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Posted on 15/03/2021

DOI: <https://doi.org/10.3897/arphapreprints.e65955>

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# Addition of 96 lichen species to the state of Odisha from Similipal Biosphere Reserve

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## Abstract

A total of 96 species of lichens taxa belonging to 45 genera and 20 families are enumerated from Similipal Biosphere Reserve, in Mayurbhanj district as an addition to the lichen biota of Odisha, India. Most of the crustose lichen taxa usually growing as epiphytes on different phorophytes of the biosphere reserve exhibit their dominance. Among crustose lichens the members of family Graphidaceae with 26 species of 14 genera shown their maximum dominance. Together with Graphidaceae the lichen genus *Pyrenula* represented by 15 species found growing luxuriantly on smooth barked trees of the biosphere reserve. The dominant trees in the biosphere such as *Shorea robusta* Gaertn. followed by *Mangifera indica* L., *Simarouba glauca* DC. and *Madhuca longifolia* (L.) J. F. Macbr., provided suitable habitat for a number of lichen taxa to colonize. The south-west (SW) region of Similipal Biosphere Reserve exhibits the maximum additions of lichens, followed by north-west (NW), north-east (NE) and south-east (SE) respectively.

## Keywords

Ascomycota, Biodiversity, Lichenized fungi, Mayurbhanj

## Introduction

Indian lichen flora is represented by 2714 species belonging to 324 genera and 78 families (Sinha et al. 2018). In the state of Odisha, a number of offhand collections were carried out for exploration of lichens in different parts of the state including Jharsuguda district (Upreti (1996)), Kapilash Reserve forest (Nayak et al. 2015), Utkal University campus (Satapathy et al. 2016), Bhitarkanika National park (Panda et al. 2017), Mahendragiri hill (Swarnalatha (2017)), Sun Temple of Konark (Nayak et al. 2017), Satkoshia hill range (Mishra et al. 2020), Khandagiri and Udayagiri (Pradhan et al. 2020) and Puri (Majhi and Pradhan 2020). The lichen taxa enumerated in earlier studies were

compiled by Nayak et al. (2016), revealing the occurrence of 252 species of lichens belonging to 81 genera and 35 families. Nayak et al. (2018), also studied lichens growing on different monuments of the state and reported species of lichen genus *Lecidella*, *Buellia*, *Lecanora* and *Lepraria*, growing luxuriantly on historical monuments of Ratnagiri and Udayagiri in Jajpur district. Bajpai et al. (2018), described a new species *Cryptothecia odishensis* R. Bajpai, S. Joseph & Upreti, from Jharsuguda district (Das et al. 2018).

Mayurbhanj, one of the biggest districts of Odisha, exhibits a large tract of dry deciduous forest with the dominance of *Shorea robusta* trees. The climatic condition of the district is suitable for the luxuriant growth of various plant species including lichens. The lichen diversity of the region has been poorly known as compared to other districts of the state because of the few cursory lichen explorations were carried in this region. Singh and Kamal (2012), Sahoo and Pradhan (2020) and Pradhan and Satapathy (2020) though explored some localities of the district, which were confined to a particular area of Similipal Biosphere Reserve and reported 141, 19 and 32 species of lichens respectively. Apart from the Biosphere region of Mayurbhanj district, community forest areas like Udala explored by Pradhan et al. (2018) reported the occurrence of 22 common species to the area. In the present study, some unexplored localities such as Devkund, Lullung, Karkatbeda, Sitakund, Talabandh, Pantho and Jamuani, which are situated in the different transitional areas of the Similipal Biosphere Reserve are systematically explored for their lichens and a total of 96 lichen taxa are enumerated as an addition to the lichen biota for the state of Odisha.

