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Floristic composition, life form and leaf size spectra of the coal mine area vegetation of darra adam khel, khyber pakhtonkhwa, Pakistan

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Abstract

An Inventory of plant species of Coal Mine area of Darra Adam Khel was prepared on the basis of field trips conducted in different parts of the year 2009, particularly in winter, summer and monsoon. The flora consisted of 54 plant species belonging to 30 families. The dominant families were Asteraceae, Lamiaceae and Solanaceae with 4 species, followed by Euphorbiaceae, Mimosaceae, Moraceae and Zygophyllaceae with 3 species. Each of the Amaranthaceae, Apocynaceae, Capparidaceae, Poaceae, Rhamnaceae, Verbenaceae had 2 species, while the remaining families had a single species. The biological spectrum showed that therophytes (16 spp., 29.6%), megaphanerophytes (14 spp., 25.9%). nanophanerophytes (10 spp., 18.5%), chamaephytes (06 spp., 11.1%), hemicryptophytes (05 spp., 9.26%), Geophytes (03 spp., 5.56%), had occurrence in the investigated area. Leaf spectra of plants consisted of microphylls (50%), mesophylls (25.9%), leptophylls (16.7%), nanophylls (5.56%) and megaphylls (1.85%). The study concludes that the dominance of therophytes indicated that the investigated area was under heavy biotic pressure.

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Introduction

The life form and leaf size spectra are important physiognomic attributes that have been widely used in vegetation studies. The life form spectra are said to be the indicators of micro and macroclimate (Shimwell 1971). Similarly leaf size classes have been found to be very useful for plant associations. According to Oosting (1956) the leaf size knowledge may help in the understanding of physiological processes of plants and plant communities. Life form and leaf size spectra indicates climatic and human disturbance of a particular area (Cain & Castro 1959). Literature dealing with the plant ecology of Pakistan shows that very little work has been done on the life form and leaf size spectra (Malik et al., 2007, Hadi et al., 2009 and Rahmatullah & Ahmad 2010). Literature dealing with the plant ecology of Coal mine area of Darra Adam Khel shows that no work has been done on the life form and leaf size spectra. The present study was undertaken to report the flora of Coal mine area of Darra Adam Khel and its ecological characteristics.

Fig 1. View of darra adam khel valley.

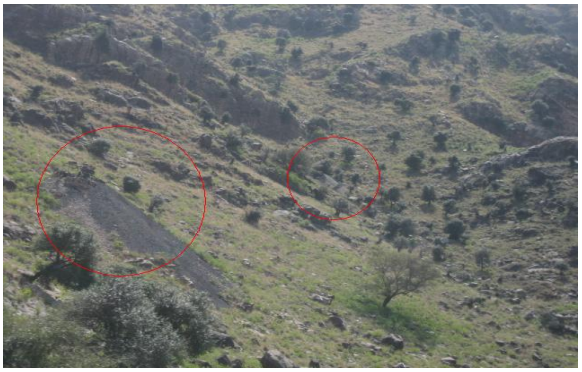

Fig 3. Coal mines.

The Coal mine area of Darra Adam Khel is situated at 33.51° to 33.85° North and 71.39° to 71.67° East. The area is hilly and the population is mainly concentrated between two parallel mountainous ranges. The climate of the area is subtropical type and some of the rain fall is received during winter and spring month. The area is consisting of xerophytes type of vegetation. The plants of the area are generally thorny, leaves are hairy and leathery to avoid excessive transpiration.

Materials and methods

The study area was thoroughly surveyed throughout the year from time to time to study the botanical and ecological conditions. It provides an opportunity to make plant collections and field observations during the flowering and fruiting of maximum number of species. Plant specimens collected from the area were dried and preserved. They were identified through 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 and Ellenberg (1974) and Hussain (1989).

