

## FLORISTIC COMPOSITION, BIOLOGICAL SPECTRUM AND PHENOLOGY OF TEHSIL HAVELIAN, DISTRICT ABBOTTABAD, KP, PAKISTAN

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### Abstract

Detailed field survey was carried out to assess the floristic composition, phenology, leaf and biological spectrum of Tehsil Havelian during 2011-2012. A total of 205 plant species belonging to 78 families were documented. According to plant habit there are 129 species of herbs, 38 species of trees and 38 species of shrubs. Asteraceae and Lamiaceae were dominant families with 15 species each, then Brassicaceae 11 species, Rosaceae and Papilionaceae with 10 species each. They were followed by Ranunculaceae with 9 species. All the remaining 72 families have less than 7 members. Flowering season was classified in two spells, first from March to July with 62.56% herbs, 19.48% shrubs, 18.46% trees, 2.56% grasses and 1.02% ferns. Second spell starts from August to November with 50% shrubs, 30% herbs and 20% trees. The life form classes were determined by the Raunkier's method which reveals that the most dominant life form was Therophytes with 89 species (43.68%), followed by Nanophanerophytes 26 species (12.62%), Megaphanerophytes 20 species (9.70%), Mesophanerophytes 19 species (9.22%), Chamaephytes 15 species (7.28%), Hemicryptophytes 15 species (7.28%), Geophytes 11 species (5.33%), Lianas 6 species (2.91%), Microphanerophytes 3 species (1.45%) and Neophytes with 1 species (0.48%). As for as leaf size concerned, Microphyll was the most prevalent leaf size with 98 species (47.80%), followed by Nanophyll 55 spp. (26.82%), Leptophyll 28 species (13.65%), Mesophyll 16 spp. (7.80%) and Megaphyll contributing with 8 species (3.90%). Study reflects the overall ecological scenario and may be beneficial as reference study for conservation and sustainable use of plants.

**Key words:** Floristic composition, Biological spectrum, Phenology, Havelian, Pakistan.

### Introduction

Havelian is Tehsil of District Abbottabad, Khyber Pakhtunkhwa lies in 34° 05' N latitude and 73° 16' E longitudes. It is located at 868 meter height above sea level. The area falls in subtropical humid zone with mild to warm temperature during April-May and September-October respectively; humid temperature in June-July, and cool to mild temperature during November-February. The temperature rises up to 35°C during the mid-summer months and drops below 0°C during winter months. The average mean monthly maximum and minimum temperature of the year are 24.66°C and 12.25°C respectively. The mean annual rainfall is 1,269 mm. Maximum rainfall occurs during July and August which is 247 mm and 244 mm respectively. This season is endowed with heavenly beauty that not only attracts tourists but also invite botanists for its unique flora. The total population of the area is 40,947.

The most useful and main source of botanical information of a particular area is its floristic checklists. Floristic composition is a good floristic marker, because any kind of changing floristic compositions in different endogenous milieu show the existence of different ecological factors; leads to inter- and intra-specific diversity (Safidkon *et al.*, 2003). Floristic study of any given area helps to evaluate the plant wealth and its potential values. The local plants identification and introduction of an area is very important to introduce the specific species of local area and their occurrence, growing seasons, finding new species and also the effect of climatic conditions like over-grazing, drought and temperature etc. on vegetation (Ali, 2008; Ahmad *et al.*, 2008).

Many workers have contributed comprehensive floristic checklists of local flora in different regions (Baig *et al.*, 1998; Qureshi & Bhatti, 2008; Abdullahi *et al.*, 2009; Jabeen *et al.*, 2009; Shaheen & Qureshi, 2011; Udayakumar *et al.*, 2011; Qin *et al.*, 2012; Youcef *et al.*, 2012).

Due to presence of diverse topographic features and microhabitats, the selected study area has a great potential for flourishing a rich plant biodiversity. The present study was planned with the objectives to investigate and document the floristic composition of the study area because the vegetation of the surrounding areas of cantonment was unexplored and never have been studied previously. It will be helpful for the conservation and sustainable utilization of plant resources of the area and also for further ecological investigations.

### Materials and Methods

The detailed field surveys have been conducted to document the floristic composition, phenology, leaf and biological spectrum of Tehsil Havelian, District Abbottabad, Khyber Pakhtunkhwa at regular intervals of different seasons of the year during 2011-2012. Three specimens of each plant species have been collected, dried and mounted on standard herbarium sheets. During the plant collection, local name, collection date, habit, habitat, flower color and phenological behavior of each plant species were recorded. The life form classes and leaf spectra of all plant species were determined and classified followed after Raunkiaer (1934) and Mueller-Dombois & Ellenberg (1974). The collected specimens were identified with the help of Flora of Pakistan (Nasir & Ali, 1971-94; Ali & Qaiser, 1995-2004). The voucher specimens were deposited in the Herbarium of Hazara University Mansehra, KP, Pakistan (Fig. 1).

