RESEARCH ARTICLE

Floristic Diversity Status Assessment of Lichens from Dima Hasao District, North East, India

Gaurav K. Mishra, Sanjeeva Nayaka*, Dalip K. Upreti

DOI: 10.18811/ijpen.v5i02.3

Abstract

An enumeration of 142 species of lichens belonging to 60 genera and 27 families from Dima Hasao district in North East region is provided. The present study supplemented 98 species new to the lichen biota of Assam. The study added one new record of basidiolichen [*Multiclavula vernalis* (Schw.) Petersen] to the lichen biota of India. The lichen genus *Graphis* with 21 species exhibit its dominance in the area followed by *Pyrenula* and *Parmotrema* with nine and eight species respectively. Among the different localities in the area Umrangso towards Khundog showed maximum diversity of lichens represented by 58 species followed by the locality in and around circuit house, represented by 42 species. The dominance of Graphidioid community in the area indicates an evergreen open canopy forest as well as the presence of smooth bark trees in the region.

Keywords: Biomonitoring, Distribution, Biodiversity, Basidiolichen.

International Journal of Plant and Environment (2019)

Introduction

The Dima Hasao district is mainly hilly ranges with different ecological settings of grassland to high altitude vegetation. The region is also endowed with abundant forest resources with many ethnic products, which are unique to the region. The forest cover of the district is 88.71% of which only 187 km2 (4.31%) is under very dense forest while open forest occupies 61% of the total forest area. The various type of forests throughout the district have tropical evergreen forests, tropical semi-evergreen forests, tropical moist and dry deciduous forests, sub-tropical forests, secondary forests and bamboo forests. The forests canopy of the district also provide excellent habitat for wildlife animals. The district also includes a village Jatinga which is popular as 'The Bird Mystery' where large number of migratory birds commits suicide every year. Earlier, the Dima Hasao district was known by the North Cachar Hills district.

The forest vegetation is dominated by a number of tree species such as *Albizia lebbeck, Castanopsis tribuloides, C. indica, Dillenia indica, Elaeocarpus robustus, E. floribundus, Gmelina arborea, Garcinia pedunculata, Mesuaferrea* sp., *Mangifera sylvatica, Morus laevigata, Melia composite, Quercus serrata, Syzygium operculatum, Stercularia roxburghii, Schima wallichii, Terminalia citrina, T. ballirica, T. chebula* and *Turpina pomifera*.

The lichens of north east region are extensively studied since last three decades and included in different monographic and revisionary studies on Indian lichens. Gupta and Sinha (2018) reported 300 species belonging to 83 genera and 26 families of lichens from the state of Assam, based on earlier published literatures and own. Recently, Gogoi *et al*. (2019) studied the lichens of Assam and 25 new records of lichens for the state have been added. In spite of floristic studies available in the past, still a number of localities in the district have not yet explored floristically, hence, in the present study an more intensive and systematic attempt has been made to record the floristic diversity of lichens from the unexplored areas of the district.

Materials and Methods

More than 500 lichen specimens growing on different substrates were collected from six forest sites of the present study area (Fig. 1). The specimens were grouped together with details of locality, substrate, ecological notes, date of collection, altitude, name of collector and specimen number. Out of six localities, Dihangi locality experience more human activities for collection of timber wood, fuel wood, fodder and frequent animal grazing. In and around circuit house, Umrangso towards Kopili, Umrangso towards Khundog, Ethonic village and Bara Halflong areas have more or less undisturbed forests due to low human activities.

The specimens were studied morphologically, anatomically and chemically. The morphological structures were studied under stereozoom microscope. The anatomical details of the thallus and fruiting bodies were studied in free hand section with water as mounting medium under compound microscope. The chemical substance in the thallus were identified through colour test technique by applying aqueous potassium hydroxide (K), Steiner's stable paraphenylenediamine (PD) and aqueous calcium hypochlorite (C) reagents. Thin layer chromatography was performed for identification of the lichen substances in solvent system A, following the techniques of Orange *et al*. (2001). For the authentic identification of different lichen taxa, literatures of Awasthi (1991, 2007); Divakar and Upreti (2005); Nayaka (2004); Upreti (1998); Gupta and Sinha (2018) were consulted. The identified specimens are preserved in the herbarium of CSIR-National Botanical Research Institute, Lucknow (LWG). The nomenclature of the identified species was updated based on the modern concept of lichen systematics (Lücking *et al*., 2016).

CSIR-National Botanical Research Institute, Rana Pratap Marg, Lucknow-226001 Uttar Pradesh, India.

