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New records of lichens from Manipur State, North-eastern India

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Abstract

A total of 140 lichen species belonging to 50 genera and 23 families with 39 species recorded for the first time from the state of Manipur, Northeast India, being reported. Fourteen species are new additions to the lichen flora of Northeast India. The crustose morphotype (49% of the species found) dominated the area, followed by foliose (43%), dimorphic, fruticose, leprose and squamulose lichens, each contributing by 4%, 2%, 1% and 1% of the species found, respectively. Nine species of phorophytic foliicolous lichens that usually colonize live leaves were also encountered. The occurrence of foliicolous lichens is quite characteristic of species diversity and indicate rather high richness in this relatively small phytogeographical area. A brief note on the phytogeographic affinities and distribution of the newly recorded lichens in Manipur has been provided.

Key words – Crustose – Foliicolous – Parmeliacaea – *Parmotrema*

Introduction

India is considered the fifth country with the greatest biodiversity in the world, with about 10% of the 20,000 species of lichens recorded in the world (Groombridge 1992). About 2400 lichen species distributed on 305 genera and 74 families have been reported to occur on various substrata in tropical, subtropical, temperate and alpine regions of India (Singh & Sinha 2010). Western Ghats is the richest State with ca. 800 species (39 % ot currently known species), followed by Eastern Himalayas with 759 species (37 %) and the Western Himalayas with 550 species (27 %). The dominant families are Parmeliaceae, Graphidaceae, Physciaceae, Usneaceae, Cladoniaceae, while the dominat genera are *Parmelia*, *Graphina*, *Usnea*, *Graphis* and *Lecanora* . About 23% of the known species, mainly belonging to *Graphina*, *Trypethelium*, *Graphis* and *Porina*, are supposed to be endemic to India. Apart from their use as bioindicators of air pollution, lichens in India are known for a variety of uses, such as spices, flavouring agents, medicines and edible. Over 30 species are used in perfumery industry owing to the presence of aromatic resinoids.

Despite such a high diversity of lichen flora (Awasthi 1960), those belonging to Northeast India, in particular, have not been adequately explored. The landscape of Manipur, one of the seven States of this region, consists of rugged hillocks, narrow valleys, and flat plains. Although lichens from Manipur were recorded as early as 1892 (Müll. Arg. 1892), more than a century has passed

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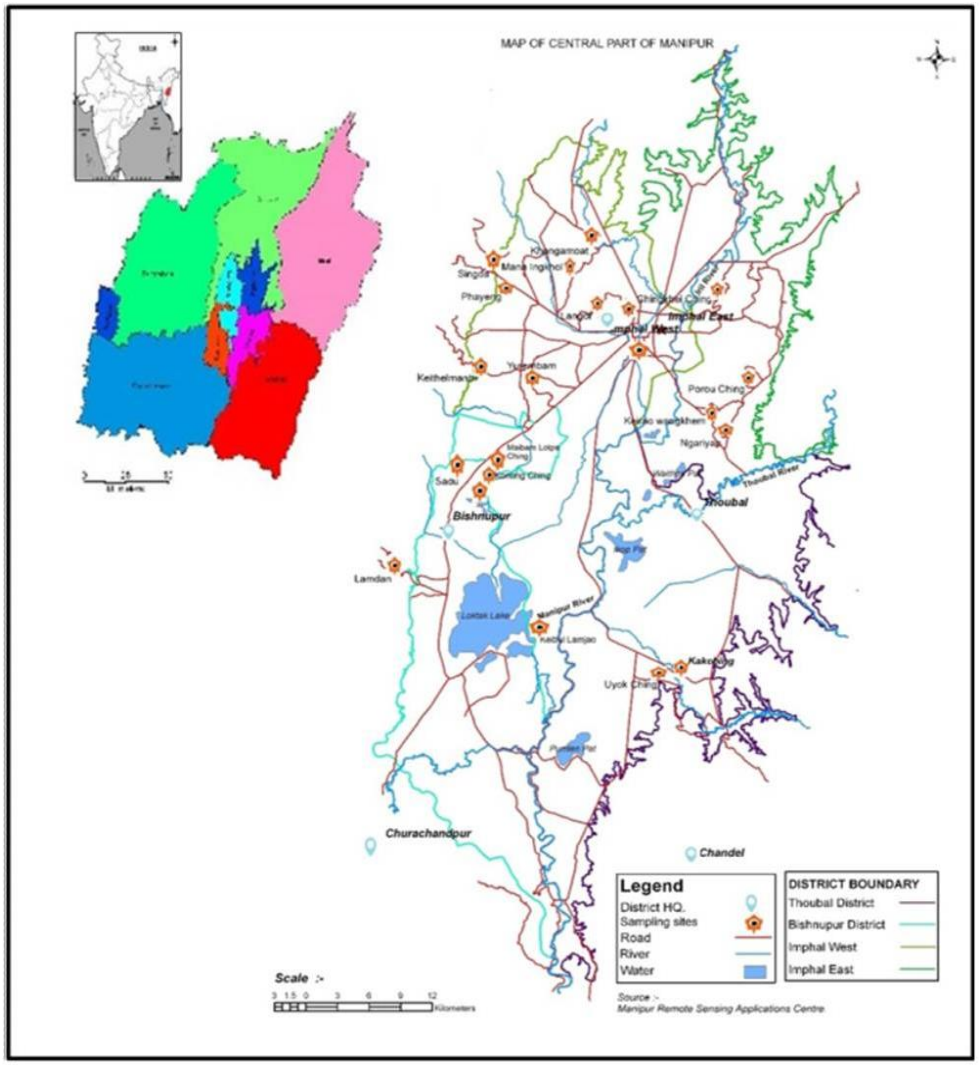


Fig.1 – Map of Manipur state showing the study sites

with only a few other sporadic reports (Awasthi 1960, 1987, Singh 1984, Singh 1980, 1981a, 1981b, 1983, 1984, Patwardhan & Nagarkar 1982, Singh & Upreti 1986, 1990, 1993) have appeared, the last one by Singh & Pinokiyo in 2003. Following rapid urbanisation and anthropogenic activities in the recent past, and as a sequel to our continued effort to assess the lichen flora from Northeast India, 39 new species of lichens, are reported from the State of Manipur as first records. Also, fourteen of these species are completely new to the entire Northeast India region.

