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An Assessment of Lichens Diversity in Almora District, Kumaun Himalaya, Uttarakhand

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ABSTRACT

The present study recorded a total of 199 lichen taxa belonging to 66 genera and 26 families from 42 localities of the district Almora in Uttarakhand. Among these localities, Jageshwar showed maximum diversity with 72 species belonging to 36 genera, followed by Soni Binsar (69 species, 33 genera) and Aera Dev (38 species, 19 genera). Among the different growth forms, foliose lichens are dominant, with 125 species, followed by crustose lichens, with 47 species. The list of lichens, along with localities, is provided.

INTRODUCTION

The Almora district is located in the central Kumaun area of Uttarakhand, between latitudes 29º30′ N and 30º20′ N and longitudes 79º20′ E to 80º20′ E. The district has a total geographical area of 3090 km^2 and the altitude ranges between 1200 to 2800 m. The vegetation of the district is classified into tropical, sub-tropical, sub-alpine and alpine types. In the lower altitude (1000–1500 m), the district exhibits deciduous forest with phorophytes such as *Pinus roxburghii* and *Syzygium cumini,* while *Quercus leucotrichophora* and *Rhododendron arboretum* are common in higher altitudes along with some coniferous trees (Mishra and Upreti 2015). The floristic survey of lichens from the Almora district was carried out by Awasthi (1957, 1960a, 1960b) and reported the genera *Anaptychia* and *Physcia*. Mishra and Upreti (2015) enumerated 112 species belonging to 41 genera and 20 families from various localities of the district. Although several explorations were carried out in the district previously for lichens, the information is scattered. The present manuscript provides a comprehensive account of lichens from the Almora district.

MATERIALS AND METHODS

The present study is based on the published literature and re-examination of the specimens preserved in the herbarium of CSIR-National Botanical Research Institute, Lucknow (LWG), which also contains the personal herbarium of Dr. D.D. Awasthi (LWG-AWAS) and herbarium of University of Lucknow (LWG-LWU). The morphology, anatomy and chemistry of the preserved specimens were studied in the laboratory. The morphological examination was done under a stereo-zoom microscope (LeicaS8 APO) and thin hand-cut sections of thallus and reproductive structures were observed under a compound microscope (Leica DM500) to study anatomy. For spot tests, routine reagents such as K, C and P were used where K is 10% aqueous solution, C is calcium hypochlorite, and P is paraphenylenediamine. The Thin Layer Chromatography (TLC) was performed in solvent system A (Toluene:1,4-dioxane: acetic acid: 180: 60: 8 ml) following the techniques of Orange *et al*. (2001). The specimens were identified up to the species level with the help of keys of Awasthi (1991), Awasthi (2007), Awasthi (2010) and Mishra & Upreti (2015). The identification of species was confirmed by matching with available type specimens or with well-identified specimens available at LWG. The nomenclature of the identified species was updated following www.indexfungorum, and families were assigned following Wijayawardene *et al*. (2022). A map of the study area was obtained by QGIS 3.28 and Uttarakhand state GIS portal https://stategisportal.nic.in/.

RESULT AND DISCUSSION

The study resulted in a total of 199 taxa belonging to 66 genera and 26 families from 42 different localities of Almora district (Table 1 & Fig. 1). Out of 42 localities of the district, Jageshwar, Soni Binsar and Aera Dev exhibit