Corresponding author: Dr. Sanjeeva Nayaka, Mobile: +91-8756104655
Email: nayaka.sanjeeva@gmail.com

How to cite this article: Mishra, G., K., Nayaka S., Upreti, D. K., Floristic Diversity Status Assessment of Lichens from Dima Hasao District, North East, India. 5(2): 84-91.

Source of support: Nil

Conflict of interest: None

Submitted: 12/02/2019 **Accepted:** 30/04/2019 **Published:** 30/04/2019

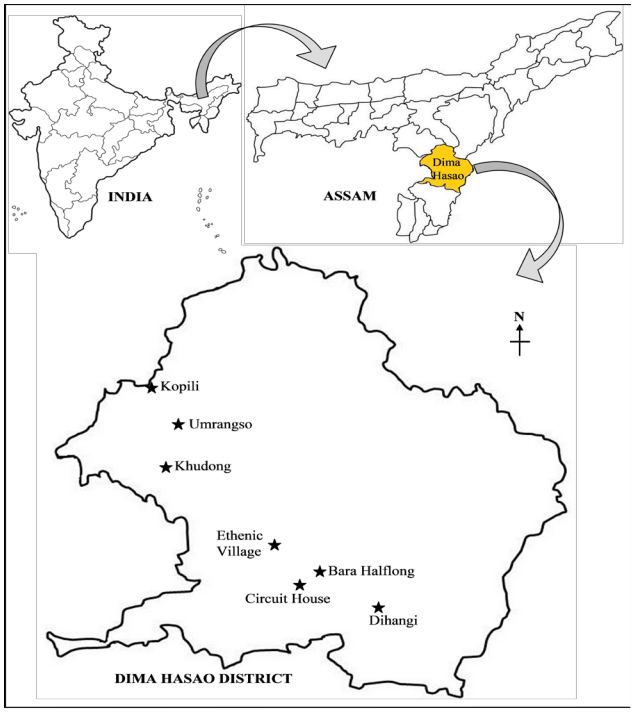

Fig. 1: Map showing collection sites in Dima Hasao district, Assam, India.

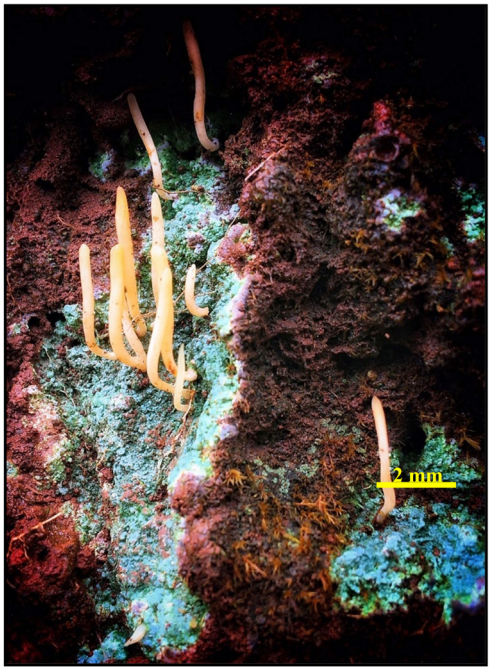

Fig. 2: Habitat of *Multiclavula vernalis* (Schw.) Peterson

The species

Multiclavula vernalis *(Schw.) Peterson (Fig. 2)*

Basionym: = *Clavaria vernalis* Schweiniz. 1822. Schr. Nat. Ges. Leipzing 1: 112.

Fruiting bodies simple, up to 2 cm high, clavate; creamy to straw orange colour, dull ochraceous orange when dry, then usually with a small white spot at the apex like cap; growing on soil and associated with the algae. Contextual hyphae somewhat parallel, loosely arranged towards the apex of the fruiting body, not agglutinated; short celled, thin to slightly thick-walled. Ascospores not seen.

Ecology and distribution

The species is widely distributed in North America (Bennett, 2006; Brodo *et al*., 2001; Nelsen, 2006), Michigan (Fryday *et al*., 2001), Tasmania (Petersen, 1967; Petersen and Kantvilas, 1986), United State and Canada (Esslinger, 2007; Nelsen, 2006). In India, the species is recorded from tropical area in the state of Assam between altitudes of 500 to 652 m, is a new record for Indian lichen biota.

Specimen examined

India, Assam, Dima Hasao district, Umrangso, alt. 500-652 m, on soil, 06.05.2017, D.K. Upreti, R. Verma & B.A. Khan 17-033657 (LWG).

Result and discussion

The identification of all the specimens collected resulted into the occurrence of 142 species belonging to 60 genera and 27 families (Table 1) including one basidiolichen. The study added 98 species new to the lichen biota of Assam, in which, crustose are dominant with 76 species followed by foliose, fruticose, leprose, dimorphic and squamulose with eight, one, eight, four, two species respectively. The lichen family Graphidaceae exhibits its dominance with nine genera and 36 species followed by Parmeliaceae with four genera and 13 species. Other lichen families in the study area showed poor representation with a single or two species each.

