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Study of Angiospermic Diversity of Bakhira Lake, Sant Kabir Nagar, Uttar Pradesh

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ABSTRACT

As producers, aquatic and marshy angiospermic plants are most important component in the Bakhira lake of Sant Kabir Nagar, Uttar Pradesh. It is therefore necessary to record and to assess the diversity and potentiality of the aquatic plant communities. In the present study on the Bakhira lake of Sant Kabir Nagar, Uttar Pradesh the aquatic and marshy angiosperms here, 201 species belonging to 115 genera of 50 families were identified. Out of total 201 species, 107 were dicot species belonging to 65 genera of 33 families while 94 species were monocot belonging to 50 genera of 17 families. During the survey of this study area *Ceratophyllum demersum* was first time reported. Two species were found to be new record viz. *Alternanthera sessilis* and *Ranunculus sceleratus* was found to be extending its distribution in the Bakhira lake of Sant Kabir Nagar, Uttar Pradesh. Due to rapid pace of urbanization, formation of new human settlements and industrialization these aquatic habitat are in severe threat of extinction. It is therefore an urgent and utmost need to record and to assess the diversity and potentiality of these aquatic plant communities before they will vanish forever.

KEYWORDS: *angiosperm, Bakhira, Sant Kabir Nagar, species, urbanization, extinction, aquatic, plant, diversity*

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INTRODUCTION

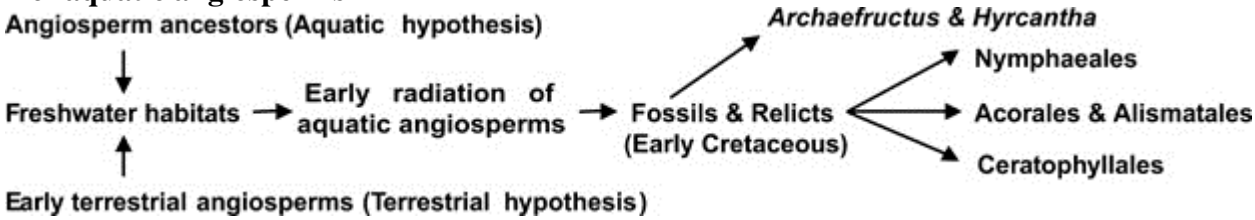
Aquatic angiospermic diversity is studied in the Bakhira lake of Sant Kabir Nagar, Uttar Pradesh. The importance of these water flora in agriculture, pisciculture and as a source of food and medicine has not received much attention. Some species, such as purple loosestrife, may grow in water as emergent plants but they are capable of flourishing in fens or simply in damp ground. Examples: *Phragmites karka*, *Cyperus papyrus, Typha angustata*, *Butomus junceus, Zizania* sp. Floating-leaved angiosperms have root systems attached to the substrate or bottom of the body of water and with leaves that float on the water surface.

Water lilies in Bakhira lake

Examples*: Nymphaea pubescens, N. nouchali, Nelumbo nucifera, Victoria amazanica, Vallisneria spiralis, Nymphoides indicum.* Submerged angiosperms completely grow underwater with root attached to the substrate like *Ceratophyllum submersum, Hydrilla verticillata, Myriophyllum spicatum, Ceratophyllum demersum.* Free-floating angiosperms are aquatic plants that are found suspended on water surface with their root not attached to substrate or sediment or bottom of water body. They are easily blown by air and provide breeding ground for mosquito eg. *Pistia* stratiotes, *Enhydra fluctuans*, *Eichhornia crassipes*, *Lemna purpusila, Wolffia microscopica* etc. Some aquatic plants are used by humans as a food source. Examples: Wild rice (*Zizania* sp.), water caltrop (*Trapa natans*), Chinese water chestnut (*Eleocharis dulcis*), lotus (*Nelumbo nucifera*), water spinach (*Ipomoea aquatica*), watercress (*Rorippa nasturtium-aquaticum*). Phytochemical and pharmacological researches suggest that freshwater macrophytes, [1] such as *Nelumbo nucifera*, *Ipomoea aquatica* and *Ludwigia adscendens* are potential sources of anticancer and antioxidative natural products. Hot water extracts of the stem and root of *Ludwigia adscendens*, and the fruit, leaf and stem of *Monochoria hastata* were found to have lipoxynase inhibitory activity. Hot water extract prepared from the leaf of *Ludwigia adscendens* exhibits alpha-glucosidase inhibitory activity.