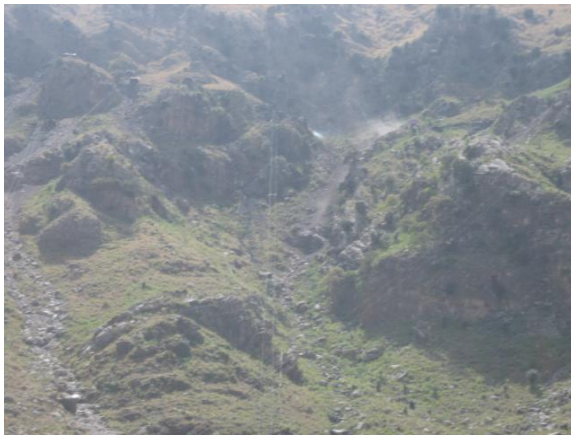

Fig 3. Vegetation around coal mine.

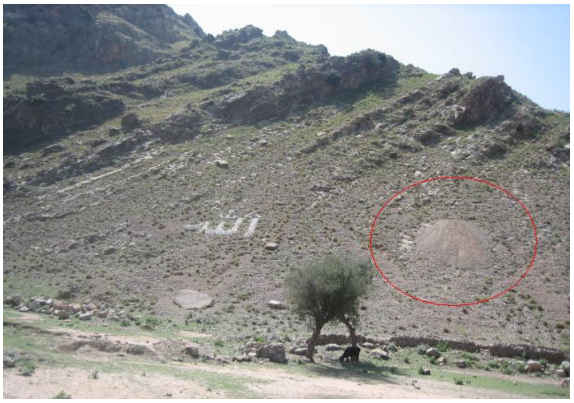

Fig 4. New dig of coal mine.

Results

The flora of Darra Adam Khel consisted of 54 plant species belonging to 30 families. The dominant families are Asteraceae, Lamiaceae and Solanaceae with 4 species, followed by Euphorbiaceae, Mimosaceae, Moraceae and Zygophyllaceae with 3 species. Each of the Amaranthaceae, Apocynaceae, Capparidaceae, Papilionaceae, Poaceae, Rhamnaceae, Verbenaceae had 2 species, while Acanthaceae, Aclepidaceae, Asclepiadaceae, Buxaceae, Cannabinaceae, Celastraceae, Cucurbitaceae, Cyperaceae, Liliaceae, Meliaceae, Nyctaginaceae, Oleaceae, Plantaginaceae, Polygonaceae, Sapindaceae, Sapotaceae had a one species each (Table 1).

Table 1. Floristic list, Life form and Leaf size classification of some plants of Darra Adam Khel.

