

Diversity of Lichens; Its Threat Need Conservation in Mizoram

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Abstract: A study on lichens of Mizoram enumerating 118 Species belonging to 37 genera and 17 families are provided. 10 (Ten) species viz. *Bacidia connexula*, *Buellia curtisii*, *Caloplaca citrina*, *Herpothallon philippinum*, *Leptogium delavayi*, *Pertusaria pertusa*, *Pertusaria pseudococcodes*, *Pyrenula andina*, *Trichothelium epiphyllum* and *Usnea nipparensis* are reported for the first time in Mizoram. Mizoram is poorly explored in study of lichens among different states of India. The region is experiencing a lot of anthropogenic problems like shifting cultivation, expansion of agriculture, introduction of plantation crops, destruction of natural forest, collection of wood, infrastructure development and road construction as a result the valuable resources lichens are lost. This study will lead to further research on Lichens and contribute to a better knowledge of their distribution in this ecologically biodiversity state of Mizoram.

Keywords: Distribution, Forests, Lichens, Mizoram, Northeast India.

I. INTRODUCTION

The symbiotic association between an alga and fungus has resulted in new life form called lichen. It is present in a wide range of habitats throughout the world and dominates about 8% of terrestrial ecosystems [1]. More than 20,000 species of lichens have been reported globally among which the Indian subcontinent has 2450 species of lichens, of which India alone has about 2040 species [2],[3]. Northeast India including Mizoram as a biodiversity hotspot of this region harbours the rich Lichens wealth among biogeographical regions of the country. Northeast states are represented by 1165 taxa of lichens of which Arunachal represents 480 followed by Nagaland with 304, Manipur with 295, Meghalaya with 184 and Assam with 150 [4]. Although Mizoram is very rich in Lichens Biodiversity, only 179 species of lichens has been recorded [5]. Mizoram lies between 23°37'01" N latitude and 93°18'00" E longitude. It is situated in the Northeast India between the border of Burma (Myanmar) and Bangladesh, covering the area about 21087 km² with more than 90% of the evergreen forest vegetation. The lichenological investigations and collection of samples were done from two reserve forests Tawi Wildlife Sanctuary, Aizawl District and Thorangtlang Wildlife Sanctuary, Lunglei District, Mizoram.

II. MATERIALS AND METHODS

The samples were collected randomly from different altitude across the Sanctuary. The present study is based on the examination of about 300 specimens of lichens collected during December 2015 to March 2017. Lichens were collected along with the substratum using sharp knife. Fructicose lichens were collected with their holdfast intact on the substratum. The specimens were examined morphologically, anatomically and chemically. The morphological features were studied using binocular zoom dissection microscope and anatomy of the samples was studied with the help of compound microscope. The K, C, KC and P tests [6],[7], which are important for identification of chemical substance in lichen, were made on thallus, cortex and medulla. The collected samples were identified and confirmed in Botanical Survey of India, Allahabad, CSIR-National Botanical Research Institute, Lucknow and Laboratory of Ecology and Diversity, Department of Botany, Mizoram University. The specimens were identified and authenticated following literature on lichens [8],[9],[10],[11],[12],[13],[14],[15],[4],[16].

