



Floristic composition, lifeform classification and biological spectrum of district Jammu, Jammu and Kashmir, North - Western Himalayas

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Abstract

The present study was carried out in the Jammu district which revealed the presence of 395 plant species belonging to 302 genera and 93 families. Fabaceae has been recorded as the largest family (25 genera / 42 species) followed by Asteraceae (24/29), Poaceae (21/23), Labiatae (12/17), Euphorbiaceae (9/16), Verbenaceae (9/10) etc. Thirty five families show monotypic representation in the area. 90.21% of the whole flora is represented by Dicots. The genus-species ratio has been evaluated as 1:30. The species when compared to Raunkiaer's life form system (1934) reveal the preponderance of therophytes (38.23%) followed by phanerophytes (19.50%) thus indicating thero-phanerophytic type of phytoclimate.

Keywords: *Biological spectrum, Floristic composition, Life forms, Phytoclimate, Phanerophytes,*

Introduction

The climate determines the type of plants that can exist in each region and the individuals of each species in a community can be grouped into various lifeforms based upon their physiognomic appearance and growth performance. Biological spectrum is formed when all species of the higher plants of a community are classified into lifeforms and their ratio is expressed in numbers or percentage. Biological spectra are useful in comparing geographically widely separated plant communities and are also regarded as indicators of biotic interaction, climate and habitat deterioration. Since different systems have been devised by many ecologists for the description and classification of plant life forms (Warming, 1909; Dansereau, 1957; Ellenberg and Muller-Dombois, 1974; Box, 1981), the Raunkiaer (1934) system is

the most accepted which is based upon the principle of position and degree of protection of the buds during adverse conditions. The Raunkiaer's Normal spectrum prepared for the phanerogamic flora of the whole world is still widely being used for comparing biological spectra of different regions. Generally, a complete list of plants called floristic composition and their life-forms defines the appearance of plant community. Since structure and rate of change of composition are sensitive indicators of whole environment, it is important to study the floristic composition and lifeforms of different plants to find phytoclimate of the area. In Jammu and Kashmir several workers have studied the floristic composition and biological spectra of different areas. This includes the works of Sapru (1975), Kaul and Sarin (1976), Kapur (1982), Dhar and Kaul (1986), Kumar (1987), Singh and Kachroo (1994), Kumar (1997), Kour (2001), Singh (2002), Kesar (2002), Dutt (2005), Jhangir (2004) etc. However, the work on this aspect for the erstwhile Jammu district has not been done so far.

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Study area

The data has been recorded from the Jammu district (latitude 32°27' to 33°50' N and longitude 74°19' to 75°20' E) covering a total area of 2942 km², comprised of five tehsils including the newly carved out Samba district. Physiographically the area is divided into Jammu foothills comprising low hills embracing features ranging from pine clad slopes to practically bare almost flat topped hillocks and gentle slopes made up of boulder mass supporting dry and thorny vegetation. The level land comprised of Chenab-Ravi plains occupies more than half the geographical area of the region. The area situated in the sub-tropical part has markedly periodic climate characterized by dry and increasingly hot season during May-July, to dry and cold season during December-January. The normal annual rainfall is 1115 mm, 75% of which is received during monsoon months. The area is criss-crossed by a number of seasonal and perennial rivers and streams, the main being River Chenab, River Tawi, Munnawar Tawi, Balole nallah, Basantar nallah etc. The altitude of the area varies from 320 m to 1034m above msl.

Materials and Method

Exhaustive field investigations have been carried out in study area during different seasons for three years for the assessment of plant diversity and floristic composition for angiosperms and gymnosperms only. The plant species were photographed and accordingly identified using local herbaria, flora and relevant literature available for the region. Utmost care was taken during survey and enumeration to avoid disturbance to flora and fauna. Biological spectrum of the flora based on the life forms was prepared by following Raunkiaer (1934) life form classes based upon the location of perennating buds. After having assigned a life form to all plants, Raunkiaer's biological spectrum was calculated as follows:

$$\text{Biological Spectrum} = \frac{\text{No. of sps. falling in particular form class}}{\text{Total no. of all the species for that community /stand}} \times 100$$

Results and Discussion

The forests of Jammu district represent typical subtropical vegetation. The lower altitudinal zonation is dominated mainly by shrubs with a few scattered patches of broad leaved trees. On moderate elevation these shrubs found to be mixed with broad leaved and Chir-pine communities, while at higher elevations are dominated exclusively by Chir-Pine communities. The forests of Jammu district have been divided into three types in accordance with the classification made in revised summary of Forest types of India by Champion and Seth (1968). These are 5B/C2 – Northern dry mixed deciduous forests; 9/C1/DS1 – Himalayan sub-tropical scrub, and 9/C1a – Himalayan sub-tropical pine forests.

