EVALUATION OF LICHEN DIVERSITY AT UTTARKASHI DISTRICT

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ABSTRACT:

A collection of 35 lichen species belonging to 24 genera and 19 families from district Uttarkashi was carried out during 2015-16. The collection was identified and presented.

INTRODUCTION

Lichens are interesting living entities as they have been described as "dual organisms" because they show symbiotic association between fungus (termed the mycobiont) and a green alga or a cyanobacterium (termed the nhvcobiont). Lichens have great economic value since time immemorial and are utilized for various purposes: Being rich in proteins, carbohydrates, fatty acids and phospholipids, lichens are considered to have good nutritive value and are used as food and fodder. *Parmelia cirrhata* Fr. is eaten as vegetable after boiling and frying in Sikkim (Saklani and Upreti, 1992). In South India, *Parmotrema abessinicum* (Kremp.)Hale is used to make curry powder. *Evemia furfuracea* (L.) Mann, (tree-moss), *E. mesomorpha* Nyl. and *E. prunastri* (L.) Ach. are used in perfumes, soaps, flavours and cosmetics (Nash and Egan, 1988). Some lichen species with cyanobacterial phycobionts (*Collema auriculatum* Hoff., *Peltigera cannina* Willd.) are capable of nitrogen fixation, hence useful in Nitrogen-cycle. Lichens are used as pollution indicators because of capability of accumulating heavy metals such as Pb, Zn, Cd, Ni, Cu, Hg and Cr, and toxic elemental pollutants such as SO2, NO and NO2 (Richarson and Nieboer, 1981; Upreti and Pandey, 1994, 2000; Bajpai et al., 2004).

Present study is based on collections of Lichen flora made during 2015 – 16 from various locations of Uttarkashi district particularly from Chirwasa, Bhojwasa, Barkot and Purola.

MATERIAL AND METHOD:

Site Description

The collection area is located between 1500m to 3500 m (asl) in the Uttarkashi district of Uttarakhand along with Bhagirathi and Yamuna valley. The local human population settled in the low land fringe areas comprises semi pastoralists with livestock grazing and agriculture as their dominant land use activities. While low elevation woodlands such as *Quercus- Rhododendron* forests are open for fodder and fuel wood collection throughout the year, nomadic grazing in the higher elevation forests and grasslands

starts in early May, reaching a maximum in July, August and stop in early October. The maximum monthly temperature in the area varies from around 16ºC to 38ºC from the higher altitude grasslands to the lower elevation *Quercus* - *Rhododendron* forests respectively during the snow free months of May to October, while the minimum temperature drops as low as (-) 16ºC in the alpine grasslands during the months of December to February. In general the climate of the collection area is less severe summer, more or less higher precipitation and prolonged winter. The climatic factors i.e. precipitation, temperature, relative humidity and wind, in association with elevation (valley or mountain ranges from foot hills to mountain zones), proximity to Great Himalaya, slope aspect and vegetation type etc, cause variation in climates at local or even micro levels (Gaur 1999). Major output of precipitation is in the form of rainfall besides occasional occurrence of due hailstorms, fog, frost, snow fall etc. The south east monsoon commences towards the end of June and bursts until the mid of September.

COLLECTION AND IDENTIFICATION METHOD:

The lichen specimens were collected with the help of Chisel and Hammer along with their ecological notes. The type of forest vegetation, host tree type, location of the lichens thallus (on trunk, branch, twigs or leaves, soil and rock substratum); together ecological notes were recorded. The collected specimens were investigated morphologically, anatomically and chemically at laboratory of the Department of Botany, Government Post Graduate College Uttarkashi. The collected samples were packed on hard card sheets inside a lichen herbarium packet (17cmX10mm) with details of the locality and are preserved.

The external morphology was studied under dissecting binocular microscope. The anatomy of the thallus and apothecia were studied under compound microscope. The external morphology was examined generally in dry condition but dark brown to bluish specimens of *Leptogium* were studied in wet condition. The anatomical structures were studied after cutting the section of dry material by microtome and with the help of safety razor blade. The thin dry sections of the thallus and ascocarp were immersed in 90% ethyl alcohol to drive off the intercellular or inter-hyphal air bubbles and the sections were mounted in water or in cotton blue in lactophenol. The colour of medulla, epithecium, hypohtecium, and ascus were recorded. The shape and size of the asci, ascospores and conidia were measured in the sections mounted in water. The measurements of the thallus, medulla, epithecium, and hymenium were generally taken in the sections mounted in cotton blue. The thallus size was measured in centimeter, lobe size and ascocarps in millimetre and thallus medulla, epithecium, hymenium thickness, asci and ascospores size in milimicron. Apothecia were studied after taking a thin sections by safety razor blade and observed under compound microscope. Thallus of lichens are divided into 3 main morphological groups; crustose, foliose and fruticose forms. The surface/ texture of thallus, areoles, margin of lobes, external cephalodia, cyphellae, psuedocyphellae, cilia,

rhizines were examined and measurements taken. Presence or absence of vegetative structures like pycnidia, isidia, soredia, bulbils etc. was recorded.

RESULTS:

A total of 35 lichen species were collected from all the three study area of Uttarkashi district.

