



Research Article

Floristic Composition and Biological Spectrum of Palangzai Miran Shah Village, District North Waziristan (Merged Areas), Khyber Pakhtunkhwa

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Abstract | This study was carried out to evaluate the biological spectrum and floristic composition of the settlement of Palangzai in Miran Shah, North Waziristan in 2017. Total 130 species from 51 families make up the floristic diversity. Poaceae and Asteraceae had 12 species apiece, while Solanaceae had 10 species, making them the most abundant family. Lamiaceae and Papilionaceae follow with six species apiece, followed by Brassicaceae, Euphorbiaceae, Fabaceae, and Rosaceae with five each. Less than five species were found in each of the other families. According to life forms, the two most prevalent life forms were Microphanerophytes, with 23 species (17.69%) and Therophytes, with 66 species (50.76%). The remaining living forms were 16 species of Chamaephytes (12.30%), 11 species of Hemicryptophytes (8.46%), 8 species of Nannophanerophytes (6.15%), and 6 species of Geophytes (4.61%). The principal leaf size classes identified by the leaf size spectra were Mesophylls, with 23 species (16.92%), Microphylls, with 38 species (29.23%), and Nanophylls, with 43 species (33.07%). There were 21 species of leptophyll (16.15%), three species of megaphyll (2.30%), two species of aphyllous (1.53%), and one species of macrophyll (0.76%) among the remaining leaf size groups. Indicating the xeric nature of the region, the most common leaf sizes were nanophylls, microphylls, and mesophylls.

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Keywords | Nanophylls, Aphyllous, Palangzai, Waziristan, Life form, Spectra



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Introduction

The northern portion of Waziristan, a hilly region in northwest Pakistan that borders Afghanistan and spans around 11,585 km² (4,473 mi²), is known as the North Waziristan district (formerly known as FATA). Between the Gomal River to the south and

the Kurram River to the north, it is located in the west and southwest of Peshawar. North Waziristan's capital city is Miran Shah.

The North Waziristan Agency was established as a full-fledged organization in 1910. The Wazir and Dawar tribes of Pashtuns live there. The district is

located between latitudes 32.35° and 33.22°N and longitudes 69.22° and 70.38°S. Afghanistan, Kurram, and Hangu District enclose it on the north, while Khyber Pakhtunkhwa Region, which borders Bannu district, encloses it on the east. Afghanistan is to the west, and South Waziristan is to the south ([Khyber Pakhtunkhwa Board of Investment and Trade](#)).

Topography

The district is hilly, and these hills and mountains creating a barrier between Afghanistan and Pakistan. The Waziristan hills are typically between 1,500 and 2,500 meters (4,900 and 6,600 feet) above sea level. The Derwesta, Laran, Vezda, Ingame, Shoidar, Shawal, Eblunkai, Alexandra, Muzdak, and Zakha Vezhda Hills are among the significant Waziristan hill ranges. Nonetheless, the mountain ranges of Khattip, Margha wazar sar, and Karawragha encircle the settlement of Palangzai.

Tochi River

The Tochi River, which flows through the district, created the Tochi Pass, which bears the river's name. Armies, people, and cultures have entered and exited this area through this pass. Ghazni, Afghanistan, and Bannu, Pakistan, are connected by it ([Mufti et al., 1997](#)).

Climate

The region experiences warm summers and frigid winters. The summer months run from May through September. In the mountainous areas, the average June high and low temperatures are 31° and 18° Celsius, respectively, whereas in the partially plain areas, they are 38° and 22° Celsius. October marks the beginning of winter, which lasts until April. The coldest months are December, January, and February. In January, the average high and low temperatures in the somewhat plain areas are 10° and -2° Celsius, respectively.

Materials and Methods

Floristic composition

The study was carried out in the spring and summer of the 2017. Plants were collected in various visits from numerous locations of the study area. The plants were mounted on the typical herbarium sheets after being dried and preserved. The Flora of Pakistan ([Nasir and Ali, 1971-94](#); [Ali and Qaiser, 1995-2010](#)) was used to identify the plants. The Herbarium of the Department of Botany at the University of Peshawar,

Pakistan, provided additional confirmation of the plants identity.

