

FLORISTIC DIVERSITY AND ECOLOGICAL CHARACTERISTICS OF VASCULAR PLANTS OF SAKRAH VALLEY MARDAN, PAKISTAN

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Abstract

This study was conducted to explore the floristic composition and ecological characteristics of vascular plants of the study area. Plant species were collected during field trips in three seasons viz., winter, summer and monsoon. The plants were classified into different life form and leaf size classes. The Pteridophytes consisted of 1 family and 1 species, gymnosperms of 2 families and 2 species and angiosperms were represented by 44 families and 121 species (6 families and 15 species of monocots and 38 families and 106 species of dicots). The Pteridophytes constituted less than 1% while gymnosperms were 1.62% and angiosperms were 98.37%. Among angiosperms, monocots were 12.39% and dicots were 87.60% of the total collected species. The leaf shape classes showed that 99 (80.48%) species had simple leaves while 24 (19.51%) species possessed compound leaves. Among these species, 27 (21.95 %) species were spiny while 96 (78.04%) species were non-spiny. Biological spectrum of flora indicated that Therophytes were dominant (34.95%), followed by Nannophanerophytes (22.76%). Leaf spectra revealed that Microphyllous (28.45%), Mesophyllous (26.01%), Nanophyllous (24.39%) were the most prevalent leaf size.

Key words: Floristic diversity, ecological characteristics, vascular plants, Sakrah valley, Mardan.

Introduction

District Mardan is located in the Khyber Pakhtunkhwa Province of Pakistan with total area 1632 km². The area mainly consists of fertile plains and green hills in the north at an altitude of 283 amsl (Fig-1). Phytogeographically the valley came under the Sino Japanese Region (Ali & Qaiser, 1986). The overall climate of Mardan is dry sub-tropical and the soil is loamy. The elevation is ranging from 310 m (Mardan City) to 2056 m (Sakrah peak). The average temperature is ranging from 2⁰C (minimum) to 42⁰C (maximum) in the months of January and June respectively. The high rainy months are March, July, August and December. In the month of August up to 126 mm rainfall has been recorded (GOP, 1998).

Sakrah, the historical Valley is situated in Tehsil Rustam of District Mardan. The area consists of ancient ruins of Buddhist era which is famous for the historic cave named Kashmir Smast. The cave was used for practicing the religious rituals by the Buddhist followers till 1850 A.D. The ruins of small fortified city were present in the Sakrah mountains but later on these were destroyed by the local peoples. The area support large number of plant species. The people of the area

depend on plants and plants resources for daily needs including food, medicine, building materials, fuel wood and timber as source of income (Khan & Shahana, 2015).

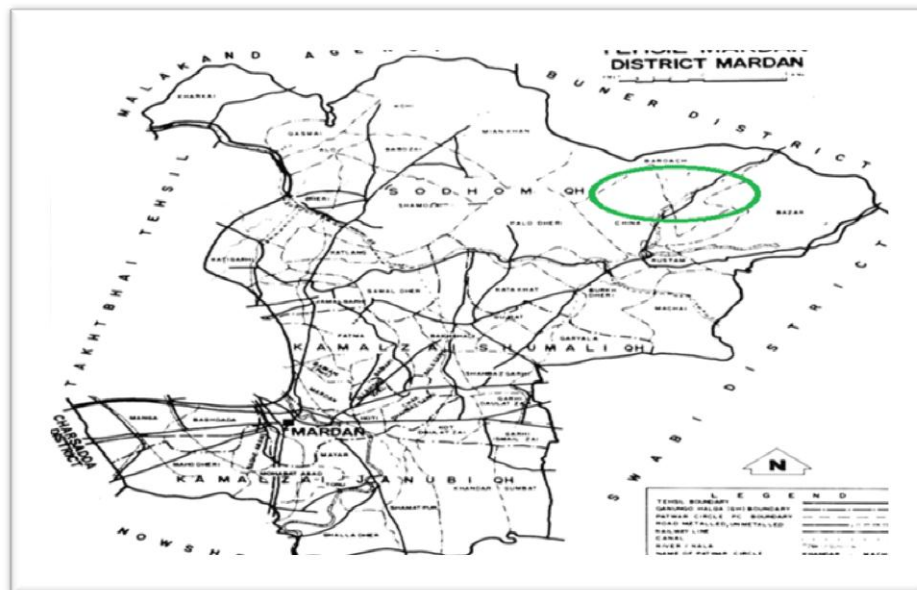


Fig-1: Map of the research area (Source: GOP, 1998)

Problem statement and aim of study

The area is previously unexplored and many indigenous species are growing in the area which needs proper documentation therefore, this study is aimed to document the plant natural resources growing in the research area. This will help in conservation of the indigenous indicator species growing in the area and will further help in developing conservation measures and strategies in future.