Materials & Methods

This study is based on more than 1100 specimens of lichens collected from twenty localities of Manipur State (23°83′ – 25°68′ N and 93°03′ – 94°78′ E), located in the Northeast part of India (Fig. 1). The specimens were collected from different substrata such as barks, twigs, rocks, soil and leaves. Trees (*Bauhinia purpurea*, *Castanopsis hystrix*, *Ficus bengalensis*, *Mangifera indica*, *Magnolia pterocarpa*, and *Quercus lamellose*) exhibit luxuriant growth of lichens. The identification of the specimens was done by studying their morphology, anatomy and chemistry. The morphology was studied using a LaboMed Digi Zoom dissecting microscope, and the anatomical details were studied using a Leica TM DM 500 optical microscope. Colour tests were performed using KOH (K), calcium hypochlorite (C) and para-phenylenediamine (P) solution. Secondary metabolites were identified by thin layer chromatography (TLC) as described by Walker & James (1980). The chromatograms were done in solvent system A (toluene: dioxane: acetic acid:

Table 1 Species composition of lichens in central part of Manipur

	Species	Sub	GF	CC	KN	KL	KW	KM	KG	KJ	KC	LD	LG	LP	ML	MI	NR	PY	PC	SC	SD	UC	YR
	Arthoniaceae																						
1.	*Arthonia inconspicua* Stirt	B	C																				+
2.	*Arthonia tumidula* (Ach.) Ach.	B	C		+	+								+					+	+			
3.	*Arthothelium abnorme* (Ach.) Müll. Arg.	B	C				+												+				
4.	*Arthothelium chiodectoides* (Nyl.) Zahlbr.	B	C	+						+						+			+			+	
5.	*Cryptothecia dissimilis* Makhija & Patw.	B	C								+						+			+		+	
6.	*Cryptothecia lunulata* (Zahlbr.) Makhija & Patw.	B	C	+		+	+	+	+		+	+		+						+			
7.	*Cryptothecia multipunctata* Jagadeesh & al.	B	C														+						
8.	*Herpothallon granulare* (Sipman) Aptroot & Lücking	B	C				+		+	+	+		+	+			+	+	+	+	+	+	
9.	*Herpothallon isidiatum* Jagadeesh & G.P. Sinha	B	C			+		+	+			+		+	+		+	+					+
	Caliciaceae																						
10.	*Baculifera curtisii* (Tuck.) Marbach	B	C	+	+		+					+	+						+		+	+	
	Candelariaceae																						
11.	*Candelaria concolor* (Dicks.) Stein*	B	F					+			+		+	+	+					+			+
	Chrysothricaceae																						
12.	*Chrysothrix candelaris* (L.) J.R. Laundon*	B	Le			+																	
	Cladoniaceae																						
13.	*Cladonia awasthiana* Ahti & Upreti*	S	D																+				
14.	*Cladonia macroceras* (Delise) Hav.**	S	D						+														
15.	*Cladonia rei* Schaer*	S	D													+							
16.	*Cladonia* sp.	S	D					+															
17.	*Cladonia verticillata* (Hoffm) Shaer	S	D													+							

	Species	Sub	GF	CC	KN	KL	KW	KM	KG	KJ	KC	LD	LG	LP	ML	MI	NR	PY	PC	SC	SD	UC	YR
Coccocarpaceae																							
18.	*Coccocarpia palmicola* (Spreng.) Arv. & D.J. Galloway	B	F					+															
Collemataceae																							
19.	*Collema leptaleum* var. *biliosum* (Mont.) Degel.**	B	F																	+			
20.	*Collema pulcellum* var. *subnigrescens* (Müll.Arg.) Degel.	B	F															+			+		
21.	*Collema* sp.	B	F																			+	
22.	*Leptogium austroamericanum* (Malme) C.W. Dodge	B	F	+			+	+	+			+				+		+					
23.	*Leptogium cyanescens* (Rabenh.) Körb.	B/R	F										+				+						
24.	*Leptogium denticulatum* Nyl.	B	F						+														+
25.	*Leptogium pichneum* (Ach.) Malme**	B	F							+													
26.	*Leptogium pseudopapillosum* P.M. Jørg.*	B	F																	+			
Ectolechiaceae																							
27.	*Lopadium leucoxanthum* (Spreng.) Zahlbr.	B	C						+														
28.	*Sporopodium* sp.	L	Fo																				
Graphidaceae																							
29.	*Diorygma junghuhnii* (Mont. & Bosch) Kalb & al.	B	C	+			+	+	+			+	+	+	+	+	+			+		+	
30.	*Diorygma megasporum* Kalb & al.	B	C														+						
31.	*Fissurina* sp.	B	C			+																	
32.	*Graphis aurita* Eschw.	B	C								+						+						
33.	*Graphis caesiella* Vain*													+									
34.	*Graphis lineola* Ach.	B	C	+		+		+	+			+			+	+		+	+	+	+	+	
35.	*Graphis nigroglauca* Leight.	B	C	+	+			+		+		+	+			+				+	+		+
36.	*Graphis pertricosa* (Kremp.) A.W. Archer	B	C											+									

	Species	Sub	GF	CC	KN	KL	KW	KM	KG	KJ	KC	LD	LG	LP	ML	MI	NR	PY	PC	SC	SD	UC	YR
37.	*Graphis platycarpa* Eschw.	B	C	+			+																
38.	*Graphis proserpens* Vain.	B	C														+			+			
39.	*Graphis pyrrhocheiloides* Zahlbr.**	B	C											+									
40.	*Graphis scripta* (L.) Ach.	B	C			+	+	+						+	+								+
41.	*Graphis* sp.					+																	
42.	*Graphis verminosa* Müll. Arg.	B	C													+							
43.	*Phaeographis* sp.	B	C											+									
44.	*Thecaria austroindica* (D.D. Awasthi & Upreti) Kr.P.Singh & G.P. Sinha	B	C			+								+	+	+				+		+	
	Haematommataceae																						
45.	*Haematomma puniceum* (Sw.) A. Massal.	B	C	+	+		+					+			+	+	+			+		+	
	Lecanoraceae																						
46.	*Lecanora achroa* Nyl.	B/R	C	+	+	+		+	+			+	+		+	+	+	+		+	+	+	+
47.	*Lecanora japonica* Müll. Arg.	B	C													+						+	
48.	*Lecanora tropica* Zahlbr.	B	C	+		+						+					+			+			
	Lecideaceae																						
49.	*Lecidea granifera* (Ach.) Vain.	B	C				+		+						+							+	
	Letrouitiaceae																						
50.	*Letrouitia transgressa* (Malme) Hafellner & Bellem.	B	C						+														
	Nephromataceae																						
51.	*Nephroma sikkimense* Asahina*	B	F																	+			
	Parmeliacaea																						
52.	*Bulbothrix isidiza* (Nyl.) Hale	B	F	+	+		+	+		+		+	+		+	+	+		+	+	+		+
53.	*Bulbothrix setschwanensis* (Zahlbr.) Hale	B	F					+		+							+	+					
54.	*Bulbothrix tabacina* (Mont. & Bosch) Hale*	B	F	+												+	+	+					
55.	*Canoparmelia texana* (Tuck.) Elix & Hale	B	F				+														+		
56.	*Hypotrachyna flexilis* (Kurok) Hale	B	F																	+			

