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Floristic structure and ecological attributes of Jelar valley flora, district Upper Dir, Pakistan

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Abstract

The present study was conducted during March 2015 to October 2016 for exploring the floristic composition and biological spectrum of Jelar valley, District Upper Dir. Raunkiaer was followed for the classification of plants into various life form and leaf size classes. Floristic list of the study area revealed that flora of Jelar valley was diverse and comprised of 250 species belonging to177 genera and 77 families. The dominant families in term of species richness were Asteraceae and Lamiaceae, (each with 20 Species, 8%), Rosaceae (19 Species, 7.6%) and Papilionaceae (16 Species, 6.4%), while the dominant genera were *Polygonum* and *Rosa* (each with 5 Species). Due to harsh climatic conditions in winter, maximum numbers of species were found in summer and autumn. Biological spectra showed that therophytes (101 Species, 40.4%) and hemicryptophytes (43 Species, 17.2%) were dominant while in leaf size classes microphylls (32%) and nanophylls (30%) were dominant. Seasonal variation in life form and leaf form spectra are also described. The present work concluded that the flora of the area is diverse. Phytoclimate of the area is therophytic type and the environmental condition of the area is greatly disturbed by biotic pressure on the flora. This floristic study is the first inventory of the area and provides baseline information for the future prediction of the flora.

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Introduction

Floristic list of an area is ecologically important as it give information about natural resources and relation of plants with each other as well as their interaction with abiotic and abiotic factors. Floristic diversity depends upon the climatic conditions, altitudinal gradient and habitat conditions (Saima *et al.,* 2009). Plants have different life forms in different regions and communities (Zarezade *et al.,* 2007). Raunkiaer (1934) proposed the term 'biological spectra' for the determination of life form. It explains distribution of a flora as well as climatic conditions under which the prevailing life form evolved. The knowledge of leaf sized spectra also help to provide the information about the physiological process of individual plants species as well as plants association (Oosting, 1956). Different researchers have explored the information about floristic composition and ecological characteristics of different areas of the world as well as of Pakistan (Cain and Castro, 1959; Shah *et al.,* 1991; Segawa and Nkuutu, 2006; Costa *et al.,* 2007; Alsherif *et al.,* 2013; Ozgur and Ansin, 2003; Khan *et al.,* 2011; Perveen *et al.,* 2008; Durrani *et al.,* 2010; Badshah *et al.,* 2013; Amjad *et al.,* 2012; Khan *et al.,* 2014; Mehmood *et al.,* 2015; Samreen *et al.,* 2016; Ali *et al.,* 2016).However, there is no reference available on the floristic study of Jelar valley, therefore the present study aims to explore the floristic composition and ecological characteristics of the area.

Methods and materials

Study Area

Jelar valley is located between 71° 56' 9" to 71°56' 4" longitude and 34° 5' 87" to 34° 58' 54" latitude in Upper Dir. Phytogeographically it can be counted in Sino-Japanese region (Ali and Qaiser, 1986). Jelar valley is situated at a distance of 16 km from Tehsil headquarter, Wari. It is surrounded by Maidan in West, Wari in the East, Molavi hills in the North and Luqman Banda in South (Fig. 1).

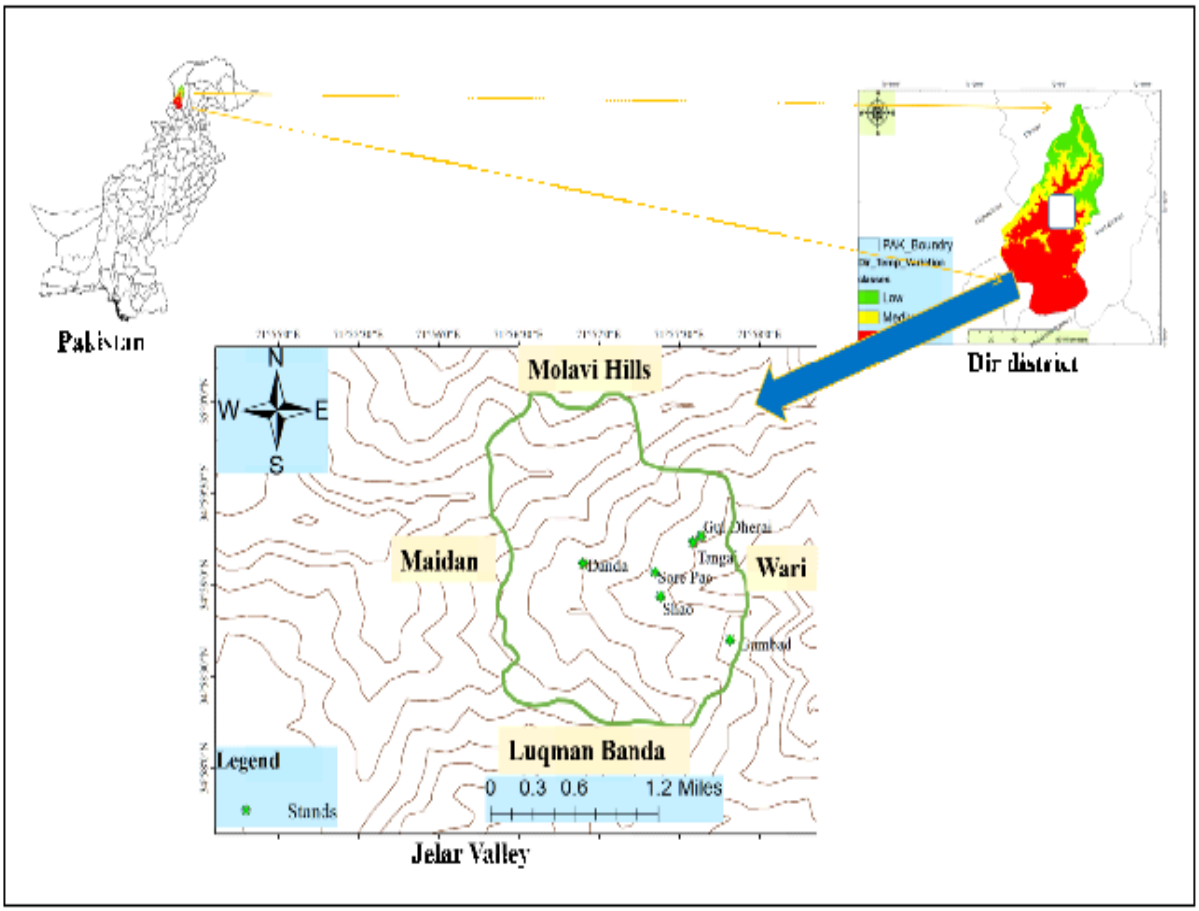

Fig. 1. Map of Dir Upper showing the location of Jelar Valley.