Material and Method

Data Collection, Preservation and Identification of Plants

Frequent field visits were carried out during winter, summer and monsoon to document and explore vascular plant biodiversity. Specimens of trees, herbs, shrubs and grasses were collected. The identification was carried out with the help of available literature (Nasir & Ali, 1970-1989; Ali & Nasir, 1989-1991; Stewart; 1972; Beg & Khan, 1974; Ali & Qaiser, 1993-2020). Whole herbs were collected for identification and pressing process, whereas for bushes and trees only their branches and floral parts were collected. The plants were classified into different life form and leaf size classes as follows after (Mueller & Ellenberg, 1974; Hussain, 1989). The plants were pressed in newspapers with the help of a presser, dried and mounted on 41.25 cm x 28.75 size herbarium sheets. The identified voucher specimens were deposited in the Herbarium of Centre of Plant Biodiversity, University of Peshawar (CPB).

Results and Discussion

A total of 123 species belonging to 49 families were collected from Sakrah valley. The Pteridophytes consisted of 1 family and 1 species, gymnosperms had 2 families and 2 species and

angiosperms were represented by 45 families and 121 species (6 families and 15 species of monocots and 39 families and 106 species of dicots). The Pteridophytes constituted less than 1% while gymnosperms were 1.62% and angiosperms were 98.37%. Among angiosperms, monocots were 12.39% and dicots were 87.60% of the total collected species. The Pteridophytes included family Adiantaceae (1sp.), the gymnosperm had Cupressaceae and Pinaceae (1 sp.) each. While in angiosperms the monocots were consisted of Poaceae (7 spp.), Arecaceae, Cyperaceae (2 spp.) each and Alliaceae, Asparagaceae, Phyllanthaceae (1 sp.) each. The dicots included Solanaceae (10 spp.), Asteraceae (8 spp.), Moraceae and Rosaceae (7 spp.), Lamiaceae (6 spp.), Chenopodiaceae and Oleaceae (5 spp.) each, Rhamnaceae and Rutaceae (4 spp.) each, Apiaceae, Brassicaceae, Euphorbiaceae, Myrtaceae, Nyctaginaceae, Salicaceae and Zygophyllaceae (3 spp.) each. While Cannabaceae, Convolvulaceae, Malvaceae and Sapindaceae (2 spp.) each. Anacardiaceae, Apocynaceae, Asclepiadaceae, Berberidaceae, Cactaceae, Caesalpiniaceae, Meliaceae, Mimosaceae, Musaceae, Oxalidaceae, Paeoniaceae, Papilionaceae, Sapotaceae, Scrophulariaceae, Simaroubaceae, Ulmaceae, Verbenaceae and Vitaceae each (Table-1 and 2).

The life form classes showed that Therophytes was the leading class with 43 species (34.95 %), followed by Nanophanerophytes with 28 species (22.76%), Megaphanerophytes with 20 species (16.26%), Mesophanerophyte with 10 species (8.13%), Geophyte 9 species (07.31%), Hemicryptophytes 6 species (4.87%), Chamaephytes 5 species (4.06%) and Macrophanerophytes 2 (1.62%) species. The leaf size class showed that Microphyllous was leading group with 35 species (28.45%), followed by Mesophyllous 32 species (26.01%), Nanophyllous 30 species (23.77%), Macrophyllous 14 species (11.38%), Leptophyllous 9 species (7.31%) and Megaphyllous 3 species (2.43%). Similarly, the leaf shape classes showed that 99 species (80.48%) had simple leaves while 24 species (19.51%) possessed compound leaves. In spinyness 27 species (21.95 %) were spiny while 96 species (78.04%) were non-spiny (Figure 2, 3, 4 & 5 and Table 1 & 2).