	Species	Sub	GF	CC	KN	KL	KW	KM	KG	KJ	KC	LD	LG	LP	ML	MI	NR	PY	PC	SC	SD	UC	YR
57.	*Hypotrachyna revoluta* (Flörke) Hale**	B	F				+																
58.	*Myelochroa aurulenta* (Tuck.) Hale	B	F																	+			
59.	*Myelochroa xantholepis* (Mont. & Bosch) Elix & Hale	B	F																			+	
60.	*Parmelinella wallichiana* (Taylor) Elix & Hale	B	F							+													
61.	*Parmotrema andinum* (Müll. Arg.) Hale**	B	F						+				+				+					+	
62.	*Parmotrema austrosinense* (Zahlbr.) Hale	B	F	+	+	+	+	+	+		+	+	+	+	+	+	+	+		+	+	+	+
63.	*Parmotrema crinitum* (Ach.) M. Choisy**	B	F				+		+											+		+	
64.	*Parmotrema cristiferum* (Taylor) Hale	B	F					+				+										+	
65.	*Parmotrema eunetum* (Stirt.) Hale**	B	F							+	+												
66.	*Parmotrema hababianum* (Gyeln.) Hale	B	F	+	+			+	+							+			+				+
67.	*Parmotrema indicum* Hale*	B	F	+					+				+			+	+		+				
68.	*Parmotrema mellissii* (C.W. Dodge) Hale	B	F		+																		
69.	*Parmotrema mesotropum* (Müll. Arg.) Hale*	B/R	F											+							+		
70.	*Parmotrema praesorediosum* (Nyl.) Hale	B	F	+	+	+			+			+	+			+		+				+	+
71.	*Parmotrema ravum* (Krog & Swinscow) Sérus.	B	F													+							
72.	*Parmotrema reticulatum* (Taylor) M. Choisy	B	F	+			+	+	+	+	+	+	+	+	+	+	+	+		+		+	+
73.	*Parmotrema saccatilobum* (Taylor) Hale*	B	F													+					+		+
74.	*Parmotrema subarnoldii* (Abbayes) Hale	B	F	+																			
75.	*Parmotrema tinctorum* (Despr. ex Nyl.) Hale	B	F	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
76.	*Usnea pangiana* Stirt.*	B/T	FR									+											
77.	*Usnea pectinata* Taylor	B	FR													+							

	Species	Sub	GF	CC	KN	KL	KW	KM	KG	KJ	KC	LD	LG	LP	ML	MI	NR	PY	PC	SC	SD	UC	YR
Pertusariaceae																							
78.	*Pertusaria leioplacella* Nyl.	B	C																+				
79.	*Pertusaria pseudococcodes* Müll. Arg.	B	C									+			+		+	+					
80.	*Pertusaria tetrathalmia* (Fée) Nyl**	B	C																				+
Physciaceae																							
81.	*Buellia morehensis* Kr.P. Singh & S.R. Singh	B	C											+									
82.	*Dirinaria applanata* (Fée) D.D. Awasthi*	B	F	+	+				+		+	+					+		+	+		+	+
83.	*Dirinaria confluens* (Fr.) D.D. Awasthi*	B	F			+										+					+		
84.	*Dirinaria consimilis* (Stirt.) D.D. Awasthi	B	F	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+		+	+
85.	*Dirinaria picta* (Sw.) Clem. & Shaer*	B	F								+				+	+	+		+				
86.	*Heterodermia albidiflava* (Kurok.) D.D. Awasthi*	B	F				+									+	+						
87.	*Heterodermia diademata* (Taylor) D.D. Awasthi	B	F	+	+		+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
88.	*Heterodermia hypocaesia* (Yasuda) D.D. Awasthi	B	F				+				+						+	+					
89.	*Heterodermia hypochraea* (Vain) Swinscow & Krog*	B	F	+			+										+						
90.	*Heterodermia incana* (Stirt.) D.D. Awasthi	B	F														+						
91.	*Heterodermia japonica* (M. Satô) Swinscow & Krog	B	F				+																
92.	*Heterodermia obscurata* (Nyl.) Trevis.	B	F				+					+				+	+						
93.	*Heterodermia pseudospeciosa* (Kurok.)W.L. Culb.	B	F			+						+				+	+			+		+	
94.	*Hyperphyscia* sp.	B	F	+																			
95.	*Phaeophyscia endococcina* (Körb.) Moberg*	B	F																	+			
96.	*Phaeophyscia hispidula* (Ach.) Moberg	CW/M	F												+								
97.	*Pyxine berteriana* (Fée) Imshaug	B	F										+			+	+	+			+		