Different topographic and ecological factors influence the climate of the valley. Winter season is harsh while summer is pleasant and short. The valley receives sufficient rain and snowfall during December to mid-March. July and August are the hottest while January and February are the coldest months during the year.

Data collection

In March, 2015 to October 2016 regular trips were arranged in different seasons to collect plants species and prepare a floristic checklist along with ecological data of the study area. The collected plants species were dried, preserved and identified with the help of Flora of Pakistan (Ali and Qaisar, 1995-2015; Ali and Nasir, 1989-1992). Voucher specimens of the species were deposited in the Herbarium, Department of Botany University of Peshawar.

Data Analysis

Plants were classified into various life form and leaf size classes following Raunkiaer (1934) and Hussainc (1989).

The following formulas were applied for the determination of Life form and leaf size spectra.

$$\text{Life form Spectra} = \frac{\text{Number of species found in a particular life form class}}{\text{Total number of all species found in the area}} \times 100$$

$$\text{Leaf size Spectra} = \frac{\text{Number of species falling in a particular leafsize class}}{\text{Total number of all species found in the area}} \times 100$$

Results and discussion

Floristic composition

The flora of Jelar valley is comprised of 250 species with 177 genera and 77 families. Among the recorded species, 41(16.4%) were trees, 32(12.8%) shrubs, 156(62.4%) herbs and 21(8.4%) were Pteridophytes. The dominant families in term of species richness were Asteraceae and Lamiaceae, (each with 20 Species, 8%), followed by Rosaceae (19 Species, 7.6%), Papilionaceae (16 Species, 6.4%). (Table 1.). Out of 77 genera, *Polygonum* and *Rosa* were the richest genera with 5 species for each genus. Shah *et al.* (2006) reported 63 plant families with 218 species from the summer vegetation of Mastuj. Saima *et al.* (2009) reported 167 species and 65 plants families from Ayub National park (Abbottabad). Al-Yemeni and Sher (2010) reported 189 species and 74 families from Asir Mountain (Saudi Arab) in which the leading families were Asteraceae, Lamiaceae, and Poaceae. These families were also reported to be dominant by Musharaf *et al.* (2011) from Dara Adam Khel and Perveen *et al.* (2008) from Dureji. Hussain *et al.*(2015) reported 571 species with 104 families from Mastuj valley and found Asteraceae, Poaceae, Papilionaceae, Rosaceae and Lamiaceae as dominant families in the locality. Ali *et al.* (2016) reported 463 species from Chail valley in which the leading families were Asteraceae, Rosaceae, Lamiaceae, Apiaceae and Papilionaceae. Variation in floristic list of Jelar valley is due to the difference in habitat, climatic conditions and altitude etc. However, the dominance of these families is due to wide range of ecological amplitude of their species.

Lamina shape

Lamina shape of different species indicated that highest numbers of species (155 Species, 62%) were with simple lamina, followed by compound lamina (63 Species, 25.2%) while 24 species (9.6%) had dissected lamina, 2 species (0.8%) had needles lamina while 3 species (1.2%) had spiny lamina (Table 2). The lamina shapes of these species are also reported by Ali *et al.* (2016) from Chail valley and Samreen *et al.* (2016) from Darazinda (D. I. Khan).

Habitat types

Plants species were also classified according to habitat conditions in which 70 species (21.21%) were found on dry mountain slope, 68 species (20.61%) were collected from wet places, 65 species (19.70 %) were found in forest, 44 (13.33%) of them were cultivated species, while 38 species (11.52 %) were found in moist shady places. Among the others,13 species (6.67%) were found in agricultural fields,3.94% within rock crevices, 7 species (2.12%) were collected from graveyards, while only 2 were introduced species and one epiphyte (1 Species, 0.30%) in the study area (Table 2, Fig. 2).

These results are in agreement with findings of Ali *et al.*(2016) and Samreen *et al.*(2016). Biotic stresses, habitat destruction, deforestation and climatic factors affect the distribution of plant species within microhabitats (Ali *et al.,* 2016; Hussain *et al.,* 2015).

Table 1. Floristic composition, life form and leaf size spectrum, habitat condition and seasonal variation of vegetation in Jelar valley Upper Dir.

