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Communication

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Additions to the lichen biota of Assam State, India

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Abstract: The present paper deals with 25 new records of lichens under 19 genera and 11 families for the state of Assam in India. The newly reported species from Assam are *Alyxoria apomelaena*, *A. culmigena*, *A. varia*, *Caloplaca pseudisteroides*, *Cryptothecia striata*, *Diorygma rupicola*, *Dirinaria papillulifera*, *Flavoplaca citrina*, *Graphis sundarbanensis*, *Herpothallon echinatum*, *Lecanographa rufa*, *Letrouitia muralis*, *Myriotrema clandestinum*, *Opegrapha discolor*, *Parmotrema crinitoides*, *Phaeophyscia hispidula*, *Porina eminentior*, *P. interstes*, *P. mastoidella*, *Pyrenula submastophora*, *P. thelomorpha*, *Rinodina oxydata*, *Synarthonia bicolor*, *Zwackhia bonplandii*, and *Z. viridis*. Brief descriptions of these additional lichen taxa from Assam are provided to facilitate their identification.

Keywords: Lichenized fungi, Nagaon District, new records, taxonomy.

সংক্ষিপ্তসাৰ – এই গৱেষণা পত্রখনত ভাৰতবর্ষৰ অসম ৰাজ্যৰ পৰা বর্তমানলৈকে অপ্রকাশিত ২৫ টা নতুন লাইকেনৰ বিষয়ে আলোচনা কৰা হৈছে। আলোচ্য লাইকেনসমূহ ১৯ টা গণ আৰু ১১ টা গোত্রৰ অন্তর্গত। অসমৰ পৰা সদ্য আলোচিত লাইকেনসমূহ হ'ল এলেয়োৰিয়া এপ'মেলিনা, এলেয়োৰিয়া কলমিজেনা, এলেয়োৰিয়া ভেৰিয়া, কেল'প্লাকা চিডিডিৰিবহড়ছ, ক্রিপ্ট'থেচিয়া ষ্ট্রেটা, ডিয়'বিগ্না কপিক'লা, ডিবিনেৰিয়া পেপিলুলিফেৰা, ফ্লেভ'প্লাকা চিট্রিনা, গ্রেফিছ ছুন্দৰবনেৰ্ছ ছ, হাৰপ'থেলন এ্ৰি চনেটাম, লেকেন'গ্রাফা কফা, লেট্রিচিয়া মিউৰেলিছ, মাইৰ'টেমা ক্লেণ্ডে ৱিনাম, অপেগ্রাফা ডিষ্ক'লৰ, পার্ম'টেমা ক্রিনিটইড়ছ, ফিঅ'ফিছিয়া হিস্পিডোলা, পৰাইনা ইমনেণ্টিয়ৰ, পৰাইনা ইটাষ্টিছ, পৰাইনা মাম্মইডেলা, পাইৰেনুলা চাৰমেষ্ট'ফৰা, পাইৰেনুলা থেল'মর্ফা, ৰিন'ডিনা অয়িডেটা, চিন্থ র্থ'নিয়া বাইক'লৰ, ষ্ট্রকিয়া ব'নপ্রাণ্ডী আৰু ষ্ট্রকিয়া ভিবিডিছ। চিনাক্তকৰণৰ সুবিধার্থে ওপৰোক্ত লাইকেনসমূহৰ সংক্ষিপ্ত বিৱৰণ দাঙি ধৰা হৈছে।

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Author contribution: RG contributed in collection, herbarium preparation, characterization, identification of the specimens and writing the manuscript. FY contributed in collection and identification of specimens and preparation of manuscript. SJ contributed in identification of the specimens and writing the manuscript. SN conceived the study, its design and contributed in identification of specimens and improvement of the manuscript.

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INTRODUCTION

Assam is rich in floral as well as faunal diversity and comes under the northeastern Indian biogeographic zone. The extraordinary physiography makes the region suitable to colonize diverse organisms including lichenized fungi. Despite being rich in biodiversity, the exploratory work on lichens of Assam is scanty. Floristic study on lichens in Assam was pioneered by Stirton (1881), a Scottish lichenologist who described 39 lichen species only from tea plants. To augment the floristic study in Assam, a few researchers made their contributions to the lichen biota of the state (Awasthi & Singh 1973; Pant & Upreti 1993; Rout et al. 2005, 2010; Gupta & Sinha 2011, 2016; Sinha et al. 2013; Daimari et al. 2014). Recently, Gupta & Sinha (2018) reported 300 species of lichen belonging to 83 genera and 26 families from Assam. The present study is an attempt to explore lichens from different localities of Nagaon District of Assam. The study resulted in 25 new records under 19 genera and 11 families to the state.

MATERIALS AND METHODS

The lichen specimens were collected from 05 February 2017 to 21 March 2018. Collected lichen specimens were dried and preserved in herbarium packets and deposited in the herbarium of CSIR-National Botanical Research Institute, Lucknow (LWG). The morphological characterization of lichen thallus was done under a Leica EZ4 stereo zoom microscope. Thin hand-cut sections of ascoma and thallus were mounted in distilled water, lactophenol cotton blue (LCB), 5% KOH, and Lugol's iodine solution and observed under a Leica DM2500 compound microscope. Chemical spot tests on the thallus and ascomatal tissue were done following Orange et al. (2001) by using the usual reagents K (5% aqueous solution of potassium hydroxide), C (aqueous solution of calcium hypochlorite), and P (0.5g of para-phenylenediamine dissolved in 5ml of ethanol). Thin layer chromatography was performed in solvent system C (toluene:acetic acid; 85:15 ml) following Orange et al. (2001). Identification of taxa was done by relevant published literature (Awasthi 1991, 2007; Upreti 1994; McCarthy 2003; Joshi et al. 2008, 2012; Ertz 2009; Lücking et al. 2009, 2016a; Aptroot 2012; Sharma & Khadikar 2012; Bungartz et al. 2013; Ram 2014; Joseph & Sinha 2015; Joseph et al. 2016, 2018). The nomenclature and classification of lichens were updated following Lücking et al. (2016b).

RESULTS

The study resulted in the addition of 25 species to the lichen flora of Assam. These species belong to 11 families and 19 genera. A brief taxonomic account of the new records is given below.

1. *Alyxoria apomelaena* (A. Massal.) Ertz, *Phytotaxa* 217 (1): 4. 2015. *Opegrapha apomelaena* A. Massal. in Krempelhuber, *Verh. K.K. Zool.-Bot. Ges. Wien* 21: 864. 1871. (Lecanographaceae) (Image 1a,b,c).

Specimen examined: LWG 35850, 21.iv.2018, Assam, Nagaon District, Kaliabor, Hatimura, 26.613°N, 92.993°E, 133m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, thin to inconspicuous, pale yellow, border line dark brown. Ascomata lirellate, rarely branched, straight to slightly curved, disc slit to exposed, epruinose; excipulum broadly continuous below the hypothecium, 25–40 µm thickened laterally; epihymenium slightly brownish 10–20 µm thick, I+ red; hymenium hyaline, inspersed with minute oil globules, 40–60 µm thick; paraphysoids branched and anastomosing; hypothecium I+ red. Asci clavate, 8-spored, 40–50 µm × 10–15 µm; ascospores hyaline, transversely 7–12-septate, 24.8–35.4 µm × 3.5–3.9 µm, perispore 1–2 µm thick.

Chemistry: Thallus K-, C-, P-, UV-; no lichen substance detected in TLC.

Distribution: India (Assam and Andaman & Nicobar Islands), Africa, Australia, Bolivia, Brazil, Chagos Archipelago, Colombia, French Guiana, Indonesia, Panama, Papua New Guinea, Peru, Solomon Islands, Thailand, The Seychelles, and Venezuela.

2. *Alyxoria culmigena* (Lib.) Ertz, *Bull. Soc. Naturalistes Luxemb*. 113:105. 2012. *Opegrapha culmigena* Lib., *Pl. Crypt. Arduenna*, Fasc. (Liège) 1: no. 15. 1830. (Lecanographaceae) (Image 2a,b,c).

Specimen examined: LWG 35851, 19.i.2017, Assam, Nagaon District, Doboka Reserve Forest, Kondoli Hill, 26.192°N, 92.781°E, 136m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, thin to inconspicuous, surface smooth, yellowish. Ascomata lirellate, emerged, straight, curved to flexuous, disc slit to exposed, black, epruinose; excipulum broadly continuous below the hypothecium, K+ slightly olivaceous; hypothecium I+ red, KI+ blue; hymenium hyaline, not inspersed; paraphysoids branched and anastomosing. Asci 8-spored; ascospores hyaline, transversely 3-septate, 18–18.5 µm × 2.5–2.9 µm, perispore ca. 1µm thick.

Image 1a. *Alyxoria apomelaena* (A. Massal.) Ertz. © Rupjyoti Gogoi.

Image 2a. *Alyxoria culmigena* (Lib.) Ertz. © Rupjyoti Gogoi.

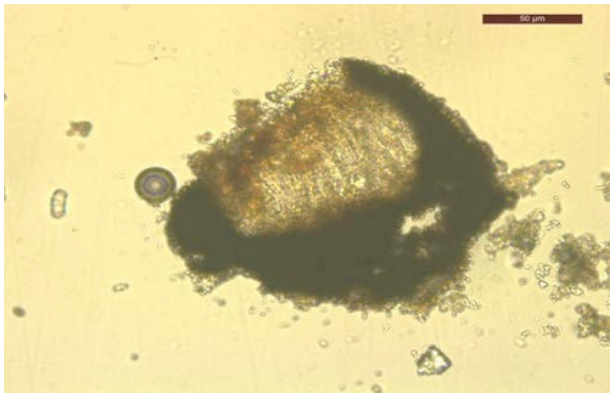

Image 1b. Longitudinal section of ascoma of *Alyxoria apomelaena* (A. Massal.) Ertz. © Rupjyoti Gogoi.

