CHAPTER 4

RESULTS AND DISCUSSION

4.1 DIVERSITY OF LICHEN:

A total of 196 lichen species under 18 families and 36 genera were recorded from the district (**Table 4.1**). Out of these 28 species are new record to Assam, 15 new to India and 15 species are endemic to Indian regions. Majority of the lichens were crustose (88%) followed by foliose (11%) and leprose (1%) (**Fig 4.1**). Fruticose lichens were not encountered during the study. Amongst the lichen families, Graphidaceae was the most dominant followed by Arthoniaceae and *Graphis* and *Pyrenula* were the most dominant genera (**Fig 4.2, 4.3**).

Table 4.1: Distribution of lichens and their growth form in the sampling sites

Sl. no.	Code	Lichen species	GF	Grid							Additional sites						
				A	D	G	H	J	L	N	Alok	BFG	CDP	GMH	PTG	S	STC
Arthoniaceae																	
1		*Arthonia collectiva* Stirt.	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
2		*A. dispersula* Nyl.	C	1	–	–	–	–	–	–	–	–	–	–	–	–	–
3	**	*A. fissurinella* Nyl.	C	–	1	–	–	–	–	–	–	–	–	–	–	–	–
4	@	*A. recedens* Stirt.	C	–	–	–	–	–	1	–	–	–	–	–	–	–	–
5	@	*Arthothelium confertum* (A.L. Smith) Makh. & Patw.	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
6		*Coniocarpon cinnabarinum* DC.	C	4	2	4	–	3	4	2	+	–	–	–	–	+	+
7		*Cryptothecia lunulata* (Zahlbr.) Makhija & Patw.	C	1	1	–	–	–	–	–	–	–	–	–	–	+	+
8		*C. subtecta* Stirt.	C	1	–	–	1	–	–	–	–	–	–	–	–	–	–
9	@	*C. verruculifera* Jagad. Ram, G.P. Sinha & Kr. P. Singh	C	–	–	1	–	–	–	–	–	–	–	–	–	–	–
10	* @	*Herpothallon*	C	–	2	1	–	6	–	2	–	–	–	+	–	+	+

		himalayanum Jagad. Ram & G.P. Sinha															
11		*H. philippinum* (Vain.) Aptroot & Lücking	C	–	–	–	–	–	–	–	–	–	–	–	–	+	–
12	*	*Stirtonia macrocarpa* Makhija & Patw.	C	–	–	–	–	–	–	–	–	–	–	–	+	–	–
Arthopyreniaceae																	
13	@	*Arthopyrenia subvelata* (Nyl.) R. C. Harris	C	1	–	–	–	–	–	–	–	–	–	–	–	–	–
Caliciaceae																	
14		*Cratiria lauricassiae* (Fée) Marbach	C	–	–	–	1	–	–	–	–	–	–	–	–	–	–
15		*Dirinaria aegialita* (Afzel. ex Ach.) B.J. Moore	F	–	1	–	–	–	–	–	–	–	–	–	–	–	–
16		*D. applanata* (Fée) D.D. Awasthi	F	5	4	5	3	5	3	3	–	–	–	–	–	–	+
17		*D. consimilis* (Stirt.) D.D. Awasthi	F	4	7	2	3	6	1	12	–	+	+	–	+	+	+
18		*D. papillulifera* (Nyl.) D.D. Awasthi	F	1	4	2	–	–	–	–	–	–	–	–	–	+	+
19		*D. picta* (Sw.) Clem. & Shear	F	4	1	1	2	3	3	2	–	–	–	–	+	+	–
20		*Pyxine cocoes* (Sw.) Nyl.	F	5	20	14	6	15	9	7	–	+	+	+	+	–	+
21		*P. coralligera* Malme	F	–	3	–	–	–	–	–	–	–	–	–	–	–	–
22	*	*P. isidiophora* (Müll. Arg.) Imshaug	F	–	1	–	–	–	–	–	–	–	–	–	–	–	–
23		*P. reticulata* (Vain.) Vain.	F	12	2	–	–	4	2	–	–	–	–	–	–	–	+
24		*P. sorediata* (Ach.) Mont.	F	1	–	–	–	–	–	–	–	–	–	–	–	–	–
Chrysothricaceae																	
25		*Chrysothrix*	L	–	2	–	–	–	–	–	–	–	–	–	–	–	–

		candelaris (L.) J.R. Laudon															
26		*C. chlorina* (Ach.) J.R. Laudon	L	–	–	–	–	–	–	–	–	–	–	–	–	–	+
Cladoniaceae																	
27	*	*Lepraria incana* (L.) Ach.	L	–	3	1	–	–	–	–	–	–	–	–	–	–	–
Coenogoniaceae																	
28	**	*Coenogonium bacilliferum* (Malme) Lücking, Aptroot & Sipman	C	1	–	–	–	–	–	–	–	–	–	–	–	–	–
29	**	*C. pineti* (Ach.) Lücking & Lumbsch	C	–	–	–	–	–	–	–	–	–	+	–	–	–	–
30	**	*C. subdilutum* (Malme) Kalb	C	1	–	–	–	–	–	–	–	–	–	–	–	–	–
31	**	*C. wrightii* (Vězda) H. Harada & Lumbsch	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
Graphidaceae																	
32	**	*Allographa fujianensis* (Z. F. Jia & J. C. Wei) Lücking & Kalb	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
33		*A. hossei* (Vain.) Lücking & Kalb	C	–	1	1	–	–	–	–	–	–	–	–	–	–	–
34		*A. malacodes* (Nyl.) Lücking & Kalb	C	4	–	–	–	2	2	1	–	–	–	–	–	–	–
35		*A. rhizicola* (Fée) Lücking & Kalb	C	1	–	–	–	–	–	1	–	–	–	–	–	–	–
36		*A. sayeri* (Müll. Arg.) Lücking & Kalb	C	–	1	–	–	–	–	–	–	–	–	–	–	–	–
37	* @	*A. stictilabiata* (Patw. & C.R. Kulk.) J. Kalb & Kalb	C	–	–	–	–	–	–	–	+	–	–	–	–	–	–
38		*A. xanthospora* (Müll. Arg.)	C	3	–	–	–	1	3	–	–	–	–	–	–	–	–

		Lücking & Kalb															
39		*Diorygma hieroglyphicum* (Pers.) Staiger & Kalb	C	–	–	–	2	1	–	–	–	–	–	–	–	–	–
40		*D. junghuhnii* (Mont. & Bosch) Kalb	C	1	–	–	1	1	–	2	+	+	–	–	–	–	–
41	*	*D. reniforme* (Fée) Kalb, Staiger & Elix	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
42	**	*D. roseopruinatum* Popong, Lücking & Parnmen	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
43		*D. soozanum* (Zahlbr.) M. Nakan. & Kashiw.	C	1	–	–	2	–	–	2	+	+	–	–	–	–	–
44		*Glyphis cicatricosa* Ach.	C	1	–	–	–	2	2	1	–	–	–	–	–	–	–
45	@	*G. duriuscula* Stirt.	C	–	–	–	–	–	1		–	–	–	–	–	–	–
46	@	*Graphis ajarekarii* Patw. & C.R. Kulk.	C	–	3		–	–	–	–	–	–	–	–	–	–	–
47		*G. alboglaucescens* Adaw. & Makhija	C	–	–	1	–	–	–	–	–	–	–	–	–	–	–
48	*	*G. analoga* Nyl.	C	5	–	–	–	–	–	–	–	–	–	–	–	–	–
49		*G. anfractuosa* (Eschw.) Eschw.	C	–	–	–	–	–	–	–	–	–	–	–	–	–	+
50		*G. aperiens* Müll. Arg.	C	–	–	–	–	1	1	–	–	–	–	–		–	–
51	**	*G. arbusculaeformis* (Vain.) Lücking	C	–	–	–	–	–	2	–	–	–	–	–	+	–	–
52		*G. arecae* Vain.	C	–	–	2	–	–	–	–	–	–	–	–	–	–	–
53	* @	*G. argentia* Makhija & Adaw.	C	1	3	1	–	–	–	–	–	–	–	–	+	–	+
54	*	*G. asahinae* Patw. & C.R. Kulk.	C	–	2	–	–	3	2	–	–	–	–	–	–	–	+

55	*	*G. bakeri* Vain.	C	–	–	1	–	–	–	–	–	–	–	–	–	–	–
56		*G. caesiella* Vain.	C	–	–	1	–	1	–	–	–	–	–	–	–	–	–
57		*G. caesiocarpa* Redinger	C	–	1		–	1	–	1	–	–	–	–	–	–	–
58		*G. capillacea* Stirt.	C	–	–	1	1	1	2	2	–	–	–	–	+	–	+
59		*G. cervina* Müll. Arg.	C	–	1	2	–	1		–	–	–	–	–	–	–	–
60		*G. cervinonigra* Zahlbr.	C	–	–	–	–	1	–	–	–	–	–	–	–	–	–
61		*G. cinnamomea* Adaw. & Makhija	C	–	–	1	–	–	–	–	–	–	–	–	–	–	–
62		*G. cincta* (Pers.) Aptroot	C	–	–	–	–	–	1	2	–	–	–	–	–	–	–
63	@	*G. coarctata* Stirt.	C	–	–	–	–	–	–	–	–	–	–	–	+	–	–
64		*G. conferta* Zenker	C	–	–	–	–	1	2	–	–	–	–	–	–	–	–
65	*	*G. consimilis* Vain.	C	1	–	–	–	–	–	–	–	–	–	–	–	–	–
66		*G. crebra* Vain.	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
67		*G. cremicolor* (H. Magn.) Lücking & A.W. Archer	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
68		*G. dendrogramma* Nyl.	C	1	–	–	–	3	3	–	–	–	–	–	–	–	–
69	@	*G. distincta* Makhija & Adaw.	C	–	–	1	–	–	–	–	–	–	–	–	–	–	–
70	**	*G. dracaenae* Vain.	C	–	–	–	–	1	–	–	–	–	–	+	–	–	–
71	*	*G. eburnea* Adaw. & Makhija	C	2	–	–	–	–	–	–	–	–	–	–	–	–	–
72	**	*G. emersa* Müll. Arg.	C	–	–	–	–	–	1	–	–	–	–	–	–	–	–
73	**	*G. enteroleuca* (Ach.) Lücking	C	–	1	–	–	–	–	1	–	–	–	–	–	–	–
74		*G. epimelaena* Müll. Arg.	C	1	1	–	–	–	–	–	–	–	–	–	–	–	–
75		*G. ficicola* Vain.	C	–	–	1	–	–	–	–	–	–	–	–	–	–	–

76		*G. filiformis* Adaw. & Makhija	C	–	–	–	–	–	–	–	–	–	–	–	–	–	+
77		*G. furcata* Fée	C	1	2	–	1	2	1	1	+	–	–	–	–	–	–
78		*G. glaucescens* Fée	C	2	1	–	–	3	1	–	+	+	–	–	–	–	–
79		*G. handelii* Zahlbr.	C	–	–	–	1	–	–	–	–	–	–	–	–	–	–
80		*G. hyphosa* Staiger	C	–	–	2	1	–	1		–	–	–	–	–	–	–
81		*G. immersella* Müll. Arg.	C	–	–	–	2	–	3	2	–	–	–	–	–	–	–
82	**	*G. immersicans* A.W. Archer	C	–	–	–	1	–	1	–	–	–	–	–	–	–	–
83		*G. intermediella* Stirt.	C	–	–	–	–	1	–	–	–	–	–	–	–	–	–
84		*G. leptocarpa* Fée	C	–	–	1	–	–	1	1	–	–	–	–	–	–	–
85		*G. librata* C. Knight	C	–	–	–	–	–	2	–	–	–	–	–	–	–	–
86		*G. lineola* Ach.	C	1	1	–	1	1	1	–	–	–	–	–	–	–	–
87	**	*G. litoralis* Lücking, Sipman & Chaves	C	–	–	–	–	–	–	–	+	–	–	–	–	–	–
88	**	*G. luluensis* A. W. Archer	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
89	*	*G. modesta* Zahlbr.	C	1	1	–	1	2	1	2	–	–	–	–	–	–	+
90	*	*G. nematoides* Leight.	C	–	–	1	–	–		–	–	–	–	–	–	–	–
91		*G. palmicola* Makhija & Adaw.	C	–	–	–	–	–	2	–	–	–	–	–	–	–	–
92		*G. pertricosa* (Kremp.) A.W. Archer	C	1	–	–	–	–	1	–	–	–	–	–	–	–	–
93		*G. pinicola* Zahlbr.	C	–	–	–	–	–	1	–	–	–	–	–	–	–	+
94		*G. plumierae* Vain.	C	–	–	–	–	–	1	–	–	–	–	–	–	–	–
95		*G. prunicola* Vain.	C	–	1	–	–	–	–	–	–	–	–	–	–	–	–
96		*G. pyrrhocheiloides*	C	1	2	2	2	–	1	1	+	+	–	–	+	–	+

		Zahlbr.															
97		*G. renschiana* (Müll. Arg.) Stizenb.	C	1	1		–	–	–	–	+	–	–	–	–	–	–
98		*G. riopiedrensis* (Fink) Lücking	C	3	6	1	–	1	–	1	–	–	–	–	–	–	–
99		*G. scripta* (L.) Ach.	C	2	–	1	1	1	2	2	–	–	–	–	–	–	+
100		*G. stipitata* A.W. Archer	C	–	1	–	–	–	–	–	–	–	–	–	+	–	–
101		*G. subasahinae* Nagarkar & Patw.	C	1	–	–	1	–	–	2	–	–	–	–	+	–	–
102		*G. submarginata* Lücking	C	–	–	–	–	1	1	–	–	–	–	–	–	–	–
103		*G. sulphurella* (Zahlbr.) Lücking	C	3	–	–	–	–	–	–	–	–	–	–	–	–	–
104		*G. sundarbanensis* Jagadeesh Ram & G.P. Sinha	C	–	–	1	1	2	3	2	–	–	–	–	–	–	–
105		*G. supracola* A.W. Archer	C	–	–	1	–	–	–	–	–	–	–	–	–	–	–
106		*Pallidogramme divaricoides* (Räsänen) Pushpi Singh & Kr. P. Singh	C	–	–	–	–	–	1	–	–	–	–	–	–	–	–
107	* @	*Phaeographis manipurensis* Müll. Arg.	C	–	–	–	–	–	1	–	–	–	–	–	–	–	–
108		*Sarcographa glyphiza* (Nyl.) Kr. P. Singh & G.P.Sinha	C	–	–	–	1	–	–	–	–	–	–	–	–	–	–
109		*S. heteroclita* (Mont.) Zahlbr.	C	–	–	–		–	–	1	–	–	–	–	–	–	–
110		*S. intricans* (Nyl.) Müll.Arg.	C	–	–	–	1	–	–	–	–	+	–	–	–	–	–
111		*S. labyrinthica* **(**Ach.) Müll. Arg.	C	1	–	–	1	1	3	1	–	–	–	–	–	–	–
112		*S. maculosa* Zahlbr.	C	–	–	–	–	1	–	–	–	–	–	–	–	–	–

113		*S. subtricosa* (Leighton) Müll. Arg.	C	–	–	–	–	–	–	–	–	+	–	–	–	–	–
114		*S. tricosa* (Ach.) Müll. Arg.	C	–	–	–	–	–	2	1	–	–	–	–	–	–	–
Lecanoraceae																	
115		*Lecanora achroa* Nyl.	C	–	–	–	–	–	–	–	–	–	–	–	–	+	–
116		*L. helva* Stizenb.	C	3	8	14	6	1	1	1	–	–	+	–	–	–	–
117	*	*L. insignis* Degel.	C	–	–	–	–	–	–	–	–	+	–	+	–	–	–
118	*	*L. leproplaca* Zahlbr.	C	–	–	–	–	–	–	–	–	–	–	+	–	–	–
119		*L. leprosa* Fée	C	–	1	–	–	–	–	–	–	–	–	–	–	–	–
120		*L. tropica* Zahlbr.	C	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Letrouitiaceae																	
121		*Letrouitia transgressa* (Malme) Hefellner & Bellem.	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
Parmeliaceae																	
122		*Parmotrema crinitoides* J.C. Wei	F	–	–	–	–	–	1	–	–	–	–	–	–	–	–
123		*P. disparile* (Nyl.) Hale	F	–	–	–	–	–	1	–	–	–	–	–	–	–	–
124		*P. mesotropum* (Müll. Arg.) Hale	F	–	–	–	1	–	–	1		–	–	–	–	–	–
125		*P. praesorediosum* (Nyl.) Hale	F	–	1	–	–	–	–	–	–	–	–	–	–	+	–
126		*P. saccatilobum* (Taylor) Hale	F	–	4	–	–	–	–	–	–	+	–	–	–	–	–
127		*P. tinctorum* (Despr. ex Nyl.) Hale	F	1	–	–	–	–	–	–	–	–	–	–	–	–	–
128		*P. tsavoense* (Krog & Swinsc.) Krog & Swinsc.	F	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Physciaceae																	
129	* @	*Physcia abuensis*	F	–	–	1	–	–	–	–	–	–	–	–	–	–	–

		D.D. Awasthi & S.R. Singh															
130	*	*P. aipolia* (Ehrh. ex Humb.) Fürnr.	F	–	–	–	–	1	–	–	–	–	–	–	–	–	–
131	*	*P. alba* (Fée) Müll. Arg.	F	–	–	–	1		–	–	–	–	–	–	–	–	–
132		*P. tribacoides* Nyl.	F	–	–	–	–	–	–	1	–	–	–	–	–	–	–
Pyrenulaceae																	
133		*Pyrenula acutalis* R.C. Harris	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
134		*P. aggregata* (Fée) Fée	C	1	–	–	–	–	–	–	–	–	–	–	–	–	–
135		*P. anomala* (Ach.) Vain.	C	–	–	–	–	–	–	–	–	+	–	–	–	–	–
136		*P. approximata* Vain.	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
137		*P. arthoniotheca* Upreti	C	–	–	–	–	–	1		–	–	–	–	–	–	–
138		*P. aspistea* (Afz. ex Ach.) Ach.	C	–	–	–	–	–	1	2	–	–	–	–	–	–	–
139		*P. brunnea* Fée	C	–	1	–	–	–	–	–	–	–	–	–	–	–	–
140		*P. cayennensis* Müll. Arg.	C	–	1	–	–	–	–	–	–	–	–	–	–	–	–
141	**	*P. chlorospila* Arnold	C	1	1	–	–	–	–	–	–	–	–	–	–	–	–
142		*P. circumfinens* Vain.	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
143		*P. citriformis* R.C. Harris	C	–	–	–	1	–	–	–	–	–	–	–	–	–	–
144		*P. confinis* (Nyl.) R.C. Harris	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
145		*P. defossa* Müll. Arg.	C	–	–	–	–	1	–	–	–	–	–	–	–	–	–
146		*P. fuscoolivacea* Vain.	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
147		*P. glabrescens* Vain.	C	–	1	–	–	–	–	–	–	–	–	–	–	–	–
148		*P. introducta* (Stirton) Zahlbr.	C	–	1	–	–	–	–	–	–	–	–	–	–	–	–
149	*	*P. lamprocarpa* Müll. Arg.	C	–	1	–	–	–	–	–	–	–	–	–	–	–	–
150		*P. leucostoma*	C	–	–	2	1	–	–	–	–	–	–	–	–	–	–

		Ach.															
151		*P. leucotrypa* (Nyl.) Upreti	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
152		*P. macrospora* (Degel.) Coppins & P. James	C	–	–	–	–	–	1	–	–	–	–	–	–	–	–
153		*P. macularis* (Zahlbr.) R.C. Harris	C	–	–	1	–	–	–	–	–	–	–	–	–	–	–
154		*P. mamillana* (Ach.) Trevis.	C	–	–	–	–	–	–	–	+	–	–	–	–	–	–
155	*	*P. mastophora* (Nyl.) Müll. Arg.	C	–	–	–	–	–	1	–	–	–	–	–	–	–	–
156	@	*P. mastophoriza* (Nyl.) Zahlbr.	C	–	–	–	–	–	–	–	+	–	–	–	–	–	–
157		*P. mastophoroides* (Nyl.) Zahlbr.	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
158	*	*P. minor* Fée	C	–	–	–	–	–	–	–	–	–	–	–	–	+	–
159		*P. nitida* (Weigel) Ach.	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
160		*P. nodulata* (Stirton) Zahlbr.	C	–	–	–	–	1	–	–	–	–	–	–	–	–	–
161		*P. oculata* A. Singh & Upreti	C	1	–	–	–	–	–	–	–	–	–	–	–	–	–
162		*P. oxysporiza* Zahlbr.	C	–	–	–	1	–	–	–	–	–	–	–	–	–	–
163		*P. pinguis* Fée	C	–	–	–	–	–	–	–	–	+	–	–	–	–	–
164		*P. quassiicola* Fée	C	1	–	–	–	–	–	–	–	–	–	–	–	+	–
165		*P. scutata* (Stirt.) Zahlbr.	C	–	–	–	–	–	–	–	–	–	–	–	–	–	+
166	@	*P. subacutalis* Upreti	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
167		*P. subducta* (Nyl.) Müll. Arg.	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
168		*P. subglabriuscula* Vain.	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
169		*P. subindica* Upreti	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
170		*P. submastophora* A. Singh & Upreti	C	–	–	–	–	–	1	–	–	–	–	–	–	–	–

171		*P. sublaevigata* (Patw. & Makhija) Upreti	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
172		*P. thelomorpha* Tuck.	C	–	1	–	–	–	–	–	–	–	–	–	–	+	–
173	*	*P. welwitschii* (Upreti & Ajay Singh) Aptroot	C	–	4	–	–	–	–	1	–	–	–	–	–	–	–
174		*P. wrightii* (Müll. Arg.) R.C. Harris	C	–	–	–	–	1	–	–	–	–	–	–	–	–	–
175		*P. zeylanica* Upreti & Ajay Singh	C	–	–	–	–	–	–	–	–	–	+	–	–	–	–
Ramalinaceae																	
176		*Bacidia alutacea* (Krempeth) Zahlbr.	C	–	–	–	1	–	–	–	–	–	–	–	–	–	–
177		*B. convexula* (Müll. Arg.) Zahlbr.	C	1	1	–	–	–	–	–	–	–	–	–	+	–	–
178		*B. millegrana* (Taylor) Zahlbr.	C	–	–	–	–	–	1	–	–	–	–	–	–	–	–
179	*	*B. personata* Malme	C	–	–	–	–	–	–	1	–	–	–	–	–	–	–
180		*B. rubella* (Hoffm.) A. Massal.	C	–	–	–	–	1	–	1	–	–	–	–	–	–	–
181		*B. submedialis* (Nyl.) Zahlbr.	C	1	–	–	–	–	–	1	–	–	–	–	–	–	–
182		*Bacidina medialis* (Tuck ex Nyl.) Kistenich, Timdal, Bendiksby & S. Ekman	C	1	–	–	–	–	–	–	–	–	–	–	–	–	–
Roccellaceae																	
183		*Enterographa mesomela* Sparrius, Saipunk. & Wolseley	C	–	–	–	–	1	–	–	–	–	–	–	+	–	–
Taxa incertaesedis																	
184		*Synarthonia inconspicua*	C	–	–	2	1	1	–	2	–	–	–	–	–	–	–

		(Stirt.) Van den Broeck & Ertz															
Teloschistaceae																	
185		*Oxneriopsis bassiae* (Ach.) S.Y. Kondr., Upreti & Hur	C	–	–	–	–	–	–	–	–	–	+	–	–	–	–
Trichotheliaceae																	
186	*	*Clathroporina mastoidea* (Ach.) R. C. Harris	C	–	–	–	–	–	–	–	+	–	–	–	–	–	–
187		*Porina belanospora* (Nyl.) Müll. Arg.	C	–	–	–	–	1	–	–	–	–	–	–	–	–	–
188		*P. bellendenica* Müll. Arg.	C	–	–	–	–	–	1	–	–	–	–	–	–	–	–
189	*	*P. effilata* M. Brand & Sérus.	C	–	–	–	–	1	–	–	–	–	–	–	–	–	–
190		*P. interestes* (Nyl.) Harm.	C	–	–	–	–	1	–	–	–	–	–	–	–	–	–
191		*P. internigrans* (Nyl.) Müll. Arg.	C	1	–	–	–	–	–	–	–	–	–	–	–	–	–
192		*P. subhibernica* Upreti	C	–	–	–	–	–	–	–	+	–	–	–	–	–	–
Trypetheliaceae																	
193		*Astrothelium pupula* (Ach.) Aptroot & Lücking	C	1	–	–	–	–	–	–	–	–	–	–	–	–	–
194		*Nigrovothelium tropicum* (Ach.) Lücking, M.P. Nelsen & Aptroot	C	–	–	–	–	–	–	–	–	–	–	–	+	–	–
195		*Trypethelium eluteriae* Spreng.	C	3	1	–	–	–	–	3	–	+	–	+	+	+	–
196	*	*Viridothelium virens* (Tuck. ex E. Michener) Lücking, M.P. Nelsen & Aptroot	C	–	–	–	–	–	–	–	–	+	–	–	–	–	–

** = New to India, * = new to Assam, @ = endemic to Indian region, GF: Growth form, C: Crustose, F: Foliose, L: Leprose, + = present, – = absent, Alok: Alokjhari, BFG: Bilashipara

florican garden, CDP: Chandor dinga pahar, GMH: Gauripur matiabag hawakhana, PTG: Panbari tea garden, S: Satrasal, STC: South Tokrerchara Pt-IV

Gupta and Sinha (2018) reported seven species from the district. On comparison with the present study it was observed that four of the species are common and therefore the district records a total of 199 lichen species. Differential and distribution of lichens is due to preference of particular microhabitat (Vinayaka 2016). Dhubri district falls under Tropical Moist Deciduous Forests of Assam (Gupta and Sinha 2018). Other regions of India including Assam is also dominated by crustose lichen. Climatic regimes such as rainfall, humidity, exposure, temperature of the regions where the lichens grow are responsible for the development and maintenance of lichen species. The metabolic activities of lichens are dependent on the moisture content of the thallus. The vegetation of the district is deciduousness with high light intensity and open canopy and these conditions are suitable for the growth of crustose and grey thallus coloured foliose lichens such as *Dirinaria*, *Parmotrema*, *Physia* and *Pyxine*. The district has no records of fruticose lichens as they love to grow in moderate to cold temperate regions. Cold wind, texture and chemical composition of the substratum are also responsible for the healthy growth of the lichen species (Kumar 2000). The specific habitat which is appropriate for lichens growth depends from the results of combination of temperature and humidity (Pitakpong 2015).

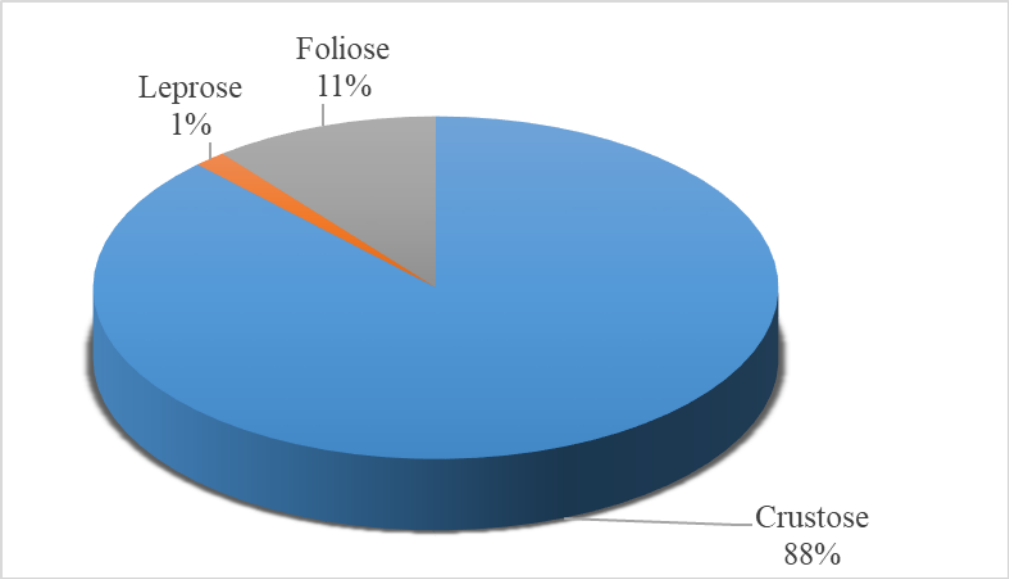

Fig 4.1: Percentile representation of lichen growth forms in the district

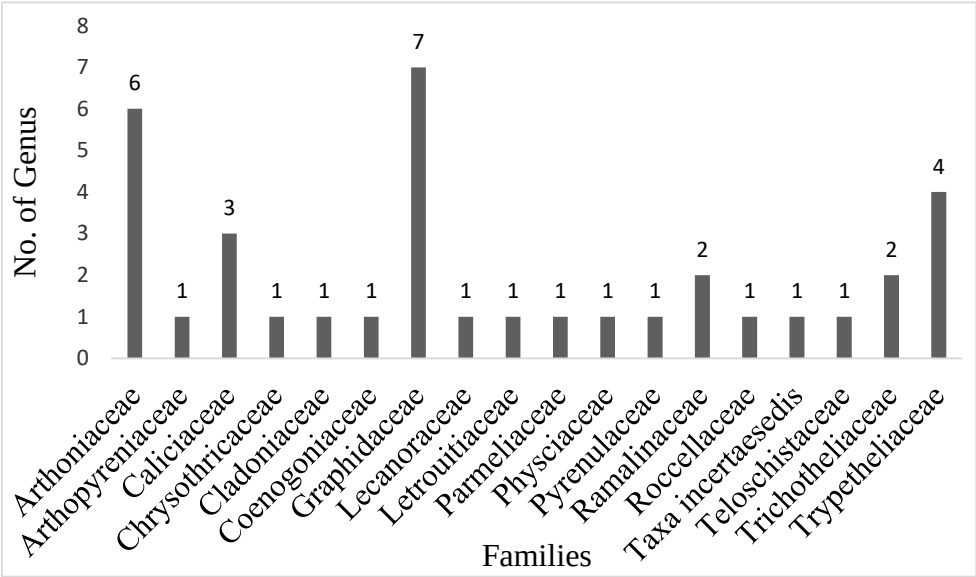

Fig 4.2: Graphical presentation of the lichen Genera under different Families

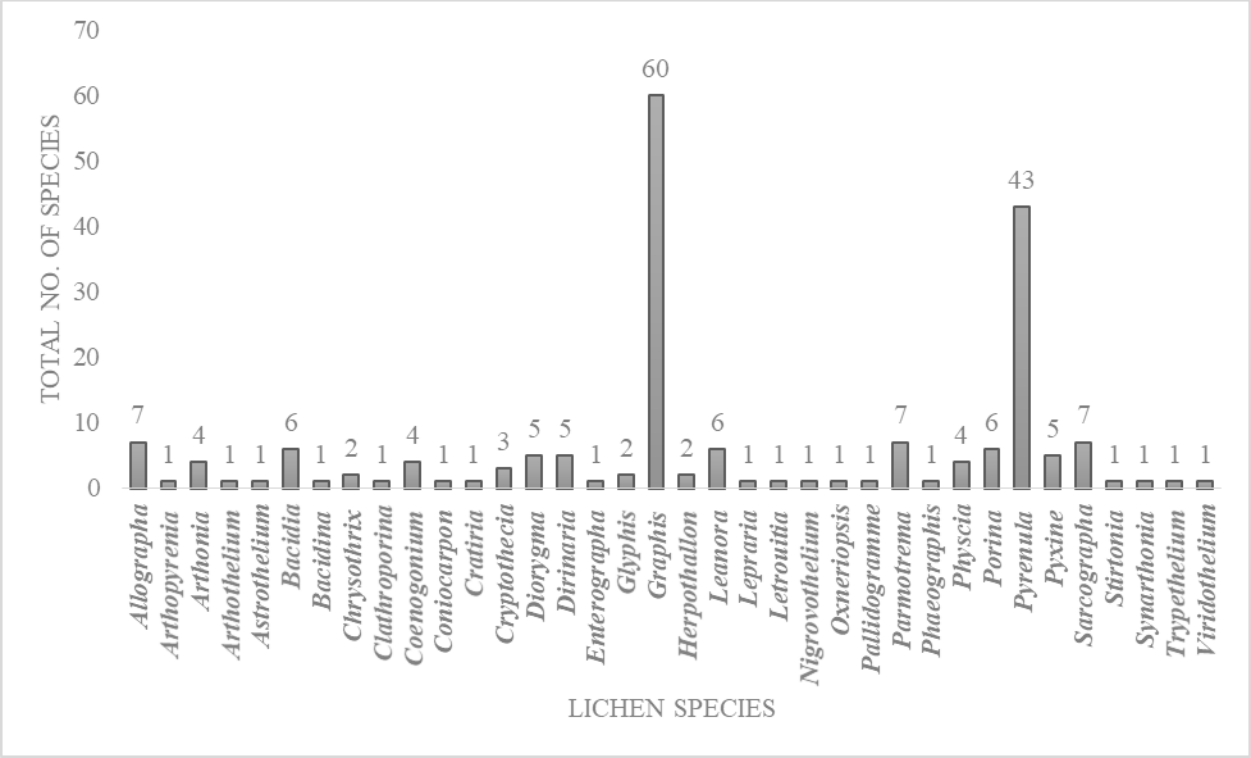

Fig 4.3: Graphical presentation of the lichen species under different genera

The results revealed that the family, Graphidaceae with 7 genera and 83 species dominates the district followed by Pyrenulacae with the genus *Pyrenula* and 43 species. The genus *Graphis* under Graphidaceae dominated the area with 60 species followd by *Pyrenula* with 43 species. As per the compilation of the published data on lichens from Assam state, the family Graphidaceae dominates the region followed by Arthoniaceae and amongst the genera, *Graphis* followed by *Pyrenula* dominates the region (Gupta and Sinha 2018).

The family Graphidaceae is expected to comprise more than 3500 species worldwide (Lücking *et al.* 2014) of which *Graphis* remain the largest genus (Lücking *et al*. 2009). A total of 390 species of *Graphis* have been reported worldwide (Lücking *et al*. 2016) and 115 species from India (Gupta and Sinha 2018), 70 species from Assam (Gogoi *et al*. 2022a) and at present the number could be more due to more exploration. In total 22 genera and 107 species of Graphidaceous lichen are reported by Gupta and Sinha (2018) from Assam. From the present study, it is apparent that the district is enriched with Graphidaceous lichen. The district is dominated by deciduous type of vegetation and the bark of these trees readily supports the growth of *Graphis*

spp. So, at present the total number of species under *Graphis* increases upto 60 for Dhubri district.

Similarly, a total of 745 species of *Pyrenula* is reported globally (Aptroot 2012) and 83 species from India (Mishra *et al*. 2020). *Pyrenula* and pyrenulaceae are the dominant genera and family among the pyrenocarpous lichens (Mishra *et al*. 2020; Rajaprabu *et al*. 2021). *Pyrenula* is the 2nd largest genus of the district with 43 species. Warm and moist climatic conditions of the Eastern Himalaya including Assam favours rich diversity of Pyrenocarpous lichens with about 295 species (Mishra *et al*. 2020). Members of the pyrenocarpous lichens inhabit bark of trees, rocks, soil and leaves. These lichens grow luxuriantly on trees having smooth and shaded barks. Most species of the genus prefers to grow on the smooth bark of *Alnus*, *Quercus* and *Ficus* species (Ingle *et al*. 2018). In the present study, majority of the species were found growing on the smooth bark of *Lannea* sp. and few species on the bark of *Artocarpous* sp., *Mangifea* sp., *Michelia* sp., *Polyalthia* sp. and *Ricinus* sp. An extensive study on *Pyrenula* from India was made by Upreti (1990, 1991a, 1991b, 1992, 1993) whereby he reported several new records. Jagadesh Ram *et al.* (2005) reported *Pyrenula subcylindrica* Jagadesh & Upreti as new species to Science from India. In India maximum diversity of the genus is reported from the Western Ghats and the Eastern Himalayan Region (Mishra *et al*. 2020, Rajaprabu *et al*. 2021). Gogoi *et al.* (2022a) enlisted 72 species of *Pyrenula* from Assam and with this the number of species becomes 77.

From the family Arthoniaceae, the species *Herpothallon himalayanum* was reported as new to science from West Begal and endemic to Indian region (Jagadeesh Ram and Sinha 2009). Bungartz *et al.* (2013) reported nine different species of *Herpothallon* and *Cryptothecia* from the Galapagos Island, three of which were new to science. Thallus of both the genus, *Herpothallon* and *Cryptothecia* are very similar with cottony- byssoid growth form, indistinct ascomata but differ in position of the ascomata.

Four species of *Stirtonia* have already been reported from Assam (Gogoi *et al*. 2022a) and with the addition of *Stirtonia macrocarpa* from the present study, it become five. Morphologically, the species *Pyxine* resembles *Dirinaria* but differs in the presence of rhizines. Dominance of graphidaceous and pyrenocarpous lichen in the district, resembles that of lichen reported from Southern part of Assam (Rout *et al.* 2010).

The genus *Viridothelium virens* is recorded as a new record of lichen biota to Assam from Dhubri district while *V. solomonense* Aptroot as a new record to Andaman and Nicobar Island. *V. virens* is the type specimen of *V. solomonense* (Niranjan and Sarma 2018).

It is evident from the literatures that 20 out of 35 districts have been explored either sporadically or extensively for lichen diversity (Behera *et al*. 2021; Gupta and Sinha 2018).

New record of lichens from the district to Assam is 28 species. The species new to Assam are viz. *Allographa stictilabiata* (Patw. & C.R. Kulk.) J. Kalb & Kalb; *Bacidia personata* Malme; *Clathroporina mastoidea* (Ach.) R. C. Harris; *Diorygma reniforme* (Fée) Kalb, Staiger & Elix; *Graphis analoga* Nyl.*; G. argentia* Makhija & Adaw.; *G. asahinae* Patw. & C.R. Kulk.; *G. bakeri* Vain.; *G. consimilis* Vain.; *G. eburnea* Adaw. & Makhija*; G. modesta* Zahlbr.**;** *G. nematoides* Leight.; *Herpothallon himalayanum* Jagad. Ram & G.P. Sinha; *Phaeographis manipurensis* Müll. Arg.; *Lecanora insignis* Degel.; *L. leproplaca* Zahlbr.; *Lepraria incana* (L.) Ach.*; Physcia abuensis* D.D. Awasthi & S. R. Singh*; P. aipolia* (Ehrh. Ex Humb.) Fürnr.*; P. alba* (Fée); *Pyrenula lamprocarpa* Müll. Arg.; *P. mastophora* (Nyl.) Müll. Arg.; *P. minor* Fée; *P. welwitschii* (Upreti & Ajay Singh) Aptroot*; Pyxine isidiophora* (Müll. Arg.) Imshaug; *Porina effilata* Brand & Sérus.; *Stirtonia macrocarpa* Makhija & Patw. and *Viridothelium virens* (Tuck & Michener) Lücking, M.P. Nelsen & Aptroot. Among these 23 crustose species, four foliose and one leprose species. Majority of the new records are from crustose growth form.

A total 15 species of lichen are new record to India, viz. *Allographa fujianensis* (Z. F. Jia & J. C. Wei) Lücking & Kalb; *Arthonia fissurinella* Nyl.; *Coenogonium bacilliferum* (Malme) Lücking, Aptroot & Sipman; *C. pineti* (Ach.) Lücking & Lumbsch; *C. subdilutum* (Malme) Kalb; *C. wrightii* (Vězda) H. Harada & Lumbsch; *Diorygma roseopruinatum* Popong, Lücking & Parnmen; *Graphis arbusculaeformis* (Vain.) Lücking; *G. dracaenae* Vain.; *G. emersa* Müll. Arg.*; G. enteroleuca* (Ach.) Lücking; *G. immersicans* A.W. Archer; *G. litoralis* Lücking, Sipman & Chaves; *G. luluensis* A. W. Archer and *Pyrenula chlorospila* Arnold. All the new records to India are crustose lichens.

A total 15 species are endemic to Indian regions viz. *Allographa stictilabiata* (Patw. & C.R. Kulk.) J. Kalb & Kalb; *Arthonia recedens* Stirt.; *Arthothelium confertum* (A.L. Smith) Makh. & Patw.; *Arthopyrenia subvelata* (Nyl.) R. C. Harris; *Cryptothecia verruculifera* Jagad. Ram, G.P. Sinha & Kr. P. Singh; *Herpothallon himalayanum* Jagad. Ram & G.P. Sinha; *Glyphis duriuscula*

Stirt.; *Graphis ajarekarii* Patw. & C.R. Kulk.; *G. argentia* Makhija & Adaw.; *G. coarctata* Stirt.; *G. distincta* Makhija & Adaw.*; Phaeographis manipurensis* Müll. Arg.; *Physcia abuensis* D.D. Awasthi & S. R. Singh; *Pyrenula mastophoriza* (Nyl.) Zahlbr. and *P. subacutalis* Upreti of which 14 are crustose and one foliose lichen. Summing up of the present findings on lichen diversity with the previously reported data, the lichen biota of Assam comprises 732 species under 146 genera 41 families. Therefore this will help to understand the lichen diversity better and give the correct status of the state.

4.1.1 ECOLOGICAL PARAMETERS:

4.1.1.1 Alpha diversity (α)

All the studied grids have rich diversity of lichen species (**Fig 4.4**). Grid N had the maximum diversity with 60 species followed by grids A and L with 50 species each. Grid H and G had the least member with 32 and 33 species respectively.

Grids N and L are situated near the river Champabati.

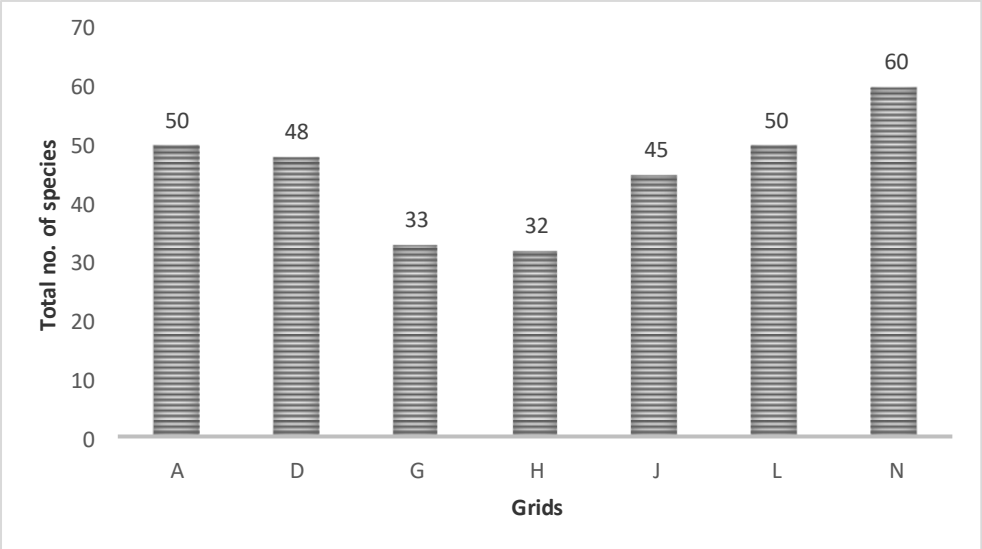

Fig 4.4: Diversity of lichens in the studied grids

All the villages had almost the same number of lichen species and Kismat hasdaha pt-II harboured the highest lichen diversity with 21 species followed by South Tokrerchara pt-IV with 20 species and Dhubri town, Falimari and Bhelupara pt-II with 18 species each. However,

Gauripur Matiabag Hawakhana, Chandor Dinga Pahar and Khajurbari pt-I had the least number of lichen with 7, 8 and 9 species respectively **(Table 4.2)**.

Table 4.2: Number of lichen species in each sampling sites

Grids	Sl. no.	Name of the villages	Total no. of lichen species
A	1	Chagolia pt-I	12
	2	Kherbari pt-II	14
	3	Bidyadabri pt -V	14
	4	kaldoba pt- III	15
	5	Barobaluchar (Uttar maragadadhar)	17
D	6	Uchita	13
	7	Pub- gaikhowa pt-I	13
	8	Debotar hasdaha pt-IV	16
	9	Dumardaha pt-II	10
	10	Kismat hasdaha pt-II	21
G	11	Chagolchara pt-III	14
	12	Dhubri town	18
	13	Khalilpur	12
H	14	Rangamati pt-III	14
	15	Gauripur town	13
	16	Alomganj pt-IX	15
J	17	Bhalukmari	14
	18	Pataner kuti	16
	19	Khajurbari pt-I	9
	20	Fakiranir jhar pt-I	12
	21	Ananda nagar	14
L	22	Bhasani goan	17
	23	Hatipota pt-II	13
	24	Jamduar pt-I	12
	25	Gopigoan pt-III	15
	26	Gourangtari pt-II	13
N	27	Falimari	18
	28	Sreegram pt-III	13
	29	Bhelupara pt-II	18
	30	Brahmin para	17
	31	Arear jhar pt-II	14
Additional sampling sites			
L	32	Alokjhari	14

G	33	Bilashipara Florican Garden	15
N	34	Chandor Dinga Pahar	8
F	35	Gauripur Matiabag Hawakhana	7
G	36	Panbari tea garden	17
B	37	Satrasal	13
D	38	South Tokrerchara pt-IV	20

Climatic conditions, pH of the porophyte or the substratum, moisture contents, texture and stability, circumference of the tree, bark crevice depth influences the growth of the lichen species (Pitakpong 2015). Although lichens are abundant in the vegetation, only a small section of tree species essentially sheltered lichens on tree trunks. Number of lichen colonies and the pH of the bark is positively related and this relationship is significant (Vinayaka 2016).

So, phorophyte or substratum preference is also an important factor in lichen ecology as it plays an important role in forest ecosystems. In the present study a total of 35 plant species have been reported to support the 196 lichen species of which *Lannea* sp. supported highest lichen species (84 species) followed by *Artocarpus heterophyllus* (39 sp.), *Michelia champaca* (38 sp.) and *Averrhoa* sp., *Elaeocarpus* sp., *Ficus* sp., *Spondias* sp. had the least number of lichen each with one species. In different climatic regimes preference of phorophyte by the epiphytic lichens differs even though, the same phorophytes are present because the bark characteristics of trees vary depending on the forest types and altitude (Vinayaka 2016).The canopy of the forest also matters where it is observed that the closed canopy forests supports less lichen diversity than open canopy forests (Vinayaka *et al.* 2011). In India, Assam is one of the states contributing enormously to lichen biota and other related studies.

4.1.1.2 Beta diversity:

All the sampling grids have almost similar values of β- diversity **(Table 4.3)** which specifies that the species diversity in all the sampling grids were almost similar. However it was slightly higher for GD-GH meaning they have low level of similarity while the beta diversity between GH-GL; GJ-GL were lower that indicates high level of similarity.

The study revealed that all the grids are rich in lichen diversity. The similarity among the different grids may be due to similar climatic conditions and suitable habitat.

All the sampling grids have almost similar Whittaker's β- diversity **(Table 4.3)** which specifies that the diversity of lichen species are almost similar in all the sampling quadrates.

Table 4.3: Whittaker's β- diversity between the grids studied

	GA	GD	GG	GH	GJ	GL	GN
GA	1.00						
GD	0.72	1.00					
GG	0.78	0.76	1.00				
GH	0.72	0.85	0.76	1.00			
GJ	0.71	0.80	0.78	0.76	1.00		
GL	0.75	0.80	0.82	0.67	0.67	1.00	
GN	0.78	0.83	0.81	0.72	0.76	0.77	1.00

4.1.1.3 Frequency and Abundance:

Frequency and abundance of the identified lichen species from different sampling grids are listed **(Table 4.4)**. Abundance of the species, *Pyxine cocoes* (10.85) was highest followed by *P. reticulata* (5.00), *Lecanora helva* (4.85), *Parmotrema saccatilobum* (4.00) and *Dirinaria applanata* (4.00). Other species ranged from 1-3.16. Frequency ranged from 14.28-85.71%. Frequency for *Dirinaria applanata*, *D. consimilis*, *D. picta*, *Lecanora helva* and *Pyxine cocoes* were 100% meaning these species are the most frequently found in the study sites.

Table 4.4: Frequency and abundance of the individual lichen species

Sl no.	Species	Frequency	Abundance
1	*Allographa fujianensis*	14.28	1
2	*Allographa hossei*	28.57	1
3	*Allographa malacodes*	57.14	2.25
4	*Allographa rhizicola*	28.57	1
5	*Allographa sayeri*	14.28	1
6	*Allographa xanthospora*	42.85	2.33
7	*Arthopyrenia subvelata*	14.28	1
8	*Arthonia collectiva*	14.28	1
9	*Arthonia dispersula*	14.28	1
10	*Arthonia fissurinella*	14.28	1
11	*Arthonia recedens*	14.28	1
12	*Arthothelium confertum*	14.28	1
13	*Astrothelium pupula*	14.28	1

14	*Bacidia alutacea*	14.28	1
15	*Bacidia convexula*	28.57	1
16	*Bacidia millegrana*	14.28	1
17	*Bacidia personata*	14.28	1
18	*Bacidia rubella*	28.57	1
19	*Bacidia submedialis*	28.57	1
20	*Bacidina medialis*	14.28	1
21	*Chrysothrix candelaris*	14.28	2
22	*Coenogonium bacilliferum*	14.28	1
23	*Coenogonium subdilutum*	14.28	1
24	*Coenogonium wrightii*	14.28	1
25	*Coniocarpon cinnabarinum*	85.71	3.16
26	*Cratiria lauricassiae*	14.28	1
27	*Cryptothecia lunulata*	28.57	1
28	*Cryptothecia subtecta*	28.57	1
29	*Cryptothecia verruculifera*	14.28	1
30	*Diorygma hieroglyphicum*	28.57	1.5
31	*Diorygma junghuhnii*	57.14	1.25
32	*Diorygma reniforme*	14.28	1
33	*Diorygma roseopruinatum*	14.28	1
34	*Diorygma soozanum*	42.85	1.66
35	*Dirinaria aegialita*	14.28	1
36	*Dirinaria applanata*	100	**4**
37	*Dirinaria consimilis*	100	**5**
38	*Dirinaria papillulifera*	42.85	2.33
39	*Dirinaria picta*	100	2.28
40	*Enterographa mesomela*	14.28	1
41	*Glyphis cicatricosa*	57.14	1.5
42	*Glyphis duriuscula*	14.28	1
43	*Graphis ajarekarii*	14.28	3
44	*Graphis alboglaucescens*	14.28	1
45	*Graphis analoga*	14.28	**5**
46	*Graphis aperiens*	28.57	1
47	*Graphis arbusculaeformis*	14.28	2
48	*Graphis arecae*	14.28	2
49	*Graphis argentia*	42.85	1.66
50	*Graphis asahinae*	42.85	2.33
51	*Graphis bakeri*	14.28	1
52	*Graphis caesiella*	28.57	1

53	*Graphis caesiocarpa*	42.85	1
54	*Graphis capillacea*	71.42	1.4
55	*Graphis cervina*	42.85	1.33
56	*Graphis cervinonigra*	14.28	1
57	Graphis cinnamomea	14.28	1
58	*Graphis cincta*	28.57	1.5
59	*Graphis conferta*	28.57	1.5
60	*Graphis consimilis*	14.28	1
61	*Graphis crebra*	14.28	1
62	*Graphis cremicolor*	14.28	1
63	*Graphis dendrogramma*	42.85	2.33
64	*Graphis distincta*	14.28	1
65	*Graphis dracaenae*	14.28	1
66	*Graphis eburnea*	14.28	2
67	*Graphis emersa*	14.28	1
68	*Graphis enteroleuca*	28.57	1
69	*Graphis epimelaena*	28.57	1
70	*Graphis ficicola*	14.28	1
71	*Graphis furcata*	85.71	1.33
72	*Graphis glaucescens*	57.14	1.75
73	*Graphis handelii*	14.28	1
74	*Graphis hyphosa*	42.85	1.33
75	*Graphis immersella*	42.85	2.33
76	*Graphis immersicans*	28.57	1
77	*Graphis intermediella*	14.28	1
78	*Graphis leptocarpa*	42.85	1
79	*Graphis librata*	14.28	2
80	*Graphis lineola*	71.42	1
81	*Graphis luluensis*	14.28	1
82	*Graphis modesta*	85.71	1.33
83	*Graphis nematoides*	14.28	1
84	*Graphis palmicola*	14.28	2
85	*Graphis pertricosa*	28.57	1
86	*Graphis pinicola*	14.28	1
87	*Graphis plumierae*	14.28	1
88	*Graphis prunicola*	14.28	1
89	*Graphis pyrrhocheiloides*	85.71	1.5
90	Graphis *renschiana*	28.57	1
91	*Graphis riopiedrensis*	71.42	2.4

92	*Graphis scripta*	85.71	1.5
93	*Graphis stipitata*	14.28	1
94	*Graphis subasahinae*	42.85	1.33
95	*Graphis submarginata*	28.57	1
96	*Graphis sulphurella*	14.28	3
97	*Graphis sundarbanensis*	71.42	1.8
98	*Graphis supracola*	14.28	1
99	*Herpothallon himalayanum*	57.14	2.75
100	*Lecanora helva*	100	**4.85**
101	*Lecanora leprosa*	14.28	1
102	*Lecanora tropica*	14.28	1
103	*Lepraria incana*	28.57	2
104	*Letrouitia transgressa*	14.28	1
105	*Pallidogramme divaricoides*	14.28	1
106	*Parmotrema crinitoides*	14.28	1
107	*Parmotrema disparile*	14.28	1
108	*Parmotrema mesotropum*	28.57	1
109	*Parmotrema praesorediosum*	14.28	1
110	*Parmotrema saccatilobum*	14.28	**4**
111	*Parmotrema tinctorum*	14.28	1
112	*Parmotrema tsavoense*	14.28	1
113	*Phaeographis manipurensis*	14.28	1
114	*Physcia abuensis*	14.28	1
115	*Physcia aipolia*	14.28	1
116	*Physcia alba*	14.28	1
117	*Physcia tribacoides*	14.28	1
118	*Porina belanospora*	14.28	1
119	*Porina bellendenica*	14.28	1
120	*Porina effilata*	14.28	1
121	*Porina interestes*	14.28	1
122	*Porina internigrans*	14.28	1
123	*Pyrenula acutalis*	14.28	1
124	*Pyrenula aggregata*	14.28	1
125	*Pyrenula approximata*	14.28	1
126	*Pyrenula arthoniotheca*	14.28	1
127	*Pyrenula aspistea*	28.57	1.5
128	*Pyrenula brunnea*	14.28	1
129	*Pyrenula cayennensis*	14.28	1
130	*Pyrenula chlorospila*	28.57	1

131	*Pyrenula circumfinens*	14.28	1
132	*Pyrenula citriformis*	14.28	1
133	*Pyrnula confinis*	14.28	1
134	*Pyrenula defossa*	14.28	1
135	*Pyrenula fuscoolivacea*	14.28	1
136	*Pyrenula glabrescens*	14.28	1
137	*Pyrenula introducta*	14.28	1
138	*Pyrenula lamprocarpa*	14.28	1
139	*Pyrenula leucostoma*	28.57	1.5
140	*Pyrenula leucotrypa*	14.28	1
141	*Pyrenula macrospora*	14.28	1
142	*Pyrenula macularis*	14.28	1
143	*Pyrenula mastophora*	14.28	1
144	*Pyrenula mastophoroides*	14.28	1
145	*Pyrenula nitida*	14.28	1
146	*Pyrenula nodulata*	14.28	1
147	*Pyrenula oculata*	14.28	1
148	*Pyrenula oxysporiza*	14.28	1
149	*Pyrenula quassicola*	14.28	1
150	*Pyrenula subacutalis*	14.28	1
151	*Pyrenula subducta*	14.28	1
152	*Pyrenula subglabriuscula*	14.28	1
153	*Pyrenula subindica*	14.28	1
154	*Pyrenula submastophora*	14.28	1
155	*Pyrenula sublaevigata*	14.28	1
156	*Pyrenula thelomorpha*	14.28	1
157	*Pyrenula welwitschii*	28.57	2.5
158	*Pyrenula wrightii*	14.28	1
159	*Pyxine cocoes*	100	**10.85**
160	*Pyxine coralligera*	14.28	3
161	*Pyxine isidiophora*	14.28	1
162	*Pyxine reticulata*	57.14	**5**
163	*Pyxine sorediata*	14.28	1
164	*Sarcographa glyphiza*	14.28	1
165	*Sarcographa heteroclita*	14.28	1
166	*Sarcographa intricans*	14.28	1
167	*Sarcographa labyrinthica*	71.42	1.4
168	*Sarcographa maculosa*	14.28	1
169	*Sarcographa tricosa*	28.57	1.5

170	*Synarthonia inconspicua*	57.14	1.5
171	*Trypethelium eluteriae*	42.85	2.33

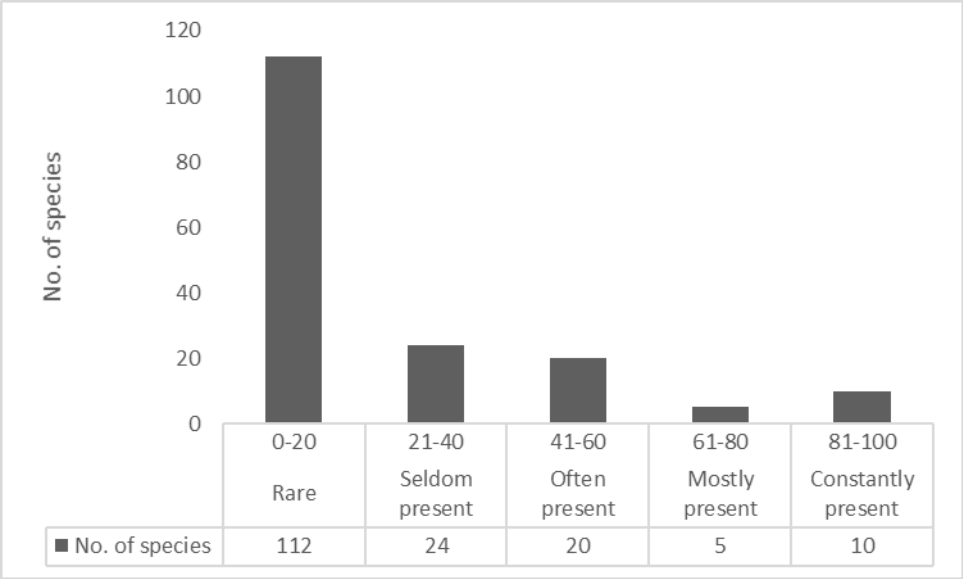

Fig 4.5: **Raunkiaer's classes of frequency of the identified lichen species**

Raunkiaer's classes of frequency of the identified lichen species revealed that only ten of the total species are constantly present and majority of the species are rare. It was observed that *Pyxine cocoes* under caliciaceae is constantly present and most abundant in the study area. Other members of caliciaceae viz. *Dirinaria applanata*, *D. consimilis*, *D. picta* and *Pyxine reticulata*, and a member from Lecanoraceae i.e. *Lecanora helva* was observed to dominate the trees and grow luxuriantly. Although the area is dominated by crustose lichens but members of foliose lichens under caliciaceae family were frequently encontered and were the most abundant species. This is due to the reason that these species are generally tolerant to air pollution. These species are therefore selected by many workers for biomonitoring studies.

4.1.2 TAXONOMIC TREATMENT OF THE IDENTIFIED LICHEN SPECIES

***Allographa* Chevall. in Hist. Graphidées, 3, 1824. (Family: Graphidaceae)**

Thallus crustose, whitish grey; apothecia prominent lirellae, pigmented, mostly massively carbonized; ascospores large, colourless, secondary substances sometimes absent. The genus was earlier treated as *Graphis* but later lichenologists Kalus Kalb and Robert Lücking (2018) segregated it as independent genus *Allographa*.

Key to the species

1a. Exciple non-carbonized.....*A.stictilabiata*

1b. Exciple carbonized.....2

2a. Exicple apically carbonized.....3

2b. Exicple not apically carbonized.....5

3a. Disc pruinose.....4

3b. Disc epruinose.....*A. malacodes*

4a. Ascospores 48–50× 5–6 µm.....*A. sayeri*

4b. Ascospores 28–29× 4–6 µm.....*A. xanthospora*

5a. Exciple laterally carbonized .....*A. hossei*

5b. Exciple completely carbonized 6

6a. Ascospores transversely septate .....*A. rhizicola*

6b. Ascospores muriform .....*A. fujianensis*

1. ***Allographa fujianensis*** (Z. F. Jia & J. C. Wei) Lücking & Kalb in Herzogia 31(1, 2): 550, 2018. Plate 1 (a)

Basionym: *Graphis fujianensis* Z.F. Jia & J.C. Wei in Mycotaxon 104: 107, 2008.

Description: Thallus crustose, grey, smooth surface, corticated; apothecia lirellate, prominent, branched, lacking or basal thaline margin, disc concealed, black, labia entire, epruinose; excipulum completely carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, muriform, I+ blue, 22–23× 5.3–5.5 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: stictic acid present.