S. No	Division/ Family/ Species	Lamina Shape	Habitat	Seasonality				Life Form	Leaf Size Spectra
				Spring	Summer	Autumn	Winter		
A.	PTERIDOPHYTA								
1.	Adiantaceae								
1	*Adiantum venustum* D.Don.	Comp	M-F	+	+	+	+	H	N
2	*Adiantum incisum* Forssk.	Comp	M-R	+	+	+	+	H	L
3	*Adiantum capillus-veneris* L.	Comp	M-R	+	+	+	+	H	N
2.	Aspleniaceae								
4	*Asplenium adiantum-nigrum* L.	Comp	M-R	+	+	+	+	H	N
5	*Asplenium trichomanes* L.	Comp	M-R	+	+	+	+	H	L
6	*Asplenium septentrionale* (L.) Hoffmann.	Comp	W-R	+	+	+		H	L
7	*Ceterach dalhousiae* (Hk.) C. Chr.	Comp	M-F	+	+	+	+	H	N
3.	Dryopteridaceae								
8	*Hypodematium crenatum* (Forssk.) Kuhn.	Comp	M	+	+	+		H	L
9	*Dryopteris serrato-dentata* (Bedd.) Hayata.	Comp	M-R	+	+	+	+	H	L
10	*Dryopteris sieboldii* L.	Comp	W	+	+	+		H	L
11	*Dryopteris odontoloma* (Moore.)	Comp	M-F	+	+	+	+	H	L
12	*Polystichum discretum* (D. Don) J. Sm.	Comp	M-R	+	+	+	+	H	N
13	*Polystichum wilsonii* Christ.	Comp	W-R	+	+	+	+	H	N
14	*Polystichum lonchitis* (L.) Roth.	Comp	W-R	+	+	+	+	H	N
4.	Cystopteridaceae								
15	*Cystopteris fragilis* (L.) Bernh.	Comp	W	+	+	+	+	G	Mic
5.	Equisetaceae								
16	*Equisetum ramossimum* Desf.	Abs	M	+	+	+		G	Aph
17	*Equisetum arvense* L.	Abs	W	+	+	+		H	L
6.	Pteridaceae								
18	*Pteridium aquilinum* (L.) Kuhn.	Comp	W-F	+	+	+	+	G	Mic
19	*Pteris cretica* L.	Comp	M	+	+	+	+	H	Mic
20	*Pteris vitata* L.	Comp	M-R	+	+	+	+	H	Mic
7.	Sinooteridaceae								
21	*Cheilanthes pteridioides* (Reichard.) C. Chr.	Comp	W	+	+	+	+	H	N
B.GYMNOSPERMS									
8.	Pinaceae								
22	*Pinus roxburghii* Sargent.	N	F	+	+	+	+	Mesp	L
23	*Pinus wallichiana* A.B. Jackson.	N	F	+	+	+	+	Megp	L

C.ANGIOSPERMS									
9.	Acanthaceae								
24	*Dicliptera roxburghiana* Nees.	S	Cu-F		+	+	+	Ch	Mic
25	*Pteracanthus urticifolius* (Wall. ex Nees) Bremekamp Oodey.	S	F	+	+			Th	Mic
10.	Alliaceae								
26	*Allium sativum* L.	S	CU	+				G	Mes
27	*Allium cepa* L.	S	CU	+				G	
11.	Amaranthaceae								
28	*Amaranthus spinosus* L.	S	W		+			Th	Mic
29	*Achyranthus aspera* L.	S	W-CU		+	+	+	Th	N
30	*Amaranthus caudatus* L.	S	W		+	+		Th	Mic
12.	Anacardiaceae								
31	*Pistacia chinensis* Bunge ssp. *Integerrima* (J.L.S.) Rech. F.	Comp	F-GY	+	+	+	+	Micp	Mic
32	*Rhus coggygria* L.	S	Cu	+	+	+	+	NP	Mic
13.	Apiaceae								
33	*Ammi visnaga* (L.) Lam.	Comp	A-D	+	+		+	Ch	L
34	*Daucuscarrota* L	Comp	CU	+			+	G	Mes
35	*Trachydium roylei* Lindl.	Comp	W	+	+	+		H	Mic
36	*Chaerophyllum reflexum* Aitch.	Comp	R	+	+	+	+	H	Mic
37	*Foeniculum vulgare* Mill.	Dis	CU		+	+		Th	N
38	*Coriandrum sativum* L.	Dis	CU		+	+		Th	L
39	*Trachyspermum ammi* (L.) Sprague.	Comp	D	+	+			Th	L
40	*Seseli libanotis* (L.) Koch.	Comp	M-F		+	+		Th	L
14.	Araceae								
41	*Arisaema flavum* (Forssk.) Schott.	Comp	W-F		+	+		G	Mes
42	*Arisaema jacquemontii* Blume.	Comp	W-F		+	+		G	Mes
15.	Araliaceae								
43	*Hedera nepalensis* K. Koch.	S	F-GY	+	+	+	+	Np	Mes
16.	Asclepiadaceae								
44	*Periploca aphylla* Decne.	Abs	D	+	+	+	+	Np	Aph
17.	Asteraceae								
45	*Conyza bonariensis* (L.) Cronquist.	S	W		+	+		Th	N
46	*Phagnalon niveum* Edgew.	S	W	+	+			Ch	N
47	*Cirsium falconeri* (Hk. F.) Petrak	Sp	D		+	+	+	H	Mes
48	*Gnaphalium affine* (D. Don.) Anderb.	S	F		+	+		H	Mes
49	*Leontopodium leontopodinum* (DC.) Hand-Mazz.	S	W		+	+		H	N
50	*Artemisia biennis* Willd.	Dis	W	+	+	+		He	Mic
51	*Bidens cernua* L.	S	W	+	+			Th	Mic
52	*Bidens chinensis* L.	S	Cu		+	+		Th	Mic
53	*Taraxacum officinale* Weber.	S	D	+	+	+		Th	Mic
54	*Artemisia scoparia* Waldst. & Kit.	Dis	W		+	+		Th	N
55	*Cosmos bipinnatus* Cav.	Comp	GY		+	+		Th	N

