

## New species and first records of *Eremothecella* (*Arthoniales*) from the Andaman and Nicobar Islands, India

T. A. M. JAGADEESH RAM  and G. P. SINHA

**Abstract:** Five species of *Eremothecella* are recorded from the Andaman Islands, two of which are described as new: *Eremothecella ajaysinghii* Jagad. Ram & G. P. Sinha and *E. nicobarica* Jagad. Ram & G. P. Sinha. *Eremothecella ajaysinghii* has whitish grey, pruinose ascomata and 8–10(–11)-septate ascospores, while *E. nicobarica* has non-pruinose ascomata and (14–)15–17-septate ascospores. *Eremothecella calamicola* Syd., *E. macrosperma* (Zahlbr.) Sérus. and *E. variratae* (Aptroot & Sipman) Sérus. are reported as new records for India. An updated worldwide key to species of the genus is presented.

**Key words:** *Arthonia*, *Arthoniaceae*, lichens, South-East Asia, taxonomy, tropical rainforest

Accepted for publication 23 August 2019

### Introduction

*Eremothecella* Syd. is characterized by dark brown to black ascomata with loose paraphyroids, globose asci that generally protrude through the ascoma surface as small warts, and applanate pycnidia with long filiform, multiseptate conidia which distinguish it from *Arthonia* (Sérusiaux 1992; Lücking 2008). The genus was established by Sydow (1917) but synonymized with *Arthonia* by Santesson (1952). Sérusiaux (1992) reinstated *Eremothecella* and included four species. Lücking (2008) also preferred to maintain *Eremothecella* as a separate genus because of *Eremothecella*-type pycnidia. Of the eight species currently known, six are foliicolous and two corticolous and until now the genus has not been reported from India.

In the course of a recent floristic review of the lichens of the Andaman and Nicobar Islands, while studying the foliicolous species of *Arthonia* s. lat., several distinct species of *Eremothecella* were encountered. Detailed studies revealed that two species were new to science

and three others represented new records for India. The new species are described below and brief notes on the new records are provided. A worldwide key to species of *Eremothecella* is presented. Thus, the total number of species in the genus becomes ten, seven of which are known from the eastern Palearctic.

### Materials and Methods

Specimens were collected in the Andaman and Nicobar Islands by one of the authors (TAMJR) and deposited in PBL and CAL. External morphological features were observed with an Olympus SZ61 stereomicroscope. Thin hand-cut sections of thalli were mounted in water, 10% KOH solution (K), Lugol's iodine solution (0.5 g iodine and 1.5 g potassium iodide in 100 ml distilled water) (I) and lactophenol cotton blue (LCB) then examined with a Nikon Eclipse 50i light transmission microscope. Thallus colour reactions were carried out using 10% aqueous potassium hydroxide solution (K), aqueous calcium hypochlorite solution (C) and Steiner's stable solution (P). Lichen substances were studied by thin-layer chromatography (Orange *et al.* 2001).

### The New Species

***Eremothecella ajaysinghii* Jagad. Ram & G. P. Sinha sp. nov.**

MycoBank No.: MB 832114

Foliicolous *Eremothecella* similar to *E. macrocephala* but with 8–10(–11)-septate, (33–)36–50(–52) × (7–)8–10(–12) µm ascospores.

T. A. M. Jagadeesh Ram: Botanical Survey of India, Andaman and Nicobar Regional Centre, Port Blair 744102, Andaman and Nicobar Islands, India. Email: tamjagadeesh@gmail.com

G. P. Sinha: Botanical Survey of India, Central Regional Centre, Allahabad – 211002, Uttar Pradesh, India.

Type: India, Andaman Islands, North Andaman, Kalara forest, elev. 62 m, 23 April 2011, *T. A. M. Jagadeesh Ram* 315 (CAL—holotype; PBL—isotype).

(Fig. 1)

*Thallus* crustose, foliicolous, dispersed or continuous, rounded to irregular in outline,

10–40 mm diam., smooth, greenish grey to green or whitish grey, thin, matt, lacking distinct prothallus, ecorticate, 12–25  $\mu\text{m}$  thick. *Photobiont* cells in radiate plates, rectangular, 8–15  $\times$  4–6  $\mu\text{m}$ , forming  $\pm$  continuous plates.

