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**A FIRST NOTE ON LICHENS OF TAWI WILDLIFE SANCTUARY, MIZORAM****P.C. LALREMRUATA<sup>1\*</sup>, R.C. LAHA<sup>1</sup>, LALHRIATPUIA<sup>2</sup> AND ZOTHANMAWIA<sup>2</sup>**<sup>1,2</sup>*Department of Botany, Mizoram University, Aizawl-796004, Mizoram, India.*<sup>2</sup>*Pachhunga University College, Aizawl, Mizoram, India.***ABSTRACT**

The present study deals with the investigation of Lichen flora of Tawi Wildlife Sanctuary, Mizoram. In the present investigations a total of 60 species belonging to 19 genera and 9 families have been recorded for the first time from Tawi Wildlife Sanctuary, Mizoram. Out of which 18 species viz. *Brigantiaea leucoxantha*, *Caloplaca ferruginea*, *Dirinaria consimilis*, *Graphis librata*, *Lobaria pseudopulmonaria*, *Lobaria discolor*, *Heterodermia pseudospeciosa*, *Hypotrachyna flexilis*, *Myelochroa subaurulenta*, *Pallidogramme chlorocarpoides*, *Pyxine cocoes*, *Pyxine consocians*, *Pyxine retirugella*, *Parmotrema chinense*, *Parmotrema cristiferum*, *Parmotrema pseudotinctorum*, *Parmotrema robustum*, *Pseudocyphellaria crocata* are new records to Mizoram. Physciaceae, Graphidaceae and Parmeliaceae are the dominant families in the study area.

**KEYWORDS:** *Lichens, New records, Mizoram, Northeast India***P.C. LALREMRUATA<sup>1\*</sup>**

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## 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 terrestrial ecosystems. During recent years, surveys on lichens community has been carried out in different parts of the world, it is estimated that there are about 13,500 to 17,000 lichen species throughout the world.<sup>1</sup> The Indian subcontinent has 2,450 species of lichens, of which India alone has about 2040 species.<sup>2</sup> Northeast India including Mizoram as a biodiversity of this region harbors 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.<sup>3</sup> Although Mizoram is very rich in Lichens Biodiversity, only 161 species of lichens has been recorded. The lichenological investigations and collection of samples were done from Tawi Wildlife Sanctuary, Mizoram. Tawi Wildlife sanctuary lies between 23° 30' 26" N; 92° 57' 58" E. It is situated in the Aizawl district, Mizoram, covering the area about 35.75 km<sup>2</sup>. The forest types located in Tawi Wildlife Sanctuary are 1) Tropical or Sub Tropical evergreen forest 2) Semi evergreen forests and 3) Scrub jungles.

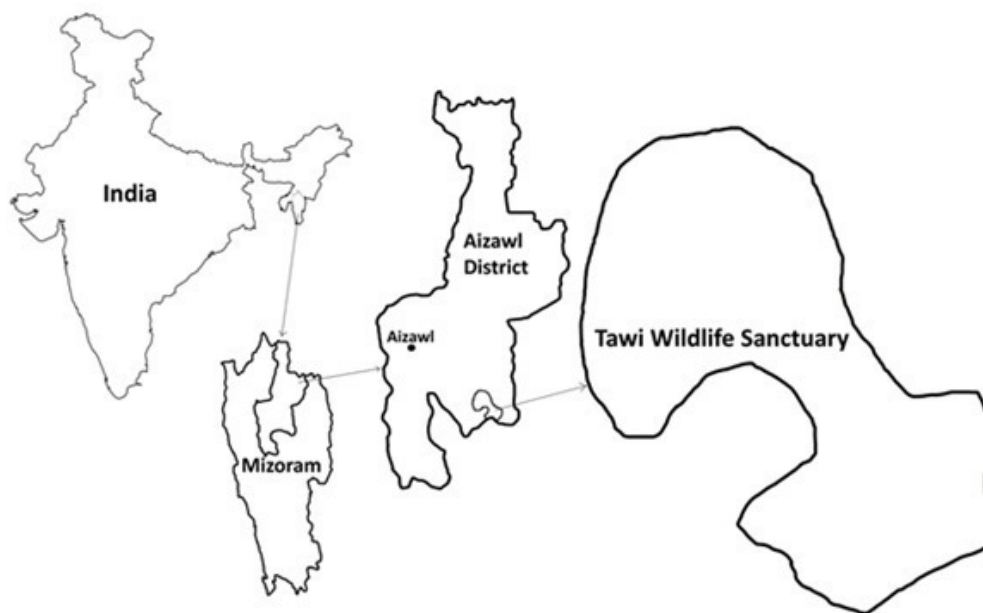


Figure 1  
Map showing Study Area, Tawi Wildlife Sanctuary, Mizoram.

