

## Occurrence of four additional non-hairy species of *Leptogium* from Maharashtra, India

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**Abstract:** In the present paper four tomentose species of *Leptogium* are recorded from Maharashtra, western India. Three species, viz. *Leptogium patwardhanii* Dube & Makhija sp. nov., *Leptogium subazureum* Dube & Makhija sp. nov., and *Leptogium verrucosum* Dube & Makhija sp. nov., are described as new to science and one species, *Leptogium propaguliferum* Vain., is recorded for the first time from India. A revised key to the non-hairy species of *Leptogium* from India is provided.

**Key words:** *Collemataceae*, key, lichens, taxonomy

### Introduction

Several taxonomic and floristic studies of lichens carried out, especially during the last two years, have made a substantial contribution to our present knowledge of the lichens of Maharashtra state of India. Although the occurrence of several lichen species has been recorded from the state, many new species are yet to be described. Our recent investigations have revealed the occurrence of 12 species of the lichen genus *Leptogium* from Maharashtra, which includes four species hitherto not reported from India.

The lichen genus *Leptogium* (Ach.) Gray is characterized by a foliose bluish grey, lead grey or brown to black thallus, a somewhat to distinctly gelatinous thallus consistency, and the cyanobacterium *Nostoc* as photobiont; mostly orbicular to elongate lobes with entire or rarely irregularly dissected margin; an upper surface with or without wrinkles; a lower surface with or without a hyphal tomentum; a homoiomerous thallus anatomy, corticated on both or only on the upper surface; lecanorine, laminal to submarginal apothecia; concave to plane or rarely convex, orange to red-brown smooth discs; a smooth or peri-

clinally to longitudinally wrinkled or even minutely lobulate thalline exciple; and hyaline, acicular to ellipsoid, transversely septate or muriform ascospores. It is a widespread lichen genus with 189 species known worldwide (Kirk *et al.* 2008 and various references therein). Some of the major treatments of this genus include Sierk (1964), Jørgensen (1975, 1994, 1997), Awasthi & Akhtar (1977, 1979), Galloway (1985), Swinscow & Krog (1988), Verdon (1992), and Galloway & Jørgensen (1995).

*Leptogium* has 37 species in India, Sri Lanka and Nepal, and 8 species from Maharashtra, namely *L. austroamericanum* (Malme) C. W. Dodge, *L. azureum* (Sw.) Mont., *L. burnetiae* var. *hirsutum* (Sierk) P. M. Jørg., *L. chloromelum* (Sw.) Nyl., *L. cyanescens* (Ach.) Körb., *L. denticulatum* Nyl., *L. indicum* D. D. Awasthi & Akhtar, and *L. javanicum* Mont. (Awasthi & Akhtar 1977, 1979; Nayaka & Upreti 2004; Awasthi 2007). In recent studies we have recognized 12 species of *Leptogium* from Maharashtra and discovered three species new to science which are described below, and one species recorded for the first time in India. A revised key to all non-hairy species of *Leptogium* from India is provided, based on the descriptions of the *Leptogium* species from the recent treatment of the macrolichens of India by Awasthi (2007).

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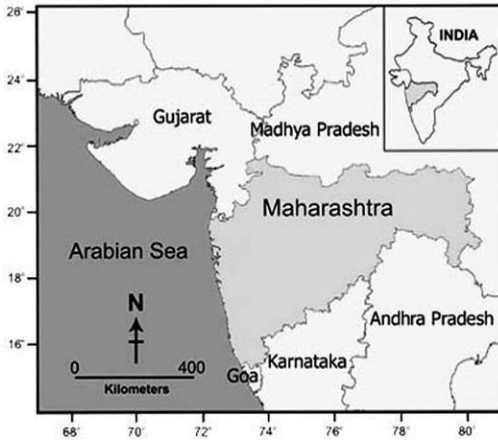


FIG. 1. Map of Maharashtra.

### Materials and Methods

A total of *c.* 800 specimens of *Leptogium*, mainly from the south-western Ghats, Eastern Himalaya, Western Himalaya and the Andaman and Nicobar Islands of India, were studied from the herbaria AMH, CAL, and from Sri Lanka from H. The present treatment, however, is the result of the morphological, anatomical and chemical studies of *c.* 200 specimens, belonging to 12 species of *Leptogium* collected from Maharashtra. The Maharashtra state is *c.* 800 km east-west and 700 km north-south, an irregular dentate pentagon, lying between 22°1'–16°4' N and 72°6'–80°9' E, and covering an area of 307 690 km<sup>2</sup> (Fig. 1). Altitudes range from sea level to *c.* 1200 m on the Western Ghats and relative humidity fluctuates between 15–90%. The forests vary from semi-evergreen to dry deciduous types occupying nearly 21% of the total geographical area. The lichen flora of Maharashtra mainly comprises pantropical species and is dominated by crustose lichens (70% of the total lichen flora and 30% of foliose and fruticose lichens). The predominant macrolichen species in Maharashtra belong to the members of the families *Collemataceae*, *Physciaceae*, and *Parmeliaceae*.

