Environment Conservation Journal 7 (1-2) 83-87, 2006
(ISSN 0972-3099)

Distribution Of Some Mosses In Nainital, Almora And Pithoragarh District Of Kumaon Region, India

D. K. Saxena, Shiv Om Singh and Kajal Srivastava
Department of Botany,
Bareilly College, Bareilly (India).

Abstract
Mukteshwar and other collection sites of Almora hills shows vegetative dominance over study sites of Nainital and Pithoragarh district, which leads to luxuriant growth of mosses in particularly these sites. Despite of weather conditions variability in vegetation may be more or less due to tourist activity and pollution rate persist in these areas of Kumaon hills. The present study of the distributional pattern of the various taxa of bryophytes clearly indicates that in term of luxuriance and frequency the Western Himalayan territory is floristically very rich.

Key words: *Kumaon hills, mosses, climate, vegetation, distribution.*

Introduction

Kumaon is essentially a region of great physical diversities. It has vast range of altitude coupled with complexity of a widely varying mountainous topography; giving rise to large differences of climate, vegetation, soil and other geological phenomena. The percentage occurrence of mosses in India is quite high than any other plant group as about 27.5% of world mosses are present in India (Banerjee, 1978). Western Himalayan territory is known for the luxuriant bryophytes cover both in frequency and variety (Pande, 1958; Gangulee, 1969).

Location: Lying between the latitudes $28^0$44' and $30^0$49'N and longitude $78^0$45' and 81^0 1' E, Kumaon region is situated at the trijunction of Nepal, Tibet and India. It constitutes a distinct geographical entity of great strategic significance and is spread over 21,035km^2 area. The moss flora studied in three north- easterly-situated districts- Nainital, Almora and Pithoragarh of Western Himalayas were used for an assessment of bryophytic vegetation. These areas offer an exquisite variety of bryoflora habitat in Western Himalayas. It has a highly distinctive flora of bryophytes including mosses (Gangulee, 1969), liverworts (Pande, 1958; Udar, 1976) and hornwort (Asthana & Srivastava, 1991). This prestigious group in diverse habitats shows distinct populations. The western Himalayan have received scant attention, so it is an attempt to reveal distribution of some mosses in Kumaon hills.

District Nainital is situated between 79^0 51'E - 80^0 15'E longitude and 29^0 15'N - 30^0 29'N latitude. It shows bryophytic vegetation with in an altitude range of 320m - 2500m. District Almora and Pithoragarh are situated at longitude 79^0 26'E - 80^0 15'E and 79^0 45'E - 81^0 21'E having latitude 29^0 15'N - 30^0 20'N and 29^0 32'N - 30^0 47'N respectively (IG, 1931). These districts reflect ecological amplitude of each species at each station. The main study sites of these three districts were Nainital, Ranikhet, Chaubatia, Katpuria, Machkhali, Mukteshwar, Kosi, Almora, Dinapani, Artola, Jageshwar, Pithoragarh and Lohaghat.

Soil

The nature of soil, though a minor factor in determining the vegetation of the hills but still is not entirely negligible. Its texture varies according to the nature of rocks found in the ridges and vegetation. Their capacity

to absorb minerals and water also varies according to the type of soil. Loam to clay soil is found in Nainital, calcareous and micaceous soil enrich in iron and mica content is found in Almora where as Pithoragarh has clay and sandy loam soil formed from weathering of rocks.

Climate

Due to great physical diversities variations was found in climatologically data. A few words about the climate of the district will not be out of place, as various adaptations in the plants described will be better understood in the light of the climatic conditions. The moss spores and vegetative propagules have the ability to germinate and colonize even if minimum favorable conditions are available. This may be the probable reason of existence even at very high altitude, where other plants usually do not grow. The altitudinal variations and the slope aspects have given rise to varying climates in different parts of Kumaon. There are three main seasons in the Himalayas: summer season (i.e. March, April, May, June), rainy season (i. e. July, August, September, October) and winter season (i.e. November, December, January, February). The most important fact in connection with the climate is that there is small amount of precipitation, insolation is very strong and evaporation vary greatly in all mountain districts (Kashyap, 1972). The winter precipitation, associated with cyclones is in the form of rainfall at lower elevation and snowfall on higher mountains. The summer precipitation is usually associated with local thunders storms used by atmospheric instability owing to strong diurnal temperature variations. The mean temperature in the month of January ranges around 80^0C in Pithoragarh and Almora where as it reaches to 6^0C on higher ranges like Nainital and Mukteshwar. The corresponding record for the month of June is 24^0C in valley place like Pithoragarh and Almora, while it goes to 20^0C at Nainital and Mukteshwar.

Temperature comes down with increasing altitudes in the Himalayas. The temperature is low for nine months of the year. By March the temperature begin to rise progressively till June. The rainy season usually commences by the end of June or early July. By late October or early November the temperature begins to fall down and the month of January marks as the coldest month of the year. Average rainfall was about 36.7 cm.