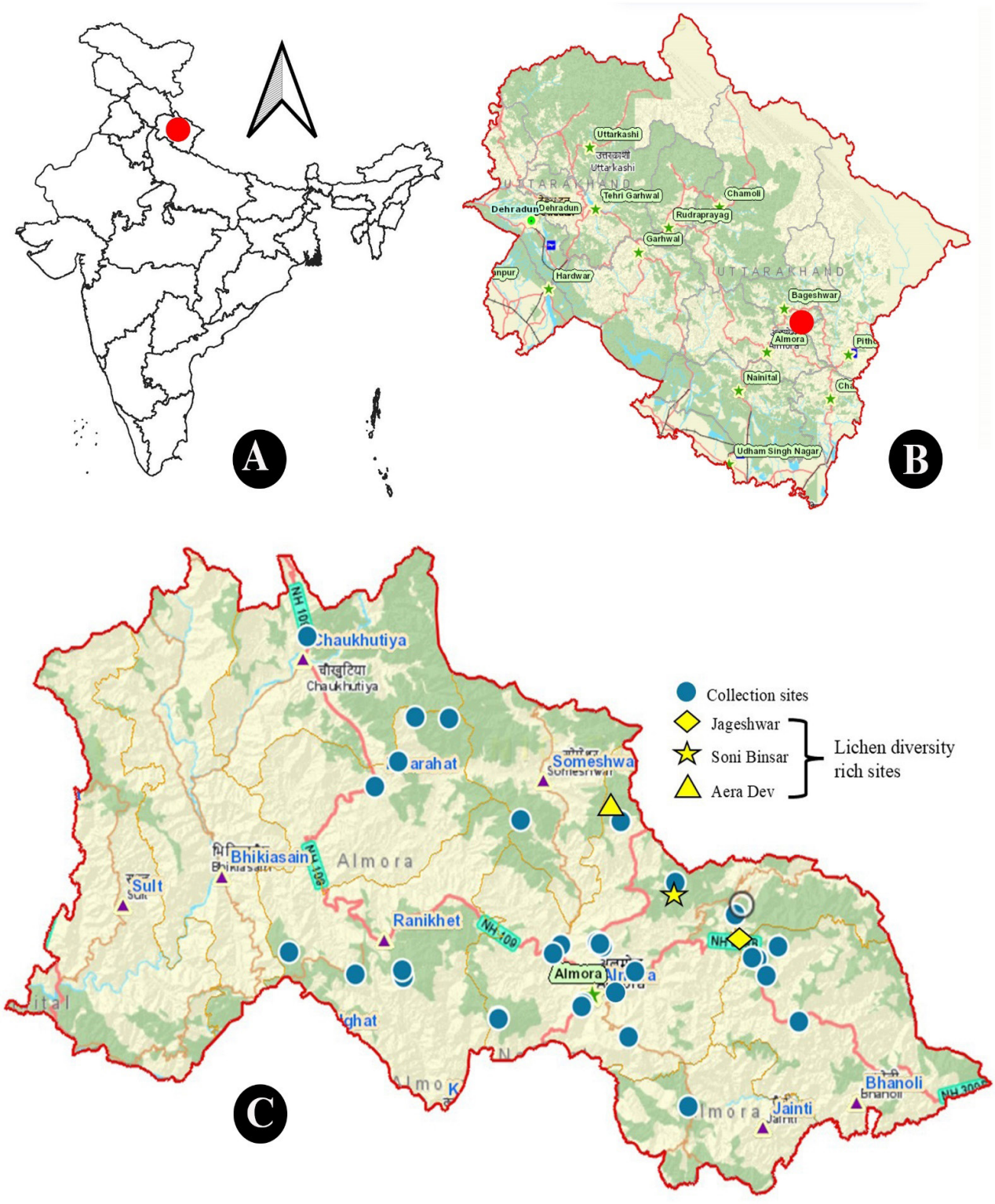

Fig. 1: Map showing collection sites. (A) India showing Uttarakhand, (B) Uttarakhand showing Almora district (C) Almora district showing study areas

Table 1: List of lichens from various localities of Almora district

S. No	Family	S. No	Lichen taxa	Locality	Growth form	Habitat	Elevation (in meter)	Reference
1	Arthoniaceae	1	*Arthonia antillarum* (Fée) Nyl.	Takula to Bageshwar	Cr	C	2700	Mishra & Upreti (2015)
2	Byssolomataceae	2	*Byssoloma subdiscordans* (Nyl.) P. James	Jageshwar	Cr	F,C,S	1828	Joshi & Tripathi (2013)
3	Caliciaceae	3	*Buellia almorensis* S.R. Singh & D.D. Awasthi	Takula	Cr	C	1600	Mishra & Upreti (2015)
		4	*B. maculata* Bungartz & Nash	Takula	Cr	C,S	1600	Mishra & Upreti (2015)
		5	*Dirinaria consimilis* (Stirt.) D.D. Awasthi	Jageshwar, Soni Binsar, Vriddha Jageshwar	Fo	C,S	1800	Joshi *et al*. (2018)
		6	*D. picta* (Sw.) Clem. & Shaer	Almora proper	Fo	C	1600	Mishra & Upreti (2015)
		7	*Pyxine berteriana* var. *berteriana* (Fée) Imshaug	Almora proper	Fo	C	1600	Mishra & Upreti (2015)
		8	*P. berteriana* var. *himalaica* D.D. Awasthi	Aera Dev, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha, On way to Kasardevi, Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C	1930	Mishra & Upreti (2015), Joshi *et al*. (2018)
		9	*P. berteroana* (Fée) Imshaug	Jageshwar	Fo	C	1800	Joshi *et al.* (2018)
		10	*P. cocoes* (Sw.) Nyl.	Jageshwar, Soni Binsar	Fo	C	1500-2400	Joshi *et al.* (2018)
		11	*P. sorediata* (Ach.) Mont.	Aera Dev, Banari Devi, Jhakhar Saim, Near Kasardevi, Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C	1800	Mishra & Upreti (2015), Joshi *et al*. (2018)
		12	*P. subcinerea* Stirt.	Jageshwar	Fo	C	1828	Joshi *et al.* (2018)
4	Candelariaceae	13	*Candelaria concolor* (Dicks.) Arnold	Chitai Golu devta	Fo	C,S	1650	Joshi *et al.* (2014a)
5	Chrysotrichaceae	14	*Chrysothrix candelaris* (L.) J.R. Laundon	Soni Binsar	Cr	C	1500-2400	Sonam *et al.* (2017)
		15	*C. chlorina* (Ach.) J.R. Laundon	Soni Binsar	Cr	C,S	1500-2400	Mishra & Upreti (2015)

6	Cladoniaceae	16	*Cladia aggregata* (Sw.) Nyl.	Shikhar forest	Dm	T	1700	Mishra & Upreti (2015)
		17	*Cladonia cartilaginea* Müll. Arg.	Tarikhet	Dm	T	1600	Mishra & Upreti (2015)
		18	*C. cervicornis* subsp. *verticillata* (Hoffm.) Ahti	Ranikhet to Chaubatia	Dm	T	1600	Mishra & Upreti (2015)
		19	*C. coniocraea* (Flörke) Spreng.	Aera Dev, Banari Devi, Chitai Golu Devta, Dol Ashram, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha,Soni Binsar, Syahi Devi, Vriddha Jageshwar	Dm	T	1800	Shashi (2017), Joshi *et al.* (2018)
		20	*C. corymbescens* Nyl.	Almora proper	Dm	C,T	1600	Mishra & Upreti (2015)
		21	*C. fimbriata* (L.) Fr.	Banari Devi	Dm	T	1900	Shashi (2017)
		22	*C. ramulosa* (With.) J.R. Laundon	Sitoli forest	Dm	T	1700	Mishra & Upreti (2015)
		23	*C. singhii* Ahti & Dixit	Soni Binsar	Dm	T	1500-2400	Mishra & Upreti (2015)
7	Collemataceae	24	*Collema leptaleum* var. *biliosum* (Mont.) Degel.	Almora proper	Fo	C	1500	Mishra & Upreti (2015)
		25	*C. pulcellum* var. *subnigrescens* (Müll. Arg.) Degel.	Syahi Devi, Vriddha Jageshwar	Fo	C,S	1500-2400	Joshi *et al.* (2018)
		26	*C. rugosum* Kremp.	Aretola, Jageshwar	Fo	C,T	1800	Khare (2012)
		27	*C. subconveniens* Nyl.	Kalp Vriksha, Soni Binsar	Fo	C,S	1500-2400	Joshi *et al.* (2018)
		28	*Leptogium askotense* D.D. Awasthi	Aera Dev, Soni Binsar	Fo	C,T,S	1700	Sonam *et al.* (2017), Joshi *et al.* (2018)
		29	*L. burnetiae* C.W. Dodge	Aera Dev, Banari Devi, Syahi Devi	Fo	C,T,S	1900	Joshi *et al.* (2018)
		30	*L. delavayi* Hue	Soni Binsar	Fo	C,M	1500-2400	Joshi *et al.* (2018)
		31	*L. moluccanum* (Pers.) Vain.	Almora proper	Fo	C,T	1650	Khare (2012)
		32	*L. papillosum* B. de Lesd Dodge	Soni Binsar	Fo	C	1500-2400	Sonam *et al.* (2017)
		33	*L. pedicellatum* P.M. Jørg.	Aera dev, Kalp Vriksha, Soni Binsar, Syahi Devi	Fo	C,M	1700	Sonam *et al.* (2017), Joshi *et al.* (2018)