S.N.	Name of Lichen Species	Family	Growth Form	Habitat	
1	*Allocetraria stracheyi* (Bab.) Kurok. & Lai	Parmeliaceae	Foliose	On rock	
2	*Aspicilia dwaliensis* Rasanen	Hymeneliaceae	Crustose	On rock	
3	*Buellia stigmea* Tuck.	Physciaceae	Crustose	On rock	
4	*Caloplaca pelodella* (Nyl.) Hasse	Teloschistaceae	Crustose	On bark	
5	*Caloplaca* sp	Teloschistaceae	Crustose	On rock	
6	*Cetrelia sanguinea* (Schaerer) Club & C. Club	Parmeliaceae	Foliose	On bark	
7	*Cetrelia braunsiana* (Muell. Arg.) Culb & C. Club	Parmeliaceae	Foliose	On bark	
8	*Cladonia furcata* (Huds) Schrader	Cladoniaceae	Squamules	On bark	
9	*Cladonia fimbriata* (L.) Fr.	Cladoniaceae	Fruticose	On bark	
10	*Chrysothrix candelaris* (L.) J. R. Laundon	Chrysothricaceae	Crustose	On rock	
11	*Cladonia* sp.	Cladoniaceae	Squamules	On rock	
12	*Cladonia squamosa* (Scop) Hoffm	Cladoniaceae	Squamules	On bark	
13	*Heterodermia incana* (Stirton) D. Awasthi	Phyasciaceae	Foliose	On bark	
14	*Hymenelia* sp.	Hymeneliaceae	Foliose	On bark	
15	*Ioplaca pindarensis* (Rasanen) Poelt & Hintergger	Teloschistaceae	Crustose	On rock	
16	*Leptogium askotense* D. Awasthi	Collemataceae	Foliose	On bark	
17	*Lobaria retigera*(Bory) Trevisan	Lobariaceae	Foliose	On bark	
18	*Leptogium pedicelatum* M. P. Jorg	Collemataceae	Foliose	On bark	
19	*Leptogium trichophorum* (Muell.) Arg.	Collemataceae	Foliose	On bark	
20	*Ochrolechia rosella* (Muell. Arg.) Vers.	Pertusariaceae	Crustose	On bark	
21	*Parmelia squarrosa*Hale	Parmeliaceae	Foliose	On bark	

22	*Parmotrema mesotropum* (Muell. Arg.) Hale	Parmeliaceae	Foliose	On bark	
23	*Peltigera polydactyla* (Neck) Hoffm	Peltigeraceae	Foliose	On bark	
24	*Punctelia borreri* (Sm) Krog.	Parmeliaceae	Foliose	On bark	
25	*Ramalina conduplicans* Vainio	Ramalinaceae	Fruticose	On bark	
26	*Ramalina himalensis*Rasanen	Ramalinaceae	Fruticose	On rock	
27	*Ramalina sinensis* Jatta	Ramalinaceae	Fruticose	On bark	
28	*Sticta nylanderiana*Zahlbr.	Stictaceae	Foliose	On bark	
29	*Umbilicaria badia* Frey	Umbilicariaceae	Foliose	On rock	
30	*Usnea aciculifera*Vainio	Usneaceae	Fruticose	On bark	
31	*Usnea indica* Mot.	Usneaceae	Fruticose	On rock	
32	*Usnea pectinata* (Taylor)	Usneaceae	Fruticose	On bark	
33	*Usnea subfloridana* (Stirton)	Usneaceae	Fruticose	On bark	
34	*Verrucaria acrotella* Ach.	Verrucariaceae	Crustose	On rock	
35	*Xanthoria sorediata* (Vain.) S. Kondratyuk & Karuefelt	Teloschistaceae	Foliose	On rock	

DISCUSSION

The study sites selected for the collection of lichen flora ranged between 2500 to 3000 m above mean sea level and have sub-alpine climatic conditions that have immense role in development of soil in evolution of species that prefer colonization of lichen like flora (Asta et al., 2001). The most common lichen species of the area were *Cladonia, Usnea, Ramalina, Leptogium and Cetrelia that prefer to grow* on moist vertical slopes along with mosses indicates the moist and humid condition of forest. The Chirwasa area have mountain caps covered with snow and have frequent landslides. *Cladonia fimbriata* (L.) Fr., is common medicinal lichen species found in the area.

Together with trees some shrubs of *Berberis* and *Cotoneaster* also provide a suitable substrate for growth of many lichen species. The growth of lichens on rock is based on the physical and chemical characters of the rocks. The hard, permanent, and moist rock preferred by most of the lichen than the rocks which weather soon and allowing less time to the lichen to produce reproductive organs(Kumar, 2008).

CONCLUSION

The Indian Himalayas are huge reservoirs of parmelioid lichens, therefore local people can use them in dyeing handicrafts and rugs, after harvesting them sustainably. Since lichens are slow growing organisms

unable to provide large scale biomass for commercial use, therefore mycobiont culture and whole thallus culture of lichens is the only method to get good biomass that will help in establishment of small cottage industries for employment to the poor villagers in Himalayan regions. The available collection of the lichen from Uttarkashi area will be helpful in documentation of lichens and will provide status of the diversity of medicinally and other important lichens of the area. The present number of species and their distribution on different substrate will act as preliminary base to carry out studies in the area in future.

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