa.org

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Caption: *Cyrtodactylus myntkyawthurai*, endemic to Myanmar. Medium: Water colours on watercolor sheet. © Aakanksha Komanduri



Macrolichens of Mathikettan Shola National Park, Western Ghats: a preliminary investigation with some new records

Aswathi Anilkumar¹ , Stephen Sequeira² , Arun Christy³ & S.M. Arsha⁴

¹⁻⁴Lichenology lab, Post-Graduate and Research Department of Botany, Maharaja's College, Ernakulam, Kerala 682011, India.

¹aswathianilkumar210@gmail.com (corresponding author), ²step@rediffmail.com, ³arunchristysebastian03@gmail.com, ⁴arsha.smohan@gmail.com

Abstract: An extensive survey of lichens was conducted in different parts of Mathikettan Shola National Park, and analysed 55 macrolichen species under six families. Two species were found to be new to the Indian peninsula, and five species were new to the lichen flora of Kerala.

Keywords: Biodiversity, Corticolous, Foliose, Fruiticolous, lichens, Kerala, Idukki, new reports, Saxicolous.

Editor: Anonymity requested.

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Author details: Aswathi Anilkumar is UGC- SRF at department of botany, Maharajas College, Kerala, India with research interest in taxonomy, ecology and molecular categorization of Lichens. Stephen Sequeira is currently working as Assistant Professor in Botany at Maharaja's College, Ernakulam, Kerala, India. His area of interest is taxonomy, ecology, molecular, pollution monitoring and climate change studies of lichens. Arun Christy currently working as project fellow at department of botany Maharajas College Ernakulam. He deals with taxonomic studies of lichens in Kerala and his area of interest are Lichenology, Ecology and Angiosperm taxonomy. Arsha SM is currently research scholar in department of Botany, Maharajas College. Her area of interest is molecular characterization of Parmelioid lichens.

Author contributions: AAK—conceptualization, performed field collection, formal analysis, writing original draft; SS—supervision, review, provided proper guidelines for the research; AC—review and editing draft; ASM—editing draft.

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INTRODUCTION

Mathikettan Shola National Park (MSNP, 9.950–10.010 N and 76.23–77.26 E), located in the high ranges of southern Western Ghats with an area of 1,282 ha falls under Poopara village of Ubumbanchola taluk in Idukki district, Kerala (Image 1). Altitude of the area ranges from 1,200–1,984 m in the highest peak—Kattamala—of the national park. The area represents a unique montane evergreen forest ecosystem with several endemic species—63 species of trees, 163 herbs and shrubs, and 15 species of climbers (Management Plan MSNP 2009).

The climatic conditions and the presence of forests intermingled with grasslands make MSNP suitable for the luxurious growth of lichens. However, to date no substantial work on lichens has reported on this unique area. Fragmentary lichen collections from different parts of Kerala (Kumar et al. 1999, 2000; Biju et al. 2010, 2012, 2014; Sonia et al. 2018, 2020) have not covered several interesting areas, including Wildlife Sanctuaries, national parks, mangrove forests, and cultivated areas (Sequiera 2003, 2005, 2008; Kumar et al. 2008). This report presents preliminary observations of macrolichens from a hitherto unrecorded area of MSNP, Idukki, Kerala.

MATERIALS AND METHODS

Data collection: An extensive survey of lichens was conducted in different parts of MSNP during the period of June 2019 to February 2020. Collection was made from Choondal (1,200–1,600 m), Karadippara (1,200 m), and Shivanpara (1,400 m) area of the national park. Substrate of collection, altitude and names of trees along with the lichen population was noted from each locality. The collected specimens were numbered, air dried and herbariums were prepared as per the standard method.

Identification: Collected specimens were identified based on morphological observation and comparison with published keys and descriptions (Awasthi 2007; Mishra & Upreti 2017). Species confirmation was done using various chemical colour tests such as potassium hydroxide (K), paraphenylene diamine (P), calcium hypochlorite (C), potassium iodide and thin layer chromatography (TLC) using a solvent containing toluene, dioxane, and acetic acid (TDA).

