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The Floristic Composition and Biological Spectrum of Chandigarh and Mussoorie Region

Vishal Sharma[1,] Nandini Paul Sharma[2]
[1, 2] *Govt. P. G. College for Girls -11,Chandigarh (Panjab University) - India*

Abstract: The present paper gives an account of different Life forms and biological spectrum of Chandigarh and Mussoorie ,constructed after enumeration of floristic composition of the region.Phanerophytes & Hemicryptophytes predominated the respective areas. Hemi cryptophytes. showed maximum deviation(+26%;Mussoorie) followed by Phanerophytes (+16%;Chandigarh) with normal biological spectrum of Raunkiaer Biological spectrum.Biological spectrum is a mirror reflection of thre floristic composition of the area and scales the vegetation physiognomy of the area.The dominance of Thero-phanerophytes in Chandigarh attributed to humid bio-climates and manifestation of the species adaptations to climatic variations. Key words:Life-forms, Floristic composition,,Biological spectrum, Chandigarh, Mussoorie

I. INTRODUCTION

The life forms refers to sum total of adaptation of their perennating organs and evolved directly in response to the environment (Ghildyal et *al*.,2016) . Raunkiaer (1934) formulated the concept of life forms and grouped plant species into five main classes; phanerophytes(with surviving buds projecting freely into the air), chamaephytes(with surviving buds situated near to the ground upto 25 cm), hemicryptophytes(with surviving buds exactly in the soil-surface), cryptophytes (with surviving buds perfectly hidden in the ground or at the bottom of the water)and therophytes(finishing their life-cycle within a season and remaining dormant as seed) . The percentage of various life form classes put together is called as the biological spectrum, an indicator of prevailing environmental conditions. Raunkiaer (1934) proposed the term "Biological Spectrum ,an index of eco-restoration of forest & mirror reflection of the phytoclimate and floristic composition of the site.

However,perusal of literature reveals that there has been more effort on the study of floristic composition ,life forms and biological spectrum in different times (Chauhan *et al.* 2014, ,;Thakur,2015;Bhattacharjya and Sarma,2016;Ghildiyal *et al*.,2016; Sahu and Barik,2017;Al-Hawshabi *et al*.,2017). But no work is reported in the floristic study of different agro-climatic zones In the present study, all life forms play an important role in depicting the phytoclimate of dual extremes i.e. cold moist and warm-dry climate. The study area experiences alternation of dry spell with moderate rainfall and cold moist temperate climate are characteristics of this area and these climatic condition are responsible for phanero-therophytic and Hemi &crptophytes dominance respectively .Presently,a shade increase of Therophytes in Chandigarh area attributed to grazing ,is an indicator of biotic pressure and warm climate (Thakur,2015).

II. MATERIAL AND METHODS

In the present study two sites Mussoorie and Chandigarh are studied .In these sites, 6 quadrats (each one with 10 m^2)were set up to assess the phytogeography of the region . Mussoorie has latitude – 30 ^{0}27' 0" N ; longitude 78^0 5' 0" E ; altitude 1,880 m. (6,170 ft.).Lal tibba heighest point 2,290 m. (7,510).Summer temp. 10 – 30^{0}c ; winter 1-10^{0}c.Chandigarh has the average temperature is 30^0 – 39^0 c in summers 5^0- 14^{0}c (max) & 1^0-5^{0}c (min.) in winters .The average rainfall in Chandigarh 111.07cm(approx.).Longitude &Latitude of Chandigarh is 76 -77'94º E ;30.7333º N . Presently six quadrats are randomnly surveyed in the month of March and classified all vascular plants in life forms following Raunkiaer's (1934) system. The preliminary phyto-sociological analysis of the study sites was accomplished by using quadrants. According to Raunkiaer's (1934) system Life forms depending upon the perennating buds has been classified into five life forms(Fig.1)
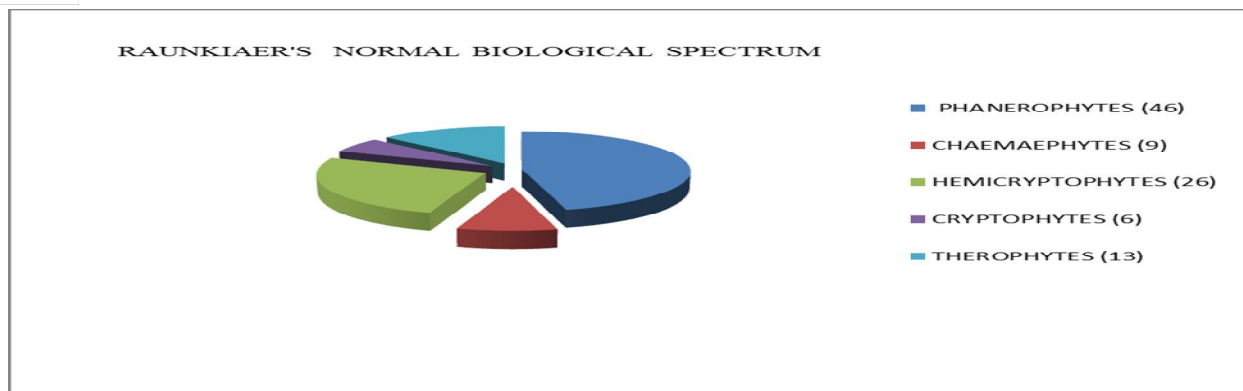
Fig.1:Normal Raunkiaer Biological Spectrum