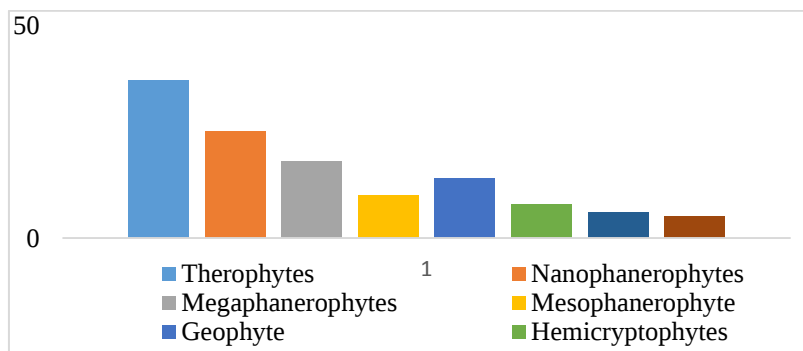


Fig.2. Life form classes in Sakrah valley.

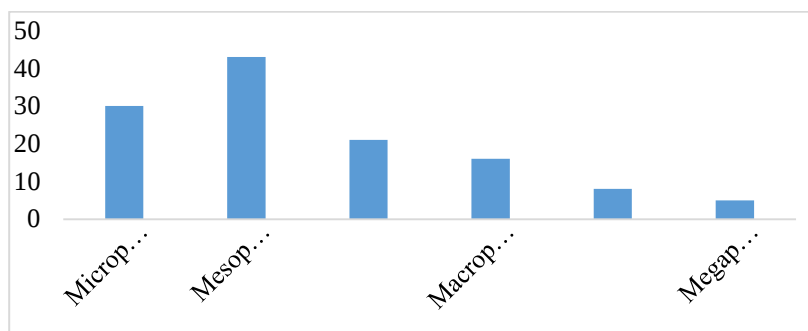


Fig.3. Leaf size classes in Sakrah valley.

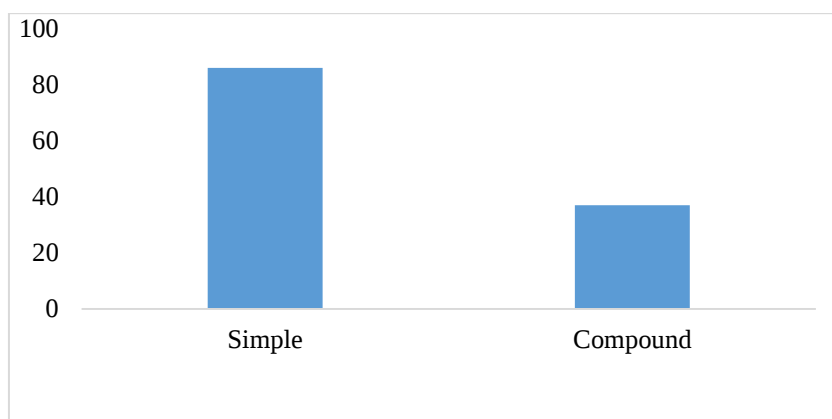


Fig. 4. Leaf shape in Sakrah valley.

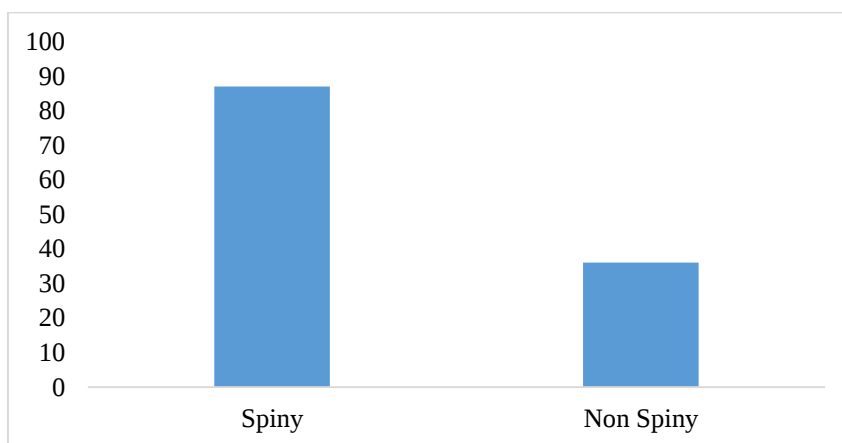


Fig. 5. Distribution of the Spinyess in Sakrah Valley.

