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FLORISTIC INVENTORY, ECOLOGICAL CHARACTERISTICS AND BIOLOGICAL SPECTRUM OF PLANTS OF PARACHINAR, KURRAM AGENCY, PAKISTAN

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Abstract

The present work was carried out to evaluate the floristic checklist and environmental distinctiveness of Plants of Parachinar, Kurram Agency across the year during 2014- 2015. A total of 283 species of 222 genera among 85 families were recorded. Asteraceae with (29 Sp.) was the most dominant followed by, Poaceae with (20 Sp.), Papilionaceae, Lamiaceae each with (19 Sp.), Brassicaceae (16 Sp.), Solanaceae (13 Sp.), Rosaceae (9 Sp.) and Polygonaceae (7 Sp.). While Euphorbiaceae, Caryophylaceae and Pinaceaeeach with (6 Sp.) were the co-dominant taxa. Rest of the families possessed either 5 or fewer species. Based on the habitat 252 (89.04%) species were grew in dry places as wild mesophytes and xerophytes. Seventeen species (6.00%) were cultivated while 11 species (3.88%) were aquatic. There were 18 spiny species (6.36%). Among the perennial, majority were evergreen. Three species (1.06%) namely *Cuscutareflexa, Periplocaaphylla* and *P. calophylla*were leafless. The leaf lamina was simple in 230 species (81.27%) and 50 species (17.66%) contained composite foliage. Therophytes107 (37.80%) and nanophanerophyte 47 species (16.66%) respectively were dominant life form groups. Leaf spectra revealed that nanophylls with 121 species (42.75%) and leptophylls with 89 (31.44%) were dominant leaf size classes. The vegetation was also characterized by microphylls and mesophylls but of least concern.

Key word: Ecological characteristics, Kurram agency, Floristic composition, Biological spectrum, Pakistan.

Introduction

Parachinar is the main town and headquarter of the Kurram Agency, Pakistan. Parachinar is located at 33° 53' 51 North, 70° 60" East with an altitude of 1725 m (5659 feet) above the sea level. It lies at a distance of about 260 km North West of the Peshawar city. It is located on a neckline of Pakistani terrain south of Peshawar so as to projects into Paktia region of Afghanistan with the contiguous point in Pakistan to Kabul and confines on the Tora Bora. The inhabitant are mainly of Tori ethnic group of Patans and speaks Pashto. Parachinar is bounded by high mountains on all sides. The major range is Koh-e-Safaid or Spin Gharwith the peak of Sikramsar at 4,728 meters. It makes a natural boundary with Tora Bora mountain of Afghanistan. It covers with snow for major time of the year.

Flora is sum total of species in a specific habitat and ecosystem, which are peculiarity of an ecological period. The plants included the figure of species, as vegetation is the qualitative expression of plants of an area (Ali, 2008). Directory of plant resources by systematists is a universal performance all over the globe to cover information on the subject of vegetation (Qureshi *et al*., 2011). The flora of the road side was presented by (Aitchison, 1881-1882) which was a pioneer work regarding flora of Kurram Valley. By doing this exercise, precious information is gathered which might be utilized as an indication for further studies. As the planet is vastly uneven, thus a considerable variety of floras are existing range from pithy or ground flora to exploration (Badshah *et al*., 2010a). The average temperature of the area is semi-arid to temperate with a distinctive geography. Life form swarm of the current research reflects moist and dry temperate region. This area has some chunky patches of oak and pine vegetation. Plant diversity, life style and dispersion of plants are linked with the altitude and precipitation variation. The scarceness of the flora shows rigorous consumption of the natural vegetation. Trees, shrubs and herb can be sustained if anthropogenic activity is lowered to an appropriate level. Owing non availability of the electricity and the natural gas its large population depends upon forest capital for all domestic purposes. Because of the profound browsing nearly all the pastures of Khyber Pakhtunkhwa have been ruined and require to restore and to make it sustainable. It is imperative to reveal that the local plant resources are inadequate to accomplish the necessities so enormous quantity of fuel and timber wood is rushed from North Waziristan. No literature is available on the flora of this area except that of (Badshah &Hussain, 2008; Shiwari *et al*., 2003 and Hussain *et al*., 2012) who worked on some traditional uses of local medicinal flora. Therefore the work at hand would play an important role to visualize floristic diversity and its environmental individuality.

Materials and Methods

Recurrent data was collected for the whole year. Specimens were dried and sealed. Plants were recognized in the light of existing flora of Pakistan (Ali &Qaisar, 1995-2009 and Nasir & Ali, (1971-2007). An inclusive alphabetical list beside families was prepared. Life form and leaf size classifications were made after Badshah *et al*. (2013); Hussain*etal*. (2006); Hussain (1989) and Raunkiaer (1934).The plants specimens were submitted to the herbarium, Department of Botany for future record (Ali, 2008).

Results and Discussion

Flora and its ecology: Natural plants wealth is restricted by gardening, excessive browsing, human activities and natural disaster. Parachinar, Kurram Agency comprised of 283 species distributed among 85 families (Table 1.) representing 10 Gymnosperms, 36 Monocotts and 241 Dicot respectively.Asteraceae (29 Sp.), Poaceae (20 Sp.), Papilionaceae, Lamiaceae each with (19 Sp.), Brassicaceae (16 Sp.) Solanaceae (13 Sp.), Rosaceae (9 Sp.), Polygonaceae (7 Sp.) and Euphorbiaceae, Caryophylaceae and Pinaceae (6 Sp. each) were the leading groups. The other groups possessed either 5 or fewer species. Durrani *et al*. (2005) and Marwat&Qureshi (2000) also noted that these families were wide spreading in their respective areas. Kotli Hill also represented these families as a prominent flora during monsoon (Malik & Malik 2004). Similarly Mustuj Valley of district Chitral was also found to be prosperous with similar taxa (Hussain, 2015). Our results are constantly agreed indigenously by (Ali & Qaiser, 1995-2015) and as well as abroad by (Eilu *et al*., 2004; Antije *et al*., 2003; Muthuramkumar *et al*., 2006 and Mendez, 2005) as Asteraceae, Poaceea, and Lamiaceaehavebeen nominated dominant taxain the present situation. Asteraceae and Poaceae owing wide ecological amplitude make them to be diversified in the ecosystem.