Image 2b. Longitudinal section of ascoma *Alyxoria culmigena* (Lib.) Ertz. © Rupjyoti Gogoi.

Image 1c. Ascospore of *Alyxoria apomelaena* (A. Massal.) Ertz. © Rupjyoti Gogoi.

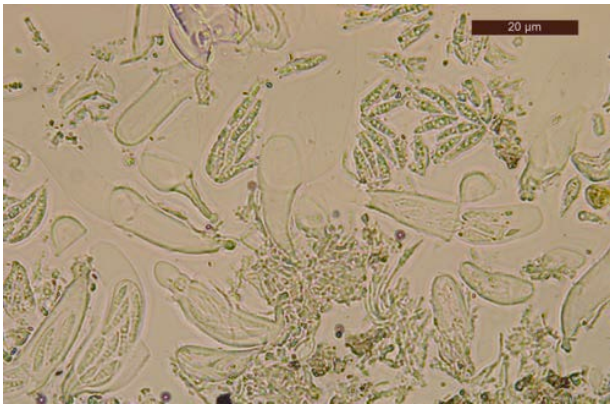

Image 2c. Ascospores of *Alyxoria culmigena* (Lib.) Ertz. © Rupjyoti Gogoi.

Chemistry: Thallus K-, C-, P-, UV-; no lichen substance detected in TLC.

Distribution: India (Andaman & Nicobar Islands and Assam), Africa, France, Galapagos Islands, Great Britain, Ireland, Malaysia, Papua New Guinea, Republic of Korea, Tasmania, and Thailand.

3. *Alyxoria varia* (Pers.) Ertz & Tehler, *Fungal Diversity* 49(1): 53. 2011. *Opegrapha varia* Pers., *Ann. Bot.* (Usteri) 1(7): 30. 1794. (Lecanographaceae) (Image 3a,b, c).

Specimens examined: LWG 35852, 31.x.2017, Assam, Nagaon District, Kampur, Kampur-Kathiatoli Road,

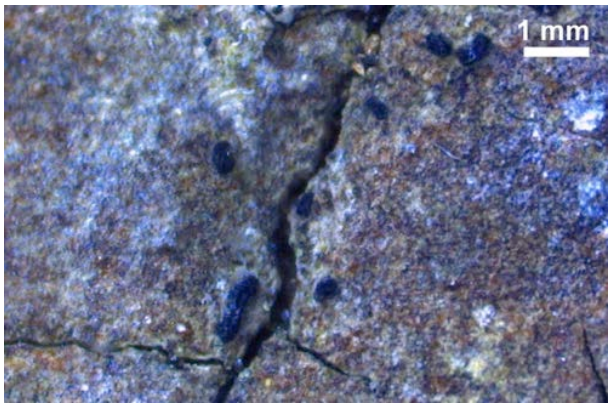

Image 3a. *Alyxoria varia* (Pers.) Ertz & Tehler. © Rupjyoti Gogoi.

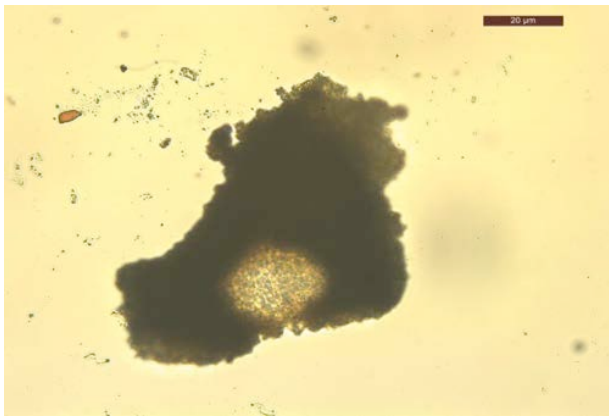

Image 3b. Longitudinal section of ascoma of *Alyxoria varia* (Pers.) Ertz & Tehler. © Rupjyoti Gogoi.

Image 3c. Ascospores of *Alyxoria varia* (Pers.) Ertz & Tehler. © Rupjyoti Gogoi.

26.173°N, 72.700°E, 81m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, inconspicuous, surface smooth, pale yellowish. Ascomata lirellate, short, unbranched, straight to flexuous, disc slit like to widely open, closed at base, epruinose; excipulum broadly continuous below the hypothecium, I+ red; hymenium hyaline, not inspersed, I+ red. Ascus 8-spored, clavate; ascospores hyaline, transversely 3–4-septate, 13.9–21.36 µm × 4.9–6.4 µm, perispore ca. 1µm thick.

Chemistry: Thallus K-, C-, P-, UV-; no lichen substance detected in TLC.

Distribution: India (Arunachal Pradesh, Assam, Goa, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh, and West Bengal plains), Africa, Australia, Belarus, Fiji, France, Galapagos Islands, Greece, Hong Kong, Indonesia, Italy, Japan, La Réunion, Montenegro, North America, Papua New Guinea, Singapore, Sri Lanka, Taiwan, and The Philippines.

4. *Caloplaca pseudisteroides* Y. Joshi & Upreti, *Lichenologist* 40(6): 537. 2008. (Teloschistaceae) (Image 4a,b,c).

Specimen examined: LWG 35853, 19.i.2017, Assam, Nagaon District, Doboka Reserve Forest, 26.201°N, 92.795°E, 90m, coll. Rupjyoti Gogoi.

Description: Thallus saxicolous, crustose, cracked, areolate to subsquamulose, olivaceous grey, hypothallus black. Ascomata apothecia, numerous, scattered, immersed to sessile, restricted to the centre of the thallus, disc brownish-black, thalline margin smooth, concolorous with the thallus; epihymenium golden brown to brown; hymenium hyaline. Asci 8-spored; ascospores polaribilocular, broadly ellipsoidal, 7.6–11.29 µm × 4–5.2 µm.

Chemistry: Thallus K+ pale yellow, C-, P-, UV-; atranorin detected in TLC.

Distribution: India (Assam and Madhya Pradesh).

5. *Cryptothecia striata* G. Thor, *Bryologist* 31: 278. 1991. (Arthoniaceae) (Image 5a,b).

Specimen examined: LWG 35854, 17.iii.2018, Assam, Nagaon District, Jugijan, Na-Nath Archaeological Site, 26.033°N, 92.774°E, 71m, coll. Rupjyoti Gogoi.

Description: Thallus saxicolous, crustose, greyish-white, cottony, ecorticate, delimited by a distinct byssoid prothallus of white, radiating hyphae, medulla white. Ascigerous areas in the centre of the thallus, merged into distinct radiating striae. Asci bitunicate, pyriform to globose with a short stalk, ascus 1-spored; ascospores hyaline, ovoid to oblong, muriform, slightly curved, 31.7–40 µm × 12.5–15 µm.

Chemistry: Thallus K-, C+ bright red, P-, UV-; gyrophoric acid detected in TLC.

Distribution: India (Andaman & Nicobar Islands and Assam) and Florida.

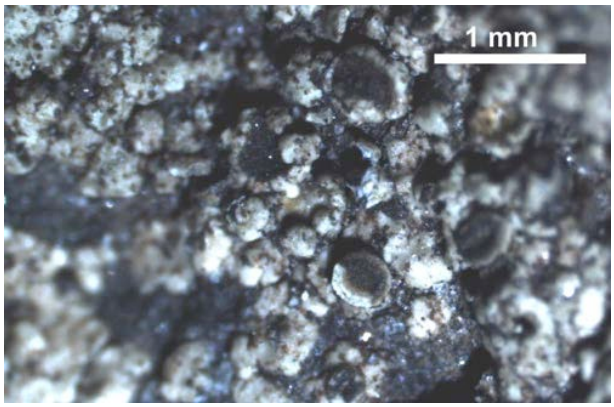

Image 4a. *Caloplaca pseudisteroides* Y. Joshi & Upreti. © Rupjyoti Gogoi.

Image 5a. *Cryptothecia striata* G. Thor. © Rupjyoti Gogoi.

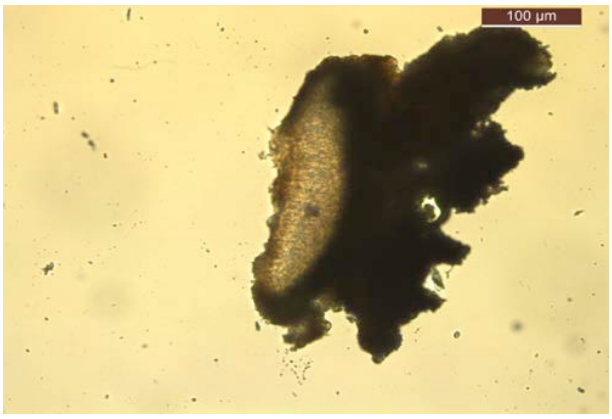

Image 4b. Longitudinal section of ascoma of *Caloplaca pseudisteroides* Y. Joshi & Upreti. © Rupjyoti Gogoi.