Table 1. Floristic composition and ecological characteristics (life form, leaf size, leaf shape and spinyess) of Plants of Sakrah Valley, District Mardan, Pakistan.

S#	Family/Botanical names	Life-form	Leaf- size	Leaf- shape	Spinyess
A. Pteridophyta					
1. Adiantaceae					
1.	<i>Adiantum capillus-veneris</i> L.	G	L	S	Non spiny
B. Gymnosperms					
2. Cupressaceae					
2.	<i>Cupressus sempervirens</i> L.	MegP	L	S	Non spiny
3. Pinaceae					
3	<i>Pinus roxburghii</i> Sarg.	MegP	Mes	Comp	Spiny
C. Angiosperms					
a. Monocotyledons					
4. Alliaceae					
4.	<i>Allium cepa</i> L.	G	Mes	S	Non spiny
5. Arecaceae					
5.	<i>Livistona chinensis</i> (Jacq.) R. Br.	Np	Meg	Comp	Non spiny
6.	<i>Phoenix dactylifera</i> L.	MegP	Meg	S	Spiny
6. Asparagaceae					
7.	<i>Asparagus officinalis</i> L.	H	N	S	Spiny

7. Cyperaceae					
8.	<i>Cyperus rotundus</i> L.	G	N	S	Non spiny
9.	<i>Fimbristylis squarrosa</i> Vahl.	G	Mic	S	Non spiny
8. Musaceae					
10.	<i>Musa paradisiaca</i> L.	G	Meg	S	Non spiny
9. Poaceae					
11.	<i>Cynodon dactylon</i> (L.) Pers.	H	N	S	Non spiny
12.	<i>Saccharum bengalensis</i> (Retz.) Trin.	H	Mes	S	Non spiny
13.	<i>Desmostachya bipinnata</i> L. Stapf.	H	Mic	S	Non spiny
14.	<i>Hordeum vulgare</i> L.	Th	Mes	S	Spiny
15.	<i>Phragmites karka</i> (Retz.) Trin.	G	Mac	S	Non spiny
16.	<i>Sorghum halepense</i> (L.) Pers.	H	Mes	S	Non spiny
17.	<i>Cenchrus ciliaris</i> L.	H	Mic	S	Non spiny
b. Dicotyledons					
10. Anacardiaceae					
18.	<i>Mangifera indica</i> L.	MesP	Mac	S	Non spiny
11. Apiaceae					
19.	<i>Coriandrum sativum</i> L.	Th	Mic	Comp	Non spiny
20.	<i>Ammi visnaga</i> (L.) Lam.	Th	Mes	Comp	Non spiny
21.	<i>Bonium persicum</i> (Bioss.) Fedtsch.	G	Mes	Comp	Non spiny
12. Apocynaceae					
22.	<i>Nerium indicum</i> Mill.	Np	Mes	S	Non spiny
13. Asclepiadaceae					
23.	<i>Calotropis procera</i> (Wight) Ali.	H	Mes	S	Non spiny
14. Asteraceae					
24.	<i>Carthamus oxyacantha</i> L.	Th	Mic	Comp	Spiny
25.	<i>Launaea procumbens</i> Roxb.	Th	Mes	Comp	Non spiny
26.	<i>Parthenium hysterophorus</i> L.	Th	Mes	Comp	Non spiny
27.	<i>Taraxacum officinale</i> F.H. Wigg	G	Mes	Comp	Non spiny
28.	<i>Sonchus asper</i> (L.) Hill.	Th	Mes	Comp	Spiny
29.	<i>Sonchus auriculata</i> L.	Th	Mes	Comp	Spiny
30.	<i>Xanthium strumarium</i> L.	Th	Mes	Comp	Spiny
31.	<i>Silybum marianum</i> (L.) Gaertn.	Th	Mes	Comp	Spiny
15. Berberidaceae					
32.	<i>Berberis lycium</i> Royle.	NP	N	S	Spiny
16. Brassicaceae					
33.	<i>Brassica campestris</i> L.	Th	Mes	S	Non spiny
34.	<i>Capsella bursa-pastoris</i> (L.) Medic.	Th	Mes	Comp	Non spiny
35.	<i>Eruca sativa</i> Mill.	Th	Mes	Comp	Non spiny
17. Caesalpiniaceae					
36.	<i>Cassia fistula</i> L.	MesP	Mac	S	Non spiny
18. Cactaceae					
37.	<i>Opuntia dilenii</i> Haw	Ch	N	S	Spiny
19. Chenopodiaceae					
38.	<i>Chenopodium ambrosioides</i> L.	Th	Mes	Comp	Non spiny
39.	<i>Chenopodium foliosum</i> Ach.	Th	Mic	Comp	Non spiny
40.	<i>Chenopodium murale</i> L.	Th	N	Comp	Non spiny
41.	<i>Kochia indica</i> Wight	Th	L	S	Non spiny