56	*Xanthium strumarium* L.	S	W		+	+		Th	Mes
57	*Myriactus wallichii* Less.	S	F		+	+		Th	Mic
58	*Sonchus asper* (Linn.) Hill.	Dis	W		+			Th	Mes
59	*Sonchus arvensis* L	Dis	A-D		+			Th	Mes
60	*Conyza canadensis* (L.) Cronquist	S	W		+	+		Th	N
61	*Tagetes minuta* L.	Dis	D-F		+	+	+	Th	N
62	*Galinosoga parviflora* Cav.	S	Cu		+	+		Th	L
63	*Onopordum acanthium* L.	Dis	A-D	+	+			Th	Mes
64	*Filago hurdwarica* (Wall. ex DC.) Wagenitz.	S	F	+	+	+		Th	L
18.	Balsaminaceae								
65	*Impatiens bicolor* Royle.	S	W		+	+		Th	Mes
66	*Impatiens brachycentra* Kar. & Kir.	S	M		+			Th	Mic
19.	Berberidaceae								
67	*Berberis lyceum* Royle.	Sp	F	+	+	+	+	Np	Mic
20.	Betulaceae								
68	*Alnus nitida* (Spach.) Endl. Gen.	S	W-F	+	+	+	+	Mesp	Mes
21.	Boraginaceae								
69	*Heliotropium undulatum* var. *suberosa* Clarke ·	S	D		+	+		G	L
70	*Myosotis alpestris* F. W. Schmidt var. *albicans* (H.Riedl.) Y.Nasir.	S	F		+			H	Mic
71	*Cynoglossum lanceolatum* Forssk.	S	D	+	+			Th	Mic
22.	Brassicaceae								
72	*Brassica campestris* L.	Dis	CU	+			+	Th	Mic
73	*Raphanus sativus* Linn. var. *sativus*.	S	CU	+			+	Th	Mac
74	*Nasturtium officinale* R.Br.	Comp	W	+	+	+	+	Th	N
23.	Buxaceae								
75	*Sarcococca saligna* (Don.) Muell.	S	D-F	+	+	+	+	Ch	Mic
24.	Cannabaceae								
76	*Cannabis sativa* L.	S	W-F	+	+	+		Th	Mic
25.	Caprifoliaceae								
77	*Lonicera asperifolia* (Decne.) Hook. f. & Thoms.	S	D	+	+	+	+	Ch	N
78	*Viburnum cotinifolium* D.Don.	S	M	+	+	+	+	NP	Mic
26.	Caryophyllaceae								
79	*Silene vulgaris* (Moench.) Carcke.	S	M	+	+			Th	N
80	*Cerastium fontanum* Baumg.	S	M	+	+			Th	N
81	*Silene conoidea* L.	S	W	+	+			Th	N
27.	Chenopodiaceae								
82	*Chenopodium album* L.	S	F-A		+	+		Th	Mic
83	*Spinacea oleracea* L.	S	CU	+	+			TH	Mic
84	*Chenopodium foliosum* Aschers.	S	D	+	+			Th	N
85	*Chenopodium ambrosioides* L.	S	W		+	+		Th	Mes
86	*Chenopodium botrys* L.	S	A		+	+		Th	Mic
28.	Commelinaceae								

87	*Commelina benghalensis* L.	S	M-A		+	+		Th	Mic
29.	Cucurbitaceae								
88	*Cucurbita pepo* L.	Dis	CU		+	+		TH	Meg
89	*Momordica charantia* L.	Dis	CU		+	+		TH	Mes
90	*Cucumis melo* L.	S	CU		+	+		Th	Mac
91	*Cucumis sativus* L.	Dis	CU		+	+		Th	Mac
92	*Cucurbita maxima* Duch. Ex Lam.	Dis	CU		+	+		Th	Meg
93	*Luffa cylindrica* (L.) Roem.	Dis	CU		+	+		Th	Mac
30.	Cyperaceae								
94	*Cyperus niveus* Retz.	S	W-CU		+			H	N
95	*Cyperus rotundus* L.	S	W		+			Th	N
31.	Ebenaceae								
96	*Diospyros kaki* L.	S	W-I	+	+	+	+	Mesp	Mes
97	*Diospyros lotus* L.	S	D-F	+	+	+	+	Megp	Mic
32.	Elaeagnaceae								
98	*Elaeagnus umbellata* Thunb.	S	D-F	+	+	+	+	Np	Mic
33.	Euphorbiaceae								
99	*Euphorbia pilulifera* (L.) Griseb.	S	Cu		+	+	+	Th	L
100	*Euphorbia helioscopia* L.	S	A-D		+	+	+	Th	N
101	*Euphorbia peplus* L.	S	A-D	+	+	+		Th	L
102	*Andrachne cordifalia* (Dcne.) Muell.	S	CU	+	+	+	+	NP	Mic
34.	Fagaceae								
103	*Quercus incana* Roxb.	S	D-F	+	+	+	+	Mesp	Mic
104	*Quercus dilatata* Royle.	S	D-F	+	+	+	+	Mesp	Mic
35.	Gentianaceae								
105	*Swertia petiolata* D. Don.	S	F		+	+		Th	Mic
106	*Swertia ciliate* (G. Don.) B. L. Burtt.	S	D-F		+	+		Th	Mes
36.	Geraniaceae								
107	*Geranium wallichianum* D. Don. ex Sweet.	Dis	F	+	+	+		Th	Mic
108	*Geranium colinum* Sweet.	Comp	F		+			H	Mic
37.	Hamameledaceae								
109	*Parrotiopsis jacquemontiana* (Dcne.) Rehder.	S	D	+	+	+	+	Np	Mes
38.	Hypericaceae								
110	*Hypericum perforatum* L.	S	D		+	+		Ch	N
39.	Juglandaceae								
111	*Juglans regia* L.	Comp	D	+	+	+	+	Mesp	Mic
40.	Lamiaceae								
112	*Otostegia fruitcosa* (Bth.) Sebald.	S	W		+			Ch	Mic
113	*Mentha arvensis* L.	S	W	+	+	+		G	N
114	*Thymus linearis* Bth. ssp. *linearis* Jalas.	S	D		+	+		H	L
115	*Ajuga bracteosa* Wall. Ex Bth.	S	D	+	+	+		H	Mic
116	*Isodon rugosus* (Wall. ex Bth.) Codd.	S	D	+	+	+	+	Np	Mes
117	*Rabdosia rugosa* Benth.	S	D-F	+	+	+	+	Np	Mes
118	*Salvia lanata* Roxb.	S	D-F		+	+	+	Th	Mes

