

Research Article

Floristic inventory and ecological evaluation of plants of Jani Khel, Bannu, Khyber Pakhtunkhwa, Pakistan

Irfan Ali Shah¹, Lal Badshah¹, Tanvir Burni¹, Noor Ul Uza^{1*}, Abdur Rahman Khan¹ and Imran Ahmad^{1,2}

1. Department of Botany, University of Peshawar, Pakistan

2. Department of Botany, Shaheed Benazir Bhutto University Sheringal, Upper Dir, Pakistan

*Corresponding author's email: noorbotany123@gmail.com

Citation

Irfan Ali Shah, Lal Badshah, Tanvir Burni, Noor Ul Uza and Imran Ahmad. Floristic inventory and ecological evaluation of plants of Jani Khel, Bannu, Khyber Pakhtunkhwa, Pakistan. Pure and Applied Biology. Vol. 11, Issue 4, pp881-890. <http://dx.doi.org/10.19045/bspab.2022.110090>

Received: 12/11/2021

Revised: 13/01/2022

Accepted: 28/01/2022

Online First: 04/02/2022

Abstract

Ethnobotanical study aids in the discovery of novel pharmaceuticals for the treatment of various ailments in scientific times. Local people have gathered ethnobotanic information through a hit-and-run manner from millennia of indigenous wisdom and passed it down from generation to generation. This knowledge serves as a foundation for scientifically investigating a plant's potential medicinal effects. It will also provide a baseline for researchers in the various field of plant sciences. The current study was conducted during 2015-16 to record the floristic composition and ecological characteristics of the flora of Jani Khel, district Bannu. The floral composition revealed 80 species belonging to 29 families. Among them, 27 families were dicotyledons and 02 were monocotyledons. Papilionaceae and Poaceae were the leading families each with 08 species followed by Asteraceae and Cucurbitaceae (07 species each), Umbelliferae (06 species), Brassicaceae and Chenopodiaceae (05 species each), Mimosaceae, Moraceae and Solanaceae (04 species each), Alliaceae, Euphorbiaceae, Plantaginaceae and Rhamnaceae were represented by 2 species each, while the remaining families comprised single species. Therophytes (48 species, 60%) was the dominant life form, followed by Microphanerophytes (10 species, 12.5 %), Hemicryptophytes (08 species, 10%), Chamaephytes (07 species, 8.75%), Nanophanerophytes (04 species, 5%) and Geophytes (03 species, 3.75%). Nanophylls with (27 species, 33.75%) and Microphylls (20 species, 25%) were dominant leaf size classes. Megaphylls and Aphyllous were considered the least infrequent leaf size spectra in the area. It was observed that the research area has a diversity of plants, but due to anthropogenic activities the flora is under pressure. So, measures should be taken to conserve the flora.

Keywords: Bannu; Ecological characteristics; Floristic composition; Jani Khel

Introduction

Jani Khel, Bannu is located between 32°69'79.66 and 32°87'78.31 North latitudes and 70°36'01.90 and 70°54'00.54 East

longitudes. It is surrounded on the West by the District North Waziristan, on the East by District Lakki Marwat, on the North by District Bannu (Tehsil Miryan), and on the

South by South Waziristan (Fig. 1). It has total area of 745 square km. The area has a unique phytodiversity of sub-tropical vegetation. The area has four seasons such as winter (mid of November to February) with temperature ranges from 5°C to 26°C, spring

(March to mid of April), Summer (mid of April to end of August) and Autumn (September to end of October). The average precipitation is about 66.8mm, in which maximum rain fall occurs in the months of July and August.