Biological spectrum

The adaptation of plants to the climate is reflected in life forms. The term bio spectrum refers to the proportion of various life forms that are found in a certain location or area. [Hussain \(1989\)](#), [Badshah et al. \(2013\)](#), and [Raunkiaer \(1934\)](#) divided the plants into the following life form classes.

Phanerophytes (Ph)

Species whose aerial portions produce perennating buds that are at least 25 cm above the ground. They were further separated into the subcategories listed below.

- Each of these types may be classified according to height:
- Megaphanerophytes (Mg). >30m (100 Ft. +)
- Mesophanerophytes (Ms). 7.6-30m (25-100 Ft.)
- Microphanerophytes (Mp). 2-7.5m (6-25 Ft.)
- Nanophanerophytes (N). 0.25-2m (0.8-6 Ft.)

Chamaephyte (Ch)

Perennial plants have buds or shoots that are up to 25 cm off the ground on an upright stem. Another name for them is surface plants. Usually, they live in arid, cool climates.

Hemicryptophytes (He)

Perennial plants with buds that are buried in soil and litter and located near the ground. These plants grow best in cold, humid areas. They consist of numerous forbs and grasses.

Geophytes/ Cryptophytes (G/Cr)

Their perennial buds are buried in water or below ground level (hydrophytes). The reproductive organs that are underground and shielded from drying and freezing are the rhizome, corm, bulb, or tuber. Only during a suitable season may the shoots appear.

Therophytes (Th)

These plants are annuals, meaning they only need one season to complete their life cycle. They only use seeds to replenish their growth. These plants can have a brief lifespan of a few weeks. Deserts and grasslands are usually home to these kinds of flora.

Climbers and lianas

These plants grow and are supported by other plants,

rocks, or artificial structures. Woody climbers like Liana are typically anchored in soil.

$$\text{Raunkiaer Biological spectrum} = \frac{\text{Number of species of a particular life form class}}{\text{Total Number of all species in a strand}} \times 100$$

Leaf size spectra

The range of leaf sizes found in a given area provides insight into how plant leaves have adapted to their surroundings. Raunkiaer (1934) separated the plants into the following leaf size classes.

- A. Leptophyll (L): 25 sq. mm
- B. Nanophyll (N): 9 × 25 sq. mm
- C. Microphyll (Mi): 9² × 25 sq. mm
- D. Mesophyll (Me): 9³ × 25 sq. mm
- E. Macrophyll (Mac): 9⁴ × 25 sq. mm
- F. Megaphyll (Ma): larger than class E.

$$\text{Raunkiaer Leaf size spectrum} = \frac{\text{Number of species of a particular leaf size class}}{\text{Total number of all species for that strand}} \times 100$$

Results and Discussion

Table 1: A description of the flora in the village of Palangzai Miran Shah in north Waziristan, Pakistan.

