Global Journal Of Biodiversity Science And Management, 3(2): 276-281, 2013
ISSN 2074-0875

Life form and Floristic Characteristics Along Altitudinal Gradient of Humid Temperate Forests Located in Remote Area of Pakistan

[1]Mohib Shah, [2]Farrukh Hussain, [3]Syed Noor Muhammad Shah, [3]Imran Ahmad and [4]Humaira Wasila

[1]Department of Botany, Abdul Wali Khan University Mardan, KPK, Pakistan.
[2]Department of Botany, University of Peshawar, KPK, Pakistan.
[3]College of Horticulture, Northwest A & F University, China
[4]College of Food Science and Engineering, Northwest A & F University, China

ABSTRACT

The life form and floristic characteristics were evaluated in Chakesar valley, District Shangla during 2007-2011. The study showed that the valley supported 319 plant species belonging to 85 families and 215 genera. 75 families of dicotyledons have 178 genera and 276 species, while 5 families of monocotyledons have 26 genera and 30 species. Gymnosperms have only one family Pinaceae with 3 genera and 5 species. The pteridophytes have 8 genera belonged to 4 families. The fungi had only species *Morchellaescullenta.* Poaceae with 26 species followed by asteraceae (25 species), Papillonaceae & Rosaceae (each with 21 species), Moraceae (10 species), and Polygonaceae and Solanaceae (each with 9 species) were the leading families in terms of number of species.The biological spectrum of the flora of Chakesar Valley revealed that it is mainly shaped as therophytic vegetation, as there were 173 species (54.23%) therophytic species. The cryptophytes constituted 11.6%, chamaephytes 10.34%, microphanerophytes 10.03% and nanophanerophytes 6.3%. Mesophanerophytes, hemicryptophytes and megaphanerophytes contributed 3.5%, 2.5% and 1.6%, respectively. The area is mostly characterized by subtropical vegetation in the lower area while Kandao site (altitude 1900 meters to 2500 meter asl.) dominated by mesophanerophytes.

Key words: "Life form", "Leaf form", "Altitude", "Chakesar", "Shangla".

Introduction

Keeping in view the importance of rangelands in Chakesar valley, District Shangla, no review work has been done in the area. Overgrazing exploited the plant resources tremendously and it is evident along altitudinal gradients. Foothills experienced same situation. It is important to note that range lands in the district were over exploited and had greatly influenced the habitat and environmental conditions. A number of reviews showed that downward trend in the rangeland conditions (Hussain &Chaughtai, 1984; Durrani*et al.* 1996, 2005; Rasool*et al*., 2005, Ahmad *et al.,* 2009 and Durrani & Razaq, 2010). The study area has no meteorological station and data were recorded for three consecutive years in different seasons. The area showed tremendous variation in both climatic and edaphic characteristics which further varied the vegetation types in various aspects. The area touches the Basin of Indus River on one side but it also stretches to western extremities on the other side.

Materials and Methods

To prepare a complete floristic list,plants were collected during spring (April), summer (July & August) and winter (November & December) seasons from 2007 to 2011 in different parts of the valley. Plants were dried, tagged with localities, habitat informations and plant characteristics. They were preserved, and mounted on the standard herbarium sheets. Plants were identified with the help of Flora of Pakistan (Nasir& Ali, 1971-94; Ali &Qaiser, 1995-2010). The identification of the plants was further confirmed at the Herbarium, Department of Botany, University of Peshawar, Pakistan. The plants with voucher numbers were submitted to the Herbarium, Department of Botany, University of Peshawar, Pakistan. A complete alphabetical floristic list of species along with families and ecological characteristics were made. Plants were classified into various life form classes after Raunkiaer (1934) and Hussain (1989).Raunkiaer Biological spectrum of the flora was calculated using the following formula.

$$\text{Raunkiaer,s Biological Spectrum} = \frac{Number\ of\ species\ of\ a\ particular\ life\ form\ class}{Total\ number\ of\ all\ species\ in\ a\ stand} \times 100$$

