

# Enumeration and New records of Lichens in Kodagu district- A Micro Hotspot in Western Ghats of Karnataka, India

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#### Abstract

The present work describes lichen diversity in Kodagu district, which is also known as micro hotspot situated in the Western Ghats of Karnataka, India. A total of 87 species belonging to 29 families under 50 genera was enumerated during the study. About 25 species of lichens are found to be new record to the lichen flora of Karnataka. Family Parmeliaceae and Physciaceae were dominated with 20 species under 5 genera and 15 species under 7 genera, respectively. Compared to other substratum most of the lichens recorded were corticolous (colonizing bark) with 78 species. Crustose and foliose growth form dominates with about 44% in all the regions. The highest diversity of lichens was enumerated in Nisargadhama [MDF] with 57 species, with highest Shannon- Simpson index of 3.75 and 0.02 respectively in which macrolichens were more dominated. Distribution of lichens in deciduous forest was more when compared to semi-evergreen and evergreen forests. The lichen rich diversity in a small, densely forested area indicates that much exploration regarding the enumeration of lichens is required.

Keywords: Deciduous forest, lichen flora, parmeliaceae, nisargadhama.

#### Introduction

Lichens are the unique group of organisms made by symbiotic association between a photosynthetic partner (alga or cyanobacteria) and a heterotrophic fungus<sup>1</sup>. The algal partner synthesizes food by photosynthesis and shares with fungal partner in turn the fungus give protection to the algae. They grow in diverse climatic conditions and on diverse substrates. The ability to quickly absorb and retain water from many sources makes it possible for lichens live in harsh environments like deserts and Polar Regions, and on exposed surfaces like bare rocks, walls, roofs and tree branches<sup>2</sup>. Lichens are commercially harvested as non-timber forest product from many rural communities in the Western Ghats<sup>3</sup>. Lichens are sensitive to microclimatic conditions and are considered as indicators of air pollution, and they constitute an important component of biodiversity. It is estimated that there are about 20,000 species of lichens present throughout the world and in India, the estimated record is 2303 species<sup>4</sup>, which represents 14% of world lichen population. In Karnataka, most of the lichenological explorations were undertaken in lichen rich regions such as the Western Ghats, which is composed of tropical and subtropical moist broadleaf forests.

The Western Ghats harbors almost 45% of the total lichens in India, the highest for any region in the Country<sup>5</sup>. Nayaka and Upretianalyzed the status of lichen diversity in the Western Ghats based on published literature which revealed the presence of 949 species with 26.7% endemism in which Karnataka alone has 336 species<sup>6</sup>. The Western Ghats range is Internationally

acknowledged as an environmental "hot spot" because of its biological diversity and the effects of human depredation<sup>7</sup>. Within this mountain chain lies Kodagu located on the Eastern slopes of the Western Ghats. It is the second smallest district in Karnataka, occupying an area of 4108 sq.km. in the Western Ghats. The many diverse kinds of vegetation from tropical evergreen forests with sholas, semi- evergreen forests to moist-deciduous forest found in the district, make Kodagu one of the micro hotspots of biodiversity within the larger hotspots of the Western Ghats<sup>8</sup>. Kodagu has approximately 65 per cent of its geographical area under tree cover, making it one of the most densely forested districts in the country<sup>9</sup>. Hence a systematic survey had taken to enumerate the distribution of lichens in Kodagu district, Karnataka.

## Material and methods

**Collection of lichens:** Lichen samples were collected systematically from different locations across the Kodagu district. Different geographic regions selected for lichen survey are given in table 1. Belt transect method was used to collect lichens. Each transect measuring 50x10 m laid in different locations of the study area. A total of 25 transects was laid in 5 different locations in the study area<sup>10</sup>. The lichen specimens were collected with the help of Chisel and Hammer along with their ecological notes, which includes; the host tree type, location of the lichen thallus (trunk, branch, twigs, leaves, soil or rock substratum) and altitude. The collected specimens were investigated morphologically, anatomically and chemically for identification. The specimens were placed on a hard card sheet

and packed in a lichen herbarium packet (17cm x 10mm) with details of the locality and preserved in the herbarium at the Department of studies in Botany, Manasagangotri, University of Mysore, Karnataka, India.

