PLANT SCIENCE TODAY
ISSN 2348-1900 (online)
Vol x(x): xx–xx
https://doi.org/10.14719/pst.3310

HORIZON
e-Publishing Group
HePG

RESEARCH COMMUNICATION

New additions of lichens from Assam, India

Prashant Kumar Behera[1,3], Siljo Joseph[2], Sanjeeva Nayaka[1]* & Rajveer Singh Chauhan[3]

[1] Lichenology Laboratory, CSIR – National Botanical Research Institute, Rana Pratap Marg, Lucknow, Uttar Pradesh, 22 6001, India

[2] Forest Botany Department, Forest Ecology and Biodiversity Conservation Division, KSCSTE – Kerala Forest Research Institute, Peechi, Thrissur, Kerala, 680 653, India

[3] Department of Botany, Deen Dayal Upadhyaya Gorakhpur University, Civil Lines, Gorakhpur, Uttar Pradesh, 273 009, India

*Email: nayaka.sanjeeva@gmail.com

OPEN ACCESS

ARTICLE HISTORY

Received: 28 October 2023
Accepted: 12 February 2024

Available online
Version 1.0 : 11 March 2024

Check for updates

Additional information

Peer review: Publisher thanks Sectional Editor and the other anonymous reviewers for their contribution to the peer review of this work.

Reprints & permissions information is available at https://horizonepublishing.com/journals/index.php/PST/open_access_policy

Publisher's Note: Horizon e-Publishing Group remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Indexing: Plant Science Today, published by Horizon e-Publishing Group, is covered by Scopus, Web of Science, BIOSIS Previews, Clarivate Analytics, NAAS, UGC Care, etc
See https://horizonepublishing.com/journals/index.php/PST/indexing_abstracting

CITE THIS ARTICLE

Behera P K, Joseph S, Nayaka S , Chauhan R S. New additions of lichens from Assam, India. Plant Science Today (Early Access). https://doi.org/10.14719/pst.3310

Abstract

An account of 7 lichen species new to lichen biota of Assam is presented. The species are *Bactrospora paludicola*, *Buellia pleiotera*, *Byssolecania deplanata*, *Graphis urandrae*, *Gyalidea fritzei*, *Mycobilimbia philippina* and *Staurothele fissa*. Among them, *B. paludicola* and *G. fritzei* are being reported for the first time from India. The lichen samples were collected from various protected areas of Assam and a detailed systematic account is provided.

Keywords

Biodiversity, Lichenized fungi, North-East, Taxonomy

Introduction

Assam is known for its opulent flora and fauna and it is located in the north eastern region of India. Because of its unique physiography, which includes a high degree of precipitation from the direct confrontation of monsoon-lashed wind from the Bay of Bengal obstructed by abruptly rising hills brings abundant rainfall to this area. The confluence of Indo-Chinese, Indo-Malayan realms, the Northeast hills (Patkai – Naga Hills and Lushai Hills), the Brahmaputra and Barak plains, which provide pristine environment for a variety of organisms to colonize, including lichens. Since late 18th century various researchers have made their contributions in studying the lichen biota of this state. A checklist of lichens for Assam by comprehending all the previous records which yielded 657 species of lichens belonging to 146 genera under 41 families (1). Later, Researchers added 31 lichens species to the lichen biota of undivided Nagaon district of Assam which also includes *Tylophoron protrudens* Nyl. a new record to the state (2). Reports are on 21 species belonging to 11 genera under 8 families from Ultapani forest range of Kokrajhar district of Assam (3). The present manuscript is the continuation of the ongoing work on lichens of Assam which resulted in several new additions to the state and India too.

Materials and Methods

The lichen specimens were collected in the years 2021 and 2022 from various protected areas of Assam including Kaziranga National Park, Manas National Park and Lakhowa Wildlife Sanctuary. The collected lichen specimens were dried and preserved in the herbarium of CSIR–National Botanical Research Institute, Lucknow (LWG). Morphological characterization of lichen thallus was done under Leica EZ4 stereo zoom microscope. Thin hand cut sections of ascoma were mounted with distilled