	Species	Sub	GF	CC	KN	KL	KW	KM	KG	KJ	KC	LD	LG	LP	ML	MI	NR	PY	PC	SC	SD	UC	YR
98.	*Pyxine cocoes* (Sw.) Nyl.	B	F		+	+			+				+	+								+	
99.	*Pyxine himalayensis* D.D. Awasthi**	B	F				+																
100.	*Pyxine petricola* Nyl.*	B/R	F															+					
101.	*Pyxine reticulata* (Vain.) Vain.**	B	F							+	+	+				+	+		+			+	
102.	*Pyxine sorediata* (Ach.) Mont.	B/R	F		+																		
103.	*Pyxine subcinerea* Stirt.*	B	F	+				+	+	+			+		+		+			+	+	+	
	Pilocarpaceae																						
104.	*Fellhanera bouteillei* (Desm.) Vězda	L	Fo																				
105.	*Micarea* sp**.**	B	C		+																		
	Porpidiaceae																						
106.	*Mycobilimbia hunana* (Zahlbr.) D.D. Awasthi*	B	C																			+	
	Pyrenulaceae																						
107.	*Anthracothecium platystomum* Müll. Arg.	B	C		+																		
108.	*Anthracothecium variolosum* (Pers.) Müll. Arg.	B	C							+													
109.	*Lithothelium* sp.	B	C							+													
110.	*Pyrenula anomala* (Ach.) Vain*	B	C							+													
111.	*Pyrenula astroidea* (Fée) R.C. Harris	B	C		+																		
112.	*Pyrenula immissa* (Stirt.) Zahlbr.	B	C		+										+		+					+	
113.	*Pyrenula interducta* (Nyl.) Zahlbr.*	B	C							+			+										
114.	*Pyrenula introducta* (Stirt) Zahlbr.*	B	C				+		+		+						+			+			+
115.	*Pyrenula leucostoma* Ach.	B	C		+														+				
116.	*Pyrenula macularis* (Zahlbr.) R.C. Harris	B	C		+														+				
117.	*Pyrenula pinguis* Fée	B	C				+		+			+							+	+	+		
118.	*Pyrenula quassiaecola* Fée.	B	C		+				+			+							+			+	
119.	*Pyrenula submastophora* Ajay Singh & Upreti**	B	C											+									

Species	Sub	GF	CC	KN	KL	KW	KM	KG	KJ	KC	LD	LG	LP	ML	MI	NR	PY	PC	SC	SD	UC	YR
Ramalinaceae																						
120. *Bacidia alutacea* (Kremp.) Zahlbr.	B	C	+																			
121. *Bacidia connexula* (Nyl.) Zahlbr.**	B	C																				+
122. *Bacidia incongruens* (Stirt.) Zahlbr.	B	C							+													
123. *Bacidia millegrana* (Taylor) Zahlbr.	B	C							+													
124. *Bacidia rufescens* (Müll. Arg.) Zahlbr.	B	C													+						+	
125. *Bacidia spadiacea* (Ach.) Zahlbr.**	B	C			+																	
126. *Bacidia submedialis* (Nyl.) Zahlbr.*	B	C															+					
127. *Phyllopsora corallina* (Eschw.) Müll. Arg.	B	S																+				
128. *Ramalina conduplicans* Vain.	B,T	FR				+																
Roccellaceae																						
129. *Graphidastra byssiseda* (Müll. Arg.) G. Thor	B	C													+							
130. *Opegrapha viridis* (Pers. ex Ach.) Behlen & Desberger	B	C																				+
131. *Opegrapha vulgata* (Ach.) Ach.	B	C		+																		
Strigulaceae																						
132. *Strigula antillarum* (Fée) Müll. Arg																						
133. *Strigula concreta* (Fée) R. Sant.																						
134. *Strigula nemathora* Mont.																						
135. *Strigula orbicularis* Fr.																						
136. *Strigula phyllogena* (Müll. Arg.) R.C. Harris																						
137. *Strigula smaragdula* Fr.																						
138. *Strigula subelegans* Vain.																						
Trypetheliaceae																						
139. *Trypethelium assimile* Stirt.	B	C		+																		
140. *Trypethelium eluteriae* Spreng*	B	C							+													

Note: Sub - Substratum, GF - Growth form, B - Bark, T - Twig, R - Rock, CW - Concrete wall, M - Moss, L –Leaves, C - Crustose, F - Foliose, Fo – Foliicolous, Fr -Fruticose, D - Dimorphic, S - Squamulose, Le – Leprose, Site CC - Chingkhei Ching, KN - Kaina, KL - Keibul Lamjao, KW - Keirao Wangkhem, KM - Keitelmanbi, KG - Khongampat, KJ - Konthoujam, KC - Konung Ching, LD - Lamdan, LG - Langol, LP - Loukoipat, ML - Maibam Lotpa Ching, MI - Mana Ingkhol, NR - Ngariyan, PY - Phayeng, PC - Porou Ching, SC - Sadu Chiru, SD - Singda, UC - Uyok Ching, YR - Yurembam

*New addition to the lichen flora of Manipur; **New records for Northeast India.

180:60:8 ml) and solvent EA (Diethyl ether: Acetic acid: 200:2 ml). Specimens were identified by comparing the morphological and the biochemical test results with the literature and identification keys (Awasthi 2007, Divakar & Upreti 2005). The identified specimens are preserved in the National Botanical Research Institute (NBRI) herbarium, Lucknow (LWG) and the Department of Ecology and Environmental Science, Assam University, Silchar (AUS).

Results

The composition of the lichen flora of the Manipur State was studied and species richness is expressed as alpha-diversity (α) totalling 140 species belonging to 50 genera and 23 families (Table 1). The crustose morphotype (49% of the total species found) was most dominant followed by the foliose (43%), the dimorphic, fruticose, leprose and squamulose morphotypes, each contributing 4%, 2%, 1% and 1%, respectively.

Nine species belonging to a special group of phorophytic lichens that usually colonize live leaves, also known as foliicolous lichens, were also encountered. Species richness was remarkably denoted by the presence of about 75–85 foliicolous lichens colonies on a single leaf. A few foliicolous lichens were also found inhabiting the leaves of orchids and of *Ferula asafoetida* (Hing) planted in preservation plot for educational purposes at an *ex-situ* Orchid Preservation Centre, Khongampat located near the capital town of Imphal of Manipur State, Northeast India. However, these were at a very young stage and hence could not be identified.

Discussion

The occurrence of fewer fruticose lichens in the area is due relatively poor light conditions in almost all the study sites. Appropriate light conditions are a pre-requisite for luxuriant growth of foliose and fruticose lichens (James et al. 1977, Broad 1989). Wolseley & Pryor (1999) reported that fruticose lichens are light sensitive and are typically associated with the canopy environment, explicitly twigs and branches and indeed, are often referred to as light demanding lichens.

Based on the annotated checklist of Singh & Sinha (2010) and recent publications on new records of lichens of Northeast India (Rout et al. 2010, Daimari et al. 2014, Devi et al. 2013; Upreti et al. 2014, Logesh et al. 2015), 39 species belonging to 21 genera and 14 families have been listed as new addition to lichen flora of Manipur. Of these, 14 species are new to Northeast India.

