New records in the lichen family *Lobariaceae* from the Western Ghats of India

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The lichen family *Lobariaceae* has 34 species represented in India. In this paper six new records are reported for the first time from different states of the Western Ghats: *Lobaria adscripta* (Nyl.) Hue, *L. fuscotomentosa* Yoshim, *Pseudocyphellaria argyracea* (Bory ex Delise) Vain, *P. aurata* (Sm. Ex. Ach.) Vain., *P. crocata* (L.) Vain. and *Sticta duplolimbata* (Hue) Vain. Of these, two are new records to Kerala, one new record to Karnataka, one to Kerala and Tamil Nadu each and *Sticta duplolimbata* (Hue) Vain**.** as new record to India (Tamil Nadu).

Key words – Karnataka – Kerala – *Lobaria* – *Pseudocyphellaria* – *Sticta* – Tamil Nadu.

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Introduction

Lichens are an important constituent of the Indian flora. India has rich vegetational wealth and diversity, mainly because of the immense variety of climatic and altitudinal range, coupled with varied ecological habitats.

Accounts of lichens in the family *Lobariaceae* from the Western Ghats are available in a few publications (Awasthi 1988, 2007, Singh KP 1976, Upreti & Divakar 2010). During expeditions by the earlier lichenologist of the Agharkar Research Institute (ARI) Pune, large number of lichens were collected and deposited in the Ajrekar Mycological Herbarium (AMH). The present study is based on these collections.

Lobariaceae Chevall. (order *Peltigerales*) has about 7 genera (+ 21 synonyms) and 370 species at the world level (Kirk et al. 2008). In India this family has major occurrences in the Himalayan region, North Western Himalayas, North East India and stretches up to South-Western Ghats. In the present paper we deal with three genera: *Lobaria*, *Pseudocyphellaria* and *Sticta*.

There are about 114 species in *Sticta*, of which 13 occur in India. The genus has 10 taxa known from Tamil Nadu, 6 species in Kerala and till now no records from Karnataka and Maharashtra (Awasthi 1988, 2007, Singh 1976, Singh & Sinha 2010).

Pseudocyphellaria contains about 170 species, especially in temperate regions. Five species are reported from India. All five are known from Tamil Nadu, and two from Kerala. Until now none has been reported from Karnataka and Maharashtra states of the Western Ghats.

Sixteen species of *Lobaria* out of 67 species are reported from India. Five species are distributed in Tamil Nadu State, one from Kerala and till now no records from Karnataka and

Maharashtra.

Four taxa within the family *Lobariaceae* are endemic to India: *Lobaria adpressa* (Mull. Arg.) Zahlbr.-Manipur, *L. himalayensis* Upreti & Divak ar, *Pseudocyphellaria argyraceae* var. *aspera* (Laurer) DD Awasthi-Tamil Nadu, and *Sticta weigelii* f. *beauvonisii* (Delise) Hue.

Materials and Methods

The study is based on examination of herbarium specimens lodged at the Ajrekar Mycological Herbarium (AMH). Sections of thalli and ascomata were mounted in water, 10% KOH (K), Lugol's solution (I), and lactophenol cotton-blue (LPCB). All measurements were made on material mounted in water. Secondary products were identified by thin-layer chromatography using standardized methods (Culberson & Kristinsson 1970, Culberson 1972, Orange et al. 2001, White & James 1985) using the solvent systems toluene-dioxane-acetic acid (180:45:5) and toluene-ethyl acetate-formic acid (139:83:8) and a specialized system diethyl ether-acetic acid (100:1). The specimens were examined under UV light (365 nm).

Lobaria adscripta (Nyl.) Hue**,** *Nouv. Arch. Mus Hist. Nat. Paris*, sér. 4, **2,** 26, 1901 Fig. 1

= *Ricasolia herbacea f. adscripta* (Nyl.) Nylander, *Flora* **50,** 539, 1867.