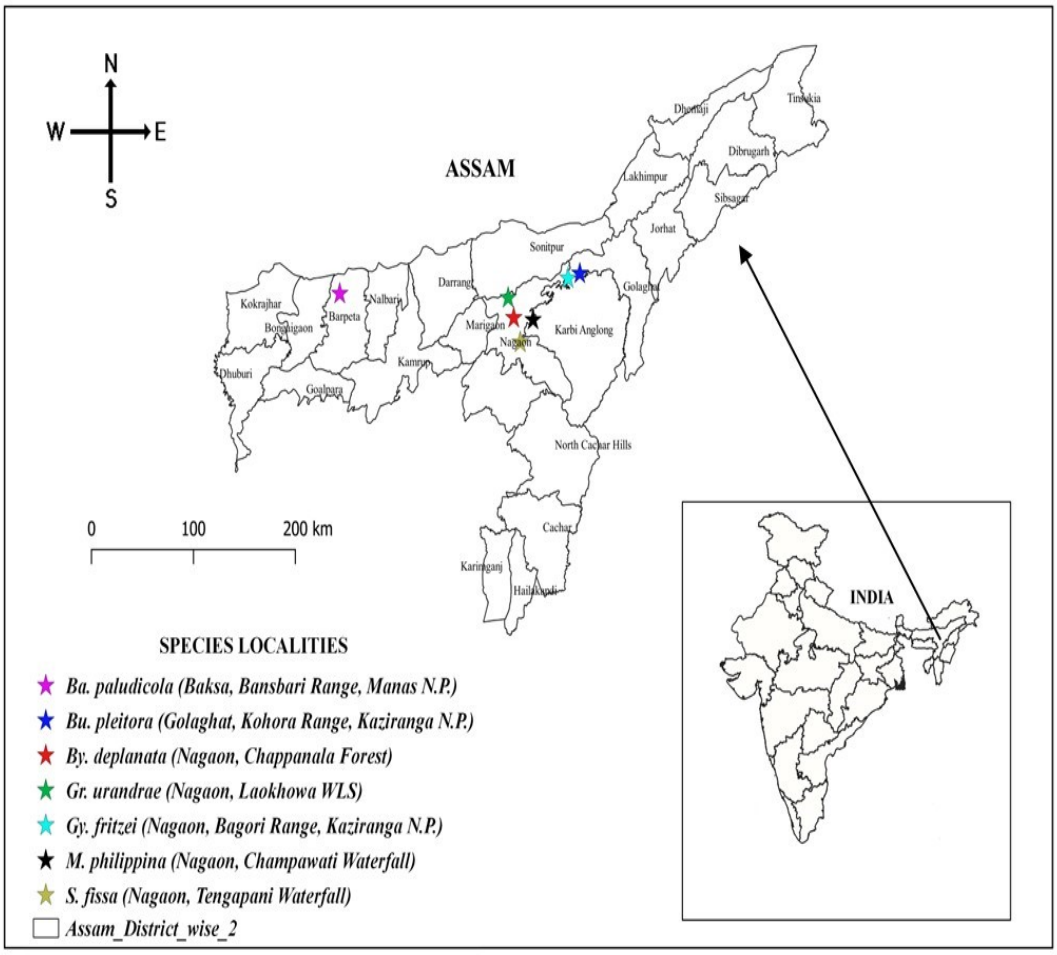

Fig. 1. Map of Assam showing the species localities.

water, lactophenol cotton blue, 5% KOH solution and Lugol's iodine solution and was observed under Leica DM2500 compound microscope for anatomical studies. Chemical spot tests on the thallus and ascomatal tissue were performed using standard laboratory reagents K (5% aqueous solution of potassium hydroxide), P (0.5 g of paraphenylenediamine dissolved in 5 mL of ethanol) and C (aqueous solution of calcium hypochlorite). Thin layer chromatography (TLC) was performed in solvent system A (Benzene: 1,4 dioxane: acetic acid; 90: 25: 4 mL) for the identification of secondary metabolites (4). Identification of taxa was done by following relevant published literature (5-9). The nomenclature of lichens was updated following indexfurgorum.org and classification mentioned was followed for arranging the species within families (10).

Results

The study resulted in 7 species namely *Bactrospora paludicola* (genera incertae sedis), *Buellia pleiotera* (Caliciaceae), *Byssolecania deplanata* (Pilocarpaceae), *Gyalidea fritzei* (Gomphillaceae), *Graphis urandrae* (Graphidaceae), *Mycobilimbia philippina* (Ramalinaceae) and *Staurothele fissa* (Verrucariaceae) as new to the lichen biota of Assam. Among them, *Bactrospora paludicola* and *Gyalidea fritzei* are new records for India. Detailed taxonomic descriptions of the new records are given below.

Taxonomic accounts

***Bactrospora paludicola* Kantvilas,** Symb. bot. upsal. 34 (1): 192. 2004 (Fig. 2 A – D)

Description: Thallus crustose, ecorticate, whitish, effuse. Photobiont chlorococcoid algae. Ascomata apothecoid, 0.2–0.6 mm in diam., scattered, sessile, disc black, convex, epruinose, proper exciple concolorous with the disc. Excipulum brown, 30–45 µm thick, IKI/KOH–. Epihymenium pale brown, 10–15 µm thick, KI–. Hymenium not inspersed, KI+ pale blue, 35–65 µm. Hypothecium brown, 70–145 µm thick, K–. Paraphyses simple. Asci 75–90 µm. Ascospore transversely septate, 12–27 septation, without constrictions, 45–77 × 2.5–3.5 µm. Pycnidia present, scattered on the surface of the thallus; conidia filiform and slightly curved, 6–12 × 0.5 –1.2 µm.

Chemistry: Thallus K–, C–, KC–, P–, UV –, TLC: No chemicals.

Remarks: *Bactrospora paludicola* resembles with *Bactrospora littoralis* Jagadeesh Ram in having black, sessile and epruinose ascomata. But *Bactrospora littoralis* differs in having excipulum KI+ pale blue, hymenium KI+ pale orange, hypothecium K+ greenish brown, paraphyses dichotomously branched (8). *Bactrospora paludicola* also resemblance to *Bactrospora myriadea* (Fée) Egea & Torrente which has been reported from Tamil Nadu state of India (11) in having black, sessile, epruinose ascomata but differ from *B. myriadea* in having pycnidia (12).