Plants Name	Family	Life form	Leaf size	Habit
Acacia farnesiana (L.) Willd.	Mimosaceae	MP	Le	Tree
Acacia modesta Wall.	Mimosaceae	MP	Le	Tree
Acacia nilotica (L.) Delice	Mimosaceae	MP	Le	Tree
Aerua persica (Burm.f.) Merrill	Amaranthaceae	CH	Mic	Herb
Ajuga bracteosa Wall. ex Benth.	Lamiaceae	TH	Mic	Herb
Albizia lebbeck (L.) Benth.	Papilionaceae	MP	Le	Tree
Amaranthus viridis L	Amaranthaceae	TH	Mic	Herb
*Asparagus gracili*s Royle	Liliaceae	G	Le	Shrub
Boerhavia diffusa auct. plur.	Nyctaginaceae	CH	Mic	Herb
Buxus walichiana Baill	Buxaceae	NP	Mic	Shrub
Calotropis procera (Wild) R.Br.	Asclepiadaceae	CH	Mes	Shrub
Cannabis sativa L.	Cannabinaceae	TH	Mic	Herb
Capparis deciduas (Forssk). Edge worth.	Capparidaceae	MP	Na	Tree
Caralluma tuberculata N. E. Brown	Asclepiadaceae	TH	Na	Herb
Carthamus oxycantha M.B.	Asteraceae	TH	Mic	Shrub
Citrullus colocynthis (L.) Schrad.	Cucurbitaceae	H	Mic	Herb
Cleome viscosa L.	Capparidaceae	TH	Mic	Herb
Cynodon dactylon (L.) Pers	Poaceae	H	Le	Herb
Cyperus rotundus L.	Cyperaceae	TH	Le	Herb
Dalbergia sissoo Roxb	Papilionaceae	MP	Mic	Tree
Datura metel L.	Solanaceae	NP	Mes	Shrub
Dodonia viscosa (L.) Jacq	Sapindaceae	NP	Mic	Shrub
Eragrostis poaoides Beauv	Poaceae	TH	Le	Herb
Euphorbia hirta L.	Euphorbiaceae	TH	Mic	Herb
Euphorbias prostrate Ait.	Euphorbiaceae	TH	Na	Herb
Fagonia cretica L.	Zygophyllaceae	TH	Le	Herb
Ficus palmate Forsk.	Moraceae	Mp	Mes	Tree
Gymnosporia royleana Wall. ex M. A. Lawson	Celastraceae	NP	Mic	Tree
Helanthus annus L.	Asteraceae	TH	Mes	Shrub
Justicia adhatoda L.	Acanthaceae	NP	Mic	Shrub
Launaea nudicaulis (L.) Hook. f.	Asteraceae	H	Mes	Herb
Launaea procumbens (Roxb) Ramayya and Rajagopal.	Asteraceae	CH	Mes	Herb
*Melia azedarac*h L.	Meliaceae	MP	Mic	Tree
Mentha arvensis L.	Lamiaceae	G	Mic	Herb
Mentha longifolia (L.) Huds	Lamiaceae	G	Mic	Herb
Monotheca buxifolia (Falc.) A. DC.	Sapotaceae	MP	Mic	Tree
Morus alba L.	Moraceae	MP	Mes	Tree
Morus nigra L.	Moraceae	MP	Mes	Tree
Nerium oleander Mill.	Apocynaceae	NP	Mic	Shrub
Olea ferrugina Royle.	Oleaceae	MP	Mic	Tree
Peganum hermala L.	Zygophylaceae	H	Mic	Herb
Plantago lanceolata L.	Plantaginaceae	H	Mes	Herb
Rhazya stricta Dcne	Apocynaceae	MP	Mes	Shrub
Ricinus communis L	Euphorbiaceae	NP	Mg	Shrub
Rumex hastatus L.	Polygonaceae	TH	Mic	Herb
Solanum surattense Burm .f	Solanaceae	TH	Mes	Herb
Teucrium stocksianum Boiss	Lamiaceae	TH	Mic	Herb
Tribulus terrestris L	Zygophyllaceae	TH	Mic	Herb
Vitex trifolia L.	Verbenaceae	NP	Mes	Shrub
Vitex negundo L.	Verbenaceae	NP	Mes	Shrub
Withania coagulans (Stocks) Dunal.	Solanaceae	CH	Mic	Shrub
Withania somnifera (L.) Dunal	Solanaceae	CH	Mes	Shrub
Zizyphus maurtiana Lam	Rhamnaceae	MP	Mic	Tree
Zizyphus nummularia (Burm.f) W.&A	Rhamnaceae	NP	Mic	Shrub

The biological spectrum showed that therophytes (16 spp., 29.6%), megaphanerophytes (14 spp., 25.9%). nanophanerophytes (10 spp., 18.5%), chamaephytes (06 spp., 11.1%), hemicryptophytes (05 spp., 9.26%), geophytes (03 spp., 5.56%), had occurrence in the investigated area. Leaf spectra of plants consisted of microphylls (50%), mesophylls (25.9%), leptophylls (16.7%), nanophylls (5.56%) and megaphylls (1.85%).

Discussion

Life forms of various species recorded from Coal Mine area of Darra Adam Khel Hills were classified into major life forms. A biospectrum is formed when all the species of higher plants are classified into life forms and their ratio expressed in number or percentage (Saxina et al., 1987). Biological spectra are useful in comparing geographically widely separated plant communities and are also regarded as an indicator of prevailing environment. Occurrence 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 in biological spectrum of the region exceeds the percentage of the same life form. However, due to biological disturbance the proportion of life forms may be altered. Biological spectrum may be materially changed due to introduction of therophytes like annual weeds, due to biotic influences like agricultural practices and grazing, deforestation and trampling etc.