**Data analysis and interpretation:** Lichen assemblages were quantitatively analysed for density and frequency. Relative frequency (RF) and relative density (RD) were determined following Phillips method<sup>11</sup>. RF=100 x (frequency of species *I*/sum of frequency values of all species), and RD=100 x (density of species *I*/sum of density values of all species). The importance value index (IVI) used here is the sum of the relative frequency and relative density. Frequency distribution, alpha diversity - Shannon-Weiner diversity index (H') and Simpson diversity index (D') have been used to assess species diversity. Alpha diversity (H') was estimated as the Shannon-Wiener index: H'= $\Sigma pi lnpi$ , Where, pi=density (number of thalli) of the species, *i*/density of all species<sup>12</sup>. All statistical analyses were performed using SPSS<sup>13-15</sup>.

**Identification of lichen species:** The external morphology was studied under stereomicroscope. The anatomy of the thallus and apothecia was studied from hand cut sections in water or on cotton blue in lactophenol. The colour of the medulla, epithecium, hypothecium and ascus and the shape and size of the asci, ascospores and conidia was measured. Chemical test of the specimens includes- colour spot tests (K, C, KC and P test) and thin layer chromatography (TLC). Identification was carried out by consulting relevant keys<sup>16-17</sup>.

#### **Results and Discussion**

In the present investigation a systematic survey to enumerate the diversity of lichens in Kodagu district was undertaken in different locations, in which a total of 87 species belonging to 29 families under 50 genera were recorded. About 25 species of lichens are found to be new record to the lichen flora of Karnataka. Out of 29 families, Parmeliaceae was dominated with 20 species under 5 genera, followed by Physciaceae with 15 species under 7 genera, Graphidaceae with 7 species, Arthoniaceae, Teloschistaceae, Lecanoraceae, Pertusariaceae with 4 species each, Ramalinaceae and Usneaceae with 3 species each, and the rest of the family with one species each

are represented in figure-1. Most of the lichens recorded were corticolous (colonizing bark) with 78 species, followed by saxicolous (rock colonizing) with 6 species, Muscicolous (on mosses), terricolous (on soil) and parasitic with one species each in figure-2. Among the different growth forms crustose and foliose were dominated with about 44% each in all the regions, fruticose growth form with 9%, leprose with 3% and squamulose with 1% were present in the study site is represented in figure-3. The highest diversity of lichens was enumerated in Nisargadhama [MDF] with 57 species in which foliose lichens were more dominated, followed by Thithimathi forest [DDF] with 47 species in which crustose lichens were dominated, least diversity was observed in Abbi falls and Talakaveri regions is presented in figure-4.

IVI value is greater in Parmotrema tinctorum with 15.37, followed by Pyxine petricola with 14.97 and Flavoparmelia caperata with 13.85, least IVI value was in Hypotrachyn aadducta with 0.67. Most common lichens with maximum frequency, abundance, distribution were Anaptychia kaspica, Caloplaca atrosanguinea, Buellia confuse, Candelaria concolor, Cryptothecia culbersonae, Chrysothrix candelaris, applanata, Dirinaria Flavoparmelia caperata, lecanoracarpenia, ochrolechia pallescens, Physciaaipolia, Pyxinepetricola. Lichen specimens like Bacidiamedialis grown parasitic on Ramalina farinacea, Parmotremamelanothrix were reported only in Nisargadhama, Conotremaindicum, Dimerellalutea, Diorygmapoitaei, Mycocaliciumhimalahense, parmentaria immerse, Parmotremamellisii, P. saccatilobum only in Thithimathi forest. Lichen species *Opegraphainaequalis, Anisomeridium concameratum* and Stirtoniasantessonii reported in Abbi falls. Terricolous lichen Cladoniamacilenta were reported only in Talakaveri, lichens like Parmeliellatriptophylla and Usneasubflorida in Virajpet (table-2). The Shannon indices for diversity and Simpson indices for dominance were calculated. Where Shannon index ranged from 3.75- 2.89 and Simpson index ranged from 0.02-0.06. Among the six different regions Nisargadhama [MDF] harbored luxuriant growth of species with highest Shannon-Simpson index of 3.75 and 0.02 respectively, and less distribution was observed in Talakaveri [EF] with 2.89 and 0.06 respectively (table-3).