Dominant tree species found in the area comprise of *Mallotus philippensis*, *Cassia fistula*, *Acacia modesta*, *Acacia catechu*, *Zizyphus mauritiana*, *Dalbergia sissoo*, *Lannea coromandalica*, *Syzigium cumini*, *Grewia optiva*, *Albizia lebbeck*, *Pinus roxburghii*, *Phyllanthus emblica* etc. The understory is prominently represented by *Lantana camara*, *Carissa opaca*, *Dodonaea viscosa*, *Murraya koenigi*, *Woodfordia fruticosa*, *Colebrookia oppositifolia*, *Punica granatum*, *Justicia adhatoda*, *Rubus ellipticus*, *Mimosa rubicaulis*, *Zizyphus oxyphylla*, *Randia tetrasperma*, *Capparis sepiaria* etc.

Among the climbers, *Phanera vahlii* and *Caesepinia decapatela* the two conspicuous lianas, climb mostly on the broad leaved trees and sometimes even up to the height of 25 metres on chirpine trees. Other climbers typical of these hills are *Tinospora cordifolia*, *Aspidopterys wallichii*, *Abrus precatorius*, *Vallaris solanacea*, *Cryptolepis buechanani*, *Hiptage benghalensis*, *Clematis gouriana*, *Porana paniculata*, *Dregea volubilis*, *Cissampelos pariera*. *Dendrophthoe falcata* and *Cuscuta reflexa* are the only hemiparasite / parasite found in the region.

The analysis of the data further revealed that the ratio of family to genera is 1: 3.24; family to species is 1: 4.24, and, genera to species are 1:1.30. The ratio of genera to species which reflects the floristic pattern in given time and space is lower than that derived for British India 1



: 7 (Hooker, 1872-97); India alone - 1 : 6 (Chatterjee, 1939); Valley of flowers - 1 : 4.3 (Kala and Rawat, 2004); Himachal Pradesh - 1 : 2.93 (Chowdhry and Wadhwa, 1984); Bashar Himalayas - 1 : 2.29 (Aswal and Mehrotra, 1994) Shimla - 1: 20 (Collet, 1902); Great Himalayan National Park - 1 : 1.94 (Singh and Rawat, 2000), Kullu - 1: 1.84 (Dhaliwal and Sharma, 1999),

Kangra - 1 :1.72 (Kapur, 1985), Mussourie - 1: 1.87 (Raizada and Saxena, 1978), Sirmour - 1: 1.65 (Kaur and Sharma, 2004). The ratio tends to match with the flora of Renuka Wildlife Sanctuary - 1 : 1.30 (Subramani *et al.*, 2007); Trikuta Hills - 1 : 1.42 (Kapur and Sarin, 1990), Patnitop and adjoining areas - 1:1.44 (Kumar, 1997) Trikuta Hills - 1:1.42 (Kour, 2001).(Table.1)

Table-1 Comparison of dominant families of District Jammu with adjoining areas of the state and with India

District Jammu (Authors)	Jammu (Sharma and Kachroo, 1981)	Patnitop Hills (Kumar, 1997)	Bhaderwah (Kumar, 1987)	Neeru watershed Bhaderwah (Dutt, 2005)	Trikuta Hills (Kour, 2001)	India (Hooker, 1872-97)
Fabaceae	Fabaceae	Asteraceae	Asteraceae	Asteraceae	Asteraceae	Orchidaceae
Asteraceae	Poaceae	Labiatae	Poaceae	Labiatae	Fabaceae	Fabaceae
Poaceae	Asteraceae	Poaceae	Apiaceae	Apiaceae	Poaceae	Poaceae
Labiatae	Cyperaceae	Fabaceae	Labiatae	Ranunculaceae	Labiatae	Rubiaceae
Euphorbiaceae	Scrophularaceae	Roasaceae	Ranunculaceae	Roasaceae	Euphorbiaceae	Euphorbiaceae
Convolvulaceae	Labiatae	Ranunculaceae	Cruciferae	Cruciferae	Scrophularaceae	Acanthaceae

As per the available records, the percentage of dicots and monocots species in the world flora is 81.3% and 18.7%, respectively. Different studies carried out in the different parts of Jammu by Kour (2001), Kumar (1987), Kumar (1997) and Singh (2002) have reported higher percentage of

dicots. The present study also revealed the higher percentage of dicots (90.21%) from the study area. The ratio of the monocot to dicot families have been recorded as 1: 9.22, of genera 1:7.60 and of species 1:9.37, respectively (Table. 2).

