

Original Research Article

An enumeration of lichens from the Bageshwar district of Kumaun Himalaya, Uttarakhand, India

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ABSTRACT

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The paper, lists 361 species of lichens belonging to 89 genera and 35 families from the Bageshwar district of Uttarakhand. The study is based on the published literature and specimens in the herbarium of National Botanical Research Institute, Lucknow (LWG). Dhakuri and Khati areas, situated between 2683–2210 m have the highest diversity of lichens represented by 215 and 172 species, respectively. Lichen, families Parmeliaceae with 23 genera and Physciaceae with 8 genera are the dominant families in the district. Among the different lichen genera, *Cladonia* with 22 species and *Heterodermia* with 18 species exhibit their dominance in the area. Trees bear a luxuriant growth of lichens and particularly *Quercus*, *Pinus*, *Alnus* and *Cedrus* exhibit the maximum diversity of epiphytic lichens in the district.

Introduction

The Bageshwar district (1688sq km) is one of the mountainous districts of Uttarakhand State. The district lies between 29°40'–30°20' N and 79°25'–80°10' E (Fig. 1). The district is bounded by Almora district in the south, Chamoli district in north and northwest, and Pithoragarh district in the east. The district is mainly represented by the rocks of Lesser Himalaya and Central Himalayas. Major rock types of central crystalline are mica, quartzite, and marble and mica schist. Foremost part of district falls under the geotectonic zone known as the Lesser Himalaya.

The district is 'Abode of Gods' is an

important pilgrim and tourist centre and the confluence of the rivers Saryu and Gomti (Fig. 1). The average annual rain fall is 1611 mm. About 1100 sq km is forested with *Abies pindro*, *Alnus nepalensis*, *Betula* spp., *Cedrus deodara*, *Pinus roxburghii*, *P. wallichiana*, *Quercus leucotrichophora*, *Q. semecarpifolia*, *Rhododendron* and *Taxus baccata* being the common trees.

The climate of the district includes, temperate and alpine that offers habitats for different plant groups including lichens. The temperate region of district up to an altitude of 3000 m exhibit luxuriant growth of *Quercus leucotrichophora*, *Q. semecarpifolia*,

Pinus wallichiana together with *Rhododendron*, *Taxus baccata*, *Abies pindrow* and *Alnus nepalensis* trees. The *Q. leucotricophora*, *Q. semecarpifolia* and *Pinus wallichiana* trees on its trunk and twigs bear luxuriant growth of epiphytic lichens. In the temperate zone trees trunk, branches and the forest floor receive good amount of moisture and shade which provide suitable habitat for growth of certain epiphytic and terricolous lichens.

The alpine zone of the district is devoid of trees but has small bushes and large exposed grassland. Due to the non availability of trees the lichen in the alpine region mostly grows on rocks, soil and branches of the shrubs.

Lichenologically the district was surveyed by Babington, Strachey and Winterbottom, Stirton in the present Awasthi has been surveyed the area for its lichens wealth in the past and about 15 type species are reported from the district till date. Many studies regarding lichen taxonomy, distribution, ecology, economic importance by different workers (Awasthi, 1988, 1991; Upreti and Chatterjee, 1999a, b; Upreti *et al.*, 2001; Pant, 2002; Upreti and Divakar, 2003; Nayaka, 2004; Joshi, 2008; Joshi *et al.*, 2008 a, b; Singh and Sinha, 2010; Mishra *et al.*, 2010; Mishra *et al.*, 2011; Kholia *et al.*, 2011; Mishra 2012) exhibit the interest in lichen flora of in Kumaun Himalaya.

However, few cursory collections of lichens from the districts are recorded in the past while carrying out monographic and revisionary studies of lichens from India (Divakar and Upreti, 2005; Nayaka, 2004; Joshi, 2008; Joshi, 2010). The present study is carried out with an aim to list the lichens from the district together with their distribution pattern in different localities to assess the loss of lichens in the area.

Materials and Methods

The present study is based on historical and recent lichen collections and on specimens preserved in the lichen herbarium of National Botanical Research Institute, Lucknow (LWG). Specimens were identified with the help of recent literature (Awasthi, 1988, 1991, 2000; Divakar and Upreti, 2005; Nayaka, 2004; Joshi, 2008). The nomenclature of the identified species was updated based on the modern concept of lichen systematic.

The specimens were identified by studying their morphology, anatomy and chemistry. The morphology of the taxa was studied using a stereo binocular microscope. The details of thallus anatomy and fruiting bodies were studied by compound microscope. The colour tests were carried out on cortex and medulla with usual chemical reagents such as aqueous potassium hydroxide (K), Steiner's stable paraphenylenediamine (PD) and aqueous calcium hypochlorite (C). Thin layer chromatography was performed for identification of the lichen substances in solvent system A (Toluene 180: 1-4 Dioxane 60: Acetic acid 8) following the techniques of Walker and James (1980).

Results and Discussion

A total of 361 species belonging to 89 genera and 35 families are reported from ten major localities of Bageshwar district (Table 1). The district shows dominance of foliose lichens (150 species) and crustose lichens (140 species). Parmeliaceae is the dominant family represented by 77 species belonging to 23 genera and is followed by Physciaceae with 39 species belonging to 8 genera (Fig. 2). The lichen genus *Lecanora* with 26 species is dominant followed by *Cladonia* with 22 species and *Heterodermia* with 18

species (Fig. 3). Having rich diversity of phorophytes, the bark inhabiting (corticolous) lichens are dominant with 242 species followed by 115 saxicolous and 66 terricolous lichen species (Fig. 4).

Temperate zone: The lichen flora in this region exhibits great diversity due to presence of diverse micro-climatic conditions. The dense forest of *Q. leucotrichophora* together with *Rhododendron* and *Alnus nepalensis* trees in lower and higher temperate region; *Q. Semecarpifolia* forming pure or mixed patches with coniferous trees *Cedrus deodar*, *Pinus wallichiana*, *Taxus baccata* and *Abies pindrow* trees provide many opportunity for luxuriant growth of lichens on bark, twigs, soil and boulders. Many epiphytic lichens such as *Parmotrema nilgherrense*, *Parmelaria thomsonii*, *Evernia strumcirrhatum*, *Ramalina conduplicans*, *Heterodermia diademata*, *Flavoparmelia caperata* and *Usnea eumitrioides* and crustose lichen like *Anthracotheceum assamiense*, *A. himalayense*, *Pyrenula immissa* and *P. introducta* are reported from various trees from the region, while species of *Graphis* exhibit their luxuriant growth on *Alnus* trees. The lichen diversity in different localities of the district is given in Figure 5.