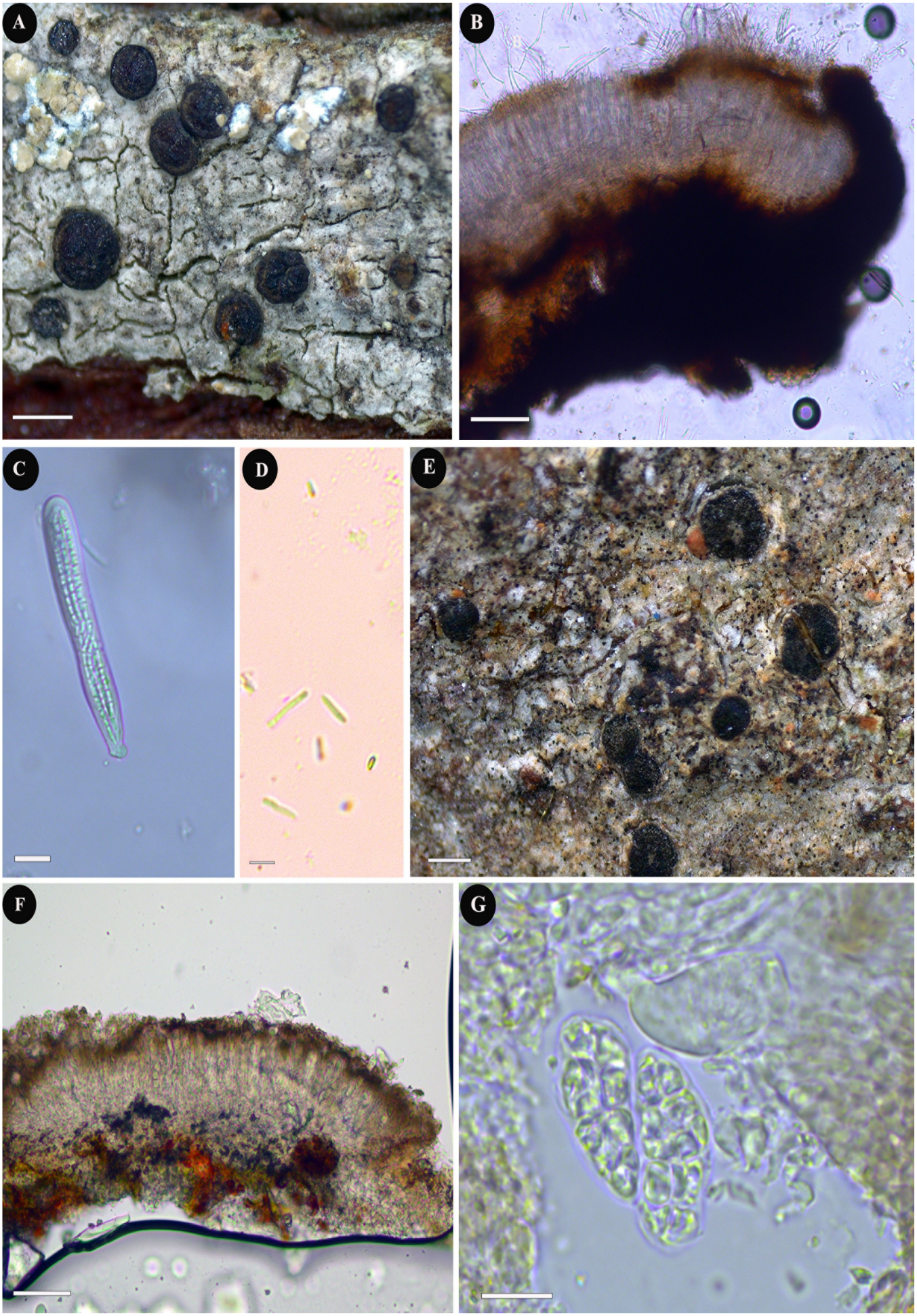

Fig. 2. **A–B:** *Bactrospora paludicola*, **A.** Thallus of *B. paludicola*; **B.** L.S. of ascoma; **C.** Ascospores; **D.** Pycnidia; **E – G:** *Gyalidea fritzei*, **E.** Thallus of *G. fritzei*; **F.** L.S. of ascoma; **G.** Ascospores. **Scale bar**: Fig. **A** and **E** = 0.2 mm; **D** = 10 µm; **B, C, F, G** = 20 µm.

Ecology and distribution: *Bactrospora paludicola* was growing on bark and it was previously reported from Tasmania (13). In India, it is being reported for the first time from the state of Assam.

Specimen examined: INDIA: Assam, Barpeta district, Bansbari Range, Manas National Park, N 26º 38' 59'', E 90º 59' 52'', elev. 119 m, 21 February 2021, P.K. Behera 65135 (LWG).

Buellia pleiotera **Malme,** Ark. Bot. 21A (14): 7.1927 (Fig. 3A)

Hafellia bahiana var. *pleiotera* (Malme) Sheard [as '*pleiotera*'], Bryologist 95(1): 82. 1992.