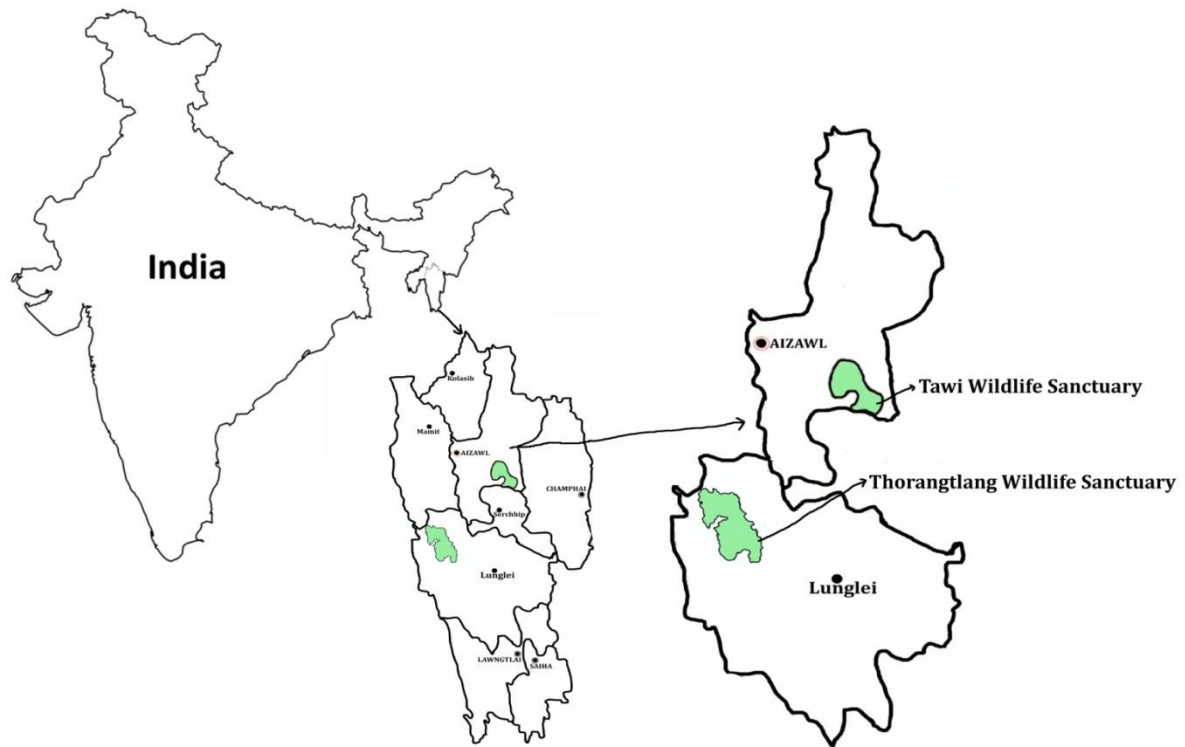


Fig 1: Map showing Study Area, Tawi Wildlife Sanctuary and Thorangtlang Wildlife Sanctuary, Mizoram.

III. RESULT AND DISCUSSION

Table: List of Lichen species with family and growth form.

Family	Genus	No.	Species	Gf
Arthoniaceae	<i>Cryptothecia</i>	1	<i>Cryptothecia involuta</i> Stirton	Cr
		2	<i>Cryptothecia lunulata</i> (Zahlbr) Makh and Patw	Cr
		3	<i>Herpothallon philippinum</i> (Vain.) Aptroot & Lücking	Cr
Brigantiaceae	<i>Brigantiaea</i>	4	<i>Brigantiaea leucoxantha</i> (Spreng.) R. Sant & Haffelner	Cr
Cladoniaceae	<i>Cladonia</i>	5	<i>Cladonia coniocrea</i> (Flörke) Spreng.	Fr
		6	<i>Cladonia fruticulosa</i> Kremp	Fr
		7	<i>Cladonia submultiformis</i> Asahina	Fr
		8	<i>Leptogium askotense</i> D.D.Awasthi	Fo
Collemataceae	<i>Leptogium</i>	9	<i>Leptogium denticulatum</i> Nyl.	Fo
		10	<i>Leptogium delavayi</i> Hue.	Fo
		11	<i>Diorygma heiroglyphicum</i> (Pers.) Staiger and Kalb	Cr
Graphidaceae	<i>Diorygma</i>	12	<i>Diorygma junghuhnii</i> (Mont. and Bosch) Kalb.Staiger & Elix	Cr
		13	<i>Diorygma megaspermum</i> Makhija, Chitale & B.O. Sharma	Cr
		14	<i>Fissurina dumastii</i> Fée	Cr
	<i>Glyphis</i>	15	<i>Glyphis cicatricose</i> Ach.	Cr
	<i>Graphis</i>	16	<i>Graphis arecae</i> Vain.	Cr

