

NEW DISTRIBUTION RECORDS OF *STRIGULA* (STRIGULACEAE, ASCOMYCOTA) FROM THE WESTERN GHATS IN INDIA

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Abstract. The paper gives new records of four foliicolous lichenised fungi from the Western Ghats: *Strigula melanobapha* (Kremp.) R. Sant., *S. nemathora* Mont. f. *nemathora*, *S. nemathora* f. *hypothelia* (Nyl.) Lücking and *S. orbicularis* Fr. A brief taxonomic description, remarks, ecological notes and distribution details are provided for all the studied taxa.

Key words: biogeography, foliicolous lichens, Indian Subcontinent, Paleotropic

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INTRODUCTION

The study of foliicolous lichens on the Indian Subcontinent (Awasthi 2010; Singh & Sinha 2010; Singh & Pinokiyo 2014) is not as exhaustive as similar work on the Neotropics (Lücking 2008). Since the majority of the territory of India is situated in the tropical zone (Paleotropics), the country provides a favourable habitat for foliicolous lichens, especially in the Western Ghats. The climatic conditions also allow considerable colonisation of foliicolous lichens in the Eastern Himalayan regions. Lichenological studies in India started at the beginning of the eighteenth century (Fries 1825), much earlier than the first worldwide monograph of foliicolous lichens, published in 1952 (Santesson 1952). After that, only a few scientists worked on this group in India (Awasthi 2010; Farkas 2014). Recently, Singh and Pinokiyo (2014) worked on the foliicolous lichens of India, but their primary study site was the Eastern Himalayas and they did not made collections from the Western Ghats. Singh *et al.* (2004) described the Western Ghats as the region with the highest number of endemic lichens. Exhaustive collections and detailed enumeration reports of foliicolous lichens have not been done in this region.

Singh (1970) reported the genus *Strigula* Fr. (Strigulaceae) for the first time for the Indian Subcontinent from the Andaman Islands, and described five species of *Strigula* along with one *Raciborskiella*. Later many researchers contributed to the foliicolous lichens of that genus in India (Sethy & Patwardhan 1987; Sinha & Singh 1987; Singh & Pinokiyo 2003; Pinokiyo *et al.* 2006). Worldwide the genus is represented by 36 species and 3 subspecific taxa, among them 16 species (14 foliicolous, 2 corticolous) known from India (Singh & Pinokiyo 2014). The genus is characterised by having a subcuticular (with few exceptions) thallus, with perithecia. Other important characters are 1–3 septate ascospores and simple or sparsely branched and anastomosed paraphyses. During a recent field survey in the Western Ghats we collected many foliicolous lichens, including several new records. In this paper we give some of these new records of the foliicolous genus *Strigula*.

MATERIALS AND METHODS

Foliicolous lichen specimens were collected randomly from different localities of the Western Ghats. Leaves of phorophytes reaching a height of up to 3 metres were considered for sampling. Samples of leaves colonised

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by lichens were collected in paper bags. A stereomicroscope (Carl Zeiss Stemi 2000C) was used for morphological studies and a compound microscope (Carl Zeiss Primo Star) for studying the anatomy of thalli and fruiting bodies. Anatomical characteristics were observed in hand-cut sections mounted in water and 10% KOH (K); all measurements were taken in water. Photographs were taken with an AxioCamERc5s camera and the images were analysed using Axio Vision LE (AxioVs40 V 4.8.2.0). The hemiamyloid reaction of the ascus was studied in Lugol's solution (0.2% I and 0.6% KI) after pretreatment with KOH. Various standard literature sources (Santesson 1952; Farkas 1987; Awasthi 1991; Lücking 1991, 1992, 2008) were used for identification and comparison of species. Voucher specimens are deposited in LWG (Lucknow) and in the herbarium of the Department of Applied Botany, Kuvempu University, Jnanasahyadri, Karnataka, India.

RESULTS AND DISCUSSION

Strigula melanobapha (Kremp.) R. Sant.

Fig. 1A–C

Symb. Bot. Upsal. 12: 188. 1952.