## Material and methods

### Study site

The Similipal Biosphere Reserve of Mayurbhanj district in north-eastern Odisha lies between 21°28' to 22°08' N and 86°04' to 86°37' E. Different geographical regions constituting Similipal Biosphere Reserve within Mayurbhanj district such as NW-north west (Brundeipoisi, Hatimundi, Jamuani, Jashipur, Kaliani, Lengighashra, Uski, Tulasibani, Handipan, Panthoroad), NE-north east (Lulung, Kadamdiha, Talabandh, Sitakund), SE-south east (Devkund, Baisinga, Baising-Badsahi road) and SW-south west (Sadanand, Karkatbeda, Badabaliposi, Ranibhol) are systematically explored for their lichen wealth (Fig. 1). *Shorea robusta* Gaertn., forms the major tree vegetation in the area both in valleys and small hillocks.

### Methodology

More than 1000 lichen specimens were collected from different localities of the Mayurbhanj district. The specimens were identified morphologically, anatomically and chemically following the available literature Awasthi (1991), Awasthi (2000), Divakar and Upreti (2005), Nayaka (2004) and Joshi (2008). The colour tests were carried out with aqueous potassium hydroxide (K), Steiner's stable paraphenylenediamine (PD) and aqueous

calcium hypochlorite (C). The identified samples deposited in the lichen herbarium of CSIR-National Botanical Research Institute, Lucknow (LWG).

## Results and Discussion

The present study revealed the occurrence of 96 species belonging to 45 genera and 20 families as an addition to the lichen biota of Odisha. The Similipal Biosphere Reserve is dominated by *Shorea robusta* Gaertn., as major tree vegetation, which ultimately provides the best suitable substratum for the luxuriant growth of lichens. The variability in bark properties at different parts of the tree i.e. within a single tree ecosystem it provides 4 different types of micro-ecosystem as well as different bark texture and fissures at base and above base, provide extra space to the propagules to get established successfully (Satya et al. 2005). Karnik et al. (1968) reported similar findings where they have concluded that the presence of triterpene and oleanolic acid, bark properties support luxuriant growth of lichens on the bark of Sal or Serga.

The rocks near stream and under forest in shady places exhibits rich growth of lichens than the exposed rocks. Species of genus *Allographa*, *Astrothelium*, *Bacidia*, *Cryptothecia*, *Fissurina*, *Hemithecium*, *Pertusaria* and *Pyrenula* grow luxuriantly in the shady places, while species of *Cryptothecia*, *Diploschistes*, *Lecanora* and *Porina* grow on exposed dry rocks. The corticolous lichen communities dominate the area represented by 91 species (45 genera), followed by rock inhabitant species represented by 5 species belongs to 4 genera (Table 1). The crustose lichens predominate the study area represented by 90 species (41 genera) of lichens, followed by foliose forms represented by 6 species (4 genera). The genus *Pyrenula* is found to be the most dominant genera represented by 15 species (Fig. 2). The lichen family Graphidaceae exhibits its dominance in the area represented by 26 species (14 genera), followed by Pyrenulaceae with 18 species belongs to 3 genera (Table 2).

The localities surveyed for lichens showed diversified groups of lichen genera both in disturbed, thin out forest and undisturbed sites. However, the south-west region of the Similipal Biosphere Reserve exhibits rich diversity of lichen represented by 44 species belongs to 29 genera, within localities of Sadanand, Karkatbeda, Badabaliposi and Ranibhol (Fig. 3). The north-west, north-east and south-east region is represented by the occurrence of 41 species (27 genera), 28 species (19 genera) and 11 species (9 genera) respectively (Fig. 4). Similar to the evergreen moist forest of India, the Graphidaceous and Pyrenocarpous lichens exhibit their rich occurrence in the study area clearly indicate the localities of biosphere reserve are still not affected by the human attributes due to heavy tourist pressure.

## Conclusions

Since the lichen exploration in the Similipal Biosphere Reserve for the present study was more concentrated in the transitional zones, an intensive exploration for lichens in the

buffer and core zone of the biosphere will definitely add more interesting lichen taxa to the lichen biota of the state of Odisha in particular and of the country in general.

## Author contributions

SP, DK-U and KB-S have equally contributed for sampling. SP was responsible for data compilation and analysis. SP and KB-S has checked the final species list. SP and DK-U contributed for identifying the lichen taxa and drafting first manuscript. All authors have collaboratively contributed for interpretation of data and finalized the manuscript.