		17	<i>Graphis assimilis</i> Nyl.	Cr
		18	<i>Graphis caesiella</i> Vain.	Cr
		19	<i>Graphis granulosa</i> (Müll Arg.) Lücking	Cr
		20	<i>Graphis insulana</i> (Müll Arg.) Lücking	Cr
		21	<i>Graphis librata</i> C.Knight	Cr
		22	<i>Graphis lineola</i> Ach.	Cr
		23	<i>Graphis proserpens</i> Vain.	Cr
		24	<i>Graphis schiffneri</i> Zahlbr	Cr
		25	<i>Graphis scripta</i> (L.) Ach.	Cr
	<i>Pallidogramme</i>	26	<i>Pallidogramme chlorocarpoides</i> Staiger & al.	Cr
	<i>Hemithecium</i>	27	<i>Hemithecium aphanes</i> (Mont. & Bosch.) Nakan & Kashiwa	Cr
	<i>Phaeographis</i>	28	<i>Phaeographis Kalbii</i> Staiger	Cr
		29	<i>Phaeographis dendroides</i> (Leight.) Müll. Arg.	Cr
	<i>Thecaria</i>	30	<i>Thecaria quassiicola</i> Fée	Cr
Lecanoraceae	<i>Lecanora</i>	31	<i>Lecanora achroa</i> Nyl.	Cr
		32	<i>Lecanora alba</i> Lumbch	Cr
		33	<i>Lecanora chlarotera</i> Nyl.	Cr
		34	<i>Lecanora concilianda</i> Vainio	Cr
		35	<i>Lecanora conorulans</i> Nyl.	Cr
		36	<i>Lecanora fimbriatula</i> Stirton	Cr
		37	<i>Lecanora tropica</i> Zahlbr	Cr
	<i>Ramboldia</i>	38	<i>Ramboldia manipurensis</i> (K.Singh) Kalb <i>et al.</i>	Cr
		39	<i>Ramboldia russula</i> (Ach.) Kalb <i>et al.</i> ,	Cr
Lecideaceae	<i>Lecidea</i>	40	<i>Lecidea granifera</i> (Ach.) Vain	Cr
Lobariaceae	<i>Lobaria</i>	41	<i>Lobaria discolor</i> (Bory) Hue	Fo
		42	<i>Lobaria retigera</i> (Bory) Trevis	Fo
		43	<i>Lobaria pseudopulmonaria</i> Gyeln	Fo
		44	<i>Pseudocyphellaria crocata</i> (L.) Vain.	Fo
Pannariaceae	<i>Pannaria</i>	45	<i>Pannaria emodi</i> P.M. Jørg	Fo
	<i>Parmeliella</i>	46	<i>Parmeliella papillata</i> P.M. Jørg	Fo
Parmeliaceae	<i>Hypotrachyna</i>	47	<i>Hypotrachyna cirrhata</i> (Fr) Divakar <i>et al.</i>	Fo
		48	<i>Hypotrachyna flexilis</i> (Kurok) Hale	Fo
		49	<i>Hypotrachyna nepalensis</i> (Taylor)	Fo
		50	<i>Hypotrachyna imbricatula</i> (Zahlbr) Hale	Fo
		51	<i>Hypotrachyna sublaevigata</i> (Nyl) Hale	Fo
	<i>Myelochroa</i>	52	<i>Myelochroa perisidians</i> (Nyl) Elix and Hale	Fo

