



Review of lichens of the high level Ferricretes and Mesas of the North Western Ghats, India

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Abstract

The paper includes 234 species in 61 genera belonging to 30 families reported from the high level Ferricretes and basalt mesas, of the North Western Ghats of Maharashtra. The average percentage of the lichen species in Maharashtra on high level Ferricretes is 22.91 % and on the basalt Mesas is 0.682 %. Of these 234 species, 50 species are new to science, reported from these plateau areas and 25 species have their type locality in and around the plateaus.

Key words – basalt – laterite – lichenized fungi – rocky outcrops.

Introduction

The Western Ghats of India are one of the important biodiversity hot spots of the world and comprise many rocky plateaus. They are a highly specialized terrestrial island-like habitat, with a unique combination of microhabitats that support endemic biodiversity due to the geology, geomorphology, climate and edaphic conditions. The flora and fauna has diversified in to narrow-niched endemics in this habitat. Cycling of nutrients and of water in this habitat is also different than any other habitats, such as forest or grasslands. Scientific recognition of this uniqueness has come only within the last decade (Watve 2013). They are categorized and treated as wastelands, as they remain dry and look barren for most part of the year.

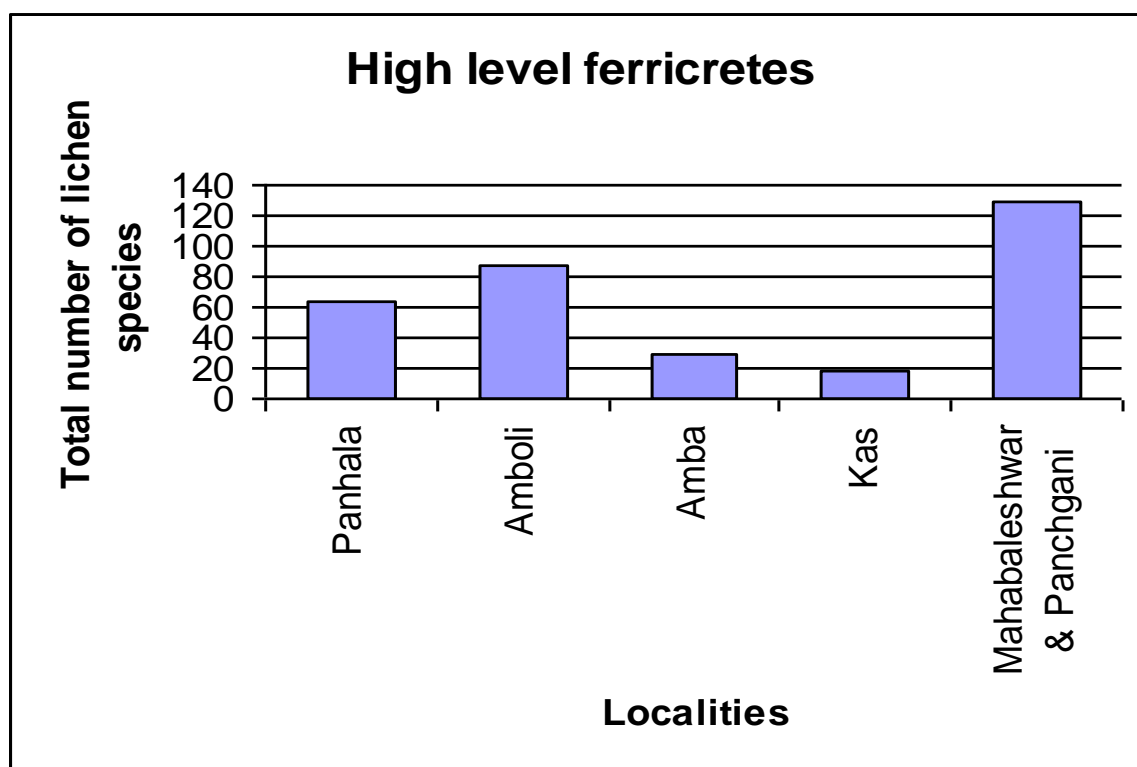
In the northern part of the Western Ghats and in the Konkan region of Maharashtra State, rocky plateaus are a very prominent part of the landscape. Ferricretes, often known as “tablelands” owing to the wide flat appearance and steep edges are common. There are a total of 67 plateau sites or rocky outcrops in the North Western Ghats and Konkan region of Maharashtra.

These plateaus are of the following three types:

High-level Ferricretes (HLF) occurs on high-level Laterites between 15–18° 20’N, extend inland to 74° E, and are located between 800 and 1400 m (Widdowson & Cox 1996) in the districts of Satara, Kolhapur, Sangli, Ratnagiri, and Sindhudurg, which include the crestline of the NW Ghats. Of these 26 plateaus are high level Ferricretes. The high level Ferricretes that are explored are Amba, Amboli, Kas, Mahabaleshwar-Panchgani and Panhala (Table 1, Fig. 1).

Table 1 High level Ferricretes

Plateaus	Microlichen taxa	Macrolichen taxa	Total number of lichen taxa	% in Maharashtra	% in India
Panhala	30	33	63	21.87	2.73
Amboli	64	24	88	30.55	3.82
Amba	24	6	30	10.41	1.30
Kas	5	14	19	6.59	0.82
Mahabaleshwar & Panchgani	72	57	130	45.13	5.64

**Fig. 1** – Graphical representation of high level Ferricretes

Basalt Mesa (BM) outcrops are exposed on mesas between 18° 20'–21° N & 73° 35'–73° 50'E. These are areas where the upper layers of rocks have eroded to expose the underlying basalt flows, and hence can occur at any altitude depending upon the degree of weathering. The basalt mesas that are explored are Anjaneri, Matheran, Durgawadi and Malshej ghat. There are 10 basalt Mesas and the remaining three are between high level Ferricretes to low level Ferricretes (Table 2, Fig. 2).