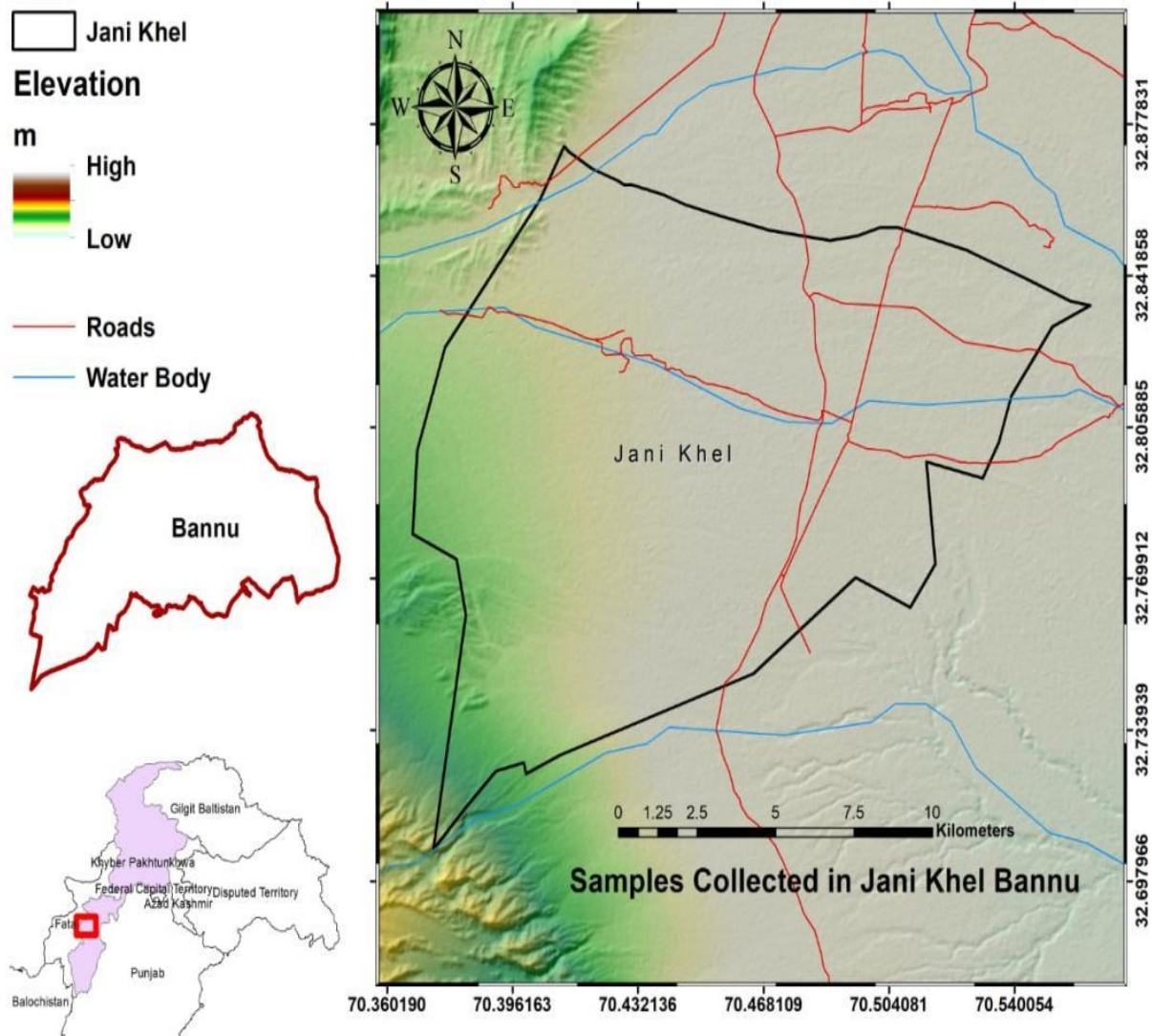


Figure 1. Map of the research area

The word flora refers to the total number of species in particular region and vegetation refers to their distribution and assemblage [1]. Flora is a complete checklist of plant species growing in any geographical area

either wild or cultivated. The floristic composition of region is affected by agriculture practices, overgrazing, deforestation, and natural disasters [2, 3].

Biological spectrum reflects the physiognomy of the flora as a result of all processes in relation with environment [4, 5]. This helps in understanding the ecological elucidation of vegetation. Classification based on life form is more reliable because it based on the position and degree of parenting bud [6]. Life form study is an important part of the flora description [7]. Similarly, leaf size classes play a significant role in physiological processes [8]. The structure of leaf usually determines the habitat condition such as microphyll leaves represent the dry and hot environmental condition [9]. The knowledge of leaf size classes might be helpful for the study of physiological processes of plants [10].

Jani Khel, Bannu is semi-arid area with and its flora faces the harsh environmental condition. The main aim of this study was to enlist the flora and ecological characteristics of the research area.

Materials and Methods

Floristic Composition

To prepare a complete floristic list of plants, specimens were collected in different seasons during 2015-2016 from different parts of Jani Khel, Bannu. The specimens were collected, preserved and mounted on standard size herbarium sheets, and then identified with the flora of Pakistan [11, 12]. Voucher numbers were allotted to specimens and the other descriptions were written on each sheet accordingly. The identified specimens were submitted to the herbarium of Botany Department, University of Peshawar.

Biological Spectrum

Life form classes of the plants were determined with standard method of [6], such as Geophytes, Nanophanerophytes, Microphanerophytes, Chamaephytes, Hemicryptophytes and Therophytes.

For estimation of leaf size in the field, [6] diagram was used. Based on leaf size

spectrum, the plants were divided into five classes such as Megaphyll, Mesophyll, Mirophyll, Leptophyll, Nanophyll and Aphyllous.

Results and Discussion

Floristic composition and ecological characteristics

The flora of Jani Khel, Bannu consisted of 80 species of 29 families (Plate 1 & Fig. 2). Dicotyledons were represented by 27 families and monocotyledons by 02 families. Papilionaceae and Poaceae were the leading families in terms of species composition (8 species each) followed by Asteraceae and Cucurbitaceae (7 species each), Umbelliferae (6 species), Brassicaceae and Chenopodiaceae (5 species each), Mimosaceae, Moraceae, and Solanaceae (4 species each), Alliaceae, Euphorbiaceae, Plantaginaceae and Rhamnaceae (2 species each) as shown in (Table 1). Habit of the flora dominated by herbs (62%) followed by trees (18%) and shrubs (11%) and climbers (9%) as shown in (Fig. 3). Close to our finding, [13] reported flora of Bannu which comprised 193 plant species of belonging 54 families. Of the species, 145 species (75.13%) were dicots and 48 species (24.87%) were monocots. Family Poaceae was dominant with 37 species. Similarly, [2] reported Poaceae (34 species), Papilionaceae (19 species) Asteraceae (14 species), Chenopodiaceae (10 species) and Brassicaceae (9 species) as dominant plants families from District Tank. [14] recorded that Poaceae is the leading family from Olea-Acacia forest of District Karak. [15] recorded Poaceae (12 species), Papilionaceae (07 species), and Asteraceae (06 species) representative families of angiosperms plants from Dureji Gam reserve which are in agreement with our findings. [16, 17] also strongly supported our results.