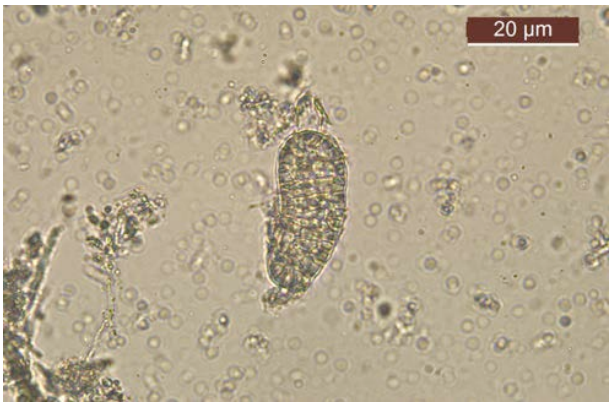

Image 5b. Ascospore of *Cryptothecia striata* G. Thor. © Rupjyoti Gogoi.

Image 4c. Ascospores of *Caloplaca pseudisteroides* Y. Joshi & Upreti. © Rupjyoti Gogoi.

6. *Diorygma rupicola* B.O. Sharma & Khadikar, *Mycotaxon*. 119: 5. 2012. (Graphidaceae) (Image 6a,b,c).

Specimen examined: LWG 35855, 18.ii.2018, Assam, Ngaon District, Samaguri, Suang Reserve Forest, 26.313°N, 92.880°E, 85m, coll. Rupjyoti Gogoi.

Description: Thallus saxicolous, crustose, greyish-white. Ascomata concolorous with the thallus, lirellate, simple, immersed, short, stellate, disc narrow, pruinose, rarely open; excipulum convergent, apically carbonized; hymenium hyaline, not inspersed. Asci 1-spored; ascospores hyaline, muriform, I+ blue, 75.5–94.6 µm × 14.3–24.6 µm.

Chemistry: Thallus K+ yellow, C-, P-; norstictic acid, stictic acid and constictic acid detected in TLC.

Distribution: India (Assam, Meghalaya, Nagaland, and Sikkim).

7. *Dirinaria papillulifera* (Nyl.) D.D. Awasthi, *Bryologist* 67: 369. 1964. *Physcia papillifera* Nyl., *Expos. Synopt. Pyrenocarp.*: 42. 1858. *Physcia papillulifera* Nyl. *Acta Soc. Sci. Fenn.* 26(10): 9. 1900. (Caliciaceae) (Image 7).

Specimen examined: LWG 35856, 10.xii.2017, Assam, Ngaon District, Jugijan, Na-Nath Archaeological Site, 26.033°N, 92.774°E, 71m, coll. Rupjyoti Gogoi.

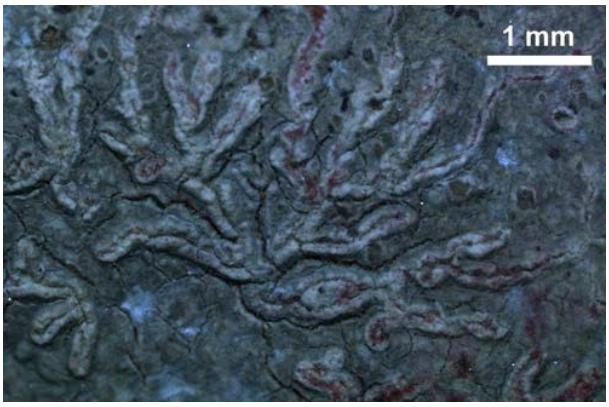

Image 6a. *Diorygma rupicola* B.O. Sharma & Khadikar. © Rupjyoti Gogoi.

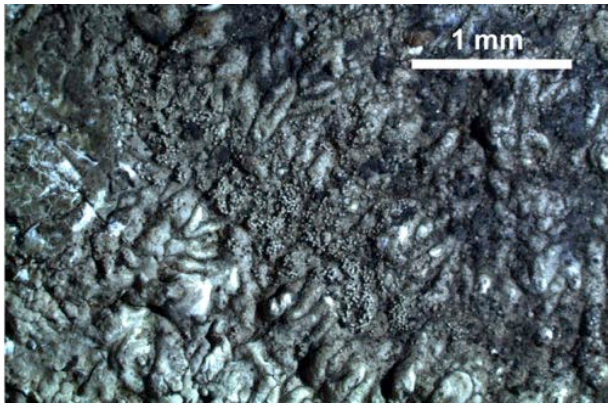

Image 7. *Dirinaria papillulifera* (Nyl.) D.D. Awasthi. © Rupjyoti Gogoi.

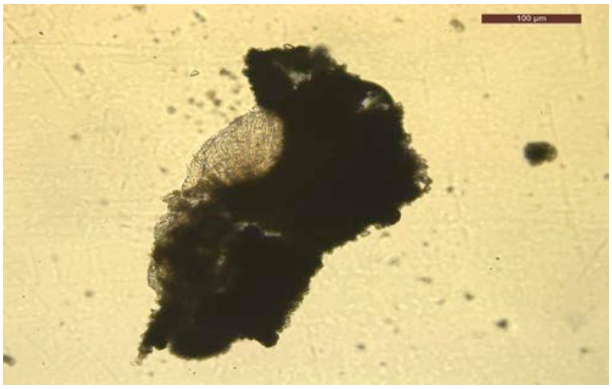

Image 6b. Longitudinal section of ascoma of *Diorygma rupicola* B.O. Sharma & Khadikar. © Rupjyoti Gogoi.

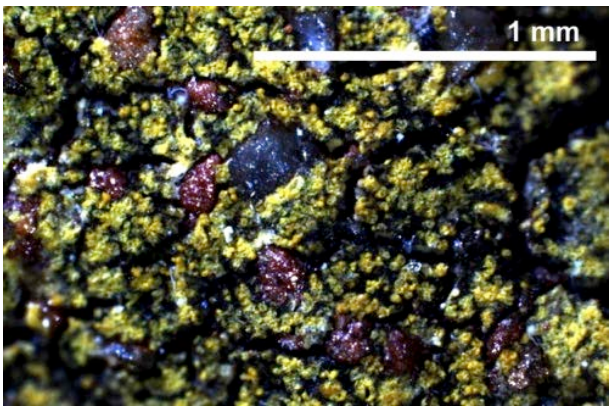

Image 8. Flavoplaca citrina (Hoffm.) Arup. © Rupjyoti Gogoi.

Image 6c. Ascospore of *Diorygma rupicola* B.O. Sharma & Khadikar. © Rupjyoti Gogoi.

Description: Thallus saxicolous, foliose, closely attached, 4.5mm across, lobe 1.8mm across, upper side grey-white, medulla white, isidia filiform. Apothecia not seen.

Chemistry: Thallus K+ yellow (cortex), C-, P-; divaricatic acid detected in TLC.

Distribution: India (Andaman & Nicobar Islands, Assam, Orissa, Tamil Nadu, Uttar Pradesh, and West Bengal plains), Brazil, Indonesia, Jamaica, Nicaragua, Panama, Sri Lanka, and Thailand.

8. *Flavoplaca citrina* (Hoffm.) Arup, Frödén & Søchting, *Nordic J. Bot.*31(1): 44. 2013. *Verrucaria citrina* Hoffm., *Deutschl. Fl.*: 198. 1796. *Caloplaca citrina* (Hoffm.) Th. Fr., *Nova Acta Regiae Soc. Sci. Upsal.*, ser. 3, 3: 218. 1861. (Telochistaceae) (Image 8).

Specimen examined: LWG 35857, 17.iii.2018, Assam, Nagaon District, Jugijan, Na-Nath Archaeological Site, 26.033°N, 92.774°E, 70m, coll. Rupjyoti Gogoi.

Description: Thallus saxicolous, crustose, areoles flat to convex, yellow, sorediate, soralia concolorous with the thallus, sometimes completely covering the thallus. Apothecia not seen.

Chemistry: Thallus K+ purple, C-, P-, UV-.

Distribution: India (Assam, Jammu & Kashmir, Madhya Pradesh, Maharashtra, and Tamil Nadu), Brazil, Hawaii, Israel, New Zealand, Ukraine, Africa, and North

America. Cosmopolitan.

9. *Graphis sundarbanensis* Jagadeesh & G.P. Sinha, *Lichenologist* 39(3): 231. 2007. (Graphidaceae) (Image 9a,b,c).

Specimen examined: LWG 35858, 10.xii.2017, Assam, Nagaon District, Jamunamukh, Erakapili, 26.098°N, 92.745°E, 68m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, greenish-grey. Ascomata lirellate, lirellae long, radiately branched, labia entire, pruinose, disc exposed; excipulum laterally carbonized; hymenium clear. Asci 8-spored, ascospores hyaline, transversely 6–8-septate, 11.8–16.1 µm × 3.1–3.8 µm.

Chemistry: Thallus K+ yellow, C-, P-, UV-; stictic acid detected in TLC.

Distribution: India (Arunachal Pradesh, Assam, Kerala, Sikkim, and West Bengal), Costa Rica, Malaysia, and Sri Lanka.

10. *Herpothallon echinatum* Aptroot, Lücking & Will-Wolf, *Biblioth. Lichenol*. 99: 38. 2009. (Arthoniaceae) (Image 10).

Specimen examined: LWG 35859, 18.ii.2018, Assam, Ngaon District, Jugijan, Na-Nath Archaeological Site, 26.033°N, 92.774°E, 71m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, greyish-white, firmly attached to the substratum, byssoid; hyothallus and prothallus white, byssoid; pseudoisidia numerous, crowded, cylindrical. Ascomata and pycnidia not seen.

Chemistry: Thallus K-, C-, P+ yellow, UV-; psoromic acid detected in TLC.

Distribution: India (Andaman Islands, Assam, and Sikkim) Australia, Costa Rica, Indonesia, Norfolk Islands, Papua New Guinea, Taiwan, and Thailand.

11. *Lecanographa rufa* (Müll. Arg.) Ertz., *Biblioth. Lichenol.* 102: 149. 2009.