The floristic list of Nara desert Qureshi & Bhatti (2008b), Bhatti *et al*. (2001), Parveen *et al*. (2008) and Qureshi & Bhatti (2005) also came up with abundant species in Asteraceae and Poaceae which equally strengthen the present conclusion. Five species in *Solanum* was declared as the principal genus. Similarly, *Euphorbia, Aristida, Plantago, Heliotropium* with 4 (species each). While *Pinus, Juncus, Chenopodium, Amaranthus, Artemisia, Heliotropium* and *Polygonum* possessed three species each. Rest of the taxa obsessed 1 or two type (Table 1). Ali & Qaisar, 2009; Nasir & Ali, 1971-2007; Ferraz *et al*., 2004; Stewart, 1972; Pinheiro *et al*., 2006 and Durrani *et al*., 2005 also reported that these genus is well represented in Pakistan. Distinctive variation in seasons and environmental setting is greatly apparent in the country. Usually summer and spring contain more species to winter and autumn as summer is pleasant while winter is severe cold in this region. Spring possessed 224 species (79.15%), summer 198 species (69.96%), autumn 120 species (42.40%) and winter 114 species (40.28%) (Table 2). Seasonal variation has certainly shaped 4 feature of the vegetation viz: perennial a sort of common among the habitat and seasons, woody plants and shrubs as a constant flora. The inconsistency in various features was mainly due to the seasonal, rhizomatous and some periodic irregular short season growing plants. Literature have also revealed that summer and spring aspect have much more diversity (Ahmad *et al*., 2009c, Badshah *et al*., 2010 and Durrani *et al*., 2010) which is in line with our findings. The flora mostly was composed of xeric plants that further agreeing to results made by Gimenez *et al*. (2004) and Musila *et al*. (2003). Only 17 taxa (6.00%) were cultivated for various purposes, 11 species (3.88%) were classified as hydrophytes and 3 species (1.06%) were found both in damp and arid situation. There were 18 spiny species (6.36%) which also showed xeric natureof the area. Most of the perennial were evergreen with an exception of fewer deciduous. A total of 230 species (81.27%) possessed simple lamina, 3 taxa (1.06%) were without leaves and the left over 50 species (17.66%), were composite and grooved. Absence of leaves and spiny adaptation indicated ruthless surroundings. The presence of aphyllous flora indicated the dryness and less rainfall in the present atmosphere. Sher & Khan (2007), Badshah *et al*. (2006), Durrani *et al*. (2005, 2010,) and Badshah *et al*. (2013) too observed parallel conduct from Udigram Swat and other parts of Pakistan. Floral diversity is the sign of high friendly environmental condition and lack of interference.

Biological spectrum and cyclic inequality: The life form shows the general outlook of the flora and vegetation, which is resulted due to various life phases in coalition with the location. It plays key role in the detection of environmental amplification of plant life. Raunkiaer (1934) proposed a consistent Life form categorization that determines the location and level of safety to parenting bloom in critical or unpleasant state. It was depicted that as whole therophytes (107 Sp., 37.80%) and nanophanerophytes (47 Sp., 16.60%) dominatedthe flora. Geophyte (37 Sp., 13.07%), hemicryptophytes (37 Sp., 13.07%), chamaephytes (30 Sp., 10.60%) and microphanerophytes (22 Sp., 7.77%) subsequently found in the area. *Viscum album* and *Cuscutareflexa* were merely parasitical plants (Table 2).

Three major phytoclimates of life form have been established on the earths which include therophytic in deserts, phanerophytic in the tropics, and hemicryptophytic in most of the temperate zone (Raunkiaer, 1934). Life forms change owing to biotic interaction as farming practices, browsing and grazing, trampling, deforestation and with change in climate. Recurring of biological spectrum showed nanophanerophytic as dominant with 40 species (33.33%) during autumn. Therophytic 21 species (17.50%) microphanerophytes18 species (15.00%), Chamaephytes with 16 species (13.33%) and hemicryptophytes with 14 species (11.66%) were next in abundance. Geophytes with 8 species (6.66%) and parasite with 3 species (2.50%) were rare life form classes in fall (Table 3).In winter the same trend was found as nanophanerophytes with 40 species and therophytes with 23 species dominated.During spring therophytes with 70 species (31.25%) emerged as dominant due to favorable temperature. Nanophanerophytes with 47 species (20.98%), chamaephytes 30 species (13.39%), geophytes 27 species (12.05%), hemicryptophytes 26 species (11.60%) and microphanerophytes 21 species (9.35%), were next important classes. Similarly, in summer there were 55 species (27.77%) of therophyte, 45 (22.72%) nanophanerophyte, 28 (14.14%) hemicryptophytes, 24 (12.12%) geophytes, 22 (11.11%) chamaephytes and 21 (10.60%) microphanerophytes (Table 3).

Table 1. Floristic index, seasonal dissimilarity, biological and leaf size spectra.