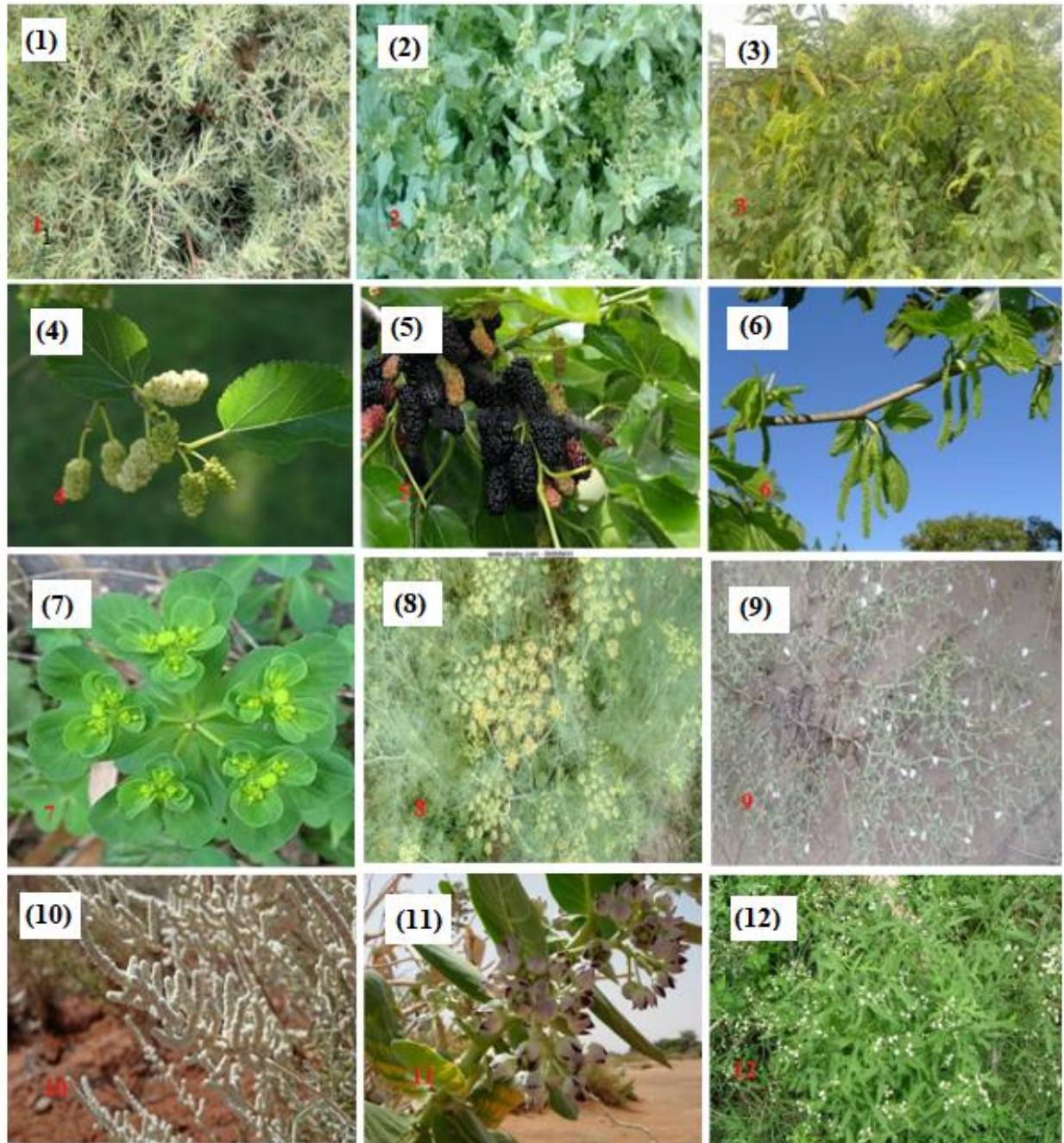


Plate 1. *Sueada fruticosa* 2. *Chenopodium albam* 3. *Acacia modesta* 4. *Morus alba* 5. *M. nigra* 6. *Morus laevigata* 7. *Euphorbia heliscopia* 8. *Anethum sowa* 9. *Fagonia indica* 10. *Arva javanica* 11. *Calotropis procera* 12. *Parthenium hysterophorus*