Table 2 Basalt Mesas

Plateaus	Microlichen taxa	Macrolichen taxa	Total number of lichen taxa	% in Maharashtra	% in India
Anjaneri	6	6	12	4.16	0.52
Durgawadi	10	14	24	8.33	1.04
Malshej ghat	11	10	21	7.29	0.911
Matheran	3	3	6	2.08	0.26

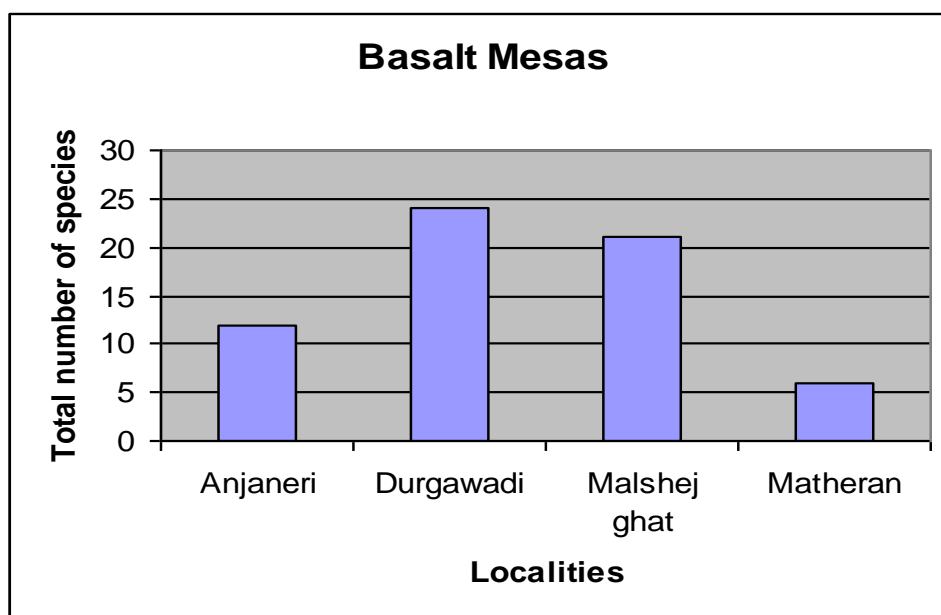


Fig. 2 – Graphical representation of basalt Mesas

Low-level Ferricretes (LLF) occur in the low-level laterites of Konkan plains between 50–200 m south of 18° 20'N in the Raigad, Ratnagiri and Sindhudurg districts, as well as all of Karnataka and the Kerala coast, extending from the sea coast to the foothills of the Western Ghats and 28 plateaus are low level Ferricretes in Maharashtra.

Many of the hill forts of Maharashtra State have exposed hilltops of basalt (Watve 2013).

Lichens are regarded as an example of controlled parasitism (where in a fungal partner, the mycobiont and one or more photosynthetic partners, the photobiont, are present to form a complex structure forming- “symbiont”. They play an important role in the mineral cycling patterns of their ecosystem. More than 2300 lichen species are presently known from India (Singh & Sinha 2010) and a total of 288 lichen species in 68 genera are known from the State of Maharashtra (Makhija *et al.* 2014).

The plateaus have a unique lichen flora, and are also facing threats from tourism, mining, and grazing (Table 3). Many organizations and researchers working on these plateau sites are actively helping in conserve them. The Maharashtra forest department has also taken a leading role in the region by identifying rocky plateaus of special conservation significance and taking steps to include details of rocky plateaus in the regional working plans.

Table 3 Details of Explored plateaus

Regions	Villages	Local names	District	Outcrop type	Land ownership	Threat	Disturbance
Nashik area	Anjaneri	Anjaneri	Nashik	BM	Partly RF	Tourism	Low
Kas area	Kas (Site K)	Apti papdi, dhang sada, thanoba sada	Satara	HLF	RF, private	Flower tourism	Moderate
Panchgani area	Godawali / Panchgani	Panchgani Tableland/ Asia plateau	Satara	HLF	Mahabaleshwar Panchgani ecosensitive zone Declared natural heritage, Conservation	Commercial landscape tourism	Very high

Regions	Villages	Local names	District	Outcrop type	Land ownership	Threat	Disturbance
Malshej Ghat area	Malshej	Malshej Ghat	Ahemdnagar	BM	Mostly private zone	Tourism	High
Panhala	Fort	Fort	Kolhapur	HLF	Reserve Forest	Grazing by cattle/Township / ESZ1	Moderate
Amba ghat area	Amba	-	Kolhapur	Secondary laterite	Reserve Forest	Tourism	Moderate
Durgawadi	Ambe-Hatviji/Junnar	Killa /Fort	Pune	BM	Private and Cultivated for rice	Grazing, Fires, Blasting for ponds	Local grazing, fires trampling by tourists, plant collection and proposed wind farms
Amboli	Amboli	Choukul sada, Hiranyakeshi sada, Khamtyahca sada	Sindhudurg	HLF	Reserve Forest	Grazing	Low
Raigad District	Matheran	Matheran	Raigad	Between HLF and LLF	Matheran Eco Sensitive Zone	Tourism	High

Review of Literature

The Maharashtra State was investigated for lichens during 2001-2008, and published as “Lichens of Maharashtra” (Makhija *et al.* 2014). Few plateaus were also explored but were of a floristic nature and plateaus or rocky outcrops were not taken into account as specialized habitats. Hence, lichen data was not exclusively available for the plateaus. Recently a list on lichens of the Mahabaleshwar-Panchgani Ecosensitive zone was published (Pandit 2014b), also two new generic records have been reported for the two high level Ferricretes (Pandit 2014a). However, the low level Ferricretes have not been surveyed in the concept of specialized habitats and collections have been made in and around the plateau and not on the actual plateau.

