ISSN (Online): 2349-1183; ISSN (Print): 2349-9265
TROPICAL PLANT RESEARCH
The Journal of the Society for Tropical Plant Research

7(3): 689–695, 2020
DOI: 10.22271/tpr.2020.v7.i3.087

Research article

A new record and an updated key of lichen genus *Dibaeis* (Icmadophilaceae, Ascomycota) from India

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[Accepted: 18 December 2020]

Abstract: The lichen genus *Dibaeis* is currently represented in India by two species, *viz.*, *Dibaeis baeomyces* and *Dibaeis pulogensis* reported from the states of Meghalaya, Sikkim and Western Bengal. The present study describes the occurrence of a new record *Dibaeis absoluta* from the Eastern Himalayan hill tracts of Mizoram, North-East India which is situated in the Indo-Burma biodiversity hotspot. The addition of present new record of *Dibaeis* species further increased the number to three in India. A revised key is also provided.

Keywords: *Dibaeis* - Lichenized fungi - Eastern Himalayas - Taxonomy.

[Cite as: Yadav S (2020) A new record and an updated key of lichen genus *Dibaeis* (Icmadophilaceae, Ascomycota) from India. *Tropical Plant Research* 7(3): 689–695]

INTRODUCTION

The lichen genus *Dibaeis* was first described by Clements (1909). Later on, several species of *Baeomyces s. lat.* have been transferred into *Dibaeis* by Gierl & Kalb (1993). *Dibaeis* was earlier treated as a synonym of genus *Baeomyces*, but the recent molecular evidences separated these two and established *Dibaeis* as an individual genus under family Icmadophilaceae (Rambold *et al.* 1993, Stenroos & DePriest 1998, Stenroos *et al.* 2002, Platt & Spatafora 1999, Grube & Kantvilas 2006, Jaklitsch *et al.* 2016). Thallus of *Dibaeis* is sparingly lichenized, dimorphic. Primary thallus crustose to squamulose. Secondary thallus ± erect, with or without, simple or branched podetioid stipes. Apothecia terminal on stipes, solitary or clustered, pinkish to rose-red, asci with I+ blue apical cap, 8-spored; ascospores colourless, simple or rarely 1-septate.

Dibaeis is a cosmopolitan genus reported from temperate to tropical regions, with the greatest diversity in the tropics (Johnston 2001). Currently, there are 20 legitimate species under the genus *Dibaeis* (Mycobank 2021). *Dibaeis baeomyces* (L. f.) Rambold & Hertel and *Dibaeis pulogensis* (Vain.) Kalb & Gierl are the two species reported from India (Singh & Sinha 2010, Sinha *et al.* 2018). These two species are reported from Indian states of Meghalaya, Sikkim and West Bengal. The present study describes the occurrence of a new record of genus *Dibaeis* from Eastern Himalayan hill tracts of Mizoram, North-East India.

MATERIALS AND METHODS

The study is based on specimens collected from Mizoram, North East India. Voucher specimens are deposited at the Calcutta University Herbarium (CUH). All collected specimens were investigated morphologically (by Leica EZ4 HD Stereo microscope) and anatomically (by Leica DM 750 compound microscope). All measurement values are presented in 'minimum-to-maximum' format. The colour tests were performed with the usual reagents, *i.e.* K (10% aqueous solution of potassium hydroxide), C (freshly prepared aqueous solution of calcium hypochlorite) and Steiner's P (1 gm of paraphenylenediamine and 10 gm of sodium sulphite in 100 ml of distilled water with 1 ml of liquid detergent) (Awasthi 2000). Lichen substances were identified by thin-layer chromatography using standard methods (Culberson 1972, Walker & James 1980, Orange *et al.* 2001).

RESULTS

Dibaeis absoluta (Tuck.) Kalb & Gierl **(Figs 1–4)**

Common name: Pink Dot Lichen (Hill 2002).