Distribution: China.

Specimen examined: INDIA: Assam, Dhubri district, **Brahmin para**, on the bark of *Artocarpus heterophyllus*, 25.12.2020, alt. 40.53 m, 26°24′785″ N, 90°32′690″ E, Suparna Biswas & Pabitra Biswas, 2020-1222 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus* at an elevation of 40.53 m.

Remarks: The species resembles *G. yunanensis* S. Joshi, Upreti & Hur in having entire labia, completely carbonized exciple, muriform ascospores, and presence of stictic acid but differ in lirellae morphology, inspersed hymenium, presence of norstictic acid in *G. yunanensis*. This species is a new record to India. (Joshi *et al.* 2015; Lücking *et al.* 2009).

2. ***Allographa hossei*** (Vain.) Lücking & Kalb in Phytotaxa 377(1): 18, 2018. Plate 1 (b)

Basionym: *Graphis hossei* Vain. in Ann. Bot. Soc. Zool-Bot. fenn. Vanamo 1(3): 53, 1921.

Description: Thallus crustose, grey, smooth surface, corticated; apothecia lirellate, prominent, branched, basal thaline margin, disc concealed, black, labia entire, epruinose; excipulum laterally carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 10–12 septate, I+ blue, 50–55 × 7–8 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Arunachal Pradesh, Assam, Kerala, Nagaland, Tamil Nadu), Brazil, Colombia, Congo, Japan, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Dhubri town**, on the bark of *Michelia champaca*, 13.03.2021, alt. 18.25 m, 26°02′186″ N, 89°95′961″ E, Suparna Biswas & Pabitra Biswas, 2020-0882 (BUBH); **Debotar hasdaha Pt-IV**, on the bark of *Lannea* sp., 22.11.2020, alt. 32.21 m, 26°05′740″ N, 89°88′984″ E, Suparna Biswas & Pabitra Biswas, 2020-0883 (BUBH).

Ecology: The species is found growing on the bark of *Michelia champaca* and *Lannea* sp. at an elevation of 18.25 m to 32.21 m.

Remarks: The species is similar to *G. tenuis* Vain. and *G. nematodiza* Vain. with entire labia, lateral carbonization, hymenium clear, transverse ascospores and no chemical compounds but differs in smaller ascospores (Pitakpong 2015).

3. ***Allographa malacodes*** **(**Nyl.) Lücking & Kalb in Herzogia 31(1, 2): 553, 2018. Plate 1 (c)

Basionym: *Graphis malacodes* Nyl. in Bull. Soc. Iinn. Normandie, sér. 2 (2): 116, 1868.

Description: Thallus crustose, grey, smooth surface, apothecia lirellate, immersed to erumpent, apically thick complete thalline margin, irregularly branched, disc concealed, black, epruinose,

labia entire, excipulum apically carbonized, hymenium colourless, clear, paraphyses simple, asci 8–spored, ascospores colourless, transversely 7–9 septate, I+ blue, 32–34 × 3–4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam), Australia, Brazil, New Colombia.

Specimen examined: INDIA: Assam, Dhubri district, **Gopigoan Pt-III**, on the bark of *Neolamarckia cadamba*, 26.12.2020, alt. 40.76 m, 26°25′718″ N, 90°23′281″ E, Suparna Biswas & Pabitra Biswas, 2020-0594 (BUBH); **Gopigoan Pt-III**, on the bark of *Lannea* sp., 26.12.2020, alt. 35.31 m, 26°25′779″ N, 90°23′354″ E, Suparna Biswas & Pabitra Biswas, 2020-0623 (BUBH); **Bidyadabri Pt-V**, on the bark of *Artocarpus heterophyllus*, 21.11.2020, alt. 56.97 m, 26°26′118″ N, 89°77′379″ E, Suparna Biswas & Pabitra Biswas, 2020-0705 (BUBH); **Bidyadabri Pt-V**, on the bark of *Artocarpus heterophyllus*, 21.11.2020, alt. 40.24 m, 26°26′120″ N, 89°77′375″ E, Suparna Biswas & Pabitra Biswas, 2020-0776 (BUBH); **Ananda nagar**, on the bark of *Neolamarckia cadamba*, 24.12.2020, alt. 34.32 m, 26°22′742″ N, 90°21′685″ E, Suparna Biswas & Pabitra Biswas, 2020-0895 (BUBH); **Arear jhar Pt-I**, on the bark of *Shorea robusta*, 25.12.2020, alt. 30.70 m, 26°26′082″ N, 90°41′810″ E, Suparna Biswas & Pabitra Biswas, 2020-0915 (BUBH); **Ananda nagar**, on the bark of *Neolamarckia cadamba*, 24.12.2020, alt. 34.32 m, 26°22′742″ N, 90°21′685″ E, Suparna Biswas & Pabitra Biswas, 2020-0947 (BUBH); **Bidyadabri Pt-V**, on the bark of *Lannea* sp., 21.11.2020, alt. 43.57 m, 26°26′120″ N, 89°77′374″ E, Suparna Biswas & Pabitra Biswas, 2020-0959 (BUBH).

Ecology: The species is found growing on the bark of *Neolamarckia cadamba, Lannea* sp., *Artocarpus heterophyllus, Shorea robusta* at an elevation of 30.70 m to 56.97 m.

Remarks: *A. malacodes* is closely related to *G. intermediella* Stirt. but differ from it in having irregularly branched lirellae (Biju *et al.* 2014).

4. ***Allographa rhizicola*** (Fée) Lücking & Kalb in Phytotaxa 377 (1): 22, 2018. Plate 1 (d)

Basionym: *Opegrapha rhizicola* Fée in Essai Crypt. Exot. (Paris) 33, 1824.

Description: Thallus crustose, whitish grey, smooth surface; apothecia lirellate, branched, lacking thalline margin, disc concealed, epruinose, labia entire; excipulum completely carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 10–septate, I+ blue, 32–35 × 6.4–7.5 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Assam, Kerala, Meghalaya, Mizoram, Nagaland), Australia, Brazil, Chile, Colombia, Costa Rica, Dominica, Indonesia, Japan, Vanuatu, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Chagolia Pt-I**, on the bark of *Michelia champaca,* 21.11.2020, alt. 33.79 m, 26°29′160″ N, 89°78′146″ E, Suparna Biswas & Pabitra Biswas, 2020-0844 (BUBH); **Brahmin Para**, on the bark of *Neolamarckia cadamba*, 25.12.2020, alt. 43.85 m, 26°24′838″ N, 90°32′637″ E, Suparna Biswas & Pabitra Biswas, 2020-1376 (BUBH).

Ecology: The species is found growing on the bark of *Michelia champaca*, *Neolamarckia cadamba*, at an elevation of 33.79 m to 43.85 m.

Remarks: The species is closely resembles with *G. cervina* Müll. Arg. and *G. koreana* S. Jpshi Hur. with lirellae morphology short and sparsely branched but differ in ascospores size (Pitakpong 2015).

5. ***Allographa sayeri*** (Müll. Arg.) Lücking & Kalb in Herzogia 31(1, 2): 555, 2018. Plate 1 (e)

Basionym: *Graphis sayeri* Müll. Arg. in Flora, Regensburg 70: 401, 1887.

Description: Thallus crustose, grey to pale grey, smooth surface, corticated; apothecia lirellate, immersed to slightly emergent, apically thin thaline margin, branched, disc concealed, black, labia entire, pruinose; excipulum apically carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 10–septate, I+ blue, 48–50 × 5–6 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam, Kerala, Uttarakhand), Australia, Honduras, Mexico.

Specimen examined: INDIA: Assam, Dhubri district, **Kismat hasdaha Pt-II**, on the bark of *Artocarpus heterophyllus,* 22.11.2020, alt. 29.89 m, 26°05′039″ N, 89°89′315″ E, Suparna Biswas & Pabitra Biswas, 2020-0758 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus* at an elevation of 29.89 m.

Remarks: The species is similar to *G. epimelaena* and *A. xanthospora* but differ from *G. epimelaena* by concealed disc and from *A. xanthospora* by smaller ascospores (Archer 1999).

6. ***Allographa stictilabiata*** (Patw. & C.R. Kulk.) J. Kalb & Kalb in Phytotaxa, 332(2): 145, 2017. Plate 1 (f)

Basionym: *Graphina stictilabiata* Patw. & C.R. Kulk. in Biovigyanam, 5(1): 7, 1979.

Description: Thallus crustose, corticolous, whitish grey with black spots; apothecia lirellate, branched, disc narrow to concealed, ascomata semi-emergent, long upto 1–10 mm long; exciple non–carbonized, labia striate, paraphyses simple; ascus 1–spored, ascospores large, light brown, muriform, papillate, 91.7–125.5 × 20–30 μm.

Chemistry: Thallus K+ yellow, C−, P−, UV−, TLC: Stictic acid present.

Distribution: India (Karnataka and Maharashtra), Endemic.

Specimen examined: INDIA: Assam, Dhubri district, **Alokjhari**, on bark of *Shorea robusta*, 12.01.2020, alt. 52.82 m, 26°25′347″N, 89°86′044″ E, Suparna Biswas & Pabitra Biswas, 2020-0171 (BUBH), 61655 (LWG).

Ecology: The species is found growing on the bark of *Shorea robusta* at an elevation of 52.82 m.

Remarks: The species is endemic to Indian region and new record to Assam.

7. ***Allographa xanthospora*** (Müll. Arg.) Lücking & Kalb, in Phytotaxa 377(1): 29, 2018. Plate 2 (a)

Basionym: *Graphis xanthospora* Müll. Arg., in Bull.Herb. Biossier 3:320, 1895.

Description: Thallus crustose, grey, smooth surface, corticated; apothecia lirellate, immersed to erumpent, branched, apically thin thaline margin, disc concealed, black; excipulum apically carbonized, labia entire, pruinose, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 8–9 septate, I+ blue, 28–29× 4–6 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam), Australia, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Chagolia Pt-I**, on bark of *Artocarpus heterophyllus*, 21.11.2020, alt. 46.90 m, 26°29′212″N, 89°78′041″ E, Suparna Biswas & Pabitra

Biswas, 2020-0580 (BUBH); **Alokjhari,** on bark of *Shorea robusta*, 12.01.2020, alt. 46.61 m, 26°25′337″N, 89°86′400″ E, Suparna Biswas & Pabitra Biswas, 2020-0601 (BUBH), 61679 (LWG); **Bhasani goan**, on bark of *Lannea* sp., 26.12.2020, alt. 37.10 m, 26°30′143″N, 90°22′440″ E, Suparna Biswas & Pabitra Biswas, 2020-0613 (BUBH); **Bidyadabri Pt-V**, on bark of *Lannea* sp., 21.11.2020, alt. 46.39 m, 26°26′123″N, 89°77′378″ E, Suparna Biswas & Pabitra Biswas, 2020-0778 (BUBH); **Ananda nagar**, on bark of *Citrus* sp., 24.12.2020, alt. 34.65 m, 26°22′747″N, 90°21′690″ E, Suparna Biswas & Pabitra Biswas, 2020-0894 (BUBH); **Gopigoan Pt-III**, on bark of *Lannea* sp., 26.12.2020, alt. 36.16 m, 26°25′719″N, 90°23′332″ E, Suparna Biswas & Pabitra Biswas, 2020-0913 (BUBH); **Gopigoan Pt-III**, on bark of *Polyalthia longifolia*, 26.12.2020, alt. 39.78 m, 26°25′718″N, 90°23′281″ E, Suparna Biswas & Pabitra Biswas, 2020-0914 (BUBH); **Kherbari Pt-II**, on bark of *Aquilaria agallocha*, 21.11.2020, alt. 25.95 m, 26°25′631″N, 89°74′396″ E, Suparna Biswas & Pabitra Biswas, 2020-0964 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus, Shorea robusta, Lannea* sp., *Citrus* sp., *Polyalthia longifolia, Aquilaria agallocha,* at an elevation of 25.95 m to 46.90 m.

Remarks: The species is similar to *G. epimelaena and G. sayeri* but differ in having smaller ascospores (Archer 1999).

Arthopyrenia A. Massal. in Ric. Auton. Lich. Crost. (Verona): 165, 1852. (Family: Arthopyreniaceae)

Thallus crustose; ascocomata perithecia, ostiole erect, peridium brown to blackish brown; paraphyses branched, hymenium inspersed; asci 8–spored, ascospores colourless, 1–5 transverse septate, oval–ellipsoidal**.**

1. ***Arthopyrenia subvelata*** (Nyl.) R. C. Harris in Lichenogr. Thomsoniana, North American Lichenology in Honor of John W. Thomson (Ithaca): 147, 1998. Plate 2 (b)

Basionym: *Verrucaria subvelata* Nyl. in Expos. Synopt. Pyrenocarp.: 56, 1858.

Description: Thallus crustose, whitish, pruinose; ascomata perithecia hemispherical, dense, immersed, aggregated, black, peridium complete, ostiole straight; hymenium yellowish, immersed with oil droplets; ascus 8–spored, ascospores colourless, oblong, transversely 3–septate, 28–29× 9–10 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam, Odisha, Pondicherry) endemic.

Specimen examined: INDIA: Assam, Dhubri district, **Kaldoba**, on the bark of *Mallotus* sp., 21.11.2020, alt. 32.91 m, 26°19′873″ N, 89°77′094″ E, Suparna Biswas & Pabitra Biswas, 2020-0573 (BUBH).

Ecology: The species is found growing on the bark of *Mallotus* sp., at an elevation of 32.91 m.

Remarks: The species is similar to *P. pupula* but differ by having white thallus and hemispherical perithecia. The species is endemic to Indian region (Gupta and Sinha 2018).

***Arthonia* Ach. in Neues J. Bot. 1:3, 1806. (Family: Arthoniaceae)**

Thallus crustose, corticolous, foliicolous, ecorticated; ascomata true apothecia, disc red- brown to black, sometimes pale or white pruina; excipulum absent, paraphysoides branched; asci 2–8 spored, ascospores colourless, or brown, 1–11 transverse septate, sometimes with a large apical cell.

Key to the species

1a**.** Ascospores 1–septate ……2

1b. Ascospores 5–10 septate……3

2a. Ascospores 10–12× 3–4 µm. ……*A. dispersula*

2b. Ascospores 15–16× 7.2–7.5 µm. ……...*A. collectiva*

3a. Apothecia round to elongated, ascospores middle cells enlarge……*A. fissurinella*

3b. Apothecia round, black, ascospores middle cells not enlarge……*A. recedens*

1. ***Arthonia collectiva*** Stirt. in Proc. Roy. phil. Soc. Glasgow 13: 188, 1881. Plate 2 (c)

Description: Thallus crustose, ecorticate, grey; apothecia black, epruinose; hymenium colourless; ascus 8-spored, ascospores brown, ellipsoid, transversely 1–septate, 15–16 × 7.2–7.5 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Arunachal Pradesh, Assam), New Guinea.

Specimen examined: INDIA: Assam, Dhubri district, **Bhelupara Pt-II**, on the bark of *Mangifera indica*, 25.12.2020, alt. 34.24 m, 26°23′124″ N, 90°33′574″ E, Suparna Biswas & Pabitra Biswas, 2020-1221 (BUBH).

Ecology: The species is found growing on the bark of *Mangifera indica* at an elevation of 34.24 m.

Remarks: The species is closely related to *A. dispersula* Nyl. in morphological character but differs from it in having larger spore size (Gupta and Sinha 2018).

2. ***Arthonia dispersula*** Nyl. in Flora, Regensburg 59: 285, 1876. Plate 2 (d)

Description: Thallus crustose, ecorticate, whitish grey; apothecia black, disc epruinose; hymenium yellowish brown; ascus 8-spored, ascospores transversely 1–septate, with a large one end cell, 10–12× 3–4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam, Sikkim, West Bengal), USA, Mexico, Sri Lanka, Cuba, Egypt, Chinese Taipei, Venezuela.

Specimen examined: INDIA: Assam, Dhubri district, **Kaldoba**, on the bark of *Albizia* sp., 21.11.2020, alt. 30.74 m, 26°19′862″ N, 89°77′090″ E, Suparna Biswas & Pabitra Biswas, 2020-0973 (BUBH).

Ecology: The species is found growing on the bark of *Albizia* sp. at an elevation of 30.74 m.

Remarks: The species is most common and most widely distributed species in the state Gujarat of India (Nayaka *et al*. 2013).

3. ***Arthonia fissurinella*** Nyl. in Flora, Regensburg 52: 125, 1869. Plate 2 (e)

Description: Thallus crustose, ecorticate; ascomata apothecia round to slightly elongated; paraphyses branched; asci 8- spores, transversely 8–10 septate, middle cells enlarged, 25–30 × 8–9 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: Brazil.

Specimen examined: India, Assam, Dhubri district, **Uchita**, on the bark of *Eucalyptus* sp., 28.10.2020, alt. 29.98 m, 26°10′686″ N, 89°85′226″ E, Suparna Biswas & Pabitra Biswas, 2020-0158 (BUBH), 61653 (LWG).

Ecology: The species is found growing on the bark of *Eucalyptus sp.* at an elevation of 30.16 m.

Remarks: The species is new record to India. Earlier the holotype was reported from Brazil.

4. ***Arthonia recedens*** Stirt. in Proc. Roy. Soc. Glasgow 11: 319, 1878. Plate 2 (f)

Description: Thallus crustose, ecorticate, whitish-grey; apothecia black, epruinose; hymenium colourless; ascus 8–spored, ascospores colourless, ellipsoid, transversely 5–9 septate, 22–24 × 8.2–9.5 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Arunachal Pradesh, Assam, West Bengal), endemic.

Specimen examined: INDIA: Assam, Dhubri district, **Bhasani goan**, on the bark of *Lannea* sp., 26.12.2020, alt. 34.42 m, 26°30′138″ N, 90°22′449″ E, Suparna Biswas & Pabitra Biswas, 2020-1429 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp. at an elevation of 34.42 m.

Remarks: The species is characterized with black apothecia, epruinose, transversely 5–9 septate ascospores.

***Arthothelium* A. Massal. in Ric. Auton. Lich. Crost. : 54, 1852. (Family: Arthoniaceae)**

Thallus crustose, corticolous, ecorticate; ascomata true apothecia; excipulum absent, paraphyses branched; asci 2–8 spored, ascospores colourless, and muriform. Secondary metabolites arthothelin, barbatic, norstictic, protocetraric, psoromic, salazinic acids present.

1. ***Arthothelium confertum*** (A.L. Smith) Makh. & Patw. in Biovigyanam 11(1): 9, 1985. Plate 3 (a)

Basionym: *Cryptothecia conferta* A.L. Sm. in Trans. Br. Mycol. Soc, 11(3-4): 194, 1926.

Description: Thallus crustose, ecorticate, whitish grey; apothecia black, disc epruinose; ascus 8–spored, ascospores muriform, ovoid, 27–28 × 12–14 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam, Sikkim), endemic.

Specimen examined: INDIA: Assam, Dhubri district, **Bhelupara Pt-II**, on the bark of *Artocarpus heterophyllus*, 25.12.2020, alt. 38.84 m, 26°23′121″ N, 90°32′703″ E, Suparna Biswas & Pabitra Biswas, 2020-1180 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus*, at an elevation of 38.84 m.

Remarks: The species is rare and endemic to Indian region.

***Astrothelium* Eschw. in Syst. Lich., 26, 1824. (Family: Trypetheliaceae)**

Thallus crustose, corticated; ascomata simple to aggregated or pseudostromatic, immersed to prominent; paraphyses branched; ascospores hyaline to brown, diamond shaped lumina, transversely septate to muriform.

1. ***Astrothelium pupula*** (Ach.) Aptroot & Lücking in Lichenologist 48(6): 882, 2016. Plate 3 (b)

Basionym: *Pyrenula pupula* Ach. in Syn. meth. lich.. 123, 1814.

Description: Thallus crustose, grey, pruinose; ascomata perithecia globular, dense, immersed, aggregated, peridium complete, ostiole straight; hymenium yellowish, immersed with oil droplets; ascus 8- spored, ascospores colourless, transversely 3–septate, 33–37 × 14–15 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Arunachal Pradesh, Assam, Karnataka, West Bengal), Sri Lanka, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Barobalurchar,** on the bark of *Mallotus sp.*, 27.12.2020, alt. 40.75 m, 26°22′160″ N, 89°84′089″ E, Suparna Biswas & Pabitra Biswas, 2020-0574 (BUBH).

Ecology: The species is found growing on the bark of *Mallotus sp.*, at an elevation of 40.75 m in Barobalurchar. Mostly widespread in Tropical regions of the world.

Remarks: The species is similar to *P. subvelata* (Nyl.) Müll. Arg., but the presence of white thallus and hemispherical perithecia in the later marks their difference (Gupta and Sinha 2018).

***Bacidia* De Not. in G. bot. ital. 2(1.1): 189, 1846. (Family: Ramalinaceae)**

Thallus crustose, corticolous, foliicolous, saxicolous; ecorticated; ascomata rounded apothecia, sessile, biatorine, brown to brown black, plae orange to orange red, exciple proper, paraphyses branched, hymenium colourless; asci 8–spored, ascospores transversely 2–many septate, acicular, elliopsoid, bacillar, fusiform, colourless.

Key to the species

1a**.** Epithecium K+ violet ……2

1b. Epithecium K−……...3

2a**.** Disc black ……...*B. personata*

2b. Disc dark brown……*B. alutacea*

3a**.** Ascospores acicular ……4

3b. Ascospores fusiform to acicular……...*B. submedialis*

4a**.** Hypothecium pale yellow ……5

4b. Hypothecium yellowish orange……...*B. convexula*

5a**.** Thallus K+ yellow, Atranorin present ……...*B. millegrana*

5b. Thallus K−, Atranorin absent ……..*B. rubella*

1. ***Bacidia alutacea*** (Krempeth) Zahlbr. in Cat. Lich. Univers. 4:174, 1926. Plate 3 (c)

Basionym: *Lecidea alutacea* Kremp. in Flora, Regensburg 61: 519, 1878.

Description: Thallus crustose, yellowish-brown; apothecia disc dark brown, epruinose; hymenium 70–80 μm high, epithecium brown, K+ violet, hypothecium pale yellow, K–; asci 8–spored, ascospores acicular, transversely 10–12 septate, 40–45 × 3–4 μm.

Chemistry: K+ yellow, C–, P–, UV–; TLC: Atranorin present.

Distribution: India (Assam, Tamil Nadu), Argentina, Australia, Brazil, Mexico, Uruguay, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Gauripur town**, on the bark of *Neolamarckia cadamba*, 10.03.2021, alt. 34.00 m, 26°09′771″ N, 89°94′940″ E, Suparna Biswas & Pabitra Biswas, 2021-0543 (BUBH).

Ecology: The species is found growing on the bark of *Neolamarckia cadamba*, at an elevation of 34.00 m. The species luxuriously grows on the smooth bark of the tree.

Remarks: *B. alutacea* (Krempeth.) Zahlbr. is closely related to *B. personata* Malme as both of them have K+ violet epithecium. The species *B. personata* Malme is differ from *B. alutacea* (Krempeth.) Zahlbr. in having always black apothecia and longer spores with more septation (Awasthi and Mathur 1987).

2. ***Bacidia convexula*** (Müll. Arg.) Zahlbr. in Cat. Lich. Univers. 4:188, 1926. Plate 3 (d)

Basionym: *Patellaria convexula* Müll. Arg. in J. Linn. Soc., Bot, 29: 222, 1982.

Description: Thallus crustose, whitish grey; apothecia disc reddish brown, convex, epruinose; hymenium colourless, epithecium pale brown, K–, hypothecium yellowish orange, K–; asci 8 spored, ascopores acicular, transversely 5–7 septate, 24–30 × 2–3 μm.

Chemistry: K–, C–, P–, UV–; TLC: Atranorin present.

Distribution: India (Assam, Madhya Pradesh Manipur, and West Bengal), Australia, Norway, Estonia, Neetherlands, Switzerland, Spain, Germany, USA, United Kingdom of Great Britain and Northern Ireland, Sweden.

Specimen examined: INDIA: Assam, Dhubri district, **Dumardaha Part II**, on the bark of *Lannea sp.*, 28.10.2020, alt. 33.22 m, 26°09′003″ N, 89°92′019″ E, Suparna Biswas & Pabitra Biswas, 2020-0757 (BUBH), 61681 (LWG); **Panbari Tea Garden**, on the bark of *Albizia* sp., 09.02.2020, alt. 53.54 m, 26°15′282″ N, 90°05′102″ E, Suparna Biswas & Pabitra Biswas, 2020-0763 (BUBH); **Panbari Tea Garden**, on the bark of *Michelia champaca*, 09.02.2020, alt. 51.54 m, 26°15′282″ N 90°05′102″ E, Suparna Biswas & Pabitra Biswas, 2020-0921 (BUBH); **Barobalurchar**, on the bark of *Bombax ceiba*, 27.12.2020, alt. 38.90 m, 26°22′112″ N, 89°84′136″ E, Suparna Biswas & Pabitra Biswas, 2020-0940 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Albizia* sp., *Bombax ceiba*, *Lannea sp.* and *Michelia champaca*, at an elevation between 33.22 m to 53.54 m.

Remarks: *Bacidia convexula* Müll. Arg. Zahlbr. resembles *B. rufescens* (Müll. Arg.) Zahlbr. in the spore separation but the spores are rod shaped to acicular in *B. rufescens* (Müll. Arg.) Zahlbr. (Awasthi and Mathur 1987).

3. ***Bacidia millegrana*** (Taylor) Zahlbr., in Wawra & Beck, Itin. Princ. S. Coburgi 2: 152, 1888. Plate 3 (e)

Basionym: *Lecanora millegrana* Taylor in London J. Bot, 6: 159, 1847.

Description: Thallus crustose, corticolous, whitish grey, granulose–verrucose; apothecia cup shaped, disc dark brown, slightly pruinose; blatorine, epithecium brown, K−, hypothecium pale yellow, K–, hymenium clear, paraphyses simple; ascus 8–spored, ascospores acicular, colourless, transversely 11–14 septate, 55–57 × 3.5–4.1 μm.

Chemistry: Thallus K+ yellow, C−, KC−, P−, UV−, TLC: Atranorin present.

Distribution: India (Assam, Tamil Nadu), Australia, Argentia, Brazil, Costa Rica, Cuba, Eucador, Mexico, Nepal, USA,Venezuela.

Specimen examined: INDIA: Assam, Dhubri district, **Jamduar Pt-I**, on the bark of *Neolamarckia cadamba*, 26.12.2020, alt. 56.16 m, 26°24′693″ N, 90°27′756″ E, Suparna Biswas & Pabitra Biswas, 2020-0120 (BUBH), 61680 (LWG).

Ecology: The species is found growing on the bark of *Neolamarckia cadamba* at an elevation of 56.16 m.

Remarks: The species is similar to *B. fusconigrescens* (Nyl.) Zahlbr. in anatomical features of apothecia but the morphological characters of thallus of *B. millegrana* i.e. granulose–verrucose, thallus, dark brown apothecia with persistent margin, broader ascospores (3.5–4.1 μm) are different from *B. fusconigrescens* (Awasthi and Mathur 1987).

4. Bacidia personata Malme in Ark. Bot. 27A (5): 14, 17, 1935. Plate 3 (f)

Description: Thallus crustose, corticolous, grey; apothecia cup shaped, epruinose, disc black; blatorine, epithecium brown, K+ violet, hypothecium pale yellow, K–, hymenium clear, paraphyses simple; ascus 8–spored, ascospores acicular, colourless, transversely 15–20 septate, 58–59 × 3.5–4.2 μm.

Chemistry: Thallus K−, C−, KC−, P−, UV−, TLC: Atranorin present.

Distribution: India (Tamil Nadu), Brazil.

Specimen examined: INDIA: Assam, Dhubri district, **Bhelupara Pt-II**, on the bark of *Lannea* sp., 25.12.2020, alt. 36.42 m, 26°23′121″ N, 90°33′577″ E, Suparna Biswas & Pabitra Biswas, 2020-1179 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., at an elevation of 36.42 m.

Remarks: The species is similar to *B. alutacea* (Krempeth.) Zahlbr. as epithecium is brown and K+ violet in both of them but differ as the ascomata of *B. personata* is black. *B. personata* is also similar to *B. phaeolomoides* in shape and size of spores but differ as *B. phaeolomoides* have granular furfuraceous thallus, brown to dark brown apothecia, epithecium K− (Awasthi and Mathur 1987). The species *B. personata* is a new record to Assam.

5. Bacidia rubella (Hoffm.) A. Massal. in Ric. Auton. Lich.crost. (Verona): 118, 1852. Plate 4 (a)

Basionym: *Verrucaria rubella* Hoffm. in Deutschi. Fl., Zweiter Theil (Erlangen): 174, 1796.

Description: Thallus crustose, corticolous, whitish grey; apothecia cup shaped, epruinose, disc red–brown; blatorine, epithecium pale brown, K−, hypothecium pale yellow, K–, hymenium clear, paraphyses simple; ascus 8–spored, ascospores acicular, colourless, transversely 10– 12 septate, 52–54 × 2.5–3.1 μm.

Chemistry: Thallus K−, C−, KC−, P−, UV−, TLC: lichen substance not detected.

Distribution: India (Assam, Himachal Pradesh, Madhya Pradesh, Tamil Nadu, Uttar Pradesh, West Bengal), Austria, Denmark, Estonia, France, Nepal, Netherlands, Norway, Switzerland, Sweden, United Kingdom of Great Britain and Northern Ireland, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Falimari,** on the bark of *Neolamarckia cadamba*, 25.12.2020, alt. 46.30 m, 26°30′149″ N, 90°41′420″ E, Suparna Biswas & Pabitra Biswas, 2020-0122 (BUBH); **Khajurbari Pt-I**, on the bark of *Lannea* sp., 24.12.2020, alt. 40.06 m, 26°26′190″ N, 90°17′890″ E, Suparna Biswas & Pabitra Biswas, 2020-0791 (BUBH), 61690 (LWG).

Ecology: The species is found growing on the bark of *Neolamarckia cadamba*, *Lannea* sp., at an elevation of 46.30 m, 36.42 m.

Remarks: The species is close to *B. fuscorubella* (Hoffm.) Bausch in size and septation of spores but differs from it as the hypothecium of *B. fuscorubella* showed K+ violet (Awasthi and Mathur 1987).

6. Bacidia submedialis (Nyl.) Zahlbr. in Cat. Lich. Univers. 4:243, 1926. Plate 4 (b)

Basionym: *Lecidea submedialis* Nyl. in Acta Soc. Sci. Fenn. 26(10): 14, 1900.

Description: Thallus crustose, corticolous, grey; apothecia cup shaped, disc dark brown; blatorine, epithecium brown, K–, hypothecium pale yellow, K–, hymenium clear, paraphyses simple; ascus 8–spored, ascospores fusiform to acicular, colourless, transversely 7–septate, 35–36 × 3.5–4.1 μm.

Chemistry: Thallus K+ yellow, C−, KC−, P−, UV−, TLC: lichen substance not detected.

Distribution: India (Assam, Arunachal Pradesh), Sri Lanka, Thailand.

Specimen examined: INDIA: Assam, Dhubri district, **Kaldoba**, on the bark of *Lannea* sp., 21.11.2020, alt. 31.03 m, 26°19′870″ N, 89°77′092″ E, Suparna Biswas & Pabitra Biswas, 2020-0147 (BUBH); **Panbari Tea Garden**, on the bark of *Michelia champaca*, 09.02.2020, alt. 46.08 m, 26°15′322″ N, 90°05′080″ E, Suparna Biswas & Pabitra Biswas, 2020-0769 (BUBH), 61684 (LWG); **Sreegram**, on the bark of *Mallotus* sp., 25.12.2020, alt. 39.76 m, 26°24′706″ N, 90°34′013″ E, Suparna Biswas & Pabitra Biswas, 2020-0926 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Michelia champaca*, *Mallotus* sp., at an elevation between 31.03 m to 46.08 m.

Remarks: The species is closely related to *B. spadicea* (Ach.) Zahlbr. and *B. subannexa* (Nyl.) Zahlbr. in the morphology of thallus but differ in having 7–septate fusiform to acicular spores (Awasthi and Mathur 1987).

***Bacidina* Vězda Folia geobot in Phytotaxa, 25(4): 431, 1990. (Family: Ramalinaceae)**

Thallus crustose, foliicolous, corticolous, greenish to pale green; apothecia rounded, disc pale yellow to orange, red or dark brown; biatorine, hymenium colourless, paraphyses unbranched; asci 8–spored, ascospores colourless, fusiform-ellipsoid to narrowly bacicular or filiform, transversely 3–40 septate. *Bacidina* is segregated from *Bacidia*.

1. ***Bacidina medialis*** (Tuck ex Nyl.) Kistenich, Timdal, Bendiksby & S. Ekman in Taxon 67(5): 890, 2018. Plate 4 (c)

Basionym: *Lecidea medialis* Tuck ex Nyl. in Annls Sci. Nat., Bot., Sér. 4 19: 346, 1863.

Description: Thallus crustose, corticolous, grey; apothecia cup shaped, disc yellow brown; blatorine, epithecium pale brown, K−, hypothecium brown, K−, hymenium clear, paraphyses simple; ascus 8 spored, ascospores ellipsoidal, colourless, transversely 5 septate, 25.4–31.05 × 2.5–3.1 μm.

Chemistry: Thallus K−, C−, KC−, P−, UV−, TLC: lichen substance not detected.

Distribution: India (Assam, Himachal Pradesh, Kerala, Lakshadweep, Maharashtra, Mizoram Orissa, Tanil Nadu, West Bengal), Argentina, Brazil, Colombia, Costa Rica, Hong Kong, Mexico, Papua New Guinea, Paraguay, Seychelles, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Barobalurcha**r, On bark of *Azadirachta* sp. 27.12.2020, alt. 38.09 m, 26°22′128″ N, 89°84′083″ E, Suparna Biswas & Pabitra Biswas, 2020-0145 (BUBH), 61670 (LWG).

Ecology: The species is found growing on the bark of *Azadirachta sp*. at an elevation of 38.09 m.

Remarks: *B. medialis* is closly related to *Bacidia incongruens* but differ in having yellow brown to red brown apothecia which is having pale yellow to orange apothecia in the later. *B. medialis is* also closely related to *B. rufescens* in the septation of spores but differ as later one having rugulose- subverrucose thallus (Awasthi and Mathur 1987).

***Chrysothrix* Mont. in Annls. Sci. Nat. Bot., sér. 3(18): 312, 1852. (Family:Chrysothricaceae)**

Thallus leprose, corticolous, lignicolous, saxicolous ecorticate, thick or thin, yellow to yellowish green, composed of granules or anastomosing filaments; apothecia rare, innate, thin non corticated margin; exciple poorly developed, paraphyses septate; asci 8–spored, spores colourless, 1–3 septate, ovoid to ellipsoid.

Key to the species

1a**.** Granules greenish, pinastric acid present……...*C. candelaris*

1b Granules yellow, calycin, vulpinic acid present……*C. chlorina*

1. ***Chrysothrix candelaris*** (L.) J.R. Laudon, in Lichenologist 13(2):110, 1981. Plate 4 (d)

Basionym: *Byssus candelaris* L. in Sp. pl. 2: 1169, 1753.

Description: Thallus leprose, ecorticate, thin, greenish, granules minute; apothecia not seen.

Chemistry: Thallus K–, C–, KC–, P+ orange; UV–; TLC: pinastric acid present.

Distribution: India (Assam, Tamil Nadu), Austria, Australia, France, Netherlands, Portugal, Spain, Sri Lanka, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Dumardaha Pt-II**, on the bark of *Lannea* sp., 28.10.2020, alt. 33.92 m, 26°09′007″ N, 89°91′993″ E, Suparna Biswas & Pabitra Biswas, 2020-0130 (BUBH), 61677 (LWG); **Pub-gaikhawa Pt-I**, on the bark of *Moringa* sp., 25.10.2020, alt. 33.48 m, 26°08′061″ N, 89°83′362″ E, Suparna Biswas & Pabitra Biswas, 2020-0605 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Moringa* sp., at an elevation of 33.48 m to 33.92 m.

Remarks: The species is similar with *C. xanthine* (Vain.) Kalb in chemistry. However differs in ranging variations in granule size (Harris and Ladd. 2008).

2. ***Chrysothrix chlorina*** (Ach.) J.R. Laudon in Lichenologist 13(2): 106, 1981. Plate 4 (e)

Basionym: *Lichen chlorinus* Ach. in Lich. Suec. prodr. (Linkőping) 6, 1799.

Description: Thallus leprose, ecorticate, thick, yellow, granules minute forming puiverulent mass; apothecia not seen.

Chemistry: Thallus K+ orange, C–, KC +red, P–orange; UV–; TLC: Calycin, vulpinic acid present.

Distribution: India (Assam, Tamil Nadu), Austria, Canada, France, Norway, Portugal, Russian Federation, Sweden, Sri Lanka, United Kingdom of Great Britain and Northern Ireland, USA.

Specimen examined: INDIA: Assam, Dhubri district, **South Tokrerchara Pt-IV**, on the bark of *Areca catechu*, 16.01.2020, alt. 24.10 m, 26°11′074″ N, 89°83′372″ E, Suparna Biswas & Pabitra Biswas, 2020-0131 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Areca catechu*, 16.01.2020, alt. 33.49 m, 26°11′097″ N, 89°83′354″ E, Suparna Biswas & Pabitra Biswas, 2020-0551 (BUBH), 61702 (LWG).

Ecology: The species is found growing on the bark of *Areca catechu* at an elevation of 24.10 m to 33.49 m.

Remarks: The species is morphologically similar with *C. onokoensis* (Wolle) R.C. Harris & Ladd. but differ in chemistry as calycin, vulpinic acid are present in *C. chlorina* which are absent in *C. onokoensis.* (Harris and Ladd. 2008).

Clathroporina (Müll. Arg.) in Flora, Regensburg, 65(33): 517, 1882. (Family: Trichotheliaceae)

Thallus crustose, corticolous, saxicolous, greenish to yellow-brown; perithecia immersed, often in swollen pustules, sometimes globose, sometims completely covered with thalline tissue, ostioles dark brown to black; paraphyses sparingly branched; asci 8–spored, ascospores colourless, transversely septate or muriform.

1. ***Clathroporina mastoidea*** (Ach.) R. C. Harris in More Florida Lichens, Incl. 10 Cent Tour Pyrenol. (New York): 172, 1995. Plate 4 (f)

Basionym: *Pyrenula mastoidea* Ach. in Mag. Gesell. Naturf. Freunde, Berlin 6(1): 16, 1814.

Description: Thallus crustose, greyish–grey, smooth; ascomata perithecia, immersed, subglobose, covered by thalline layer, brownish black, ostiole black, K+ reddish; involucrellum covered by thaline layer, outer layer black, extending below the excipulum, excipulum yellow; ascus 8–spored, ascospores colourless, fusiform, transversely 7–8 septate, 48–49 × 5–6 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Andaman Islands, Kerala), Australia, Brazil, Colombia, Costa Rica, Ecuador, French Guiana, Guyana, Papua new Guinea, Solomon Islands, Thailand.

Specimen examined: INDIA: Assam, Dhubri district, **Alokjhari**, on the bark of *Shorea robusta*, 12.01.2020, alt. 57.10 m, 26°25′336″ N, 89°86′005″ E, Suparna Biswas & Pabitra Biswas, 2020-1528 (BUBH).

Ecology: The species is found growing on the bark of *Shorea robusta* at an elevation of 57.10 m.

Remarks: The species is similar with *Porina interestes* (Nyl.) Harm. but differ as ostiole of *C. mastoidea* is K+ reddish (Gupta and Sinha 2018). The species is a new record to Assam.

Coenogonium Ehrenb. Ex Nees in Horae Phys. Berolinenses: 120, 1820. (Family: Coenogoniaceae)

Thallus crustose, foliicolous, corticolous, whitish to silver grey, smooth, ecorticate; apothecia rounded, terminal or marginal, sessile or shortly stalked, disc plane to concave; biatorine, excipulum well developed, hymenium colourless, paraphyses unbranched; asci 8–spored, ascospores colourless, ellipsoid to fusiform or acicular, transversely 1–3 septate or simple.

Key to the species

1a**.** Ascospores 18–22 µm long…….....2

1b Ascospores 10–12 µm long …….....3

2a. Disc epruinose …….....*C. bacilliferum*

2b**.** Disc pruinose …….....*C. wrightii*

3a. Thallus glabrous, disc epruinose ……*C. pineti*

3b**.** Thallus verruculose, disc pruinose …….....*C. subdilutum*

1. ***Coenogonium bacilliferum*** (Malme) Lücking, Aptroot & Sipman, in Fungal Diversity 23: 297, 2006. Plate 5 (a)

Basionym: *Dimerella bacillifera* Malme in Ark. Bot. 26A (13): 5, 1935.

Description: Thallus crustose, glabrous, whitish grey; apothecia rounded, disc yellow, epruinose; biatorine, hymenium colourless; ascus 8–spored, ascospores transversely 1–septate, colourless, 18–22 × 2.3–2.7 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: Argentia, Brazil, Costa Rica, Uruguay.

Specimen examined: India, Assam, Dhubri district, **Kaldoba**, on the bark of *Polyalthia longifolia*, 21.11.2020, alt. 21.03m, 26°19′870″ N, 89°77′092″ E, Suparna Biswas & Pabitra Biswas, 2020-0539 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia* at an elevation of 21.03 m.

Remarks: The species is a distinctive species due to larger ascospores 18–22 × 2.3–2.7 µm. The species is a new record to India.

2. Coenogonium pineti (Ach.) Lücking & Lumbsch, in Mycologia 96(2):290, 2004. Plate 5 (b)

Basionym: *Lecidea pineti* Ach. in Lich. Univ. 195, 1810.

Description: Thallus crustose, glabrous, whitish grey; apothecia rounded, small, disc pale yellow, margin smooth, epruinose; biatorine, hymenium colourless; ascus 8–spored, ascospores transversely 1–septate, colourless, 10–12 × 4.3–4.7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: Australia, Denmark, Estonia, Germany, Luxembourg, Norway, Netherlands, New Zealands, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Chandor Dinga Pahar**, on the bark of *Tectona grandis*, 11.02.2020, alt. 36.56 m, 26°19′025″ N, 90°35′456″ E, Suparna Biswas & Pabitra Biswas, 2020-0966 (BUBH).

Ecology: The species is found growing on the bark of *Tectona grandis* at an elevation of 36.56 m.

Remarks: The species is similar to *C. lutescens* and *C. urceolatum* as they have small apothecia but differ from both as *C. pineti* have slightly larger and wider ascospores than them. *C. urceolatum* also differ as it have orange apothecia (Kantvilas *et al.* 2018). The species is a new record to India.

3. ***Coenogonium subdilutum*** (Malme) Kalb in Lichenes Neotropici, Fascicle 13: 545, 2001. Plate 5 (c)

Basionym: *Dimerella subdiluta* Malme in Ark. Bot. 26 (13): 6, 1935.

Description: Thallus crustose, verruculose, whitish grey; apothecia rounded, medium sized, disc yellow, margin smooth, biatorine, white pruina; hymenium colourless; ascus 8–spored, ascospores transversely 1–septate, colourless, 10–11 × 2.7–3.5 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: Brazil, Dominican Republic, French Guiana, Paraguay, Uruguay, Costa Rica, Puerto Rico.

Specimen examined: INDIA: Assam, Dhubri district, **Barobalurchar**, on the bark of *Azadirachta* sp., 27.12.2020, alt. 40.75 m, 26°22′160″ N, 89°84′089″ E, Suparna Biswas & Pabitra Biswas, 2020-0823 (BUBH), 61689 (LWG).

Ecology: The species is found growing on the bark of *Azadirachta sp.* at an elevation of 40.75 m.

Remarks: The species is distinctive with verruculose thallus, smooth margin of the apothecia with yellow disc and smaller ascospores. The species is a new record to India.

4. ***Coenogonium wrightii*** (Vězda) H. Harada & Lumbsch, in Harada, Okamoto & Yoshimura, Lichenology 2(2): 127, 2004. Plate 5 (d)

Basionym: *Dimerella wrightii* Vězda in Folia geobot. Phytotax. Bohemoslov. 4:446, 1969.

Description: Thallus crustose, glabrous, whitish grey; apothecia rounded, disc yellow, biatorine, white pruina; hymenium colourless; ascus 8–spored, ascospores transversely 1–septate, colourless, 21–22 × 3.3–3.4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: Brazil, Colombia, Japan.

Specimen examined: INDIA: Assam, Dhubri district, **Arear jhar Pt-II**, on the bark of *Shorea robusta*, 25.12.2020, alt. 32.33 m, 26°26′103″ N, 90°41′810″ E, Suparna Biswas & Pabitra Biswas, 2020-0867 (BUBH).

Ecology: The species is found growing on the bark of *Shorea robusta* at an elevation of 32.33 m.

Remarks: The species is distinctive with larger size of ascospores. The species is a new record to India.

Coniocarpon DC. in Fl. Franc., Edn 3 (2): 323, 1805. (Family: Arthoniaceae)

Thallus crustose, smooth, immersed or erumpent; apothecia irregularly rounded to weakly lobed, solitary or forming loose to dense aggregation, disc dark, white pruinose and with layer of orange—red pruina present; exciple brown, epithecium brown, hypothecium and hymenium colourless; asci 8–spored, ascospores colourless, ovoid, with an enlarged apical cell.

1. ***Coniocarpon cinnabarinum*** DC., in FI. Franc., Edn 3 (2): 323, 1805. Plate 5 (e)

Description: Thallus crustose, ecorticate, whitish grey, pinkish or reddish tinge, finely powdery; apothecia rounded, disc cinnabar-red to pink, white pruina, margins with red to pink pruina; hymenium colourless; ascus 8–spored, ascospores transversely 5–septate, with a large apical cell, colourless, 18–22× 7–8 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Arunachal Pradesh, Assam, Goa, Karnataka, Manipur, Tamil Nadu, West Bengal), Australia, Banglaadesh, China, Colombia, France, Galapagos island, Hawaii, Ireland, Mexico, Netherlands, New Zealand, Norway, Sri Lanka, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Bidyadabri Pt-V**, on the bark of *Lannea* sp., 21.11.2020, alt. 57.63 m, 26°26′118″ N, 89°77′365″ E, Suparna Biswas & Pabitra Biswas, 2020-0477 (BUBH); **Bhelupara Pt-II**, on the bark of *Ricinus* sp., 29.12.2019, alt. 35.63 m, 26°22′818″ N, 90°33′587″ E, Suparna Biswas & Pabitra Biswas, 2020-0483 (BUBH); **Dhubri town**, on the bark of *Delonix regia*, 30.12.2019, alt. 29.32 m, 26°02′815″ N, 89°99′590″ E, Suparna Biswas & Pabitra Biswas, 2020-0490 (BUBH); **Dumardaha Pt-II**, on the bark of *Lannea* sp., 28.10.2020, alt. 34.50 m, 26°09′006″ N, 89°91′994″ E, Suparna Biswas & Pabitra Biswas, 2020-0493 (BUBH); **Satrasal,** on the bark of *Polyalthia longifolia*, 04.01.2020, alt. 36.99 m, 26°16′284″ N, 89°73′446″ E, Suparna Biswas & Pabitra Biswas, 2020-0501 (BUBH); **Dhubri town**, on the bark of *Polyalthia longifolia*, 13.03.2021, alt. 34.00 m, 26°02′131″ N, 89°99′572″ E, Suparna Biswas & Pabitra Biswas, 2020-0502 (BUBH); **Dhubri town**, on the bark of *Polyalthia longifolia*, 30.12.2019, alt. 27.66 m, 26°02′122″ N, 89°99′582″ E, Suparna Biswas & Pabitra Biswas, 2020-0562 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Mallotus* sp., 31.12.2019, alt. 31.17 m, 26°10′475″ N, 89°81′330″ E, Suparna Biswas & Pabitra Biswas, 2019-0569 (BUBH); **Bidyadabri Pt-V**, on the bark of *Ricinus* sp., 21.11.2020, alt. 41.76 m, 26°26′122″ N, 89°77′329″ E, Suparna Biswas & Pabitra Biswas, 2020-0602 (BUBH); **Kaldoba**, on the bark of *Lannea* sp., 21.11.2020, alt. 31.13 m, 26°19′862″ N, 89°77′090″ E, Suparna Biswas & Pabitra Biswas, 2020-0604 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Lannea* sp., 16.01.2020, alt. 23.97 m, 26°11′074″ N, 89°83′372″ E, Suparna Biswas & Pabitra Biswas, 2020-0664 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Mangifera* sp., 16.01.2020, alt. 33.75 m, 26°11′098″ N, 89°83′358″ E, Suparna Biswas & Pabitra Biswas, 2020-

0665 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Neolamarckia cadamba*, 02.01.2020, alt. 23.66 m, 26°09′737″ N, 89°82′6517″ E, Suparna Biswas & Pabitra Biswas, 2020-0666 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Lannea sp.*, 02.01.2020, alt. 33.26 m, 26°09′4968″ N, 89°82′727″ E, Suparna Biswas & Pabitra Biswas, 2020-0667 (BUBH); **Barobalurchar**, on the bark of *Azadirchta* sp., 27.12.2020, alt. 40.75 m, 26°22′160″ N, 89°84′089″ E, Suparna Biswas & Pabitra Biswas, 2020-0674 (BUBH), 61688 (LWG); **Dhubri town**, on the bark of *Michelia champaca*, 30.12.2019, alt. 33.66 m, 26°02′194″ N, 89°95′910″ E, Suparna Biswas & Pabitra Biswas, 2020-0682 (BUBH); **Bhalukmari**, on the bark of *Neolamarckia cadamba*, 24.12.2020, alt. 47.45 m, 26°30′231″ N, 90°23′118″ E, Suparna Biswas & Pabitra Biswas, 2020-0693 (BUBH); **Bhasani goan**, on the bark of *Mangifera* sp., 26.12.2020, alt. 37.67 m, 26°30′142″ N, 90°22′473″ E, Suparna Biswas & Pabitra Biswas, 2020-0696 (BUBH); **Gourangtari Pt-II**, on the bark of *Pongamia pinnata*, 26.12.2020, alt. 44.01 m, 26°24′482″ N, 90°31′940″ E, Suparna Biswas & Pabitra Biswas, 2020-0697 (BUBH); **Falimari,** on the bark of *Litchi chinensis*, 25.12.2020, alt. 42.73 m, 26°30′145″ N, 90°41′435″ E, Suparna Biswas & Pabitra Biswas, 2020-0701 (BUBH); **Fakiranir Jhar Pt-I,** on the bark of *Artocarpus heterophyllus*, 24.12.2020, alt. 40.43 m, 26°21′883″ N, 90°14′876″ E, Suparna Biswas & Pabitra Biswas, 2020-0789 (BUBH); **Bhalukmari**, on the bark of *Ricinus* sp., 24.12.2020, alt. 52.09 m, 26°30′248″ N, 90°23′132″ E, Suparna Biswas & Pabitra Biswas, 2020-0790 (BUBH); **Gourangtari Pt-II,** on the bark of *Lannea* sp., 26.12.2020, alt. 44.15 m, 26°24′462″ N, 90°31′947″ E, Suparna Biswas & Pabitra Biswas, 2020-0794 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Ricinus* sp., *Delonix regia*, *Polyalthia longifolia, Mallotus* sp., *Mangifera* sp., *Neolamarckia cadamba*, *Azadirchta* sp., *Michelia champaca*, *Pongamia pinnata, Litchi chinensis*, *Artocarpus heterophyllus* at an elevation of 23.66 m to 57.63 m.

Remarks: The species is variable in its ascomata. The species can be distinguished from all the other species by the round to stellate ascomata, cinnabar-red to pink pruina and transversely 3-5 septate ascospores with large apical cell (Gupta and Sinha 2018).

Cratiria Marbach in Biblioth. Lichenol. 74: 160, 2000. (Family: Caliciaceae)

Thallus crustose, corticolous, corticate, smooth; ascomata apothecia rounded, lecidine, adnate to sessile, disc black or reddish black, pruinose or epruinose; excipulum with a dark inner and

outermost part, hymenium colourless, often inspersed, paraphyses simple to branched; asci 4–8 ascospores, ascospores colourless, *Buellia* or *Cratiria* type, transversely 3–septate, ellipsoidal, thick walled.

1. *Cratiria lauricassiae* (Fée) Marbach in Biblthca Lichenol. 74: 160, 2000. Plate 5 (f)

Basionym: *Lecidea lauri-cassiae* Fée in Essai Crypt. Exot., Suppl. Révis, 101, 1837.

Description: Thallus crustose, whitish grey to grrenish grey, ecorticate; apothecia rounded, lecidine, sessile, disc black, epruinose; excipulum with a dark brown inner and outermost part, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 3–septate, 20–22×7–8 µm.

Chemistry: Thallus K+ yellow, C–, KC–, P+ yellow; UV–; TLC: atranorin, conorstictic, norstictic acids present.

Distribution: India (Assam, Uttar Pradesh, West Bengal), Australia, Brazil, Dominica, Jamaica, Japan, Papua New Guinea, Paraguay, Spain, Sri Lanka, Thailand, USA.

Specimen examined: India, Assam, Dhubri district, **Rangamati Pt-III**, on the bark of *Michelia champaca*, 27.12.2020, alt. 21.01 m, 26°16′107″ N, 90°05′975″ E, Suparna Biswas & Pabitra Biswas, 2020-0151 (BUBH).

Ecology: The species is found growing on the bark of *Michelia champaca* at an elevation of 21.01 m.

Remarks: The species is closely related to *Buellia lauricassiaeoides* Aptroot. but differ as the latter have pale central part in the excipulum, smaller ascospores and absence of norstictic acid. The species *Cratiria lauricassiae* is distinct from other members by transversely 3 septate ascospores (Gupta and Sinha 2018).

***Cryptothecia* Stirt in Proc. Roy. Soc. Glasgow 10:164, 1876. (Family: Arthoniaceae)**

Thallus crustose, corticolous, foliicolous, ecorticate; ascomata not organized, asci or ascigerous tissue scattered in the thallus, embedded, asci solitary in thallus; paraphysoides branched; 1–8 spored, ascospores colourless, submuriform to muriform. Secondary metabolites depsides and depsiodones present.

Key to the species

1a**.** Thallus contain barbatic acid…….....*C. lunulata*

1b Thallus not contain barbatic acid…….....2

2a**.** Thallus contain perlatolic acid…….....*C. verruculifera*

2b Thallus not contain perlatolic acid …….....*C. subtecta*

1. ***Cryptothecia lunulata*** (Zahlbr.) Makhija & Patw. in Biovigyanam 11(1): 6, 1985. Plate 6 (a)

Basionym: *Arthothelium lunulatum* Zahlbr. in Rechinger Denkschr. Kaiserl. Akad. Wiss. Wien, Math., Naturwiss. Kl. 88: 17, 1911.

Description: Thallus crustose, grey–white, smooth, thin, dark brown coloured hypothalloidal region at the periphery; ascigerous part of the thallus foveolate, white, ascus 8–spored, ascospores slightly curved in the middle, ellipsoid, muriform, transversely 7–9 septate and 1–2 vertical septate, colourless, 35–37× 15.2–16.2 μm.

Chemistry: Thallus K–, C+ red, KC+ red, P–; UV–; TLC: barbatic acid, gyrophoric acids present.

Distribution: China, Insula neu Pommern, Papua New Guinea, Singapore, India (Andaman and Nicobar Islands, Arunachal Pradesh, Assam, Goa, Karnataka, Madhya Pradesh, Maharastra, Mizoram, Tamil Nadu and West Bengal).

Specimen examined: INDIA: Assam, Dhubri district, **Kismat hasdaha Pt-II,** on the bark of *Gmelina arborea*, 22.11.2020, alt. 27.73 m, 26°05′039″ N, 89°89′316″ E, Suparna Biswas & Pabitra Biswas, 2020-0154 (BUBH), 61697 (LWG); **South Tokrerchara Pt-IV**, on the bark of *Artocarpus heterophyllus*, 16.01.2020, alt. 28.81 m, 26°11′061″ N, 89°83′376″ E, Suparna Biswas & Pabitra Biswas, 2020-0486 (BUBH); **Bidyadabri Pt-V**, on the bark of *Lannea* sp., 21.11.2020, alt. 55.02m, 26°26′120″ N, 89°77′365″ E, Suparna Biswas & Pabitra Biswas, 2020-0498 (BUBH); **Satrasal**, on the bark of *Lannea* sp., 04.01.2020, alt. 36.89 m, 26°16′151″ N, 89°73′461″ E, Suparna Biswas & Pabitra Biswas, 2020-0767 (BUBH).

Ecology: The species is found growing on the bark of *Gmelina arborea*, *Artocarpus heterophyllus*, *Lannea* sp. at an elevation of 27.73 m to 55.02 m.

Remarks: The species is distinguished by the presence of barbatic acid and gyrophoric acid. Only six species viz. *C. albomaculatella, C. albata, C. aleurina, C. caesioalba, C. fuscopunctata* and *C. lunulata* in *Cryptothecia* genus contain barbatic acid (Woo *et al*. 2017).

2. ***Cryptothecia subtecta* Stirt.** in Proc. Roy. Phil. Soc. Glasgow 11: 320, 1878. Plate 6 (b)

Description: Thallus crustose, ecorticate, whitish greyish and smooth, thin, prothallus thin black line border at the border; ascomata white, scattered, powdery, asci solitary in ascigerous parts; ascus 8–spored, muriform, ascospores transversely 7–9 septate and 2–4 vertical septate, colourless, 28–30× 15.8–17.7 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: confluentic acid present.

Distribution: India (Assam, West Bengal), Portugal, Thailand, Viet Nam.

Specimen examined: INDIA: Assam, Dhubri district, **Chagolia Pt-I,** on the bark of *Azadirachta indica,* 21.11.2020, alt. 47.77m, 26°29′133″ N, 89°78′213″ E, Suparna Biswas & Pabitra Biswas, 2020-0780 (BUBH), 61693 (LWG); **Alomganj Pt-IX**, on the bark of *Artocarpus heterophyllus,* 27.12.2020, alt. 47.09 m, 26°13′5104″ N, 90°03′674″ E, Suparna Biswas & Pabitra Biswas, 2020-0905 (BUBH).

Ecology: The species is found growing on the bark of *Azadirachta indica, Artocarpus heterophyllus* at an elevation of 47.09 m to 47.77 m.

Remarks: The ascigerous parts and ascospores of the species is similar to *C. dispersa* Makhija & Patw. as but the latter one having verrucose thallus and gyrophoric acid . *C. subtecta* Stirt. distinguished from others having whitish to greyish white thallus, extensive ascigerous parts, smaller ascospores and the presence of confluentic acid (Gupta and Sinha 2018).

3. ***Cryptothecia verruculifera*** Jagad. Ram, G.P. Sinha & Kr. P. Singh in Lichenologist 41(6): 610, 2009. Plate 6 (c)

Description: Thallus crustose, ecorticate, whitish grey and smooth, thin, prothallus thin black line border at the border; ascomata white, scattered, powdery, asci solitary in ascigerous parts; ascus 8–spored, muriform, ascospores transversely 7–9 septate and 2–4 vertical septate, colourless, 55–58× 20.8–24.7 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: perlatolic acid present.

Distribution: India (Assam, Bihar, Kerala, Orissa, Madhya Pradesh, Mizoram, Uttarkhand, West Bengal), endemic.

Specimen examined: India, Assam, Dhubri district, **Chagolchara Pt-III**, on the bark of *Artocarpus heterophyllus*, 29.10.2020, alt. 29.56 m, 26°02′510″ N, 89°94′427″ E, Suparna Biswas & Pabitra Biswas, 2020-0785 (BUBH), 61640 (LWG).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus* at an elevation of 29.56 m.

Remarks: The species is distinguished by perlatolic acid in their thallus.

***Diorygma* Eschw. in Syst. Lich.: 13, 1824. (Family: Graphidaceae)**

Thallus crustose, corticolous, whitish, with various shades of grey, corticated; apothecia lirellate, branched, disc open, sometimes with thick white or yellowish pruina, thaline margin thik and bulging or thin; excipulum carbonized or pale, labia divergent, epithecium colourless or brownish, hymenium colourless, clear; asci 1–8 spored, ascospores colourless, transversely septate to muriform, secondary metabolites orcinol depsidones, lichexanthone present or absent.

Key to the species

1a**.** Ascospores I+ blue…….....*D. hieroglyphicum*

1b Ascospores I+ violet…….....2

2a**.** Norstictic acid present…….....3

2b Norstictic acid absent…….....*D. reniforme*

3a**.** Pink-red pruina present on ascomata ……*D. roseopruinatum*

3b Pink-red pruina absent on ascomata ……..4

4a**.** Hymenium distinctly I+ violet ……..*D. junghuhnii*

4b Hymenium weakly I+ bluish violet …….*D. soozanum*

1. ***Diorygma hieroglyphicum*** (Pers.) Staiger & Kalb, in Symb. Bot. upsal. 34(1): 151, 2004. Plate 6 (d)

Basionym: *Opegrapha hieroglyphica* Pers. in Ann. Wetter. Gesellsch. Ges. Naturk. 2(1):16, 1810.