RESULTS AND DISCUSSION

More than 500 specimens were collected from the study area in MSNP. Critical analysis of the specimens revealed 55 macrolichen species under 17 genera belonging to six families; eight species were fruticose (13%) and 47 (87%) were foliose in nature. There was a maximum diversity of corticolous lichens represented by 47 species (87%), with the rest being saxicolous in nature (13%). Numerical representation of the taxa recorded is presented in Table 1. Family Parmeliaceae was predominant with 25 species from seven genera, followed by Physciaceae with 11 species from two genera, Peltigeraceae with nine species from three genera, Collemataceae with four species from two genera, Coccocarpiaceae with three species from one genus, and Ramalinaceae with one species. Among 17 genera, *Parmotrema* and *Heterodermia* were found to be dominant in the study area with nine species each followed by *Usnea* (6 species), *Sticta*, *Psuedocyphellaria* and *Hypotrachyna* with four species each, *Coccocarpia*, *Ramalina* and *Leptogium* with two species each, *Phaeophyscia*, *Xanthoparmelia* and *Canoparmelia* with two species each, *Lobaria*, *Collema*, *Physcia*, *Myelochroa*, *Parmelina* with one species each. Among the 55 species reported from the national park, two species were new to peninsular India and five species were found to be new to the lichen flora of Kerala.

New reports of lichens to Peninsular India

1. *Leptogium furfuraceum* (Harm.) Sierk.

Thallus corticolous, weekly adnate, dark brown to slate gray, lobes flabellate to orbicular, 3–5 cm wide, margins entire to lacerate; upper surface distinctly wrinkled, isidiate; isidia globular to clavate, laminal to marginal; lower surface with white tomentose on lower surface; apothecia absent (Image 2).

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 10.009N to 77.239E, 1,458 m, on bark, July, Aswathi Anilkumar (2442).

The species has an earlier record from Uttarakhand state (Awasthi 2007). The present collection shows its extended distribution in peninsular India.

2. *Parmelina usambarensis* (Steiner & Zahlbr.) Hale

Thallus saxicolous, loosely attached on rock, whitish mineral grey, 3–5 cm across; lobes sublinear to rotund, 5–6 mm wide, divaricately branched, ciliate, sparsely to densely isidiate; isidia cylindrical, simple to branched; medulla white; lower surface shiny black, rhizines black, simple, 1 mm long; apothecia not present (Image 3).

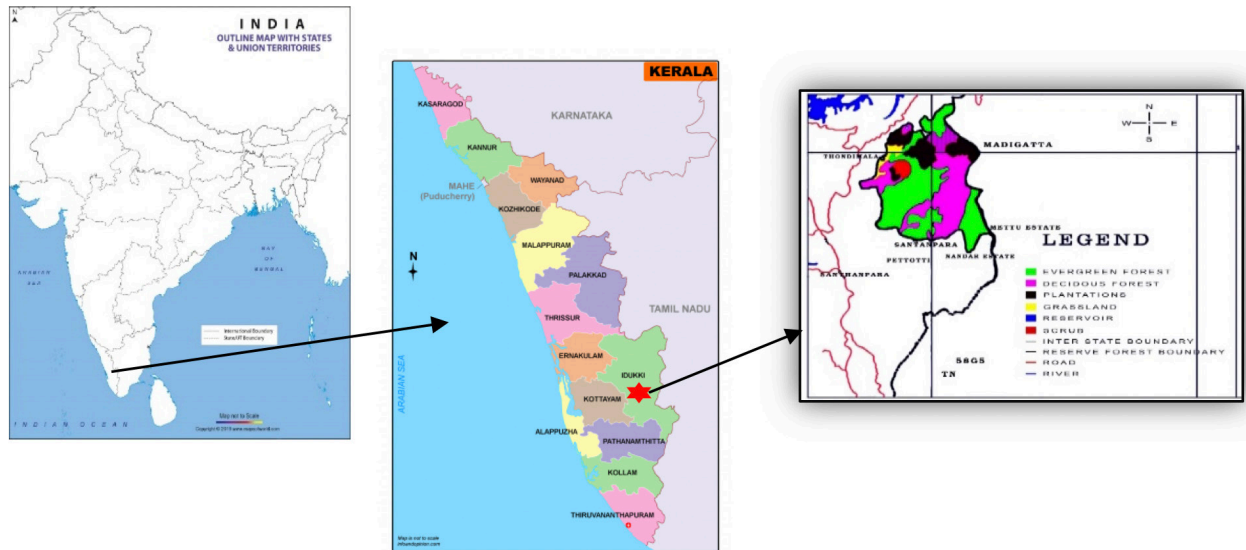


Image 1. Vegetative map of study area. Map source: www.mapsofindia.com; www.infoandopinion.com

Cortex K⁺ yellow; medulla K⁺ red, C, KC, P⁺ red.

