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FLORISTIC DIVERSITY OF LAKH BAHOSI BIRD SANCTUARY- A TWIN LAKES WETLAND OF UTTAR PRADESH, INDIA

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ABSTRACT

The present paper explores floristic composition, diversity and nature of plant communities occurring in the Lakh Bahosi Bird Sanctuary, Uttar Pradesh, which is totally based on field survey and identification. During the preliminary field survey around 110 species have been collected from the study site in which the dominant and keystone genera are *Ficus bengalensis, Azardirachta indica, Alstonia scholaris, Terminalia arjuna* and *Syzygiumjambolanum* etc. Besides, some aquatic species like *Azolla* pinnata, *Typha latifolia, Ipomoea aquatica, Nymphaea nouchali*, and *Pontederia crassipes* are also growing as dominant plant resources. Critical literature survey and studies indicates that the wetland diversity has been fast deteriorating due to over-exploitation of biological resources by human population of surrounding areas.

KEYWORDS: Protected areas, Kannauj District, Bird Sanctuary, Lakh Bahosi, Wetland

Wetlands with water logged soil conditions possess characteristic life forms, both plants and animals, which can tolerate long periods of water saturated environments. They are the sites of hydromorphic soils and have a wealth of biodiversity. Previous studies have identified their economic, ecological and cultural values. The ecological roles of wetlands have been recognized as to maintenance of water quality as well as quantity, hydrology, flood control, carbon cycle, climate stability, water cycle, recharge of ground water. The state of Uttar Pradesh in India is endowed with 12 significant wetlands constituting a part of the Upper Gangetic plains, which are proclaimed as bird sanctuaries.

Lakh Bahosi Sanctuary is located near Lakh Bahosi village in Kannauj District of Uttar Pradesh established in 1989. It is one of largest bird sanctuaries in India spread in areas of 80 sq. km. The sanctuary is a famous spot for the birdwatchers and nature enthusiasts. This area has been covered by huge numbers of flora and fauna. The wetland area has large number of aquatic plants also. Although the diversity of the area has been explored since 20 years ago by Sinha (2005) but not given much emphasis in recent years. The floristic composition of protected areas like wetlands/bird sanctuary is more significant to learn the diversity and taxonomy of the plants. Although other bird sanctuaries of Uttar Pradesh are more explored recently but this particular area has not been given more emphasis so the present study has been aimed to study its floristic composition, diversity, habit and habitat and their threat status as per IUCN categories.

MATERIALS AND METHODS

Study Site

Lakh Bahosi Wildlife Sanctuary is about 38 km from the historic city of Kannauj. The Sanctuary is formed of two oxbow Jheels near the village Bahosi. Both the Jheels, Lakh and Bahosi, are located near the Lower Ganga Canal, so the overflow and seepage of water accumulates in the Jheels, resulting in about 600 ha of shallow wetlands perfectly suitable for water birds. By winter, the water spread is reduced by evaporation and drainage. Nonetheless, at least 400 ha in the deeper parts still retain enough water to attract at least 50,000 waterfowl (Rahmani and Arora 1992). Apart from these two Jheels, there are numerous wetlands beside the canal in an area of about 8,000 ha. To protect them, the Uttar Pradesh government declared a sanctuary of 8,023 ha, including forest land, village land, agricultural fields, and revenue lands. A major part of the Sanctuary (5,300 ha) is private land. The area has been identified as an Important Bird Area due to the presence of globally threatened species such as the Greater Spotted Eagle *Aquila clanga, Sarus crane Grus antigone*, and congregations of about 50,000 water birds.