A. Biological Spectrum

The ratio of the life forms of different species in terms of their number or percentage in is known as biological spectrum or phytoclimatic spectrum. A normal biological spectrum was prepared by Raunkiaer where he mentioned the percentage value of different life forms(Fig.1).

B. Sampling Population

For the study of quantitative characteristics of a community, it is essential to sample a population of adequate size.. Therefore, sampling should be done at random & should cover at least 10-20% of the area under study. There are 4 types of sampling techniques- transects, quadrats, loop method, plotless or point method.

(1)TRANSECTS: A cross section of sample area used for recording, mapping or study of vegetation is called transect. It may be a line, bisect or belt across the sample area.

(a)Line transect- Line transect is one dimensional transect which is used for measuring frequency & cover of a species. A steel tape or chain is stretched between two points which are usually kept at distance of one chain or 33.5 m. The line is taken as 1 cm wide belt. The observer walks along the transect and records plant species and the distance they cover along the line.

 (b) QUADRATS: Quadrats are squarish or rectangular ($10m^2$) plots which are used for sampling floristic composition of the area.The names of the species and the number of individuals of each species is also recorded in each quadrats.

III. RESULTS & DISCUSSIONS

Biological spectrum are useful in comparing geographically widely separated plant communities and these physiognomic features of the ecosystem are regarded as indicators of biotic interaction, climate and habitat deterioration. Occurence of similar biological spectrum in different regions indicates similar climatic conditions. According to Raunkiaer(1934) the climate of a region is characterized by life form while the biological spectrum of the region exceeds the percentage of the same life form.

In present survey at Mussoorie, sampled species in the area has 50% Hemicryptophytes and 24%Cryptophytes .In the floristic life-form spectrum (Fig.2), the most striking feature was the high percentage of Hemicryptophytes and crptophytes,which are indicator of high altitude and colder climate while phanero & therophytes are characterized of dry climate.The present findings regarding the dominance of of hemicrptophytes and cryptophytes is in compliance with Sindhuja et al.,2012 and;Ahmad et al.,2013;Kharkwal et al.,2013;Kai,2013; Nasir et al.,2016; Sahu and Barik,2017). In the present investigation, Hemicryptophytes and Cryptophytes showed maximum divergence among the study sites. The phyto-spectrum of the present study shows variation from the normal biological spectrum of Raunkiaer(1934;Fig.2).The present name of Mussoorie is due to shrub Coriaria nepalensis,which is very dominant species , stands in class E of frequency(81-100%) and the Presence of Constance is in class 5.The predominant species found in Mussoorie quadrats is Bichhu Buti(Utrica dioca) and the interesting point to note is co-existence of Utrica dioca with Polygonum,the natural medicine of the Bichhu Buti;a remarkable gift of nature to humankind. A steady decrease in Phanerophytes has been observed in this site.Quercus leucotrichophora(Banj) ,lifeline for the local inhabitants ,due probably to their capability to satisfy day to day requirements(Fuelwood,fodder&timber). A sudden decline of Oak(banj)trees is due to complex interaction of looping,pests,chronic &environmental stress.The decline of banj tree is of great concern due to its vital role in soil conservation and landslide hence, the poor representation of phanerophytes in Mussoorie, indicates very adverse climatic conditions to support this type of life forms and also effect under-storey shrubs(Coriaria nepalense,Daphne papyraceae, Mahonia

nepalense Sarcococca saligyne).The Grewia optiva(wonder tree) also shows its presence in all quadrats studied.The occurrence of Barberis apiculata in the region was an indicator of habitat degradation in the temperate region due to their thorny stem &unpalatable shoots(Tiwari et al.,2012).