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 10.009N to 77.245E, 1,603 m, on rock, July, Aswathi Anilkumar (2436).

This species has been reported earlier from eastern Himalaya and from Manipur state. The present collection from the study area shows its distribution in peninsular India.

New reports of lichen from Kerala

1. *Xanthoparmelia congensis* (Stein) Hale

Thallus saxicolous, very tightly adnate to the rock, foliose but centrally subcrustose, 1.5–4 cm across; lobes sub dichotomously branched, sublinear, 0.05–0.4 mm wide; upper side greenish yellow, shiny at apices, dull at the center, aeriolate, isidiate; isidia pale, simple, globose often bursting open at top not forming soredia; medulla white; apothecia not seen, lower side black, shiny, rhizinate; apothecia not seen (Image 4).

Medulla K⁺ yellow, C, KC, P⁺ dark orange; stictic, constictic, and norstictic acid present.

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 10.009N to 77.242E, 1,603 m, on rock, July, Aswathi Anilkumar (2498).

Found distributed in the state of Karnataka, Madhya Pradesh, Tamil Nadu, and Uttarakhand. The present collection confirms its extended distribution to the state of Kerala.

2. *Xanthoparmelia pseudocongensis* Hale

Thallus saxicolous, subcrustose, very tightly adnate to

the substratum, 7 cm across; lobes sublinear to rotund, 0.7–0.9 mm wide, black rimmed; upper surface yellowish-green, shiny in periphery, dull in center, isidiate; isidia cylindrical, simple, black tipped; medulla white; lower surface black, shiny, rhizinate, rhizines black. Apothecia absent (Image 5).

Cortex K; Medulla K⁺ yellow, C, KC, P⁺ orange; Stictic, Constictic and norstictic acid present.

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 10.006N to 77.243E 1,582 m, on rock, July, Aswathi Anilkumar & Stephen Sequeira (2497).

Recorded from Madhya Pradesh and Rajasthan.

3. *Parmotrema chinense* (Osbeck) Hale & Ahti

Corticulous, less adnate, 3–5 cm across; lobes irregular, 1–4 mm wide; upper surface white grey to dark grey, margins entire, ciliate, emaculate, smooth, sorediate; Soredia marginal to submarginal; medulla white; lower surface black in centre, shiny, rhizinate, brown towards margin, erhizinate; apothecia not seen (Image 6).

Cortex K⁺ yellow, medulla K⁺ yellow, C, KC, P⁺ pale orange; atranorin, stictic, and constictic acids present.

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 10.008N to 77.245E, 1,606 m, on bark, July, Aswathi Anilkumar (2427).

Awasthi (2007) reported the occurrence of this species from Nilgiri and Palni hills of Tamil Nadu. The present collection confirms its extended distribution to the state of Kerala.