Lakh Bahosi Bird Sanctuary was created in 1988 with the aim of protection and conservation of the wetland with special emphasis to the local and migratory birds, conservation of their natural habitat including aquatic plants and animals. The Bombay Natural History Society, Mumbai (BNHS) has also listed this Sanctuary as one of the 'Important Bird Area' sites. This wetland is

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included in the list of wetlands in defined under National Wetland Conservation Programme by the Ministry of Environment & Forest, Govt. of India. Lakh Bahosi Bird Sanctuary consists of two main lakes i.e. Lakh & Bahosi named after respective villages. Approximately 50 thousand water fowls visit this Sanctuary every year between the months of November to March. This Wetland serves as their habitat for nesting as well as breeding for some birds. Thus, this sanctuary has become an attractive destination for the bird lovers as well as tourists since several years. (Figure 1A & 1B)

Efforts to protect bird sanctuaries in Uttar Pradesh include stricter enforcement of conservation laws, promoting sustainable tourism practices, and addressing pollution and habitat loss through government and community initiatives. Protecting bird sanctuaries is crucial for the preservation of biodiversity and the well-being of many bird species. Effective conservation strategies are needed to ensure the survival of these vital habitats. These are several strategies that can help to protect diversity of bird sanctuaries:

Habitat Protection and Restoration: Designating bird sanctuaries as protected areas is one of the most effective ways to safeguard their habitats from human encroachment and exploitation.

Legal Protection, Stronger Enforcement of Laws: Strengthen legal frameworks that protect bird sanctuaries and wildlife, ensuring strict enforcement against illegal activities like poaching, logging, and land conversion.

Community Engagement and Awareness, Local Involvement: Engage local communities in conservation efforts. When communities understand the importance of sanctuaries, they are more likely to protect these areas.

Factors which leads to pollution in Lakh Bahosi Jheel of Bird sanctuary:

1. Agriculture
2. Grazing
3. Fishing
4. Groundwater recharge

Central Lake and Water Source

The Lakh Bahosi Bird Sanctuary is primarily supplied with water from the Ganga Canal. This canal's overflow and seepage accumulate in the two main lakes (Jheels) within the sanctuary, named Lakh and Bahosi. These shallow lakes are vital for the sanctuary's water bird habitat.

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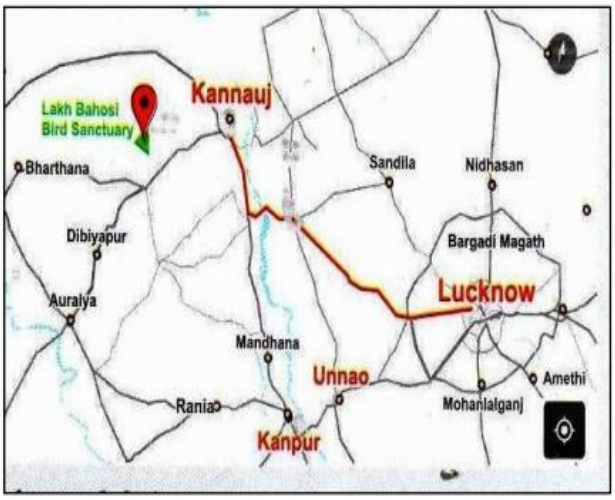

Figure 1A: Location Map of Lakh Bahosi Bird Sanctuary (Source: Google Maps)

Figure 1B: Layout of Lakh Bahosi Bird Sanctuary (Source: Google maps)

Data Collection and Analysis

Tours were conducted to the Lakh Bahosi bird Sanctuary for observation and cataloguing of the flora, in different seasons during 2023 to 2024. Field observations were made on different parts of Sanctuary, photographs of landscapes flora and vegetation types were taken. Healthy and complete plant specimens were cut using scattier and then collected in a polybag and field data on habit and habitat, flowering fruiting time were recorded. For floristic analysis, the plant specimens collected directly from the fields were dried and preserved as reference material by following the ideal herbarium techniques of

Jain and Rao (1977). All specimens were identified with the help of some local flora (Bor 1960, Kanjilal 1966) as well as Duthie's flora and by the help of online websites also. The entire collected voucher specimens were verified through checking with The Plant List (www.theplantlist.org), The International Plant Name Index (IPNI), and Index Kweinsis (IK). Specimens were also matched with the available identified herbarium specimens. In taxonomic treatment, the families are listed as per the Bentham and Hooker's system of classification and all genera within families and species within each Genus are arranged alphabetically (Plate 1 & 2). All results are summarized appropriately and depicted through tables 1 and figures 2.

