

Diversity, distribution and medicinal importance of lichens in Gwaldam area, Chamoli District, Uttarakhand, India

Shobha Rawat

Department of Botany, Kumaun University, Soban Singh Jeena Campus,
Almora-263601, India

E-mail: shobharawat1981@gmail.com

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ABSTRACT

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The present study was conducted, for the first time, in temperate Himalayan forests of Gwaldam area in Chamoli district, Garhwal Himalaya, Uttarakhand to understand the effect of altitudinal variation on structure and composition of the vegetation and to record the floristic diversity and medicinal importance of the lichens in the study area. Three altitudinal zones, viz. upper zone (1900-2000 m asl.), middle zone (1700-1800 m asl.) and lower zone (1500-1600 m asl.) were recognized. Upper zone has 17 species of lichens whereas middle and lower zones have 19 species each. Altogether, 34 lichen species belonging to 20 genera and 11 families were recorded from the area. Of these, 12 lichen species are of medicinal importance. Lichen families Parmeliaceae and Physciaceae dominate the area followed by Cladoniaceae. In the Gwaldam forest, parmelioid and physcioid lichens exhibit their luxuriant growth on coniferous and oak trees together with *Alnus* and *Betula utilis* trees. Gwaldam area is hub of ITPB's SSB training and Guerrilla training. Their training activity directly disturbs the forest resulting in poor number of lichens in the forest.

Key-words: Lichens, diversity, distribution, medicinal importance, Gwaldam area, Chamoli District, Uttarakhand, Garhwal Himalaya, India.

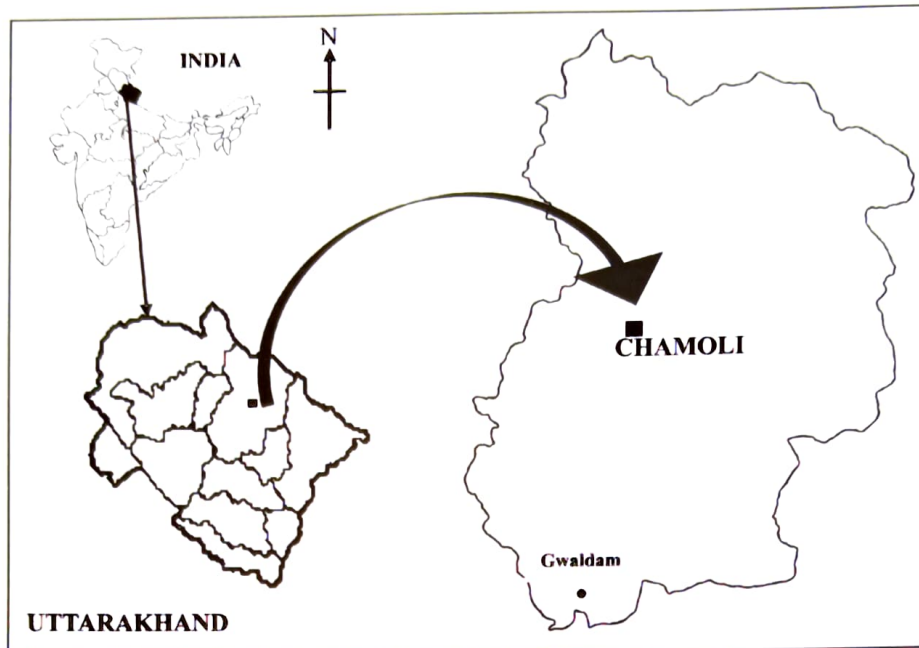
INTRODUCTION

Lichens have been identified in Garhwal Himalaya by Upreti and Negi (1995) and Rawat et al. (2009, 2010, 2011, 2013a, b, c, 2014). The present study deals with biodiversity, distribution and medicinal importance of lichens, for the first time, from Gwaldam area (Lat. 30.02°N, Long. 79.57°E) in Chamoli district, Uttarakhand (Text-figure 1) at an average elevation of 1500-2000 m and covering an area of 1.2526 km². Meteorological data were collected from Gwaldam by Rawat and Chandra (2012). Gwaldam area has forest of coniferous and oak trees together with *Alnus* and *Betula utilis* trees. *Pinus roxburghii*, *Betula utilis*, *Alnus* sp., *Quercus floribunda*, *Quercus*

semecarpifolia, *Quercus leucotrichophora*, *Cedrus deodara*, *Pinus roxburghii* and *Rhododendron arboretum* are dominant trees.