Opegrapha rufa Müll. Arg., *Bot. Jb.* 20: 280. 1894. (Lecanographaceae) (Image 11a,b,c).

Specimen examined: LWG 35860, 08.ii.2017, Assam, Nagaon District, Samaguri, Suang Reserve Forest, Loong Soong Tea Estate, 26.369°N, 92.899°E, 109m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, areolate, whitish-grey. Ascomata lirellate, numerous, evenly distributed in the thallus, straight to often flexuose, unbranched, rarely with a single branch, disc highly exposed, covered with thick pruina; excipulum black, broadly continuous below the hypothecium; hymenium hyaline, I+ directly red; paraphysoids branched and anastomosing; epihymenium dark brown with pruina. Asci narrowly clavate, 8-spored; ascospores hyaline, transversely 3–5-septate, not constricted at septa, 19.3–22.6 µm × 3.6–5.3 µm.

Chemistry: Thallus K-, C-, P-; no lichen substance

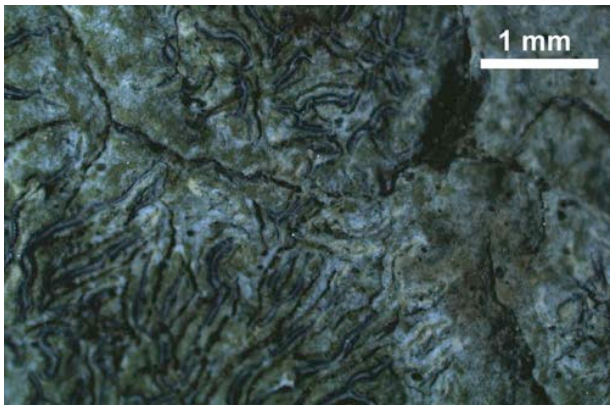

Image 9a. *Graphis sundarbanensis* Jagadeesh & G.P. Sinha. © Rupjyoti Gogoi.

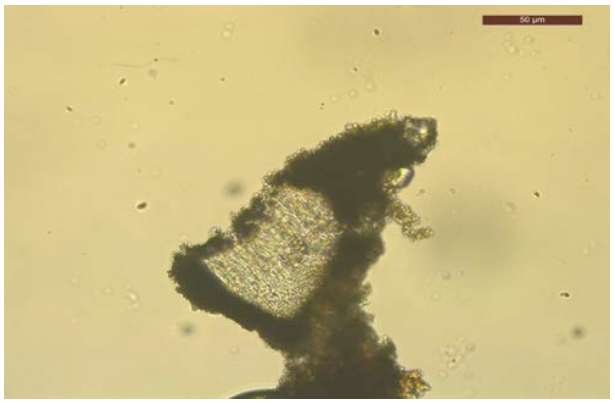

Image 9b. Longitudinal section of ascoma of *Graphis sundarbanensis* Jagadeesh & G.P. Sinha. © Rupjyoti Gogoi.

Image 9c. Ascospore of *Graphis sundarbanensis* Jagadeesh & G.P. Sinha. © Rupjyoti Gogoi.

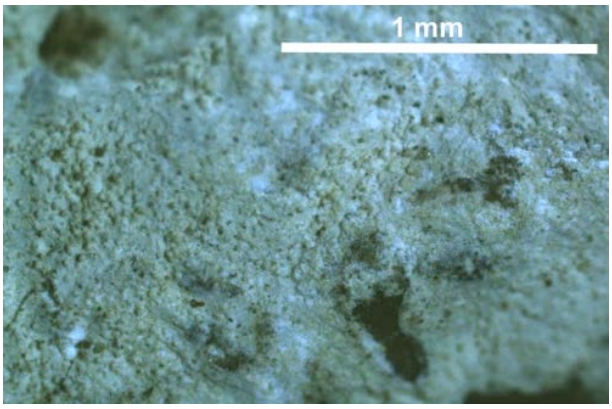

Image 10. *Herpothallon echinatum* Aptroot, Lücking & Will-Wolf. © Rupjyoti Gogoi.

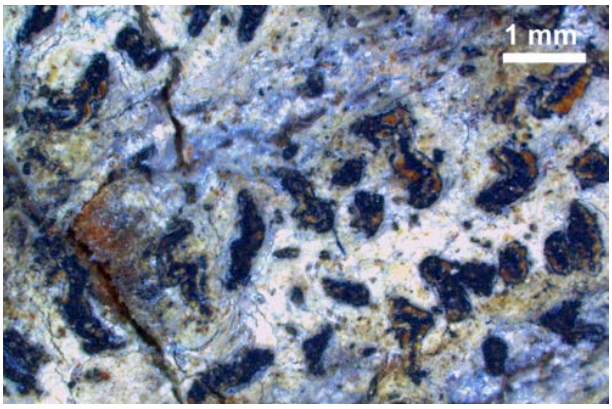

Image 11a. *Lecanographa rufa* (Müll. Arg.) Ertz. © Rupjyoti Gogoi.

detected in TLC.

Distribuition: India (Assam and West Bengal) and Tanzania.

12. *Letrouitia muralis* Hafellner, Nova Hedwigia 35: 695. 1983. (Letrouitiaceae) (Image 12a,b,c).

Specimen examined: LWG 35861, 10.i.2018, Assam, Nagaon District, Lanka, Lumding Reserve Forest, 25.875°N, 93.020°E, 130m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, verrucose, orange-yellow. Ascomata biatorine, scattered, rounded, sessile, constricted at base, disc brown, slightly concave or plane, margin distinct, prominent, concolorous with the thallus; hymenium hyaline. Asci clavate, 2–4-spored; ascospores hyaline, ellipsoidal, transversely 6–7-septate, with lenticular locules, 24.7–29.3 µm × 9.6–12.5µm.

Chemistry: Thallus and apothecia K+ purple, C-, P-; TLC not performed.

Distribution: India (Assam, Karnataka, and Tamil Nadu), Africa, Australia, and The Philippines.

13. *Myriotrema clandestinum* (Fée) Hale, *Mycotaxon* 11: 133. 1980. *Thelotrema clandestinum* Fée, *Essai Crypt. Ecorc.*: 90. 1837. (Graphidaceae) (Image 13a,b,c).

Specimen examined: LWG 35862, 18.ii.2018, Assam, Nagaon District, Samaguri, Suang Reserve Forest, Chapanala, 26.320°N, 92.904°E, 119m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, glossy, ashy grey, corticated. Ascomata immersed; hymenium hyaline, without collumella. Asci 8-spored; ascospores consistently, transversely 3-septate, hyaline, 10.1–13.7 µm × 3.5–5.4 µm.

Chemistry: Thallus K-, C-, P+ yellow, UV-; psoromic acid detected in TLC.

Distribution: India (Andaman & Nicobar Islands,

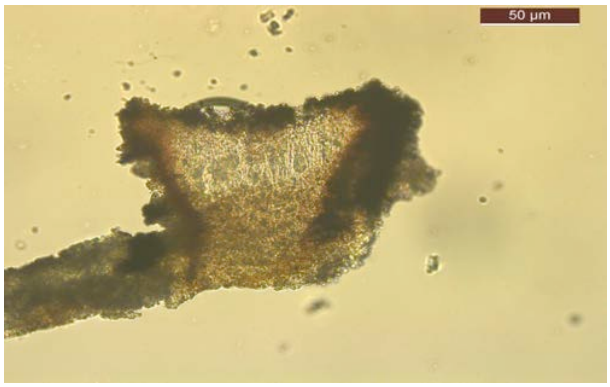

Image 11b. Longitudinal section of ascoma of *Lecanographa rufa* (Müll. Arg.) Ertz. © Rupjyoti Gogoi.

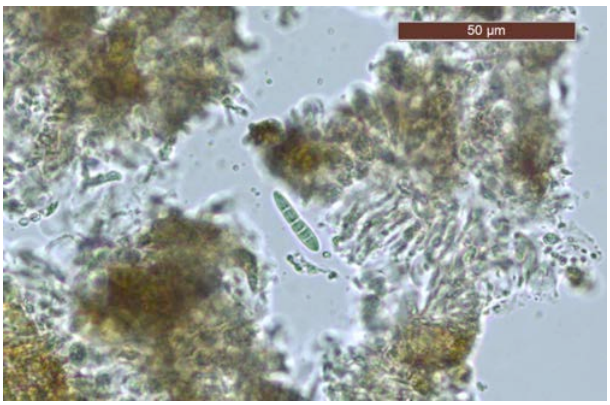

Image 11c. Ascospore of *Lecanographa rufa* (Müll. Arg.) Ertz. © Rupjyoti Gogoi.

Assam, Arunachal Pradesh, Karnataka, Kerala, Maharashtra, and Megahlaya), Australia, Colombia, El Salvador, Indonesia, New Caledonia, Philippines, Solomon Islands, Sri Lanka, Taiwan, and Venezuela.

Image 12a. *Letrouitia muralis* Hafellner. © Rupjyoti Gogoi.

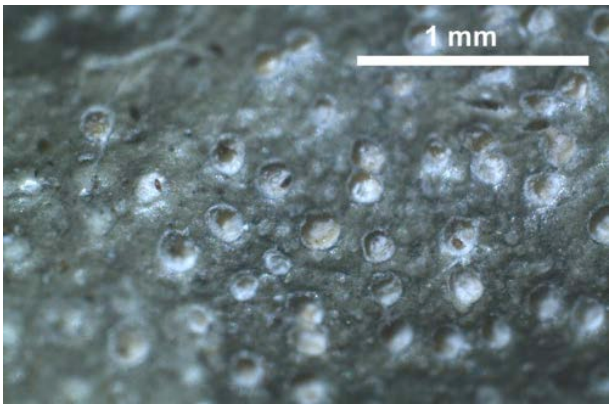

Image 13a. *Myriotrema clandestinum* (Fée) Hale. © Rupjyoti Gogoi.

