Phytotaxa 652 (3): 241–245
https://www.mapress.com/pt/

Article

ISSN 1179-3155 (print edition)
PHYTOTAXA
ISSN 1179-3163 (online edition)

https://doi.org/10.11646/phytotaxa.652.3.6

Solenopsora rhizomorpha (Catillariaceae): A new lichen species from India

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Abstract

A new species of *Solenopsora* (Lichenized fungi), *S. rhizomorpha* from the Western Ghats biodiversity hotspot, India, is described and illustrated, along with its distribution map. The species is characterized by small foliose-type thallus covered with white pruina, presence of rhizines, and lacking secondary metabolites. In addition, the genus *Solenopsora* is recorded in India for the first time.

Key words: Lichenized Ascomycota, Western Ghats, Kerala, Eravikulam National Park, Mathikettan Shola National Park

Introduction

The genus *Solenopsora* Massalango (1855: 20) is mainly found in temperate and subtropical regions of the world. Its highest diversity and distribution are centred in the Mediterranean, Macaronesian, and Madrean floristic regions. Taxonomic treatment of several taxa has varied over time and the concepts lack clarity (Guttová *et al*. 2014). The genus *Solenopsora* is characterized by the lecanorine ascomata, *Catillaria*-type ascus, hyaline 1-septate ascospores and paraphyses with a sharply delimited brown cell wall pigment in the upper part of the apical cell (Ryan & Timdal 2002, Van Den Boom & Ertz 2012), and comprises approximately 20 species (Lücking *et al*. 2016). The morphology exhibits a wide range of variation; the thalli can be placodioid, squamulose, small foliose, effigurate or crustose, with or without vegetative propagules, and rhizines may be present or absent (Verdon & Rambold 1998, Guttová *et al*. 2014). The genus is currently placed in the family Catillariaceae, and recent studies indicates that the generic circumscription and phylogenetic position are still problematic and requires further studies (Guttová *et al*. 2014, Fačkovcová *et al*. 2020, Cannon *et al*. 2022, Nimis 2024).

While studying lichens in the Kerala part of Western Ghats, we found an interesting specimen that was identified as a species of the lichen genus *Solenopsora* and it is described as new to science. Also, the genus *Solenopsora* is recorded in India for the first time.

Materials and methods

The specimens were collected during field work carried out in Eravikulam National Park and Mathikettan Shola National Park of Idukki district, Kerala (Figure 1). The collected specimens were air dried, and herbarium specimens were prepared following the standard method and were deposited at Maharaja's College herbarium (MCH) and Kerala Forest Research Institute herbarium (KFRI). Morphological and anatomical characters of the lichen specimens were examined with a stereo zoom microscope (Olympus SZ61) and trinocular compound microscope (Leica DM2000 LED). Hand-cut sections of thalli and ascomata mounted in distilled water, KOH solution (K), lactophenol cotton blue (LPCB) were studied. The amyloid reactions were tested in Lugol's iodine solution without (I) or with pre-treatment

Accepted by Frank Bungartz: 23 May 2024; published: 7 Jun. 2024

with KOH (KI). All measurements were made on material mounted in distilled water. The chemistry was studied by spot tests and thin layer chromatography following Orange *et al*. (2001).