The crustose lichens exhibited their dominance in the area represented by 113 species followed by 14 foliose species and eight species of leprose lichens (Fig. 3). The lichen genus *Graphis* and *Pyrenula* with 21 and nine species each and *Parmotrema* with eight species showed the maximum diversity in the district. A total 40 genera shows poor diversity in the area as represented by a single or two species each. The study area shows dominance of bark loving lichen species (Corticolous) with 138 species followed by soil inhabiting (terricolous) lichens with four species. *Diorygma soozanum* (Zahlbr.) M. Nakan. & Kashiw, *Parmotrma tinctorum* (Despr. ex Nyl.) Hale, *P. reticulatum* (Taylor) M. Choisy and *Trypethelium eluteriae* Spreng., are the most commonly occurring taxa in the study area.

Among the six localities Umrangso towards Khundog area exhibit the maximum diversity of lichens, represented by 57 species followed by area in and around circuit house, Ethonic

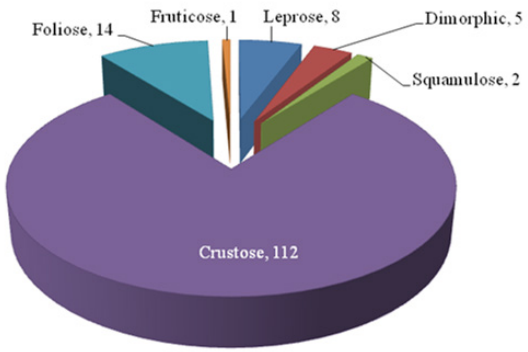

Fig. 3: Different growth forms and their number in the district.

villege, Bara Halflong with 41, 35 and 34 species respectively (Fig. 4). The Dihangi and Umrangso towards Kopili areas have higher anthropogenic activities, thus showing poor diversity of lichens. Most of the localities in Umrangso towards Kopili and Khundog sites exhibit dominance of *Castanopsis indica* and *Dillenia indica* trees. Both trees provided suitable habitat for different taxa of lichens to colonize on their trunk and branches. The site from Umrangso towards Khundog exhibit rich diversity of pyrenocarpous lichens with seven species followed by the Ethnic village locality with four species. Similar to studies carried out by Rout *et al*. (2010) and Dey *et al*. (2015) in the nearby regions of the state of Assam which also exhibit rich diversity of pyrenocarpous and graphidaceous lichens indicating an evergreen vegetation with abundance of smooth barked trees.

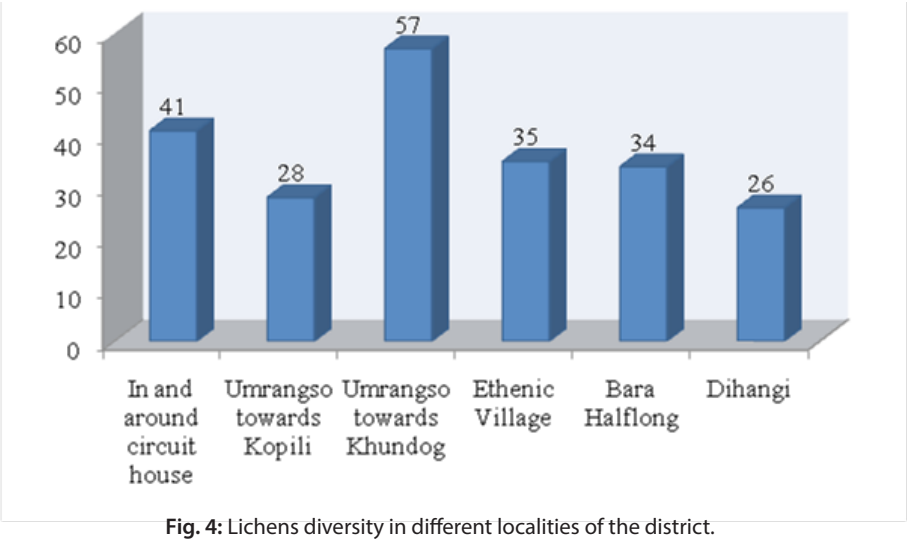

Fig. 4: Lichens diversity in different localities of the district.

Table 1: The list of lichens taxa recorded in Dima Hasao district, Assam.