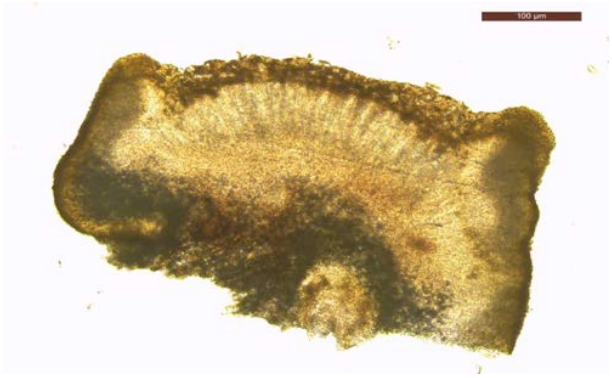

Image 12b. Longitudinal section of ascoma of *Letrouitia muralis* Hafellner. © Rupjyoti Gogoi.

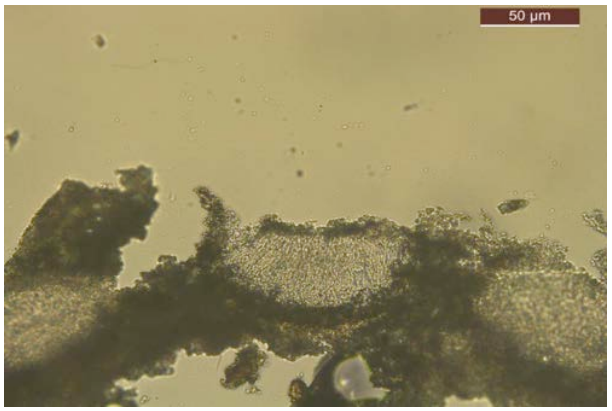

Image 13b. Longitudinal section of ascoma *Myriotrema clandestinum* (Fée) Hale. © Rupjyoti Gogoi.

Image 12c. Ascospore of *Letrouitia muralis* Hafellner. © Rupjyoti Gogoi.

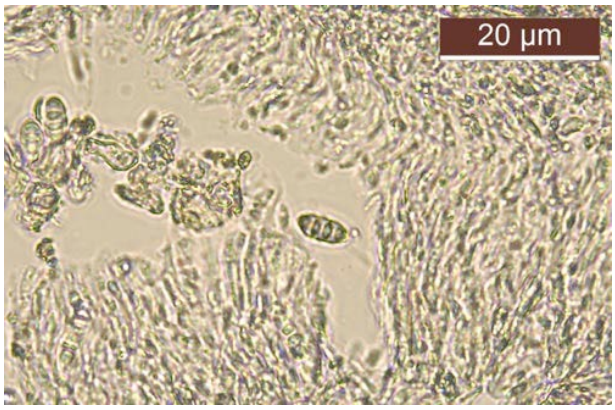

Image 13c. Ascospore of *Myriotrema clandestinum* (Fée) Hale. © Rupjyoti Gogoi.

14. *Opegrapha discolor* Vain., *Ann. Acad. Sci.Fenn.*, Ser. A, 15(6): 276. 1921. (Opegraphaceae) (Image 14a,b,c).

Specimen examined: LWG 35863, 10.xii.2017, Assam, Nagaon District, Jamunamukh, Erakapili, 26.098°N, 92.745°E, 74m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, thin to inconspicuous, rimose, olive-green. Ascomatalirellate, short, variable, disc slit to ± open, epruinose; excipulum black, broadly continuous below the hypothecium; hymenium I+ red. Asci bitunicate, clavate, 8-spored; ascospores hyaline, transversely 3-septate, 13.3–13.9 µm × 2.7–3.9 µm, perispore ca. 1µm thick.

Chemistry: Thallus K-, C-, P+ yellow, UV-; no lichen

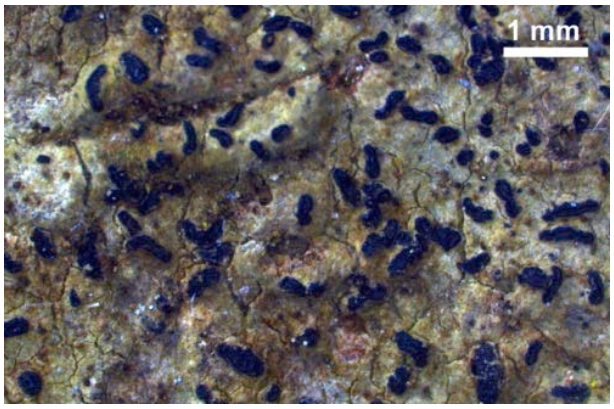

Image 14a. *Opegrapha discolor* Vain. © Rupjyoti Gogoi.

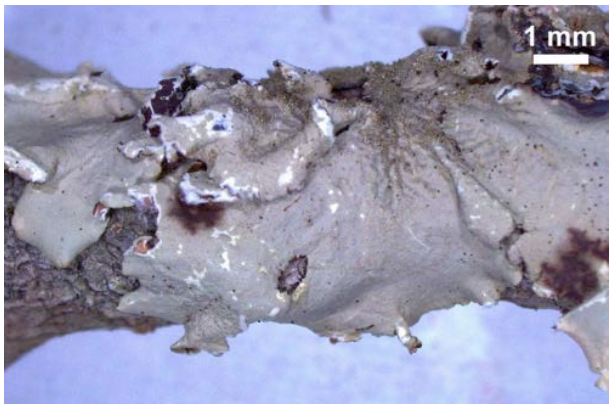

Image 15. *Parmotrema crinitoides* J.C. Wei. © Rupjyoti Gogoi.

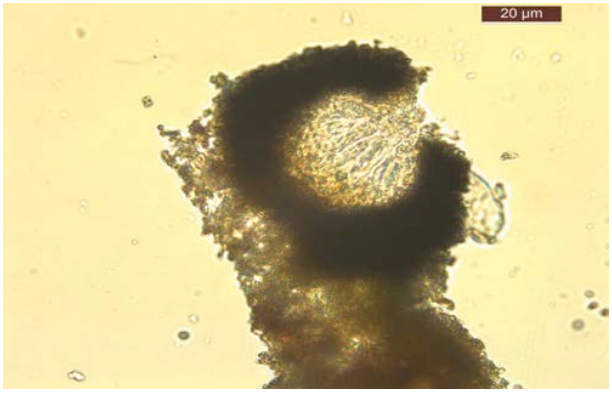

Image 14b. Longitudinal section of ascoma of *Opegrapha discolor* Vain. © Rupjyoti Gogoi.

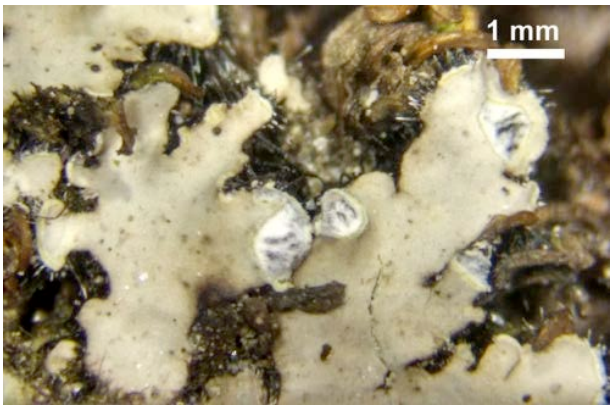

Image 16. *Phaeophyscia hispidula* (Ach.) Moberg. © Rupjyoti Gogoi.

Image 14c. Ascospores of *Opegrapha discolor* Vain. © Rupjyoti Gogoi.

substance detected in TLC.

Distribution: India (Assam, Bihar, and West Bengal) and The Philippines.

15. *Opegrapha discolor* Vain., *Ann. Acad. Sci.Fenn.*, Ser. A, 15(6): 276. 1921. (Opegraphaceae) (Image 14a,b,c).

Specimen examined: LWG 35863, 10.xii.2017, Assam, Nagaon District, Jamunamukh, Erakapili, 26.098°N, 92.745°E, 140m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, thin to inconspicuous, rimose, olive-green. Ascomatalirellate, short, variable, disc slit to ± open, epruinose; excipulum black, broadly continuous below the hypothecium; hymenium I+ red. Asci bitunicate, clavate, 8-spored; ascospores hyaline, transversely 3-septate, 13.3–13.9 µm × 2.7–3.9 µm, perispore ca. 1µm thick.

Chemistry: Thallus K-, C-, P+ yellow, UV-; no lichen substance detected in TLC.

Distribution: India (Assam, Bihar, and West Bengal) and The Philippines.

16. *Phaeophyscia hispidula* (Ach.) Moberg, *Bot. Not.* 131:260. 1978. 1810. *Parmelia hispidula* Ach., *Lich. Univ.*: 468. (Physciaceae) (Image 16).

Specimen examined: LWG 35865, 21.iv.2018, Assam, Nagaon District, Kaliabor, Hatimura, 26.613°N, 92.993°E, 134m, coll. Rupjyoti Gogoi.

Description: Thallus muscicolous, foliose, 3cm

across, lobes 1.5–2.0 mm, upper side grey, soralia laminal, capitates, extending towards the margin; lower side black; rhizines long, black, projecting beyond the lobe; medulla white. Apothecia not seen.