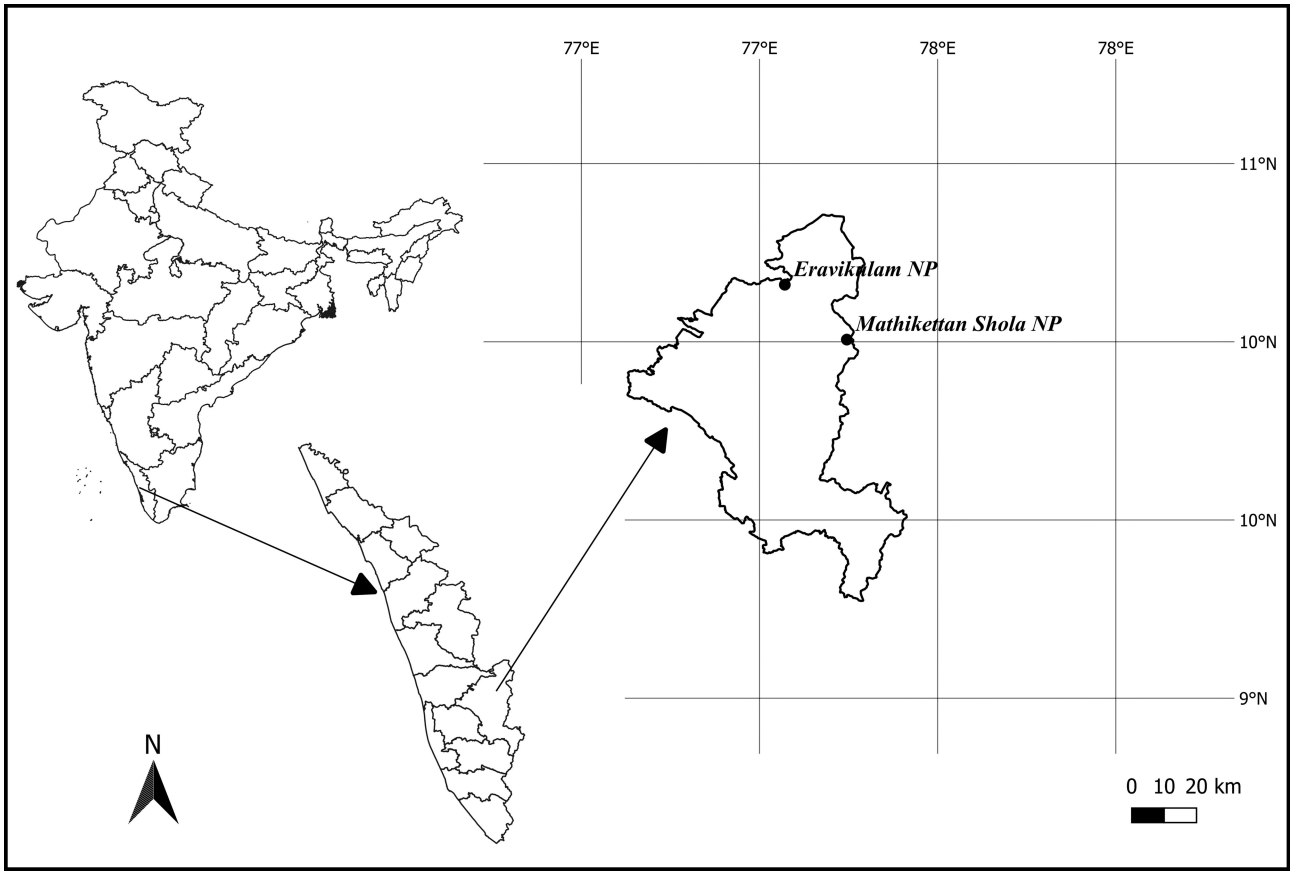

FIGURE 1. Map showing the collection sites of *Solenopsora rhizomorpha* from Idukki district, Kerala, India.

Taxonomy

Solenopsora rhizomorpha A. Christy, Sequiera & S. Joseph, *sp. nov.* Mycobank No.: MB854033
(Fig. 2)

Similar to *Solenopsora elixiana* Verdon & Rambold but differing in having an irregular or rosette-forming chalky white thallus with slightly larger subsessile to shortly stipitate apothecia, and lacking secondary metabolites.

Type:—INDIA. Kerala: Idukki district, Munnar, Eravikulam National Park, 10.1599° N 77.0709° E, elev. 2029 m, 22 November 2023, *Arun Christy 23-40170* (holotype KFRI!, isotype MCH!)

Thallus saxicolous, small foliose, in irregular patches or rosette-forming, 1–1.5 cm wide. Lobes ca. 1–3 (–4) mm broad, 400–700 µm thick in section, corticate on both sides; upper surface chalky white, smooth, continuous, slightly convex, covered by white pruina, isidia and soredia absent; lower surface dark brown to black, attached by sparse pale to black rhizines; upper cortex filled with dull gelatinous substances, clearing in K, 40–65 µm thick; algal layer appears in irregular bundles, 100–160 µm thick; medulla of interwoven hyphae, 200–480 µm thick; lower cortex hyaline to brown, 80–140 µm thick. Photobiont chlorococcoid, cells spherical, 4.5–8.5 µm diam.

Apothecia lecanorine, ca. 0.5–1.7 mm diam., subsessile to shortly stipitate; disc plane to slightly convex, dark brown to blackish, usually slightly white pruinose when young; margin concolorous with the thallus, densely white pruinose when young, thalline excipulum eventually excluded at maturity. Epithecium pale brown. Hymenium hyaline, non inspersed, 50–70 µm high, K−, I+ dark blue; paraphyses sparingly branched, conglutinated, apices swollen, brown pigmented. Hypothecium hyaline, 70–140 µm high. Asci 8-spored, *Catillaria*-type, cylindrical-clavate, 33–45 × 9–13 µm, with KI+ evenly blue tholus, ocular chamber not seen. Ascospores hyaline, 1-septate, ellipsoid-elongate to slightly fusiform, 12–15 × 3–4 µm, without perispore.