Received: 10 May 2020 Published online: 31 December 2020
https://doi.org/10.22271/tpr.2020.v7.i3.087

Description: Thallus crustose, dimorphic, primary thallus very thin, 300–600 µm, green to dark green, generally smooth when dry, slimy and warty when wet, closely adhered to rock substrate or soil. Soredia and Isidia absent. Photobiont green alga, 9–15 × 10–22 µm. Apothecia round to ellipsoidal, solitary to clustered, sessile when young, develop very short stipe as matures, 0.5–1.0 mm in diam., concave to plane, margin sometimes undulates when dry, ivory-white in colour with faint pinkish tinge, pruinose. Stipe up to 1 mm in length, corticated, granular, pruinose, base lichenised, ivory-white in colour. Excipulum 26–76 µm thick and colourless, Hymenium 26–62 µm thick, KI+ weakly reddish brown., Hypothecium 87–191 µm thick and colourless, composed of loosely entangled, branched hyphae 1.0–1.5 µm thick. Paraphyses loosely entangled, branched, occasionally anastomosed, 1.5–2.5 µm thick, with the apical cell sometimes gradually expanded to 3 µm wide. Asci 8-spored, 71–81 × 1.5–2.5 µm, of the *Icmadophila*-type, narrowly cylindrical with an extended basal 'tail', and with a slightly thickened tholus and amyloid only at the very outermost apical part, apex I+ blue. Ascospores ellipsoid to nearly ovoid, colourless, simple to 1 septate, 8–11 × 2.0–3.5 µm. Pycnidia not found.

Chemistry: Primary thallus K –, P –, C – UV-; apothecial disc and stipe K + yellow, P + yellow, C –, UV + whitish. TLC: Baeomycesic acid, squamatic acid and barbatic acid are present.

Distribution and habitat: Perry & Moore (1969) reported this species from North Carolina. According to Gierl & Kalb (1993), *Dibaeis absoluta* has a very widespread distribution. It was one of the 283 lichen species reported from Mount Kinabalu located in Ranau district, West Coast Division of Sabah, Malaysia (Sipman 1993). Yamamoto *et al.* (1998) reported its presence from Kinunkei valley, Kyoto, Japan. It is considered to be a pantropical or subtropical lichen, and it has been found on the continents of Asia, Australia, North America, and South America (Hill 2002). Kurokawa & Kashiwadani (2006) listed it in the checklist of Japanese Lichens and Allied Fungi. It has been reported as a new record from Bolivia (Flakus & Wilk 2006). Lumbsch *et al.* (2011) reported it from Fiji. In a phytochemical account of lichens of New Zealand, *Dibaeis absoluta* was reported to have baeomycesic acid, hypoprotocetraric acid, and squamatic acid (Walker & Elizabeth 1997). It was reported to be present on smaller rock outcrops, deeply shaded beneath shrubs and sedges in the Meredith Range, north-western Tasmania (Kantvilas *et al.* 2012). It was reported to be growing on sandstone in the City of Boulder, Colorado (Tripp 2015).