Description: Thallus crustose, white to pale grey, corticated, rough surface; apothecia lirellate, immersed, branched, thalline margin distinct, disc open with creamy yellow pruinose, excipulum divergent, wekly carbonized, hymenium colourless, clear, I+ weakly violet paraphyses simple; asci 1 spored, ascospores colourless, muriform, I+ blue, 87–88 × 29–30 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P+ yellow; UV–; TLC: constictic acid, norstictic acids, stictic acid present.

Distribution: India (Andaman and Nicobar Islands, Assam, Kerala Maharashtra, Mizoram), Australia, Brazil, Cambodia, Cameroon, Colombia, Costa Rica, Nepal, New Caledonia, Pupua New Guinea, Philippines, Singapore, Sri Lanka, Tanzania.

Specimen examined: INDIA: Assam, Dhubri district, **Ananda nagar,** on the bark of *Mangifera indica,* 24.12.2020, alt. 36.70 m, 26°22′740″ N, 90°21′681″ E, Suparna Biswas & Pabitra Biswas, 2020-0109 (BUBH), 61652 (LWG); **Panbari Tea Garden**, on the bark of *Shorea robusta,* 09.12.2020, alt. 47.27 m, 26°15′303″ N, 90°05′091″ E, Suparna Biswas & Pabitra Biswas, 2020-0614 (BUBH); **Rangamati Pt-III**, on the bark of *Michelia champaca*, 27.12.2020, alt. 21.01 m, 26°16′107″ N, 90°05′975″ E, Suparna Biswas & Pabitra Biswas, 2020-0888 (BUBH); **Alomganj Pt-IX**, on the bark of *Artocarpus heterophyllus,* 27.12.2020, alt. 47.09 m, 26°13′510″ N, 90°03′674″ E, Suparna Biswas & Pabitra Biswas, 2020-0889 (BUBH).

Ecology: The species is found growing on the bark of *Mangifera indica, Shorea robusta, Michelia champaca, and Artocarpus* at an elevation of 21.01 m to 47.27 m.

Remarks: The simultaneous occurrence of both stictic and norstictic acid as major compounds of the species.

2. ***Diorygma junghuhnii*** **(**Mont. & Bosch.) Kalb, Staiger & Elix in Symb. Bot. upsal. 34(1): 157, 2004. Plate 6 (e)

Basionym: *Graphis junghuhnii* Mont. & Bosch in Pl. Jungh., 4:471, 1856.

Description: Thallus crustose, pale grey to greenish grey, ecorticated, smooth surface; apothecia lirellate, immersed, branched, thalline margin distinct, disc brown to dark brown, open with

white pruinose; excipulum divergent, hymenium colourless, clear, I+ violet, paraphyses simple; asci 1–2 spored, ascospores colourless, muriform, I+ violet, 97–122 × 33–35 μm.

Chemistry: Thallus K–, C–, KC–, P+ orange; UV–; TLC: norstictic acid present.

Distribution: India (Andaman and Nicobar Islands, Assam, Mizoram), Australia, Brazil, China, Costa Rica, Fiji, Guatemala, Guyana, Philippines, Seychelles, Togo, Tanzania, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Bilashipara Florican Garden**, on the bark of *Pongamia pinnata*, 10.02.2020, alt. 37.86 m, 26°25′066″ N, 90°27′691″ E, Suparna Biswas & Pabitra Biswas, 2020-0106 (BUBH); **Kharbari Pt-II**, on the bark of *Michelia champaca*, 21.11.2020, alt. 43.19 m, 26°25′613″ N, 89°74′361″ E, Suparna Biswas & Pabitra Biswas, 2020-0113 (BUBH); **Alokjhari,** on the bark of *Shorea robusta*, 12.01.2020, alt. 60.67 m, 26°25′335″ N, 89°86′057″ E, Suparna Biswas & Pabitra Biswas, 2020-0164 (BUBH); **Alokjhari**, on the bark of *Shorea robusta*, 12.01.2020, alt. 60.67 m, 26°25′032″ N, 89°86′125″ E, Suparna Biswas & Pabitra Biswas, 2020-0765 (BUBH); **Rangamati Pt-III,** on the bark of *Artocarpus heterophyllus*, 27.12.2020, alt. 25.43 m, 26°26′099″ N, 90°05′974″ E, Suparna Biswas & Pabitra Biswas, 2020-0788 (BUBH); **Fakiranir jhar Pt-I**, on the bark of *Mangifera indica*, 24.12.2020, alt. 37.45 m, 26°21′876″ N, 90°14′942″ E, Suparna Biswas & Pabitra Biswas, 2020-0792 (BUBH); **Arear jhar Pt-II**, on the bark of *Shorea robusta*, 25.12.2020, alt. 49.91 m, 26°26′074″ N, 90°41′802″ E, Suparna Biswas & Pabitra Biswas, 2020-0799 (BUBH); **Falimari,** on the bark of *Neolamarckia cadamba*, 25.12.2020, alt. 45.90 m, 26°30′150″ N, 90°41′414″ E, Suparna Biswas & Pabitra Biswas, 2020-0917 (BUBH).

Ecology: The species is found growing on the bark of *Pongamia pinnata, Michelia champaca, Shorea robusta, Artocarpus heterophyllus, Mangifera indica, Neolamarckia cadamba* at an elevation of 25.43 m to 60.67 m.

Remarks: The species is similar with *D. roseopruinatum* but differ as the latter one contain pink-red pruina on ascomata.

3. ***Diorygma reniforme*** (Fée) Kalb, Staiger & Elix in Symb. Bot. upsal. 34 (1): 167, 2004. Plate 6 (f)

Basionym: *Graphis reniformis* Fée in Essai Crypt. Exot. (Paris): 46, 1825.

Description: Thallus crustose, corticolous, pale- grey; apothecia lirellate, lirellae white, covered by thalline layer, pruinose present; exciple divergent, carbonized, hymenium clear, I+ weakly bluish violet, paraphyses anastomishing; ascus 1–spored, hyaline, muriform, I+ violet, 110–114× 30–35µm.

Chemistry: K+ red, C-, P+ yellow; UV-; TLC: Atranorin, Salazinic acid, Protocetraric acids present.

Distribution: India (Mizoram), Africa, Brazil, Congo, Colombia, Costa Rica, Cuba, Guyana, Puerto Rico, Singapore, Thailand, USA.

Specimen examined: India, Assam, Dhubri district, **Arear jhar Pt-II,** on the bark of *Shorea robusta*, 25.12.2020, alt. 30.70 m, 26°26′082″ N, 90°41′810″ E, Suparna Biswas & Pabitra Biswas, 2020-0853 (BUBH).

Ecology: The species is found growing on the bark of *Shorea robusta* at an elevation of 30.70 m.

Remarks: The species is characterized with pruina on disc, 1 spored ascus, muriform and presence of Atranorin, Salazinic acid, Protocetraric acids. The species is a new record to Assam.

4. ***Diorygma roseopruinatum*** Popong, Lücking & Parnmen, in Phytotaxa 189 (1): 207, 2014. Plate 7 (a)

Description: Thallus crustose, grey, corticated, smooth surface; apothecia lirellate, immersed, branched, thalline margin distinct, disc brown to dark brown, open with white pruinose and with pink-red pruina; excipulum divergent, hymenium colourless, clear, paraphyses simple; asci 1 spored, ascospores colourless, muriform, I+ violet, 73–77 × 20–21 µm.

Chemistry: Thallus K+ olive, C–, KC–, P+ yellow; UV–; TLC: norstictic acid present.

Distribution: New Caledonia.

Specimen examined: INDIA: Assam, Dhubri district, **Falimari,** on the bark of *Neolamarckia cadamba,* 25.12.2020, alt. 47.76 m, 26°30′149″ N, 90°41′416″ E, Suparna Biswas & Pabitra Biswas, 2020-0797 (BUBH).

Ecology: The species is found growing on the bark of *Neolamarckia cadamba* at an elevation of 47.76 m.

Remarks: The species is similar with *D. junghuhnii* in morphology, chemistry and ascospore type but differ as pink-red pruina present on ascomata (Papong *et al.* 2014). The species is a new record to India.

5. ***Diorygma soozanum*** (Zahlbr.) M. Nakan. & Kashiw. in Bull. natn. Sci. Mus., Tokyo, B 29(2): 86, 2003. Plate 7 (b)

Basionym: *Graphina soozana* Zahlbr. in Feddes Repert. Spec. Nov. Regni Veg. 31: 215, 1933.

Description: Thallus crustose, creamy white to pale grey, ecorticated, smooth surface; apothecia lirellate, immersed, branched, thalline margin distinct, disc open with thick white pruinose; excipulum divergent, uncarbonized, hymenium colourless, clear, I+ weakly bluish violet, paraphyses simple; asci 1 spored, ascospores colourless, muriform, I+ violet, 115–130 × 38–43 μm.

Chemistry: Thallus K+ yellow turning red, C–, KC–, P–; UV–; TLC: constictic acid, norstictic acid present.

Distribution: India (Arunachal Pradesh, Assam), China, Japan, Taiwan.

Specimen examined: INDIA: Assam, Dhubri district, **Kherbari Pt-II**, on the bark of *Aquilaria agallocha*, 21.11.2020, alt. 25.95 m, 26°25′631″ N, 89°74′396″ E, Suparna Biswas & Pabitra Biswas, 2020-0115 (BUBH); **Bilashipara Florican Garden**, on the bark of *Pongamia pinnata*, 10.02.2020, alt. 36.23 m, 26°25′063″ N, 90°27′652″ E, Suparna Biswas & Pabitra Biswas, 2020-0117 (BUBH); **Alokjhari**, on the bark of *Shorea robusta*, 12.01.2020, alt. 57.10 m, 26°25′336″ N, 89°86′005″ E, Suparna Biswas & Pabitra Biswas, 2020-0127 (BUBH); **Alokjhari**, on the bark of *Shorea robusta*, 12.01.2020, alt. 62.39 m, 26°25′032″ N, 89°86′125″ E, Suparna Biswas & Pabitra Biswas, 2020-0128 (BUBH); **Falimari**, on the bark of *Artocarpus heterophyllus*, 25.12.2020, alt. 48.09 m, 26°30′153″ N, 90°41′405″ E, Suparna Biswas & Pabitra Biswas, 2020-0129 (BUBH), 61650 (LWG), **Arear jhar Pt-II**, on the bark of *Shorea robusta*, 25.12.2020, alt. 22.94 m, 26°26′103″ N, 90°41′794″ E, Suparna Biswas & Pabitra Biswas, 2020-0595 (BUBH); **Alomganj Pt-IX**, on the bark of *Michelia champaca*, 27.12.2020, alt. 48.06 m, 26°13′295″ N, 90°03′366″ E, Suparna Biswas & Pabitra Biswas, 2020-0753 (BUBH); **Alomganj Pt-IX**, on the bark of *Artocarpus heterophyllus*, 27.12.2020, alt. 47.23 m, 26°13′509″ N, 90°03′663″ E, Suparna Biswas & Pabitra Biswas, 2020-0752 (BUBH).

Ecology: The species is found growing on the bark of *Aquilaria agallocha*, *Pongamia pinnata*, *Shorea robusta*, *Michelia champaca*, *Artocarpus heterophyllus* at an elevation of 25.95 m to 62.39 m.

Remarks: The species is similar with *D. tuberculosum* but differ with I+ violet reaction of the spores. Furthermore, in the peripheral spore locules are distinctly smaller than the central ones. In *D. junghuhnii* the entire hymenium always reacts distinctly I+ violet (Kalb *et al.* 2004).

Dirinaria **(Tuck.) Clem. in Gen. Fung., 84, 1909. (Family: Caliciaceae)**

Thallus foliose, closely adpressed to the substratum, lobes small, dichotomously to pinnately divided, confluent centrally, upper surface plane to concave, thallus corticated on both sides, grey to darker grey, with or without soredia and isidia; medulla white sometimes faintly yellow, lower cortex brownish, rhizines absent, epithecium pale brown or red, hypothecium dark brown to brown black, paraphyses branched; ascomata apothecia, lecanorine, sessile, disc black, often pale grey, margin prominent; ascus 8–spored, ascospores brown to dark brown, ellipsoid, transversely 1–septate, secondary metabolites atranorin, chloroatranorin, orcinol depsides, triterpenes, quinones present.

Key to the species

1a**.** Thallus isidiate–sorediate…….....*D. aegialita*

1b Thallus either isidiate/sorediate …….....2

2a**.** Thallus only isidiate ……..... *D. papillulifera*

2b Thallus only sorediate …….....3

3a**.** Thallus contain sekikaic acid ……*D. consimilis*

3b Thallus contain divaricatic acid ……4

4a**.** Lobes small, pinnatifid ……*D.picta*

4b Lobes wide, dichotomously divided ……...*D. applanata*

1. ***Dirinaria aegialita*** (Afzel. ex Ach.) B.J. Moore in Bryologist 71: 248, 1968. Plate 7 (c)

Basionym: *Parmelia aegialita* Afzel . ex. Ach. in Methodus, Sectio post. (Stockholmiae): 191, 1803.

Description: Thallus foliose, lobes small, adpressed to the substratum, grey, epruinose, densely isidiate–sorediate, isidia simple, lower surface lack, rhizine absent; medulla white; apothecia not seen.

Chemistry: Medulla K–, C–, KC–, P–; UV–; TLC: atranorin, divaricatic acid, triterpenoids present.

Distribution: India (Andaman and Nicobar Island, Arunachal Pradesh, Assam, Chhattisgarh, Kerala, Madhya Pradesh, Mizoram, Odisha, Sikkim, Tamil Nadu, West Bengal), Africa, Australia, Brazil, Colombia, Costa Rica, Ecuador, Kenya, Mexico, Nepal, Pacific Ocean Islands, Sri Lanka, Thailand, Taiwan, Trinidad and Tobago, USA.

Specimen examined: India, Assam, Dhubri district, **Pub- gaikhawa Pt- I**, on the bark of *Mangifera indica*, 25.10.2020, alt. 29.16 m, 26°08′059″ N, 89°83′365″ E, Suparna Biswas & Pabitra Biswas, 2020-0975 (BUBH).

Ecology: The species is found growing on the bark of *Mangifera sp.* at an elevation of 29.16 m.

Remarks: The species is distinguished from other species by its isidiate–sorediate or isidiate–postulate thallus. The species resemble with *D. papillulifera* (Nyl.) D.D. Awasthi but differ as the soredia and pustules absent in the latter one (Gupta and Sinha 2018).

2. ***Dirinaria applanata*** (Fée) D.D. Awasthi in J. Indian bot. Soc. 49: 135, 1970. Plate 7 (d)

Basionym: *Parmelia applanata* Fée in Essai Crypt. Exot. (Paris): 126, 1825.

Description: Thallus foliose, lobes small, adpressed to the substratum, grey, pruinose, maculate, sorediate, laciniae dichotomously to irregularly divided, wide, round, confluent, lower surface lack, rhizine absent; medulla white, apothecia not seen.

Chemistry: Medulla K–, C–, KC–, P–; UV–; TLC: atranorin, divaricatic acid, triterpenoids present.

Distribution: India (Assam, Madhya Pradesh, Maharashtra, Nagaland, Karnataka, Kerala, Tamil Nadu, Uttaranchal, West Bengal), Australia, Brazil, Colombia, Costa Rica, Japan, Mexico, New Zealand, Papua New Guinea, Portugal, USA.

Specimen examined: INDIA: Assam, Dhubri district, **South Tokrerchara Pt-IV**, on the bark of *Mangifera indica*, 29.12.2019, alt. 28.42 m, 26°10′718″ N, 89°81′565″ E, Suparna Biswas &

Pabitra Biswas, 2020-0505 (BUBH); **Dhubri town**, on the bark of *Delonix regia,* 13.03.2021, alt. 34.00 m, 26°02′131″ N, 89°99′572″ E, Suparna Biswas & Pabitra Biswas, 2020-0508 (BUBH); **Gauripur Matiabag Hawakhana**, on the bark of *Michelia champaca,* 08.02.2020, alt. 44.82m, 26°09′793″ N, 89°97′546″ E, Suparna Biswas & Pabitra Biswas, 2020-0553 (BUBH); **Pub- gaikhawa Pt- I**, on the bark of *Moringa* sp., 25.10.2020, alt. 28.84 m, 26°08′062″ N, 89°83′3686″ E, Suparna Biswas & Pabitra Biswas, 2020-0722 (BUBH); **Gourangtari Pt-II**, on the bark of *Lannea* sp., 26.12.2020, alt. 43.51 m, 26°24′466″ N, 90°31′947″ E, Suparna Biswas & Pabitra Biswas, 2020-0730 (BUBH); **Khajurbari Pt-I**, on the bark of *Lannea* sp., 24.12.2020, alt. 40.06 m, 26°26′190″ N, 90°17′890″ E, Suparna Biswas & Pabitra Biswas, 2020-0748 (BUBH).

Ecology: The species is found growing on the bark of *Mangifera indica*, *Delonix regia*, *Michelia champaca*, *Moringa* sp., *Lannea* sp. at an elevation of 28.42 m to 44.82 m. The species is widely distributed in tropical regions of the world.

Remarks: The species is distinguished from other species by its confluent laciniae at the periphery with flabellate tips and capitate soralia. The species externally resemble with *D. leopoldii* (Stein.) D.D. Awasthi but differ as divaricatic acid absent in the latter one (Gupta and Sinha 2018).

3. ***Dirinaria consimilis*** (Stirt.) D.D. Awasthi in J. Indian bot. Soc. 49: 135, 1970. Plate 7 (e)

Basionym: *Physcia consimilis* Stirt. in Proc. Roy. phil. Soc. Glasgow, 11: 310, 1879.

Description: Thallus foliose, lobes small, adpressed to the substratum, grey, pruinose, sorediate, soredia farinose, laciniae radiating, confluent at periphery, subdichotomously to subpinnately divided, lower surface black, rhizine absent; medulla white; apothecia not seen.

Chemistry: Medulla K–, C–, KC–, P–; UV–; TLC: atranorin, sekikaic acid present.

Distribution: India (Assam, Madhya Pradesh, Manipur, Mizoram, Nagaland, Tamil Nadu, Uttar Pradesh, West Bengal), Australia, Brazil, Congo, Japan, Myanmar, Nepal, Thailand.

Specimen examined: INDIA: Assam, Dhubri district, **Bilashipara Florican Garden**, on the bark of *Mallotus* sp., 10.02.2020, alt. 42.14 m, 26°25′163″ N, 90°27′603″ E, Suparna Biswas & Pabitra Biswas, 2020-0480 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Mangifera indica,* 29.12.2019, alt. 39.49 m, 26°10′724″ N, 89°81′581″ E, Suparna Biswas & Pabitra

Biswas, 2019-0489 (BUBH); **Chagolchara Pt-III,** on the bark of *Artocarpus heterophyllus*, 29.10.2020, alt. 29.00 m, 26°02′510″ N, 89°94′427″ E, Suparna Biswas & Pabitra Biswas, 2020-0497 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Artocarpus heterophyllus*, 16.01.2020, alt. 28.81 m, 26°11′061″ N, 89°83′376″ E, Suparna Biswas & Pabitra Biswas, 2020-0504 (BUBH); **Chandor dinga Pahar**, on the bark of *Neolamarckia cadamba*, 11.02.2020, alt. 36.64 m, 26°19′341″ N, 90°34′748″ E, Suparna Biswas & Pabitra Biswas, 2020-0712 (BUBH); **Pataner Kuti**, on the bark of *Artocarpus heterophyllus*, 27.12.2020, alt. 37.28 m, 26°28′092″ N, 89°86′817″ E, Suparna Biswas & Pabitra Biswas, 2020-0749 (BUBH); **Alomganj Pt- IX**, on the bark of *Bombex cieba*, 27.12.2020, alt. 47.49 m, 26°13′512″ N, 90°03′681″ E, Suparna Biswas & Pabitra Biswas, 2020-0726 (BUBH), 61637 (LWG).

Ecology: The species is found growing on the bark of *Mallotus* sp., *Mangifera indica*, *Artocarpus heterophyllus*, *Neolamarckia cadamba*, *Bombex cieba* at an elevation of 28.81 m to 47.49 m. The species is widely distributed in tropical regions of the world.

Remarks: The species is distinguished from other species by the presence of sekikaic acid.

4. ***Dirinaria papillulifera*** (Nyl.) D.D. Awasthi in Bryologist 67: 369, 1964. Plate 7 (f)

Basionym: *Physcia papillulifera* Nyl. in Acta Soc. Sci. fenn. 26(10): 9, 1900.

Description: Thallus foliose, lobes small, adpressed to the substratum, upper side grey, soredia absent, only isidiate, isidia filiform, branched, laciniae radiating, confluent at periphery, lower surface blak, rhizine absent; medulla white; apothecia not seen.

Chemistry: Medulla K–, C–, KC–, P–; UV–; TLC: atranorin, divaricatic acid present.

Distribution: India (Andaman and Nicobar Islands, Assam, Mizoram, Odisha, West Bengal), America, Bolivia, Brazil, Congo, Ecudor, Indonesia, Jamaica, Mexico, Papua New Guinea, Philippines.

Specimen examined: INDIA: Assam, Dhubri district, **Dhubri town**, on the bark of *Cocoes nucifera*, 10.01.2020, alt. 25.99 m, 26°02′9536″ N, 89°95′986″ E, Suparna Biswas & Pabitra Biswas, 2020-0725 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Areca catechu*, 16.01.2020, alt. 28.99 m, 26°11′101″ N, 89°83′442″ E, Suparna Biswas & Pabitra Biswas, 2020-0710 (BUBH); **Dhubri town**, on the bark of *Cocos nucifera*., 10.01.2020, alt. 29.04m, 26°02′253″ N, 89°95′986″ E, Suparna Biswas & Pabitra Biswas, 2020-0740 (BUBH); **Dhubri**

town, on the bark of *Polyalthia longifolia*, 13.03.2021, alt. 29.04 m, 26°02′228″ N, 89°99′437″ E, Suparna Biswas & Pabitra Biswas, 2021-0800 (BUBH), 61695 (LWG).

Ecology: The species is found growing on the bark of *Cocoes nucifera*, *Areca catechu, Polyalthia longifolia* at an elevation of 25.99 m to 29.04 m. The species is widely distributed in sub-tropical regions of the world.

Remarks: The species is distinguished from other species by the presence of only filiform isidia and divaricatic acid.

5. ***Dirinaria picta*** (Sw.) Clem. & Shear in Gen. fung., Edn 2 (Minneapolis): 323, 1931. Plate 8 (a)

Basionym: *Lichen pictus* Sw. in Prodr.: 146, 1788.

Description: Thallus foliose, adpressed to the substratum, occurring in suborbicular patches, lobes small, lobes pinnatifid, apicies round, upper surface smooth, grey, sorediate, soredia farinose, soralia hemispherical, laminal, lower surface lack, rhizine absent, medulla white, apothecia not seen.

Chemistry: Medulla K–, C–, KC–, P–; UV–; TLC: atranorin, divaricatic acid, triterpenoids present.

Distribution: India (Andaman and Nicobar Island, Arunachal Pradesh, Assam, Lakshadweep, Tamil Nadu, Uttar Pradesh, West Bengal), Africa, America, Australia, Brazil, Colombia, Mexico, New Zealand, Pacific Ocean Islands, Papua New Guinea, Seychelles, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Gaurangtari Pt- II**, on the bark of *Shorea robusta*, 26.12.2020, alt. 47.59 m, 26°24′459″ N, 90°31′933″ E, Suparna Biswas & Pabitra Biswas, 2020-0728 (BUBH), 61668 (LWG); **Arear Jhar Pt-II**, on the bark of *Shorea robusta*, 25.12.2020, alt. 22.94 m, 26°26′103″ N, 90°41′794″ E, Suparna Biswas & Pabitra Biswas, 2020-0743 (BUBH).

Ecology: The species is found growing on the bark of *Shorea robusta* at an elevation of 22.94 m to 47.59 m.

Remarks: The species is distinguished from other species by the presence of hemispherical soralia and stellate radiate lobes. The species resemble with *D. applanata* and *D. consimilis* but

differ from the first one by its confluent and stellate radiate lobes and from the second one as sekikaic acid lacking (Gupta and Sinha 2018).

Enterographa Fée Eassai Crypt. Ecorc. : 32, 1824. (Family: Roccellaceae)

Thallus crustose, corticolous, whitish grey to olive green, smooth, ecorticate or corticated; ascomata rounded, elongated to lirellioform, irregular, disc closed or open, pink, red–brown, dark brown, black, epruinose; paraphysoides branched; asci 8–spored, ascospores colourless, fusiform, transversely 3–25 septate; secondary metabolites gyrophoric, psoromic acid, conpsoromic acid, protocetraric acid, norstictic acid, lichexanthone present or absent.

1. ***Enterographa mesomela*** Sparrius, Saipunk. & Wolseley, in Lichenologist 38 (1): 30, 2006. Plate 8 (b)

Description: Thallus grey–green, cracked, ascomata apothecia, round, black, pseudothalline margin, hymenium I+ blue, asci 8–spored, ascospores fusiform, tapering at one end, transversely 9–10 septate, 33.1–32.4× 4.2–4.5 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: Confluentic acid present.

Distribution: India (Assam, West Bengal), Thailand, Viet Nam.

Specimen examined: INDIA: Assam, Dhubri district, **Ananda nagar,** on the bark of *Lannea* sp., 24.12.2020, alt. 41.35 m, 26°22′736″ N, 90°21′6751″ E, Suparna Biswas & Pabitra Biswas, 2020-0133 (BUBH); **Panbari Tea Garden**, on the bark of *Michelia champaca,* 09.02.2020, alt. 53.54 m, 26°15′282″ N, 90°05′102″ E, Suparna Biswas & Pabitra Biswas, 2020-0134 (BUBH); **Panbari Tea Garden**, on the bark of *Michelia champaca,* 09.02.2020, alt. 43.51 m, 26°15′355″ N, 90°05′074″ E, Suparna Biswas & Pabitra Biswas, 2020-0768 (BUBH), 61667 (LWG).

Ecology: The species is found growing on the bark of *Lannea* sp., *Michelia champaca* at an elevation of 41.35 m to 43.51 m.

Remarks: The species is morphologically close to *E. assamica* Pooja Gupta, S. Joseph & G.P. Sinha but differ as *E. mesomela* is UV–, absence of lichexanthone, hymenium I+ blue (Gupta *et al.* 2019).

Glyphis Ach. in Syn. Meth. Lich. : 106, 1814. (Family: Graphidaceae)

Thallus crustose, corticolous, pale yellow, ochre to pale brown, rarely white or creamy, corticated; apothecia lirellate, sometimes embedded in carbonized stroma with white or pale brown surface branched, disc open, with brownish granular surface, thaline margin distinct, excipulum completely carbonized, brown to dark brown, labia entire, hymenium colourless, clear, paraphyses simple to branched; asci 2–8 spored, ascospores colourless, transversely septate to muriform; secondary metabolites absent or present sometimes.

Key to the species

1a**.** Pseudostromata white–greyish white, zeorin present…….*G. cicatricosa*

1b Stromata black, zeorin absent…….*G. duriuscula*

1. ***Glyphis cicatricosa*** Ach. in Syn. Meth. lich. (Lund): 107, 1814. Plate 8 (c)

Description: Thallus crustose, yellowish white brown, corticated, smooth surface; apothecia lirellate, branched, pseudostroma white to greyish white, disc open brown with thick brown pruinose, margin black; excipulum completely carbonized, labia entire, divergent, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 5–11 septate, biseriate, locules lentiform, I+ violet, 38–40 × 8–10 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: Zeorin present.

Distribution: India (Andaman and Nicobar Island, Assam, Karnataka, Kerala, Mizoram, Tamil Nadu, West Bengal), Africa, Australia, Brazil, Colombia, Costa Rica, Guyana, Jamaica, Mexico, Papua New Guinea, Portugal, Puerto Rico, South America, Sri Lanka, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Pataner Kuti**, on the bark of *Eucalyptus* sp., 27.12.2020, alt. 35.59 m, 26°28′046″ N, 89°86′829″ E, Suparna Biswas & Pabitra Biswas, 2020-0112 (BUBH), 61700 (LWG); **Bhelupara Pt-II**, on the bark of *Lannea* sp., 25.12.2020, alt. 34.78 m, 26°23′160″ N, 90°33′597″ E, Suparna Biswas & Pabitra Biswas, 2020-0566 (BUBH); **Ananda nagar**, on the bark of *Lannea* sp., 24.12.2020, alt. 41.39 m, 26°22′736″ N, 90°21′675″ E, Suparna Biswas & Pabitra Biswas, 2020-0857 (BUBH); **Jamduar Pt-I**, on the bark of *Lannea sp.*, 26.12.2020, alt. 40.63 m, 26°24′693″ N, 90°27′770″ E, Suparna Biswas & Pabitra Biswas, 2020-0910 (BUBH); **Jamduar Pt-I**, on the bark of *Lannea* sp., 26.12.2020, alt. 39.45 m, 26°24′689″ N, 90°27′773″ E, Suparna Biswas & Pabitra Biswas, 2020-0944 (BUBH);

Bidyadabri Pt-V, on the bark of *Lannea* sp., 21.11.2020, alt. 41.76 m, 26°26′122″ N, 89°77′329″ E, Suparna Biswas & Pabitra Biswas, 2020-0981 (BUBH).

Ecology: The species is found growing on the bark of *Eucalyptus* sp., *Lannea* sp. at an elevation of 34.78 m to 41.76 m.

Remarks: The species is similar with *G. batuana* Hardini, Kasiamdari & Purnomo but differ as larger ascospores and pseudostromata is present in *G. cicatricosa* Ach. (Hardini *et al.* 2018a).

2. ***Glyphis duriuscula*** Stirt. in Proc. Roy. phil. Soc. Glasgow, 13: 189, 1881. Plate 8 (d)

Description: Thallus crustose, yellow, corticated, smooth surface; apothecia lirellate, branched, stroma black, disc open brown with thick brown pruinose, margin black; excipulum completely carbonized, labia entire, divergent, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 7–9 septate, biseriate, locules lentiform, I–ve, 26–27 × 10.1–10.5 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam, Nagaland, West Bengal), endemic.

Specimen examined: India, Assam, Dhubri district, **Gopigoan Pt-III,** on the bark of *Lannea sp.,* 26.12.2020, alt. 41.03 m, 26°25′721″ N, 90°23′301″ E, Suparna Biswas & Pabitra Biswas, 2020-0983 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp. at an elevation of 41.03m.

Remarks: The species is distinguished with black stromata, brown pruinose on ascomata and colourless ascospores. The species is endemic to Indian region.

Graphis Adans. in Familles des Plantes 2: 11, 1763. (Family: Graphidaceae)

Thallus crustose, corticolous, white to pale grey, ecorticate to corticated; apothecia lirellate, elongate, sessile or branched, immersed in thallus or emergent, disc dark brown, branched, open or closed, labia entire or striae; excipulum with distinct carbonized, labia entire, convergent or divergent, hymenium colourless, clear or inspersed, paraphyses simple to branched; asci 2–8 spored, ascospores colourless, transversely septate to submuriform or muriform, secondary metabolites orcinol depsides, lichexanthone present or absent.

Key to the species

1a. Ascospores muriform…….2

1b Ascospores transversely septate…….7

2a. Excipulum apically carbonized…….*G. sulphurella*

2b. Excipulum laterally/ completely carbonized…….3

3a. Excipulum completely carbonized……*G. cremicolor*

3b. Excipulum laterally carbonized……4

4a. Disc with pruinose…….....*G. renschiana*

4b. Disc epruinose…….....5

5a. Hymenium inspersed……*G. pertricosa*

5b. Hymenium clear…….....6

6a. Norstictic acid present……..*G. analoga*

6b. Lichen substance not detected……*G. consimilis*

7a. Excipulum apically carbonized……8

7b. Excipulum laterally/ completely carbonized……...14

8a. Disc exposed……..9

8b. Disc concealed…….. ..10

9a. Norstictic acid present……..*G. alboglaucescens*

9b. Lichen substance not detected……*G. epimelaena*

10a. Disc with pruinose…….*G. glaucescens*

10b. Disc with epruinose…….....11

11a. Lirellae with apically thin complete thalline margin…….....*G. eburnea*

11b. Lirellae with lateral thalline margin…….12

12a. Stictic acid present……..*G. arecae*

12b. Lichen substance not detected……...13

13a. Ascospores 18–20×5.7–7.4 µm…….*G. coarctata*

13b. Ascospores 28–30×8–9 µm…….*G. intermediella*

14a. Excipulum laterally carbonized……..15

14b. Excipulum completely carbonized…….44

15a. Thallus UV+…….....*G. stipitata*

15b. Thallus UV–…….....16

16a. Hymenium clear…….....17

16b. Hymenium inspersed……38

17a. Disc exposed……18

17b. Disc concealed/ narrow……24

18a. Basal/ lateral/ apically thick thalline margin……..19

18b. Lacking thalline margin……..*G. distincta*

19a. Basal to lateral / apically thick complete thalline margin…….....20

19b. Lateral thalline margin…….21

20a. Basal to lateral thalline margin……*G. immersella*

20b. Apically thick complete thalline margin……..*G. riopiedrensis*

21a. Constictic, norstictic, salazinic, stictic acids present…….22

21b. Lichen substance not detected……*G. scripta*

22a. Norstictic acid present…….....23

22b. Norstictic acid absent ……..*G. sundarbanensis*

23a. Norstictic acid additionally with salazinic and stictic acids present……*G. subasahinae*

23b. Norstictic acid only present……...*G. pyrrhocheiloides*

24a. Disc narrow……...*G. capillacea*

24b. Disc concealed……...25

25a. Basal/ lateral / apically thick complete thalline margin…….26

25b. Lacking thalline margin……..*G. filiformis*

26a. Basal/ apically thick complete thalline margin……...27.

26b. Lateral thalline margin…….28

27a. Basal thalline margin……*G. ajarekarii*

27b. Apically thick complete thalline margin…….....*G. nematoides*

28a. Disc with pruinose……29

28b. Disc epruinose……...34

29a. Norstictic acid present……..30

29b. Norstictic acid absent……32

30a.Norstictic additionally with constictic, protocetraric salazinic, stictic acids present…….31

30b. Norstictic acid only…….*G. caesiella*

31a. Constictic, norstictic, stictic acids present…….....*G. argentia*

31b. Norstictic, salazinic, protocetraric acids present……..*G. litoralis*

32a. Salazinic acid present only……..*G. bakeri*

32b Salazinic acid absent, stictic, protocetraric acid present……..33

33a. Stictic acid only present…….....*G. dendrogramma*

33b. Protocetraric acid only present……..*G. supracola*

34a. Norstictic acid present……*G. librata*

34b. Lichen substance not detected……35

35a. Lirellae sessile……*G. enteroleuca*

35b. Lirellae branched…….36

36a. Lirellae erumpent, elongate, branched…….37

36b. Lirellae prominent, elongate, branched…….*G. prunicola*

37a. Thallus ecorticated……*G. furcata*

37b. Thallus corticated……*G. pinicola*

38a. Disc exposed……39

38b. Disc concealed/ narrow……41

39a. Disc with pruinose……40

39b. Disc epruinose……...*G. handelii*

40a. Norstictic acid present……*G. crebra*

40b. Lichen substance not detected……*G. submarginata*

41a. Disc concealed……42

41b. Disc narrow……...*G. plumierae*

42a. Constictic acid, norstictic acid, stictic acid present……43

42b. Lichen substance not detected……*G. lineola*

43a. Stictic acid only present……...*G. leptocarpa*

43b. Stictic acid absent, constictic, norstictic acid present……*G. cincta*

44a. Hymenium inspersed…….....45

44b. Hymenium clear…….....49

45a. Lateral/ apically thin complete thalline margin…….46

45b. Lacking thalline margin…….*G. anfractuosa*

46a. Apically thin complete thalline margin…….....*G. luluensis*

46b. Lateral thalline margin…….....47

47a. Norstictic acid, stictic acid present……48

47b. Lichen substance not detected……*G. arbusculaeformis*

48a. Norstictic acid present……*G. aperiens*

48b. Norstictic acid absent, stictic acid present……*G. cervinonigra*

49a. Disc exposed/ slightly open/ narrow……50

49b. Disc concealed……..54

50a. Disc narrow/ slightly open……51

50b. Disc exposed……52

51a. Disc slightly open, pruinose……..*G. cinnamomea*

51b. Disc narrow, epruinose……*G. conferta*

52a. Salazinic acid, stictic acid, Constictic acid present……53

52b. Lichen substance not detected……*G. palmicola*

53a. Salazinic acid present……*G. ficicola*

53b. Salazinic acid absent, stictic, constictic acid present……...*G. modesta*

54a. Lateral/ basal thalline margin……..55

54b. Lacking thalline margin…….....*G. emersa*

55a. Basal thalline margin……*G. dracaenae*

55b. Lateral thalline margin……56.

56a. Disc with pruinose……57

56b. Disc epruinose……..58

57a. Norstictic acid present……..*G. caesiocarpa*

57b. Lichen substance not detected……*G. hyphosa*

58a. Constictic, norstictic, stictic acid present……..59

58b. Lichen substance not detected……*G. immersicans*

59a. Constictic, norstictic, stictic acid present……*G. asahinae*

59b. Constictic acid absent, norstictic, stictic acid present……...*G. cervina*

1. ***Graphis ajarekarii*** Patw. & C.R. Kulk. in Norw. JI Bot. 26(1): 45, 1979. Plate 8 (e)

Description: Thallus crustose, olive grey, smooth surface; apothecia lirellate, black, simple to branched, basal thaline margin, disc concealed, epruinose; excipulum laterally carbonized, labia

entire, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 9–10 septate, I+ blue, 23–25 × 5.8–6.5 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: norstictic, stictic acid present.

Distribution: India (Andhra Pradesh, Arunachal Pradesh, Assam, Karnataka, Kerala, Tamil Nadu), endemic.

Specimen examined: INDIA: Assam, Dhubri district, **Uchita,** on the bark of *Mallotus sp.,* 28.10.2020, alt. 31.96 m, 26°10′685″ N, 89°85′228″ E, Suparna Biswas & Pabitra Biswas, 2020-0586 (BUBH); **Dumardaha Pt-II,** on the bark of *Lannea sp.,* 28.10.2020, alt. 36.24 m, 26°09′003″ N, 89°92′013″ E, Suparna Biswas & Pabitra Biswas, 2020-0938 (BUBH).

Ecology: The species is found growing on the bark of *Mallotus sp., Lannea sp.* at an elevation of 31.96 m to 36.24 m.

Remarks: The species is similar with *G. nigroglauca* Leight with ascospore size, chemistry but differ as completely carbonized exciple in *G. nigroglauca* and lirellae morphology also different. The species was recorded as a magnicolous lichen and have antioxidant as well as antidaibetic properties. The species is endemic to Indian region (Bharadwaj 2019; Makhija *et al*. 2006; Tatipamula *et al.* 2018).

2. ***Graphis alboglaucescens*** Adaw. & Makhija in Mycotaxon 99: 312, 2007. Plate 8 (f)

Description: Thallus crustose, whitish green, smooth surface; apothecia lirellate, black, simple to branched, immersed, lateral thaline margin, disc black, exposed, white pruinose; excipulum apically carbonized, labia entire, hymenium colourless, clear, paraphyses simple; asci 8– spored, ascospores colourless, transversely 9–10 septate, I+ blue, 15–21 × 4.8–5.5 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Assam, Karnataka), Brazil, El Salvador, Mexico.

Specimen examined: INDIA: Assam, Dhubri district, **Dhubri town**, on the bark of *Polyalthia longifolia,* 13.03.2021, alt. 30.00 m, 26°02′228″ N, 89°99′437″ E, Suparna Biswas & Pabitra Biswas, 2020-0608 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia* at an elevation of 30.00 m.

Remarks: The species is characterized with completely carbonized, clear hymenium, transseptate ascospores.

3. ***Graphis analoga*** Nyl. in Annals Sci. Nat., Bot., sér. 4 11: 244, 1859. Plate 9 (a)

Description: Thallus crustose, whitish grey, smooth surface; apothecia lirellate, black, simple, prominent, basal thaline margin, disc black, closed, epruinose; excipulum laterally carbonized, labia entire, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, muriform, I+ blue, 25–26 × 8.5–8.8 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Uttarakhand), America, Australia, Brazil, Chinese Taipei, Costa Rica, France, Madagascar, Philippines, Seychelles.

Specimen examined: INDIA: Assam, Dhubri district, **Barobalurchar,** on the bark of *Jatropha sp.,* 27.12.2020, alt. 42.97 m, 26°22′157″ N, 89°84′088″ E, Suparna Biswas & Pabitra Biswas, 2020-0824 (BUBH); **Chagolia Pt-I,** on the bark of *Artocarpus heterophyllus*, 21.11.2020, alt. 34.49 m, 26°29′159″ N, 89°78′145″ E, Suparna Biswas & Pabitra Biswas, 2020-0827 (BUBH); **Kherbari Pt-II**, on the bark of *Michelia champaca*, 21.11.2020, alt. 24.95 m, 26°25′646″ N, 89°73′968″ E, Suparna Biswas & Pabitra Biswas, 2020-0919 (BUBH), 61651 (LWG); **Kaldoba**, on the bark of *Tectona grandis,* 21.11.2020, alt. 34.92 m, 26°19′870″ N, 89°77′091″ E, Suparna Biswas & Pabitra Biswas, 2020-0920 (BUBH); **Chagolia Pt-I**, on the bark of *Artocarpus heterophyllus,* 21.11.2020, alt. 34.49 m, 26°29′159″ N, 89°78′145″ E, Suparna Biswas & Pabitra Biswas, 2020-0953 (BUBH).

Ecology: The species is found growing on the bark of *Jatropha sp., Michelia champaca*, *Tectona grandis, Artocarpus heterophyllus* at an elevation of 24.95 m to 42.97 m.

Remarks: The species is characterized with closed disc, laterally carbonized, clear hymenium, muriform spores; a new record to Assam.

4. ***Graphis anfractuosa*** (Eschw.) Eschw. in Martius, Fl. Bras. Enum.pl. 1(1):86, 1833. Plate 9 (b)

Basionym: *Scaphis anfractuosa* Eschw. in Syst. Lich. 25, 1824

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, black, prominent, branched, lacking thalline margin, disc closed, epruinose; excipulum completely carbonized, labia entire, convergent, hymenium colourless, inspersed, paraphyses simple; asci 8–spored, ascospores colourless, transversely 10–septate, I+ blue, 35–41 × 7.8–8.5 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Arunachal Pradesh, Assam, Tamil Nadu, Uttarakhand), Australia, Borneo, Brazil, Colombia, Costa Rica, Dominica, Florida, French Guiana, Hawaii, Japan, Malaysia, Philippines, and New Zealand, USA .

Specimen examined: INDIA: Assam, Dhubri district, **South Tokrerchara Pt-IV**, on the bark of *Mallotus sp.,* 29.12.2019, alt. 35.01 m, 26°16′132″ N, 89°83′460″ E, Suparna Biswas & Anjali Biswas, 2019-0771 (BUBH), 61671 (LWG).

Ecology: The species is found growing on the bark of *Mallotus sp.* in South Tokrerchara Pt-IV at an elevation of 35.01 m.

Remarks: The species is characterized with sessile lirellae, completely carbonized, inspersed hymenium, and transseptate ascospores.

5. ***Graphis aperiens*** Müll. Arg. in Flora, Regensburg 74(1): 113, 1891. Plate 9 (c)

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, black, erumpent, short, branched, lateral thalline margin, disc exposed, pruinose, labia entire; excipulum completely carbonized, hymenium colourless, inspersed, paraphyses simple; asci 8–spored, ascospores colourless, transversely 8–9 septate, I+ blue, 26–38 × 6.8–7.2 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Assam), Australia, Colombia, Japan, Seychelles, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Gopigoan Pt-III,** on the bark of *Lannea* sp., 26.12.2020, alt. 43.69 m, 26°25′723″ N, 90°23′289″ E, Suparna Biswas & Pabitra Biswas, 2020-0380 (BUBH); **Ananda nagar**, on the bark of *Neolamarckia cadamba*, 24.12.2020, alt. 34.04 m, 26°22′741″ N, 90°21′685″ E, Suparna Biswas & Pabitra Biswas, 2020-0930 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Neolamarckia cadamba* at an elevation of 34.04 m to 43.69 m.

Remarks: The species is similar with *G. Koreana* S. Joshi & Hur with characters as completely carbonized, transseptate ascospores, norstictic acid as secondary compounds but differ as *G. aperiens* having open disc with pruinose, lateral thalline margin, inspersed hymenium, and small ascospores with less transverse septa (Joshi *et al.* 2013a).

6. ***Graphis arbusculaeformis*** (Vain.) Lücking in Lichenologist 44 (3): 391, 2012. Plate 9 (d)

Basionym: *Graphis subdisserpens* f. *arbusculaeformis* Vain. in Bot. Tidsskr. 29: 132, 1909.

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, black, erumpent, branched, lateral thalline margin, disc closed, epruinose; excipulum completely carbonized, labia entire, hymenium colourless, inspersed, paraphyses simple; asci 8–spored, ascospores colourless, transversely 10–septate, I+ blue, 27–31 × 7.8–8.5 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: Brazil, Thailand.

Specimen examined: INDIA: Assam, Dhubri district, **Panbari Tea Garden**, on the bark of *Camellia sinensis*, 09.02.2020, alt. 42.43 m, 26°15′356″ N, 90°05′077″ E, Suparna Biswas & Pabitra Biswas, 2020-0511 (BUBH); **Gourangtari Pt-II**, on the bark of *Lannea* sp., 26.12.2020, alt. 44.50 m, 26°24′480″ N, 90°31′930″ E, Suparna Biswas & Pabitra Biswas, 2020-0852 (BUBH); **Gourangtari Pt-II**, on the bark of *Pongamia pinnata*, 26.12.2020, alt. 43.01 m, 26°24′529″ N, 90°31′903″ E, Suparna Biswas & Pabitra Biswas, 2020-0870 (BUBH).

Ecology: The species is found growing on the bark of *Camellia sinensis*, *Lannea* sp. *and Pongamia pinnata* at an elevation of 42.43 m to 44.50 m.

Remarks: The species is characterized with completely carbonized, inspersed hymenium, transseptate ascospores and no secondary compounds present. The species is a new record to India.

7. ***Graphis arecae*** Vain. in Ann. Acad. Sci, fenn., Ser. A 15(6): 249, 1921. Plate 9 (e)

Description: Thallus crustose, corticolous, grey; apothecia lirellate, black, lirellae immersed, elongate and irregularly branched, thick lateral thalline margin, epruinose, disc concealed; excipulum apically carbonized, labia entire, hymenium clear, paraphyses simple; ascus 8–spored, ascospores colourless, transversely 8–9 septate, 28–29 × 6–8 μm.

Chemistry: Thallus K+ Yellow, C−, P+ orange; UV−; TLC: Constictic, Stictic acids present.

Distribution: India (Assam, Kerala, Mizoram, Tamil Nadu), Brazil, Philippines.

Specimen examined: INDIA: Assam, Dhubri district, **Chagolchara Pt-III**, on the bark of *Artocarpus heterophyllus*, 29.10.2020, alt. 29.56 m, 26°02′510″ N, 89°94′427″ E, Suparna Biswas & Pabitra Biswas, 2020-0107 (BUBH); **Dhubri town**, on the bark of *Polyalthia longifolia*, 30.12.2019, alt. 35.33 m, 26°02′258″ N, 89°99′486″ E, Suparna Biswas & Pabitra Biswas, 2019-0681 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus*, *Polyalthia longifolia* at an elevation of 29.56 m to 35.33 m.

Remarks: The species is characterized with apically carbonized, clear hymenium, transversely septate ascospores, constictic, stictic acids as secondary compounds.

8. ***Graphis argentia*** Makhija & Adaw. in Mycotaxon 91: 372, 2005. Plate 9 (f)

Description: Thallus crustose, corticolous, grey; apothecia lirellate, black, lirellae erumpent, irregularly branched, lateral thalline margin, disc concealed, labia entire, pruinose; excipulum laterally carbonized, hymenium clear, paraphyses simple; ascus 6- spored, ascospores colourless, transversely 8–9 septate, 28–29 × 6–8 μm.

Chemistry: Thallus K+ Yellow, C−, P−; UV−; TLC: Constictic, Norstictic, Stictic acids present.

Distribution: India (Andaman and Nicobar Islands), endemic.

Specimen examined: INDIA: Assam, Dhubri district, **South Tokrerchara Pt-IV**, on the bark of *Cocos nucifera*, 06.12.2019, alt. 24.17 m, 26°11′093″ N, 89°83′359″ E, Suparna Biswas & Pabitra Biswas, 2019-0616 (BUBH); **Panbari Tea Garden**, on the bark of *Michelia champaca*, 09.02.2020, alt. 51.69 m, 26°15′303″ N, 90°05′093″ E, Suparna Biswas & Pabitra Biswas, 2020-0617 (BUBH); **Khalilpur**, on the bark of *Polyalthia longifolia*, 10.03.2021, alt. 36.00 m, 26°03′858″ N, 89°96′196″ E, Suparna Biswas & Pabitra Biswas, 2021-0624 (BUBH); **Uchita**, on the bark of *Mallotus sp.*, 28.10.2020, alt. 22.29 m, 26°10′696″ N, 89°85′225″ E, Suparna Biswas & Pabitra Biswas, 2020-0626 (BUBH); **Debotar hasdaha Pt-IV**, on the bark of *Lannea sp.*, 22.11.2020, alt. 30.23 m, 26°05′731″ N, 89°88′970″ E, Suparna Biswas & Pabitra Biswas, 2020-0745 (BUBH); **Bidyadabri Pt-V**, on the bark of *Artocarpus heterophyllus*, 21.11.2020, alt.

26.97 m, 26°26′118″ N, 89°77′379″ E, Suparna Biswas & Pabitra Biswas, 2020-0751 (BUBH); **Jamduar Pt-I**, on the bark of *Lannea sp.,* 26.12.2020, alt. 42.98 m, 26°24′694″ N, 90°27′771″ E, Suparna Biswas & Pabitra Biswas, 2020-0808 (BUBH); **Khalilpur**, on the bark of *Polyalthia longifolia,* 10.03.2021, alt. 36.00 m, 26°03′858″ N, 89°96′196″ E, Suparna Biswas & Pabitra Biswas, 2021-0847 (BUBH); **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 22.11.2020, alt. 34.05 m, 26°05′069″ N, 89°89′316″ E, Suparna Biswas & Pabitra Biswas, 2020-0858 (BUBH).

Ecology: The species is found growing on the bark of *Cocos nucifera, Michelia champaca, Polyalthia longifolia, Mallotus sp., Lannea sp., Artocarpus heterophyllus* at an elevation of 24.17 m to 51.69 m.

Remarks: The species is characterized with laterally carbonized, clear hymenium, transverse ascospores, constictic, norstictic, stictic acids as secondary compounds. The species is a new record to Assam and endemic to Indian region.

9. ***Graphis asahinae*** Patw. & C.R. Kulk. in Norw. Jl Bot. 26(1): 46, 1979. Plate 10 (a)

Description: Thallus crustose, corticolous, grey; apothecia lirellate, black, lirellae erumpent, short to elongate and irregularly branched, thick lateral thalline margin, epruinose, disc concealed; excipulum completely carbonized, labia entire, convergent, hymenium clear, paraphyses simple; ascus 6–spored, ascospores colourless, transversely 8–9 septate, 28–29 × 6–8 μm.

Chemistry: Thallus K+ Yellow, C−, P−; UV−; TLC: Constictic, Norstictic, Stictic acids present.

Distribution: India (Kerala and Tamil Nadu), Brazil.

Specimen examined: INDIA: Assam, Dhubri district, **Gopigoan Pt-III**, on the bark of *Lannea* coromandelica, 26.12.2020, alt. 44.14 m, 26°25′721″ N, 90°23′290″ E, Suparna Biswas & Pabitra Biswas, 2020-0172 (BUBH), 61654 (LWG); **Kismat hasdaha Pt-II,** on the bark of *Lannea* sp., 22.11.2020, alt. 31.75 m, 26°05′050″ N, 89°89′330″ E, Suparna Biswas & Pabitra Biswas, 2020-0606 (BUBH); **Debotar hasdaha Pt-IV**, on the bark of *Lannea* sp., 22.11.2020, alt. 25.66 m, 26°05′764″ N, 89°88′963″ E, Suparna Biswas & Pabitra Biswas, 2020-0759 (BUBH); **Bhalukmari,** on the bark of *Syzygium* sp., 24.12.2020, alt. 47.30 m, 26°29′998″ N, 90°22′929″ E, Suparna Biswas & Pabitra Biswas, 2020-0836 (BUBH); **South Tokrerchara Pt-IV,** on the bark of *Mangifera indica*, 06.12.2019, alt. 29.71 m, 26°11′095″ N, 89°83′360″ E,

Suparna Biswas & Pabitra Biswas, 2020-0936 (BUBH); **Bhalukmari**, on the bark of *Neolamarckia cadamba*, 24.12.2020, alt. 37.30 m, 26°29′998″ N, 90°22′929″ E, Suparna Biswas & Pabitra Biswas, 2020-0945 (BUBH); **Bhalukmari**, on the bark of *Neolamarckia cadamba*, 24.12.2020, alt. 47.45 m, 26°30′231″ N, 90°23′118″ E, Suparna Biswas & Pabitra Biswas, 2020-0949 (BUBH).

Ecology: The species is found growing on the bark of *Syzygium* sp., *Mangifera indica*, *Neolamarckia cadamba* at an elevation of 25.66 m to 47.45 m.

Remarks: The species is characterized with completely carbonized, clear hymenium, transverse ascospores, constictic, norstictic, stictic acids as secondary compounds. The species is a new record to Assam.

10. *Graphis bakeri* Vain. in Ann. Acad. Sci. fenn., Ser. A 15(6): 253, 1921. Plate 10 (b)

Description: Thallus crustose, white–grey, smooth surface; apothecia lirellate, elongate, branched, erumpent, lateral thalline margin, disc concealed, labia entire, pruinose; excipulum laterally carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 9–10 septate, I+ blue, 23–25 × 7.1–7.4 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: salazinic acid present.

Distribution: India (Andaman and Nicobar Islands, Himachal Pradesh, Kerala), Philippines.

Specimen examined: INDIA: Assam, Dhubri district, **Khalilpur**, on the bark of *Polyalthia longifolia*, 10.03.2021, alt. 36.00 m, 26°03′858″ N, 89°96′196″ E, Suparna Biswas & Pabitra Biswas, 2021-0848 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia* at an elevation of 36.00 m.

Remarks: The species is characterized with laterally carbonized, clear hymenium, transverse ascospores, salazinic acid as secondary compound. The morphology of the species is similar with *G. caesiella* Vain. but chemistry differ. The species is a new record to Assam (Ohmura *et al.* 2020).

11. *Graphis caesiella* Vain. in Acta Soc. Fauna Flora fenn. 7(2): 122, 1890. Plate 10 (c)

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, elongate, branched, erumpent, lateral thalline margin, disc concealed, labia entire, pruinose; excipulum laterally carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 7–9 septate, I+ blue, 20–21 × 6.5–7.4 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Assam, Lakshadweep, Mizoram), Australia, Brazil, Costa Rica, Ecuador, Japan, Mexico, Myanmar, Papua New Guinea, Puerto Rico, Rio de Janerio, Singapore, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Dhubri town**, on the bark of *Polyalthia longifolia,* 13.03.2021, alt. 30.00 m, 26°02′228″ N, 89°99′437″ E, Suparna Biswas & Pabitra Biswas, 2021-0819 (BUBH); **Khajurbari Pt-I,** on the bark of *Lannea* sp., 24.12.2020, alt. 32.42 m, 26°26′194″ N, 90°17′929″ E, Suparna Biswas & Pabitra Biswas, 2020-0948 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia, Lannea* sp. at an elevation of 30.00 m to 32.42 m.

Remarks: The morphology of the species is similar with *G. bakeri* Vain., *G. dendrogramma* Nyl., *G. supracola* A.W. Archer but their chemistry differ (Ohmura *et al.* 2020).

12. *Graphis caesiocarpa* Redinger in Ark. Bot. 27A (3): 23, 1935. Plate 10 (d)

Description: Thallus crustose, whitish–grey, smooth surface, ecorticate; apothecia lirellate, elongate, branched, immersed to erumpent, lateral thalline margin, disc concealed, pruinose; excipulum completely carbonized, labia entire, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 8–10 septate, I+ blue, 29– 31 × 6.5– 6.7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Assam), Brazil, Colonbia, El Salvador, Guyana, Jamaica, Viet Nam.

Specimen examined: INDIA: Assam, Dhubri district, **Fakiranir jhar Pt-I**, on the bark of *Artocarpus heterophyllus,* 24.12.2020, alt. 37.41 m, 26°21′879″ N, 90°14′943″ E, Suparna Biswas & Pabitra Biswas, 2020-0807 (BUBH); **Arear jhar Pt-II,** on the bark of *Polyalthia longifolia,* 25.12.2020, alt. 31.33 m, 26°26′085″ N, 90°41′794″ E, Suparna Biswas & Pabitra Biswas, 2020-0869 (BUBH); **Debotar hasdaha Pt-IV**, on the bark of *Lannea* sp., 22.11.2020,

alt. 25.66 m, 26°05′764″ N, 89°88′963″ E, Suparna Biswas & Pabitra Biswas, 2020-0907 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus, Polyalthia longifolia, and Lannea* sp. at an elevation of 25.66 m to 37.41 m.

Remarks: The species is similar in chemistry with *G. assimilis* Nyl. but differ with lirellae morphology. *G. caesiocarpa* is also similar with *G. koreana* in having concealed disc, labia entire, transversely septate ascospores and norstictic acid presence but differ as *G. caesiocarpa* have caesiella morph lirellae, with lateral thalline margin and small ascospores (Joshi *et al.* 2013a; Joshi *et al.* 2013b).

13. ***Graphis capillacea*** Stirt. in Proc. Roy. phil. Soc. Glasgow 11: 315, 1879. Plate 10 (e)

Description: Thallus crustose, whitish–grey, smooth surface, ecorticate; apothecia lirellate, elongate, branched, erumpent, disc narrow, thinly pruinose, labia entire, covered by thaline layer; excipulum laterally carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 7– 9 septate, I+ blue, 28– 31 × 7.5– 7.7 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P+ yellow; UV–; TLC: norstictic acid, salazinic acid present.

Distribution: India (Assam, Kerala, Nagaland, Tamil Nadu, West Bengal), Brazil.

Specimen examined: INDIA: Assam, Dhubri district, **South Tokrerchara Pt-IV**, on the bark of *Mallotus nudiflora,* 02.01.2020, alt. 32.87 m, 26°09′139″ N, 89°82′181″ E, Suparna Biswas & Pabitra Biswas, 2020-0485 (BUBH); **Rangamati Pt-III**, on the bark of *Bombex cieba,* 27.12.2020, alt. 23.40 m, 26°16′106″ N, 90°05′978″ E, Suparna Biswas & Pabitra Biswas, 2020-0560 (BUBH); **Gourangatri Pt-II**, on the bark of *Pongamia pinnata,* 26.12.2020, alt. 44.01 m, 26°24′482″ N, 90°31′940″ E, Suparna Biswas & Pabitra Biswas, 2020-0578 (BUBH); **Bhasani goan**, on the bark of *Lannea sp.,* 26.12.2020, alt. 37.10 m, 26°30′143″ N, 90°22′440″ E, Suparna Biswas & Pabitra Biswas, 2020-0584 (BUBH); **Falimari,** on the bark of *Neolamarckia cadamba,* 25.12.2020, alt. 47.76 m, 26°30′149″ N, 90°41′416″ E, Suparna Biswas & Pabitra Biswas, 2020-0598 (BUBH); **Ananda nagar**, on the bark of *Neolamarckia cadamba,* 24.12.2020, alt. 34.41 m, 26°22′741″ N, 90°21′685″ E, Suparna Biswas & Pabitra Biswas, 2020-0610 (BUBH); **Panbari Tea Garden**, on the bark of *Michelia champaca,* 09.02.2020, alt. 33.54

m, 26°15′282″ N, 90°05′102″ E, Suparna Biswas & Pabitra Biswas, 2020-0760 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Mangifera indica*, 06.12.2019, alt. 24.17 m, 26°10′893″ N, 89°83′359″ E, Suparna Biswas & Pabitra Biswas, 2019-0762 (BUBH); **Khalilpur**, on the bark of *Polyalthia longifolia*, 10.03.2021, alt. 29.00 m, 26°04′046″ N, 89°96′253″ E, Suparna Biswas & Pabitra Biswas, 2020-0955 (BUBH).

Ecology: The species is found growing on the bark of *Mallotus nudiflora, Bombex cieba, Pongamia pinnata, Lannea* sp., *Neolamarckia cadamba, Michelia champaca, Mangifera indica, Polyalthia longifolia* at an elevation of 23.40 m to 47.76 m.

Remarks: The species is characterized with lateral carbonization, clear hymenium, transverse septate ascospores, norstictic acid, salazinic acids as secondary compounds.