Alpine Zone: This zone is devoid of trees and has small bushes and large areas of exposed grassland. Due to absent of tall trees in this zone the lichens grow luxuriantly on rocks, soil and branches of small shrubs such as *Lobothallina* spp., *Xanthoria elegans*, *Ioplaca pindarensis*, *Acarospora oxytona*., *Rhizocarpon geographium* and *Umbilicaria indica*. In and around Pindari Glacier 283 species belonging to 77 genera and 35 families were reported by Joshi *et al.* (2011). Three major localities came under this zone.

The district exhibit luxuriant growth of corticolous lichens. *Quercus leucotrichophora* and *Q. semecarpifolia* form pure forest patches at high altitude of 2700–3000m. The microclimatic conditions and forest composition in different sites or localities are different. The comparatively younger and shorter trees of *Quercus* growing among older and taller trees present moist and shady conditions at their trunks and branches and have a cover of crustose lichen taxa, dominated by *Graphis proserpens*, *Amendina punctata*, *Bacidia milligrana*, *Diorygma hieroglyphicum*, *Pertusaria leucosorodes*, *Pertusaria quassiae*. According to Kholia *et al.* (2011) the young twigs of diameter class 1.0–2.0 cm have a dominance of crustose and foliose lichens. Taller trees do not bear crustose lichens on their trunks and twigs. On the trunk, species of *Leptogium* and *Heterodermia* grow abundantly, along with mosses. The twigs also show many foliose and fruticose taxa. Most of the fallen twigs in the old forests of Dhakuri area bear species of *Usnea* and *Cetraria* together with patches of *Lobaria*. Many Graphidioid group prefer to grow on the bark of old *Quercus* trees. *Quercus semecarpifolia* is an excellent host tree for luxuriant growth of lichens and it provides rich lichen biomass. The canopy of the tree plays important role in creation of moisture and shade on the main branches and trunk of the tree.

The probable reason for good lichen flora of *Q. semecarpifolia* is the variation of tree bark at different parts of the tree. Within a single tree four different niches are available for lichens to colonize. The tree has rough, hard and furrowed bark at the base, sometimes laden with soil or mosses. The trunk base, 2–3 m above ground have slightly narrow fissured more or less smooth barked, the bark remains smooth, soft at the

main branches and twigs. The rough base of the tree bears good growth of species of *Lobaria* and some crustose lichens. The trunk base up to 1–2 m from ground allows an easy foothold to the members of Collemataceae and Parmeliaceae. Smooth bark on young branches and twigs of the tree exhibit luxuriant growth of crustose lichen genera *Everniastrum*, *Lecanora* and *Usnea*.

From the above studies it is clear that localities situated in lower temperate region or village proper and other populated areas

exhibit poor to scarce growth of lichens due to heavy anthropogenic activities. Increasing temperature, air pollution and habitat loss have become major detrimental factors for lichen diversity in the district. Apart from their use as bioindicator, lichens play a major role in nutrient cycle and establishment of an ecosystem. The present enumeration of lichens from different localities of Bageshwar district will act as a base line record for future studies on the effect of environmental changes in the area.

Table.1 Distribution, growth forms and substrate of lichens in Bageshwar district

S.N.	Lichen taxa	Substrate	1	2	3	4	5	6	7	8	9	10	GF
Acarosporaceae													
1	<i>Acarospora smaragdula</i> (Wahlenb.) Massal.	S	+						+				Sq
2	<i>Acarospora veronensis</i> Massal.	S						+					Sq
3	<i>Sarcogyne privigna</i> (Ach.) Massal.	S		+			+						Cr
Agyriaceae													
4	<i>Trapelia coarctata</i> (Sm.) M. Choisy	S				+				+			Cr
Arthoniaceae													
5	<i>Arthothelium chiodectoides</i> (Nyl.) Zahlbr.	C				+	+						Cr
Caliciaceae													
6	<i>Calicium subquercinum</i> Asah.	C							+	+			Cr
Candelariaceae													
7	<i>Candelaria concolor</i> (Dicks.) Stein	C	+		+				+	+		+	F
8	<i>C. indica</i> (Hue) Vain.	C			+	+	+				+	+	F
9	<i>Candelariella vitellina</i> (Hoffm.) Müll. Arg.	S					+	+					Cr
Chrysothricaceae													
10	<i>Chrysothrix candelaris</i> (L.) J.R. Laundon	C, S	+			+			+	+			L
11	<i>C. chlorina</i> (Ach.) J.R. Laundon	C							+				L
Cladoniaceae													
12	<i>Cladonia cartilaginea</i> Müll. Arg.	T			+	+	+	+					Di
13	<i>C. ceratophyllina</i> (Nyl.) Vain.	T	+										Di
14	<i>C. chlorophaea</i> (Flörke ex Sommerf.) Spreng.	T				+	+	+	+				Di
15	<i>C. coccifera</i> (L.) Willd.	T					+						Di
16	<i>C. coniocraea</i> (Flörke) Spreng.	T	+		+	+	+						Di
17	<i>C. corniculata</i> Ahti & Kashiw.	T	+		+	+			+	+			Di
18	<i>C. corymbescens</i> Nyl. ex Leight.	T	+		+	+		+	+				Di
19	<i>C. delavayi</i> Abbayes	T					+						Di
20	<i>C. didyma</i> (Fée) Vain.	T	+						+	+			Di
21	<i>C. fenestralis</i> Nuno	T		+			+	+	+				Di
22	<i>C. fimbriata</i> (L.) Fr.	T			+				+				Di
23	<i>C. furcata</i> (Huds.) Schrad.	T			+	+	+	+	+				Di
24	<i>C. fruticulosa</i> Kremp.	T	+										Di