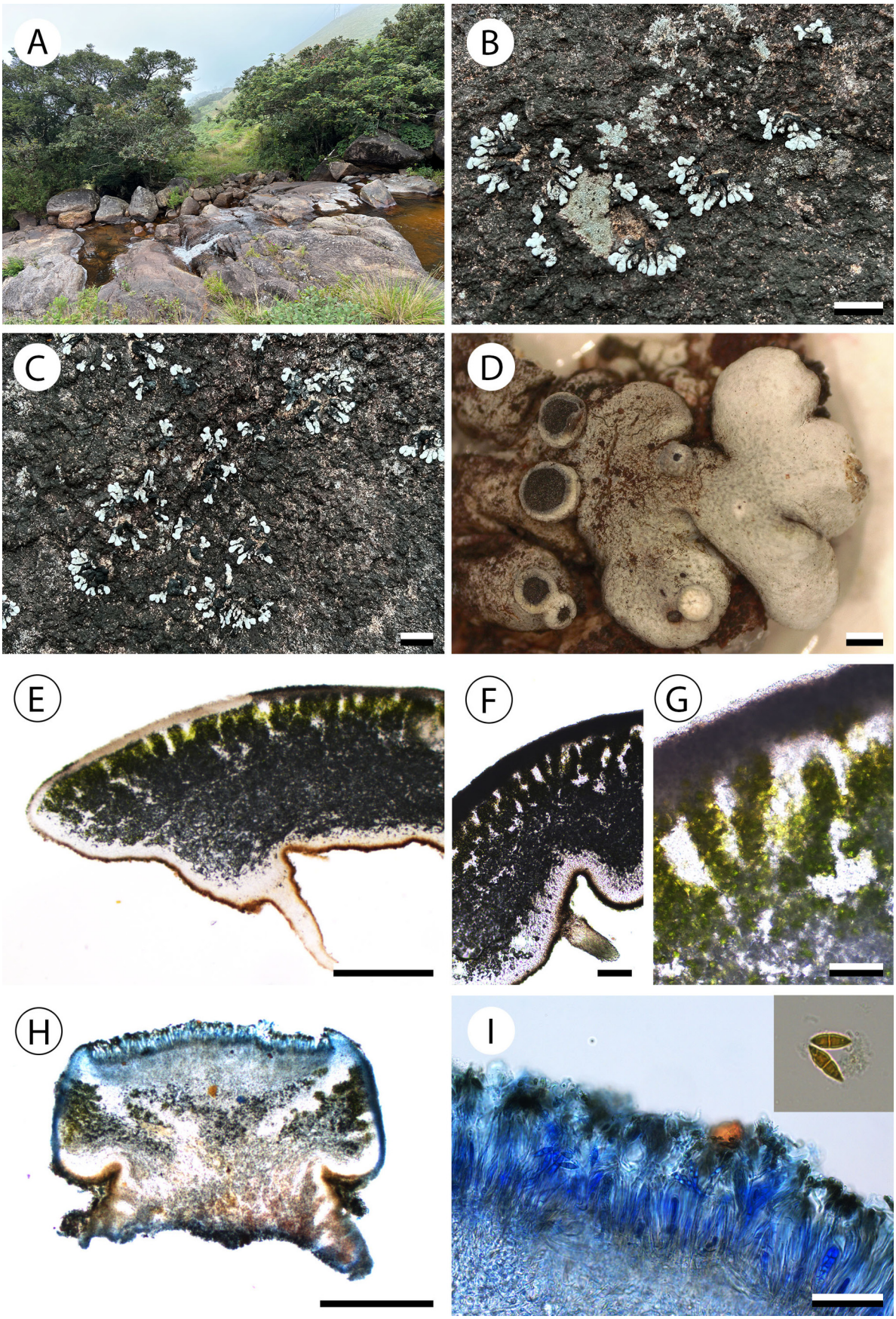

FIGURE 2. *Solenopsora rhizomorpha*: A. Photograph of collection locality (holotype). B & C. Habits; D. An enlarged view of thallus. E & F. Cross section of thallus (E in K, F in water). G. Thallus section showing the algal layer (in water). H. Section of an apothecium (in K followed by LPCB). I. Section of hymenial region (in LPCB), inset: ascospores (in KI). Scale bars: B & C = 5 mm; D, E & H = 500 µm; F = 100 µm; G & I = 50 µm.

Pycnidia not seen.

Chemistry: Cortex and Medulla K−, C−, KC−, P−, UV−. No chemicals detected by TLC.

Additional materials examined (paratypes)*:* INDIA. Kerala: Idukki district, Munnar, Eravikulam National Park, 10.1599° N 77.0709° E, elev. 2029 m, 02 October 2020, *Arun Christy 4237* (MCH); *ibid.*, Mathikettan Shola National Park, 10.006° N 77.245° E, elev. 1740 m, 30 December 2021, *Aswathi Anilkumar 5380* (MCH).