Thallus corticolous, foliose, light brownish to orangish, smooth, ± wrinkled, rarely, dichotomously branched, with distinct notches, 8–10(–11) mm long.

Lobes dichotomously branched, wavy margins (4–)5–8(–10) mm wide, lacking soredia, isidia, cyphellae and pseudocyphellae on both surfaces; medulla white, K–; KC + light pinkish; algal layer with green algae, single celled, uniform. Lower surface centrally rough, smooth in the peripheral regions, whitish to light brownish, short black rhizines clustered centrally and a bare peripheral zone. Apothecia substipitate, lecanorine, emergent, numerous, concolorous with the thallus, more on margin and lamina, up to (0.8–)1–2.5(–5) mm, concave; disc concave, mud brown, smooth, margins of apothecia slightly wavy or dentate. Ascospores hyaline, acicular, 3–4-septate, 32–44.8 × 6.4–9.6 µm.

Chemistry – Gyrophoric acid present.

Distribution – India (Kerala), Sri Lanka, New Zealand.

Specimens Examined – India, Kerala, Munnar Road, 23.9.1973, C.R. Kulkarni & P.D. Badhe, 73.1773, 73.1805, 73.2126, 73.2127, 73.2128, 73.2129, 73.2130, 73.2132, 73 .2133, 73.2134, 1975, 78.186, 79.39, 79.187, 79.145.

Remarks – The species forms a new record for Kerala. The species is characterized by absence of the vegetative propagules (isidia and soredia), presence of green algae, apothecia with a dentate margin and hyaline, acicular ascospores and presence of gyrophric acid. It was reported from Sri Lanka but according to (Awasthi 2007) it no longer is reported from the area.

Lobaria fuscotomentosa **Yoshim.,** *J. Hattori Bot. Lab.* **34**, 311, 1971. Fig. 2

Thallus corticolous, foliose, yellowish brown to orangish brown in dried or herbarium specimens, surface wrinkled, appears slightly uneven, but unfolded areas, smooth, dichotomously branched with notches seen, 10–14 cm long. Lobes large, 7–9(10) mm wide, margins wavy, lacking soredia, isidia, cyphellae and pseudocyphellae on both surfaces; corticated on both surfaces; medulla white, KC+ pinkish, algal layer green, single celled; lower surface smooth in the peripheral regions with blackish tomentum in the centre and leaving a bare peripheral zone, concolorous with the thallus (yellowish white) and slightly dark centrally. Apothecia dark brown, substipitate, concave, present laminally; disc mud brown to dark brown, concave smooth, epruinose, 2–3 mm wide, crenate, lecanorine margin, rough, wrinkled or sometimes, wavy exciple yellowish brown, paraplectenchymatous, 112–144 µm thick, epihymenium yellowish brown; hymenium hyaline not inspersed; hypothecium hyaline; ascospores hyaline, transverse septate, acicular, 2-septate, 38.4–40.4 × 3.2–6.4 µm.

Chemistry – Gyrophoric and congyrophoric acids present.

Distribution – India (Kerala, Manipur, Nagaland, Tamil Nadu, Uttaranchal), China, Japan.

Specimens Examined – India, Kerala, Munnar Road, 23.9.1973, P.D. Badhe & C.R. Kulkarni, 73.2131; Tamil Nadu, Kodaikanal, Berijam Lake View Point, 24.1.1975, P.G. Patwardhan & A.V. Prabhu, 75.136, 75.149, 75.161.

Remarks – The species forms a new record to Kerala & Tamil Nadu. It is characterized by mud brown apothecia and a crenate margin and with gyrophoric and congyrophoric acids.