119	*Salvia moorcruftiana* Wall.	S	D-F	+	+			Th	Mac
120	*Salvia nubicola* Wall. Ex Sweet.	S	D		+	+	+	Th	Mes
121	*Ajuga parviflora* Bth.	S	W		+	+	+	Th	Mes
122	*Micromeria biflora* (Ham.) Bth.	S	W		+	+	+	Ch	L
123	*Plectranthus rugosus* Wall-ex Benth.	S	D		+	+		Ch	N
124	*Ocimum bascillicum* L.	S	D	+	+	+	+	Ch	N
125	*Origanum vulgare* L.	S	M-F	+	+			H	N
126	*Mentha longifolia* (L.) Huds.	S	W	+	+	+		H	N
127	*Scutellaria chamaedrifolia* Hedge & Paton.	S	F	+	+	+	+	H	N
128	*Thymus serphyllum* L.	S	D		+	+		H	L
129	*Calamintha umbrosa* (M.Bieb.) Fisch. & Mey.	S	M-F	+	+	+		Th	N
130	*Teucrium stocksianum* Boiss.	S	D-W		+			TH	Mic
131	*Teucrium royleanum* Boiss.	S	D-W	+	+			TH	Mic
41.	Loganaceae								
132	*Buddleja crispa* Bth.	S	A-D	+	+	+	+	NP	N
42.	Malvaceae								
133	*Abelmoschus esculentus* (L.) Moench.	Sp	CU	+	+	+	+	Th	Mes
134	*Malva neglecta* Wallr.	S	A		+	+		Th	Mic
43.	Meliaceae								
135	*Melia azedarach* L.	Comp	GY-W	+	+	+	+	Megp	Mic
44.	Moraceae								
136	*Broussonetia papyrifera* (L.) Herit. Ex Vent.	S	M	+	+	+	+	Megp	Mes
137	*Ficus foveolata* Wall. ex Miq.	S	M	+	+	+	+	H	Mic
138	*Morus nigra* L.	S	A	+	+	+	+	Megp	Mes
139	*Morus alba* L.	S	A	+	+	+	+	Megp	Mes
140	*Ficus carica* L.	S	D-F	+	+	+	+	Megp	Mes
141	*Ficus serrata* L.	Dis	D	+	+	+	+	Megp	Mes
45.	Myrsinaceae								
142	*Myrsine africana* L.	S	M-F	+	+	+	+	NP	N
46.	Nyctaginaceae								
143	*Mirabilis jalapa* L.	S	M-I	+	+	+	+	Th	Mes
47.	Oleaceae								
144	*Jasminum humile* L.	Comp	M-F	+	+	+	+	Np	Mic
145	*Olea ferruginea* Royle.	S	D-GY	+	+	+	+	Mesp	Mic
146	*Jasminum officinale* L.	Comp	D-F	+	+	+	+	NP	N
48.	Onagraceae								
147	*Epilobium hirsutum* L.	S	W	+	+	+		H	N
148	*Oenothera speciosa* Soland.	S	W		+	+		Th	N
49.	Oxalidaceae								
149	*Oxalis corniculata* L.	Comp	M-A	+	+	+		Th	N
50.	Papaveraceae								
150	*Papaver somniferum* L.	Dis	D	+	+			Th	Mes
51.	Papailionaceae								
151	*Phaseolus vulgare* L.	Comp	CU		+			Ch	Mes

152	*Medicago denticulate* Willd.	Comp	A	+	+			Th	N
153	*Astragalus affghanus* Boiss.	Comp	M	+	+	+		Th	N
154	*Indigofera heterantha* Wall. Ex Brandis var. *gerardiana* (Wall. Ex Baker) Ali.	Comp	D-F	+	+	+	+	Np	L
155	*Robinia pseudo-acacia* L.	S	D-F	+	+	+	+	Megp	Mic
156	*Astragalus grahammianus* Royle ex Benth.	Comp	M-F	+	+	+		Ch	L
157	*Medicago lupulina* L.	Comp	M-F	+	+			Th	N
158	*Medicago minima* (L.) Grufb.	Comp	A		+	+		Th	N
159	*Trigonella gracilis* Benth.	Comp	M-A		+	+		Th	N
160	*Pisum sativum* L.	Comp	CU	+				Th	Mic
161	*Lathyrus aphaca* L.	Comp	A	+				Th	Mic
162	*Melilotus officinale* (L.) Desr.	S	M-F		+	+		Th	N
163	*Desmodium elegans* DC.	Comp	D-F	+	+	+	+	NP	Mic
164	*Indigofera heterantha* Wall ex Brandis var. *heterantha*.	Comp	D-F	+	+	+	+	NP	L
165	*Lespedeza juncea* (L.F.) Persoon.	Comp	D	+	+	+	+	Th	L
166	*Trifolium repens* L.	Comp	F	+	+			Th	N
52.	Philadelphaceae								
167	*Deutzia staminea* R. Br .ex Wall.	S	D	+	+	+	+	Micp	Mic
53.	Plantaginaceae								
168	*Plantago major* L.	S	W		+	+		Th	Mes
169	*Plantago lanceolata* L.	S	W		+	+		Th	Mic
170	*Plantago ovata* Forssk.	S	W		+	+		Th	Mic
54.	Platanaceae								
171	*Platanus orientails* L.	Dis	F	+	+	+	+	Megp	Mes
55.	Plumbaginaceae								
172	*Limonium cabulicum* (Boiss.) O. Kuntze.	S	D	+	+	+	+	Np	Mes
56.	Poaceae								
173	*Oryza sativa* L.	S	CU	+	+			G	Mic
174	*Themeda anathera* (Nees) Hack	S	D		+	+	+	H	N
175	*Dicanthium annulatum* (Forssk.) Stapf.	S	GY-A	+	+	+		H	N
176	*Cynodon dactylon* (L.) Pers.	S	A-D		+	+		H	Mic
177	*Zea mays* L.	S	CU		+	+		Th	Mes
178	*Triticum aestivum* L.	S	CU			+	+	Th	Mic
179	*Apluda mutica* L.	S	A-D		+			H	N
180	*Hordeum vulgare* L.	S	CU	+	+			H	Mic
181	*Setaria viridis* (L.) P. Beauv.	S	D		+	+		Th	N
57.	Polygonaceae								
182	*Rumex hastatus* D. Don.	S	W		+	+	+	Ch	N
183	*Bistorta amplexicaulis* (D. Don.) Green.	S	W-F		+	+	+	H	Mes
184	*Polygonum aviculare* L.	S	W		+	+		Th	N
185	*Polygonum posumbo* Buch. Ham. Ex D. Don.	S	W		+	+		Th	N
186	*Polygonum capitatum* Buch.-Ham. Ex D. Don.	S	W		+	+		Th	N
187	*Rumex dentatus* L.	S	W		+	+		Ch	Mes
188	*Polygonum maculosa* S. F. Gay.	S	W		+	+		Th	Mic