Explorations of the rocky plateaus have so far concentrated on angiosperms, amphibians and reptiles (Bhattaria *et al.* 2012, Giri *et al.* 2004, 2008, Gower *et al.* 2007, Lekhak & Yadav 2012, Yadav & Sardesai 2002). New species of vertebrates, invertebrates, angiosperms and pteridophytes have been reported from rocky plateaus in the study area, indicating their biodiversity richness. However, the cryptogamic vegetation not been studied in detail. A cryptogamic crust covers a large portion of rocky plateaus and it is considered as one of the major communities on rock outcrops world over (Porembski *et al.* 2000).

Büdel has remarked on the surprisingly high variety of cyanobacteria and cyanobacterial lichens on outcrops across the tropical regions. The lichen diversity of rock outcrops has never specifically been reviewed. In view of this, the paper presents a review of lichens reported on rocky plateau sites. It will serve as a baseline for future studies on this subject. By using the outcrop data of Watve (2013) as the baseline data, this review produces a list of lichens from these poorly investigated plateaus.

Materials & Methods

For the preparation of this review paper, primary, as well as secondary data has been used. During the surveys conducted for the compilation of book “Lichens of Maharashtra” vouchers

Table 4 List of lichens occurring on various substrates

Taxa	Saxicolous	Corticolous	Terricolous	Muscicolous
<i>Aspicilia calcarea</i>	+			
<i>Caloplaca abuensis</i>	+			
<i>Caloplaca amarkantaka</i>	+			
<i>Caloplaca cupulifera</i>	+			
<i>Cladonia</i> sp.			+	
<i>Cladonia scabriuscula</i>	+		+	
<i>Collema furfureolum</i>	+			
<i>Collema polycarpon</i>	+			
<i>Collema tenax</i> var. <i>tenax</i>	+			
<i>Collema texanum</i> var. <i>texanum</i>	+			
<i>Diploschistes rampodensis</i>	+			
<i>Diploschistes</i> cf. <i>rampodensis</i>	+			
<i>Immersaria</i> cf. <i>olivacea</i>	+			
<i>Koerberiella wimmeriana</i>	+			
<i>Lepraria lobificans</i>	+			
<i>Leptogium burnetiae</i> var. <i>hirsutum</i>				+
<i>Leptogium chloromelum</i>				+
<i>Leptogium cyanescens</i>		+		+
<i>Leptogium denticulatum</i>		+		+
<i>Leptogium patwardhanii</i>				+
<i>Leptogium ulvaceum</i>			+	
<i>Leptogium verrucosum</i>	+	+		
<i>Parmotrema tinctorum</i>	+	+		
<i>Pertusaria corallina</i>	+			
<i>Porina</i> sp.	+			
<i>Ramalina</i> sp.			+	
<i>Staurothele clopima</i>	+			
<i>Staurothele fissa</i>	+			
<i>Thelenella</i> sp.	+			
<i>Trapelia placodioides</i>	+			
<i>Verrucaria acrotella</i>	+			

specimens were collected and deposited at Ajrekar Mycological herbarium (AMH) lodged at ARI. These primary occurrence records together with field ecological data on lichen habitats, collected during various survey tours from 2001 to 2014 has been analyzed here. Currently work is going on as part of the funded project from the Department of Science & Technology, Govt. of India, project on the two outcrops of Kas and Panchgani, where lichen explorations and ecological data collections were made. In addition to this, regional research on lichens since 2000-2008 has been reviewed for this compilation.

Results and Discussion

The secondary data sources on lichens are voluminous. However, they deal mainly with taxonomy and nomenclature issues. There is a dearth of ecological information beyond lichens forms and substrates. Only 9-10 rocky plateaus have been repeatedly surveyed by lichenologists. Still a very large number of 234 species in 61 genera belonging to 30 families are reported from the nine plateau regions of NW Ghats of Maharashtra. This clearly indicates the importance of this habitat for lichen biodiversity and need for further detailed studies systematically from this habitat.

The dominant families for the few studied plateau regions are *Graphidaceae* with highest species number of 47 species, followed by *Physciaceae*- 31 species, *Collemataceae* with 23 species, *Lecanoraceae* 18 species, *Parmeliaceae* with 15 species, *Thelotrema*-*Graphidaceae* with 14 species and *Ramalinaceae* with 13 species. The average percentage of species on high level Ferricretes is 22.91 % and on the basalt Mesas is 0.68 %, whereas the low level Ferricretes plateaus in Maharashtra mentioned by Watve (2013) have not been well-studied, but their surroundings are explored for lichens so we do not have lichen reports from specific plateaus as such.

Table 5 Comparative lichen data of the high level Ferricretes and basalt Mesas [1 Amba, 2 Amboli, 3 Kas, 4 Mahabaleshwar-Panchgani, 5 Panhala, 6 Anjaneri, 7 Matheran, 8 Durgawadi, 9 Malshej ghat]