Description: Thallus crustose, ochraceous grey, smooth to slightly warted, fissured, prothallus absent, K+ yellow turning red, Photobiont chlorococcoid algae. Apothecia black, sessile, disc flat, convex, epruinose, margin epruinose, 0.3–0.5 mm diam. Excipulum brown, 30–40 µm thick, K–. Epihymenium olive green, K+ violet. Hymenium clear, 60–85 µm high in the middle. Hypothecium carbonaceous, 80–100 µm thick. Ascus 12–16 spored. Ascospores brown, ellipsoid, smooth walled, one septate, with sub-apical and septal wall thickening, 11–15 × 4 – 5 µm. Pycnidia absent.

Chemistry: Thallus K + yellow, C –, KC –, P + yellow, UV –, TLC: Norstictic acid.

Remarks: *Buellia pleiotera* resembles *B. mesospora* Elix & Kantvilas in having grey, smooth to fissured thallus, black, sessile apothecia, sub-apical thickening in the ascospores. But differs from *B. mesospora* in having smaller ascospores and septal wall thickening (14).

Ecology and distribution: The species was found growing on the bark and it is a new record for Assam. Earlier it was reported from the state of Kerela (15).

Specimen examined: INDIA: Assam, Golaghat district, Bagori Range, Kaziranga National Park, N 26º34'41'', E 93º17'27'', elev. 139 m, 18 March 2021, P.K. Behera, S. Joseph, K.K. Ingle, R. Ngangom, V. Kumar and R. Gogoi 64874 (LWG).

Byssolecania deplanata **(Müll. Arg.) R. Sant.**, Symb. bot. upsal. 12(1): 555.1952 (Fig. 3B)

Patellaria deplanata Müll. Arg., Lichen Epihylli Novi: 8, 1890.

Description: Thallus crustose, epiphyllous, greenish grey, effuse, scattered in patches, smooth, 30 mm diam., hypothallus absent. Photobiont chlorococcoid algae. Ascomata apothecoid, sessile, round, 0.2–1.2 mm diam., yellowish-reddish brown, margin absent, epruinose. Excipulum colourless, 20–30 µm. Epihymenium indistinct. Hymenium colourless, 45–60 µm high in the middle. Hypothecium pale yellowish – brown, 5–8 µm thick, K–. Paraphyses simple. Asci 4–8 spored, I+ pale blue. Ascospores colourless, ellipsoid-oblong, transversely septate, 5–7 septate, 15–25 × 3–5 µm. Pycnidia absent.

Chemistry: Thallus K–, C–, KC–, P–, UV –, TLC: No chemicals.

Remarks: *Byssolecania deplanata* resembles *B. fumosonigricans* (Müll. Arg.) R. Sant. in having reddish brown and epruinose ascomata and latter species differs in having transversely 3 **–** septate ascospores.

Ecology and distribution: The species was found growing on leaves and it is a new record for Assam. From India the taxa were earlier reported from Arunachal Pradesh (16) and Meghalaya (9).

Specimen studied: INDIA: Assam, Nagaon district, Samaguri village, Chappanala Forest area, N 26º 59' 24'', E 92º 50'29.77'', elev. 77 m, 24 February 2020, S. Joseph, R. Gogoi, P.K. Behera, K.K. Ingle, R. Ngangom and V. Kumar 50778 (LWG).

Graphis urandrae **Vain.,** Ann. Acad. Sci. fenn., Ser. A 15(6): 255. 1921 (Fig. 3C)

Description: Thallus crustose, greyish, rough, cracked. Apothecia sessile, short, unbranched lirellate with thalline margin; disc concealed with entire labia, epruinose. Exciple laterally carbonized. Epithecium thin, pale brown; hymenium clear, 122–140 µm high, I/KI–; hypothecium thin, hyaline. Paraphyses simple. Ascus 6–8 spored. Ascospores hyaline, ellipsoid, transversely 4 – 9 septate, 18 –36 × 3–5 µm.

Chemistry: Thallus K–, C–, KC–, P–, UV –, TLC: No chemicals.

Remarks: *Graphis urandrae* resembles *Allographa hossei* (Vain.) Lücking & Kalb in having concealed disc, which is not visible from above, laterally carbonized exciple, clear hymenium and absence of lichen secondary metabolites. The latter species differs from *G. urandrae* in having greenish grey thallus, irregularly branched lirellae and has much larger ascospores of dimension 50–67 × 10–11 µm and 13–14 transverse septa (17).

Ecology and distribution: The species was found reported growing on the bark and it is a new record for Assam. Earlier it was reported from Sikkim and North Andaman.

Specimen studied: INDIA: Assam, Nagaon district, Laokhowa Wildlife Sanctuary, N 26º 51' 33'', E 92º 42'26.11'', elev. 72 m, 22 February 2020, S. Joseph, K.K. Ingle, P.K. Behera, R. Ngangom, V. Kumar and R. Gogoi 47554 (LWG).

Gyalidea fritzei **(Stein) Vězda,** Folia geobot. phytotax. bohemoslov. 1: 324.1966 (Fig. 2 E–G)

Gyalecta fritzei Stein, in Cohn, Krypt. -Fl. Schlesien (Breslau) 2 (2): 154. 1879.