However , dominance of phanerophytes in Chandigarh is expression of humid bio-climates(Al-Hawshabi et al.,2017). Hemicryptophytes and Cryptophytes did show appreciable change in their proportions in Chandigarh . But in Chandigarh scenario is completely different where the vegetation is thero-phanerophytic and the analysis of vegetation life form, reveals that 62% individuals belongs to phanerophytes followed by therophytes (16%), Chamephytes(12%) hemicryptophytes (5%), and cryptophytes (5%) which infer humid/tropical arid climate in Chandigarh(Jamir et al.,2006). The predominance of thero-phanerophytic unique to
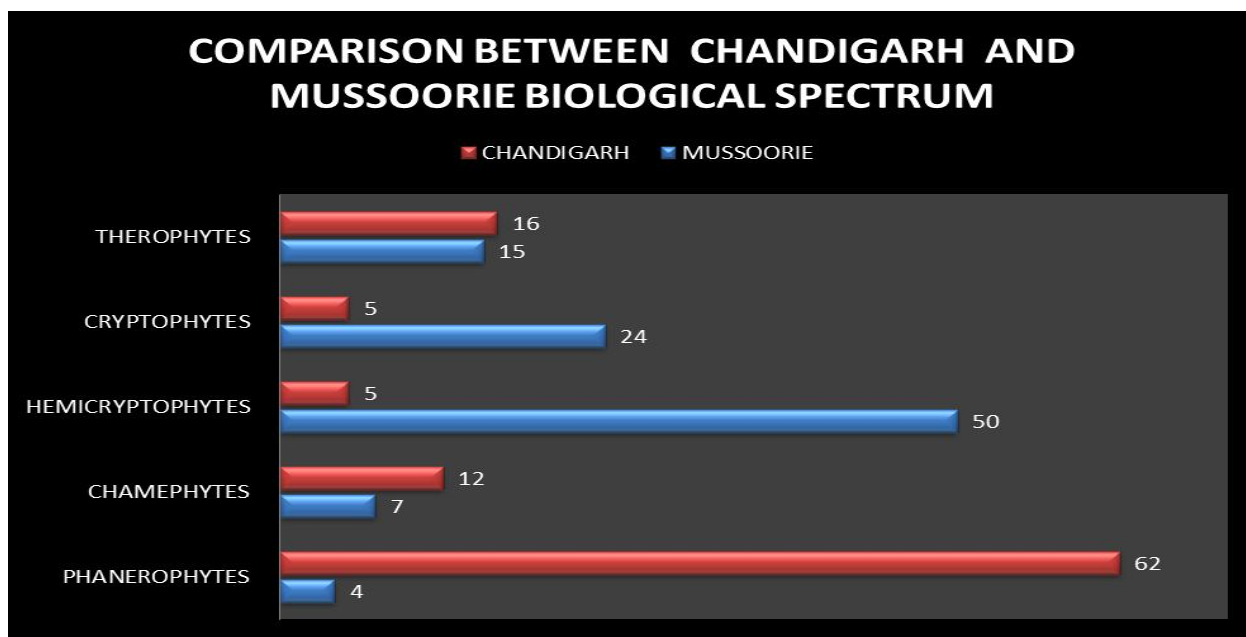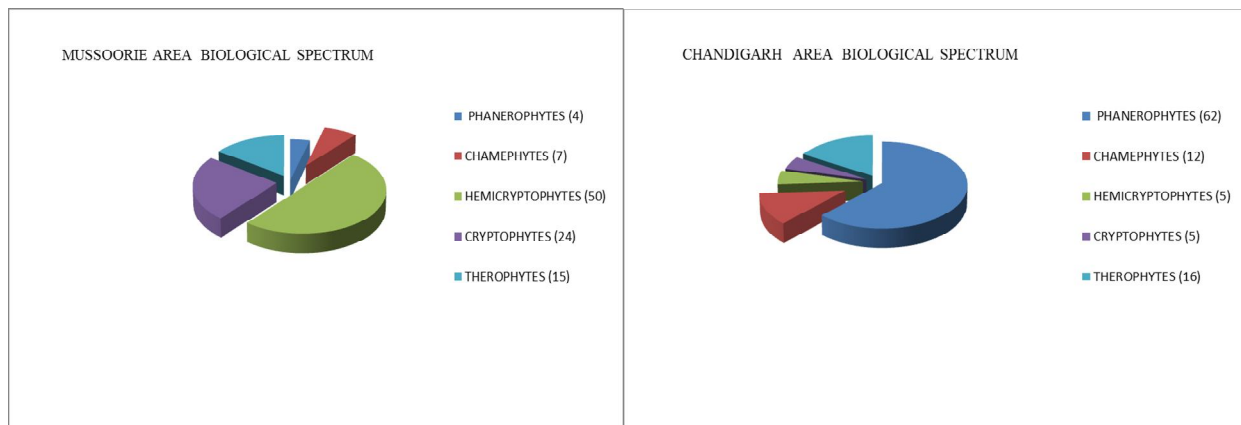