		34	*L. pseudopapillosum* P.M. Jørg.	Dunagiri	Fo	C	1400	Shashi (2017)
		35	*L. saturninum* (Dicks.) Nyl.	On way to Kasardevi	Fo	C,S	1767	Shashi (2017)
		36	*L. trichophorum* Müll. Arg.	Dunagiri	Fo	C,T,M	1400	Shashi (2017)
		37	*Rostania coccophylla* (Nyl.) Otálora, P.M. Jørg. & Wedin	Soni Binsar	Fo	C	1500-2400	Shashi (2017)
8	Lecanoraceae	38	*Lecanora achroa* Nyl.	Soni Binsar	Cr	S	1500-2400	Sonam *et al.* (2017)
		39	*L. austrointumescens* Lumbsch and Elix	Ranikhet to Chaubatia	Cr	C	2100	Mishra & Upreti (2015)
		40	*L. caesiorubella* Ach.	Soni Binsar	Cr	S	1500-2400	Mishra & Upreti (2015)
		41	*L. chlarotera* Nyl.	Almora proper	Cr	S	1600	Mishra & Upreti (2015)
		42	*L. concilianda* Vain.	Chaubatia	Cr	C	1800	Mishra & Upreti (2015)
		43	*L. fimbriatula* Stirt.	Chaubatia	Cr	C	1800	Mishra & Upreti (2015)
		44	*L. helva* Stizenb.	Ranikhet to Chaubatia	Cr	C	2100	Mishra & Upreti (2015)
		45	*L. leprosa* Fée	Soni Binsar	Cr	C	1500-2400	Mishra & Upreti (2015)
		46	*L. luteomarginata* Nayaka, Upreti & Lumbsch	Jageshwar	Cr	S	1800, 1828	Joshi & Tripathi (2013), Joshi *et al.* (2014a)
		47	*L. polytropa* (Hoffm.) Rabenh.	Soni Binsar	Cr	C	1500-2400	Sonam *et al.* (2017)
		48	*L. pruinomarginata* R. Adhikari, Ngangom & Nayaka	Surmaney, Dhol forest	Cr	C	2100	Adhikari *et al.* (2023)
		49	*L. saligna* (Schrad.) Zahlbr.	Ranikhet to Chaubatia	Cr	C	2100	Mishra & Upreti (2015)
		50	*L. subimmersa* (Fée) Vain.	Aretola to Jageshwar	Cr	S	1800	Mishra & Upreti (2015)
		51	*L. uttarkashiensis* R. Adhikari, Ngangom & Nayaka	Surmaney, Dhol forest	Cr	C	2100	Adhikari *et al.* (2023)
9	Lecideaceae	52	*Porpidia albocoerulescens* (Wulf.) Hertel & Knoph	Aretola to Jageshwar, Jageshwar	Cr	S	1800, 1828	Joshi & Tripathi (2013), Mishra & Upreti (2015)

		53	*P. macrocarpa* (DC) Hertel & Knoph	Soni Binsar	Cr	S	1500-2400	Sonam *et al.* (2017)
10	Lobariaceae	54	*Lobaria isidiosa* (Müll. Arg.) Vain.	Jageshwar ridge	Fo	T,S,M	2000	Khare (2012)
		55	*L. kurokawae* Yoshim.	Aera Dev, Jhakar Saim, Soni Binsar	Fo	T,M	1700	Joshi *et al.* (2018)
		56	*L. pseudopulmonaria* Gyeln.	Jageshwar ridge	Fo	C,S	1700	Mishra & Upreti (2015)
		57	*L. retigera* (Bory) Trevis.	Aera Dev, Banari Devi, Jageshwar ridge, Soni Binsar, Vriddha Jageshwar	Fo	C,S,T	1700	Mishra & Upreti (2015), Sonam *et al.* (2017), Joshi *et al.* (2018)
		58	*Pseudocyphellaria crocata* (L.) Vain.	Jageshwar	Fo	C	1800	Joshi *et al.* (2018)
		59	*Sticta henryana* Müll. Arg.	Shikhar forest	Fo	C	1700	Mishra & Upreti (2015)
11	Megasporaceae	60	*Aspicilia caesiocinerea* (Nyl. ex Malbr.) Arnold	Almora proper	Cr	S	1676	Mishra & Upreti (2015)
		61	*A. dwaliensis* Räsänen	Almora proper	Cr	S	2700	Mishra & Upreti (2015)
12	Monoblastiaceae	62	*Anisomeridium polypori* (Ellis & Everh.) M.E. Barr	GBPNIHESD, Kosi-Katarmal	Cr	P	1300	Joshi *et al.* (2014d)
13	Nephromataceae	63	*Nephroma helveticum* Ach.	On way to Chaubatia	Fo	C,S	1500	Mishra & Upreti (2015)
14	Parmeliaceae	64	*Bulbothrix isidiza* (Nyl.) Hale	Aera dev, Jageshwar, Syahi Devi, Vriddha Jageshwar	Fo	C	1700	Joshi *et al.* (2018)
		65	*B. meizospora* (Nyl.) Hale	Chitai Golu Devta, Dwarson Golu Devta, Soni Binsar, Syahi Devi, Takula ridge, Vriddha Jageshwar	Fo	C,S	2300	Mishra & Upreti (2015), Sonam *et al.* (2017), Joshi *et al.* (2018)
		66	*B. setschwanensis* (Zahlbr.) Hale	Aera Dev, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha, Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C	1800-2400	Sonam *et al.* (2017), Joshi *et al.* (2018)
		67	*Canoparmelia aptata* (Kremp.) Elix & Hale	Almora proper, Jageshwar, Soni Binsar	Fo	C	1700	Mishra & Upreti (2015), Sonam *et al.* (2017), Joshi *et al.* (2018)