25	<i>C. macilenta</i> Hoffm.	T	+							Di
26	<i>C. macroptera</i> Räs.	T						+		Di
27	<i>C. pocillum</i> (Ach.) Grognot	T				+	+	+		Di
28	<i>C. pyxidata</i> (L.) Hoffm.	T		+	+	+	+	+		Di
29	<i>C. scabriuscula</i> (Del.) Leight.	T		+					+	Di
30	<i>C. singhii</i> Ahti & Dixit	T				+			+	Di
31	<i>C. squamosa</i> Hoffm.	T	+						+	Di
32	<i>C. subulata</i> (L.) Web. ex Wigg.	T				+	+			Di
33	<i>C. Verticillata</i> (Hoffm.) Schaer.	T				+			+	Di
Coccocarpiaceae										
34	<i>Coccocarpia erythroxyli</i> (Spreng.) Swinsc. & Krog	C, S,T				+	+	+		F
35	<i>C. pellita</i> (Ach.) Müll. Arg.	C	+							F
Collemataceae										
36	<i>Collema auriforme</i> (With.) Coppins & J.R. Laundon	C							+	F
37	<i>C. coccophorum</i> Tuck.	S			+		+	+		F
38	<i>C. crispum</i> (Huds.) G.H. Web.	S					+	+		F
39	<i>C. furfuraceum</i> (Arn.) Du Rietz	C				+			+	F
40	<i>C. kauaiense</i> H. Magn.	C							+	F
41	<i>C. pulcellum</i> Ach.	C,S			+	+			+	F
42	<i>C. subconveniens</i> Nyl.	C			+				+	F
43	<i>C. subflaccidum</i> Degel.	C			+					F
44	<i>C. subnigrescens</i> Degel.	C			+	+			+	F
45	<i>Leptogium asiaticum</i> P.M. Jorg.	C,S			+				+	F
46	<i>L. askotense</i> D.D. Awasthi	C,T	+		+				+	F
47	<i>L. burgessii</i> (L.) Mont	C		+		+			+	F
48	<i>L. burnetiae</i> Dodge	C,S,T	+		+	+	+	+	+	F
49	<i>L. cyanescens</i> (Rabenh.) Körb.	C,S			+	+				F
50	<i>L. delavayi</i> Hue	C,T	+						+	F
51	<i>L. furfuraceum</i> (Harm.) Sierk	C	+							F
52	<i>L. javanicum</i> Mont.	C			+				+	F
53	<i>L. pedicellatum</i> P.M. Jorg.	C,S,T			+	+	+		+	F
54	<i>L. saturninum</i> (Dicks.) Nyl.	C,S			+				+	F
55	<i>L. trichophorum</i> Müll. Arg.	C,T			+	+			+	F
Coniocybaceae										
56	<i>Coniocybe coniophaea</i> Norm.	C				+			+	Cr
Graphidaceae										
57	<i>Graphis chlorotica</i> Massal	C				+	+			Cr
58	<i>G. duplicata</i> Ach.	C	+						+	Cr
59	<i>G. lineola</i> Ach.	C							+	Cr
60	<i>G. longiramea</i> Müll. Arg.	C							+	Cr
61	<i>G. proserpens</i> Vain.	C			+	+			+	Cr
62	<i>G. scripta</i> (L.) Ach.	C			+	+			+	Cr
63	<i>Hemithecium aphanes</i> (Mont. & Bosch) M. Nakan. & Kashiw.	C				+			+	Cr
Haematommataceae										
64	<i>Haematomma puniceum</i> (Sw. ex Ach.) Massal.	C			+				+	Cr
Icmadophilaceae										
65	<i>Thamnotia vermicularis</i> (Sw.) Schaer.	T		+			+	+		Fr
Magasporeceae										
66	<i>Aspicilia almorensis</i> Räs.	S				+	+		+	Cr
67	<i>A. caesiocinerea</i> (Nyl. ex Malbr.) Arnold	S					+	+	+	Cr

68	<i>A. calcarea</i> (L.) Körb.	S	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Cr
69	<i>A. cinerea</i> (L.) Körb.	S																	Cr
70	<i>A. dwaliensis</i> Räs.	S	+																Cr
71	<i>A. griseocinerea</i> Räs.	S																	Cr
72	<i>A. maculata</i> (H. Magn.) D.D. Awasthi	S																	Cr
73	<i>Lobothallia alphoplaca</i> (Wahlenb.) Poelt & Leuckert	S																	Cr
74	<i>L. praeradiosa</i> (Nyl.) Hafellner	S	+																Cr
Lecanoraceae																			
75	<i>Lecanora alba</i> Lumbsch	C																	Cr
76	<i>L. argentata</i> (Ach.) Degel.	C	+																Cr
77	<i>L. austrointumescens</i> Lumbsch & Elix	C	+																Cr
78	<i>L. campestris</i> (Schaer.) Hue	S																	Cr
79	<i>L. cenisia</i> Ach.	S																	Cr
80	<i>L. cinereofusca</i> var. <i>cinereofusca</i> H. Magn.	C,S	+																Cr
81	<i>L. cinereofusca</i> var. <i>himalayensis</i> Upreti	S																	Cr
82	<i>L. fimbriatula</i> Stirt.	C																	Cr
83	<i>L. flavidofusca</i> Müll. Arg.	C	+																Cr
84	<i>L. formosula</i> Lumbsch	C																	Cr
85	<i>L. frustulosa</i> (Dicks.) Ach.	C																	Cr
86	<i>L. garovaglii</i> (Körb) Zahlbr.	S	+																Cr
87	<i>L. helva</i> Stizenb.	C																	Cr
88	<i>L. henssenii</i> Vänskä	S																	Cr
89	<i>L. impudens</i> Degel.	C																	Cr
90	<i>L. imshaugii</i> Brodo.	C																	Cr
91	<i>L. insignis</i> Degel	C	+																Cr
92	<i>L. interjecta</i> Müll. Arg.	C																	Cr
93	<i>L. japonica</i> Müll. Arg.	C																	Cr
94	<i>L. meridionalis</i> H. Magn.	C																	Cr
95	<i>L. muralis</i> var. <i>dubyi</i> (Müll. Arg.) Poelt	S																	Cr
96	<i>L. muralis</i> var. <i>muralis</i> (Schreb.) Rabenh.	S	+																Cr
97	<i>L. perplexa</i> Brodo	C	+	+	+														Cr
98	<i>L. phaedrophthalma</i> Poelt	S	+																Cr
99	<i>L. subimmersa</i> (Fée) Vain.	S																	Cr
100	<i>L. subrugosa</i> Nyl.	C																	Cr
101	<i>Lecidella carpathica</i> Körb.	C																	Cr
102	<i>Miriquidica mexicana</i> Rambold, Sipman & Hertel	S	+																Cr
103	<i>Rhizoplaca chrysoleuca</i> (Sm.) Zopf	S	+																Sq
104	<i>Tephromela atra</i> (Huds.) Hafellner	S																	Cr
105	<i>T. khatiensis</i> (Räs.) Lumbsch	S	+																Cr
Lecideaceae																			
106	<i>Lecidea paratropoides</i> Müll. Arg.	S	+																Cr
107	<i>Porpidia albocoerulescens</i> (Wulf.) Hertel & Knoph	C,S																	Cr
108	<i>P. crustulata</i> (Ach.) Hertel & Knoph	C,S																	Cr
109	<i>P. macrocarpa</i> (DC.) Hertel & Schwab.	C,S																	Cr
Lobariaceae																			
110	<i>Lobaria discolor</i> (Bory) Hue	C																	F
111	<i>L. isidiosa</i> (Müll. Arg.) Vain.	C																	F
112	<i>L. kurokawae</i> Yoshim.	C,S,T	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	F
113	<i>L. meridionalis</i> Vain.	C																	F
114	<i>L. pindarensis</i> Räs.	C,S																	F