*Ascomata* few to many, rounded to irregular, plane, slightly prominent, dark brown to

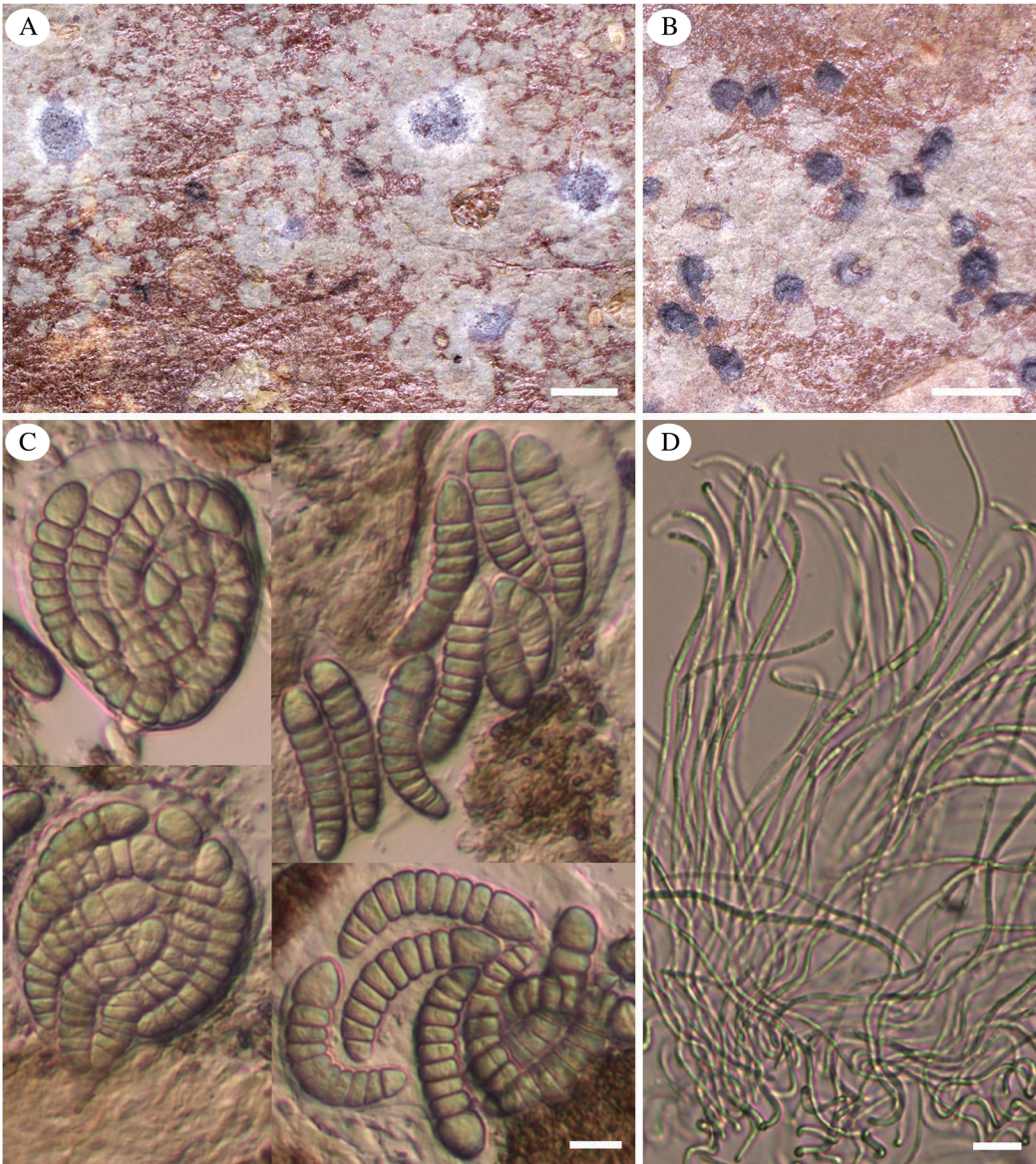


FIG. 1. *Eremothecella ajaysinghii* (holotype). A, thallus with ascomata; B, thallus with pycnidia; C, asci and ascospores; D, conidia. Scales: A & B = 1 mm; C & D = 10  $\mu\text{m}$ . In colour online.