42.	<i>Spinacia oleracea</i> L.	Th	Mic	S	Non spiny
20. Cannabaceae					
43.	<i>Cannabis sativa</i> L.	Th	Mes	Comp	Non spiny
21. Convolvulaceae					
44.	<i>Convolvulus arvensis</i> L.	Th	Mic	Comp	Non spiny
22. Cuscutaceae					
45.	<i>Cuscuta reflexa</i> Roxb.	Th	N	S	Non spiny
23. Euphorbiaceae					
46.	<i>Mallotus philippensis</i> (L.) Muel.	NP	Mac	S	Non spiny
47.	<i>Ricinus communis</i> L.	NP	Meg	Comp	Non spiny
48.	<i>Chrozophora obliqua</i> (Vahl) A. Juss.	Th	Mic	Comp	Non spiny
24. Lamiaceae					
49.	<i>Plectranthus rugosus</i> Wall. ex Benth.	G	Mes	S	Non spiny
50.	<i>Mentha arvensis</i> L.	G	N	S	Non spiny
51.	<i>Mentha longifolia</i> L.	G	N	S	Non spiny
52.	<i>Ocimum basilicum</i> L.	Th	Mic	S	Non spiny
53.	<i>Salvia aegyptiaca</i> L.	G	Mes	S	Non spiny
54.	<i>Otostegia limbata</i> (Benth.) Boiss.	Th	Mic	S	Spiny
25. Malvaceae					
55.	<i>Grewia optiva</i> J.R. Drumm. ex Burret	NP	Mes	S	Non spiny
56.	<i>Hibiscus rosa-sinensis</i> L.	NP	Mes	Comp	Non spiny
26. Meliaceae					
57.	<i>Melia azadarach</i> L.	MegP	Mes	S	Non spiny
27. Mimosaceae					
58.	<i>Acacia modesta</i> Wall.	MesP	L	S	Spiny
59.	<i>Acacia nilotica</i> L.	NP	N	S	Spiny
60.	<i>Albizia lebbeck</i> (L.) Benth.	MegP	N	S	Non spiny
28. Moraceae					
61.	<i>Ficus carica</i> L.	NP	Mes	Comp	Non spiny
62.	<i>Ficus religiosa</i> L.	MegP	Mac	S	Non spiny
63.	<i>Ficus palmata</i> Forssk.	NP	Meg	Comp	Non spiny
64.	<i>Morus alba</i> L.	MegP	Mac	S	Non spiny
65.	<i>Morus laevigata</i> Wall. ex Brandis.	MegP	Mac	Comp	Non spiny
66.	<i>Broussonetia papyrifera</i> L.	MesP	Mac	Comp	Non spiny
67.	<i>Morus nigra</i> L.	MegP	Mac	S	Non spiny
29. Myrtaceae					
68.	<i>Eucalyptus lanceolata</i> L.	MesP	Mes	S	Non spiny
69.	<i>Psidium guajava</i> L.	NP	Mac	S	Non spiny
70.	<i>Syzygium cumini</i> (L.) Skeels.	NP	N	S	Non spiny
30. Nyctaginaceae					
71.	<i>Boerhavia diffusa</i> L.	Th	Mic	S	Non spiny
72.	<i>Bougainvillea glabra</i> Comm. ex Juss.	NP	Mic	S	Spiny
73.	<i>Mirabilis jalapa</i> L.	Th	Mes	S	Non spiny
31. Oleaceae					
74.	<i>Olea europaea</i> L.	MesP	N	S	Non spiny
75.	<i>Olea ferruginea</i> Royle.	MegP	N	S	Non spiny
76.	<i>Jasminum officinale</i> L.	NP	Mic	Comp	Non spiny