Etymology: The specific epithet '*rhizomorpha*' refers to the presence of rhizines which is a characteristic feature in the new species.

Distribution and ecology: The species is found growing on open rocks in grasslands of Eravikulam National Park and Mathikettan Shola National Park. The species is restricted in its distribution and has only been found at these two locations so far. The specimens were collected from high-elevation areas (above 1700 m) that receive intense sunlight. In Eravikulam National Park, the specimens were found on open rocks near a stream and a waterfall, while in Mathikettan Shola National Park, they were found on open rocks near grasslands.

Notes: The new species, *S. rhizomorpha* is easily distinguished from most other known species of the genus by the presence of rhizines. Only the following species of *Solenopsora* were known to be rhizinate: *Solenopsora elixiana* Verdon & Rambold (1998: 401), *Solenopsora holophaea* (Mont.) Sampaio (1921: 26), *Solenopsora marina* (Zahlbr.) Zahlbruckner (1928: 756). Although, the species mentioned above have rhizines, they differ from *S. rhizomorpha* in several taxonomically important characteristics. Table 1 provides a detailed comparison of these differences. Morphologically, *S. rhizomorpha* shows similarities with *Solenopsora candicans* (Dicks.) Steiner (1915: 288) by the presence of rosette forming, lobed marginate thallus. However, *S. rhizomorpha* can easily be distinguish from *S. candicans* with the presence of rhizines and the absence of secondary metabolites. *S. candicans* contains pannarin and zeorin which give the medulla a P+ orange reaction (Dobson 2018, Guttová & Nimis 2021, Cannon *et al.* 2022, Nimis 2024).

TABLE 1. Table showing comparison of *Solenopsora rhizomorpha* with allied species.

	S. rhizomorpha (New Species)	***S. elixiana*** (Verdon & Rambold 1998)	***S. holophaea*** (Dobson 2018, Guttová & Nimis 2021, Cannon *et al.* 2022, Nimis 2024)	***S. marina*** (Guttová & Nimis 2021, Nimis 2024)
Thallus	Small foliose, in irregular patches or rosette-forming, 1–1.5 cm wide. Lobes ca. 1–3 (–4) mm broad. Upper surface chalky white, smooth, continuous, slightly convex, covered by white pruina	Small foliose, up to 4 cm wide, irregularly imbricately lobate. Lobes rotund or oblong with truncate apices, 1–2(2.5) mm broad. Upper surface greyish green to whitish green, with white-pruinose margins	Squamulose, squamules 1–3 mm wide, rounded, concave to flat, contiguous or imbricate, with entire to crenulate or flexuose, raised margins. Upper surface olive-green to olive-brown, epruinose	Squamulose, forming rosettes or irregular patches up to 5–6 cm in diam., outer squamules elongate, flexuose, folded; central parts of thallus crustose-areolate. Upper surface pale green to glaucous green, with white-pruinose margins
Apothecia	Apothecia ca. 0.5–1.7 mm diam., subsessile to shortly stipitate	Apothecia 0.2–0.4 mm diam., stipitate	Apothecia 0.5–1.5 mm diam., sessile to shortly stipitate	Apothecia to ca. 0.5(–1) mm diam., sessile
Ascospores	Ellipsoid-elongate to slightly fusiform, 12–15 × 3–4 µm	Ellipsoid to narrow ellipsoid, with acute to acuminate apices, 10–17 × 3.5–5 µm	Ellipsoid-elongate to slightly fusiform, 11–24 × 4–6 µm	Narrowly ellipsoid to fusiform, 9–16 × 3–3.5 µm
Chemistry	Cortex and Medulla K−, C−, KC−, P−, UV−. No chemicals detected by TLC	K−, C−, KC+ fleetingly red, P−, UV−. Lobaric acid present	Cortex and medulla K−, C−, KC−, P−, UV−. Terpenoids and unidentified substances present	Medulla K− C−, KC−, P−. Terpenoids and unidentified substances present

Acknowledgements

The authors are thankful to the Director, KSCSTE-Kerala Forest Research Institute, and to Principal, Maharaja's College, Ernakulam for providing necessary facilities. One of authors (SS) thankful to Kerala State Council for Science, Technology and Environment (KSCSTE), Thiruvananthapuram, Govt. of Kerala for providing the financial support for the work. One of the authors (SJ) is thankful to Department of Science and Technology (DST), New Delhi for the financial assistance under INSPIRE Faculty scheme (IFA18-LSPA 124). The authors are also thankful to the Kerala Forest Department for granting the specimen collection permission from the forest areas.

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