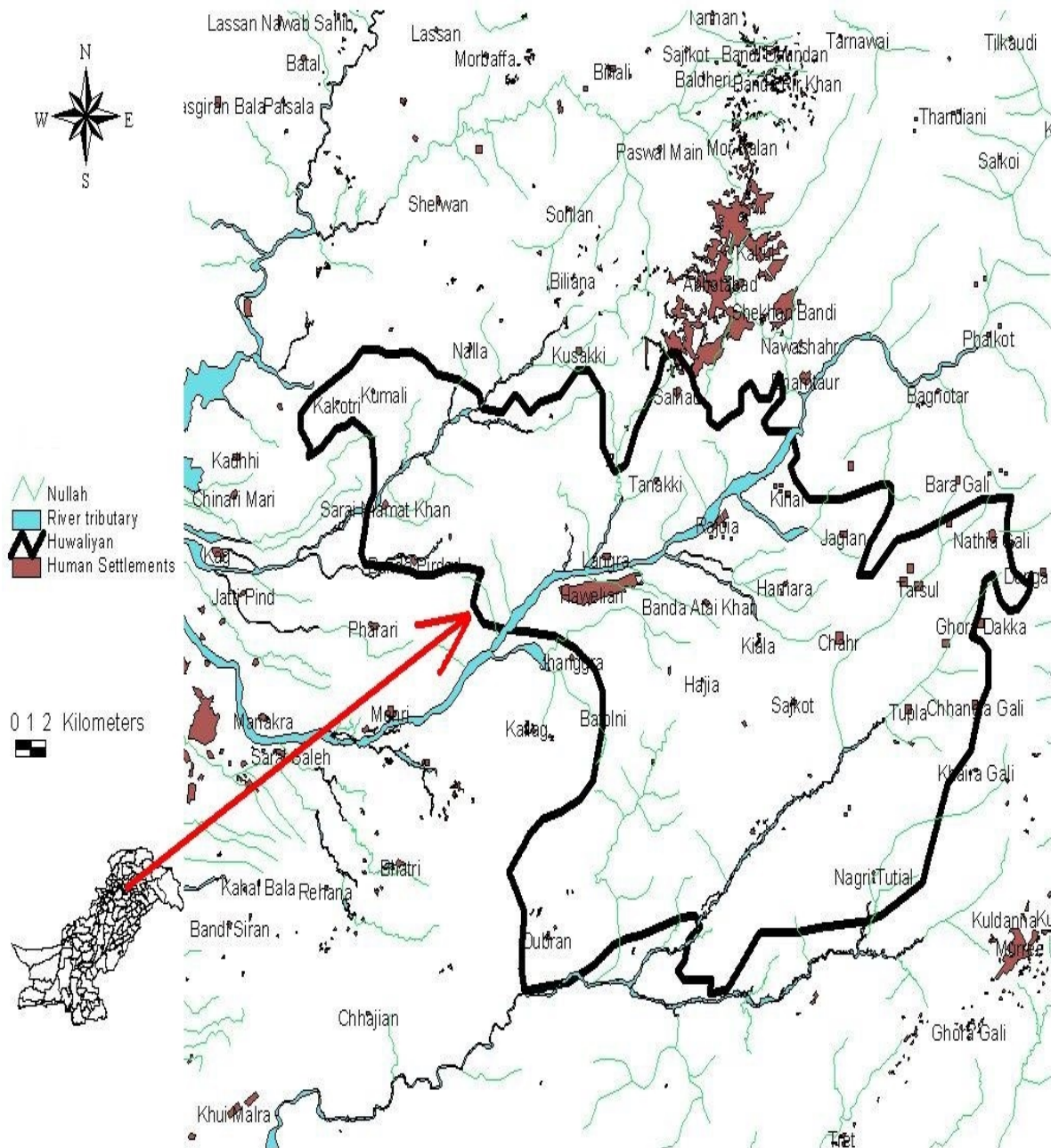


Fig. 1. Map of Tehsil Havelian, Abbottabad, Pakistan.

## Results

In present study, a total 205 plant species belonging to 164 genera and 78 families were recorded from study area. 197 plant species belong to angiosperms, 5 species belong to gymnosperms and 3 species belong to Pteridophytes (Fig. 2). Angiospermatophyta contains 75 families while 3 families are of Gymnosperms (Fig. 3).

According to plant habit there are 129 species of herbs, 38 species of trees and 38 species of shrubs (Fig. 4). Asteraceae and Lamiaceae were dominant families with 15 species each, then Brassicaceae 11 species, Rosaceae and Papilionaceae with 10 species each. They

were followed by Ranunculaceae with 9 species, Liliaceae 6, Poaceae, Polygonaceae and Plantaginaceae with 5 species each, Acanthaceae, Caryophyllaceae, Euphorbiaceae and Solanaceae with 4 species each. Apiaceae, Apocynaceae, Asclepidaceae, Caprifoliaceae, Malvaceae, Mimosaceae, Moraceae, Oleaceae and Papaveraceae with 3 species each. Alliaceae, Anacardiaceae, Boraginaceae, Campanulaceae, Cyperaceae, Fagaceae, Iridaceae, Lythraceae, Myrtaceae, Nyctaginaceae, Pinaceae, Pteridaceae, Salicaceae, Sapindaceae, Utricaceae and Verbinaceae had 2 species each. The remaining 40 Families had 1 species each (Table 1 & Fig. 5).

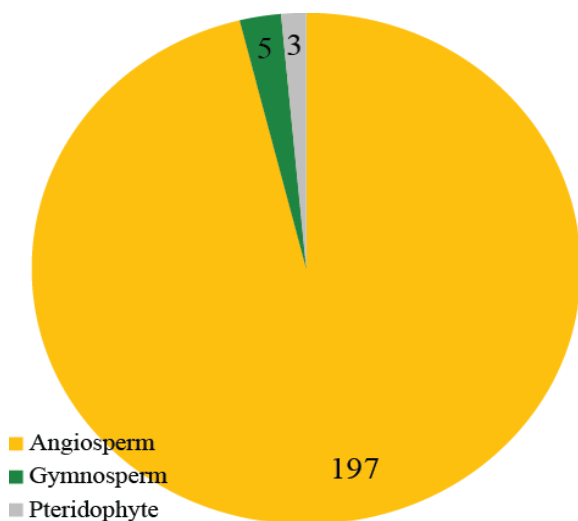


Fig. 2. Division of the plant species recorded from the study area.

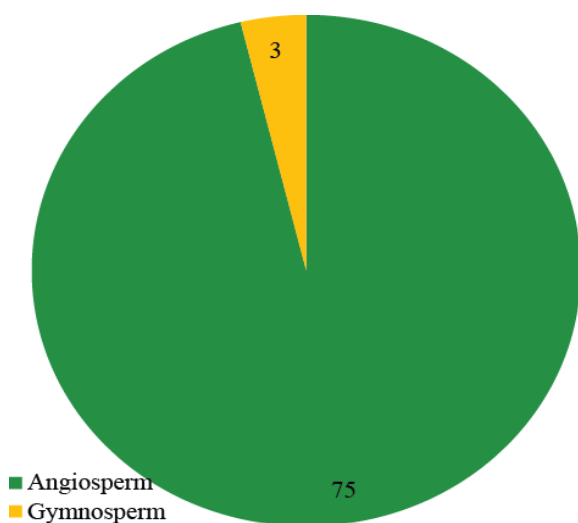


Fig. 3. Angiosperm and gymnosperm families of the plant species recorded from the study area.

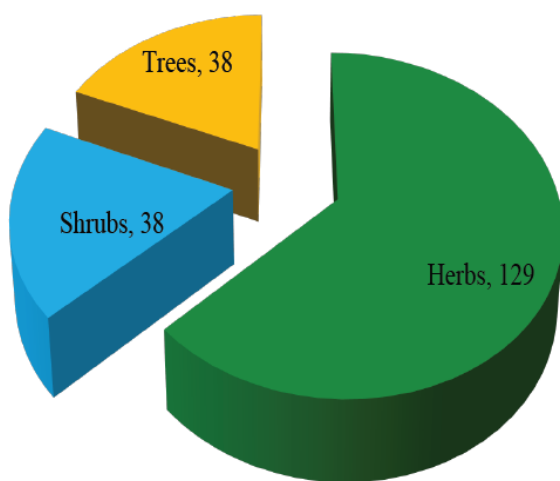


Fig. 4. Growth habit of the plant species recorded from the study area.