Chemistry: Thallus K-, C-, P-, UV-; no lichen substance detected in TLC.

Distribution: India (Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Manipur, Nagaland, Rajasthan, Sikkim, Tamil Nadu, and Uttarakhand), Australia, Bhutan, Nepal, New Zealand, and Taiwan.

17. *Porina eminentior* (Nyl.) P.M. McCarthy, *Lichenologist* 32(1): 42. 2000. *Thelenella eminentior* Nyl., *Annls. Sci. Nat., Bot.*, sér. 4, 15: 54. 1861. (Porinaceae) (Image 17a,b,c).

Specimen examined: LWG 35866, 05.ii.2017, Assam, Nagaon District, Samaguri, Suang Reserve Forest, Chapanala, 26.322°N, 92.904°E, 140m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, epiphloeodal, pale yellow, irregularly to rimose areolate, verruculose. Ascomata perithecia, hemispherical, numerous, emergent, concolorous with the thallus; ostiole apical; involucrellum yellowish-brown to orange-brown. Asci 8-spored; ascospores submuriform to muriform, transversely 7–8 septa, longitudinally 0–2 septa, 34.6–53.4 µm × 11.9–14.6 µm.

Chemistry: Thallus K-, C-, P-, UV-.

Distribution: India (Assam and Meghalaya), Australia, Brazil, Japan, New Caledonia, Papua New Guinea, The Philipinnes, and Vanuatu.

18. *Porina interstes* (Nyl.) Harm., *Bull. Séances Soc. Sci. Nancy,* sér. 3, 12: 126. 1911

Verrucaria interstes Nyl. *Bull. Soc. Linn. Normand.*, sér. 2, 2: 123. 1868. (Porinaceae) (Image 18a,b,c).

Specimen examined: LWG 35867, 10.xii.2017, Assam, Nagaon District, Hojai, Kumrakata Reserve Forest, 26.001°N, 92.779°E, 68m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, greenish-grey. Ascomata perithecia, numerous, ±4mm, solitary to aggregated, brownish to orange tinge, ostiole apical, peridium brownish black. Asci 8-spored, ascospores hyaline, transversely 7–15-septate, 42–43.6 µm × 5.0–5.5 µm.

Chemistry: Thallus K-, C-, P-, UV-.

Distribution: India (Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Goa, Karnataka, Kerala, Madhya Pradesh, Tamil Nadu, and West Bengal).

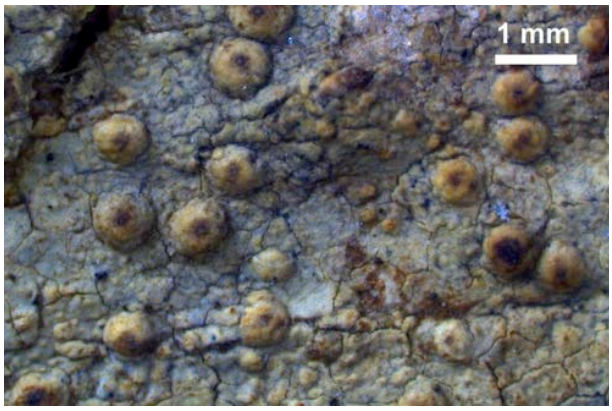

Image 17a. *Porina eminentior* (Nyl.) P.M. McCarthy. © Rupjyoti Gogoi.

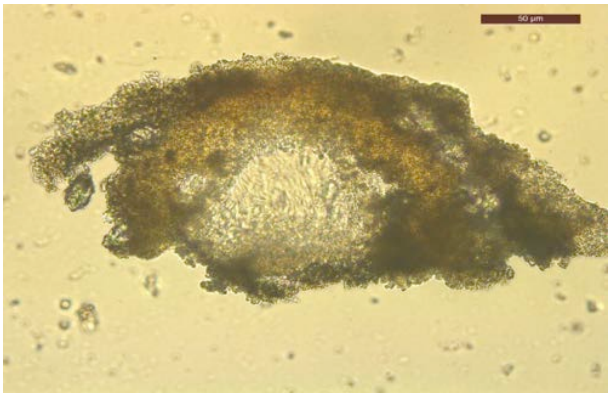

Image 17b. Longitudinal section of ascoma of *Porina eminentior* (Nyl.) P.M. McCarthy. © Rupjyoti Gogoi.

Image 17c. Ascospores of *Porina eminentior* (Nyl.) P.M. McCarthy. © Rupjyoti Gogoi.

19. *Porina mastoidella* (Nyl.) Müll. Arg., *Bot. Jahrb. Syst.* 6: 401. 1885. *Verrucaria mastoidella* Nyl., *Flora* 50: 8. 1867. (Porinaceae) (Image 19a,b,c).

Specimen examined: LWG 35868, 18.ii.2018, Assam, Nagaon District, Samaguri, Suang Reserve Forest, Chapanala, 26.335°N, 92.876°E, 118m, coll. Rupjyoti

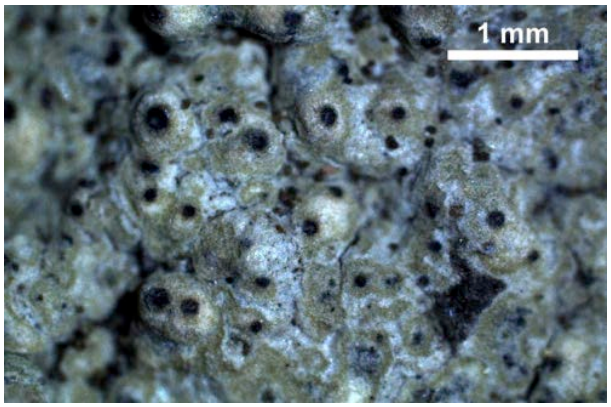

Image 18a. *Porina interstes* (Nyl.) Harm. © Rupjyoti Gogoi.

Image 19a. *Porina mastoidella* (Nyl.) Müll. Arg. © Rupjyoti Gogoi.

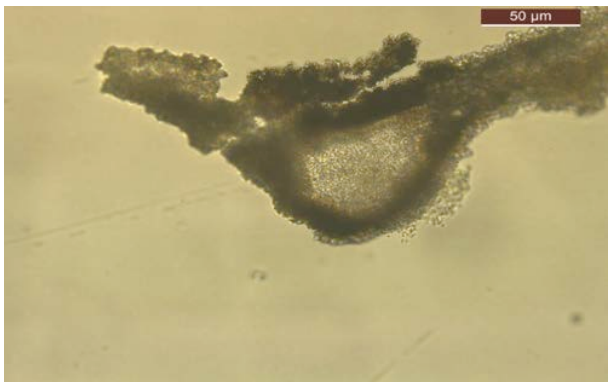

Image 18b. Longitudinal section of ascoma of *Porina interstes* (Nyl.) Harm. © Rupjyoti Gogoi.

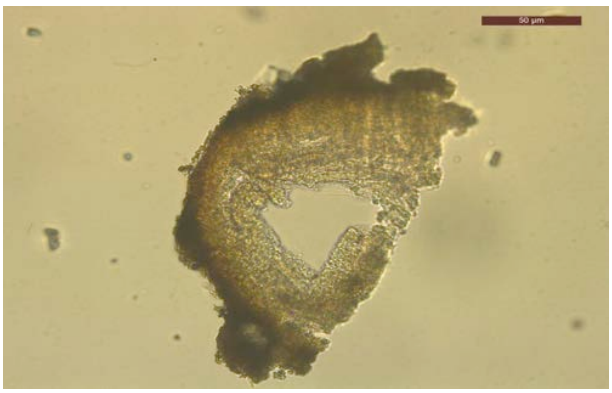

Image 19b. Longitudinal section of ascoma of *Porina mastoidella* (Nyl.) Müll. Arg. © Rupjyoti Gogoi.

Image 18c. Ascospores of *Porina interstes* (Nyl.) Harm. © Rupjyoti Gogoi.

Image 19c. Ascospore of *Porina mastoidella* (Nyl.) Müll. Arg. © Rupjyoti Gogoi.

Gogoi.

Description: Thallus corticolous, crustose, yellowish, border line black, ecorticate. Ascomata perithecia, brownish black to black, hemispherical, solitary, rarely grouped into 2–4, ostiole apical, excipulum K+ red, involurellum brown, hymenium inspersed. Asci, 8-spored, ascospores fusiform, 10.8–12.5 µm × 2.4–3.2 µm.

Chemistry: Thallus K-, C-, P-, UV-.

Distribution: India (Arunachal Pradesh, Assam, and West Bengal), Christmas Islands, Solomon Islands, Taiwan, and Vanuatu.

20. *Pyrenula submastophora* Ajay Singh & Upreti, *Geophytology* 17: 85. 1987. (Pyrenulaceae) (Image 20a,b,c).

Specimen examined: LWG 35869, 18.ii.2018, Assam, Nagaon District, Samaguri, Suang Reserve Forest, Chapanala, 26.335°N, 92.876°E, 101m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, brownish, border line black. Ascomata perithecia, emergent, solitary, rarely grouped, black, ostiole apical; hymenium hyaline, paraphysoids simple; peridium black, carbonized, collumellate at base. Asci clavate, 8-spored; ascospores brown, distoseptate, 3-septate, terminal lumina separated from exospores wall, 19.7–23.9 µm × 9.2–11.7 µm.

Chemistry: Thallus K-, C-, P-, UV-.

Distribution: India (Andaman & Nicobar Islands, Assam, and Kerala).

21. *Pyrenula thelomorpha* Tuck., *Gen. Lich.* (Amherst): 275. 1872. *Anthracothecium thelemorphum* (Tuck.) Zahlbr., *Cat. Lich. Univ.* 1: 469. 1922. (Pyrenulaceae) (Image 21a,b,c).