The specimens were examined using a stereomicroscope and a light microscope. Sections of the thalli and apothecia were stained with Lugol's iodine solution. All sections examined were mounted in lactophenol. TLC was carried out using the standard methods (Culberson & Kristinsson 1970; White & James 1985). All specimens were observed under UV light (365 nm).

Material was identified by comparison with the specimens in AMH, determined by P. M. Jørgensen, and with the descriptions of species (Sierk 1964; Jørgensen 1975, 1994, 1997; Awasthi & Akhtar 1977, 1979; Galloway 1985; Swinscow & Krog 1988; Verdon 1992; Galloway & Jørgensen 1995; Awasthi 2007). The specimens recorded in the text are deposited in the Ajrekar Mycologi-

cal Herbarium (AMH), Agharkar Research Institute, Pune, India.

### The Species

#### *Leptogium patwardhanii* Dube & Makhija sp. nov.

Similis *Leptogium austroamericanum*, sed excipulo proprio euparaplectenchymatico differt.

Typus: India, Maharashtra, Amboli, in semi-evergreen forest, corticolous, 690 m elev., 18 October 1974, A. V. Prabhu & C. R. Kulkarni 74.1560 (AMH—holotypus).

(Figs 2A, 4A & B)

*Thallus* corticolous, growing with mosses, foliose, ashy grey when dry, dark olive-green and swollen when wet, loosely attached to the substratum, 3–15 cm diam., 124–140 µm thick, irregularly lobate. *Lobes* orbicular, 4–9 mm broad, margin wavy, corticated on both surfaces by a single layered, 6–8 µm thick cortex. *Upper surface* smooth to rough, isidiate. *Isidia* granular to cylindrical, rarely clavate, simple to branched, laminal to marginal, concolorous with the thallus. *Lower surface* rough, etomentose, slightly wrinkled when wet, without tufts of hyphal hairs.

*Apothecia* common, scattered, laminal to marginal or submarginal, sessile, shortly stipitate or constricted at the base, 0.5–1 mm diam. *Disc* plane, eventually convex, epruinose, reddish brown, smooth. *Thalline exciple* concolorous with the thallus, with multilayered cortex. *Proper exciple* distinctly euparaplectenchymatous throughout. *Epithecium* brownish, 5–8 µm thick. *Hymenium* hyaline, 200–228 µm high, I+ blue. *Subhymenium* pale yellow to colourless, 60–80 µm thick. *Asci* 8-spored, cylindrical-clavate, shortly stalked, 100–120 × 12–14 µm. *Ascospores* ellipsoid, fusiform sometimes with one end acuminate, muriform, transversely 3–5-septate, vertically 1-septate, 20–40 × 11–13 µm.

*Chemistry.* Thallus K–, C–, KC–, P–, UV–; no lichen substances present.