Corresponding Author: Mohib Shah, Department of Botany, Abdul Wali Khan University Mardan, KPK, Pakistan.
E-mail: mohibshah1@gmail.com / mohibshah@yahoo.com

Glob. J. Biodivers. Sci. Manag., 3(2): 276-281, 2013

Plants were also classified into different leaf size classes, after Raunkiaer (1934).Raunkiaer (1934) Leaf size spectrum was determined as followings.

$$\text{RaukiarianLeaf Size Spectrum} = \frac{Number\ of\ species\ of\ a\ particular\ life\ form\ class}{Total\ number\ of\ all\ species\ in\ a\ stand} \times 100$$

For rapid determination of leaf sizes of plants in the field, Raunkiaer (1934) diagram was used.

Results and Discussion

A considerable importance in ecological work has been given to floristic composition and its characteristics as it is necessary to know species that make the vegetation. The floristic composition is simply a list of the species and its ecological features.

The present study identified a total of 319 plant species including one valuable mushroom *Morchella*. These belonged to 85 families and 215 genera. There are 75 families of dicotyledons having 178 genera and 276 species. Monocotyledons have 5 families, 26 genera and 30 species. Gymnosperms have only one family Pinaceae (1.6%) with 3 genera and 5 species. It includes *Abiespindrow* Royle, *Piceasmithiana* (Wall.) Boiss. *Pinusgerardiana* Wall.ex Lamb. *Pinusroxburghii* Sargent and *Pinuswallichiana* A.B. Jackson. The pteridophytes have 8 genera and 8 species within 4 families. The fungi have only species *Morchellaesculenta* Pers. Ex Fr. As a whole Poaceae (26 species), Asteraceae (25 species), Lamiaceae (23 species), Papilonaceae & Rosaceae (each with 21 species), Moraceae (10 species), and Polygnaceae and Solanaceae (each with 9 species) were the leading families in terms of number of species (Figure 3).

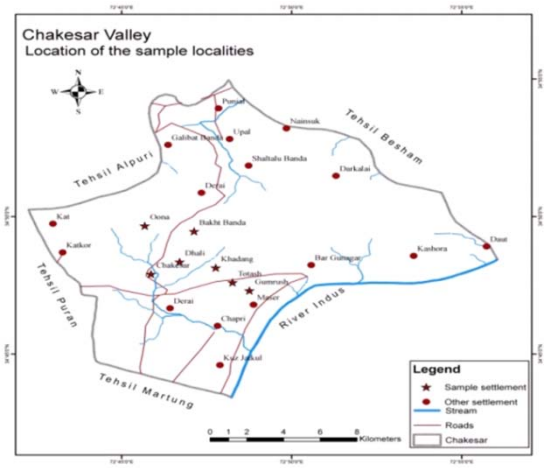

Fig. 1: Chakesar Valley, Location of the Sample Site.

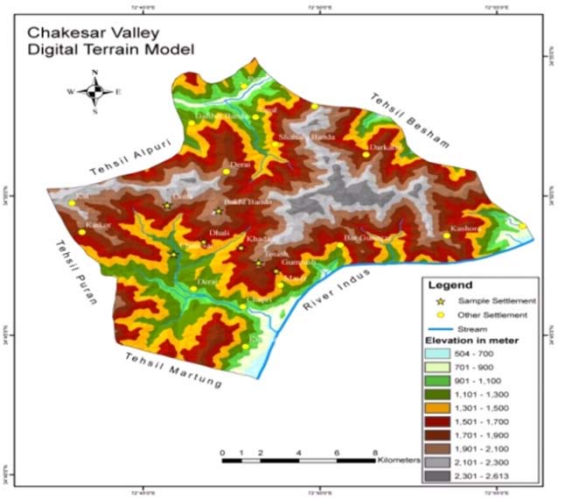

Fig. 2: Chakesar Valley, Digital Terrain Model.