Pseudocyphellaria argyracea (Bory ex Delise) Vain, Hedwigia **37,** 34, 1898. Fig. 3

Thallus foliose, light yellowish brown to dark reddish brown, smooth to ± glossy but with numerous sorediate-isidiate cells seen fallen all over the thallus, dichotomously branched 8–10 cm wide, eciliate. Isidia greyish white, ± sorediate, globular to coralloid, appear marginally very thick and the lobe appears thick and revolute. Lobes concolorous with the thallus, wavy, loaded with thick isidia, the lobe becomes revolute or involute, folded, 4–12 mm wide, eciliate, notched. Algal layer thin with blue green algae *Nostoc*, medulla white. Lower surface brownish–black, covered with thick black tomentum, covered all over except leaving a bare peripheral zone of 1–2 mm wide, within the tomentum are embedded the pseudo-cyphellae. Pseudocyphellae white coloured fine hairy appearance, 0.2–0.5 mm across.

Apothecia not seen, material is vegetative.

Chemistry – gyrophoric acid present.

Distribution – India (Tamil Nadu, Karnataka), Sri Lanka. Widely distributed in tropics of Africa and America, Australia, Japan, New Zealand, Thailand. Palaeotropical.

Specimens Examined – India, Karnataka, Mercara–Bagmandala Road, near Bagmandala, 19.12.1974, M.B. Nagarkar, 74.3431; Kerala, Marayoor, near Munnar, Anamalai hills, 23.1.1976, P.G. Patwardhan, 76.499, Devicolam, Cardamom hills, 25.1.1976, P.G. Patwardhan, 76.713; Periyar lake, Tekadi, 26.1.1976, M.B. Nagarkar & K.D. Gole, 76.962.

Remarks – This species forms a new record to Karnataka and was found associated with bryophytes, moss and probably *Selaginella*. The species is characterized by a sorediate – isidiate thallus, blue green algae *Nostoc*, white medulla and presence of gyrophoric acid.

Pseudocyphellaria aurata (Sm. ex Ach.) Vain, Acta Soc. Fauna Fl. Fenn. **7,** 183, 1890. Fig. 4

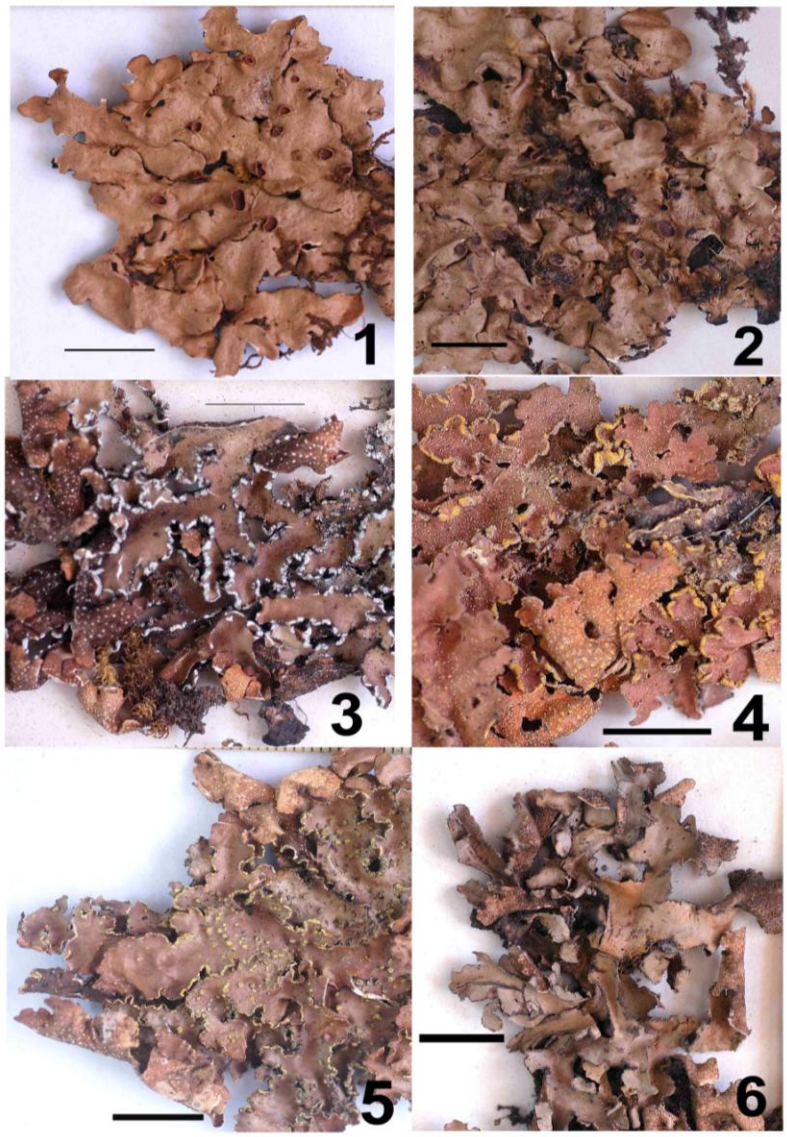
Thallus foliose, corticolous, orangish brownish, greyish yellowish to sometimes with reddish brown tinge, not stipitate, eciliate, sorediate, non isidiate, dichotomously branched, 9–13 cm wide. Lobes concolorous with the thallus, sorediate, soredia scattered all over, clumped at margins and also seen on the lamina, 4–6 mm wide. Margins sorediate, eciliate, smooth to wavy, rolled. Soredia yellow, marginally present, abundant, clumped and scattered all over the lamina, more on the lower side of margins. Corticate on both surfaces, cellular. Upper cortex 67–78 µm; algal layer with green algae, 75– 60 µm thick,; medulla white, 230– 232 (–267) µm and lower cortex hyaline, 86 µm. Lower surface light brownish with few white tomentum, not form a turft or thick cover, pseudocyphellae yellow, 0.2–0.5 mm wide, abundant covering all over the lower surface.