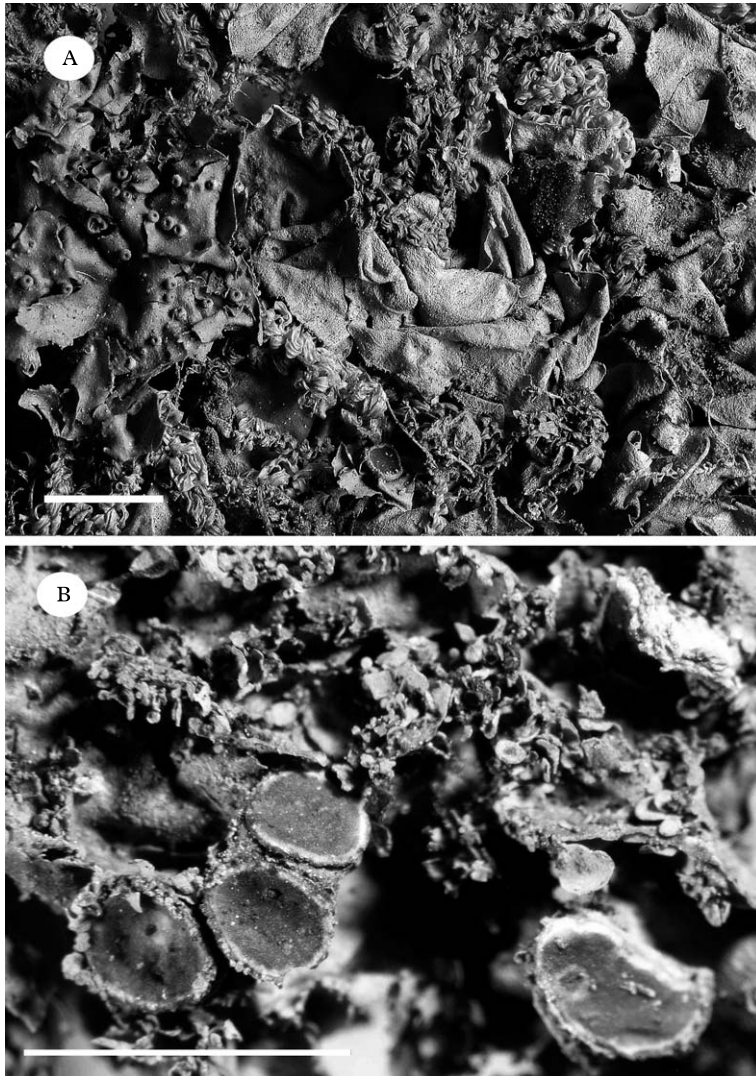


FIG. 2. *Leptogium* species, habitus. A, *L. patwardhanii* (74.1560—holotype, AMH); B, *L. propaguliferum* (00. 216, AMH). Scale: A, B = 5 mm.

*Remarks.* *Leptogium patwardhanii* belongs to the section *Euleptogium* Tuck. (Tuckerman 1872) and is distinguished by the presence of isidia, a multilayered cortex of the thalline exciple and a distinctly euparaplectenchymatous proper exciple and larger  $20\text{--}40 \times 11\text{--}13 \mu\text{m}$  ascospores. It is similar to *Leptogium austroamericanum* and *L. cyanescens* in colour, size of lobes and nature of isidia, but these two species differ in having a

prosoplectenchymatous proper exciple; the proper exciple is euparaplectenchymatous in *L. patwardhanii*.

*Leptogium coralloideum* (Meyen & Flot.) Vain., an isidiolate species, differs from the new species in having a plicate thallus with minute phyllidia densely crowded on the ridges and margins of the lobes, apothecia with a thick thalline exciple with a one cell layered cortex and paraplectenchymatous

tissue present at the base above the photobiont layer, and minutely ornamented ascospores.

*Leptogium patwardhanii* is so far known only from the semi-evergreen forest of Amboli (700 m alt.) in Maharashtra state, which receives heavy monsoon rains during the months of June to September followed by a prolonged eight months dry period. Amboli has many endemic species and the new species may prove to be restricted to Maharashtra.

*Additional specimen examined. India: Maharashtra:* Sindhudurg District, Amboli, in semi-evergreen montane forest, 690 m elev., 1974, *A. V. Prabhu & C. R. Kulkarni* 74.1559 (AMH).

### ***Leptogium propaguliferum* Vain.**

*Ann. Acad. Sci. Fenn., ser.* 15(6): 40 (1921).

(Figs 2B, 4C & D)

*Thallus* corticolous, foliose, loosely attached to the substratum, slate-blue, membranaceous and slightly swollen when wet, 4–6 cm diam., 50–100(–160)  $\mu\text{m}$  thick. *Lobes* orbicular, shallowly or deeply dissected, isidiate lobulate, 4–7 mm broad, corticated by a single cell layered, 5–7(–10)  $\mu\text{m}$  thick cortex on both sides. *Isidia* simple, globular to cylindrical, concolorous with the thallus, laminal to marginal, later turning into lobules. *Upper surface* slightly rough. *Lower surface* paler, with tufts of hyphal hairs here and there.

*Apothecia* laminal to submarginal, sessile to shortly stipitate, 0.5–2 mm diam. *Disc* smooth, plane, orange-brown to brown. *Thalline exciple* thin, rarely smooth, mostly isidiate to lobulate, with a cortical layer 6–9 cells thick. *Proper exciple* prosoplectenchymatous throughout. *Epithecium* brown, 15–25  $\mu\text{m}$  thick. *Hymenium* hyaline, 150–225  $\mu\text{m}$  high, I+ blue. *Subhymenium* pale yellow to colourless, 37.5–75  $\mu\text{m}$  thick. *Ascospores* 8 per ascus, ellipsoid, muriform, transversely 3–4-septate, vertically 1-septate, 20–40  $\times$  10–16  $\mu\text{m}$ .

*Chemistry.* Thallus K–, C–, KC–, P–, UV–; no lichen substance present.

*Remarks.* *Leptogium propaguliferum* is somewhat similar to *L. denticulatum* in its external morphology but differs in the characters of the proper exciple which is prosoplectenchymatous, whereas in *L. denticulatum* the proper exciple is euparaplectenchymatous. With respect to the characters of the proper exciple it comes close to *Leptogium indicum*, *L. moluccanum* (Pers.) Vain., and *L. azureum*, but all these species have much smaller ascospores (not exceeding 25  $\mu\text{m}$  in length) and also differ in other morphological characters.

*Leptogium propaguliferum*, recorded here for the first time from India, grows on the bark of trees in exposed conditions on the roadside, mostly in dry deciduous forests but also found in moist deciduous forests on the hill tops. This species is also known from Australia (Queensland) and the Philippines.