Division	Families	S. No	Species	Life form	Leaf size	Habit	
Gymnosperm	1) Ephedraceae	1	Ephedra nebrodensis	Th	N	Shrub	
Pteridophytes	2) Equisetaceae	2	Equisetum arvense L.	G	Ap	Herb	
Monocotyledon	3) Alliaceae	3	Allium cepa Linn	G	N	Herb	
	4) Arecaceae	4	Nanorrhopes ritchiana (Griff.)	Mp	Mac	Shrub	
		5	Phoenix dactylifera L.	Mp	Mes	Tree	
	5) Poaceae	6	Cenchrus ciliaris L	H	L	Herb	
		7	Cymbopogon jwarancusa (Jones)	H	N	Herb	
		8	Cynodon dactylon (L.) Pers	H	L	Herb	
		9	Dicanthium annulatum (Forssk.) Stapf	H	N	Herb	
		10	Hordeum vulgare L	H	Mic	Herb	
		11	Oryza sativa L.	Th	Mic	Herb	
		12	Poa annua Linn	Th	L	Herb	
		13	Polypogon monspeliensis (L.)	Th	Mic	Herb	
		14	Saccharum bengalensis Retz.	Ch	N	Shrub	
		15	Saccharum spontaneum L.	Ch	L	Shrub	
	Dicotyledon	6) Amaranthaceae	16	Triticum aestivum L	Th	Mic	Herb
			17	Zea mays L.	Th	Mes	Herb
			18	Aerva javanica (Burm.f.) Juss	Ch	L	Herb
			19	Amaranthus varidus L.	Th	N	Herb
7) Apocyanaceae		20	Nerium indica Mill	Np	Mic	Shrub	
		8) Asclepiadaceae	21	Calotropis procera subsp. Hamiltonii (Wight). Ali.	Ch	Mes	Shrub
22			Caralluma tuberculata N.E.Br.	Th	N	Herb	
23			Periploca aphylla Decne.	Np	Ap	Shrub	
9) Asparagaceae		24	Asparagus gracilus Royle	Ch	L	Shrub	
10) Asteraceae		25	Artemesia maritime	Ch	Mic	Herb	
		26	Centurea iberica Trevir. ex Spreng.	Th	N	Herb	
	27	Cirsium arvense (L) scop	Th	Mic	Herb		
	28	Conyza Canadensis (L.) Cronquist	Th	Mic	Herb		
	29	Helianthus annus L.	Th	Mes	Shrub		
	30	Parthinium hysterophorous L.	Th	Mes	Herb		
	31	Silybum marianum L	Ch	Mic	Herb		
	32	Sonchus asper L.	Th	Mic	Herb		
	33	Sonchus oleraceus L	Th	Mic	Herb		
	34	Taraxicum officinale F. H. Wigg.	Th	Mic	Herb		
	35	Xanthium strumarium L.	Th	N	Herb		
	36	Lactuca sativa L.	Th	Mic	Herb		

Table continued on next page.....

