J. Mountain Res. P-ISSN: 0974-3030, E-ISSN: 2582-5011
Vol. 15, (2020), 197-200 DOI: https://doi.org/10.51220/jmr.v15i1.23

DOMINANCE AND DIVERSITY OF FALLEN EPIPHYTIC LICHENS IN A BROAD-LEAVED FOREST ECOSYSTEM OF GARHWAL HIMALAYA, INDIA

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Received: 11.11.2020; Revised: 10.12.2020; Accepted: 12.12.2020

Abstract: The communication is aimed at providing quantitative information on fallen epiphytic lichens in a broad-leaved forest ecosystem dominated by Oak (*Quercus semecarpifolia*). A total of 17 lichen species were encountered during the field samplings. *Parmotrema perlatum* was the dominant lichen species with higher values of density and diversity followed by *Lecanora chlaroteraa,* the co-dominant species. Medium diversity index (Shannon-Wiener) is an indicator for further investigation at broader level of forest ecosystems.

Keywords: Epiphytic lichens, Dominance, Diversity, Garhwal Himalaya

Introduction

Lichens are the stable self-supporting association of mycobiont and a photobiont in which the mycobiont is the ex-habitant (Hawksworth 1998). Among the 20,000 known lichen species in the world, 95% belongs to Ascomycetes group of fungi while Basidiomycetes and Deuteromycetes groups are represented only by 3 and 2% of species, respectively. In lichen thallus, the mycobiont predominates with 90% of the thallus volume and provides structure and colour with partial contribution from algal partner (Nayaka and Upreti 2005). The alga due to its chlorophyll contents, assimilates the carbon dioxide of the air and forms organic compound for the use of fungus as well as for its own (Schneider 1994). The net result is the harmonious and well balanced exchange of benefits between the two symbionts for their growth and development (Awasthi, 2000). By virtue of their peculiar structure and physiology, lichens have high tolerance to environmental stresses and are able to grow in diverse geographical regions from icy expanses to tropical, temperate and subtropical parts, and from drier, hot desert to moist humid climate (Upreti *et al*. 2015).

Garhwal Himalaya exhibits submontane to alpine climate with distinct physiography, altitudes and aspects which harbour a variety of forest types. Owing to varied topography and altitudes, diverse forest and alpine communities may occur within a distance of 300-500 km. These climatic conditions and forest ecosystems support a variety of lichens in general and epiphytic lichens in particular. Although a number of studies on lichen floristics of Garhwal Himalaya are available (Upreti *et al.* 2010, Kumar2010, Shukla2016), quantitative studies of epiphytic lichens are completely lacking. Therefore, present communication is an attempt to study of fallen epiphytic lichens in a broad-leaved forest dominated by *Quercus semecarpifolia.*

Materials and Methods

The study was carried out at Furkhandakhal forest area of Khirsu forest range of Pauri district in Garhwal Himalaya. The area is located at an altitude of 2040m asl. Forest is dominated by brown oak (*Quercus semecarpifolia*) with associated species like *Rhododendron arboreum, Myrica esculenta* etc. Quantitative analysis of epiphytic lichens was carried out using quadrats of 1.00×1.00m². Data were analyzed for abundance, density and frequency (Curtis and McIntosh 1950). The ratio of abundance to frequency was used to interpret the distribution pattern of the lichen species. The distribution is considered regular if the ratio is <0.025, random (between 0.025 and 0.05) and contiguous if>0.05 (Curttis and Cottam, 1956). Species diversity ($\bar{H}$) was calculated following Shannon and Wiener (1963). Lichens species were identified using OLYMPUS SZ40 110AL2X WD28 stereo-zoom microscope and with the help of pertinent literature (Awasthi, 2000; Shneidener, 1994)

Results and Discussion

A total of 17 epiphytic lichens were recorded during the phytosociological investigation in the broad-leaved forest dominated by *Quercus semecarpifolia*. *Parmotrema perlatum* emerged as the dominant epiphytic lichen species with higher values of abundance and density (Table1.) *Lecanora chlarotera* was the co-dominant lichen specieswith low frequency. The fallen density of lichens depends on the forest cover and tree diversity. High density of lichens on ground shows the good canopy cover of trees with density.

Candelaria sp., *Heterodermia albidiflava, Usnea filipendula, U. florida, Flavoparmelia soredians* were the least important species with lower values of density. Dominant species *Parmotrema perlatum*was observed in all the sampling units indicating favorable climatic conditions for this species. Abundance to frequency (A/F) ratio was used to interpret the distribution pattern of the lichen species. Majority of the species were contiguously distributed, however, random distribution was not uncommon (Table1.).

Table1: Density (Ind. m^{-2}), diversity ($\bar{H}$), A/F ratio and distribution pattern of fallen lichens.

Species	Density	A/F	($\bar{H}$)	Distribution pattern
Parmotrema perlatum	11.80	0.12	0.353	Contiguous
Ramalinafastigiata	0.50	0.12	0.053	Contiguous
Usnea longissimia	3.80	0.10	0.223	Contiguous
Evernia prunastri	5.20	0.10	0.265	Contiguous
Graphis scripta	4.10	0.11	0.234	Contiguous
Lecanora chlarotera	7.70	0.21	0.317	Contiguous
Caloplaca cerina	1.10	0.07	0.097	Contiguous
Flavoparmeliacaperata	0.60	0.06	0.062	Contiguous
Usnea filipendula	0.30	0.03	0.034	Random
Heterodermiaalbidiflava	0.20	0.05	0.026	Random
Candelaria sp.	0.10	0.01	0.012	Regular
Pertusaria multipuncta	0.30	0.03	0.034	Random
Buelliastillingiana	1.60	0.04	0.128	Random
Usnea florida	0.30	0.07	0.034	Contiguous
Graphis subserpentina	1.00	1.00	0.092	Contiguous
Flavoparmeliasoredians	0.10	0.01	0.012	Regular
Lecanora hybocarpa	1.00	1.00	0.092	Contiguous

Odum (1971) stated that in natural conditions, the contiguous distribution is most common. Variation in distribution pattern seems to be associated with multitude of factors, especially the biotic. It is interesting to note in this study that 64.70% lichen species showed contiguous distribution pattern while only 0.23 and 0.11% species showed random and regular distribution, respectively. Preponderance of clumped distribution is the sign of healthy ecosystem with low level of biotic disturbances. Species diversity is commonly considered as an important ecological attribute of a natural and organized community (Hariston 1964) and has been said to increase in a successional sequence leading to climax stage. Further, diversity is a combination of two factors, the number of species present, referred to as species richness and the distribution of individuals among the species, referred to an evenness or equitability. Single species population are defined as having the diversity, of zero regardless of the index used. Species diversity, therefore, refers to the variations that exist among the different forms. In the present study Shannon-Wiener diversity index has been used. Diversity of epiphytic lichens ranged from 0.012 to 0.353 and the cumulative diversity index reached to 2.068 (Table1).

The index is comparable with the tree diversity of different forest ecosystems of Garhwal Himalaya.

The study concludes that Furkhandakhal Oak forest is a rich reservoir of epiphytic lichens on account of luxuriant forest ecosystem with pollution free environment. Although the diversity of fallen lichens is often affected by various biotic and abiotic factors but nonetheless, this preliminary study on the dominance and diversity of fallen epiphytic lichens certainly opens up new horizon of lichen study in relatively less disturbed areas on a larger scale.

Acknowledgements

Authors are thankful to Head, Department of Botany and Microbiology for providing necessary laboratory facilities. One of the authors (AF) thankfully acknowledges the financial assistance rendered by the UGC as Ph D Fellowship.

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