		53	<i>Myelochroa subaurulenta</i> (Nyl) Elix & Hale	Fo
		54	<i>Myelochroa xantholepsis</i> (Mont. & Bosch.) Elix & Hale	Fo
	<i>Parmotrema</i>	55	<i>Parmotrema chinense</i> (Osbeck) Hale & Ahti	Fo
		56	<i>Parmotrema cristiferum</i> (Taylor) Hale	Fo
		57	<i>Parmotrema hababianum</i> (Gyeln.) Hale	Fo
		58	<i>Parmotrema indicum</i> Hale	Fo
		59	<i>Parmotrema pseudotinctorum</i> (Abbayes) Hale	Fo
		60	<i>Parmotrema ravum</i> (Krog and Swins.) Serus	Fo
		61	<i>Parmotrema reticulatum</i> (Taylor and) Choisy	Fo
		62	<i>Parmotrema robustum</i> (Degel.) Hale	Fo
		63	<i>Parmotrema saccatilibum</i> (Taylor) Hale	Fo
		64	<i>Parmotrema stupeum</i> (Taylor) Hale	Fo
		65	<i>Parmotrema tinctorum</i> (Nyl) Hale	Fo
	<i>Relicina</i>	66	<i>Relicina sydneyensis</i> (Gyeln.) Hale	Fo
	<i>Usnea</i>	67	<i>Usnea aciculifera</i> Vain.	Fo
		68	<i>Usnea baileyi</i> (Stirton) Zahlbr.	Fo
		69	<i>Usnea fragilis</i> Stirton	Fo
		70	<i>Usnea longissima</i> Ach.	Fo
		71	<i>Usnea nipparensis</i> Asahina	Fo
		72	<i>Usnea orientalis</i> Motyka	Fo
		73	<i>Usnea pangiana</i> Stirton	Fo
		74	<i>Usnea pectinata</i> Taylor	Fo
		75	<i>Usnea undulata</i> Stirton	Fo
Pertusariaceae	<i>Pertusaria</i>	76	<i>Pertusaria albescens</i> (Huds) M.Choisy & Werner	Cr
		77	<i>Pertusaria amara</i> Nyl.	Cr
		78	<i>Pertusaria leucosorodes</i> Nyl.	Cr
		79	<i>Pertusaria multipunctata</i> (Turner) Nyl.	Cr
		80	<i>Pertusaria pertusa</i> (Weigel) Tuck	Cr
		81	<i>Pertusa pseudococcodes</i> Müll Arg.	Cr
		82	<i>Pertusaria pustulata</i> (Ach.) Duby	Cr
Physciaceae	<i>Buellia</i>	83	<i>Buellia aeruginascens</i> (Nyl) Zahlbr	Cr
		84	<i>Buellia morehensis</i> K.Singh and S.R.Singh	Cr
		85	<i>Buellia curtisii</i> (Tuck)	Cr
	<i>Dirinaria</i>	86	<i>Dirinaria aegialita</i> (Afz. In Ach.) Moore	Fo
		87	<i>Dirinaria confluens</i> (Fr.) D.D.Awasthi	Fo
		88	<i>Dirinaria consimilis</i> (Stirt.) D.D. Awasthi	Fo