S. No.	Division / Family / Species	Habitat	Seasonality				L. form	L. size	Lamina	Spinescence
			A	W	S	Sm				
	A. Gymnosperms									
	1. Taxaceae									
1.	*Taxus fuana* Nan Li & R.R. Mill	D	+	+	+	+	Mp	N	S	-
	2. Pinaceae									
2.	*Abies pindrow* Royl	D	+	+	+	+	Mp	N	S	-
3.	*Cedrus deodara* (Roxb.ex Lamb) G.Don	D	+	+	+	+	Mp	N	S	-
4.	*Picea smithiana* (Wall). Boiss	D	+	+	+	+	Mp	N	S	-
5.	*Pinu roxburghii* Roxb.	D	+	+	+	+	Mp	N	S	-
6.	*Pinus gerardiana* Wall. ex Lamb	D	+	+	+	+	Mp	N	S	-
7.	*Pinus wallichiana* A. B Jackson	D	+	+	+	+	Mp	N	S	-
	3. Cupressaceae									
8.	*Cupressus funibris* Endl	D	+	+	+	+	Np	L	S	-
9.	*Cupressus sempervirons* L.	D	+	+	+	+	Mp	L	S	-
10.	*Juniperus excelsa* H,B	D	+	+	+	+	Np	L	S	-
	B. Monocotyledons									
	4. Alliaceae									
11.	*Allium cepa* L.	C	-	+	+	-	G	N	S	-
12.	*Allium sativum* L.	C	-	+	+	-	G	N	S	-
	5. Asparagaceae									
13.	*Asparagus adscendens* Roxb.	D	-	-	+	+	G	L	S	-
	6. Asphodelaceae									
14.	*Asphodelus tenuifolius* Cav.	W&D	-	+	-	-	G	L	S	-
	7. Cyperaceae									
15.	*Cyperus longus* L.	W	-	+	+	-	G	N	S	-
16.	*Cyperus rotundus* L.	W	+	+	-	+	G	N	S	-
	8. Iridaceae									
17.	*Moraea sisyrinchium* (L.) Ker Gawl.	D	+	+	+	+	G	L	S	-
	9. Juncaceae									
18.	*Juncus articulatus* L.	W	-	-	+	+	G	L	S	-
19.	*Juncus bufonius* L.	W	-	-	+	+	G	L	S	-
20.	*Juncus inflexus* L.	W	-	-	+	+	G	L	S	-
	10. Liliaceae									
21.	*Hemerocallis fulva* (L.) L.	D	-	-	+	-	G	L	S	-
22.	*Notholirion thomsonianum* (D. Don) Stapf	D	+	-	-	+	G	N	S	
23.	*Tulipa clusiana* DC	D	-	-	+	-	G	N	S	-
	11. Orchidaceae									
24.	*Zeuxine strataumatica* (L.) Schlechter	W & D	+	+	+	+	H	L	S	-
	12. Poaceae									
25.	*Apluda mutica* L.	D	-	-	+	+	H	N	S	-
26.	*Aristida adscensionis* L.	D	+	-	-	-	H	Mic	S	-
27.	*Aristida cyanantha* Nees ex Steud	D	+	-	+	+	H	N	S	-
28.	*Aristida mutabilis* Trin. & Rupr.	D	+	+	+	-	Th	N	S	-
29.	*Aristida triticoides* Henr.	D	+	-	-	-	H	N	S	-
30.	*Avena sativa* L.	W&D	-	+	-	-	Th	N	S	-
31.	*Cenchrus ciliaris* L.	D	-	+	-	+	H	L	S	-
32.	*Cymbopogon jwarancusa* (Jones) Schult	D	+	+	+	+	H	Mic	S	-
33.	*Cynodon dactylon* (L.) Pers.	D	+	+	+	+	H	L	S	-
34.	*Dichanthium annulatum* (Forssk.) Stapf.	D	-	+	-	-	H	N	S	-
35.	*Lolium temulentum* L.	D	-	-	+	-	Th	N	S	-
36.	*Oryza sativa* L.	C	-	-	-	+	Th	Mic	S	-
37.	*Paspalidium flavidum*(Retz) A.camus	D	+	-	-	-	G	N	S	-
38.	*Phalaris aquatica* L.	W	-	-	-	+	G	N	S	-
39.	*Poa annua* L.	W	-	+	+	-	Th	L	S	-
40.	*Saccharum spontaneum* L.	D	+	+	-	-	Ch	L	S	-

Table 1. (Cont'd.).

S. No.	Division / Family / Species	Habitat	Seasonality				L. form	L. size	Lamina	Spinescence
			A	W	S	Sm				
41.	*Setaria pumila* (Poir.) Roem. & Schult.	D	-	+	-	-	Th	L	S	-
42.	*Sorghum halepense* (L.) Pers.	D	+	+	+	+	Ch	N	S	-
43.	*Triticum aestivum* L.	C	-	+	+	+	Th	Mic	S	-
44.	*Zea mays* L.	C	-	-	-	+	Th	Mes	S	--
	13. Typhaceae									
45.	*Typha latifolia* L.	W	+	+	+	+	G	Mes	S	-
46.	*Typha minima* Funck ex Hoppe	W	+	-	-	+	G	Mes	S	--
	C. Dicotyledon									
	1. Amaranthaceae									
47.	*Achyranthes aspera* L.	D	+	-	-	-	Th	N	S	Sp
48.	*Amaranthus hybridus* L.	D	-	-	+	-	Th	N	S	Sp
49.	*Amaranthus viridis* L.	D	+	-	-	-	Th	N	S	--
50.	*Celosia argentea* L.	D	-	-	+	-	Th	N	S	-
	2. Acanthaceae									
51.	*Strobilanthus attenuates* Nees.	D	+	+	+	-	Ch	N	S	-
	3. Anacardiaceae									
52.	*Pistacia chinensis* ssp. *integerrima* (J. L. Stewart) Rech. F	D	+	+	+	+	Np	Mic	S	-
	4. Apocyanaceae									
53.	*Nerium indicum* Mill.	D	+	+	+	+	Np	Mic	S	-
54.	*Rhazya stricta* Decne.	D	-	-	+	+	Ch	N	S	-
	5. Asclepiadaceae									
55.	*Periploca aphylla* Decne.	D	+	+	+	+	Np	Ap	Abs	-
56.	*Periploca calophylla* (Wight) Falc.	D	+	+	+	+	Np	Ap	Abs	-
	6. Araliaceae									
57.	*Hedera nepalensis* K. Koch	D	+	+	+	+	H	Mic	S	-
	7. Asteraceae									
58.	*Anaphalis contorta* (D.Don) Hkf	D	+	+	+	+	Ch	Mic	S	-
59.	*Artemisia absynthium* L.	D	-	-	+	+	Ch	Mic	S	-
60.	*Artemisia maritima* L.	D	-	-	+	+	Ch	L	S	-
61.	*Artemisia scoparia* Waldst. & Kit	D	-	-	+	+	Ch	L	S	-
62.	*Aster mooliuscullus* (Dc) Clarke	D	+	-	-	-	H	L	S	-
63.	*Centaurea iberica* Trevir. ex Spreng.	D	-	-	+	-	Th	N	S	Sp
64.	*Cichorium intybus* L.	D	-	-	+	-	Ch	N	S	Sp
65.	*Circium arvense* (L.) Scop.	D	+	-	-	-	Th	L	S	-
66.	*Conyza bonariensis* (L.) Cronquist	D	-	-	+	+	Th	Mic	S	-
67.	*Coreopsis rosea* Nutt.	D	-	-	+	-	Th	L	S	-
68.	*Eclipta prostrata* (L.) L.	W	+	+	+	-	Th	N	S	-
69.	*Gaillardia aristata* Pursh	D	-	-	+	-	Th	L	S	-
70.	*Gaillardia pulchella* Foug,	D	-	-	+	-	Th	L	S	-
71.	*Galinsoga parviflora* Cav.	D	-	-	+	-	Th	N	S	-
72.	*Hertia intermedia* (Boiss) O. Ktze.	D	+	+	+	+	Np	Mic	S	-
73.	*Inula vestata* Wall ex. DC	D	+	-	-	-	Th	L	S	-
74.	*Launaea nudicaulis* (L.) Hook. f.	D	+	-	+	-	Th	Mes	S	-
75.	*Lectuca saligna* L.	C	+	+	-	+	Th	Mes	S	-
76.	*Leontopodium leontopodinum* (DC.) Hand.	D	+	-	-	-	Th	L	S	-
77.	*Myriactis wallichii* Less	D	+	-	-	-	Th	L	S	-
78.	*Phagnalon niveum* Edgew.	D	+	+	+	+	Np	Mic	S	-
79.	*Saussurea heteromalla* (D. Don) Hand	D	-	-	+	+	Th	N	S	-
80.	*Senecio chrysenthemoides* DC	D	-	-	+	+	Th	L	Com	-
81.	*Seriphidium kurramense* (Qazilb.) Y. R. Sling	D	+	+	+	+	Ch	L	S	-
82.	*Sonchus arvensis* L.	D	-	-	-	+	Th	Mic	Dis	-
83.	*Sonchus asper* (L.) Hill	D	-	+	-	-	Th	Mic	Dis	-
84.	*Tagates patula* L.	D	-	-	+	-	Th	L	Com	-
85.	*Taraxacum officinale* F. H. Wigg.	D	-	-	-	+	Th	Mic	S	-