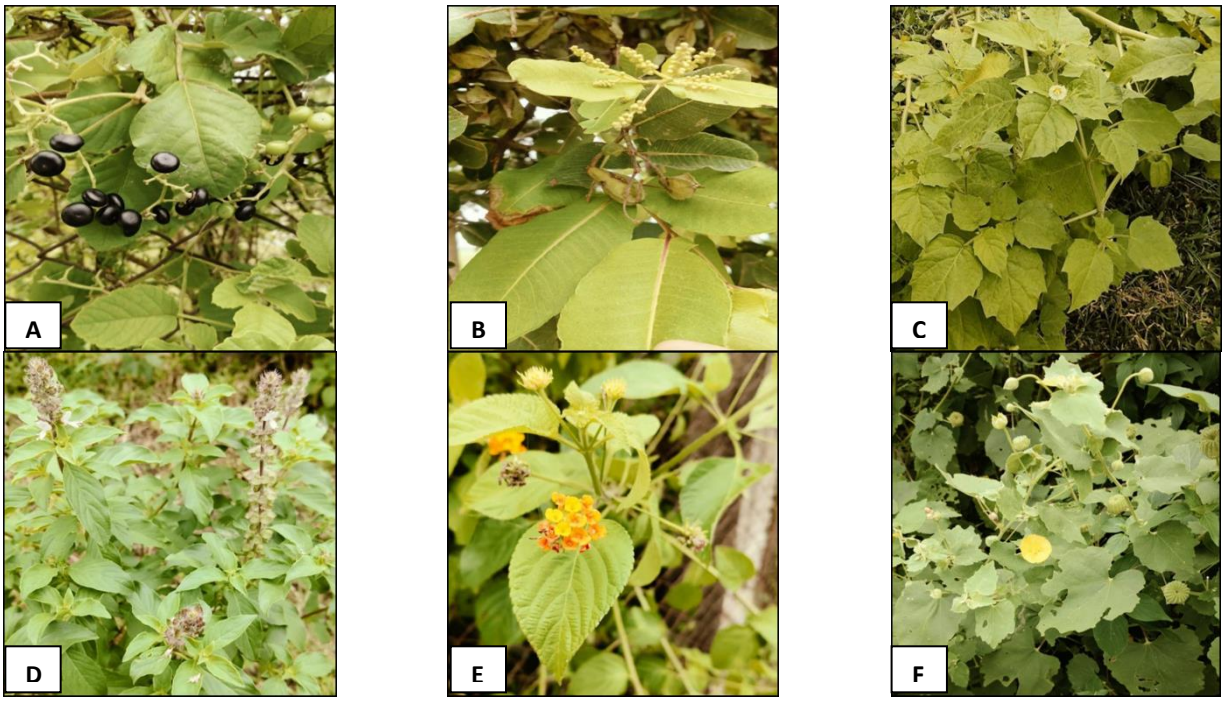

Plate 1: A- ***Cayratia japonica*****, B-** ***Terminalia arjuna*****, C-** ***Physalis peruviana*****, D-** ***Ocimum americanum*****, E -** ***Lantana camara*****, F-** ***Abutilon indicum***

