

Ecology of Riparian Vegetation of Lund Khuwar, District Mardan, KP, Pakistan

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Abstract

The current study was carried out on the riparian vegetation of Lund Khuwar, Kaloshah, District Mardan. During research 77 plant species belonging to 61 genera and 36 families were observed and described ecologically. Asteraceae having 8 genera (13.11%) and 10 species (12.98%), followed by Poaceae which was represented by 8 genera (13.11%) and 8 species (10.8%). Lamiaceae having 4 genera (6.55%) and 4 species (5.19%) and Moraceae had 3 genera (3.91%) and 4 species (5.19%). The leading genera were Acacia and Chenopodium with 3 (4.91%) species each. Genera like Amaranthus, Euphorbia, Juncus, Marsilea, Morus, Populus, Polygonum, Tegetes, Zinnia and Zizipus were consisting of two 2 (3.27%) species each. There were 2 (5.55%) families of Pteridiophytes which were consisting of 4 (5.19%) species and 3 (4.91%) of the total genera. There were 4 (11.1%) families of Monocotyledoneae with 12 (15.85%) species and 30 (83.83%) families of Dicotyledoneae. The dicot families comprised of 61 (79.22%) species of the total number of species. Life form, leaf size, phenology and abundance classes were also determined during present study. The plants were identified with the help of available literature (Flora of Pak). The plants were submitted to the Herbarium of Centre of Plant Biodiversity, University of Peshawar, Pakistan.

Keywords: Riparian vegetation; Ecological evaluation; Life form; Leaf size; Lund khwar

Introduction

The name "Lund Khwar" literally means "the ever-flowing stream or brook". Archaeological and historical evidence clue towards the Gandharan era. Lund Khwar is a historical village and union council of Takht Bhai Tehsil in Mardan District of Khyber Pakhtunkhwa, Pakistan. The district lies from 34° 05' to 34° 32' north latitudes and 71° 48' to 72° 25' east longitudes.

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It is located at 34° 23' N 71° 59' E, with an altitude of 371 m (1220 feet). It is located 18 km from Takht Bahi, 10 km from Sher Garh and about 30 km from Mardan on the National Highway between Swat and Peshawar District. The town is surrounded by two main streams and a smaller brook from 3 directions which flow throughout the year. It is bounded on the north by Buner district and Malakand protected area, on the east by Swabi and Buner districts, on the south by Nowshera district and on the west by District Charsadda. Mardan district may broadly be divided into two parts, north eastern hilly area and south western plain. The entire northern side of the district is bounded by the hills. The highest points in these hills are Pajja or Sakra, 2056 m high and Garo or Pato, 1816 m high. The south western half of the district is mostly composed of fertile plain with low hills strewn across it. The climate of the research area is moderate. The summer season is extremely hot. A steep rise of temperature observed from May to June. Even July, August and September record quite high temperatures. During May and June dust storms are frequent at night. The temperature reaches to its maximum in the month of June i.e. 41.50°C. The coldest months are December and January. The mean minimum temperature recorded for the month of January is 2.09° C. Most of the rainfall occurs in the month of July, August, December and January. Maximum rainfall recorded for the month of August 125.85 mm. towards the end of cold weather there are occasional thunder storms and hail storms. The relative humidity is quite high throughout the year while maximum humidity has been recorded in December i.e. 73.33% [1]. Many studies for listing floristic diversity and its ecological evaluation have been done in different area. Some of the prominent are Haq et al. documented the ecological characteristics of twenty one species of Onion crop from University of Peshawar, Botanical Garden, District Nowshera [2]. Reported 186 species from Santh Saroola, Kotli Sattian, Rawalpindi, Pakistan. [3] Identified 93 plant species belonging to 67 genera and 30 families including Phanerophyte with the large number of species (37), Therophyte (33), Chaemophytes (12), Hemicryptophyte (6) and Cryptophyte (3). The riparian zone is the place where aquatic systems merge with the other terrestrial environment. Virtually all rainwater runoff must pass through the zone before moving into adjacent aquatic/estuarine systems [4]. Riparian vegetation reduced periphyton growth in pasture streams and influences the composition of the macro invertebrate community. The vegetation canopy shades incident light and reduces water temperatures thus influencing primary productivity [5]. Loss of riparian vegetation can decrease the amount of suitable habitat for riparian and aquatic fauna such as fish and invertebrates, thereby reducing stream productivity and fish carrying capacity [6]. Plant diversity and ecological characteristics are important in term of land degradation and erosion [7,8]. Conducted their research on linkages between spatial variation in riparian vegetation and floristic quality to the environmental heterogeneity of River Soan and its associated streams. People interpret rivers as a carriage where they dump all the garbage and let out sewers into the waterways [9,10]. Identified 21 species belonging to 14 families as riparian plant species from Korang river, Islamabad.