68	*C. ecaperata* (Müll. Arg.) Elix & Hale	Jageshwar ridge	Fo	C	2200	Mishra & Upreti (2015)
69	*C. pustulescens* (Kurok.) Elix	Soni Binsar	Fo	C	1500-2400	Sonam *et al.* (2017)
70	*C. texana* (Tuck) Elix & Hale	Aera Dev, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha, Ranikhet, Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C	1800	Mishra & Upreti (2015), Joshi *et al.* (2018)
71	*Cetrelia braunsiana* (Müll. Arg.) W.L. Culb. & C.L. Culb.	Jageshwar	Fo	C	1800	Joshi *et al.* (2018)
72	*C. cetrarioides* (Delise ex Duby) Culb & C. Culb	Soni Binsar	Fo	C	1500-2400	Sonam *et al.* (2017)
73	*Nephromopsis pallescens* (Schaer.) Park	Soni Binsar	Fo	C	1500-2400	Sonam *et al.* (2017)
74	*Crespoa crozalsiana* (B. de Lesd. ex Harm.) Lendemer & B.P. Hodk.	RAL-GBPNIHESD, Kosi-Katarmal	Fo	C	1300	Shashi (2017)
75	*Dolichousnea longissima* (Ach.) Articus	Jageshwar	Fr	C	1800	Mishra & Upreti (2015)
76	*Flavoparmelia caperata* (L.) Hale	Aera Dev, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha,Soni Binsar, Syahi Devi, Takula, below Dinapani, Vriddha Jageshwar	Fo	C	1676	Mishra & Upreti (2015), Joshi *et al.* (2018)
77	*Flavopunctelia borrerioides* Kurok.	Jageshwar, Banari Devi, Syahi Devi	Fo	C	1800	Joshi *et al.* (2018)
78	*F. flaventior* (Stirt.) Hale	Aera Dev, Banari Devi, Chitai Golu Devta, Jageshwar, Jhakhar Saim, Syahi Devi, Vriddha Jageshwa	Fo	C	1900	Joshi *et al.* (2018)
79	*F. soredica* (Nyl.) Hale	Dunagiri	Fo	C	1400	Shashi (2017)
80	*Hypotrachyna exsecta* (Taylor) Hale	Chitai Golu devta	Fo	C	1650	Joshi *et al.* (2018)

81	*H. cirrhata* (Fr.) Divakar, A. Crespo, Sipman, Elix & Lumbsch	Aera Dev, Banari Devi, Chitai Golu Devta, Dunagiri, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha,Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C	1828	Mishra & Upreti (2015), Joshi *et al.* (2018)
82	*H. horrescens* (Taylor) Krog & Swinscow	Jageshwar, Soni Binsar	Fo	C	1800	Joshi *et al.* (2018)
83	*H. nepalensis* (Taylor) Divakar, A. Crespo, Sipman, Elix & Lumbsch	Aera Dev, Banari Devi, Near Kasardevi, Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C	1800-2400	Mishra & Upreti (2015), Sonam *et al.* (2017), Joshi *et al.* (2018)
84	*H. osseoalba* (Vain.) Y.S. Park & Hale	Jageshwar	Fo	C	1828	Joshi *et al.* (2018)
85	*Myelochroa aurulenta* (Tuck.) Elix & Hale	Aera Dev, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha, Ranikhet to Chaubatia, Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C	2000	Mishra & Upreti (2015), Joshi *et al.* (2018)
86	*Parmelina tiliacea* (Hoffm.) Hale	Jageshwar, Soni Binsar	Fo	C,S	1800	Joshi *et al.* (2018)
87	*Parmelinella wallichiana* (Taylor) Elix & Hale	Jageshwar, Soni Binsar	Fo	C,S	1500-2400	Mishra & Upreti (2015), Joshi *et al.* (2018)
88	*Parmotrema andinum* (Müll. Arg.) Hale	Aera Dev	Fo	C	1650	Joshi *et al.* (2018)
89	*P. austrosinense* (Zahlbr.) Hale	Soni Binsar, Syahi Devi, Tarikhet	Fo	C,S	1600	Mishra & Upreti (2015), Sonam *et al.* (2017), Joshi *et al.* (2018)
90	*P. crinitum* (Ach.) M. Choisy	Aera Dev, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha, Soni Binsar, Syahi Devi forest, Vriddha Jageshwar	Fo	C	1819	Joshi *et al.* (2018), Tripathi & Joshi (2019)
91	*P. grayanum* (Hue) Hale	Soni Binsar	Fo	S	1500-2400	Mishra & Upreti (2015)