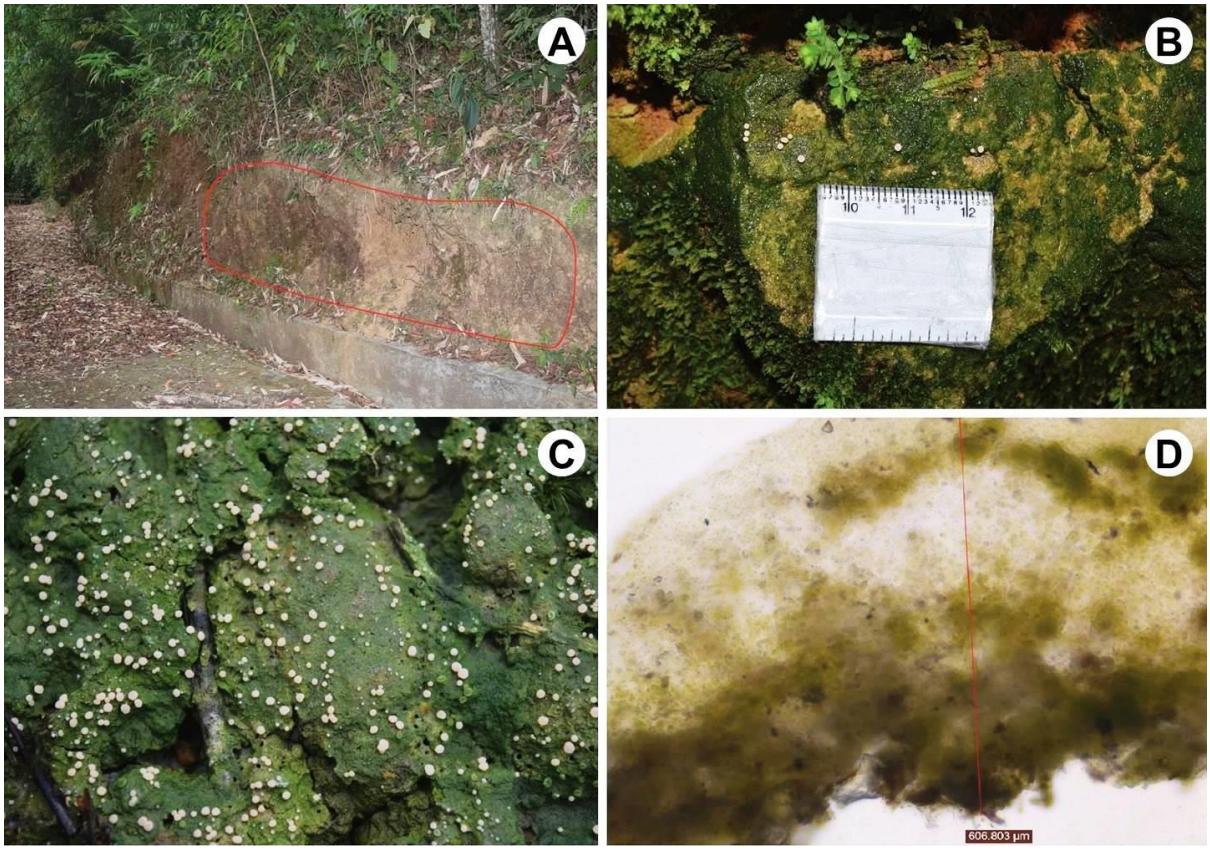

Figure 1. *Dibaeis absoluta* (Tuck.) Kalb & Gierl: **A**, Habitat (highlighted by the red outline): the species grows on the side face of soil where competition from other plant groups is less; **B**, Thallus on sandstone; **C**, Thallus on moist soil; **D**, Transverse section of the thallus.