Phytogeographic affinities and distribution of the newly recorded lichens in Manipur is also furnished.

Taxonomy

CANDELARIACEAE

1. *Candelaria concolor* (Dicks.) Stein, Cohn, Krypt. Fl. Schles. 2(2): 84. 1879 Fig. 2

= *Lichen concolor* Dicks., Fasc. Pl. Crypt. Br.: Pl. 9, fig. 8. 1783.

Distribution – *C. concolor* is a new report to Manipur and is previously known from Himachal Pradesh, Jammu & Kashmir, Karnataka, Nagaland, Sikkim and Uttarakhand.

Specimens examined – India, Manipur, Imphal West, Yurembam, 736 m, 2 Nov 2011, RKSD, 139/A (AUS).

CHRYSOTHRICACEAE

2. *Chrysothrix candelaris* (L.) J.R. Laundon, Lichenologist 13(2): 101– 121, 1981

= *Byssus candelaris* L., Sp. PL 2: 1169, 1753.

Distribution – *C. candelaris* is a new report to Manipur and is previously reported from Assam, Himachal Pradesh, Jammu & Kashmir, Sikkim and Tamil Nadu of India.

Specimens examined **–** India, Manipur, Bishnupur district, Keibul Lamjao, 911 m, 11 Feb 2015, RKSD, 212 (AUS).

CLADONIACEAE

3. *Cladonia awasthiana* Ashti & Upreti, Biblioth. Lichenol. 88: 9. 2004.

Distribution – *C. awasthiana* is widely distributed in Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand, and is a new report to Manipur.

Specimens examined **–** India, Manipur, Imphal West, Phayeng, 871 m, 2 Jan 2012, RKSD, 27097 (LWG/AUS).

4. *Cladonia macroceras* (Delise) Hav., Bergens Mus. Aarbok. Naturgidensk. Rekke 1927 (3): 12. 1928. Fig. 3

=*Cenomyce gracilis* var. *macroceras* Delise in Duby, Bot. Gall. 2: 624. 1830.

Distribution **–** In India, the species was previously reported from Uttarakhand. The species is a terricolous lichen growing on red loam mixed with gravels, and is a new report to Manipur.

Specimen examined **–** INDIA, Manipur, Imphal West district, Khongampat, 816 m, 10 Dec 2012, AUSJR-RKSD167 (LWG/AUS).

5. *Cladonia rei* Schaer., Lich. Helv. Spic.: 34, 1823.

Distribution – *C. rei* is a new report to Manipur and was previously reported from Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir and Uttarakhand.

Specimens examined **–** India, Manipur, Imphal West, Mana Ingkol Ching, 816 m, 28 Dec 2011, RKSD, 27050 (LWG).

COLLEMATACEAE

6. *Collema leptaleum* var**. *biliosum*** (Mont.) Dengel., Symb. Bot. Upsal. 20(2): 105. 1974. Fig. 4

= *Collema nigrescens* var. *biliosum* Mont., Ann. Sci. Nat. Bot., ser. 2(18): 20, 1842.

Distribution – *C. leptaleum* var. *biliosum* was previously reported from Maharashtra, Tamil Nadu and Uttarakhand, and is a new report for Northeast India.

Specimens examined **–** India, Manipur, Senapati, Sadu Chiru, 1066 m, 8 Aug 2013, RKSD, 14–3–025713 (LWG/AUS).

7. *Leptogium pichneum* (Ach.) Malme, Ark. Bot. 19(8): 20, 1924. Fig. 5

Distribution **–** *L. pichneum* was previously reported from Andaman & Nicobar Islands, Kerala, Madhya Pradesh and Tamil Nadu, and is a new report for Northeast India.

Specimens examined **–** India, Manipur, Imphal West, Konthoujam Lairembi, 763 m, 24 Mar 2012, RKSD, 439 (AUS).

8. *Leptogium pseudopapillosum* P.M. Jørg. Symb. Bot. Upsal., 32(1): 120, 1997.

Distribution **–** *L. pseudopapillosum* was previously reported from Kerala, Nagaland, Tamil Nadu and Uttarakhand, and is a new report to Manipur.

Specimens examined **–** India, Manipur, Senapati, Sadu Chiru, 1066 m, 24 Mar 2015, RKSD, 14-3-025715 (LWG).

GRAPHIDACEAE

9. *Graphis caesiella* Vain, Acta Soc. Fauna Fl. Finn. 7: 122, 1890.

Distribution – *G. caesiella* was previously reported only from Lakshadweep and is a new report to Manipur.

Specimens examined **–** India, Manipur, Bishnupur, Loukoipat, 854 m, 11 Feb 2015, RKSD, 1213 (AUS).

10. *Graphis pyrrhocheiloides* Zahlbr., Cat. Lich. Univ. 2: 321, 1923. Fig. 6

Distribution **–** *G. pyrrhocheiloides* is a new report for Northeast India and was previously reported from Karnataka, Maharashtra, and West Bengal.

Specimens examined **–** India, Manipur, Bishnupur, Loukoipat, 854 m, 11 Feb 2015, RKSD, 14-3-025714 (AUS).

PORPIDIACEAE

11. *Mycobilimbia hunana* (Zahlbr.) D.D. Awasthi & R. Mathur, Proc. Indian Acad. Sci., Pl. Sci. 97(6): 501, 1987.

= *Bacidia hunana* Zahlbr. in Handel– Mazzetti, Symb. Sinic. Pars III: 113, 1930.

Distribution **–** *M. hunana* is reported from Mizoram, Nagaland and West Bengal, and is a new report to Manipur.

Specimens examined **–** India, Manipur, Thoubal, Uyok Ching, 819 m, 8 Aug 2013, RKSD, 15–25680 (LWG/AUS).

NEPHROMATACEAE

12. *Nephroma sikkimense* Asahina, J. Jap. Bot. 38: 193. Fig. 7

Distribution **–** *N. Sikkimense* is an endemic species which was reported only from Sikkim.

Specimens examined **–** India, Manipur, Senapati, Sadu Chiru, 1066 m, 8 Aug 2013, RKSD, 15–25672 (LWG/AUS).

