

Lichens: Indicators of Climate Change

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Abstract—To have complete information on diversity among earth's living resources, there is need to have a complete set of information on different aspects of all the higher and lower groups. The present study is one such step towards the collection of information on one of the lower but significant group of plants i.e. Lichens which are the pioneers and perhaps the oldest living creatures on earth. Besides, they withstand extreme environmental conditions, help in paedogenesis, serve as food option, have medicines value, are used in dye making and perfumery, have correlation with pollution, lichenometry and change in climate as well. Lichens like other biological forms respond to the climate change. However, studies on role of lichens in assessing the impact of climate change had been initiated during the last two decades only. Most of the work was carried out in the temperate part of the globe such as Arctic region where data on lichen community distribution has been collected and plotted periodically for correlating with the change in climate. Because of their sensitive physiology, it is expected that change in climatic conditions can lead to the probable extinction of these useful and one of the oddest living forms on earth. The present paper deals with the study of lichens in district Rajouri predicting the impact of local conditions on their distribution patterns. The baseline data collected will be used for further climate change studies of longer durations.

Keywords: Lichens, lichenometry, community distribution, climate change.

1. INTRODUCTION

Lichens are cosmopolitan and very common organisms occupying wide range of environments including soil and rock surfaces, trees and manmade structures. [8]. They are highly valued ecological indicators known for their sensitivity to a wide variety of environmental factors including quality of air and other physical parameters.[10]. Lichens have been observed to respond rapidly to climate change [1]. Since they don't have vascular system, they are sensitive towards the environmental factors such as temperature, relative humidity, rainfall and even air pollutants. During last few years, several studies have been carried out to understand the role of climatic factors with the lichen physiology and distribution [5], [6], [11]. Therefore lichen distribution, could be a useful tool to assess bioclimatic features of a territory[7].

A number of lichen species especially epiphytic forms have been proved to be distributed along ecological ranges defined

by variation of main climatic factors [4], [9]. Based on these lines a study was initiated in 2010 in the Rajouri district of J&K state situated in the lower hills of Pir Panjal mountain range. The unique topography of the study area along with the climatic conditions supports a wide range of vegetation from subtropical to alpine. Thus wide range of species such as *Pinus roxburghii*, *Phyllanthus emblica*, *Quercus leucotricophora*, *Buxus wallichiana*, *Dalbergia sissoo*, *Olea ferruginea*, *Cassia fistula*, *Acacia catechu*, *Syzygium cumini*, *Punica granatum*, *Rhododendron arboreum*, and *Juniperus communis* provide substrates for lichens to grow in the region.

Epiphytic lichen distribution was studied through field sampling at 49 localities of 7 tehsils of Rajouri district. The study was carried out to observe the relationship between the distribution of epiphytic lichens with the microclimatic conditions of the area to generate a baseline data to carry out further climatic studies in the region.

2. MATERIALS AND METHODS

2.1 Study area

Rajouri district located at the lap of Pir Panjal mountain range between 70° - 74°4' East longitude and 32°58' -33°35' North latitude. Its boundaries are connected with district Jammu and Reasi on the eastern side, district Poonch on the west, Pulwama on the north and the famous Red Cliff Line (L.O.C) passes at the south end of district. The total geographical area of the district is 2630sq.m lying at an elevation of 400 – 6000m amsl. The district experiences hot summers and moderately cold winters. The average temperature varies from 7°C to 37°C in different parts of the district. The district can be broadly divided into hilly and plain areas, which is drained by river Nowshehra Tawi and river Thandepaniwali Tawi. Besides, there are two other rivers like Niari Tawi and Ans river.

3. METHODS

Epiphytic lichens were collected from 49 localities of 07 tehsils (Darhal, Thanna mandi, Naushehra, Rajouri town, Sundrebani, Kalakote and Budhal) from district Rajouri. The

lichen specimens were identified by studying their morphology, apothecial anatomy and chemistry at the Lichenology Laboratory, National Botanical Research Institute (CSIR), Lucknow and Conservation Biology Laboratory, Centre for Biodiversity Studies, BGSB University, Rajouri. The chemical investigations of the specimens were performed following the techniques of Walker and James [12]. For authentication of the specimens lichenological literature of [2 - 3] was consulted.

Epiphytic lichens were sampled using 1×5 cm quadrats placed on tree trunks. From each site quadrats were randomly sampled for analyzing the species richness. Epiphytic lichens were analysed to determine their distribution patterns and diversity in the region.

4. CONCLUSIONS

A total of 19 species belonging to 15 genera and 8 families were recorded from 49 localities of 7 tehsils of the region. In total, 19 epiphytic lichen species were found among 107 plots laid during the course of study. One to 16 species occurred per plot. Plot-level species richness was highly heterogeneous within the different localities with maximum in thick forest areas and lowest in the open areas. Maximum diversity was found in Koteranka which is dominated by *Quercus leucotrichophora* species indicating the preferred choice of epiphytic lichens. About 19 epiphytic lichen species were found in the region ($n = 107$, 2010 - 2014). Among all plots surveyed in Rajouri district ($n = 107$), plot-level species richness ranged from 3 to 19 species in Koteranka ($n = 73$). The study region supports moderate (8 species) to high diversity (>15 species) plots although richness is, heterogeneous.

Koteranka exhibits maximum number of epiphytic forms represented by 18 species followed by Darhal and Thannamandi with 10 species each, Rajouri with 09 species, Naushehra with 07 species, Sunderbani with 06 species while the minimum diversity is observed in the Kalakote area with only 04 epiphytic lichen species. (Fig. 1).

As compared to the epiphytic lichen diversity of other adjoining districts, Rajouri district shows less diversity of lichens. It can be attributed to many factors and local climatic conditions are one of them. The areas of the district such as Kalakote, Sunderbani and Naushehra encounter dry conditions through out the year are supported by less number of lichens as compared to the parts which are having good forest cover such as Darhal, Shahdra Sharief, Koteranka and some parts of Rajouri. These regions receive good rainfall and low temperature prevails throughout the year which accounts for comparable good diversity of lichens. The data presented in the paper will serve as the baseline data for continued monitoring and for similar futuristic studies.

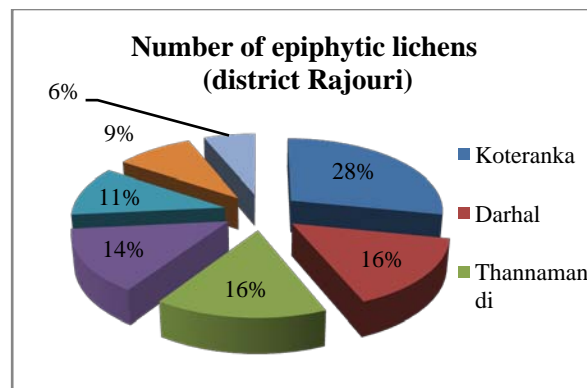


Fig. 1: Percentage wise distribution of epiphytic lichens in different localities of District Rajouri.

5. ACKNOWLEDGEMENTS

We are grateful to the Director, Centre for Biodiversity Studies, BGSB University, Rajouri and Director, National Botanical Research Institute, Lucknow for providing necessary facilities.

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