Description: Thallus crustose, thin superficial or immersed, smooth, white, effuse. Photobiont chlorococcoid algae. Apothecia round and sessile, disc persistently deeply concave, almost perithecoid when young, pale orange to dark brown, 0.2–0.3 mm diam. Exciple well-developed, brown, 20–35 µm. Epihymenium greenish brown, 8–12 µm. Hymenium pale brown, 80–160 µm. Hypothecium pale brown, 80–90 µm. Paraphyses simple. Asci clavate, thin walled but slightly thickened on apical portion, 76–120 × 25–45 µm, K/I–, 4–8 spored. Ascospores hyaline, ellipsoidal, muriform with 5–7 transverse septa and 2–3 longitudinal divisions, 18–42 × 12 –21 µm.

Chemistry: Thallus K–, C–, KC–, P–, UV –, TLC: No chemicals.

Remarks: *Gyalidea fritzei* resembles *G. lecideopsis* (Massal.) Lettau ex Vězda in having muriform ascospores but differs in having black apothecia with whitish margins, smaller spore size 30–35 × 12–14 µm, fewer number of spores 4–6 per ascus (5) and occurs on calcareous rock (18). *Gyalidea fritzei* also resembles *G. lecideopsis* var. *convarians* (Nyl.) Vězda which occurs on silicious rock but differ in having much larger ascospores 30–60 µm long and fewer ascospores 1–6 per ascus (18).

Ecology and distribution: *Gyalidea fritzei* was found growing on silicious rock. The species has been previously reported from Italy (19) and Kenya (20). In India it is being reported for the first time from the state of Assam.

Specimen examined: INDIA: Assam, Nagaon district, Bagori Range, Kaziranga National Park, N 26°34'47'', E 93°17'25'', elev. 101 m, 18 February 2020, S. Joseph, K.K. Ingle, P.K. Behera, R. Ngangom, V. Kumar and R. Gogoi 64938 (LWG).

***Mycobilimbia philippina* (Vain.) D.D. Awasthi**, Proc. Indian Acad. Sci., Pl. Sci. 97 (6): 501 (1987) (Fig. 3D)

Bilimbia philippina Vain., Ann. Acad. Sci. Fenn., Ser. A 15: 76. 1921.

Description: Thallus crustose, grey, effuse, ecorticated. Photobiont green alga. Apothecia sessile, round, lecideine, 0.5–0.8 mm in diameter, disc black. Exciple reddish brown, 30–45 µm, K–. Epihymenium not distinct. Hymenium pale brown, 30–45 µm high in the middle. Hypothecium brown, K–. Paraphyses simple and colourless. Ascus 6–8 spored. Ascospores hyaline, ellipsoid, 3 septate, 16–32 × 5–6 µm.

Chemistry: Thallus K–, C–, KC–, P–, UV –, TLC: No chemicals.

Remarks: *Mycobilimbia philippina* resembles *M. hunana* (Zahlbr.) Awasthi in having hyaline, 3 septate ascospores. However, the latter species differs in having reddish brown exciple which gives K+ violet reaction, crowded apothecia and found mostly in terricolous habitat (21).

Ecology and distribution: The species was found growing on the rock and it is a new record for Assam. Earlier, it was reported from the state of Arunachal Pradesh and West Bengal (16).

Specimen examined: INDIA: Assam, Nagaon district, Chapanala, Champawati Waterfalls, N 26° 19'05'', E 92° 53'59'', elev. 330 m, 18 February 2020, S. Joseph, K.K. Ingle, P.K. Behera, R. Ngangom, V. Kumar and R. Gogoi 50783 (LWG).

***Staurothele fissa* (Taylor) Zwackh,** Flora, Regensburg 45: 552 (1862) (Fig. 3E)

Verrucaria fissa Tayl. in Mack., Flora Hibern. 2:95. 1836.

Description: Thallus crustose, thin, greenish brown, areolate, shinny. Perithecial verrucae immersed in thalline warts. Photobiont a protococcoid green alga. Ascomata perithecoid, sessile, simple, 0.2–0.5 mm in diam. Excipulum brown, 35–40 µm. Hymenium clear with globular algal. Paraphyses not distinct. Ascus 1–2 spored. Ascospores hyaline, muriform, 32–45 × 14–24 µm.

Chemistry: Thallus K–, C–, KC–, P–, UV –, TLC: No chemicals.

Remarks: This species resembles most members of the genus *Verrucaria* but differs in having muriform ascospores (22). *Staurothele fissa* resembles *S. clopima* (Wahlenb.) Th. Fr. in having 2 spored asci and muriform ascospores but the latter species differs from former in having dark brown ascospores (5).

Ecology and distribution: The species was found growing on the rock and it is a new record for Assam. Earlier it was reported from the state of Himachal Pradesh (23), Maharashtra (24), Uttarakhand (25).

Specimen examined: INDIA: Assam, Nagaon district, Kathiatoli village, Tengapani Waterfall, N 26°10'19'', E 92 °45'59'', elev. 330 m, 20 February 2020, S. Joseph, K.K. Ingle, P.K. Behera, R. Ngangom, V. Kumar and R. Gogoi 50735 (LWG).