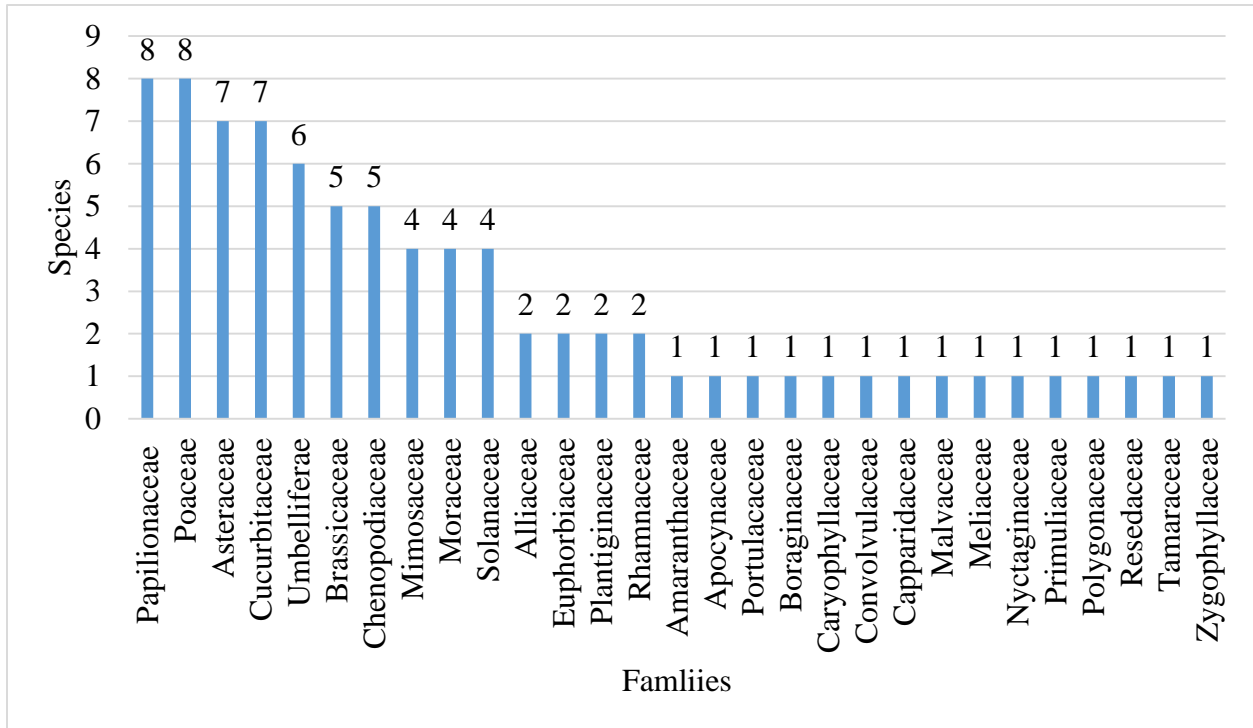


Figure 2. Species distribution in the families

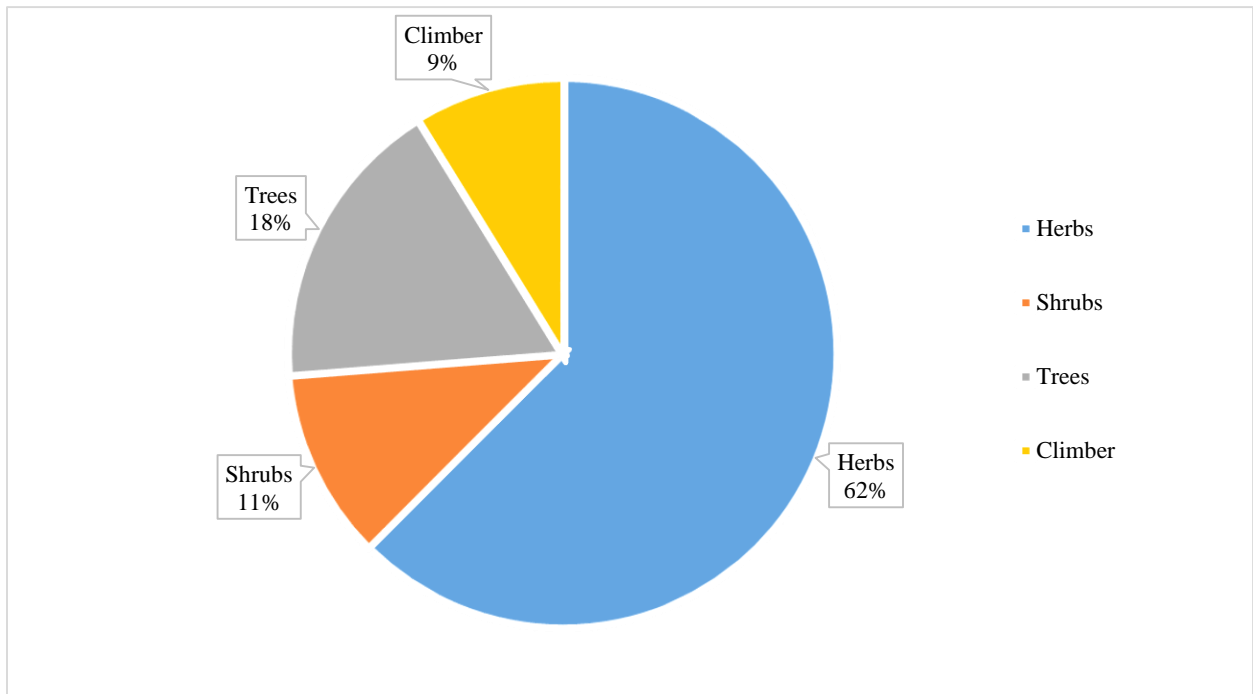


Figure 3. Habit of the species

Table 1. Floristic composition, Life form and Leaf size spectrum of flora of Jani Khel, Bannu