## Conflicts of interest

The authors declare that there is no conflict of interest.

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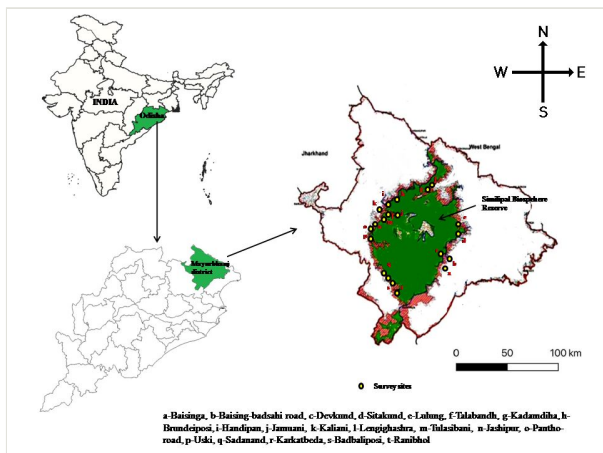


Figure 1.

Different sites of collection from Similipal Biosphere Reserve (SBR) [This figure of Similipal Biosphere Reserve is meant for representation purposes only. It should not be reproduced further for any other purposes]

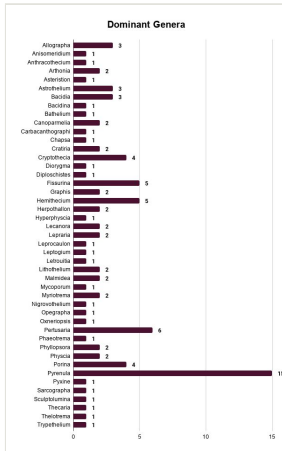


Figure 2.  
Graphical representation of the dominant group of lichen genera



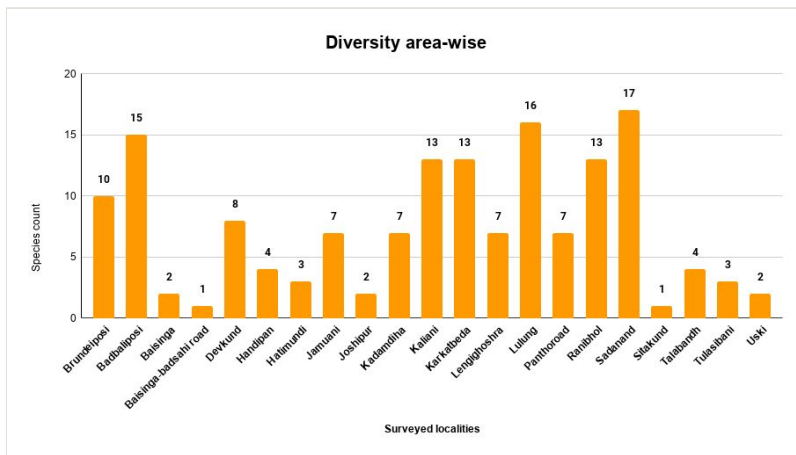


Figure 3. Area-wise distribution of lichen species in Similipal Biosphere Reserve, Mayurbhanj, Odisha.

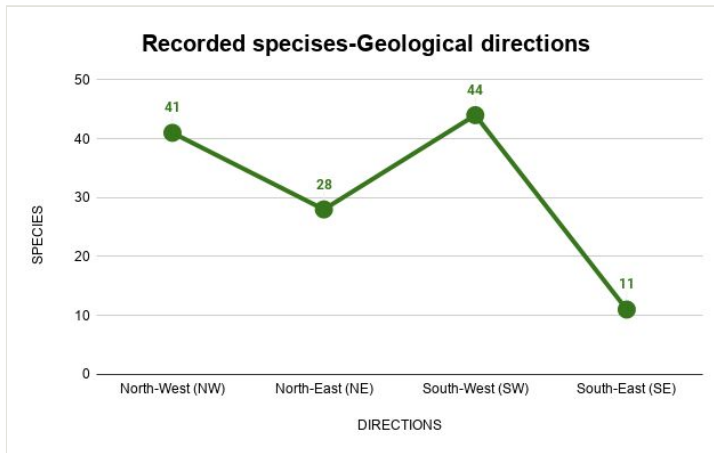


Figure 4.