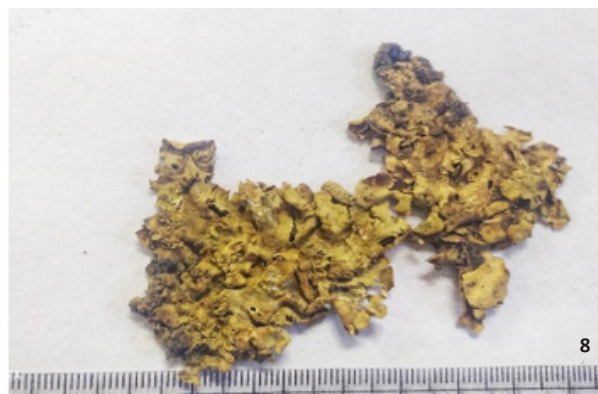
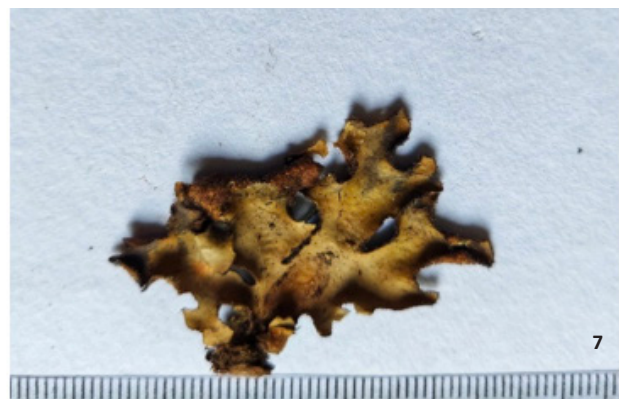
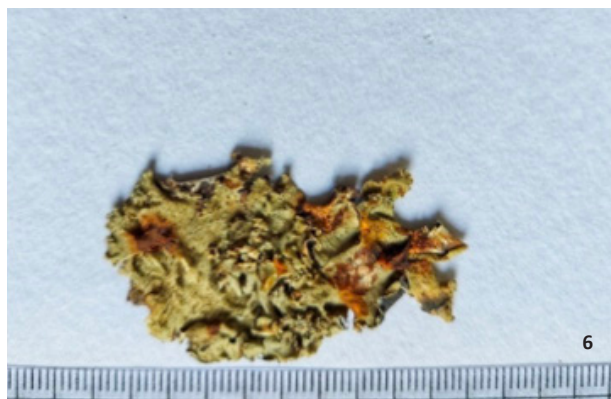
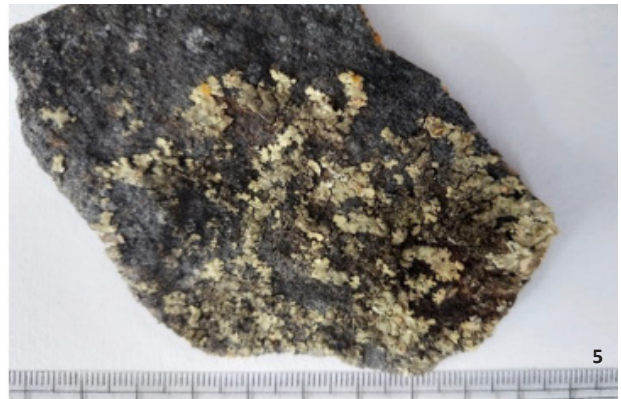
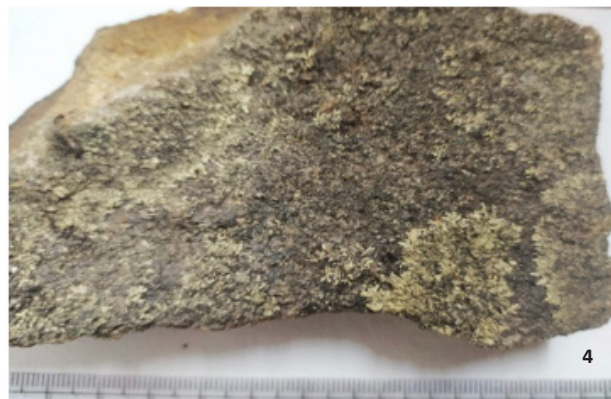


Image 2–8. New reports to lichen flora of peninsular India and Kerala: 2—*Leptogium furfuraceum* | 3—*Parmelina usambarensis* | 4—*Xanthoparmelia congensis* | 5—*Xanthoparmelia psuedocongensis* | 6—*Parmotrema chinense* | 7—*Sticta duplolibata* | 8—*Lobaria japonica*. © Aswathi Anilkumar and Stephen Sequeira.

Table 1. Enumeration of macro lichens from Mathikettan Shola National Park.