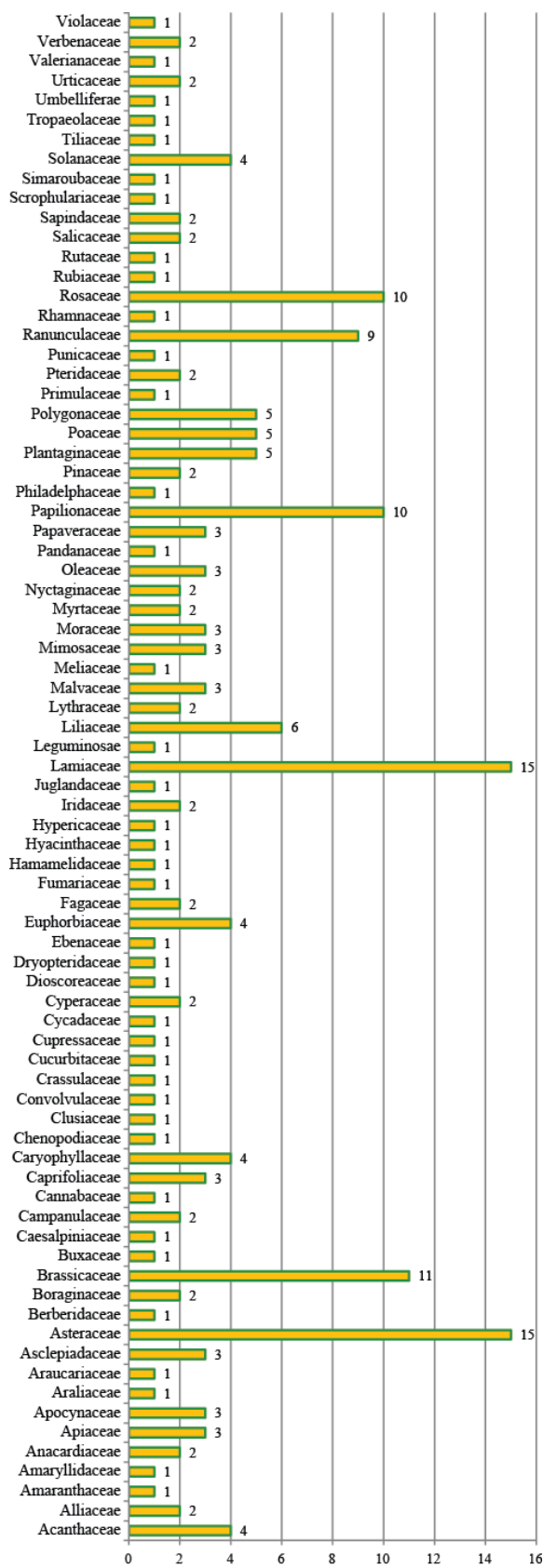


Fig. 5. Plant species family wise distribution of recorded from the study area.

Table 1. List of plant species, biological spectrum and phenology of Tehsil Havelian, District Abbottabad, KP, Pakistan.

S. No.	Species	Family	Plant habit	Life form classes		Phenology	
				Life form	Leaf size spectra	Flowering	Fruiting
1.	<i>Acacia arabica</i> (Lam.) Willd.	Mimosaceae	T	MP	L	March-May	July
2.	<i>Acacia modesta</i> Wall.	Mimosaceae	T	MP	L	March-May	July
3.	<i>Acacia nilotica</i> (L.) Delile	Mimosaceae	S	MesP	L	June	July
4.	<i>Adiantum capillus-veneris</i> L.	Pteridaceae	H	TH	N	Spores produced	June-August
5.	<i>Aerva javanica</i> (Burm.f.) Juss. ex Schult.	Amaranthaceae	H	CH	N	Jan-Dec	Feb
6.	<i>Aesculus indica</i> (Wall ex Cambess.) Hook.	Sapindaceae	T	MP	Mic	May-June	July-Aug
7.	<i>Alanthus altissima</i> (Mill) Swingle	Simaroubaceae	T	MP	Mic	March-April	May-June
8.	<i>Ainsliea aptera</i> DC.	Asteraceae	H	TH	Mic	March-June	June-July
9.	<i>Ajuga integrifolia</i> Buch.-Ham.	Lamiaceae	H	TH	N	March-May	June-July
10.	<i>Ajuga parviflora</i> Benth.	Lamiaceae	H	TH	N	May-June	June-July
11.	<i>Alliaria petiolata</i> (M.Bieb.) Cavara & Grande	Brassicaceae	H	TH	Mic	April-May	June-July
12.	<i>Allium cepa</i> L.	Alliaceae	H	G	Mic	June-July	August
13.	<i>Allium sativum</i> L.	Alliaceae	H	G	Mic	March	April-May
14.	<i>Androsace rotundifolia</i> Hardw.	Primulaceae	H	H	N	May-Jun	July-Aug
15.	<i>Aquilegia pubiflora</i> Wall. ex Royle	Ranunculaceae	H	H	N	May-Jun	July-Aug
16.	<i>Arabis saxicola</i> Edgew.	Brassicaceae	H	CH	L	May-June	July-Aug
17.	<i>Araucaria</i> sp.	Araucariaceae	T	MP	Mag	-	-
18.	<i>Arnebia hispidissima</i> (Lehm.) A.DC.	Boraginaceae	H	TH	L	March-April	May-June
19.	<i>Arabislopsis wallichii</i> (Hook. f. & Thomson) N. Busch	Brassicaceae	H	CH	Mic	June	July
20.	<i>Artemisia</i> sp.	Asteraceae	H	CH	N	Sept-Oct	Nov-Dec
21.	<i>Asparagus officinalis</i> L.	Liliaceae	H	G	L	April-May	June-July
22.	<i>Asplenium dalhousiae</i> Hook.	Asclepiadaceae	H	TH	N	July-Aug	Sept.
23.	<i>Barbarea cristata</i> L.	Acanthaceae	S	H	Mic	June-July	August
24.	<i>Bauhinia variegata</i> L.	Caesalpiniaceae	T	MP	Mes	April-May	June-July
25.	<i>Berberis lycium</i> Royle	Berberidaceae	S	NP	Mic	June	July
26.	<i>Boerhaavia diandra</i> L.	Nyctaginaceae	S	Ch	N	Aug-Oct	Sept-Nov
27.	<i>Bougainvillea</i> sp.	Nyctaginaceae	T	MP	Mic	August	Sept.
28.	<i>Brassica campestris</i> L.	Brassicaceae	H	TH	Mes	March-April	May-June
29.	<i>Bromus secalinus</i> L.	Poaceae	H	TH	N	May-June	July
30.	<i>Bromus tectorum</i> L.	Poaceae	H	TH	Mic	April-May	June-July
31.	<i>Callistemon citrinus</i> (Curtis) Skeels	Myrtaceae	T	MesP	Mic	May-June	July
32.	<i>Calotropis procera</i> (Aiton) Dryand.	Asclepiadaceae	S	MP	Mes	June-Oct	Sept-Nov
33.	<i>Campanula cashmeriana</i> Royle	Campanulaceae	H	CH	L	June-July	August
34.	<i>Campanula pallida</i> Wall.	Campanulaceae	H	CH	L	May-June	July
35.	<i>Campylotropis meeboldii</i> (Schindl.) Schindl.	Papilionaceae	S	NP	N	July-Sept	Aug-Oct
36.	<i>Cannabis sativa</i> L.	Cannabaceae	H	TH	Mic	May-June	July
37.	<i>Capsella bursa-pastoris</i> (L.) Medic.	Brassicaceae	H	TH	Mic	April-May	June-July
38.	<i>Centaurea iberica</i> Trevit. ex Spreng.	Asteraceae	H	CH	Mes	May-June	July
39.	<i>Cerastium glomeratum</i> Thuill.	Caryophyllaceae	H	TH	Mic	April	May-June
40.	<i>Cerastium tomentosum</i> L.	Caryophyllaceae	H	TH	L	May-June	July
41.	<i>Chenopodium album</i> L.	Chenopodiaceae	H	TH	N	June-July	August

Table 1. (Cont'd.).