***Ceratophyllum demersum* in Bakhira lake**

Origin of aquatic angiosperms



Sl. No.	Family	Species	Uses	Habitat category
1	Saururaceae	*Houttaynia cordata* Thunb.	Leaf extract given to eat in diarrohea	Wetland hydrophyte
2	Urticaceae	*Pilea microphylla* (L.) Liebm.	Plant infusion diuretic	Wetland hydrophyte
3	Ranunculaceae	*Ranunculus sceleratus* L.	leafs used in ashma, tonsil	Rooted emergent
4	Nelumbonaceae	*Nelumbo nucifera* Gaertner	Flowers used in skin diseases; thalamus edible; flowers in ritual purpose.	Rooted floating
5	Nymphaeaceae	*Nymphaea nouchali* Burm.f.	Fruit and seed edible	Rooted floating
		N. rubra Roxb.ex Andrews	Fruit and seed edible	Rooted floating
		N.stellata Willd.	Fruit and seed edible	Rooted floating
		Euryale ferox Salisbury	Fruit edible	Rooted floating
6	Ceratophyllaceae	*Ceratophyllum demersum* Linn.	cooling against boils	Freely Submerged
7	Caryophyllaceae	*Drymaria cordata* Willd.	Paste of leaves applied in insect bite & to cure sinus.	Wetland hydrophytes
		Stellaria media (L.) Vill.	Edible as leafy vegetable	Wetland hydrophytes
8	Amaranthaceae	*Alternanthera sessilis* (L.) R. Br. ex DC.	tender shoots edible as leafy vegetables	Wetland hydrophytes
		A. philoxeroides (Mart). Griselo	tender shoot as leafy vegetable	Rooted emergent
9	Polygonaceae	*Persicaria barbata* (L.) Hara	Roots astringent	Wetland hydrophytes
		Persicaria chinensis (L.) H.Gross	As leafy vegetable	Wetland hydrophytes
		Persicaria hydropiper (L.) Spach.	Dry plants burnt to control mosquito	Wetland hydrophytes
		Persicaria hydropiper Ssp. Flaccida (L.) Spach.	Dry plants burnt to control mosquito	Wetland hydrophytes
		P. orientale (L.) Asse.	Leaves in healing wounds	Wetland hydrophytes
		P. perfoliata (L.)H.	Tender shoot edible as vegetable	Wetland hydrophytes
		P. strigosa (Roxb.) Nakai	Whole plants given to eat to control dysentery of cow	Wetland hydrophytes
		P. viscosa (Buch.-Ham. ex. D.Don) H. Gross ex Nakai	Fumigation of plant to control insect.	Wetland hydrophytes
		Polygonum plebejum (L.) Hara	Roots in treatment of pneumonia	Wetland hydrophytes
		Rumex maritimus L.	edible as leafy vegetables	Wetland hydrophytes
		Rumex dentatus L.	edible as leafy vegetables	Wetland hydrophytes
10	Capparidaceae	*Cleome gynandra* L.	Paste of leaves applied to cure boils	Wetland hydrophytes
11	Brassicaceae	*Cardamine hirsuta* Hook.&T	As leafy vegetable	Wetland hydrophytes
		Rorippa palustris(L.) Bess.	As leafy vegetable	Wetland hydrophytes
		Rorippa sinuata (N.) Hitc	As leafy vegetable	Wetland hydrophytes
12	Rosaceae	*Fragaria indica* Andr.	fruits edible	Wetland hydrophytes
13	Papilionaceae	*Aeschynomene aspera* Linn.	white spongy portion of stem is used in preparation of hat, doll, crown etc.	Wetland hydrophytes
		A. indica L.	white spongy portion of stem is used in preparation of hat, doll, crown etc.	Wetland hydrophytes
14	Hypericaceae	*Hypericum boreale* Fassett	Twigs used in urenary disorders	Wetland hydrophytes
15	Oxalidaceae	*Oxalis corniculata* L.	Tender shoots used as leafy vegetables, in dysentery	Wetland hydrophytes
16	Balsaminaceae	*Hydrocera triflora* (L.)Wt & Arn.	Dye of flower used in nail	Rooted emergent
17	Lythraceae	*Rotala rotundifolia* (Buch-Ham) Koeh	Juice of aerial part given to treat cough, cold, fever	Wetland hydrophytes
18	Onagraceae	*Ludwigia adscendens* (L.) Hara	Used as vegetables	Rooted floating
		L.octavalvis (Mich.)Raven	A kind of tea made from leaves	Wetland hydrophytes
		L. perennis L.	Boiled leaf extract used externally in reducing fever	Wetland hydrophytes
		L. prostrata Roxb.	Plant extract given to eat in leucorrhea	Wetland hydrophytes
19	Haloragaceae	*Myriophyllum indicum* L.	As organic fertilizer	Rooted submerged
20	Trapaceae	*Trapa natans var.incisa* Makino	Fruit edible	Rooted floating
		Trapa natans var.bispinosa (Roxb.)Makino	Fruit edible	Rooted floating
21	Apiaceae	*Centella asiatica* (L.) Urban	Leaf extract given to eat in dysentery	Wetland hydrophytes
		Hydrocotyle sibthorpioides Lamk.	Leaf extract tonic	Wetland hydrophytes
		Oenanthe fistulosa Flamingo	Aerial parts given to eat in digestive disorders	Wetland hydrophytes
		Oenanthe javanica (Bl.)DC.	As leafy vegetable	Wetland hydrophytes
22	Menyanthaceae	*Nymphoides cristata* Roxb.	Tubers given to eat in gastric	Free floating
		N. indica (L.)Kuntz	Tubers eaten in fever and jaundice	Free floating
23	Convolvulaceae	*Ipomoea aquatica* Forsk.	As leafy vegetable	Rooted floating