PARMELIACEAE

13. *Bulbothrix tabacina* (Mont. & Bosch.) Hale , Phytologia 28: 481.1974 & Smithsonian Contr. Bot. 32: 24, 1976.

= *Parmelia tabacina* Mont. & Bosch, Syll. Gen. Sp. Crypt.: 327, 1856.

Distribution **–** *B. tabacina* is a new report to Manipur. The species is distributed only in Nagaland.

Specimens examined **–** India, Manipur, Imphal East district, Chingkhei Ching, 867 m, 18.10.2011, RKSD, 27035 (LWG); Imphal West, Mana Ingkol Ching, 816 m, 28 Dec 2011, RKSD, 311 (AUS).

14. *Hypotrachyna revoluta* (Florke) Hale, Smithsonian Contr. Bot. 25: 60. 1975.

= *Parmelia revoluta* Flörke, Deutschl. Lich. 1: 11. 1815. Fig. 8

Distribution – The species earlier is reported only from Tamil Nadu. *H. revoluta* is a new report for Northeast India.

Specimens examined **–** India, Manipur, Imphal East, Keirao Wangkhem, 834 m, 18 Feb 2012, RKSD, 383 (AUS).

15. *Parmotrema andinum* (Müll. Arg.) Hale, Phytologia 28: 334, 1974 Fig. 9

= *Parmelia andina* Müll. Arg., Rev. Mycol. (Toulouse) 1: 169. 1879.

Distribution – This species is known from Andhra Pradesh, Himachal Pradesh, Jharkhand, Karnataka, Madhya Pradesh, Orissa, Tamil Nadu and Uttarakhand, and is a new report for Northeast India.

Specimens examined **–** India, Manipur, Imphal West, Langol, 811 m, 13 Oct 2011, RKSD, 27061(LWG); Konthoujam Lairembi, 763 m, 18 Feb 2012, RKSD, 415(AUS).

16. *Parmotrema crinitum* (Ach.) M. Choisy, Bull. Mens. Soc. Linn. Soc. Bot. Lyon 21: 175, 1952.

= *Parmelia crinita* Ach., Syn. Meth. Lich.: 196, 1814.

Distribution – A cosmopolitan species known from Andhra Pradesh, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Tamil Nadu and Uttarakhand, but is newly reported in Manipur.

Specimens examined – INDIA: Manipur, Imphal East, Keirao Wangkhem, 837 m, 9 Oct 2011, RKSD, 01(AUS); Imphal West, Khongampat, 799 m, 10 Dec 2011, RKSD, 27057 (LWG).

17. *Parmotrema eunetum* (Stirt.) Hale, Phytologia 28: 336, 1974. Fig. 10

= *Parmelia euneta* Stirt., Scott. Naturalist (Perth) 4: 298, 1878.

Distribution – The species is a new report for Northeast India being previously known for Kerala and Uttarakhand.

Specimens examined – India, Manipur, Imphal West, Konthoujam Lairembi, 763 m, 18 Feb 2012, RKSD, 27056 (LWG); Bishnupur, Ngariyan Hills, 848 m, 12 Dec 2011, RKSD, 211(AUS).

18. *Parmotrema indicum* Hale, Mycotaxon 5: 436, 1977.

Distribution – *P. indicum* is new report for Northeast India. It was previously reported for Kerala and Tamil Nadu.

Specimens examined – India, Manipur, Imphal West, Langol, elevation 811 m, 13 Oct 2011, RKSD, 27060 (LWG); Imphal East district, Chingkhei Ching, elevation 811 m, 18 Oct 2011, RKSD 78/B(AUS).

19. *Parmotrema mesotropum* (Mull. Arg.) Hale, Phytologia 28: 337, 1974.

= *Parmelia mesotropa* Müll. Arg., Rev. Mycol. (Toulouse) 10: 55, 1888.

Distribution – *P. mesotropum* is reported from Arunachal Pradesh, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh and Uttarakhand, and is new addition to the lichen flora of Manipur.

Specimens examined – India, Manipur, Imphal West, Phayeng, elevation 871 m, 02 Jan 2012, RKSD, 375 (AUS).

20. *Parmotrema saccatilobum* (Taylor) Hale, Phytologia 28: 339, 1974.

= *Parmelia saccatiloba* Taylor in Hook.f., London J. Bot. 6: 174, 1847.

Distribution – The taxon is widely distributed in Andaman & Nicobar Islands, Assam, Goa, Kerala, Maharashtra, Nagaland, Sikkim, Tamil Nadu, Uttarakhand and West Bengal, and is new report to Manipur.

Specimens examined – India, Manipur, Imphal West, Mana Ingkol Ching, 816 m, 23 Oct 2011, RKSD, 27059 (LWG); Imphal West, Phayeng, elevation 871 m, 02 Jan 2012, RKSD, 367 (AUS).

21. *Usnea pangiana* Stirt., Scott. Naturalist (Perth) 7: 77, 1883.

Distribution – *U. pangiana* is reported from Arunachal Pradesh, Assam, Kerala, Meghalaya, Nagaland, Sikkim, Uttarakhand and West Bengal, and is new report to Manipur.

Specimens examined – India, Manipur, Churachandpur, Lamdan, 1102 m, 4 Jun 2014, RKSD, 15–25677 (LWG/AUS).

PERTUSARIACEAE

22. *Pertusaria tetrathalmia* (Fée) Nyl., Acta Soc. Sci. Fenn. 7: 448, 1863.

= *Trypethelium tetrathalmium* Fée, Essai Crypt. Ecorc, 69, 1824.

Distribution – *P. tetrathalmia* is new report for Northeast India and it was previously reported for Karnataka, Kerala, Madhya Pradesh and Tamil Nadu.

Specimens examined – India, Imphal West district, Yurembam, elevation 736 m, 2 Nov 2011, RKSD, 144 (AUS).

PHYSCIACEAE

23. *Dirinaria applanata* (Fee) D.D.Awasthi., J. Indian Bot. Soc. 49: 135, 1970

= *Parmelia applanata* Fée, Essai Crypt. Ecorc.: 126, 1824.

Distribution – *D. applanata* is widely distributed in Andaman & Nicobar Islands, Karnataka, Madhya Pradesh, Maharashtra, Nagaland, Sikkim, Tamil Nadu, Uttar Pradesh, Uttarakhand and West Bengal and is new report to Manipur.