S. #	Species name	Voucher number	Family	Habit	Life form	Leaf size
1	<i>Allium cepa</i> L.	Shah.Bot.01(UOP)	Alliaceae	H	Geo	Nan
2	<i>A. sativum</i> L.	Shah.Bot.02(UOP)		H	Geo	Nan
3	<i>Polypogon monspeliensis</i> (L) D.f.	Shah.Bot.03(UOP)	Poaceae	H	The	Mic
4	<i>Avena fatua</i> L.	Shah.Bot.04(UOP)		H	The	Mic
5	<i>Cymbopogon jawarancusa</i> (Jones)Schlt	Shah.Bot.05(UOP)		H	The	Mic
6	<i>Eragrostis minor</i> Host	Shah.Bot.06(UOP)		H	Hem	Nan
7	<i>Hordeum vulgare</i> L.	Shah.Bot.07(UOP)		H	The	Mic
8	<i>Triticum aestivum</i> L.	Shah.Bot.08(UOP)		H	The	Mic
9	<i>Zea mays</i> L.	Shah.Bot.09(UOP)		H	The	Mes
10	<i>Oryza sativa</i> L.	Shah.Bot.10(UOP)		H	The	Mic
11	<i>Aerva javanica</i> (Burm.f) Juss, ex Schult.	Shah.Bot.11(UOP)	Amaranthaceae	H	Cha	Lep
12	<i>Calotropis procera</i> Willd	Shah.Bot.12(UOP)	Apocynaceae	S	Cha	Mes
13	<i>Portulaca oleracea</i> L.	Shah.Bot.13(UOP)	Portulacaceae	H	The	Nan
14	<i>Parthenium hysterophorus</i> L.	Shah.Bot.14(UOP)	Asteraceae	H	The	Mes
15	<i>Scorzonera lacinata</i> L.	Shah.Bot.15(UOP)		H	Geo	Mic
16	<i>Calendula arvensis</i> L.	Shah.Bot.16(UOP)		H	The	Nan
17	<i>Filago pyramidata</i> L.	Shah.Bot.17(UOP)		H	The	Lep
18	<i>Conzya Canadensis</i> (L.) Cronquist	Shah.Bot.18(UOP)		H	The	Lep
19	<i>Cirsium arvensis</i> (L.) Scop.	Shah.Bot.19(UOP)		H	The	Mic
20	<i>Carthamus oxycantha</i> M.Bieb	Shah.Bot.20(UOP)		H	The	Mic
21	<i>Heliotropium europaeum</i> L.	Shah.Bot.21(UOP)	Boraginaceae	H	The	Mic
22	<i>Brassica rapa</i> L.	Shah.Bot.22(UOP)	Brassicaceae	H	The	Nan
23	<i>Malcolmia cabulica</i> L.	Shah.Bot.23(UOP)		H	The	Mic
24	<i>Eruca sativa</i> Mill	Shah.Bot.24(UOP)		H	The	Nan
25	<i>Malcolmia africana</i> (L.) R Br.	Shah.Bot.25(UOP)		H	The	Nan
26	<i>Farsetia jacquemontii</i> Hook.f.&thoms	Shah.Bot.26(UOP)		H	The	Nan
27	<i>Spinacia oleracea</i> L.	Shah.Bot.27(UOP)	Chenopodiaceae	H	The	Mic
28	<i>Sueada fruticosa</i> Forssk.ex J.F.Gmelin	Shah.Bot.28(UOP)		S	Cha	Lep
29	<i>Salsola fetid</i> Delile.	Shah.Bot.29(UOP)		S	Cha	Lep
30	<i>Chenopodium Album</i> L.	Shah.Bot.30(UOP)		H	The	Nan
31	<i>C. murale</i> L.	Shah.Bot.31(UOP)		H	The	Lep
32	<i>Cucumis sativus</i> L.	Shah.Bot.32(UOP)	Cucurbitaceae	C	The	Mic
33	<i>Cucurbita pepo</i> L.	Shah.Bot.33(UOP)		C	The	Mes
34	<i>C. maxima</i> Duchesne	Shah.Bot.34(UOP)		C	The	Meg
35	<i>Luffa acutangula</i> (L.) Roxb.	Shah.Bot.35(UOP)		C	The	Mac
36	<i>L. cylindrica</i> L.	Shah.Bot.36(UOP)		C	The	Mac
37	<i>Momordica charantia</i> L.	Shah.Bot.37(UOP)		C	The	Mes
38	<i>Spergula arvensis</i> L.	Shah.Bot.38(UOP)	Caryophyllaceae	H	He	Nan
39	<i>Convolvulus arvensis</i> L.	Shah.Bot.39(UOP)	Convolvulaceae	H	The	Nan
40	<i>Euphorbia heliscopa</i> L.	Shah.Bot.40(UOP)	Euphorbiaceae	H	The	Nan
41	<i>Ricinis communis</i> L.	Shah.Bot.41(UOP)		S	Cha	Mes
42	<i>Capparis deciduas</i> Forssk Edgew	Shah.Bot.42(UOP)	Capparidaceae	T	Nanp	Aph
43	<i>Malva neglecta</i> wallr.	Shah.Bot.43(UOP)	Malvaceae	S	The	Mic
44	<i>Melia azadarach</i> L.	Shah.Bot.44(UOP)	Meliaceae	T	Micp	Nan
45	<i>Acacia nilotica</i> (L.) Delile	Shah.Bot.45(UOP)	Mimosaceae	T	Micp	Lep
46	<i>A. modesta</i> wall	Shah.Bot.46(UOP)		T	Micp	Lep
47	<i>Albizia lebbeck</i> L.	Shah.Bot.47(UOP)		T	Micp	Lep
48	<i>Prosopis juliflora</i> swarts	Shah.Bot.48(UOP)		T	Nanp	Lep
49	<i>Morus alba</i> L.	Shah.Bot.49(UOP)	Moraceae	T	Micp	Mes