Materials and Methods

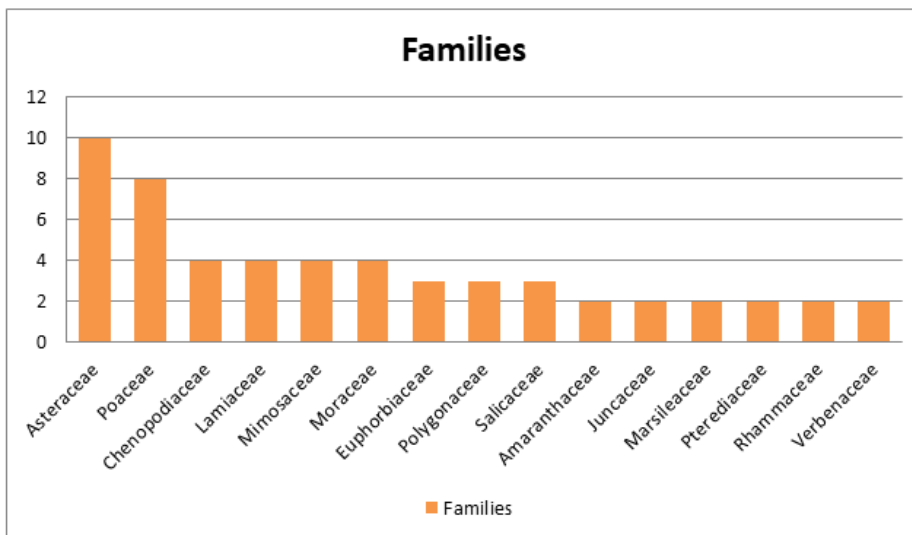
Regular study tours were made to the research area during March 2014 to May 2015 in the blooming period of the plants to collect plant specimens and all the related ecological information about the riparian plants species. Plant specimens were collected carefully with their full structure (stem, leaves, flowers etc.) from different parts of Lund Khuwar. During the process of collection photographs were also taken through Digital Camera. After collection specimens were placed in folded

newspapers, dried and pressed for about two weeks to get them moisture free. At the same time the plants were numbered and marked with data, location and other characteristics of species. Plants identification was carried out with the help of available literature [11-15]. Ecological characteristics of plant species were known after Raunkiaer [16] and Hussain [17]. The vouchers specimens were deposited at Centre of Plant Biodiversity University of Peshawar Herbarium (UPBG).

Results and Discussion

Floristic Families

During the study there were total 77 species belonging to 61 genera and 36 families constituted of the riparian vegetation of the study area. Asteraceae was the leading family and was represented by 8 genera (13.11%) and 10 species (12.98%) followed by Poaceae which was represented by 8 genera (13.11%) and 8 species (10.8%) followed by Lamiaceae had 4 genera (6.55%) with 4 species (5.19%). Malik et al. also studied these families were well represented in Kotli Hill during monsoon [18]. Durrani et al. also observed that these families were dominant in their research areas [19]. Badshah et al. also documented these families in their study from the rangeland of District Tank, Pakistan [20]. Hussain et al. also expressed that Asteraceae and poaceae was the leading families in their studies from Mastuj valley, Hindukush Range, Pakistan [21].