Discussion

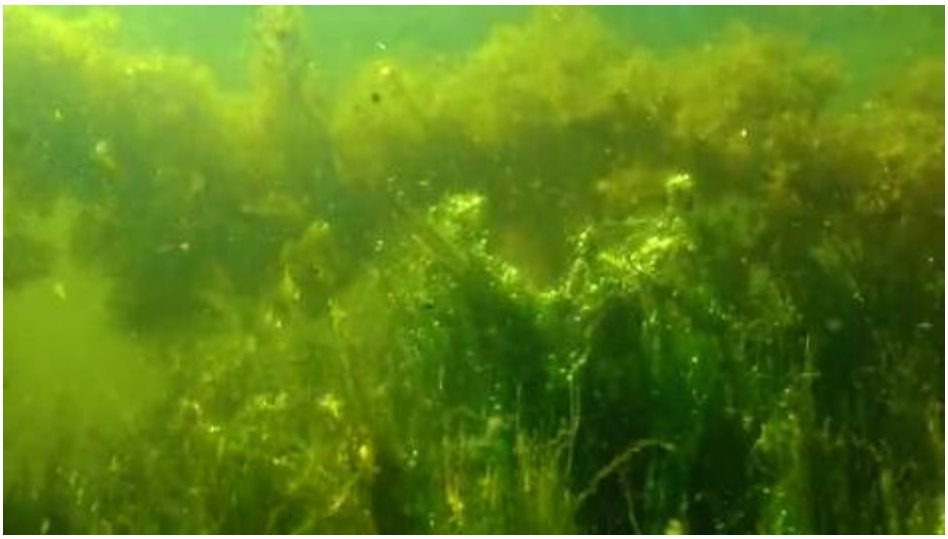
Aquatic macrophytes play a vital role in Bakira lake. They serve as primary producers of oxygen through photosynthesis, provide a substrate for algae and shelter for many invertebrates, aid in nutrient cycling to and from the sediments, and help stabilize river and stream banks. Biological filtration is an increasingly popular method of sewage treatment; some aquatic plants are being used to remove nutrients and reduce concentrations of phosphorus and nitrogen from raw sewage or from the effluent sewage treatment facilities. Aquatic plants are also able to absorb other substances, including pollutants such as phenols. Aquatic plants supply a wide variety of wildlife with food and suitable nesting habitats. Some, even help to control pest populations; duckweeds are known to reduce mosquito numbers, which has the added benefit of decreasing the incidence of certain insect-borne diseases. As macrophyte biomass increases, the mean water velocity of the Bakhira lake decreases. If river discharge is constant, such a reduction in velocity will raise the water level, thereby presenting the possibility of overflowing banks or raising water tables.