black, ±moderately to densely greyish pruinose, pruina sometimes increasingly dense along the margin, 0.4–1.1 mm across, 45–80 µm thick. *Epithecium* pale to dark brown, incrustated with numerous small colourless to sordid green granules (pruina) dissolving in K, 6–10 µm thick, I+ red, KI+ pale blue. *Hymenium* pale brown, 40–72 µm high, I+ intensely orange-red, KI+ blue then quickly yellow. *Hypothecium* pale brown, 5–10 µm thick, I+ orange-brown, KI+ ochraceous yellow. *Paraphysoids* branched and anastomosing, 1.0–1.5 µm wide. *Asci* globose to subglobose, 8-spored, 40–72 × 38–60 µm, I+ orange, KI+ pale blue in inner parts of tholus. *Ascospores* colourless, becoming brownish and wrinkled, clavate, 8–10(–11)-septate, somewhat curved, distal cell enlarged, with very slight constrictions at septa, (33–)36–50(–52) × (7–)8–10(–12) µm.

*Pycnidia* numerous, applanate, elliptical to ±rounded, irregular, black, 0.2–0.5 × 0.2–0.3 mm. *Conidia* colourless, filiform, one end wider than the other, multiseptate, 70–125 × 1.5–2.0 µm.

**Chemistry.** Thallus K–, C–, KC–, P–; no lichen substances detected by TLC.

**Remarks.** *Eremothecella ajaysinghii* is very close to *E. macrocephala* (R. Sant.) G. Thor *et al.*, which also has pruinose ascomata and 9–13-septate ascospores, but the latter species has larger ascospores (52–74 × 8–15 µm). *Eremothecella cyaneoides* Lücking and *E. variratae* (Aptroot & Sipman) Sérus. are other species having ascomatal pruina; however, *E. cyaneoides* has smaller, 3–5-septate ascospores, while in *E. variratae* the ascomata have an orange-yellow pruina (Santesson 1952; Aptroot & Sipman 1991; Thor *et al.* 2000; Lücking *et al.* 2001). The new species has been commonly found in the shaded parts of evergreen forests in both the Andaman and Nicobar Islands. It usually grows on the leaves of palms, including *Calamus* species and *Korthalsia laciniosa*, plus *Donax canniformis*, *Garcinia nervosa*, *Heritiera littoralis* and some other dicotyledons in the dense to open shady understory of evergreen and mangrove forests.

**Etymology.** The species is named in honour of the late Dr Ajay Singh, a renowned Indian lichenologist who established the lichenology division and lichen herbarium in the National Botanical Research Institute, Lucknow and was a pioneer in the study of lichens of the Andaman and Nicobar Islands in the post-independence period.

**Additional specimens examined.** **India:** *Andaman and Nicobar Islands:* North Andaman, Diglipur, Khalighat, on *Heritiera littoralis*, elev. 10 m, 2011, Jagadeesh Ram 437 (PBL). Middle Andaman, Mayabunder, Tugapur forest, 2012, Jagadeesh Ram 838 (PBL); South Andaman, Baratang Island, Nayadera mangrove forest, 2012, Jagadeesh Ram 2272 (PBL); *ibid.*, 12°05'95.0"N, 92°44'53.6"E, 2013, Jagadeesh Ram 2627 (PBL). Little Andaman: Vishnu Nala Dam forest, 2012, Jagadeesh Ram 1712B (PBL). Car Nicobar Island, Passa forest, 9°12'75.3"N, 92°45'66.5"E, elev. 8 m, 2014, Jagadeesh Ram 3896 (PBL); Perka, 9°10'64.1"N, 92°46'98.7"E, elev. 8 m, 2014, Jagadeesh Ram 3982 (PBL); *ibid.*, 9°10'59.8"N, 92°47'03.2"E, elev. 10 m, 2014, Jagadeesh Ram 3987 (PBL); Katchal Island, E-Wall forest, 7°59'67.0"N, 93°23'81.7"E, elev. 15 m, 2014, Jagadeesh Ram 3715 (PBL); Little Nicobar Island, School Point forest, 7°24'31.7"N, 93°42'71.2"E, elev. 5 m, 2014, Jagadeesh Ram 4311 (PBL); Great Nicobar Island, Shompen Hut forest, 6°58'94.4"N, 93°51'03.5"E, elev. 30 m, 2014, Jagadeesh Ram 3314 (PBL); Afra Bay forest, 7°10'97.7"N, 93°44'27.9"E, elev. 30 m, 2014, Jagadeesh Ram 4451 (PBL); Murray Point forest, 7°13'62.2"N, 93°48'74.3"E, elev. 10 m, 2014, Jagadeesh Ram 4485 (PBL).