14. *Graphis cervina* Müll. Arg. in Nuovo G. bot. ital.. 24(3): 199, 1892. Plate 10 (f)

Description: Thallus crustose, whitish–grey, smooth surface; apothecia lirellate, immersed to erumpent, lateral thalline margin, short, branched, labia entire, disc concealed, epruinose; excipulum completely carbonized, hymenium colourless, clear, ascospores colourless, transversely 7–9 septate, 22–24 × 5.5–5.7 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: norstictic acid, stictic acid present.

Distribution: India (Assam), Hong Kong, Japan.

Specimen examined: INDIA: Assam, Dhubri district, **Debotar hasdaha Pt-IV**, on the bark of *Lannea* sp., 22.11.2020, alt. 32.21 m, 26°05′740″ N, 89°88′984″ E, Suparna Biswas & Pabitra Biswas, 2020-0627 (BUBH); **Bhalukmari**, on the bark of *Neolamarckia cadamba*, 24.12.2020, alt. 47.75 m, 26°30′231″ N, 90°23′118″ E, Suparna Biswas & Pabitra Biswas, 2020-0814 (BUBH); **Dhubri town**, on the bark of *Polyalthia longifolia*, 13.03.2021, alt. 33.66 m, 26°02′194″ N, 89°95′910″ E, Suparna Biswas & Pabitra Biswas, 2020-0815 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Neolamarckia cadamba, Polyalthia longifolia* at an elevation of 32.21 m to 47.75 m.

Remarks: The species differ from *G. koreana* with lirellae morph, small ascospores and have stictic acid in addition to the norstictic acid as secondary compounds (Joshi *et al.* 2013a).

15. ***Graphis cervinonigra*** Zahlbr. in Feddes Repert. Spec. Nov. Regni veg. 31: 210, 1933. Plate 11 (a)

Description: Thallus crustose, whitish–grey, smooth surface; apothecia lirellate, erumpent, short, irregularly branched, lateral thalline margin, disc concealed, epruinose, labia entire; excipulum completely carbonized, hymenium colourless, inspersed, ascus 8–spored, ascospores colourless, transversely 6–7 septate, 22–24 × 4.5–5.7 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: Constictic acid, norstictic acid, present.

Distribution: India (Assam), Brazil, Hong Kong.

Specimen examined: INDIA:Assam, Dhubri district, **Fakiranir jhar Pt-I,** on the bark of *Artocarpus heterophyllus*, 24.12.2020, alt. 42.47 m, 26°21′893″ N, 90°14′829″ E, Suparna Biswas & Pabitra Biswas, 2020-0946 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus* at an elevation of 42.47 m.

Remarks: The species is similar with *G. centrifuga* Räsänen in having branched lirellae, labia entire, complete carbonization, transverse sepatate ascospores, norstictic acid in thallus but differ as *G. centrifuga* have radially branched lirellae, smaller ascospores. *G. cervinonigra* also resembles *G. gonimica* Zahlbr. with similar anatomy and chemistry but differ as *G. cervinonigra* have irregularly branched lirellae (Joshi *et al.* 2013b).

16. *Graphis cinnamomea* Adaw. & Makhija in Mycotaxon 96: 54, 2006. Plate 11 (b)

Description: Thallus crustose, whitish–grey, smooth surface, apothecia lirellate, erumpent, lacking thalline margin, short, branched, labia entire, disc slightly open, pruinose, excipulum completely carbonized, hymenium colourless, clear, ascospores colourless, transversely 7–9 septate, 33–35 × 8.5–8.7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: norstictic acid, salazinic acid present.

Distribution: India (Assam, Kerala, Tamil Nadu), Brazil.

Specimen examined: INDIA: Assam, Dhubri district, **Khalilpur,** on the bark of *Polyalthia longifolia*, 10.03.2021, alt. 36.00 m, 26°03′858″ N, 89°96′196″ E, Suparna Biswas & Pabitra

Biswas, 2021-0382 (BUBH); **Rangamati Pt-III,** on the bark of *Mallotus sp.*, 27.12.2020, alt. 26.34m, 26°16′105″ N, 90°05′977″ E, Suparna Biswas & Pabitra Biswas, 2020-1377 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia, Mallotus* sp. at an elevation of 26.34 m to 36.00 m.

Remarks: The species is characterized with lirellae with lacking thalline margin, completely carbonized, clear hymenium, transversely septate ascospores, norstictic acid, and salazinic acids as secondary compounds.

17. *Graphis cincta* (Pers.) Aptroot, in Archer, in Mc Carthy (Ed.), Flora of Australia, (57) Lichens 5 (Melbourne): 651, 2009. Plate 11 (c)

Basionym: *Opegrapha cincta* Pers. in Ann. Wetter. Gesellsch. Ges. Naturk. 2(1): 15, 1810

Description: Thallus crustose, off white, smooth surface; apothecia lirellate, elongate, branched, erumpent, basal to lateral thalline margin, disc concealed, epruinose, labia entire; excipulum laterally carbonized, hymenium colourless, inspersed, paraphyses simple; asci 8–spored, ascospores colourless, transversely 4–5 septate, I+ blue, 27–29 × 7.5–7.6 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: norstictic acid, constictic acid present.

Distribution: India (Assam, Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu), Australia, Brazil, Eucador, Indonesia, Mexico, Papua New Guinea, Philippines, West Indies.

Specimen examined: INDIA: Assam, Dhubri district, **Jamduar Pt-I,** on bark of *Lannea* sp., 26.12.2020, alt. 40.03 m, 26°24′685″N, 90°27′774″ E, Suparna Biswas & Pabitra Biswas, 2020-0138 (BUBH), 61696 (LWG); **Sreegram Pt-III**, on bark of *Bombex cieba* 25.12.2020, alt. 49.06 m, 26°24′620″N, 90°34′150″ E, Suparna Biswas & Pabitra Biswas, 2020-0596 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Bombex cieba* at an elevation of 40.03 m. and 49.06 m.

Remarks: The species is similar with *G. inspersa* Zahlbr. but differs in morphology of lirellae as elongate and slender (Pitakpong 2015).

18. ***Graphis coarctata*** Stirt. in Proc. Roy. phil. Soc. Glasgow 11: 314, 1879. Plate 11 (d)

Description: Thallus crustose, greyish green, smooth surface; apothecia lirellate, erumpent, lateral thaline margin, short, branched, disc concealed, epruinose, labia entire; excipulum

apically carbonized, hymenium clear; asci 8–spored, ascospores colourless, transversely 3–5 septate, I+ blue, 18–20 × 5.7–7.4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam, West Bengal), endemic.

Specimen examined: INDIA: Assam, Dhubri district, **Panbari Tea Garden**, on the bark of *Camellia sinensis*, 09.02.2020, alt. 42.43 m, 26°15′356″ N, 90°05′077″ E, Suparna Biswas & Pabitra Biswas, 2020-0735 (BUBH), 61657 (LWG).

Ecology: The species is found growing on the bark of *Camellia sinensis* at an elevation of 42.43 m.

Remarks: The species is characterized with apically carbonized, concealed disc, transverse ascospores, no secondary metabolites present.

19. *Graphis conferta* Zenker, in Goebel & Kunze, Pharmaceutische Waarenkunde (Eisenach) 1(3): 166, 1827. Plate 11 (e)

Description: Thallus crustose, whitish–grey, smooth surface; apothecia lirellate, erumpent to prominent, lacking thalline margin, short, sessile, disc narrow, labia entire, epruinose; excipulum completely carbonized, hymenium colourless, clear, ascospores colourless, transversely 7–9 septate, 35–37 × 9.5–9.7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Tamil Nadu, West Bengal), Brazil, Colombia, Congo, Costa Rica, French Guiana, Guyana, Indonesia, Malayasia, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Gopigoan Pt-III**, on the bark of *Lannea* sp., 26.12.2020, alt. 41.03 m, 26°25′721″ N, 90°23′301″ E, Suparna Biswas & Pabitra Biswas, 2020-0383 (BUBH); **Pataner Kuti,** on the bark of *Lannea* sp., 27.12.2020, alt. 29.27 m, 26°28′059″ N, 89°86′832″ E, Suparna Biswas & Pabitra Biswas, 2020-0850 (BUBH); **Jamduar Pt-I,** on the bark of *Citrus* sp., 26.12.2020, alt. 39.55 m, 26°24′684″ N, 90°27′773″ E, Suparna Biswas & Pabitra Biswas, 2020-0929 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Citrus* sp., at an elevation of 29.27 m to 41.03 m.

Remarks: The speies is characterized with short, sessile lirellae, narrow disc, completely carbonized, clear hymenium, transverse septate ascospores. The species is a new record to Assam.

20. *Graphis consimilis* Vain. in Hedwigia 46: 177, 1907. Plate 11 (f)

Description: Thallus crustose, white-grey, smooth surface; apothecia lirellate, elongate, erumpent, branched, basal thaline margin, disc concealed, labia entire, epruinose; excipulum laterally carbonized, hymenium colourless, clear; asci 8–spored, ascospores colourless, muriform, I+ blue, 33–34 × 6.7–7.4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Uttarakhand), Colombia.

Specimen examined: INDIA: Assam, Dhubri district, **Kaldoba**, on bark of *Lannea* sp., 21.11.2020, alt. 30.74 m, 26°19′862″N, 89°77′091″ E, Suparna Biswas & Pabitra Biswas, 2020-0385 (BUBH), 61659 (LWG).

Ecology: The species is found growing on the bark of *Lannea* sp. at an elevation of 30.74m.

Remarks: The species is similar with *G. tenuirima* (Shirley) A.W. Archer as ascomatal anantomy and no secondary compounds are present in both of them, but differ with erumpent to prominent lirellae, concealed disc, larger ascospores. The species is a new record to Assam (Joshi *et al*. 2013c).

21. *Graphis crebra* Vain. in Hedwigia 38: 256, 1899. Plate 12 (a)

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, elongate, erumpent, branched, lateral thaline margin, disc exposed, labia entire, pruinose; excipulum laterally carbonized, hymenium colourless, inspersed; asci 8–spored, ascospores colourless, transversely 8–10 septate, I+ blue, 28–30 × 5.7–5.9 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: norstictic acids present.

Distribution: India (Assam), Australia, Brazil, Cayman Islands, China, Ecuador, Guadeloupe, Kenya, Seychelles.

Specimen examined: INDIA: Assam, Dhubri district, **Brahmin Para**, on the bark of *Lannea* sp., 25.12.2020, alt. 47.32m, 26°24′856″ N, 90°32′664″ E, Suparna Biswas & Pabitra Biswas, 2020-1532 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., at an elevation of 47.32m. **Remarks:** The species is similar with *G. handelii* Zahlbr. with labia entire, carbonization lateral, hymenium inspersed, transverse ascospores but differ as *G. crebra* have white pruinose on disc (Pitakpong 2015).

22. *Graphis cremicolor* (H. Magn.) Lücking & A.W. Archer, in Lichenologist 41(4): 436, 2009. Plate 12 (b)

Basionym: *Graphina cremicolor* H. Magn. in Ark. Bot., Ser., 2 3(10): 267, 1955.

Description: Thallus crustose, grey, smooth surface, corticated; apothecia lirellate, immersed, branched, lateral thaline margin, disc closed, black, labia entire, epruinose; excipulum completely carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, muriform, I+ blue, 28–29× 5.5–6.6 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Assam), Brazil, Colombia, Philippines, Seychelles.

Specimen examined: INDIA: Assam, Dhubri district, **Falimari,** on the bark of *Lannea* sp., 25.12.2020, alt. 48.52 m, 26°30′147″ N, 90°41′407″ E, Suparna Biswas & Pabitra Biswas, 2020-1530 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., at an elevation of 48.52 m.

Remarks: The species is close to *G. koreana* but differ as *G. cremicolor* having muriform ascospores, lirellae with lateral thalline margin (Joshi *et al.* 2013a).

23. ***Graphis dendrogramma*** Nyl., in Crombie, J. Linn. Soc., Bot. 16(2):226, 1877. Plate 12 (c)

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, elongate, erumpent, branched, basal to lateral thaline margin, disc concealed, labia entire, pruinose; excipulum laterally carbonized, hymenium colourless, clear; asci 8–spored, ascospores colourless, transversely 8–10 septate, I+ blue, 28–32 × 5.7–6.4 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: stictic acids present.

Distribution: India (Arunachal Pradesh, Assam, Kerala, Sikkim, West Bengal), Brazil, Cayman Islands, Colombia, Costa Rica, French Polynesia, Jamaica, Malaysia, Papua New Guinea, Philippines, Sri Lanka.

Specimen examined: INDIA: Assam, Dhubri district, **Gopigoan Pt-III,** on the bark of *Lannea* sp., 26.12.2020, alt. 41.03 m, 26°25′721″ N, 90°23′301″ E, Suparna Biswas & Pabitra Biswas, 2020-0585 (BUBH); **Jamduar Pt-I**, on the bark of *Lannea* sp., 26.12.2020, alt. 39.45 m, 26°24′689″ N, 90°27′773″ E, Suparna Biswas & Pabitra Biswas, 2020-0590 (BUBH); **Ananda nagar**, on the bark of *Neolamarckia cadamba,* 24.12.2020, alt. 35.83 m, 26°22′748″ N, 90°21′684″ E, Suparna Biswas & Pabitra Biswas, 2020-0611 (BUBH); **Bhasani goan**, on the bark of *Mangifera indica*, 26.12.2020, alt. 38.26 m, 26°30′142″ N, 90°22′473″ E, Suparna Biswas & Pabitra Biswas, 2020-0621 (BUBH); **Bidyadabri Pt-V**, on the bark of *Lannea* sp., 21.11.2020, alt. 35.90 m, 26°26′119″ N, 89°77′379″ E, Suparna Biswas & Pabitra Biswas, 2020-0774 (BUBH); **Bhalukmari,** on the bark of *Mangifera* sp., 24.12.2020, alt. 40.96 m, 26°30′132″ N, 90°23′116″ E, Suparna Biswas & Pabitra Biswas, 2020-0892 (BUBH); **Fakiranir jhar Pt-I,** on the bark of *Mallotus nudiflora,* 24.12.2020, alt. 42.47 m, 26°21′893″ N, 90°14′829″ E, Suparna Biswas & Pabitra Biswas, 2020-0951 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Neolamarckia cadamba, Mangifera indica, Mallotus nudiflora* at an elevation of 35.83 m to 42.47 m.

Remarks: The morphology of the species is similar with *G. caesiella* Vain., but their chemistry differ. Ohmura *et al.* (2020). *G. dendrogramma* Nyl. is also similar with *G. sundarbanensis* Jagadeesh Ram & G.P. Sinha but differ as disc is open in *G. sundarbanensis* (Kalb *et al.* 2018).

24. *Graphis distincta* Makhija & Adaw. in Mycotaxon 91: 374, 2005. Plate 12 (d)

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, elongate, erumpent, branched, disc exposed, labia entire, pruinose, lacking thalline margin; excipulum laterally carbonized, hymenium colourless, clear; asci 8–spored, ascospores colourless, transversely 8–10 septate, I+ blue, 34–37 × 5.7–6.4 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P+ orange; UV–; TLC: constictic, protocetraric, stictic acids present.

Distribution: India (Assam, Andaman and Niobar Island), endemic.

Specimen examined: INDIA: Assam, Dhubri district, **Chagolchara Pt-III,** on the bark of *Polyalthia longifolia*, 29.10.2020, alt. 30.50 m, 26°02′508″ N, 89°94′404″ E, Suparna Biswas & Pabitra Biswas, 2020-0688 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia* at an elevation of 30.50 m.

Remarks: The species is similar with *G. supracola* A. W. Archer but differ as *G. distincta* have exposed disc, stictic, constictic acids as additional secondary compounds (Joshi *et al.* 2013b). The species is endemic to Indian region.

25. *Graphis dracaenae* Vain. in Hiern, Cat. Afr. Pl. 2(2):439, 1901. Plate 12 (e)

Description: Thallus crustose, whitish–grey, smooth surface; apothecia lirellate, erumpent to prominent, basal thalline margin, short, branched, disc concealed, labia entire, epruinose; excipulum completely carbonized, hymenium colourless, clear; ascospores colourless, transversely 5–7 septate, 24–25 × 5.5–5.7 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: Australia, Brazil, Canada, Colombia, Costa Rica, Netherlands, Norway, Sweden, United Kingdom of Great Britan and Northern Ireland, USA, Viet Nam.

Specimen examined: INDIA: Assam, Dhubri district, **Fakiranir jhar Pt-I,** on the bark of *Mangifera indica*, 24.12.2020, alt. 37.45 m, 26°21′876″ N, 90°14′942″ E, Suparna Biswas & Pabitra Biswas, 2020-0854 (BUBH); **Gauripur Matiabag Hawakhana**, on the bark of *Michelia champaca,* 08.02.2020, alt. 47.80 m, 26°09′788″ N, 89°97′547″ E, Suparna Biswas & Pabitra Biswas, 2020-0873 (BUBH).

Ecology: The species is found growing on the bark of *Mangifera indica*, *Michelia champaca* at an elevation of 37.45 m to 47.80 m.

Remarks: The species is characterized with erumpent to prominent lirellae, concealed disc, completely carbonized, clear hymenium, transverse ascospores, lichen substance not detected. The species is a new record to India.

26. ***Graphis eburnea*** Adaw. & Makhija in Mycotaxon 99: 314, 2007. Plate 12 (f)

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, elongate, erumpent, branched, disc concealed, epruinose, apically thin complete thalline margin; excipulum apically carbonized, hymenium colourless, clear; asci 8–spored, ascospores colourless, transversely 7–9 septate, I+ blue, 32–35 × 4.7–5.4 µm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Karnataka), Australia.

Specimen examined: INDIA: Assam, Dhubri district, **Kaldoba,** on the bark of *Albizia* sp., 21.11.2020, alt. 30.74 m, 26°19′862″ N, 89°77′090″ E, Suparna Biswas & Pabitra Biswas, 2020-0965 (BUBH).

Ecology: The species is found growing on the bark of *Albizia* sp. at an elevation of 30.74 m.

Remarks: The species is characterized with concealed disc, apically carbonized, clear hymenium, transverse ascospores, norstictic acid secondary compound. The species is a new record to Assam.

27. *Graphis emersa* Müll. Arg. in Hedwigia 32(2): 132, 1893. Plate 13 (a)

Description: Thallus crustose, whitish–grey, smooth surface; apothecia lirellate, prominent, lacking thalline margin, short, sessile, labia entire, disc closed, epruinose; excipulum completely carbonized, hymenium colourless, clear; ascospores colourless, transversely 7–9 septate, 31–33 × 7.5–8.7 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: Australia, Brazil, Colombia, Costa Rica, El Salvador, Mexico, Papua New Guinea.

Specimen examined: INDIA: Assam, Dhubri district, **Hatipota Pt-II**, on the bark of *Neolamarckia cadamba*, 26.12.2020, alt. 47.99 m, 26°22′694″ N, 90°35′492″ E, Suparna Biswas & Pabitra Biswas, 2020-1529 (BUBH).

Ecology: The species is found growing on the bark of *Neolamarckia cadamba* at an elevation of 47.99m.

Remarks: The species having similar morphology of lirellae with *G. meridionalisn* M. Nakan. But differ as the latter one have 1-2 ascospores in asci (Pitakpong 2015). The species is a new record to India.

28. *Graphis enteroleuca* (Ach.) Lücking in Lichenologist 41(4): 436, 2009. Plate 13 (b)

Basionym: *Opegrapha enteroleuca* Ach. in Syn. meth. lich. (Lund): 78, 1814.

Description: Thallus crustose, white-grey, smooth surface; apothecia lirellate, prominent, thick lateral thaline margin, short, sessile, disc concealed, epruinose; excipulum laterally carbonized, hymenium colourless, clear; asci 8–spored, ascospores colourless, transversely 9–10 septate, I+ blue, 32–35 × 4.4–5.7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: El Salvador.

Specimen examined: INDIA: Assam, Dhubri district, **Dumardaha Pt-II**, on the bark of *Lannea* sp., 28.10.2020, alt. 33.22 m, 26°09′003″ N, 89°92′019″ E, Suparna Biswas & Pabitra Biswas, 2020-0846 (BUBH); **Bhelupara Pt-II**, on the bark of *Mallotus* sp., 25.12.2020, alt. 39.61 m, 26°24′770″ N, 90°32′702″ E, Suparna Biswas & Pabitra Biswas, 2020-0886 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Mallotus* sp. at an elevation of 33.22 m to 39.61 m.

Remarks: The species is characterized with short sessile lirellae, laterally carbonized, clear hymenium, and transverse ascospores. The species is a new record to India.

29. *Graphis epimelaena* Müll. Arg. in Bull. Herb. Boissier 3(5):319, 1893. Plate 13 (c)

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, elongate, immersed, thick lateral thaline margin, branched, disc slightly exposed, pruinose; excipulum apically carbonized, hymenium colourless, clear; asci 8–spored, ascospores colourless, transversely 8–10 septate, I+ blue, 42–45 × 10.4–10.7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam), Australia, China, Colombia, Mexico.

Specimen examined: INDIA: Assam, Dhubri district, **Dumardaha Pt-II**, on the bark of *Artocarpus heterophyllus*, 28.10.2020, alt. 33.22 m, 26°09′003″ N, 89°92′019″ E, Suparna Biswas & Pabitra Biswas, 2020-0581 (BUBH); **Bidyadabri Pt-V**, on the bark of *Lannea* sp., 21.11.2020, alt. 36.87 m, 26°26′120″ N, 89°77′374″ E, Suparna Biswas & Pabitra Biswas, 2020-0703 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus*, *Lannea* sp. at an elevation of 33.22 m to 36.87 m.

Remarks: The species is similar with *G. glaucescens* Fée, but differ as the thallus is ecorticated and disc is concealed in *G. glaucescens* (Kalb *et al.* 2018).

30. *Graphis ficicola* Vain. in Ann. Acad. Sci. fenn, Ser. A 15(6): 240, 1921. Plate 13 (d)

Description: Thallus crustose, whitish–grey, smooth surface; apothecia lirellate, immersed to erumpent, lateral thalline margin, branched, labia entire, disc exposed, epruinose; excipulum completely carbonized, hymenium colourless, clear; ascospores colourless, transversely 9–10 septate, 35–37 × 8.5–8.8 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: salazinic acid present.

Distribution: India (Assam), Indonesia.

Specimen examined: INDIA: Assam, Dhubri district, **Khalilpur**, on the bark of *Polyalthia longifolia*, 10.03.2021, alt. 33.00 m, 26°03′011″ N, 89°96′486″ E, Suparna Biswas & Pabitra Biswas, 2020-0849 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia* at an elevation of 33.00 m.

Remarks: The species si characterized with completely carbonized, clear hymenium, transverse ascospores, salazinic acid present.

31. *Graphis filiformis* Adaw. & Makhija in Mycotaxon 99: 314, 2007. Plate 13 (e)

Description: Thallus crustose, white-grey, smooth surface; apothecia lirellate, elongate, erumpent to prominent, branched, disc concealed, epruinose, lacking thalline margin, excipulum laterally carbonized, hymenium colourless, clear; asci 8–spored, ascospores colourless, transversely 7–9 septate, I+ blue, 28–29 × 7.7–9.4 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Assam, Karnataka), Australia, Brazil, Guyana, Mexico, Martinique.

Specimen examined: INDIA: Assam, Dhubri district, **South Tokrerchara Pt-IV**, on the bark of *Areca catechu*, 06.12.2019, alt. 29.17 m, 26°11′095″ N, 89°83′360″ E, Suparna Biswas & Pabitra Biswas, 2019-0615 (BUBH).

Ecology: The species is found growing on the bark of *Areca catechu* at an elevation of 29.17m.
Remarks: *G. filiformis* is closely related to *G. pyrrhocheiloides* Zahlbr. with the morphology and chemistry but the ascospore size of the latter one is larger. *G. filiformis* is also closely related to *G. intricate* Fée with morphology but differ as the latter one having basally carbonized excipulum (Gupta and Sinha 2018).

32. *Graphis furcata* Fée in Essai Crypt. Exot. (Paris): 40, 1824. Plate 13 (f)

Description: Thallus crustose, whitish–grey, smooth surface, ecorticated; apothecia lirellate, simple, black, erumpent, elongate, branched, disc concealed, lateral thalline margin, labia entire, epruinose; excipulum laterally carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 7–9 septate, I+ blue, 18–20 × 6.4–7.4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Andaman and Nicobar Islands, Assam), Australia, Brazil, Colombia, Costa Rica, Guyana, Papua New Guinea, Philippines, Trinidad and Tobago, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Fakiranir jhar Pt-I**, on the bark of *Artocarpus* heterophyllus, 24.12.2020, alt. 36.89 m, 26°21′882″ N, 90°14′888″ E, Suparna Biswas & Pabitra Biswas, 2020-0587 (BUBH); **Ananda nagar**, on the bark of *Neolamarckia cadamba*, 24.12.2020, alt. 45.83 m, 26°22′748″ N, 90°21′684″ E, Suparna Biswas & Pabitra Biswas, 2020-0591 (BUBH); **Bidyadabri Pt-V**, on the bark of *Lannea* sp., 21.11.2020, alt. 43.67 m, 26°26′120″ N, 89°77′373″ E, Suparna Biswas & Pabitra Biswas, 2020-0603 (BUBH); **Bhasani goan**, on the bark of *Mangifera indica*, 26.12.2020, alt. 38.26m, 26°30′142″ N, 90°22′473″ E, Suparna Biswas & Pabitra Biswas, 2020-0619 (BUBH); **Alokjhari,** on the bark of *Shorea robusta*, 12.01.2020, alt. 62.39 m, 26°25′032″ N, 89°86′175″ E, Suparna Biswas & Pabitra Biswas, 2020-0669 (BUBH), 61638 (LWG); **Kismat hadaha Pt-II**, on the bark of *Lannea* sp., 21.11.2020, alt. 37.07 m, 26°05′068″ N, 89°89′338″ E, Suparna Biswas & Pabitra Biswas, 2020-0706 (BUBH); **Uchita**, on the bark of *Eucalyptus* sp., 28.11.2020, alt. 41.75 m, 26°10′739″ N, 89°85′245″ E, Suparna Biswas & Pabitra Biswas, 2020-0783 (BUBH);

Rangamati Pt-III, on the bark of *Mallotus nudiflora*, 27.12.2020, alt. 34.01 m, 26°16′105″ N, 90°05′977″ E, Suparna Biswas & Pabitra Biswas, 2020-0879 (BUBH); **Bhelupara Pt-II**, on the bark of *Mallotus nudiflora,* 25.12.2020, alt. 36.42 m, 26°23′121″ N, 90°33′577″ E, Suparna Biswas & Pabitra Biswas, 2020-0918 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus, Neolamarckia cadamba, Lannea* sp., *Mangifera indica, Shorea robusta, Eucalyptus* sp., *Mallotus nudiflora* at an elevation of 34.01 m to 62.39 m.

Remarks: The species is similar with *G. scripta* (L.) Ach. in ascospores length but differ as the thallus of latter one posses labia with white pruinose. The species is also similar with *G. foliicola* Vain. but differ as the latter one have not well- developed thallus (Pitakpong 2015).

33. *Graphis glaucescens* Fée in Essai Crypt. Exot. (Paris): 36, 1824. Plate 14 (a)

Description: Thallus crustose, whitish–grey, smooth surface, ecorticated; apothecia lirellate, immersed to erumpent, black, branched, lateral thaline margin, pruinose, disc concealed, labia entire; excipulum apically carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 7–11 septate, I+ blue, 30–33 × 7.4–10.4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Andaman and Nicobar Islands, Arunachal Pradesh, Assam, Kerala, Tamil Nadu, Uttarakhand, West Bengal), Australia, Brazil, Costa Rica, Dominica, Eucador, Indonesia, New Colombia, Papua New Guinea, Mexico, Paraguay, Philippines, Singapore, Solomon Islands, Thailand.

Specimen examined: INDIA: Assam, Dhubri district, **Chagolia Pt-I,** on the bark of *Artocarpus heterophyllus,* 21.11.2020, alt. 42.00 m, 26°29′194″ N, 89°78′045″ E, Suparna Biswas & Pabitra Biswas, 2020-0492 (BUBH); **Pub-gaikhawa Pt-I**, on the bark of *Areca catechu,* 25.10.2020, alt. 31.65 m, 26°08′052″ N, 89°83′371″ E, Suparna Biswas & Pabitra Biswas, 2020-0576 (BUBH); **Chagolia Pt-I,** on the bark of *Artocarpus heterophyllus,* 21.11.2020, alt. 46.90 m, 26°29′212″ N, 89°78′041″ E, Suparna Biswas & Pabitra Biswas, 2020-0579 (BUBH); **Bhasani goan**, on the bark of *Artocarpus heterophyllus,* 26.12.2020, 37.10 m, 26°30′143″ N, 90°22′440″ E, Suparna Biswas & Pabitra Biswas, 2020-0593 (BUBH); **Pataner Kuti,** on the bark of *Mangifera indica,* 27.12.2020, alt. 37.87 m, 26°28′092″ N, 89°86′820″ E, Suparna Biswas & Pabitra Biswas, 2020-

0609 (BUBH); **Alokjhari**, on the bark of *Shorea robusta*, 12.01.2020, alt. 46.73 m, 26°25′091″ N, 89°86′188″ E, Suparna Biswas & Pabitra Biswas, 2020-0736 (BUBH); **Ananda nagar**, on the bark of *Mangifera indica*, 24.12.2020, alt. 36.70 m, 26°22′740″ N, 90°21′681″ E, Suparna Biswas & Pabitra Biswas, 2020-0750 (BUBH), 61656 (LWG); **Bilashipara Florican Garden**, on the bark of *Polyalthia longifolia*, 10.02.2020, alt. 42.14 m, 26°25′163″ N, 90°27′603″ E, Suparna Biswas & Pabitra Biswas, 2020-0761 (BUBH); **Alokjhari,** on the bark of *Shorea robusta*, 12.01.2020, alt. 60.67 m, 26°25′335″ N, 89°86′057″ E, Suparna Biswas & Pabitra Biswas, 2020-0770 (BUBH); **Ananda nagar**, on the bark of *Neolamarckia cadamba*, 24.12.2020, alt. 35.85 m, 26°22′756″ N, 90°21′692″ E, Suparna Biswas & Pabitra Biswas, 2020-0897 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus*, *Areca catechu*, *Mangifera indica*, *Shorea robusta*, *Polyalthia longifolia*, *Neolamarckia cadamba* at an elevation of 31.65 m to 60.67 m.

Remarks: The species is similar with *G. bulacana* Vain. with similar morphology of lirellae and Chemistry as both have no chemical but differ as *G. bulacana* have smaller ascospores (Pitakpong 2015).

34. *Graphis handelii* Zahlbr. in Handel-Mazzetti, Symb. Sinic. 3: 44, 1430. Plate 14 (b)

Description: Thallus crustose, whitish grey, smooth surface, ecorticated; apothecia lirellate, black, erumpent, branched, lateral thaline margin, disc exposed, epruinose; excipulum laterally carbonized, labia entire, convergent, hymenium colourless, inspersed, paraphyses simple; asci 8–spored, ascospores colourless, transversely 8–11 septate, I+ blue, 30–35 × 7–8 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P+ yellow; UV–; TLC: norstictic acid and connorstictic acids present.

Distribution: India (Assam, West Bengal), Australia, Brazil, China, Costa Rica, Colombia, Cuba, Hawaii, Indonesia, Japan, New USA, Paraguay.

Specimen examined: INDIA: Assam, Dhubri district, **Alomganj Pt-IX**, on the bark of *Bombex cieba*, 27.12.2020, alt. 45.72 m, 26°23′328″ N, 90°03′348″ E, Suparna Biswas & Pabitra Biswas, 2020-0564 (BUBH).

Ecology: The species is found growing on the bark of *Bombex cieba* at an elevation of 45.72m.

Remarks: The species is similar with *G. crebra* Vain. with labia entire, carbonization lateral, hymenium inspersed, transverse ascospores but differ as *G. crebra* have white pruinose on disc (Pitakpong 2015).

35. *Graphis hyphosa* Staiger in Biblthca Lichenol. 85: 235, 2002. Plate 14 (c)

Description: Thallus crustose, whitish–grey, smooth surface; apothecia lirellate, immersed, lateral thalline margin, branched, disc concealed, labia entire, pruinose; excipulum completely carbonized, hymenium colourless, clear; ascospores colourless, transversely 9–10 septate, 34–35 × 8.5–9.1 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam), Brazil, Colombia, Costa Rica, El Salvador, Paraguay.

Specimen examined: INDIA: Assam, Dhubri district, **Gourangtari**, on the bark of *Holarrhena* sp., 26.12.2020, alt. 47.59 m, 26°24′459″ N, 90°31′933″ E, Suparna Biswas & Pabitra Biswas, 2020-0570 (BUBH); **Alomganj Pt-IX**, on the bark of *Artocarpus heterophyllus,* 27.12.2020, alt. 47.23 m, 26°13′509″ N, 90°03′663″ E, Suparna Biswas & Pabitra Biswas, 2020-0878 (BUBH); **Dhubri town**, on the bark of *Polyalthia longifolia,* 13.03.2021, alt. 29.24 m, 26°02′131″ N, 89°99′572″ E, Suparna Biswas & Pabitra Biswas, 2021-0890 (BUBH); **Khalilpur**, on the bark of *Polyalthia longifolia*, 10.03.2021, alt. 36.00 m, 26°03′858″ N, 89°96′196″ E, Suparna Biswas & Pabitra Biswas, 2021-0906 (BUBH).

Ecology: The species is found growing on the bark of *Holarrhena* sp., *Artocarpus heterophyllus*, *Polyalthia longifolia,* at an elevation of 29.24 m to 47.59 m.

Remarks: The species is similar with *G. caesiella* Vain. but differ as exciple is laterally carbonized in *G. caesiella* and K+ is yellow (Malcolm Hodges 2022, Georgia Biodiversity portal, Department of Natural Resources, Wildlife resources division, Lichens).

36. *Graphis immersella* Müll. Arg. in Bull. Herb. Boissier 3: 319, 1895. Plate 14 (d)

Description: Thallus crustose, grey, smooth surface, apothecia lirellate, black, short, immersed, branched, basal to lateral thaline margin, disc exposed, epruinose, excipulum laterally carbonized, labia entire convergent, hymenium colourless, clear, paraphyses simple, asci 8–spored, ascospores colourless, transversely 9–10 septate, I+ blue, 25–28 × 5–7 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P+ yellow; UV–; TLC: constictic acid and stictic acids present.

Distribution: India (Andaman and Nicobar Islands, Assam), Australia, Bolivia, Brazil, Colombia, Dominica, Fiji, Guyana, Papua New Guinea, Philippines, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Gauripur town**, on the bark of *Lannea* sp., 10.03.2021, alt. 28.00 m, 26°09′771″ N, 89°94′940″ E, Suparna Biswas & Pabitra Biswas, 2020-0577 (BUBH); **Gopigoan Pt-III**, on the bark of *Jatropha* sp., 26.12.2020, alt. 35.58 m, 26°25′721″ N, 90°23′359″ E, Suparna Biswas & Pabitra Biswas, 2020-0858 (BUBH); **Alomganj Pt-IX**, on the bark of *Michelia champaca*, 27.12.2020, alt. 49.74 m, 26°13′305″ N, 90°03′381″ E, Suparna Biswas & Pabitra Biswas, 2020-0904 (BUBH); **Jamduar Pt-I,** on the bark of *Neolamarckia cadamba*, 26.12.2020, alt. 28.84 m, 26°24′692″ N, 90°27′758″ E, Suparna Biswas & Pabitra Biswas, 2020-0909 (BUBH); **Jamduar Pt-I,** on the bark of *Neolamarckia cadamba*,, 26.12.2020, alt. 38.38 m, 26°24′692″ N, 90°27′758″ E, Suparna Biswas & Pabitra Biswas, 2020-0911 (BUBH); **Brahmin Para**, on the bark of *Neolamarckia cadamba*,, 25.12.2020, alt. 43.85 m, 26°24′838″ N, 90°32′637″ E, Suparna Biswas & Pabitra Biswas, 2020-0922 (BUBH); **Bhelupara Pt-II,** on the bark of *Jatropha* sp., 25.12.2020, alt. 33.86 m, 26°22′815″ N, 90°33′585″ E, Suparna Biswas & Pabitra Biswas, 2020-0925 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Jatropha* sp., *Michelia champaca*, *Neolamarckia cadamba*, at an elevation of 28.00 m to 49.74 m.

Remarks: The species is similar with *G. suzanae* Koch & Feuerstein morphologically and anatomically but differ as lirellae is immersed and produces stictic acid as secondary compound in *G. immersella* (Feuerstein *et al*. 2016).

37. *Graphis immersicans* A.W. Archer in Aust. Syst. Bot. 14(2): 262, 2001. Plate 14 (e)

Description: Thallus crustose, whitish–grey, smooth surface; apothecia lirellate, erumpent, lateral thalline margin, short to elongate, branched, disc concealed, labia entire, epruinose; excipulum completely carbonized, hymenium colourless, clear; ascospores colourless, transversely 5–7 septate, 25–28 × 6.5–7.7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: Australia, Brazil, Colombia, Martinique, Mexico.

Specimen examined: INDIA: Assam, Dhubri district, **Gopigoan Pt-III,** on the bark of *Lannea* sp., 26.12.2020, alt. 44.14 m, 26°25′721″ N, 90°23′290″ E, Suparna Biswas & Pabitra Biswas, 2020-0851 (BUBH); **Gauripur town**, on the bark of *Lannea* sp., 10.03.2021, alt. 26.00 m, 26°09′770″ N, 89°94′940″ E, Suparna Biswas & Pabitra Biswas, 2021-0871 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp. at an elevation of 26.00 m to 44.14 m.

Remarks: The species is similar with *G. dracaenae* but differ with their lirellae morph. The species is also similar with *G. oxyclada* but larger and more septate ascospores are present in *G. oxyclada* (Klab *et al.* 2018). The species is a new record to India.

38. *Graphis intermediella* Stirt. in Proc. Roy. phil. Soc. Glasgow 11: 316 ,1878. Plate 14 (f)

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, immersed to erumpent, branched, lateral thaline margin, disc concealed, epruinose; labia entire, excipulum apically carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 9–10 septate, I+ blue, 28–30 × 8–9 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Arunachal Pradesh, Assam, Kerala, Nagaland, Odisha, West Bengal), Brazil, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Fakiranir jhar Pt-I**, on the bark of *Neolamarckia cadamba*,, 24.12.2020, alt. 37.80 m, 26°21′884″ N, 90°14′940″ E, Suparna Biswas & Pabitra Biswas, 2020-0979 (BUBH).

Ecology: The species is found growing on the bark of *Neolamarckia cadamba* at an elevation of 37.80 m.

Remarks: The species is closely related to *Allographa malacodes* but differ from it by the character of irregularly branched lirellae (Biju *et al.* 2014).

39. *Graphis leptocarpa* Fée in Essai Crypt. Exot. (Paris):36, 1824. Plate 15 (a)

Description: Thallus crustose, white-grey, smooth surface; apothecia lirellate, erumpent, branched, lateral thalline margin, disc concealed, epruinose, labia entire; excipulum laterally

carbonized, hymenium colourless, inspersed, paraphyses simple; asci 8–spored, ascospores colourless, transversely 7–8 septate, I+ blue, 23–25× 6–7 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: stictic acid present.

Distribution: India (Assam), Brazil, Colombia, Costa Rica, Cuba, Guadeloupe, Guyana, Philippines, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Dhubri town**, on the bark of *Delonix regia*, 30.12.2019, alt. 28.23 m, 26°02′081″ N, 89°99′589″ E, Suparna Biswas & Pabitra Biswas, 2019-0561 (BUBH); **Sreegram Pt-III** on the bark of *Mallotus* sp., 25.12.2020, alt. 40.50 m, 26°24′706″ N, 90°34′013″ E, Suparna Biswas & Pabitra Biswas, 2020-0821 (BUBH); **Jamduar Pt-I,** on the bark of *Lannea* sp., 26.12.2020, alt. 42.59 m, 26°24′688″ N, 90°27′774″ E, Suparna Biswas & Pabitra Biswas, 2020-0912 (BUBH).

Ecology: The species is found growing on the bark of *Delonix regia*, *Mallotus* sp., *Lannea* sp. at an elevation of 28.23 m to 42.59 m.

Remarks: The species is similar with *G. cincta* but differ as inspersed hymenium, presence of norstictic acid in *G. cincta* (Seavey and Seavey 2011).

40. *Graphis librata* C. Knight in Trans. Proc. N. Z. Inst. 16:404, 1883. Plate 15 (b)

Description: Thallus crustose, white-grey, smooth surface; apothecia lirellate, short, black, erumpent, branched, lateral thalline margin, disc concealed, epruinose; labia entire, excipulum laterally carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 5–9 septate, I+ blue, 25–27× 5–7 µm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Assam, Maharashtra, Mizoram), Australia, Brazil, Costa Rica, Dominica, El Salvador, Guadeloupe, Guyana, Mexico, New Zealand, Papua New Guyana, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Hatipota Pt-II**, on the bark of *Mallotus* sp., 26.12.2020, alt. 52.08 m, 26°22′588″ N, 90°35′491″ E, Suparna Biswas & Pabitra Biswas, 2020-0168 (BUBH); **Hatipota Pt-II**, on the bark of *Holarrhena* sp., 26.12.2020, alt. 48.65 m, 26°22′597″ N, 90°35′478″ E, Suparna Biswas & Pabitra Biswas, 2020-0795 (BUBH), 61643 (LWG).

Ecology: The species is found growing on the bark of *Mallotus* sp., *Holarrhena* sp., at an elevation of 48.65 m to 52.08 m.

Remarks: The species is similar with *G. filiformis* Adaw. & Makhija. but *G. librata* is differ from *G. filiformis* as the lirellae is shorter and erumpt in *G. librata* (Pitakpong 2015).

41. *Graphis lineola* Ach. in Lich. Univ.: 264, 1810. Plate 15 (c)

Description: Thallus crustose, white grey, smooth surface; apothecia lirellate, black, erumpent, unbranched, lateral thalline margin, disc concealed, epruinose; labia entire, excipulum laterally carbonized, hymenium colourless, inspersed, paraphyses simple; asci 8–spored, ascospores colourless, transversely 8–9 septate, I+ blue, 26–28× 5–6 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Arunachal Pradeh, Assam, Karnataka, Mizoram, Tamil Nadu, Uttarakhand, West Bengal), Australia, Brazil, Colombia, Costa Rica, Jamaica, Mexico, Paraguay, Puerto Rico, Taiwan, West Indies, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Hatipota Pt-II**, on the bark of *Jatropha* sp., 26.12.2020, alt. 52.08 m, 26°22′599″ N, 90°35′496″ E, Suparna Biswas & Pabitra Biswas, 2020-0612 (BUBH); **Dumardaha Pt-II**, on the bark of *Lannea* sp., 28.10.2020, alt. 35.55 m, 26°09′005″ N, 89°91′989″ E, Suparna Biswas & Pabitra Biswas, 2020-0812 (BUBH); **Barobalurchar**, on the bark of *Bombex cieba,* 27.12.2020, alt. 38.75 m, 26°22′111″ N, 89°84′133″ E, Suparna Biswas & Pabitra Biswas, 2020-0939 (BUBH); **Rangamati Pt-III**, on the bark of *Lannea* sp., 27.12.2020, alt. 43.98 m, 26°16′079″ N, 90°05′963″ E, Suparna Biswas & Pabitra Biswas, 2020-0954 (BUBH).

Ecology: The species is found growing on the bark of *Jatropha* sp., *Lannea* sp., *Bombex cieba,* at an elevation of 35.55 m to 52.08 m.

Remarks: The species is similar with *G. submarginata* Lücking, but *G. lineola* Ach. is differ with concealed disc and epruinose labia (Pitakpong 2015).

42. *Graphis litoralis* Lücking, Sipman & Chaves in Fieldiana, Bot. 46 (1549): 88, 2008. Plate 15 (d)

Description: Thallus crustose, white-grey, smooth surface; apothecia lirellate, immersed to erumpent, lateral thalline margin, branched, disc concealed, black, pruinose; excipulum laterally carbonized, labia entire, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 7–9 septate, I+ blue, 32–34× 3–4 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P+ orange; UV–; TLC: Norstictic, salazinic, protocetraric acids present.

Distribution: Brazil, Costa Rica.

Specimen examined: INDIA: Assam, Dhubri district, **Alokjhari,** on the bark of *Shorea robusta,* 12.01.2020, alt. 62.39 m, 26°25′032″ N, 89°86′125″ E, Suparna Biswas & Pabitra Biswas, 2020-0565 (BUBH); **Khalilpur,** on the bark of *Polyalthia longifolia,* 10.03.2021, alt. 33.00 m, 26°03′011″ N, 89°96′486″ E, Suparna Biswas & Pabitra Biswas, 2021-0849 (BUBH).

Ecology: The species is found growing on the bark of *Shorea robusta, Polyalthia longifolia* at an elevation of 33.00 m to 62.39 m.

Remarks: The species is similar with *G. sublitoralis* J. Kalb but differ as shorter and broader ascospores, lacking of protocetraric acids in *G. sublitoralis* as well as with lirellae morphology (Kalb *et al.* 2018). The species is a new record to India.

43. *Graphis luluensis* A. W. Archer in Mycotaxon 89(2): 326, 2004. Plate 15 (e)

Description: Thallus crustose, grey, verrucose; apothecia lirellate, black, erumpent, branched, apically thin complete thalline margin, disc closed, epruinose, labia entire, excipulum completely carbonized, hymenium colourless, inspersed, paraphyses simple; asci 8–spored, ascospores colourless, transversely 5–7 septate, I+ blue, 28–32 × 6.8–7.3 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: stictic acid present.

Distribution: Australia, Colombia, China, Papua New Guinea, Philippines, Solomon Islands.

Specimen examined: INDIA: Assam, Dhubri district, **Sreegram Pt-III** on the bark of *Lannea* sp., 25.12.2020, alt. 34.57 m, 26°24′709″ N, 90°34′009″ E, Suparna Biswas & Pabitra Biswas, 2020-1531 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp. at an elevation of 34.57 m in Sreegram Pt-III.

Remarks: The species is similar with *G. omiana* J. Kalb, but differ as larger and and more septate ascospores are present in *G. omiana* (Kalb *et al.* 2018). The species is a new record to India.

44. *Graphis modesta* Zahlbr. in Rechinger, Denkschr. Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. KI. 88: 19, 1911. Plate 15 (f)

Description: Thallus crustose, corticolous, grey; apothecia lirellate, black, lirellae with lateral thaline margin, immersed, disc exposed, pruinose present; excipulum completely carbonized, labia entire, convergent, hymenium clear, paraphyses simple; ascus 6–8 spored, ascospores colourless, transversely 5–8 septate, 20–23 × 6.2–6.8 μm.

Chemistry: Thallus K+ yellow, C−, KC−, P+ yellow; UV−; TLC: Stictic acid, constictic acid.

Distribution: India (Maharashtra), Brazil, Colombia, Papua New Guinea, Seychelles.

Specimen examined: INDIA: Assam, Dhubri district, **Rangamati Pt-III**, on the bark of *Artocarpus heterophyllus*, 27.12.2020, alt. 28.84 m, 26°16′101″ N, 90°05′977″ E, Suparna Biswas & Pabitra Biswas, 2020-0173 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Mangifera indica*, 16.01.2020, alt. 33.75 m, 26°11′098″ N, 89°83′358″ E, Suparna Biswas & Pabitra Biswas, 2020-0499 (BUBH); **Bilashipara Florican Garden**, on the bark of *Pongamia pinnata*, 09.11.2020, alt. 42.14 m, 26°25′163″ N, 90°27′603″ E, Suparna Biswas & Pabitra Biswas, 2020-0825 (BUBH); **Uchita**, on the bark of *Mallotus* sp., 28.10.2020, alt. 30.16 m, 26°10′686″ N, 89°85′227″ E, Suparna Biswas & Pabitra Biswas, 2020-0830 (BUBH); **Fakiranir Jhar Pt-I**, on the bark of *Artocarpus heterophyllus*, 24.12.2020, alt. 40.07 m, 26°21′881″ N, 90°14′939″ E, Suparna Biswas & Pabitra Biswas, 2020-0834 (BUBH); **Bhasani goan**, on the bark of *Mangifera indica*, 26.12.2020, alt. 37.98 m, 26°30′142″ N, 90°22′474″ E, Suparna Biswas & Pabitra Biswas, 2020-0837 (BUBH), 61649 (LWG); **Brahmin para**, on the bark of *Artocarpus heterophyllus*, 25.12.2020, alt. 45.70 m, 26°24′780″ N, 90°32′713″ E, Suparna Biswas & Pabitra Biswas, 2020-0838 (BUBH); **Falimari,** on the bark of *Litchi chinensis*, 25.12.2020, alt. 42.73 m, 26°30′145″ N, 90°41′356″ E, Suparna Biswas & Pabitra Biswas, 2020-0840 (BUBH); **Chagolia Pt-I**, on the bark of *Artocarpus heterophyllus*, 21.11.2020, alt. 54.49 m, 26°29′159″ N, 89°78′145″ E, Suparna Biswas & Pabitra Biswas, 2020-0845 (BUBH); **Khajurbari Pt-I**, on the bark of *Lannea* sp., 24.12.2020, alt. 40.06 m, 26°26′190″ N, 90°17′890″ E, Suparna Biswas & Pabitra Biswas, 2020-0896 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus*, *Mangifera indica*, *Pongamia pinnata*, *Mallotus* sp., *Litchi chinensis*, *Lannea* sp., at an elevation of 28.84 m to 54.49 m.

Remarks: *G. modesta* is similar to *G. discarpa* as stictic acid is present in both but differ as concealed disc and lirellae with complete thalline margin in *G. discarpa* **(**Lücking *et al*. 2009). *G. modesta* is similar to *G. handelii* but differ as hymenium is inspersed, presence of norstictic acid in *G. handelii*. The species is also similar with *G. crebra* but differ as *G. crebra* have lateral carbonization and norstictic acid (Seavey and Seavey 2011). The species is a new record to Assam.

45. *Graphis nematoides* Leight. in Trans. Linn. Soc. London 27(2): 176, 1870. Plate 16 (a)

Description: Thallus crustose, corticolous, grey; apothecia lirellate, black, lirellae prominent, branched, apically thick complete thaline margin, disc concealed, epruinose; excipulum laterally carbonized, labia entire, convergent, hymenium clear, paraphyses simple; ascus 6–8 spored, ascospores colourless, transversely 5–7 septate, 21–23 × 5.2–5.8 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: salazinic acid present.

Distribution: India, Brazil, Sri Lanka.

Specimen examined: India, Assam, Dhubri district, **Dhubri town**, on the bark of *Polyalthia longifolia*, 13.03.2021, alt. 28.00 m, 26°02′270″ N, 89°95′976″ E, Suparna Biswas & Pabitra Biswas, 2021-0861 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia* at an elevation of 28.00 m.

Remarks: The species is characterized with laterally carbonized, clear hymenium, transverse ascospores, salazinic acid as secondary compound present. The species is a new record to Assam.

46. ***Graphis palmicola*** Makhija & Adaw. in Mycotaxon 91: 378, 2005. Plate 16 (b)

Description: Thallus crustose, whitish–grey, smooth surface; apothecia lirellate, erumpent, elongate, lateral thalline margin, branched, disc exposed, labia entire, epruinose; excipulum

completely carbonized, hymenium colourless, clear; ascospores colourless, transversely 9–10 septate, 32–35 × 7.5–7.7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam, Nicobar Island), Brazil, Malaysia.

Specimen examined: INDIA: Assam, Dhubri district, **Gourangtari Pt-II**, on the bark of *Pongamia pinnata*, 26.12.2020, alt. 43.13 m, 26°24′471″ N, 90°31′958″ E, Suparna Biswas & Pabitra Biswas, 2020-0295 (BUBH); **Bhasani goan**, on the bark of *Lannea* sp., 26.12.2020, alt. 37.10 m, 26°30′143″ N, 90°22′440″ E, Suparna Biswas & Pabitra Biswas, 2020-0931 (BUBH).

Ecology: The species is found growing on the bark of *Pongamia pinnata*, *Lannea* sp. at an elevation of 37.10 m to 43.13 m.

Remarks: The species resembles *G. deserpens* Vain. but differ as irregularly branched lirellae, muriform ascospores are present in *G. deserpens* (Hardini *et al.* 2018b).

47. *Graphis pertricosa* (Kremp.) A.W. Archer in Telopea 11(1): 73, 2005. Plate 16 (c)

Basionym: *Enterographa pertricosa* Kremp. in Nuovo G. bot. ital.. 7(1): 39, 1875.

Description: Thallus crustose, grey, verrucose surface, corticated; apothecia lirellate, black, erumpent, short, branched, apically thin thalline margin, disc concealed, epruinose, labia entire; excipulum laterally carbonized, hymenium colourless, inspersed, paraphyses branched; asci 8–spored, ascospores colourless, muriform, I+ blue, 28–32× 8.6–8.8 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Assam, Andaman and Nicobar Islands, Karnataka, Manipur, Tamil Nadu), Australia, Indonesia, Malaysia, Tanzania, Papua New Guinea.

Specimen examined: INDIA: Assam, Dhubri district, **Gourangtari Pt-II**, on the bark of *Moringa* sp., 26.12.2020, alt. 49.15 m, 26°24′502″ N, 90°31′924″ E, Suparna Biswas & Pabitra Biswas, 2020-0961 (BUBH); **Kherbari Pt-II**, on the bark of *Michelia champaca*, 21.11.2020, alt. 43.47 m, 26°25′646″ N, 89°74′396″ E, Suparna Biswas & Pabitra Biswas, 2020-0388 (BUBH), 61660 (LWG).

Ecology: The species is found growing on the bark of *Moringa* sp., *Michelia champaca* at an elevation of 43.47 m to 49.15 m.

Remarks: The species is similar with *G. yunnanensis* S. Joshi, Upreti & Hur in having labia entire, hymenium inspersed, muriform ascospores, and norstictic acid in thallus but differ with lirellae morphology, lateral carbonization, absence of stictic acid in *G. pertricosa* (Joshi *et al*. 2015).

48. *Graphis pinicola* Zahlbr. in Handel-Mazzetti, Symb. Sinic. 3:43, 1930. Plate 16 (d)

Description: Thallus crustose, grey, smooth surface, corticated; apothecia lirellate, black, erumpent, elongate, branched, lateral thalline margin, disc concealed, epruinose; excipulum laterally carbonized, labia entire, hymenium colourless, clear, paraphyses branched; asci 8–spored, ascospores colourless, transversely 5–7 septate, I+ blue, 33–34× 6–7 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam, Kerala, Tamil Nadu), Brazil, China, Colombia, Mexico, Guyana, Papua New Guinea, USA.

Specimen examined: INDIA: Assam, Dhubri district, **South Tokrerchara Pt-IV**, on the bark of *Artocarpus heterophyllus*, 17.01.2020, alt. 24.17 m, 26°10′893″ N, 89°83′359″ E, Suparna Biswas & Pabitra Biswas, 2020-0737 (BUBH), 61672 (LWG); **Jamduar Pt-I,** on the bark of *Citrus* sp., 26.12.2020, alt. 39.55 m, 26°24′684″ N, 90°27′773″ E, Suparna Biswas & Pabitra Biswas, 2020-0943 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus*, *Citrus* sp. at an elevation of 24.17 m to 39.55 m.

Remarks: The species is similar with *G. lineola* and *G. librata* but *G. lineola* is differ with inspersed hymenium and *G. librata* differ with norstictic acid as secondary compound (Seavey and Seavey 2011).

49. ***Graphis plumierae*** Vain. in Ann. Acad. Sci. fenn., Ser., A 6(7): 161, 1915. Plate 16 (e)

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, black, immersed, branched, lateral thalline margin, disc narrow, pruinose, labia entire; excipulum laterally

carbonized, hymenium colourless, inspersed, paraphyses branched; asci 8–spored, ascospores colourless, transversely 5–7 septate, I+ blue, 25–26× 6–7 µm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Assam), Brazil, Guyana, Puerto Rico.

Specimen examined: INDIA: Assam, Dhubri district, **Bhasani goan**, on the bark of *Neolamarckia cadamba*, 26.12.2020, alt. 40.48 m, 26°30′141″ N, 90°22′427″ E, Suparna Biswas & Pabitra Biswas, 2020-0567 (BUBH).

Ecology: The species is found growing on the bark of *Neolamarckia cadamba* at an elevation of 40.48 m.

Remarks: The species is similar with *G. crebra* Vain. but differ as disc is open in *G. crebra* (Kalb *et al.* 2018).

50. *Graphis prunicola* Vain. in Bot. Mag., Tokyo 35: 73, 1921. Plate 16 (f)

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, black, prominent, elongate, branched, lateral thalline margin, disc concealed, black, epruinose; excipulum laterally carbonized, labia entire, hymenium colourless, clear, paraphyses branched; asci 8– spored, ascospores colourless, transversely 9–10 septate, I+ blue, 35–36× 8–9 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam), Brazil, Colombia, Japan.

Specimen examined: INDIA: Assam, Dhubri district, **Uchita**, on the bark of *Eucalyptus* sp., 28.10.2020, alt. 30.16 m, 26°10′686″ N, 89°85′227″ E, Suparna Biswas & Pabitra Biswas, 2020-0860 (BUBH).

Ecology: The species is found growing on the bark of *Eucalyptus* sp. at an elevation of 30.16 m.

Remarks: The species is characterized with concealed disc, lateral carbonization, clear hymenium, transverse ascospores, and no secondary metabolites.

51. ***Graphis pyrrhocheiloides*** Zahlbr. in Cat. Lich. Univers. 2: 321, 1923 Plate 17 (a)

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, black, elongate, branched, immersed with lateral thalline margin, disc exposed, black, pruinose; labia entire,

excipulum laterally carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 5–septate, I+ blue, 32–34× 8–9 µm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Assam, Karnataka, Maharashtra, West Bengal), Australia, Brazil, Colombia, Costa Rica, France, Netherlands, Norway, Sweden, Thailand, United Kingdom of Great Britain and Northern Ireland, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Pub-gaikhawa Pt-I**, on the bark of *Azadirachta indica*, 25.10.2020, alt. 24.55 m, 26°08′054″ N, 89°83′370″ E, Suparna Biswas & Pabitra Biswas, 2020-0108 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Mangifera indica*, 16.01.2020, alt. 23.79 m, 26°11′074″ N, 89°83′872″ E, Suparna Biswas & Pabitra Biswas, 2020-0114 (BUBH); **Panbari Tea Garden**, on the bark of *Albizia* sp., 09.02.2020, alt. 47.27 m, 26°15′303″ N, 90°05′091″ E, Suparna Biswas & Pabitra Biswas, 2020-0116 (BUBH); **Panbari Tea Garden,** on the bark of *Albizia* sp., 09.02.2020, alt. 55.16 m, 26°15′292″ N, 90°05′092″ E, Suparna Biswas & Pabitra Biswas, 2020-0118 (BUBH); **Alokjhari**, on the bark of *Shorea robusta*, 12.01.2020, alt. 51.26 m, 26°25′339″ N, 89°86′055″ E, Suparna Biswas & Pabitra Biswas, 2020-0148 (BUBH); **Chagolchara Pt-III**, on the bark of *Neolamarckia cadamba*, 29.10.2020, alt. 39.70 m, 26°02′517″ N, 89°94′410″ E, Suparna Biswas & Pabitra Biswas, 2020-0588 (BUBH); **Falimari**, on the bark of *Litchi chinensis*, 25.12.2020, alt. 42.73 m, 26°30′145″ N, 90°41′435″ E, Suparna Biswas & Pabitra Biswas, 2020-0592 (BUBH); **Dhubri town**, on the bark of *Mangifera indica*, 10.01.2020, alt. 18.26 m, 26°02′246″ N, 89°95′925″ E, Suparna Biswas & Pabitra Biswas, 2020-0746 (BUBH); **Rangamati Pt-III**, on the bark of *Artocarpus heterophyllus*, 27.12.2020, alt. 28.84 m, 26°16′101″ N, 90°05′977″ E, Suparna Biswas & Pabitra Biswas, 2020-0787 (BUBH); **Bhasani goan**, on the bark of *Lannea* sp., 26.12.2020, alt. 44.49 m, 26°30′142″ N, 90°22′425″ E, Suparna Biswas & Pabitra Biswas, 2020-0884 (BUBH); **Chagolia Pt-I,** on the bark of *Michelia champaca*, 21.11.2020, alt. 33.79 m, 26°29′160″ N, 89°78′146″ E, Suparna Biswas & Pabitra Biswas, 2020-0934 (BUBH); **Alomganj Pt-IX**, on the bark of *Bombex cieba*, 27.12.2020, alt. 45.72 m, 26°13′328″ N, 90°03′348″ E, Suparna Biswas & Pabitra Biswas, 2020-0935 (BUBH); **Chagolchara Pt-III**, on the bark of *Polyalthia longifolia*, 29.10.2020, alt. 29.07 m, 26°02′511″ N, 89°94′405″ E, Suparna Biswas & Pabitra Biswas, 2020-0957 (BUBH); **Debotar hasdaha Pt-IV**, on the bark of *Lannea* sp.,

22.11.2020, alt. 26.33 m, 26°05′754″ N, 89°88′964″ E, Suparna Biswas & Pabitra Biswas, 2020-0958 (BUBH); **Bilashipara Florican Garden,** on the bark of *Pongamia pinnata*, 10.02.2020, alt. 42.14 m, 26°25′163″ N, 90°27′603″ E, Suparna Biswas & Pabitra Biswas, 2020-1456 (BUBH).