GRAPH.1. Studied of 36 families of the riparian vegetation in Lund Khuwar, District Mardan, KP, Pakistan.

GRAPH. 1 showing Moraceae having 3 genera (3.91%) and 4 species (5.19%). Families like Chenopodiaceae 2 genera (3.27%) and 4 species (5.19%). Mimosaceae had 2 genera (3.27%) and 4 species (5.19%). Euphorbiaceae having 2 genera (3.27%) and 3 species (3.89%). Salicaceae 2 genera (3.27%) and 3 species (3.89%). Verbinaceae having 2 genera (3.27%) and 3 species (3.89%). Amaranthaceae 2 genera (3.27%) and 2 species (2.59%). Cannabaceae having 2 genera (3.27%) and 2 species (2.59%). Polygonaceae with single genus (1.29%) and 3 species (3.89%). Juncaceae, Marsileaceae, Pteridaceae and Rhamnaceae were represented with single genera (1.29%) and having two 2 species (2.59%) each family. The remaining 20 families are monophilitic and comprised on single genera and a single species (TABLE 1).

TABLE 1. Floristic Diversity and Ecological Characteristics of Riparian Vegetation of Lund Khuwar, District Mardan, KP, Pakistan.

S.No	Division / Families / Species	Life form	Leaf size	Phenology	Abundance class	Serial stage
A. Pteridophyta						
1. marsileaceae						
1	<i>Marsilea minuta</i>	G	Mic	-	Amphibian	-
2	<i>Marsilea quadrifolia L.</i>	H	Mes	Rep	Partially sub-merged	Rare
2. Pteridaceae						
3	<i>Adiantum capillus-veneris L.</i>	G	N	-	-	-
4	<i>Pteris vittata L.</i>	G	Mec	Veg	Amphibian	Occasional
B. Dicotyledoneae						
3. Acanthaceae						
5	<i>Justicia adhatoda L.</i>	Ch	Mes	Meg	Terrestrial	Rare
4. Aizoaceae						
6	<i>Trianthema portulacastrum L.</i>	-	-	-	-	-
5. Amaranthaceae						
7	<i>Amaranthus spinosus L.</i>	Th	Mic	-	Amphibian	-
8	<i>Amaranthus viridis L.</i>	Th	Mes	Rep	Amphibian	Occasional
6. Asclepiadaceae						
9	<i>Calotropus procera W.T.Aiton</i>	Ch	Mac	Rep	Terrestrial	Frequent
7. Asteraceae						
10	<i>Artemisia annua L.</i>	H	Mic	-	Terrestrial	-
11	<i>Conyza aegyptiaca L.</i>	Th	Mic	Veg	Partly submerged	Abundant
12	<i>Lactuca dissecta D. Don</i>	Th	Mic	-	Amphibian	-
13	<i>Parthenium hysterophorus L.</i>	Th	Mic	Rep	Amphibian	Frequent
14	<i>Sonchus asper (L.) Hill</i>	Th	Mes	Rep	Amphibian	Rare
15	<i>Tagetes erecta L.</i>	Th	Mic	-	Amphibian	-
16	<i>Tagetes minuta L.</i>	Th	Mic	Rep	Amphibian	Rare
17	<i>Xanthium strumarium L.</i>	Th	Mac	Rep	Amphibian	Occasional
18	<i>Zinnia elegans Jacq.</i>	Th	Mic	Rep	Amphibian	Rare
19	<i>Zinnia L.</i>	Th	Mes	Rep	Amphibian	Rare
8. Bignoniaceae						
20	<i>Jacaranda mimosifolia D. Don</i>	Mec P	Mes	-	Terrestrial	-
9. Brassicaceae						
21	<i>Nasturtium officinale W.T.Aiton</i>	Th	N	-	Amphibian	-
10. Cannabinaceae						
22	<i>Cannabis sativa Linn.</i>	Th	Mic	-	Terrestrial	-