Thallus epiphyllous, subcuticular, very thin, metallic green to dark green or greenish brown and usually bordered by a thin black, sometimes interrupted line. Photobiont a species of *Cephaleureos*, cells in one to several layers, angular-oblong, irregularly arranged. Perithecia conical to hemispherical, greyish black (covered by thin thallus layer up to ostiole), 0.4–0.7 mm. Ascospores hyaline, ellipsoid to fusiform, biserial, 1-septate, rarely 3-septate, constricted at septa, 12–20 × 3–5 µm, spores not breaking into halves within the asci but sometimes outside the asci in squash mount; cells with acute ends, unequal in size. Conidiomata pycnidia, numerous, black at lobe margins, basally immersed, wart-shaped; macroconidia simple, bacillar to ellipsoid, 1-septate, 10–12 × 2–3 µm diam.

REMARKS. The species is characterised by its elongated, dichotomously branched lobes of the

thallus with interrupted black-bordered margins. It can be distinguished from *S. tremens* Müll. Arg., which has smaller (ca 0.4 mm) perithecia. *Strigula subtilissima* (Fée) Müll. Arg. and *S. maculata* (Cooke & Massée) R. Sant. are also similar to *S. melanobapha* but they have oblong-bacillar ascospores (8–18 × 2–3 µm), smaller macroconidia (4–7 µm long), and the thallus is bordered by a continuous black line.

ECOLOGY AND DISTRIBUTION. It grows on leaves of *Memecylon malabaricum* in shola forest (montane forest). It has a pantropical distribution. In India it is reported from the Andaman Islands and Arunachal Pradesh (Singh & Pinokiyo 2014).

SPECIMENS EXAMINED: INDIA. KARNATAKA. Chikmagalur District: Chandra-Drona Parvatha: shola forest on the way to Mullaiahnagiri Peak, 13°23'25"N, 75°42'59"E, 1693 m, epiphyllous on *Memecylon malabaricum* (C. B. Clarke.) Cogn., 4 Dec. 2013, *Shravan Kumar S. & Y.L. Krishnamurthy* 5562.