50	<i>M. laevigata</i> Wal.exBrandis.	Shah.Bot.50(UOP)		T	Micp	Mic
51	<i>M. nigra</i> L.	Shah.Bot.51(UOP)		T	Micp	Mes
52	<i>Ficus religiosa</i> L.	Shah.Bot.52(UOP)		T	Nanp	Mes
53	<i>Boerhavia procera</i> L.	Shah.Bot.53(UOP)	Nyctaginaceae	H	Hem	Nan
54	<i>Medicago polymorpha</i> L.	Shah.Bot.54(UOP)	Papillionaceae	H	The	Nan
55	<i>M. minima</i> (L.) Grufb	Shah.Bot.55(UOP)		H	The	Nan
56	<i>Dalbergia sissoo</i> Roxb	Shah.Bot.56(UOP)		T	Micp	Nan
57	<i>Astragalus hamosus</i> L.	Shah.Bot.57(UOP)		H	Cha	Lep
58	<i>Argyrolobium roseum</i> L.	Shah.Bot.58(UOP)		H	The	Nan
59	<i>Cicer arietinum</i> L.	Shah.Bot.59(UOP)		H	The	Lep
60	<i>Alhagi maurorum</i> Medik	Shah.Bot.60(UOP)		S	Hem	Lep
61	<i>Vicia sativa</i> L.	Shah.Bot.61(UOP)		C	The	Mic
62	<i>Anagallis arvensis</i> L.	Shah.Bot.62(UOP)	Primuliaceae	H	The	Nan
63	<i>Plantago ciliate</i> (Boiss) Rech	Shah.Bot.63(UOP)	Plantaginaceae	H	The	Nan
64	<i>P. lanceolata</i> L.	Shah.Bot.64(UOP)		H	Hem	Mes
65	<i>Rumex dentatus</i> L.	Shah.Bot.65(UOP)	Polygonaceae	H	The	Mes
66	<i>Oligomeris linifolia</i> (Vahl. Ex Hornem.) J. F. Macbr.	Shah.Bot.66(UOP)	Resedaceae	H	The	Nan
67	<i>Ziziphus nummularia</i> (Burm.f.)	Shah.Bot.67(UOP)	Rhamnaceae	T	Nanp	Nan
68	<i>Z. mauritina</i> Lam.	Shah.Bot.68(UOP)		T	Micp	Nan
69	<i>Capsicum Annuum</i> L.	Shah.Bot.69(UOP)	Solanaceae	H	The	Nan
70	<i>Withania coagulans</i> (Stocks) Dunal	Shah.Bot.70(UOP)		S	Cha	Mic
71	<i>Solunum surattense</i> Burm. f.	Shah.Bot.71(UOP)		H	Hem	Mic
72	<i>Datura alba</i> Nees	Shah.Bot.72(UOP)		S	The	Mic
73	<i>Tamarixa phylla</i> (L.) karst	Shah.Bot.73(UOP)	Tamaraceae	T	Micp	Lep
74	<i>Anethum sowa</i> Roxb..ex Fleming	Shah.Bot.74(UOP)	Umbelliferae	H	The	Lep
75	<i>Foeniculum vulgare</i> Mill.	Shah.Bot.75(UOP)		H	The	Lep
76	<i>Coriandrum sativum</i> L.	Shah.Bot.76(UOP)		H	Hem	Nan
77	<i>Trachyspermum ammi</i> L.	Shah.Bot.77(UOP)		H	The	Lep
78	<i>Ammi visnaga</i> (L.) lam	Shah.Bot.78(UOP)		H	The	Lep
79	<i>Torilis leptophylla</i> (L.) Rchb.f.	Shah.Bot.79(UOP)		H	The	Nan
80	<i>Fagonia indica</i> Burm.f.	Shah.Bot.80(UOP)	Zygophyllaceae	S	The	Lep

KEY: Habit: H-Herb, S-Shrub, T-Tree, C-Climber; **Life form:** Cha-Chamaephytes, Geo-Geophytes, Hem-Hemicryptophytes, Micp-Microphanerophytes, Nanp-Nanophanerophytes, The-Therophytes; **Leaf Size:** Aph-Aphylloues, Lep-Leptophyll, Mac-Macrophyll, Meg-Megaphyll, Mes-Mesophyll, Mic-Microphyll, Nan-Nanophyll

Life form

The observed life form of the plants was dominated by Therophytes with 48 species (60%) followed by Microphanerophytes with 10 species (12.5%), Hemicryptophytes with 08 species (10%), Chamaephytes with 07 species (8.75%), Nanophanerophytes with 04 species (5%) and Geophytes with 03 species (3.75%) as shown in (Table 2 & Fig. 4). [6] recognized three phytoclimate on the earth. Phanerophytic climate which lies in tropics, Therophytic climate which lies in deserts and Hemicryptophytes which include greater parts of the cold temperate zone. In the present study, dominance of Therophytes life

form is due to the abiotic factors like high temperature and drought, and biotic influence like extensive agriculture practice, deforestation, grazing and trampling. Close to our finding, [13] studied recorded Therophytes (60.62%) and Hemicryptophytes (09.84%) the dominant life form classes from District Bannu. Similarly, [18] reported Therophytes (16 species, 29.6%) and Megaphanerophytes (14 species, 25.9%) dominant life forms from Dara Adam Khel. [2] studied the flora of District Tank and recorded Therophytes and Hemicryptophytes the leading life form classes. [18] studied the biological spectrum

and found Therophyte dominant life form in their research area. [19] observed Therophytes and Phanerophytes the leading plant life form of Khanpur Dam, Khyber Pakhtunkhwa, Pakistan which is comparable with our findings. [20] observed that therophytes (234 species, 26.97%) and hemicryptophytes (154 species, 26.97%) are the characteristic life form of the flora of District Chitral, which was additionally in agreement to our results.