58.	Primulaceae								
189	*Androsace rotundifolia* Hardw.	S	D-F		+	+		Th	Mic
59.	Punicaceae								
190	*Punica granatum* L.	S	D	+	+	+	+	Micp	Mic
60.	Ranunculaceae								
191	*Clematis graveolens* Roxb. ex. D.C.	Comp	D	+	+	+		G	Mic
192	*Ranunculus laetus* Wall. Ex Hk. F. & Thoms.	Dis	W	+	+			G	N
193	*Ranunculus muricatus* L.	Dis	W	+	+			G	Mic
194	*Delpinium* sp. Wall. Ex H. &T.	Dis	M		+	+		H	N
195	*Ranunculus hirtellus* Royle.	Dis	W		+			Th	N
61.	Rhamnaceae								
196	*Sageretia thea* (L.) Brongn.	S	D	+	+	+	+	NP	N
197	*Rhamnus pentapomica* Fisch. & C.A.Mey.	S	D-F	+	+	+	+	Micp	N
198	*Ziziphus sativa* Gaertn.	S	D-F	+	+	+	+	Megp	N
199	*Zizyphus oxyphylla* Edge.	S	D	+	+	+	+	Np	N
62.	Rosaceae								
200	*Prunus persica* (L.) Batsch.	S	CU	+	+	+	+	Micp	Mes
201	*Prunus domestica* L.	S	CU	+	+	+	+	Micp	Mes
202	*Prunus armeniaca* L.	S	Cu	+	+	+	+	Micp	Mes
203	*Pyrus pyrifolia* (Burm.) Nak.	S	CU	+	+	+	+	Micp	Mes
204	*Pyrus communis* L.	S	CU	+	+	+	+	MegP	Mac
205	*Rosa moschata* non J. Herrm.	Comp	CU	+	+	+	+	Np	Mic
206	*Spiraea canescens* D. Don.	S	F	+	+	+	+	Np	Mic
207	*Rosa webbiana* Wall. Ex Royle.	Comp	F	+	+	+	+	Np	N
208	*Rosa alba* L.	Comp	CU	+	+	+	+	Np	N
209	*Rubus ulmifolius* subsp. *sanctus* Schreber.	Comp	W	+	+	+	+	Np	Mes
210	*Rubus ellipticus* Smith.	Comp	W-F	+	+	+	+	Np	N
211	*Duchesnea indica* (Andr.) Focke.	Comp	W	+	+	+	+	Th	Mic
212	*Rosa brunonii* Lindl.	Comp	F	+	+	+	+	Np	N
213	*Pyrus malus* L.	S	M-A	+	+	+	+	Micp	Mes
214	*Pyrus pashia* Ham. Ex D.Don.	S	CU	+	+	+	+	Micp	Mes
215	*Sorbaria tomentosa* (Lindl.) Rehder	Comp	W	+	+	+	+	NP	Mic
216	*Cotoneaster nummularia*Fisch.& Mey.	S	F	+	+	+	+	NP	N
217	*Rosa canina* L.	Comp	M-F	+	+	+	+	Np	N
218	*Poterium sanguisorba* Waldst. & Kit.	Dis	W		+	+	+	Th	N
63.	Rubiaceae								
219	*Galium stewartii* L.	S	M-R	+	+	+		Th	L
64.	Rutaceae								
220	*Zanthoxylum armatum* DC.	Comp	CU	+	+	+	+	NP	Mic
221	*Citrus sinensis* (L.) Osbeck.	S	CU	+	+	+	+	Np	Mes
65.	Salicaceae								
222	*Populus alba* L.	S	W	+	+	+	+	Mesp	Mes
223	*Salix tetrasperma* Roxb.	S	W	+	+	+	+	Micp	Mic
224	*Salix alba* L.	S	W	+	+	+	+	Megp	Mic
225	*Populus nigra* L.	S	W	+	+	+	+	Megp	Mic

66.	Sapindaceae								
226	*Dodonaea viscosa* (L.) Jacq.	S	D	+	+	+	+	Np	N
67.	Saxifragaceae								
227	*Bergenia ciliata* (Haw.) Sternb.	S	W		+	+	+	G	Mes
68.	Scrophulariaceae								
228	*Scrophularia umbrosa* Dumort.	S	D		+	+		Ch	N
229	*Verbascum thapsus* L.	S	W	+	+			Th	Meg
230	*Scrophularia nodosa* L.	S	D		+			Th	N
69.	Simarubaceae								
231	*Ailanthus altissima* (Mill.) Swingle.	Comp	A-I	+	+	+	+	Megp	Mic
70.	Smilacaceae								
232	*Smilax glaucophylla* Klotzsch.	S	EPI	+	+	+	+	Np	Mes
71.	Solanaceae								
233	*Solanum tuberosum* L.	Comp	CU		+			G	Mes
234	*Capsicum frutescens* L.	S	CU	+	+	+	+	Np	Mes
235	*Datura innoxia* Mill.	S	D		+	+		Th	Mes
236	*Hyoscyamus niger* L.	S	F	+				Th	Mes
237	*Solanumnigrum*L. var. *villosum*.	S	D-W		+	+		Th	Mes
238	*Lycopersicom esculentum* Miller.	S	CU	+	+	+	+	Th	Mic
239	*Capsicum annuum* L.	S	CU		+	+		Th	Mic
240	*Solanum nigrum* L. var. *nigrum*.	S	D-W		+			Th	Mic
241	*Datura stramonium* L.	S	D-F		+	+	+	Ch	Mes
72.	Thymeleaeceae								
242	*Daphne mucronata* Royle.	S	D-F	+	+	+	+	Np	N
243	*Wikstroemia canescens* Meissn.	S	F	+	+	+	+	NP	N
73.	Ulmaceae								
244	*Celtis caucasica* Willd.	S	GY	+	+	+	+	Megp	Mic
245	*Celtis australis* L.	S	D	+	+	+	+	Mesp	Mic
74.	Urticaceae								
246	*Urtica dioca* L.	S	D	+	+	+		Th	Mic
247	*Girardinia palmata* (Forssk.) Gaudich.	Dis	D	+	+	+		Th	N
75.	Valerianaceae								
248	*Valeriana wallichii* DC.	S	M-F	+	+	+		Th	Mic
76.	Violaceae								
249	*Viola canescens* Wall. Ex Roxb.	S	M-R		+	+		H	Mic
77.	Vitaceae								
250	*Vitis vinifera* L.	S	CU	+	+	+		Np	Mes

Seasonal variation of vegetation

Seasonal variation of vegetation (Fig. 3) shows that highest number of species i.e. 241 (33%) were found in summer, while less number of species were found in winter season (Table 2.). Samreen *et al.,* (2016) reported highest number of species in spring season in Darazinda (D. I. Khan) which falls in a different phytogeographical region. However, our findings are supported by Durrani *et al.* (2010), Badshah *et al.* (2013) and Ali *et al.* (2016) who reported highest number of species in summer.