*Specimens examined. India: Maharashtra:* Kolhapur Distr., Gaganbawada to Kumbhi, on roadside *Ficus bengalensis* tree, 2000, *B. C. Behera* 00.358; Kolhapur Distr., Panhala, elev. 950 m, 1974, *P. G. Patwardhan & A. V. Prabhu* 74.1209, *P. G. Patwardhan & C. R. Kulkarni* 74.1149, 74.1209, 74.1223; Kolhapur Distr. 2000, on *Mangifera indica*, *U. V. Makhija & K. R. Randive* 00.455; Nasik Distr., Anjaneri, dry deciduous forest, 2002, *U. V. Makhija & A. V. Bhosale* 02.265; Nasik Distr., Bramahgiri, 2002, *U. V. Makhija & A. V. Bhosale* 02.267; Nasik Distr., Saptashringi, 2002, *B. C. Behera & G. S. Chitale* 02.256; Pune Distr., Amby valley, 26 km from Lonavala, 2003, *G. S. Chitale & B. A. Adawadkar* 03.251; Pune Distr., Dongarwadi, 2000, 00.138; Sinhgad, 2003, *U. V. Makhija & G. S. Chitale* 03.40; Pune Distr., Tamihini Ghat, 2003, *N. Verma & A. A. Sonone* 03.431; Satara Distr., Lingmala, 2003, *B. C. Behera & G. S. Chitale* 03.500; Satara Distr., Panchgani, 2001, *U. V. Makhija* 01.70; Sindhudurg Distr., Amboli, 1980, *P. G. Patwardhan* 80.483; on the way to Amboli from Ajra, 4 km from Ajra, 2000, *U. V. Makhija & V. A. Mantri* 00. 216; Thane Distr., Malshej Ghat, Neemgiri, 2002, *U. V. Makhija & G. S. Chitale* 02.240, 02.241, 02.245.

### ***Leptogium subazureum* Dube & Makhija sp. nov.**

Similis *Leptogium azureum*, sed ascosporis majoribus differt.

Typus: India, Maharashtra, Ajra to Amboli road, 4 km from Ajra, corticolous, 900 m elev., 7 December

1974, P. G. Patwardhan & A. V. Prabhu 74.2246 (AMH—holotypus).

(Figs 3A & 4E)

*Thallus* corticolous, foliose, lead-grey when dry to dark olive-green, swollen when wet, loosely attached to the substratum, 3–15 cm diam., 50–100 µm thick, irregularly lobate; non-isidiate. *Lobes* flattened, orbicular, 4–8 mm broad, margin wavy, corticated on both surfaces by a single cell layered cortex of 8–10 µm, isodiametric cells. *Upper surface* smooth to rough, with a few wrinkles. *Lower surface* slightly wrinkled when wet, more or less of the same colour or slightly paler, tomentose, with tufts of hyphal hairs here and there.

*Apothecia* common, scattered, laminal to marginal or submarginal, sessile, or shortly stipitate, constricted at the base, solitary, 0.5–2 mm diam. *Disc* plane to convex, rounded, epruinose, orange-brown, smooth. *Thalline exciple* concolorous with the thallus, with multilayered cortex. *Proper exciple* distinctly euparaplectenchymatous at the margins and prosoplectenchymatous at the base. *Epitecium* brownish, 6–9 µm thick. *Hymenium* hyaline, 110–150 µm high, I+ blue. *Subhymenium* hyaline, 20–45 µm thick. *Asci* 8-spored, cylindrical-clavate, shortly stalked, 70–120 × 9–14 µm. *Ascospores* fusiform, thin walled, muriform, 21–44 × 8–14 µm.

*Chemistry.* Thallus K–, C–, KC–, P–; UV–; no lichen substances present.

*Remarks.* *Leptogium subazureum* is distinguished by its non-isidiate thallus, apothecia with a euparaplectenchymatous proper exciple at the margin and a prosoplectenchymatous proper exciple at the base. It is similar to *Leptogium azureum* in external morphology, the colour of the thallus, the absence of isidia, and tomentum, but differs in having larger ascospores of 21–44 × 8–14 µm (ascospores are 15–28 × 8–16 µm in *L. azureum*).

*Leptogium subazureum* is one of the most common lichen species from the Western

Ghats of Maharashtra and appears to be endemic in Maharashtra where it grows with mosses on exposed tree trunks and twigs in semi-evergreen forests with *Leptogium javanicum* and members of the *Physciaceae*.