Specimen examined: LWG 35870, 24.iv.2018, Assam, Nagaon District, Jamunamukh, Erakapili, 26.098°N, 92.745°E, 74m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, epiphloeodal, greyish-brown. Ascomata perithecia, solitary to 2–4 confluent, black, emergent, peridium black, ostiole apical, ascomatal wall black, continuous below the hamathecium. Asci cylindrical, bitunicate, 6-spored; ascospores muriform, narrowly ellipsoidal, brown at maturity, distoseptate, 30.8–41.0 µm × 9.9–13.9 µm.

Chemistry: Thallus K-, C-, P-, UV-; no lichen substance detected in TLC.

Distribution: India (Assam, Karnataka, and West Bengal). Pantropical distribution.

22. *Rinodina oxydata* (A. Massal.) A. Massal., *Geneac. Lich.*: 19. 1854..*Mischoblastia oxydata* A. Massal., *Ric. Auton. Lich. Crost.*: 42. 1853. (Physciaceae) (Image 22a,b)

Specimen examined: LWG 35871, 10.xii.2017, Assam, Nagaon District, Jugijan, Rajbari Archaeological Site, 26.035°N, 92.787°E, 85m, coll. Rupjyoti Gogoi.

Description: Thallus saxicolous, crustose, olivaceous, areolate. Ascomata lecanorine, black; epihymenium brownish; hymenium hyaline. Asci 8-spored; ascospores brown, transversely 1-septate, *Mischoblastia* type, ovoid, 14.4–16.2 µm × 9.1–10.37 µm.

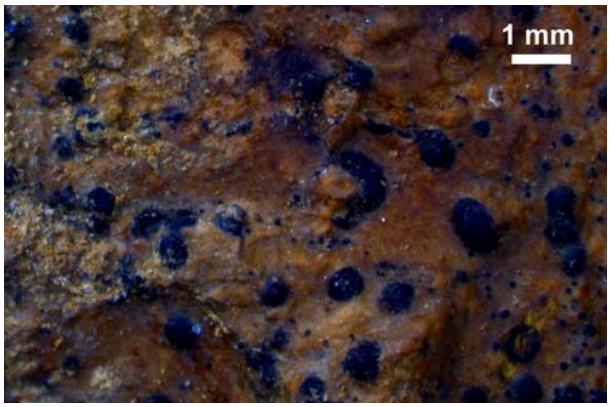

Image 20a. *Pyrenula submastophora* Ajay Singh & Upreti. © Rupjyoti Gogoi.

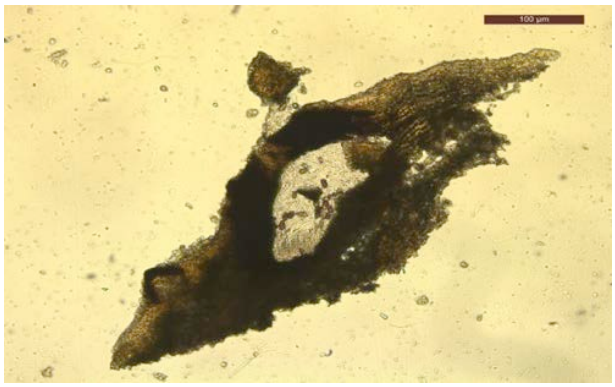

Image 20b. Longitudinal section of ascoma of *Pyrenula submastophora* Ajay Singh & Upreti. © Rupjyoti Gogoi.

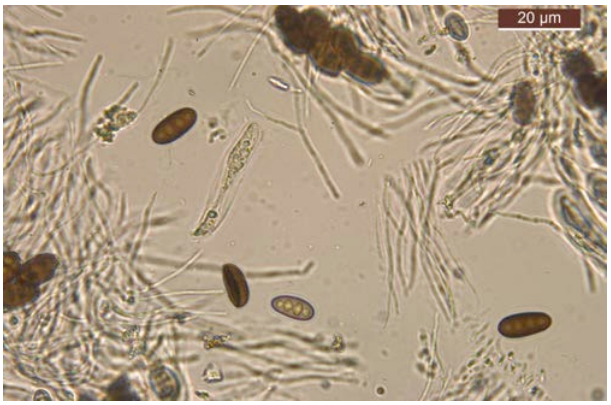

Image 20c. Ascospores of *Pyrenula submastophora* Ajay Singh & Upreti. © Rupjyoti Gogoi.

Chemistry: Thallus K+ yellow, C-, P-, UV-; no lichen substances detected in TLC.

Distribution: India (Assam, Madhya Pradesh, Tamil Nadu, Uttarakhand, and West Bengal), Bangladesh, Canary Island, Indonesia, Italy, and Japan.

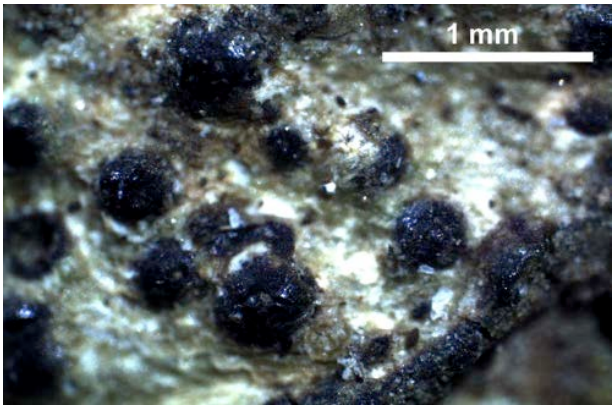

Image 21a. *Pyrenula thelomorpha* Tuck. © Rupjyoti Gogoi.

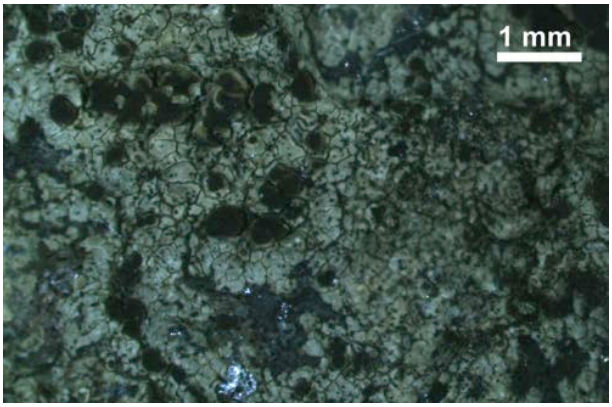

Image 22a. *Rinodina oxydata* (A. Massal.) A. Massal. © Rupjyoti Gogoi.

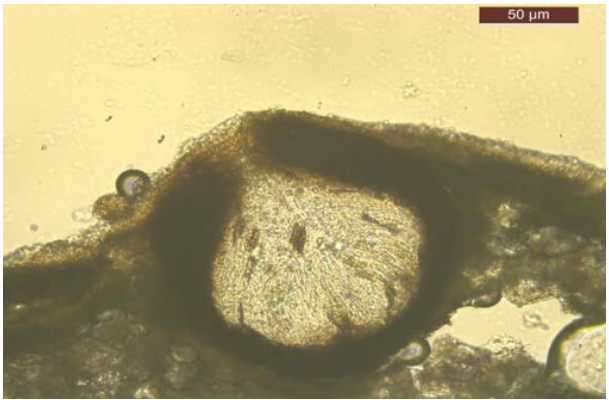

Image 21b. Longitudinal section of ascoma of *Pyrenula thelomorpha* Tuck. © Rupjyoti Gogoi.

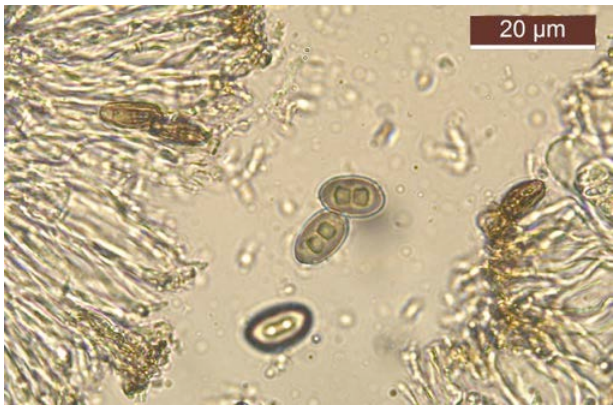

Image 22b. Ascospores of *Rinodina oxydata* (A. Massal.) A. Massal. © Rupjyoti Gogoi.

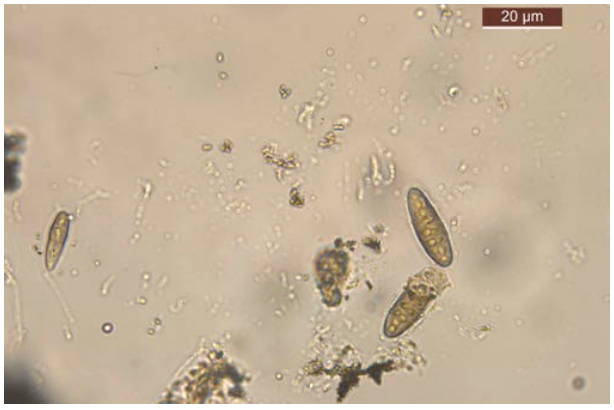

Image 21c. Ascospores of *Pyrenula thelomorpha* Tuck. © Rupjyoti Gogoi.

23. *Synarthonia bicolor* Müll. Arg., *Bull. Soc. R. Bot. Belg.* 30: 86. 1891. (Arthoniaceae) (Image 23a,b,c).