Specimens examined – India, Manipur, Imphal East district, Kaina, 907 m, 24 Mar 2012, RKSD 27064 (LWG); Imphal West, Mana Ingkol Ching, 816 m, 28 Dec 2011, RKSD, 311 (AUS).

24. *Dirinaria confluens* (Fr.) D.D. Awasthi, Biblioth. Lichenol. 2: 28. 1975**.**

=*Parmelia confluens* Fr., Syst. Orb. Veg. 1:284. 1825.

Distribution – *D. confluens* is widely distributed in Andaman & Nicobar Islands, Arunachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Nagaland, Orissa, Sikkim, Tamil Nadu and Uttar Pradesh and is new report to Manipur.

Specimens examined – India, Manipur, Imphal West, Mana Ingkol Ching, 816 m, 23 Oct 2011, RKSD, 108 (AUS).

25. *Dirinaria picta* (Sw.) Clem. & Shaer., Gen. Fungi : 323, 1931

= *Lichen pictus* Sw., Prodr.: 146, 1788.

Distribution – *D. picta* is reported for Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Lakshadweep, Tamil Nadu, Uttar Pradesh and West Bengal and is new report to Manipur.

Specimens examined **–** India, Manipur, Imphal East district, Porou Ching, 801 m, 24 Mar 2012, RKSD, 485 (AUS).

26. *Heteterodermia albidiflava* (Kurok.) D.D.Awasthi, Geophytology 3: 113, 1973; *Anaptychia albidiflava* Kurok., Beih. Nova Hedwigia 6: 42, 1962.

Distribution – An endemic species to India, known for Himachal Pradesh, Madhya Pradesh, Mizoram, Sikkim and West Bengal, and is new addition to the lichen flora of Manipur.

Specimens examined **–** India, Manipur, Imphal East district, Keirao Wangkhem, 834 m, 18 Feb 2012, RKSD, 404 (AUS).

27. *Heterodermia hypochraea* (Vain.) Swinscow & Krog, Lichenologist 8: 119. 1976.

Distribution **–** *H. hypochraea* was previously reported only for Nagaland, and is new report to Manipur.

Specimens examined **–** India, Manipur, Imphal East district, Keirao Wangkhem, 834 m, 18 Feb 2012, RKSD, 04 (AUS).

28. *Phaeophyscia endococcina* (Körb.) Moberg, Symb. Bot. Upsal 22(1): 35, 1977

= *Parmelia endococcina* Körb., Parerga Lichenol: 36, 1859.

Distribution **–** *P. endococcina* is previously known from Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Sikkim and Uttarakhand, and is a new addition to the lichen flora of Manipur.

Specimens examined **–** India, Manipur, Senapati, Sadu Chiru, 1066 m, 8 Aug 2013, RKSD, 14–3–025727 (LWG/AUS).

29. *Pyxine himalayensis* D.D. Awasthi, Phytomorphology 30: 371, 1980. Fig. 11

Distribution – *P. himalayensis* is previously reported for West Bengal. This species is new report for Northeast India

Specimens examined **–** India, Manipur, Imphal East, Keirao Wangkhem, 837 m, 9 Oct 2011, RKSD, 24/A (AUS).

30. *Pyxine petricola* Nyl., J. Bot. London 14: 263, 1876.

Distribution – *P. petricola* is widely distributed in Assam, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra and Tamil Nadu and is new report to Manipur.

Specimens examined **–** India, Manipur, Imphal West, Phayeng, 871 m, 2 Jan 2012, RKSD, 354 (AUS).

31. *Pyxine reticulata* (Vain.) Vain., Ann. Acad. Sci. Fenn., ser. A, 70, 1914.

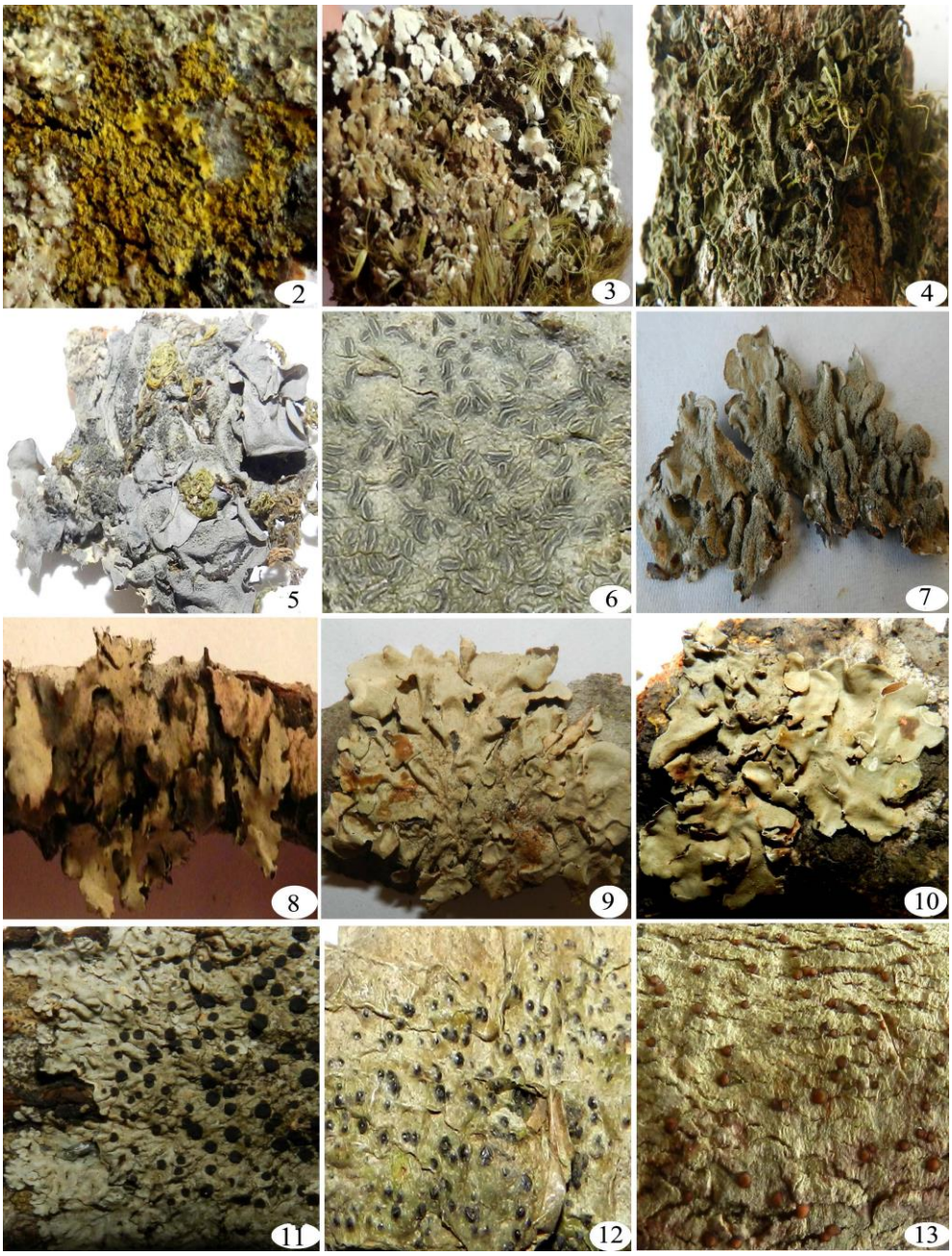
= *Physcia reticulate* Vain. In Hiern & al., Cat. Afr. Pl. 2(2): 412, 1901.