MATERIAL AND METHODS

In June 2015, more than 350 lichen specimens were collected from different available substrates of Gwaldam area. The specimens were identified in respect of their morphology, anatomy and chemistry. The chemistry of all the specimens was performed by colour spot tests (K, C, Pd) followed by thin layer chromatographic (TLC) methods as described by Walker and James (1980). The chromatograms were developed in solvent A (Toluene: 1-4 dioxane: acetic



Text-figure 1. Map showing location of Gwaldam in Uttarakhand, from where lichens were collected.

acid 180: 60: 8 ml). The collected specimens were identified with the help of recent publications (Awasthi 1988, 1991, 1998, 2000, 2007, Singh & Sinha 2010, Divakar & Upreti 2005, Nayaka 2004, Joshi 2008). The specimens are deposited in the Herbarium of CSIR-National Botanical Research Institute, Lucknow (LWG).

RESULT

Altogether, 34 lichen species belonging 20 genera and 11 families are enumerated from Gwaldam (Table 1). Maximum number of lichen species (29 species) grow on bark (corticolous) followed by saxicolous (7 species) and terricolous (1 species). Foliose lichens dominate in all the three zones. The lichen families Parmeliaceae (with 7 genera and 12 species) and Physciaceae (with 3 genera and 6 species) dominate the area followed by Cladoniaceae (with 1 genus and 5 species) and Lecanoraceae (with 1 genus and 3 species). In Gwaldam forest, parmelioid and physcioid lichens exhibit their maximum growth on coniferous and oak trees together with *Alnus* and *Betula utilis* trees. Of the total 34 lichen species, 12 species have medicinal properties. *Parmotrema tinctorium* (Nyl.) Hale has anticancer/cytotoxicity, antioxidant/tyrosinase

inhibition, immunomodulating medicinal properties and this species is present in all the zones. The lichens were collected from three altitudinal zones. Upper altitudinal zone (1900-2000 m asl., Gwaldam) has 17 species, middle zone (1700-1800 m asl., Bhaguna) has 19 species and lower zone (1500-1600 m asl., Nag) also has 19 species. The poor representation of lichen in Gwaldam forest is due to its strategic importance. An ITBP base camp and SSB training centre, which was meant for some secret military operation and SSB imparted Guerrilla warfare training, is located here. All training grounds, sports fields, stadium, helipads and other infra-structure facilities are in this forest. Therefore, their training activity directly disturbs the forest resulting in poor number of lichens. Other bioedaphic factors are also responsible for negative effect on lichen diversity. Although there is sufficient moisture needed for lichen growth, fragments and pieces of lichens were recorded instead of healthy patches. Forest composition, species richness, diversity pattern and spatial or temporal distribution are important ecological attributes significantly correlated with prevailing environmental as well as anthropogenic variables (Rawat 2012, Ahmad et al. 2011). There are a large number of environmental factors which influence

