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Biological Characteristics of plant species in Tehsil Takht-e-Nasrati, Pakistan

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Abstract

A record of plant species of tehsil Takht-e-Nasrati was organized on the source of field trips conducted in diverse parts during 2009 - 2010, for all intents and purposes in spring, summer and winter. The flora consisted of 161 plant species belonging to 57 families. The biological spectrum explains that therophytes (77 spp., 47.83%), phanerophytes (40 spp., 24.85%), hemicryptophytes (30 spp., 18.63%), chamaephytes (11 spp., 6.83%), cryptophyte (03 spp., 1.86%) had rate in the investigated area. Leaf spectra of plants consisted of microphylls (52.8%), nanophylls (19.88%), megaphylls (18.01%) and leptophylls (9.32%). The study brings a conclusion that the preeminence of therophytes in the investigated area was beneath deep biotic stress and dry condition.

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Introduction

The life form spectra are supposed to be the signal of micro and macroclimate (Shimwell, 1971). Leaf size classes have been set up to be very positive for plant links. The leaf size knowledge may help out in the accepting of physiological processes of plants and plant communities (Oosting, 1956). Life form and leaf size spectra indicates climatic and creature fracas of a particular area (Cain & Castro, 1959). The life form and leaf size spectra are significant physiognomic feature that comprise generally in vegetation studies. Disturbances can have an unfathomable outcome on life forms, phenology and distribution of plant populations. Disturbances caused by man and animals such as fire, scraping and profound grazing frequently reappear within the life period of a plant life and may comprise significant constituent of its life cycle (Agrawal 1989). Literature dealing with the life form and leaf size spectra of Pakistan shows that very little work has been made (Malik, *et al*., (2007), Perveen, *et al*., (2008), Hadi, *et al*., (2009), Abbas, *et al*., (2010), Qureshi & Ahmad, (2010) and Khan, *et al*., 2011). No attempt has been made on the biological characteristics of research area to explain the plant ecology. The current revised was carried out to collect information about biodiversity of the region and its biological characteristics.

Materials and methods

The study area was thoroughly surveyed during the year 2009 - 2010 from time to time to learn the botanical and biological situation. It presents a prospect to compose plant compilation and field interpretation throughout the flowering and fruiting of maximum quantity of species. Plant specimens collected from the area were dried and preserved. They were identified from first to last available literature Nasir & Ali, (1971-1995) and Ali & Qaisar, (1971-2006). These plant specimens were submitted to the Herbarium, Department of Botany, University of Peshawar, Pakistan. The plants were classified into different life form and leaf size classes as follows after Raunkiaer, (1934), Muller & Ellenberg, (1974) and Hussain (1989).

Location of the study area and physiography

Tehsil Takht-e-Nasrati is situated at 32.47° to 33.28° North and 70.30° to 71.30° East. The research area is bounded by Tehsil Karak on the North East, district Mianwali on the East, district Lakki Marwat on the South West and Tribal area adjoining district Bannu on the West. The total area of Tehsil is about 613.66 Sq. kilometer. Majority of the area consist rigged dry hills and rough field areas i.e. 323.97 Sq. kilometers. Agriculture land is about 289.7 Sq. kilometer. The major income source of the area is agriculture, which is rain depended. Tehsil is situated at 340 m above the sea level.

Climate

The area is located in semi-arid climatic region, having hot summer and very cold winter. Three distinct seasons' i.e. rainy, winter and summer are definitely noticeable. In the year 2001 - 2010 the mean maximum temperature was 39.5° C, in the month of the June, where as the mean minimum temperature was as low as 4.26° C, in the month of January, recorded on District level. The rainfall is scanty and uncertain. Winter rains are generally of long duration and of low intensity. Summer monsoon rains are torrential in heavy shore intensity. In the year 2001 - 2010, 121.6mm of rainfall per 10 year was recorded on district level. The climate and weathers are also influenced by wind. In hottest months especially June swivel winds are developed on the plain area at after noon due to local heating. Sometimes strong, dry and hot winds with huge dust enter the area from different sides. Maximum wind velocity 5.5 km/h is recorded in June during summer and minimum 2.9 km/h in January during the rainy season. Highest humidity 77.51was recorded at 08.30 h during September while lowest 29.42 % during April (Table. 1).