Table 1. (Cont'd.).

S. No.	Division / Family / Species	Habitat	Seasonality				L. form	L. size	Lamina	Spinescence
			A	W	S	Sm				
86.	*Xanthium strumarium* L.	D	-	-	+	-	Th	N	S	Sp
	8. Balsamacea									
87.	*Impatiens lemannii* subsp. kurramensis Grey-Wilson	W	+	+	+	+	Np	N	S	-
	9. Betulaceae									
88.	*Betula utlis* D. Don	D	+	+	+	+	Mp	N	S	-
	10. Berberidaceae									
89.	*Berberis calliobotrys* Aitch. ex Koehne	D	+	+	+	+	Np	L	S	-
90.	*Berberis lycium* Royle	D	+	+	+	+	Np	N	S	-
	11. Boraginaceae									
91.	*Heliotropium crispum* Desf.	D	+	+	+	+	H	N	S	-
92.	*Heliotropium elipticum* Ledeb.	D	-	-	+	+	Th	N	S	-
93.	*Heliotropium europaeum* L.	D	-	-	+	-	Th	Mic	S	-
94.	*Heliotropium ovalifolium* Forssk.	D	-	-	+	+	Th	Mic	S	-
95.	*Nonnea edgewerthii* DC	D	-	-	-	+	Th	N	S	-
	12. Brassicaceae									
96.	*Brassica deflexa* Boiss	D	+	+	-	-	Th	Mic	Dis	-
97.	*Brassica rapa subsp. campestris* (L.) Clapham.	C	-	+	+	-	Th	N	Dis	-
98.	*Capsella bursa-pastoris* (L.) Medik	D	-	-	-	+	Th	L	Com	-
99.	*Cardamine impatiens* L.	D	-	-	-	+	Th	L	S	-
100.	*Cardaria chalepense* (L.) Hand.	D	-	-	+	+	Th	N	S	-
101.	*Conringia orientalis* (L.) Andrz	D	-	-	+	+	Th	L	S	-
102.	*Coronopus didymus* (L.) Smith	D	-	-	-	+	Th	L	S	-
103.	*Descurainia sophia* (L.) Webb & Berth	D	-	-	-	+	Th	L	S	-
104.	*Eruca sativa* Mill.	D	-	-	+	+	Th	N	S	-
105.	*Isatis brevipes* (Bunge) Jafri	D	-	-	+	+	Th	L	S	-
106.	*Lepidium pinnatifidum* Ledeb	D	-	-	+	+	Th	N	S	-
107.	*Malcolmia africana* (L.) R. Br.	D	-	-	+	-	Th	N	S	-
108.	*Nasturtium officinale* R.Br.	D	-	-	+	+	G	N	Com	-
109.	*Notoceras bicorne* (Aiton) Amo	D	-	-	-	+	Th	L	S	-
110.	*Sisymbrium irio* L.	D	-	-	+	+	Th	N	Dis	-
111.	*Sisymbrium loeselii* L.	D	-	-	+	+	Th	Mic	S	-
	13. Buddlejaceae									
112.	*Buddleja crispa* Benth	D	+	+	+	+	Np	N	S	-
	14. Buxaceae									
113.	*Buxus papillosa* C.K.Schneid	D	+	+	+	+	Np	N	S	-
	15. Cannabaceae									
114.	*Cannabis sativus* L.	D	-	-	+	-	Th	N	Com	-
	16. Caprifoliaceae									
115.	*Lonicera hispida* Pall. ex Willd.	D	+	+	+	+	Np	Mic	S	-
116.	*Viburnum grandiflorum* Wall. ex DC.	D	+	-	+	+	Np	Mic	S	-
	17. Caryophyllaceae									
117.	*Cerastium glomeratum* Thuill	D	-	-	+	-	Th	L	S	-
118.	*Dianthus crinitus* Sm.	D	+	+	+	+	Ch	L	S	-
119.	*Silene conoidea* L.	D	-	-	+	-	Th	N	S	-
120.	*Spergula arvensis* L.	D	-	-	+	-	Th	N	S	-
121.	*Stellaria media* (L.) Vill.	D	-	-	+	-	Th	L	S	-
122.	*Vaccaria hispanica* (Miller) Rauschert	D	-	-	+	-	Th	L	S	-
	18. Caesalpiniaceae									
123.	*Cassia senna* L.	D	-	-	-	+	Ch	L	Com	-
124.	*Gleditsia triacanthos* L.	C	-	-	+	+	Mp	L	Com	-
	19. Celastraceae									
125.	*Euonymus japonicus* Thunb.	D	+	+	+	+	Np	Mes	S	-
	20. Chenopodiaceae									
126.	*Chenopodium album* L.	D	-	+	+	-	Th	N	S	-

Table 1. (Cont'd.).