	Species	Family	Thallus type and substratum
1	<i>Coccocarpia palmicola</i> (Spreng.) Arvidss. & D.J. Galloway	Coccocarpiaceae	Foliose Saxicolous
2	<i>Coccocarpia pellita</i> (Ach.) Mull. Arg. Em. R. Sant.	Coccocarpiaceae	Foliose Saxicolous
3	<i>Coccocarpia</i> sp.	Coccocarpiaceae	Foliose Saxicolous
4	<i>Collema auriforme</i> (With.) Coppins & J.R. Laundon	Collemataceae	Foliose Corticolous
5	<i>Leptogium cyanescens</i> (Rabenh.) Körb.	Collemataceae	Foliose Corticolous
6	<i>Leptogium marginella</i> (Sw.) Gray	Collemataceae	Foliose Corticolous
7	<i>Lobaria japonica</i> (Zahlbr.) Asahina	Peltigeraceae	Foliose Corticolous
8	<i>Psuedocyphellaria argyreae</i> (Bory ex Delise) Vain.	Peltigeraceae	Foliose Corticolous
9	<i>Psuedocyphellaria aurata</i> (Sm. Ex Ach.) Vain	Peltigeraceae	Foliose Corticolous
10	<i>Psuedocyphellaria ceylonensis</i> H. Magn.	Peltigeraceae	Foliose Corticolous
11	<i>Psuedocyphellaria crocata</i> (L.) Vain	Peltigeraceae	Foliose Corticolous
12	<i>Psuedocyphellaria intricata</i> (Delise) Vain	Peltigeraceae	Foliose Corticolous
13	<i>Sticta duplolibata</i> (Hue) Vain.	Peltigeraceae	Foliose Corticolous
14	<i>Sticta limbata</i> (Sm.) Ach	Peltigeraceae	Foliose Corticolous
15	<i>Sticta orbicularis</i> (R. Br.) Hue	Peltigeraceae	Foliose Corticolous
16	<i>Sticta weigelii</i> (Ach.) Vain.	Peltigeraceae	Foliose Corticolous
17	<i>Canoparmelia pustulcescence</i> (Kurok.) Elix	Parmeliaceae	Foliose Corticolous
18	<i>Canoparmelia texana</i> (Tuck.) Elix & Hale	Parmeliaceae	Foliose Corticolous
19	<i>Hypotrachyna cirrhata</i> (Fr.) Divakar, A. Crespo, Sipman, Elix & Lumbsch	Parmeliaceae	Foliose Corticolous
20	<i>Hypotrachyna dactylifera</i> (Vain.) Hale	Parmeliaceae	Foliose Corticolous
21	<i>Hypotrachyna infirma</i> (Kurok.) Hale	Parmeliaceae	Foliose Corticolous
22	<i>Hypotrachyna nepalense</i> (Taylor) Divakar, A. Crespo, Sipman, Elix & Lumbsch	Parmeliaceae	Foliose Corticolous
23	<i>Myelochroa xantholepis</i> (Mont. & Bosch) Elix & Hale	Parmeliaceae	Foliose Corticolous
24	<i>Parmelina usambarensis</i> (Steiner & Zahlbr.) Hale	Parmeliaceae	Foliose Saxicolous
25	<i>Parmotrema chinense</i> (Osbeck) Hale & Ahti	Parmeliaceae	Foliose Corticolous
26	<i>Parmotrema indicum</i> Hale	Parmeliaceae	Foliose Corticolous
27	<i>Parmotrema tinctorum</i> (Despr. ex Nyl) Hale	Parmeliaceae	Foliose Corticolous
28	<i>Parmotrema reticulatum</i> (Taylor) Choisy	Parmeliaceae	Foliose Corticolous
29	<i>Parmotrema crinitum</i> (Ach.) Choisy	Parmeliaceae	Foliose Corticolous
30	<i>Parmotrema praesorediosum</i> (Nyl.) Hale	Parmeliaceae	Foliose Corticolous
31	<i>Parmotrema hababianum</i> (Gyeln.) Hale	Parmeliaceae	Foliose Corticolous
32	<i>Parmotrema cristiferum</i> (Taylor) Hale	Parmeliaceae	Foliose Corticolous
33	<i>Parmotrema stuppeum</i> (Taylor) Hale	Parmeliaceae	Foliose Corticolous
34	<i>Usnea baileyi</i> (Stirt.) Zahlbr.	Parmeliaceae	Fruticose Corticolous
35	<i>Usnea rigidula</i> (Stirt.) G. Awasthi	Parmeliaceae	Fruticose Corticolous
36	<i>Usnea thomsonii</i> Stirt.	Parmeliaceae	Fruticose Corticolous
37	<i>Usnea pectinate</i> Taylor	Parmeliaceae	Fruticose Corticolous
38	<i>Usnea picta</i> (J. Steiner) Mot.	Parmeliaceae	Fruticose Corticolous
39	<i>Usnea subflorida</i> (Zahlbr.) Mot.	Parmeliaceae	Fruticose Corticolous
40	<i>Xanthoparmelia congensis</i> (B. Stein) Hale	Parmeliaceae	Foliose Saxicolous
41	<i>Xanthoparmelia pseudocongensis</i> Hale	Parmeliaceae	Foliose Saxicolous
42	<i>Heterodermia boryi</i> (Fée) Kr.P. Singh & S.R. Singh	Physciaceae	Foliose Corticolous
43	<i>Heterodermia comosa</i> (Eschw.) Follman & Redon	Physciaceae	Foliose Corticolous
44	<i>Heterodermia hypocaesia</i> (Yasuda) D.D. Awasthi	Physciaceae	Foliose Corticolous
45	<i>Heterodermia incana</i> (Stirton) D. D. Awasthi	Physciaceae	Foliose Corticolous
46	<i>Heterodermia isidiophora</i> (Vain.) D.D. Awasthi	Physciaceae	Foliose Corticolous
47	<i>Heterodermia japonica</i> (Sato) Swinsc. & Krog	Physciaceae	Foliose Corticolous
48	<i>Heterodermia obscurata</i> (Nyl.) Trevis.	Physciaceae	Foliose Corticolous
49	<i>Heterodermia speciosa</i> (Wulf.) Trevis.	Physciaceae	Foliose Corticolous
50	<i>Heterodermia togashii</i> (Kurok.) D.D. Awasthi	Physciaceae	Foliose Corticolous
51	<i>Pheophyscia hispidula</i> (Ach.) Moberg	Physciaceae	Foliose Corticolous
52	<i>Pheophyscia orbicularis</i> (Neck.) Moberg	Physciaceae	Foliose Corticolous
53	<i>Physcia tribacoides</i> Nyl.	Physciaceae	Foliose Saxicolous
54	<i>Ramalina conduplicans</i> Vain.	Ramalinaceae	Fruticose Corticolous
55	<i>Ramalina pacifica</i> Asahina	Ramalinaceae	Fruticose Corticolous