23	<i>Celtis australis</i> L.	Mes P	Mic	Veg	Amphibian	Rare
11. Caryophyllaceae						
24	<i>Stellaria media</i> (L.) Vill.	Th	Mes	Rep	Amphibian	Rare
12. Chenopodiaceae						
25	<i>Chenopodium ambrosioides</i> L.	Th	Mes	Rep.	Amphibian	Frequent
26	<i>Chenopodium foliosum</i> Ach.	Th	Mic	Rep.	Amphibian	Frequent
27	<i>Chenopodium murale</i> L.	Th	Mes	Veg	Amphibian	Occasional
28	<i>Kochia indica</i> Wight	Th	N.	Rep	Terrestrial	Rare
13. Convulvolaceae						
29	<i>Ipomoea purpurea</i> L.	Th	Mic	Rep	Amphibian	Rare
14. Euphorbiaceae						
30	<i>Ricinus cummunis</i> L.	NP	Mac	Veg	Amphibian	Occasional
31	<i>Euphorbia hirta</i> L.	Th	N	-	Amphibian	-
32	<i>Euphorbia prostrata</i> Aiton	Th	L	-	Amphibian	-
15. Fabaceae						
33	<i>Prosopis cineraria</i> (L.) Druce	Mac P	Mes	-	Terrestrial	-
16. Lamiaceae						
34	<i>Nepta cataria</i> L.	Meg P	Mic	Rep	Amphibian	Rare
35	<i>Ajuga bracteosa</i> Wall.	Th	Mes	-	Amphibian	Rare
36	<i>Mentha longifolia</i> (L.) Huds	G	Mic	Veg	Amphibian	Rare
37	<i>Salvia moorcroftiana</i> Wall. ex Benth.	Th	Mic	-	Amphibian	-
17. Maliaceae						
38	<i>Melia azadarach</i> L.	Meg P	Mic	Veg	Amphibian	Frequent
18. Malvaceae						
39	<i>Malvastru coromandelianum</i> (L.) Gracke	Th	Mes	Veg	Amphibian	Rare
19. Mimosaceae						
40	<i>Acacia Arabica</i> Mill.	NP	L	Veg	Amphibian	Occasional
41	<i>Acacia modesta</i> Wall.	NP	L	Veg	Amphibian	Rare
42	<i>Acacia nilotica</i> L.	NP	N	-	Terrestrial	-
43	<i>Prosopis juliflora</i> (Sw.) DC.	Mac P	Mic	-	Terrestrial	-
20. Moraceae						
44	<i>Broussonetia papyrifera</i> (L.) Vent.	Meg P	Mac	Veg	Amphibian	Rare
45	<i>Ficus carica</i> L.	NP	Mac	Veg	Amphibian	Occasional
46	<i>Morus alba</i> L.	Meg P	Mac	-	Terrestrial	-
47	<i>Morus nigra</i> L.	Meg p	Mac	Vegetative	Amphibian	Rare
21. Myrtaceae						
48	<i>Eucalyptus lanceolatus</i> DC.	Meg P	Mes	Veg	Amphibian	Occasional