77.	<i>Jasminum sambac</i> (L.) Aiton.	NP	Mes	S	Non spiny
78.	<i>Ligustrum lucidum</i> L.	NP	Mic	S	Non spiny
32. Oxalidaceae					
79.	<i>Oxalis corniculata</i> L.	Th	L	Comp	Non spiny
33. Paeoniaceae					
80.	<i>Paeonia emodi</i> Wall.	G	Mes	S	Non spiny
34. Papilionaceae					
81.	<i>Dalbergia sissoo</i> Roxb. ex DC.	Megp	Mic	S	Non spiny
35. Phyllanthaceae					
82.	<i>Andrachne telephioides</i> L.	Th	L	S	Non spiny
36. Punicaceae					
83.	<i>Punica granatum</i> L.	MesP	Mic	S	Spiny
37. Rhamnaceae					
84.	<i>Sageretia thea</i> (Osbeck) M.C. Johnst.	NP	N	S	Spiny
85.	<i>Ziziphus jujuba</i> Mill.	MacP	N	S	Spiny
86.	<i>Ziziphus nummularia</i> (Burm. f) Wight and Arn.	MacP	N	S	Spiny
87.	<i>Ziziphus oxyphylla</i> Edgew.	NP	Mes	S	Spiny
38. Rosaceae					
88.	<i>Eriobotrya japonica</i> (Thunb.) Lindley.	MegP	Mes	S	Non spiny
89.	<i>Prunus armeniaca</i> L.	MegP	Mic	S	Spiny
90.	<i>Prunus persica</i> L.	MacP	Mic	S	Spiny
91.	<i>Pyrus communis</i> L.	MegP	Mes	S	Spiny
92.	<i>Prunus dulcis</i> (Mill.) D. A. Webb	Np	Mic	S	Non spiny
93.	<i>Pyrus malus</i> L.	MesP	Mes	S	Spiny
94.	<i>Rosa indica</i> L.	Ch	N	S	Spiny
39. Rutaceae					
95.	<i>Citrus aurantium</i> L.	MacP	Mes	S	Spiny
96.	<i>Citrus limon</i> (L.) Osbeck	MacP	Mic	S	Spiny
97.	<i>Zanthoxylum armatum</i> DC.	Ch	N	S	Non spiny
98.	<i>Citrus sinensis</i> (L.) Osbeck	MesP	Mic	S	Spiny
40. Salicaceae					
99.	<i>Salix acmophylla</i> L.	MegP	Mic	S	Non spiny
100.	<i>Salix babylonica</i> L.	MegP	Mic	S	Non spiny
41. Sapindaceae					
101.	<i>Litchi chinensis</i> Sonn.	MesP	Mes	S	Non spiny
102.	<i>Dodonaea viscosa</i> (L.) Jacq.	NP	Mic	S	Spiny
103.	<i>Cardiospermum halicacabum</i> L.	Th	Mic	Comp	Non spiny
42. Sapotaceae					
104.	<i>Monothea buxifolia</i> Falc.	NP	N	S	Spiny
43. Scrophulariaceae					
105.	<i>Verbascum thapsus</i> L.	G	Mac	S	Non spiny
44. Simaroubaceae					
106.	<i>Ailanthus altissima</i> (Mill.) Swingle	MegP	Mes	S	Non spiny
45. Solanaceae					
107.	<i>Datura innoxia</i> Mill.	Th	Mac	S	Spiny
108.	<i>Datura metal</i> L.	Th	Mes	Comp	Spiny
109.	<i>Datura stramonium</i> L.	Th	Mes	Comp	Spiny

110.	<i>Capsicum frutescens</i> L.	Th	Mic	S	Non spiny
111.	<i>Solanum lycopersicum</i> L.	Th	Mac	Comp	Non spiny
112.	<i>Cestrum diurnum</i> L.	Np	Mic	S	Non spiny
113.	<i>Solanum virginianum</i> L.	Th	Mes	Comp	Spiny
114.	<i>Solanum nigrum</i> L.	Th	Mic	Comp	Non spiny
115.	<i>Solanum surattense</i> Burm. F.	Th	Mic	Comp	Spiny
116.	<i>Withania somnifera</i> L.	Ch	Mes	S	Non spiny
46. Ulmaceae					
117.	<i>Celtis australis</i> L.	MacP	Mac	S	Non spiny
118.	<i>Celtis tetrandra</i> L.	MesP	Mac	S	Non spiny
47. Verbenaceae					
119.	<i>Vitex negundo</i> L.	NP	Mic	S	Non spiny
48. Vitaceae					
120.	<i>Vitis vinifera</i> L.	NP	Mac	Comp	Non spiny
49. Zygophyllaceae					
121.	<i>Peganum harmala</i> L.	Ch	Mic	S	Non spiny
122.	<i>Tribulus terrestris</i> L.	Th	L	S	Spiny
123.	<i>Fagonia cretica</i> Burm.	Th	L	S	Spiny