92	*P. hababianum* (Gyeln.) Hale	Almora proper, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim	Fo	C	1600	Mishra & Upreti (2015), Joshi *et al.* (2018)
93	*P. haitiense* (Hale) Hale	RAL-GBPNIHESD, Kosi-Katarmal	Fo	C	1250	Rai *et al.* (2019)
94	*P. melanothrix* (Mont.) Hale	Aera Dev, Chitai Golu Devta, Dwarson Golu Devta, Jhakhar Saim, Soni Binsar, Vriddha Jageshwar	Fo	C	1650-2400	Sonam *et al.* (2017), Joshi *et al.* (2018)
95	*P. mesotropum* (Müll. Arg.) Hale	Soni Binsar	Fo	C	1500-2400	Sonam *et al.* (2017)
96	*P. nilgherrense* (Nyl.) Hale	Jageshwar, Soni Binsar	Fo	C,S	1800	Mishra & Upreti (2015), Sonam *et al.* (2017),
97	*P. praesorediosum* (Nyl.) Hale	Aera Dev, Banari Devi, Chitai Golu Devta, Dwarahat, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha,Soni Binsar, Vriddha Jageshwar	Fo	C	1800	Mishra & Upreti (2015), Joshi *et al.* (2018)
98	*P. rampoddense* (Nyl.) Hale	Karbala pine forest	Fo	C	1800	Mishra & Upreti (2015)
99	*P. ravum* (Krog and Swinscow) Sérus.	Aera Dev, Dwarson Golu Devta	Fo	C,S	1650	Joshi *et al.* (2018)
100	*P. reticulatum* (Taylor) M. Choisy	Aera Dev, Almora proper, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha,Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C	1650	Mishra & Upreti (2015), Joshi *et al.* (2018)
101	*P. saccatilobum* (Taylor) Hale	Aera Dev, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Vriksha, Soni Binsar	Fo	C	1828	Joshi *et al.* (2018)
102	*P. sancti-angelii* (Lynge) Hale	Ranikhet to Chaubatia	Fo	C	1800	Mishra & Upreti (2015)

103	*P. subtinctorium* (Zahlbr.) Hale	Almora proper, Jageshwar	Fo	C	1650	Mishra & Upreti (2015), Joshi *et al.* (2018)
104	*P. subthomsonii* (D.D. Awasthi) A. Crespo, Divakar & Elix	Pandekholi	Fo	C,S	1400	Mishra & Upreti (2015)
105	*P. tinctorum* (Despr. ex Nyl.) Hale	Aera Dev, Almora proper, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha,Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C	1650	Mishra & Upreti (2015), Joshi *et al.* (2018)
106	*Punctelia borreri* (Sm.) Krog	Aera Dev, Almora proper Syahi Devi, Vriddha Jageshwar	Fo	C	1650	Mishra & Upreti (2015), Joshi *et al.* (2018)
107	*P. neutralis* (Hale) Krog	Banari Devi	Fo	C	1900	Shashi (2017)
108	*P. rudecta* (Ach.) Krog	Aera Dev, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha,Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C	1600	Mishra & Upreti (2015), Joshi *et al.* (2018)
109	*P. subrudecta* (Nyl.) Krog	Aera Dev, Banari Devi, Jageshwar, Ranikhet to Chaubatia, Soni Binsar, Vriddha Jageshwar	Fo	C	1800	Mishra & Upreti (2015), Joshi *et al.* (2018)
110	*Remototrachyna adducta* (Nyl.) Divakar & A. Crespo	Jageshwar	Fo	C	1828	Joshi *et al.* (2014b)
111	*R. infirma* (Kurok.) A. Crespo & Divakar	Jageshwar	Fo	C	1820	Joshi *et al.* (2014b)
112	*Usnea aciculifera* Vain.	Almora proper	Fr	C	1650	Mishra & Upreti (2015)
113	*U. angulata* Ach.	Ranikhet to Chaubatia	Fr	C	2040	Shukla *et al.* (2014)
114	*U. compressa* Taylor	Ranikhet to Chaubatia	Fr	C	2040	Mishra & Upreti (2015)
115	*U. eumitrioides* Mot.	Near Almora	Fr	C	3000	Mishra & Upreti (2015)
116	*U. fragilis* Stirt.	Jageshwar ridge	Fr	C	3000	Mishra & Upreti (2015)
117	*U. himalayana* C. Bab.	Dhaula Devi	Fr	C	1750	Shashi (2017)

		118	*U. nepalensis* G. Awasthi	Jageshwar	Fr	C	1800	Joshi *et al.* (2018)
		119	*U. orientalis* Mot.	Almora proper, Soni Binsar	Fr	C	1650	Mishra & Upreti (2015), Sonam *et al.* (2017)
		120	*U. rubicunda* Stirt.	Aretola to Jageshwar	Fr	C	1800	Mishra & Upreti (2015)
		121	*U. splendens* Stirt.	Aera Dev, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha, Ranikhet to Chaubatia, Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fr	C	2040	Mishra & Upreti (2015), Joshi *et al.* (2018)
		122	*U. subfloridana* Stirt.	Jageshwar	Fr	C	3000	Mishra & Upreti (2015)
		123	*U. undulata* Stirt.	Almora proper	Fr	C	1600	Mishra & Upreti (2015)
		124	*Xanthoparmelia mexicana* (Gyeln.) Hale	Aera Dev	Fo	S	1500-2400	Joshi *et al.* (2018)
		125	*X. australasica* D.J. Galloway	Thapalia village	Fo	S	3100	Mishra & Upreti (2015)
		126	*X. conspersa* (Ach.) Hale	Almora proper	Fo	S	1600	Mishra & Upreti (2015)
		127	*X. pseudocongensis* Hale	Soni Binsar	Fo	-	-	Gahtori *et al.* (2022)
		128	*X. saxeti* (Stizenb.) G. Amo, A. Crespo, Elix & Lumbsch	Sun Temple, Kosi Katarmal, Jhakar Saim	Fo	S	2116	Joshi *et al.* (2014c), Joshi *et al.* (2018)
15	Peltigeraceae	129	*Peltigera collina* (Ach.) Schrad.	Jageshwar	Fo	T	1800	Joshi *et al.* (2018)
		130	*P. dolichorrhiza* (Nyl.) Nyl.	Ranikhet	Fo	T	1780	Mishra & Upreti (2015)
		131	*P. membranacea* (Ach.) Nyl.	Ranikhet to Chaubatia	Fo	T	2300	Mishra & Upreti (2015)
		132	*P. polydactylon* (Neck.) Hoffm.	Ranikhet to Chaubatia	Fo	T	1800	Mishra & Upreti (2015)
		133	*P. praetextata* (Flörke) Zopf	Gwaldam, Ranikhet	Fo	T	1950	Mishra & Upreti (2015)
		134	*P. rufescen*s (Weiss) Humb.	Ranikhet to Chaubatia	Fo	T,S	1800	Mishra & Upreti (2015)