Division	Families	S. No	Species	Life form	Leaf size	Habit
	11) Bignoniaceae	37	<i>Tecomella undulata</i> (Sm.) Seem.	Mp	Mic	Tree
	12) Boraginaceae	38	<i>Heliotropium europaeum</i> L.	Th	Mic	Herb
		39	<i>Heliotropium strigosum</i> Willd.	Th	Mic	Herb
		40	<i>Onosma griffithii</i> L.	Th	Mic	Herb
		41	<i>Onosma hispidia</i> L.	Th	Mic	Herb
	13) Brassicaceae	42	<i>Brassica compestres</i> L.	Th	Mes	Herb
		43	<i>Brassica rapa</i> (L.) Clapham.	Th	N	Herb
		44	<i>Malcolmia cubulica</i> L.	Th	Mic	Herb
		45	<i>Sisymbrium irio</i> L.	Th	N	Herb
		46	<i>Raphanus sativus</i> L.	Th	Mic	Herb
	14) Cactaceae	47	<i>Opuntia delenii</i> How	Np	L	Shrub
	15) Cannabaceae	48	<i>Canabis sativa</i> Linn	Th	Mic	Shrub
	16) Caryophyllaceae	49	<i>Achanthophyllum honigbergeri</i>	Np	L	Herb
		50	<i>Silene arenosa</i> C. Koch.	Th	N	Herb
	17) Chenopodiaceae	51	<i>Chenopodium ambrosoides</i> L.	Th	L	Herb
		52	<i>Chenopodium murale</i> L.	Th	L	Herb
	18) Convolvulaceae	53	<i>Convolvulus arvensis</i> L	Th	N	Herb
		54	<i>Convolvulus prostratus</i> Forssk	Th	L	Herb
	19) Cucurbitaceae	55	<i>Citrullus colocynthis</i> (L.)Schrad.	Th	Mic	Herb
		56	<i>Cucurbita pepo</i> L	Th	Mg	Herb
		57	<i>Lagenaria siceraria</i> L	Th	Mg	Herb
		58	<i>Luffa cylindrical</i> L	Th	Mg	Herb
	20) Dipsacaceae	59	<i>Scabiosa oliveri</i> Coult	Th	N	
	21) Eleagnaceae	60	<i>Eleagnus engustifolia</i> L	Th	N	Tree
	22) Euphorbiaceae	61	<i>Andrachne cordifolius</i> (Wall.ex Decne) Decne	Mp	N	Herb
		62	<i>Euphorbia heliscopia</i> L.	Th	L	Herb
		63	<i>Euphorbia hirta</i> L.	Th	L	Herb
		64	<i>Euphorbia prostrata</i> Aiton	Ch	Mes	Herb
		65	<i>Racinus communis</i> L.	Ch	Mes	Tree
	23) Fabaceae	66	<i>Alhagi maurorum</i> Medik	H	L	Shrub
		67	<i>Argyrolobium roseum</i> Jaub	Th	N	Herb
		68	<i>Melilotus indica</i> (L.) All.	Th	N	Herb
		69	<i>Trifolium repens</i> L.	Th	N	Herb
		70	<i>Trifolium alexandranum</i> L	Th	N	Herb
	24) Fumariaceae	71	<i>Fumaria indica</i> (Hauskn.) Pugsley.	Th	N	Herb
	25) Lamiaceae	72	<i>Eremostachya superba</i> Royle ex Benth.	H	Mes	
		73	<i>Mentha longifolia</i> (L.) L.	G	N	Herb
		74	<i>Ocimum basilicum</i> L.	Ch	N	Herb
		75	<i>Salvia moorcroftiana</i> Wall.	Ch	Mic	Herb
		76	<i>Teucrium stocksianum</i> Boiss	Th	Mic	Herb
		77	<i>Vitex negundo</i> L.	Np	Mes	Shrub
	26) Linaceae	78	<i>Linum corymbulosum</i> Reichenb.	Th	N	Herb
	27) Lipidiaceae	79	<i>Cardaria draba</i> (L.) Desv.	Th	N	Herb
	28) Malvaceae	80	<i>Abutilon indicum</i> (L.) Sweet	Ch	N	Herb
		81	<i>Abelmoschus esculentu</i> L.Moench.	Th	Mic	Herb
	29) Meliaceae	82	<i>Melia azedarch</i> L.	Mp	L	Tree
	30) Mimosaceae	83	<i>Acacia modesta</i> Wall.	Mp	L	Tree
		84	<i>Acacia nilotica</i> (L.) Willd. ex. Delile	Mp	L	Tree

Table continued on next page.....