Strigula nemathora Mont. f. *nemathora*

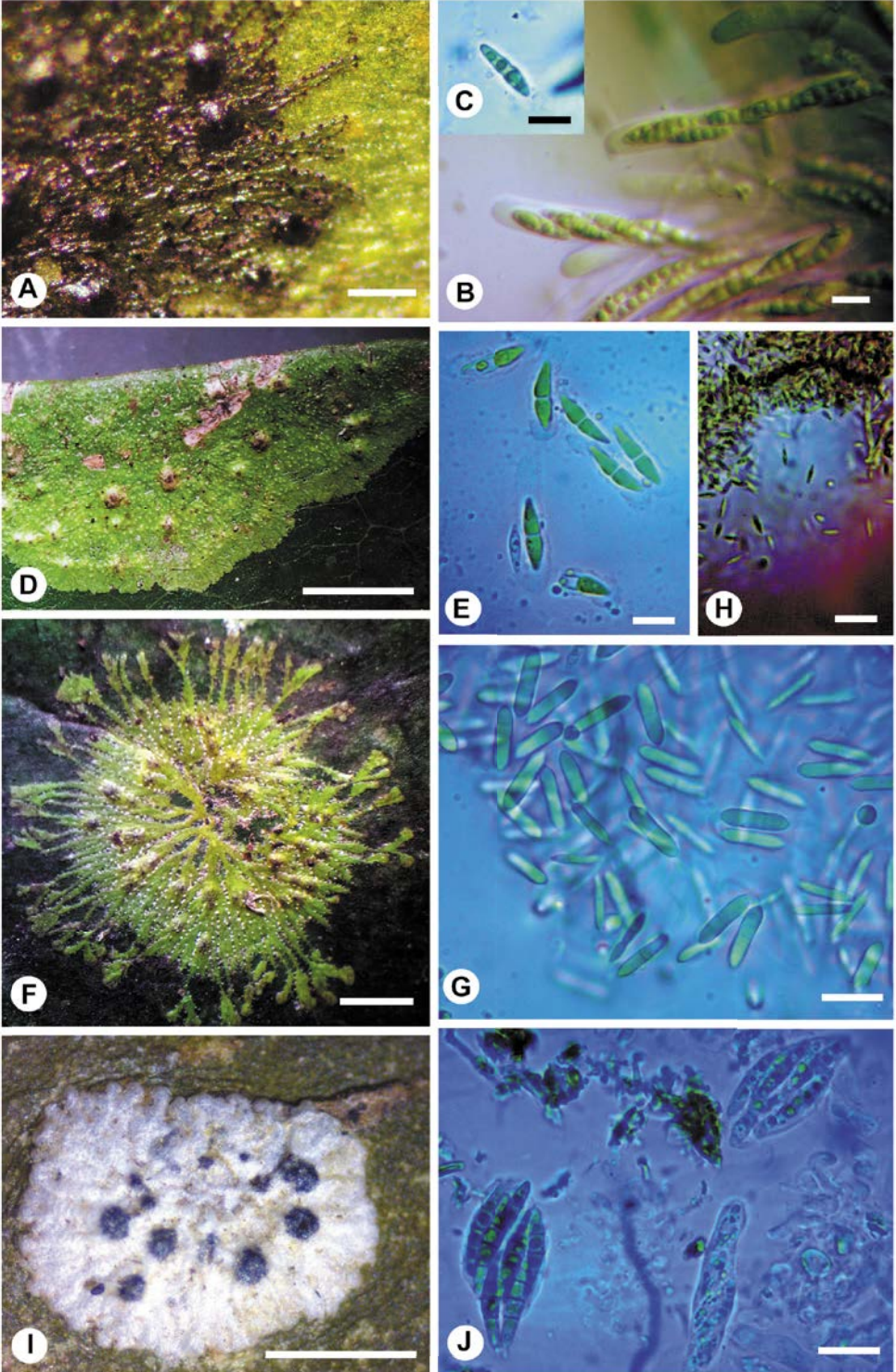
Fig. 1D & E

in Sagra, Hist. Phys. Cuba Bot. Pl. Cell. 2: 139. 1842.

Thallus subcuticular, bluish to greenish white, continuous or strongly lobate, its surface or margins densely covered with small white papillae. Photobiont *Cephaleuros*, cells in one to several layers, angular-rounded, irregularly arranged. Perithecia covered with thallus tissue, hence visible as brown to dark brown, involucrellum colourless, only in upper parts dark; ascospores fusiform, 15–22 × 4–6 µm. Pycnidia common, macroconidia bacillar to ellipsoid, 1-septate, 9–12 × 2.0–3.0 µm; microconidia simple, fusiform, 3–4 × 1.2–1.8 µm.

REMARKS. The absence of an involucrellum in the perithecia is the key character differentiating *S. nemathora* from the other species of *Strigula*. *Strigula nemathora* f. *nemathora* can be distinguished from the other forms of the species by

Fig. 1. A–C – *Strigula melanobapha* (Kremp.) R. Sant., A – thallus with perithecia, B – asci, C – ascospore. D & E – *S. nemathora* Mont. f. *nemathora*, D – thallus with perithecia, E – ascospores. F, G & H – *S. nemathora* f. *hypothelia* (Nyl.) Lücking, F – thallus with perithecia, G – macroconidia, H – microconidia. I & J – *S. orbicularis* Fr., I – thallus with perithecia, J – asci and ascospores. Scale bars: A = 0.1 mm; B, C, E, G, H & J = 10 µm; D, F & I = 1 mm.



its more or less linear thalline lobes with minutely papillose margins and dissected ends.

ECOLOGY AND DISTRIBUTION. *Strigula nemathora* f. *nemathora* usually grows on leaves of *Cinnamomum* spp. at lower elevations in evergreen and moist deciduous forest. It has a pantropical distribution. In India it is reported from the Andaman Islands and Arunachal Pradesh (Singh & Pinokiyo 2014).

SPECIMENS EXAMINED: INDIA. KARNATAKA. Shimoga district: Chakranagara: evergreen forest, 13°48'52"N, 74°57'55"E, alt. 602 m, epiphyllous on *Cinnamomum malabratum* (Burman) Blume, 15 March 2013, *Shravan Kumar S. & Y.L. Krishnamurthy 5671, 5674*; Tamil Nadu Nagarcovil district: moist deciduous forest, 08°16'00"N, 77°28'12"E, alt. 611 m, epiphyllous on *Cinnamomum* sp., 15 Jan. 2014, *Shravan Kumar S. & Y.L. Krishnamurthy 5703*.