Geographic directions wise lichen distribution in Similipal Biosphere Reserve (SBR), Mayurbhanj, Odisha.

Table 1.

Enumeration of new record of lichen for the state of Odisha from Similipal Biosphere Reserve (SBR), Mayurbhanj.

GF= Growth Form, S=Substratum, NW=North West, NE=North East, SW=South West, SE=South East, C=Crustose, F=Foliose, B=Bark, R=Rock, + (Present), - (Absent).

Sl. No.	Lichen Species and family	GF	S	NW	NE	SW	SE	Herbarium (CWG)
1	<i>Allographa flabillata</i> (Makhija, Adaw. & Patw) Lücking & Kalb [Graphidaceae]	C	B	-	+	-	-	CUTM-255
2	<i>Allographa norlabiata</i> (Patw. & C.R. Kulk.) Lücking & Kalb [Graphidaceae]	C	B	-	-	+	-	CUTM-517
3	<i>Allographa salacinilabiata</i> (Patw. & C.R. Kulk.) Lücking & Kalb [Graphidaceae]	C	B	-	-	+	-	CUTM-518
4	<i>Anisomeridium subnexum</i> (Nyl.) R.C. Harris [Monoblastiaceae]	C	B	-	-	+	-	CUTM-372
5	<i>Anthracotheccium macrosporum</i> (Hepp) Müll. Arg. [Pyrenulaceae]	C	B	-	-	+	-	CUTM-576
6	<i>Arthonia polymorpha</i> Ach. [Arthoniaceae]	C	B	-	+	-	-	CUTM-573
7	<i>Arthonia ravidia</i> Stirt. [Arthoniaceae]	C	B	-	+	-	-	CUTM-148
8	<i>Asteristion leucophthalmum</i> (Nyl.) I. Medeiros, Lücking & Lumbsch [Graphidaceae]	C	B	-	+	-	-	CUTM-564
9	<i>Astrothelium meristosporum</i> (Mont. & Bosch) Aptroot & Lücking [Trypetheliaceae]	C	B	+	+	+	-	CUTM-457
10	<i>Astrothelium scorcia</i> (Fée) Aptroot & Lücking [Trypetheliaceae]	C	B	+	-	-	+	CUTM-246
11	<i>Astrothelium subdiscretum</i> (Nyl.) Aptroot & Lücking [Trypetheliaceae]	C	B	-	-	-	+	CUTM-231
12	<i>Bacidia incongruens</i> (Stirt.) Zahlbr [Ramalinaceae]	C	B	-	+	-	-	CUTM-450
13	<i>Bacidia nigrosticta</i> Zahlbr. [Ramalinaceae]	C	B	+	+	+	-	CUTM-84
14	<i>Bacidia personata</i> Malme [Ramalinaceae]	C	B	+	-	-	-	CUTM-79
15	<i>Bacidina arnoldiana</i> (Körb.) V. Wirth & Vězda [Ramalinaceae]	C	B	-	+	-	-	CUTM-574
16	<i>Bathelium tuberculosum</i> (Makhija & Patw.) R.C. Harris [Trypetheliaceae]	C	B	-	+	-	-	CUTM-575
17	<i>Canoparmelia aptata</i> (Kremp.) Elix & Hale [Parmeliaceae]	F	B	+	-	-	-	CUTM-481
18	<i>Canoparmelia pruinata</i> (Müll. Arg.) Elix & J. Johnst. [Parmeliaceae]	F	B	+	-	-	-	CUTM-247
19	<i>Carbacanthographis induta</i> (Müll. Arg.) Lücking [Graphidaceae]	C	B	-	+	-	-	CUTM-582
20	<i>Chapsa leprocarpa</i> (Nyl.) Frisch [Graphidaceae]	C	B	+	-	-	-	CUTM-440
21	<i>Cratiria lauri-cassiae</i> (Fée) Marbach [Caliciaceae]	C	B	-	-	+	-	CUTM-77
22	<i>Cratiria rutilantoides</i> Marbach [Caliciaceae]	C	B	+	+	+	-	CUTM-52
23	<i>Cryptothecia aleurina</i> (Nyl.) Makhija & Patw. [Arthoniaceae]	C	R	+	-	-	-	CUTM-417
24	<i>Cryptothecia farinosa</i> Jagad. Ram, G.P. Sinha & Kr.P. Singh [Arthoniaceae]	C	B	-	+	-	-	CUTM-580