Table-2 Percentage and ratios of the families, genera and species of dicots and monocots (excluding family Pinaceae and genera / species thereof).

Taxa	Dicots		Monocots		Total	Ratio	
	Total number	% age	Total number	% age		Monocots	Dicots
Families	83	90.21	09	9.79	92	1	9.22
Genera	266	88.37	35	11.63	301	1	7.60
Species	356	90.35	38	9.65	394	1	9.37



The number of different life forms has been given for each family on the basis of study of 395 species. The species belonging to different families have been arranged in nine broad life forms as depicted in Table - 3. When compared to Raunkiaer's normal Biological spectrum, the biological spectrum of study area shows that hemicryptophytes, nano phanerophytes, macro phanerophytes and geophytes reveal a lower percentage, whereas therophytes, hemi - cryptophytes and chameophytes showed higher percentage. Rest of the life forms revealed minor deviation from the normal spectrum (Table.4). The higher percentage of therophytes (38.23%) occurring in the area is the characteristics of

subtropics and often related to soil conditions and climate (Subramani *et al.* 2007). Moreover, the predominance of therophytes is also attributed to the introduction of annual weeds, biotic influences like agricultural practices and grazing, deforestation and trampling *etc.* (Sher and Khan, 2007; Mohammad and Sher, 2010). Macro-phanerophytes (19.49%) occupying the second position reveals the predominance of trees as the area falls in Shiwaliks which provides congenial edaphic and climatic conditions for the growth of overstorey. A bit lower percentage of nanophanerophytes (9.37%) may be attributed to ground disturbances like grazing, forest fires, encroachments *etc.*

Table .3: Number of life forms in different families of district Jammu

Family	Ph							Ch	H	Cr		Th
	MMM	MM	M	N	L	P	E			G	HH	
Fabaceae	-	1	3	2	2	-	3	5	3	-	-	26
Asterceae	-	-	-	-	-	-	-	3	1	1	-	23
Poaceae	-	-	-	-	-	-	-	15	3	-	1	5
Labiatae	-	-	-	2	-	-	-	2	5	-	1	7
Euphorbiaceae	-	1	4	4	-	-	-	-	1	-	-	7
Convolvulaceae	-	-	-	-	1	-	3	2	3	-	-	2
Acanthaceae	-	-	1	1	-	-	-	5	-	-	-	3
Solanaceae	-	-	-	1	-	-	-	1	-	-	-	8
Verbanaceae	-	-	3	3	-	-	-	-	-	-	-	5
Mimosaceae	-	4	3	1	-	-	-	-	-	-	-	-
Rubiaceae	-	1	3	2	-	-	-	-	-	-	-	3
Amranthaceae	-	-	-	1	-	-	1	-	3	-	-	4
Caesalpiniaceae	-	-	3	-	3	-	-	-	-	-	-	2
Scrophulariaceae	-	-	-	-	-	-	-	1	-	-	-	8
Moraceae	1	3	4	-	-	-	-	-	-	-	-	-
Cucurbutaceae	-	-	-	-	-	-	2	-	-	-	-	2
Apocynaceae	-	-	2	2	2	-	-	-	-	-	1	-
Malvaceae	-	-	1	2	-	-	-	-	-	-	-	3
Rosaceae	-	-	1	2	-	-	1	1	1	-	-	-
Liliaceae	-	-								4	-	-
Cruciferae	-	-	Floristic composition, lifeform classification							-	-	4
Asclpiadaceae	-	-	-	-	4	-	1	1	-	-	-	-
Boraginaceae	-	-	-	-	-	-	-	1	1	-	-	3