Nymphoides in Bakhira lake

Fishing and navigation is another concern, as tall emergent plants can prevent access for shoreline fishing. Submerged species can also spoil the gravel spawning beds of some fish (salmonids, in particular) and high densities of photosynthesizing macrophytes are capable of causing large fluctuations in oxygen; this can stress many fish species. Similarly, fish mortality may ensue when photosynthesis does not exceed respiration (under prolonged hot and cloudy conditions), thus resulting in oxygen depletion. [2]

While some aquatic angiosperms in Bakhira lake deter certain disease-carrying organisms, others provide an ideal habitat. Several human diseases are transmitted through intermediate hosts that are either dependent upon certain macrophytes for completion of their life cycle or inhabit stagnant water resulting from the obstruction of water-courses by vegetation.

It has been reviewed that aquatic macrophytes tend to replace sexual reproduction with vegetative reproduction, which may be related to the difficulty in raising the flowers above the water for aerial fertilization. Vegetative, or asexual, reproduction is a vital key to survival among the aquatic plants. Some species in Bakhira lake rarely generate viable seeds and those that are produced serve more as a "back-up" to ensure the species' survival in the event of a disaster. Vegetative reproduction occurs primarily via stem fragmentation, but some species use the whole plant (*Lemna, Eichhornia crassipes*), shoot fragments (*Ceratophyllum demersum*), and specialized organs such as tubers (*Hydrilla, Potamogeton*). Floating-leaved species are ordinarily fertilized in the same manner as emergents, with their chief adaptation to the aquatic environment being the production of long peduncles (flower stalks) capable of lifting the flower above the water (e. g. *Nymphaea*). These peduncles must often be longer than the depth of the water to accommodate changes in water level and water velocity (in flowing waters) in the Bakhira lake.



Thickets of aquatic angiosperms under water Bakhira lake

Results and Conclusions

Aquatic macrophytes have served humans well over the centuries, providing food, medicines, and building materials. The tribals of Bakhira lake area regularly harvested water lilies (*Nymphaea* spp.) for human consumption. They used lilies as dried and seeds were pounded or ground into flour, which was used to make bread. Other parts were eaten raw. [3] Various *Nymphaea* species are still cultivated in the Orient for their fruits, seeds, and rhizomes. In Bakhira lake area various tribes dig up the starch-laden rhizomes for food.

Water chestnuts are cultivated in the lake area. The familiar Chinese water chestnut is actually the corm of an *Eleocharis* sp., a member of the Cyperaceae family. [4]

Wild rice is an annual grass and is not related to the cultivated rice that first comes to mind. Its seeds are regularly gathered and eaten in the Bakhira area by tribal and local community.

Although an introduced species, water cress provides fresh foliage for salads and as a garnish. It has been naturalized throughout Bakhira lake area.

***Lemna* in Bakhira lake**

Giant reeds grow to a height of 3 meters, thus yielding a viable option for construction materials. They are frequently used in Bakhira area by tribal and local community for thatching roofs, building fences, making musical instruments, and in pulp mills for paper, cardboard, cellophane, insulation, fiberboard, and even building blocks. [5]

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