Place of collection	Latitude	Longitude	Elevation	Type of vegetation
Nisargadhama	12 <sup>°</sup> 26'25.76"N	75 <sup>°</sup> 56'10.27"E	839m	Moist deciduous [MDF]
Thithimathi forest	12 <sup>°</sup> 13'18.32"N	76 <sup>°</sup> 00'05.14"E	879m	Dry deciduous[DDF]
Dubare camp	12 <sup>°</sup> 22'06.42"N	75 <sup>°</sup> 54'17.82"E	853m	Semi-evergreen[SEF]
Abbi falls	12 <sup>°</sup> 27'29.27"N	75 <sup>°</sup> 43'10.17"E	1048m	Semi-evergreen[SEF]
Talakaveri	12 <sup>°</sup> 23'00.56"N	75 <sup>°</sup> 29'39.14"E	1183m	Evergreen forest[EF]
Virajpet	12 <sup>°</sup> 11'32.52"N	75 <sup>°</sup> 57'06.26"E	873m	Scrub forest[SF]

Table-1 Parameters of collection sites





Figure- 1 Dominance of lichen families with respect to species in the Kodagu district



Dominance of substratum for the growth of lichens

The vegetation in Kodagu follows a typical west to east gradient and is correlated to the similar west to east relief rainfall and temperature gradient. Evergreen and semi-evergreen forests blanket the western and central regions of the district. Moist and dry deciduous forests dominate some parts of the eastern regions, and the eastern and southeastern areas of the district contain scrub forests<sup>18</sup>. In the present study, the diversity of lichen among the different locations with different forest types in Kodagu district was reported. Eighty seven species of lichens were encountered during the entire study. Distribution of lichens in deciduous forest was more when compared to semi-evergreen and evergreen forests. In a study on diversity of macrolichens in the Bhadra wildlife sanctuary reported similar results<sup>19</sup>. Crustose and foliose lichens were almost same with 44% and 43% respectively. The lichen flora in the study area exhibit greatest abundance in variety and luxuriance of growth and seems to prefer the bark of trees (90%) more as their substratum. Among the macrolichen species recorded in the Siruvani Hills, 92.2 % of lichens had colonized bark

(corticolous) and it was highest at middle elevations<sup>20</sup>. Species diversity tends to decrease with increasing elevation; it peaks at some intermediate level of elevation, giving rise to a humpedshaped relationship<sup>12</sup>. Apart from the substratum, other ecological factors like altitude, elevation, humidity, forest types also play a vital role for colonization of lichens. Family Parmeliaceae is dominant in the present studied regions followed by family Physciaceae, which is similar to the results obtained by Karakoti et al<sup>21</sup>. Parmeliaceae with 137 species belonging to 22 genera is the dominant family in the entire Western Ghats of India<sup>22</sup>. In our previous study of the distribution of foliicolous lichens in Karnataka have reported 18 species of lichens from Kodagu district, in which 14 species are obligately foliicolous<sup>23</sup>. The presence of 87 species of lichens in an area of forest cover is quite significant; this rich diversity indicated good forest health<sup>24</sup>. Owing to close ecophysiological links, lichens are also recognized as promising candidates for air quality biomonitoring<sup>25</sup>.