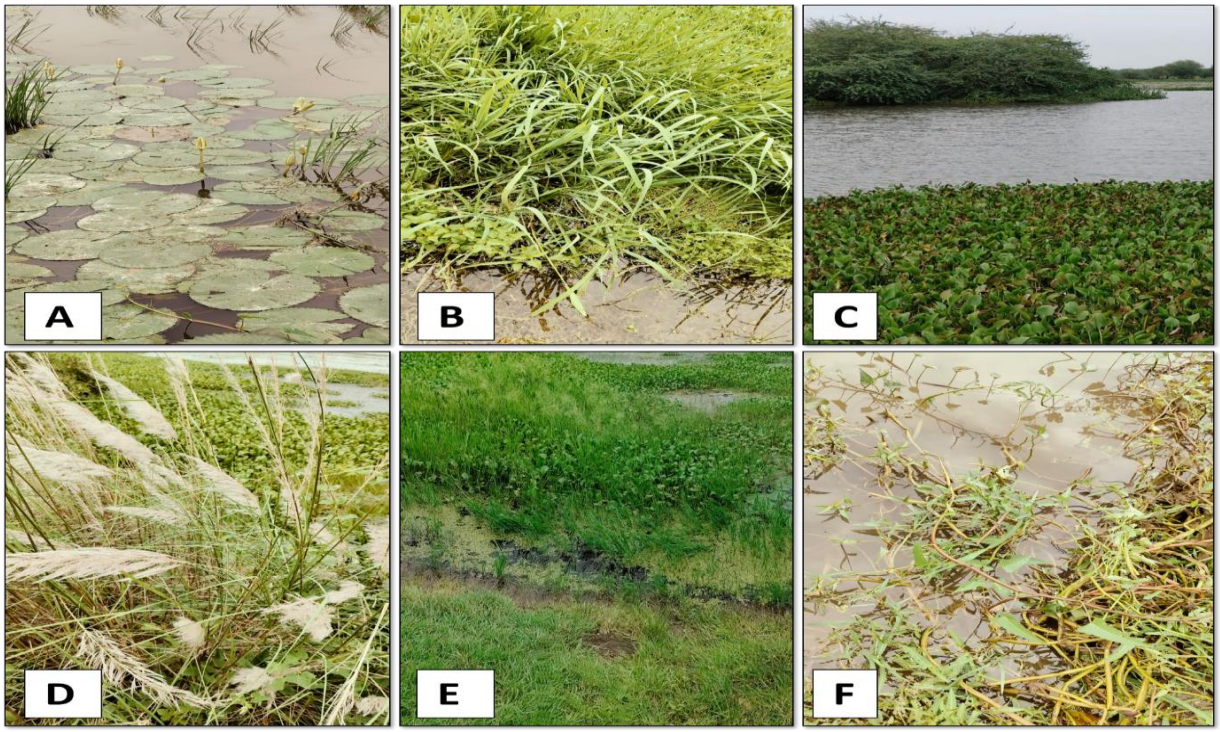

Plate 2: A- ***Nymphaea nouchali*****, B -***Leersia oryzoides*****, C-** ***Pontederia crassipes*****, D-** ***Saccharum spontaneum*****, E-** ***Alismaplantago-aquatica*****, F-** ***Ipomoea aquatic***

Table 1: List of plant species from the Lakh Bahosi Bird Sanctuary Kannauj, Uttar Pradesh

S.No.	Family Genus and Species	Habit	Habitat	IUCN Status
1	Ranunculaceae			
	Ranunculus sceleratus	H	Sm	LC
2	Malvaceae			
	Abutilon indicum	S	Tr	NE
	Sida cardifolia	S	Tr	NE
	Melochia corchorifolia	Us	Tr	LC
	Sida acuta	H	Tr	NE
	Urena lobata	Us	Tr	NE
3	Oxalidaceae			
	Oxalis corniculata	H	Tr	NE
4	Meliaceae			
	Azadirachta indica	T	Tr	NE
5	Rhamnaceae			
	Ziziphus oenopila	S	Tr	NE
	Ziziphus mauritiana	S	Tr	NE
6	Convolvulaceae			
	Evolvulus alsinoides	H	Tr	LC
	Ipomoea aquatica	H	Aq	NE
	Ipomea carnea	C	Tr/Sm	NE
7	Cyperaceae			
	Cyperus rotundus	H	Sm/Tr	NE
8	Portulacaceae			
	Portulaca oleracea	H	Tr	LC
9	Verbanaceae			
	Tictona grandis	T	Tr	EN
	Lantana camara	S	Tr	NE
10	Acanthaceae			
	Peristrophebicalyculata	H	Tr	NE
11	Papilionaceae			
	Medicago sativa	H	Tr	NE
12	Primulaceae			
	Anagallis arvensis	H	Tr	NE
13	Lamiaceae			
	Lucas aspera	H	Tr	NE
	Ocimum americanum	H	Tr	NE
14	Papaveraceae			
	Argemone mexicana	H	Tr	NE
15	Scrophulariaceae			
	Lindenbergia indica	H	Tr	LC
16	Hydrochariataceae			
	Hydrilla verticillata	H	Aq	LC
	Vallisneria spiralis	H	Aq	LC
17	Ceratophyllaceae			
	Ceratophyllumdemersum	H	Sm	LC
18	Myrtaceae			
	Syzygiumcumini	T	Tr	NE
19	Mimosaceae			
	Acacia nilotica	T	Tr	LC
20	Phyllanthaceae			
	Phyllanthus reticulatus	S	Tr	LC
	Phyllanthus amarus	H	Tr	NE