Leaf size spectrum

Leaf size spectrum of Jani Khel demonstrated Nanophylls 33.75% (27 species, 33.75%), followed by Microphylls 25% (20 species), Leptophylls 22.5% (18 species), Mesophylls 13.75% (11 species), Macrophylls 2.5% (02 species) and Megaphylls and Aphyllous 1.5% (01 species) of each as shown in (Table 2 & Fig. 5). Leaf size spectrum of plants

revealed that Nanophylls, Microphylls and Leptophylls are characteristic of hot and dry habitat vegetation [21, 22]. This study shows that the weather condition of Jani Khel is hot and dry that supports the Nanophylls and Microphylls leaf sizes. [13] declared Nanophylls 48.18% (93 species) and Leptophylls 21.24% (41 species) are the dominant leaf size classes in District Bannu, which explained our outcomes. Similarly, [16] explored leaf size spectra of the plants of Sheikh Malton, Mardan that comprised of Microphyll (46.2%), Mesophyll (25.3%) and Nanophylls (25.3%) which are close to the current findings. The study of [2] declared the leaf size of District Tank, comprised of 46.8% (96 species) Nanophylls, and Leptophylls 27.8% (57 species) which also strengthened our results.

Table 2. Percentage distribution of life form and leaf spectra of flora

S#	A. Life Form	No. of species	% age of species
1.	Therophytes	48	60%
2.	Hemicryptophytes	08	10%
3.	Chamaephytes	07	8.75%
4.	Geophytes	03	3.75%
5.	Nanophanerophytes	04	5%
6.	Microphanerophytes	10	12.5%
	Total	80	100
	B. Leaf size	No. of species	% age of species
1.	Leptophyll	18	22.5%
2.	Nanophyll	27	33.75%
3.	Microphyll	20	25%
4.	Macrophyll	02	2.5%
5.	Mesophyll	11	13.5%
6.	Megaphyll	01	1.25%
7.	Aphyllous	01	1.25%
	Total	80	100

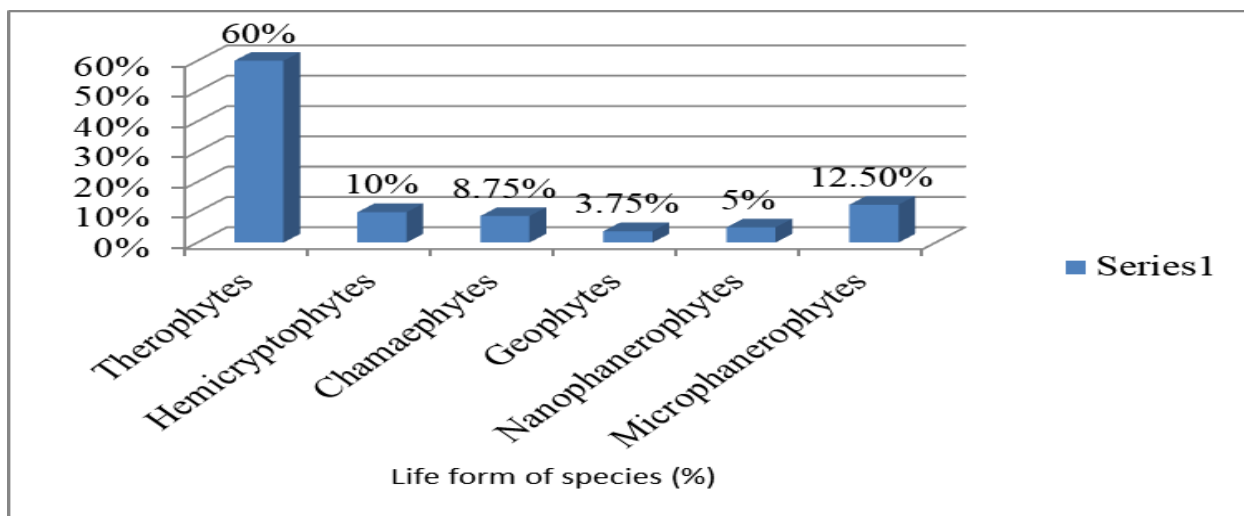


Figure 4. % Life form of flora of Jani Khel, Bannu

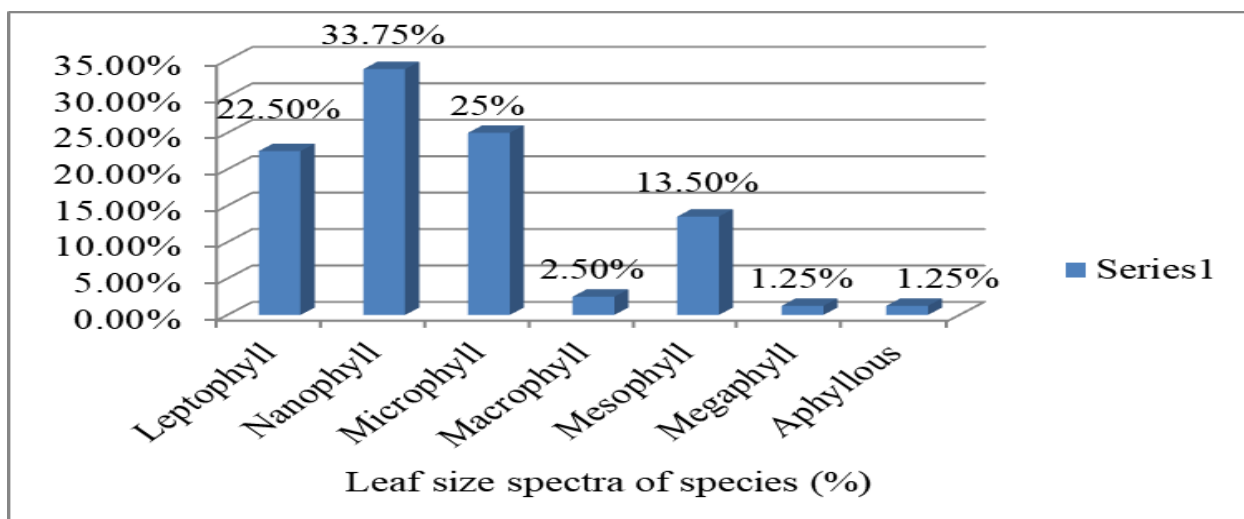


Figure 5. % Leaf size of flora of Jani Khel, Bannu

Conclusion and Recommendations

The flora of Jani Khel, Bannu consisted of 80 plants species belonging to 29 families. Papilionaceae, Poaceae, Asteraceae, Umbelliferae, Chenopodiaceae were the most prevalent families. The climatic condition of the area is dry and hot which supports Therophyte and Microphyllous classes of biological spectrum. The current study believed that many species have been left unrecorded, so a long-term comprehensive study needed to document it.