S. No.	Division / Family / Species	Habitat	Seasonality				L. form	L. size	Lamina	Spinescence
			A	W	S	Sm				
127.	*Chenopodium ambrosioides* L.	D	-	-	+	-	Th	L	S	-
128.	*Chenopodium murale* L.	D	+	-	-	-	Th	L	S	-
129.	*Salsola tragus* L.	D	-	-	+	+	Th	L	S	-
130.	*Salsola griffithii* (Bunge) Freitag & Khan	D	+	+	+	+	Ch	L	S	-
	21. Convolvulaceae									
131.	*Convolvulus arvesis* L.	D	-	+	-	-	Th	N	S	-
132.	*Ipomoea purpura* (L.) Roth.	D	-	-	-	+	Th	N	S	-
	22. Crassulaceae									
133.	*Hylotelephium ewersii* (Ledeb.) H. Ohba	D	-	-	+	+	G	L	S	-
134.	*Rosularia adenotricha* (Wall. ex Edgew.) Jansson & Rech.f	D	-	-	+	+	G	N	S	-
	23. Cuscutaceae									
135.	*Cuscuta reflexa* Roxb.	D	+	+	+	+	P	Ap	Abs	-
	24. Dipsacaceae									
136.	*Dipsacus inermis* Wall.	D	-	-	-	+	Th	Mic	S	-
137.	*Scabiosa candollei* DC.	D	-	-	-	+	H	L	S	-
	25. Ebenaceae									
138.	*Diospyros kaki* L.	C	+	+	+	+	Np	Mes	S	-
139.	*Diospyros lotus* L.	D	+	+	+	+	Np	Mic	S	-
	26. Elaeagnaceae									
140.	*Elaeagnus angustifolia L*	D	+	+	+	+	Np	N	S	-
	27. Euphorbiaceae									
141.	*Andrachne cordifolia* (Wall. ex Decne.) Muell	D	+	+	+	+	Np	N	S	-
142.	*Euphorbia cornigera* Boiss.	D	+	-	-	-	Th	L	S	-
143.	*Euphorbia granulata* Forssk.	D	+	-	-	-	H	L	S	-
144.	*Euphorbia helioscopia* L.	D	-	-	+	-	Th	N	S	-
145.	*Euphorbia prostrata* Ait.	D	+	-	+	-	Th	L	S	-
146.	*Ricinus communis* L.	D	-	-	+	+	Ch	Mes	S	-
	28. Fagaceae									
147.	*Quercus baloot* Griff	D	+	+	+	+	Np	N	S	Sp
148.	*Quercus semicarpifolia* Smith	D	+	+	+	+	Mp	Mic	S	-
	29. Fumariaceae									
149.	*Fumaria indica* (Hausskn.) Pugsley	D	-	+	-	-	Th	N	Dis	-
	30. Gentianaceae									
150.	*Erodium cicutarium* (L.) L. Herit, ex Aiton	D	-	-	-	+	Th	L	S	-
151.	*Erodium malacoides* (L.) L. Herit ex Aiton	D	-	-	-	+	Th	N	S	-
	31. Hypericaceae									
152.	*Hypericum perforatum* L.	D	-	-	+	+	Ch	L	S	-
	32. Hippocastanaceae									
153.	*Aesculus indica* (Wall.ex Camb.) Hook.f.	D	+	+	+	+	Np	Mes	Com	-
	33. Juglandaceae									
154.	*Juglans regia* L.	C	+	+	+	+	Mp	Mes	S	-
	34. Lamiaceae									
155.	*Calamintha vulgaris* (L.) Druce	D	+	+	+	+	Np	Mic	S	-
156.	*Isodon rugosus* (Wall. ex Benth.) Codd	D	+	-	+	+	Ch	N	S	-
157.	*Lamium amplexicaule* L.	D	-	-	+	+	Th	L	S	-
158.	*Marrubium vulgare* L.	D	-	-	+	+	H	N	S	-
159.	*Mentha longifolia* (L.) L.	D	-	+	+	-	G	N	S	-
160.	*Mentha spicata* L.	D	-	+	+	-	G	N	S	-
161.	*Nepeta podostachys* Benth.	D	-	-	+	+	H	L	S	-
162.	*Ocimum basilicum* L.	D	+	+	+	+	Ch	N	S	-
163.	*Origanum vulgare* L.	D	+	_	-	-	H	L	S	-
164.	*Phlomis bracteosa* Royle ex Benth.	D	+	+	+	+	Np	Mic	S	-
165.	*Phlomis stewertii* Hook. f.	D	+	+	+	+	Np	N	S	-

Table 1. (Cont'd.).