Specimen examined: LWG 35872, 18.ii.2018, Assam, Nagaon District, Nowgong College Campus, 26.348°N, 92.684°E, 84m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, greyish, border line brownish-black. Ascomata solitary when young, with white thalline margin without algal cells, turning into monocarpocentral synascomata and finally becoming pluri-carpocentralsynascomata forming a pseudostromatic structure, with a hardly visible white thalline margin, individual ascomata lirellate to rounded or irregular, pruinose; hymenium hyaline, I+ red, KI+ blue; paraphysoids branched and anastomosing. Asci 8-spored, *Arthonia*-type; ascospores hyaline, transversely 3–5-septate, 13.2–19.2 µm × 5.4–6.2 µm.

Chemistry: Thallus K-, C-, P-, UV+ yellow; lichexanthone detected in TLC.

Distribution: India (Assam and West Bengal) and Costa Rica.

24. *Zwackhia bonplandii* (Fée) Ertz, *Bull. Soc. Naturalistes Luxemb.* 113: 106. 2012. *Opegrapha bonplandii* Fée, *Essai Crypt. Exot. (Paris)*: 25. 1825 (1824). (Lecanographaceae) (Image 24a,b,c).

Specimen examined: LWG 35873, 19.i.2017, Assam, Nagaon District, Doboka Reserve Forest, 26.192°N,

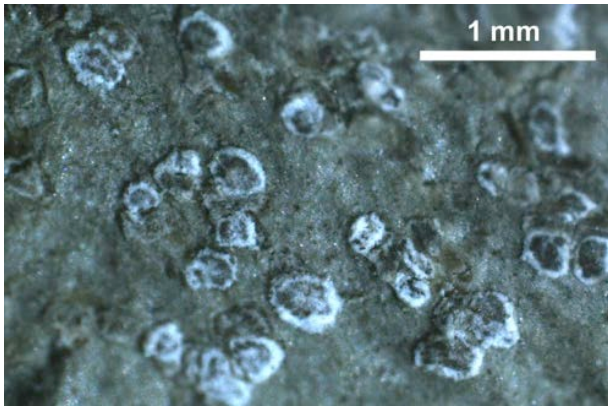

Image 23a. *Synarthonia bicolor* Müll. Arg. © Rupjyoti Gogoi.

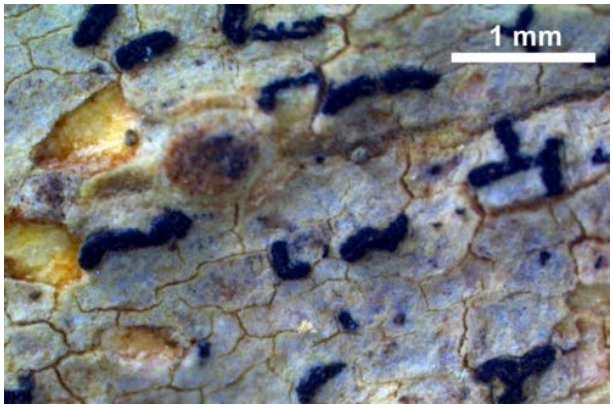

Image 24a. *Zwackhia bonplandii* (Fée) Ertz. © Rupjyoti Gogoi.

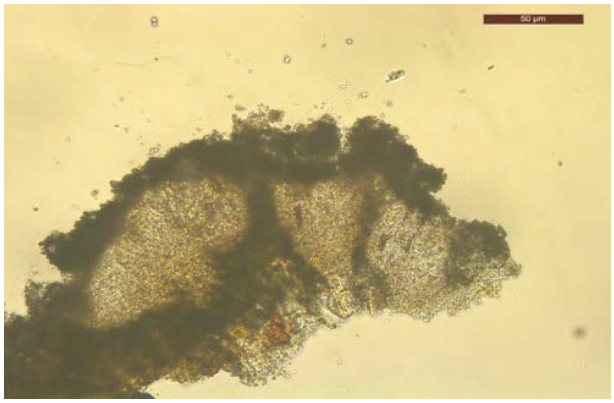

Image 23b. Longitudinal section of ascoma of *Synarthonia bicolor* Müll. Arg. © Rupjyoti Gogoi.

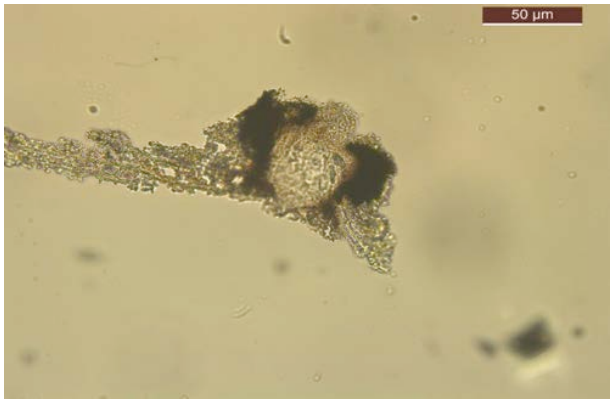

Image 24b. Longitudinal section of ascoma of *Zwackhia bonplandii* (Fée) Ertz. © Rupjyoti Gogoi.

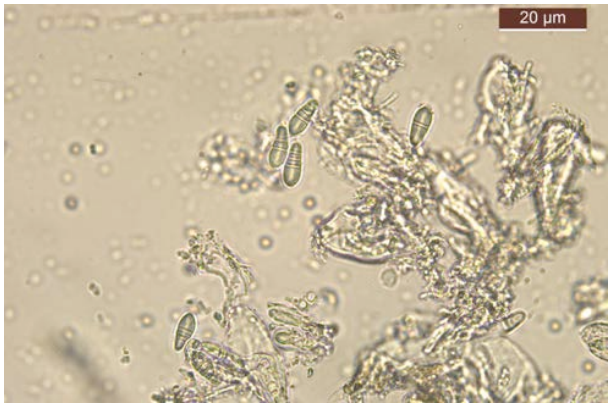

Image 23c. Ascospores of *Synarthonia bicolor* Müll. Arg. © Rupjyoti Gogoi.

Image 24c. Ascospore of *Zwackhia bonplandii* (Fée) Ertz. © Rupjyoti Gogoi.

92.781°E, 136m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, thin to inconspicuous, surface smooth. Ascomata lirellate, scattered, numerous, rarely branched, emerged, straight to curved, epruinose, disc slit to ±exposed, black; excipulum carbonized, broadly continuous below the hypothecium; hymenium hyaline, not inspersed, I+ red; paraphysoidsbarnched and anastomosing. Asci clavate, 8-spored; ascospores hyaline, transversely 9–12-septate, fusiform, 40.1–60.7 µm × 4.7–6.1 µm, perispore ca. 1µm thick.

Chemistry: Thallus K-, C-, P-, UV-; no lichen substance

Image 25a. *Zwackhia viridis* (Ach.) Poetsch & Schied. © Rupjyoti Gogoi.

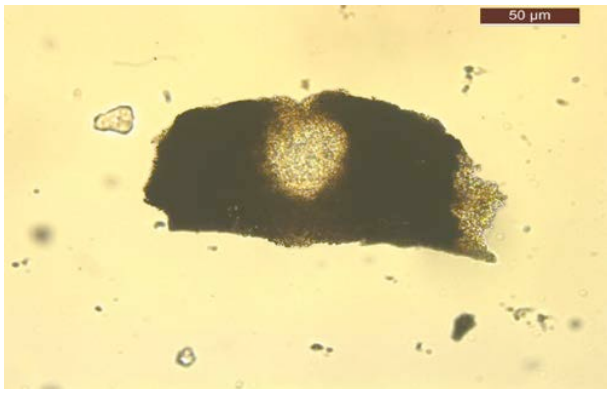

Image 25b. Longitudinal section of ascoma of *Zwackhia viridis* (Ach.) Poetsch & Schied. © Rupjyoti Gogoi.

Image 25c. Ascospore of *Zwackhia viridis* (Ach.) Poetsch & Schied. © Rupjyoti Gogoi.

detected in TLC.

Distribution: India (Andaman & Nicobar Islands, Assam, and West Bengal), Africa, Bermuda, Malaysia, New Zealand, and Thailand.

25. *Zwackhia viridis* (Ach.) Poetsch & Schied., *Syst. Aufz. Krypt. Pfl.*: 186. 1872. *Opegrapha rubella* var. *viridis* Ach., *Methodus*: 22. 1803. (Lecanographaceae) (Image 25a,b,c).

Specimen examined: LWG 35874, 18.ii.2018, Assam, Nagaon District, Samaguri, Suang Reserve Forest, Chapanala, 26.335°N, 92.876°E, 109m, coll. Rupjyoti Gogoi.

Description: Thallus corticolous, crustose, thin to inconspicuous, smooth to craked, border line dark brown. Ascomata lirellate, scattered, rarely aggregated, lirellae short, straight to flexuous, disc slit to ±open, epruinose; excipulum broadly continuous below the hypothecium; hymenium I+ red, hyaline, not inspersed; paraphysoids branched and anastomosing. Asci clavate, 8-spored; ascospores hyaline, transversely 7–10-septate, cells almost equal in size, 22.5–35.5 µm × 2.8–3.5 µm, perispore ca. 1µm thick.

Chemistry: Thallus K-, C-, P-, UV-; no lichen substance detected in TLC.

Distribution: India (Andaman & Nicobar Islands, Assam, Karnataka, and Manipur), Africa, Australia, France, Indonesia, La Réunion, Madagascar, Malaysia, Papua New Guinea, Republic of Korea, Sri Lanka, Taiwan, Thailand, and The Philippines.

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