Figure- 3 Percentage of different growth forms in entire study



Figure- 4 No. of lichen growth forms in each locality

Lichen Taxa Collection site										
(* new record to Karnataka)	Family	form	Substratum	1	ر ۲۹	m	4	ie vo	9	
Amandinea punctata (Hoffm.) Coppins and Scheid.*	Physciaceae	Crustose	Bark	ı	6.85	8.09	I	I	ı	
Anaptychia kaspica Gyelnik*	Physciaceae	Foliose	Bark	ı	2.42	3.79	ı	8.04	3.17	
Anisomeridium concameratum (Stirt.) Aptroot*	Trichotheliaceae	Crustose	Bark	ı	ı	ı	7.28	ı	ı	
Anthracothecium sublaevigatum Patw. and Makh.	Pyrenulaceae	Crustose	Bark	2.96	ı	3.88	1	4.11	·	
Arthonia inconspicua Stirton*	Arthoniaceae	Crustose	Bark	1.27	3.47	I	3.15	I	I	
Arthonia medusula (Pers.) Nyl.	Arthoniaceae	Crustose	Bark	1.35	4.45	1.46	ı	ı	1.52	
Arthopyrenia analepta (Ach.) Massel.	Arthopyreniaceae	Crustose	Bark	ı	3.55	ı	I	4.48	I	
Bacidia medialis (Tuck.) Zahlbr*	Bacidiaceae	Crustose	Parasitic	1.52	ı	I	ı	ı	T	
Brownliella cinnabarina (Ach.) S.Y.Kondr., Karnefelt, A. Thell, Elix, J.Kim, A.S. Kondr. and J.S. Hur.*	Teloschistaceae	Crustose	Rock	3.96	4.91	'	3.25		2.01	
Brigantiaea leucoxantha (Sprengel)	Brigantiaceae	Crustose	Bark	3.20	I	7.82				
Buellia confuse D.D. Awasthi	Physciaceae	Crustose	Bark	4.36	7.57	ı	3.56	8.04	4.69	
Bulbothrix setschwanensis (Zahlbr.)*	Parmeliaceae	Foliose	Bark	4.44	ı	3.88	ı	I	1.52	
Caloplaca atrosanguinea (G. Merr.) Lamb	Teloschistaceae	Crustose	Bark	ı	6.75	3.01	3.04	9.53	ı	
Caloplaca subsoluta (Nyl.) Zahlbr	Teloschistaceae	Crustose	Bark	4.28	0.89	ı	1.73	I	ı	
Campylothelium nitidum MüLL. Arg.	Trypetheliaceae	Crustose	Bark	ı	3.16	2.84	ı	ı	ı	
Candelaria concolor (Dicks.) Stein	Candelariaceae	Foliose	Bark	7.43	6.10	9.97	ı	13.85	5.78	
Cladonia macilenta Hoffm.*	Cladoniaceae	Fruticose	Soil	ı	ı	I	I	2.99	I	
Cryptothecia culbersonae Patw. and Makh.	Arthoniaceae	Crustose	Bark	5.01	7.56	8.61	12.3 2	11.4 1		
Chrysothrix candelaris (L.) Laundon	Chrysothricaceae	Leprose	Bark	4.20		7.44	3.88	5.23	4.94	
Chrysothrix chlorina (Ach.) Laundon	Chrysothricaceae	Leprose	Bark	4.36	ı	ı		ı	ı	
Conotrema indicum Makh. and Patw.	Stictidaceae	Crustose	Bark	I	1.29	I	I	I	I	
Cyphelium inquinans (Sm.) Trevis*	Mycocaliciaceae	Crustose	Bark	I	0.97	I	ı	I	I	

Table- 2 Lichen flora of Kodagu district

Lichen Taxa	Family	Growth	Substratum	Collection site						
(* new record to Karnataka)	гатну	form	Substratum	1	2	3	4	S	6	
Dimerella lutea (Dickson) Trevisan*	Gyalectaceae	Crustose	Bark	ı	1.29				,	
Diorygma poitaei (Fée) Kalb, Staiger and Elix*	Graphidaceae	Crustose	Bark	I	1.13	ı	I	I	I	
<i>Diorygma pruinosum</i> (Eschw.) Kalb, Staiger and Elix*	Graphidaceae	Crustose	Bark	I	I	I	I	I	3.05	
Dirinaria applanata (Sw.) Vain.	Physciaceae	Foliose	Bark	6.71	4.99	4.65	10.5 4	I	10.0 9	
Dirinaria confluens (Fr.) Awas.	Physciaceae	Foliose	Bark	4.12	4.85	ı	9.23	8.41	3.65	
Dirinaria consimilis (Stirton) Awas.	Physciaceae	Foliose	Bark	1.92	2.26	ı	3.04	I	6.63	
Dirinaria papillulifera (Nyl.)Awas.*	Physciaceae	Foliose	Bark	1.3	ı	1.72	I	ı	1.40	
<i>Flavoparmelia caperata</i> (L.) Ach.	Parmeliaceae	Foliose	Bark	7.43	10.75	8.01	6.66	13.85	9.00	
Graphis nakanishiana Patw. and kulk.	Graphidaceae	Crustose	Bark	-	ı	1.29	ı	ı	1.76	
Graphis pyrrhocheiloides Zahlbr.	Graphidaceae	Crustose	Bark	0.84	ı	ı	ı	4.86	ı	
Graphis scripta (L.) Ach.	Graphidaceae	Crustose	Bark	2.11	I	2.16	5.88	I	I	
Haemotaemma puniceum (Sm. Ex Ach.) Massal.	Haematommataceae	Crustose	Bark	2.84	4.35	5.34	2.73	2.05	1.88	
Heterodermia comosa (Eschw.) Follmann and Redón	Physciaceae	Foliose	Bark	4.33	ı	8.01	ı	ı	8.96	
<i>Heterodermia hypocaesia</i> (Yasuda) D.D. Awasthi	Physciaceae	Foliose	Bark	3.84	ı		ı	7.85	ı	
Heterodermia leucomela L.	Physciaceae	Foliose	Bark	8.11	I	9.42	I	I	I	
Heterodermia podocarpa (Bèl.)Awas.	Physciaceae	Foliose	Bark	1.76		5.69	1	,	5.90	
Heterodermia psuedospeciosa (Kurok.)Culb.*	Physciaceae	Foliose	Bark, Rock	2.28	6.77	I	I	2.43	I	
Hyperphyscia minor (Fee.) Awas.*	Physciaceae	Foliose	Bark	3.25	3.87	ı	2.94	ı	ı	
Hypotrachyna orientalis (Hale) Hale*	Parmeliaceae	Foliose	Bark	I	1.13	1.29	ı	ı	I	
Lecanora argentata (Ach.) Malme*	Lecanoraceae	Crustose	Bark	1.94	I	I	4.19	I	I	
Lecanora carpinea L.	Lecanoraceae	Crustose	Bark	8.00	7.97	8.25	9.28	I	5.71	
Lecanora chlarotera Nyl	Lecanoraceae	Crustose	Bark	2.24	ı	2.16	3.35	5.79	3.29	
Lecidella euphoria (Florke) Hertel*	Lecanoraceae	Crustose	Bark	1.60	ı	2.33	ı	ı	I	