115	<i>L. pseudopulmonaria</i> Gyeln.	S	+			+	+		F
116	<i>L. quercizans</i> Michaux.	T				+			F
117	<i>L. retigera</i> (Bory) Trev.	C,S,T			+	+	+	+	F
118	<i>Sticta damaecornis</i> (Sw.) Ach.	C				+	+	+	F
119	<i>S. henryana</i> Zahlbr.	C						+	F
120	<i>S. indica</i> D.D. Awasthi & Upreti	C	+		+	+			F
121	<i>S. nylanderiana</i> Zahlbr.	C,T	+		+	+		+	F
122	<i>S. orbicularis</i> (R. Br. ex Meyen & Flot.) Hue	T			+			+	F
123	<i>S. platyphylloides</i> Nyl.	C			+			+	Fr
124	<i>S. praetextata</i> (Räs.) D.D. Awasthi	C,T				+	+	+	F
Nephromataceae									
125	<i>Nephroma helveticum</i> Ach.	C,S,T	+			+	+	+	F
126	<i>N. isidiosum</i> (Nyl.) Gynl.	C	+						F
Ochrolechiaceae									
127	<i>Ochrolechia harmandii</i> Verseghy	C	+						Cr
128	<i>O. pallescens</i> (L.) Mass.	C						+	Cr
129	<i>O. subpallescens</i> Vers.	C						+	Cr
130	<i>O. yasudae</i> var. <i>corallina</i> Poelt	C			+	+		+	Cr
131	<i>O. rosella</i> (Müll. Arg.) Verseghy	C	+		+			+	Cr
Pannariaceae									
132	<i>Fuscopannaria saltuensis</i> P.M. Jorg.	S			+	+	+	+	Sq
Parmeliaceae									
133	<i>Bryoria bicolor</i> (Ehrh.) Brodo & D. Hawksw.	C			+			+	Fr
134	<i>B. confusa</i> (D.D. Awasthi) Brodo & D. Hawksw.	C				+		+	Fr
135	<i>B. smithii</i> (Du Rietz) Brodo & D. Hawksw.	C			+			+	Fr
136	<i>Bulbothrix isidiza</i> (Nyl.) Hale	S			+			+	F
137	<i>B. meizospora</i> (Nyl.) Hale	C,S			+	+	+	+	F
138	<i>B. sensibilis</i> (J. Steiner & Zahlbr.) Hale	C,S			+			+	F
139	<i>B. setschwanensis</i> (Zahlbr.) Hale	S			+	+		+	F
140	<i>Canoparmelia aptata</i> (Kremp.) Elix & Hale	C				+			F
141	<i>C. texana</i> (Tuck.) Elix & Hale	C			+				F
142	<i>Cetraria nigricans</i> Nyl.	C					+	+	F
143	<i>C. islandica</i> Ach.	C			+				F
144	<i>Cetrelia braunsiana</i> (Müll. Arg.) W. Culb. & C. Culb.	C			+	+	+	+	F
145	<i>C. cetrarioides</i> (Del. ex Duby) W. Culb. & C. Culb.	C			+	+	+	+	F
146	<i>C. collata</i> (Nyl.) W.L. Culb. & C.F. Culb.	C						+	F
147	<i>C. olivetorum</i> (Nyl.) W. Culb. & C. Culb.	C				+	+	+	F
148	<i>Cetrellopsis rhytidocarpa</i> subsp. <i>rhytidocarpa</i> (Mont. & Bosch) Randlane & Saag	C			+	+		+	F
149	<i>Everniastrum cirrhatum</i> (Fr.) Hale ex Sipman	C,S	+		+	+		+	F
150	<i>E. nepalense</i> (Taylor) Hale	C			+	+		+	F
151	<i>Flavocetraria cucullata</i> (Bell.) Kärnefelt & Thell	T					+		Fr
152	<i>Flavocetrariella leucostigma</i> (Lév.) D.D. Awasthi	T	+			+	+		Fr
153	<i>F. melaloma</i> (Nyl.) D.D. Awasthi	S,T					+	+	F
154	<i>Flavoparmelia caperata</i> (L.) Hale	C,S				+		+	F
155	<i>Hypotrachyna adducta</i> (Nyl.) Hale	C				+		+	F
156	<i>H. awasthii</i> Hale & Patw.	C				+	+		F
157	<i>H. crenata</i> (Kurok.) Hale	C			+			+	F
158	<i>H. infirma</i> (Kurok.) Hale	C,S						+	F
159	<i>H. osseoalba</i> (Vain.) Y.S. Park & Hale	C			+	+		+	F
160	<i>H. physcioides</i> (Nyl.) Hale	C			+			+	F