Fig2.Biological spectrum of Chandigarh and Mussoorie

arid and semi-arid regions attributed to the dry climate,topographic variation, hence the life form is the mani-festation of the adaptations of species to the climatic variations (Chauhan et al ,2014;Khan et al.,2014;Raina et al.,2014;Nasir et al.,2016;Sahu and Barik,2017) . The increased density and abundance of Ageratum conyzoides poses a threat to native species and results in the decrease of the biomass, diversity and ecological indices (Dogra et al.,2009).The dominant life forms in biological spectrum of a region indicate the phytoclimate of that region (Sharma et al. 2014, Thakur 2015, ;Bhattacharjya and Sarma,2016;Nasir et al.,2016;Al-Hawshabi et al.,2017). The life-forms are mirror reflection of area bio-climate(Meher-Homji ,1964) .

Floristic spectra are taken into account all the species regardless of their frequency and abundance. Vegetation biological spectra consider the dominance of species populations. In Chandigarh(Kansal) ,it is interesting fact that earlier the Dominant species is Eucalyptus but now the species is masked with the presence of weeds like Adhatoda vasica , Ageratum conyzoides,Cannabis sativa and Lantana. Camara.These species shows maximum frequence, Adundance ,density and Presence & Constance .

Table 1:List of Genera/species present in Mussoorie

QUADRATS

S.No	Spp.	I	II	III	IV	V	VI
1	Berberis apiculata	2	2	1	2	2	3
2	Capsella bursa-pastoris	4	4	6	-	-	-
3	Cedrus deodara	-	-	-	-	6	6
4	Clematis grata/connata	17	6	-	-	-	-
5	Coriaria nepalensis	25	35	28	38	50	40
6	Cupressus torulosa	2	2	1	2	2	3
7	Geranium nepalense	5	-	-	-	-	-
8	Gravelia robusta	4	2	1	2	1	2
9	Grewia optiva(Bhimal)	2	4	1	4	2	2
10	Mahonia napelense	4	6	4	2	2	2
11	Pinus roxburghii	-	-	-	2	-	-
12	Pinus wallichiana	-	2	-	-	-	2
13	Podocarpus gracilior	2	1	1	2	2	3
14	Polygonum capitatum	20	20	25	16	13	15
15	Pteris biavrita	-	3	3	8	10	2
16	Quercus leucotrichophora	2	2	2	2	2	5
17	Urtica dioca	20	22	28	20	15	16
18	Viola canescens	6	4	6	4	2	2

TABLE2:List of Genera/species present in Chandigarh (Kansal forest area)

QUADRATS

S.No	Species	I	II	III	IV	V	VI
1	Adhatoda vasica	15	-	-	20	30	-
2	Ageratum conyzoides	-	40	48	15	13	10
3	Alstonia scholaris	-	8	-	-	-	-
4	Bambusa vulgaris var.striata	-	-	-	-	2	-
5	Bombax ceiba(Salmalia)	-	10	-	-	-	-
6	Bouganvillea spectabilis	-	15	-	-	-	10
7	Callistemon viminalis	50	-	-	-	-	48
8	Cassia fistula	-	15	-	-	-	-
9	Cannabis sativa	10	-	10	48	27	-
10	Eucalyptus umbellate var.pruiniflora	20	4	6	4	10	4
11	Lantana camara	-	7	20	4	-	10
12	Murraya koenigii	-	-	6	7	8	6
13	Phoenix sylvestris(Date-palm)	5	1	-	-	-	10
14	Zizyphus jujoba(Ber)	4	1	5	6	4	4

IV. CONCLUSION

It is concluded that vegetation biological spectrum more accurately describes the vegetation physio-gnomy of the site. The differential pattern of rainfall appears as most operative factor as compared to biotic factors

for evaluation of biological spectrum. The present study also conclude that vegetation biological spectrum is considerable at all scales and provides a clear picture of prevailing climate and are mirror image of floristic composition and phytoclimate of the area and a general pattern of decline in monotonic species was observed with increase elevation.

V. ACKNOWLEDGEMENT

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