			Localities						*Selected specimens number*	
SN	*Lichens taxa*	*Family*	*1*	*2*	*3*	*4*	*5*	*6*		*GF*
1	**Amandinea submontana* Marbach	Caliciaceae	+	-	-	-	-	-	17-033605	Cr
2	**Anthracothecium interlatens* (Nyl.) Aptroot	Pyrenulaceae	-	+	+	-	-	-	17-033988, 17-033985	Cr
3	*A. macrosporum* (Hepp.) Müll. Arg.		-	+	-	-	+		17-033910, 17-033915	Cr
4	**Bacidia alutacea* (Kremp.) Zahlbr.	Ramalinaceae	-	-	-	-	-	+	17-033643	Cr
5	**B. nigrofusca* (Müll. Arg.) Zahlbr.		-	-	-	-	+	-	17-033899	Cr
6	*B. rubella* (Hoffm.) Massal.		-	-	-	-	+	+	17-033601, 17-033602	Cr
7	**Baculifera entochlora* (J. Steiner) Marbach	Caliciaceae	+	-	-	-	-	-	17-033992	Cr
8	**Blastenia herbidella* (Arnold) Servít	Teloschistaceae	-	-	-	-	+	-	17-029681	Cr
9	*Bulbothrix isidiza* (Nyl.) Hale	Parmeliaceae	+	+	-	+	-	-	17-033964, 17-033961, 17-033976	Fo
10	**B. setschwanensis* (Zahlbr.) Hale		-	-	+	-	-	-	17-033991	Fo
11	**B. tabacina* (Mont. & Bosch) Hale		+	-	+	-	-	+	17-033821, 17-033963, 17-033962	Fo
12	**Calicium robustellum* Nyl.	Caliciaceae	-	-	+	-	-	-	17-033768	Cr
13	**Caloplaca kashmirensis* Y. Joshi & Upreti	Teloschistaceae	+	-	-	-	+	-	17-029684, 17-029666	Cr
14	**Canoparmelia pustulescens* (Kurok.) Elix	Parmeliaceae	+	-	-	-	-	-	17-033890	Fo

15	**Chapsa discoides* (Stirt.) Lücking	Thelotrematacеae	+	-	-	-	-	-	17-033906	Cr
16	**C. leprocarpa* (Nyl.) Frisch		+	-	-	-	-	-	17-033891	Cr
17	**Chiodecton andamanicum* Jagad. Ram	Roccellaceae	-	+	-	-	-	-	17-033698	Cr
18	**C. congestulum* Nyl.		-	-	+	-	-	-	17-033907	Cr
19	**C. leptosporum* Müll. Arg.		-	-	+	-	-	-	17-033908	Cr
20	*Chrysothrix* sp.	Chrysotrichaceae	+	-	-	-	+	-	17-033768, 17-033767	Le
21	**Cladonia fruticulosa* Kremp.	Cladoniaceae	-	-	+	-	-	-	17-033802	Di
22	**C. scabriuscula* (Delise) Nyl.		-	+	+	-	-	-	17-033806, 17-033808	Di
23	**C. subradiata* (Vain.) Sandst.		-	-	+	-	-	-	17-033803	Di
24	**C. verticillata* (Hoffm.) Schaer.		-	-	+	-	-	-	17-033799	Di
25	*Cratiria obscurior* (Stirt.) Marbach & Kalb	Caliciaceae	+	-	-	-	+	-	17-033898	Cr
26	**Cryptothecia awasthii* Makhija & Patw.	Arthoniaceae	-	+	-	-	-	-	17-031350	Le
27	**C. albomaculans* Jagadeesh and G. P. Sinha		-	-	-	+	-	-	17-031360	Le
28	**C. albomaculatella* Aptroot & Wolseley		+	-	-	-	+	+	17-033809	Le
29	**C. farinosa Jagadeesh,* G. P. Sinha & Kr. P. Singh		-	+	-	-	-	-	17-031341	Le
30	**C. stirtonii* A. L. Sm		-	+	-	-	-	-	17-031344	Le
31	*C. striata* G. Thor		-	+	-	-	-	-	17-031346	Le
32	**C. verruculifera* Jagadeesh, G. P. Sinha & Kr. P. Singh		-	-	-	-	+	-	17-031361	Le
33	*Diorygma hieroglyphicellum* Sutjar. & Kalb.	Graphidaceae	-	+	+	-	-	-	17-033954, 17-032087	Cr
34	*D. junghuhnii* (Mont. & Bosch) Kalb, Staiger & Elix		-	-	+	+	+	-	17-033951	Cr
35	**D. soozanum* (Zahlbr.) M. Nakan. & Kashiw.		+	+	+	-	+	-	17-033933, 17-033766	Cr
36	*Dirinaria applanata* (Fée) D.D. Awasthi	Caliciaceae	+	-	+	-	+	-	17-033866, 17-033869, 17-033865	Cr
37	*D. consimilis* (Stirt.) D.D. Awasthi		-	-	-	-	-	+	17-033867	Cr
38	*D. picta* (Sw.) Clem. & Shear		-	+	+	-	-	-	17-033868, 17-033870	Cr
39	*Dyplolabia afzelii* (Ach.) A. Massal.	Graphidaceae	-	-	-	-	-	+	17-033630	Cr
40	**Enterographa compunctula* (Nyl.) Redinger	Roccellaceae	+	-	-	-	+	-	17-033766	Cr