Ranunculaceae	-	-	-	-	-	-	1	-	-	-	-	2
Tiliaceae	-	-	2	-	-	-	-	-	-	-	-	3
Rhamnaceae	-	1	1	1	-	-	-	1	-	-	-	-
Polygonaceae	-	-	-	-	-	-	-	1-	-	-	-	3
Capparidaceae	-	-	-	2	-	-	-	-	-	-	-	1
Flacourtiaceae	-	-	3	-	-	-	-	-	-	-	-	-
Caryophyllaceae	-	-	-	-	-	-	-	-	1	-	-	3
Rutaceae	-	1	1	1	-	-	-	-	-	-	-	-
Celastraceae	-	2	1	-	2	-	-	-	-	-	-	-
Anacardiaceae	-	3	-	-	-	-	-	-	-	-	-	-
Apiaceae	-	-	-	-	-	-	-	-	1	-	-	1
Loganiaceae	-	-	1	-	-	-	-	1	-	-	-	1
Bignoniaceae	-	1	1	-	-	-	-	1	-	-	-	1
Chenopodiaceae	-	-	-	-	-	-	-	-	-	-	-	3
Cyperaceae	-	-	-	-	-	-	-	-	2	-	-	-
Menispermaceae	-	-	-	-	-	-	1	1	-	-	-	-
Nymphaeaceae	-	-	-	-	-	-	-	-	-	-	1	-
Violaceae	-	-	-	-	-	-	-	-	2	-	-	-
Linaceae	-	-	-	-	-	-	-	1	-	-	-	1
Malpighiaceae	-	1	1	-	1	-	-	-	-	-	-	-
Geraniaceae	-	-	-	-	-	-	-	1	-	-	-	-
Oxalidaceae	-	-	-	-	-	-	-	1	-	-	-	-
Meliaceae	-	2	-	-	-	-	-	-	-	-	-	-
Vitaceae	-	-	-	1	-	-	1	-	-	-	-	-
Sapindaceae	-	-	-	1	-	-	1	-	-	-	-	-
Combretaceae	-	2	-	-	-	-	-	-	-	-	-	-
Myrtaceae	-	1	1	-	-	-	-	-	-	-	-	-
Lythraceae	-	-	-	1	-	-	-	-	-	-	1	-
Onagraceae	-	-	-	-	-	-	-	-	-	-	-	2
Primulaceae	-	-	-	-	-	-	-	-	1	-	-	1
Ehretiaceae	-	-	2	-	-	-	-	-	-	-	-	-
Nyctaginaceae	-	-	-	-	-	-	-	1	-	-	-	1
Dioscoreaceae	-	-	-	-	-	-	-	-	-	2	-	-
Commelinaceae	-	-	-	-	-	-	-	-	-	-	-	2
Portulacaceae	-	-	-	-	-	-	-	-	-	-	-	2
Papaveraceae	-	-	-	-	-	-	-	-	-	-	-	1
Fumariaceae	-	-	-	-	-	-	-	-	-	-	-	1
Pittosporaceae	-	1	1	-	-	-	-	-	-	-	-	-



Floristic composition, lifeform classification

Polygalaceae	-	-	-	-	-	-	-	-	-	-	-	1
Bombacaceae	-	1	-	-	-	-	-	-	-	-	-	-
Sterculiaceae	-	-	-	1	-	-	-	-	-	-	-	-
Leeaceae	-	-	1	-	-	-	-	-	-	-	-	-
Moringaceae	-	-	1	-	-	-	-	-	-	-	-	-
Punicaceae	-	-	-	1	-	-	-	-	-	-	-	-
Begoniaceae	-	-	1	-	-	-	-	-	-	-	-	-
Campanulaceae	-	-	-	-	-	-	-	-	-	-	-	1
Sphenocleaceae	-	-	-	-	-	-	-	-	-	-	-	1
Plumbaginaceae	-	-	-	-	-	-	-	-	-	-	-	1
Myrsinaceae	-	-	-	1	-	-	-	-	-	-	-	-
Ebenaceae	-	-	1	-	-	-	-	-	-	-	-	-
Oleaceae	-	-	-	1	-	-	-	-	-	-	-	-
Gentianaceae	-	-	-	-	-	-	-	-	1	-	-	-
Cuscutaceae	-	-	-	-	-	2	-	-	-	-	-	-
Marytyniaceae	-	-	-	-	-	-	-	-	-	-	-	1
Plantaginaceae	-	-	-	-	-	-	-	-	1	-	-	-
Loranthaceae	-	-	-	-	-	2	-	-	-	-	-	-
Ulmaceae	-	-	1	-	-	-	-	-	-	-	-	-
Cannabaceae	-	-	-	-	-	-	-	1	-	-	-	-
Urticaceae	-	-	-	1	-	-	-	-	-	-	-	-
Zingiberaceae	-	-	-	-	-	-	-	-	-	1	-	-
Pontedericeae	-	-	-	-	-	-	-	-	-	-	1	-
Typhaceae	-	-	-	-	-	-	-	1	-	-	-	-
Arecaceae	-	-	1	-	-	-	-	-	-	-	-	-
Potamogetonaceae	-	-	-	-	-	-	-	-	-	-	1	-
Pinaceae	-	1	-	-	-	-	-	-	-	-	-	-
Agavaceae	-	-	-	1	-	-	-	-	-	-	-	-
Zygophyllaceae	-	-	-	-	-	-	-	-	-	-	-	1
Caprifoliaceae	-	-	-	-	-	-	-	-	1	-	-	-
Molluginaceae	-	-	-	-	-	-	-	-	1	-	-	-
Pedaliaceae	-	-	-	-	-	-	-	-	-	-	-	1
Total (395)	1	27	49	37	15	4	16	47	33	8	7	151



