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BIOLOGICAL SPECTRUM OF THE VEGETATION OF NORTH-EAST HARYANA IN INDIA

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ABSTRACT

The present paper deals with the study of the Biological spectrum of the vegetation of North-East Haryana. A detailed study of different life-forms indicated that Nanophanerophytes (N) and Hemicryptophytes (Hc) are poorly represented. The study also indicates the presence of therochamaephytic (42%, 22%) flora. The dominance of therophytes might have partly resulted from disturbance in vegetation due to heavy grazing and exploitation of forests for extensive cultivation. A comparison of the biological spectrum of this area with those of other regions of India reveals that the climate is semi-arid.

INTRODUCTION

The plants are classified taxonomically into families, genera and species. The plants of different species can be grouped into life-form or growth-form classes depending on their similarities in structure and functions. The life-form classification which has been most widely used is that of Raunkiaer's (1934) with some modifications made from time to time by a number of workers such as Braun-Blanquet (1932), Dansereau (1956), Oosting (1956) and D. Muller-Dombois & H. Ellenberg (1974). Raunkiaer (1934) worked out the life-form system with the purpose of using the flora of a given tract as an indicator of its climate for he firmly believed that the plant climate is characterised by the statistics of life-form, i.e., the life-forms best adapted to certain climate will form a higher percentage of flora than others. The Raunkiaer's system is ecologically oriented and based primarily on the position of the buds or organs from which new shoots or foliage develop after the unfavourable season. The simplest form of a life-form spectrum is to classify all the species on a list into five basic Raunkiaerlan life form classes (D. Muller-Dombois & H. Ellenberg, 1974).

Using Raunkiaer's life-form classification, Meher-Homji (1964), compared the biological spectra of various regions of India and found that these spectra were related to the bio-climate of the regions. Recently, Yadava and Singh (1977) have compared the biological spectra of a number of Indian grasslands which indicate a preponderance of therophyte and cryptophytes.

North-east Haryana lies between 29°8′ to 30°56′ N lat. and 76°15′ to 77°37′ E long. It is bounded in the north by the Siwalik hills and territories of Himachal Pradesh, in the east by the river Yamuna ; in the west by Punjab and in the south by the districts of Jind and Rohtak of Haryana.

The soils of Haryana are old alluvium. They are mildly acidic to neutral and rich in Silica but dificient in nitrogen, phosphorus and carbonate (Duggal, 1970).

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The climate is monsoonic. Maximum temperature varies from 20.6°C-26.2°C (January) to 37.6°C-39.3°C (June). The whole year can be divided into three seasons, viz., summer (April to June), rainy (last week of June to September) and winter (November to February). Most of the rainfall (80%) is received during the rainy season.

MATERIALS AND METHODS

The present work is based on extensive floristic explorations of North-east Haryana. The study was carried out for four years. The plant species have been studied in detail especially for their form, habit, height and nature of perennating bud.

The classification of plants into their life-forms has been done according to Raunkiaer's system as revised by Ellenberg H and D. Muller Dombois (1967 b). It is based on the following major criteria :

Phanerophytes : Plants that grow taller than 2 m and whose shoots do not die back periodically to that height, e.g. *Adina cordifolia, Anogeissus latifolia, Terminalia alata.*

Nanophanerophytes : Similar to the Phanerophytes but they are less than 2 m in height, e.g. *Dendrocalamus strictus, Caesalpinia bonduc, Mimosa himalayana.*

Chamaephytes : Plants whose mature branch of shoot system remains perennially within 50 cm above the ground surface or plants that grow taller than 50 cm but whose shoots die back periodically. This applies particularly to those with erect or ascending shoots, they may be herbaceous e.g., *Baliospermum montanum, Cymbopogon martinii, Girardinia palmata, Barleria prionitis* or woody, e.g. *Clerodendrum phlomidis, Capparis sepiaria.*

Hemicryptophytes : Biennial or perennial herbaceous plants with periodic shoot reduction to a remnant shoot system that lies relatively flat on the ground surface, e.g., *Cynodon dactylon, Coronopus didymus.*

Therophytes : Plants whose shoot and root system die after seed production and which complete their life cycle within one year, e.g. *Eragrostis tenella, Chloris barbata, Sonchus oleraceus, Capsella bursa-pastoris, Portulaca oleracea, Phyllanthus urinaria.*

Geophytes : Herbaceous plants which have their survival organs often well protected in the soil, with periodic reduction of the complete shoot system to storage organs. These plants may be hydrophytes, e.g., *Nymphaea nouchali, Scirpus tuberosus* or terrestrial e.g., *Cyperus bulbosus, Heteropogon contortus, Fimbristylis besumbellata.*

Lianas : Plants that germinate on the ground and maintain their contact with the soil but supporting themselves on others, e.g. *Atylosia scarabaeoides, Ipomoea cairica, Jasminum roxburghianum, Stephania glabra, Smilax zeylanica.*

Epiphytes : Plants that germinate and root on other plants (including parasites), e.g., *Rhyncostylis retusa, Cuscuta reflexa, Scurrula cordifolia.*

Specimens of the collected plants are deposited in the herbarium of Botany Department, Kurukshetra University, Kurukshetra.