41	**Fissurina cingalina* (Nyl.) Staiger	Graphidaceae	-	-	+	+	-	+	17-033792, 17-033793, 17-032090	Cr
42	*F. dumastii* Fée		+	-	-	-	-	-	17-033790	Cr
43	*Glyphis cicatricose* Ach.		-	-	-	+	-	+	17-033839, 17-033660	Cr
44	**Graphidastra byssiseda* (Müll. Arg.) G. Thor	Roccellaceae	-	-	+	-	-	-	17-033661	Cr
45	**Graphis albissima* Müll. Arg.	Graphidaceae	-	+	-	-	-	-	17-033902	Cr
46	**G. ajarekarii* Patw. & C. R. Kulk.		-	-	-	-	-	+	17-033756	Cr
47	**G. aquilonia* (A.W. Archer) Staiger		-	-	-	+	-	-	17-033816	Cr
48	**G. arecae* Vain.		+	-	-	-	-	-	17-033835	Cr
49	*G. caesiella* Vain.		-	-	-	-	+	-	17-033834	Cr
50	**G. caesiocarpa* Redinger		-	-	-	-	+	-	17-033742	Cr
51	*G. capillacea* Strit		-	-	-	-	+	-	17-033750	Cr
52	**G. duplicata* Ach.		-	+	+	-	-	-	17-033658, 17-033659	Cr
53	**G. elongata* Zenker		+	-	-	+	-	-	17-033836/B, 17-033744	Cr
54	**G. insulana* (Müll. Arg.) Lücking & Sipman		-	-	-	-	+	+	17-033825, 17-032094	Cr
55	*G. librata* C. Knight		+	-	-	-	+	+	17-032100, 17-032096, 17-032095	Cr
56	*G. lineola* Ach.		+	-	+	-	-	+	17-033826, 17-033613	Cr
57	**G. nigrocarpa* Adaw. & Makhija		-	+	-	-	-	-	17-033769	Cr
58	**G. pinicola* Zahlbr.		+	-	-	-	+	-	17-033830, 17-032098	Cr
59	**G. rimulosa* (Mont.) Trevis.		-	-	+	-	-	-	17-033699	Cr
60	*G. scripta* (L.) Ach.		-	-	-	-	+	+	17-033829, 17-033700	Cr
61	**G. striatula* (Ach.) Spreng.		-	-	-	-	-	+	17-033749	Cr
62	*G. subasahinae* Nagarkar & Patw.		-	+	-	-	-	-	17-033903	Cr
63	**G. submarginata* Lücking		-	-	-	-	-	+	17-033902	Cr
64	**G. subregularis* A.W. Archer		-	-	+	-	-	-	17-033775/A	Cr
65	*G. tenella* Ach.		-	-	-	+	+	+	17-033827, 17-034603, 17-032093	Cr
66	*Gyalolechia bassiae* (Ach.) Søchting, Frödén & Arup ex Ahti	Teloschistaceae	-	-	+	-	-	-	17-029688	Cr
67	**Haematomma puniceum* (Ach.) A. Massal.	Haematommataceae	+	-	+	-	-	-	17-033608, 17-033653	Cr
68	**Hemithecium epixanthum* (Mont. & Bosch) Chitale & Makhija	Graphidaceae	-	-	-	+	-	-	17-033776	Cr
69	*Herpothallon granulare* (Sipman) Aptroot & Lücking	Arthoniaceae	+	-	-	-	-	-	17-033810	Cr
70	*H. philippinum* (Vain.) Aptroot & Lücking		+	-	-	-	+	-	17-033812, 17-033813	Cr