	Vitaceae			
	Cayratia japonica	C	Tr	NE
	Nymphaceae			
21	*Nymphaea nouchali*	H	Aq	LC
	Nelumbo nucifera	H	Aq	LC
22	Tiliaceae			
	Corchorus trilocularis	H	Tr	NE
23	Zygophyllaceae			
	Tribulus cistoides	H	Tr	NE
24	Pontederiaceae			
	Pontederia crassipes	H	Aq	LC
	Rubiaceae			
25	*Oldenlandiacorymbosa*	H	Tr	LC
	Anthocephalus chinensis	T	Tr	
	Fabaceae			
26	*Dalbergia sissoo*	T	Tr	LC
	Mimosa pudica	H	Tr	LC
	Cassia tora	H	Tr	LC
	Mimosaceae			
27	*Prosopis juliflora*	T	Tr	LC
	Acacia nilotica	T	Tr	LC
28	Combretaceae			
	Terminalia arjuna	T	Tr	LC
	Cucurbitaceae			
	Coccinia grandis	C	Tr	NE
	Lagenaria siceraria	C	Tr	NE
29	*Cucurbita moschata*	C	Tr	NE
	Luffa cylindrica	C	Tr	NE
	Luffa echinata	H	Tr	LC
	Asteraceae			
	Acmella paniculata	H	Tr	LC
	Ageratina ligustrina	Us	Tr	LC
	Cirsium arvense	H	Tr	NE
	Eclipta prostrata	H	Tr	LC
	Cyanthillium cinereum	H	Tr	NE
	Xanthium strumarium	H	Tr	NE
30	*Sonchus asper*	H	Tr	NT
	Eclipta prostrata	H	Tr	NE
	Parthenium hysterophorus	H	Tr	NE
	Vernonia cinerea	H	Tr	NE
	Ageratum conyzoides	H	Tr	NE
	Tridaxprocumbens	H	Tr	NE
	Launaeaasplenifolia	H	Tr	NE
	Erigeron sumatrensis	H	Tr	NE
	Centipeda minima	H	Sm	NE
	Apocynaceae			
31	*Nerium oleandar*	S	Tr	LC
	Thevetia peruviana	S	Tr	VU
	Alstonia scholaris	S	Tr	NE