Lichen Taxa	Eam!la	Fomily Growth Substratum				ollect	tion si	site		
(* new record to Karnataka)	Family	form	Substratum	1	2	3	4	S	9	
Leptogium chloromelum (Swartz ex Ach.) Nyl.*	Collemataceae	Foliose	Rock	3.97	4.75	,	3.46	,	,	
Leptogium wilsonii Zahlbr.	Collemataceae	Foliose	Bark	I	I	ī	2.73	4.86	66.9	
Maronea constans (Nyl.) Hepp	Fuscideaceae	Crustose	Bark	0.84	I	ı	I	ı	ı	
Melanohalea exasperatula (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. and Lumbsch*	Parmeliaceae	Foliose	Mosses	-	ı	3.62		'	ı	
Myriotrema terebratulum (Nyl.) Hale	Thelotremataceae	Crustose	Bark	2.36	ı	5.86	T	ı	ı	
Ochrolechia pallescens (L.) Massel.	Pertusariaceae	Crustose	Bark	5.09	4.03	4.31	3.04	6.35	ı	
Opegrapha inaequalis Fee*	Graphidaceae	Crustose	Bark	ı	ı	ı	3.15	I	ı	
Parmeliella triptophylla (Ach.)Müll. Arg.	Pannariaceae	Squamulose	Rock	I	I	ı	I	ı	1.64	
Parmelina muelleri (Vainio) Hale.	Parmeliaceae	Foliose	Bark		3.97	3.78	ı	ı	ı	
Parmelina wallichiana (Taylor) Hale.	Parmeliaceae	Foliose	Bark	3.72	ı	ı	ı	I	2.43	
Parmotrema austrosinensis (Zahlbr.) hale	Parmeliaceae	Foliose	Bark	8.48	7.31	9.55	I	I	ı	
Parmotrema crinite (Ach.) Choisy	Parmeliaceae	Foliose	Bark	2.24	2.42		I	I	1.43	
Parmotrema grayanum (Hue) Hale	Parmeliaceae	Foliose	Bark	ı		7.49	,		,	
Parmotrema hababianum (Gyelnik) Hale	Parmeliaceae	Foliose	Bark	2.68	I	2.50	I	I	ı	
Parmotrema margaritata (Hue) Hale	Parmeliaceae	Foliose	Bark	I	I	7.57	I	I	1.86	
Parmotrema melanothrix (Mont).	Parmeliaceae	Foliose	Bark	1.68	ı		ı	ı	ı	
Parmotrema mellissii (C. W. Dodge) Hale	Parmeliaceae	Foliose	Bark	I	4.93		I	I	ı	
Parmotrema saccatilobum (Taylor) Hale	Parmeliaceae	Foliose	Rock	ı	3.63		ı	ı	ı	
Parmotrema subarnoldii des Abb.	Parmeliaceae	Foliose	Bark	3.00	1	3.79	1	ı	ı	
Parmotrema subtinctorum (Zahlbr.) Hale	Parmeliaceae	Foliose	Bark	3.25		3.54	,	ı	3.29	
Parmotrema tinctorum Nyl.	Parmeliaceae	Foliose	Bark	ı	,	8.18	11.3 8		15.3 7	
Parmotrema zollingeri (Hepp) Hale*	Parmeliaceae	Foliose	Bark	3.12				ı	ı	
Pertusaria albescens (Huds.) Choisy and Wern.	Pertusariaceae	Crustose	Bark	4.01	4.19	3.28	4.46	ı	3.60	

