G.B. Pant National Institute of Himalayan Environment

Special Lecture Series
Lecture-7
20th December 2023 (Wednesday)
10:30 am (Hybrid mode)

Lichens as a tool to monitor environmental pollution and climate change

Dr. D. K. Upreti

Welcome
Prof. Sunil Nautiyal
Director, NIHE

Dr. Dalip K. Upreti, FNA, FNASc, obtained his M.Sc. from Kumaon University, Ph.D. from Lucknow University, joined CSIR-NBRI as scientist and served as the Director. He is well known for his research on taxonomy, bio-monitoring, climate change and bio-prospection studies related to lichens. He has received several awards such as J.B.S. Haldane Memorial Scroll (1997), Prof. B.A. Razi Medal Award (2006), Prof. K. S. Thind award (2012), Environmental Conservation Award (2013), Award of Excellence (2013), Janki Ammal National Award (2015). He discovered 130 new species and 300 new records of lichens in India. He has published more than 400 research papers, 13 books and 50 book chapters. He implemented 35 research projects, supervised over 40 Ph.D. and 43 M.Sc., M.Phil. students. He is President of Indian Lichenological Society and member of the NAAC.

About Speaker
Dr. Devendra Kumar

Vote of thanks
Dr. Arun Jugran

Moderator
Dr. Suresh Rana

Webex link: https://gbpnihehq.my.webex.com/gbpnihehq.my/j.php?MTID=m181a1e4c33e797d43b5c0b0bd6c752fa
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Password: Himalaya@2023

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D. K. Upreti

Lichenology laboratory, Plant Diversity, Systematics and Herbarium Division
CSIR-National Botanical Research Institute, Rana Pratap Marg, Lucknow-226001

Abstract

Lichens, one of the excellent examples of symbiotic association, are group of non-vascular cryptogams and occur in all possible environmental habitats of the world. Lichen though exhibit high diversity in tropical regions but grow in luxuriance in temperate and alpine areas. Lichens are extremely sensitive to environmental stress and frequently used in atmospheric pollution, eutrophication and climate change studies. Lack of root system and protective cuticle and stomata, allow lichens to accumulate mineral elements and different metals (organic, inorganic) exceeding their metabolic requirements. Moreover, lichens are long living, ectohydric organisms with a limited control on water and gas exchange, thus have characteristics features which make them an excellent bioindicator of environmental changes.

In the Himalaya, lichens grow abundantly and reported extensively in the systematic studies. Few biomonitoring studies with the help of lichens in the Himalayas are initiated recently and loads of organic and inorganic pollutants are recorded from different localities of Garhwal Himalaya. A single lichen species or different lichen communities or lichen biomass can be used for carrying out the biomonitoring studies of an area. Since Himalayan region is well known for its rich lichen diversity exhibit occurrence of several lichen biomonitoring communities and sensitive species in both temperate and alpine regions. Areas with high anthropogenic activities exhibit absence of sensitive lichen species thus have low lichen diversity as compared with the pollution free areas. Cyanophycean lichens play an important role in forest nutrient cycle and indicate forest age and continuity. The Lobarian Group comprised of Lobaria, Pseudocephallaria, Peltigera and Sticta are sensitive to air quality and reliable indicators of species rich old forest with long forest continuity. The yellow foliose morphological group comprising of foliose lichen species of Xanthoparmelia is consistently correlated with stable productive landscape. The growth of graphidaceous (Graphis, Opergrapha, Scareographya, Phaeographis) and pyrenocarpous (Anthracothecium, Pyrenula, Lithothelium, Porina) influenced by the nature of bark. Both groups mostly prefer to grow on a smooth bark tree in evergreen forest.

The Lecanorioid group comprised of *Lecanora, Lecidella and Biatora*, indicates well illuminated environmental condition of the forest with considerable exposure of light and wind. The Parmelioid group comprised of mostly the species of lichen genera *Bulbothrix, Flavoparmelia, Parmotrema, Parmelia, Punctelia*. The forest with closed canopy and less sunlight support few species of *Parmelioid* genera to grow while the open thinned out forest with more sunlight exhibit dominance of Parmelioid lichens. The Pertusorioid group includes species of lichen genus Pertusaria and indicates old tree forest with rough-barked trees. The member of the Lecideoid group such as Lecidea, Protoblastedia, Haematomma, Bacidia, Buellia and Schadonia colonized mostly on bark of deciduous trees in sheltered and well lit exposed sides. The Leprarioid Group forms powdery thallus on the substrates indicates moist and dry vertical slopes, rough-barked trees of moist and dry habitats. The species of *Chrysothrix* appears first after forest fire. The lichen species of *Physcia, Pyxine, Dirinaria, Heterodermia, Phaeophyscia* and Rinodina belongs to Physcioid Group and considered as the pollution tolerant lichens and have ability to grow on varied substrates in both moist and dry habitats. The species of *Caloplaca, Letroutia, Brigantiaea and Xanthoria* belongs to Teloschistacean Group having yellow thallus and apothecia, indicates exposed and shelter rock. The dark orange pigment present on the upper cortex of the thallus act as a filter and to protect the lichens from high UV radiation. The genera of the lichen family Lichninaceae mostly having cyanobacteria as their photobiont belongs to Lichinioid Group and prefers dry rocks and barks having higher concentration of calcium and indicate presence of calcareous substrates in the habitats. The species of lichen genera *Peltula* belongs to Peltuloid Group, indicates a stable rock substratum. The thelotremaitoid group comprised of species of *Thelotrema, Ocellularia, Leucodecton and Myriotrema* indicates a tropical rain forest habitat. Saxicolous species of *Rhizocarpon*, *Candelaria* and *Xanthoria* are frequently used for lichenometry studies to study glacier retreat.

Mapping of single species for estimating the accumulation of metals and its absence and presence in different localities of an area can provide useful data to know environmental condition of that area. In long term monitoring programmes the lichen communities/ groups play vital role for getting baseline data and further assessment of the environmental condition of a particular region. The Himalayan region of India is extensively and intensively explored for its lichen wealth in the past and account of sensitive species/bioindicator communities/biomass of lichens in certain regions are available and can be used to assess the present environmental condition and future changes if any due to anthropogenic or climatic change.