	Solanceae			
	Datura metal	S	Tr	NE
	Solanum nigrum	H	Tr	NE
	Physalis peruviana	H	Tr	LC
	Lycopersicon esculentum	H	Tr	LC
	Datura stramonium	H	Tr	NE
32	Nyctiganceae			
	Bougainvillea spectabilis	C	Tr	NE
33	Amaranthaceae			
	Achyranthes aspera	H	Tr	NE
	Alternanthera pungens	H	Tr	LC
	Alternathera polygonoides	H	Tr	NE
	Amaranthus virdis	H	Tr	NE
	Amaranthus spinosus	H	Tr	NE
34	Chenopodiaceae			
	Chenopodium album	H	Tr	NE
35	Polygonaceae			
	Polygonum plebeium	H	Tr	LC
36	Euphorbiaceae			
	Euphorbia hirta	H	Tr	NE
	Phyllanthus reticulatus	S	Tr	LC
	Ricinus communis	S	Tr	NE
	Croton bonnplandianum	H	Tr	NE
37	Moraceae			
	Artocarpus heterophyllus	T	Tr	NE
	Ficus religiosa	T	Tr	LC
	Morus alba	T	Tr	LC
	Ficus bengalensis	T	Tr	NE
	Ficus hispida	T	Tr	NE
38	Areceae			
	Phoenix dactylifera	S	Tr	LC
	Phoenix sylvestris	S	Tr	LC
	Pistia stratiotes	H	Aq	LC
39	Lemnaceae			
	Lemna perpusilla	H	Aq	NE
	Spirodela polyrhiza	H	Aq	LC
40	Poaceae			
	Setaria distans	H	Tr	NE
	Setaria verticillata	H	Tr	NE
	Saccharum spontaneum	H	Tr	NE
	Setaria viridis	H	Tr	NE
	Eclipta alba	H	Tr	LC
	Cyanodon dactylon	H	Tr	NE
	Crypsis schoenoides	H	Tr	LC
41	Typhaceae			
	Typha latifolia	H	Aq	LC
42	Aizoaceae			
	Trianthema protulacastrum	H	Tr	NE
43	Molluginaceae			
	Glinus lotoides	H	Tr	LC
44	Salvinaceae			
	Azolla pinnata	H	Aq	LC
	Azolla caroliniana	H	Aq	LC
45	Marsileaceae			
	Marsilea minuta	H	Aq	LC
46	Pteridaceae			
	Pteris vittata	H	Tr	NE

(H= Herb; C=Climber; S= Shrub; L= Liana, T=Tree; Aq=Aquatic; Tr=Terrestrial; Sm=Semi-aquatic)

RESULTS AND DISCUSSION

Floristic Analysis

A wealthy floristic assemblage with blend of aquatic, wetland and terrestrial plants under different habit ranges of herbs, shrubs, climbers, lianas and trees occur in Lakh Bahosi Bird Sanctuary. There are 110 plant species distributed over 94 genera and 48 families of which 43 families, 84 genera and 97 species are Dicots and 3 families, 7 genera and 9species are monocots, while the pteridophytes have only 4 species. Evidently, the dicot families representation (87.75%) is almost 4 times that of monocot (6.12%), while the Pteridophytes represent 6.12 %. At Generic level there are 89.36 % dicots, 7.44% monocots and only 6.12% pteridophytes and at species level, 88.18% dicots, 8.18% monocots and 3.63% Pteridophytes. The flora of the sanctuary is richer in generic composition and diversity as compared to the species diversity among each family. It may therefore be concluded that the small sanctuary possesses a high generic diversity as compared to the family and species with complete dominance of dicots at all levels. (Table 1 and Figure 2)

Habit Types

The maximum representation of the flora is of herbaceous species (72 species) including aquatic herbs, while there are only 14 shrubs, 3 under shrubs, 7 climbers and 14 tree species indicating that the sanctuary flora is predominantly herbaceous with free-floating, suspended amphibious, anchored submerged herbs. Trees are scattered all over contributing to infrequent tree canopy while shrubs and undershrubs mostly border the core water regimes.