### ***Eremothecella nicobarica* Jagad. Ram & G. P. Sinha sp. nov.**

Mycobank No.: MB 832115

Foliicolous *Eremothecella* similar to *E. macrosperma* but with (14–)15–17-septate, 60–72 × 10–13 µm ascospores.

Type: India, Nicobar Islands, Great Nicobar Island, East West Road, Shompen Hut forest, 6°58'87.9"N, 93°51'79.5"E, elev. 10 m, 30 May 2015, T. A. M. Jagadeesh Ram 3298 (CAL—holotype; PBL—isotype).

(Fig. 2)

**Thallus** crustose, foliicolous, dispersed into ±rounded, confluent patches or irregular in outline, smooth, 15–50 mm across, pale greenish grey to pale green, thin, matt, lacking distinct prothallus, ecorticate, 10–20 µm thick. *Photobiont* cells angular-rounded to rectangular, 7–14 × 3–6 µm, in irregular or sometimes radiate plates.



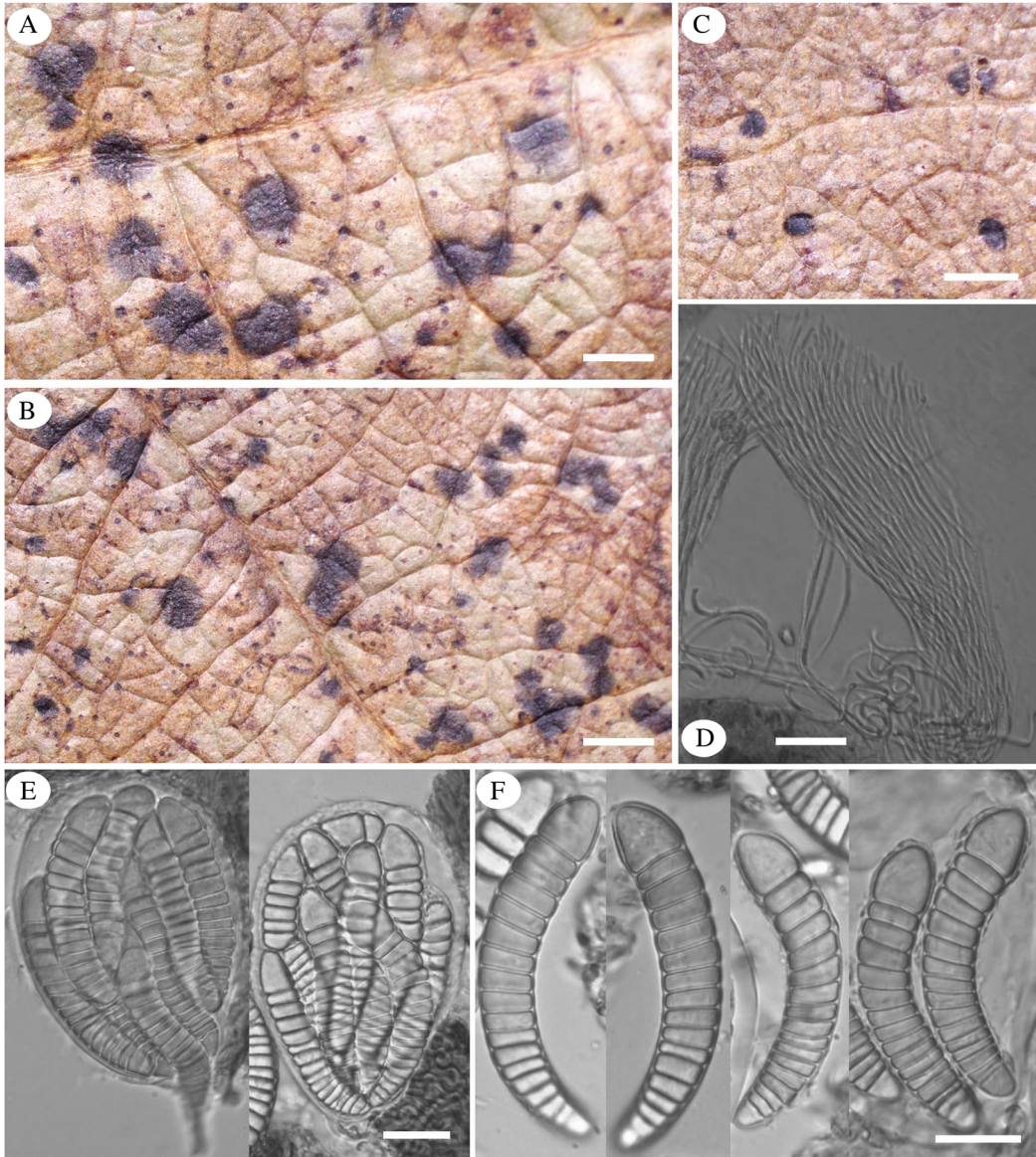


FIG. 2. *Eremothecella nicobarica* (holotype). A & B, thallus with ascomata; C, thallus with pycnidia; D, conidia; E, asci; F, ascospores. Scales: A–C = 1 mm; D–F = 20  $\mu$ m. In colour online.

*Ascomata* few to many, sharply delimited, hardly raised above thallus level, rounded to irregular in outline, 0.5–1.3 mm diam. and 70–120  $\mu$ m thick, dark brown to blackish brown, non-pruinose. *Epitecium* formed by a layer of densely packed, parallel, periclinal hyphae, dark brown, 5–12  $\mu$ m thick, K+ sordid

brown, I+ orange-brown, KI+ ochraceous yellow. *Hymenium* pale brown, 70–110  $\mu$ m high, I+ intensely orange-red, KI+ blue then quickly yellow. *Hypothecium* brown, 5–12  $\mu$ m thick, I+ orange-brown, KI+ ochraceous yellow. *Paraphysoids* branched and anastomosing, 1.0–1.5  $\mu$ m wide. *Asci* obovate to globose,