Acknowledgements

The authors are thankful to the Director, CSIR–National Botanical Research Institute, Lucknow for providing laboratory facilities, to Department of Biotechnology, New Delhi for the financial assistance under the sanction number BT/01/17/NE/TAX, to the Forest Department, Assam for the permission to conduct field tour and collection of lichen samples (Permission Letter No: WL/FG.31/Pt/Technical Committee/2018) and co-operation during the field visits, to the members of Lichenology Laboratory for their co-operation during the study and to Dr. Farishta Yamin, Nowgong College, Nagaon, Assam and Dr. Rupjyoti Gogoi, Bhattadev University, Bajali, Assam for their co-operation and valuable suggestions during the field visit. One of the authors, PKB is thankful to Ms. Mallika Basumatry, BTR Development Fellow, Office of the District Commissioner, Udalguri, Assam and Mr. Mithun Deka (driver cum field guide) for their assistance during the field visits. This manuscript bears institute's Publication Ethical Committees allotted number CSIR-NBRI _MS/2023/10/24.

Authors' contributions

PKB and SJ collected samples and identified them. PKB drafted the manuscript while SN corrected it and supervised the whole work. RSC provided intellectual input for smooth drafting of this manuscript.

Compliance with ethical standards

Declaration : Authors do not have any conflict of interests to declare.

Ethical issues: None

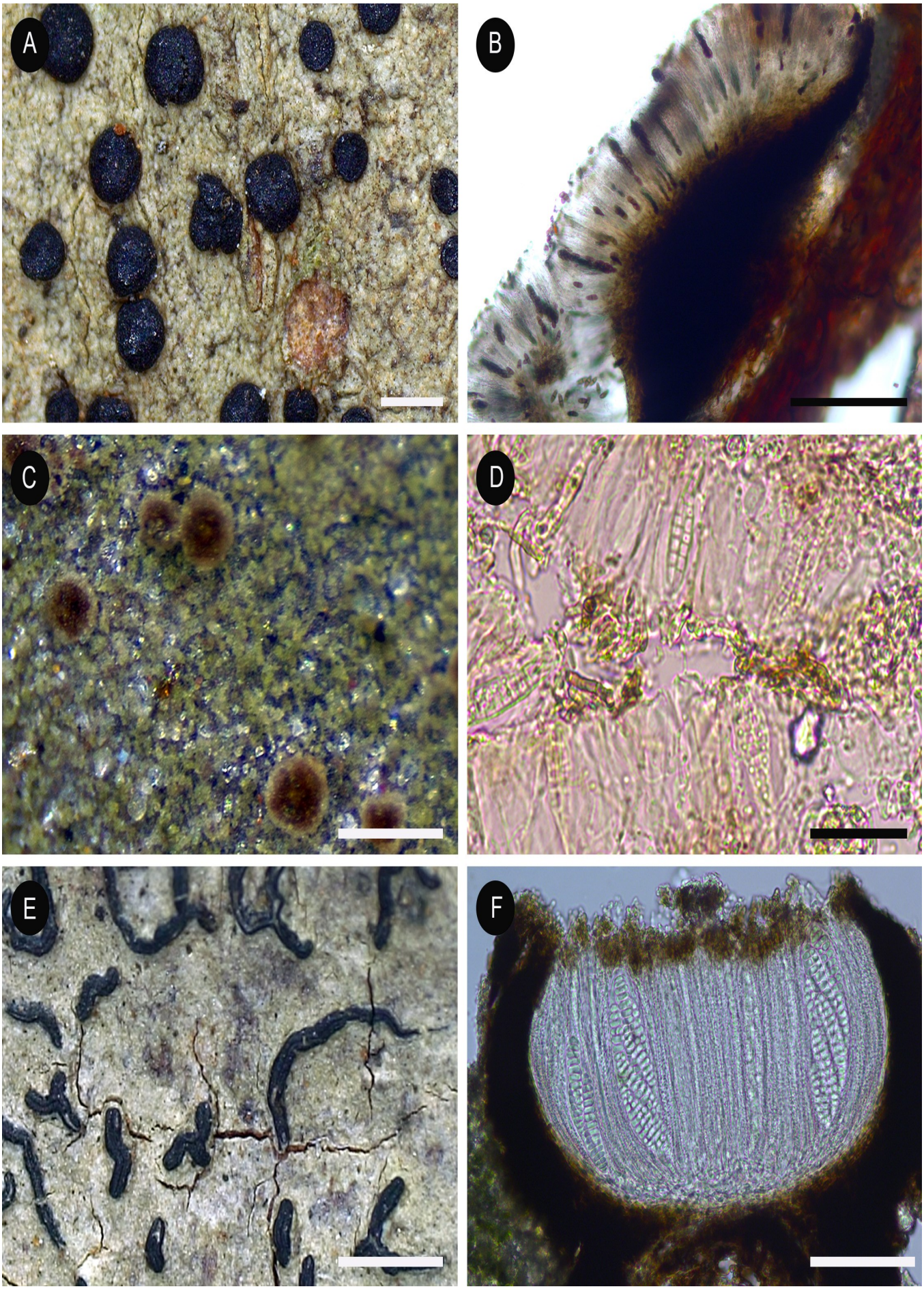

Fig. 3. **A–B:** *Buellia pleiotera*, **A.** Thallus of *B. pleiotera*; **B.** L.S. of ascoma; **C–D**: *Byssolecania deplanata*, **C.** Thallus of *B. deplanata*; **D.** Ascospores of *B. deplanata* after squashing the ascoma; **E–F:** *Graphis urandrae*, **E.** Thallus of *Graphis urandrae*; **F.** L.S. of ascoma. **Scale bar**: Fig. **A**=0.2 mm **C** and **E** = 0.6 mm; **B** = 20 µm; **D** and **F** = 40 µm.