	<i>Heterodermia</i>	89	<i>Heterodermia albidiflava</i> (Kurok.) Awasthi	Fo
		90	<i>Heterodermia boryii</i> (Fée) Kr.P.Singh and S.RSingh	Fo
		91	<i>Heterodermia comosa</i> (Eschw.) Follman and Redón	Fo
		92	<i>Heterodermia dactyliza</i> (Nyl.) Swinc. and Krog	Fo
		93	<i>Heterodermia diademata</i> (Taylor) D.D.Awasthi	Fo
		94	<i>Heterodermia japonica</i> (Sato) swinc. and Krog.	Fo
		95	<i>Heterodermia obscurata</i> (Nyl.) Trevis	Fo
		96	<i>Heterodermia pseudospeciosa</i> (Kurok.) Culb	Fo
		97	<i>Heterodermia speciosa</i> (Wulf) Trevis	Fo
	<i>Physcia</i>	98	<i>Physcia dilatata</i> Nyl.	Fo
		99	<i>Physcia integrate</i> Nyl.	Fo
	<i>Pyxine</i>	100	<i>Pyxine cocoes</i> (Sw.) Nyl	Fo
		101	<i>Pyxine consocians</i> Vain	Fo
		102	<i>Pyxine retirugella</i> Nyl.	Fo
		103	<i>Pyxine subcinerea</i> Stirt.	Fo
Porinaceae	<i>Porina</i>	104	<i>Porina subcutanae</i> Ach.	Cr
	<i>Trichothelium</i>	105	<i>Trichothelium epiphyllum</i> Mull. Arg.	Cr
Porpidiaceae	<i>Mycobilimbia</i>	106	<i>Mycobilimbia hunana</i> (Zahlbr.) D.D.Awasthi	Cr
Pyrenulaceae	<i>Pyrenula</i>	107	<i>Pyrenula andina</i> Aptroot	Cr
		108	<i>Pyrenula approximans</i> (Kremp.) Mull. Arg.	Cr
		109	<i>Pyrenula complanata</i> (Mont.) Trevis	Cr
		110	<i>Pyrenula zeylanica</i> Upreti and A.Singh	Cr
Ramalinaceae	<i>Bacidia</i>	111	<i>Bacidia connexula</i> (Nyl.)	Cr
		112	<i>Bacidia fusconigrecens</i> (Nyl) Zahlbr	Cr
		113	<i>Bacidia laurocerasi</i> (Delise ex Duby) Vain	Cr
		114	<i>Bacidia medialis</i> (Tuck. ex Nyl.) Zahlbr	Cr
	<i>Ramalina</i>	115	<i>Ramalina conduplicans</i> Vain	Fo
		116	<i>Ramalina hossei</i> Vain	Fo
Teloschistaceae	<i>Caloplaca</i>	117	<i>Caloplaca citrina</i> (Hoff.) Arup, Fröden & Söchting	Cr
		118	<i>Caloplaca ferruginea</i> (Huds.) Th. Fr.	Cr

Gf = Growth form; Cr = Crustose; Fo = Foliose; Fr = Fructicose

The earlier worker like Singh and Sinha, Pinokiyo and Singh (2008) [17] and Longesh *et al.*, (2015) [18] identified 182 species from the state of Mizoram. Lalremruata *et al.*, (2017) [5] further added 18 species of lichens collected from Tawi wildlife sanctuary, Aizawl District, Mizoram. Out of 118 species identified in the present study, 10 species viz. *Bacidia connexula*, *Buellia curtisii*, *Caloplaca citrina*, *Herpothallon philippinum*, *Leptogium delavayi*, *Pertusaria pertusa*, *Pertusaria pseudococcodes*, *Pyrenula andina*, *Trichothelium epiphyllum* and *Usnea nipparensis* are newly reported to the state. *Lobaria retigera*, *Everniastrum cirrhatum*, *Heterodermia diademata*, *Parmotream reticulatum*, *Parmotrema*

tinctorum and *Usnea baileyi* exhibit their widespread distribution similar to other Northeastern state like Arunachal Pradesh, Manipur, Nagaland and Sikkim [14],[15],[4],[19]. Genus like *Graphis* (10 species), *Heterodermia* (9 species), *Lecanora* (7 species), *Parmotrema* (11 species), *Pertusaria* (7 species) and *Usnea* (9 species) are dominant and and Graphidaceae, Lecanoraceae, Parmeliaceae and Physciaceae are dominant families in the studied area.

Shifting cultivation and other anthropogenic activities in some of the studied area show declined growth of macrolichens like *Usnea*, *Everniastrum*, *Ramalina* and *Parmotrema*. The urgent need is to prevent the anthropogenic activities, restore microclimatic conditions and to conserve the lichen flora of the region.

IV. CONCLUSION

The studied region exhibits variety of microhabitats which harbour good luxuriant growth and colonisation of a number of lichen species on different substrata. The present study reveals the presence of 118 species of lichen from the two wildlife sanctuary sites of the state. It is the need of the hour to develop lichen conservation units, protect the important resources of poorly explored region and to provide data base of the lichen flora of the state.

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