S. No.	Species	Family	Plant habit	Life form classes		Phenology	
				Life form	Leaf size spectra	Flowering	Fruiting
42.	<i>Cirsium vulgare</i> (Savi) Ten.	Asteraceae	H	TH	Mic	April	May-June
43.	<i>Clematis grata</i> Wall.	Ranunculaceae	T	L	N	July-Aug	Sept-Oct
44.	<i>Clematis montana</i> Bush.-Ham. ex DC.	Ranunculaceae	S	L	Mic	May-June	July
45.	<i>Clematis</i> sp.	Ranunculaceae	H	L	N	May	June-July
46.	<i>Colebrookea oppositifolia</i> Sm.	Lamiaceae	T	MP	Mes	April	May-June
47.	<i>Convolvulus arvensis</i> L.	Convolvulaceae	H	G	N	March-April	May-June
48.	<i>Conyza japonica</i> (Thunb.) Less. ex Less.	Asteraceae	H	TH	L	Sept	Oct
49.	<i>Conyza</i> sp.	Asteraceae	H	TH	Mic	July-Sept	Sept-Oct
50.	<i>Coriandrum sativum</i> L.	Apiaceae	H	TH	L	April-May	June-July
51.	<i>Cotinus coggygria</i> Scop.	Anacardiaceae	H	TH	Mic	June	July
52.	<i>Crambe cordifolia</i> Steven	Brassicaceae	H	TH	Mic	March-April	May-June
53.	<i>Crucihimalaya himalaica</i> (Edgew.) Al-Shehbaz, O'Kane & R.A. Price.	Brassicaceae	H	TH	Mic	March-April	May-June
54.	<i>Cycas</i> sp.	Cycadaceae	S	MP	Mes	-	-
55.	<i>Cynodon dactylon</i> L.	Poaceae	H	G	L	Throughout the year except	December
56.	<i>Cyperus alternifolius</i> L.	Cyperaceae	H	H	N	April-May	Dec
57.	<i>Cyperus rotundus</i> L.	Cyperaceae	H	H	N	May	June-July
58.	<i>Dalbergia sissoo</i> DC.	Papilionaceae	T	MP	Mic	May-June	July-Aug
59.	<i>Datura alba</i> L.	Solanaceae	H	TH	Mes	June-July	August
60.	<i>Desmodium elegans</i> DC.	Papilionaceae	S	NP	N	July-Aug	Sept-Oct
61.	<i>Debregeasia saeneb</i> (Forsk.) Hepper & J.R.I. Wood	Urticaceae	S	NP	N	April-May	June-July
62.	<i>Deutzia staminea</i> R.Br. ex Wall.	Philadelphaceae	S	NP	N	April-May	June-July
63.	<i>Dicliptera bupleuroides</i> Nees	Acanthaceae	H	TH	N	June-Oct	Sept-Oct
64.	<i>Dioscorea deltoidea</i> Wall. ex Griseb.	Dioscoreaceae	H	L	Mic	June-July	August
65.	<i>Diospyros lotus</i> L.	Ebenaceae	T	MP	Mic	Sept-Oct	November
66.	<i>Dodonaea viscosa</i> (L.) Jacq.	Sapindaceae	S	NP	Mic	April-May	June-July
67.	<i>Dryopteris wallichiana</i> (Spreng.) Hyl.	Dryopteridaceae	H	H	Mag	May-June.	July-Aug
68.	<i>Eleocharis</i> sp.	Poaceae	H	TH	N	May-June	July-Aug
69.	<i>Eruca sativa</i> L.	Brassicaceae	H	TH	Mic	April-May	June-July
70.	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	T	MP	Mic	Sept-Oct	Nov-Dec
71.	<i>Euphorbia helioscopia</i> L.	Euphorbiaceae	H	MP	Mic	Aug-Sept	Oct-Nov
72.	<i>Euphorbia wallichii</i> Hook.f	Euphorbiaceae	H	TH	N	Aug-Sept	Oct-Nov
73.	<i>Ficus carica</i> L.	Moraceae	T	TH	N	Apr-May	June-July
74.	<i>Foeniculum vulgare</i> L.	Papilionaceae	H	MP	Mic	April	July
75.	<i>Foeniculum vulgare</i> Mill.	Apiaceae	H	TH	Mic	April-May	June-July
76.	<i>Fragaria nubicola</i> (Lindl. ex Hook. f) Lacaite	Rosaceae	H	TH	Mic	May-June	July
77.	<i>Fumaria indica</i> (Hauusskn.) Pugsley	Fumariaceae	H	TH	N	May-June	July
78.	<i>Gagea reticulata</i> (Pall.) Schult. & Schult.f.	Liliaceae	H	CH	Mic	March-April	May-June
79.	<i>Galinsoga parviflora</i> Cav.	Fumariaceae	H	TH	L	June-July	August
80.	<i>Galium aparine</i> L.	Rubiaceae	H	TH	Mic	May-June	July
81.	<i>Gerbera gossypina</i> (Royle) Beauverd	Asteraceae	H	TH	L	March-April	May-June
82.	<i>Grewia optiva</i> J.R. Drumm. ex Burret	Tiliaceae	T	TH	L	Feb-March	April-May

Table I. (Cont'd.).