Glob. J. Biodivers. Sci. Manag., 3(2): 276-281, 2013

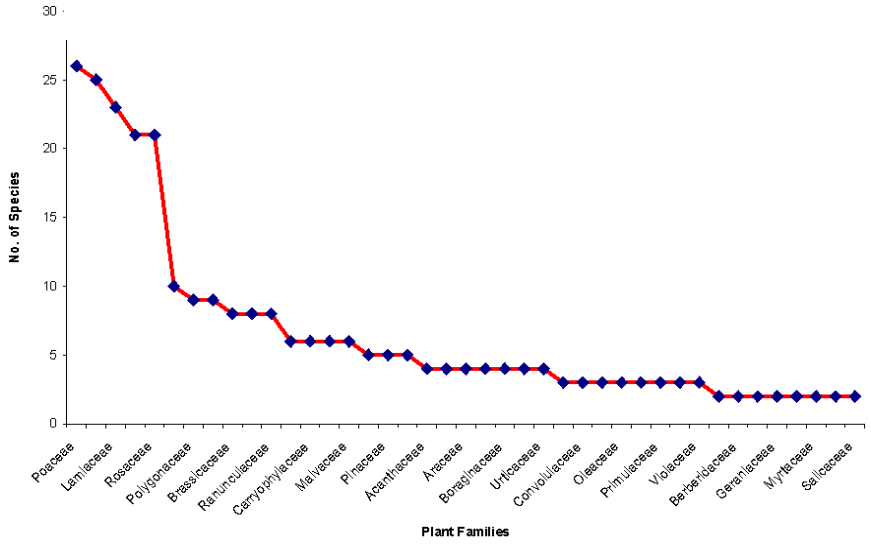

Fig. 3: Plant families sharing floristic composition of the Chakesar valley, Shangla, Pakistan.

Among dicotyledons, Asteraceae was the leading family with 25 species (7.8%), followed by Lamiaceae (23 sp; 7.7%), Papillionaceae & Rosaceae (each with 21 sp; 6.6%), Moraceae (10 sp; 3.1%), Polygonaceae & Solanaceae (each with 9 species 2.8 % each). Brassicaceae, Cucurbitaceae and Ranunculaceae each had 8 species (2.5%). Apiaceae, Carryophyllaceae, Euphorbiaceae and Malvaceae had 6 species each (1.9% each). Seven families had 4 species (1.3%), 8 families had 3 species each (0.9%) another 8 families had 2 species each (0.6%). Each of the remaining 34 families contributed single species to the flora (Figure 3). Among monocotyledons, Poaceae with 26 species (8.2%) dominated, which was followed by Asparagaceae, Alliaceae and Asphodelaceae.

The area is floristically very rich, supporting 319 plant species, of diverse taxonomic and ecological nature. Batalaha&Mantovani(2001) recorded 360 vascular species belonged to 236 genera and 69 families. Asteraceae and Fabaceae were the most common families. This is similar to the present list. In our case the numbers of families were85. Similarly Abuodha*et al.*(2003) also identified 174 plant species belonging to 62 families in which Papilionaceae and Poaceae were dominant families. This also supports the present findings. Klein *et al.* (2007) described that Asteraceae and Poaceae were the richest families. Jafri & Akhani (2008) reported 607 plants belonged to 329 genera and 85 families. Hussain &Perveen (2009) reported 70 plants from Dureji game reserve while Sher and Khan (2007) stated that flora of Chagharzai valley consisted of 222 plant species. All these studies agree with the present work as same families as represented by us are having highest number of species in their studies.

It is observed that diversity in floristic compositions related to altitudes, precipitation and other local ecological features of the area. Berg *et al.* (2000) suggested that rainfall and altitude strongly influenced the floristic differences among different forests. However Steege *et al.*, (2000) stated that rainfall is not a good reason for tree diversity.

Dhali and Oona, two research sites are close to each other and receive same amount of precipitation but had different vegetation (Figures 1 & 2). Similarly in the present, the two sites namely: Dhanakol and Bakht Banda varied in vegetation due to variation in altitude and precipitation. Adam &Mamat (2005) and Cattanio *et al.* (2002) stated that slight topographic change affects forests composition along topographic gradients). It is obvious in all the studied sites having different topography supported variety of communities. In our case it appeared topography and aspects delineated the floristic composition and vegetation. Oona hill had different vegetation and flora due to difficult terrain and inaccessibility.