25	<i>Cryptothecia porosa</i> Makhija & Patw. [Arthoniaceae]	C	B	+	+	+	-	CUTM-469
26	<i>Cryptothecia verruculifera</i> Jagad. Ram, G.P. Sinha & Kr.P. Singh [Arthoniaceae]	C	B	-	+	+	-	CUTM-536
27	<i>Diorygma macgregorii</i> (Vain.) Kalb, Staiger & Elix [Graphidaceae]	C	B	-	+	-	-	CUTM-484
28	<i>Diploschistes actinostoma</i> (Ach.) Zahlbr. [Graphidaceae]	C	R	+	-	-	-	CUTM-441
29	<i>Fissurina coarctata</i> Makhija & Adaw. [Graphidaceae]	C	B	-	+	-	-	CUTM-565
30	<i>Fissurina disposita</i> B.O. Sharma, Khadilkar & Makhija [Graphidaceae]	C	B	+	-	-	-	CUTM-108
31	<i>Fissurina indica</i> B.O. Sharma, Khadilkar & Makhija [Graphidaceae]	C	B	-	+	-	-	CUTM-570
32	<i>Fissurina insidiosa</i> C. Knight & Mitt. [Graphidaceae]	C	B	-	-	-	+	CUTM-569
33	<i>Fissurina nitidescens</i> (Nyl.) Nyl. [Graphidaceae]	C	B	-	-	+	-	CUTM-109
34	<i>Graphis balaghatensis</i> (Adaw. & Makhija) J. Kalb & Kalb [Graphidaceae]	C	B	-	+	-	+	CUTM-519
35	<i>Graphis galactoderma</i> (Zahlbr.) Lücking [Graphidaceae]	C	B	+	-	-	-	CUTM-62
36	<i>Hemithecium aphanes</i> (Mont. & Bosch) M. Nakan. & Kashiw. [Graphidaceae]	C	B	+	-	-	-	CUTM-91
37	<i>Hemithecium epixanthum</i> (Mont. & Bosch) Chitale & Makhija [Graphidaceae]	C	B	+	-	-	-	CUTM-228
38	<i>Hemithecium flavoalbum</i> (Makhija, Adaw. & Patw.) B.O. Sharma & Khadilkar [Graphidaceae]	C	B	-	-	-	+	CUTM-615
39	<i>Hemithecium lamii</i> (Redinger) V.Tewari & Upreti [Graphidaceae]	C	B	+	-	-	-	CUTM-92
40	<i>Hemithecium multistriatum</i> (Müll. Arg.) Chitale & Makhija [Graphidaceae]	C	B	-	-	+	-	CUTM-524
41	<i>Herpothallon coralloides</i> Jagad. Ram [Arthoniaceae]	C	B	+	-	-	-	CUTM-317
42	<i>Herpothallon minutum</i> Jagad. Ram [Arthoniaceae]	C	B	+	-	+	-	CUTM-313
43	<i>Hyperphyscia minor</i> (Fée) D.D. Awasthi [Physciaceae]	C	B	+	-	+	-	CUTM-442
44	<i>Lecanora allophana</i> (Ach.) Nyl. [Lecanoraceae]	C	B	+	-	+	-	CUTM-529
45	<i>Lecanora subimmersa</i> (Fée) Vain. [Lecanoraceae]	C	R	+	-	-	-	CUTM-260
46	<i>Lepraria cupressicola</i> (Hue) J.R. Laundon [Stereocaulaceae]	C	B	-	-	-	+	CUTM-555
47	<i>Lepraria ecorticata</i> (J.R. Laundon) Kukwa [Stereocaulaceae]	C	B	-	-	+	-	CUTM-483
48	<i>Leprocaulon textum</i> (K. Knudsen, Elix & Lendemmer) Lendemmer & B.P. Hodk. [Leprocaulaceae]	C	B	-	+	-	-	CUTM-554
49	<i>Leptogium wilsonii</i> Zahlbr. [Collembataceae]	F	B	-	+	-	-	CUTM-578
50	<i>Letrouitia aureola</i> (Tuck.) Hafellner & Bellem [Letrouitiaceae]	C	B	+	-	+	-	CUTM-41
51	<i>Lithothelium decumbens</i> (Müll. Arg.) Aptroot [Pyrenulaceae]	C	B	-	-	+	-	CUTM-418
52	<i>Lithothelium illotum</i> (Vain.) Aptroot [Pyrenulaceae]	C	B	-	+	-	-	CUTM-566
53	<i>Malmidea atlantica</i> (M. Cáceres & Lücking) M. Cáceres & Kalb [Malmideaceae]	C	B	+	-	+	+	CUTM-354