Table . 4. Biological spectra and phytoclimate of some parts of North-West Himalayan region based on sub life form classes

Region / Phytoclimate	MMM	MM	M	N	Ch	H	G	HH	Th	L	P	E
Normal Spectrum (Raunkiaer, 1934)	-	-	28.00	15.00	9.00	26.00	4.00	2.00	13.00	-	-	3.00
Trikuta Hills (Kapur and Sarin, 1985) Thero- chameophytic	-	-	9.44	14.45	22.94	13.87	4.62	1.73	31.02	1.55	0.19	0.19
Trikuta Hills (Kour, 2001) Thero- hemicryptophytic	-	-	21.68	11.67	13.30	24.00	7.73	3.09	26.01	1.03	-	3.00
Chamba District (Sharma and Singh, 1995) Thero-cryptophytic	0.30	3.30	4.41	8.12	4.71	15.03	16.94	2.81	39.28	4.11	-	1.00
Renuka Wildlife Sanctuary (Subramani <i>et al</i>, 2007)	0.52	12.34	16.54	19.16	7.61	5.51	2.10	3.41	31.24	0.79	0.52	0.26
Neeru Watershed (Bhaderwah) (Dutt, 2005) Thero- hemicryptophytic	-	-	9.27	7.73	16.49	26.28	7.73	3.09	26.80	0.51	-	2.06
Bhaderwah forests (Kumar ,1987) Thero- hemicryptophytic	-	-	6.35	6.14	11.5	37.10	4.50	3.30	29.30	1.43	-	0.40
Patnitop forests (Kumar ,1997) Thero- hemicryptophytic			10.4	8.5	15.2	26.4	3.5	3.2	29.8	2.6	-	0.2
Kathua district (Jhangir ,2004) Thero- phanerophytic	-	-	16.63	12.79	12.36	15.77	2.55	1.27	32.89	5.11	-	0.63
Jammu district Thero- phanerophytic (Present study)	0.25	6.84	12.40	9.37	11.90	8.35	2.02	1.78	38.23	3.80	1.01	4.05

MMM – Megaphanerophyte, MM – Mesophanerophyte, M – Microphanerophytes, N – Nanophanerophyte, Ch – Chamaephytes, G – Geophyte, HH – Hydrophyte and Halophyte, H – Hemicryptophyte, Th – Therophyte, P – Parasite, L – Liana and E – Epiphyte.



On the basis of the present study phytoclimate of the area, as per the Raunkiaer terminology, may be described as thermo-phanerophytic. The therophytes are plants of warm and dry climate and phanerophytes of warm and moist climate. The climate of the study area in general is warm and dry during summers and warm and moist during rainy season, thus confirming the preponderance of therophytes and phanerophytes. Similar studies on phytoclimatic association have also been conducted by Sapru (1975), Kaul and Sarin (1976), Kapur (1982), Dhar and Koul (1986), Kumar (1987), Singh and Kachroo (1994), Kumar (1997), Kour (2001), Singh (2002), Kesar (2002), Jhangir (2004) and Dutt (2005) for Jammu and Kashmir state. The Biological spectra and phytoclimate of some areas of Jammu and Kashmir and other parts of north-west Himalayan region based on sub life form classes have been represented in Table.4.

Conclusion

The forests of Jammu district represent typical subtropical vegetation. During the floristic survey Fabaceae, Asteraceae, Poaceae and Labiatae have been found to be the dominant families in terms of genera to species ratio. On the basis of the present study, the phytoclimate of the area, as per the Raunkiaer terminology, has been described as thermo-phanerophytic.

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