RESULT AND DISCUSSION

Out of a total of 705 species collected from the area, the maximum number of species (516) occurred during rainy season, and minimum during the summer season (363). A total of 418 species was recorded in the winter months.

The analysis of flora for different life-form classes indicates that there are 300 therophytes (th), 161, Chamaeophytes (Ch), 86, Phanerophytes (Ph), 17, Nanophanerophytes (N), 62, Lianas (L), 37, Geophytes (6), 36 Hemicryptophytes (Hc), and 5 epiphytes (E). The ephemeral and other herbs under therophytic are more abundant and have the highest percentage (42.5%). Next to therophytes are chamaephytes (22.8%). The

Table : Biological spectrum of the statistics of the species in certain parts of India

Region	No. of dry months	Th	Ph	N	Ch	Hc	HH	G	P	L	E	
Normal spectrum	..	13	28	15	9	26	2	4	..	..	3	
Indian Rajasthan desert	11-12	40	9.7	4.6	18.9	15.5	3.4	..	..	7.8	..	Therophytic
Semi-arid zone of Northern India	9-10	33	11	12.3	18.3	10.4	3	5.2	1	6	..	Thero-chamaephytic
Semiarid zone of Southern India	7	28	15	15.3	12.4	11	4	6	1	7	..	
Poona region	7	26	22	16	20	4	2	1	..	7	..	Nanophanerophytic-chamaephytic
North-east Haryana	8-9	42.5	12.1	2.4	22.8	5.1	5.2			8.7	0.7	Thero-chamaephytic

other life forms i.e. Phanerophytes, Nanophanerophytes, Geophytes, Lianas, and Epiphytes show 12.1, 2.4, 5.2, 8.7, 0.7 representation respectively.

In table the biological spectrum of the species in North-east Haryana and spectra of some other regions of India are presented. The biological spectrum of North-east Haryana shows that the percentage of therophytes is maximum, whereas, the nanophanerophytes and Hemicryptophytes are poorly represented. This is natural since the annuals are best adapted to tide over the unfavourable period which they do in the form of seeds. The preponderance of therophytes is indicative of a warm dry climate in conformity with bioclimate diagram of Danserau (1952).

A comparison of biological spectrum of North-east Haryana to that of semi-arid zone of Northern India reported by Meher-Homji (1964) reveals higher percentages of chamaephytes and therophytes in North-east Haryana.

A comparison of biological spectrum of Raunkiaer (1934) and the present study of North-east Haryana indicates that the percentage of therophytes and chamaephytes are higher in the present case but the percentage of hemicryptophytes (Hc) and Nanophanerophytes (N) is lower. Since the present spectrum shows the dominance of therophytes and chamaephytes as compared to the normal spectrum, the flora may be called thero-chamaephytes.

Singh and Yadav (1974) have also reported therochamaephytic flora for the grassland ecosystem at Kurukshetra. According to Meher-Homji (1964), the therophytes and chamaephytes are dominant life-form under arid and semi-arid climates.

The chamaephytes which considerably reduce the transpiring surface (Shoot-reduction) during the dry period from an important group among the arid zone vegetation (Zohary, 1954). Slightly larger percentage of phanerophytes as compared to the typical semiarid zone of India, is because of more moist conditions in Northern parts of the area, e.g., at Kalesar, Morni and Kalka which support a range of forests from dry deciduous to moist deciduous (*Shorea robusta*) and evergreen (*Pinus roxburghii*). The dominance of therophytes within the study area also indicates that the

vegetation has been slightly disturbed due to heavy grazing and exploitation of forest land for extensive cultivation.

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REFERENCES

BRAUN-BLANQUET, J. Plant Sociology : The Plant communities (Transal. rev. and ed. by C. D. Fuller and H. S. Conard). Hafner, London. 1932.

*DANSEREAU, P. Biogeography: An ecological perspective. New York. 1957.

DUGGAL, S. L. Soil geographical zone of Haryana. Haryana Agriculture University, Hissar. 1970.

ELLENBERG, H. AND D. MULLER-DOMBOIS. A key to Raunkiaer plant life forms with revised subdivisions. Ber. Geobot. Inst. Int. Eth. Stifig. Rubel Zurich, 31 : 56-73 (1967b) Edited by D. Muller-Dombois & H. Ellenberg. 449-455. 1974.

MEHER-HOMJI, V. M. Life forms and biological spectrum or epharmonic criteria of aridity and humidity in Tropics. *Journ. Indian bot. Soc.* 43(3) : 423-430. 1964.

MULLER, D.-Dombois AND H. Ellenberg. Aims and methods of vegetation ecology. 1974.

OOSTING, H. J. The study of plant communities : An introduction to plant Ecology. 2nd ed. 1956.

RAUNKIAER, C. The life-forms of plants and statistical plant geography. 1934.

SINGH, J. S. AND P. S. YADAV. Biomass structure and net primary productivity in grassland ecosystems at Kurukshetra. *Ecological Monograph*, 39-74. 1974.

YADAV, P. S. AND J. S. SINGH. Grassland vegetation its structure function, utilization and management. Progress in Ecology. Vol. II. New Delhi. 1977.

ZOHARY, M. Hydro-ecological typer in the vegetation of near East-Deserts. In Biology of deserts. Pro. Symp. Hot. and Cold deserts. Inst. of Biology. London. 1954.

*Original not seen