Distribution – A cosmopolitan species previously reported for Andaman & Nicobar Islands, Karnataka and Tamil Nadu. *P. reticulata* is new report for Northeast India.

Specimens examined – India, Manipur, Imphal West, Mana Ingkol Ching, 816 m, 23 Oct 2011, RKSD, 98 (AUS); Imphal West, Khongampat, 799 m, 10 Dec 2011, RKSD, 190 (AUS).

32. *Pyxine subcinerea* Stirt., Trans. & Proc. New Zealand Inst. 30: 397, 1898.

Distribution – A cosmopolitan species known from Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Nagaland, Sikkim, Tamil Nadu, Uttarakhand, and West Bengal. *P. subcinerea* is a new report to Manipur.



Figs 2–12–New reports of lichens of Manipur state. 2 *Candelaria concolor* (Dicks.) Stein 3 *Cladonia macroceras* (Delise) Hav. 4 *Collema leptaleum* var. *biliosum* (Mont.) Dengel. 5 *Leptogium pichneum* (Ach.) Malme. 6 *Graphis pyrrhocheiloides* Zahlbr. 7 *Nephroma sikkimense* Asahina. 8 *Hypotrachyna revoluta* (Florke) Hale. 9 *Parmotrema andinum* (Müll. Arg.) Hale. 10 *Parmotrema eunetum* (Stirt.) Hale. 11 *Pyxine himalayensis* D.D. Awasthi. 12 *Pyrenula submastophora* Ajay Singh and Upreti. 13 *Bacidia connexula* (Nyl.) Zahlbr.

Specimens examined – India, Manipur, Bishnupur, Ngariyan hills, 992 m, 12 Dec 2011, RKSD, 258 (AUS).

PYRENULACEAE

33. *Pyrenula anomala* (Ach.) Vain., Ann. Acad. Sci. Fenn., ser. A, 6: 189, 1915.

= *Trypethelium anomalum* Ach., Syn. Meth. Lich.: 105, 1814.

Distribution – The species is new report to Manipur and was previously reported for Andaman & Nicobar Islands and Arunachal Pradesh.

Specimens examined – India, Manipur, Imphal West, Konthoujam Lairembi, 763 m, 24 Mar 2012, RKSD, 15-25676 (LWG).

34. *Pyrenula introducta* (Stirt) Zahlbr., Cat. Lich. Univ, 1: 433, 1922.

= *Verrucaria introducta*, Proc. Roy. Soc. Glasgow, 13: 191, 1881.

Distribution – *P. introducta* is previously reported for Andaman & Nicobar Islands, Andhra Pradesh, Assam, Arunachal Pradesh, Kerala, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal, and is new report for Manipur.

Specimens examined – India, Manipur, Imphal West, Khongampat, 856 m, 10 Dec 2011, RKSD, 176 (LWG); Imphal East, Keirao Wangkhem, 834 m, 18 Feb 2012, RKSD, 16 (AUS).

35. *Pyrenula submastophora* Ajay Singh and Upreti, Geophytology 17: 85, 1987. Fig. 12

Distribution – The species is new report for Northeast India and was previously known for Andaman & Nicobar Islands and Kerala.

Specimens examined – India, Manipur, Bishnupur, Loukoipat, 854 m, 11 Feb 2015, RKSD, 213 (AUS).

RAMALINACEAE

36. *Bacidia connexula* (Nyl.) Zahlbr., Cat. Lich. Univ. 4:187, 1926

= *Lecidea connexula* Nyl., Lich. Jap.: 111, 1890. Fig. 13

Distribution – *B. connexula* is new report for Northeast India. It was previously reported for Madhya Pradesh and West Bengal.

Specimens examined – India, Imphal West district, Yurembam, elevation 736 m, 2 Nov 2011, RKSD, 144 (AUS).

37. *Bacidia spadiacea* (Ach.) Zahlbr., Denkschr. Kaiserl. Akad. Wiss. Wien. Math. Naturwiss. Kl. 83:128, 1909

=*Lecidea spadicea* Ach., Synops. Lich.: 34, 1814.

Distribution – *B. spadicea* is a new report for Northeast India. This species is reported from Tamil Nadu and West Bengal.

Specimens examined – India, Manipur, Bishnupur district, Keibul Lamjao, 891 m, 2 Feb 2015, RKSD, 1167 (AUS).

38. *Bacidia submedialis* (Nyl.) Zahlbr., Cat. Lich. Univ. 4:243, 1926

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

Distribution – This species is a new report for Manipur. Previously it was reported for Arunachal Pradesh, Goa, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh, and West Bengal.

Specimens examined – India, Manipur, Imphal West, district, Phayeng, 871 m, 2 Jan 2012, RKSD, 350 (AUS).

TRYPETHELIACEAE

39. *Trypethelium eluteriae* Spreng, Anleit, Kent. 3:351, 1804.

Distribution – *T. eluteriae* is reported as a new addition to the lichen flora of Manipur. Previously it was reported for Andaman & Nicobar Islands, Arunachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Nagaland, and Tamil Nadu.

Specimens examined – India, Manipur, Imphal West, Konthoujam Lairembi, 763 m, 24 Mar 2015, RKSD, 15–25675 (LWG).

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