S. No.	Species	Family	Plant habit	Life form classes		Phenology	
				Life form	Leaf size spectra	Flowering	Fruiting
83.	<i>Hieracium Umbella</i> Nagila & Peter	Asteraceae	H	MP	Mic	March-April	May-June
84.	<i>Himaliella heteromalla</i> (D.Don) Raab-Straube.	Asteraceae	H	H	Mic	March-April	May-Sept
85.	<i>Hedera nepalensis</i> K. Koch	Araliaceae	H	TH	N	April-Aug	June-Sept
86.	<i>Hypericum perforatum</i> subsp. <i>Songaricum</i> (Ledeb. ex Rehb.) N. Robson	Hypericaceae	S	L	Mic	June-Aug	Sept
87.	<i>Ipomoea eriocarpa</i> R. Br	Convolvaceae	H	G	N	Sept-Oct	Nov-Dec
88.	<i>Iris reichenbachii</i> Heuff.	Iridaceae	H	TH	Mic	April-May	June-July
89.	<i>Iris sanguinea</i> L.	Iridaceae	H	G	Mag	April-May	June-July
90.	<i>Isodon rugosus</i> (Wall. ex Benth.) Codd	Lamiaceae	S	G	Mag	July-Sept	Oct-Nov
91.	<i>Jasminum humile</i> L.	Oleaceae	S	NP	N	Aug	Sept
92.	<i>Jasminum officinale</i> L.	Oleaceae	S	NP	Mic	April-May	Jun-Aug
93.	<i>Juglans regia</i> L.	Juglandaceae	T	NP	Mic	July	August
94.	<i>Justicia adhatoda</i> L.	Acanthaceae	S	MP	Mag	March-April	May-June
95.	<i>Lagerstroemia indica</i> L.	Lythraceae	T	NP	Mic	June-July	August
96.	<i>Laminium amplexicaule</i> L.	Lamiaceae	H	NP	Mic	March-April	May-June
97.	<i>Lathyrus aphaca</i> L.	Papilionaceae	H	TH	N	Aug-Sept	Oct-Nov
98.	<i>Lathyrus odorata</i> L.	Papilionaceae	H	TH	Mic	April	May-June
99.	<i>Lathyrus sativus</i> L.	Papilionaceae	H	TH	L	June-July	August
100.	<i>Lonicera quinquelocularis</i> Hard.	Papilionaceae	S	TH	N	May-June	July-Aug
101.	<i>Lotus garcini</i> Ser.	Caprifoliaceae	H	MicP	Mic	March-April	May-June
102.	<i>Luffa cylindrica</i> (L.) M.Roem.	Cucurbitaceae	H	H	L	April-May	June-July
103.	<i>Lythrum salicaria</i> L.	Lythraceae	H	L	Mag	Jan-March	April-May
104.	<i>Mallotus philippensis</i> (Lam.) Müll.Arg.	Euphorbiaceae	S	G	Mic	June-July	August
105.	<i>Malva nicaeensis</i> All.	Malvaceae	H	NP	Mic	May	June-July
106.	<i>Malva parviflora</i> L.	Malvaceae	H	TH	Mic	May	June-July
107.	<i>Malvastrum coromandelianum</i> (L.) Garcke	Malvaceae	H	TH	Mic	May-June	July
108.	<i>Medicago polymorpha</i> L.	Leguminosae	H	H	N	March-April	June-July
109.	<i>Melia azedarach</i> L.	Meliaceae	T	TH	N	April	May
110.	<i>Mentha arvensis</i> L.	Lamiaceae	H	MP	Mic	July-Sept	Aug-Oct
111.	<i>Mentha longifolia</i> (L.) L.	Lamiaceae	H	H	Mic	July-Sept	Oct-Nov
112.	<i>Micromeria biflora</i> (Buch.-Ham. ex D. Don) Benth.	Lamiaceae	H	H	Mic	Feb-March	April-May
113.	<i>Morus alba</i> L.	Moraceae	T	CH	L	April-May	June-July
114.	<i>Morus nigra</i> L.	Moraceae	T	MP	Mes	April-May	June
115.	<i>Narcissus tazetta</i> L.	Amaryllidaceae	H	MP	Mes	Jan-Oct, Nov-Dec	March-Jan
116.	<i>Nastium officinale</i> L.	Tropaeolaceae	H	G	Mic	April-May	June-July
117.	<i>Nasturtium officinale</i> R.Br.	Brassicaceae	H	TH	Mic	April-May	June-July
118.	<i>Nepeta raphanophiza</i> Benth.	Lamiaceae	H	TH	L	March-April	May-June
119.	<i>Nepeta gracilliflora</i> Benth.	Lamiaceae	H	TH	L	May-June	July-Aug
120.	<i>Nepeta tuberosa</i> L.	Lamiaceae	H	TH	Mic	June-Aug	July-Sept
121.	<i>Nerium indicum</i> Mill.	Apocynaceae	S	NP	Mic	May-June	July-Aug
122.	<i>Nerium oleander</i> L.	Apocynaceae	S	NP	Mic	March-Oct	April-Nov
123.	<i>Notholirion thomsonianum</i> (Royle) Stapf	Liliaceae	H	TH	Mic	March-April	May-June

Table 1. (Cont'd).

S. No.	Species	Family	Plant habit	Life form classes		Phenology	
				Life form	Leaf size spectra	Flowering	Fruiting
124.	<i>Olea ferruginea</i> Wall. ex Aitch.	Oleaceae	T	MP	Mic	April-May	June-July
125.	<i>Pandanus odorifer</i> (Forssk.) Kuntze	Pandanaceae	S	MicP	Mag	May-June	June-July
126.	<i>Papaver nudicaule</i> L.	Papaveraceae	H	TH	Mic	June-Aug	Sept-Oct
127.	<i>Papaver rhoeads</i> L.	Papaveraceae	H	TH	Mic	June-July	August
128.	<i>Papaver somniferum</i> L.	Papaveraceae	H	TH	Mic	April-May	June
129.	<i>Parrotiopsis jacquemontiana</i> (Decne.) Rehdter	Hamamelidaceae	S	MP	Mic	March-May	June-July
130.	<i>Parthenium hysterophorus</i> L.	Asteraceae	H	TH	N	April	May
131.	<i>Periploca aphylla</i> Decne.	Asclepiadaceae	S	NP	L	March-July	April-Aug
132.	<i>Persicaria nepalensis</i> (Meisn.) Miyabe	Polygonaceae	H	TH	Mic	June-Sept	July-Oct
133.	<i>Persicaria orientalis</i> (L.) Spach	Polygonaceae	H	TH	Mic	June-July	August
134.	<i>Pertya atchisonii</i> C.B.Clarke	Asteraceae	H	TH	N	July	August
135.	<i>Pinus roxburghii</i> Sarg.	Pinaceae	T	MP	N	May	July
136.	<i>Pinus wallichiana</i> Jackson	Pinaceae	T	MP	N	May	July
137.	<i>Pistacia integerrima</i> J.L.Stewart ex Brandis	Anacardiaceae	T	MP	Mic	May-June	July
138.	<i>Plantago lanceolata</i> L.	Plantaginaceae	H	TH	Mes	June-July	August
139.	<i>Plantago ovata</i> L.	Plantaginaceae	H	TH	Mic	June-July	August
140.	<i>Polygonum aviculare</i> L.	Polygonaceae	H	TH	L	June-July	August
141.	<i>Populus tomentosa</i> Carriere	Salicaceae	T	MP	Mic	April-May	June-July
142.	<i>Potentilla barmehalensis</i> Cambess.	Rosaceae	H	CH	N	Aug-Sept	Oct-Nov
143.	<i>Prunus arminiacae</i> L.	Rosaceae	T	MP	Mic	March-April	May-June
144.	<i>Prunus domestica</i> L.	Rosaceae	T	MP	Mic	March-April	May-June
145.	<i>Prunus dulcis</i> (Mill.) D.A. Webb.	Rosaceae	T	MP	Mic	March-April	May-June
146.	<i>Prunus persica</i> (L.) Batsch	Rosaceae	T	MP	Mic	March-April	May-June
147.	<i>Prunus cornuta</i> (Wall. ex Royle) Steud.	Rosaceae	T	MesP	Mic	March-April	May-June
148.	<i>Pteris eritica</i> L.	Pteridaceae	H	TH	Mic	April-June	July
149.	<i>Punica granatum</i> L.	Punicaceae	T	MP	N	June-July	August
150.	<i>Pyrus pashia</i> Buch.-Ham. ex D. Don	Rosaceae	T	MP	Mic	June-July	August
151.	<i>Pyrus</i> spp.	Rosaceae	T	MP	Mic	March-April	May-June
152.	<i>Quercus oblongata</i> D. Don.	Fagaceae	T	MP	Mic	June	July
153.	<i>Quercus</i> sp.	Fagaceae	T	MP	Mic	May-June	July
154.	<i>Ranunculus acris</i> L.	Ranunculaceae	H	H	Mic	May-July	August
155.	<i>Ranunculus aquatilis</i> L.	Ranunculaceae	H	TH	Mic	May-June	July-Aug
156.	<i>Ranunculus arvensis</i> L.	Ranunculaceae	H	TH	Mic	March-April	May-June
157.	<i>Ranunculus muricatus</i> L.	Ranunculaceae	H	TH	Mic	April	May
158.	<i>Raphanus raphanistrum</i> L.	Brassicaceae	H	TH	N	May-June	July
159.	<i>Ricinis communis</i> L.	Euphorbiaceae	T	NP	Mag	June-July	August
160.	<i>Rosmarinus officinalis</i> L.	Lamiaceae	S	NP	Mic	May-June	June-July
161.	<i>Rubus fruticosus</i> L.	Rosaceae	S	NP	Mic	March-April	May-June
162.	<i>Rumex dentatus</i> D. Don	Polygonaceae	H	TH	Mes	August	Sept
163.	<i>Rumex hastatus</i> L.	Polygonaceae	H	TH	N	April-May	June-July
164.	<i>Rydingia limbatata</i> (Benth.) Scheen & V.A. Albert	Lamiaceae	S	NP	Mic	May-June	July-Aug
165.	<i>Salix alba</i> L.	Salicaceae	T	MP	N	May-June	July



Table I. (Cont'd.).