Similarly, tree invasion had impact on floristic composition. This invasion has substantially facilitated or antagonized the impacts on population of many plant species Butler *et al.* (2005). *Ailanthus altissima*is is an invasive exotic species which was recorded in all the investigated five hills. It is reached to the top of Oona hill, Dhali hill and Dhanakol hill and is spreading at alarming rate. It has replaced the natural vegetation in many parts of this area.

The investigated area is under severe grazing pressure except Bakht Banda where topographic conditions did not allow sustaining existence throughout the year. Transhumant stays for short time in summer and then moves their herds to the Kohistan district. Sasaki *et al.* (2005) stressed that the pattern of floristic composition is governed under different grazing intensities. After analyzing the soil moisture and landform features they concluded the pattern of floristic composition is not affected but stress grazing intensities were responsible for change in floristic diversity. However, Visser & Both (2005) stated that phenological behavior of many species

mistimed due to climatic changes. Haugaasen & Per (2007) were of the opinion that unflooded forests were most diverse floristically. Dhanakol hill some places where land slide occurred and supported poor diversity due to rain water.

Fire is another factor that limits plant composition. It's not a promising one. It seems that fire does not have any significant impact; however, Morrison *et al.* (2006) stated that fire frequency account for about 60 % floristic variation.

Soil moisture and water availability are important factors which governs seed germination and survival of plants. Drought had dramatically not only decreased the accessibility of plants but had also badly affect availability of nutritious flora and reduced the honey yield in the area. Cayuela *et al.* (2008) had same inspiration that water stress decreased alpha and beta diversity during community establishment.

Madsen &Ilgaard (2008) investigated that floristic composition changed significantly irrespective of time. Phenological behavior of many species mistimed due to climatic change. Putin *et al.*(2010) discussed species responses to climate change that strongly rely on projecting altered environmental conditions on species distribution. Climate change also influences species interaction. They also discussed that how these interactions may alter during climate change and result species range shifts. It is suggested that conceptual analogies between species responses to climate warming and exotic species introduced in new ranges. These results are also similar to our works. Durrani & Razaq (2010) discussed that protected rangelands had rich floristic diversity than unprotected one. The investigated site had some rangelands that were unprotected and highly disturbed. Qureshi & Bhatti (2010) strenghthened our view that floristic composition is affected by anthropogenic activities with coupled with irrigation water deficit and allelopathic behavior of alien species. Ibrar *et al.* (2007) also stated that people living in Ranyal hill are very poor and they lack basic health and livelihood facility like electricity, gas and coal. Our research area also lacks these facilities and this is the main cause of interference in local vegetation.

Raunkaierian' s Life form spectrum:

Life form spectrum is useful in comparison of areas, which are widely separated geographically having no common species. Life form is directly evolved in response to the climatic conditions. The proportions of life forms in an area give a better understanding of its climatic zone. The biological spectrum of the flora of Chakesar Valley revealed that it is mainly shaped as therophytic vegetation as there were 173 species (54.23%) therophytic species. The cryptophytes constituted 11.6%, chamaephytes 10.34%, microphanerophytes 10.03% and nanophanerophytes 6.3%. Mesophanerophytes, hemicryptophytes and megaphanerophytes contributed 3.5%, 2.5% and 1.6%, respectively. The area is mostly characterized by subtropical vegetation in the lower area while Kandao site (altitude 1900 meters to 2500 meter asl.) had dominanace of mesophanerophytes (Figure 4).