## MATERIALS AND METHODS

Specimens were collected from different habitats across the Sanctuary during March 2015 to June 2016. 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 (5% of Potassium Hydroxide), C (Calcium hypochlorite or freshly prepared aqueous solution of Bleaching powder), KC (application of K quickly followed by C) and P (Steiner's stable solution prepared by mixing 1gm p-phenylenediamine, 10gms Sodium sulphite, 0.5mm liquid detergent neutral solution in 100ml distilled water) tests,<sup>4,5</sup> which are important for identification of chemical substance in lichen, were made on thallus, cortex and medulla. The specimen were identified and authenticated at Botanical Survey of India, Allahabad, following literature on lichens by Awasthi (1991).

## RESULTS AND DISCUSSION

In the present investigations, a total of 60 species belonging to 19 genera and 9 families have been

recorded. Out of which 18 species viz. *Brigantiaea leucoxantha*, *Caloplaca ferruginea*, *Dirinaria consimilis*, *Graphis librata*, *Lobaria pseudopulmonaria*, *Lobaria discolor*, *Heterodermia pseudospeciosa*, *Hypotrachyna flexilis*, *Myelochroa subaurulenta*, *Pallidogramme chlorocarpoides*, *Pyxine cocoes*, *Pyxine consocians*, *Pyxine retirugella*, *Parmotrema chinense*, *Parmotrema cristiferum*, *Parmotrema pseudotinctorum*, *Parmotrema robustum*, *Pseudocyphellaria crocata* are new record to Mizoram. Physciaceae, Graphidaceae and Parmeliaceae are the dominant families in the study area.

### New record to Mizoram

#### *-Brigantiaea leucoxantha* (Sprenzel) R. Sant & Haf.

Thallus crustose; corticolous, whitish grey effuse thallus; black, sessile, constricted at the base apothecia; concave when young, plane or convex at maturity, yellow-orange pruina disc; prominent, orange or black margin, K+ violet; epihymenium K+ violet; colourless, clear, hymenium; simple paraphyses; photobiont green alga; spores musiform (44-) 52-88(-116) x 24-36 (-52)µm.

**Specimen examined**

Tawi wildlife Sanctuary, 23°30'6.61"N 93°0'7.73"E, 1174 m. alt., 19.6.2016. P.C.Lalremruata 16-55.(MUH).

**-Caloplaca ferruginea (Huds.) Th. Fr.**

Thallus corticolous, areolate-verrucose to leprose-granular, grey-white; Spores 2-loculate 12-15 x 6-7 µm, Apothecia reddish to yellow-rust coloured, margin concolorous, sub-blatorine, subpersistent.

**Specimen examined**

Tawi wildlife Sanctuary, 23°30'4.61"N 93°0'3.73"E, 1280m alt. 19.6.2016. P.C.Lalremruata 16-26.(MUH).

**-Dirinaria consimilis (Stirton) D.D.Awasthi**

Thallus corticolous, 8 - 13cm across; lobes 1-2mm wide, flabellate, plicate; upper side grey, sorediate; soralia capitate with granular soredia. Apothecia to 1.5mm in diam; ascospores 14-23x6-8µm. Medulla K-, C-, P-. Sekikaic acid present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°33'6.61"N 93°1'7.73"E, 1340m alt., 19.6.2016. P.C.Lalremruata 16-65.(MUH).

**-Graphis librata C.Knight.**

Thallus crustose, pale greyish white, thin, dull; lirellae immersed to erumpent, with lateral thallin margin; Paraphyses branch only at the tip, ascomata conspicuous, black, scattered, occasionally branched; Spores 8 per ascus, septate, irregularly uniseriate, 15-25(-30) x 5-8µm. Norstictic acid present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°35'6.61"N 93°10'7.73"E, 1193m alt., 18.6.2016. P.C.Lalremruata 16-3.(MUH).