Ecology: The species is found growing on the bark of *Azadirachta indica*, *Mangifera indica*, *Albizia* sp., *Shorea robusta*, *Neolamarckia cadamba*, *Litchi chinensis*, *Artocarpus heterophyllus*, *Lannea* sp., *Michelia champaca*, *Bombex cieba*, *Polyalthia longifolia*, *Pongamia pinnata* at an elevation of 18.26 m to 55.16 m.

Remarks: The species is closely related to *G. inamoena* Zahlbr. with anatomy, ascospore size and chemistry but differ with carbonization. *G. pyrrhocheiloides* is laterally carbonized while *G. inamoena* is apically carbonized (Makhija *et al*. 2006).

52. *Graphis renschiana* (Müll. Arg.) Stizenb. in Ber. Tät. St. Gall. Naturw. Ges.: 184, 1889. Plate 17 (b)

Basionym: *Graphina renschiana* Müll. Arg. in Flora Regensburg, 68(28): 512, 1885.

Description: Thallus crustose, grey, smooth surface, corticated; apothecia lirellate, erumpent, elongate, lateral thalline margin, branched, disc concealed, black, labia entire, pruinose; excipulum laterally carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, muriform, I+ blue, 28–30× 8.1–8.7 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: norstictic acid present.

Distribution: India (Arunachal Pradesh, Assam), China, Costa Rica, Guyana, Madagascar, Papua New Guinea, Puerto Rico.

Specimen examined: INDIA: Assam, Dhubri district, **Debotar hasdaha Pt-IV**, on the bark of *Lannea* sp., 22.11.2020, alt. 30.23 m, 26°05′731″ N, 89°88′970″ E, Suparna Biswas & Pabitra Biswas, 2020-0782 (BUBH); **Kaldoba**, on the bark of *Lannea* sp., 21.11.2020, alt. 33.85 m, 26°19′867″ N, 89°77′086″ E, Suparna Biswas & Pabitra Biswas, 2020-0963 (BUBH); **Alokjhari**, on the bark of *Shorea robusta*, 12.01.2020, alt. 60.31 m, 26°25′033″ N, 89°86′057″ E, Suparna Biswas & Pabitra Biswas, 2020-0976 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Shorea* at an elevation of 30.23 m to 60.31 m.

Remarks: The species is similar with *G. nadurina* Aptroot but differ as prominent, unbranched, lirellae with apically thick complete thalline margin is present in *G. nadurina* (Joshi *et al.* 2013b).

53. *Graphis riopiedrensis* (Fink) Lücking in Lichenologist 41(4): 440, 2009. Plate 17 (c)

Basionym: *Graphina riopiedrensis* Fink in Mycologia, 19: 217, 1927.

Description: Thallus crustose, grey to pale grey, smooth surface, corticated; apothecia lirellate, immersed to slightly emergent, elongate, apically thck complete thaline margin, branched, disc exposed, black, labia entire, epruinose; excipulum laterally carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 10–septate, I+ blue, 38–40 × 5–6 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: stictic acid present.

Distribution: India (Assam), Puerto Rico.

Specimen examined: INDIA: Assam, Dhubri district, **Uchita**, on the bark of *Eucalyptus* sp., 28.10.2020, alt. 30.97 m, 26°10′691″ N, 89°85′224″ E, Suparna Biswas & Pabitra Biswas, 2020-0625 (BUBH); **Bidyadabri Pt-V**, on the bark of *Lannea* sp., 21.11.2020, alt. 40.24 m, 26°26′120″ N, 89°77′375″ E, Suparna Biswas & Pabitra Biswas, 2020-0628 (BUBH); **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 21.11.2020, alt. 27.73 m, 26°05′039″ N, 89°89′316″ E, Suparna Biswas & Pabitra Biswas, 2020-0801 (BUBH); **Bhalukmari,** on the bark of *Neolamarckia cadamba*, 24.12.2020, alt. 47.45 m, 26°30′231″ N, 90°23′118″ E, Suparna Biswas & Pabitra Biswas, 2020-0802 (BUBH); **Uchita,** on the bark of *Eucalyptus* sp., 28.10.2020, alt. 41.57 m, 26°10′739″ N, 89°85′245″ E, Suparna Biswas & Pabitra Biswas, 2020-0804 (BUBH); **Chagolchara Pt-III**, on the bark of *Neolamarckia cadamba,* 29.10.2020, alt. 34.20 m, 26°02′502″ N, 89°94′403″ E, Suparna Biswas & Pabitra Biswas, 2020-0805 (BUBH); **Kherbari Pt-II**, on the bark of *Aquilaria agallocha,* 21.11.2020, alt. 25.95 m, 26°25′631″ N, 89°74′396″ E, Suparna Biswas & Pabitra Biswas, 2020-0806 (BUBH); **Sreegram Pt-III**, on the bark of *Mallotus* sp., 25.12.2020, alt. 39.76 m, 26°24′706″ N, 90°34′013″ E, Suparna Biswas & Pabitra Biswas, 2020-0809 (BUBH); **Chagolchara Pt-III**, on the bark of *Mangifera indica*, 29.10.2020,

alt. 42.00 m, 26°02′519″ N, 89°94′420″ E, Suparna Biswas & Pabitra Biswas, 2020-0810 (BUBH); **Kismat hasdaha Pt-II,** on the bark of *Lannea* sp., 22.11.2020, alt. 30.98 m, 26°05′051″ N, 89°89′328″ E, Suparna Biswas & Pabitra Biswas, 2020-0811 (BUBH); **Chagolia Pt-I**, on the bark of *Artocarpus heterophyllus,* 21.11.2020, alt. 46.90 m, 26°29′212″ N, 89°78′041″ E, Suparna Biswas & Pabitra Biswas, 2020-0816 (BUBH); **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 22.11.2020, alt. 31.75 m, 26°05′050″ N, 89°89′330″ E, Suparna Biswas & Pabitra Biswas, 2020-0859 (BUBH); **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 22.11.2020, alt. 31.75 m, 26°05′051″ N, 89°89′310″ E, Suparna Biswas & Pabitra Biswas, 2020-0872 (BUBH).

Ecology: The species is found growing on the bark of *Eucalyptus* sp., *Lannea* sp., *Neolamarckia cadamba, Aquilaria agallocha, Mallotus* sp., *Mangifera indica, Artocarpus heterophyllus* at an elevation of 25.95 m to 47.45 m.

Remarks: The species is characterized with lateral carbonized, clear hymenium, transverse ascospores, stictic acid present.

54. ***Graphis scripta*** (L.) Ach. in K. Vetensk-Acad. Nya Handl. 30:145, 1809. Plate 17 (d)

Basionym: *Lichen scriptus* L. in Sp. pl. 2:1140, 1753.

Description: Thallus crustose, grey to pale grey, smooth surface, ecorticate; apothecia lirellate, erumpent, branched, lateral thalline margin, disc exposed, black; excipulum laterally carbonized, labia entire, pruinose, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 6–9 septate, I+ blue, 42–45× 6–7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Arunachal Pradesh, Assam, Goa, Himachal Pradesh, Karnataka, Kerala, Manipur, Mizoram, Nagaland, Sikkim, Tamil Nadu, West Bengal), Canada, Estonia, France, Germany, Netherlands, Norway, Switzerland, United Kingdom of Great Britain and Northern Ireland, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Hatipota Pt-II**, on the bark of *Ricinus* sp., 26.12.2020, alt. 31.08 m, 26°22′679″ N, 90°35′489″ E, Suparna Biswas & Pabitra Biswas, 2020-0111 (BUBH), 61685 (LWG); **Rangamati Pt-III**, on the bark of *Artocarpus heterophyllus*, 27.12.2020, alt. 25.43 m, 26°16′099″ N, 90°05′974″ E, Suparna Biswas & Pabitra Biswas, 2019-

0146 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Artocarpus heterophyllus*, 25.12.2019, alt. 31.06 m, 26°11′099″ N, 89°83′367″ E, Suparna Biswas & Pabitra Biswas, 2019-0506 (BUBH); **Panbari Tea Garden**, on the bark of *Michelia champaca*, 09.02.2020, alt. 46.08 m, 26°15′322″ N, 90°05′080″ E, Suparna Biswas & Pabitra Biswas, 2020-0547 (BUBH); **Bhasani goan**, on the bark of *Mangifera indica*, 26.12.2020, alt. 38.26 m, 26°30′142″ N, 90°22′473″ E, Suparna Biswas & Pabitra Biswas, 2020-0620 (BUBH); **Chagolchara Pt-III**, on the bark of *Mangifera indica*, 29.10.2020, alt. 42.00 m, 26°02′519″ N, 89°94′420″ E, Suparna Biswas & Pabitra Biswas, 2020-0786 (BUBH); **Sreegram Pt-III**, on the bark of *Bombex cieba*, 25.12.2020, alt. 49.06 m, 26°24′629″ N, 90°34′150″ E, Suparna Biswas & Pabitra Biswas, 2020-0798 (BUBH); **Barobalurchar,** on the bark of *Azadirchta indica*, 27.12.2020, alt. 40.75 m, 26°22′160″ N, 89°84′089″ E, Suparna Biswas & Pabitra Biswas, 2019-0813 (BUBH); **Uchita**, on the bark of *Neolamarckia cadamba*, 28.10.2020, alt. 26.61 m, 26°10′693″ N, 89°85′224″ E, Suparna Biswas & Pabitra Biswas, 2020-0820 (BUBH); **Bhelupara Pt-II**, on the bark of *Mallotus* sp., 25.12.2020, alt. 36.42 m, 26°23′121″ N, 90°33′577″ E, Suparna Biswas & Pabitra Biswas, 2020-0887 (BUBH); **Bidyadabri Pt-**V, on the bark of *Lannea* sp., 21.11.2020, alt. 41.76 m, 26°26′122″ N, 89°77′329″ E, Suparna Biswas & Pabitra Biswas, 2020-0937 (BUBH); **Pataner Kuti,** on the bark of *Artocarpus heterophyllus*, 27.12.2020, alt. 37.28 m, 26°28′092″ N, 89°86′817″ E, Suparna Biswas & Pabitra Biswas, 2020-0952 (BUBH).

Ecology: The species is found growing on the bark of *Ricinus* sp., *Artocarpus heterophyllus*, *Michelia champaca*, *Mangifera indica*, *Bombex cieba*, *Azadirchta indica*, *Neolamarckia cadamba*, *Mallotus* sp., *and Lannea* sp. at an elevation of 25.43 m to 49.06 m.

Remarks: The species is similar with *G. tenuirima* but differ with submuriform ascospores in *G. tenuirima*. (Kalb *et al.* 2018).

55. *Graphis stipitata* A.W. Archer, Mycotaxon 80: 368, 2001. Plate 17 (e)

Description: Thallus crustose, grey, smooth surface; apothecia lirellate, erumpent, basal thaline margin, branched, disc moderately open, black, epruinose; excipulum laterally carbonized, labia entire, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 5–7 septate, I+ blue, 17–19× 6–7 µm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV+; TLC: norstictic acids present.

Distribution: India (Assam), Australia, Brazil, Colombia (gbif.org; Gogoi *et al.* 2022a)

Specimen examined: INDIA: Assam, Dhubri district, **Panbari Tea Garden**, on the bark of *Albizia* sp., 09.02.2020, alt. 41.92 m, 26°15′355″ N, 90°05′074″ E, Suparna Biswas & Pabitra Biswas, 2020-0067 (BUBH), 6136(LWG).

Ecology: The species is found growing on the bark of *Albizia* sp. at an elevation of 41.92m.

Remarks: The species is UV+; lichexanthone present.

56. *Graphis subasahinae* Nagarkar & Patw. in Biovigyanam 8(2): 130, 1982. Plate 17 (f)

Description: Thallus crustose, olivaceous, greenish, smooth surface; apothecia lirellate, semi-emergent, branched, lateral thalline margin, disc slightly open, black, epruinose; labia entire, excipulum laterally carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 5–7 septate, I+ blue, 18–19× 4–6 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P+ orange; UV–; TLC: norstictic, salazinic, stictic acids present.

Distribution: India (Arunachal Pradesh, Assam), Colombia.

Specimen examined: INDIA: Assam, Dhubri district, **Panbari Tea Garden**, on the bark of *Michelia champaca*, 09.02.2020, alt. 46.08 m, 26°15′322″ N, 90°05′080″ E, Suparna Biswas & Pabitra Biswas, 2020-0772 (BUBH), 61694 (LWG); **Gauripur**, on the bark of *Gmelina arborea*, 10.03.2021, alt. 34.00 m, 26°09′771″ N, 89°94′940″ E, Suparna Biswas & Pabitra Biswas, 2021-0817 (BUBH); **Bheluparra Pt-II**, on the bark of *Neolamarckia cadamba*, 25.12.2020, alt. 30.53 m, 26°24′785″ N, 90°32′690″ E, Suparna Biswas & Pabitra Biswas, 2020-0924 (BUBH); **Brahmin Para**, on the bark of *Averrhoa* sp., 25.12.2020, alt. 40.70 m, 26°24′875″ N, 90°32′664″ E, Suparna Biswas & Pabitra Biswas, 2020-0933 (BUBH); **Barobalurchar**, on the bark of *Jatropha* sp., 27.12.2020, alt. 42.97 m, 26°22′157″ N, 89°84′088″ E, Suparna Biswas & Pabitra Biswas, 2020-0956 (BUBH).

Ecology: The species is found growing on the bark of *Michelia champaca*, *Gmelina arborea*, *Neolamarckia cadamba*, *Averrhoa* sp., *and Jatropha* sp. at an elevation of 30.53 m to 46.08 m.

Remarks: The species is closely related to *G. asahinae* Patw. & Kulk. but differ as *G. asahinae* have branched lirellae with non-carbonized base, smaller ascospores and K+ red containing

salazinic acid (Gupta and Sinha 2018). The species is also similar with *G. sublitoralis* J. Kalb but differ as disc is epruinose in *G. subasahinae* (Kalb *et al*. 2018).

57. ***Graphis submarginata*** **Lücking**, in Fieldiana, Bot. 46(1549): 112, 2008. Plate 18 (a)

Description: Thallus crustose, grey, smooth surface, corticated; apothecia lirellate, erumpent, branched, lateral thaline margin, disc exposed, black, labia entire, pruinose; excipulum laterally carbonized, hymenium colourless, inspersed, paraphyses simple; asci 8–spored, ascospores colourless, transversely 9–10 septate, I+ blue, 28–29× 5–6 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam), Argentina, Brazil, Costa Rica, New Caledonia.

Specimen examined: INDIA: Assam, Dhubri district, **Pataner Kuti**, on the bark of *Eucalyptus* sp., 27.12.2020, alt. 37.66 m, 26°28′096″ N, 89°86′820″ E, Suparna Biswas & Pabitra Biswas, 2020-0583 (BUBH); **Gopigoan Pt-III,** on the bark of *Lannea* sp., 26.12.2020, alt. 43.69 m, 26°25′723″ N, 90°23′289″ E, Suparna Biswas & Pabitra Biswas, 2020-0822 (BUBH).

Ecology: The species is found growing on the bark of *Eucalyptus* sp., *Lannea* sp. at an elevation of 37.66 m to 43.69 m.

Remarks: The species is similar with *G. lineola* Ach. but differ *as G. lineola* is with concealed disc and epruinose labia (Pitakpong, 2015).

58. ***Graphis sulphurella*** (Zahlbr.) Lücking, in Lichenologist 41(4): 441, 2009. Plate 18 (b)

Basionym: *Graphina sulphurella* Zahlbr. in Annls. Mycol. 10(4): 366, 1912.

Description: Thallus crustose, grey, smooth surface, ecorticated; apothecia lirellate, immersed, apically thick complete thaline margin, branched, disc exposed, black, labia entire, epruinose; excipulum apically carbonized, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, muriform, I+ blue, 25–28× 7–8 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam)**,** USA (Hawaii).

Specimen examined: INDIA: Assam, Dhubri district, **Kherbari Pt-II**, on the bark of *Michelia champaca*, 21.11.2020, alt. 21.17 m, 26°25′634″ N, 89°74′395″ E, Suparna Biswas & Pabitra

Biswas, 2020-0704 (BUBH), 61658 (LWG); **Chagolia Pt-I,** on the bark of *Artocarpus heterophyllus*, 21.11.2020, alt. 46.50 m, 26°29′212″ N, 89°78′041″ E, Suparna Biswas & Pabitra Biswas, 2020-0754 (BUBH); **Bidyadabri Pt-V**, on the bark of *Lannea* sp., 21.11.2020, alt. 26.39 m, 26°26′123″ N, 89°77′378″ E, Suparna Biswas & Pabitra Biswas, 2020-0775 (BUBH).

Ecology: The species is found growing on the bark of *Michelia champaca*, *Artocarpus heterophyllus*, *Lannea* sp., at an elevation of 21.17 m to 46.50 m.

Remarks: The species is characterized with immersed lirellae, apically carbonized, clear hymenium, muriform ascospores, no secondary metabolites present.

59. *Graphis sundarbanensis* Jagadeesh Ram & G.P. Sinha, in Lichenologist 39(3): 231, 2007. Plate 18 (c)

Description: Thallus crustose, grey, smooth surface, corticated; apothecia lirellate, erumpent, branched, basal to lateral thaline margin, disc exposed, black; excipulum laterally carbonized, labia entire, pruinose, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 9–10 septate, I+ blue, 38–39× 5–6 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: stictic acid present.

Distribution: India (Assam, Kerala, West Bengal), Brazil, Fiji, Papua New Guinea, Seychelles, Vanuatu.

Specimen examined: INDIA: Assam, Dhubri district, **Brahmin Para**, on the bark of *Spondias* sp., 25.12.2020, alt. 38.84 m, 26°24′771″ N, 90°32′703″ E, Suparna Biswas & Pabitra Biswas, 2020-0599 (BUBH); **Rangamati Pt-III**, on the bark of *Lannea* sp., 27.12.2020, alt. 33.98 m, 26°16′079″ N, 90°05′963″ E, Suparna Biswas & Pabitra Biswas, 2020-0607 (BUBH); **Gopigoan Pt-III**, on the bark of *Polyalthia longifolia,* 26.12.2020, alt. 35.33 m, 26°25′721″ N, 90°23′359″ E, Suparna Biswas & Pabitra Biswas, 2020-0622 (BUBH); **Jamduar Pt-I**, on the bark of *Lannea* sp., 26.12.2020, alt. 39.45 m, 26°24′689″ N, 90°27′773″ E, Suparna Biswas & Pabitra Biswas, 2020-0629 (BUBH); **Dhubri town**, on the bark of *Michelia champaca,* 10.01.2020, alt. 18.25 m, 26°02′186″ N, 89°95′961″ E, Suparna Biswas & Pabitra Biswas, 2020-0784 (BUBH), 61673 (LWG); **Rangamati Pt-III**, on the bark of *Azadirachta sp.*, 27.12.2020, alt. 31.99 m, 26°16′100″ N, 90°05′990″ E, Suparna Biswas & Pabitra Biswas, 2020-0818 (BUBH); **Gourangtari Pt-II**, on the bark of *Neolamarckia cadamba,* 26.12.2020, alt. 48.28 m, 26°24′538″ N, 90°31′884″ E,

Suparna Biswas & Pabitra Biswas, 2020-0885 (BUBH); **Patanер Kuti**, on the bark of *Bombex cieba*, 27.12.2020, alt. 35.89 m, 26°28′072″ N, 89°86′809″ E, Suparna Biswas & Pabitra Biswas, 2020-0891 (BUBH); **Bhalukmari**, on the bark of *Neolamarckia cadamba*, 24.12.2020, alt. 46.20 m, 26°29′979″ N, 90°22′911″ E, Suparna Biswas & Pabitra Biswas, 2020-0893 (BUBH); **Falimari,** on the bark of *Artocarpus heterophyllus*, 25.12.2020, alt. 40.40 m, 26°30′155″ N, 90°41′397″ E, Suparna Biswas & Pabitra Biswas, 2020-0927 (BUBH).

Ecology: The species is found growing on the bark of *Spondias* sp., *Lannea* sp., *Polyalthia longifolia, Michelia champaca, Azadirachta* sp., *Neolamarckia cadamba, Bombex cieba, Artocarpus heterophyllus* at an elevation of 18.25 m to 48.28 m.

Remarks: The species is similar with *G. dendrogramma* Nyl. but differ as disc is open in *G. sundarbanensis*. The species is also similar with *G. pyrrhocheiloides* Zahlbr. in thallus and ascomata but differ as larger ascospores and norstictic acid present in *G. pyrrhocheiloides* (Jagadeesh Ram and Singh 2007 and Kalb *et al.* 2018).

60. *Graphis supracola* A.W. Archer in Aust. Syst. Bot. 14(2): 267, 2001. Plate 18 (d)

Description: Thallus crustose, grey, smooth surface, corticated; apothecia lirellate, immersed to erumpent, branched, lateral thaline margin, disc concealed, pruinose; excipulum laterally carbonized, labia entire, hymenium colourless, clear, paraphyses simple; asci 8–spored, ascospores colourless, transversely 8–9 septate, I+ blue, 28–29× 4–6 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: protocetraric acid present.

Distribution: India (Assam), Australia, Bolivia, Brazil, China, Colombia, Congo, Guyana, Myanmar, Togo, Viet Nam.

Specimen examined: INDIA: Assam, Dhubri district, **Chagolchara Pt-III**, on the bark of *Polyalthia longifolia*, 29.10.2020, alt. 30.14 m, 26°02′511″ N, 89°94′406″ E, Suparna Biswas & Pabitra Biswas, 2020-0110 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia* at an elevation of 30.14 m.

Remarks: The species is similar with *G. distincta* Makhija & Adaw. but differ with exposed disc, stictic, constictic acids as additional secondary compounds. (Joshi *et al.* 2013b).

***Herpothallon* Tobler in Flora, Regensburg 131:92, 1937. (Family: Arthoniaceae)**

Thallus crustose, corticolous, forming rounded to irregular patches; loosely or firmly attached with the substratum, densely packed to byssoid hyphae in the upper part of the thallus, white, psuedoisidia present, prothallus distinct with interwoven hyphae, whitish; ascomata rare, asci usually immature, 2–8 spored, ascospores when present muriform.

Key to the species

1a**.** Thallus UV−……*H. himalayanum*

1b Thallus UV+……*H. philippinum*

1. ***Herpothallon himalayanum*** Jagad. Ram & G.P. Sinha in Mycotaxon 110: 40, 2009. Plate 18 (e)

Description: Thallus crustose, corticolous, loosely appressed to the substrate, grey; prothallus dirty white, pseudo-isidioid outgrowths arising from the verrucose surface; bear pycnidia, hypothallus below the entire thallus whitish.

Chemistry: Thallus K−, C+ red, KC+ red, P−, UV−, TLC: Gyrophoric acid, lecanoric acid present.

Distribution: India (West Bengal), Endemic.

Specimen examined: INDIA: Assam, Dhubri district, **Khajurbari Pt-I**, on the bark of *Lannea* sp., 24.12.2020, 39.00 m, 26°26′244″ N, 90°17′950″ E, Suparna Biswas & Pabitra Biswas, 2020-0169 (BUBH); **Gauripur Matiabag Hawakhana**, on the bark of *Michelia champaca*, 08.02.2020, 48.26 m, 26°09′790″ N, 89°97′546″ E, Suparna Biswas & Pabitra Biswas, 2020-0487 (BUBH); **Dhubri town**, on the bark of *Delonix regia,* 30.12.2019, 30.89 m, 26°02′222″ N, 89°99′549″ E, Suparna Biswas & Pabitra Biswas, 2019-546 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Michelia champaca*, 17.01.2020, 28.81 m, 26°11′061″ N, 89°83′376″ E, Suparna Biswas & Pabitra Biswas, 2020-0548 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Lannea* sp., 02.01.2020, 39.78 m, 26°09′491″ N, 89°82′733″ E, Suparna Biswas & Pabitra Biswas, 2020-0568 (BUBH); **Falimari**, on the bark of *Neolamarckia cadamba*, 25.12.2020, 46.30 m, 26°30′149″ N, 90°41′420″ E, Suparna Biswas & Pabitra Biswas, 2020-0618 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Lannea* sp., 06.12.2019, 34.00 m, 26°11′093″ N,

89°83′359″ E, Suparna Biswas & Pabitra Biswas, 2019-0826 (BUBH); **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 22.11.2020, 29.08 m, 26°05′038″ N, 89°89′317″ E, Suparna Biswas & Pabitra Biswas, 2020-0831 (BUBH), 61641 (LWG); **Khajurbari Pt-I**, on the bark of *Mangifea indica,* 24.12.2020, 34.65 m, 26°26′294″ N, 90°17′972″ E, Suparna Biswas & Pabitra Biswas, 2020-0835 (BUBH); **Falimari**, on the bark of *Laurus* sp., 25.12.2020, 46.01 m, 26°30′149″ N, 90°41′416″ E, Suparna Biswas & Pabitra Biswas, 2020-0841 (BUBH); **Satrasal**, on the bark of *Lannea* sp., 04.01.2020, 32.33 m, 26°16′146″ N, 89°73′459″ E, Suparna Biswas & Pabitra Biswas, 2020-0842 (BUBH); **Satrasal**, on the bark of *Lannea* sp., 04.01.2020, 40.67 m, 26°16′303″ N, 89°73′415″ E, Suparna Biswas & Pabitra Biswas, 2020-0843 (BUBH); **Pub-Gaikhawa Pt-I**, on the bark of *Mangifera* sp., 25.10.2020, 28.01 m, 26°08′062″ N, 89°83′369″ E, Suparna Biswas & Pabitra Biswas, 2020-0876 (BUBH); **Pub-gaikhawa Pt-I**, on the bark of *Artocarpus heterophyllus*, 25.10.2020, 35.92 m, 26°08′052″ N, 89°83′380″ E, Suparna Biswas & Pabitra Biswas, 2020-0877 (BUBH); **Ananda nagar**, on the bark of *Ficus* sp., 24.12.2020, 34.93 m, 26°22′707″ N, 90°21′729″ E, Suparna Biswas & Pabitra Biswas, 2020-0899 (BUBH); **Bhalukmari**, on the bark of *Mangifera indica*, 24.12.2020, 52.18 m, 26°30′099″ N, 90°23′107″ E, Suparna Biswas & Pabitra Biswas, 2020-0900 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Michelia champaca, Delonix regia, Neolamarckia cadamba, Mangifea indica, Laurus* sp., *Artocarpus heterophyllus, Ficus* sp. at an elevation of 28.01 m to 52.18 m.

Remarks: The species is similar with *H. albidum* (Fée) Aptroot, Lücking & G. Thor externally but differ with chemistry and blue-green prothallus. The species is an endemic to Indian region (Jagadeesh Ram and Sinha 2009).

2. ***Herpothallon philippinum*** (Vain.) Aptroot & Lücking in Biblthca Lichenol. 99: 56, 2009. Plate 18 (f)

Basionym: *Chiodecton philippinum* Vain. in Ann. Acad. Sci. fenn., Ser. A 15(6): 286, 1921.

Description: Thallus crustose, corticolous, loosely appressed to the substrate, dull, grey, prothallus byssoid, white, pseudo–isidioid numerous felty with projecting hairs; pycnidia not seen; hypothallus below the entire thallus whitish.

Chemistry: Thallus K−, C+ red, KC+ red, P−,UV+ pale grey–white, TLC: Gyrophoric acid, lecanoric acid present.

Distribution: India (Andaman Islands, Assam), Brazil, Congo, Costa Rica, Ecuador, El Salvador, Indonesia, Philippines, Thailand, Vanuatu.

Specimen examined: INDIA: Assam, Dhubri district, **Satrasal**, on the bark of *Neolamarckia cadamba*, 04.01.2020, 32.95 m, 26°16′130″ N, 89°73′460″ E, Suparna Biswas & Pabitra Biswas, 2020-1459 (BUBH).

Ecology: The species is found growing on the bark of *Neolamarckia cadamba* at an elevation of 32.95 m.

Remarks: The species have similar pseudoisidia like *H. isidiatum* Jagadeesh & G.P. Sinha, *H. antillarum* (Vain.) Aptroot, Lücking & G. Thor, *H. australsicum* (Elix) Elix & G. Thor but all with different chemistry (Gupta and Sinha 2018).

Lecanora Ach. in Luyken, Kongl. Vetensk. Acad. Nya Handl. 31: 66, 1809. (Family: Lecanoraceae)

Thallus crustose, corticolous; ascomata apothecia, apothecia lecanorine, immersed or sessile, disc variously coloured, yellow–orange, orange–red, red–brown, brown to black, epruinose or pruinose; amphithecium with large or small crystals, hymenium colourless; epithecium usually pigmented, with or without crystals, hypothecium colourless or pigmented, paraphyses simple to branched; asci 8–16 spored, ascospores simple, colourless; secondary metabolites atranorin, usnic acid, xanthones and a wide range of depsidones, terpenoids and aliphatic acids present.

Key to the species

1a**.** Thallus containing usnic acid……...*L. achroa*

1b Thallus absence of usnic acid…….2

2a**.** Thallus containing gangleodin……*L. leprosa*

2b Thallus absence of gangleodin ……...3

3a**.** Thallus containing atranorin, zeorin……..4

3b Thallus absence of atranorin, zeorin ……..5

4a. Thallus sorediate…….*L. leproplaca*

4b. Thallus esorediate…….*L. tropica*

5a. Thallus containing pannarin……*L. insignis*

5b. Thallus absence of pannarin……*L. helva*

1. *Lecanora achroa* Nyl., in Crombie, J. Bot., Lond. 14: 263, 1876. Plate 19 (a**)**

Description: Thallus crustose, grey, smooth, epruinose; ascomata apothecia, sessile, lecanorine, disc yellow to orange, margin concolorous with the thallus; amphithecium with large crystals, insoluble in K, epithecium brown with pigments dissolving in K, hymenium colourless, clear, hypothecium colourless with oil droplets; ascus 8–spored, ascospores colourless, simple, 6–9 × 1–3 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P+ yellow; UV–; TLC: 2′–O–methylperlatolic, usnic acid present.

Distribution: India (Assam, Himachal Pradesh, Madhya Pradesh, Manipur, Mizoram, Sikkim, Uttar Pradesh), Antarctica, Brazil, Cayman Islands, Costa Rica, Fiji, Indian ocean Islands, Jamaica, Mexico, Nea Zealand, Papua New Guinea, Puerto Rico, South Pacific regions, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Satrasal**, on the bark of *Polyalthia longifolia*, 04.01.2020, 41.29 m, 26°16′299″ N, 89°73′417″ E, Suparna Biswas & Pabitra Biswas, 2020-1458 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia* at an elevation of 41.29 m.

Remarks: The species is close to *L. helva* Stizneb. and *L. leprosa* Fée with their morphological character but differ as both of the latter species lacking usnic acid and having different chemistry. *L. achroa* is distinguished by the small apothecia with orange brown disc, small ascospores and presence of usnic acid (Gupta and Sinha 2018).

2. *Lecanora helva* Stizneb in Ber. Tät. St. Gall. Naturw. Ges.: 218, 1889. Plate 19 (b)

Description: Thallus crustose, yellowish grey, smooth, ecorticate, epruinose, esorediate; ascomata apothecia, sessile, lecanorine, disc pale brown to orange, margin prominent; amphithecium with large crystals, small crystals soluble in K, but large crystals insoluble in K, epithecium pale brown with small crystals, hymenium colourless, clear, hypothecium colourless with oil droplets; ascus 8–spored, ascospores colourless, simple, 10–12 × 2–3 µm.

Chemistry: Thallus K+ yellow, C+ yellow, KC–, P+ yellow; UV–; TLC: 2′–O–methylperlatolic acid present.

Distribution: India (Assam, Goa, Himachal Pradesh, Kerala, Madhya Pradesh, Maharashtra, Mizoram, Tamil Nadu), Africa, Australia, Brazil, Colombia, Fiji, Mexico, New Caledonia, Papua New Guinea, Pacific regions, Seychelles, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Alomganj Pt-IX**, on the bark of *Michelia champaca*, 27.12.2020, 47.02 m, 26°13′296″ N, 90°03′366″ E, Suparna Biswas & Pabitra Biswas, 2020-0141 (BUBH), 61639 (LWG); **Debotar hasdaha Pt-IV**, on the bark of *Lannea* sp., 22.11.2020, 32.21 m, 26°05′740″ N, 89°88′984″ E, Suparna Biswas & Pabitra Biswas, 2020-0142 (BUBH); **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 22.11.2020, 30.26 m, 26°05′070″ N, 89°89′333″ E, Suparna Biswas & Pabitra Biswas, 2020-0143 (BUBH); **Barobalurchar**, on the bark of *Azadirachta indica*, 27.12.2020, 40.75 m, 26°22′160″ N, 89°84′089″ E, Suparna Biswas & Pabitra Biswas, 2020-0144 (BUBH); **Chagolchara Pt-III**, on the bark of *Mallotus nudiflorus*, 29.10.2020, 29.63 m, 26°02′5084″ N, 89°94′436″ E, Suparna Biswas & Pabitra Biswas, 2020-0494 (BUBH); **Dhubri town**, on the bark of *Delonix regia*, 30.12.2019, 31.26 m, 26°02′249″ N, 89°99′500″ E, Suparna Biswas & Pabitra Biswas, 2019-0503 (BUBH); **Chandor Dinga Pahar**, on the bark of *Tectona grandis*, 11.02.2020, 55.60 m, 26°19′338″ N, 90°34′743″ E, Suparna Biswas & Pabitra Biswas, 2020-0668 (BUBH); **Barobalurchar**, on the bark of *Jatropha* sp., 27.12.2020, 42.97 m, 26°22′157″ N, 89°84′088″ E, Suparna Biswas & Pabitra Biswas, 2020-0672 (BUBH); **Dumardaha Pt-II**, on the bark of *Lannea* sp., 28.10.2020, 33.22 m, 26°09′003″ N, 89°92′019″ E, Suparna Biswas & Pabitra Biswas, 2021-0675 (BUBH); **Uchita**, on the bark of *Eucalyptus* sp., 28.10.2020, 41.57 m, 26°10′739″ N, 89°85′245″ E, Suparna Biswas & Pabitra Biswas, 2021-0676 (BUBH); **Dumardaha Pt-II**, on the bark of *Lannea* sp., 28.10.2020, 37.02 m, 26°09′002″ N, 89°92′014″ E, Suparna Biswas & Pabitra Biswas, 2020-0677 (BUBH); **Uchita,** on the bark of *Mallotus*

nudiflorus, 28.10.2020, 30.16 m, 26°10′686″ N, 89°85′227″ E, Suparna Biswas & Pabitra Biswas, 2021-0678 (BUBH); **Uchita**, on the bark of *Lannea* sp., 28.10.2020, 30.16 m, 26°10′686″ N, 89°85′227″ E, Suparna Biswas & Pabitra Biswas, 2020-0679 (BUBH); **Khalilpur**, on the bark of *Polyalthia longifolia*, 10.03.2021, 36.00 m, 26°03′858″ N, 89°96′196″ E, Suparna Biswas & Pabitra Biswas, 2021-0684 (BUBH); **Khalilpur**, on the bark of *Bombex cieba*, 10.03.2021, 36.00 m, 26°03′301″ N, 89°96′486″ E, Suparna Biswas & Pabitra Biswas, 2021-0686 (BUBH); **Chagolchara Pt-III**, on the bark of *Polyalthia longifolia*, 29.10.2020, 30.14 m, 26°02′511″ N, 89°94′406″ E, Suparna Biswas & Pabitra Biswas, 2021-0687 (BUBH); **Rangamati Pt-III**, on the bark of *Michelia champaca*, 27.12.2020, 21.01 m, 26°16′107″ N, 90°05′975″ E, Suparna Biswas & Pabitra Biswas, 2020-0690 (BUBH); **Alomganj Pt-IX**, on the bark of *Artocarpus heterophyllus*, 27.12.2020, 47.09 m, 26°13′510″ N, 90°03′674″ E, Suparna Biswas & Pabitra Biswas, 2020-0692 (BUBH); **Kaldoba**, on the bark of *Lannea* sp., 21.11.2020, 21.03 m, 26°19′870″ N, 89°77′092″ E, Suparna Biswas & Pabitra Biswas, 2020-0707 (BUBH); **Hatipota Pt-II**, on the bark of *Lannea coromandelica,* 26.12.2020, 52.18 m, 26°22′599″ N, 90°35′496″ E, Suparna Biswas & Pabitra Biswas, 2020-0756 (BUBH); **Khalilpur,** on the bark of *Polyalthia longifolia*, 10.03.2021, 29.00 m, 26°04′046″ N, 89°96′253″ E, Suparna Biswas & Pabitra Biswas, 2021-0803 (BUBH); **Bhalukmari,** on the bark of *Lannea* sp., 24.12.2020, 46.20 m, 26°29′979″ N, 90°22′911″ E, Suparna Biswas & Pabitra Biswas, 2020-0856 (BUBH); **Khalilpur**, on the bark of *Polyalyhia longifolia,* 10.03.2021, 32.00 m, 26°03′366″ N, 89°96′832″ E, Suparna Biswas & Pabitra Biswas, 2020-0875 (BUBH); **Dhubri town**, on the bark of *Polyalthia longifolia,* 13.03.2021, 29.24 m, 26°02′131″ N, 89°99′572″ E, Suparna Biswas & Pabitra Biswas, 2020-0880 (BUBH); **Khalilpur**, on the bark of *Polyalthia longifolia*, 10.03.2021, 33.00 m, 26°03′011″ N, 89°96′486″ E, Suparna Biswas & Pabitra Biswas, 2021-0901 (BUBH); **Alomganj Pt-IX**, on the bark of *Artocarpus heterophyllus*, 27.12.2020, 47.23 m, 26°13′509″ N, 90°03′663″ E, Suparna Biswas & Pabitra Biswas, 2020-0903 (BUBH); **Bhelupara Pt-II**, on the bark of *Neolamarckia cadamba*, 25.12.2020, 40.53 m, 26°24′785″ N, 90°32′690″ E, Suparna Biswas & Pabitra Biswas, 2020-0928 (BUBH); **Gauripur**, on the bark of *Lannea coromandelica*, 10.03.2021, 34.04 m, 26°09′771″ N, 89°94′940″ E, Suparna Biswas & Pabitra Biswas, 2020-0960 (BUBH).

Ecology: The species is found growing on the bark of *Michelia champaca*, *Lannea* sp., *Azadirachta indica, Mallotus nudiflorus, Delonix regia, Tectona grandis, Jatropha* sp.,

Eucalyptus sp., *Polyalthia longifolia*, *Bombex cieba*, *Artocarpus heterophyllus*, *Lannea coromandelica, Neolamarckia cadamba* at an elevation of 21.01 m to 55.60 m.

Remarks: The species is close to *L. achroa* Nyl. and *L. leprosa* Fée with their morphological character but differ as both of the latter having different chemistry. *L. helva* is distinguished by the small orange to pale brown apothecial discs. *L. achroa* have smaller ascospores than *L. helva* Stizneb. and *L. leprosa* have greenish thallus with smooth surface (Gupta and Sinha 2018).

3. ***Lecanora insignis*** Degel. in Ark. Bot. 30A (3): 53, 1941. Plate 19 (c)

Description: Thallus crustose, greyish white, smooth, ecorticate, epruinose, esorediate; ascomata apothecia, sessile, lecanorine, disc pale brown, margin verrucose; amphithecium with large crystals, crystals soluble in K, hymenium colourless, clear, hypothecium colourless to slightly yellowish; ascus 8–spored, ascospores colourless, simple, ellipsoidal, 14–18 × 10–11 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: pannarin present.

Distribution: India (Jammu and Kashmir), Austria, Canada, China, Germany, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Bilashipara Florican Garden**, on the bark of *Lannea* sp., 10.02.2020, 37.86 m, 26°25′066″ N, 90°27′691″ E, Suparna Biswas & Pabitra Biswas, 2020-0512 (BUBH); **Gauripur Matiabag Hawakhana**, on the bark of *Michelia champaca,* 08.02.2020, 44.88 m, 26°09′792″ N, 89°97′555″ E, Suparna Biswas & Pabitra Biswas, 2020-0550 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp. at an elevation of 37.86m.

Remarks: The species is similar to *L. sulcata* (Hue) H. Miyaw but differ as pannarin is absent in *L. sulcata* (Lü and Zhao 2017). The species is a new record to Assam.

4. ***Lecanora leproplaca*** Zahlbr., in Magnusson & Zahlbruckner, Ark. Bot. 31A(6): 64, 1944. Plate 19 (d)

Description: Thallus crustose, corticolous, grey, sorediate; apothecia round, disc brown, margin white, epruinose; amphithecium with large crystals, epihymenial pigments not dissolving in K, hypothecium uniformly hyaline to slightly yellowish; ascus 8–spored, ascospores colourless, simple, 20–22.6 × 6–8.7 μm.

Chemistry: Thallus K+ yellow, C−, P−, UV−; TLC: Atranorin, zeorin present.

Distribution: India (Kerala, Madhya Pradesh), Australia, Brazil, Central and South America, Domonica, EL Salvador, Fiji, Hawaiian Islands, Jamaica, Papua New Guinea, Seychelles, South Africa, Thailand.

Specimen examined: INDIA: Assam, Dhubri district, **Gauripur Matiabag Hawakhana**, on the bark of *Michelia champaca*, 08.02.2020, 44.82 m, 26°09′793″ N, 89°97′546″ E, Suparna Biswas & Pabitra Biswas, 2020-0174 (BUBH), 61698 (LWG).

Ecology: The species is found growing on the bark of *Michelia champaca* at an elevation of 44.82 m.

Remarks: The speies is characterized with sorediate thallus, epruinose, presence of large crystals, not dissolving in K, atranorin, zeorin. The species is a new record to Assam.

5. ***Lecanora leprosa*** Fée, Essai Crypt. Exot. (Paris): 118, 1824. Plate 19 (e)

Description: Thallus crustose, whitish grey, rough, epruinose, esorediate; ascomata apothecia, sessile, lecanorine, disc pale yellowish brown, margin thick; amphithecium with large crystals, epihymenial pigmentation dissolving in K, hymenium colourless, clear, hypothecium colourless to slightly yellowish; ascus 8–spored, ascospores colourless, simple, 10–14 ×6–7 μm.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: gangleodin present.

Distribution: India (Assam), Australia, Brazil, Cayman Islands, Ecuador, Japan, Jamaica, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Pub-gaikhawa Pt-I,** on the bark of *Polyalthia longifolia*, 25.10.2020, 28.84 m, 26°08′062″ N, 89°83′368″ E, Suparna Biswas & Pabitra Biswas, 2020-0542 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia* at an elevation of 28.84 m.

Remarks: The species is close to *L. helva and L. achroa* with their morphological character but differ as both of the latter having different chemistry (Gupta and Sinha 2018).

6. ***Lecanora tropica*** Zahlbr., Cat. Lich. Univers. 5: 589, 1928. Plate 19 (f)

Description: Thallus crustose, whitish grey, rough, epruinose, esorediate; ascomata apothecia, sessile, lecanorine, disc dark red–brown, margin thick; amphithecium with small crystals,

epithecium reddish brown, lacking crystals, pigmentation not dissolving in K, hymenium colourless, clear, hypothecium colourless; ascus 8–spored, ascospores colourless, simple, 10–14 ×7–8 μm.

Chemistry: Thallus K+ yellow, C+ yellow, KC–, P+ yellow; UV–; TLC: atranorin, zeorin present.

Distribution: India (Assam, Himachal Pradesh, Karnataka, Madhya Pradesh, Mizoram, Odisha, Sikkim, Tamil Nadu, Uttar Pradesh, Uttarakhand, West Bengal), Australia, Brazil, Colombia, Costa Rica, Cuba, El Salvador, Japan, Mexico, Papua New Guinea, Paraguay, Thailand, Tropical America.

Specimen examined: INDIA: Assam, Dhubri district, **Pataner kuti**, on the bark of *Mangifera indica,* 27.12.2020, 40.20 m, 26°28′075″ N, 89°86′809″ E, Suparna Biswas & Pabitra Biswas, 2020-0978 (BUBH).

Ecology: The species is found growing on the bark of *Mangifera indica* in Pataner kuti at an elevation of 40.20 m.

Remarks: The species is close to *L. argentata* with their morphological character and apothecial anatomical character but differ as *L. argentata* have galeodin. *L. tropica* is characterized by red brown apothecial disc, presence of chodatin and zeorin (Gupta and Sinha 2018).

***Lepraria* Ach. in Methodus, Sectio prior (Stockholmiae): 3, 1803. (Family: Cladoniaceae)**

Thallus leprose, loosely attached to the substratum, spreading irregularly, upper surface pale blue, green, grey, yellow, yellow–green, white, sometimes pigmented, soredia often present, pruinose, globose to fine or coarse; medulla present or absent, composed of interwoven hyphae, ascomata absent.

1. ***Lepraria incana*** (L.) Ach. in Methodus, Sectio prior (Stockholmiae): 4, 1803. Plate 20 (a)

Basionym: *Byssus incana* L. Sp. pl. 2: 1169, 1753.

Description: Thallus leprose, powdery, greenish–grey, thick, firmly attached to the substratum, shape irregular, margin diffuse, lbes absent, medulla poorly developed; soredia abundant, loosely packed.

Chemistry: Thallus K+ yellow, C–, KC–, P–; UV–; TLC: divaricatic acid present.

Distribution: India (Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Mizoram, Orissa, Rajasthan, Tamil Nadu, Uttarakhand), Austria, Denmark, Estonia, France, Germany, Ireland, Netherlands, Sweden, United Kingdom of Great Britain and Northern Ireland.

Specimen examined: INDIA: Assam, Dhubri district, **Chagolchara Pt-III**, on the bark of *Polyalthia longifolia*, 29.10.2020, 29.56 m, 26°02′510″ N, 89°94′427″ E, Suparna Biswas & Pabitra Biswas, 2020-0476 (BUBH); **Pub-gaikhawa Pt-I,** on the bark of *Lannea* sp., 25.10.2020, 28.95 m, 26°08′059″ N, 89°83′365″ E, Suparna Biswas & Pabitra Biswas, 2020-0484 (BUBH); **Dumardaha Pt-II**, on the bark of *Lannea* sp., 28.10.2020, 34.67 m, 26°09′002″ N, 89°92′008″ E, Suparna Biswas & Pabitra Biswas, 2020-0491 (BUBH); **Gauripur Matiabag Hawakhana**, on the bark of *Michelia champaca*, 08.02.2020, 44.88 m, 26°09′792″ N, 89°97′555″ E, Suparna Biswas & Pabitra Biswas, 2020-0560 (BUBH); **Dumardaha Pt-II,** on the bark of *Lannea* sp., 28.10.2020, 23.97 m, 26°09′007″ N, 89°91′993″ E, Suparna Biswas & Pabitra Biswas, 2020-0563 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia*, *Lannea* sp., *Michelia champaca* at an elevation of 23.97 m to 44.88 m. The species is found to be growing on different substratum viz. moss, rock, soil, bark.

Remarks: The species is characterized with leprose growth from, presence of abundant loosely packed soredia, powdery, divaricatic acid as secondary compound. The species is a new record to Assam.

***Letrouitia* Hafellner & Bellem. Nova in Hedwigia 35: 281, 1982. (Family: Letrouitiaceae)**

Thallus crustose, corticolous, pale yellow, greenish yellow to orange yellow, corticated; apothecia lecanorine, sessile, disc yellow–orange to orange to brownish, margin prominent, pale orange, usullay lighter than the disc; exciple biatorine, paraphyses branched; asci 2–8 spored, ascospores brown, transversely septate to submuriform or muriform, secondary metabolites anthraquinones present or absent.

1. ***Letrouitia transgressa*** (Malme) Hefellner & Bellem., in Hafellner, Nova Hedwigia 35(4): 710, 1981. Plate 20 (b)

Basionym: *Bombyliospora domingensis* f. *transgressa* Malme in Ark. Bot. 18(12): 5, 1923.

Description: Thallus crustose, whitish- grey, smooth; ascomata apothecia, scattered, rounded, sessile, disc black, margin prominent, yellowish orange; hymenium colourless, clear; ascus 8–spored, ascospores colourless, submuriform, transversely 8–12 septate, 1–3 vertical septa, locules lens shaped, 30–35 × 13–14 μm.

Chemistry: Thallus K+ purple, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Andhra Pradesh, Arunachal Pradesh, Assam, Karnataka, Madhya Pradesh, Nagaland, Uttar Pradesh, West Bengal), Australia, Brazil, China, Colombia, Indonesia, Nepal, New Caledonia, Papua New Guinea, South America, Thailand.

Specimen examined: INDIA: Assam, Dhubri district, **Arear jhar part II**, on the bark of *Lannea sp.*, 25.12.2020, 49.00 m, 26°26′074″ N, 90°41′802″ E, Suparna Biswas & Pabitra Biswas, 2020-0863 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp. at an elevation of 49.00 m.

Remarks: The species is similar with *L. parabola* (Nyl.) R. Sant & Hefellner as they have submuriform ascospores at maturity but differ as *L. transgressa* have transverse septation with lens shaped lumina of ascospores in the primary stage whereas *L. parabola* have spiral septation and smaller ascospores with fewer septa (Joshi *et al*. 2013d).

Nigrovothelium Lücking, M.P. Nelsen & Aptroot in Lichenologist 48 (6): 757, 2016.

(Family: Trypetheliaceae)

Thallus corticated, olive-green to brownish; ascomata perithecia, solitary or aggregated, ostioles apical, black; hamathecium inspersed or clear, hyaline, paraphysoides anstomishing; ascospores hyaline, transversely 3–septate, diamond shaped lumina.

1. ***Nigrovothelium tropicum*** (Ach.) Lücking, M.P. Nelsen & Aptroot, in Lichenologist 48(6): 757, 2016. Plate 20 (c)

Basionym: *Verrucaria tropica* Ach. in Lich. Univ. 278, 1810.

Description: Thallus crustose, yellowish brown, smooth, epruinose, corticated; ascomata perithecia yellowish, pseudostromata present, stromata black, polycarpous, ostiole apical, black; hymenium colourless, inspersed with oil granules; ascus 8–spored, ascospores colourless, transversely 3–septate, 22–24× 6–7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Arunachal Pradesh, Andaman Nicobar Islands, Assam, Karnataka, Kerala, Maharashtra, Mizoram, Tamil Nadu, West Bengal), Australia, Brazil, Colombia, Cuba, Eucador, Indonesia, Puerto Rico, Sri Lanka, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Satrasal**, on the bark of *Messua ferrea*, 04.01.2020, 36.99 m, 26°16′284″ N, 89°73′446″ E, Suparna Biswas & Pabitra Biswas, 2020-0571 (BUBH).

Ecology: The species is found growing on the bark of *Messua ferrea* at an elevation of 36.99 m. Mostly widespread Tropical regions of the world.

Remarks: The species shows variable thallus colour and morphology and can be distinguished due to presence of 3–septate ascospores and absence of lichexanthone (Gupta and Sinha 2018).

Oxneriopsis S. Y. Kondr., D. Upreti & Hur in Acta bot. hung. 59(1-2): 113, 2017. (Family: Teloschistaceae)

Thallus crustose, corticolous, upper surface yellow or orange, greyish or greenish grey, pruinose; upper cortex paraplectenchymatous, firmly attached with the substratum, medulla white; ascomata apothecia, lecanorine, sessile, disc flat, yellow, yellow–orange to orange brown, dark brown or blackish brown; hymenium hyaline, inspersed, paraphyses simple; asci–8 spored, ascospores hyaline, 1–septate, ellipsoid.

1. ***Oxneriopsis bassiae*** (Ach.) S.Y. Kondr., Upreti & Hur, in Acta bot. hung. 62(3-4): 367, 2020. Plate 20 (d)

Basionym: *Lepraria bassiae* Ach. in Methodus, Sectio prior: 5, 1803.

Description: Thallus crustose, corticolous, smooth, upper surface yellow, firmly appressed to the substrate; medulla white; apothecia not seen.

Chemistry: Thallus K+ purple, C–, KC–, P−, UV−; TLC: parietin, fragilin present.

Distribution: India (Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Odisha, Rajasthan, Sikkim, Tamil Nadu and Uttar Pradesh), Australia, Brazil, Costa Rica, Fiji, Madagascar, Seychelles.

Specimen examined: INDIA: Assam, Dhubri district, **Chandor Dinga Pahar**, on the bark of *Neolamarckia cadamba*, 11.02.2020, 36.64 m, 26°19′341″ N, 90°34′748″ E, Suparna Biswas & Pabitra Biswas, 2020-0766 (BUBH), 61683 (LWG).

Ecology: The species is found growing on the bark of *Neolamarckia cadamba* at an elevation of 36.64 m.

Remarks: The species is characterized with Thallus upper surface yellow, K+ purple, parietin present.

Pallidogramme Staiger, Kalb & Lücking in Fieldiana, Bot. 46(1549): 14, 2008. (Family: Graphidaceae)

Thallus crustose; apothecia lirellate, labia well developed, convergent, distinctly crenate; exciple not carbonized, paraphyses simple, tips smooth; ascospores brown or colourless.

1. ***Pallidogramme divaricoides*** (Räsänen) Pushpi Singh & Kr. P. Singh in Lichenologist 49 (5): 531, 2017. Plate 20 (e)

Basionym: *Phaeographis divaricoides* Räsänen in Arch. Soc. Zool. Bot. fenn. Vanamo 5(1): 31, 1950.

Description: Thallus crustose, greenish-brown, smooth surface; apothecia lirellate, simple to divaricately branched; excipulum open, pale brown, labia entire, hymenium colourless, inspersed, paraphyses simple; asci 8–spored, ascospores brown, oblong–ellipsoid, transversely 5–7 septate, 33–35× 8–9µm.

Chemistry: Thallus K+ red, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Arunachal Pradesh, Assam, Kerala, Mizoram, Nagaland, Sikkim, West Bengal), Nepal.

Specimen examined: INDIA: Assam, Dhubri district, **Hatipota Pt-II**, on the bark of *Syzygium* sp., 26.12.2020, 48.65 m, 26°22′597″ N, 90°35′478″ E, Suparna Biswas & Pabitra Biswas, 2020-0972 (BUBH).

Ecology: The species is found growing on the bark of *Syzygium* sp. at an elevation of 48.65 m.

Remarks: The species is closely related to *Phaeographina chlorocarpoides* (Nyl.) Zahlbr. but differ as transverse ascospores and simple to simple to divaricately branched lirellae present in *P. divaricoides* (Biju *et al*. 2014).

Parmotrema A. Massal. in Atti Reale Ist. Veneto Sci. Lett. Arti. Ser. 3, 5: 248, 1860. (Family: Parmeliaceae)

Thallus foliose, loosely attached to the substratum, lobate, lobes broad, rotund, margin entire, upper surface grey, grey–green, rarely yellow green, smooth, plane to rugose, wrinkled, shiny or dull; ciliate or eciliate, sometimes with white maculae, usually epruinose, with or without isidia, soredia or pustules, lacking pseudocyphellae; lower surface black or brown, with a characteristic pale brown or white erhizinate marginal zone, plane to sometimes wrinkled, rhizines; medulla usually white sometimes pigmented in whole or part, lower cortex brown to black; apothecia lecanorine, hymenium colourless, paraphyses simple; asci 8 spored, ascospores colourless, simple; secondary metabolites orcinol depsides, orcinol depsidones, xanthones, aliphatic acids, pulvinic acids derivatives, anthraquinones, dibenzofurans.

Key to the species

1a**.** Thallus isidiate/sorediate……2

1b Thallus lacking isidia/soredia…….6

2a. Thallus isidiate……. 3

2b. Thallus sorediate……*P. praesorediosum*

3a. Medulla K+ yellow…… *P. crinitoides*

3b. Medulla K–……4

4a. Medulla P+ red……...*P. saccatilobum*

4b. Medulla P–…….5

5a. Medulla C+ red……*P. tinctorum*

5b. Medulla C–……...*P. tsavoense*

6a. Medulla KC+ red, P+ red …… *P. disparile*

6b. Medulla KC–, P–…… *P. mesotropum*

1. ***Parmotrema crinitoides*** J. C. Wei, Enumeration of Lichens in China (Beijing): 177, 1991. Plate 20 (f)

Description: Thallus foliose, greyish, lobes wide; eciliate, white maculae, isidiate; lower side brown, medulla white; apothecia not seen.

Chemistry: Medulla K+ yellow, C–, KC+ red, P+ orange; UV–; TLC: stictic and constictic acids present.

Distribution: India (Assam, Kerala, Mizoram), Australia, China, Norfolk Island.

Specimen examined: INDIA: Assam, Dhubri district, Hatipota Pt-II, on the bark of *Mallotus* sp., 26.12.2020, 46.00 m, 26°22′710″ N, 90°35′497″ E, Suparna Biswas & Pabitra Biswas, 2020-0544 (BUBH).

Ecology: The species is found growing on the bark of *Mallotus* sp. at an elevation of 46.00 m.

Remarks: The species is characterized with presence of wide, eciliate, white maculae, isidiate lobes and stictic and constictic acids as lichen substances.

2. ***Parmotrema disparile*** (Nyl.) Hale in Phytologia 28(4): 336, 1974. Plate 21 (a)

Basionym: *Parmelia disparilis* Nyl. in Syn. meth. lich. (Parisiis) 1(2): 381, 1860.

Description: Thallus foliose, greyish, lobes wide; eciliate, white maculae, lacking isidia, soredia and pustules; lower side black, medulla white, apothecia not seen.

Chemistry: Medulla K–, C–, KC+ red, P+ red; UV–; TLC: protocetraric acid present.

Distribution: India (Assam, Tamil Nadu), Africa, Congo, Madagscar, Mexico, Myanmar, Tanzania, Vanuatu.

Specimen examined: INDIA: Assam, Dhubri district, **Hatipota Pt-II**, on the bark of *Mallotus* sp., 26.12.2020, 47.46 m, 26°22′689″ N 90°35′491″ E, Suparna Biswas & Pabitra Biswas, 2020-0982 (BUBH).

Remarks: The species resembles to *P. zollingeri*. The specis *P. zollingeri* is differ by ciliate axils and emaculate lobes (Awasthi 2007).

3. ***Parmotrema mesotropum*** (Müll. Arg.) Hale in Phytologia 28(4): 337, 1974. Plate 21 (b)

Basionym*: Parmelia mesotropa* Müll. Arg. in Revue mycol., Toulouse, 10(38): 55, 1888.

Description: Thallus foliose, greyish, lobes wide; eciliate, white maculae, lacking isidia, soredia and pustules; lower side black, medulla white; apothecia not seen.

Chemistry: Medulla K–, C–, KC–, P–; UV–; TLC: caperatic acid present.

Distribution: India (Assam, Himachal Pradesh, Karnataka, Madhya Pradesh, Uttaranchal), Argentia, Bolvinia, Brazil, Central and South America, Costa Rica, Guyana, Mexico, Paraguay.

Specimen examined: INDIA: Assam, Dhubri district, **Alomganj Pt-IX**, on the bark of *Lannea* sp., 27.12.2020, 43.84 m, 26°13′517″ N, 90°03′681″ E, Suparna Biswas & Pabitra Biswas, 2020-0175 (BUBH); **Falimari**, on the bark of *Neolamarckia cadamba*, 25.12.2020, 46.30 m, 26°30′149″ N, 90°41′420″ E, Suparna Biswas & Pabitra Biswas, 2020-0733 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Neolamarckia cadamba* at an elevation of 43.84 m to 46.30 m.

Remarks: The species resembles to *P. latissimum*. The specis *P. latissimum.* is differ by presence of salazinic acid (Awasthi 2007).

4. ***Parmotrema praesorediosum*** (Nyl.) Hale in Phytologia 28(4): 338, 1974. Plate 21 (c)

Basionym: *Parmelia praesorediosa* Nyl. in Sert. Lich. Trop. Labuan Singapore: 18, 1891.

Description: Thallus foliose, greyish, lobes rotund, margins entire; eciliate, lacking isidia, pustules and soredia present, upper surface emaculate; lower surface minutely wrinkled, black, medulla white; apothecia not seen.

Chemistry: Medulla K–, C–, KC–, P–; UV–; TLC: atranorin, chloroatranorin, fatty acids, protopraesorediosic, praesorediosic acids present.

Distribution: India (Andhra Pradesh, Assam, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Nagaland, Odisha, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal), Africa, Australia, America, Brazil, China, Colombia, Cuba, Fiji, Indonesia, Japan, Malaysia, Mexico, Papua New Guinea, Puerto Rico, Nea Caledonia, Nepal, Singapore, Sri Lanka, Taiwan, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 22.11.2020, 31.50 m, 26°05′069″ N, 89°89′318″ E, Suparna Biswas & Pabitra Biswas, 2020-0716 (BUBH), 61675 (LWG).

Ecology: The species is found growing on the bark of *Lannea* sp. at an elevation of 31.50m. The species is widely distributed in Tropical to temperate regions of the world.