71	**Heterodermia albidiflava* (Kurok.) D.D. Awasthi	Physciaceae	-	-	-	-	+	-	17-033617	Cr
72	*H. diademata* (Taylor) D.D. Awasthi		+	-	+	+	+	-	17-033614, 17-033618, 17-033611	Cr
73	**Hyperphyscia adglutinata var. pyrithrocardia* (Müll. Arg.) D.D. Awasthi		-	-	+	-	-	-	17-033654	Cr
74	**H. minor* (Fée) Kalb.		-	-	-	+	-	-	17-033610	Cr
75	**Lathagrium auriforme* (With.) Otálora, P.M. Jørg. & Wedin	Collemataceae	+	-	-	-	-	-	17-033888	Cr
76	**Lecanora austrointumescens* Lumbsch & Elix	Lecanoraceae	+	-	+	-	+	-	17-033882, 17-033880, 17-033877	Cr
77	**Lecidella elaeochroma* (Ach.) M. Choisy		-	+	-	-	-	-	17-033845	Cr
78	**Lepra albescens* (Huds.) Hafellner	Pertusariaceae	-	-	+	-	-	-	17-033641	Cr
79	**Leptogium chloromelum* (Ach.) Nyl.	Collemataceae	-	-	-	+	-	-	17-033993	Cr
80	*L. flavocrocea* (Nyl.) Hafellner & Bellem.		-	-	-	+	-	-	17-029667	Cr
81	**L. transgressa* (Malme) Hafellner & Bellem		-	+	-	-	-	-	17-033926	Cr
82	*Letrouitia flavocrocea* (Nyl.) Hafellner & Bellem	Letrouitiaceae	-	-	-	+	-	-	17-029667	Cr
83	*L. transgressa* (Malme) Hafellner & Bellem		-	+	-	-	-	-	17-033925	Cr
84	**L. vulpine* (Tuck.) Hafellner & Bellem.		-	+	-	-	-	-	17-033854	Cr
85	**Lopadium leucoxanthum* (Spreng.) Zahlbr.	Lopadiaceae	-	+	-	+	-	-	17-033927	Cr
86	**Malmidea papillosa* Weerakoon & Aptroot	Malmideaceae	-	+	+	+	-	-	17-033848, 17-033990, 17-033849	Cr
87	*M. granifera* (Ach.) Kalb, Rivas Plata & Lumbsch		-	-	-	+	-	-	17-033847	Cr
88	*Micarea* spp.	Pilocarpaceae	-	-	-	-	+		17-033732	Cr
89	**Mikhtomia flavorubescens* (Huds.) S.Y. Kondr. & J.-S. Hur	Teloschistaceae	-	-	-	-	-	+	17-029690	Cr
90	**M. gordejevii* (Tomin) S. Y. Kondr., Kärnefelt, Elix, A. Thell		-	-	-	-	-	+	17-029679	Cr
91	***Multiclavula vernalis* (Schw.) Petersen	Clavulinaceae	-	-	+	-	-	-	17-033657	Cr
92	*Myriotrema microporum* (Mont.) Hale	Graphidaceae	-	-	+	-	-	-	17-033664	Cr
93	**M. rugiferum* (Harm.) Hale		-	-	+	-	-	-	17-033663	Cr
94	**Nigrovothelium bullatum* Lücking, Upreti & Lumbsch	Trypetheliaceae	-	-	-	+	-	-	17-033650	Cr
95	**N. tropicum* (Ach.) Lücking, M.P. Nelsen & Aptroot		-	-	-	+	-	+	17-033648	Cr
96	**Pallidogramme bengalense* B.O. Sharma & Khadilkar	Graphidaceae	-	-	+	-	-	-	17-033775	Cr
97	**P. chapadana* (Redinger) Staiger, Kalb. & Lücking		-	-	+	-	-	-	17-033780	Cr
98	*P. chlorocarpoides* (Nyl.) Staiger, Kalb & Lücking		-	-	+	+	-	+	17-033778	Cr
99	**P. chrysenterodes* (Nyl.) Kr.P. Singh & Swarnal.		-	-	+	-	-	-	17-033781	Cr
100	*P. chrysenteron* (Mont.) Staiger, Kalb & Lücking		+	-	-	-	-	-	17-033773	Cr