161	<i>H. pindarensis</i> (D.D. Awasthi & S.R. Singh) D.D. Awasthi	C			+	+		+	+	F
162	<i>H. pluriformis</i> (Nyl.) Hale	C,S			+	+	+	+		F
163	<i>H. radiculata</i> (Kurok.) Elix	C			+			+		F
164	<i>H. scytophylla</i> (Kurok.) Hale	S	+		+	+		+	+	F
165	<i>Menegazzia terebrata</i> (Hoffm.) A. Massal	S						+	+	F
166	<i>Myelochroa aurulenta</i> (Tuck.) Elix. & Hale	C			+	+	+	+	+	F
167	<i>M. entotheiochroa</i> (Hue) Elix & Hale	C		+						F
168	<i>M. macrogalbinica</i> Divakar, Upreti & Elix	C						+		F
169	<i>M. metarevoluta</i> (Asah.) Elix & Hale	C				+			+	F
170	<i>M. subaurulenta</i> (Nyl.) Elix & Hale	C,S	+		+	+		+	+	F
171	<i>M. upretii</i> Divakar & Elix	C				+			+	F
172	<i>M. xantholepis</i> (Mont. & Bosch) Elix & Hale	C						+	+	F
173	<i>Nephromopsis ahtii</i> (Randlane & Saag) Randlane & Saag	C						+		F
174	<i>N. nephromoides</i> (Nyl.) Ahti & Rande	C				+		+		F
175	<i>N. pallescens</i> (Shaer.) Park	C	+		+	+	+	+	+	F
176	<i>N. stracheyi</i> (Bab.) Müll. Arg.	C	+			+		+	+	F
177	<i>Parmelaria subthomsonii</i> D.D. Awasthi	C,S				+	+	+		F
178	<i>P. thomsonii</i> (Stirt.) D.D. Awasthi	C				+		+	+	F
179	<i>Parmelia marmariza</i> Nyl.	C						+		F
180	<i>P. meiophora</i> Nyl.	C					+	+	+	F
181	<i>Parmeliella papillata</i> P.M. Jørg.	C	+							F
182	<i>Parmelinella wallichiana</i> (Taylor) Elix & Hale	C,S				+	+	+	+	F
183	<i>Parmotrema direagens</i> (Hale) Hale	C						+	+	F
184	<i>P. eunetum</i> (Stirt.) Hale	C				+		+		F
185	<i>P. grayanum</i> (Hue) Hale	S				+		+		F
186	<i>P. hababianum</i> (Gyeln.) Hale	C				+				F
187	<i>P. indicum</i> Hale	C				+				F
188	<i>P. nilgherrense</i> (Nyl.) Hale	C				+	+	+	+	F
189	<i>P. praesorediosum</i> (Nyl.) Hale	C				+		+		F
190	<i>P. reticulatum</i> (Taylor) Choisy	C	+		+			+	+	F
191	<i>P. sancti angelii</i> (Lynge) Hale	C				+		+		F
192	<i>P. tinctorum</i> (Despr. ex Nyl.) Hale	C,S				+			+	F
193	<i>Platismatia erosa</i> W.L. Culb. & C.F. Culb.	C				+		+		F
194	<i>Sulcaria sulcata</i> (Lév) Bystr. ex Brodo & D. Hawksw.	C	+		+			+		Fr
195	<i>Tuckneraria laureri</i> (Kremp.) Randlane & A. Thell	C						+		Fr
196	<i>Usnea baileyi</i> (Stirt.) Zahlbr.	C						+		Fr
197	<i>U. compressa</i> Taylor	C				+	+	+	+	Fr
198	<i>U. dendritica</i> Stirt.	C	+							Fr
199	<i>U. eumitrioides</i> Mot.	C						+	+	Fr
200	<i>U. longissima</i> Ach.	C	+		+	+	+	+	+	Fr
201	<i>U. nepalensis</i> G. Awasthi	C				+		+	+	Fr
202	<i>U. orientalis</i> Mot.	C	+		+	+	+	+	+	Fr
203	<i>U. pangiana</i> Stirt.	C				+		+	+	Fr
204	<i>U. perplexans</i> Stirt.	C				+		+	+	Fr
205	<i>U. robusta</i> Stirt.	C					+	+		Fr
206	<i>U. sordida</i> Mot	C						+	+	Fr
207	<i>U. splendens</i> Stirt.	C				+	+	+	+	Fr
208	<i>U. subfloridana</i> Stirt.	C				+	+	+		Fr
209	<i>U. thomsonii</i> Stirt.	C					+	+	+	Fr
210	<i>U. undulata</i> Stirt.	C					+		+	Fr

Peltigeraceae										
211	<i>Peltigera canina</i> (L.) Willd.	C,T		+	+	+		+	+	F
212	<i>P. didactyla</i> (With.) J.R. Laundon	T					+	+		F
213	<i>P. dolichorrhiza</i> (Nyl.) Nyl.	T		+				+	+	F
214	<i>P. leucophlebia</i> (Nyl.) Gyeln.	T	+		+	+	+			F
215	<i>P. polydactylon</i> (Neck.) Hoffm.	C,T	+		+	+	+	+	+	F
216	<i>P. praetextata</i> (Flörke) Zopf	C,S,T	+	+		+	+	+	+	F
217	<i>P. rufescens</i> (Weiss) Humb.	C,S,T	+		+	+	+		+	F
218	<i>Solorina simensis</i> Hochst.	S,T			+	+			+	F
Pertusariaceae										
219	<i>Pertusaria albescens</i> (Huds.) M. Choisy & Werner	C				+		+	+	Cr
220	<i>P. amara</i> (Ach.) Nyl.	C	+					+		Cr
221	<i>P. bryontha</i> (Ach.) Nyl.	C				+			+	Cr
222	<i>P. concinna</i> Erichsen	C				+			+	Cr
223	<i>P. coronata</i> (Ach.) Th. Fr.	C			+			+	+	Cr
224	<i>P. kodaikanalensis</i> Choisy	S				+			+	Cr
225	<i>P. leucosora</i> Nyl.	S				+		+	+	Cr
226	<i>P. leucosorodes</i> Nyl.	C			+			+		Cr
227	<i>P. multipuncta</i> (Turn.) Nyl.	C			+	+		+	+	Cr
228	<i>P. pallidula</i> Stirt.	C			+			+		Cr
229	<i>P. pertusa</i> (L.) Tuck.	C	+		+			+		Cr
230	<i>P. punctata</i> Nyl.	C			+			+		Cr
231	<i>P. quassiae</i> (Fée) Nyl.	C			+			+	+	Cr
Physciaceae										
232	<i>Buellia aethalea</i> (Ach.) Th. Fr	C			+					Cr
233	<i>Dirinaria confluens</i> (Fr.) D.D. Awasthi	C				+	+			F
234	<i>Heterodermia albidiflava</i> (Kurok.) D.D. Awasthi	C			+	+			+	F
235	<i>H. angustiloba</i> (Müll. Arg.) D.D. Awasthi	C			+	+	+		+	F
236	<i>H. boryi</i> (Fée) K.P. Singh & S.R. Singh	C,S			+		+	+	+	F
237	<i>H. dactyliza</i> (Nyl.) Swinsc. & Krog	C,S				+	+		+	F
238	<i>H. diademata</i> (Taylor) D.D. Awasthi	C,S	+		+	+			+	F
239	<i>H. dissecta</i> (Kurok.) D.D. Awasthi	C,S	+				+	+		F
240	<i>H. dissecta</i> var. <i>koyana</i> (Kurok.) J.C. Wei	C,S	+		+	+	+		+	F
241	<i>H. firmula</i> (Nyl.) Trevis.	C,S			+				+	F
242	<i>H. hypocaesia</i> (Yasuda) D.D. Awasthi	C,S				+	+		+	F
243	<i>H. incana</i> (Stirt.) D.D. Awasthi	C,S							+	F
244	<i>H. japonica</i> (Sato) Swinsc. & Krog	C,S			+	+			+	F
245	<i>H. leucomelos</i> (L.) Poelt	C,T	+		+	+	+	+	+	F
246	<i>H. microphylla</i> (Kurok.) Skorepa	C,T				+	+		+	F
247	<i>H. obscurata</i> (Nyl.) Trevisan	C							+	F
248	<i>H. pseudospeciosa</i> (Kurok.) W. Culb.	C				+			+	F
249	<i>H. rubescens</i> (Räs.) D.D. Awasthi	C			+					F
250	<i>H. speciosa</i> (Wulf.) Trevis.	C			+	+			+	F
251	<i>H. tremulans</i> (Müll. Arg.) W. Culb.	C					+	+		F
252	<i>Hyperphyscia syncolla</i> (Tuck. ex Nyl.) Kalb	C				+		+	+	F
253	<i>Phaeophyscia ciliata</i> (Hoffm.) Moberg	C	+				+	+	+	F
254	<i>P. constipata</i> (Norrl. & Nyl.)	C							+	F
255	<i>P. endococcina</i> (Körb.) Moberg	C			+	+	+	+		F
256	<i>P. hispidula</i> (Ach.) Moberg	C	+		+	+	+		+	F
257	<i>P. nepalensis</i> (Poelt) D.D. Awasthi	C				+			+	F