Table 1. Climatic data of Tehsil Takht-e-Nasrati for the year 2001-2010

Months	Temperature (C°)		Humidity (%)		Rainfall (mm)	Soil temperature (C°) Average	Wind speed (Km Per Hour)
	Max	Min	Max	Min			
January	19.18	4.26	75.80	35.24	27.43	7.03	2.9
February	21.69	7.29	77.39	42.23	37.72	9.14	3.2
March	28.20	12.06	75.38	35.23	37.17	13.89	3.5
April	34.74	17.94	66.12	**29.42**	36.54	19.02	5.2
May	38.32	22.33	59.66	30.73	31.6	21.87	5.4
June	39.50	25.9	59.96	32.89	74.24	25.78	5.5
July	38.44	25.76	73.33	38.76	121.6	26.77	5.2
August	36.66	25.29	75.68	42.61	108.3	26.37	4.1
September	35.47	21.95	**77.51**	39.29	61.58	23.49	3.7
October	32.33	16.79	71.55	35.51	15.13	20.09	3.5
November	26.71	10.01	71.56	36.66	5.80	14.10	3.2
December	21.93	5.67	75.20	35.90	15.38	8.96	3.1
Mean	**31.1**	**16.27**	**71.57**	**36.21**	**47.71**	**18.04**	**4.04**

Results

The biological spectrum explains that therophytes (77 spp., 47.83%), hemicryptophytes (30 spp., 18.63%), phanerophyte (40 spp, 24.85%), megaphanerophytes (17 spp., 10.6%). nanophanerophytes (16 spp., 9.94%), microphanerophytes (4 spp, 2.48 %), parasite (3 spp, 1.86%) chamaephytes (11 spp., 6.83%), cryptophytes (Geophytes) (03 spp., 1.86%), had originated in the investigated area (Table. 2). Leaf spectra of plants consisted of microphylls (85 spp. 52.8%), nanophylls (32 spp. 19.88%) megaphylls (29 spp. 18.01%) and leptophylls (15 spp. 9.32%) (Table. 3).

Table. 2. Total number of species and percentage of life-form classes.

Life - form	Code	No of species	Percentage	
Phanerophyte	PP	40	-	24.85
Megaphanerophyte	MgP	17	10.6	-
Nanophanerophyte	NP	16	9.94	-
Microphanerophyte	MiP	04	2.48	-
Parasite	P	03	1.86	-
Chameophyte	CP	11	-	06.83
Therophyte	TP	77	-	47.83
Hemicryptophyte	HP	30	-	18.63
Cryptophyte	CP	03	-	01.86
Geophyte	GP	03	1.86	-

Table. 3. Leaf size classes in Tehsil Takht-e-Nasrati.

Leaf size class	Code	No of species	Percentage
Microphyll	MiP	85	52.8
Nanophyll	NP	32	19.88
Megaphyll	MeP	29	18.01
Leptophyll	LP	15	9.32

Discussion

The climate of a region is characterized by life form (Raunkiaer 1934). Plant species were mark out from Tehsil Takht-e-Nasrati and classified into major life forms to create biospectrum. Comparing geographically far and wide separated plant communities and as an indicator of prevailing environment, the biological spectra is helpful. Biological spectrum may be significantly changed due to preface of therophytes like annual weeds, biotic pressure like agricultural practices and grazing, deforestation and trampling etc. The dominance of therophytes in the study area indicated that the investigated area was under heavy biotic pressure due to deforestation and over grazing. Similar trend regarding prevalence of therophytes was observed by Hussain, *et al.,* (1997 a, b), Khan, *et al.,* (2011). Comparisons of the percentage of the life form classes of the research area with Raunkiaer standard biological spectrum, the therophyte form the largest life form class and their percentage is more than thrice (47.83%) that of the standard biological