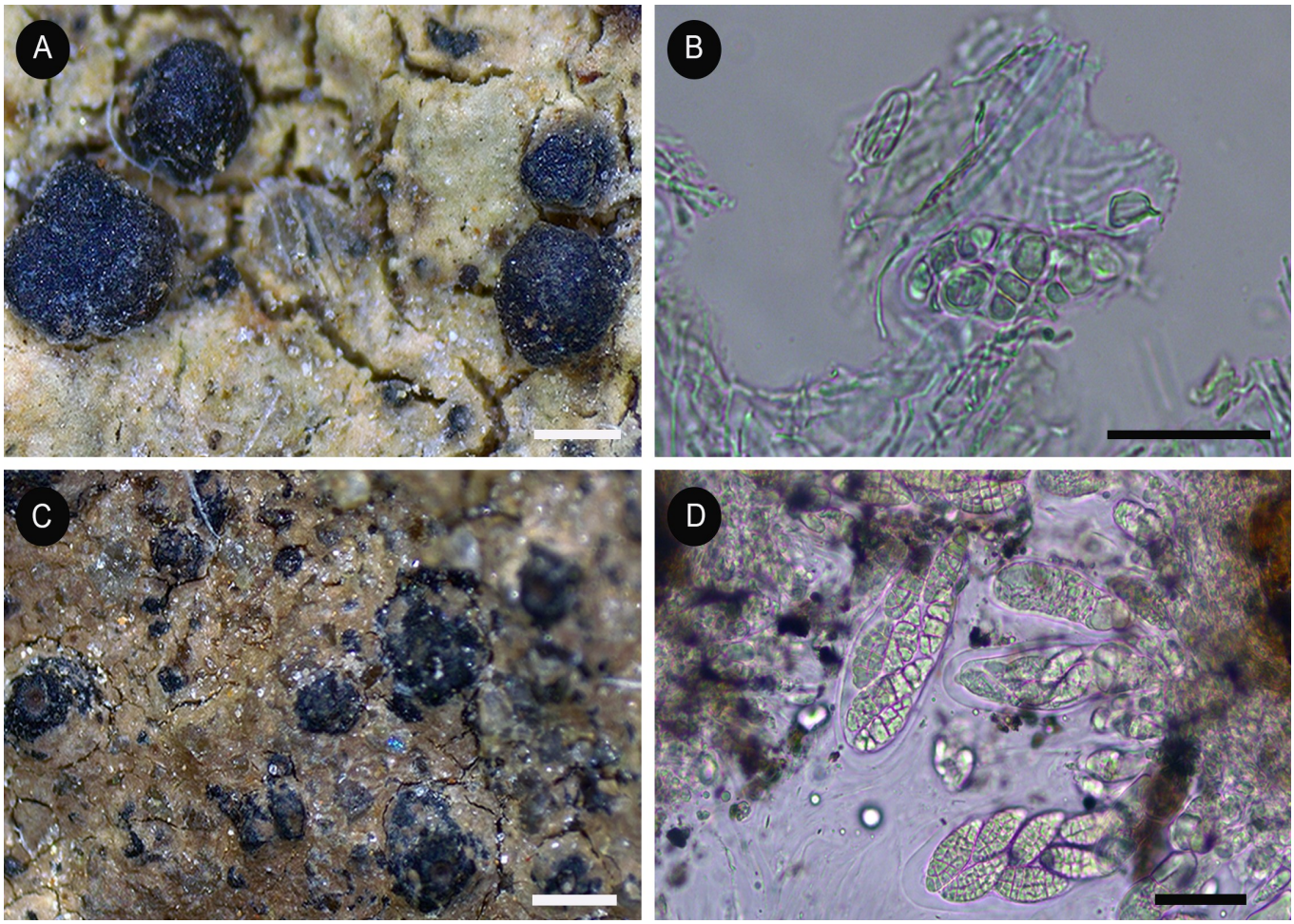

Fig. 4. **A–B:** *Mycobilimbia philippina*; **A.** Thallus of *M. philippina*; **B.** Ascospores of *M. philippina*; **C–D:** *Staurothele fissa*; **C**. Thallus of *Staurothele fissa*; **D.** Ascospores of *S. fissa*. **Scale bar**: Fig. **A** & **C** = 0.2 mm; **B** & **D** = 0.3 mm; **E** = 20 µm.