258	<i>P. orbicularis</i> (Neck.) Moberg	C		+	+		+		F	
259	<i>P. primaria</i> (Poelt) Trass	C				+	+		F	
260	<i>P. pyrrophora</i> (Poelt) D.D. Awasthi & M. Joshi	C	+		+			+	F	
261	<i>Physcia caesia</i> (Hoffm.) Fűrnr	C					+	+	F	
262	<i>P. dilatata</i> Nyl.	C			+			+	+	
263	<i>P. phaea</i> (Tuck.) Thoms.	C						+	F	
264	<i>Pyxine himalayensis</i> D.D. Awasthi	C		+	+			+	F	
265	<i>P. minuta</i> Vain.	C		+					F	
266	<i>P. philippina</i> Vain.	C		+	+				+	
267	<i>P. sorediata</i> (Ach.) Mont.	C		+				+	+	
268	<i>P. subcinerea</i> Stirt.	C		+				+	+	
269	<i>Rinodina conradii</i> Körb.	C			+	+			Cr	
270	<i>R. sophodes</i> (Ach.) A. Massal.	C						+	Cr	
Pilocarpaceae										
271	<i>Lopadium saxicolum</i> H. Magn.	S	+					+	Cr	
Pyrenulaceae										
272	<i>Anthracotheceum assamiense</i> (Stirt.) A. Singh	C	+					+	Cr	
273	<i>A. depressum</i> Müll. Arg.	C			+			+	Cr	
274	<i>A. himalayense</i> (Räs.) D.D. Awasthi	C	+	+				+	+	
275	<i>A. himalayense</i> var. <i>pseudohimalayense</i> (A. Singh) A. Singh	C						+	+	
276	<i>A. manipureense</i> Müll. Arg.	C	+		+			+	+	
277	<i>A. oculatum</i> Müll. Arg.	C		+					Cr	
278	<i>A. platystomum</i> Müll. Arg.	C	+	+	+			+	+	
279	<i>A. platystomum</i> var. <i>papillatum</i> A. Singh & Upreti	C		+	+			+	+	
280	<i>A. thwaitesii</i> (Leight.) Müll. Arg.	C	+		+			+	+	
281	<i>Lithothelium himalayense</i> Upreti & Aptroot	C						+	Cr	
282	<i>L. obtectum</i> (Müll. Arg.) Aptroot	C	+					+	Cr	
283	<i>Pyrenula albella</i> Müll. Arg.	C	+						Cr	
284	<i>P. anamalaiensis</i> (Upreti & A. Singh) Upreti	C	+					+	Cr	
285	<i>P. glabrescens</i> Vain.	C						+	+	
286	<i>P. globifera</i> (Eschw.) Aptroot	C						+	Cr	
287	<i>P. himalayana</i> Upreti	C			+			+	Cr	
288	<i>P. immissa</i> (Stirt.) Zahlbr.	C	+	+	+			+	Cr	
289	<i>P. introducta</i> (Stirt.) Zahlbr.	C			+			+	+	
290	<i>P. neoculata</i> Aptroot	C			+			+	Cr	
291	<i>P. pinguis</i> Fée	C	+	+				+	Cr	
292	<i>P. pyrenuloides</i> (Mont.) R.C. Harris	C						+	+	
293	<i>P. quassiaecola</i> Fée	C	+		+			+	+	
294	<i>P. subumbilicata</i> (C. Knight) Aptroot	C	+	+	+			+	+	
Psoraceae										
295	<i>Psora himalayana</i> (C. Bab.) Timdal	T		+				+	Sq	
Ramalinaceae										
296	<i>Bacidia alutacea</i> (Kremp.) Zahlbr.	C			+			+	Cr	
297	<i>B. incongruens</i> (Stirt.) Zahlbr.	C		+				+	Cr	
298	<i>B. laurocerasi</i> (Del. ex Duby) Zahlbr.	C		+				+	+	
299	<i>B. millegrana</i> (Taylor) Müll. Arg.	C			+	+			Cr	
300	<i>B. nigrofusca</i> (Müll. Arg.) Zahlbr.	C			+			+	+	
301	<i>B. phaeolomoides</i> (Müll. Arg.) Zahlbr.	C						+	+	
302	<i>B. rosella</i> (Pers.) De Not.	C		+				+	Cr	
303	<i>B. rubella</i> (Hoffm.) Massal.	C						+	Cr	