spectrum (13.0%). The phanerophytes forms, the second highest class with (24.85%). Their percentage was 46.0 in the standard biological spectrum. Chamaphytes (6.83 %) had less than thrice their percentage in the standard biological spectrum (26.0%). Thus, the biological spectrum of the research area marker "Therophytic" Phytoclimate at the same time as this class proves the greatest deviation from the standard spectrum. Hemicryptophyte is twice (18.63 %) than in the standard biological spectrum (9.00 %). Cryptophytes was less percentage 1.86 than in the standard spectrum 6.00 (Table. 4). In this cram, the domination of therophytes and phanerophytes over other life forms give the impression to be a comeback with to the warm dried up weather, topographic discrepancy, human being and creature intrusion.

Table. 4. Comparison of biological spectrum of the area with Raunkiaer's Standard Biological Spectrum (SBS).

Spectrum	PP	CP	TP	HP	CP	Total
S.B.S	46.00	26.00	13.00	9.00	6.00	100
Current study	24.85	06.83	47.83	18.63	01.86	100
Deviation in Percentage	+21.15	+19.17	-34.83	-9.63	+4.14	00

The dominance of therophytes occurs due to un-favorable environment conditions as definite by a lot of research (Shimwell 1971; Malik & Hussain 1990, Khan *et al*., 2011). Qadir & Shetvy (1986) considered chamaephytes and therophytes as the major life form in unfavorable environment in desert region. In the investigated area arid conditions, low temperature in winter, high temperature in summer, wind and biotic factors result in un-favourable conditions paving way for therophyte. Saxina *et al.,* (1987) stated that hemicryptophytes dominated temperate zone in overlapping and loose continuum. The current results in this regard also agree with them. Therophytes endure in unfavorable condition during seeds production. The predominance of therophytes in variable conditions such as dry, hot or cold met for low to higher elevation might be the reason for their higher percentage in the present study.

The present study shows that leptophylls were high at the hilly area while microphylls and nanophylls were present in plain area. Species with large leaves take place in warmer wet climates while smaller leaves are characteristic of cold and arid climates and degraded habitats. A high percentage of microphylls might be due to dry climate in area. Leaf size spectrum of the plant revealed that microphyllous species followed by nanophylls species were dominant in the investigated area. Microphylls are usually characteristic of steppes while nanophylls and leptophylls are characteristic of hot deserts (Cain & Castro, 1959; Tareen & Qadir, 1993). The soil was poorly developed with thin sheet that banned root penetration. Furthermore, roots absorb low moisture and nutrients under dry conditions. In this region's the plant face drought during winter especially in dry soil. The species with microphyllous leaves were abundant due to ecological adaptation for these arid conditions. The present findings agree with those of Qadir & Tareen (1987) who reported high percentage of microphylls in the dry temperate climate of Quetta district. These data indicated that the percentage of various leaf form classes varied with increasing altitude. Saxina *et al.,* (1987) also observed that the percentage of microphylls was positively linked with the increasing altitude and this also hold up our findings. On the other hand in the tropical wet forest as reported by Dolph & Dilcher (1980 a, b) large leaved species were dominant. This disagreement is mainly due to climatic variation such as temperature and wet tropical condition. The situation in our case is far more xeric than in the wet tropics. The size of leaves alone could not be used to identify specific leaf zone or climates. Other features of plants such as habit and root system might also play important role in biodiversity.

Conclusion

In the current cram, the high percentage of therophyte is evidenced in the study region for the

reason that the region is semiarid zone of Khyber Pakhtonkhawa. The dominance of therophytes indicated that the investigated area was under heavy biotic pressure due to deforestation and over grazing. Most of the plants were uprooted for burning purposes and grazed by the livestock. Many plant species were decreasing in the area like *Monotheca buxifolia* and *Salvadora oleoides* and special care is needed for their plant life conservation. Further study is needed to quantify the data and suggest plans for the biodiversity and conservation of the area.