Table 1: List of lichen taxa from Gwaldam area, Chamoli district, Uttarakhand

	Lichen species	Habitat	Habit	Gwaldam	Nag	Bhaguna	Medicinally important
1	Cladoniaceae						
1	<i>Cladonia awasthiana</i> Ahti & Upreti	T	fr	-	-	+	
2	<i>Cladonia coniocrea</i> (Flörke) Spreng.	C	fr	-	-	-	-
3	<i>Cladonia fruticulosa</i> Kremp.	T, C	fr	+	+	-	-
4	<i>Cladonia scabricula</i> (Delise) Nyl.	C	fr	-	-	+	1
5	<i>Cladonia subradiata</i> (Vain) Sandst	C	fr	+	-	-	3
2	Collemaataceae						
6	<i>Leptogium askotense</i> D. D. Awasthi	C	fo	+	+	+	-
3	Imperfect lichenied Fungi						
7	<i>Leprocaulon arbuscula</i> (Nyl.) Nyl.	C	cr	-	-	+	-
4	Lecanoraceae						
8	<i>Lecanora</i> 1	C	cr	-	+	-	-
9	<i>Lecanora</i> 2	C	cr	+	+	-	-
10	<i>Haematomma puniceum</i> (Sw.) A. Massal	C	cr	-	-	+	-
5	Lobariaceae						
11	<i>Lobaria isidiosa</i> (Müll. Arg.) Vain	C	fo	-	-	+	-
12	<i>Lobaria retigera</i> (Bory) Trevisan	C	fo	-	-	+	1
6	Megasporaceae						
13	<i>Aspicilia dwaliensis</i> Räsänen	S	cr	-	-	-	-
7	Parmeliaceae						
14	<i>Bulbothrix bulbochaeta</i> (Hale) Hale	C	fo	-	+	+	-
15	<i>Canoparmelia texana</i> (Tuck.) Elix & Hale	C	fo	+	-	-	-
16	<i>Canoparmelia ecaperata</i> (Mull Arg.)& Hale	C	fo	+	+	-	2
17	<i>Everniastrum cirrhatum</i> (Fr.) Hale ex Sipaman	C	fo	+	+	+	1, 2
18	<i>Everniastrum nepalense</i> (Taylor) Hale ex Sipaman	C	fo	-	+	-	1, 3
19	<i>Flavoparmelia caperata</i> (L.) Hale	S, C	fo	-	-	-	1, 2
20	<i>Hypotrachyna crenata</i> (Kurok.) Hale	S	fo	-	+	+	-
21	<i>Hypotrachyna pluriformis</i> (Nyl.) Hale	S	fo	-	-	+	-
22	<i>Parmelinella wallichiana</i> (Taylor) Elix & Hale	S	fo	+	-	+	2, 3
23	<i>Parmotrema austrosinense</i> (Zahlbr.) Hale	C	fo	-	-	+	-
24	<i>Parmotrema reticulata</i> (Taylor) Choisy	T, C, S	fo	+	+	+	1, 2
25	<i>Parmotrema tinctorium</i> (Nyl.) Hale	C, S	fo	+	+	+	3, 4, 5
8	Pertusariaceae						
26	<i>Pertusaria leucosoroa</i> Nyl.	C	cr	+	-	-	-
9	Physciaceae						
27	<i>Heterodermia diademata</i> (Taylor) D. D. Awasthi	C	fo	-	+	+	1
28	<i>Heterodermia incana</i> (Stirton) D. Awasthi	C	fo	+	-	-	-
29	<i>Heterodermia japonica</i> (Satô) Swinsc. & Krog	C	fo	+	-	-	-
30	<i>Heterodermia speciosa</i> (Wulfen) Trevisan	C	fo	+	+	-	-
31	<i>Phaeophyscia hispidula</i> (Ach.) Essl.	C	fo	-	+	-	-
32	<i>Physcia dilatata</i> Nyl.	C	fo	-	-	+	-
10	Pyrenulaceae						
33	<i>Pyrenula complanata</i> (Mont.) Trevis	C	cr	+	-	-	-
11	Ramalinaceae						
34	<i>Ramalina conduplicans</i> Vainio	C	fr	-	-	+	2
	Total species/ total medicinal lichen species			19	17	19	12

C = Corticolous, S = Saxicolous, T = Terricolous; fr = Fruticose, cr = Crustose, fo = Foliose; 1 = Traditional medicine, 2 = Antimicrobial activity, 3 = Anticancer/Cytotoxicity, 4 = Antioxidant/Tyrosinase inhibition, 5 = Immunomodulating.

the species richness and composition, such as elevation and habitat (Chandra et al. 2010). Slobodkin and Sanders (1969) opined that floristic diversity of any community is a function of severity, variability and predictability of the environment in which it develops. The study will be baseline information for future biomonitoring studies in the area.