304	<i>Phyllopsora catervisorediata</i> G.K. Mishra, Upreti & Nayaka	C				+		+		Sq			
305	<i>P. corallina</i> var. <i>subglaucella</i> G.K. Mishra, Upreti & Nayaka	C				+			+	+	Sq		
306	<i>P. parvifolia</i> (Pers.) Müll. Arg.	C					+	+		+	Sq		
307	<i>Ramalina celastri</i> (Spreng.) Krog & Swinscow	C					+			+	Fr		
308	<i>R. conduplicans</i> Vain.	C	+		+	+			+	+	Fr		
309	<i>R. sinensis</i> Jatta	C	+			+	+		+	+	Fr		
Rhizocarpaceae													
310	<i>Rhizocarpon badioatrum</i> (Flörke ex Spreng.) Th. Fr.	S								+	Cr		
311	<i>R. geographicum</i> (L.) DC.	S		+					+	+	Cr		
312	<i>R. macrosporum</i> Räs.	S							+	+	Cr		
313	<i>R. sublucidum</i> Räs.	S								+	Cr		
Sphinctrinaceae													
314	<i>Sphinctrina tubaeformis</i> Massal.	C						+			+	Cr	
Stereocaulaceae													
315	<i>Lepraria lobificans</i> Nyl.	C,S,T									+	+	L
316	<i>L. vouauxii</i> (Hue) Laundon	T								+			L
317	<i>Stereocaulon foliolosum</i> var. <i>foliolosum</i> Nyl.	T			+	+	+	+	+	+	+	+	Di
318	<i>S. foliolosum</i> var. <i>botryophorum</i> (Müll. Arg.) I.M. Lamb	T								+	+		Di
319	<i>S. foliolosum</i> var. <i>strictum</i> (Bab.) I.M. Lamb	T		+	+	+	+	+	+	+	+	+	Di
320	<i>S. glareosum</i> (Sav.) H. Magn.	T				+	+	+	+	+			Di
321	<i>S. himalayense</i> D.D. Awasthi & I.M. Lamb	T							+	+			Di
322	<i>S. myriocarpum</i> Th. Fr.	T		+	+	+	+	+	+	+	+	+	Di
323	<i>S. paradoxum</i> I. M. Lamb	T								+			Di
324	<i>S. piluliferum</i> Th. Fr.	T		+		+					+	+	Di
325	<i>S. pomiferum</i> Duvign.	T				+	+	+	+	+	+	+	Di
Teloschistaceae													
326	<i>Caloplaca approximata</i> (Lyngé) Magnusson	S		+					+	+			Cr
327	<i>C. arenaria</i> (Pers.) Mull.Arg.	S								+	+		Cr
328	<i>C. cinnabarina</i> (Ach.) Zahlbr.	S									+		Cr
329	<i>C. citrina</i> (Hoffm.) Th. Fr.	S							+	+		+	Cr
330	<i>C. cupulifera</i> (Vain.) Zahlbr.	S									+		Cr
331	<i>C. flavocitrina</i> (Nyl.) H. Olivier	S								+		+	Cr
332	<i>C. flavorubescens</i> (Huds.) Laundon	C,S								+		+	Cr
333	<i>C. flavovirescens</i> (Wulf.) Dalla Torre & Sarnth.	C,S								+	+	+	Cr
334	<i>C. jatolii</i> Y. Joshi & Upreti	C		+									Cr
335	<i>C. lithophila</i> H. Magn.	S									+	+	Cr
336	<i>C. obliterans</i> (Nyl.) Blomb. & Forss.	S								+	+		Cr
337	<i>C. ochroplaca</i> Poelt & Hinter.	S								+		+	Cr
338	<i>C. pachychelia</i> Poelt & Hinter.	S		+						+			Cr
339	<i>C. pyracea</i> (Ach.) Th. Fr.	C,S										+	Cr
340	<i>C. saxicola</i> (Hoffm.) Nordin	S								+			Cr
341	<i>C. subbassiae</i> Y. Joshi & Upreti	S								+		+	Cr
342	<i>C. triloculans</i> Zahlbr.	S									+	+	Cr
343	<i>Ioplaca pindarensis</i> (Räs) Poelt & Hinter.	S		+		+					+	+	Cr
344	<i>Xanthoria elegans</i> (Links.) Th. Fr.	S				+				+	+		F
345	<i>X. sorediata</i> (Vain.) Poelt	S				+				+	+		F
Thelotremataceae													
346	<i>Diploschistes awasthii</i> Pant & Upreti	T								+			Cr
347	<i>D. diacapsis</i> (Ach.) Lumbsch	T		+						+		+	Cr

348	<i>D. gypsaceus</i> (Ach.) Zahlbr.	T				+			Cr
349	<i>D. scruposus</i> (Schreb.) Norman	T			+	+	+		Cr
Umbilicariaceae									
350	<i>Umbilicaria indica</i> Frey	S			+	+	+	+	F
351	<i>U. indica</i> var. <i>nana</i> Frey	S	+					+	F
352	<i>U. vellea</i> (L.) Ach.	S	+						F
Verrucariaceae									
353	<i>Catapyrenium cinereum</i> (Pers.) Körb.	T			+			+	Sq
354	<i>Dermatocarpon meiophyllizum</i> Vain.	S				+	+		F
355	<i>D. minutum</i> (L.) Mann	S				+	+	+	F
356	<i>D. velleum</i> Zschacke	S			+	+		+	F
357	<i>Endocarpon nigrozonatum</i> A. Singh & Upreti	S						+	Sq
358	<i>E. subrosetum</i> A. Singh & Upreti	S					+	+	Sq
359	<i>Staurothele fissa</i> (Taylor) Zwackh	S					+		Cr
360	<i>Verrucaria acrotella</i> Ach.	S				+		+	Cr
361	<i>V. coerulea</i> (Ramond) DC.	S			+				Cr

GF- Growth Forms, **+** Present, **Cr-** Crustose, **Fo-** Foliose, **Fr-** Fruticose, **Le-** Lepraria, **Di-** Dimorphic, **S-** Saxicolous, **C-** Corticolous, **T-** Terricolous. **1-** Jatoli, **2-** Zero Point, **3-** Loharkhet, **4-** Dwali, **5-** Phurkia, **6-** Mirtoli, **7-** Dhakuri, **8-** Khati, **9-** Song, **10-** Kapkot.

Fig.1 Localities of Bageshwar district surveyed for lichens

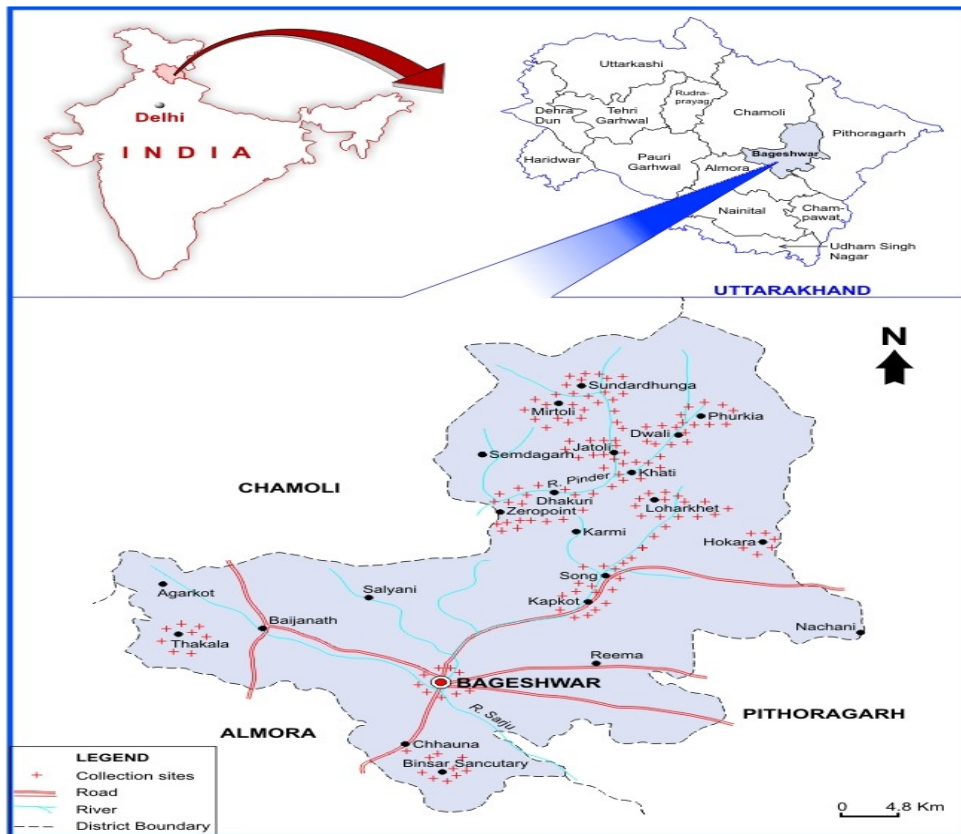


Fig.2 Number of species and genera in the ten dominant lichen families in Bageshwar district