Table 2. Summary of Ecological characteristics of vascular plants of Sakrah Valley, Mardan.

S. No.	Ecological characteristic	No. of species	(%) of species
1	Life form classes		
A	Therophytes	37	30.1
B	Nanophanerophytes	25	20.3
C	Megaphanerophytes	18	14.6
D	Mesophanerophyte	10	8.1
E	Geophyte	14	11.3
F	Hemicryptophytes	8	6.5
G	Chamaephytes	6	4.8
H	Macrophanerophytes	5	4.1
	Total	123	99.98
2	Leaf size		
A	Microphyllous	30	24.3
B	Mesophyllous	43	34.9
C	Nanophyllous	21	17.1
D	Macrophyllous	16	13.1
E	Leptophyllous	8	6.5
F	Megaphyllous	5	4.1
	Total	123	99.99
3	Leaf shape		
A	Simple	86	69.9
B	Compound	37	30.1
	Total	123	99.99
4	Spiny nature		
A	Spiny	87	70.7
B	Non Spiny	36	29.2
	Total	123	99.99

Key:

1. Life-form: H. Hemicryptophytes, G. Geophytes, Th. Therophytes, Ch.Chamaephytes, MesP. Mesophanaerophyte, MegP. Megaphanerophytes, NP. Nanophanerophytes,
2. Leaf-size: N. Naonphyll, L. Leptophyll, Mic. Microphyll, Meg. Megaphyll. Mes. Mesophyll, Mac.Macrophyll,
3. Leaf shape: S. simple, Comp. compound.
4. Spiny nature: Spiny, Non spiny.

Discussion

The present study was compared with other similar studies carried out in the surrounding areas of the research area. Our floristic list has showed similarity to the findings of Sher & Khan (2007) in which they reported 222 plant species belonging to 88 families from Chagharzai Valley, District Buner. The findings also agree with Badshah et al, (2013) and Sher et al, (2014). In a study by Khan et al, (2014) reported 132 species belonging to 104 genera and 47 families from Shahbaz Garhi, District Mardan in which family Poaceae and class therophytes were the dominant in his study that showing similarity with the findings of the present research. Similarly, 38 families were reported from Sheikh Maltoon Town district Mardan by Khan et al, (2013) and recorded Therophytes as dominant life form and Microphylls as dominant leaf class. Being surrounding area of the present research area their finding also showed similarity with our findings. Khan et al, (2014) also documented 124 genera from tehsil Katlang district Mardan and concluded the dominance of therophytes which indicates that the area is under severe biotic stress and similar findings are reported in the present study also. In a study 77 species were collected and like our study some dominant genera including *Amaranthus*, *Euphorbia*, *Juncus*, *Marsilea*, *Morus*, *Populus*, *Polygonum*, *Tagetes*, *Zinnia* and *Ziziphus* were reported by Khan et al, (2018) from riparian zone of Lund Khuwar, district Mardan Pakistan. A research was also conducted by Khan and Musharaf (2015) and carried out assessment of 34 species for its conservation status belonging to 20 families. They reported that 12 species were rare, 11 were vulnerable, 9 were endangered and 2 were infrequent. The present floristic list has provided a baseline for write up of complete flora of the area with taxonomic description and keys for identification and further exploration.

Conclusion

The area has rich diversity which has an important role in maintaining the natural flora intact. The ecological diversity also support the natural flora of the area, but the area is facing anthropogenic and other threats including deforestation, soil erosion, cutting for fuel wood and other purposes. Therefore, proper conservation measures are required to conserve the plant diversity growing in the area. Further, over exploitation must be completely banned to control loss of plants natural resources of area.

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