S. No.	Division / Family / Species	Habitat	Seasonality				L. form	L. size	Lamina	Spinescence
			A	W	S	Sm				
166.	*Prunella vulgaris* L.	D	-	-	+	+	Ch	N	S	-
167.	*Salvia plebeia* R. Br	D	-	-	-	+	Th	Mic	S	-
168.	*Salvia nubicola* Wall.	D	-	-	-	+	H	Mes	S	-
169.	*Scutellaria linearis* Benth.	D	-	-	-	+	H	L	S	-
170.	*Stachys parviflora* Benth.	D	-	-	+	+	H	L	S	-
171.	*Teucrium stocksianum* Boiss.	D	+	+	+	+	Ch	L	S	-
172.	*Thymus linearis* Benth	D	-	-	+	+	H	L	S	-
173.	*Ziziphora clinodioides* Lam.	D	-	-	+	+	G	L	S	-
	35. Loranthaceae									
174.	*Viscum album* L.	D	+	+	+	+	P	L	S	-
175.	*Viscum cruciatum* Sieber ex Spreng	D	+	+	+	+	P	L	S	-
	36. Lythraceae									
176.	*Lythrum salicaria* L.	D	-	-	+	+	H	L	S	-
	37. Malvaceae									
177.	*Malva neglecta* Wallr.	D	-	+	+	+	Th	Mic	S	-
178.	*Malva parviflora* L.	D	-	-	+	+	Th	Mic	S	-
179.	*Malvastrum coromandelianum* (L.) Garcke	D	-	-	+	-	H	N	S	-
	38. Meliaceae									
180.	*Melia azedarach* L.	D	+	+	+	+	Mp	N	Com	-
181.	*Cedrella toona* Roxb.	D	++	+	+	+	Mp	N	Com	-
	39. Mimosaceae									
182.	*Prosopis glandulosa* Torr	D	+	+	+	+	Np	L	Com	Sp
183.	*Prosopis juliflora* (Swartz) DC	D	+	+	+	+	Np	L	Com	Sp
	40. Moraceae									
184.	*Ficus carica* L.	D	+	+	+	+	Np	Mes	S	-
185.	*Morus alba* L.	D	+	+	+	+	Mp	Mes	S	-
186.	*Morus nigra* L.	D	+	+	+	+	Mp	Mes	S	-
	41. Morinaceae									
187.	*Morina persica* L.	D	-	-	+	+	Th	Mic	S	Sp
	42. Myrtaceae									
188.	*Eucalyptus globulus* Labill.	D	+	+	+	+	Mp	N	S	-
	43. Oleaceae									
189.	*Fraxinus xanthoxyloides* (G. Don) DC	D	+	+	+	+	Np	N	Com	-
190.	*Olea ferruginea* Royle	D	+	+	+	+	Np	N	S	-
191.	*Syringa emodi* Wall. ex Royle	D	+	+	+	+	Np	N	S	-
	44. Onagraceae									
192.	*Epilobium hirsutum* L.	D	-	-	+	+	H	N	S	-
	45. Oxalidaceae									
193.	*Oxalis pes-caprae* L.	D	-	-	+	+	Th	N	Com	-
	46. Papavaraceae									
194.	*Papaver somniferum* L.	D	-	-	+	+	Th	L	Dis	-
	47. Papilionaceae									
195.	*Arachis hypogaea* L.	D	-	-	-	+	H	L	S	Sp
196.	*Astragalus psilocentros* var. *pilosus* Parker.	D	-	-	+	-	Ch	L	Com	Sp
197.	*Astragalus tribuloides* Delile	D	+	-	-	-	Ch	L	Com	Sp
198.	*Caragana gerardiana* Royle ex Benth	D	+	+	+	-	Ch	L	Com	Sp
199.	*Ebenus stellata* Boiss	D	+	+	+	+	Ch	L	S	-
200.	*Indigofera heterantha var. heterantha* Wall.	D	-	-	+	+	Ch	L	Com	-
201.	*Indigofera linifolia* (L. f) Retz	D	-	-	+	+	Th	L	Com	-
202.	*Lathyrus aphaca* L.	D	+	-	-	-	Th	N	Com	-
203.	*Lathyrus sativus* L.	D	-	-	+	+	Th	N	Com	-
204.	*Medicago laciniata* (L.) Mill.	D	-	+	+	-	Th	N	Com	-
205.	*Medicago lupulina* L.	D	-	-	+	-	Th	N	Com	-
206.	*Melilotus indica* (L.) All.	D	-	+	+	-	Th	N	S	-

Table 1. (Cont'd.).

S. No.	Division / Family / Species	Habitat	Seasonality				L. form	L. size	Lamina	Spinescence
			A	W	S	Sm				
207.	*Pisum sativum* L.	D	-	-	+	+	Th	N	Com	-
208.	*Robinia pseudo-acacia* L.	C	+	+	+	+	Np	N	Com	-
209.	*Sophora mollis* Gram	D	-	-	+	+	Np	L	Com	-
210.	*Trifolium pratense* L.	C	-	+	+	-	Th	N	Com	-
211.	*Trifolium repens* L.	C	-	+	+	-	Th	N	Com	-
212.	*Trigonella monantha ssp.* incisa (Benth.) Ali comb. & stat	C	-	-	+	+	Th	L	Comp	-
213.	*Vicia sativa* L.	D	-	-	+	-	Th	L	Com	-
	48. Platanaceae									
214.	*Platanus orientalis* L.	D	-	-	+	+	Mp	Mes	S	-
	49. Plantaginaceae									
215.	*Plantago ciliata subsp. lanata* (Boiss.) Rech.	D	+	-	-	+	Th	N	S	-
216.	*Plantago lanceolata* L.	D	-	-	+	+	Th	N	S	-
217.	*Plantago major* L.	D	-	-	+	+	Th	Mic	S	-
218.	*Plantago ovata* Forssk	D	-	-	+	+	Th	N	S	-
	50. Podophyllaceae									
219.	*Podophyllum emodi* Wall. ex Royle	D	-	-	+	+	G	N	Com	-
	51. Polygalaceae									
220.	*Polygala abyssinica* R. Br.	D	-	-	-	+	Th	L	S	-
	52. Polygonaceae									
221.	*Bistorta amplexicaulis* (D. Don) Green	D	-	-	+	+	G	N	S	-
222.	*Oxyria digyna* (L.) Hill	D	+	+	+	+	H	L	S	-
223.	*Polygonum aviculare* L.	D	-	-	+	-	Th	L	S	-
224.	*Polygonum glabrum* Willd	D	-	-	+	-	Th	N	S	-
225.	*Polygonum plebejum* R. Br.	D	-	+	+	-	H	N	S	-
226.	*Rumex nepalensis* L.	D	-	-	+	-	G	Mes	S	-
227.	*Rumex dentatus* L.	D	-	-	+	+	Th	Mic	S	-
	53. Primulaceae									
228.	*Anagallis arvensis* L.	D	-	-	-	+	Th	N	S	-
229.	*Androsace rotundifolia* Hardwicke	D	-	-	+	+	G	N	S	-
	54. Punicaceae									
230.	*Punica granatum* L.	D	+	-	+	+	Np	N	S	-
	55. Ranunculaceae									
231.	*Adonis aestivalis* L.	D	-	-	+	-	Th	L	S	-
232.	*Aquilegia pubiflora var. pubiflora* L.	D	-	-	+	+	G	Mic	S	-
233.	*Clematis orientalis* L.	D	+	+	+	+	Ch	N	Com	-
234.	*Ranunculus laetus* Wall. ex Hook.f. & Thoms	D	+	+	+	+	G	Mic	S	-
	56. Rhamnaceae									
235.	*Berchemia edgeworthii* Lawson	D	+	+	+	+	H	N	S	Sp
236.	*Sageretia thea var. brandrethiana* (Aitch.) Qaiser & Nazim	D	+	+	+	+	Np	N	S	Sp
	57. Rosaceae									
237.	*Crataegus songarica* K. Koch	D	+	+	+	+	Np	Mes	S	-
238.	*Duchesnea indica* (Andrews) Focke	D	-	-	+	+	G	N	Com	-
239.	*Fragaria nubicola* (Hook.f.) Lindl. ex Lacaita	D	-	-	+	+	G	N	Com	-
240.	*Malus pamila* Mill.	C	-	-	+	+	Np	Mic	S	-
241.	*Potentilla gerardiana* Lindl. ex Lehm.	D	-	-	+	+	H	N	S	-
242.	*Potentilla supina* L.	D	-	-	+	+	H	N	Com	-
243.	*Rosa brunonii* Lindl.	D	-	-	+	+	Ch	N	Com	-
244.	*Rosa webbiana* Wall. ex Royle	D	+	+	+	+	Ch	N	Com	-
245.	*Rubus anatolicus* (Focke) Hausskn	D	-	-	+	+	H	N	Com	-
	58. Rubiaceae									
246.	*Galium tricornutum* Dandy	D	-	-	+	+	Th	N	S	-
247.	*Rubia cordifolia* L.	D	-	-	+	+	H	N	S	-
	59. Rutaceae									
248.	*Skimia laureola* (DC) Seib & Zucc.	D	+	+	+	+	Ch	Mic	S	-