Division	Families	S. No	Species	Life form	Leaf size	Habit
	31) Moraceae	85	<i>Ficus carica</i> L.	Np	Mes	Tree
		86	<i>Morus alba</i> L.	Mp	Mes	Tree
		87	<i>Morus nigra</i> L.	Mp	Mes	Tree
	32) Myrtaceae	88	<i>Euclyptus maculate</i>	Mp	N	Tree
	33) Oleaceae	89	<i>Olea ferruginea</i> Wall.ex Aitch.	Mp	Mic	Tree
	34) Oxalidaceae	90	<i>Oxalis carniculata</i> L.	Th	N	Herb
	35) Papilionaceae	91	<i>Astragalus</i> sp L	Ch	L	Shrub
		92	<i>Lathyrus sativus</i> L	Th	N	Herb
		93	<i>Medicago laciniata</i> (L.) Mill.	Th	N	Herb
		94	<i>Medicago sativus</i> L	H	N	Herb
		95	<i>Pisum sativum</i> L.	Th	Mic	Herb
		96	<i>Vicia sativa</i> L.	Th	N	Herb
	36) Plantaginaceae	97	<i>Plantago ciliata</i> Desf.	Th	N	Herb
		98	<i>Plantago lanceolara</i> L.	Th	N	Herb
	37) Polygonaceae	99	<i>Persicaria glabra</i> (Willed.)M.Gomez.	Th	N	Herb
		100	<i>Rumex dentatus</i> L.	G	Mes	Herb
	38) Primulaceae	101	<i>Anagallis arvensis</i> L.	Th	N	Herb
	39) Punicaceae	102	<i>Punica granatum</i> Linn.	Mp	Mic	Tree
	40) Ranunculaceae	103	<i>Delphinium suava</i> Huth	Th	N	Herb
		104	<i>Ranunculus muricatus</i> L	G	Mic	Herb
	41) Resadaceae	105	<i>Oligomeris lenifolia</i> (Vahl)	Th	N	Herb
	42) Rhamnaceae	106	<i>Segeratia thea</i> (Osbeck)M.C. Johnston	Mp	N	Shrub
		107	<i>Zizyphus mauritiana</i> Lam.	Mp	N	Tree
	43) Rosaceae	108	<i>Cydonia oblonga</i>	Mp	Mes	Tree
		109	<i>Eriobotrya japonica</i> (Thumb.)	Mp	Mes	Tree
		110	<i>Malus pumila</i> L.	Mp	Mes	Tree
		111	<i>Prunus armeniaca</i> Marsh	Mp	Mes	Tree
		112	<i>Prunus domestica</i> L.	Mp	Mic	Tree
	44) Rubiaceae	113	<i>Galium aparine</i> L.	Th	N	Herb
	45) Salacaceae	114	<i>Salix tetrasperma</i> Roxb.	Mp	Mes	Trees
	46) Sepotaceae	115	<i>Monothea boxifolia</i> (Falc.) A. DC.	Mp	Mic	Tree
	47) Solanaceae	116	<i>Datura innoxia</i> Mill	Th	Mes	Herb
		117	<i>Datura metal</i> L.	Np	Mes	Herb
		118	<i>Hyoscymas insanus</i> Stocks	Ch	Mic	Herb
		119	<i>Solanum incanum</i> L	G	Mic	Herb
		120	<i>Lycopersicum esculentum</i> L.	Th	Mic	Herb
		121	<i>Solanum melongena</i> L.	H	Mic	Herb
		122	<i>Solanum nigrum</i> L.	Th	Mic	Shrub
		123	<i>Solanum surattense</i> Burm. f.	H	N	Herb
		124	<i>Withania coagulans</i> (Stocks) Dunal	Ch	Mic	Shrub
		125	<i>Withania somnifera</i> (L.) Dunal	Ch	Mic	Shrub
	48)Spindaceae	126	<i>Dodonea viscosa</i> (L.) Jacq.	Np	N	Shrub
	49) Tamaraceae	127	<i>Tamarix aphylla</i> (L.) Karst	Mp	L	Tree
	50) Vitaceae	128	<i>Vitex venifera</i> linn	Mp	Mes	Shrub
	51)Zygophyllaceae	129	<i>Fegonia indica</i> Hadidi	Th	L	Herb
		130	<i>Peganum harmala</i> L.	H	L	Herb

Keys: Life form leaf size spectra; Th: Therophytes; L: Leptophyll; H: Hemicryptophytes; N: Nanophyll; Ch: Chamaephytes; Mic: Microphyll; G: Geophytes; Mes: Mesophyll; Np: Nannophanerophytes; Mac: Macrophyll; Mp: Microphanerophytes; Mg: Megaphyll; AP: Aphyllous.



Figure 1: A view of village Palangzai.