The dominance of therophytes (16 spp., 29.6%) in the study area indicated that the investigated area was under heavy biotic pressure due to deforestation and over grazing. Generally, they were more abundant in the spring as it reflected spring aspect. During spring there is always a flush of annuals, which gives an outlook to the community (Fig. 6). Similar trend regarding prevalence of therophytes was observed by Hussain *et al.* (1997 a, b). The dominance of therophytes occurs due to un-favorable habitat conditions, as confirmed by many studies (Shimwell 1971; Malik & Hussain 1990). Qadir and Shetvy (1986) considered chamaephytes and therophytes as the major life form in unfavorable environment in desert region. In the investigated area dry conditions, low temperature in winter, high temperature in summer, wind and biotic factors result in un-favourable conditions paving way for chamaephytes. Saxina *et al.* (1987) stated that hemicryptophytes dominated temperate and alpine zones in overlapping and loose continuum. The present findings in this regard also agree with them. Therophytes survive under adverse condition through 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.

Leaf size spectrum of the plant revealed that microphyllous species followed by Mesophyll species were dominant in spring and monsoon in the investigated area. Microphylls are usually characteristic of steppes, while nanophylls and leptophylls are characteristic of hot deserts (Cain and Castro, 1959; Tareen & Qadir, 1993). The present study shows that leptophylls were high at the foot hills, while microphylls and nanophylls were present in high altitudes (1500 m). Species with large leaves occur in warmer moist climates while smaller leaves are characteristic of cold and dry climates and degraded habitats.

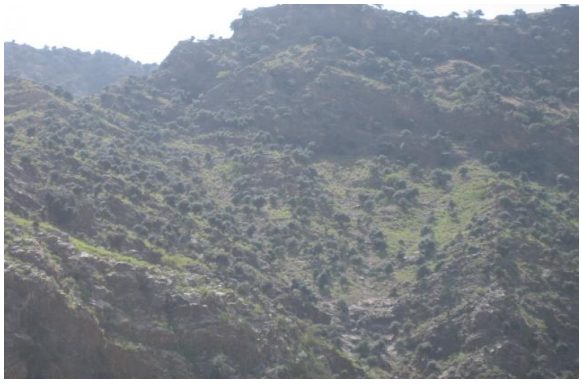

Fig 5. Vegetation on hill.

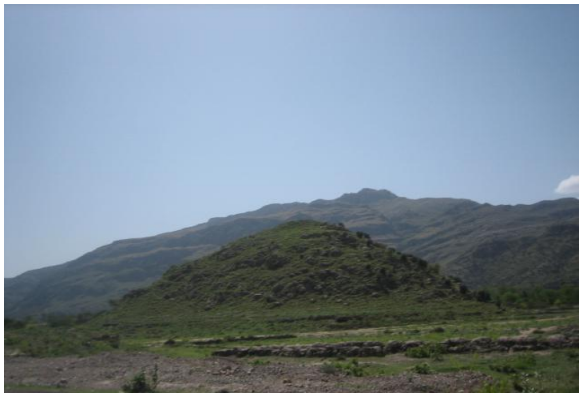

Fig 6. Vegetation during spring.

A high percentage of microphylls might be due to dry climate in subtropical area. Here the soil was poorly developed with thin sheet that prevented root penetration. Furthermore, roots absorb low moisture and nutrients under dry conditions. In subtropical regions 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 and 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 related with the increasing altitude and this also support our findings. However, in the tropical wet forest, as reported by Dolph and Dilcher (1980a 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.

Conclusion

The dominance of therophytes indicated that the investigated area was under heavy biotic pressure due to Coal Mine, 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 special care is needed for their conservation. Further study is needed to quantify the data and suggest plans for the conservation of the area.

Acknowledgement

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