Table 1. (Cont'd.).

S. No.	Division / Family / Species	Habitat	Seasonality				L. form	L. size	Lamina	Spinescence
			A	W	S	Sm				
	60. Salicaceae									
249.	*Poplus capsicus* Bornm	D	-	-	+	+	Mp	Mic	S	-
250.	*Poplus nigra* L.	D	-	-	+	+	Np	Mic	S	-
251.	*Salix alba* L.	D	+	+	+	+	Mp	N	S	-
252.	*Salix denticulata* Andersson	D	-	-	+	+	Np	Mic	S	-
253.	*Salix wallichiana* Anderssson	D	-	-	+	+	Np	Mic	S	-
	61. Sambucaceae									
254.	*Sambucus nigra* L.	C	+	+	+	+	Np	N	Com	-
	62. Saxifragaceae									
255.	*Bergenia stracheyi* (Hook.f. & Thorns.) Engl.	D	-	-	+	+	G	Mic	S	-
	63. Scrophulariaceae									
256.	*Verbascum thapsus* L.	D	+	+	+	-	Th	Mes	S	-
257.	*Verbascum erianthum* Benth.	D	+	+	+	-	Th	Mic	S	-
258.	*Veronica aqutica* Bern.	D	-	-	+	-	G	N	Dis	-
259.	*Veronica didyma* Tenore	D	-	-	+	+	G	N	S	-
	64. Solanaceae									
260.	*Datura alba* Nees.	D	-	-	+	-	Th	Mic	S	Sp
261.	*Petunia alba* Juss	D	-	-	-	+	Th	L	S	-
262.	*Solanum dulcamara* L.	D	+	+	+	+	Np	N	S	-
263.	*Solanum melangina* L.	C	-	-	+	+	Th	Mic	S	-
264.	*Solanum nigrum* L.	D	-	-	+	+	Th	Mic	S	-
265.	*Solanum nigrum var. villosum* L.	D	-	-	+	+	Th	N	S	-
266.	*Solanum surattense* Burm. f.	D	+	-	-	-	H	Mic	S	Sp
267.	*Withania coagulans* (Stocks) Dunal	D	+	+	+	+	Ch	Mic	S	-
268.	*Withania somnifera* (L.) Dunal	D	-	-	+	+	Ch	Mic	S	-
	65. Thymelaeaceae									
269.	*Daphne mucronata* Royle	D	+	+	+	+	Np	L	S	-
270.	*Wikstroemia canescens* Meisn	D	+	+	+	+	Np	N	S	-
	66. Umbellifereae									
271.	*Bupleurum candollei* Wall. ex DC	D	-	-	+	+	Np	N	S	-
272.	*Torilis leptophylla* (L.) Reichb. F	D	-	-	+	+	H	L	S	-
273.	*Trachyspermum ammi* (L.) Sprague	D	-	-	-	+	Th	L	S	-
	67. Ulmaceae									
274.	*Celtis eriocarpa* Decne.	D	+	+	+	+	Mp	N	S	-
	68. Urticaceae									
275.	*Urtica pilulifera* L.	D	-	-	+	-	G	Mic	S	-
	69. Verbinaceae									
276.	*Phyla nodiflora* (L.) Green.	D	-	-	+	+	H	L	S	-
277.	*Verbena officinalis* L.	D	-	-	+	+	H	N	S	-
278.	*Vitex negundo* L.	D	+	+	+	+	Np	N	Com	-
	70. Violaceae									
279.	*Viola canescens* Wall. ex Roxb.	D	-	-	+	+	G	Mic	S	-
280.	*Viola stocksii* Boiss.	D	+	-	-	-	G	Mic	S	-
	71. Vitaceae									
281.	*Vitis vinifera* L	D	+	-	+	+	Np	Mes	S	-
	72. Zygophyllaceae									
282.	*Peganum harmala* L.	D	-	-	+	-	H	L	Dis	-
283.	*Tribulus terrestris* L.	D	+	-	-	-	H	L	Com	Sp

Key: D = Dry; W = Wet; C = Cultivated; A = Autumn; S = Spring; W = Winter; Sm = Summer; Th = Therophyte; H = Hemicryptophyte; Ch = Chamaephyte; G = Geophyte; Np = Nanophanerophyte; Mp = Microphanerophyte; P = Parasite L = Leptophyll; N = Nanophyll; Mic = Microphyll; Mes = Mesophyll; Ap = Aphyllous; S = Simple; Dis = Disected; Com = Compound; Abs = Absent; Sp = Spiny

Table 2. Summary of characteristics of flora listed in table 1.