101	*Parmotrema austrosinense* (Zahlbr.) Hale	Parmeliaceae	+	-	+	-	-	+	17-033673, 17-033672, 17-033606	Fo
102	**P. cooperi* (J. Steiner & Zahlbr.) Sërus.		+	-	-	+	-	-	17-033820, 17-033815	Fo
103	**P. hababianum* (Gyeln.) Hale		-	-	-	+	-	-	17-033671	Fo
104	*P. praesorediosum* (Nyl.) Hale		-	-	-	+	-	-	17-033757	Fo
105	**P. reticulatum* (Taylor) M. Choisy		+	+	+	+	-	-	17-033675	Fo
106	*P. sancti-angelii* (Lynge) Hale		-	-	-	-	+	-	17-033670	Fo
107	*P. tinctorum* (Despr. ex Nyl.) Hale		+	+	+	+	+	+	17-033676, 17-033677	Fo
108	*P. zollingeri* (Hepp) Hale		+	-	-	-	-	-	17-033607	Fo
109	**Pertusaria albescens* (Huds.) M. Choisy & Werner	Pertusariaceae	-	-	+	-	-	-	17-033641	Cr
110	**P. granulate* (Eschw.) Müll. Arg.		-	-	+	-	-	-	17-033640	Cr
111	**P. leioplacella* Nyl.		+	+	+	-	-	-	17-033636, 17-033639, 17-033638	Cr
112	**P. maculate* Kr. P. Singh & G.P. Sinha		-	-	-	+	-	-	17-033645	Cr
113	**P. punctata* Nyl.		-	-	-	+	-	-	17-033646	Cr
114	**P. rigida* Müll. Arg.		-	-	-	+	-	-	17-033644	Cr
115	**P. subochracea* Stirt.		-	-	+	-	-	-	17-033637	Cr
116	**Phaeographis caesiodisca* Staiger	Graphidaceae	-	-	+	-	-	-	17-033973	Cr
117	**Phaeophyscia endococcina* (Körb.) Moberg	Physciaceae	-	-	-	-	+	-	17-033995	Fo
118	*P. hispidula* (Ach.) Essl.		-	-	-	-	+	-	17-033844	Fo
119	**Phlyctis karnatakana* S. Joshi & D.K. Upreti	Phlyctidaceae	-	-	+	-	-	-	17-033656	Cr
120	**P. himalayensis* (Nyl.) D.D. Awasthi		-	-	+	-	-	-	17-033767	Cr
121	**Phyllopsora corallina* (Eschw.) Müll. Arg.	Ramalinaceae	+	-	+	+	-	+	17-033887, 17-03385, 17-033884, 17-033886	Sq
122	**P. furfuracea* (Pers.) Zahlbr.		+	-	-	-	-	-	17-033883, 17-033885	Sq
123	**Physcia dubia* (Hoffm.) Lettau	Physciaceae	-	-	+	-	-	-	17-033655	Cr
124	**P. tribacioides* Nyl.		+	-	-	-	-	-	17-033996	Cr
125	**Platythecium dimorphodes* (Nyl.) Staiger	Graphidaceae	-	-	+	-	-	-	17-033779	Cr
126	**Polymeridium suffusum* (C. Knight) Aptroot	Trypetheliaceae	-	-	+	-	-	-	17-033609	Cr
127	**Pseudocyphellaria aurata* (Ach.) Vain.	Lobariaceae	-	-	+	-	-	-	17-033997	Cr
128	**Pyrenula andina* Aptroot	Pyrenulaceae	+	-	+	-	-	-	17-033980, 17-033983	Cr
129	*P. arthoniotheca* Upreti		-	-	-	-	+	-	17-033972	Cr
130	*P. brunnea* Fée		-	+	-	-	-	-	17-033921	Cr
131	*P. complanata* (Mont.) Trevis.		-	-	-	+	-	-	17-033971	Cr
132	**P. oculata* Ajay Singh & Upreti		-	-	+	-	-	-	17-033918	Cr
133	**P. ravenelii* (Tuck.) R. C. Harris		-	-	-	-	+	-	17-033724	Cr
134	*P. quassiicola* Fée		-	+	+	+	-	-	17-033989, 17-033969, 17-033919	Cr
135	**P. subducta* (Nyl.) Müll. Arg.		-	-	-	+	-	+	17-033968, 17-033970	Cr
136	**P. mastophoroides* (Nyl.) Zahlbr		-	-	-	+	+	-	17-033923, 17-033922	Cr

137	**Ramboldia haematites* (Fée) Kalb, Lumbsch & Elix	Ramboldiaceae	-	-	+	-	-	-	17-033920	Cr
138	**Sarcographa subtricosa* (Leight.) Müll. Arg.	Graphidaceae	+	-	+	-	-	-	17-032091, 17-033838	Cr
139	**Stigmatochroma adauctum* (Malme) Marbach	Caliciaceae	+	-	+	-	-	-	17-033999, 17-033765	Cr
140	**Thecaria austroindica* (D.D. Awasthi & Upreti) Kr.P. Singh & G.P. Sinha	Graphidaceae	+	-	-	+	+	+	17-033621, 17-033626, 17-033635, 17-033627	Cr
141	*Trypethelium eluteriae* Spreng.	Trypetheliaceae	+	+	-	+	-	+	17-033697	Cr
142	**Usnea pectinata* Stirt.	Parmeliaceae	-	-	+	-	-	-	17-034601	Fr