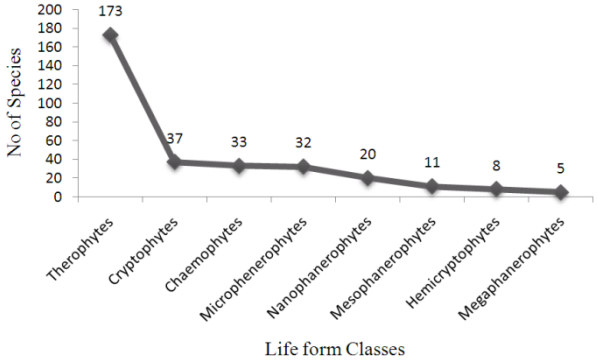

Fig. 4: Raunkiarian Life form spectrum of the flora of Chakesar Valley, Shangla, Pakistan.

The research area consisting of five different hills supported heterogeneous habitats and could be classified as Irano Turanian phytochory. The semi-arid in the lower reaches and humid climate in the upper parts had diverse vegetation of herbaceous, shrubby and trees strata. The results showed that Chakesar valley is rich in phytodiversity with thero phanerophytic phytoclimate. The phanerophytes were and chamaephytes were similar to the normal spectrum but hemicryptophytes less than and cryptophytes had more than normal spectrum. Guo*et al*. (2009) reported that phanerophytes were dominant in their area of investigation. Manhas *et al*. (2009) concluded that therophytes were dominating life form in swamps, representing high anthrapogenic disturbance in the region and limited niche space for vegetation. Therophytes are adapted to the dryness of the region and shortage of rainfall because these plants spend vegetative period in the form of seed (Asri, 2003). Hemicryptophytes adapted to habitat conditions by using different ways such as reserving water, using ground water, reducing their water need by losing their leaves and reduction of vegetative growth. In fact life forms of

the plants indicate the possibility of adaptation of plants to environmental condition especially climatic condition. They stated that therophytes more than normal and phanerophytes less than normal that is indicating the area is arid climate. Rana *et al*. (2002) stated the vegetation that biological diversity showed hydro chamaeophytic phyto-climate. Grassland vegetation is characterized by high % age of hemicryptophytes which the whole flora is therophytic and vegetation is thero hemigeophytic. In such the flowering period in such climate was vernal (Saxena *et al.*, 2004). According to Nadaf & Murtazvi (2011) hemicryptophytes were the dominant life form class and most plants belong to IranoTuranian floral elements.

The predominance of therophytes reflects an effective strategy for avoiding water losses due to humidity extremes and water deficiency. The importance of therophytes increases with decreases of rainfall. Difference in amount of phanerophytes and therophytes in this region with Raunkiaer normal spectrum is too much and this may be a result of dryness of the region.

The Kando Hill (Bakht Banda site) presented a wide physiognomic variation than other sites. It had a closed and tallest physiognomy and considerably varies in climatic conditions. It was dominated by phanerophytic vegetation with microphyllous leaf form class. Dhanakol prevailing decidous phanerophytic vegetation with leaf form microphylous. Gumrush hill has nanophanerophytes with microphyllous leaf form. Dhali and Oona hill had open physiognomy and supported scrubland vegetation. Hemicryptophytes and chamaephytes prevailed in these habitats. The proportion of phanerophytes expected to increase from openphysiognomy to close one. Bakht Banda is the best represented site for closed physiognomy where phanerophytes increased with altitude.

Furthermore, there was a bias in our study in relation to other survey Mantovani, (2001) observation of all species was done in the field at least one year whereas our study was completed in three years i.e. from 2007-2010. Hence our results considered all possible life forms classes over period of three years.

Leaf Size spectrum:

The figure 5 depicts that leaf size spectrum is predominantly characterized by microphyllous (177 sp; 55.7%) species followed by mesophyllous species (57 sp; 17.9%). There were 32 (10.1%) nanophylls and 29 species (9.1 %) leptophyll. The macrophyll (17 sp.) constituted 5.3% and 6 sp., (1.9 %) to the leaf spectrum.