54	<i>Malmidea duplomarginata</i> (Papong & Kalb) Kalb & Papong [Malmideaceae]	C	B	-	-	+	-	CUTM-357
55	<i>Mycoporium awasthii</i> (Makhija & Patw.) Kr.P. Singh & G.P. Sinha [Mycoporaceae]	C	B	+	-	-	-	CUTM-470
56	<i>Myriotrema clandestinum</i> (Fée) Hale [Graphidaceae]	C	B	-	-	+	-	CUTM-378
57	<i>Myriotrema rugiferum</i> (Harm.) Hale [Graphidaceae]	C	B	+	-	-	-	CUTM-476
58	<i>Nigrothelium bullatum</i> Lücking, Upreti & Lumbsch [Trypetheliaceae]	C	B	+	-	-	-	CUTM-93
59	<i>Opegrapha medusulina</i> Nyl. [Opegraphaceae]	C	B	+	-	-	-	CUTM-445
60	<i>Oxneriopsis bassiae</i> (Ach.) S.Y. Kondr., Upreti & Hur [Teloschistaceae]	C	B	+	-	+	+	CUTM-31
61	<i>Pertusaria coronata</i> (Ach.) Th. Fr. [Pertusariaceae]	C	B	+	-	-	-	CUTM-383
62	<i>Pertusaria himalayensis</i> D.D. Awasthi & Preeti Srivast. [Pertusariaceae]	C	B	+	-	-	-	CUTM-503
63	<i>Pertusaria pseudococcodes</i> Müll. Arg. [Pertusariaceae]	C	B	-	-	+	-	CUTM-492
64	<i>Pertusaria pustulata</i> (Ach.) Duby [Pertusariaceae]	C	B	+	+	+	-	CUTM-498
65	<i>Pertusaria rigida</i> Müll. Arg. [Pertusariaceae]	C	B	+	-	-	-	CUTM-380
66	<i>Pertusaria splendens</i> D.D. Awasthi & Preeti Srivast. [Pertusariaceae]	C	B	+	-	-	-	CUTM-505
67	<i>Phaeotrema pachysporum</i> (Nyl.) Zahlbr [Graphidaceae]	C	B	+	-	-	-	CUTM-143
68	<i>Phyllopsora corallina</i> (Eschw.) Müll. Arg. [Ramalinaceae]	C	B	-	-	-	+	CUTM-142
69	<i>Phyllopsora furfuracea</i> (Pers.) Zahlbr. [Ramalinaceae]	C	B	-	-	+	-	CUTM-140
70	<i>Physcia dilatata</i> Nyl. [Physciaceae]	F	B	-	-	+	-	CUTM-423
71	<i>Physcia tribacioides</i> Nyl. [Physciaceae]	F	B	+	-	-	-	CUTM-115
72	<i>Porina americana</i> Fée [Porinaceae]	C	B	-	-	+	-	CUTM-352
73	<i>Porina atlantica</i> (Erichsen) P.M. Jørg. [Pertusariaceae]	C	B	-	-	+	-	CUTM-16
74	<i>Porina nigrofusca</i> Müll. Arg. [Pertusariaceae]	C	R	-	-	-	+	CUTM-245
75	<i>Porina subinterstes</i> (Nyl.) Müll. Arg. [Porinaceae]	C	R	-	+	-	-	CUTM-350
76	<i>Pyrenula aggregata</i> (Fée) Fée [Pyrenulaceae]	C	B	-	-	+	-	CUTM-121
77	<i>Pyrenula andina</i> Aptroot [Pyrenulaceae]	C	B	-	-	+	-	CUTM-343
78	<i>Pyrenula approximans</i> (Kremp.) Müll. [Pyrenulaceae]	C	B	-	-	+	-	CUTM-336
79	<i>Pyrenula balia</i> (Kremp.) R.C. Harris [Pyrenulaceae]	C	B	+	-	+	-	CUTM-123
80	<i>Pyrenula circumfiniens</i> Vain. [Pyrenulaceae]	C	B	-	+	+	-	CUTM-342
81	<i>Pyrenula dermatodes</i> (Borrer) Schaer. [Pyrenulaceae]	C	B	-	+	-	-	CUTM-110
82	<i>Pyrenula finitima</i> Müll. Arg. [Pyrenulaceae]	C	B	+	+	-	-	CUTM-665
83	<i>Pyrenula maravalensis</i> Vain. [Pyrenulaceae]	C	B	-	+	+	-	CUTM-122
84	<i>Pyrenula mastophoroides</i> (Nyl.) Zahlbr. [Pyrenulaceae]	C	B	-	+	-	-	CUTM-560
85	<i>Pyrenula nitidula</i> (Bres.) R.C. Harris [Pyrenulaceae]	C	B	-	-	+	-	CUTM-446
86	<i>Pyrenula ochraceoflava</i> (Nyl.) R.C. Harris [Pyrenulaceae]	C	B	-	-	+	-	CUTM-120