Rainfall is greatly affected by the high ridges and altitudes, which catches the clouds and precipitated their moisture. The distribution of rainfall over the year is highly variable. Monsoon occurs in the months of July, August, and September. Very low rainfall was obtained during winter seasons and November, December and April are driest months.

Vegetation

Different types of vegetation and soil were found under similar climatic conditions. A wide variety of alpine vegetation occurs including higher and lower plants. The natural vegetation of the area is comprised of *Cedrus deodar, Cassia fistula, Salmalia malabaricum, Querous di litata, Abies pinddrow, Tectona grandis, Juglana regia, Rhododendron arboreum and Pinus roxburhie*.

Mosses are specialist in frugality, they make little demand upon the habitat but are get effected by climatic conditions. Indeed the cool, moist conditions are especially favorable to a great array of mosses (Udar, 1976). Each species here occupies some small environmental niche to which it is highly adapted. Although small in size mosses play a fundamental role in the balance of nature. Because of special habitat requirements, some species may be frequent in one part of the region but absent in other part (Smith, 1982).

Bryophytic flora is found firmly attached to the trees, shrubs, saplings of trees and knotholes. Tree bases and exposed roots represent the shadiest habitat for bryophytes, usually combined with a high degree of humidity. These habitats provide very suitable niche for bryophytes (Tewari *et al*, 1987). The knothole also seems to be an ideal place for the growth of bryophytes perhaps due to be more moisture content and shade than the surrounding tree trunks (Tewari *et al*, 1994). Relative density and abundance for the respective sites were also

concomitant with percent frequency. A decrease in the number of species from one site to another may cause by climate or emission.

The bryoflora collected from the study sites were brought to laboratory in plastic bags for taxonomical identification. Bryophytes are duly identified with the help of various available books (Gangulee, 1969; Chopra, 1975 and Smith, 1978) and loaned specimens (Newyork Botanical Garden, U. S. A. and Duke University, U. S. A.). For further confirmation of identifications, specimens were sent to Herbarium of Egar University, Hungary. The voucher species were also deposited in the Herbarium of Bareilly College, Bareilly. All the families, genera and species are arranged alphabetically together with their substrate, place and altitude.

List Taxa

Pottieaceae

Barbula vinealis Brid., Br. Univ., 1827.
Substratum: Found attached on calcareous rocks and soil.
Distribution: Nainital, Chaubatia, Katpuria, Ranikhet, Mukteshwar, Almora, Kosi, Artola, Jageshwar, Dinapani, Kausani, Pithoragarh, Lohaghat.

B. constricta Mitt. in Musci Ind. Or: 33.
Substratum: Found attached on calcareous rocks, building and soil.
Distribution: Nainital, Chaubatia, Mukteshwar, Almora, Artola, Jageshwar, Dinapani, Pithoragarh.

Hypnaceae

Hypnum cupressiforme Hedw., Sp. Musc., 1801
It is a cosmopolitan, pleurocarpous, and epiphytic moss.
Substratum: found at wet, shady places, tree barks, on flat rocks in the low lands.
Distribution: Nainital, Chaubatia, Ranikhet, Mukteshwar, Almora, Artola, Jageshwar, Dinapani, Pithoragarh, Lohaghat.

Bryaceae

Rhodobryum roseum (Hedw.) Limpr., Laubm., 1895.
It is an acrocarpous moss, found in wet climate.
Distribution: Nainital, Chaubatia, Katpuria, Ranikhet, Mukteshwar, Almora, Artola, Jageshwar, Dinapani, Pithoragarh, Lohaghat.

Bryum cellulare Hook
It is an acrocarpous moss.
Substratum: found in wet climate.
Distribution: Nainital, Chaubatia, Katpuria, Ranikhet, Mukteshwar, Almora, Artola, Jageshwar, Pithoragarh, Lohaghat.

Plagiotheciaceae

Isopterigum elegans (Brid.) Schimp.
It is a pleurocarpous, epiphytic moss variety of *Plagoithecium elegans*.
Substratum: found at wet, shady places, tree barks, soil.
Distribution: Nainital, Chaubatia, Ranikhet, Mukteshwar, Almora, Artola, Jageshwar, Dinapani, Pithoragarh, Lohaghat.

Polytrichaceae

Atricum undulatum (Hedw.) P., Beauv
Substratum: found at wet, shady places.
Distribution: Nainital, Chaubatia, Katpuria, Ranikhet, Mukteshwar, Almora, Artola, Jageshwar, Dinapani, Pithoragarh.

Polytricum juniperium Hedw., ibid., 89,18, f.6-10.
Cosmopolitian moss.
Substratum: found at wet, shady places.
Distribution: Nainital, Ranikhet, Mukteshwar, Almora, Jageshwar, Pithoragarh.