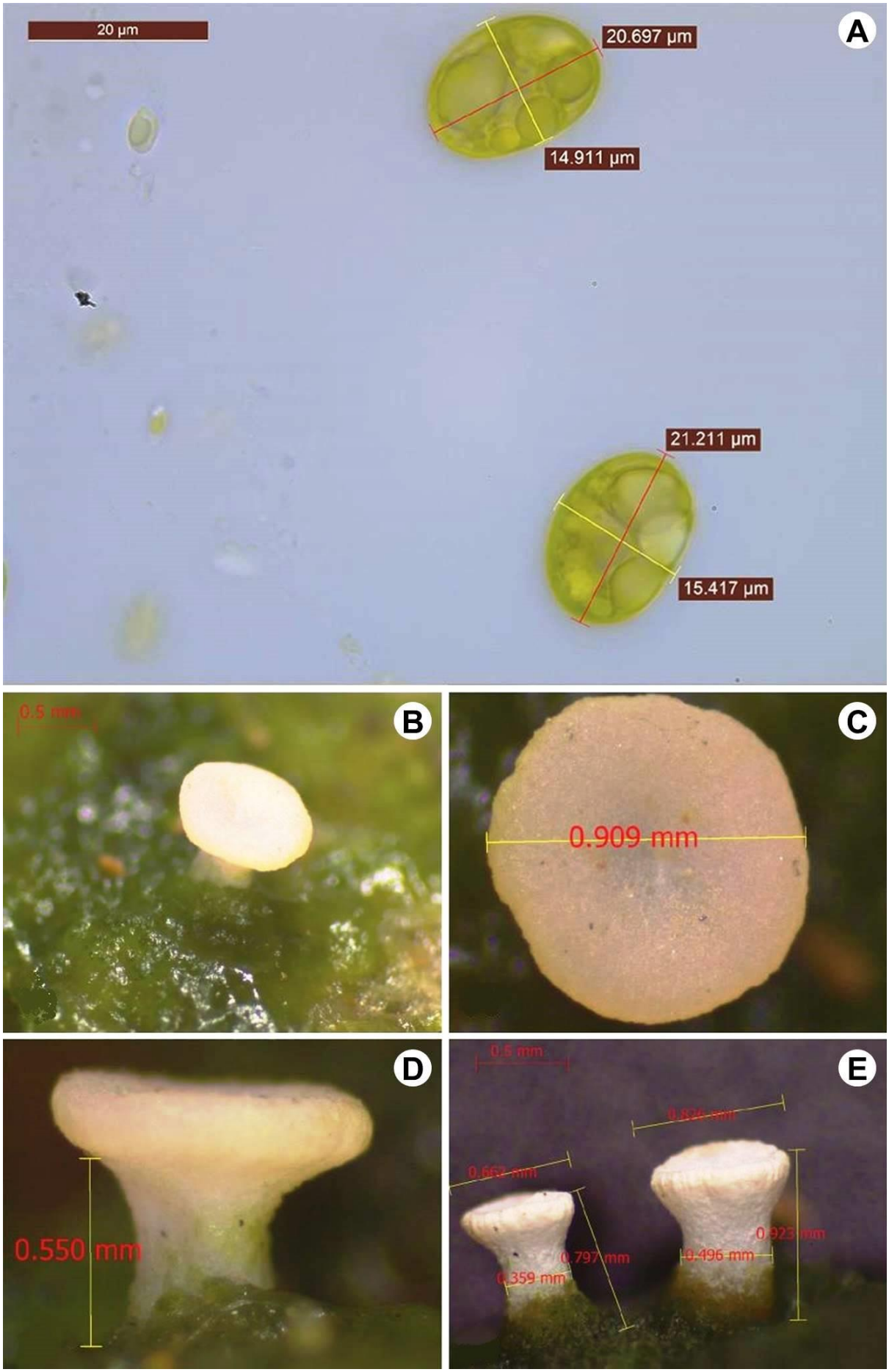

Figure 2. *Dibaeis absoluta* (Tuck.) Kalb & Gierl: **A**, Photobiont cells; **B**, Thallus is crusty when dry, warty and jelly like when wet; **C–E**, Apothecial disc is round and plane to slightly concave when wet.