22. Nyctaginaceae						
49	<i>Mirabilis jalapa</i> L.	Th	Mes	Rep	Amphibian	Rare
23. Oxalidaceae						
50	<i>Oxalis corniculata</i> L.	Th	-	Rep	Amphibian.	Occasional
24. Papilionaceae						
51	<i>Dilbergia sissoo</i> Roxb.	Meg P	Mic	Veg	Terrestrial	Occational
25. Polygonaceae						
52	<i>Polygonum barbatum</i> L.	Th	Mic	Rep	Amphibian	Occasional
53	<i>Polygonum capitatum</i> Buch.Ham	Th	Mic	Veg	Amphibian	Occasional
54	<i>Polygonum persicaria</i> Mill.	Th	Mes	Rep	Amphibian	Occasional
26. Potamogetonaceae						
55	<i>Potamogeton crispus</i> L.	Th	Mic	Veg	Submerged	Rare
27. Rhamnaceae						
56	<i>Ziziphus nummularia</i> Mill.	NP	G	Rep	Terrestrial	Fragrant
57	<i>Zizipus rotundifolia</i> Mill.	NP	Mes	-	Terrestrial	-
28. Rosaceae						
58	<i>Rosa indica</i> L.	Ch	Mic	-	Amphibian	-
29. Rubiaceae						
59	<i>Rubus fruticosus</i> L.	Th	Mic	Veg	Amphibian	Occasional
30. Salicaceae						
60	<i>Populous nigra</i> L.	Th	Mes	Rep	Amphibian	Abundant
61	<i>Populus alba</i> L.	Meg P	Mes	-	Amphibian	-
62	<i>Salix tetrasperma</i> Roxb.	Meg P	Mes	Veg	Amphibian	Occasional
31. Simarubiaceae						
63	<i>Alianthus altissima</i> Mill. (Swingle)	Mup	Mes	-	Terrestrial	-
32. Solanaceae						
64	<i>Solanum surrattense</i> Wall. ex Benth	Th	Mes	Veg	Amphibian	Rare
33. Verbenaceae						
65	<i>Phyla nodiflora</i> (L.) Greene	Th	N	-	Amphibian	-
66	<i>Verbena officinalis</i> L.	Th	Mac	Rep	Amphibian	Occasional
C. Monocotyledonae						
34. Cyperaceae						
67	<i>Cyperis rutundis</i> L.	H	Mic	Rep	Amphibian	Frequent
35. Juncaceae						
68	<i>Juncus himalensis</i> L.	Th	G	Veg	Amphibian	Occasional
69	<i>Juncus tenuis</i> Willd.	G	Mic	-	Amphibian	-
36. Poaceae						

70	<i>Arundo donax</i> L.	G	Mes	Veg	Amphibian	Frequent
71	<i>Bracharia reptans</i> (L.) C.A. Gradner and C.E. Hubb.	Th	Mic	Rep	Amphibian	Rare
72	<i>Cynodon dactylon</i> (L.) Pers	H	N	-	Amphibian	-
73	<i>Dactyloctenium aegyptium</i> (L.) Wild.	Th	N	Rep	Amphibian	Frequent
74	<i>Desmostachya bipinnata</i> (L.) Stapf	Th	Mac	Rep	Amphibian	Occasional
75	<i>Dichanthium annulatum</i> (Forssk.) Stapf	H	Mic	Rep	Amphibian	Rare
76	<i>Eleusine indica</i> (L.) Garetn.	Th	Mes	Rep	Amphibian	Occasional
77	<i>Setaria viridis</i> (L.) P.Beauv.	H	N	Veg	Amphibian	Frequent

Keys:

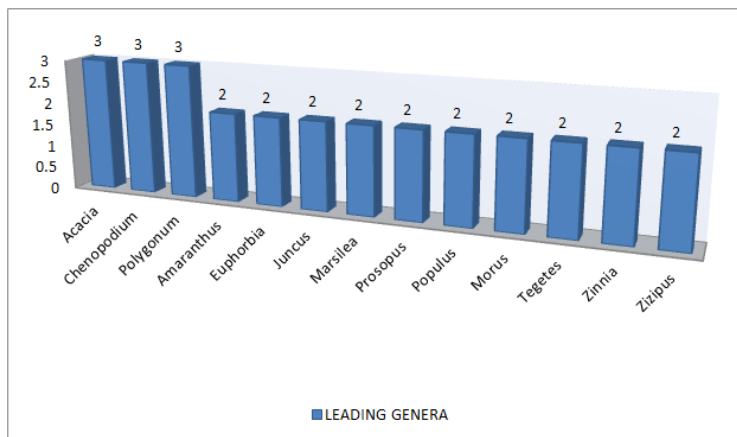
Life-form Classes: Th. Therophyte, G. Geophyte, H. Hemicyrptoyte, MicP. Microphanerophyte, MesP. Mesophanerophyte, MegP. Megaphanerophyte, Ch. Chamaephyte, NP. Nanophanerophyte.