Families	Genera	Species	Names of Taxon	Growth forms	HLF					BM				Status		
					1	2	3	4	5	6	7	8	9			
<i>Arthoniaceae</i>	2	7	<i>Arthothelium albescens</i> Patw. & Makhija	Crustose				+						Restricted		
			<i>Arthothelium awasthii</i> Patw. & Makhija	Crustose				+					+			
			<i>Arthothelium deplanatum</i> (Müll. Arg.) Makhija & Patw.	Crustose						+	+					
			<i>Arthothelium nigrodiscum</i> Patw. & Makhija	Crustose				+			+					
			<i>Arthothelium saxicola</i> Makhija & Patw.	Crustose											+	Restricted
			<i>Arthothelium subruanum</i> Makhija & Patw.	Crustose											+	Restricted
			<i>Cryptothecia lunulata</i> (Zahlbr.) Makhija & Patw.	Crustose											+	Restricted
<i>Arthopyreniaceae</i>	1	3	<i>Mycomicrothelia exigua</i> (Müll. Arg.) D. Hawksw.	Crustose	+	+	+									
			<i>Mycomicrothelia hemispherica</i> (Mull. Arg.) D. Hawksw.	Crustose										+	Restricted	
			<i>Mycomicrothelia obovata</i> (Stirt.) D. Hawksw.	Crustose										+	Restricted	
<i>Brigantiaceae</i>	1	1	<i>Brigantiaea patwardhanii</i> Chitale & Makhija	Crustose					+					Restricted		
<i>Caliciaceae</i>	1	3	<i>Buellia panchganiensis</i> Makhija & Dube	Crustose									+	Restricted		
			<i>Buellia</i> sp. B	Crustose										+	Restricted	
			<i>Buellia tabularis</i> Makhija & Dube	Crustose										+	Restricted	
<i>Cladoniaceae</i>	1	2	<i>Cladonia scabriuscula</i> (Delise) Nyl.	Fruticose									+	Restricted		
			<i>Cladonia</i> sp.	Fruticose										+	Restricted	
<i>Coccocarpiaceae</i>	1	2	<i>Coccocarpia erythroxyli</i> (Spreng.) Swinscow & Krog	Foliose									+	Restricted		
			<i>Coccocarpia palmicola</i> (Spreng.) Arv. & D. J. Gall.	Foliose										+	Restricted	
<i>Collemaaceae</i>	2	25	<i>Collema conglomeratum</i> Hoffm. var.	Foliose									+	Restricted		
			<i>Collema crassiusculum</i> (Malme) Degel.	Foliose										+	Restricted	
			<i>Collema furfureolum</i> Mull. Arg.	Foliose										+	Restricted	
			<i>Collema leptaleum</i> Tuck. var. <i>biliusum</i> (Mont.) Degel.	Foliose										+	Restricted	
<i>Collema polycarpon</i> Hoffm. var. <i>polycarpon</i>	Foliose										+	Restricted				

Families	Genera	Species	Names of Taxon	Growth forms	HLF					BM				Status				
					1	2	3	4	5	6	7	8	9					
Graphidaceae	8	47	<i>Collema pulcellum</i> Ach. var.	Foliose				+							Restricted			
			<i>subnigrescens</i> (Mull. Arg.) Degel.															
			<i>Collema tenax</i> var. <i>tenax</i> (Sw.) Ach.	Foliose						+							Restricted	
			<i>Collema texanum</i> var. <i>texanum</i> Tuck.	Foliose													Restricted	
			<i>Leptogium austroamericanum</i> (Malme) Dodge	Foliose						+							Restricted	
			<i>Leptogium azureum</i> (Sw.) Mont.	Foliose						+		+						
			<i>Leptogium burnetiae</i> var. <i>hirsutum</i> (Sierk) P.M. Jørg.	Foliose						+		+	+			+	Common	
			<i>Leptogium chloromelum</i> (Sw.) Nyl.	Foliose													Restricted	
			<i>Leptogium cochleatum</i> (Dicks.) P.M. Jorg. & P. James	Foliose													Restricted	
			<i>Leptogium cyanescens</i> (Ach.) Korb.	Foliose							+		+					
			<i>Leptogium denticulatum</i> Nyl.	Foliose													+	
			<i>Leptogium gelatinosum</i> (With.) J.R. Laudon	Foliose													+	Restricted
			<i>Leptogium indicum</i> Awasthi & Akthar	Foliose									+	+				
			<i>Leptogium javanicum</i> Mont	Foliose									+	+	+	+	+	Common
			<i>Leptogium patwardhanii</i> A. Dube & Makhija	Foliose									+					Restricted
			<i>Leptogium phyllocarpum</i> (Pers.) Mont.	Foliose														Restricted
			<i>Leptogium propaguliferum</i> Vain.	Foliose									+					Common
			<i>Leptogium subazureum</i> A. Dube & Makhija	Foliose							+	+						Common
			<i>Leptogium ulvaceum</i> (Pers.) Vain.	Foliose														Restricted
			<i>Leptogium verrucosum</i> A. Dube & Makhija	Foliose													+	Restricted
			<i>Carbacanthographis awasthii</i> (Patw. & Nagarkar) Chitale & Makhija	Crustose													+	Restricted
			<i>Diorygma "microsporum"</i> ad int.	Crustose														Restricted
			<i>Diorygma "patwardhanii"</i> ad int	Crustose														Restricted
			<i>Diorygma albocinerascens</i> Makhija, Chitale & B.O. Sharma	Crustose									+				+	Common
			<i>Diorygma albovirescens</i> Makhija, Chitale & B.O. Sharma	Crustose														Restricted
			<i>Diorygma excipuloconvergentum</i> Makhija, Chitale & B.O. Sharma	Crustose									+				+	Common
			<i>Diorygma junghuhnii</i> (Mont. & Bosch) Kalb. in Kalb	Crustose														Restricted