4. *Sticta duplolibata* (Hue) Vain.

Corticolous thallus, photobiont cyanobacterium, holdfast seen, foliose, 4–5 cm wide; upper surface yellowish-brown, glossy, ciliate, cilia black, isidiate; Isidia black, marginal; medulla off white; lower surface brown, tomentose, cyphellae yellow; apothecia not known (Image 7).

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 10.007N to 77.246E, 1,591 m, on rock, July, Aswathi Anilkumar (2480).

Recently collected from Nilgris hills of Tamil Nadu (Pandit & Sharma 2012). The present collection confirms its extended distribution to the state of Kerala.

5. *Lobaria japonica* (Zahlbr.) Asahina

Thallus corticolous, loosely adnate, 5–9 cm across, yellow brown, dull, photobiont green algae; Upper surface smooth without reticulate ridges, minor wrinkles; no isidia and soredia; lower surface pale brown, tomentose, rhizinate, rhizines black; apothecia immature (Image 8).

Cortex K⁺; medulla K⁺, C⁺, KC⁺, P⁻. No lichen materials

Specimen examined: India, Kerala, Idukki, Mathikettan Shola National Park, 10.006N to 77.243E, 1,582 m, on rock, July, Aswathi Anilkumar (2380).

Collected from Nilgris hills of Tamil Nadu and Nagaland.

CONCLUSION

It is estimated that India supports about 2,532 lichen species under 324 genera and 78 families, including 541 endemic species (Singh & Sinha 2010). Only about 691 species are so far reported from Kerala since only fragmentary studies have been done on lichen taxonomy from the state. This study mainly focused on survey of macro lichen species from Mathikettan Shola National Park, and the results revealed that further extensive exploratory studies may end up with new additions to lichen biota of the state, and also to the country.

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