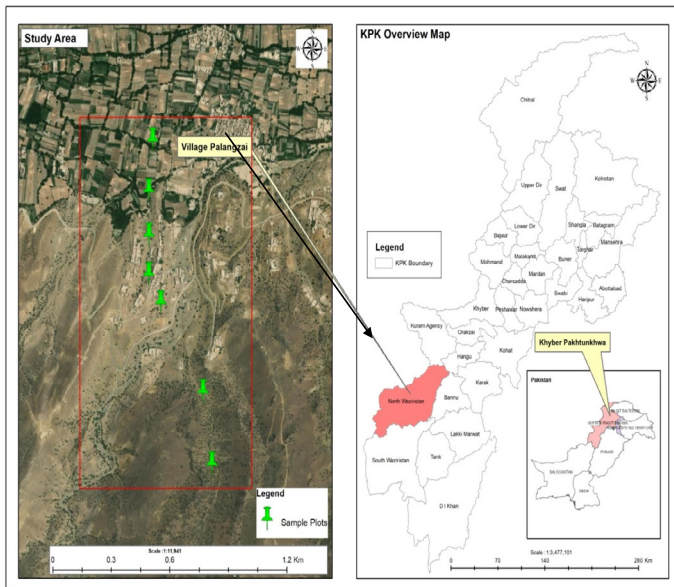


Figure 2: Map of Village Palangzai, North Waziristan Agency. Country: Pakistan, Established: 1910, Headquarter: Miran Shah, Total area: 4,707 km² (1,817 sq mi), Population (1998): 361,246; Density: 77/km² (200/sq mi); Main Language(s): Pashto, Urdu. However, for quick results of the leaf sizes of plants in the field, Raunkiaer (1934) diagrams (Figure 3) was used.

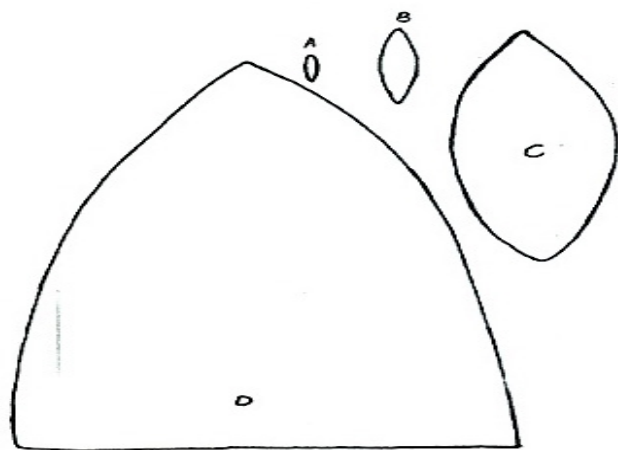


Figure 3: Leaf size classes.

Table 2: Percentage distribution of life form and leaf size spectra of Flora of Vill: Palangzai, Miran Shah (NW).

S. No	Life form	No: of species	%age
1	Therophytes	66	50.76%
2	Microphanerophytes	23	17.69%
3	Chamaephytes	16	12.30%
4	Hemicryptophytes	11	8.46%
5	Nannophanerophytes	8	6.15%
6	Geophytes	6	4.61%
Leaf size			
1	Nanophyll	43	33.07%
2	Microphyll	38	29.23%
3	Mesophyll	22	16.92%
4	Leptophyll	21	16.15%
5	Megaphyll	3	2.30%
6	Aphyllous	2	1.53%
7	Macrophyll	1	0.76%



Figure 4: Less than a, Leptophyll (L); between A and B, Nanophyll (N); between B and C, Microphyll (Mi); between C and 2 times D, Mesophyll (Me); between 2 times D and 8 times the size of the diagram as bounded by the black line, Megaphyll (Mg) (Cottam and Curtis, 1950).

Table 3: Families wise check list of flora.