Life form

Life form reflects the macro and microclimatic conditions of the area (Raunkiaer, 1934; Shimwell, 1971) while, biological spectrum is useful for the comparison of geographically distinct communities as well as it is used as an indicator for existing environmental conditions of the area (Khan *et al.,* 2014) which may be altered due to grazing and human disturbance (Cain and Castro, 1959). In the present study, therophytes (101 Species, 40.4%) were dominant followed by hemicryptophytes (43 Species, 17.2%) (Fig. 4.). Results presented here are in line with the findings of Al-Yemeni and Sher (2010), Sharma *et al.* (2014), Samreen *et al.* (2016) and Ali *et al.* (2016). Occurrence of similar biological spectra in different regions indicates similar climatic conditions. In the present study, the dominancy of therophytes indicates the disturbed environmental conditions in the area because therophytes dominate in disturbed environmental conditions because, in normal spectra therophytes are the indicator species of desert climate, hemicryptophytes of high altitude while geophytes are the characteristics species of Mediterranean climatic conditions ((Shah *et al.,* 1991; Sikarwar, 1996; Guo *et al.,* 2009; Al-yameni and Sher, 2010; Manhas *et al.,* 2010; Badshah *et al.,* 2013; Ali *et al.,* 2016).

Table 2. Ecological characteristics of vegetation of Jelar valley.

S/no	Characteristics		
1	Vegetation	Number	%age
i	Families	77	-
ii	Genera	177	-
iii	Species	250	-
2	Habitat type		
i	Dry mountain slope	70	21.21
ii	Wet places	68	20.61
iii	Forest	65	19.70
iv	Cultivated	44	13.33
v	Moist shady places	38	11.52
vi	Agricultural fields	22	6.67
vii	Rock crevices	13	3.94
viii	Graveyards	7	2.12
ix	Introduced	2	0.61
x	Epiphyte	1	0.30
3	Seasonality		
i	Spring	161	22
ii	Summer	241	33
iii	Autumn	202	28
iv	Winter	123	17
4	Life form classes		
i	Therophytes	101	40.4
ii	Hemicryptophytes	43	17.2
iii	Nanophanerophytes	38	15.2
iv	Megaphanerophytes	16	6.4
v	Chameophytes	16	6.4
vi	Geophytes	16	6.4

vii	Microphanerophytes	11	4.4
viii	Mesophanerophytes	9	3.6
5	Leaf Size spectra		
i	Microphyll	80	32.0
ii	Nanophyll	75	30.0
iii	Mesophyll	57	22.8
iv	Leptophyll	27	10.8
v	Macrophyll	6	2.4
vi	Aphyllous	2	0.8
vii	Megaphyll	3	1.2
6	Lamina Shape		
i	Simple	155.0	62.00
ii	Compound	63.0	25.20
iii	Dissected	24.0	9.60
iv	Needles	2.0	0.80
v	Absent	3	1.20
vi	Spiny	3	1.20

The environmental conditions of the area are greatly disturbed by biotic pressures on vegetation which has resulted in an increase in the density of short lived species. Our findings are also supported by Saxena *et al.* (2004), Al-Yameni and Sher (2010), Naqinezhad and Zarezadeh (2012), Ilyas *et al.* (2012), Alsherif *et al.* (2013), Farag. (2014) and Ali *et al.* (2016) that biotic pressure on vegetation greatly affect the vegetation.

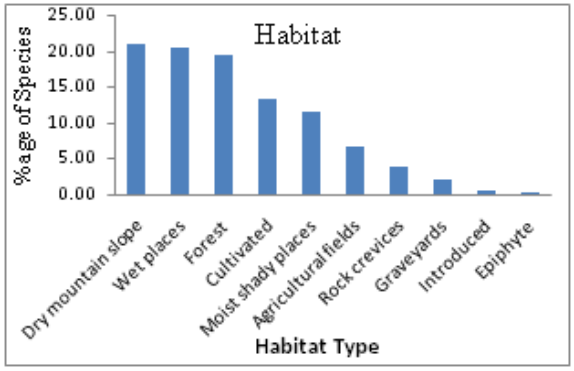

Fig. 2. Percentage of species based on their habitat

Seasonal variation in Life form

The results of seasonal variation in different life form classes revealed that in spring, therophytes (40 Species, 24.8%) were dominant followed by nanophanerophytes (38 Species, 23.6%), while, in summer therophytes (95 Species, 39.4%) were dominant followed by hemicryptophytes (43 Species, 17.8%). Similarly, in autumn the maximum numbers of species (70 Species, 34.7%) were therophytes followed by nanophanerophytes. In winter season, nanophanerophytes (38 Species, 30.9%) were abundant followed by hemicryptophytes (Fig. 5.). Similar study was conducted by Ali *et al.* (2016) in Chail valley and reported therophytes as the dominant life form in spring, summer and nanophanerophytes during autumn and winter season.

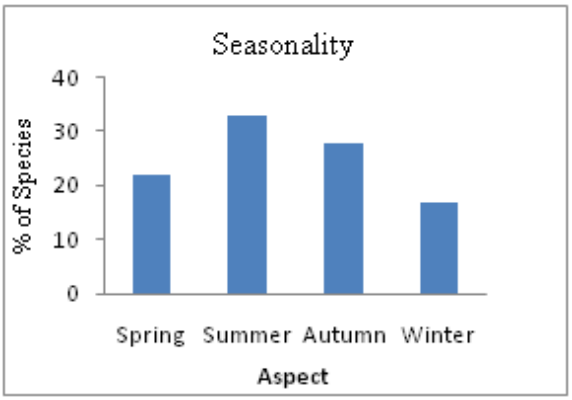

Fig. 3. % age no. of species in different seasons.