16	Pertusariaceae	135	*Lepra albescens* (Huds.) Hafellner	Soni Binsar	Cr	C	1500-2400	Mishra & Upreti (2015)
		136	*L. leucosora* (Nyl.) Hafellner	Soni Binsar	Cr	S	1500-2400	Mishra & Upreti (2015)
		137	*L. leucosorodes* (Nyl.) I. Schmitt, B.G. Hodk. & Lumbsch	Chaubatia	Cr	C	1800	Mishra & Upreti (2015)
		138	*Pertusaria himalayensis* D.D. Awasthi & P. Srivast.	Almora proper	Cr	C	1600	Mishra & Upreti (2015)
		139	*P. indica* P. Srivast. & D.D. Awasthi	Karbala pine forest	Cr	S	1600	Mishra & Upreti (2015)
		140	*P. pertusa* (L.) Tuck.	Forest guest house	Cr	C	1828	Mishra & Upreti (2015)
		141	*P. quassiae* (Fée) Nyl.	Soni Binsar	Cr	C	1500-2400	Mishra & Upreti (2015)
		142	*P. variolosa* (Kremp.) Vain.	Ranikhet to Chaubatia	Cr	C	1800	Mishra & Upreti (2015)
17	Phlyctidaceae	143	*Phlyctis himalayen*sis (Nyl.) D.D. Awasthi	Ranikhet to Chaubatia	Cr	C	1800	Mishra & Upreti (2015)
18	Physciaceae	144	*Anaptychia pseudoroemeri* D.D. Awasthi & S.R. Singh	Jhakar Saim	Fo	C,S	2000	Joshi *et al.* (2018)
		145	*Heterodermia albidiflava* (Kurok.) D.D. Awasthi	Soni Binsar	Fo	C	1500-2400	Shashi (2017)
		146	*H. comosa* (Eschw.) Follmann & Redón	Aera Dev, Jageshwar	Fo	C,S	1676	Mishra & Upreti (2015), Joshi *et al.* (2018)
		147	*H. diademata* (Taylar) D.D. Awasthi	Aera Dev, Almora proper Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha,Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C,S	1650	Mishra & Upreti (2015), Joshi *et al.* (2018)
		148	*H. dissecta* (Kurok.) D.D. Awasthi	Nagpani to Ranikhet	Fo	C,S	1590	Mishra & Upreti (2015)
		149	*H. firmula* (Nyl.) Trevis.	Banari Devi, Jageshwar, Ranikhet to Chaubatia, Soni Binsar, Vriddha Jageshwar	Fo	C,S	2186	Mishra & Upreti (2015), Sonam *et al.* (2017), Joshi *et al.* 2018

150	*H. flabellata* (Fée) D.D. Awasthi	Syahi Devi forest	Fo	C	1819	Tripathi & Joshi (2019)
151	*H. himalayensis* (D.D. Awasthi) D.D. Awasthi	Shitlakhet Shai Devi temple	Fo	C,S	1800-2000	Mishra & Upreti (2015)
152	*H. hypochraea* (Vain.) Swinscow & Krog	Banari devi, Syahi Devi	Fo	C	1900	Joshi *et al.* (2018)
153	*H. incana* (Stirt.) D. D. Awasthi	Aera Dev, Jageshwar, Ranikhet to Chaubatia, Syahi Devi, Vriddha Jageshwar	Fo	C,S	2100	Mishra & Upreti (2015), Joshi *et al.* (2018)
154	*H. isidiophora* (Nyl.) D.D. Awasthi	Almora proper	Fo	C	1650	Mishra & Upreti (2015)
155	*H. obscurata* (Nyl.) Trevis.	Jageshwar, Soni Binsar	Fo	C	1828	Joshi *et al.* (2018)
156	*H. podocarpa* (Bél.) D.D. Awasthi	Aera Dev, Chitai Golu Devta, Dwarson Golu Devta, Jhakhar Saim, Vriddha Jageshwar	Fo	C	2000	Joshi *et al.* (2018)
157	*H. pseudospeciosa* (Kurok.) W.L. Culb.	Jageshwar	Fo	C	1828	Joshi *et al.* (2018)
158	*H. punctifera* (Kurok.) D.D. Awasthi	Ranikhet to Chaubatia	Fo	C	2100	Mishra & Upreti (2015)
159	*H. rubescens* (Räsänen) D.D. Awasthi	Almora proper, Vriddha Jageshwar	Fo	C,S	1650	Mishra & Upreti (2015), Joshi *et al.* (2018)
160	*H. speciosa* (Wulf.) Trevis.	Aera Dev, Almora proper, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha,Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C,T	1700	Mishra & Upreti (2015), Joshi *et al.* (2018)
161	*Hyperphyscia adglutinata* (Flörke) H. Mayrhofer & Poelt	Aera Dev, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha,Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C	1828	Joshi *et al.* (2018)
162	*H. adglutinata* var. *pyrithrocardia* (Müll. Arg.) D.D. Awasthi	Soni Binsar	Fo	C	1500-2400	Gahtori *et al.* (2022)