S. No.	Ecological characteristics	No.	Percentage
	A. Flora		
1.	Total species	283	-
2.	Family	85	-
3.	Genera	222	-
	B. Seasonality/Aspect		
1.	Autumn	120	42.40
2.	Winter	114	40.28
3.	Spring	224	79.15
4.	Summer	198	69.96
	C. Habitat types		
1.	Wet	11	3.88
2.	Dry	252	89.04
3.	Both	3	1.06
4.	Cultivated	17	6.00
	D. Habit		
1.	Spiny	18	6.36
2.	Smooth	265	93.63
	E. Leaf type		
1.	Simple	230	81.27
2.	Compound/ disected	50	17.66
3.	Absent	3	1.06
	F. Life form spectra		
1.	Therophyte	107	37.80
2.	Hemicryptophyte	37	13.07
3.	Chamaephyte	30	10.60
4.	Geophyte	37	13.07
5.	Nanophanerophyte	47	16.60
6.	Microphanerophyte	22	7.77
7.	Parasite	3	1.06
	G. Leaf size spectra		
1.	Leptophyll	89	31.44
2.	Nanophyll	121	42.75
3.	Microphyll	51	18.02
4.	Mesophyll	19	6.71
5.	Aphyllous	03	1.06

It is pragmatic to classify the vegetation into strata. Microphanerophytes constituted the tree layer and nanophanerophytes that of shrub layer. Therophytes, hemicryptophytes and geophytes give rise to herbaceous layer. The stratification is however less obvious due to drought, deforestation and heavy grazing. Shimwell (1971) and Cain & Castro (1959) concluded therophytes as the characteristics of desert environment. The dominant biological spectrum in Brazil was phanerophytes and hemicryptophyte also in harmony with the current study (Batalha & Martins 2002). Hussain *et al*. (2009) determined parallel trend concerning the occurrence of hemicryptophytes and therophytes in ruined and dry habitats. Nanophanerophytes and therophytes were common across the year particularly in spring due to availability of water. Guo *et al*., 2009; Musila *et al*., 2003 and Manhas *et al*., 2010 suggested occurrence of therophytes due to hostile habitation which is in agreement to our findings. Similarly life form, from Kotli Hill, Sarsawa supported nanophanerophyte, hemicryptophytes and therophytes respectively as stated by Nazir & Malik (2006). The high proportion of therophytes is in accordance with our findings. Therophytes and chamaephytes were also measured as the main biological form in open plains and deserted condition by Batalha & Martins (2002, 2004) and Gutkowski *et al*., (2002). Dry-cool climate and heavy grazing direct to ruthless circumstance in Kurram Agency. Conclusion from Odisha, India of (Kar *et al*., 2010) regarding the prevalence of nanophanerophytes and therophytes are just similar to the present work.

Leaf spectrum: The overall leaf size spectra showed that the leaf spectrum consisted of 121 Sp. (42.75%) of class nanophylls and 89 Sp. (31.44%) of leptophylls. Mesophylls and microphylls respectively showed 19 Sp. (6.71%) and 51 Sp. (18.02%). *Periplocacalopyhlla, Cuscutareflexa* and *Periplocaaphylla*was leafless plants in the area (Table 2). Temporal variation in the leaf size index dominated by nanophylls with 49 Sp. (40.83%) in autumn. Thirty one species (25.83%) as Leptophylls, 22 species (18.33%), as microphylls, 15 species (12.50%) as mesophylls and 3 species (2.50%) as aphyllous were subsequently existing. Winter being, dry possessed nanophylls as 51 sp. (44.37%) and leptophylls (25 Sp.). The other sizes were 22 (19.29%) as Microphyll and 13 (11.40%) (Table 3). Nanophylls with 104 species (46.42%), leptophylls with 61 species (27.23%), microphylls with 41 species (18.30%) and leafless 3 (1.33%) respectively were present in spring. However summer was dominated with 79 sp. (39.89%) by nanophylls and 60 sp. (30.30%) by leptophylls. Microphyll 41 (20.70%), and mesophyll 15 (7.57%) of least concern. Tareen & Qader, 1993; Cain & Castro 1959 and Husain *et al*., 2005 stated that nanophylls and leptophylls are the indicators of warm desert and brackish habitats and Microphylls that of steppes conditions.

Moist and Dry climate consisted high proportion of nanonphyllous. Nasir & Sultan (2002) observed that leptophylls are prevalent in dry and unfavorable situation. While moist environmental condition in Azad Kashmir supported microphyllous vegetation opposite to our results (Hussain & Chudhary, 2009). Meager nutrients make the soil deserted thereby making tolerance for roots to catch and transport mineral ultimately, supporting nanophyllous and leptophyllous shrubbery similar to the current study (Costa *et al*., 2007). In the present study it is crystal clear that leaf spectrum is constantly changing according to the season and weather due to ephemerals and bulbous geophytes, but the evergreen more or less maintained the same status throughout the year. Hussain *et al*. (2015) stated that regional climatic condition play key role in determination, the leaf spectrum dominancy. The nanophyllous and microphyllous in Waziristan and Kotli is right in favor of the present findings (Badshah *et al*., 2010a; Malik *et al*., 2007). The harmony is mostly due to the hilly and topographic similarity among the areas. The leaf spectrum and biological spectrum alone is not sufficient for the ecological study of a region but quantitative studies like vegetation structure and conservation is equally important.

Table 3. Seasonal diversity in life form and leaf sizes.

S. No.	Parameters	Seasons							
		Autumn		Winter		Spring		Summer	
		No	% Age	No	% Age	No	% Age	No	% Age
	Life form								
1.	Therophyte	21	17.50	23	20.17	70	31.25	55	27.77
2.	Hemicryptophyte	14	11.66	10	8.77	26	11.60	28	14.14
3.	Chamaephyte	16	13.33	13	11.40	30	13.39	22	11.11
4.	Nanophanerophyte	40	33.33	40	35.08	47	20.98	45	22.72
5.	Microphanerophyte	18	15.00	15	13.15	21	9.35	21	10.60
6.	Geophyte	08	6.66	10	8.77	27	12.05	24	12.12
7.	Parasites	03	2.5	003	2.63	03	1.33	03	1.51
	Total	**120**	**100**	**114**	**100**	**224**	**100**	**198**	**100**
	Leaf size								
1.	Leptophyll	31	25.83	25	21.92	61	27.23	60	30.30
2.	Nanophyll	49	40.83	51	44.37	104	46.42	79	39.89
3.	Microphyll	22	18.33	22	19.29	41	18.30	41	20.70
4.	Mesophyll	15	12.50	13	11.40	15	6.69	15	7.57
5.	Aphyllous	03	2.50	03	2.63	03	1.33	03	1.51
	Total	**120**	**100**	**114**	**100**	**224**	**100**	**198**	**100**

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