Authors' Contributions

Conceived and designed the experiments: T Burni & L Badshah, Performed the

experiments: IA Shah, Contributed materials: T Burni, L Badshah, AR Khan & I Ahmad, Wrote the paper: NU Uza & IA Shah.

References

1. Ali A, Badshah L & Hussain F (2016). Floristic composition and Ecological characteristics of Chail Valley, District Swat, Pakistan. *Pak J Bot* 48(3): 1013-1026.
2. Badshah L, Hussain F & Sher Z (2013). Floristic inventory, Ecological characteristics and biological spectrum of rangeland, District Tank, Pakistan. *Pak J Bot* 45(4): 1159-1168.

3. Shah M & Rozina (2013). Phytosociological attributes and Phytodiversity of Dheri Baba Hill and Peer Taab Graveyard, district Swabi, Khyber Pakhtunkhwa, Pakistan. *PJLS* 1(1): 1-6.
4. Khan M, Hussain F, Musharaf S & Imdadullah S (2011). Floristic composition, life form and leaf size spectra of the coal mine area vegetation of Darra Adam Khel, Khyber Pakhtunkhwa, Pakistan. *J Biol Environ Sci* 1(3): 1-6.
5. Traiser C, Klotz S, Uhl D & Mosbrugger V (2005). Environmental signals from leaves—a physiognomic analysis of European vegetation. *New Phytol* 166(2): 465-484.
6. Raunkiær C (1934). *The Life Forms of Plants and Statistical Plants Geography being the collected Papers of C. Raunkiaer*. Clarendon press, Oxford.
7. Hussain A, Mirza SN, Khan IA & Naeem MA (2009). Determination of relative species composition and seasonal plant communities of Nurpur reserved forest in scrub rangelands of District Chakwal. *Pak J Agri Sci* 46(1): 55-59.
8. Yates MJ, Verboom GA, Rebelo AG & Cramer MD (2010). Eco-physiological significance of leaf size variation in Proteaceae from the Cape Floristic Region. *Function Ecol* 24(3): 485-492.
9. Khan W, Khan SM, Ahmad H, Alqarawi AA, Shah GM, Hussain M & Abd_Allah (2018). Life forms, leaf size spectra, regeneration capacity and diversity of plant species grown in the Thandiani forests, District Abbottabad, Khyber Pakhtunkhwa, Pakistan. *Saudi J Biol Sci* 25(1): 94-100.
10. Oosting HJ (1956). *The Study of Plant Communities*, 2nd edition, pp: 69-78. W.H. Freeman and Co., Sanfrancisco.
11. Ali SI & Qaisa M (1995-2010). *Flora of Pakistan*. Pakistan Agricultural Research Council, Islamabad.
12. Nasir E & Ali SI (1971-2007). *Flora of West Pakistan* Department of Botany, University of Karachi, Karachi, Pakistan.
13. Ihsan U, Din SU, Ullah F, Khan SU, Khan A, Khan RA & Shah Z (2016). Floristic composition, ecological characteristics and biological spectrum of District Bannu, Khyber Pakhtunkhawa, Pakistan. *J Human Ecol* 54(1):1-11.
14. Naveed S, Hussain F, Khattak I, & Badshah L (2012). Floristic Composition and Ecological Characteristics of Olea-Acacia Forest of Shamshokii District Karak. *Global J Sci Front Res* 12(8): 31-6.
15. Perveen A, Sarwar GR & Hussain I (2008). Plant biodiversity and phytosociological attributes of Dureji (Khirthar Range). *Pak J Bot* 40(1): 17-24.
16. Khan M, Hussain F & Musharaf S (2013). Floristic composition and biological characteristics of the vegetation of Sheikh Maltoon Town District Mardan, Pakistan. *Annual Res Rev Bio* 31-41.
17. Qureshi R (2008). Vegetation assessment of Sawan Wari of Nara desert, Pakistan. *Pak J Bot* 40(5): 1885-1895.
18. Khan M, Hussain F & and Musharaf S (2014). Floristic composition and ecological characteristics of Shahbaz Garhi, District Mardan, Pakistan. *Global J Sci Front Res* 14(1): 7-17.
19. Qureshi R, Shaheen H, Ahmed MI & Munir M (2014). Phytodiversity and plant life of Khanpur Dam, Khyber Pakhtunkhwa, Pakistan. *Pak J Bot* 46(3): 841-849.
20. Hussain F, Shah M, Badshah L & Durani JL (2015). Diversity and ecological characteristics of Flora of Mastuj Valley, Distric Chitral, Pakistan. *Pak J Bot* 47(2): 415-510.
21. Cain SA & G.M. De Oliveria Castro (1959). *Manual of Vegetation Analysis*. Harper & Brothers, New York.
22. Tareen RB, & Qadir SA (1993). Life form and Leaf size spectra of the plant communities of diverse areas ranging from Harnai, Sinjawi to Duki regions of Pakistan. *Pak J Bot* 25 (1): 83-92.