S. No	Families	No of species
1	Equisetaceae	1
2	Alliaceae	1
3	Arecaceae	2
4	Poaceae	12
5	Amaranthaceae	2
6	Apocyanaceae	1
7	Asclepiadaceae	3
8	Asparagaceae	1
9	Asteraceae	12
10	Bignoniaceae	1
11	Boraginaceae	4
12	Brassicaceae	5
13	Cactaceae	1
14	Cannabaceae	1
15	Caryophyllaceae	2
16	Chenopodiaceae	2
17	Convolvulaceae	2
18	Cucubitateae	4
19	Dipsacaceae	1
20	Eleagnaceae	1
21	Euphorbiaceae	5
22	Ephedraceae	1
23	Fabaceae	5
24	Fumariaceae	1
25	Lamiaceae	6
26	Linaceae	1
27	Lipidiaceae	1
28	Malvaceae	2
29	Meliaceae	1
30	Mimosaceae	2
31	Moraceae	3
32	Myrtaceae	1
33	Oleaceae	1
34	Oxalidaceae	1
35	Papilionaceae	6
36	Plantaginaceae	2
37	Polygonaceae	2
38	Primulaceae	1
39	Punicaceae	1
40	Ranunculaceae	2
41	Resadaceae	1
42	Rhamnaceae	2
43	Rosaceae	5
44	Rubiaceae	1
45	Salacaceae	1
46	Septotaceae	1
47	Solanaceae	10
48	Spindaceae	1
49	Tamaraceae	1
50	Vitaceae	1
51	Zygophyllaceae	2
Total		130

The study identified 130 plant species belonging to 51 families, highlighting significant floristic diversity in the Palangzai Miran Shah region. Among the divisions, dicotyledons dominated, contributing the highest number of families and species, indicating the region's diverse ecological niches. This aligns with patterns observed in semi-arid to arid regions, where dicots often dominate due to their adaptive traits. The life-form classification reveals that therophytes (Th) dominate the flora, followed by chamaephytes (Ch) and microphanerophytes (Mp). This dominance of therophytes is characteristic of semi-arid regions and reflects the harsh climatic conditions and grazing pressure. The prevalence of annual plants (therophytes) suggests their ability to complete life cycles quickly during favorable conditions.

The leaf size spectra indicate a predominance of microphyllous (Mic) and nanophyllous (N) species. These adaptations help minimize water loss through reduced surface area, demonstrating the region's adaptation to xeric conditions.

Families

Families like Poaceae, Fabaceae, and Asteraceae contributed significantly to the species count. These families are commonly dominant in disturbed habitats and arid ecosystems due to their resilience and ecological versatility. Key species such as *Ephedra nebrodensis* (Gymnosperm) and *Nerium indica* (Apocyanaceae) underline the region's unique xerophytic adaptations.

Comparison with similar regions

When compared to other semi-arid areas in Pakistan, such as the Thar Desert and Cholistan, Palangzai Miran Shah shares similarities in life-form spectra and dominance of Poaceae and Fabaceae. However, the presence of endemic or regionally adapted species like *Caralluma tuberculata* and *Withania somnifera* indicates localized ecological adaptations and highlights the unique floristic composition of North Waziristan.

Environmental pressures and conservation implications

The floristic composition reflects a vegetation community under stress from anthropogenic activities such as overgrazing, deforestation, and agricultural expansion. The dominance of therophytes may also indicate disturbance or land degradation. Conservation efforts should focus on protecting

perennial shrubs and trees, which play a critical role in stabilizing the soil and maintaining biodiversity.

This study provides a baseline for understanding the floristic composition and biological spectrum of North wazirestan Palangzai Miran Shah village. The findings can inform biodiversity conservation strategies and promote sustainable land management in the region.

Novelty Statement

This study presents the first comprehensive floristic assessment of Palangzai, Miran Shah, North Waziristan, a region previously unexplored in botanical research due to its geopolitical sensitivity and rugged terrain. By documenting 130 plant species across 51 families, the study significantly enhances the understanding of the area's biodiversity. The identification of therophytes as the dominant life form (50.76%), along with detailed life-form analysis using Raunkiaer's classification, provides new insights into the ecological adaptations of plant species in this semi-arid environment. This research serves as a baseline for future conservation efforts and contributes valuable data for ecological restoration and sustainable land management in North Waziristan's merged tribal areas.

Author's Contribution

Dilawar Jan: Data collection.

Muhammad Farooq: Thesis writing.

Lal Badshah and Salim Saifullah: Software.

Mehboob Khan: Analysis.

Sanam Zarif: Resources provision.

Conflict of interest

The authors have declared no conflict of interest.

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