S. No.	Species	Family	Plant habit	Life form classes		Phenology	
				Life form	Leaf size spectra	Flowering	Fruiting
166.	<i>Salvia moerhoffiana</i> Benth.	Lamiaceae	H	TH	Mes	May	June-July
167.	<i>Sarcococca prunifloris</i> Lindl.	Buxaceae	S	NP	Mic	Dec-March	April-May
168.	<i>Scandix pectin-veneris</i> L.	Umbelliferae	H	TH	L	April-May	June-July
169.	<i>Scilla griffithii</i> Hochr.	Hyacinthaceae	H	TH	L	March-April	May-June
170.	<i>Sedum rupestre</i> L.	Crassulaceae	H	CH	L	June-July	August
171.	<i>Setaria pumila</i> (Poir.) Roem. & Schult.	Poaceae	H	TH	N	April	May-June
172.	<i>Silene conoidea</i> L.	Caryophyllaceae	H	TH	N	May-June	July
173.	<i>Sisymbrium</i> sp.	Brassicaceae	H	TH	Mic	May-June	July
174.	<i>Solanum cordatum</i> Forssk.	Solanaceae	S	CH	N	April-May	June-July
175.	<i>Solanum nigrum</i> L.	Solanaceae	H	TH	Mic	March	April-May
176.	<i>Solanum surattense</i> Bum. f.	Solanaceae	H	TH	N	May-June	July
177.	<i>Sonchus asper</i> L.	Asteraceae	H	TH	N	March-April	May-June
178.	<i>Stellaria media</i> L.	Caryophyllaceae	H	TH	L	May	June-July
179.	<i>Strobilanthes glutinosus</i> Nees	Acanthaceae	H	H	N	March-April	May-June
180.	<i>Tegetes minuta</i> L.	Asteraceae	H	CH	Mic	Jan-Aug	March-Sept
181.	<i>Taraxacum officinale</i> G.H. Weber ex Wiggers.	Asteraceae	H	TH	Mic	April-May	June-July
182.	<i>Teucrium capitatum</i> L.	Lamiaceae	H	CH	L	April-Aug	May-Sept
183.	<i>Thalictrum rochebrunianum</i> Franch. & Sav.	Ranunculaceae	S	NP	N	July-August	Sept-Oct
184.	<i>Thuja plicata</i> Donn ex. D. Don	Cupressaceae	T	MP	Mes	May-June	July
185.	<i>Torilis leptophylla</i> (L.) Rchb. f.	Apiaceae	H	TH	Mic	May-June	July
186.	<i>Trichodesma indicum</i> (L.) Lehmann.	Boraginaceae	H	TH	N	May-June	July
187.	<i>Trifolium echinatum</i> var. <i>carmeli</i> (Boiss.) Gibelli & Belli.	Papilionaceae	S	NP	N	June-July	August
188.	<i>Trifolium repens</i> L.	Papilionaceae	H	TH	N	April-May	June-July
189.	<i>Tulipa clusiana</i> DC.	Liliaceae	H	TH	Mic	April-May	June-July
190.	<i>Tulipa gesneriana</i> L.	Liliaceae	H	TH	Mic	April-May	June-July
191.	<i>Tulipa turkestanica</i> (Regel) Regel	Liliaceae	H	TH	Mic	April-May	June-July
192.	<i>Urtica dioica</i> L.	Urticaceae	H	TH	Mic	Jan-March	April
193.	<i>Valeriana jatamansi</i> Wall.	Valerianaceae	H	G	N	March-April	May-June
194.	<i>Verbascum thapsus</i> L.	Scrophulariaceae	H	TH	Mes	May	June-July
195.	<i>Verbena bipinnatifida</i> Nutt	Verbenaceae	S	H	L	March-April	May-June
196.	<i>Veronica anagallis</i> L.	Plantaginaceae	H	TH	N	April	May-June
197.	<i>Veronica arvensis</i> L.	Plantaginaceae	H	TH	Mic	March-April	July
198.	<i>Viburnum nervosum</i> D. Don	Caprifoliaceae	S	MP	Mic	May-June	June-July
199.	<i>Viburnum cotinifolium</i> D. Don	Caprifoliaceae	S	NP	Mic	Mid May	August
200.	<i>Vinca major</i> L.	Apocynaceae	S	NP	Mic	June-July	June-July
201.	<i>Viola odorata</i> L.	Violaceae	H	TH	Mic	April-May	April
202.	<i>Vitex negundo</i> L.	Verbenaceae	S	TH	N	Feb-March	August
203.	<i>Wulffonia antheristana</i> Benth.	Plantaginaceae	H	TH	N	June-July	August
204.	<i>Zanthoxylum armatum</i> DC.	Rutaceae	S	NP	Mes	March-April	May-June
205.	<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn.	Rhamnaceae	S	NP	Mic	March-June	May-July

Abbreviations for Plant habit: H=Herb, S=Shrub and T=Tree.

Abbreviations for Life form: MP=Mesophanerophytes, MesP=Mesophanerophytes, MicP=Microphanerophytes, N=P=Nanophanerophytes, CH=Chamaephytes, G=Geophytes, TH=Therophytes, L=Liana.

Abbreviations for Leaf size: L=Leptophyll, N=Nanophyll, Mic=Microphyll, Mes=Mesophyll, Meg=Megaphyll.



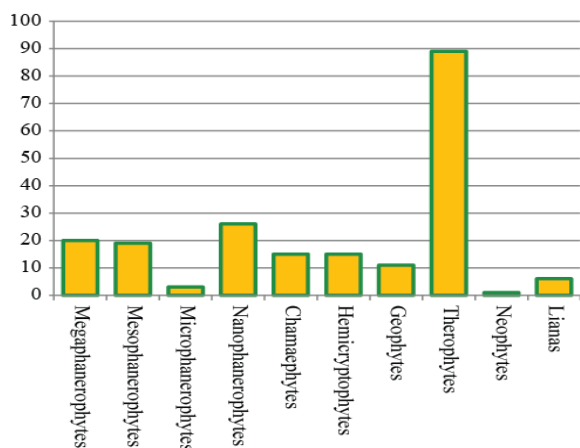


Fig. 6. The Life Form of the plant species recorded from the study area.

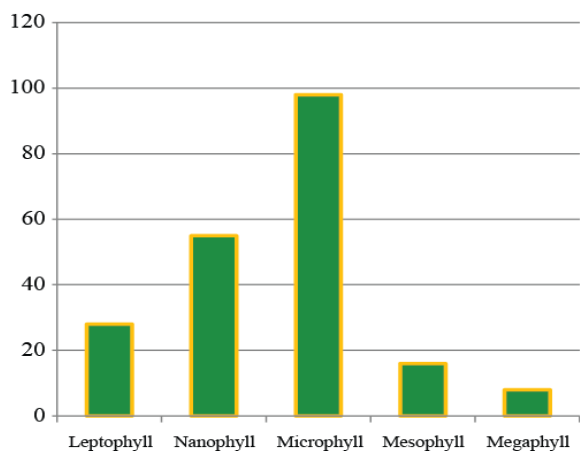


Fig. 7. The Leaf Spectra of the plant species recorded from the study area.