Apothecia few, orangish brown, adnate to substipitate, 0.5–1.5 mm in diam.; disc orangish brown (dry) convex, epruinose, margin concolorous to the disc, not much distinct.

Chemistry – Atranorin and Salazinic acids present.

Distribution – India (Arunachal Pradesh, Manipur, Nagaland, Kerala, Tamil Nadu, Uttaranchal), Sri Lanka. Widely distributed in tropical and subtropical regions of the world.

Specimens Examined – India, Kerala, Kumali Road, Cardamom hills, 25.1.1976, C.R. Kulkarni, 76.806, Thekadi, 26.1.1976, P.G. Patwardhan, 76.958. Tamil Nadu, Pykara Road, Nilgiris, 18.9.1973, P.G. Patwardhan & M.B. Nagarkar, 73.1222; M.B. Nagarkar & P.G. Patwardhan, 73.1167, 73.1292, 73.1293, Windicap, Nilgiris, 18.9.1973, A.V. Prabhu, 73.1303.



Figs 1–6 – Habit **1** *Lobaria adscripta* **2** *L. fuscotomentosa* **3** *Pseudocyphellaria argyraceae* **4** *P. aurata* **5** *P. crocata* **6** *Sticta duplolimbata.* Bars = 10 mm

Remarks – *Pseudocyphellaria aurata* is characterized by a distinct yellow sorediate margin, white medulla and a green algae. It is reported from subtropical to lower temperate regions (alt. 1300–2300m) of India (Awasthi 2007). It is reported for the first time from Kerala and thus forms a new record.

Pseudocyphellaria crocata (L.) Vain, Hedwigia **35**: 34, 1898. Fig. 5

= *Lichen crocatus* L., Mantissa Alter, p 310, 1771.

Thallus foliose, corticolous, loosely attached to the substratum, greyish brown to yellowish, heteromerous, sorediate-isidioid. Lobes 10–11 mm broad, marginally to submarginally sorediate-isidiod, margins crenate, involute; isidioid-soralia granular, yellowish; pseudocyphellae yellow. upper surface smooth to rough, sometimes cracked with age, upper cortex hyaline, paraplectenchymatous, 21–30 µm tall; algal layer with blue green algae–*Gleocapsa*,

30–45 µm thick; medulla hyaline to white, 30–45 µm thick. Lower surface yellowish to light brown, wrinkled, broad bare marginal zone, tomentum dull black to grayish–brown, white, simple to branched. Lower cortex hyaline to yellowish, paraplectenchymatous, 15–21 µm thick.