65–100 × 52–70 μm, I–, KI+ pale blue in inner parts of tholus. *Ascospores* colourless, clavate, curved, (14–)15–17-septate, distal cell enlarged, with very slight constrictions at septa, 60–72 × 10–13 μm.

*Pycnidia* few, applanate, oval to drop-shaped, 0.2–0.4 × 0.2–0.3 mm, black. *Conidia* colourless, filiform, one end wider than the other, multiseptate, 60–120 × 1.5–2.0 μm.

**Chemistry.** Thallus K–, C–, KC–, P–; no lichen substances detected by TLC.

**Etymology.** The specific epithet refers to its inventory from the Nicobar Islands.

**Remarks.** *Eremothecella nicobarica* is distinct from all the other species by the (14–)15–17-septate ascospores. It is similar to *E. macrosperma* (Zahlbr.) Sérus., which also has non-pruinose ascomata, but differs in its 7–12-septate ascospores. *Eremothecella calamicola* Syd. is another species lacking ascomatal pruina but it has smaller, 5–7-septate ascospores (Santesson 1952; Lücking 2008). The new species is known by the type collection and is found on dicotyledonous leaves in the shady understorey of an evergreen forest on Great Nicobar Island.

## New Records

### *Eremothecella calamicola* Syd.

This pantropical species was commonly found in the shaded parts of evergreen forests in both the Andaman and Nicobar Islands. It usually grows on the leaves of *Calamus*, *Korthalsia laciniosa*, *Pinanga manii* and some dicotyledons in the understorey communities. It is characterized by non-pruinose ascomata and 5–7-septate ascospores (30–45 × 7–10 μm).