Brychytheciaceae

Brachythecium reflexum (Starke) Br. Eur., 1853.
Substratum: found at wet, shady places, on decaying branches lying on the forest floor.
Distribution: Nainital, Mukteshwar, Almora, Artola, Jageshwar, Pithoragarh.

Grimmiaceae

Racomitrium crispulum (Hook. f. et. Wils.);
Cladocarpous moss.
Substratum: found under moist conditions, acidic rocks.
Distribution: Nainital, Ranikhet, Mukteshwar, Kausani, Almora, Artola, Jageshwar, Pithoragarh.

Thuidiaceae

Thudium cymbifolium (Doz. and Molk.)
Substratum: found at terrestrial, on sandy/ calcareous rock.
Distribution: Nainital, Ranikhet, Mukteshwar, Kausani, Almora, Artola, Jageshwar, Pithoragarh.

Thudium delicatulum (Hedw.) Mitt., J. Linn. Soc. Bot., 1869.
Substratum: found at terrestrial, on sandy / calcareous rock.
Distribution: Nainital, Ranikhet, Chaubatia, Mukteshwar, Kausani, Almora, Artola, Jageshwar, Pithoragarh.

Dicraneaceae

Dicranum undulatum Schard. Ex Brid., J. F. Bot., 1801.
Substratum: Found attached on calcareous rocks and soil.
Distribution: Nainital, Chaubatia, Katpuria, Ranikhet, Mukteshwar, Almora, Kosi, Artola, Jageshwar, Dinapani, Kausani, Pithoragarh, Lohaghat.

Sphagnaceae

Sphagnum squarrosum Cram Samml. Deutschl. Lanbm. 24, 1803.
Carpet moss and is one of the important component of the bogs
Substratum: found at wet, shady places, also grow in water (aquatic moss)
Distribution: Nainital, Ranikhet, Mukteshwar, Almora, Artola, Jageshwar, Pithoragarh.

Preliminary survey of various localities of district Nainital, Almora and Pithoragarh yield different mosses during summer rainy and winter seasons and also provide few suitable habitats for a variety of bryophytes to grow in Kumaon hills. Their abundance often reveals unpolluted environment and is indicator of forest conditions. Their sensitiveness to pollution indicates forest conditions. Unlike the ecologists who used the

term habitat in general as well as a more limited sense (Watson, E. V., 1955 and Smith, 1982) in the present work the term has generally been used to indicate the kind of place or places in which a plant or a plant association lives. The present communication also provides the extended range of distribution mosses from the western Himalaya at higher altitude (1850 - 2450m).

Acknowledgements

Authors would like to thanks to Prof. Tamas Pocs of Eager University and Prof. Zoltan Tuba, Szent Istvan University for their support. Special thanks to all the research scholar of our lab who helped in completing this paper. Thanks are due to the Ministry of Environment and Forest Govt. of India for the financial assistance.

References

Asthana, A. K. and Srivastava, S. C. 1991 : *Indian Hoenworts* (A taxonomic study) J. Cramer, Weinhein (Germany).

Banerjee, L.K. 1978 : *Statistical assessment of plant diversity*. In: Proceeding of national workshop on environmental statistics. Goa. 12-13 Jan.

Chopra, R. S. 1975 : *Taxonomy of Indian mosses*. Publication and information directorate (C S I R), New Delhi.

Gangulee, H. C. 1969 : *Mosses of eastern India and adjacent regions*. III Bull. Bot. Soc. Beng. 23: 131-134.

Imperial Gazatter- Atlas of India 1931 : Oxford at the clarender press vol: XXVI

Kashyap, S. R. 1929 : *Liverworts of the Western Himalayas and the Punjab plain*. Part I, The University of Punjab, Lahore.

Pande, S.K. 1958 : Some aspects of Indian Hepaticology. ***J. Hattori Bot. Lab***. 24: 115-202.

Smith, A. J. E. 1978 : *The moss flora of Britain and Ireland*. Cambridge University Press, London.

Smith, A. J. E. 1982 : *Bryophyte Ecology*, London Newyork Chapman and Hall.

Tewari, S. D., Pant, G., Airi, S. K. and Adhikari, P. S. 1987 : Hookeria acutifolia Hook and Grev., A new record for western Himalayas. India; ***Yushania***. 4:13-16.

Tewari, S.D., Pant, G., Joshi, S. and Airi, S.K. 1993-94 : *High altitude (above timberline) bryoflora of Kumaon Himalayas*. In: Pangtey Y. P. S. and Rawal, R. S. (eds.). High altitude of the Himalayas Gjanodaya, Nainital: 263-280.

Udar, R. 1976. *Bryology of India*. The Chronica Botanica Co., New Delhi.