*Additional specimens examined.* **India:** Maharashtra: Kolhapur Distr., Ajra to Amboli road, 4 km from Ajra, semi-evergreen forest, 900 m elev., 1974, P. G. Patwardhan & A. V. Prabhu 74.2252; Kolhapur Distr., Amba, 1974, A. V. Prabhu & M. B. Nagarkar 74.2206; Kolhapur Distr., Panhala, semi-evergreen forest, 914 m elev., 2000, U. V. Makhija & V. A. Mantri 00.493; Kolhapur Distr., Radhanagari, 2000, U. V. Makhija & B. C. Behera 00.321, 00.322; Pune Distr., Bhimashankar, 1997, U. V. Makhija 97.33A; Pune Distr., Sinhadgad Fort, elev. 800 m, 2000, U. V. Makhija 00.8; Nashik Distr., Saptashringi Gad, 2002, B. C. Behera & G. S. Chitale 02.262; Satara Distr., Mahabaleshwar, Arther Seat, 8 km from Mahabaleshwar, moist deciduous forest, 1200 m elev., 1974, A. V. Prabhu & M. B. Nagarkar 74.1731, 74.1744; Satara Distr., Mahabaleshwar, 2001, B. A. Adawadkar 01.69; Satara Distr., Panchagani, 1000 m elev., 2001, B. A. Adawadkar 01.6; Sindhudurg Distr., Amboli, 1974, P. G. Patwardhan & M. B. Nagarkar 74.2359; Sindhudurg Distr., Nanapali, Amboli to Sawantwadi road, at 690 m elev., 1974, A. V. Prabhu 74.2383; Sindhudurg Distr., Mahadeogad, Amboli, 900 m elev., 2000, U. V. Makhija & B. C. Behera 00.154, 00.155; Thane Distr., Neemgiri, Malshej Ghat, 2002, U. V. Makhija & G. S. Chitale 02.242, 02.244, 02.245 (AMH).

### *Leptogium verrucosum* Dube & Makhija sp. nov.

Similar *Leptogium javanicum* sed thallo verrucoso differt.

Typus: India, Maharashtra, Purandar fort, saxicolous, on the walls of fort, 38 km from Pune, 1350 m elev., 13 September 2002, B. A. Adawadkar 02.247 (AMH—holotypus).

(Figs 3B & 4F)

*Thallus* both corticolous or saxicolous, foliose, dark grey, swollen when wet, loosely attached to the substratum, 3–5 cm diam., 90–105 µm thick, irregularly lobate. *Lobes* orbicular, shallowly dissected, elongate, 4–7 mm broad, margin wavy, upcurved, folded, dentate, numerous wart-like pycnidia present all over the entire surface, but mostly marginal, non-isidiate, corticated on both surfaces by a single layered cortex of 7–11 µm, isodiametric cells. *Upper surface* smooth to rough, wrinkled. *Lower surface* rough,

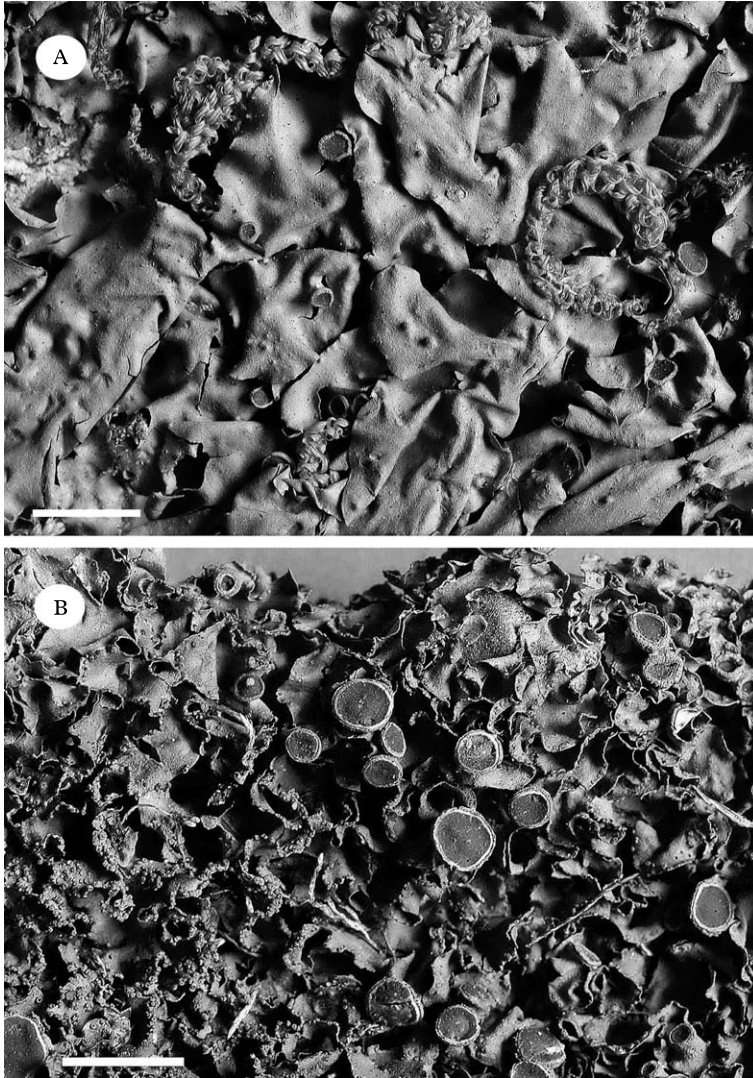


FIG. 3. *Leptogium* species, habitus. A, *L. subazureum* (74.2246—holotype, AMH); B, *L. verrucosum* (02.247—holotype, AMH). Scale: A, B = 5 mm.

etomentose, highly wrinkled when wet, with tufts of hyphal hairs here and there.