References

1. Gogoi R, Devi D, Nayaka S, Yasmin F. A checklist of lichens of Assam, India. Asian J Conserv Biol. 2022;11:49-65. https://doi.org/10.53562/ajcb.73760
2. Gogoi R, Yasmin F, Nayaka S. Addition to the lichen biota of undivided Nagaon district with special reference to *Tylophoron protrudens* Nyl., a new record to Assam state of India. Crypt Biodivers Assess. 2022;6:34-38.
3. Islary P, Biswas S, Nayaka S, Joseph S, Upreti DK. New distributional records of lichenized fungi for India from Assam. Vegetos. 2022;1-9. https://doi.org/10.1007/s42535-022-00523-y
4. Orange A, James PW, White FJ. Micro-chemical methods for the identification of Lichens. London: British Lichen Society; 2001.
5. Awasthi DD. A key to the Microlichens of India, Nepal and Sri Lanka. Bibliotheca Lichenologica. 1991;40:1-340. https://doi.org/10.2307/1222799
6. Egea JM, Torrente P. The lichen Genus *Bactrospora*. The Lichenologist. 1993;25:211-25. https://doi.org/10.1006/lich.1993.1028
7. Marbach B. Corticole und lignicole Arten der Flechtengattung *Buellia* – sensu lato in den Subtropen und Tropen. Bibl Lichenol, J Cramer, Berlin. 2000;74:1-384.
8. Jagadeesh Ram TAM. New species and new records in Roccellaceae (Arthoniales) from the Andaman Islands, India. Phytotaxa. 2014;177:155-62. https://dx.doi.org/10.11646/phytotaxa.177.3.3
9. Singh KP, Pinokiyo A. Folicolous lichens of India. Dehradun, India, Bishen Singh Mahendra Pal Singh; 2014.
10. Wijayawardene NN, Hyde KD, Dai DQ *et al*. Outline of fungi and fungus like taxa – 2021. Mycosphere. 2022;13:53-453. https://doi.org/10.5943/mycosphere/11/1/8
11. Balaji P, Hariharan GN. Annotated checklist of lichens of Chennai, Tamil Nadu, India. Phytotaxonomy. 2005;5:2-8.
12. Sobreira PNB, Aptroot A, da Silva Cáceres ME. A world key to species of the genus *Bactrospora* (Roccellaceae) with a new species from Brazil. The Lichenologist. 2015;47:131-36. https://doi.org/10.1017/S0024282914000607
13. Kantvilas G. *Bactrospora*, version 2023:1 In MF de Salas (Ed.) Flora of Tasmania Online. 5pp. (Tasmania Herbarium, Tasmania Museum and Art Gallery: Hobart). https://flora.tmag.tas.gov.au/lichen-genera/bactrospora/ (accessed 28 November 2023).
14. Elix JA, Kantvilas G. New species and new records of *Buellia* sensu. str. (Physciaceae, Ascomycota) in Australia. Australas Lichenol. 2014;74:17-25.
15. Singh SR, Awasthi DD. The lichen genus *Buellia* in India. Biol Mem. 1981;6:169-96.
16. Singh KP, Singh P, Sinha GP. Lichen diversity in the Eastern Himalaya biodiversity hotspot region, India. Crypt Biodivers Assess. 2018;Spl. 71:114. https://doi.org/10.21756/cab.esp9
17. Kalb J, Lücking R, Kalb K. The lichen genera *Allographa* and *Graphis* (Ascomycota: Ostropales, Graphidaceae) in Thailand – eleven new species, forty–seven new records and a key to all one hundred and fifteen species so far recorded for the country. Phytotaxa. 2018;377:1-83. https://doi.org/10.11646/phytotaxa.377.1.1
18. Thomson JW, Murray BM. *Staurothele discedens* and *Gyalidea lecideopsis* var. *convarians* rediscovered in Alaska, together with *Polyblastia cucurbitula* sp. nov. Bryologist. 1988;86-90. https://doi.org/10.2307/3242620

19. Nascimbene J. Lichenological studies in N-Italy: New record for Lombardy. Cryptogam Mycol. 2006;27:79.

20. Suija A, Kaasalainen U, Kirika PM, Rikkinen J. *Taitaia*, a novel lichenicolous fungus in tropical montane forests in Kenya (East-Africa). The Lichenologist. 2018;47:131-36. https://doi.org/10.1017/S0024282918000026

21. Joshi S, Hur JS. A new record of the genus *Mycobilimbia* (Ramalinaceae) from South Korea. Mycobiology. 2012;40:91-93. https://doi.org/10.5941/MYCO.2012.40.2.91

22. Lendemer JC. New and interesting records of lichens and lichenicolous fungi from New Jersey and Pennsylvania. Evansia. 2008;24:102-09. https://doi.org/10.1639/0747-9859-25.4.102

23. Nayaka S, Yadav V, Srivastava R, Upreti DK. An enumeration and new records of lichens from Solan district, Himachal Pradesh, India. Biol Mem. 2002;28:25-33.

24. Deshmukh VP, Bajpai R, Upreti DK, Wagh VV, Rajurkar AV, Bondarkar SG. Lichen Diversity of Gawilgarh fort, Amravati district, Maharashtra, India. Crypt Biodivers Assess. 2017;2:53-57. https://doi.org/10.21756/cab.v2i02.11120

25. Mishra GK, Upreti DK. An enumeration of lichens from the Bageshwar district of Kumaun Himalaya, Uttarakhand, India. Int J Curr Microbiol Appl Sci. 2014;3:420-35.