Families	Genera	Species	Names of Taxon	Growth forms	HLF					BM				Status	
					1	2	3	4	5	6	7	8	9		
			<i>Diorygma megaspermum</i> Makhija, Chitale & B.O. Sharma	Crustose		+		+							
			<i>Diorygma megasporum</i> Kalb, Staiger & Elix	Crustose		+	+		+	+					Common
			<i>Diorygma megistosporum</i> Makhija, Chitale & B.O. Sharma	Crustose					+	+					
			<i>Diorygma panchganiense</i> Makhija, Chitale & B.O. Sharma	Crustose						+					Restricted
			<i>Diorygma rufosporum</i> (Patw. & Kulk.) B.O. Sharma & Makhija	Crustose					+						Restricted
			<i>Fissurina cingalina</i> (Nyl.) Staiger	Crustose			+			+					
			<i>Glyphis cicatricosa</i> Ach.	Crustose			+								Restricted
			<i>Graphis ajarekarii</i> Patw. & C.R. Kulk.	Crustose			+								Restricted
			<i>Graphis aurita</i> Eschw. in Martius	Crustose			+								Restricted
			<i>Graphis duplicata</i> Ach.	Crustose							+				Restricted
			<i>Graphis elevativerrucosa</i> Chitale & al	Crustose			+								Restricted
			<i>Graphis galactoderma</i> (Zahlbr.) Lucking	Crustose							+				Restricted
			<i>Graphis lineola</i> Ach.	Crustose							+				Restricted
			<i>Graphis maharashtrana</i> Chitale & al.	Crustose						+	+			+	
			<i>Graphis nigroglauca</i> Leight.	Crustose						+					Restricted
			<i>Graphis panhalensis</i> (Patw. & Kulk.) Chitale & al.	Crustose						+					Restricted
			<i>Graphis parilis</i> Kremph.	Crustose							+				Restricted
			<i>Graphis platycarpa</i> Eschw.	Crustose							+				Restricted
			<i>Graphis polystriata</i> Makhija, A. Dube, Adaw. & Chitale	Crustose			+	+	+	+		+		+	Common
			<i>Graphis proserpens</i> Vain.	Crustose							+				Restricted
			<i>Graphis</i> sp. 1	Crustose							+				Restricted
			<i>Graphis subducta</i> Vain.	Crustose							+				Restricted
			<i>Graphis subserpentina</i> (Nyl.) Mull Arg.	Crustose							+				Restricted
			<i>Graphis treblocarpa</i> (Bel.) Nyl.	Crustose							+				Restricted
			<i>Graphis tsunodae</i> Zahlbr.	Crustose							+				Restricted
			<i>Graphis vittata</i> Vain.	Crustose							+				Restricted
			<i>Hemithecium amboliense</i> Makhija & A. Dube	Crustose						+					Restricted
			<i>Hemithecium aphanes</i> (Mont. et Bosch) M. Nakan. & Kashiw.	Crustose			+	+							
			<i>Hemithecium epixanthum</i> (Mont. & Bosch) Chitale & Makhija	Crustose				+			+			+	

Families	Genera	Species	Names of Taxon	Growth forms	HLF					BM				Status	
					1	2	3	4	5	6	7	8	9		
			<i>Hemithecium microspermum</i> Chitale, Makhija & B.O. Sharma	Crustose		+									Restricted
			<i>Hemithecium multistriatum</i> (Müll. Arg.) Chitale & Makhija	Crustose		+									Restricted
			<i>Hemithecium nakanishianum</i> (Patw. & C.R. Kulk.) Makhija & A. Dube	Crustose	+	+		+	+		+				Common
			<i>Hemithecium norsticticum</i> Makhija & A. Dube	Crustose	+			+						+	
			<i>Hemithecium pyrrochroa</i> (Mont. & Bosch.) V. Tewari & Upreti	Crustose				+							Restricted
			<i>Hemithecium salacinilabiatum</i> (Patw. & C.R. Kulk.) Chitale & Makhija	Crustose		+									Restricted
			<i>Hemithecium stictilabiatum</i> (Patw. & C.R. Kulk.) Chitale & Makhija	Crustose	+	+									
			<i>Pallidogramme commutabilis</i> (Kremp.) Chitale & Makhija	Crustose				+							Restricted
			<i>Pallidogramme indica</i> A. Dube & Makhija	Crustose	+	+									
			<i>Pallidogramme undulatolirellatum</i> A. Dube & Makhija	Crustose	+	+									
			<i>Platygramme halei</i> (Patw. & C.R. Kulk.) Makhija & Chitale	Crustose		+									Restricted
<i>Lecanoraceae</i>	1	18	<i>Lecanora alba</i> Lumbsch	Crustose				+							Restricted
			<i>Lecanora allophana</i> (Ach.) Röhl.	Crustose				+							Restricted
			<i>Lecanora andina</i> Rasanen	Crustose				+							Restricted
			<i>Lecanora austrointumescens</i> Lumbsch & Elix	Crustose				+							Restricted
			<i>Lecanora cenisia</i> Ach.	Crustose			+	+					+		
			<i>Lecanora</i> cf. <i>chlarotera</i> Nyl.	Crustose				+							Restricted
			<i>Lecanora</i> cf. <i>fimbriatula</i> Stirt.	Crustose	+	+	+		+		+	+			Common
			<i>Lecanora</i> cf. <i>imshaugii</i> Brodo	Crustose			+	+	+	+				+	Common
			<i>Lecanora</i> cf. <i>perplexa</i> Brodo	Crustose					+						Restricted
			<i>Lecanora</i> cf. <i>xylophila</i> Hue	Crustose										+	Restricted
			<i>Lecanora chlarotera</i> Nyl.	Crustose				+	+						
			<i>Lecanora expallens</i> Ach.	Crustose				+							Restricted
			<i>Lecanora interjecta</i> Mull. Arg.	Crustose				+							Restricted
			<i>Lecanora lavidofusca</i> Mull. Arg.	Crustose				+							Restricted
			<i>Lecanora</i> sp. 1 (Table Land)	Crustose				+							Restricted