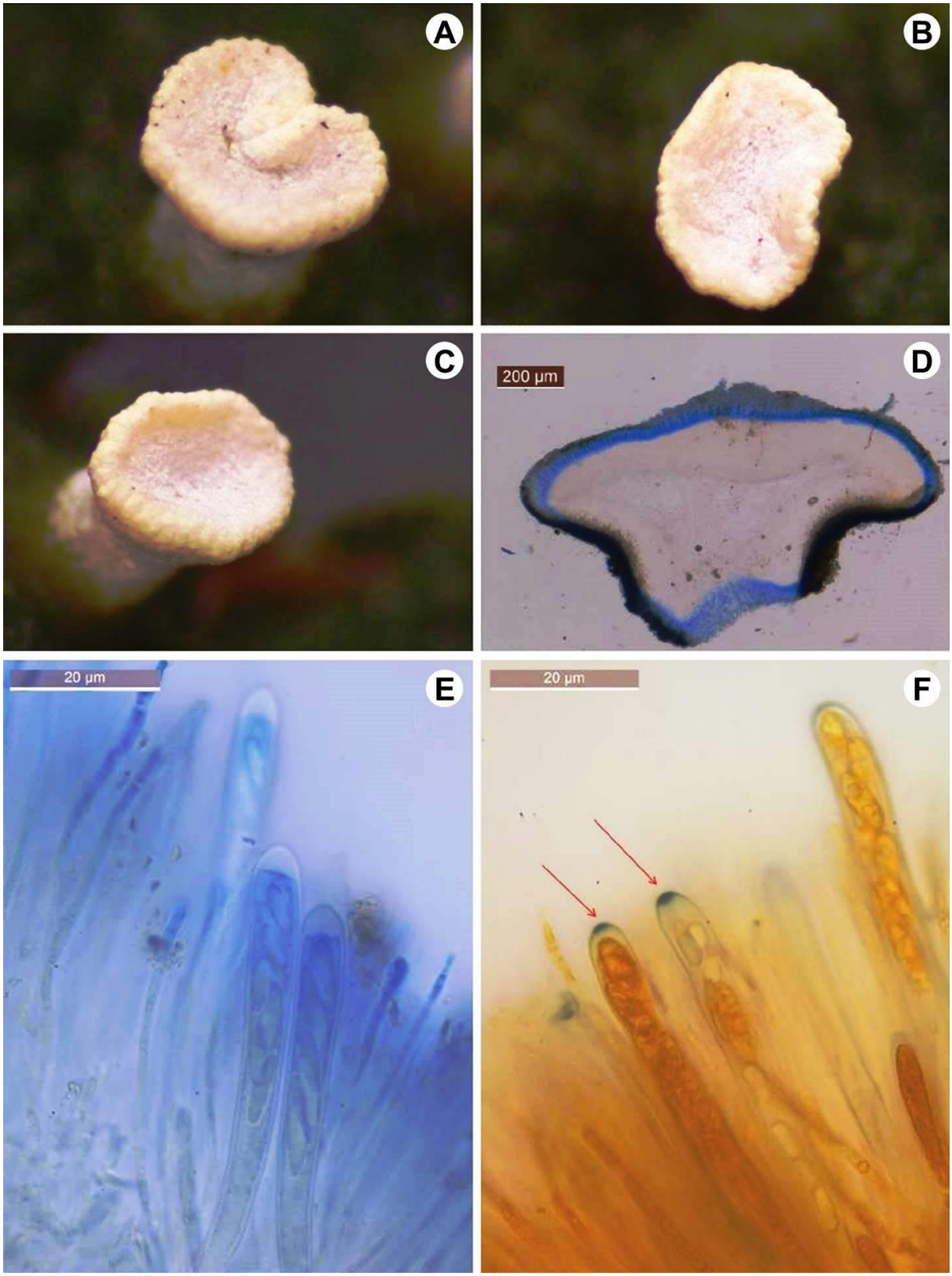

Figure 3. *Dibaeis absoluta* (Tuck.) Kalb & Gierl: **A–C**, Apothecial disc can be irregularly shaped and steeply concaved when dry; **D**, T. S. of apothecia; **E**, Asci are of *Icmadophila*-type; **F**, Asci are I + violet at the tip, amyloid only at the very outermost apical part.

In this study, *Dibaeis absoluta* was found to be growing on exposed sedimentary rocks and soil in moist and shady sites. It grows as a thin green layer or crust which resembles an algal colony. It can be difficult to spot this species during the dry season since the apothecia are few and flaccid, and therefore, it appears almost like an algal colony. However, during rainy season, apothecia are both numerous and turgid making it easier to spot the species in its habitat. Landslides and slash & burn form of agriculture are two major threats to the habitat of this species in Mizoram.