*Apothecia* adnate to short stalked, sometimes constricted, reddish brown, in young condition vertical wrinkles seen on apothecia. *Disc* 1–3 mm diam. *Thalline exciple* concolorous with the thallus, with multilayered cortex. *Proper exciple* distinctly euparaplectenchymatous at margins and prosoplectenchymatous below. *Epithecium* brown, 9–15

$\mu\text{m}$  thick. *Hymenium* hyaline, 90–105  $\mu\text{m}$  high. *Subhymenium* hyaline, 27–30  $\mu\text{m}$  high. *Asci* 8-spored, cylindrical-clavate, shortly stalked, 90–96  $\times$  9–21  $\mu\text{m}$ . *Ascospores* muriform transversely 2–4-septate, vertically 1–2-septate, ends acute, 15–32  $\times$  6–12  $\mu\text{m}$ .

*Pycnidia* numerous, concolorous with the thallus, marginal, giving warty appearance to the thallus, 0.1–0.2 mm diam. *Conidia* bacilliform, hyaline, 3–5  $\times$  0.7–1.7  $\mu\text{m}$ .

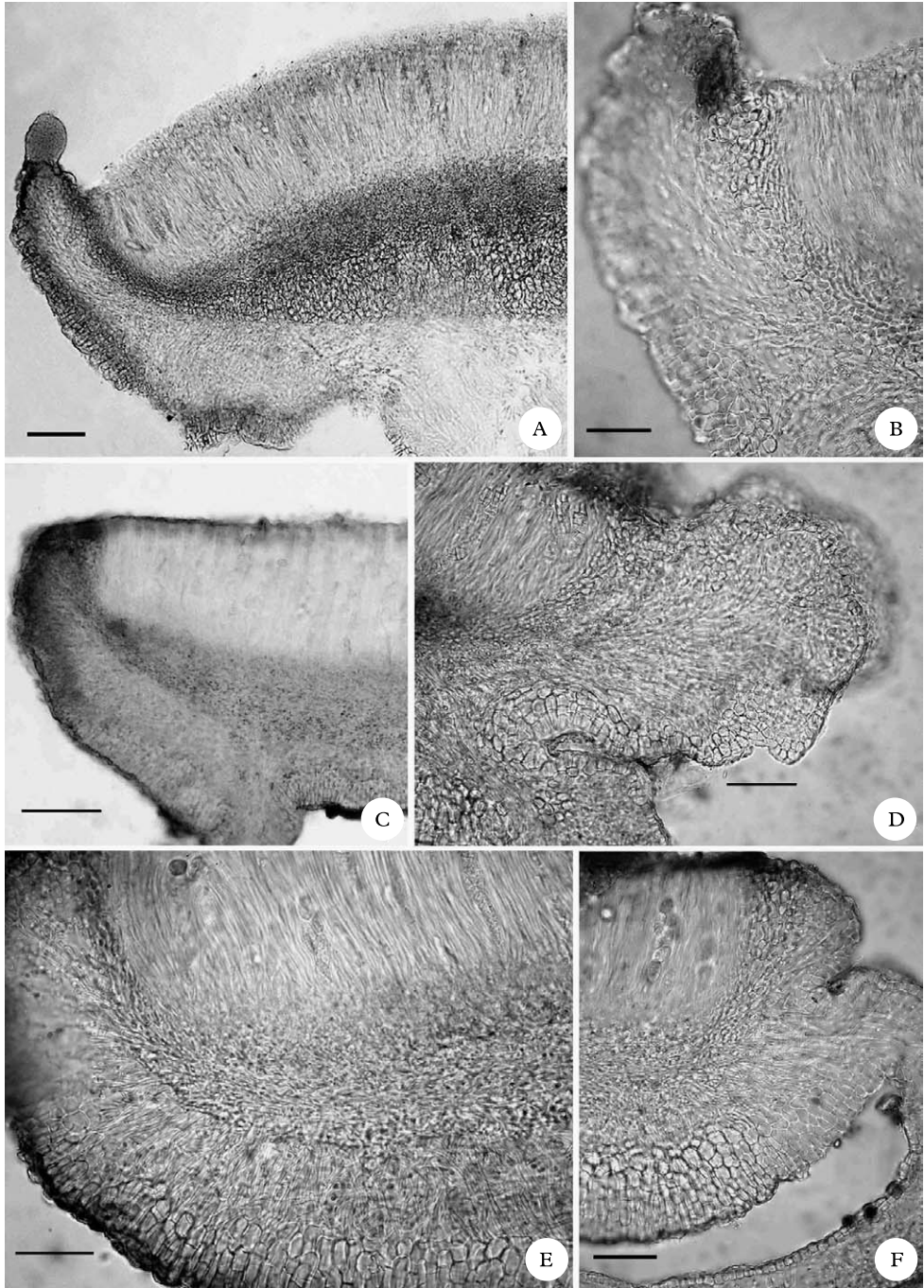


FIG. 4. *Leptogium* species, cross sections of apothecia. A & B, proper exciple euparaplectenchymatous, *L. patwardhanii* (74.1560—holotype, AMH); C–F, proper exciple prosoplectenchymatous; C, D, *L. propaguliiferum* (00.216, AMH); E, *L. subazureum* (74.2246—holotype, AMH); F, *L. verrucosum* (02.247—holotype, AMH). Scale: A & C = 100  $\mu\text{m}$ ; B, D, E, & F, = 50  $\mu\text{m}$ .