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References

Abbas H, Qaiser M, Alam J. 2010. Conservation status of *Cadaba heterotricha* stocks (capparaceae): an endangered species in Pakistan. Pak. J. Bot. **42(1),** 35-46.

Agrawal A K. 1990. Floristic composition and phenology of temperate grasslands of Western Himalaya as affected by scraping, fire and heavy grazing. Vegetatio **88**, 177-187.

Ali SI, Qaiser M. 1995-2006. Flora of Pakistan. Fakhri printing Press Karachi, Pakistan.

Cain SA, De Oliveria Castro GM. 1959. Manual of Vegetation Analysis. Harper & Brothers, New York.

Dolph GE, Dilcher DL. 1980a. Variation in leaf size with respect to climate in Costa Rica. Biotropica **12**, 91–9.

Dolph GE, Dilcher DL. 1980b. Variation in leaf size with respect to climate in the tropics of the Western Hemisphere. Bull. Torrey. Bot. Club **107,** 145–54.

Hadi F, Naseem M, Shah SM, Asadullah, Hussain F. 2009. Prevalence and ecological characteristics of summer weeds in crop and vegetable fields of Botanical Garden Azakhel, University of Peshawar, Pakistan. Pak. J. Pl. Sci. **15 (2),** 101-105.

Hussain F. 1989. Field and Laboratory Manual for Plant Ecology. Univ. Grants Commission, Islamabad.

Hussain F, Ilyas M, Takatsuki S. 1997a. Plant communities of Girbanr Hills, Swat district, northwestern Pakistan. Ecol. Rev. **23,** 247–60.

Hussain F, Khaliq A, Ilahi I. 1997b. Effect of altitude, aspect and biotic factor on the plant diversity of Dabargai Hills Swat, Pakistan. In: Mufti, S.A., C.A. Wood and S. Hassan (eds), Biodiversity of Pakistan: Pakistan Museum of Natural History Islamabad 169–79.

Khan M, Hussain F, Musharaf S, Imdadullah. 2011. Floristic composition, life form and leaf size spectra of the coal mine area vegetation of Darra Adam Khel, Khyber Pakhtonkhwa, Pakistan. Journal of Biodiversity and Environmental Sciences **1(3),** 1-6.

Malik ZH, Hussain F, Malik NZ. 2007. Life form and Leaf Size Spectra of Plant Communities Harbouring Ganga Chotti and Bedori Hills during 1999-2000. International Journal of Agriculture & Biology **9 (6),** 833-838.

Nasir E, Ali SI. 1970-1994. Flora of Pakistan. Fascicles. Karachi. Pakistan.

Oosting HJ. 1956. The Study of Plant Communities, 2nd edition, 69–78. W.H. Freeman and Co., Sanfrancisco.

Perveen A, Sarwar GR, Hussain I. 2008. Plant biodiversity and phytosociological attributes of Dureji (Khirthar range). Pak. J. Bot. **40(1),** 17-24.

Qureshi R, Ahmad M. 2010. Some notes on the vegetation of Achhro thar (white desert) of Nara region, Sindh, Pakistan. Pak. J. Bot. **42(5),** 2985-2994

Raunkiaer C. 1934. The life form of plants and statistical plant geography. The Clarendon Press,. Oxford, 632 p.

Shimwell DW. 1971. The Description and Classification of Vegetation Sedgwick and Jackson, p: 322. London.

Saxina AK, Pandey TP, Singh JS. 1987. Altitudinal variation in the vegetation of Kaumaun Himalaya. Perspective Env. Bot. 44–66.

Tareen RB, Qadir SA. 1993. Life form and Leaf size spectra of the plant communities of diverse areas ranging from Harnai, Sinjawi to Duki regions of Pakistan. Pak. J. Bot. **25 (1),** 83-92.