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REFERENCES

- Ahmad I, Ahmad M. S. A., Hussain M. & Ashraf M. Y. 2011. Spatiotemporal variations in soil characteristics and nutrient availability in open scrub type semi-arid rangelands of typical sub-mountainous Himalayan tract. *Pakistan J. Bot.* 43(1): 565-571.
- Awasthi D. D. 1988. A key to macrolichen of India and Nepal. *J. Hattori. Bot. Lab.* 65: 207-302.
- Awasthi D. D. 1991. A key to the microlichens of India, Nepal and Sri Lanka. *Biblioth. Lichenol.* 40: 1-337 Addendum. *J. Crammer Berlin Stuttgart.*
- Awasthi, D. D. 1998. A key to the macrolichens of India and Nepal. *J. Hattori Bot. Lab.* 65: 207-303.
- Awasthi, D. D. 2000. Lichenology in Indian subcontinent. Bishen Singh Mahendra Pal. Dehradun. India.
- Awasthi D. D. 2007. A compendium of the macrolichen from India, Nepal and Sri Lanka. Bishen Singh Mahendra Singh, Dehradun.
- Chandra J., Rawat V. S., Rawat Y. S. & Ram J. 2010. Vegetational diversity along an altitudinal range in Garhwal Himalaya, *Int. J. Biodiversity Conservation* 2(1): 14-18.
- Divakar P. K. & Upreti D. K. 2005. Parmelioid lichens in India. (A revisionary study). Bishen Singh Mahendra Pal Singh, Dehradun.
- Joshi Y., Sati S. C. Upreti D. K., 2008. Morphotaxonomic studies on lichen family Teloschistaceae from India, Kumaun University, Nainital.
- Nayaka S. 2004. Revisionary studies on lichen genus *Lecanora* sensu lato in India. Ph.D Thesis, Dr. Ram Manohar Lohia Avadh University Faizabad, U.P., India.
- Rawat S., Singh R. P. & Upreti, D. K. 2013a. Lichen diversity of Durmi Forest in Chamoli District, Uttarakhand. *J. Econ. Taxon. Bot.* 37(2): 223.
- Rawat S., Singh R. P. & Upreti, D. K. 2013b. Lichen flora of Niti Area from Garhwal Himalaya, Uttarakhand. *J. Nature & Sci.* 9: 103-105.
- Rawat S., Upreti D. K. & Divakar P. K. 2011. *Xanthoparmelia xizangensis* (J. C. Wei) Hale, a new record of lichen from India. *Geophytology* 41(1-2): 101-103.
- Rawat S., Upreti D. K. & Singh R. P. 2009. Lichen flora of Mandal and adjoining localities towards Ukhimath in Chamoli district of Uttarakhand. *J. Phytol. Res.* 22(1): 47-52.
- Rawat S., Upreti D. K. & Singh R. P. 2010. Lichen diversity in Valley of Flowers National Park Western Himalaya, Uttarakhand, India. *Phytotaxonomy* 10: 112-117.
- Rawat S., Upreti D. K. & Singh R. P. 2011. Lichen diversity in Jumma and Malari areas of Chamoli district, Uttarakhand. *Biotic Potential and Abiotic Stress*, pp.142-152.
- Rawat S., Upreti D. K. & Singh R. P. 2013c. Lichen diversity, distribution and its Medicinal properties in Joshimath-Jogidhara-Lata Ghursu forest, Garhwal Himalaya, Uttarakhand, India. *J. Econ. Taxon. Bot.* 37(4): 647-653.
- Rawat S., Upreti D. K. & Singh R. P. 2014. Five new lichens records from India. *Geophytology* 44(1): 77-80.
- Rawat V. S. & Chandra J. 2012. Tree layer vegetational analysis in temperate forest of Uttarakhand. *Nature & Science* 10(10): 167-171.
- Singh K. P. & Sinha G. P. 2010. Indian Lichens. An annotated checklist. Botanical Survey of India. Kolkata.
- Slobodkin, L. B. & Sanders, H. L. 1969. On the contribution of environmental predictability to species diversity, *Brookhaven Symposia in Biology*, vol. 22, pp. 82-93.
- Upreti D. K. & Negi H. R. 1995. Lichens of Nanda Devi Biosphere Reserve, Uttar Pradesh, India. *J. Econ. Taxon. Bot.* 3:627-635.
- Walker F. J. & James P. W. 1980. A revised guide to microchemical technique for the identification of lichen products. *Brit. Lichen Soc. Bull.* 46 (supplement): 13-29.