***Strigula nemathora* f. *hypothelia* (Nyl.)**

Lücking

Fig. 1F–H

Fl. Neotrop. Monogr. **103**: 248. 2008

Thallus epiphyllous, subcuticular, greenish white, continuous or strongly lobate, its margins densely covered with small sterile verrucae visible as white papillae. Photobiont *Cephaleuros*, cells in one to several layers, rounded, irregularly arranged. Perithecia covered with thin thalline tissue making it concolourous with the thallus, brownish, convex, 0.4–0.6 mm diam., involucrellum colourless, only in upper ostiolar region dark; asci 8-spored; ascospores 1-septate, fusiform, 15–22 × 4–5 µm. Conidiomata not observed.

REMARKS. *Strigula nemathora* f. *hypothelia* is distinguished from *S. nemathora* f. *nemathora* by its interspaces in the thallus and distinctly branched lobes. The white papillae on the thallus surface and the absence of an involucrellum in the perithecia are unique characters making it easy to distinguish from other species of *Strigula*.

ECOLOGY AND DISTRIBUTION. It grows on leaves of *Hopea parviflora* Bedd, *Persea macrantha* (Nees) Kosterm. and *Psychotria nigra* (Gaertn.) Alston, observed during early winter in shola forest. It has a pantropical distribution. In

India it is reported from the Andaman Islands and Arunachal Pradesh (Singh & Pinokiyo 2014).

SPECIMENS EXAMINED: INDIA. KARNATAKA. Chikmagalur district. Kudremukh, evergreen forest, near stream in Bagavathi Nature Camp, 13°08'38"N, 75°15'33"E, alt. 1567 m, epiphyllous on *Persea macrantha*, 18 Nov. 2011, *Shravan Kumar S. & Y.L. Krishnamurthy 5504, 5514*; Chikmagalur district. Kigga, on the way to Narasimha Parvatha, shola forest, 13°25'20"N, 75°10'35"E, alt. 842 m, epiphyllous on *Hopea parviflora* Bedd., 14 Nov. 2013, *Shravan Kumar S. & Y.L. Krishnamurthy 5688*.

***Strigula orbicularis* Fr.**

Fig. 1I & J

Linnaea **5**: 549. 1830

Thallus epiphyllous, subcuticular, greyish to whitish green, white when dead, 5–20 mm diam., 20–30 µm thick; margins lobulate. Photobiont *Cephaleuros*, cells in one to several layers, angular-rounded, irregularly arranged. Perithecia wart-shaped, prominent but covered by thallus except for uppermost black part, 0.1–0.2 mm; ascospores irregularly biseriolate in the ascus, 3-septate, oblong to fusiform, 15–22 × 3–6 µm. Pycnidia immersed, black, macroconidia 3–7 septate, filiform, 25–40 × 2–2.5 µm, microconidia not seen.

REMARKS. The species is characterised by the absence of black marginal lines, immersed perithecia and triseptate ascospores.

ECOLOGY AND DISTRIBUTION. This species shows luxuriant growth on leaves of *Dichapetalum gelonioides* (Roxb.) Engl., *Hopea canarensis* Hole and other shrubs in dry and shady places at lower elevations in moist deciduous forest and swamp. It is known from the Andaman Islands, Arunachal Pradesh, Assam, Meghalaya and Sikkim. Globally it has a pantropical distribution (Singh & Pinokiyo 2014).

SPECIMENS EXAMINED: INDIA. KARNATAKA. Udupi district. Belthangadi: *Myristica* swamp forest, 13°04'37"N, 75°14'46"E, alt. 246 m, epiphyllous on *Dichapetalum gelonioides* (Roxb.) Engl., 24 Nov. 2012, *Shravan Kumar S. & Y.L. Krishnamurthy 5508*; KERALA. Wayanad district: on the way to Sultan Batheri, moist deciduous forest, 11°40'45"N, 76°08'12"E, alt. 772 m,

epiphyllous on *Hopea canarensis* Hole., 11 Nov. 2013, Shравan Kumar S. & Y.L. Krishnamurthy 5678.

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