163	*Leucodermia boryi* (Fée) Kalb	Banari Devi, Jageshwar, Syahi Devi	Fo	C	1800	Joshi *et al.* (2018)
164	*L. leucomelos* (L.) Kalb	Soni Binsar	Fo	C,T	1500-2400	Mishra & Upreti (2015)
165	*Phaeophyscia constipata* (Norrl. & Nyl.) Moberg	Takula	Fo	T,S	3000	Mishra & Upreti (2015)
166	*P. endococcina* (Körb.) Moberg	Banari devi, Jhakar Saim, Syahi Devi	Fo	C,S	1900	Shashi (2017), Joshi *et al.* (2018)
167	*P. exornatula* (Zahlbr.) Kashiw.	Jageshwar	Fo	C	1828	Joshi *et al.* (2016)
168	*P. hispidula* (Ach.) Moberg	Aera Dev, Almora proper, Banari Devi, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha, Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fo	C	1650	Mishra & Upreti (2015), Joshi *et al.* (2018)
169	*P. orbicularis* (Neck.) Moberg	Jageshwar	Fo	C	1800	Joshi *et al.* (2018)
170	*P. primaria* (Poelt) Trass	Almora proper	Fo	C	1650	Mishra & Upreti (2015)
171	*P. pyrrhophora* (Poelt) D.D. Awasthi & M. Joshi	Jageshwar, Jhakar Saim	Fo	C	2000	Mishra & Upreti (2015), Joshi *et al.* (2018)
172	*Physcia aipolia* (Ehrh. ex Humb.) Fürnr.	Chaubatia	Fo	C	1800	Mishra & Upreti (2015)
173	*P. dilatata* Nyl.	Almora proper, Banari Devi, Jageshwar, Kalp Vriksha	Fo	C	1600	Mishra & Upreti (2015), Joshi *et al.* (2018)
174	*P. tribacoides* Nyl.	Almora proper	Fo	C	1600	Mishra & Upreti (2015)
175	*Physconia enteroxantha* (Nyl.) Poelt	Almora proper	Fo	C,T	1650	Mishra & Upreti (2015)
176	*Polyblastidium hypocaesium* (Yasuda ex Räsänen) Kalb	Banari Devi, Ranikhet to Chaubatia	Fo	C,S	2100	Mishra & Upreti (2015), Joshi *et al.* (2018)
177	*P. japonicum* (M. Satô) Kalb	Jageshwar, Jhakhar Saim, Ranikhet to Chaubatia, Syahi Devi	Fo	C,S	2100	Mishra & Upreti (2015), Joshi *et al.* (2018)
178	*Rinodina obnascens* (Nyl.) H. Olivier	Not known	Cr	S	2611	Kumar *et al.* (2021)

19	Pyrenulaceae	179	*Pyrenula complanata* (Mont.) Trevis.	Near Maupani to Digtarh	Fo	C	3000	Mishra & Upreti (2015)
20	Ramalinaceae	180	*Bacidia connexula* (Nyl.) Zahlbr.	Soni Binsar	Cr	C	1500-2400	Mishra & Upreti (2015)
		181	*Mycobilimbia philippina* (Vain.) D.D. Awasthi	Jageshwar	Cr	S	1828	Joshi & Tripathi (2013)
		182	*Phyllopsora corallina* (Eschw.) Müll. Arg.	Jageshwar	Sq	C	1828	Joshi *et al.* (2018)
		183	*Ramalina conduplicans* Vain.	Aera Dev, Banari Devi, Bhatkot forest near Dunagiri, Chitai Golu Devta, Dwarson Golu Devta, Jageshwar, Jhakhar Saim, Kalp Vriksha,Soni Binsar, Syahi Devi, Vriddha Jageshwar	Fr	C	1800	Mishra & Upreti (2015), Joshi *et al.* (2018)
		184	*R. hossei* Vain.	Jageshwar, Soni Binsar	Fr	C	1828	Joshi *et al.* (2014) Sonam *et al.* (2017),
		185	*R. sinensis* Jatta	Bhatkot forest near Dunagiri, Soni Binsar	Fr	C	1500	Mishra & Upreti (2015), Sonam *et al.* (2017),
21	Stereocaulaceae	186	*Lepraria lobificans* Nyl.	Near Artola	Cr	T	1700	Bajpai *et al.* (2018)
		187	*Stereocaulon myriocarpum* Th. Fr.	Almora proper	Fr	T,S	1600	Mishra & Upreti (2015)
22	Teloschistaceae	188	*Caloplaca irrubescens* (Arnold) Zahlbr.	Thapalia village	Cr	S	1500	Mishra *et al.* (2020)
		189	*C. subdolosa* (Nyl.) Zahlbr.	Takula	Cr	S	1950	Mishra & Upreti (2015)
		190	*Gyalolechia flavovirescens* (Wulfen) Søchting, Frödén & Arup	Jageshwar	Cr	S	1828	Joshi & Tripathi (2013)
		191	*Neobrownliella cinnabarina* (Ach.) S.Y. Kondr., Upreti & A. Thell	Almora proper	Cr	S	1600	Mishra & Upreti (2015)
		192	*N. holochracea* (Nyl.) S. Y. Kondr., Upreti & A. Thell	Kasardevi	Cr	S	1800	Mishra *et al.* (2020)
		193	*Squamulea squamosa* (B. de Lesd.) Arup, Søchting & Frödén	Thapalia village	Cr	C,S	1900	Mishra & Upreti (2015)
		194	*S. subsoluta* (Nyl.) Arup, Søchting & Frödén	Jageshwar	Cr	S	1828	Joshi & Tripathi (2013)

23	Tephromelataceae	195	*Tephromela khatiensis* (Räsänen) Lumbsch	Jageshwar, Kasardevi	Cr	S	3000, 1828	Joshi & Tripathi (2013), Mishra & Upreti (2015)
24	Trapeliaceae	196	*Trapelia coarctata* (Turner) M. Choisy	Soni Binsar	Cr	S	1500-2400	Sonam *et al.* (2017)
25	Umbilicariaceae	197	*Umbilicaria virginis* Schaerer	Soni Binsar	Fo	S	1500-2400	Sonam *et al.* (2017)
26	Verrucariaceae	198	*Dermatocarpon vellereum* Zschacke	Aera Dev, Almora proper, Soni Binsar	Fo	S	1600	Mishra & Upreti (2015), Sonam *et al.* (2017), Joshi *et al.* (2018)
		199	*Endocarpon rosettum* A. Singh & Upreti	Thapalia village	Sq	S	1500	Mishra & Upreti (2015)

Abbreviations: Growth forms: Cr = Crustose, Dm= Dimorphic, Fo= Foliose, Fr= Fruticose, Sq= Squamulose. Habitat: C= Corticolous, F= Foliicolous, M= Muscicolous, P= on Plastic, S= Saxicolous, T= Terricolous.

the luxuriant growth of lichens represented by 72, 69 and 38 species, respectively. The study area showed a dominance of foliose lichens with 125 species, followed by crustose (47 species), fruticose (17 species), dimorphic (08 species) and squamulose forms (02 species) (Fig 2). The Parmeliaceae is the dominant family in the study area represented by 65 species belonging to 16 genera, followed by Physciaceae with 35 species and 8 genera. The other important families in the Almora district are Collemataceae, with 14 species and three genera, and Lecanoraceae with 14 species and one genus (Fig. 3). The lichen genus *Parmotrema* exhibits its dominance as represented by 18 species, followed by *Heterodermia* with 16 species. *Bulbothrix setschwanensis, Heterodermia diademata*, *Hypotrachyna cirrhata, Parmotrema reticulatum, Phaeophyscia hispidula* and *Physcia dilatata* are the most common and widely distributed species found growing on various substrates, both in tropical and temperate areas of the district.