Results show that 10 different life form classes were recorded in the study area (Table 1). The most dominant life form was Therophytes with 89 species (43.68%), followed by Nanophanerophytes 26 species (12.62%), Megaphanerophytes 20 species (9.70%), Mesophanerophytes 19 species (9.22%), Chamaephytes 15 species (7.28%), Hemicyrptophytes 15 species (7.28%), Geophytes 11 species (5.33%), Lianas 6 species (2.91%), Microphanerophytes 3 species (1.45%) and Neophytes with 1 species (0.48%) (Table 1 & Fig. 6). In leaf size spectra, Microphyll was the most dominant one with 98 species (47.80%), followed by Nanophyll 55 spp. (26.82%), Leptophylls 28 species (13.65%), Mesophyll 16 spp. (7.80%) and Megaphyll contributing with 8 species (3.90%) (Fig. 7).

In the study area, two flowering seasons were recorded, one from May to August and second from September to November. Similarly, variation was observed in fruiting season but mostly plants flowered from May to August. In the first spell, 195 plant species flowered including herbs (62.56%), shrubs (19.48%), trees (18.46%), grasses (2.56%) and 1.02% ferns. During the second flowering season, 10 plant species flowered

were 50 % shrubs, 30% herbs and 20% trees. There were two exceptional cases which flowered in both flowering seasons including *Narcissus tazetta* and *Cynodon dactylon* (Table 1).

### Discussion

The main reflection of vegetation of any area is its floristic structure. The flora of a particular region is the sum total of the species within either related to wild or cultivated species (Longhi *et al.*, 1992). Floristic list is also representative of the view that species has its own ecological amplitude and interaction to the environment and to other species (Giusti *et al.*, 1995). According to plant habit, herbaceous growth habit with 129 species was the most dominant one. Our findings are congruent with many researchers of allied, neighboring and national regions (Ijaz, 2014; Ijaz *et al.*, 2015; Khattak *et al.*, 2015; S.M. Khan *et al.*, 2015; K.U. Khan *et al.*, 2015; Shah *et al.*, 2015; Ahmad *et al.*, 2016 and Rahman *et al.*, 2016). Asteraceae and Lamiaceae were dominant families with 15 species each. Iqbal *et al.* (2015) and Ijaz *et al.* (2016) also reported Asteraceae as the most leading family. Our findings are in agreement with a report of Stewart (1972) that these families were well represented in Pakistan, some other studies also indicated that these families were major families in the flora of Pakistan (Nasir & Ali, 1971-94; Ali & Qaiser, 1995-2004).

Life form is actually due to adaptation of plants in different environmental conditions. Adaptation is very necessary for the survival of plants and to describe vegetation (Mera *et al.*, 1999; Cain & Castro, 1959). In the study area life form of all species were recorded and classified into different classes. Therophytes were dominant followed by Phanerophytes, Hemicyrptophytes and Chamaephytes. Similar findings were observed by Hussain *et al.* (1997) in Girbanr Hills and our result was in agreement with these studies. Hemicyrptophytes usually prevail in open physiognomies while Phanerophytes in closed ones (Batalha & Martins, 2002; Barik & Misra, 1998). Therophytes were indicator of cold dry climate at different altitudinal regions of the world in the investigated area high proportion of Therophytes regards these factors. Malik & Malik (2004) studied that Phanerophytes were at high scale in Kotli Hills, the result of present study was in agreement with that.

Phenology is a periodic phenomenon in plants. At different altitude and growing seasons vegetation of any area shows different physiognomic conditions and each species shows different aspect such as flowering, disappearance and appearance. In the investigated area growing season started from March. In March-April few herbaceous and shrubby species started growth and few species were in flowering condition. Flowering reaches to its peak during May-August. In investigated area there were two flowering seasons. One from May to August and 2<sup>nd</sup> from September to November similarly fruiting season also varied but mostly plants flowered from May to July. Our findings are congruent with the results of Shrestha *et al.* (1998); Kim (1996) and Malik (2005). Two flowering seasons were reported in Harboi range, Kalat (Durrani, 2000).

Usually flowering period starts at the end of dry season and in the beginning of wet period (Morellato, 1995), so in turn fruiting occurred in dry season because the beginning of next rainy period will offer suitable conditions for seed germination (Morellato *et al.*, 1989). According to Marquês *et al.* (2004), phenological period and climate of the area are related to each other in terms of temperature, day length and also rainfall. In present study seeds were set down in cold season mostly in December and germinate in next spring season. In majority of plants the leaf falling period is cool season i.e. January and February, leaf flushing usually occurred in warm period i.e. in March and April, in rainy season i.e. in August flowering was at its peak and usually in September and October fruit maturation takes place. In short, in our study area plants grow and goes up to flowering and fruiting stage in warm and wet season and shed seeds which gain cold treatment in winter season and then once again grows up in favorable season.