Abbreviations: GF: Growth Form, **+:** Present, **-:** Absent, **Cr:** Crustose, **Di:** Dimorphic, **Fo:** Foliose, **Fr:** Fruticose, **Le:** Leprose; *New record for Assam state. **New record for country (basidiolichen)

Localities: 1: In and around circuit house, **2:** Umrangso towards Kopili, **3:** Umrangso towards Khundog, **4:** Ethonic village, **5:** Bara Halflong, **6:** Dihangi

Conclusion

The present study added 98 species to the lichen biota of Assam which includes *Multiclavula vernalis* as new record, dimorphic and fruticose species which were absent in earlier reports. The occurrence of 142 species within a geographically small area clearly indicates the richness of lichens. The extensive survey of lichens in the district will definitely contribute more taxa to the lichen flora of the region and the present enumeration of lichens will act as a baseline data for carrying out future lichen resource survey related to biomonitoring studies.

Acknowledgement

Authors are thankful to the Director, CSIR-National Botanical Research Institute, Lucknow for providing facilities and also thankful to Assam State Biodiversity Board and Dr. L.B. Chaudhary, Sr. Principal Scientist at CSIR-NBRI, Lucknow for their cooperation during the field work. One of the authors GKM would like to thanks to the Department of Science & Technology, New Delhi for award of N-PDF (PDF/2017/000356) and Mr. Prashant Behara for photography.

References

Awasthi, D.D. 1991. A key to the microlichens of India, Nepal and Sri Lanka. *Biblioth. Lichenol.* **40**: 1-337.

Awasthi, D.D. 2007. *A compendium of the macrolichens from India*, Nepal and Sri Lanka. Bishen Singh and Mahendera Pal Singh, Dehradun, India.

Bennett, J. P. 2006. New or overlooked Wisconsin lichen records. *Evansia* **23**: 28-33.

Brodo, I. M., Sharnoff, S. D., Sharnoff S. 2001. Lichens of North America. Yale University Press, New Haven and London. 795 pp.

Dey, A.K., Mishra, G.K., Jout, R., Upreti, D.K. 2015. An enumeration of epiphytic lichens from Hojai sub-division of Nagaon district, Assam, India. *International Journal of Advanced Research in Biological Sciences* **2**(10): 111-115.

Divakar, P.K., Upreti, D.K. 2005. *Parmelioid Lichens in India (a revisionary study)*. Bishen Singh and Mahendera Pal Singh, Dehradun, India.

Esslinger, T. L. 2007. A cumulative checklist for the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada. North Dakota State University: http://www. ndsu.nodak.edu/instruct/esslinge/chcklst/chcklst7.htm (Most Recent Update 2 April 2007), Fargo, North Dakota.

Fryday, A. M., Fair, J. B., Googe, M. S., Johnson, A.J. (2001). Checklist of lichens and allied fungi of Michigan. Contributions from the University of Michigan Herbarium **23**: 145–223.

Gogoi, R., Joseph, S., Nayaka, S., Yasmin, F. 2019. Additions to the lichen biota of Assam State, India. *Journal of Threatened Taxa* **11**(6): 13765–13781. https://doi.org/10.11609/jott. 4642.11.6.13765-13781.

Gupta, P., Sinha, G.P. 2018. *Lichen flora of Assam*. Journal of Forestry. Add. Ser. V. Bishen Singh Mahendra Pal Singh.

Lücking, R., Hodkinson, B.P., Leavitt, S.D. 2016. The 2016 classification of lichenized fungi in the Ascomycota and Basidiomycota – Approaching one thousand genera. *Bryologist* **119**(4): 361-416.

Nayaka, S. 2004. Revisionary studies on lichen genus *Lecanora sensu lato* in India. Ph.D. thesis. Dr. RML Avadh University.

Nelsen, M. P. 2006. An addition to the lichen flora of New Jersey: the basidiolichen Multiclavula vernalis (Schw.) *Petersen. Evansia* **23**:11

Orange, A.P., James, W., White, F.J. 2001. *Microchemical Methods for the Identification of Lichens*. British Lichen Society, U.K.

Petersen, R. H. 1967. Notes on clavarioid fungi IX: Redefinition of the Clavaria vernalis-C. mucida complex. *American Midland Naturalist* **77**: 205–221

Petersen, R. H., Kantvilas, G. 1986. Three lichen-forming clavarioid fungi from Tasmania. *Australian Journal of Botany* **34**: 217–222.

Rout, J. Das, P., Upreti, D.K. 2010. Epiphytic lichen diversity in a Reserve Forest in southern Assam, northeast India. *Tropical ecology* **51**(2): 281-288

Upreti, D.K. 1998. A key to the lichen genus *Pyrenula* from India, with nomeclatural notes. *Nova Hedwigia* **66**(3-4): 185-203.