Remarks: *P. praesorediosum* close to *P. grayanum* but differ as the latter one has cilia in margin (Awasthi 2007).

5. ***Parmotrema saccatilobum*** (Taylor) Hale in Phytologia 28(4): 339, 1974. Plate 21 (d)

Basionym: *Parmelia saccatilobum* Taylor in London J. Bot. 6: 174, 1847.

Description: Thallus foliose, greyish, lobes rotund, postulate, margins entire; eciliate, lacking soredia, isidia present, isidia filiform, branched, upper surface emaculate; lower surface black, rhizines present, medulla white; apothecia not seen.

Chemistry: Medulla K–, C–, KC+ red, P+ red; UV–; TLC: atranorin, protocetraric acids present.

Distribution: India (Assam, Goa, Kerala, Mizoram, Nagaland, South Andaman Island, Uttaranchal, West Bengal), Australia, China, Fiji, New Caledonia, Taiwan, Papua New Guinea, Singapore, Thailand, Vanuatu.

Specimen examined: INDIA: Assam, Dhubri district, **Bilashipara Florican Garden**, on the bark of *Shorea robusta*, 10.02.2020, 46.14 m, 26°25′166″ N, 90°27′585″ E, Suparna Biswas & Pabitra Biswas, 2020-0709 (BUBH); **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 22.11.2020, 31.50 m, 26°05′069″ N, 89°89′318″ E, Suparna Biswas & Pabitra Biswas, 2020-0715 (BUBH); **Bilashipara Florican Garden**, on the bark of *Shorea robusta*, 10.02.2020, 13.10 m, 26°25′089″ N, 90°27′638″ E, Suparna Biswas & Pabitra Biswas, 2020-0739 (BUBH).

Ecology: The species is found growing on the bark of *Shorea robusta*, *Lannea* sp. at an elevation of 13.10 m to 46.14 m.

Remarks: The species close to *P. tinctorum* but differ as *P. tinctorum* has broader rotund lobes and lecanoric acid in medulla. The species *P. saccatilobum* is characterized by absence of cilia, presence of cylindrical isidia and protocetraric acid in medulla (Gupta and Sinha 2018).

6. ***Parmotrema tinctorum*** (Despr. Ex Nyl.) Hale in Phytologia 28(4): 339, 1974. Plate 21 (e)

Basionym: *Parmelia tinctorum* Despr. Ex. Nyl. in Flora, Regensburg, 55: 547, 1872.

Description: Thallus foliose, greyish, loosely attached, lobes rotund, postulate, margins entire; eciliate, lacking soredia, isidia present, cylindrical, upper surface emaculate; lower surface black, rhizines present; medulla white, apothecia not seen.

Chemistry: Medulla K–, C+ red, KC+ red, P–; UV–; TLC: atranorin, lecanoric acid, salazinic acid present.

Distribution: India (Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Jharkhand, Kashmir, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Sikkim, Tamil Nadu, Uttaranchal, West Bengal), Africa, America, Australia, Brazil, China, Indonesia, Japan, Mexico, New Zealand, Papua New Guinea, Spain, Switzerland, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Kaldoba**, on the bark of *Lannea* sp., 21.11.2020, 33.85 m, 26°19′867″ N, 89°77′086″ E, Suparna Biswas & Pabitra Biswas, 2020-0969 (BUBH).

Ecology: The species is found growing on the bark of, *Lannea* sp. at an elevation of 33.85m. Widely distributed in tropical regions of the world.

Remarks: The species is characterized by broad rotund, eciliate, isidiate lobes and lecanoric acid in medulla (Gupta and Sinha 2018).

7. ***Parmotrema tsavoense*** (Krog & Swinsc.) Krog & Swinsc. in Lichenologist 15(2): 130, 1983. Plate 21 (f)

Basionym: *Parmelia tsavoensis* Krog & Swinscow in Bull. Br. Mus. Nat. Hist., Bot. 9(3): 220, 1981.

Description: Thallus foliose, greyish, loosely attached, lobes rotund, postulate, margins entire; eciliate, lacking soredia, isidia present, upper surface emaculate; lower surface black, rhizines present; medulla white; apothecia not seen.

Chemistry: Medulla K–, C–, KC+ red, P–; UV–; TLC: physodic, oxyphysodic acids present.

Distribution: India (Assam, Kerala, Mizoram, Tamil Nadu), Africa, Kenya.

Specimen examined: INDIA: Assam, Dhubri district, **Pub-gaikhawa Pt-I**, on the bark of *Shorea robusta*, 25.10.2020, 29.04 m, 26°08′056″ N, 89°83′363″ E, Suparna Biswas & Pabitra Biswas, 2020-0541 (BUBH).

Ecology: The species is found growing on the bark of *Shorea robusta* at an elevation of 29.04m.

Remarks: The species resembles to *P. stuhlmannii* but differ as the lattre one has olivetoric and lecanoric acid in medulla (Awasthi 2007).

***Phaeographis* Müll. Arg. in Flora 65: 336. 1882. (Family: Graphidaceae)**

Thallus crustose, corticolous, pale grey to creamish, yellowish ochre to olive-green, yellowish brown, corticated; apothecia lirellate, sometimes in stroma like, branched, disc open, pale brown to dark grey, sometimes with white pruina; excipulum mostly not carbonized, exciple open or closed, black, brown, yellow or colourless, hymenium colourless, sometimes inspersed, paraphyses simple to branched; asci 1–8 spored, ascospores brown, transversely septate to submuriform or muriform; secondary metabolites orcinol depsidones, lichexanthone, isohypocrellin present or absent.

1. ***Phaeographis manipurensis*** Müll. Arg. in J. Linn. Soc., Bot. 29: 226, 1892. Plate 22 (a)

Description: Thallus crustose, olive brown, smooth surface; apothecia lirellate, branched, disc black; excipulum open, pale brown, labia entire; hymenium colourless, inspersed; paraphyses simple; asci 8–spored, ascospores brown, oblong–ellipsoid, transversely 8–10 septate, 39–40× 8–9μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Manipur), endemic to North East India.

Specimen examined: INDIA: Assam, Dhubri district, **Gopigoan Pt-III**, on the bark of *Syzygium* sp., 26.12.2020, 35.31 m, 26°25′719″ N, 90°23′354″ E, Suparna Biswas & Pabitra Biswas, 2020-0971 (BUBH).

Ecology: The species is found growing on the bark of *Syzygium* sp. at an elevation of 35.31m.

Remarks: The species is close to *Pallidogramme divaricoides* with exciple character but differ with the lirellae morphology. The species is endemic to North-East India and a new record to Assam.

***Physcia* (Schreb.) Michaux in FI. Boreali-americana, Tom 2: 326, 1803. - Lichen sect. Physcia Schreber, Caroli Linné Gen. PI, ed. 8, 2: 768, 1791. (Family: Physciaceae)**

Thallus foliose, loosely attached, radially lobate, upper side grey to dark grey; with or without soredia and isidia; lower side pale brown to black, rhizine present; upper cortex paraplectenchymatous, lower cortex paraplectenchymatous or prosoplectenchymatous, medulla white; apothecia laminal, lecanorine, disc brown to black; hymenium and hypothecium colourless; atranorin always present in upper cortex.

Key to the species

1a**.** Thallus sorediate……2

1b Thallus lacking soredia……...3

2a. Lower cortex prosoplectenchymatous……...*P. abuensis*

2b. Lower cortex paraplectenchymatous ……*P. tribacoides*

3a. Lower side pale brown …….....*P. aipolia*

3b. Lower side grey ……...*P. alba*

1. ***Physcia abuensis*** D.D. Awasthi & S. R. Singh in Norw. Jl Bot. 26(2): 93, 1979. Plate 22 (b)

Description: Thallus foliose, loosely attached to the substratum, upper side grey, pruinose; marginally densely sorediate, soralia to laminal region; lower side grey, lower cortex prosoplectenchymatous, rhizine present, black; medulla white; apothecia not seen.

Chemistry: Medulla K+ yellow, C–, KC–, P+ yellow; UV–; TLC: Zeorin present.

Distribution: India (Rajasthan), endemic (Awasthi 2007).

Specimen examined: INDIA: Assam, Dhubri district, **Dhubri town**, on the bark of *Litchi chinensis,* 10.01.2020, 41.43 m, 26°02′282″ N, 89°95′974″ E, Suparna Biswas & Pabitra Biswas, 2020-0176 (BUBH), 61674 (LWG).

Ecology: The species is found growing on the bark of *Litchi chinensis* at an elevation of 41.43m.

Remarks: The species is characterized by presence of laminal region soralia, lower cortex prosoplectenchymatous, Zeorin. The species is endemic to Indian region and a new record to Assam.

2. ***Physcia aipolia*** (Ehrh. ex Humb.) Fürnr. in Naturhist. Topogr. Regensburg (Regensburg) 2: 249, 1839. Plate 22 (c)

Basionym: *Lichen aipolius* ex Humb. in Fl. Friberg. Spec. (Berlin): 19, 1793.

Description: Thallus foliose, loosely attached to the substratum, upper side grey; white-maculae, pruinose, lacking isidia and soredia, rhizine present; lower side pale brown; lower cortex prosoplectenchymatous; medulla white; apothecia not seen.

Chemistry: Medulla K+ yellow, C–, KC–, P–; UV–; TLC: Zeorin present.

Distribution: India (Himachal Pradesh, Jammu & Kashmir, Mizoram, Tamil Nadu), Austria, Canada, France, Nepal, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Pataner kuti**, on the bark of *Neolamarckia cadamba*, 27.12.2020, 40.39 m, 26°28′075″ N, 89°86′821″ E, Suparna Biswas & Pabitra Biswas, 2020-1134 (BUBH).

Ecology: The species is found growing on the bark of *Neolamarckia cadamba* in Pataner kuti at an elevation of 40.39 m. Widely distributed in lower temperate regions of the world.

Remarks: The species is characterized by lacking soredia and isidia, lower side pale brown, lower cortex prosoplectenchymatous, zeorin present. The species is a new record to Assam.

3. ***Physcia alba*** (Fée) Müll. Arg. in Revue mycol., Toulouse 9(35): 136, 1887. Plate 22 (d)

Basionym: *Parmelia alba* Fée in Essai Crypt. Exot. (Paris): 125, 1825.

Description: Thallus foliose, loosely attached to the substratum, upper side grey; lacking soredia and isidia; lower side grey, rhizine present, black; lower cortex prosoplectenchymatous, medulla white; apothecia not seen.

Chemistry: Medulla K+ yellow, C–, KC–, P–; UV–; TLC: Zeorin present.

Distribution: India (Jammu & Kashmir, Tamil Nadu), Brazil, Colombia, Costa Rica, Cuba, Jamaica, Mexico, Panama, Puerto Rico, Saint Lucia, South America.

Specimen examined: INDIA: Assam, Dhubri district, **Gauripur town**, on the bark of *Lannea* sp., 10.03.2021, 28.00 m, 26°09′771″ N, 89°94′940″ E, Suparna Biswas & Pabitra Biswas, 2021-0741 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp. at an elevation of 28.00 m.

Remarks: The species is characterized by lacking soredia and isidia, lower side grey, lower cortex prosoplectenchymatous, zeorin present. The species is a new record to Assam.

4. ***Physcia tribacoides*** Nyl. in Flora, Regensburg 57:307, 1874. Plate 22 (e)

Description: Thallus foliose, loosely attached to the substratum, upper side grey; pruinose, sorediate, marginal soralia; lower side grey, lower cortex paraplectenchymatous, rhizine present, black; medulla white; apothecia not seen.

Chemistry: Medulla K+ yellow, C–, KC–, P–; UV–; TLC: Zeorin present.

Distribution: India (Assam, Kerala, Manipur, Tamil Nadu), Australia, Brazil, Europe, France, Ireland, New Zealand, Nepal, New Zealand, Portugal, Spain, South Africa, USA, Zimbabwe.

Specimen examined: INDIA: Assam, Dhubri district, **Arear jhar Pt-II**, on the bark of *Shorea robusta*, 25.12.2020, 22.94 m, 26°26′103″ N, 90°41′794″ E, Suparna Biswas & Pabitra Biswas, 2020-0864 (BUBH).

Ecology: The species is found growing on the bark of *Shorea robusta* in Arear jhar Pt-II at an elevation of 22.94 m.

Remarks: The species is characterized by presence of marginal soralia, lower cortex paraplectenchymatous, Zeorin.

Porina **Ach. in Kong. Vetensk. Akad. Nya Handl., 158, 1809. (Family: Trichotheliaceae)**

Thallus crustose, corticolous, folicolous, saxicolous, white, grey, green, orange to pink, brown, ecorticate; ascomata perithecia, solitary, dispersed, superficial or immersed, surrounded by thalline excipulum, light coloured to darker, semi globular or globular, ostiole erect, punctiform; involucrellum black, brown, hymenium colourless, hamathecium of paraphyses simple to branched; asci 8–spored, ascospores colourless, fusiform to filiform, ellipsoid, bifusiform or oblong; transversely 3–35 septate or submuriform to muriform; secondary metabolites absent or not known.

Key to the species

1a**.** Ascospores distinctly 7–septate……*P. internigrans*

1b Ascospores more than 7– septate……..2

2a**.** Ascospores 7–8 septate…….*P. interestes*

2b Ascospores 7–16 septate……..3

3a**.** Ascospores 7–14 septate……...*P. effilata*

3b Ascospores 11–16 septate……4

4a**.** Ascospores less than 60µm long ……*P. bellendenica*

4b Ascospores more than 60µm long ……. 5

5a**.** Ascospores 13–16 septate…… *P. subhibernica*

5b Ascospores 11–15 septate……. *P. belanospora*

1. ***Porina belanospora*** (Nyl.) Müll. Arg. in Bot. Jahrb. Syst. 6: 400, 1885. Plate 22 (f)

Description: Thallus crustose, greyish–green, yellow, smooth, ecorticate; ascomata perithecia, immersed, subglobose, covered by thalline layer, brownish black, ostiole pale brown; involucrellum brown, extending below the excipulum, excipulum pale yellow-orange; ascus 8–spored, ascospores colourless, fusiform, transversely 11–15 septate, 64–66 × 5.1–5.6 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Andaman and Nicobar Islands, Arunachal Pradesh, Assam, Karnataka, Kerala, Maharashtra, Meghalaya, West Bengal), Colombia, New Zealand.

Specimen examined: INDIA: Assam, Dhubri district, **Bhalukmari**, on the bark of *Elaeocarpus* sp., 24.12.2020, 49.88 m, 26°30′232″ N, 90°23′119″ E, Suparna Biswas & Pabitra Biswas, 2020-0793 (BUBH), 61703 (LWG).

Ecology: The species is found growing on the bark of *Elaeocarpus* sp. in Bhalukmari at an elevation of 49.88 m.

Remarks: The species is characterized with immersed ascomata, excipulum pale yellow-orange, ascospores fusiform, transversely 11–15 septate and 64–66 × 5.1–5.6 µm.

2. ***Porina bellendenica*** Müll. Arg. in Hedwigia 30: 56 (1891) Plate 23 (a)

Description: Thallus crustose, greyish–green, smooth, ecorticate; ascomata perithecia, immersed, hemispherical, covered by thalline layer, ostiole pale brown-black; involucrellum

apical, extending below the excipulum, excipulum pale brown; ascus 8–spored, ascospores colourless, fusiform, transversely 11–13 septate, 44–46 × 4.1–5.1 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam), Australia, Christmas Island, Chinese Taipei, French Polynesia.

Specimen examined: INDIA: Assam, Dhubri district, **Bhasani goan**, on the bark of *Polyalthia longifolia*, 26.12.2020, 35.07 m, 26°30′138″ N, 90°22′447″ E, Suparna Biswas & Pabitra Biswas, 2020-0545 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia* at an elevation of 35.07 m.

Remarks: The species resembles *P. internigrans* morphologically but the ascospores are smaller in *P. bellendenica* (Liu *et al*. 2020).

3. ***Porina effilata*** M. Brand & Sérus., in Lichenologist 39(1): 24, 2007. Plate 23 (b)

Description: Thallus crustose, grey, smooth; ascomata perithecia, immersed; involucrellum and exciple yellow, ostiole black, prominent; ascus 8–spored, ascospores colourless, fusiform, transversely 7–14 septate, 45–49 × 10–11 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: no lichen substance.

Distribution: India (Andaman and Nicobar Islands), Finland, France, Ireland, Portugal, Spain, United Kingdom of Great Britain and Northern Ireland.

Specimen examined: India, Assam, Dhubri district, **Pataner kuti**, on the bark of *Bombex cieba*, 27.12.2020, 31.20 m, 26°28′060″ N, 89°86′834″ E, Suparna Biswas & Pabitra Biswas, 2020-1225 (BUBH).

Ecology: The species is found growing on the bark of *Bombex cieba* at an elevation of 31.20m.

Remarks: The species is distinguished by large pale perithecia and large ascospores. The species is similar with *P. rhodostoma* but differ as the latter species having shorter ascospores and presence of isidia (Orange 2013). The species is a new record to Assam.

4. ***Porina interestes*** (Nyl.) Harm. in Bull. Séanc. Soc. Sci. Nancy, sér. 3 12: 126, 1911. Plate 23 (c)

Description: Thallus crustose, greyish–grey, yellow, smooth; ascomata perithecia, immersed, subglobose, covered by thalline layer, brownish black, ostiole black; involucrellum covered by thaline layer, outer layer black; extending below the excipulum, excipulum yellow; ascus 8–spored, ascospores colourless, fusiform, transversely 7–8 septate, 38–39 × 5–6 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Andaman and Nicobar Islands, Assam, Goa, Karnataka, Kerala, Tamil Nadu, West Bengal), Guinea.

Specimen examined: INDIA: Assam, Dhubri district, **Pataner Kuti**, on the bark of *Michelia champaca*, 27.12.2020, 31.20 m, 26°28′060″ N, 89°86′834″ E, Suparna Biswas & Pabitra Biswas, 2020-1457 (BUBH).

Ecology: The species is found growing on the bark of *Michelia champaca* at an elevation of 31.20 m.

Remarks: The species is distinguished by greenish-grey, smooth, completely covered involucrellum and yellow excipulum. The species is closely related to *P. mastoidea* and *P. internigrans*. But both the species differ as *P. mastoidea* ostioles is K+ reddish and *P. internigrans* have much wider perithecia and larger ascospore (Upreti 1994).

5. ***Porina internigrans*** (Nyl.) Müll.Arg. in Rep. Meetings Australs. Assoc. Advancem. Sci.: 452, 1895. Plate 23 (d)

Basionym: *Verrucaria mastoidea* var. *internigrans* Nyl. in Bull. Soc. Linn. Normandie, sér. 2(2):123, 1868.

Description: Thallus crustose, greenish-greyish, smooth; ascomata perithecia, immersed, subglobose to hemispherical, covered by thalline layer, ostiole black, indistinct to prominent, shiny; involucrellum incurving toward excipulum, excipulum golden yellow; ascus 8–spored, ascospores colourless, fusiform, transversely 7–septate, 55–56 × 15–16 μm.

Chemistry: Thallus K+ red, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Andaman and Nicobar Islands, Arunachal Pradesh, Assam, Goa, Karnataka, Kerala, Meghalaya, Nagaland, Tamil Nadu, West Bengal), Australia, Brazil, Colombia, Costa

Rica, Guyana, New Caledonia, Papua New Guinea, Solomon Islands, Thailand, Vanuatu, Vietnam.

Specimen examined: INDIA: Assam, Dhubri district, **Kaldoba**, on the bark of *Polyalthia longifolia*, 21.11.2020, 34.92 m, 26°19′870″ N, 89°77′091″ E, Suparna Biswas & Pabitra Biswas, 2020-0540 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia* at an elevation of 34.92 m.

Remarks: The species distinguished by greenish-grey thallus, smooth, brown-black ostiole, golden-yellow excipulum, 7–septate ascospore. The species is close to *P. nucula* Ach. and *P. interestes.* But the latter one have narrower ascospores and *P. nucula* has bigger perithecia and 7–14 septate ascospores (Upreti 1994).

6. ***Porina subhibernica*** Upreti in Bryologist, 97 (1): 76, 1994. Plate 23 (e)

Description: Thallus crustose, greenish–grey, smooth; ascomata perithecia, solitary, globose to subglobose, covered by thalline layer, area around ostiole naked and brown–black; involucrellum apical, incurving toward excipulum, outer layer black; ascus 8–spored, ascospores colourless, fusiform, transversely 13–16 septate, 68–69 × 5–7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Arunachal Pradesh, Assam, Goa, Karnataka, Kerala, Madhya Pradesh Sikkim, Tamil Nadu), endemic.

Specimen examined: INDIA: Assam, Dhubri district, **Alokjhari**, on the bark of *Pongamia pinnata*, 12.01.2020, 56.13 m, 26°25′127″ N, 89°86′150″ E, Suparna Biswas & Pabitra Biswas, 2020-0139 (BUBH), 61646 (LWG).

Ecology: The species is found growing on the bark of *Pongamia pinnata* at an elevation of 56.13 m.

Remarks: The species is close to *P. hinernica* James & Swinscow, *P. dolichophora* (Nyl.) Müll. Arg., *P. nucula* Ach. as all of them have 13–16 septate ascospores but differ as *P. hinernica* have granular thallus, long paraphyses, *P. dolichophora* have K+ red thallus, *P. nucula* have wider ascospores (Upreti 1994). The species is endemic to Indian region.

***Pyrenula* Ach. in Syn. Meth. Lich.: 125, 1814. (Family: Pyrenulaceae)**

Thallus crustose, corticolous, sometimes with pseudocyphellae; ascomata perithecia, black, solitary, often 2–3 aggregated in pseudostromata, immersed or emergent, naked in upper part, often partly immersed in thallus, ostiole apical or lateral, often mamillate, papillate; involucrellum dark brown to black, peridium black, spreading laterally or not spreading, hymenium inspersed or clear, hamathecium branched; asci 8–spored, ascospores brown coloured, transversely 1–5 septate or muriform, locules lentiform, rhomboidal, octagonal or triangular; secondary metabolites lichexanthone, anthraquinones in the thallus often present or absent.

Key to the species

1a**.** Ascospores muriform…….2

1b Ascospores transversely septate……..7

2a. Thallus with pseudocyphellae……3

2b. Thallus lacking pseudocyphellae……...6

3a. Thallus with maculae……...*P. macularis*

3b. Thallus without maculae…….....4

4a. Ostiole indistinct……....*P. leucostoma*

4b. Ostiole distinct…….....5

5a. Ascospores more than 30 μm long……*P. thelomorpha*

5b. Ascospores less than or equal to 30 μm long……*P. welwitschii*

6a. Hymenium clear…….....*P. confinis*

6b. Hymenium inspersed……...*P. sublaevigata*

7a. Hymenium inspersed…….....8

7b. Hymenium clear…….....17

8a. Ascomata embedded/ immersed……....9

8b. Ascomata not embedded/ immersed……11

9a. Ascospores more than 30 µm long……...10

9b. Ascospores less than 30 µm long……....*P. circumfinens*

10a. Ascospores papillate……..*P. oculata*

10b. Ascospores not papillate……..*P. mastophoroides*

11a. Ascospores citriform…….……..*P. citriformis*

11b. Ascospores not citriform…….……...12

12a. Ostioles mamillate—papillate……..*P. mamillana*

12b. Ostioles not mamillate–papillate……..13

13a. Ascospores less than 20 µm long……...*P. cayennensis*

13b. Ascospores more than 20 µm long…….14

14a. Ascospores thick walled……..*P. subglabriuscula*

14b. Ascospores thin walled…….....15

15a. Ostioles papillate…….....*P. nodulata*

15b. Ostioles not papillate……16

16a. Centrum below uninspersed…….....*P. acutalis*

16b. Centrum below inspersed…….....*P. subacutalis*

17a. Perithecia solitary……...18

17b. Perithecia aggregated…….37

18a. Thallus with pseudocyphellae…….……...19

18b. Thallus lacking pseudocyphellae…….……...23

19a. Ascospores less than 20 µm long……...*P. glabrescens*

19b. Ascospores more than 20 µm long…….20

20a. Ostioles indistinct……..*P. introducta*

20b. Ostioles distinct……..….21

21a. Ascospores lumina angular……...*P. quassicola*

21b. Ascospores lumina not angular……..22

22a. Ascomata 0.15–0.2 mm in diameter……*P. chlorospila*

22b. Ascomata 0.5–0.9 mm in diameter……*P. macrospora*

23a. Ascospores less than or equal to 20 μm long…….24

23b. Ascospores more than 20 μm long…….30

24a. Ostioles papillate–mamillate……*P. aspistea*

24b. Ostioles not papillate–mamillate ……25

25a. Peridium spreading laterally……..26

25b. Peridium not spreading laterally……29

26a. Ostioles distinct……....*P. brunnea*

26b. Ostioles indistinct……...27

27a. Ascospores middle locules transversely elongated……...*P. lamprocarpa*

27b. Ascospores middle locules rhomboidal…….28

28a. Ascospores 15–17 × 5.8–6.1 μm. ……*P. minor*

28b. Ascospores 19–21 × 6.1–6.8 μm. ……..*P. scutata*

29a. Ascospores thin walled, oblong……...*P. mastophoriza*

29b. Ascospores thick walled, ellipsoidal…….....*P. nitida*

30a. Ascospores papillate……...31

30b. Ascospores not papillate……32

31a. Ascospores thin walled……..*P. approximata*

31b. Ascospores thick walled……....*P. defossa*

32a. Ascospores less than 30 μm long……...33

32b. Ascospores more than 30 μm long…….....35

33a. Ascospores thin walled …….....*P. oxysporiza*

33b. Ascospores thick walled …….....34

34a. Middle locules rhomboidal……...*P. submastophora*

34b. Locules round……..*P. fuscoolivacea*

35a. Ascospores ellipsoidal…….....36

35b. Ascospores fusiform…….....*P. subducta*

36a. Locules vertically elongated……..*P. pinguis*

36b. Locules rhomboidal……*P. zeylanica*

37a. Thallus with pseudocyphellae…….……..*P. wrightii*

37b. Thallus lacking pseudocyphellae…….……...38

38a. Ostioles indistinct……..*P. aggregata*

38b. Ostioles distinct……..….39

39a. Ascospores more than 20 μm long…….40

39b. Ascospores less than 20 μm long……...42

40a. Thallus K+ red……..*P. leucotrypa*

40b. Thallus K–……..41

41a. Perithecia immersed in thallus…….....*P. mastophora*

41b. Perithecia not immersed in thallus…….....*P. subindica*

42a. Ostiole white……*P. anomala*

42b. Ostiole black……...*P. arthoniotheca*

1. ***Pyrenula acutalis*** R.C. Harris, in Mem. N. Y. bot. Gdn 49: 85, 1989. Plate 23 (f)

Description: Thallus crustose, yellowish brown, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical; hymenium colourless, inspersed, centrum below uninspersed, paraphyses simple; ascus 8–spored, ascospores brown, transversely 3–septate, terminal lumina elongated towards ends, middle lumina diamond shaped, thin walled, papillate ends, 26–28 × 8–9 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam, Goa Karnataka, Odisha, West Bengal), Australia, Brazil, Colombia, Costa Rica, Denmark, Mexico, Norway, Sweden, Taiwan, United State of Great Britain and Northern Ireland, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Brahmin para**, on the bark of *Lannea* sp., 25.12.2020, 40.72 m, 26°24′843″ N, 90°32′683″ E, Suparna Biswas & Pabitra Biswas, 2020-0700 (BUBH), 61663 (LWG).

Ecology: The species is found growing on the bark of *Lannea* sp. at an elevation of 40.72 m.

Remarks: The species is close to *P. subacutalis* R.C. Harris with ascocarp and spore size but differ as oil globules at apex near ostioles and centrum uninspersed below in *P. acutalis* (Upreti 1991b).

2. ***Pyrenula aggregata*** (Fée) Fée in Essai Crypt. Exot., Suppl. Révis. (Paris): 80, 1837. Plate 24 (a)

Basionym: *Verrucaria aggregata* Fée in Essai Crypt. Exot. (Paris): 91, 1825.

Description: Thallus crustose, whitish grey, lacking psuedocyphellae; ascomata perithecia aggregated, covered with layer of thallus, ostiole indistinct, apical; hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, transversely 3–septate, lumina in a straight line, 13–14 × 7.3–7.8 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV+ yellow; TLC: Lichexanthone present.

Distribution: India (Andaman and Nicobar Islands, Arunachal Pradesh, Assam), Costa Rica, USA, Taiwan.

Specimen examined: INDIA: Assam, Dhubri district, **Barobalurchar**, on the bark of *Jatropha* sp., 27.12.2020, 53.54 m, 26°22′1478″ N, 89°84′098″ E, Suparna Biswas & Pabitra Biswas, 2020-0673 (BUBH), 61661 (LWG).

Ecology: The species is found growing on the bark of *Jatropha* sp. at an elevation of 53.54m.

Remarks: The species is closely related to *P. cinereovelata* Vain. with their external morphology but differ as the species *P. cinereovelata* Vain having centrum with oil globules (Gupta and Sinha 2018).

3. ***Pyrenula anomala*** (Ach.) Vain. in Ann. Acad. Sci. fenn., Ser. A 6(7): 189, 1915. Plate 24 (b)

Basionym: *Trypethelium anomalum* Ach. in Syn. meth. lich. (Lund): 105, 1814.

Description: Thallus crustose, yellowish brown, lacking psuedocyphellae; ascomata perithecia aggregated, black, ostiole apical, white; hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, transversely 3–septate, lumina in a straight line, 14–16 × 6.3–7.4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Andaman and Nicobar Islands, Assam, West Bengal), Australia, Brazil, Colombia, Costa Rica, Guyana, Mexico, Papua New Guinea, Philippines, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Bilashipara Florican Garden**, on the bark of *Pongamia pinnata,* 10.02.2020, 42.14 m, 26°25′163″ N, 90°27′603″ E, Suparna Biswas & Pabitra Biswas, 2020-0137 (BUBH), 61665 (LWG).

Ecology: The species is found growing on the bark of *Pongamia pinnata* at an elevation of 42.14 m. The species distributed tropical to sub-tropical regions of the world.

Remarks: The species is distinguished from other species of *Pyrenula* by aggregated ascomata into pseudostromata and 3–septate ascospores (Gupta and Sinha 2018).

4. ***Pyrenula approximata*** Vain. in Bot. Tidsskr. 29: 145, 1909. Plate 24 (c)

Description: Thallus crustose, yellowish brown, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical, black; hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, transversely 3–septate, thin end walled, papillate, 25–27 × 10.5–11.3 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substances not detected.

Distribution: India (Arunachal Pradesh, Assam), Sweden.

Specimen examined: INDIA: Assam, Dhubri district, **Brahmin para**, on the bark of *Spondias* sp., 25.12.2020, 47.32 m, 26°24′856″ N, 90°32′664″ E, Suparna Biswas & Pabitra Biswas, 2020-1223 (BUBH).

Ecology: The species is found growing on the bark of *Spondias* sp. at an elevation of 47.32 m.

Remarks: The species is characterized with lacking psuedocyphellae, hymenium clear, ascospores thin walled, papillate ends.

5. ***Pyrenula arthoniotheca*** Upreti in Nova Hedwigia 66(3-4): 566, 1998. Plate 24 (d)

Description: Thallus crustose, brown, lacking psuedocyphellae; ascomata perithecia aggregated, black, ostiole apical, black; hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, transversely 3–septate, lumina in a straight line, 15–17 × 5.5–7.3 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substances not detected.

Distribution: India (Andaman and Nicobar Islands, Assam), Austria, Brazil, Cuba, Guyana.

Specimen examined: INDIA: Assam, Dhubri district, **Hatipota Pt- II**, on the bark of *Areca catechu*, 26.12.2020, 47.00 m, 26°22′694″ N, 90°35′492″ E, Suparna Biswas & Pabitra Biswas, 2020-1174 (BUBH).

Ecology: The species is found growing on the bark of *Areca catechu* at an elevation of 47.00m. The species widely distributed tropical regions of the world.

Remarks: The species is characterized perithecia aggregated, hymenium clear and ascospores lumina in a straight line.

6. ***Pyrenula aspistea*** (Afz. ex Ach.) Ach. in Mag. Gesell. Naturf. Freunde, Berlin 6(1): 17, 1814. Plate 24 (e)

Basionym: *Verrucaria aspistea* Afzel. ex Ach. in Methodus, Sectio prior (Stockholmiae): 121, 1803.

Description: Thallus crustose, yellowish brown, lacking psuedocyphellae; ascomata perithecia, solitary, black, ostiole apical, black, papillate-mamillate; peridiumm spreading laterally, hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, thick walled, ellipsoidal, transversely 3–septate, two middle locules of spores rhomboidal, end locules triangular with the base of the triangle against the end of the spores, 16–19 × 7.3–7.5 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substances not detected.

Distribution: India (Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Goa), Australia, Brazil, Colombia, Costa Rica, Guyana, Papua New Guinea, Puerto Rico, Spain, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Gauripur Matiabag Hawakhana**, on the bark of *Michelia champaca*, 08.02.2020, 48.65 m, 26°09′788″ N, 89°97′557″ E, Suparna Biswas

& Pabitra Biswas, 2020-0124 (BUBH); **Bhelupara Pt-II**, on the bark of *Ricinus* sp., 25.12.2020, 34.24 m, 26°23′124″ N, 90°33′574″ E, Suparna Biswas & Pabitra Biswas, 2020-0159 (BUBH); **Brahmin Para**, on the bark of *Mangifera indica*, 25.12.2020, 41.69 m, 26°24′845″ N, 90°32′677″ E, Suparna Biswas & Pabitra Biswas, 2020-0160 (BUBH); **Gourangtari Pt-II,** on the bark of *Artocarpus heterophyllus*, 26.12.2020, 43.01 m, 26°24′529″ N, 90°31′903″ E, Suparna Biswas & Pabitra Biswas, 2020-0698 (BUBH); **Gourangtari Pt-II,** on the bark of *Artocarpus heterophyllus*, 26.12.2020, 53.54 m, 26°24′529″ N, 90°31′903″ E, Suparna Biswas & Pabitra Biswas, 2020-0755 (BUBH), 61642 (LWG).

Ecology: The species is found growing on the bark of *Michelia champaca*, *Ricinus* sp., *Mangifera indica, and Artocarpus heterophyllus* at an elevation of 34.24 m to53.54 m.

Remarks: The species is similar with *P. pseudobufonia* but differ as the thallus is UV+ and hymenium is inspersed in *P. pseudobufonia* (Malcolm Hedges, Georgia Department of Natural Resources, and Wildlife Resources Division).

7. ***Pyrenula brunnea*** Fée in Eassai Crypt. Exot., Suppl. Révis. (Paris): 81, 1837. Plate 24 (f)

Description: Thallus crustose, yellowish brown, lacking psuedocyphellae; ascomata perithecia, solitary, black, ostiole apical; peridium spreading laterally, hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, thick walled, oblong, ellipsoidal, transversely 3–septate, locules round, 16–17 × 5.5–7.1 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substances not detected.

Distribution: India (Arunachal Pradesh, Meghalaya, Assam), Tropical America.

Specimen examined: INDIA: Assam, Dhubri district, **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 22.11.2020, 37.07 m, 26°05′068″ N, 89°89′338″ E, Suparna Biswas & Pabitra Biswas, 2020-0495 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp. in Kismat hasdaha Pt-II at an elevation of 37.07 m. The species is widely distributed tropical regions of the world.

Remarks: The species is close to *P. scutata* but differ as ascocarps are convex- depressed with shining ostioles and ascospores are bigger in *P. scutata* (Upreti 1991a)

8. ***Pyrenula cayennensis*** Müll. Arg. in Flora, Regensburg 67(35):662, 1884. Plate 25 (a)

Description: Thallus crustose, whitish grey, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical, black; peridium spreading laterally, hymenium colourless, inspersed, paraphyses simple; ascus 8–spored, ascospores brown, transversely 3–septate, thin walled, middle locules transversely elongated, 12–14 × 8.8–10.4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Andaman Islands, Assam, Kerala, Tamil Nadu, West Bengal), Brazil, French Guiana, Guyana, Nepal, Philippines, Solomon Islands, Venezuela.

Specimen examined: INDIA: Assam, Dhubri district, **Uchita**, on the bark of *Lannea* sp., 28.10.2020, 26.61 m, 26°10′693″ N 89°85′224″ E, Suparna Biswas & Pabitra Biswas, 2020-1452 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp. at an elevation of 26.61 m.

Remarks: The species is similar with *P. pseudobufonia* (Rehm) R.C. Harris but differ as thallus is UV– and smaller ascospores in *P. cayennensis* (Ingle *et al.* 2018).

9. ***Pyrenula chlorospila*** Arnold in Flora, Regensburg 70: 155, 1887. Plate 25 (b)

Description: Thallus crustose, corticolous, yellowish, pseudocyphellae, maculae absent, perithecia numerous, unicarpic, black; ascomata 0.15–0.2 mm in diameter, ostiole white, apical; involucrellum present, peridium black, carbonized, spreading laterally, hamathecium not inspersed, hymenium clear, paraphyses simple; ascus 8–spored, ascospores brown in colour, transversely 3–septate, middle locules diamond shaped and terminal locules triangular with their base towards the end, 26–30 ×10–12 μm.

Chemistry: Thallus K–, C–, P–, UV–; TLC: lichen substance not detected.

Distribution: Denmark, France, Greece, Ireland, Maltese Islands, Netherlands, Russia, Spain, Ukraine, United Kingdom of Great Britain and Northern Ireland, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Debotar hasdaha Pt-IV**, on the bark of *Lannea* sp., 22.11.2020, 25.66 m, 26°05′7648″ N, 89°88′963″ E, Suparna Biswas & Pabitra Biswas, 2020-0281 (BUBH), 61701 (LWG); **Baidyadabri Pt-V**, on the bark of *Lannea* sp., 21.11.2020, 57.63 m, 26°26′118″ N, 89°77′365″ E, Suparna Biswas & Pabitra Biswas, 2020-0400 (BUBH).

Ecology: The species was found growing on the smooth bark of *Lannea* sp. at an elevation of 34 m.

Remarks: *P. chlorospila* Arnold is similar with *P. macrospora* (Degel.) Coppins & P. James. Both the species differs with their ascomata size (Weerakoon *et al*. 2012). The species is a new record to India.

10. *Pyrenula circumfinens* Vain. Plate 25 (c)

Description: Thallus crustose, greenish grey, psuedocyphellae; ascomata perithecia solitary, black, embedded in thallus, ostiole apical, black; peridium not spreading laterally, hymenium colourless, inspersed, paraphyses simple; ascus 8–spored, ascospores brown, thin walled, transversely 3–septate, papillate ends, 22–24 × 7.5–8.3 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Assam), Insulae Antillanae.

Specimen examined: INDIA: Assam, Dhubri district, **Sreegram Pt-III**, on the bark of *Bombex cieba*, 25.12.2020, 54.88 m, 26°24′6299″ N, 90°34′141″ E, Suparna Biswas & Pabitra Biswas, 2020-1176 (BUBH).

Ecology: The species was found growing on the smooth bark of *Bombex cieba* at an elevation of 54.88 m**.**

Remarks: The species is similar with *P. subgregantula* Müll. Arg. in having similar size and septation of ascospores but differ as *P. circumfinens* have solitary ascomata (Ingle *et al*. 2018).

11. *Pyrenula citriformis* R.C. Harris in Mem. N.Y. bot. Gdn 49: 87, 1989. Plate 25 (d)

Description: Thallus crustose, bowinsh, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical, black; peridium spreading laterally, hymenium colourless, inspersed, paraphyses simple; ascus 8–spored, ascospores brown, ellipsoidal, thin walled, citriform, transversely 3–septate, middle locules not transversely elongated, 21–22 × 7.8–8.4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Assam, Kerala), Costa Rica, Fiji, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Alomganj Pt-IX**, on the bark of *Lannea* sp., 27.12.2020, 48.78m, 26°13′488″ N, 90°03′645″ E, Suparna Biswas & Pabitra Biswas, 2020-1451 (BUBH).

Ecology: The species was found growing on the smooth bark of *Lannea* sp. at an elevation of 48.78 m**.**

Remarks: The species is characterized with lacking psuedocyphellae, perithecia solitary, peridium spreading laterally, hymenium inspersed, ascospores ellipsoidal, thin walled, citriform, middle locules not transversely elongated.

12. *Pyrnula confinis* (Nyl.) R.C. Harris in More Florida Lichens, Incl. 10 Cent Tour Pyrenol. (New York): 109, 1995. Plate 25 (e)

Basionym: *Verrucaria confinis* Nyl. in Annls Sci. Nat., Bot., sér. 4 3: 173, 1855.

Description: Thallus crustose, white, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical, black; peridiumm not spreading laterally, hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, muriform, 4–6 transverse septate, 1–4 septate vertically, 18–20 × 10.8–12.4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV+ yellow; TLC: lichen substance not detected.

Distribution: India (Assam, South India, West Bengal), Australia, Brazil, Costa Rica, French Guiana, New Caledonia, Papua New Guinea, Puerto Rico, Seychelles, Solomon Islands, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Bhelupara Pt-II**, on the bark of *Bombex cieba*, 25.12.2020, 36.14 m, 26°22′637″ N, 90°33′567″ E, Suparna Biswas & Pabitra Biswas, 2020-0488 (BUBH).

Ecology: The species was found growing on the smooth bark of *Bombex cieba* at an elevation of 36.14 m.

Remarks: The species is characterized with thallus UV+, lacking psuedocyphellae, perithecia solitary, ostiole apical, hymenium clear, ascospores muriform, 4–6 transverse septate, 1–4 septate vertically.

13. *Pyrenula defossa* Müll. Arg. in Flora, Regensburg 65(33): 518, 1882. Plate 25 (f)

Description: Thallus crustose, grey, lacking psuedocyphellae; ascomata perithecia solitary, black, ostiole apical, black; peridiumm not spreading laterally, hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, thick walled, ellipsoidal, transversely 3–septate, two middle locules of spores rhomboidal and papillate towards adjoining locules, end locules papillate towards the middle locules, 28–30 × 10.2–11.4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Arunachal Pradesh, Assam), Australia, Viet Nam.

Specimen examined: INDIA: Assam, Dhubri district, **Fakiranir jhar Pt-I**, on the bark of *Polyalthia longifolia*, 24.12.2020, 35.58 m, 26°21′890″ N, 90°14′818″ E, Suparna Biswas & Pabitra Biswas, 2020-0555 (BUBH).

Ecology: The species was found growing on the smooth bark of *Polyalthia longifolia* at an elevation of 35.58 m.

Remarks: The species resembles to *P. olivaceofusca* Müll. Arg with the ascomata and ascospores size but differ as *P. olivaceofusca* have olive brown–dark brown black thallus and indistinct ostioles (Upreti 1990).

14. ***Pyrenula fuscoolivacea*** Vain. in Ann. Acad. Sci. fenn., Ser. A 15(6): 339, 1921. Plate 26 (a)

Description: Thallus crustose, olive-yellow, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical; peridium not spreading laterally, hymenium clear, paraphyses simple; ascus 8–spored, ascospores brown, ellipsoidal, thick walled, transversely 3–septate, locules round, 23–25× 12.2–14.2 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Arunachal Pradesh, Assam, Kerala), Philippines, Sri Lanka.

Specimen examined: INDIA: Assam, Dhubri district, **Arear jhar Pt-II**, on the bark of *Shorea robusta*, 25.12.2020, 22.23 m, 26°26′108″ N, 90°41′794″ E, Suparna Biswas & Pabitra Biswas, 2020-0866 (BUBH).

Ecology: The species was found growing on the smooth bark of *Shorea robusta* at an elevation of 22.23 m.

Remarks: The species is close to *P. atropurpurea* (Eschw. Ex Mart.) Müll. Arg., in ascospores shape and size but differ as *P. atropurpurea* have laterally spreading peridium and smaller ascospores (Upreti 1991a).

15. ***Pyrenula glabrescens*** Vain. in Ann. Acad. Sci. fenn., Ser. A 6(7): 191, 1915. Plate 26 (b)

Description: Thallus crustose, brownish, psuedocyphellae; ascomata perithecia solitary, immersed, ostiole apical, mamillate, papillate, black; peridium laterally spreading, hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, thin walled, ellipsoidal, transversely 3–septate, two middle locules of spores transversely elongated , 18–19 × 7–8 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Andaman and Nicobar Islands, Arunachal Pradesh, Assam, Karnataka, Kerala), Insulae Antillanae.

Specimen examined: INDIA: Assam, Dhubri district, **Uchita**, on the bark of *Mangifera indica*, 28.10.2020, 47.69 m, 26°10′740″ N, 89°85′246″ E, Suparna Biswas & Pabitra Biswas, 2020-1453 (BUBH).

Ecology: The species was found growing on the bark of *Mangifera indica* at an elevation of 47.69 m.

Remarks: The species is characterized by psuedocyphellae, perithecia solitary, ostiole apical, mamillate, papillate, hymenium clear, ascospores thin walled, ellipsoidal, two middle locules of spores transversely elongated.

16. ***Pyrenula introducta*** (Stirton) Zahlbr. in Cat. Lich. Univers. 1: 433, 1922. Plate 26 (c)

Basionym: *Verrucaria introducta* Stirt. in Proc. Roy. phil. Soc. Glasgow, 13: 191, 1880.

Description: Thallus crustose, yellowish brown, psuedocyphellae; ascomata perithecia solitary, black, immersed, ostiole apical, indistinct, peridium slightly spreading; hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, thick walled, ellipsoidal, transversely 3–septate, two middle locules of spores rhomboidal and papillate towards adjoining locules, end locules papillate towards the middle locules, 36–38 × 13–14 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Arunachal Pradesh, Assam, Kerala, Tamil Nadu, Uttar Pradesh, West Bengal), Australia, South America.

Specimen examined: INDIA: Assam, Dhubri district, **Debotar hasdaha Pt-IV**, on the bark of *Lannea* sp., 22.11.2020, 30.23 m, 26°05′731″ N, 89°88′970″ E, Suparna Biswas & Pabitra Biswas, 2020-0496 (BUBH).

Ecology: The species was found growing on the bark of *Lannea* sp. at an elevation of 30.23m.

Remarks: The species is close to *P. immisa* and *P. oculata*. but differ as *P. immisa* has oil globules in the nucleus and *P. oculata* has oculate conditions of ascocarps (Upreti 1990).

17. ***Pyrenula lamprocarpa*** Müll. Arg. in Bull. Soc. R. Bot. Belg. 30(1): 94, 1891. Plate 26 (d)

Description: Thallus crustose, greenish grey, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical, indistinct, hymenium clear, paraphyses simple, peridium spreading laterally, thick walled; ascus 8–spored, ascospores brown, transversely 3–septate, middle locules transversely elongated, end locules triangular with the base of triangle against the end of ascospore, lumina round, 16–17× 7.2–8.1 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Andaman and Nicobar Islands, Arunachal Pradesh), Costa Rica.

Specimen examined: INDIA: Assam, Dhubri district, **Pub-gaikhawa Pt-I**, on the bark of *Polyalthia longifolia,* 25.10.2020, 33.48 m, 26°08′061″ N, 89°83′362″ E, Suparna Biswas & Pabitra Biswas, 2020-0575 (BUBH).

Ecology: The species was found growing on the bark of *Polyalthia longifolia* at an elevation of 33.48 m.

Remarks: The species is close to *P. bilirana* Vainio with their morphology and size and shape of ascospores but differ as peridium is columelate in *P. lamprocarpa* (Upreti 1992). The species is a new record to Assam.

18. ***Pyrenula leucostoma*** Ach. in Mag. Gesell. Naturf. Freunde, Berlin 6(1): 19-20, 1814. Plate 26 (e)

Description: Thallus crustose, brownish grey, psuedocyphellae; ascomata perithecia solitary, black, semi-immersed in thallus, ostiole apical, indistinct; hymenium colourless, clear,

paraphyses simple; ascus 8–spored, ascospores brown, muriform, ellipsoidal transversely 7–septate, 1–3 septate vertically, distoseptate, 33–35 × 15.5–16.3 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Assam, Kerala, West Bengal), Brazil, Colombia, Cuba, Guadeloupe, Guyana, New Caledonia, Philippines, Puerto Rico, Samoa, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Chagolchara Pt-III**, on the bark of *Polyalthia longifolia*, 29.10.2020, 30.14 m, 26°02′511″ N, 89°94′406″ E, Suparna Biswas & Pabitra Biswas, 2020-0135 (BUBH); **Dhubri town**, on the bark of *Polyalthia longifolia*, 13.03.2021, 29.24 m, 26°02′131″ N, 89°99′572″ E, Suparna Biswas & Pabitra Biswas, 2021-0683 (BUBH); **Gauripur town**, on the bark of *Lannea* sp., 10.03.2021, 34.04 m, 26°09′771″ N, 89°94′940″ E, Suparna Biswas & Pabitra Biswas, 2021-0689 (BUBH).

Ecology: The species was found growing on the bark of *Polyalthia longifolia, Lannea* sp. at an elevation of 29.24 m to 34.04 m. The species is well distributed in tropical regions of the world.

Remarks: The species is closely related to *P. thelomorpha* Tuck., both of them have pseudocyphellae thallus differ as the species *P. leucostoma* Ach. have smaller ascospores (Gupta and Sinha 2018).

19. ***Pyrenula leucotrypa*** (Nyl.) Upreti in Nova Hedwigia 66(3-4): 570, 1998. Plate 26 (f)

Basionym: *Trypethelium leucotrypum* Nyl. in Flora, Regensburg 50: 9, 1867.

Description: Thallus crustose, brown, lacking psuedocyphellae; ascomata perithecia agregated, embedded in pseudostromata, black, ostiole apical, black; hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, ellipsoid, transversely 3–septate, 21–23 × 6.5–7.3 μm.

Chemistry: Thallus K+ red, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Arunachal Pradesh, Andaman Islands, Assam, Sikkim, West Bengal), Brazil.

Specimen examined: INDIA: Assam, Dhubri district, **Bhelupara Pt-II**, on the bark of *Mangifera indica*, 25.12.2020, 35.63 m, 26°22′818″ N, 90°33′587″ E, Suparna Biswas & Pabitra Biswas, 2020-0702 (BUBH), 61676 (LWG).

Ecology: The species was found growing on the bark of *Mangifera indica* at an elevation of 35.63 m.

Remarks: The species is characterized by lacking psuedocyphellae, perithecia agregated, embedded in pseudostromata, black, ostiole apical, hymenium clear and ascospores ellipsoid.

20. *Pyrenula macrospora* (Degel.) Coppins & P. James in Lichenologist 12(1): 107, 1980. Plate 27 (a)

Basionym: *Pyrenula nitida* var. *macrospora* Degel. In Göteborgs Kungl. Vetensk. Samhälles Handl., Ser. B, Math. Naturvensk.Skr. 1(7): 8, 1941.

Description: Thallus crustose, greenish grey, psuedocyphellae; ascomata perithecia solitary, ascomata 0.5–0.9 mm in diameter, ostiole apical; peridium spreading laterally, hymenium clear, paraphyses simple; ascus 8–spored, ascospores brown, fusiform, transversely 3–septate, lumina in a straight line, 38–39× 11.2–12.9 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Assam), France.

Specimen examined: INDIA: Assam, Dhubri district, **Gopigoan Pt-III**, on the bark of *Lannea* sp., 26.12.2020, 43.69 m, 26°25′723″ N, 90°23′289″ E, Suparna Biswas & Pabitra Biswas, 2020-1224 (BUBH).

Ecology: The species was found growing on the smooth bark of *Lannea* sp. at an elevation of 43.69 m. The species widely distributed in temperate regions of the world.

Remarks: The species resembles to *P. complanata* (Mont.) Trevis. in having clear hymenium, ascospores same size and septation but differ as ascomata is smaller and thallus without psuedocyphellae in *P. complanata* (Ingle *et al*. 2018).

21. ***Pyrenula macularis*** (Zahlbr.) R.C. Harris in Mem. N. Y. bot. Gdn 49: 94, 1989. Plate 27 (b)

Basionym: *Anthracothecium maculare* Zahlbr. in Mycologia, 22(2): 70, 1930.

Description: Thallus crustose, yellowish brown, maculae, psuedocyphellae; ascomata perithecia solitary, ostiole apical; peridium spreading laterally, hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, muriform, transversely 8–septate, 1–5 septate vertically, 25–29 × 13.5–15.7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Arunachal Pradesh, Andaman Islands, Assam, Kerala, Orrisa, West Bengal), Australia, Guadeloupe, Indonesia, Papua New Guinea, Puerto Rico, Seychelles, Sri Lanka, Thailand.

Specimen examined: INDIA: Assam, Dhubri district, **Khalilpur**, on the bark of *Polyalthia longifolia*, 10.03.2021, 29.00 m, 26°04′046″ N, 89°96′253″ E, Suparna Biswas & Pabitra Biswas, 2021-0685 (BUBH).

Ecology: The species was found growing on the bark of *Polyalthia longifolia* at an elevation of 29.00 m.

Remarks: The species is characterized by thallus yellowish brown, maculae, psuedocyphellae, perithecia solitary, ostiole apical, peridium spreading laterally, hymenium clear, ascospores muriform, transversely 8–septate, 1–5 septate vertically.

22. ***Pyrenula mamillana*** (Ach.) Trevis. in Conspect. Verruc.: 13 (1860) Plate 27 (c)

Basionym: *Verrucaria mamillana* Ach. in Methodus, Sectio prior (Stockholmiae): 120, 1803.

Description: Thallus crustose, yellow ochre, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical, mammilate, papillate, black; peridium spreading laterally, hymenium browinsh, inspersed, paraphyses simple; ascus 8–spored, ascospores brown, ellipsoidal, thick walled, transversely 3–septate, locules lentiform, 18–20 × 5–6.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Andaman and Nicobar Islands, Assam, Karnataka), Australia, Brazil, Colombia, Costa Rica, French Guiana, Guyana, New Guinea, Papua New Guinea, Philippines, Puerto Rico, Sri Lanka, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Alokjhari**, on the bark of *Polyalthia longifolia*, 12.01.2020, 60.67 m, 26°25′335″ N, 89°86′057″ E, Suparna Biswas & Pabitra Biswas, 2020-0553 (BUBH).

Ecology: The species was found growing on the smooth bark of *Polyalthia longifolia* at an elevation of 60.67 m.

Remarks: The species is similar with *P. submarginata* Vainio with the ascospores but differ as *P. submarginata* have plain ostioles and clear hymenium (Upreti 1991a).

23. ***Pyrenula mastophora*** (Nyl.) Müll. Arg. in Flora, Regensburg 66: 426, 1883. Plate 27 (d)

Basionym: *Verrucaria mastophora* Nyl. in Annls Sci. Nat., Bot., sér. 4(15): 52, 1861.

Description: Thallus crustose, yellow–grey, lacking psuedocyphellae; ascomata perithecia aggregated, immersed in thallus, ostiole apical; hymenium clear, paraphyses simple; ascus 8–spored, ascospores brown, thick walled, ellipsoidal, transversely 3–septate, two middle locules rhomboidal, end locules triangular with the base of the triangle against the end of the spores, 27–29× 10.2–10.9 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Andaman and Nicobar Islands), Australia, Brazil, Costa Rica, Fiji, Guyana, New Caledonia, Philippines, Solomon Islands, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Bhasani goan**, on the bark of *Lannea* sp., 26.12.2020, 36.22 m, 26°30′141″ N, 90°22′456″ E, Suparna Biswas & Pabitra Biswas, 2020-0177 (BUBH), 61691 (LWG).

Ecology: The species was found growing on the smooth bark of *Lannea* sp. at an elevation of 36.22 m.

Remarks: The species is close to *P. submastophora* with ascocarp and ascospores size but differ as ecolumelate ascocarps present in *P. mastophora* (Upreti 1992).The species is a new record to Assam.

24. *Pyrenula mastophoriza* (Nyl.) Zahlbr. in Cat. Lich. Univers. 1: 439, 1922. Plate 27 (e)

Basionym: *Verrucaria mastophoriza* Nyl. in Bull. Soc. Linn. Normandie, sér., 2(7): 180, 1873.

Description: Thallus crustose, yellowish brown, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical; peridium not spreading laterally, hymenium clear, paraphyses simple; ascus 8–spored, ascospores brown, oblong, transversely 3–septate, middle locules transversely elongated, lumina round, thin walled, papillate end, 15–17× 7.2–7.9 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

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

Specimen examined: INDIA: Assam, Dhubri district, **Alokjhari,** on the bark of *Polyalthia longifolia*, 12.01.2020, 60.67 m, 26°25′335″ N, 89°86′057″ E, Suparna Biswas & Pabitra Biswas, 2020-0572 (BUBH).

Ecology: The species was found growing on the smooth bark of *Polyalthia longifolia* at an elevation of 60.67 m.

Remarks: The species is close to *P. mastophorizans* Müll. Arg. with their morphology but differ as their ascospores are different (Upreti 1990). The species is endemic to Indian region.

25. ***Pyrenula mastophoroides*** (Nyl.) Zahlbr. in Cat. Lich. Univers. 1:439, 1922. Plate 27 (f)

Basionym: *Verrucaria mastophoroides* Nyl. in Acta Soc. Sci. fenn. 7(2): 490, 1863.

Description: Thallus crustose, whitish–grey; ascomata perithecia solitary, globose, immersed, ostiole apical; peridium not spreading laterally, hymenium inspersed, paraphyses simple; ascus 8–spored, ascospores brown, transversely 3–septate, lumina in a straight line, terminal lumina separated from the exospore wall, 35–37× 7.2–7.9 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Assam, Mizoram, West Bengal), Bolivia, Colombia, Costa Rica, Indonesia, Puerto Rico.

Specimen examined: INDIA: Assam, Dhubri district, **Sreegram Pt-III**, on the bark of *Bombex cieba*, 25.12.2020, 50.96 m, 26°24′628″ N, 90°34′149″ E, Suparna Biswas & Pabitra Biswas, 2020-1177 (BUBH).

Ecology: The species was found growing on the smooth bark of *Bombex cieba* at an elevation of 50.96 m.

Remarks: The species resembles *P. ocellulata* Wijeyaratne, Lücking and Lumbsch with inspersed hymenium and size of ascospores but differ as perithecia is hemispherical and shiny in *P. ocellulata* (Wijeyaratne *et al*. 2012).

26. ***Pyrenula minor*** Fée in Essai Crypt. Exot., Suppl. Révis. (Paris): 79, 1837. Plate 28 (a)

Basionym: *Pyrenula minor* Fée in Essai Crypt. Exot., Suppl. Révis. (Paris): 79, 1837.

Description: Thallus crustose, greenish, lacking psuedocyphellae; ascomata perithecia, solitary, ostiole apical, indistinct; peridium slightly spreading laterally, hymenium clear, paraphyses simple; ascus 8–spored, ascospores brown, ellipsoid, thick walled, transversely 3–septate, two middle locules of spores rhomboidal, end locules triangular with the base of the triangle against the end of the spores, 15–17 ×5.8–6.1 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Andaman and Nicobar Islands), Brazil, Colombia, Costa Rica, Guyana, El Salvador, French Guiana, Philippines, Sri Lanka, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Satrasal**, on the bark of *Lannea* sp., 04.01.2020, 36.89 m, 26°13′151″ N, 89°73′461″ E, Suparna Biswas & Pabitra Biswas, 2020-0178 (BUBH).

Ecology: The species was found growing on the smooth bark of *Lannea* sp. at an elevation of 36.89 m.

Remarks: The species is similar with *P. tristissima* Vain. but differ as *P. minor* have smaller ascospores (Ingle *et al*. 2018). The species is a new record to Assam.

27. ***Pyrenula nitida*** (Weigel) Ach. in Mag. Gesell. Naturf. Freunde, Berlin 6(1): 21, 1814. Plate 28 (b)

Basionym: *Sphaeria nitida* Weigel in Observ. Bot.: 45, 1772.

Description: Thallus crustose, brown, lacking psuedocyphellae; ascomata perithecia, solitary, ostiole apical, indistinct; hymenium clear, paraphyses simple, peridium not spreading laterally; ascus 8–spored, ascospores brown, ellipsoid, thick walled, transversely 3–septate, two middle locules of spores rhomboidal, end locules triangular with the base of the triangle against the end of the spores, 18–20 × 6.8–7.7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Andaman and Nicobar Islands, Assam, Karnataka, Tamil Nadu, West Bengal), Austria, Denmark, France, Germany, Netherlands, Norway, Sri Lanka, Switzerland, Sweden, United Kingdom of Great Britain and Northern Ireland, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Sreegram Pt-III,** on the bark of *Bombex cieba*, 25.12.2020, 46.17 m, 26°24′631″ N, 90°34′156″ E, Suparna Biswas & Pabitra Biswas, 2020-1178 (BUBH).

Ecology: The species was found growing on the smooth bark of *Bombex cieba* at an elevation of 46.17 m.

Remarks: The species is close to *P. subnitidella* (Nyl.) Müll. Arg. but differ as centrum is I+ blue in *P. nitida* (Upreti 1992).

28. ***Pyrenula nodulata*** (Stirton) Zahlbr. in Cat. Lich. Univers. 1: 447, 1922. Plate 28 (c)

Basionym: *Verrucaria nodulata* Stirt. in Proc. Roy. phil. Soc. Glasgow 13: 192, 1881.