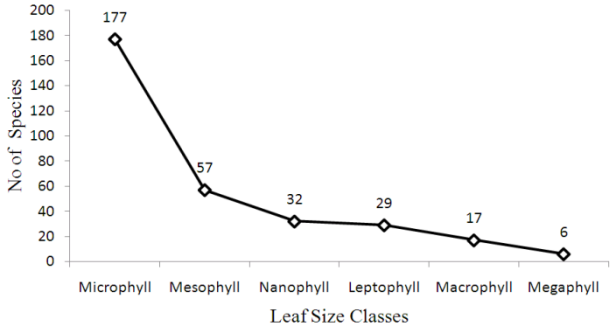

Fig. 5: Leaf form spectrum of Flora of Chakesar Valley, Shangla, Pakistan.

The therophytes are more than normal suggesting dry subtropical climate. Microphyll dominate in the leaf form spectrum. The vegetation is mostly evergreen but deciduous elements are considerable. Dhanakol and Gumrush prevailing decidous phanerophytic vegetation with leaf form microphyllous. Gumrush hill has nanophanerophytes with microphyllous leaf form. Wergerand & Ellenbroek (2004) discussed that leaf size classes and leaf constancy type of the woody species revealed a diversification of leaf sizes as the climate changed from temperate to hot and arid and particularly microphylls became relatively less important and were replaced by smaller leaves in the hot area. Sher & Khan (2007) also described leaf spectra of plants consisted of microphylls followed by mesophyll and nanophyll. Their results agree with us. Gou *et al*. (2009) investigated that microphy was dominant and leaf quality was mainly papery and conaceous. This is similar to us. Al-Yemni&Sher (2010) described that microphyll dominated the study area followed by nanophyll, leptophyll and mesophyll. The leaf size spectra indicated that micro Nanophyllous species were dominating the area and Sher& Khan (2007) also showed thatmicrophylls was dominant followed by mesophylls nanophyllsleptophylls and megaphylls.

References

Al-Yemeni, M.N., H. Sher, 2010. Biological spectrum with some others ecological attributes of the flora and vegetation of the Asir Mountain of South West, Saudi Arabia. Afr. J. Biotechnol., 9(34): 5556-5565.

Asri, Y., 2003. Plant diversity in Touran Biosphere Rservoir, Vol.305. p306. Publishing research institute of forests and rangelands, Tehran, Iran.

Batalha, M.A., W. Mantovani, 2001. Floristic composition of the Cerrado in the Pé-De-Gigante Reserve (Santa Rita Do Passa Quatro, Southeastern Brazil). Acta Botanica Brasilica, 15(3): 22-30.

Durrani, M.J., A. Razaq, 2010. Floristic diversity, ecological characteristics and ethnobotanical profile of plants of Aghberg rangelands, Baluchistan, Pakistan. Pak. J. Pl. Sci., 16(1): 29-36.

Hussain, M.I., A. Perveen, 2009. Plant biodiversity and phytosociological attributes of Tiko Baran (Khirthar Range*), Pak. J. Bot.*,41(2): 581-586.

Ibrar, M., F. Hussain, A. Sultan, 2007. Ethno botanical studies on plant resources of Ranyal hill, District Shangla, Pakistan. Pak. J. Bot., 39(2): 329-337.

Nadaf, M., S.M. Mortazavi, 2011. Investigation flora and lif form of plants in protected region Sarigol, North Khrasan Province, Iran. Pak. J. Boil. Sci., 14(1): 78-81.

Qureshi, R., G.R. Bhatti, 2008. Diversity of microhabitats and their plant resources in Nara desert, Pakistan. Pak. J. Bot., 40(3): 979-992.

Sasaki, T., T. Okayasu, K. Takeuchi, U. Jamsran, S. Jadambaa, 2005. Patterns of floristic composition under different grazing intensities in Bulgan, South Gobi, Mongolia. J. Grassland Sci., 51(3): 235-242.

Saxena, A.K., P. Pandey, J.S. Singh, 2004. Biological spectrum and other structural functional attributes of the vegetation of Kumaun Himalaya. Plant ecology, 49(2): 111-119.

Sher, H., M.N. Al-Yemeni, 2011. Ecological investigation of the weed flora in arable and non-arable land of Al-kharj, Saudi Arabia. Afr. J. Agric. Res., 6(4): 901-906.