*Chemistry.* Thallus K-, C-, KC-, P-; UV-; no lichen substances present.

*Remarks.* *Leptogium verrucosum* is distinguished from the other species of this genus by the presence of numerous pycnidia giving the thallus a warty appearance, the highly wrinkled upper and lower surfaces which are uneven in section with globose pycnidia embedded in the thallus and the adnate or shortly stalked apothecia having vertical wrinkles on the thalline exciple in young condition.

The new species seems to be somewhat similar to *Leptogium azureum* and *L. javanicum* Mont. in respect to the colour of the thallus, structure of the proper exciple which

is distinctly euparaplectenchymatous only at the margins, and the ascospores. However, it differs from *Leptogium azureum* in having a vertically wrinkled thalline exciple and differs from *L. javanicum* in having a warty thallus owing to the presence of numerous pycnidia.

*Leptogium verrucosum* is a rare species and grows on rock as well as on bark in moist shady places in stunted, dry deciduous forest in rain shadow areas.

*Additional specimens examined. India: Maharashtra:* Nasik Distr., Bramhagiri, dry deciduous forest, 720 m elev., 2002, U. V. Makhija & A. V. Bhosale 02.268; Nasik Distr., Durgwadi, near Junnar, 2004, G. S. Chitale 04.132 (on rock); Pune Distr., Purandar Fort, 38 km from Pune, 2002, B. A. Adawadkar 02.247 (AMH).

### Key to the non-hairy species of *Leptogium* from India

- |      |   |  |
|------|---|--|
| 1    | Thallus and/or apothecia isidiate . . . . .   | 2  |
|      | Thallus and apothecia without isidia . . . . .  | 10   |
| 2(1) | Isidia coralloid; margin of lobes and apothecia isidiate . . . . .  |  |
|      | . . . . . <b>L. coralloideum (Meyen &amp; Flot.) Vain.</b>  |  |
|      | Isidia not coralloid . . . . .  | 3  |
| 3(2) | Isidia squamiform . . . . .   | 4  |
|      | Isidia otherwise, globular, cylindrical, or rarely squamiform . . . . .   | 5  |
| 4(3) | Isidia only on thalline margin, rarely on lobe margins; thallus longitudinally wrinkled . . . . .   | <b>L. marginellum (Sw.) Gray</b>                   |
|      | Isidia on lobes and also on thalline exciple; thallus slightly wrinkled; margins of the lobes isidiate, lobulate, with 2 mm wide, squamiform isidia . . . . .     | <b>L. denticulatum Nyl.</b>                        |
|      | . . . . . [synonym of <i>Leptogium leptophyllum</i> (Meyen & Flot.) Vain. (Vainio 1921)]  |  |
| 5(3) | Isidia rarely squamiform . . . . .  | 6  |
|      | Isidia never squamiform . . . . .   | 8  |
| 6(5) | Isidia black . . . . .  | <b>L. pichneum (Ach.) Nyl.</b>                     |
|      | Isidia not black, concolorous with the thallus . . . . .  | 7  |
| 7(6) | Thallus lead-grey, rough, with lobules at margins; lobes up to 13 mm wide; isidia, cylindrical; apothecia isidiate . . . . .                                      | <b>L. cyanescens (Rabenh.) Körb.</b>               |
|      | Thallus bluish lead-grey, wrinkled; lobes 2–7 mm wide; isidia globular to rarely branched, or squamiform, laminal to marginal; Indian specimens sterile . . . . . | <b>L. austroamericanum (Malme) C. W. Dodge</b>     |
| 8(5) | Isidia turning into lobules . . . . .   | <b>L. propaguliferum Vain.</b>                     |
|      | Isidia not turning into lobules . . . . .   | 9  |
| 9(8) | Thallus strongly longitudinally wrinkled; lobes anastomosing; isidia only at margins; Indian specimens sterile . . . . .  | <b>L. millegranum Sierk</b>                        |
|      | Thallus smooth, not wrinkled, not anastomosing; isidia laminal, as well as marginal . . . . .   | <b>L. patwardhanii Dube &amp; Makhija sp. nov.</b> |