Description: Thallus crustose, yellowish to brown, lacking psuedocyphellae; ascomata perithecia, solitary, ostiole apical, white, papillate; hymenium inspersed, paraphyses simple, peridium not spreading laterally; ascus 8–spored, ascospores brown, ellipsoid, papillate, transversely 3–septate, thin walled, middle locules not transversely elongated, 25–26 × 10.8–11.7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Assam), Fiji.

Specimen examined: INDIA: Assam, Dhubri district, **Khajurbari Pt-I**, on the bark of *Lannea* sp., 24.12.2020, 40.06 m, 26°26′190″ N, 90°17′890″ E, Suparna Biswas & Pabitra Biswas, 2020-0695 (BUBH).

Ecology: The species was found growing on the smooth bark of *Lannea* sp. at an elevation of 40.06 m.

Remarks: The species is close to *P. plittii* Harris but differ as ascocarp is bigger and ascospores are smaller in *P. plittii* **(**Upreti 1991b).

29. *Pyrenula oculata* A. Singh & Upreti in Geophytology 17(1): 84, 1987. Plate 28 (d)

Description: Thallus crustose, ochre–yellow, pseudocyphellae, oculate; ascomata perithecia, solitary, immersed, ostiole apical; hymenium inspersed, paraphyses simple, peridium not spreading laterally; ascus 8–spored, ascospores brown, ellipsoid, thick walled, transversely 3–

septate, two middle locules of spores rhomboidal and papillate towards adjoining locules, end locules papillate towards the middle locules, 38–39× 16–17 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Andaman and Nicobar Islands, Arunachal Pradesh, Assam, Kerala), China.

Specimen examined: INDIA: Assam, Dhubri district, **Barobalurchar**, on the bark of *Jatropha* sp., 27.12.2020, 42.97 m, 26°22′157″ N, 89°84′088″ E, Suparna Biswas & Pabitra Biswas, 2020-0671 (BUBH).

Ecology: The species was found growing on the smooth bark of *Jatropha* sp. at an elevation of 42.97 m.

Remarks: The species is close to *P. introducta* with thallus and ascospores type but differ as *P. oculata* has oculate conditions of ascocarps (Upreti 1990).

30. ***Pyrenula oxysporiza*** Zahlbr. in Cat. Lich. Univers. 1: 499, 1922. Plate 28 (e)

Description: Thallus crustose, grey, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical; peridium spreading laterally, hymenium clear, paraphyses simple; ascus 8–spored, ascospores brown, ellipsoidal, thin walled, transversely 3–septate, locules not transversely elongated, 23–25× 10.1–10.4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Arunachal Pradesh, Assam, Kerala), Sri Lanka.

Specimen examined: INDIA: Assam, Dhubri district, **Rangamati Pt-III**, on the bark of *Polyalthia longifolia*, 27.12.2020, 26.11 m, 26°16′101″ N, 90°05′975″ E, Suparna Biswas & Pabitra Biswas, 2020-0554 (BUBH).

Ecology: The species was found growing on the smooth bark of *Polyalthia longifolia* at an elevation of 26.11 m.

Remarks: The species is close to *P. approximans* (Krempelh.) Müll. Arg. but differ as ascomata is large and peridium not laterally spreading in *P. approximans* (Upreti 1991b).

31. *Pyrenula pinguis* Fée in Essai Crupt. Exot. (Paris): 75, 1825. Plate 28 (f)

Description: Thallus crustose, yellow ochre, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical; peridium spreading laterally, hymenium clear, paraphyses simple; ascus 8–spored, ascospores brown, ellipsoidal, thick walled, transversely 3–septate, locules vertically elongated, 33–35× 16–17 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Andhra Pradesh, Assam, Karnataka, Kerala, Manipur, Uttar Pradesh), Colombia, Costa Rica, Mexico, Paraguay, Sri Lanka, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Bilashipara Florican Garden**, on the bark of *Lannea* sp., 10.02.2020, 53.54 m, 26°25′175″ N, 90°27′603″ E, Suparna Biswas & Pabitra Biswas, 2020-0980 (BUBH).

Ecology: The species was found growing on the smooth bark of *Lannea* sp. at an elevation of 53.54 m.

Remarks: The species is close to *P. oculifera* Vainio and *P. trombetana* Vainio but differ as ostioles is umbonate and peridium is rounded in both *P. oculifera* and *P. trombetana* (Upreti 1993).

32. ***Pyrenula quassiicola*** Fée in Essai Crypt. Exot., Suppl. Révis. (Paris): 79, 1837. Plate 29 (a)

Description: Thallus crustose, yellow–olive green, psuedocyphellae; ascomata perithecia solitary, ostiole apical; hymenium clear, paraphyses simple; ascus 8–spored, ascospores brown, transversely 3–septate, fusiform with pointed ends, lumina angular, terminal lumina separated from the exospore by an endospore layer, thick walled, 32–35 × 15.3–17.6 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Andhra Pradesh, Arunachal Pradesh, Assam, Goa, Karnataka, Kerala, Manipur, Sikkim, Uttar Pradesh), Australia, Brazil, Colombia, Costa Rica, Mexico, South Africa, Guyana, Papua New Guyana, Sri Lanka, Tropical Africa, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Satrasal**, on the bark of *Lannea* sp., 04.01.2020, 36.89 m, 26°16′151″ N, 89°73′461″ E, Suparna Biswas & Pabitra Biswas, 2020-0140 (BUBH), 61669 (LWG); **Kherbari Pt-II**, on the bark of *Michelia champaca*, 21.11.2020, 43.19 m, 26°25′613″ N, 89°74′361″ E, Suparna Biswas & Pabitra Biswas, 2020-0162 (BUBH).

Ecology: The species was found growing on the smooth bark of *Lannea* sp., *Michelia champaca* at an elevation of 36.89 m to 43.19 m.

Remarks: The species is close to *P. obscurior* Vainio but differ as the oil substance is present in ascospores of *P. quassicola* (Upreti 1992).

33. ***Pyrenula scutata*** (Stirt.) Zahlbr. in Cat. Lich. Univers. 1: 452, 1922. Plate 29 (b)

Basionym: *Verrucaria scutata* Stirt. in Proc. Roy. phil. Soc. Glasgow, 13: 192, 1881.

Description: Thallus crustose, yellowish, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical, indistinct; peridium spreading laterally, hymenium clear, paraphyses simple; ascus 8–spored, ascospores brown, ellipsoidal, thick walled, transversely 3–septate, two middle locules of spores rhomboidal, end locules triangular with the base of the triangle against the end of the spores, 19–21 × 6.1–6.8 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Assam, Maharashtra), Viet Nam.

Specimen examined: INDIA: Assam, Dhubri district, **South Tokrerchara Pt-IV**, on the bark of *Citrus* sp., 29.12.2019, 41.48 m, 26°10′715″ N, 89°81′552″ E, Suparna Biswas & Pabitra Biswas, 2019-0482 (BUBH).

Ecology: The species was found growing on the smooth bark of *Citrus* sp. at an elevation of 41.48 m.

Remarks: The species is close to *P. atropurpurea* (Eschw. Ex Mart.) Müll. Arg., in peridium shape and size but differ as *P. atropurpurea* have aggregated perithecia and smaller ascospores. (Upreti 1991a).

34. ***Pyrenula subacutalis*** Upreti in Feddes Repert. Spec. Nov. Regni veg. 102(5-6): 429, 1991. Plate 29 (c)

Description: Thallus crustose, brown, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical; peridium not spreading laterally, hymenium inspersed, centrum below inspersed, paraphyses simple; ascus 8–spored, ascospores brown, ellipsoidal, thin walled, transversely 3–septate, middle locules not transversely elongated, 17–20 × 7.1–8.8 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Arunachal Pradesh, Assam, Goa, Karnataka, Orissa), endemic.

Specimen examined: INDIA: Assam, Dhubri district, **Arear jhar Pt-II**, on the bark of *Shorea robusta*, 25.12.2020, 22.00 m, 26°26′103″ N, 90°41′794″ E, Suparna Biswas & Pabitra Biswas, 2020-0865 (BUBH).

Ecology: The species was found growing on the smooth bark of *Shorea robusta* at an elevation of 22.00 m.

Remarks: The species is close to *P. acutalis* R.C. Harris with ascocarp and spore size but differ as oil globules at apex near ostioles and centrum uninspersed below in *P. acutalis*. The species also resembles *P. approximans* (Krempelh.) Müll. Arg. in shape ans size of ascocarps but differ as centrum is not inspersed with oil globules in *P. approximans* (Upreti 1991b). The species is endemic to Indian region.

35. ***Pyrenula subducta*** (Nyl.) Müll. Arg. in Flora, Regensburg 67(35): 666, 1884. Plate 29 (d)

Basionym: *Verrucaria subducta* Nyl. in Acta. Soc. Sci. fenn. 7(2): 489, 1863.

Description: Thallus crustose, yellow–brown, smooth, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical; peridium spreading laterally, hymenium clear, paraphyses simple; ascus 8–spored, ascospores brown, fusiform, transversely 3–septate, lumina in a straight line, 39–41× 7.2–7.9 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Assam, Mizoram), Brazil, Colombia, Costa Rica, Guadeloupe.

Specimen examined: INDIA: Assam, Dhubri district, **Brahmin para**, on the bark of *Michelia champaca*, 25.12.2020, 40.53 m, 26°24′785″ N, 90°32′690″ E, Suparna Biswas & Pabitra Biswas, 2020-0970 (BUBH).

Ecology: The species was found growing on the smooth bark of *Michelia champaca* at an elevation of 40.53 m.

Remarks: The species is similar with *P. complanata* (Mont.) Trevis. in having apical ostiole, clear hymenium but differ as ascomata is larger and ascospores are smaller in *P. complanata*. (Ingle *et al*. 2018).

36. ***Pyrenula subglabriuscula*** Vain. in Ann. Acad. Sci. fenn., Ser. A 15 (6): 344, 1931. Plate 29 (e)

Description: Thallus crustose, greyish, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical; peridium spreading laterally, hymenium inspersed, paraphyses simple; ascus 8–spored, ascospores brown, ellipsoidal, thick walled, transversely 3–septate, locules globular, 21–23× 8.1–9.4 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Arunachal Pradesh, Assam, Karnataka), Philippines, Sri Lanka.

Specimen examined: INDIA: Assam, Dhubri district, **Arear jhar Pt-II**, on the bark of S*horea robusta*, 25.12.2020, 34.33 m, 26°26′074″ N, 90°41′802″ E, Suparna Biswas & Pabitra Biswas, 2020-0868 (BUBH); **Bhelupara Pt-II,** on the bark of *Lannea* sp., 25.12.2020, 34.78 m, 26°31′160″ N, 90°33′597″ E, Suparna Biswas & Pabitra Biswas, 2020-1454 (BUBH).

Ecology: The species was found growing on the smooth bark of S*horea robusta, Lannea* sp. at an elevation of 34.33 m to34.78 m.

Remarks: The species is similar with *P. mamillana* but differ as *P. mamillana* have convex conico depressed ascocarps (Upreti 1991a).

37. ***Pyrenula subindica*** Upreti in Nova Hedwigia 66(3-4): 574, 1998. Plate 29 (f)

Basionym: *Melanotheca indica* Nyl. in Flora, Regensburg 50: 9, 1867.

Description: Thallus crustose, grey, lacking psuedocyphellae; ascomata perithecia, aggregate, ostiole apical; hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, transversely 3–septate, 22–23 × 6.6–6.9 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Assam, West Bengal), Sri Lanka.

Specimen examined: INDIA: Assam, Dhubri district, **Arear jhar Pt-II**, on the bark of *Michelia champaca*, 25.12.2020, 39.07 m, 26°26′085″ N, 90°41′804″ E, Suparna Biswas & Pabitra Biswas, 2020-0556 (BUBH); **Chandor Dinga pahar**, on the bark of *Michelia champaca*,

11.02.2020, 36.00 m, 26°19′331″ N, 90°34′748″ E, Suparna Biswas & Pabitra Biswas, 2020-0968 (BUBH).

Ecology: The species was found growing on the bark of *Michelia champaca,* at an elevation of 36.00 m to 39.07 m.

Remarks: The species is characterized by lacking psuedocyphellae, perithecia aggregate, ostiole apical, hymenium clear, and ascospores transversely 3–septate.

38. ***Pyrenula sublaevigata*** (Patw. & Makhija) Upreti in Nova Hedwigia 66(3-4): 574, 1998. Plate 30 (a)

Basionym: *Anthracothecium sublaevigatum* Patw. & Makhija in Kavaka, 8: 25, 1981.

Description: Thallus crustose, yellowish brown, lacking psuedocyphellae; ascomata perithecia solitary, embedded, globose, ostiole apical; hymenium colourless, inspersed, paraphyses simple; ascus 8–spored, ascospores brown, muriform, transeversely 8–septate, upto 3–septate vertically, 32–35 × 15.6–16.9 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Arunachal Pradesh, Assam, Karnataka), Brazil, Colombia.

Specimen examined: INDIA: Assam, Dhubri district, **Falimari**, on the bark of *Artocarpus heterophyllus,* 25.12.2020, 50.40 m, 26°30′151″ N, 90°41′403″ E, Suparna Biswas & Pabitra Biswas, 2020-0119 (BUBH), 61678 (LWG).

Ecology: The species was found growing on the bark of *Artocarpus heterophyllus* at an elevation of 50.40 m.

Remarks: The species is characterized by lacking psuedocyphellae, perithecia solitary, embedded, globose, ostiole apical, hymenium inspersed, ascospores brown, muriform, transeversely 8–septate, upto 3–septate vertically.

39. ***Pyrenula submastophora*** A. Singh & Upreti in Geophytology 17(1): 85, 1987. Plate 30 (b)

Description: Thallus crustose, yellow brown, lacking psuedocyphellae; ascomata perithecia solitary, ostiole apical, indistinct; peridium spreading laterally, hymenium clear, paraphyses simple; ascus 8–spored, ascospores brown, ellipsoidal, thick walled, transversely 3–septate, two

middle locules rhomboidal, end locules triangular with the base of triangle against the end of spores, 22–24 × 8–9 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Andaman & Nicobar Islands, Assam, Maharashtra), China.

Specimen examined: INDIA: Assam, Dhubri district, **Hatipota Pt-II**, on the bark of *Ricinus* sp., 26.12.2020, 47.46 m, 26°22′689″ N, 90°35′491″ E, Suparna Biswas & Pabitra Biswas, 2020-0121 (BUBH), 616704 (LWG).

Ecology: The species was found growing on the bark of *Ricinus* sp. at an elevation of 47.46 m.

Remarks: The species is close to *P. mastophora* with ascocarp and ascospores size but differ as ecolumelate ascocarps present in *P. mastophora* (Upreti 1992).

40. ***Pyrenula thelomorpha*** Tuck. in Gen. lich. (Amherst): 275, 1872. Plate 30 (c)

Description: Thallus crustose, yellowish brown, psuedocyphellae; ascomata perithecia solitary, globose, ostiole apical; hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, muriform, transeversely 8–septate, upto 2–3 septate vertically, 38–39 × 12.6–14.9 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Assam), Australia, Costa Rica, El Salvador, French Guiana, Guadeloupe, New Caledonia, USA, Viet Nam, Vanuatu.

Specimen examined: INDIA: Assam, Dhubri district, **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 22.11.2020, 31.75 m, 26°05′050″ N, 89°89′330″ E, Suparna Biswas & Pabitra Biswas, 2020-0123 (BUBH), 61644 (LWG); **South Tokrerchara Pt-IV**, on the bark of *Lannea* sp., 16.01.2020, 23.79 m, 26°11′074″ N, 89°83′372″ E, Suparna Biswas & Pabitra Biswas, 2020-0136 (BUBH), 61682 (LWG).

Ecology: The species was found growing on the bark of *Lannea* sp. at an elevation of 23.79 m to 31.75 m.

Remarks: The species is closely related to *P. leucostoma* Ach. both of them have pseudocyphellae thallus differ as smaller ascospores are found in *P. leucostoma* Ach. (Gupta and Sinha 2018).

41. ***Pyrenula welwitschii*** (Upreti & Ajay Singh) Aptroot in Lichenologist 44(1): 36, 2011. Plate 30 (d)

Basionym: *Anthracothecium welwitschii* Upreti & Ajay Singh in Feddes Repert. Spec. Nov. Regni Veg. 99(3-4): 151, 1988.

Description: Thallus crustose, olivaceous brown, psuedocyphellae; ascomata perithecia solitary, globose, ostiole apical; hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, muriform, transeversely 8–septate, upto 3–septate vertically, 26–30 × 11–12 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Uttarakhand), Angola.

Specimen examined: INDIA: Assam, Dhubri district, **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 22.11.2020, 30.26 m, 26°05′070″ N, 89°89′333″ E, Suparna Biswas & Pabitra Biswas, 2020-0179 (BUBH); **Brahmin para**, on the bark of *Lannea* sp., 25.12.2020, 40.72 m, 26°24′843″ N, 90°32′683″ E, Suparna Biswas & Pabitra Biswas, 2020-0699 (BUBH); **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 22.11.2020, 37.07 m, 26°05′068″ N, 89°89′338″ E, Suparna Biswas & Pabitra Biswas, 2020-0828 (BUBH); **Kismat hasdaha Pt-II**, on the bark of *Lannea coromandelica*, 22.11.2020, 31.75 m, 26°05′050″ N, 89°89′330″ E, Suparna Biswas & Pabitra Biswas, 2020-0829 (BUBH); **Debotar hasdaha Pt-IV**, on the bark of *Lannea* sp., 22.11.2020, 32.21 m, 26°05′740″ N, 89°88′984″ E, Suparna Biswas & Pabitra Biswas, 2020-0832 (BUBH), 61686 (LWG).

Ecology: The species was found growing on the bark of *Lannea* sp. at an elevation of 30.26 m to 40.72 m.

Remarks: The species is close to *P. dissimulans* (Müll. Arg.) R.C. Harris with their morphology and shape of ascospores but differ as *P. welwitschii* has smaller ascospores (Thangjam *et al.* 2020). The species is a new record to Assam.

42. *Pyrenula wrightii* (Müll. Arg.) R.C. Harris in More Florida Lichens, Icl. 10 Cent Tour Pyrenol. (New York.): 111, 1995. Plate 30 (e)

Basionym: *Melanotheca wrightii* Müll. Arg. in Bot. Jb. 6: 396, 1885.

Description: Thallus crustose, yellowish brown, psuedocyphellae; ascomata perithecia aggregated, ostiole apical; hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, transeversely 3–septate, 33–37 × 16.3–16.9 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Arunachal Pradesh, Assam), Cuba, Puerto Rico.

Specimen examined: INDIA: Assam, Dhubri district, **Bhalukmari,** on the bark of *Jatropha* sp., 24.12.2020, 52.09 m, 26°30′248″ N, 90°23′132″ E, Suparna Biswas & Pabitra Biswas, 2020-0694 (BUBH), 61662 (LWG).

Ecology: The species was found growing on the bark of *Jatropha* sp. at an elevation of 52.09 m.

Remarks: The species is characterized by thallus yellowish brown, psuedocyphellae, perithecia aggregated, ostiole apical, hymenium clear, ascospores brown, transeversely 3–septate.

43. *Pyrenula zeylanica* Upreti & Ajay Singh in Geophytology 18(1): 76, 1988. Plate 30 (f)

Description: Thallus crustose, brownish grey, lacking psuedocyphellae; ascomata perithecia, solitary, embedded, ostiole apical, punctate; hymenium colourless, clear, paraphyses simple; ascus 8–spored, ascospores brown, ellipsoid, thick walled, transversely 3–septate, two middle locules of spores rhomboidal and papillate towards adjoining locules, end locules papillate towards the middle locules, 35–39 × 12.6–15.9 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected

Distribution: India (Arunachal Pradesh, Assam, Kerala, Mizoram, Nagaland), Sri Lanka.

Specimen examined: INDIA: Assam, Dhubri district, **Chandor Dinga Pahar**, on the bark of *Neolamarckia cadamba*, 11.02.2020, 36.64 m, 26°19′341″ N, 90°34′748″ E, Suparna Biswas & Pabitra Biswas, 2020-0967 (BUBH).

Ecology: The species was found growing on the bark of *Neolamarckia cadamba* at an elevation of 36.64 m.

Remarks: The species is close to *P. oculata* but differ as hymenium is inspersed in *P. oculata.* (Upreti 1990).

***Pyxine* Fr. in Syst. Orb. Veg.: 267, 1825. (Family: Caliciaceae)**

Thallus foliose, loosely to closely attached with the substratum, grey, lobes radiating, subdichotomously or irregularly branched, upper surface with pruinose, maculate, pseudocyphellae; soredia and isidia present or absent; medulla white, yellow, red; lower surface black, rhizines black, upper surface greyish; ascomata apothecial, lecanorine, lecidine in appearance, margin prominent; ascus 8 spored, ascospores brown, 1–3 septate; secondary metabolites atranorin, chloroatranorin, lichexanthone, terpens, norstictic acids present or absent.

Key to the species

1a**.** Medulla white…….2

1b Medulla yellow……..*P. sorediata*

2a**.** Thallus both isidia and soredia……..*P. coralligera*

2b**.** Thallus only isidia or soredia……3

3a**.** Thallus sorediate……4

3b**.** Thallus isidia ……*P. isidiophora*

5a. Thallus UV+…….*P. cocoes*

5b. Thallus UV–……*P. reticulata*

1. ***Pyxine cocoes*** (Sw.) Nyl. Belarra (Bilbao) 5: 108, 1857. Plate 31 (a)

Basionym: *Lichen cocoes* Sw. in Prodr.: 146, 1788.

Description: Thallus foliose, tightly attached to the substratum, grey, lobes small, linear, discrenate, pruina, maulate at the marginal regions; sorediate, soredia farinose, soralia orbicular, laminal; lower surface black, rhizine present, black; medulla white; apothecia not seen.

Chemistry: Medulla K–, C–, KC–, P–; UV+ yellow; TLC: lichexanthone, triterpenes present.

Distribution: India (Assam, Kerala, Karnataka, Maharashtra, Manipur, Mizoram, Odisha, Tamil Nadu, Uttar Pradesh, West Bengal), Australia, Brazil, Colombia, Ecuador, Guyana, Jamaica, Kenya, Philippines, Seychelles, USA.

Specimen examined: INDIA: Assam, Dhubri district, **South Tokrerchara Pt-IV**, on the bark of *Lannea* sp., 16.01.2020, 24.17 m, 26°11′898″ N, 89°83′359″ E, Suparna Biswas & Pabitra Biswas, 2020-0481 (BUBH); **Gauripur Matiabag Hawakhana**, on the bark of *Michelia*

champaca, 08.02.2020, 47.88 m, 26°09′788″ N, 89°97′557″ E, Suparna Biswas & Pabitra Biswas, 2020-0557 (BUBH); **Chandor Dinga Pahar**, on the bark of *Neolamarckia cadamba*, 11.02.2020, 36.64 m, 26°19′341″ N, 90°34′748″ E, Suparna Biswas & Pabitra Biswas, 2020-0708 (BUBH); **South Tokrerchara Pt-IV**, on the bark of *Cocos nucifera*, 29.12.2019, 32.64 m, 26°10′098″ N, 89°81′988″ E, Suparna Biswas & Pabitra Biswas, 2019-0711 (BUBH); **Dumardaha Pt-II**, on the bark of *Lannea* sp., 28.10.2020, 35.97 m, 26°09′004″ N, 89°91′999″ E, Suparna Biswas & Pabitra Biswas, 2020-0713 (BUBH); **Dumardaha Pt-II,** on the bark of *Lannea* sp., 28.10.2020, 36.24 m, 26°09′003″ N, 89°92′013″ E, Suparna Biswas & Pabitra Biswas, 2020-0714 (BUBH); **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 22.11.2020, 36.66 m, 26°05′068″ N, 89°89′341″ E, Suparna Biswas & Pabitra Biswas, 2020-0717 (BUBH); **Uchita,** on the bark of *Mallotus* sp., 28.10.2020, 32.13 m, 26°10′684″ N, 89°85′228″ E, Suparna Biswas & Pabitra Biswas, 2020-0718 (BUBH); **Uchita,** on the bark of *Mallotus* sp., 28.10.2020, 30.16 m, 26°10′686″ N, 89°85′227″ E, Suparna Biswas & Pabitra Biswas, 2020-0719 (BUBH); **Pub-gaikhawa Pt-I**, on the bark of *Lannea* sp., 25.10.2020, 29.04 m, 26°08′056″ N, 89°83′363″ E, Suparna Biswas & Pabitra Biswas, 2020-0720 (BUBH); **Dumardaha Pt-II**, on the bark of *Lannea* sp., 28.10.2020, 33.92 m, 26°09′007″ N, 89°91′993″ E, Suparna Biswas & Pabitra Biswas, 2020-0721 (BUBH); **Dumardaha Pt-II**, on the bark of *Lannea* sp., 28.10.2020, 37.02 m, 26°09′002″ N, 89°92′014″ E, Suparna Biswas & Pabitra Biswas, 2020-0723 (BUBH); **Chagolchara Pt-III**, on the bark of *Neolamarckia cadamba*, 29.10.2020, 39.70 m, 26°02′517″ N, 89°94′410″ E, Suparna Biswas & Pabitra Biswas, 2020-0724 (BUBH); **Bhasani goan**, on the bark of *Mangifera indica*, 26.12.2020, 34.42 m, 26°30′138″ N, 90°22′451″ E, Suparna Biswas & Pabitra Biswas, 2020-0727 (BUBH); **Hatipota Pt-II**, on the bark of *Gmelina arborea*, 26.12.2020, 53.74 m, 26°22′594″ N, 90°35′491″ E, Suparna Biswas & Pabitra Biswas, 2020-0729 (BUBH); **Hatipota Pt-II**, on the bark of *Mallotus* sp., 26.12.2020, 47.99 m, 26°22′694″ N, 90°35′492″ E, Suparna Biswas & Pabitra Biswas, 2020-0732 (BUBH); **Khajurbari Pt-I**, on the bark of *Lannea* sp., 24.12.2020, 32.42 m, 26°26′194″ N, 90°17′929″ E, Suparna Biswas & Pabitra Biswas, 2020-0734 (BUBH), 61705 (LWG).

Ecology: The species is found growing on the bark of *Lannea* sp., *Michelia champaca*, *Neolamarckia cadamba*, *Cocos nucifera*, *Mallotus* sp., *Mangifera indica*, *Gmelina arborea* at an elevation of 24.17 m to 53.74 m. Widely distribted from sub tropical to temperate regions of the world.

Remarks: The species resemble with *P.subcinerea* Stirt. with the morphology and chemistry but differ as the latter one have yellow medulla and soredia (Gupta and Sinha 2018).

2. ***Pyxine coralligera*** Malme in Bih. K. svenska VetenskAkad. Handl., Afd. 3 23(13): 40, 1897. Plate 31 (b)

Description: Thallus foliose, adnate, upper side grey, lobes small, dichotomous, radiating, pruina, pseudocyphellae laminal, the marginal regions; isidia present, cylindrical, soredia granular; lower surface black, rhizine present, black; medulla yellow; apothecia not seen.

Chemistry: Medulla K–, C–, KC–, P+ orange; UV–; TLC: atranorin, triterpenes present.

Distribution: India (Andaman & Nicobar Islands, Assam, Kerala, Manipur), Australia, Brazil, China, Colombia, Costa Rica, Cuba, East Africa, El Salvador, Kenya, Papua New Guinea, Sri Lanka, Tanzania, Thailand, Tropical America.

Specimen examined: INDIA: Assam, Dhubri district, **Debotar hasdaha Pt-IV**, on the bark of *Lannea* sp., 22.11.2020, 30.23 m, 26°05′731″ N, 89°88′970″ E, Suparna Biswas & Pabitra Biswas, 2020-0125 (BUBH), 61692 (LWG); **Kismat hasdaha Pt-II**, on the bark of *Lannea* sp., 22.11.2020, 31.50 m, 26°05′069″ N, 89°89′318″ E, Suparna Biswas & Pabitra Biswas, 2020-0744 (BUBH); **Debotar hasdaha Pt-IV**, on the bark of *Lannea* sp., 22.11.2020, 33.47 m, 26°05′751″ N, 89°89′027″ E, Suparna Biswas & Pabitra Biswas, 2020-0781 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp. an elevation of 30.23 m to 33.47 m.

Remarks: The species resemble with *P.consocians* Vain., but differ as the latter one have norstictic acid in the medulla (Awasthi 2007).

3. ***Pyxine isidiophora*** (Müll. Arg.) Imshaug in Trans. Am. Microsc. Soc. 76: 257, 1957. Plate 31 (c)

Basionym: *Pyxine cocoes* f. *isidiophora* Müll. Arg. in Flora, Regensburg 65(20): 319, 1882.

Description: Thallus foliose, attached to the substratum, upper side grey, lobes small, pseudocyphellae at the marginal regions; isidiate, isidia cylindrical, branched; lower surface black, rhizine present, black; medulla white; apothecia not seen.

Chemistry: Medulla K–, C–, KC–, P–; UV–; TLC: atranorin, triterpenes present.

Distribution: India (West Bengal), Cuba, French Polynesia, Honduras, Sri Lanka.

Specimen examined: INDIA: Assam, Dhubri district, **Debotar hasdaha Pt-IV**, on the bark of *Lannea* sp., 22.11.2020, 27.73 m, 26°05′039″ N, 89°89′316″ E, Suparna Biswas & Pabitra Biswas, 2020-0170 (BUBH), 61699 (LWG).

Ecology: The species is found growing on the bark of *Lannea* sp. at an elevation of 27.73m.

Remarks: The species is characterized with small lobes, pseudocyphellae at the marginal regions, isidia cylindrical, atranorin, triterpenes present. The species is a new record to Assam.

4. ***Pyxine reticulata*** (Vain.) Vain. in Ann. Acad. Sci. fenn., Ser. A 6(7): 70, 1915. Plate 31 (d)

Basionym: *Physcia reticulata* Vain., in Hiern, Cat. Afr. Pl. 2(2): 412, 1901.

Description: Thallus foliose, tightly attached to the substratum, grey, lobes small, reticulate pseudocyphellae, maulate at the laminal regions; sorediate, soredia farinose, soralia orbicular; lower surface black, rhizine present, black; medulla white; apothecia not seen.

Chemistry: Medulla K–, C–, KC–, P–; UV–; TLC: triterpenes present.

Distribution: India (Andaman & Nicobar Islands, Assam, Karnataka, Kerala, Tamil Nadu), Brazil, Kenya, Seychelles, South Africa, Tanzania, Uganda.

Specimen examined: INDIA: Assam, Dhubri district, **Kherbari Pt-II**, on the bark of *Bombex cieba*, 21.11.2020, 41.69 m, 26°25′618″ N, 89°74′364″ E, Suparna Biswas & Pabitra Biswas, 2020-0132 (BUBH); **Hatipota Pt-II**, on the bark of *Mangifera indica*, 26.12.2020, 47.42 m, 26°22′635″ N 90°35′490″ E, Suparna Biswas & Pabitra Biswas, 2020-0731 (BUBH), 61666 (LWG).

Ecology: The species is found growing on the bark of *Bombex cieba, Mangifera indica* at an elevation of 41.69 m to 47.42 m. Widely distributed in tropical Africa regions of the world.

Remarks: The species is characterized with small lobes, pseudocyphellae reticulate maulate at the laminal regions, soredia farinose, soralia orbicular.

5. ***Pyxine sorediata*** (Ach.) Mont., in Sagra, Hist. phys. Cuba, Bot. Pl. Cell. 9: 124, 1845. Plate 31 (e)

Basionym: *Lecidea sorediata* Ach. in Syn. meth. lich. (Lund): 54, 1814.

Description: Thallus foliose, adnate, upper side grey, lobes small, dichotomous, radiating, pruina, marginal regions white pseudocyphellae; isidia absent, soredia granular; grey, lower surface black, rhizine present, black; medulla yellow; apothecia not seen.

Chemistry: Medulla K–, C–, KC–, P–; UV–; TLC: Triterpenes present.

Distribution: India (Andaman & Nicobar Islands, Assam, Manipur, Nagaland, Tamil Nadu, Uttaranchal, West Bengal), Australia, Brazil, Canada, China, Colombia, Ecuador, Nepal, Spain, Portugal, Sri Lanka, Russia, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Barobalurchar**, on the bark of *Bombex cieba*, 27.12.2020, 39.96 m, 26°22′110″ N, 89°84′133″ E, Suparna Biswas & Pabitra Biswas, 2020-0974 (BUBH).

Ecology: The species is found growing on the bark of *Bombex cieba* at an elevation of 30.23 m to 33.47 m.

Remarks: The species is characterized with small lobes, pruina, marginal regions white pseudocyphellae, soredia, and medulla yellow.

Sarcographa Fée in Eassai Crypt. Écorc. : 35 & 58, 1824. (Family: Graphidaceae)

Thallus crustose, corticolous, yellowish ochre to olive–green, yellowish brown, corticated or ecorticate; apothecia lirellate, simple or branched, embedded in carbonized stroma with white or pale brown surface, disc open; excipulum carbonized at the base, hymenium colourless, paraphyses simple to branched; asci 8–spored, ascospores brown, elongate to fusiform, transversely septate to muriform; secondary metabolites orcinol depsidones present or absent.

Key to the species

1a**.** Ascospores muriform……*S. glyphiza*

1b**.** Ascospores transversely septate…….2

2a**.** Ascospores distinctly transversely 3–septate……...3

2b**.** Ascospores transversely 3–7septate……4

3a**.** Ascospores less than 20 μm long……*S. tricosa*

3b**.** Ascospores more than 20 μm long……..*S. subtricosa*

4a. Constictic, norstictic, stictic acids present……*S. maculosa*

4b. Stictic acid present only…….....5

5a**.** Ascospores 3–5 septate…….....6

5b**.** Ascospores transversely 5–7septate……*S. heteroclita*

6a**.** Ascospores I+ blue…….....*S. intricans*

6b**.** Ascospores I+ red…….*S. labyrinthica*

1. ***Sarcographa glyphiza*** (Nyl.) Kr. P. Singh & G.P.Sinha in Indian Lichens, An Annotated Checklist (Kolkata): 13, 2010. Plate 31 (f)

Basionym: *Graphis glyphiza* Nyl. in Annls Sci., Nat., Bot., sér, 4 (19): 374, 1863.

Description: Thallus crustose, yellowish brown, corticated, cortex yellowish; apothecia lirellate, black, elongate, branched, stromata whitish grey, disc open with white pruinose; excipulum entire, black, hymenium colourless, clear, hypothecium yellowish; asci 8 spored, ascospores brown, muriform, I+ red, 27–29 × 10–11 μm.

Chemistry: Thallus K+ red, C–, KC–, P+ purple; UV–; TLC: constictic acid, stictic acids present.

Distribution: India (Assam, Kerala, Nagaland, West Bengal), Australia, China, Hong Kong, Japan, Myanmar, Papua New Guinea, Singapore, Sri Lanka, Thailand.

Specimen examined: INDIA: Assam, Dhubri district, **Alomganj Pt-IX**, on the bark of *Michelia champaca*, 27.12.2020, alt. 47.55 m, 26°13′473″ N, 90°03′654″ E, Suparna Biswas & Pabitra Biswas, 2020-0977 (BUBH).

Ecology: The species is found growing on the bark of *Michelia champaca* at an elevation of 47.55 m.

Remarks: The species resembles *S. verrucosa* (Vain.) Zahlbr. morphologically but differ as *S. glyphiza* have larger ascospores and K+ reddish thallus, constictic acid, stictic acids present (Gupta *et al*. 2020).

2. ***Sarcographa heteroclita*** (Mont.) Zahlbr., in Rechinger, Denkschr. Kaiserl. Akad. Wiss. Wien, Math. - Naturwiss. Kl. 88: 19, 1911. Plate 32 (a)

Synonymy: ***Glyphis heteroclite*** Mont. in Annls Sci., Nat., Bot., sér. 2(19): 83, 1843.

Description: Thallus crustose, pale grey, corticated, cortex colourless; apothecia lirellate, branched, stromata white, disc open with white pruinose; excipulum complete, dark brown, hymenium colourless, hypothecium colourless; asci 8–spored, ascospores brown, transversely 5–7 septate, I+ blue, 20–22 × 8–10 μm.

Chemistry: Thallus K+ red, C–, KC–, P–; UV–; TLC: Stictic acid present.

Distribution: India (Assam), Indonesia, Panama, Sri Lanka, Venezuela.

Specimen examined: INDIA: Assam, Dhubri district, **Falimari**, on the bark of *Artocarpus heterophyllus,* 25.12.2020, 68.09 m, 26°30′153″ N, 90°41′409″ E, Suparna Biswas & Pabitra Biswas, 2020-0923 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus* at an elevation of 68.09 m. The species is widely distributed in tropical regions of the world.

Remarks: The species is characterized with stromata white, disc open with white pruinose, excipulum complete, dark brown, ascospores transversely 5–7 septate.

3. ***Sarcographa intricans*** (Nyl.) Müll.Arg. in Flora, Regensburg 70: 77, 1887. Plate 32 (b)

Basionym: *Graphis intricans* Nyl. Acta Soc. Sci. fenn. 7(2): 473, 1863.

Description: Thallus crustose, grey, corticated, cortex colourless; apothecia lirellate, branched, stromata white, disc open with white pruinose; excipulum complete, dark brown, hymenium colourless, hypothecium colourless; asci 8–spored, ascospores brown, transversely 3–5 septate, I+ blue, 19–20 × 6–7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: Stictic acid present.

Distribution: India (Assam), Australia, Brazil, Colombia, Costa Rica, Papua New Guinea, Seychelles, Singapore, Sri Lanka, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Bilashipara Florican Garden**, on the bark of *Mangifera indica*, 10.02.2020, 37.86 m, 26°25′066″ N, 90°27′691″ E, Suparna Biswas & Pabitra Biswas, 2020-0500 (BUBH); **Gauripur town**, on the bark of *Lannea* sp., 10.03.2020, 26.20 m, 26°09′771″ N, 89°94′940″ E, Suparna Biswas & Pabitra Biswas, 2020-0962 (BUBH).

Ecology: The species is found growing on the bark of *Mangifera indica, Lannea* sp. in Bilashipara Florican Garden, Gauripur town at an elevation of 26.20 m to 37.86 m.

Remarks: The species resembles to *S. leprieurii* morphologically but differ as ascospores are small in *S. intricans.*

4. ***Sarcographa labyrinthica*** (Ach.) Müll. Arg. in Mém. Soc. Phys. Hist. nat. Genéve 29(8): 62, 1887. Plate 32 (c)

Basionym: *Glyphis labyrinthica* Ach. in Syn. meth. lich. (Lund): 107, 1814.

Description: Thallus crustose, brownish yellow, corticated, cortex colourless; apothecia lirellate, round to ovate, branched, stromata white, disc dark brown, open with white pruinose; excipulum complete, carbonized, hymenium colourless, inspersed, hypothecium colourless; asci 8 spored, ascospores brown, transversely 3–5 septate, locules lentiform, I+ red, 20–22 × 7–8 μm.

Chemistry: Thallus K+ red, C–, KC–, P–; UV–; TLC: Stictic acid present.

Distribution: India (Andaman and Nicobar Islands, Arunachal Pradesh, Assam, Kerala, Mizoram), Africa, Australia, Brazil, Colombia, Congo, Costa Rica, Cuba, French Guiana, Guyana, Malaysia, Philippines, South America , Sri Lanka.

Specimen examined: INDIA: Assam, Dhubri district, **Gopigoan Pt-III**, on the bark of *Lannea* sp., 26.12.2020, 33.64 m, 26°25′718″ N, 90°23′356″ E, Suparna Biswas & Pabitra Biswas, 2020-0510 (BUBH); **Rangamati Pt-III**, on the bark of *Bombex cieba*, 27.12.2020, 23.40 m, 26°16′106″ N, 90°05′978″ E, Suparna Biswas & Pabitra Biswas, 2020-0559 (BUBH); **Kherbari Pt-II,** on the bark of *Aquilaria agalocha,* 21.11.2020, 23.84 m, 26°25′629″ N, 89°74′398″ E, Suparna Biswas & Pabitra Biswas, 2020-0779 (BUBH), 61687 (LWG); **Brahmin para**, on the bark of *Artocarpus heterophyllus*, 25.12.2020, 40.53 m, 26°24′785″ N, 90°32′690″ E, Suparna Biswas & Pabitra Biswas, 2020-0855 (BUBH); **Gourangtari Pt-II**, on the bark of *Lannea sp.*, 26.12.2020, 43.81 m, 26°24′482″ N, 90°31′933″ E, Suparna Biswas & Pabitra Biswas, 2020-0932 (BUBH); **Jamduar Pt-I**, on the bark of *Lannea sp.,* 26.12.2020, 41.77 m, 26°24′693″ N, 90°27′770″ E, Suparna Biswas & Pabitra Biswas, 2020-0941 (BUBH); **Ananda nagar,** on the bark of *Lannea sp.,* 24.12.2020, 41.39 m, 26°22′736″ N, 90°21′675″ E, Suparna Biswas & Pabitra Biswas, 2020-0950 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Bombex cieba, Aquilaria agalocha, Artocarpus heterophyllus* at an elevation of 23.40 m to 43.81 m.

Remarks: The species resembles *S. verrucosa* (Vain.) Zahlbr. morphologically but differ as *S. labyrinthica* have transversely septate 4—6 ascospores and K+ reddish thallus (Gupta *et al*. 2020).

5. ***Sarcographa maculosa*** Zahlbr. in Cat. Lich. Univers. 2: 464, 1923. Plate 32 (d)

Basionym: *Glyphis maculosa* Stirt. in Proc. Roy. phil. Soc. Glasgow 13: 189, 1881.

Description: Thallus crustose, pale olive, corticated, cortex colourless; apothecia lirellate, elongate, branched, stromata white, disc open with white pruinose; excipulum entire, brown, hymenium colourless, hypothecium pale yellow, I–; asci 8 spored, ascospores brown, transversely 3–5 septate, 24–25 × 7.3–7.8 μm.

Chemistry: Thallus K+ red, C–, KC–, P–; UV–; TLC: Constictic, norstictic, stictic acids present.

Distribution: India (Assam), Seychelles, Thailand.

Specimen examined: INDIA: Assam, Dhubri district, **Fakiranir Jhar Pt-I**, on the bark of *Areca catechu,* 24.12.2020, 34.00 m, 26°21′894″ N, 90°14′818″ E, Suparna Biswas & Pabitra Biswas, 2020-1175 (BUBH).

Ecology: The species is found growing on the bark of *Areca catechu* at an elevation of 34.00m.

Remarks: The species is characterized with stromata white, disc open with white pruinose, excipulum entire, brown, ascospores transversely 3–5 septate.

6. ***Sarcographa subtricosa*** (Leighton) Müll. Arg. in Flora, Regensburg 70: 78, 1887. Plate 32 (e)

Basionym: *Glyphis subtricosa* Leight. in Trans. Linn. Soc. London 27(2): 181, 1870.

Description: Thallus crustose, brownish yellow, ecorticated, cortex colourless; apothecia lirellate, branched, stromata white, thin, disc black, open with white pruinose; excipulum complete, carbonized, hymenium colourless, inspersed, hypothecium colourless; asci 8 spored, ascospores brown, transversely 3–septate, locules lentiform, I+ red, 20–22 × 6–7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Assam, Karnataka), Australia, Paraguay, Sri Lanka.

Specimen examined: INDIA: Assam, Dhubri district, **Bilashipara florican garden**, on the bark of *Polyalthia longifolia*, 10.02.2020, 42.14 m, 26°25′163″ N, 90°27′603″ E, Suparna Biswas & Pabitra Biswas, 2020-0478 (BUBH).

Ecology: The species is found growing on the bark of *Polyalthia longifolia* at an elevation of 42.14 m.

Remarks: The species resembles to *S. tricosa* with morphology differ as ascospores of *S. subtricosa* is larger than *S. tricosa.*

7. ***Sarcographa tricosa*** (Ach.) Müll. Arg. in Mém. Soc. Phys. Hist. nat. Genéve 29(8): 63, 1887. Plate 32 (f)

Basionym: *Graphis tricosa* (Ach.) in Lich. Univ.: 674, 1810.

Description: Thallus crustose, whitish to brownish grey or greenish yellow, ecorticated, cortex colourless; apothecia lirellate, branched, stromata white, thin, disc black, open with white pruinose; excipulum complete, carbonized, hymenium colourless, inspersed, hypothecium colourless; asci 8 spored, ascospores brown, transversely 3–septate, locules lentiform, I+ red, 15–17 × 7–8 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (Arunachal Pradesh, Assam, West Bengal), Brazil, Colombia, Costa Rica, Cuba, French Guiana, Japan, Puerto Rico, Sri Lanka, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Jamduar Pt-I**, on the bark of *Citrus* sp., 26.12.2020, 37.02 m, 26°24′684″ N, 90°27′772″ E, Suparna Biswas & Pabitra Biswas, 2020-0509 (BUBH); **Brahmin para,** on the bark of *Artocarpus heterophyllus*, 25.12.2020, 48.59 m, 26°24′865″ N, 90°32′660″ E, Suparna Biswas & Pabitra Biswas, 2020-0916 (BUBH); **Jamduar Pt-I**, on the bark of *Lannea* sp., 26.12.2020, 39.45 m, 26°24′689″ N, 90°27′773″ E, Suparna Biswas & Pabitra Biswas, 2020-0942 (BUBH).

Ecology: The species is found growing on the bark of *Citrus* sp., *Artocarpus heterophyllus*, *Lannea* sp. at an elevation of 37.02 m to 48.59 m. The species is widely distributed in tropical regions of the world. Widely distributed in tropical regions of the world.

Remarks: The specie's stromata resembles with *S. medusulina* (Nyl.) Müll. Arg. But the latter one differ as having 3–5 septate ascospores, caronization of the excipulum spreading to the adjacent parts of the stromata. The species is distinguished as they have constant 3–septate ascospores, thin irregularly spreading stromata (Gupta and Sinha 2018).

***Stirtonia* A.L. Sm. in Trans. Brit. Mycol. Soc. 11: 192, 1926. (Family: Arthoniaceae)**

Thallus crustose, ecorticate, white to greyish; ascomata not organized, paraphysoides tightly enclosing the asci, asci confined to small, white soft hyphae and rare immersed in thallus; asus 8 spored, ascospores colourless, transversely septate.

1. *Stirtonia macrocarpa* Makhija & Patw. in Biovigyanam 13(2): 48 (1987) Plate 33 (a)

Description: Thallus crustose, whitish; ascomata apothecia, ascigerous zone mostly round, disc with white pruinose; excipulum hyaline indistinct, hymenium colourless; asci 8–spored, ascospores colourless, transversely 5–septate, without enlarged cell, 22–25 × 6.2–7.7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: 2′–O– methylperlatolic acid present.

Distribution: India (Andaman and Nicobar Islands), Bangladesh, Brazil, Guyana, Philippines, Solomon Islands.

Specimen examined: INDIA: Assam, Dhubri district, **Panbari Tea Garden**, on the bark of *Michelia champaca*, 09.02.2020, alt. 46.08 m, 26°15′322″ N, 90°05′080″ E, Suparna Biswas & Pabitra Biswas, 2020-0589 (BUBH).

Ecology: The species is found growing on the bark of *Michelia champaca* at an elevation of 46.08 m.

Remarks: The species is characterized with ascigerous zone mostly round, disc with white pruinose, excipulum hyaline indistinct, ascospores transversely 5–septate, without enlarged cell, 2′–O–methylperlatolic acid present.

***Synarthonia* Müll. Arg. in Bull. Soc. R. Bot. Belg. 30(1): 85, 1981. (Taxa incertaesedis)**

Thallus crustose, whitish to whitish to greenish-grey to green, smooth to verrucose to farinose, sorediate or not, ecorticate; apothecia solitary or irregular clusters, immersed to sessile or not, disc white, greyish, orange to white pruinose; exciple uncarbonized, asci 8–spored, ascospores colourless or brownish, transversely septate with an enlarged apical cell or muriform; parietin, evernic acid, psoromic acid present.

1. ***Synarthonia inconspicua*** (Stirt.) Van den Broeck & Ertz in Plant Ecology and Evolution 151 (3) : 333, 2018. Plate 33 (b)

Basionym: *Arthonia inconspicua* Stirt. in Proc. Roy. Phil. Soc. Glasgow 11: 319, 1878.

Description: Thallus crustose, whitish grey; apothecia round, white, disc with white pruinose; excipulum hyaline, indistinct, hymenium colourless; asci 8–spored, ascospores colourless, transversely 5–septate, one end enlarged, 22–23 × 7.2–7.7 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV+; TLC: parietin present.

Distribution: India (Assam, Tamil Nadu), Chinese Taipei, Congo, Colombia, Costa Rica, Cuba, Ecuador, Madagascar, Netherlands Antilles, Rwanda, Sierra Leone, Tanzania, Uganda, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Bhalukmari**, on the bark of *Neolamarckia cadamba*, 24.12.2020, alt. 46.20 m, 26°29′979″ N, 90°22′911″ E, Suparna Biswas & Pabitra Biswas, 2020-0153 (BUBH), 61647 (LWG); **Dhubri town,** on the bark of *Michelia champaca,* 10.01.2020, alt. 31.25 m, 26°02′195″ N, 89°95′927″ E, Suparna Biswas & Pabitra Biswas, 2020-0558 (BUBH); **Bhelupara Pt-II**, on the bark of *Lannea* sp., 25.12.2020, alt. 34.78 m, 26°23′160″ N, 90°33′597″ E, Suparna Biswas & Pabitra Biswas, 2020-1391(BUBH); **Gauripur town**, on the bark of *Lannea* sp., 10.03.2021, alt. 34.04 m, 26°09′771″ N, 89°94′940″ E, Suparna Biswas & Pabitra Biswas, 2021-0742 (BUBH); **Chagolchara Pt-III,** on the bark of *Neolamarckia cadamba*, 29.10.2020, alt. 39.70 m, 26°02′517″ N, 89°94′410″ E, Suparna Biswas & Pabitra Biswas, 2020-0833 (BUBH); **Falimari**, on the bark of *Laurus* sp., 25.12.2020, 75.01 m, 26°30′149″ N, 90°41′416″ E, Suparna Biswas & Pabitra Biswas, 2020-0839 (BUBH).

Ecology: The species is found growing on the bark of *Lannea* sp., *Neolamarckia cadamba*, *Michelia champaca,* and *Laurus* sp. at an elevation of 34.04 m to 75.01 m. The species luxuriously grows on the smooth bark of the trees and in dry conditions.

Remarks: *Synarthonia inconspicua* Stirt is the correct name of type specimens *Synarthonia bicolor* Müll. Arg., *Arthonia inconspicua* Stirt., *A. subcaesia* C.W. Dodge and *A. translucens* Stirt. (Van den Broeck *et al*. 2018).

***Trypethelium* Sprengel in Anleit. Kenntn. Gew. 3: 350, 1804. (Family: Trypetheliaceae)**

Thallus crustose, corticolous, corticated, often pruinose; ascomata perithecia, embedded in pseudostroma, psudostroma greyish white, yellow, yellowo–range, brown–black, black, red, ostiole apical; hymenium gelatinized, often inspersed, branched pseudoparaphyses; asci 8–spored, ascospores colourless, transversely 3–many septate; secondary metabolites lichexanthone and anthraquinones in pseudostromata often present or absent.

1. ***Trypethelium eluteriae*** Spreng. in Anleit. Gew. 3: 350, 1804. Plate 33 (c)

Description: Thallus crustose, yellowish brown, pruinose, corticated; ascomata perithecia yellow, immersed in pseudostromata, polycarpous, ostiole apical, black; peridium complete, hymenium colourless; ascus 8–spored, ascospores colourless, transversely 6–14 septate, 30–34 × 8–9.3 μm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not present.

Distribution: India (Andaman Nicobar Islands, Assam, Karnataka, Kerala, Meghalaya, Nagalnd, Tamil Nadu, West Bengal), Australia, Bahamas, Brazil, Colombia, Cuba, Mexico, Puerto Rico, Sri Lanka, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Falimari**, on the bark of *Artocarpus heterophyllus*, 25.12.2020, alt. 47.27 m, 26°30′151″ N, 90°41′403″ E, Suparna Biswas & Pabitra Biswas, 2020-0149 (BUBH); **Falimari,** on the bark of *Laurus* sp., 25.12.2020, alt. 43.62 m, 26°30′147″ N, 90°41′426″ E, Suparna Biswas & Pabitra Biswas, 2020-0150 (BUBH); **Kherbari Pt-II,** on the bark of *Aquilaria agallocha*, 21.11.2020, alt. 26.87 m, 26°25′639″ N, 89°74′399″ E, Suparna Biswas & Pabitra Biswas, 2020-0155 (BUBH); **Bilashipara Florican Garden**, on the bark of *Pongamia pinnata*, 10.02.2020, alt. 42.14 m, 26°25′163″ N, 90°27′603″ E, Suparna Biswas & Pabitra Biswas, 2020-0156 (BUBH), 61645 (LWG); **Kismat hasdaha Pt-II**, on the bark of *Artocarpus heterophyllus*, 22.11.2020, alt. 29.89 m, 26°05′039″ N, 89°89′315″ E, Suparna Biswas & Pabitra Biswas, 2020-0163 (BUBH); **Panbari Tea Garden**, on the bark of *Michelia champaca*, 09.02.2020, alt. 51.69 m, 26°15′303″ N, 90°05′093″ E, Suparna Biswas &

Pabitra Biswas, 2020-0165 (BUBH);, **Kherbari Pt-II**, on the bark of *Artocarpus heterophyllus*, 21.11.2020, alt. 36.87 m, 26°25′639″ N, 89°74′399″ E, Suparna Biswas & Pabitra Biswas, 2020-0166 (BUBH); **Satrasal**, on the bark of *Mesua ferrea*, 04.01.2020, alt. 36.30 m, 26°16′324″ N, 89°73′411″ E, Suparna Biswas & Pabitra Biswas, 2020-0479 (BUBH); **Gauripur Matiabag Hawakhana**, on the bark of *Michelia champaca*, 08.02.2020, alt. 47.60 m, 26°09′788″ N, 89°97′557″ E, Suparna Biswas & Pabitra Biswas, 2020-0507 (BUBH); **Panbari Tea Garden**, on the bark of *Michelia champaca*, 09.02.2020, alt. 46.17 m, 26°15′277″ N, 90°05′100″ E, Suparna Biswas & Pabitra Biswas, 2020-0600 (BUBH); **Panbari Tea Garden**, on the bark of *Albizia* sp., 09.02.2020, alt. 47.27 m, 26°15′303″ N, 90°05′091″ E, Suparna Biswas & Pabitra Biswas, 2020-0764 (BUBH); **Bilashipara Florican Garden**, on the bark of *Pongamia pinnata*, 10.02.2020, alt. 32.59 m, 26°25′064″ N, 90°27′605″ E, Suparna Biswas & Pabitra Biswas, 2020-0773 (BUBH).

Ecology: The species is found growing on the bark of *Artocarpus heterophyllus*, *Laurus* sp., *Aquilaria agallocha, Pongamia pinnata, Michelia champaca, Mesua ferrea*, *Albizia* sp. at an elevation of 26.87 m to 51.69 m.

Remarks: The species shows variation in thallus and pseudostromata colour (Gupta and Sinha 2018).

***Viridothelium* Lücking *et al.* in Lichenologist, 48(6): 758, 2016. (Family: Trypetheliaceae)**

Thallus crustose, corticated; ascomata perithecia, simple or aggregated in pseudostromata, ostiole apical, simple or fused, black; hymenium colourless, clear or inspersed, paraphysoides anastomosing; ascus 8–spored, ascospores colourless, transversely septate; no secondary metabolites present except anthraquinones.

1. ***Viridothelium virens*** (Tuck. ex E. Michener) Lücking, M.P. Nelsen & Aptroot, in Lichenologist 48(6): 759, 2016. Plate 33 (d)

Basionym: *Trypethelium virens* Tuck. ex. E. Michener, in Darlington, Fl. Cestrica, Edn. 3 (Philadelphia): 453, 1853.

Description: Thallus crustose, olive green to yellowish, corticated, smooth; ascomata perithecia yellow, pseudostromata distinct, stromata brown black to black, polycarpous, ostiole apical,

black, hymenium colourless, clear; ascus 8–spored, ascospores colourless, transversely 9–11 septate, fusiform, I+ weakly violet, 39–42× 8–9 µm.

Chemistry: Thallus K–, C–, KC–, P–; UV–; TLC: lichen substance not detected.

Distribution: India (West Bengal), Canada, Colombia, Japan, Mexico, Thailand, USA.

Specimen examined: INDIA: Assam, Dhubri district, **Bilashipara Florican Garden**, on the bark of *Pongamia pinnata*, 10.02.2020, alt. 36.23 m, 26°25′063″ N, 90°27′652″ E, Suparna Biswas & Pabitra Biswas, 2020-0152 (BUBH), 61648 (LWG).

Ecology: The species is found growing on the bark of *Pongamia pinnata* at an elevation of 36.23 m. Distributed in mostly temperate regions of the world.

Remarks: The species is characterized by distinct pseudostromata, stromata brown black to black, polycarpous, ostiole apical, black, ascospores transversely 9–11 septate, fusiform, I+ weakly violet. The species is a new record to Assam.

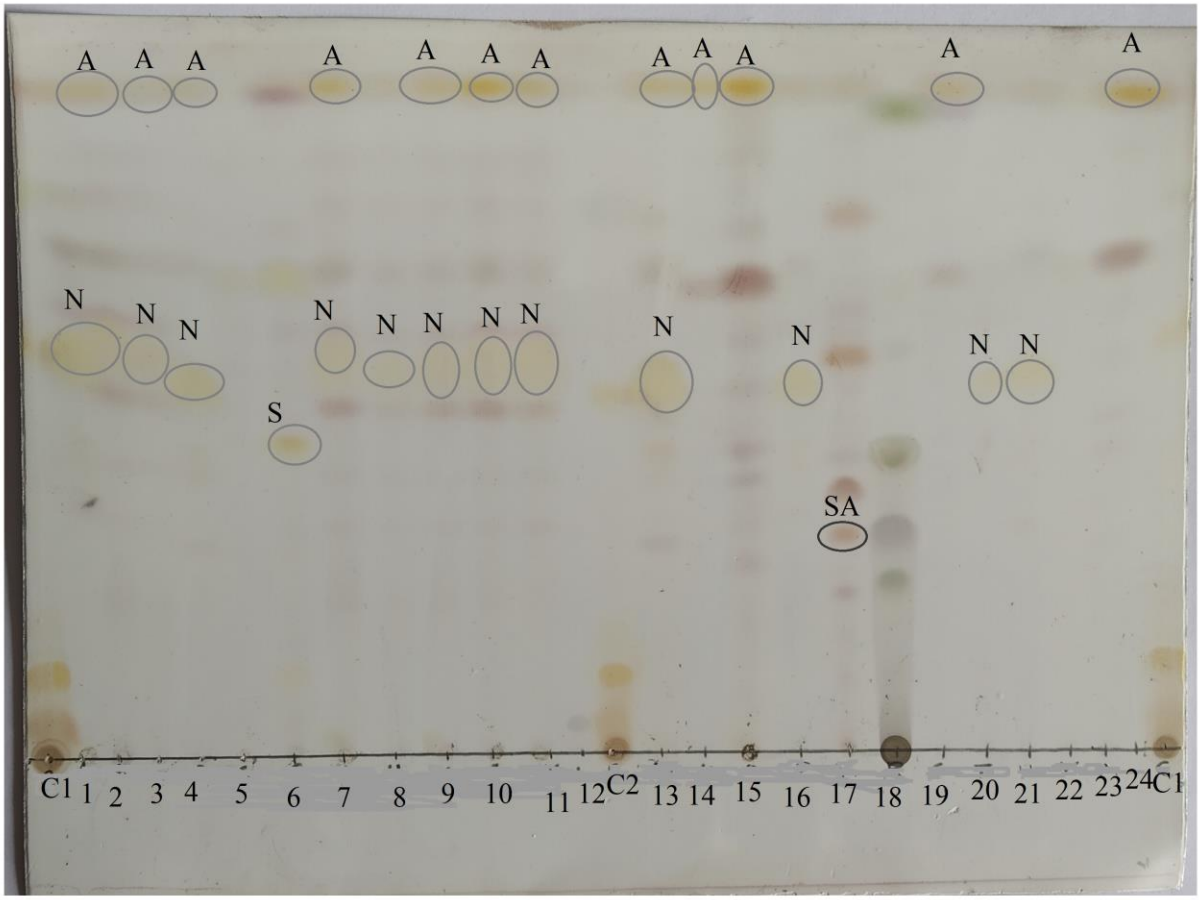

Fig 4.6: TLC for different identified lichen taxa of *Graphis* and *Bacidia* 1. *Graphis alboglaucescens*, 2. *G. analoga*, 3. *G. aperiens*, 4. *G. anfractuosa*, 5. *G. arbusculaeformis*, 6. *G. dendrogramma*, 7. *G. caesiella*, 8. *G. caesiocarpa*, 9. *G. crebra*, 10. *G. cremicolor*, 11. *G. coarctata*, 12. *G. conferta*, 13. *G. eburnea*, 14. *Bacidia alutacea*, 15. *B. millegrana*, 16. *G. emersa*, 17. *G. bakeri*, 18. *G. consimilis*, 19. *B. convexula*, 20. *G. filiformis*, 21. *G. librata*, 22. *G. dracaenae*, 23. *G. enteroleuca*, 24. *B. personata*, C_1, C_2- Control (*Parmelinella wallichiana);* A, N, S and SA denotes Atranorin, Norstictic acid, Stictic acid and Salazinic acid respectively.