The seasonal variation in life form was also reported by Al-yameni and Sher. (2010) from Asir Mountains (Saudi Arabia), Durrani *et al.* (2010) from

Baluchistan, Samreen *et al.* (2016) from Darazinda (D. I. Khan), Ali *et al.* (2016) from Chail Valley (Swat), Badshah *et al.* (2016) from Kuram Agency (Parachinar) and Ullah *et al.* (2016) from Bannu (Pakistan).

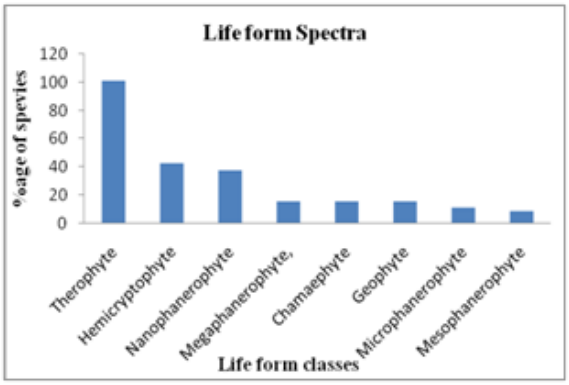

Fig. 4. Life form spectra of vegetation of Jelar valley.

Leaf size spectra

The knowledge of leaf size is helpful for the understanding of physiological processes of plants species and their communities (Oosting, 1956) as well as the leaf sized classes are useful for associations. In the present study, the leaf size spectra indicated that the leading dominant leaf size class was microphylls (80 Species, 32%) followed by nanophylls (75 Species, 30%) while, aphyllous plants were represented with only 2 species in the area (Fig. 6.).

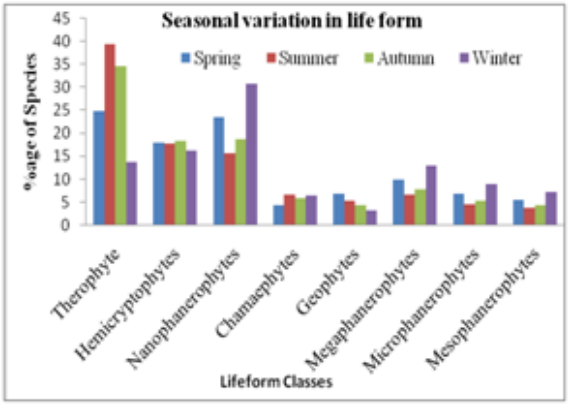

Fig. 5. Seasonal variation in Life form of vegetation.

Seasonal variation in leaf size spectra

The results of seasonal variation in leaf size spectra revealed that in all the seasons, microphylls were dominant, while the differences were found in the percentage contribution of species in different seasons as microphylls were 34% in spring, 31.5% in summer, 30% in autumn and 31% in winter (Fig 7.).

Seasonal variation occurs in leaf sized spectra due to annuals herbaceous species in the area as reported by different authors (Ali *et al.,* 2016; Al-Yemeni and Sher, 2010). Khan *et al.*(2011) reported the biological spectrum of vegetation of Dara Adam Khel and found microphyllus and mesophyllus species dominant during spring and monsoon seasons. Amjad *et al.* (2012) reported leptophylls and microphylls the dominant leaf form classes from Sub-Tropical to Alpine and Subalpine vegetation of Basu Hills (Gilgit).

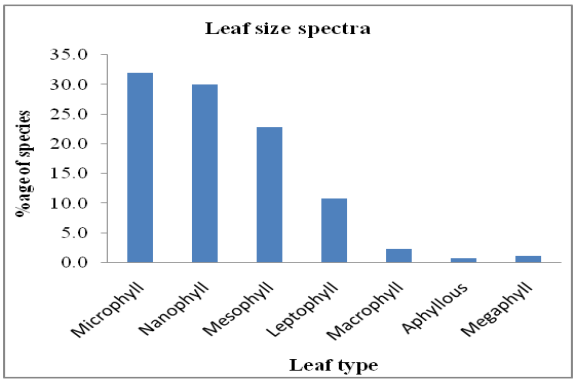

Fig. 6. Leaf size spectra of vegetation of Jelar valley.

Our findings are also in line with Malik and Hussain. (1990) who studied the vegetation of dry subtropical area of Kotli (Kashmir). Our results are also in agreement with Qadir and Tareen (1987) who reported the same leaf forms from dry temperate areas of Quetta.

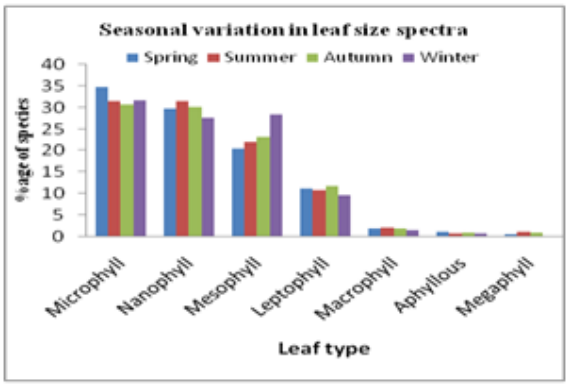

Fig. 7. Seasonal variation in Leaf spectra of vegetation.

The percentage of different leaf form classes varied with change in altitude (Saxena *et al.,* 1987).Dolph and Dilcher. (1980) reported megaphyll as a dominant leaf form.

Our results are also strongly supported by Amjad *et al.* (2012) who stated that abundance of microphylls is the characteristic of cold, dry climates and degraded habitat. However, leaves alone could not be used for the recognition of a definite climate, but in combination with other characteristics (morphological and anatomical) would provide more perfect results to establish leaf zones.

Conclusion

It is concluded that the flora of the area is diverse. Phytoclimate of the area is therophytic type and the environmental condition of the area is greatly disturbed by biotic pressure on the flora which supporting the increase of short lived species in the area. This study provides baseline information on the flora of the area and further study is recommended for the exploration of quantitative information of vegetation.

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