The Almora district has a rich diversity of phorophytes, which are preferred by the bark-inhabiting (Corticolous) lichens exhibiting their dominance with 149 species which is followed by 65 saxicolous and 28 terricolous, 05 muscicolous and 01 foliaceous lichen, species. In the district, coniferous (*Cedrus deodara, Pinus* sp.) and oak (*Quercus* sp.) trees grow luxuriantly at elevations between 1500 to 2000 m, either in mixed or isolated forest patches and harbor luxuriant growth of lichens. The district is under constant pressure from visitors because it is one of the most popular tourist destinations in northern India. The district is also conveniently located for plant exploration field trips. The Ranikhet has lost its maximum biodiversity as the result of the high volume of tourists, the rapid rate of urbanization, and the regular botanical excursions by students from various institutions. The majority of plant groups, including lichens, are now only found in small areas of forests. Due to the change in microclimate and loss of habitat, the plants available in luxuriance in the past are now vanished.

The present study also revealed that the localities situated in and around Dwarahat, Dunagiri, Takula and other populated areas have poor to scarce growth of lichens due to heavy anthropogenic activities. However, in these areas, the lichens colonize cultivated trees such as *Grewia, Populus, Prunus, Pyrus* and *Rubina.* The present enumeration of lichens from the Almora district will act as a baseline record for future biomonitoring studies in the area.

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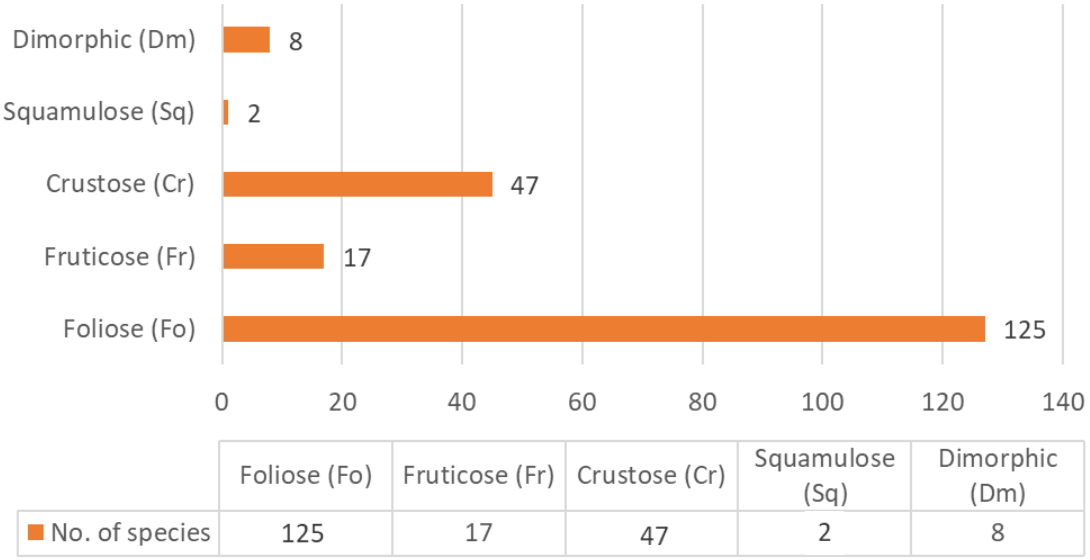

Fig. 2: Graph shows different growth forms of the lichens in the Almora district

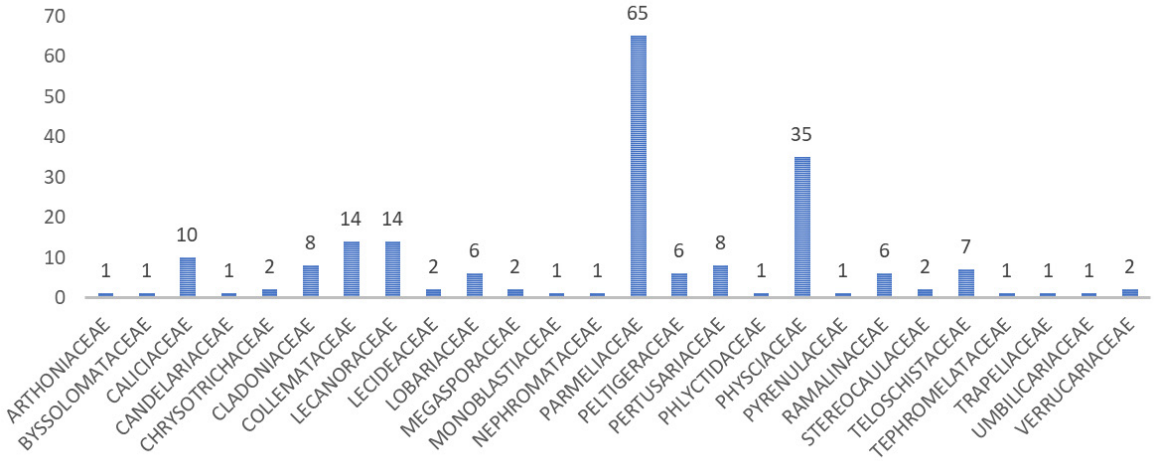

Fig. 3: Graph shows species diversity under the different families in the Almora district

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