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

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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, Fruiticose, lichens, Kerala, Idukki, new reports, Saxicolous.
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), paraphenylenediamine (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, Peltigeraeaceae with nine species from four genera, Coccocarpiaceae with three species from one genus, and Ramalinaceae with one species. Among 17 genera, Parmotrema and Heteroderma 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, 10.009 N to 77.239 E, 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).
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, 0.05–0.4mm 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+ 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
    Corticolous, 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+; Medulla K+ yellow, C+, KC+, P+ 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 congestis | 5—Xanthoparmelia psuedocongensis | 6—Parmotrema chinense | 7—Sticta duploimbata | 8—Lobaria japonica.
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Table 1. Enumeration of macro lichens from Mathikettan Shola National Park.

| Species                                      | Family                      | Thallus type and substratum         |
|----------------------------------------------|-----------------------------|-------------------------------------|
| Coccocarpia palmicola (Spreng.) Arvids. & D.J. Galloway | Coccocarpiaeae              | Foliose Corticolous                  |
| Coccocarpia pellita (Ach.) Mull. Arg. Em. R. Sant. | Coccocarpiaeae              | Foliose Corticolous                  |
| Coccocarpia sp.                               | Coccocarpiaeae              | Foliose Corticolous                  |
| Collema auriforme (With.) Coppins & J.R. Laundon | Collemataceae               | Foliose Corticolous                  |
| Leptogium cyanescens (Rabenb.) Körb.          | Collemataceae               | Foliose Corticolous                  |
| Leptogium marginella (Sw.) Gray               | Collemataceae               | Foliose Corticolous                  |
| Lobaria japonica (Zahlbr.) Asahina            | Peltigeraceae               | Foliose Corticolous                  |
| Pseudeocyphellaria argyracea (Bory ex Delise) Vain | Peltigeraceae               | Foliose Corticolous                  |
| Pseudeocyphellaria aurata (Sm. & Ach.) Vain.  | Peltigeraceae               | Foliose Corticolous                  |
| Pseudeocyphellaria cyeylonensis H. Magn.      | Peltigeraceae               | Foliose Corticolous                  |
| Pseudeocyphellaria crocata (L.) Vain.         | Peltigeraceae               | Foliose Corticolous                  |
| Pseudeocyphellaria intricata (Delise) Vain.   | Peltigeraceae               | Foliose Corticolous                  |
| Sticta duplilimbo (Hue) Vain.                 | Peltigeraceae               | Foliose Corticolous                  |
| Sticta limbata (Sm.) Ach.                     | Peltigeraceae               | Foliose Corticolous                  |
| Sticta arbolearis (R. Br.) Hue                | Peltigeraceae               | Foliose Corticolous                  |
| Sticta weigerlii (Ach.) Vain.                 | Peltigeraceae               | Foliose Corticolous                  |
| Canoparmelia pustulescens (Kurok.) Elix       | Parmeliaceae                | Foliose Corticolous                  |
| Canoparmelia texana (Tuck.) Elix & Hale       | Parmeliaceae                | Foliose Corticolous                  |
| Hypotrachyna cirrata (Fr.) Divakar, A. Crespo, Sipman, Elix & Lumbsch | Parmeliaceae                | Foliose Corticolous                  |
| Hypotrachyna dactylifera (Vain.) Hale         | Parmeliaceae                | Foliose Corticolous                  |
| Hypotrachyna infirma (Kurok.) Hale            | Parmeliaceae                | Foliose Corticolous                  |
| Hypotrachyna nepalense (Taylor) Divakar, A. Crespo, Sipman, Elix & Lumbsch | Parmeliaceae                | Foliose Corticolous                  |
| Myelochroa xantholepis (Mont. & Bosch) Elix & Hale | Parmeliaceae                | Foliose Corticolous                  |
| Parmelina usambarensis (Steiner & Zahlbr.) Hale | Parmeliaceae                | Foliose Corticolous                  |
| Parmotrema chinense (Osbeck) Hale & Ahti      | Parmeliaceae                | Foliose Corticolous                  |
| Parmotrema indicum Hale                       | Parmeliaceae                | Foliose Corticolous                  |
| Parmotrema tinctorum (Despr. ex Nyl) Hale     | Parmeliaceae                | Foliose Corticolous                  |
| Parmotrema reticulatum (Taylor) Chaisy        | Parmeliaceae                | Foliose Corticolous                  |
| Parmotrema cristiferum (Taylor) Hale          | Parmeliaceae                | Foliose Corticolous                  |
| Parmotrema hababianum (Geyrn.) Hale           | Parmeliaceae                | Foliose Corticolous                  |
| Parmotrema stippeurn (Taylor) Hale            | Parmeliaceae                | Foliose Corticolous                  |
| Usnea baileyi (Stirt.) Zahlbr.                | Parmeliaceae                | Fruticose Corticolous                |
| Usnea rigidula (Stirt.) G. Awashti            | Parmeliaceae                | Fruticose Corticolous                |
| Usnea spathulata (J. Steiner) Mot.             | Parmeliaceae                | Fruticose Corticolous                |
| Xanthoparmelia congensis (B. Stein) Hale      | Parmeliaceae                | Foliose Saxicolous                   |
| Xanthoparmelia pseudocongensis Hale           | Parmeliaceae                | Foliose Saxicolous                   |
| Heteroderma boryi (Fée) Kr.P. Singh & S.R. Singh | Physciaceae                | Foliose Corticolous                  |
| Heteroderma comosa (Eschw.) Follman & Redon   | Physciaceae                | Foliose Corticolous                  |
| Heteroderma hypocaecisa (Yasuda) D.D. Awashti | Physciaceae                | Foliose Corticolous                  |
| Heteroderma incana (Stirtini) D. D. Awashti   | Physciaceae                | Foliose Corticolous                  |
| Heteroderma istiophora (Vain.) D.D. Awashti   | Physciaceae                | Foliose Corticolous                  |
| Heteroderma japonica (Sato) Swinsc. & Krog     | Physciaceae                | Foliose Corticolous                  |
| Heteroderma obscura (Nyl.) Trevir.            | Physciaceae                | Foliose Corticolous                  |
| Heteroderma speciosa (Wulf.) Trevir.          | Physciaceae                | Foliose Corticolous                  |
| Heteroderma tagashii (Kurok.) D.D. Awashti    | Physciaceae                | Foliose Corticolous                  |
| Phephysia hispidula (Ach.) Moberg             | Physciaceae                | Foliose Corticolous                  |
| Phephysia oricellaris (Nech.) Moberg          | Physciaceae                | Foliose Corticolous                  |
| Physcia tribacoides Nyl.                     | Physciaceae                | Foliose Saxicolous                   |
| Ramalina conduplicans Vain.                  | Ramalinaceae               | Fruticose Corticolous                |
| Ramalina pacifica Asahina                    | Ramalinaceae               | Fruticose Corticolous                |
4. *Sticta duplolimbata* (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 corticolus, 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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