The genera, *Allographa* and *Graphis* are so closely related that identification of the genera by considering only morphological, anatomical characters are not enough. Morphology-based phylogenetic binning technique has to be employed for most of *Graphis* sp. with high assurance to either genus (Berger *et al*. 2011). The genus, *Bacidina* and *Bacidia* were put into the single genus, *Bacidia*. However, on the basis of thallus, cell structure of the proper exciple, presence of goniocysts, presence of crystals in the cortex, size of conidiogenous cells, these are segregated into independent genus (Ekman 1996). Secondary metabolites of some of the *Graphis* and *Bacidia* species observed in Thin Layer Chromatography (TLC) are shown in **Fig 4.6**.

Lichen species *Caloplaca bassiae, Chrysothrix candelaris, C. chlorina, Dirinaria applanata, D. consimilis, Parmotrema presorediasum, P. saccatilobum, and Pyxine cocoes* were also reported from the historical monuments of Sonitpur district of Assam (Choudhury *et al.* 2016). *Arthonia dispersula, Dirinaria picta, Graphis scripta, Lecanora achora, Parmotrema mesotropum, Phaeophyscia hispidula, Pyrenula brunnea* were also reported from the barks of magnicolous plants of Odisha, India (Panda *et al*. 2017)

Lichen compounds are known to have various biological properties. Some of the identified lichen species with their properties are mentioned in **Table 4.5.** Based on the availability of their biomass, they may be further use for the welfare for animals including human being as well as other economically important crop plants or trees.

Table 4.5: List of some lichens enumerated from the district and their properties

Sl. no.	Lichen species	Properties	References
1	*Dirinaria aegialita*	Antimicrobial, antioxidant, anticancer	Pradhan *et al*. (2022)

2	*D. applanata*	Antimicrobial	Pradhan *et al*. (2022)
3	*D. papillulifera*	Antimicrobial	Pradhan *et al*. (2022)
4	*D. picta*	Antimicrobial	Pradhan *et al*. (2022)
5	*D. consimilis*	Anti-inflammatory	Tatipamula and Vedula (2018)
6	*Graphis ajarekarii*	Antioxidant, antidiabetic	Tatipamula *et al.* (2018)
7	*G. hossei*	Antioxidant	Behera *et al*. (2003; 2004)
8	*G. pyrrhocheiloides*	Antioxidant	Behera *et al*. (2003; 2004)
9	*G. scripta*	Antimicrobial, antioxidant, anticancer	Yamamoto *et al.* (1998)
10	*Parmotrema tinctorum*	Antioxidant,antimicrobial, antidiabetic	Tatipamula *et al.* (2018a), Rajan *et al.* (2016)
11	*P. praesorediosum*	Antimicrobial, antioxidant, anticancer	Pradhan *et al*. (2022)
12	*P. saccatilobum*	Analgesic, anti-inflammatory	Bugni *et al*. (2009)
13	*Physcia aipolia*	Antimicrobial	Rankovic´ *et al.* (2008)

4.2 PHYTOCHEMICAL SCREENING:

Both methanolic and hexane extracts of all the tested lichen species showed the presence of compounds viz. alkaloid, flavonoid, phenol, tannin and triterpenoids (**Table 4.6).** Presence of the above mentioned compounds indicates their potential antimicrobial property. However, all the tested lichen species showed absence of saponin. Presence of secondary compounds in the lichen samples was observed better in methanolic extracts than the hexane extracts.

Table 4.6: Phytochemical analysis of the methanolic and hexane crude extracts of the selected foliose lichen species

Lichen substance	**Tests Performed**	**L1**		**L2**		**L3**		**L4**		**L5**		**L6**		**L7**	
		M	**H**	**M**	**H**	**M**	**H**	**M**	**H**	**M**	**H**	**M**	**H**	**M**	**H**
Alkaloid	Dragondroff's test	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Mayer's reagent test	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Wagner's reagent test	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Flavonoid	NaOH	+	+	+	+	+	+	+	+	+	+	+	+	–	–

	solution test														
	Ammonium test	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Aluminium Chloride test	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Phenol	Nitrous Acid test	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Ferric Chloride test	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Tannin	Ferric Chloride test	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Saponin	Foam test	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Triterpenoids	Salkowski test	+	+	+	+	+	+	+	+	–	–	+	+	+	+

L1-*Dirinaria applanata,* L2- *Dirinaria consimilis,* L3- *Dirinaria papillulifera,* L4- *Dirinaria picta,* L5- *Parmotrema saccatilobum,* L6- *Pyxine cocoes,* L7- *Pyxine reticulata;* M-Methanol, H-Hexane; (+) indicates presence and (–) indicates absence

Furthermore, the thin layer chromatography of the selected lichen species showed the presence of secondary compounds such as atranorin, divaricatic acids, sekikaic acids, protocetraric acids, lichexanthone and triterpenes (**Fig 4.7**). These compounds are known to have potent antimicrobial activity.

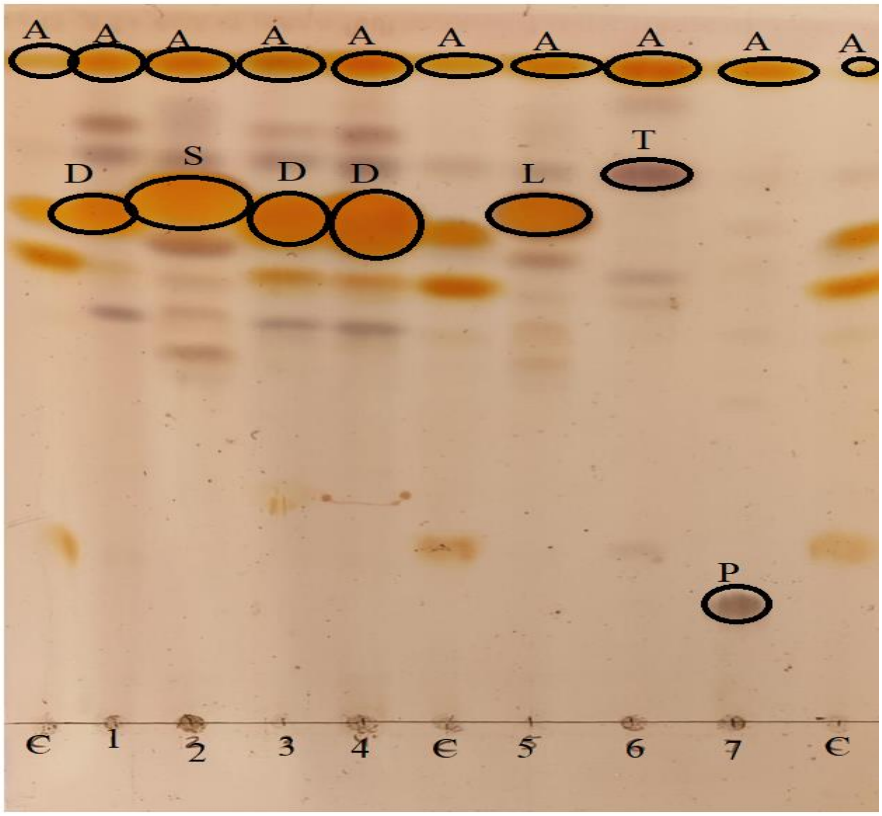

Fig 4.7: **TLC of the lichen species selected for antimicrobial test**: 1. *D. applanata,* 2. *D. consimilis,* 3. *D. papillulifera,* 4. *D picta,* 5. *Pyxine cocces,* 6. *P. reticulata* and 7. *Parmotrema saccatilobum,* C. Control (*Parmelinella wallichiana*); A, D, L, S, P and T denotes Atranorin, Divaricatic acid, Lichexanthone, Sekikaic acid, Protocetraric acid and Triterpenes respectively.

4.3 ESTIMATION OF TOTAL PHENOLIC AND FLAVONOID CONTENT:

4.3.1 Total Phenolic content:

Total phenol content was determined as Gallic acid equivalent (GAE), using the equation obtained from gallic acid standard curve (Y=0.0072x+0.5511) (**Fig 4.8**). Phenolic content of all the lichen species were higher in methanolic extract than the hexane extract. Highest phenolic content was found in methanolic extracts of *D. picta* (112.33±0.13 mg GAE g^{-1}DW) followed by *D. papillulifera* (73.84±3.19 mg GAE g^{-1}DW) (**Fig 4.9**).

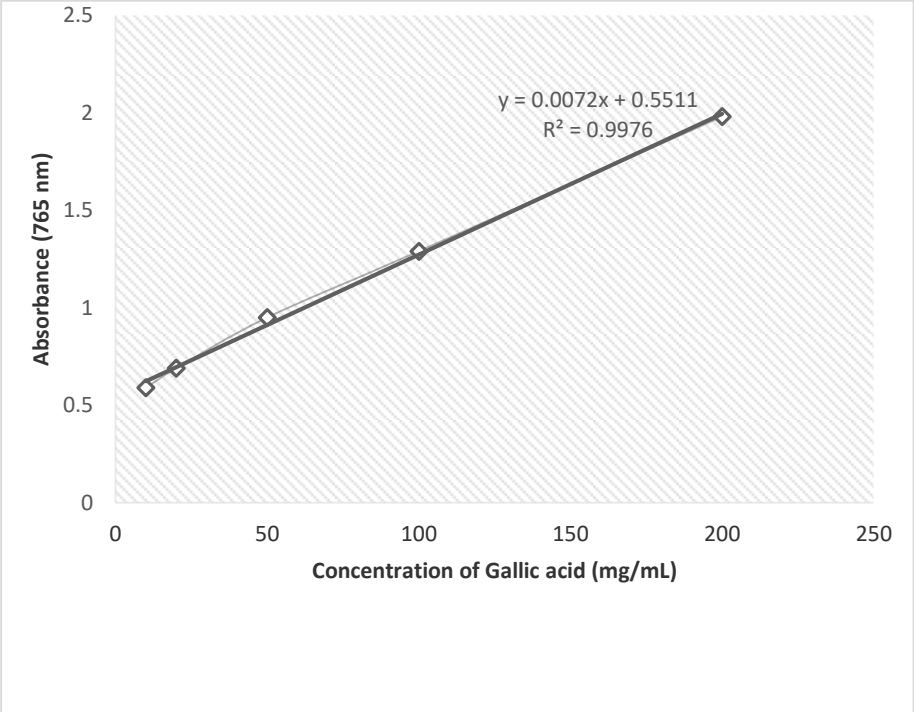

Fig 4.8: Calibration curve for standard Gallic acid

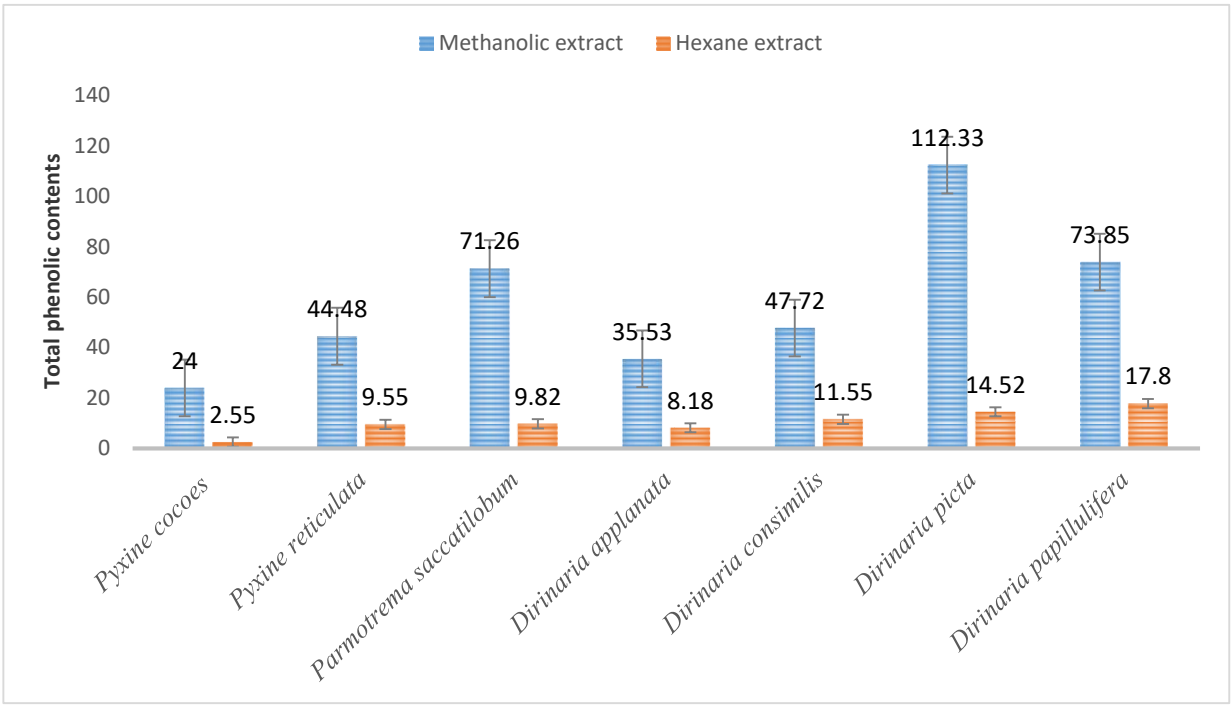

Fig 4.9: Total phenolic contents (mg GAE g^{-1}DW) of lichen species selected for antimicrobial activity

Phenolic compounds was more in methanolic extracts i.e. the polar solvent than in hexane extracts i.e. non-polar solvent. Phenols are the largest classes of secondary metabolites of lichens which have anti-inflammatory, antiallergic, anticancer, antihypertensive, antirheumatic, and antibacterial activity. The antimicrobial properties of phenolic compounds are explained by the presence of phenolic hydroxyl groups and the number of which is in correlation with their toxicity towards pathogenic microorganisms. The probable mechanisms of this action include inhibition of extracellular microbial enzymes, deprivation of the substrates required for microbial growth, or direct action on microbial metabolism through inhibition of oxidative phosphorylation, by sulfhydryl groups and some nonspecific interactions (Cowan 1999).

4.3.2 Total flavonoid content:

Total flavonoid content was determined by Quercetin equivalent (QE) using the equation obtained from quercetin standard curve (Y=0.0025x+0.0044) (**Fig 4.10**). The total flavonoid content was also higher in methanolic extracts than in hexane extracts. Highest flavonoid content was found in methanolic extract of *D. papillulifera* (26.54±0.67 mg QE g^{-1}DW) followed by *D. picta* (21.23±1.35 mg QE g^{-1}DW) (**Fig 4.11)**.

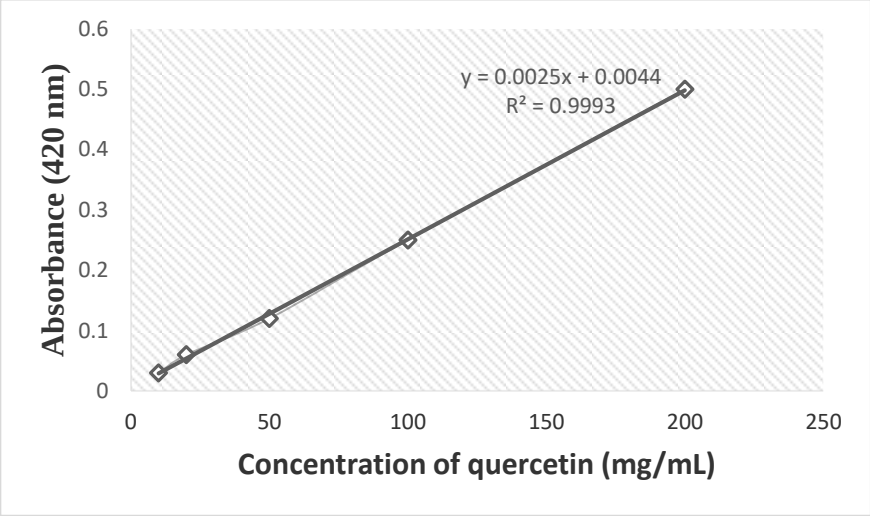

Fig 4.10: Calibration curve for standard Quercetin

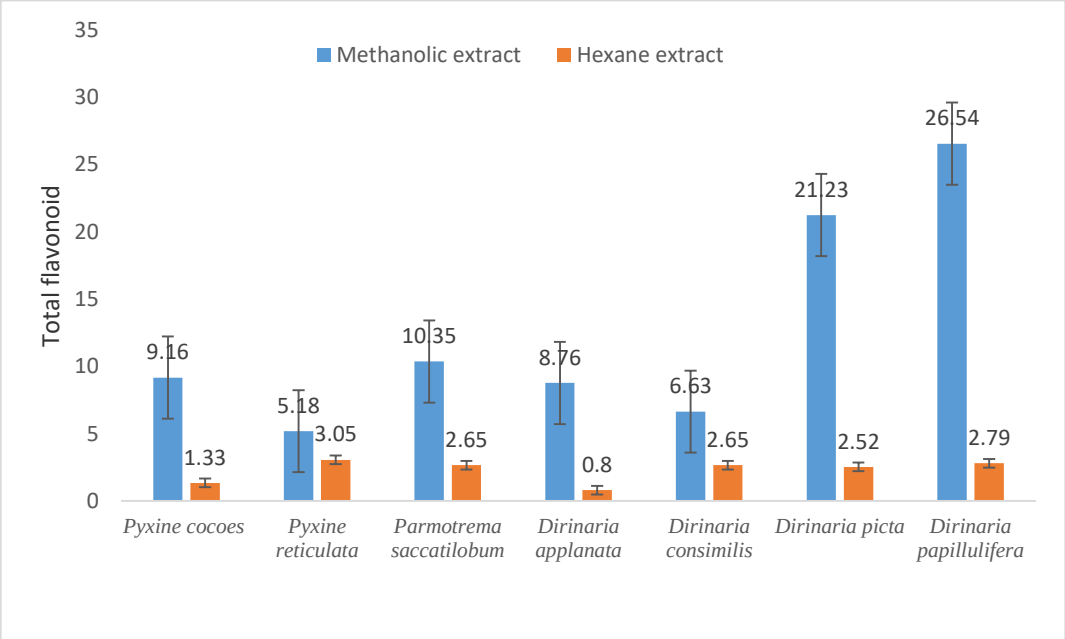

Fig 4.11: Total flavonoid contents (mg QE g^{-1}DW) of lichen species

Flavonoids are the most important natural phenolics compounds with low molecular weight having broad spectrum of chemical and biological activities including free radical scavenging properties (Zawawi *et al.* 2021).

Depsidones are produced by oxidative cyclization of depsides, have an additional ether bond between aromatic rings. Depsidone and depside compounds of lichens are atranorin, divaricatic acid, lecanoric acid, evernic acid, salazinic acid, physodic acid, stictic acid and they have potent antimicrobial activity (Kosanic´ *et al*. 2013, 2014a; Manojlovic´ *et al*. 2012; Rankovic´ *et al.* 2014).

Anthraquinones such as parietin, parietinic acid, emodin, fallacinol, fallacinal, and xanthones are important secondary metabolites were shown to have a high antimicrobial effect (Manojlovic´ *et al.* 2002; 2010). There is no clear mechanisms regarding microbial invasion of depsides, tridepsides, tetradepsides, depsidones, anthraquinones, and xanthones. The viable mechanisms of antimicrobial activity of lichen extracts are inhibition of synthesis of cell wall, protein, nucleic acids; cell membranes alteration; antimetabolite activity (Cowan 1999).

These species are rich in secondary metabolites for which they are used for bioprospection studies. In recent advances regarding lichenological studies in India researchers are trying to

develop anti-microbial nanomaterials from lichen compounds. As lichen metabolites have more functional polar groups and have different active sites, potent nano-materials can be easily synthesise and employ it for various economic uses.

4.4 SCREENING OF ANTIMICROBIAL ACTIVITIES:

4.4.1 Disc diffusion:

The antimicrobial activity of the methanolic and hexane extracts of selected lichen species against tested phytopathogens by disc diffusion method are shown in **Table 4.7**. The activity was observed to be more in methanolic extracts than hexane extracts and represented by zone of inhibition.

It was also observed that the methanolic extracts of all the lichen species were found to be more active against *P. oryzae* and *C. gloesporoides* with greater zone of inhibition than the positive control. Among the lichen species, methanolic extracts of ***D. picta*** showed more zone of inhibition compared to other lichen species against all the four tested pathogens.

Table 4.7: Zone of inhibition (ZOI) of the selected lichen species against the tested phytopathogens

Sl. no.	Lichen species	Lichen extract (3mg/ml)	Zone of inhibition (mm)			
			S1	S2	S3	S4
1	*Dirinaria applanata*	Methanol	21.66±2.35	26.66±1.88	21.33±2.62	12.66±0.94
		Hexane	13.00±0.94	21.33±0.47	10.66±1.24	7.66±0.47
2	*D. consimilis*	Methanol	16.00±0.00	24.66±1.24	23.66±1.25	12.00±0.81
		Hexane	12.00±0.00	20.66±2.35	11.66±2.35	10.00±0.81
3	*D. papillulifera*	Methanol	23.00±0.81	27.66±1.88	25.66±2.05	13.00±0.81
		Hexane	13.00±0.81	23.00±1.63	10.33±0.47	9.66±0.47
4	***D. picta***	**Methanol**	**23.66±0.47**	**28.33±1.69**	**27.00±1.41**	**17.00±1.41**
		Hexane	13.33±0.40	23.66±1.24	11.33±0.47	12.00±0.81
5	*Parmotrema saccatilobum*	Methanol	22.66±1.69	27.00±1.41	24.33±0.94	13.33±1.24
		Hexane	13.33±0.47	23.66±3.39	14.33±3.29	10.66±0.47
6	*Pyxine cocces*	Methanol	21.00±0.81	23.33±2.35	18.66±0.94	10.66±1.24

		Hexane	14.33±0.47	21.66±1.69	13.00±1.41	7.33±0.47
7	*P. reticulata*	Methanol	22.33±0.47	22.66±1.69	20.00±0.00	10.33±0.47
		Hexane	14.00±0.47	20.66±0.47	11.33±1.88	8.00±0.00
8	*Positive control		**25.00±0.00**	15.67±0.94	16.33±0.94	**20.67±0.94**
9	Negative control		–	–	–	–

S1- *X. oryzae*; S2- *P. oryzae*; S3- *C. gloeosporioides*; S4- *S. sclerotiorum*, *Amoxycilin and Nystatin

The ZOI induced by the **methanolic extracts** of the lichen species against the pathogens were in the order:

1. Against ***X. oryzae*****:** *D. picta > D. papillulifera > P. saccatilobum > P. reticulata > D. applanata > P. cocoes > D. consimilis*
2. Against ***P. oryzae*****:** *D. picta > D. papillulifera > P. saccatilobum > D. applanata > D. consimilis > P. cocoes > P. reticulata*
3. Against ***C. gloeosporioides*****:** *D. picta > D. papillulifera > P. saccatilobum > D. consimilis > D. applanata > P. reticulata > P. cocoes*
4. Against ***S. sclerotiorum*****:** *D. picta > P. saccatilobum > D. papillulifera > D. consimilis > D. applanata > P. cocoes > P. reticulata*

Similarly, the ZOI induced by the hexane extracts of the lichen species against the tested pathogens were in the order:

1. Against ***X. oryzae*****:** *P. cocoes > P. reticulata > D. picta = P. saccatilobum > D. papillulifera = D. applanata > D. consimilis*
2. Against ***P. oryzae*****:** *D. picta = P. saccatilobum > D. papillulifera > P. cocoes > D. applanata > D. consimilis = P. reticulata*
3. Against ***C. gloeosporioides*****:** *P. saccatilobum > P. cocoes > D. consimilis > D. picta = P. reticulata > D. applanata > D. papillulifera*
4. Against ***S. sclerotiorum*****:** *D. picta > P. saccatilobum > D. consimilis > D. papillulifera > P. reticulata > D. applanata > P. cocoes*

From the above results it is evident that the methanolic extracts of *D. picta* have better potential antifungal activity against the tested phytopathogenic strains. The extracts were effective in inhibiting the mycelial growth of phytopathogenic fungi and the vulnerability to the extract was in the order: *P. oryzae* > *C. gloeosporioides* > *X. oryzae* > S. *sclerotiorum.*

4.4.2 Minimal inhibitory concentrations (MIC) and IC_{50} values

The Minimal inhibitory concentrations and IC_{50} values of the lichen species against the tested phytopathogens are given in **Table 4.8**. The MIC values of the methanolic extracts were lower than that of hexane extracts. The reason behind this in methanolic solvents the secondary compounds dissolved in more quantity than the hexane extracts.

MIC values of the methanolic extracts of all the lichen species to inhibit the pathogens *P. oryzae* and *C. gloeosporioides* were lower than the positive control.

Table 4.8: MIC and IC_{50} values of the tested foliose lichens against tested phytopathogens

Sl. no.	Lichen species	Lichen extract	S1		S2		S3		S4	
			MIC (µg/ml)	IC_{50} (µg/ml)	MIC (µg/ml)	IC_{50} (µg/ml)	MIC (µg/ml)	IC_{50} (µg/ml)	MIC (µg/ml)	IC_{50} (µg/ml)
1	*Dirinaria applanata*	Methanol	2100	766.49	1800	954.44	1800	803.23	1800	881.11
		Hexane	3000	1573.62	2400	1013.75	3000	1382.79	3000	1260.59
2	*D. consimilis*	Methanol	2400	628.93	1800	762.03	1800	590.14	1800	628.02
		Hexane	3000	1268.21	2700	989.05	2400	829.22	2400	1349.82
3	*D. papillulifera*	Methanol	1500	647.04	1500	523.07	1500	493.7	1800	1012.66
		Hexane	3000	1504.92	2400	887.98	3000	1154.56	2700	1188.42
4	*D. picta*	Methanol	1500	743.37	**1200**	476.43	**1500**	669.36	1500	741.66
		Hexane	3000	1371.78	2100	611.53	2700	894.96	2100	965.319
5	*Parmotrema saccatilobum*	Methanol	1800	813.55	1500	660.39	1500	531.14	1800	813.55
		Hexane	3000	1560.54	2100	654.98	2400	838.29	2400	729.2

6	*Pyxine cocces*	Methanol	2100	760.12	1800	915.51	1800	581.95	2100	911.24
		Hexane	2700	745.99	2400	801.15	2400	806.94	3000	1308.27
7	*P. reticulata*	Methanol	1800	954.44	2400	942.27	1800	363.14	2100	777.96
		Hexane	2700	942.02	2700	377.16	2700	838.25	2700	1108.89
8	*Positive control		900	615.25	3000	1046.08	2100	965.31	1200	596.86

S1- *X. oryzae*; S2- *P. oryzae*; S3-*C. gloeosporioides*; S4- *S. sclerotiorum*, *Amoxycilin and Nystatin

Therefore, it can be concluded that all the tested lichen species are remarkably more effective against the pathogens, *P. oryzae* and *C. gloeosporioides* and among the tested lichen species, *D. picta* is the most potent. The species is reported to consist of compounds such as divaricatic acid, carbamic acid, propionic acid, glycolic acid, 1,3-hydroxy-3-methylglutaric acid, ribonic acid, gluconic acid, β-amyrone and various sugar and amino acid moieties, naphthalene, acenaphthylene, acenaphthene, anthracene, phenanthrene, fluoranthene, pyrene, benzo anthracene and chrysene, 5-methyluridine, ethyl syringate, δ-guanidinovaleric acid, orsellinic acid, ethyl ester, 3,4-dihydroxyphenylvaleric acid, usnic acid, ethyl everninate, 2-O-methylatranorin which have potent antimirobial activity (Haung *et al*. 2017; Samdudin *et al.* 2013; Tatipamula *et al.* 2019). In a similar study, Ahmed *et al*. (2020) used acetone, methanol, petroleum ether, and diethyl ether extracts of three species of foliose lichen *Dirinaria picta, D. Papillulifera* and *D. applanata* against bacterial species, *Staphylococcus aureus* and *E. coli*. All the species were found far more effective than the positive control. Sahoo *et al.* (2021) revealed *Parmotrema andium* and *Dirinaria applanata* possess metabolites like alkaloids, phenols, flavonoids and saponins. Phytochemical analysis also revealed the presence of tannin and resin in *Dirinaria applanata*. Antimicrobial activity of *P. andium* and *D. applanata* against *Aspergillus niger, Bacillus subtilis, Candida albicans, E. coli, Fusarium oxysporum, Penicillium verrucosum, Staphylococcus aureus* and *Vibrio cholera* were tested. Zone of inhibition indicates

more effectiveness against the bacterial pathogens than the fungal origin, but less effective as compared to positive control.

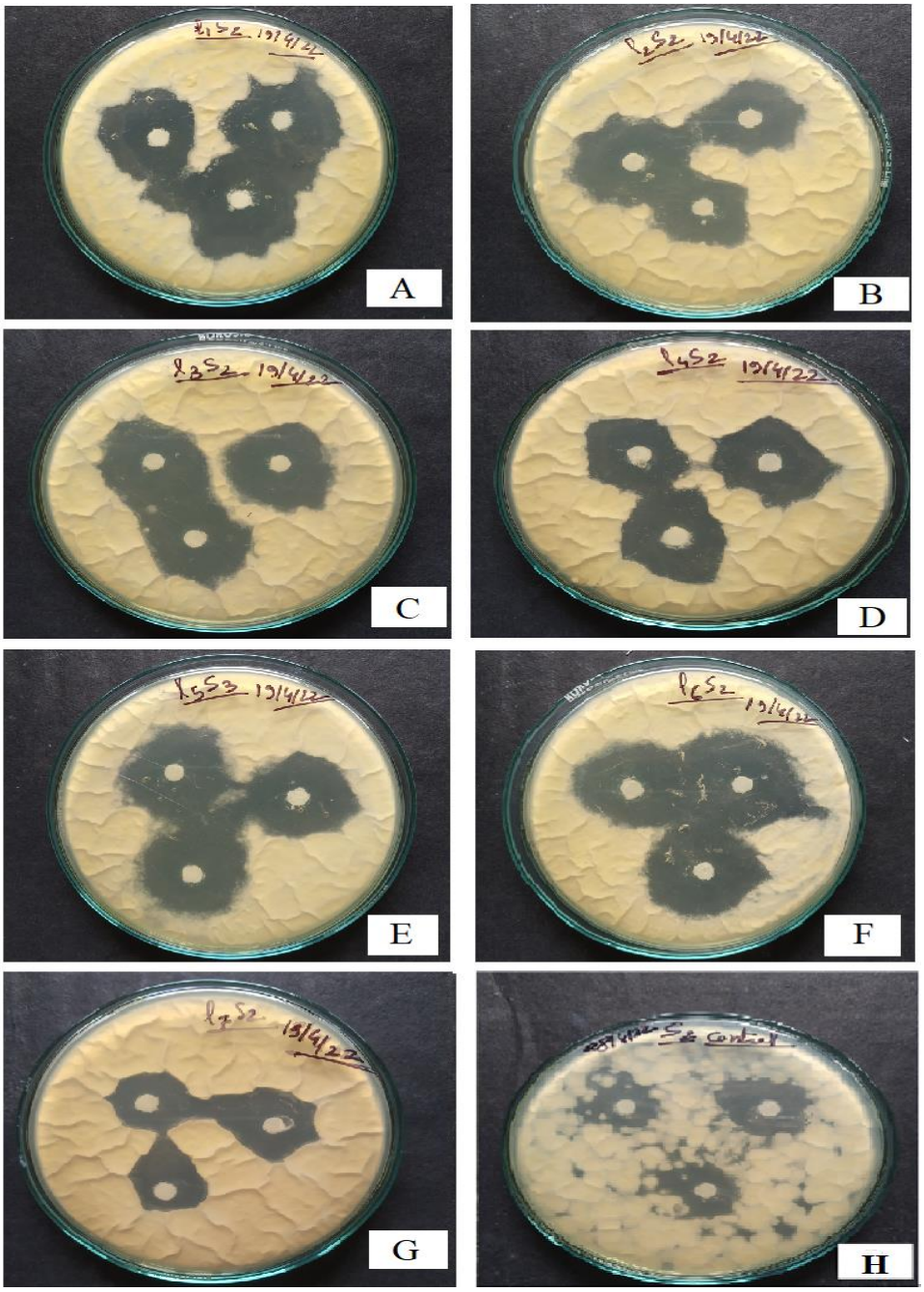

Fig 4.12: Methanolic extracts of lichen species against ***P. oryzae***, A- *Dirinaria picta*; B- *D. papillulifera*; C- *Parmotrema saccatilobum*; D- *D. applanata*; E- *D. consimilis*; F- *Pyxine cocoes*; G- *P. reticulata*; H- Nystatin

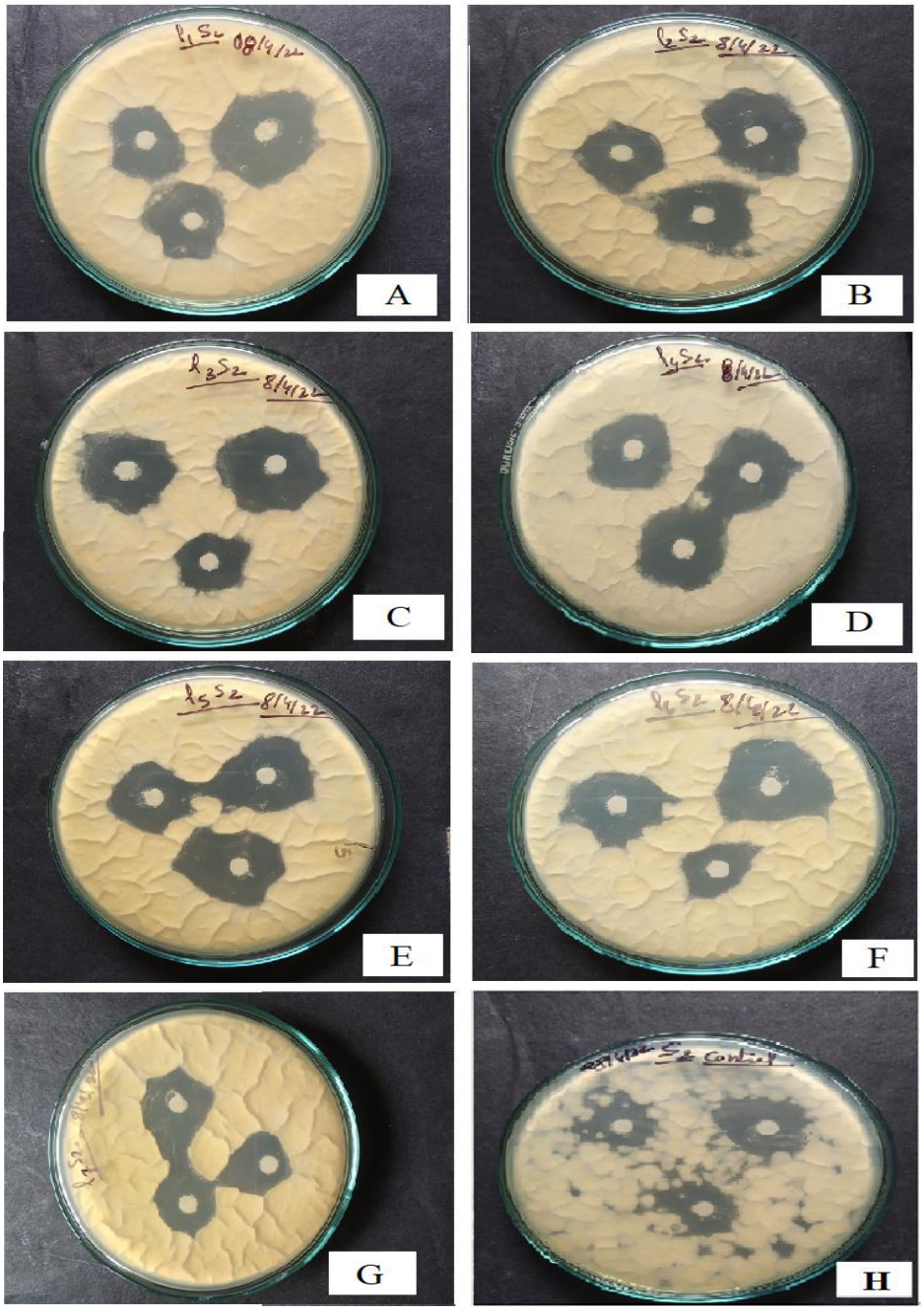

Fig 4.13: Hexane extracts of lichen species against ***P. oryzae***, A- *D. picta*; B- *P. saccatilobum*; C- *D. papillulifera*; D- *Pyxine cocoes*; E- *D. applanata;* F- *D. consimilis;* G- *Pyxine reticulata*; H- Nystatin

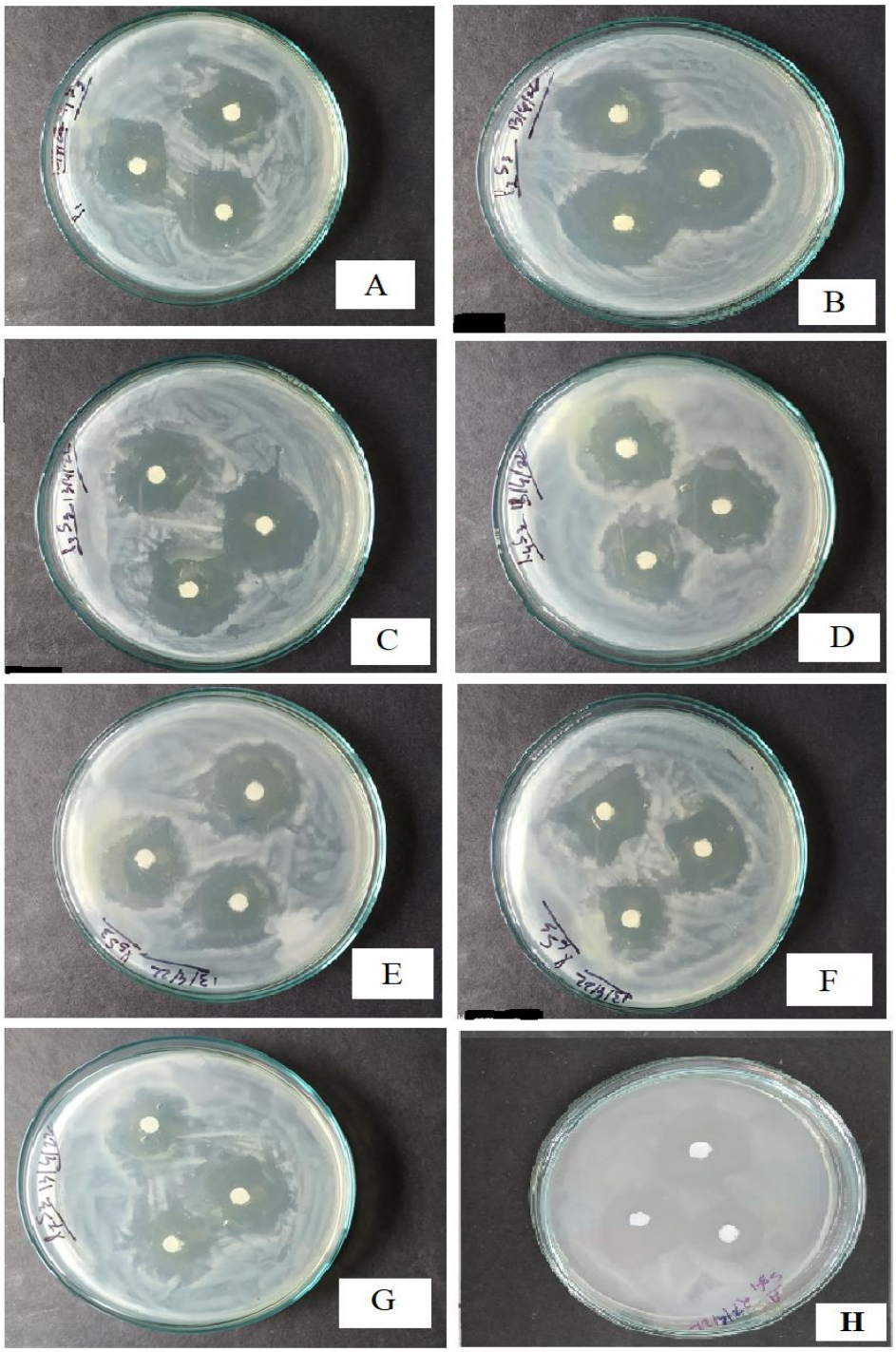

Fig 4.14: Methanolic extracts of lichen species against ***C. gloeosporioides,*** A- *Dirinaria papillulifera;* B- *D. picta*; C- *Parmotrema saccatilobum*; D- *D. consimilis;* E- *D. applanata*; F- *Pyxine reticulata; G- P. cocoes*; H- Nystatin

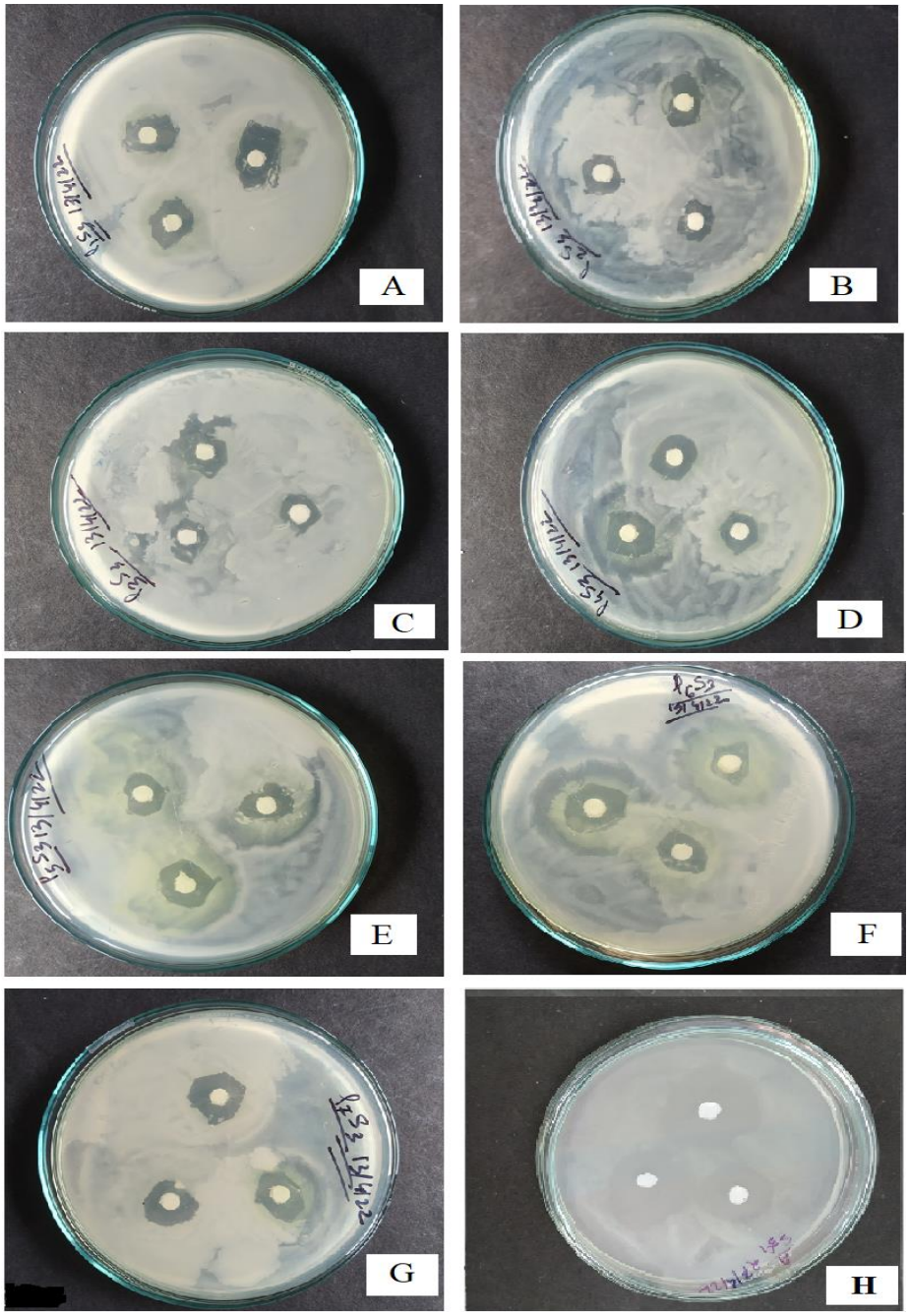

Fig 4.15: Hexane extracts of lichen species against ***C. gloeosporioides,*** A- *P. saccatilobum*; B- *P. cocoes;* C- *D. consimilis; D- D. picta;* E- *P. reticulata;* F- *D. applanata*; G- *D. papillulifera*; H- Nystatin

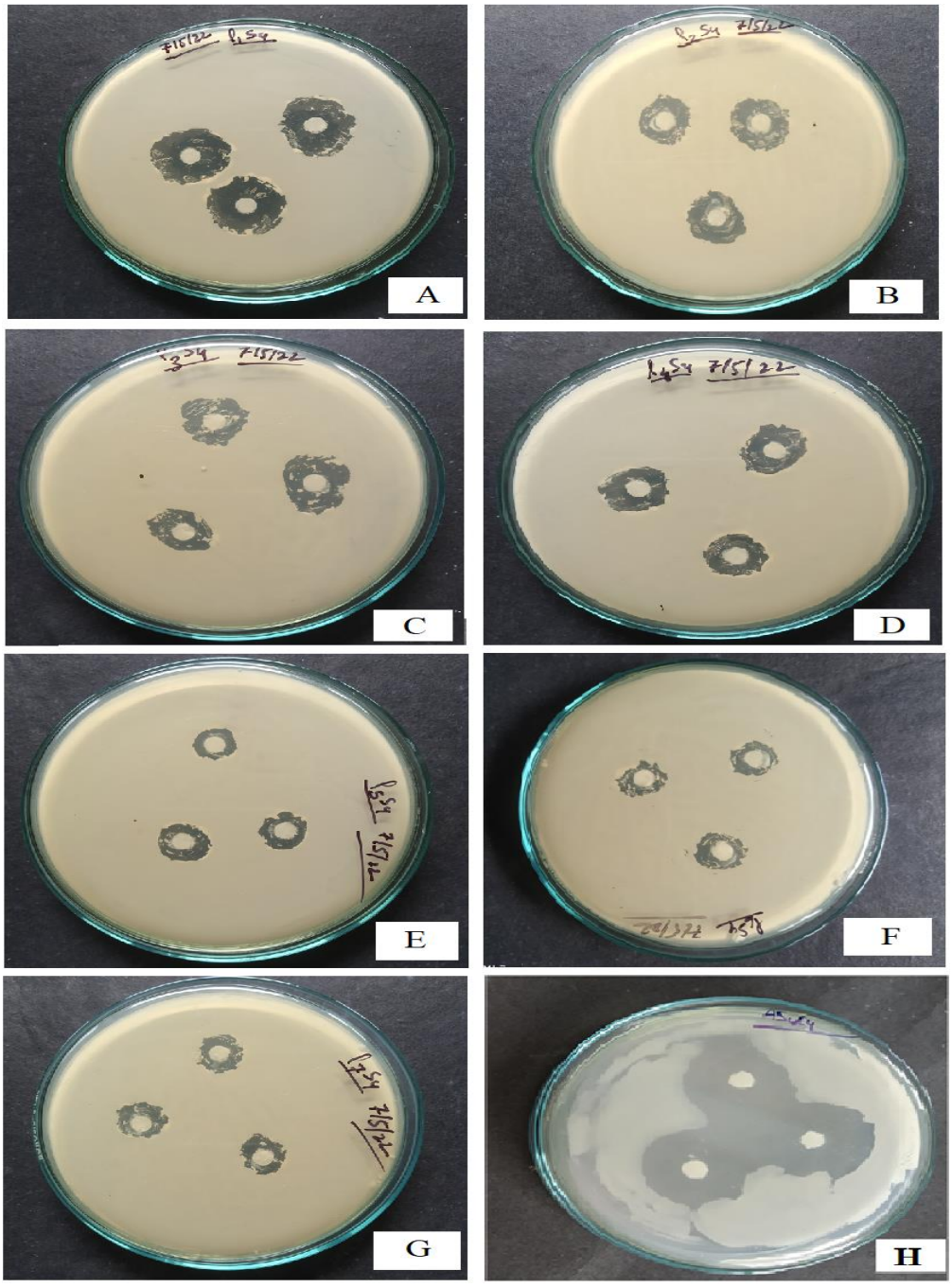

Fig 4.16: Methanolic extracts of lichen species against ***S. sclerotiorum***, A- *D. picta;* B- *P. saccatilobum*; C- *D. papillulifera*; D- *D. consimilis;* E- *D. applanata*; F- *P. cocoes;* G- *P. reticulata*; H- Nystatin

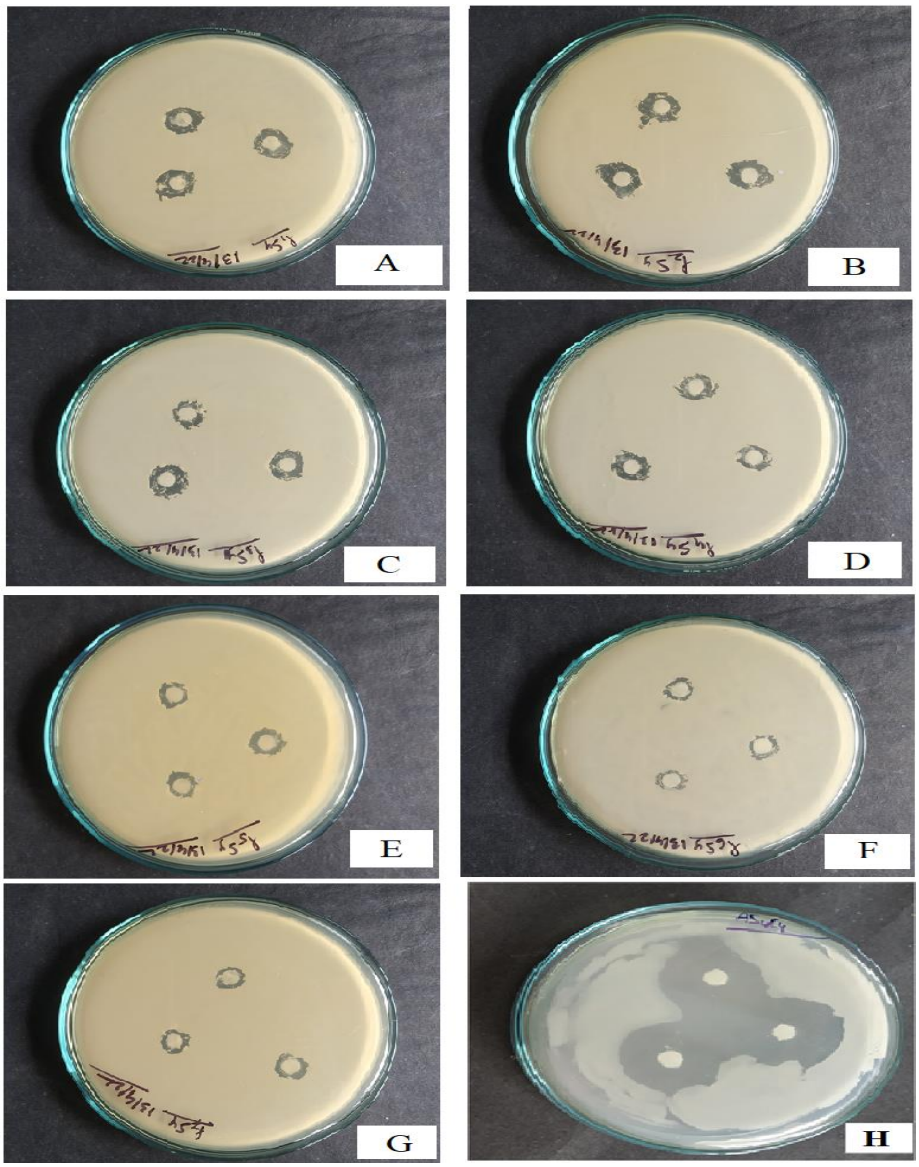

Fig 4.17: Hexane extracts of lichen species against ***S. sclerotiorum***, A- *P. saccatilobum*; B- *D. picta;* C- *D. consimilis*; D- *D. papillulifera;* E- *P. reticulata*; F- *D. applanata;* G- *P. cocoes*; H- Nystatin

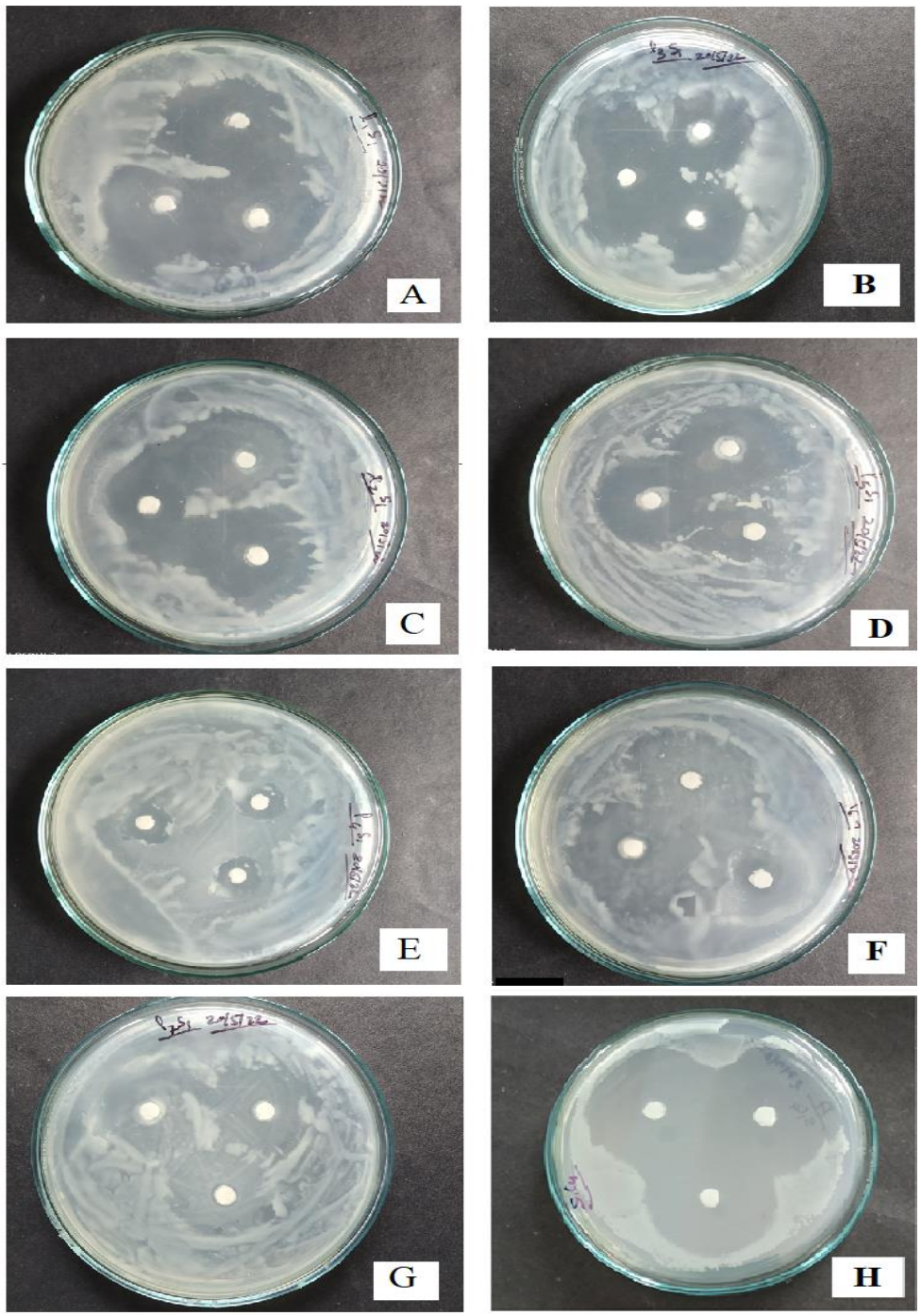

Fig 4.18: Methanolic extracts of lichen species against ***X. oryzae***, A- *D. picta;* B- *D. papillulifera*; C- *P. saccatilobum*; D- *P. reticulata*; E- *D. applanata*; F- *P. cocoes;* G- *D. consimilis*; H- Amoxycilin

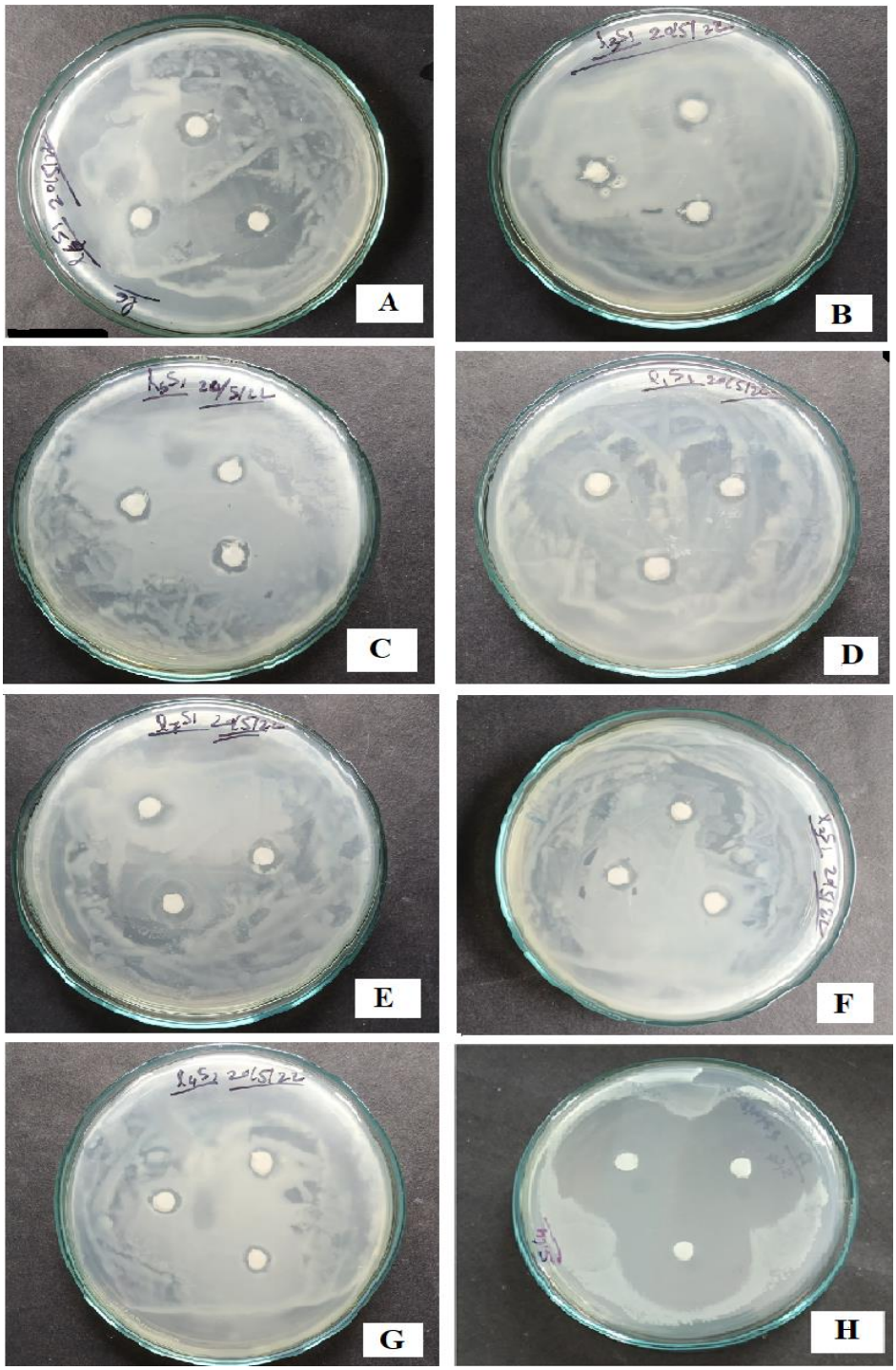

Fig 4.19: Hexane extracts of lichen species against ***X. oryzae***, A- *P. cocoes;* B- *P. reticulata*; C- *D. picta*; D- *P. saccatilobum;* E- *D. papillulifera*; F- *D. applanata;* G- *D. consimilis;* H- Amoxycilin