Families	Genera	Species	Names of Taxon	Growth forms	HLF					BM				Status
					1	2	3	4	5	6	7	8	9	
			<i>Lecanora</i> sp. A	Crustose	+									Restricted
			<i>Lecanora</i> sp. B	Crustose		+			+	+		+		Common
			<i>Lecanora xylophila</i> Hue	Crustose			+							Restricted
<i>Megasporaceae</i>	1	1	<i>Aspicilia calcarea</i> (L.) Sommerf.	Crustose				+						Restricted
<i>Monoblastiaceae</i>	1	1	<i>Anisomeridium albisedum</i> (Nyl.) R. C. Harris	Crustose					+					Restricted
<i>Pannariaceae</i>	1	3	<i>Parmeliella brisbanensis</i> (Knight.) P.M. Jorg. & D.J. Galloway	Crustose-squamulose-foliose							+			Restricted
			<i>Parmeliella fuscata</i> P. M. Jørg.	Squamulose					+					Restricted
			<i>Parmeliella subfuscata</i> A. Dube & Makhija	Squamulose					+					Restricted
<i>Parmeliaceae</i>	7	15	<i>Bulbothrix isidiza</i> (Nyl.) Hale	Foliose				+						
			<i>Bulbothrix meizospora</i> (Nyl.) Hale	Foliose					+					Restricted
			<i>Bulbothrix tabacina</i> (Mont. & Bosch) Hale	Foliose					+					Restricted
			<i>Myelochroa aurulenta</i> (Tuck.) Elix & Hale	Foliose						+				Restricted
			<i>Parmelinella simplicior</i> (Hale) Elix & Hale	Foliose	+	+		+	+	+		+	+	Common
			<i>Parmelinella wallichiana</i> (Tayl.) Elix & Hale	Foliose				+	+					
			<i>Parmotrema kamatii</i> Patw. & A. V. Prabhu	Foliose				+		+			+	
			<i>Parmotrema praesorediosum</i> (Nyl.) Hale	Foliose					+					Restricted
			<i>Parmotrema reticulatum</i> (Taylor) Choisy	Foliose	+									Restricted
			<i>Parmotrema sancti-angelii</i> (Lynge) Hale	Foliose					+	+				
			<i>Parmotrema tinctorum</i> (Nyl.) Hale	Foliose					+	+	+		+	Common
			<i>Remototrachyna awasthi</i> (Hale & Patw.) Divakar & Crespo	Foliose					+	+	+		+	Common
			<i>Rimelia reticulata</i> (Taylor) Hale & A. Fletcher	Foliose						+				Restricted
			<i>Usnea complanata</i> (Mull. Arg.) Motyka	Foliose							+		+	
			<i>Usnea ghattensis</i> G. Awasthi	Foliose								+		
<i>Pertusariaceae</i>	1	8	<i>Pertusaria alutacea</i> (Kremph.) Zahlbr.	Crustose									+	Restricted
			<i>Pertusaria cf. depressa</i> (Fee) Mont. et Bosch	Crustose									+	Restricted
			<i>Pertusaria cf. quassiae</i> (Fée) Nyl.	Crustose						+	+			
			<i>Pertusaria cinchonae</i> Müll. Arg.	Crustose									+	Restricted
			<i>Pertusaria corallina</i> (L.) Arnold	Crustose									+	Restricted

Families	Genera	Species	Names of Taxon	Growth forms	HLF					BM				Status		
					1	2	3	4	5	6	7	8	9			
Phlyctidaceae	1	2	<i>Pertusaria pertusa</i> (L.) Tuck.	Crustose				+						Restricted		
			<i>Pertusaria quassiae</i> (Fée) Nyl.	Crustose	+			+	+			+		Common		
			<i>Pertusaria</i> sp. C	Crustose		+									Restricted	
			<i>Phlyctis communis</i> Chitale & Makhija	Crustose	+	+	+		+						Common	
			<i>Phlyctis karnatakana</i> S. Joshi & Upreti	Crustose					+						Restricted	
Physciaceae	7	32	<i>Dirinaria applanata</i> (Fée) D. D. Awasthi	Foliose		+			+							
			<i>Heterodermia incana</i> (Stirt.) D. D. Awasthi	Foliose		+	+	+					+		Common	
			<i>Heterodermia albicans</i> (Pers.) Swinscow & Krog L.	Foliose					+						Restricted	
			<i>Heterodermia angustiloba</i> (Miill. Arg.) Awasthi	Foliose					+	+				+		
			<i>Heterodermia antillarum</i> (Vain.) Swinscow & Krog	Foliose							+				Restricted	
			<i>Heterodermia boryi</i> (Fée) Kr. P. Singh & S. Singh	Foliose				+	+							
			<i>Heterodermia</i> cf. <i>japonica</i> (M. Satô) Swinscow & Krog	Foliose						+					Restricted	
			<i>Heterodermia diademata</i> (Taylor) Awasthi	Foliose			+	+	+	+	+			+	+	Common
			<i>Heterodermia flabellata</i> (Fée) D. D. Awasthi	Foliose				+			+					
			<i>Heterodermia hypocaesia</i> (Yesuda) D.D. Awasthi	Foliose						+						Restricted
			<i>Heterodermia hypoleuca</i> (Ach.) Trevis.	Foliose					+							Restricted
			<i>Heterodermia japonica</i> (Sato) Swinscow & Krog	Foliose								+				Restricted
			<i>Heterodermia leucomelos</i> (L.) Poelt	Foliose							+					Restricted
			<i>Heterodermia obscurata</i> (Nyl.) Trevis.	Foliose				+			+					
			<i>Heterodermia podocarpa</i> (Bel.) Awasthi	Foliose						+	+			+	+	Common
			<i>Heterodermia pseudospeciosa</i> (Kurok.) W. Culb.	Foliose					+	+	+	+			+	Common
			<i>Heterodermia</i> sp.	Foliose							+					Restricted
<i>Heterodermia speciosa</i> (Wulfen) Trevis.	Foliose				+	+	+	+				+	Common			
<i>Phaeophyscia endococcina</i> var. <i>endococcinodes</i> (Poelt) Moberg	Foliose							+				+				
<i>Phaeophyscia hispidula</i> (Ach.) Moberg	Foliose					+		+	+			+	+	Common		
<i>Phaeophyscia hispidula</i> var. <i>exornatula</i> (Zahlbr.) Moberg	Foliose								+				Restricted			