B. Leaf-size Classes: L. Leptophyll, N. Nanophyll, Mic. Microphyll, Mes. Mesophyll, Mac. Macrophyll, Meg. Megaphyll

C. Phenological Stages: Rep. Reproductive, Veg. Vegetative.

Genera

During riparian studies as shown in GRAPH 2 the Acacia and Chenopodium were the leading genera consisting of 3 (4.91%) species each. Genera like Amaranthus, Euphorbia, Juncus, Marsilea, Morus, Populus, Prosopus, Polygonum, Tegetes, Zinnia and Zizipus were consisting of 2 (3.27%) species each.



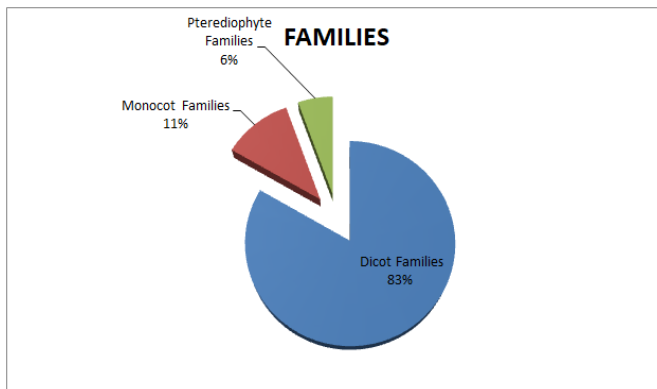
GRAPH 2. Percentage of species contained.

Pteridiophytes

There were 2 (5.55%) families of Pteridiophytes which consists of 4 (5.19%) species. Pteridiaceae and Marsileaceae were the two Pteridiophytic families with 2 (2.59%) species and 3 (4.91%) genera each.

Monocot families

There were 4 (11.1%) monocot families having 12 (15.85%) species. Cyperaceae, Juncaceae, Poaceae and Potamogetonaceae were the monocot families found in the riparian zone of the study area.



GRAPH.3. Percentage of Families distribution (Pteridiophytes, Monocot and Dicot families).

Dicot families

The remaining 30 (83.83%) families were Dicot. The dicot families comprised of 61 (79.22%) species. Acanthaceae, Aizoaceae, Amaranthaceae, Asclepiadaceae, Asteraceae, Bignoniaceae, Brassicaceae, Cannabaceae, Caryophyllaceae, Chenopodiaceae, Convolvulaceae, Euphorbiaceae, Fabaceae, Lamiaceae, Maliaceae, Mimosaceae, Malvaceae, Moraceae, Myrtaceae, Nyctaginaceae, Oxalidaceae, Papilionaceae, Polygonaceae, Rhamnaceae, Rosaceae, Rubiaceae, Salicaceae, Simarubiaceae, Solanaceae and Verbinaceae were the dicot families in the research area as shown in GRAPH 3.

Biological Spectrum

Life form

Biological spectra expressed that therophyte were the dominant life form class having 7 (19.44%) families, 28 (45.90%) genera and 40 (1.94%) species followed by Megaphanerophyte with 7 (19.49%) families, 9 (14.75%) genera and 9 (11.68%) species of the total plants. Costa et al. also documented 47 families including 42.9% therophytes, 26.3% phanerophytes, 15.8% chamaephytes, 12.8% hemicryptophytes and 2.3% cryptophytes [22]. The second leading life form class was Geophyte which was consisting of 5 (13.88%) families, 6 (9.83%) genera and 6 (7.79%) species. These were then followed by Hemicryptophyte had 4 (11.11%) families, 6 (9.83%) genera and 6 (7.79%) species. Nanophanerophyte was the fourth class with 4 (11.11%) families, 4 (6.55%) genera and 7 (9.09%) species of the total plants. Chamaephyte was consisting of 3 (8.33%) families, 3 (4.47%) genera and 3 (3.89%) species. Macrophanerophyte possessed 3 (8.33%) families, 2 (3.27%) genera and 3 (3.89%) species, while Mesophanerophyte and Microphanerophyte were consisting of 1 (2.77%) families, 1 (1.63%) genera and 1 (1.29%) species each. Our present findings are agreement with that of [20,21,23-26] who also reported