## References

- Abdullahi, M.B., S.S. Sanusi, S.D. Abdul and F.B.J. Sawa. 2009. An assessment of the herbaceous species vegetation of Yankari Game Reserve, Bauchi, Nigeria, *Am-Eur. J. Agric. & Environ Sci.*, 6(1): 20-25.
- Ahmad, K., Z.I. Khan, M. Ashraf, M.I. Hussain and E.H. Aleem. 2008. Status of plant diversity at Kufri (Soone Valley) Punjab, Pakistan and prevailing threats. *Pak. J. Bot.*, 40(3): 993-997.
- Ahmad, Z., S.M. Khan, S. Ali, I.U. Rahman, H. Ara, I. Noreen and A. Khan. 2016. Indicator species analyses of weed communities of maize crop in district Mardan, Pakistan. *Pak. J. Weed Sci. Res.*, 22(2): 227-238.
- Ali, S.I. 2008. Significance of Flora with special reference to Pakistan. *Pak. J. Bot.*, 40(3): 967-971.
- Ali, S.I. and M. Qaiser. 1995-2004. Flora of Pakistan. Pakistan Agriculture Research Council, Islamabad.
- Baig, K., Usman and M. Joshi. 1998. Effect of forest covers on certain site and soil characteristics in Kumaun Himalayas. *Ind. J. Forest.*, 21(3): 224-226.
- Barik, K.L. and N. Misra. 1998. Biological spectrum of grassland ecosystem of South Orissa. *Ecoprint*, 5(1): 73-77.
- Batalha, M.A. and F.R. Martins. 2002. Floristic, frequency and vegetation life form spectra of cerrado sites. *Braz. J. Biol.*, 64: 203-209.
- Cain, S.A. and G.M.D. Castro. 1959. Manual of vegetation analysis. Happer and Brothers, Pub. New York. pp. 355.
- Durrani, M.J. 2000. Ecological evaluation of some rangeland plants of Harboi hills, Kalat, Balochistan. Ph.D. Thesis University of Peshawar.
- Giusti, L., A. Slanis and P. Acenolaza. 1995. Phytosociology of alder woods (*Alnus acuminata* subspecies. *acuminata*) of Tucuman, Argentina. *Lilloa.*, 38(2): 93-120.
- Hussain, F., M. Ilyas and S. Takatsuki. 1997. Plant communities of Girbanr Hills, Swat district, northwestern Pakistan. *Eco. Rev.*, 23(4): 247-260.
- Ijaz, F. 2014. Biodiversity and traditional uses of plants of Sarban Hills, Abbottabad. M. Phil. Thesis Hazara University Mansehra, KP, Pakistan.
- Ijaz, F., Z. Iqbal, I.U. Rahman, S.M. Khan, G.M. Shah, K. Khan and A. Afzal. 2016. Investigation of traditional medicinal floral knowledge of Sarban Hills, Abbottabad, KP, Pakistan. *J. Ethnopharmacol.*, 179: 208-233.
- Ijaz, F., Z. Iqbal, J. Alam, S.M. Khan, A. Afzal, I.U. Rahman, M. Afzal, M. Islam and Sohail. 2015. Ethno medicinal study upon folk recipes against various human diseases in Sarban Hills, Abbottabad, Pakistan. *World J. Zoology*, 10(1): 41-46.
- Iqbal, M., S. Khan, M.A. Khan, I.U. Rahman, Z. Abbas and Zahidullah. 2015. Exploration and inventorying of weeds in wheat crop of the district Malakand, Pakistan. *Pak. J. Weed Sci. Res.*, 21(3): 435-452.
- Jabeen, A., M.A. Khan, M. Ahmad, M. Zafar and F. Ahmad. 2009. Indigenous uses of economically important Flora of Margallah Hills National Park, Islamabad, Pakistan. *Afric. J. Biotech.*, 8(5): 763-784.
- Khan, K.U., M. Shah, H. Ahmad, M. Ashraf, I.U. Rahman, Z. Iqbal, S.M. Khan and A. Majid. 2015. Investigation of traditional veterinary phytomedicines used in Deosai Plateau, Pakistan. *Global Vet.*, 15(4): 381-388.
- Khan, S.M., N.U. Din, Sohail, I.U. Rahman, F. Ijaz, Z. Iqbal and Z. Ali. 2015. Ethnobotanical study of some medicinal plants of Tehsil Kabal, District Swat, KP, Pakistan. *Med. Aromat. Plants*, 4: 189. doi:10.4172/2167-0412.1000189
- Khattak, N.S., F. Nouroz, I.U. Rahman and S. Noreen. 2015. Ethno veterinary uses of medicinal plants of district Karak, Pakistan. *Journal of Ethnopharmacol.*, 171: 273-279.
- Kim, A.C. 1996. Lianas da Mata Atlantica do estado Sao Paulo (Brazil). Campinas. UNICAMP. Dissertacao (Mestradoem Biologia).
- Longhi, S.J., G.L. Selle., L.I.M. Ragagnin and J.E. Damiani. 1992. Floristic composition and phytosociological structure of a *Podocarpus lambertii* 'copse' in Rio Grande do Sul. *Cien-Flor.*, 2(1): 9-26.
- Malik, Z.H. 2005. Comparative study on the vegetation of Ganga Chotti and Bedori hills District Bagh, Azad Jammu and Kashmir with special reference to Range conditions. Ph.D. Thesis, University of Peshawar.
- Malik, Z.H. and N.Z. Malik. 2004. Present status of subtropical chir pine vegetation of Kotli Hills, Azad Jammu and Kashmir. *J. Res. (Sci) B. Z. Uni. Multan*, 15(1): 85-90.
- Marquês, M.C.M., J.J. Roper and A.P.B. Salvalaggio. 2004. Phenological patterns among plants life-form in a subtropical forest in Southern Brazil. *J. Plant Ecol.*, 173(2): 203-213.
- Mera, A.G., M.A. Hagen and J.A.V. Orellana. 1999. Aerophyte, a new life form in Raunkiaer's classification. *J. Veg. Sci.*, 10: 65-68.
- Morellato, L.P.C. 1995. As astacoes do anon a floresta. pp 37-41. in: L.P. Morellato and H.F. Leitao Filho (orgs). Ecologia e preservacao deuma floret tropical urbana. Reserva de Santa Genebra. Editora da UNICAMP-Campinas.
- Morellato, L.P.C., R.R. Rodrigues., H.F.L. Filho and C.A. Joly. 1989. Estudo comparativo da fenologia de esp arboreas de floresta de altitude floresta mesofila semidecidua na serra Japi; Junidia. Sao.Paulo Revista Brasileira. *Botanica*, 12(1/2): 85-98.
- Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and Methods of Vegetation Ecology. Wiley & Sons, New York.
- Nasir, E. and S.I. Ali. 1971-1994. Flora of Pakistan. Pakistan Agriculture Research Council, Islamabad.
- Qin, X., R. Zhang and F. Xing. 2012. A Study on the Flora and vegetation of Cat Dua Island, Northeastern Vietnam, *Pak. J. Bot.*, 44(4): 1229-1232.
- Qureshi, R. and G.R. Bhatti. 2008. Diversity of micro-habitats and their plant resources in Nara Desert, Pakistan. *Pak. J. Bot.*, 40(3): 979-992.
- Rahman, I.U., F. Ijaz, A. Afzal, Z. Iqbal, N. Ali and S.M. Khan. 2016. Contributions to the phytotherapies of digestive disorders; Traditional knowledge and cultural drivers of Manoor Valley, Northern Pakistan. *J. Ethnopharmacol.*, 192: 30-52.

- Raunkiaer, C. 1934. The Life forms of plants and statistical plant geography, Oxford.
- Safidkon, F., R. Kalvandi., M. Atri and M.M. Barazandeh. 2003. Contribution for the characterization of *Thymus eriocalyx* Chemotypes. The International Magazine for Cosmetics and Fragrances.
- Shah, A.H., S.M. Khan, A.H. Shah, A. Mehmood, I.U. Rahman and H. Ahmad. 2015. Cultural uses of plants among Basikhel Tribe of District Tor Ghar, Khyber Pakhtunkhwa, Pakistan. *Pak. J. Bot.*, 47(SI): 23-41.
- Shaheen, H. and R.A. Qureshi. 2011. Vegetation types of Sheosar Lake and surrounding landscape in Deosai Plains of North Pakistan, Western Himalayas. *J. Med. Plant Res.*, 5(4): 599- 603.
- Shrestha, S., P.K. Jha and K.K. Shrestha. 1998. Vegetation of degraded, regenerating and natural forests in Riayle, Kavrepalanchok, Nepal. *Pak. J. Plant Sci.*, 4: 13-28.
- Stewart, R.R. 1972. An Annotated Catalogue to the vascular plants of West Pakistan and Kashmir. Fakhri Printing Press, Karachi.
- Udayakumar, M., M. Ayyanar and T. Sekar. 2011. Angiosperms, Pachaiyappa's College, Chennai, Tamil Nadu, India, Check List, 7(1): 37-48.
- Youcef, B., M. Lamine, B. Hocine, M. Rabah, L. Ali and M.B. Belhamra. 2012. Diversity of halophyte desert vegetation of the different saline habitats in the valley of Oued Righ, Low Sahara Basin, Algeria. *Res. J. Environ. Earth Sci.*, 4(3): 308-315.

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