**-Heterodermia pseudospeciosa (Kurok.) W.Culb.**

Thallus corticolous, foliose, rosetiform, to 5cm across, branched; lobes short, flexuose, to 1.5mm wide, corticated on both sides, upper side greyish white, sorediate on apices of lobules; lower side white to dark, with sparse rhizines. Indian specimen sterile. Medulla K+ yellow turning red, P+ yellow. Zeorin, norstictic and salazinic acids present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°39'6.61"N 93°8'7.73"E, 1123m alt., 17.3.2016. P.C.Lalremruata 16-7.(MUH).

**-Hypotrachyna flexilis (Kurok) Hale**

Thallus corticolous, foliose, adnate, to 6(-8)cm across, lobate; lobes to 5mm wide, flexuose; upper side whitish grey, lacking isidia and soredia; lower side black with dichotomously branched rhizines; medulla white. Apothecia dense, to 3mm in diam.; ascospores 11-21x6-11µm. Medulla K-, C-, P-. Protolichesterinic acid and triterpenoids present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°30'6.61"N 93°0'7.73"E, 1179m alt., 18.3.2016. P.C.Lalremruata 16-17.(MUH).

**-Lobaria discolor (Bory) Hue**

Thallus corticolous, foliose, adnate, to 11cm across; lobes non-scrobiculate, 3-17 mm wide, with crenulate

margins; upper side pale to ochraceous brown, smooth, shiny, lacking isidia and soredia; lower side brownish, diffused tomentose and sparsely rhizines in central part; photobiont a green alga. Apothecia to 2mm diam; ascospores 3-septate, fusiform, 25-58x 6-9 µm. Upper cortex K+ yellow; medulla K-, C-, KC+ red. Gyrophoric acid present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°30'6.61"N 93°0'7.73"E, 1417m alt., 19.3.2016. P.C.Lalremruata 16-9.(MUH).

**-Lobaria pseudopulmonaria Gyeln.**

Thallus corticolous, foliose, adnate, to 15cm across; lobes 10-30 mm wide, truncate; upper side pale brown to brown, scrobiculate, reticulately ridged, lacking isidia and soredia; lower side brown black, tomentose and sparsely rhizinate in grooves, nude on convexities; photobiont a *Nostoc*. Apothecia usually on ridges, to 2.5mm in diam.; ascospores 3-septate, fusiform, 20-35x 6-9 µm. Upper cortex K-, medulla K+ yellow to red, C-, P+ yellow-orange. Norstictic, stictic, constictic acids and triterpenoids present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°30'6.61"N 93°0'7.73"E, 1395m alt., 19.3.2016. P.C.Lalremruata 16-4.(MUH).

**-Myelochroa subaurulenta (Nyl.) Elix & Hale**

Thallus corticolous, adnate, to 10cm across; lobes to 4mm wide, ciliate in axils, upper side grey to darker, lacking isidia and soredia; lower side rhizinate; medulla yellow to pale orange yellow. Apothecia 5-10mm in diam.; ascospores (6-) 8-14 (-18) x 6-8 (-10) µm. Medulla K+, C+, KC+. Secalonic acid A, zeorin, leucotylic acid (+ or-), leucotylin (+or-) and terpenes present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°40'6.61"N 93°5'7.73"E, 1239m alt. 15.11.2015. C.Lalremruata 15-33.(MUH).

**-Pallidogramme clorocarpoides (Nyl) Staiger.**

Thallus crustose, pale fawn; ascomata whitish, conspicuous, scattered, often branch; Proper exciple reddish brown; hymenium 150-180µm thick; spores 2-4 per ascus, 80-20 x (20-) 25-37µm. Stictic acid present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°32'6.61"N 93°9'7.73"E, 1318m alt., 18.6.2016. P.C.Lalremruata 16-14.(MUH).

**-Parmotrema chinense (Osbeck) Hale & Ahti.**

Thallus corticolous, to 7 cm across; lobes to 8 mm wide; upper side grey, emaculate; soralia marginal to submarginal; sorediate lobes often revolute; lower side centrally black; marginal zone brown, medulla white. Indian specimen sterile. Medulla K+ Yellow, C-, P+ pale-orange. Stictic and constictic acids present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°29'6.61"N 93°2'7.73"E, 1450m alt. 19.3.2016. P.C.Lalremruata 16-20.(MUH).