Lichen Taxa	Family Growth St	C-1-44	Collection site						
(* new record to Karnataka)	Family	form	Substratum	1	7	3	4	S	9
Pertusaria concinna Erichsen	Pertusariaceae	Crustose	Bark	2.68	4.69	3.01	2.83	ī	3.17
Pertusaria leucosorodes Nyl.	Pertusariaceae	Crustose	Bark	1.60	4.69	ı	2.83	4.29	
Phaeographis dendritica (Ach.) Müll. Arg.	Graphidaceae	Crustose	Bark		ı			2.05	1.04
Physcia aipolia (Ehrh. ex Humb.) Furnr.	Physciaceae	Foliose	Bark	6.95	7.31	6.87	12.7 4	13.8 5	9.17
Pseudocyphelleria aurata (Ach.) Vainio	Lobariaceae	Foliose	Bark	3.60	7.65		ī		10.65
Pseudoparmelia texana (Tuck.) Hale*	Parmeliaceae	Foliose	Bark	3.00	ı		ı		3.53
Pyrenula sp.	Trypetheliaceae	Crustose	Bark	1	2.18		ī		1
Pyxine petricola Nyl.	Physciaceae	Foliose	Bark	8.30	11.5 5	7.58	10.7 9	14.9 7	13.4 3
Ramalina baltica Lettau	Ramalinaceae	Fruticose	Bark	2.68	ı		1.41		1
<i>Ramalina inflate</i> (Hook. f. and Taylor) Hook. f. and Taylor	Ramalinaceae	Fruticose	Bark	ı	1.13				1.76
Ramalina farinacea (L.) Ach*	Ramalinaceae	Fruticose	Bark	1.00	2.58	2.24			
Roccella montagnei Bel. Emend. Awas.	Roccellaceae	Foliose	Bark	3.73	2.74	5.00		ı	3.77
<i>Remototrachyna adducta</i> (Nyl.) Divakar, Lumbsch, Ferencova, Prado andCrespo *	Parmeliaceae	Foliose	Bark	0.67	ı	3.18		6.36	
Sphinctrina auglica Nyl.*	Sphinctrinaceae	Crustose	Bark		1.29				
Stirtonia santessonii Makhija and Patw.*	Arthoniaceae	Crustose	Bark	ı	I		1.41	ı	
Teloschistes flavicans (Swartz) Norm.	Teloschistaceae	Fruticose	Bark	2.00	6.30		ı	ı	7.55
Usnea baileyi (Stirton) Zahlbr.	Usneaceae	Fruticose	Bark	3.84	I			1	3.29
Usnea subflorida (Zahlbr.)Mot.	Usneaceae	Fruticose	Bark	1	ı	1			3.05
Usnea eumitrioides Mot.*	Usneaceae	Fruticose	Bark	2.24	I				1.28

Collection sites: 1. Nisargadhama; 2. Thithimathi forest; 3. Dubare camp; 4. Abbi falls; 5. Talakaveri; 6.Virajpet

Table-3   Details of various parameters calculated for lichen richness in six study sites of Kodagu district									
Locality	Shannon- weiner index	Simpson index of diversity	Total individual	Total species					
Nisargadhama	3.75	0.02	1257	57					
Thithimathi	3.53	0.03	1066	47					
Dubare forest	3.36	0.03	935	42					

Abbi falls	3.12	0.05	626	30
Talakaveri	2.89	0.06	414	25
Virajpet	3.25	0.04	651	38

## Conclusion

The present study will help in understanding the relationship between lichen species distribution and elevation bands and also to understand the possible effects of climate change on lichen species distribution. It is extremely important to document the existing vegetation and study the effect of biotic pressures and environmental quality.

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