87	<i>Pyrenula platystoma</i> (Müll. Arg.) Aptroot [Pyrenulaceae]	C	B	+	-	-	-	CUTM-226
88	<i>Pyrenula scutata</i> (Stirt.) Zahlbr. [Pyrenulaceae]	C	B	-	-	+	-	CUTM-335
89	<i>Pyrenula subducta</i> (Nyl.) Müll. Arg. [Pyrenulaceae]	C	B	-	-	+	-	CUTM-338
90	<i>Pyrenula submastophora</i> Ajay Singh & Upreti [Pyrenulaceae]	C	B	-	-	+	-	CUTM-344
91	<i>Pyxine meissnerina</i> Nyl. [Caliciaceae]	F	B	-	-	+	-	CUTM-346
92	<i>Sarcographa intricans</i> (Nyl.) Müll. Arg. [Graphidaceae]	C	B	-	-	+	-	CUTM-132
93	<i>Sculptolumina japonica</i> (Tuck.) Marbach [Caliciaceae]	C	B	+	-	-	-	CUTM-75
94	<i>Thecaria austroindica</i> (D.D. Awasthi & Upreti) Kr.P. Singh & G.P. Sinha [Graphidaceae]	C	B	+	-	+	-	CUTM-126
95	<i>Thelotrema canarense</i> Patw. & C.R. Kulk [Graphidaceae]	C	B	+	-	+	-	CUTM-434
96	<i>Trypethelium subeluteriae</i> Makhija & Patw. [Trypetheliaceae]	C	B	-	-	+	-	CUTM-435

Table 2.

List of dominant lichen families.

Lichen Family	Number of Species
Arthoniaceae	8
Caliciaceae	4
Collemataceae	1
Graphidaceae	26
Lecanoraceae	2
Leprocaulaceae	1
Letrovitiaceae	1
Malmideaceae	2
Monoblastiaceae	1
Mycoporaceae	1
Opegraphaceae	1
Parmeliaceae	2
Pertusariaceae	8
Physciaceae	3
Porinaceae	2
Pyrenulaceae	18
Ramalinaceae	6
Stereocaulaceae	2
Teloschistaceae	1
Trypetheliaceae	6