**Specimens examined.** **India:** Andaman and Nicobar Islands: South Andaman, Havelock Island, Kala Pathar forest, 2012, *Jagadeesh Ram* 2101 (PBL). Kamorta Island, Vikas Nagar – Pillpillow forest, 6°58'95.8"N, 93°51'59.8"E, elev. 15 m, 2014, *Jagadeesh Ram* 3475 (PBL); Katchal Island, E-Wall forest, 7°59'67.0"N, 93°23'77.8"E, elev. 15 m, 2014, *Jagadeesh Ram* 3717A (PBL); *ibid.*, 7°59'67.0"N, 93°23'81.7"E, elev. 15 m, 2014, *Jagadeesh Ram* 3731 (PBL); *ibid.*, 7°59'70.5"N, 93°23'63.4"E, elev. 15 m, 2014, *Jagadeesh Ram* 3733

(PBL); Little Nicobar Island, Akupa forest, 7°22'65.4"N, 93°39'79.8"E, elev. 10 m, 2014, *Jagadeesh Ram* 4226 (PBL); School Point forest, 7°24'31.7"N, 93°42'71.2"E, elev. 5 m, 2014, *Jagadeesh Ram* 4312 (PBL); Pulopattia forest, 7°19'37.7"N, 93°43'49.0"E, elev. 15 m, 2014, *Jagadeesh Ram* 4373 (PBL); Great Nicobar Island, Shompen Hut forest, 6°58'87.1"N, 93°51'25.1"E, elev. 30 m, 2015, *Jagadeesh Ram* 3313 (PBL); Nature Trail forest, 7°00'20.3"N, 93°52'80.3"E, elev. 10 m, 2014, *Jagadeesh Ram* 3334 (PBL); *ibid.*, 7°00'31.0"N, 93°52'76.7"E, elev. 25 m, 2014, *Jagadeesh Ram* 4574 (PBL); Afra Bay forest, 7°10'97.7"N, 93°44'27.9"E, elev. 30 m, 2014, *Jagadeesh Ram* 4448 (PBL).

### *Eremothecella macrosperma* (Zahlbr.) Sérus.

This species was previously known from Indonesia, Japan and Papua New Guinea. It was found on the leaves of *Heritiera littoralis* and *Calamus* in the shaded parts of mangrove and evergreen forests in both the Andaman and Nicobar Islands. It is characterized by non-pruinose ascomata and 7–12-septate ascospores (35–60 × 9–14 μm).

**Specimens examined.** **India:** Andaman and Nicobar Islands: North Andaman, Diglipur, Radhanagar II seashore, on the way to Nayakattai, on *Heritiera littoralis*, elev. 5 m, 2011, *Jagadeesh Ram* 286 (PBL). Katchal Island, E-Wall forest, 7°59'67.0"N, 93°23'81.7"E, elev. 15 m, 2014, *Jagadeesh Ram* 3714 (PBL); Great Nicobar Island, Afra Bay forest, 7°10'73.6"N, 93°44'29.4"E, elev. 30 m, 2014, *Jagadeesh Ram* 4453 (PBL).

### *Eremothecella variratae* (Aptroot & Sipman) Sérus.

This species was previously known from Papua New Guinea and was found on the leaves of *Calamus*, *Mangifera*, *Korthalsia laciniosa* and *Pinanga manii* in the shaded understorey of evergreen forests in the Nicobar Islands. It is characterized by the orange-yellow pruinose ascomata and 5–7-septate ascospores (28–42 × 7–10 μm).

**Specimens examined.** **India:** Andaman and Nicobar Islands: Little Nicobar Island, Akupa forest, 7°22'65.7"N, 93°39'80.4"E, elev. 5 m, 2014, *Jagadeesh Ram* 4242 (PBL); Pulopanja forest, 7°19'41.8"N, 93°43'45.6"E, elev. 28 m, 2014, *Jagadeesh Ram* 4370 (PBL); Pulopattia forest, 7°19'36.9"N, 93°43'51.1"E, elev. 5 m, 2014, *Jagadeesh Ram* 4382 (PBL); Great Nicobar Island, Afra Bay Forest, 7°10'96.3"N, 93°44'29.7"E, elev. 20 m, 2014, *Jagadeesh Ram* 4438 (PBL).