Families	Genera	Species	Names of Taxon	Growth forms	HLF					BM				Status	
					1	2	3	4	5	6	7	8	9		
			<i>Phaeophyscia orbicularis</i> (Neck.) Moberg	Foliose										+	Restricted
			<i>Phaeophyscia pyrrophora</i> (Poelt) D.D. Awasthi & M. Joshi	Foliose				+	+						
			<i>Physcia abuensis</i> D.D. Awasthi & Singh	Foliose				+	+	+					
			<i>Physcia integrata</i> Nyl.	Foliose					+	+	+				
			<i>Physcia tribacoides</i> Nyl.	Foliose					+	+	+		+	+	Common
			<i>Physcia undulata</i> Moberg	Foliose					+						Restricted
			<i>Physconia enteroxantha</i> (Nyl.) Poelt	Foliose						+					Restricted
			<i>Pyxine cocoes</i> var. <i>cocoes</i> (Swartz) Nyl.	Foliose						+					Restricted
			<i>Pyxine cocoes</i> var. <i>prominula</i> (Stirt.) D. Awasthi	Foliose						+					Restricted
			<i>Pyxine petricola</i> var. <i>petricola</i> Nyl.	Foliose							+	+			
<i>Pilocarpaceae</i>	1	1	<i>Micarea</i> sp.	Crustose								+			Restricted
<i>Porianaceae</i>	1	9	<i>Porina africana</i> Müll. Arg.	Crustose	+	+									
			<i>Porina angusta</i> Makhija & al.	Crustose											Restricted
			<i>Porina atropertiostiola</i> Makhija & al.	Crustose											Restricted
			<i>Porina</i> cf. <i>subpungens</i> Malme	Crustose											Restricted
			<i>Porina karnatakensis</i> Makhija & al.	Crustose											Restricted
			<i>Porina lucida</i> R. Sant.	Crustose											Restricted
			<i>Porina masonhalei</i> Makhija & Chitale	Crustose											Restricted
			<i>Porina</i> sp.	Crustose											Restricted
			<i>Porina</i> sp. A	Crustose											
<i>Porpidiaceae</i>	2	2	<i>Immersaria</i> cf. <i>olivacea</i> Calatayud & Rambold	Crustose											Restricted
			<i>Koerberiella wimmeriana</i> (Körber) B. Stein	Crustose											Restricted
<i>Pyrenulaceae</i>	2	7	<i>Lithothelium obtectum</i> (Müll. Arg.) Aptroot	Crustose											Restricted
			<i>Pyrenula</i> cf. <i>mastophoriza</i> (Nyl.) Zahlbr.	Crustose											Restricted
			<i>Pyrenula depressa</i> (Müll. Arg.) Makhija & Chitale	Crustose											Restricted
			<i>Pyrenula glabrescens</i> Vain.	Crustose											Restricted
			<i>Pyrenula</i> sp. B	Crustose											Restricted
			<i>Pyrenula</i> sp. C	Crustose											Restricted
			<i>Pyrenula</i> sp. D	Crustose											Restricted
<i>Ramalinaceae</i>	4	14	<i>Bacidia albicerata</i> (Kremp.) Zahlbr.	Crustose											Restricted
			<i>Bacidia alutacea</i> (Kremp.) Zahlbr.	Crustose											Restricted

Families	Genera	Species	Names of Taxon	Growth forms	HLF					BM				Status	
					1	2	3	4	5	6	7	8	9		
			<i>Bacidia fusconigrescens</i> (Kremp.) Zahlbr.	Crustose		+		+							
			<i>Bacidia incongruens</i> (Stirt.) Zahlbr.	Crustose		+									Restricted
			<i>Bacidia personata</i> Malme	Crustose				+							Restricted
			<i>Bacidia rubella</i> (Hoffm.) A. Massal.	Crustose	+			+							
			<i>Bacidia</i> sp. A	Crustose	+										Restricted
			<i>Bacidia subacerina</i> Nyl. ex Vain.	Crustose					+						Restricted
			<i>Bacidia submedialis</i> (Nyl.) Zahlbr.	Crustose		+									Restricted
			<i>Lopezaria isidiza</i> (Makhija & Nagarkar) Aptroot & Sipman	Crustose				+							Restricted
			<i>Phyllopsora breviuscula</i> (Nyl.) Müll. Arg.	Squamulose	+										Restricted
			<i>Phyllopsora corallina</i> (Eschw.) Mull. Arg.	Squamulose			+		+						
			<i>Phyllopsora foliata</i> (Stirt.) Zahlbr	Squamulose	+	+									
<i>Rocellaceae</i>	1	1	<i>Enterographa micrographa</i> (Nyl.) Redinger	Crustose	+	+									
<i>Stereocaulaceae</i>	1	3	<i>Lepraria coriensis</i> (Hue) Sipman	Leprose					+						Restricted
			<i>Lepraria lobificans</i> Nyl.	Leprose					+						Restricted
			<i>Lepraria</i> sp.	Leprose					+						Restricted
<i>Teloschistaceae</i>	1	8	<i>Caloplaca abuensis</i> Joshi & Upreti	Crustose					+						Restricted
			<i>Caloplaca amarkantakana</i> Joshi & Upreti	Crustose					+						Restricted
			<i>Caloplaca cupulifera</i> (Vain.) Zahlbr.	Crustose					+						Restricted
			<i>Caloplaca flavorubescens</i> (Huds.) J.R. Laundon	Crustose					+				+		
			<i>Caloplaca herbidella</i> (Nyl. ex Hue) H. Magn.	Crustose			+			+					
			<i>Caloplaca inconspicua</i> Arup	Crustose						+			+		
			<i>Caloplaca pollinii</i> (A. Massal.) Jatta	Crustose						+					Restricted
			<i>Caloplaca</i> sp. A	Crustose							+				Restricted
<i>Thelotremoid-Graphidaceae</i>	5	14	<i>Chapsa laceratula</i> (Müll. Arg.) Rivas Plata & Lücking	Crustose	+	+									
			<i>Chapsa leprocarpa</i> (Nyl.) A. Frisch	Crustose	+										Restricted
			<i>Chapsa</i> sp. A	Crustose			+			+					
			<i>Chapsa</i> sp. B	Crustose			+								Restricted
			<i>Diploschistes rampoddensis</i> (Nyl.) Zahlbr.	Crustose				+					+		
			<i>Diploschistes</i> cf. <i>rampoddensis</i> (Nyl.) Zahlbr.	Crustose						+					Restricted
			<i>Diploschistes</i> sp. A	Crustose				+							Restricted