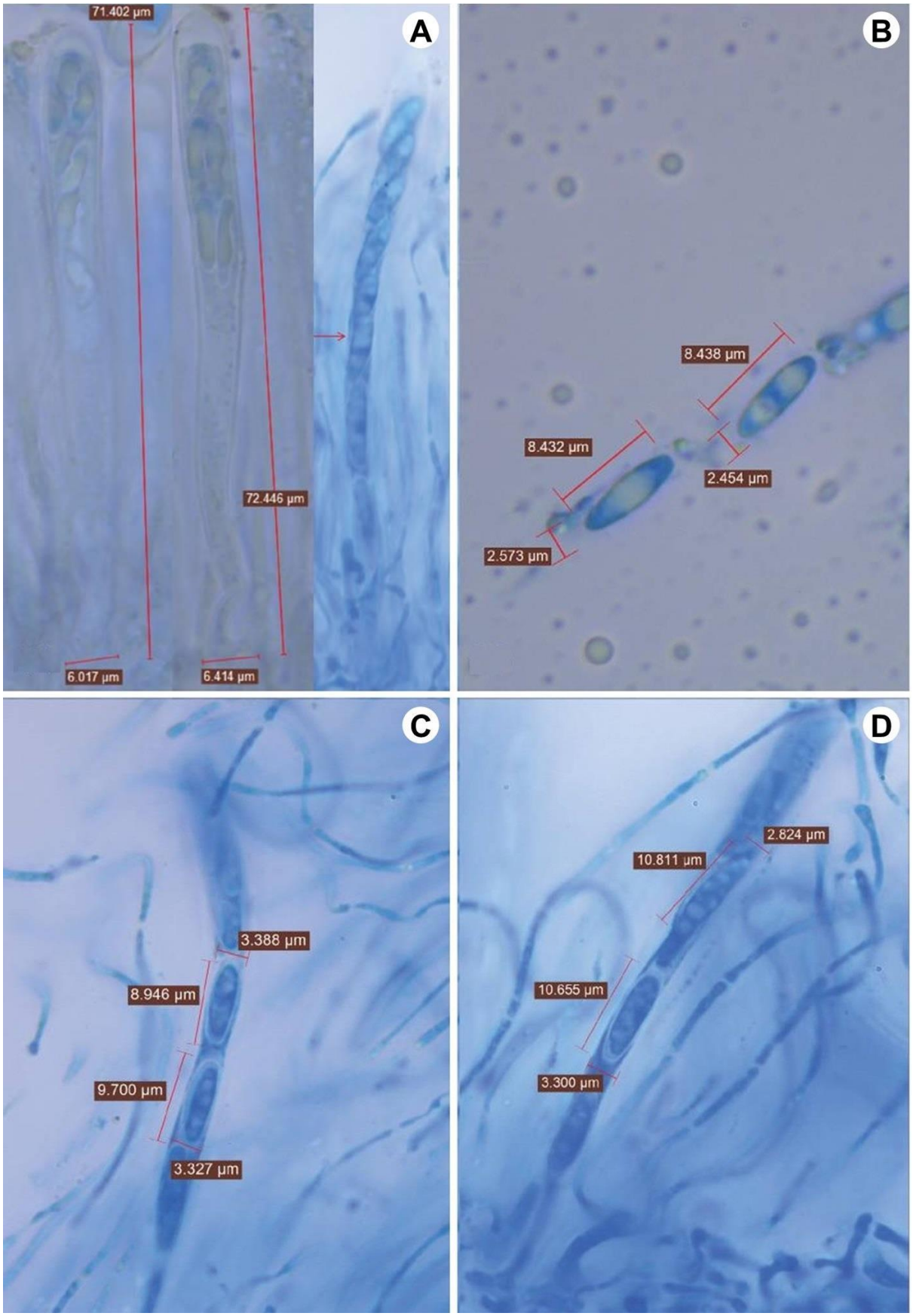

Figure 4. Asci and ascospores of *Dibaeis absoluta* (Tuck.) Kalb & Gierl.

Remarks: *Dibaeis baeomyces* is characterized with grey crustose-verruculose thallus with apothecia borne on podetial stipes of up to 5 mm in length and *Dibaeis. pulogensis* is characterized with grey, sorediate, crustose-verruculose thallus borne on podetial stipes of up to 8 mm in length, whereas, *Dibaeis absoluta* has a very thin green to dark green colour thallus with apothecia borne on podetial stipes of up to 1 mm in

length. *Dibaeis sorediata* also have podetial stipes of 1 mm in length, however, the thallus is sorediate as the name suggests.

Kantvilas (2018) provisionally classified *Dibaeis inundata* Kantvilas as *Dibaeis absoluta* on account of its esorediate thallus and ± flat and sessile apothecia, however, on further investigation, the differences between the two species were revealed. Whereas *Dibaeis inundata* is associated exclusively with very wet, at least intermittently submerged habitats, *Dibaeis absoluta* occurs on rocks that may be moist or shaded but are never wet with free-running water. Furthermore, the thallus of *Dibaeis inundata* is markedly thicker and chalky white, whereas that of *Dibaeis absoluta* is very thin and dull greenish grey.

Specimens examined: INDIA, Mizoram, Champhai district, enroute to Zote village, 1375 m altitude, N 23° 28' 42.30", E 093° 21' 46.80", on moist soil under shade, 01.08.2018, *Sandeep Yadav L0161* (CUH); Mizoram, Aizawl district, Bethlehem Vengthlang, FRCBR reserve forest, 791 m altitude, N 23° 43' 51.53", E 92° 43' 17.11", on sedimentary rock on side of trail, 22.07.2017, *Sandeep Yadav L0165* (CUH).

Key to species of genus Dibaeis found in India

1a Primary thallus sorediate, Apothecia convex, up to 2–4 mm in diameter, podetial stipe up to 4–8 mm tall ..... *Dibaeis pulogensis*

1b Primary thallus lacking soredia ……..... 2

2a Podetial stipe up to 5mm tall, Apothecia up to 2.5 mm in diameter ..... *Dibaeis baeomyces*

2b Podetial stipe up to 1 mm tall, Apothecia up to 1.0 mm in diameter ..... *Dibaeis absoluta*

AKNOWLEDGEMENTS

I sincerely thank Director General, Indian Council of Forestry Research and Education (ICFRE), Dehradun, India for funding this study. I am indebted to Dr. R.S.C. Jayaraj, IFS, Director, Rain Forest Research Institute, Jorhat, Assam, India for his continuous support and guidance. I express my heartfelt gratitude to my senior colleague, Sh. Hans Raj, Scientist D for his extensive support and guidance. I am immensely grateful to Dr. D.K. Upreti, Emeritus Scientist and Dr. Sanjeeva Nayaka, Senior Principal Scientist of CSIR-National Botanical Research Institute, Lucknow for their incessant support.

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