- 10(1) Thallus lobes anastomosing . . . . . 11  
 Thallus lobes not anastomosing . . . . . 13
- 11(10) Disc blackish; thallus thick, wrinkled on the both sides; lobes numerous, ascending, complicated, gelatinous; apothecia large, with thicker margin . . . . .  
 . . . . . **L. phyllocarpum** var. **crassiusculum** (Taylor) Zahlbr.  
 Disc not blackish . . . . . 12
- 12(11) Thallus grey to blackish grey, strongly wrinkled; apothecia up to 1.5 mm diam., sessile, on the thickened margin of the lobes; thalline exciple wrinkled, without lobules . . . . . **L. chloromelum** (Sw.) Nyl.  
 Thallus dark grey to lead-grey, longitudinally wrinkled; apothecia up to 4 mm diam., subpedicellate; stalk dilated; thalline exciple wrinkled-lobulate . . . . .  
 . . . . . **L. phyllocarpum** var. **phyllocarpum** (Pers.) Mont.
- 13(10) Thallus with numerous warts . . . . . **L. verrucosum** Dube & Makhija sp. nov.  
 Thallus without warts . . . . . 14
- 14(13) Thallus pulvinate or subpulvinate . . . . . 15  
 Thallus neither pulvinate nor subpulvinate . . . . . 17
- 15(14) Thallus subpulvinate; lobes erect, tufted, corniculate . . . . .  
 . . . . . **L. palmatum** (Huds.) Mont.  
 Thallus pulvinate; lobes not erect, not corniculate . . . . . 16
- 16(15) Thallus lacinate-lobate; upper side grey-brown, wrinkled; apothecia only on the upper side of the thallus; thalline exciple tuberculate, lacinate . . . . .  
 . . . . . **L. fallax** Müll. Arg.  
 Thallus lobes elongate, orbicular; upper side dark grey to bluish grey, rough; apothecia often present on both sides of the lobes; thalline exciple periclinally wrinkled . . . . . **L. gelatinosum** (With.) J. R. Laundon
- 17(14) Thallus consisting of sheets of tissue, not organized in distinct lobes, deeply plicate; ascospores transversely septate . . . . . 18  
 Thallus organized in distinct lobes; ascospores muriform . . . . . 19
- 18(17) Thallus thick; apothecia up to 3 mm diam.; thalline exciple wrinkled; ascospores 9–13(–18)-septate, 45–60 (–67) × 3–8 µm . . . . . **L. adpressum** Nyl.  
 Thallus thin; apothecia to 1.5 mm diam.; thalline exciple entire to granulose excluded; ascospores 5–7(–9)-septate, (30–) 35–40(–45) × 5–7 (–8) µm . . . . .  
 . . . . . **L. brebissonii** Mont.
- 19(17) Proper exciple euparaplectenchymatous throughout . . . . . 20  
 Proper exciple euparaplectenchymatous only at margins . . . . . 23
- 20(19) Thalline exciple wrinkled  
 Thallus terricolous, wrinkled; upper side dark grey to brown-black; cortex of thalline exciple 1–2 cell layered from base to margin; ascospores 28–53 × 9–16 µm . . . . .  
 . . . . . **L. platynum** (Tuck.) Herre  
 Thalline exciple not wrinkled . . . . . 21
- 21(20) Ascospores up to 25 µm long; lower side wrinkled . . . . . **L. corticola** (Taylor) Tuck.  
 Ascospores up to 35 µm long; lower side smooth . . . . . 22
- 22(21) Thallus 50–90 (–135) µm thick . . . . .  
 . . . . . **L. cochleatum** (Dicks.) P. M. Jorg. & P. James  
 Thallus 80–170 µm thick . . . . . **L. ulvaceum** (Pers.) Vain.

- 23(19) Apothecia distinctly stalked; stalk tubular . . . . . 24  
 Apothecia sessile, sustipitate; stalk not tubular . . . . . 25
- 24(23) Thallus with lower side wrinkled; apothecia shortly stalked, to 2.5 mm diam., stalk tubular; thalline exciple periclinally wrinkled . . . . .  
 . . . . . **L. indicum D. D. Awasthi & Akhtar**
- Thallus with upper and lower side wrinkled; apothecia somewhat dome-shaped, stalked, to 5 mm diam.; stalk to 2 mm long, dilated; thalline exciple vertically plicate, sometimes lobulate . . . . . **L. javanicum Mont.**
- 25(23) Ascospores large up to 40 µm long; thallus smooth to rough, with few wrinkles; apothecia sessile, or shortly stipitate . . . . .  
 . . . . . **L. subazureum Dube & Makhija sp. nov.**
- Ascospores less than 30 µm long . . . . . 26
- 26(25) Thallus rough, 50–100(–150) µm thick . . . . . **L. azureum (Sw. ex Ach.) Mont.**  
 Thallus smooth, 30–60 µm thick . . . . . **L. moluccanum (Pers.) Vain.**

We are grateful to Professor P. M. Jørgensen for his valuable suggestions and reviewing an early version of the manuscript. We are thankful to the Ministry of Environment and Forests, Government of India, New Delhi, for their financial support.

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Accepted for publication 22 April 2010