**World key to the species of *Eremothecella***

- 1      Thallus foliicolous ..... 2  
       Thallus corticolous ..... 9
- 2(1)   Ascospores transversely septate ..... 3  
       Ascospores muriform .... ***Eremothecella cingulata*** (R. Sant.) Ferraro & Lücking
- 3(2)   Ascomata densely whitish grey or orange-yellow pruinose ..... 4  
       Ascomata non-pruinose ..... 7
- 4(3)   Ascospores 3–7-septate ..... 5  
       Ascospores 8–13-septate ..... 6
- 5(4)   Ascomata whitish grey pruinose; ascospores 3–5-septate, 25–35 × 8–10 µm .....  
       ..... ***Eremothecella cyaneoides*** Lücking  
       Ascomata orange-yellow pruinose; ascospores 5–7-septate, 28–42 × 7–10 µm .....  
       ..... ***Eremothecella varitatae*** (Aptroot & Sipman) Sérus.
- 6(4)   Ascospores 8–10(–11)-septate, (33–)36–50(–52) × (7–)8–10(–12) µm .....  
       ..... ***Eremothecella ajaysinghii*** Jagad. Ram & G. P. Sinha  
       Ascospores 9–13-septate, 52–74 × 8–15 µm .....  
       ..... ***Eremothecella macrocephala*** (R. Sant.) G. Thor *et al.*
- 7(3)   Ascospores 5–7-septate, 30–45 × 7–10 µm ..... ***Eremothecella calamicola*** Syd.  
       Ascospores 7–17-septate ..... 8
- 8(7)   Ascospores 7–12-septate, 35–60 × 9–14 µm .....  
       ..... ***Eremothecella macrosperma*** (Zahlbr.) Sérus.  
       Ascospores (14–)15–17-septate, 60–72 × 10–13 µm .....  
       ..... ***Eremothecella nicobarica*** Jagad. Ram & G. P. Sinha
- 9(1)   Pycnidia 0·2–0·4 mm diam.; conidia usually helicoid; ascomata unknown .....  
       ..... ***Eremothecella helicella*** Aptroot & M. Cáceres  
       Pycnidia 0·1–0·2 mm diam.; conidia not helicoid; ascomata 0·5–1·0 mm diam.;  
       ascospores 3-septate, microcephalic, 16–21 × 6–7 µm .....  
       ..... ***Eremothecella microcephalica*** Sipman

We are grateful to Dr R. Lücking for his comments on the new species and sending relevant literature; the Director, Botanical Survey of India, Kolkata and the Head, BSI, Andaman and Nicobar Regional Centre, Port Blair for the use of facilities; the Authorities of the Department of Environment & Forests, Andaman and Nicobar Islands for facilitating the fieldwork; Dr Siljo Joseph, NBRI, Lucknow for assistance with literature.

REFERENCES

- Aptroot, A. & Sipman, H. (1991) New lichens and lichen records from Guinea. *Willdenowia* **20**: 221–256.  
 Lücking, R. (2008) Follicolous lichenized fungi. *Flora Neotropica Monograph* **103**: 1–866.  
 Lücking, R., Streimann, H. & Elix, J. A. (2001) Further records of foliicolous lichens and lichenicolous fungi from Australasia, with an updated checklist for continental Australia. *Lichenologist* **33**: 195–210.



- Orange, A., James, P. W. & White, F. J. (2001) *Microchemical Methods for the Identification of Lichens*. London: British Lichen Society.
- Santesson, R. (1952) Foliicolous lichens 1. A revision of the taxonomy of the obligately foliicolous lichenized fungi. *Symbolae Botanicae Upsalienses* **12**: 1–590.
- Sérusiaux, E. (1992) Reinstatement of the lichenized genus *Eremothecella* Sydow. *Systema Ascomycetum* **11**: 39–47.
- Sydow, H. (1917) Beitrag zur Kenntnis der Pilzflora der Philippinen-Inseln. *Annales Mycologici* **15**: 165–268.
- Thor, G., Lücking, R. & Matsumoto, T. (2000) The foliicolous lichen flora of Japan. *Symbolae Botanicae Upsalienses* **32**: 1–72.