Apothecia, concolorous with the thallus, submarginal, 0.5–1.8 mm in diam., emergent; disc open, convex; exciple paraplectenchymatous, hyaline to slightly yellowish; epithecium brownish, 15–21 µm thick, K–; hymenium hyaline to yellowish, 30–75 µm thick; subhymenium yellowish, 45 µm thick; hypothecium hyaline, 60–90 µm thick, asci 8–sporate. Ascospores brownish, fusiform, 3–transseptate, 21–22 × 6–6.5 µm blunt ends.

Chemistry – Divaricatic and norstictic acids, tenuiorin and an unknown spot above divaricatic acid present.

Distribution – India (Arunachal Pradesh, Karnataka, Nagaland, Tamil Nadu– Nilgiri hills, Uttarakhand, Uttar Pradesh, East & NW Himalayas), East Africa and distributed in tropical regions of the world.

Specimens Examined – India, Karnataka, Nandi hills, 7.11.1963, (Herbarium of Prof. Panchagavi), Panchagavi, 22, 23, 31; Nandi hills, 3.1.1981, P.G. Patwardhan & M.B. Nagarkar, 81.244, P.G. Patwardhan & U.V. Makhija, 81.245; 26.9.1981, P.K. Sethy & M.B. Nagarkar, 81.584.

Remarks – *Ps. croactata* is characterized by yellow pseudocyphellae, white medulla, yellow soredia and blue green algae. It is closely related to *Ps. aurata* (Ach.) Vain. which can be easily distinguished by a green phycobiont and yellow medulla. This species is reported for the first time from Karnataka.

Sticta duplolimbata (Hue) Vain, Philipp. J. Sci., C. Bot. **8(2)**: 125, 1913. Fig. 6

= *Sticta ciliaris f. duplolimbata* Hue, Nouv. Archiv. Du Muséum, ser. **4(3)**: 102, 1901.

Thallus foliose, greyish brownish, isidiate ciliate, 3–4 cm wide, cilia black, few, marginal, isidia greyish black, only marginally, grouped, ± coralloid to ± lobulate giving rise to young thallus. Upper surface yellowish brown, smooth to glossy, sometimes isidia are seen, laminal, single point attachment, 5–8 mm wide. Lobes distinctly dichotomously branched, notched, margins wavy, isidiate, 5–10 mm wide but not dissected. Algal layer with blue green algae,–*Nostoc*. Medulla whitish to dirty white. Lower surface yellowish to brown, covered with thick tomentum all over the surface, distinct, cyphellae are embedded in the tomentum. Cyphellae yellowish–brown, 0.5–1 mm wide, inner lining covered with white hair like structures. Apothecia not seen, material is vegetative.

Chemistry – No lichen substances present.

Distribution – India (Tamil Nadu), Australia, New Caledonia, Philippines, Sri Lanka.

Specimens Examined – India, Tamil Nadu, Pykara, Nilgiris, 18.9.1973, C.R. Kulkarni & P.D. Badhe, 73.1299, 73.1300; Korakundha, Nilgiris, 19.9.1973, P.G. Patwardhan & M.B. Nagarkar, 73.1435, 73.1551; 7.11.1973, P.G. Patwardhan & M.B. Nagarkar, 73.2991; Devicolam forest, Cardamom hills, 25.1.1976, M.B. Nagarkar, K.D. Gole, 76.794.

Remarks – The species was reported from Sri Lanka at 7000ft (2100 m) alt. and has not been collected from Sri Lanka after 1950, inspite of widespread collections from the different parts of India. The species is characterized by an isidiate thallus, presence of blue green algae–*Nostoc* and lower surface cyphellate and absence of lichen acids. The species forms a new record to India.

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