dominance of therophytes in **(Table 2(A))**. The dominance of Therophytes indicates the harshness and longevity of winter season [27].

TABLE.2A. Summary of Biological Spectra of Riparian Plant Species of Lunkhuwar, District Mardan (Life form).

S. No	Parameters	No of Species/ %age	No of genera/ %age	No of families/ %age
1	Therophyte	40 (1.94%)	28 (45.90%)	7 (19.44%)
2	Megaphanerophyte	9 (11.68%)	9 (14.75%)	7 (19.49%)
3	Geophyte	6 (7.79%)	6 (9.83%)	5 (13.88%)
4	Hemicryptophyte	6 (7.79%)	6 (9.83%)	4 (11.11%)
5	Nanophanerophyte	7 (9.09%)	4 (6.55%)	4 (11.11%)
6	Chamaephyte	3 (3.89%)	3 (4.47%)	3 (8.33%)
7	Mesophanerophyte	1 (1.29%)	1 (1.63%)	1 (2.77%)
8	Microphanerophyte	1 (1.29%)	1 (1.63%)	1 (2.77%)

Leaf size

Microphyll was the dominant leaf size class which was comprised of 17 (47.22%) families, 25 (40.98%) genera and 27 (35.04%) species followed by Mesophyll which was consisted of 14 (38.88%) families, 22 (36.06%) genera and 23 (29.8%) species. The Nanophyll class was consisting of 7 (19.4%) families, (9 14.75%) genera and 9 (11.6%) species. Macrophyll was consisting of 6 (16.66%) families, 8 (13.11%) genera and 10 (12.98%) species. Leptophyll having 2 (5.55%) families 2 (3.27%) genera and 3(3.89%) species. The last class represented by Megaphyll 2 (5.55%) families 2 (3.27%) genera and 2 (2.595) species. The recent findings agreed with that of [25,27,28] Who also documented that microphyll were the dominant class in **(Table 2(B))**.

TABLE.2B. Summary of Biological Spectra of Riparian Plant Species of Lunkhuwar, District Mardan (Leaf size).

S. No	Parameters	No of Species/ %age	No of genera/ %age	No of families/ %age
1.	Microphyll	27 (35.04%)	25 (40.98%)	17 (47.22%)
2.	Mesophyll	23 (29.8%)	22 (36.06%)	14 (38.88%)
3.	Nannophyll	9 (11.6%)	9 (14.75%)	7 (19.4%)
4.	Macrophyll	10 (12.98%)	8 (13.11%)	6 (16.66%)
5.	Leptophyll	3 (3.89%)	2 (3.27%)	2 (5.55%)

Phenology

In Phenological stages there were two categories reproductive and vegetative stages. 26 species (33.76%) were reproductive stage and 26 species (33.76%) observed by Vegetative stage. There were 25 (32.46%) species which were cannot identified either these are in vegetative or in reproductive stage in (Table 2(C)).

TABLE 2C. Summary of Biological Spectra of Riparian Plant Species of Lunkhuwar, District Mardan (Phenology).