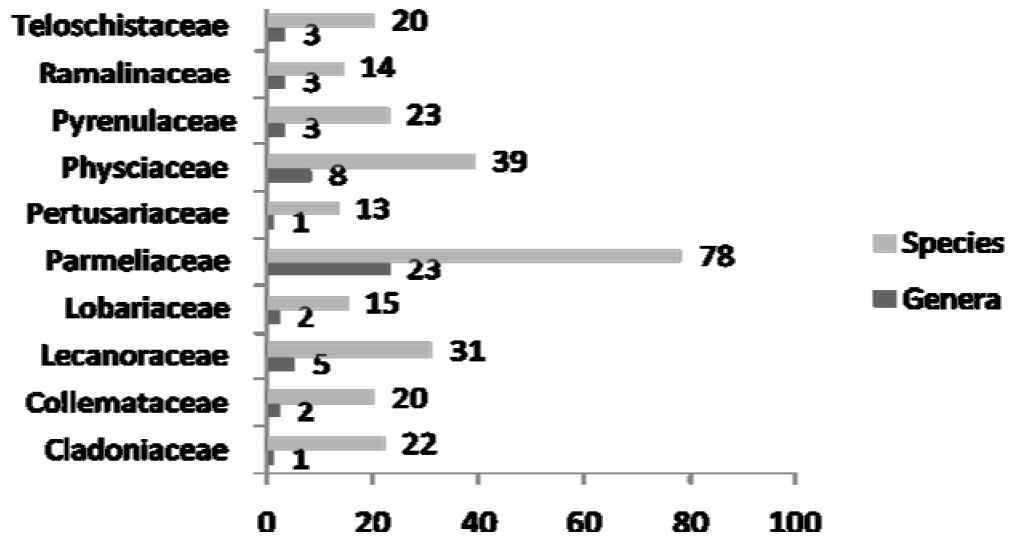


Fig.3 Number of species in the ten dominant lichen genera in Bageshwar district

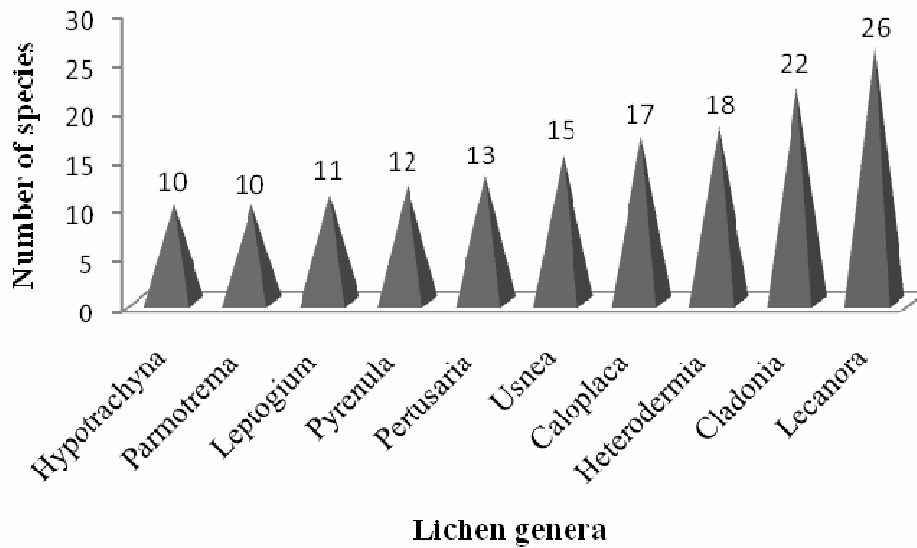


Fig.4 Common species of lichens sharing major substrate in the Bageshwar district

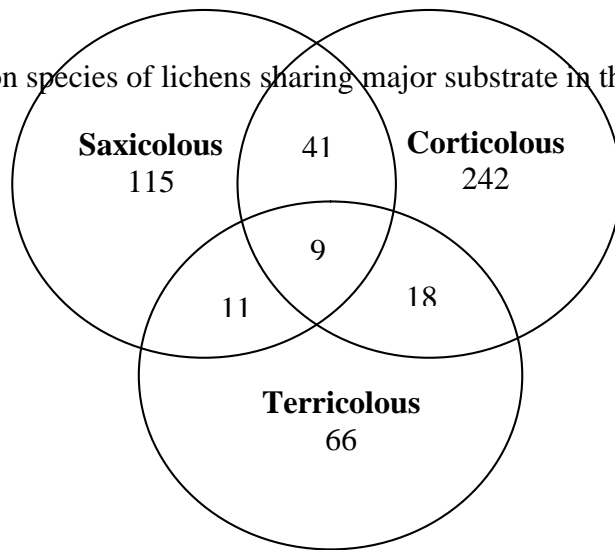
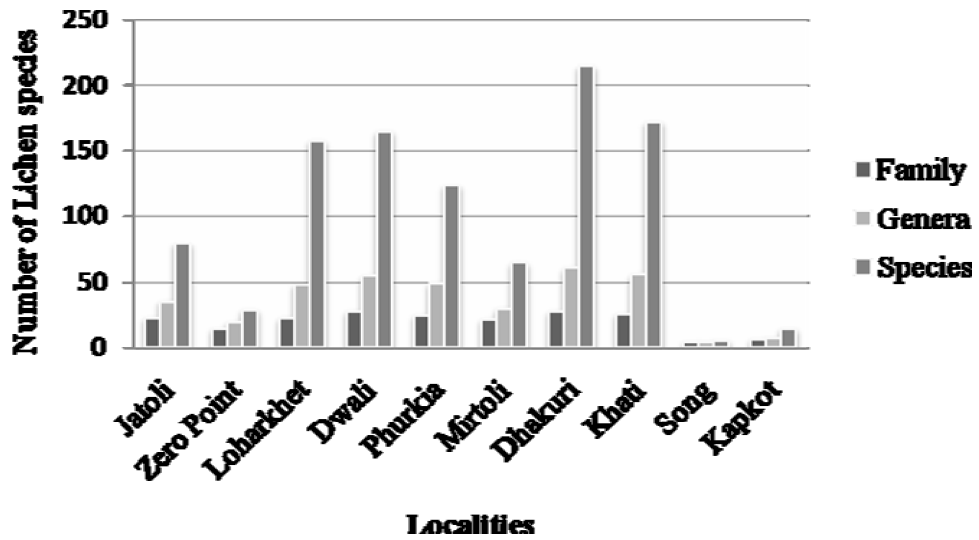


Fig.5 Diversity of lichens in different localities of Bageshwar district



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