Families	Genera	Species	Names of Taxon	Growth forms	HLF					BM				Status
					1	2	3	4	5	6	7	8	9	
			<i>Myriotrema clandestinum</i> (Fée) Hale	Crustose	+									Restricted
			<i>Myriotrema masonhalei</i> (Patw. & C.R. Kulk.) Hale	Crustose		+								Restricted
			<i>Myriotrema</i> sp. B	Crustose		+								Restricted
			<i>Ocellularia allosporoides</i> (Nyl.) Patw. & C.R. Kulk.	Crustose		+								Restricted
			<i>Ocellularia terebrata</i> (Ach.) Müll. Arg.	Crustose	+									Restricted
			<i>Thelotrema monosporum</i> Nyl.	Crustose				+						Restricted
			<i>Thelotrema subtile</i> Tuck.	Crustose	+	+								Restricted
<i>Trapelariaceae</i>	1	1	<i>Trapelia placioides</i> Coppins & James	Crustose				+						Restricted
<i>Trypetheliaceae</i>	2	2	<i>Trypethelium plicatorimosum</i> Makhija & Patw.	Crustose		+								Restricted
			<i>Laurera vezdae</i> Makhija & Patw.	Crustose	+									Restricted
Uncertain position in <i>Caliciales</i>	1	1	<i>Heterocyphelium leucampyx</i> (Tuck.) Vain.	Crustose		+								Restricted
Uncertain position in <i>Pyrenulaceae</i>	1	1	<i>Trichotrema filisporum</i> (Patw. & al.) Makhija & Patw.	Crustose		+								Restricted
<i>Verrucariaceae</i>	3	4	<i>Endocarpon subrosetum</i> A. Singh & Upreti	Squamulose				+						Restricted
			<i>Staurothele clopima</i> (Wahlenb.) Th. Fr.	Crustose				+						Restricted
			<i>Staurothele fissa</i> (Taylor) Zack.	Crustose				+						Restricted
			<i>Verrucaria acrotella</i> Ach.	Crustose				+						Restricted

The total number of crustose forms is 151 spp, foliose 69 spp, fruticose six species, leprose three species squamulose six species and crustose-squamulose-foliose one species. Lichens were seen to utilize diverse substrates on the plateaus, such as rock, bark, soil and also sometimes mosses, 23 species are exclusively saxicolous (on rocks and boulders) which is 9.82 % of the total plateau lichens, three species are seen share both bark and rock surfaces, 203 species are exclusively corticolous (on bark) which is 86.75 %, four species exclusively terricolous (on soil), three species exclusively muscicolous (on moss) and two species are seen share both the barks and moss. (TABLE 4) and the remaining species are all corticolous as per the list (TABLE 5). The majority of the species ca. 158 species are restricted to one plateau, whereas 24 species are common to more than four plateaus, while the remaining have an apparently rare status. Though these areas appear barren and rocky the barren part covers 9.82 % of lichen cover of the total plateau area. Further systematic studies might give a better idea regarding regional distribution of species. However, it is clear that speciation on these terrestrial island habitat continues even now.

Similarly various inselbergs, duricrust, limestone, and quartzite rich, granite outcrops have been explored for their lichen studies worldwide and there is a mention that “Every single rock outcrop and quarry supported at least one red-listed cryptogam species and among lichens the central European endemic *Endocarpon latzelianum* was found new to Germany” (Thiel & Spribille 2007).

Thus detailed studies will enhance knowledge of lichen diversity on these poorly explored plateaus. The isolation or fragmentation of ecological habitats can have significant impact on biodiversity. Fragmentation may disrupt ecological processes critical to the maintenance of biodiversity, especially if over long periods. Hence rehabilitation of areas within short periods and maintaining ecological corridors become necessary mitigation measures. Introduction of burning as weed control can disrupt natural ecosystems. The recovery of lichens is very slow.

This list will be helpful at the national and regional levels to protect and raise government and public interest to help identify lichens to the specific national conservation action programs. Nevertheless, a number of lichens occurring on the basaltic rock at great heights, have never been studied due to difficulties in collection. Such studies will certainly result in many new and interesting lichens.

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