**-Parmotrema cristiferum (Taylor) Hale.**

Thallus corticolous, foliose, coriaceous, to 25 cm across; lobes 10-15 mm wide, ciliate; upper side grey, centrally

brownish, cracked, soralia marginal on lateral lobules in central part, soredia granular; lower side centrally black, wide marginal zone brown, medulla white. Apothecia rare, impoferate; ascospores absent or immature in Indian specimens. Medulla K+ yellow turning red, C-, P+ orange-red. Salazinic, consalazinic acids present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°29'6.61"N 93°5'7.73"E, 1255m alt.19.3.2016. P.C.Lalremruata 16-6.(MUH).

**-Parmotrema pseudotinctorum (Abbayes) Hale**

Thallus corticolous, foliose, to 6cm across; lobes 2-6 mm wide, eciliate; upper side grey, isidiate thick, irregularly inflated, branched; lower side centrally black; wide marginal zone brownish, medulla white. Indian specimen sterile. Medulla K-, C+, P-. Lecanoric acid present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°31'6.61"N 93°2'7.73"E, 1297m alt., 17.6.2016. P.C.Lalremruata 16-41.(MUH).

**-Parmotrema robustum (Degel.) Hale.**

Thallus corticolous, foliose, to 10cm across; lobes 5-10mm wide, sparsely ciliate, sometimes only in axils; upper side grey, faintly white-maculate, soralia linear on margins of lacinules, lower side black; medulla white. Indian specimen sterile. Medulla K+ yellowish, C-, P+ orange-red. Protocetraric acid present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°34'6.61"N 93°2'7.73"E, 1364m alt.17.6.2016. P.C.Lalremruata 16-44.(MUH).

**-Pseudocyphellaria crocata (L.) Vain.**

Thallus corticolous, to 8cm across, lobes to 10mm wide; upper side brownish; soralia, marginal, linear, yellow; lower side brownish, pseudocyphellae yellow; photobiont a Nostoc. Indian specimen sterile. Medulla K+ Yellow, P+ orange. Triterpenoids, tenuiorin, gyrophobic acid and methylgyrophobate present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°31'6.61"N 93°1'7.73"E, 1174m alt.17.6.2016. P.C.Lalremruata 16-5.(MUH).

**-Pyxine cocoes (Sw.) Nyl.**

Thallus corticolous, foliose, to 6cm across; lobes 0.5-1 (-2)mm wide; upper side yellowish grey; maculae

laminal and marginal turning into pseudocyphellae and then into soralia; Apothecia to 1mm in diam; ascospores (12) 16-20x 6-8(-10) µm. Upper cortex UV+ yellow. Upper cortex UV+ yellow; medulla K-, C-, P-. Lichexanthone and triterpenes present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°30'9.61"N 93°0'8.73"E, 1450m alt.19.6.2016. P.C.Lalremruata 16-19.(MUH).

**-Pyxine consocians Vain.**

Thallus corticolous, foliose, to 4cm across; lobes 0.5-1 mm wide; upper side greyish, maculae marginal to laminal, isidia nodular to subcylinder, apically bursting into crateriform soralia; soralia granular; medulla white to stramineous. Apothecia rare, to 2mm in diam; ascospores 12-18 (-20) x 7-9µm. Upper cortex UV-; medulla K+ yellow-red, C-, KC-, P+ deep yellow to orange. Norstictic acid and triterpenes present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°30'6.61"N 93°0'7.73"E, 1318m alt.18.6.2016. P.C.Lalremruata 16-13.(MUH).

**-Pyxine retirugella Nyl.**

Thallus corticolous, to 3cm across; lobes 0.8-1.5 mm wide; upper side greyish, maculae raised becoming reticulate; soralia laminal, orbicular; medulla white. Apothecia rare, internal stipe colourless, K-, ascospores 16-20 x 6-9 µm; Upper cortex UV-, medulla K+ yellow. Norstictic acid and triterpenes present.

**Specimen examined**

Tawi wildlife Sanctuary, 23°30'9.61"N 93°0'8.73"E, 1410m alt.18.6.2016. P.C.Lalremruata 16-56.(MUH).