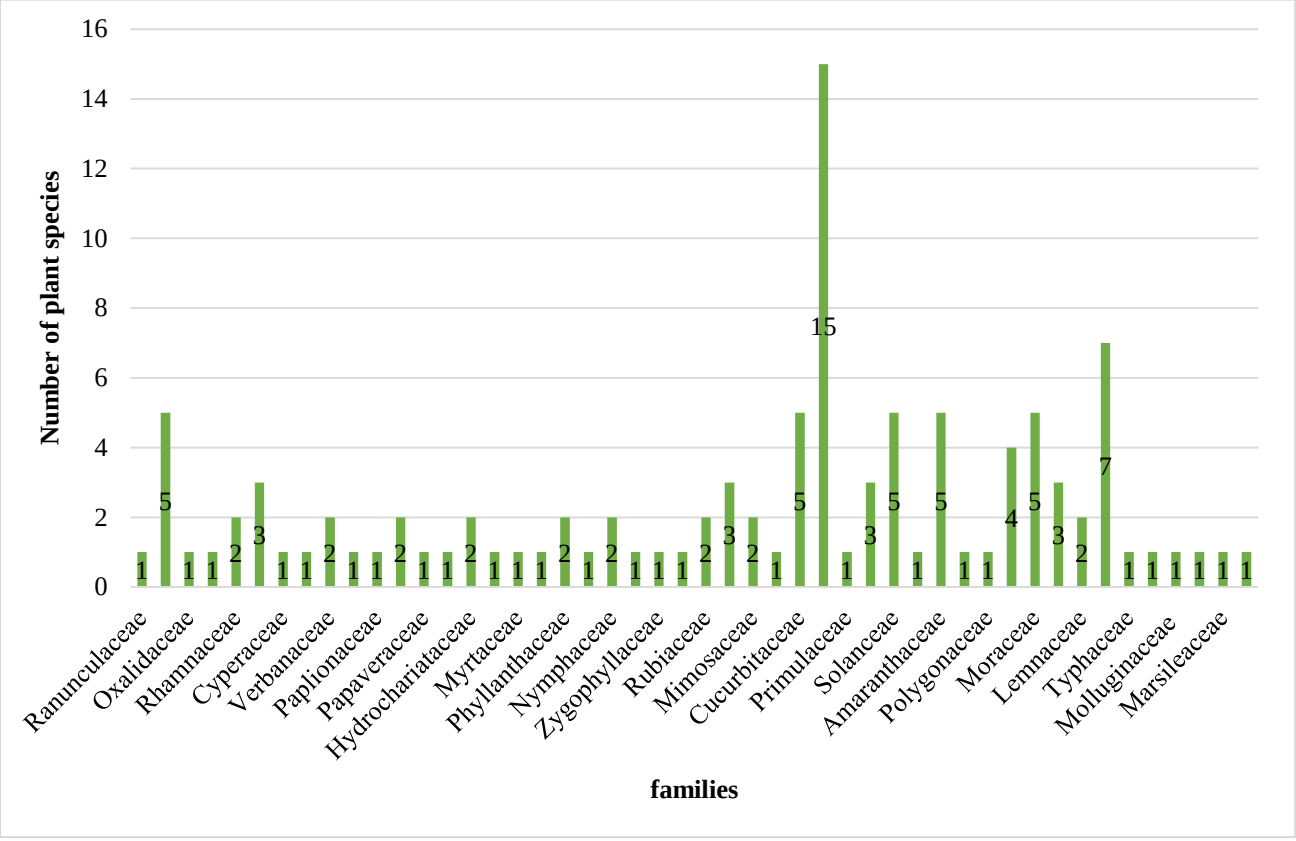

Figure 2: Family wise graphical representation of plant species present at Lakh Bahosi Bird Sanctuary

Families, Genera and Species Analysis

Among the five dominant families, Asteraceae was most dominant with 15 species (13.63%) followed by Poaceae with 7 species (6.36%), Solanaceae, Malvaceae and Amaranthaceae with 5 species each having 4.90 % coverage. These together constitute one-third of the sanctuary flora contributing 37 species i.e. 33.63%. The family Asteraceae alone with 15 Genera (15.95%) suggests a rich representation of ornamental and weeds within the sanctuary comprising grassland and bird food chain resources. The families Poaceae with 5 genera (5.31%) and Malvaceae, Solanaceae, and Amaranthaceae with 5 genera each were also well represented. The most dominant genera with maximum species representation are *Setaria, Phyllanthus,Ficus bengalensis., Azardirachta indica, Alstonia scholaris, Terminalia arjuna* and *Syzygium jambolanum* etc. (Figure 2)

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