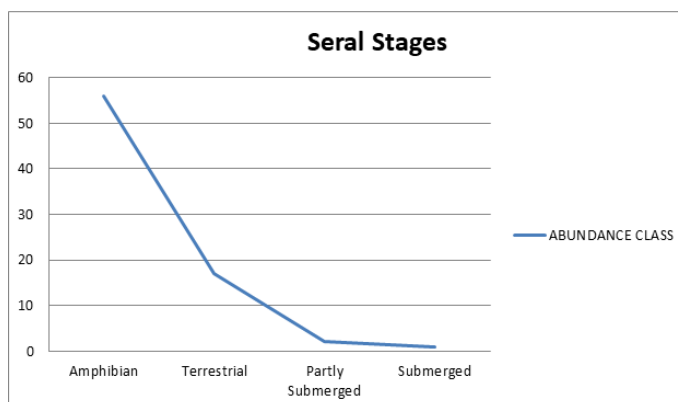
S. No	Parameters	No of Species/ %age	No of genera/ %age	%age
1.	Vegetative	26	-	33.76%
2.	Reproductive	26	-	33.76%
3.	Non-identified	25	-	32.46%

Abundance Class

The amphibian plant species were found as the leading plant species during the present research work which consists of 56 (72.72%) of the total species followed by terrestrials which comprised of 17 (22.07%) species followed by Partly-Submerged plants had 2 (2.59%) species and Submerged 1 (1.29%) species as shown in (Graph 4 and Table 2(D)).

Table 2D. Summary of Biological Spectra of Riparian Plant Species of Lunkhuwar, District Mardan (Abundance class).

S. No	Parameters	No of Species/ %age	No of genera/ %age	%age
1.	Amphibian	56	-	72.72%
2.	Terrestrial	17	-	22.07%
3.	Partially sub-merged	2	-	2.59%
4.	Sub-merged	1	-	1.29%



GRAPH 4. Seral Stages.

Studies based on distribution patterns of riparian vegetation in riparian corridors and use of riparian vegetation as an indicator of health of freshwater ecosystem is fewer [8]. Conducted their studies on Role of riparian vegetation in Pakistan [29]. Worked on concept of continuity/discontinuity is applied to the riparian vegetation of the corridor of the River Adour (S.W France) for the purpose of longitudinal structure explanation and to test the degree of floristic continuity of the fluvial axis [30]. Hupp and Osterkamp [31] worked on riparian vegetation and fluvial geomorphic process in U.S. During their studies they concluded that riparian vegetation and fluvial-geomorphic processes and landforms are intimately connected parts of the bottomland landscape. Conduct a study on riparian plant communities, and that was small in overall area, are among the most valuable natural areas in the Southwest [32]. Studied influences of the riparian zone vegetation characteristics on bank erosion and riparian buffers along with native indigenous vegetation or mixed indigenous and introduced flora [5]. Five different types of forest and riparian zones were selected. Studied the importance of low-flow and high-flow characteristics to restoration of riparian vegetation along rivers in arid south-western United States [33]. According to Fauling [34] riparian zone act as a link between aquatic and terrestrial ecosystems and play an important role in their ecological functions. Studied that these areas are adjacent to surface water bodies and are essential for ecological attributes such water quality and wildlife [35]. Nasir et al. works on threats to low riparian ecosystem of Indus river [36]. This river is emanating from deterioration river flow regime coupled with associated anthropogenic activities. Ali et al. conducted their research on mapping and analysis of the riparian zone of the Indus River Basin, Pakistan [37]. They analyze quantitatively the health of riparian vegetation, study the wetland condition and channel sinuosity. Nandakumar et al. studied the phytosociological analysis of riparian tree species of Alakym stream; Pariyaram, Kerala, India [38]. They studied that the vegetation of this stream consists of variety of herbs, shrubs, climbers and trees. Works on linkage b/w the restoration of rivers and riparian zones/wetlands in Europe [39]. They carry their research on floodplains in Europe are heavily impacted by human intervention. Studied the environmental diversity and spatial variations in riparian vegetation of Korang river in Islamabad, Pakistan [10]. As the recent research work is the first ever record of riparian vegetation in Lund Khwar District Mardan which might help for future intensive and extensive researches in the area.

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