Singh and Sinha (2010) mentioned the occurrence of *Cladonia fruticulosa* and *Cladonia submultiformis*, Chinlapianga et al.,(2015) further added 159 species of lichens to the list base on lichens specimens collected from different regions of the state. Although the diversity of lichens is very high, but only 161 species has been identified in Mizoram. Out of 60 species identified in the present studies, 18 species are first addition to Mizoram. *Heterodermia diademata*, *Lobaria retigera*, *Usnea baileyi*, *Hypotrachyna cirrhata*, *Lobaria retigera*, *Parmotrema reticulatum*, *Parmotrema tinctorum* exhibit widespread distribution in the studied area. Family like Graphidaceae, Parmeliaceae and Physciaceae are dominant family similar to the other reserve forests of Mizoram.<sup>6</sup>

**Table 1**  
**List of Lichen species with family and growth form.**

Sl. No.	Name of species	Family	Growth form
1	<i>Brigantiaea leucoxantha</i>		
2	<i>Caloplaca ferruginea</i>		
3	<i>Diorigma jughunii</i>		
4	<i>Diorigma megaspermum</i>		
5	<i>Graphis arecae</i>		
6	<i>Graphis granulosa</i>	Graphidaceae	
7	<i>Graphis librata</i>		
8	<i>Graphis lineola</i>		Crustose
9	<i>Graphis proserpens</i>		
10	<i>Graphis scripta</i>		
11	<i>Pallidogramme clorocarpoides</i>		
12	<i>Lecanora Achroa</i>		
13	<i>Lecanora alba</i>		
14	<i>Lecanora chlarotera</i>	Lecanoraceae	
15	<i>Lecanora coronulans</i>		
16	<i>Lecanora tropica</i>		
17	<i>Lobaria discolor</i>		
18	<i>Lobaria pseudopulmonaria</i>	Lobariaceae	
19	<i>Lobaria retigera</i>		
20	<i>Pseudocyphellaria crocata</i>		
21	<i>Hypotrachyna cirrhata</i>		
22	<i>Hypotrachyna flexilis</i>		
23	<i>Parmotrema chinense</i>		Foliose
24	<i>Parmotrema cristiferum</i>		
25	<i>Parmotrema pseudotinctorum</i>	Parmeliaceae	
26	<i>Parmotrema ravum</i>		
27	<i>Parmotrema reticulatum</i>		
28	<i>Parmotrema robustum</i>		
29	<i>Parmotrema stuppeum</i>		
30	<i>Parmotrema tinctorum</i>		
31	<i>Pertusaria albescens</i>		
32	<i>Pertusaria amaria</i>	Pertusariaceae	Crustose
33	<i>Pertusaria multipunctata</i>		
34	<i>Pertusaria pustulata</i>		
35	<i>Dirinaria consimilis</i>		
36	<i>Heterodermia albidiflava</i>		
37	<i>Heterodermia boryii</i>		
38	<i>Heterodermia comosa</i>		
39	<i>Heterodermia dactyliza</i>		
40	<i>Heterodermia diademata</i>		
41	<i>Heterodermia flabellatas</i>		
42	<i>Heterodermia japonica</i>		
43	<i>Heterodermia podocarpa</i>	Physciaceae	Foliose
44	<i>Heterodermia pseudospeciosa</i>		
45	<i>Heterodermia speciosa</i>		
46	<i>Myelochroa subaurulenta</i>		
47	<i>Physcia dilatata</i>		
48	<i>Physcia integrata</i>		
49	<i>Pyxine cocoes</i>		
50	<i>Pyxine consocians</i>		
51	<i>Pyxine retirugella</i>		
52	<i>Pyxine subcinerea</i>		
53	<i>Pyrenula approximans</i>	Pyrenulaceae	Crustose
54	<i>Pyrenula complanata</i>		
55	<i>Ramalina conduplicans</i>		
56	<i>Ramalina hossei</i>	Ramalinaceae	
57	<i>Ramalina sinensis</i>		Fructicose
58	<i>Usnea baileyi</i>		
59	<i>Usnea orientalis</i>	Usnaceae	
60	<i>Usnea pangiana</i>		



**Figure 2**  
**Photographs of some Lichens**

## CONCLUSION

The present investigation documented 60 lichen taxa for the first time from Tawi wildlife sanctuary, Aizawl District of Mizoram, Northeast India. Occurrence of 60 species from a small region clearly indicates the rich potential of lichen diversity of Mizoram. These findings will lead to further research on Lichens and contribute to a better knowledge of their distribution in Mizoram as well as in India.

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## CONFLICT OF INTEREST

Conflict of interest declared none.

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