DOI: 10.32606/IJSR.V10.I1.00024 Received: 27-03-2019 Accepted: 03-08-2019

Indian J.Sci.Res. 10 (1): 159-163, 2019 Original Research Article ISSN: 0976-2876 (Print)
ISSN: 2250-0138 (Online)

STUDY OF BIOLOGICAL DIVERSITY WITH PARTICULAR REFERENCE TO MACROPHYTES FLORA OF MANIKA MANN OF MUZAFFARPUR, BIHAR

RAGINI KUMARI[a1] AND POONAM SINHA[b]

[a]Department of Botany, M.D.D.M. College, Muzaffarpur, Bihar, India
[b]University Department of Botany, B.R. Ambedkar Bihar University, Muzaffarpur, Bihar, India

ABSTRACT

Manika Mann is a perennial water body and therefore, different hydrophytes and algal flora constitute a rich biodiversity. As the Mann is surrounded by the agricultural lands so the pond water is enriched with different nutrients that promote growth of different kinds of macrophytes and diverse algal flora. During seasonal survey, the epihydates, helophytes, hyperhydate, plankton, pleustophytes, rosulates, vittate of macrophytes were found. During rainy season the bed of the Mann is completely filled with rain water as well the runoff water from the surrounding. During this seasons only floating macrophytes, such as *Eicchornia*, *Lemna*, *Ipomoea* spp, were found on the surface. From Octobed to December, *Trapa, Euryal ferox*, *Eicchornia*, *Pistia* were noted on the surface, while in the water, few feet deep, *Ceratopyllum*, *Vallisneria*, *Hydrilla* etc. were noted. During this period near the bank, *Colocasia*, wild species of *Poaceae*, members of *Cyperaceae* were found. During summer the water depth is reduced and is present in the bed only. The marshy and moist marginal land was occupied by Sedge grass and members of *Poaceae*.

KEYWORDS: Manika Mann, Biodiversity, Macrophytes, *Euryale*, Sedge grass, Wild Species of *Poaceae*

Manika Mann of Muzaffarpur, Mushahari Block is situated at geographical coordinates at $26^0$7'0" North and $85^0$24'0" East. It is 8 KM away from the district headquarter of Muzaffarpur. This Mann is a perennial source of water. The main source of water is the rain fall, but due to its depth even in summer water is present, although the level of water is low and restricted to the bed side.

However, in rainy seasons, water comes from the surrounding as the Mann has lower level than the surrounding. Due to this in different season's different Macrophytes flora are found.

From the survey of literature, it was observed that aquatic macrophytes have been studied in different parts of India. Some of them may be cited here such as: Gopal and Goel (1993), Thakur *et al*., (1995), Bandyopadhyay and Kumar (2001), Bandyopadhyay and Mukherjee (2005), Paresh and Bill (2006), Bhat *et al*., (2007), Adhikari and Babu (2008), Narain and Mishra (2008), Sujana and Sivaperuman (2008), Kumar (2010), Mishra *et al*., (2012), Singh and Satyanarayan (2012), Kumar and Prabhakaran (2013), Mishra and Narain (2014), Kumar and Chelak (2015), Patel and Patel (2016), Singh and Kumari (2017), Swamy *et al*., (2016), Kuldeep and Acharya (2018). These workers have made survey of fresh water ponds and presented the list of aquatic macrophytes found in their studies.

However, we do not get reports regarding studies of Manika Mann, with respect to biodiversity of macrophytes & flora. Keeping these ideas in mind the present work was carried out in different seasons and the macrophytes & flora were studied. The details have been mentioned in the chapter Materials and Methods.

MATERIALS AND METHODS

Seasonal survey of Manika Mann was done to locate the presence of different macrophytes belonging to lower groups that were non-flowering plants as well the flowering plants belonging to Dicot and Monocot groups. The plants belonging lower groups were identified on the basis of morphology and the reproductive parts. The plants belonging to dicotyledons were identified with the help of, Haines flora Vol (I-IV). In case where the species was not identified they were simply identified up to genus. In different seasons there was different habitat and naturally different plants species belonging to different groups were detected. Here the flowering plants were grouped on the basis of their growth form and habitat conditions, as proposed by Cook (1996), reported by Bandhopadhyay and Mukherjee (2005).

[1]**Corresponding author**

Epihydate

All such plants where roots were anchoring with the substratum and leaves or stems were floating just above the surface, meaning thereby they were not raised above the water surface. So here the plants had contact with soil, water and air.

Helophytes

All such hydrophytes that can tolerate longer periods of submergence but are not specialized physiologically.

Hyperhydate

Here roots penetrate the substratum but leaves or stems emerging above the water surface. So such plants have contact with soil, water and air.

Plankton

They occupy the zone between the bottom and the lower surface of water. So they are free swimming below the water surface.

Pleustophyte

Plants free floating on the surface of water. They are neither attached or penetrate the substratum.

Rosulate

Here plants are submerged, rooted in substratum and leaves are borne in rosette.

Tenagophyte

Plants with juvenile stage submerged in or floating on water and the adult at the flowering stage becomes terrestrial.

Vittate

Plants submerged, rooted in the substrate, leaves along the elongated stem.

List of Species

During survey of the Manika Mann, four members of Pteridophytes such as: *Equisetum*, *Marsilea*, *Azolla* and *Pteris* were located (Table-1).

Similarly, different forms of aquatic plants were identified in different seasons. These hydrophytic plants have been grouped as suggested by Cook (1996).

Similarly, aquatic plants belonging to dicotyledons and monocotyledons were identified, along with their families genus and species. They have been arranged in the table 2.

List of macrophytes found during survey of different seasons of Manika Mann. (Table 3)

Table 1: Members of Pteridophytes

Pteridophytes:	*Equisetum spp.*
	Marsilea minuta
	Azolla pinnata
	Pteris

Table 2: Angiospermic Macrophytes Dicotyledons

Sr. No.	Species	Families
1	*Achyranthes aspera*	Amaranthaceae
2	*Alternanthera sessilis*	Amaranthaceae
3	*A. Polygonoids*	Amaranthaceae
4	*Alternanthera spp.*	Amaranthaceae
5	*Amaranthus spinosa*	Amaranthaceae
6	*Bacopa monnieri*	Scrophulariaceae
7	*Bacopa procumbens*	Scrophulariaceae
8	*Centella asiatica*	Apiaceae
9	*Hydrocotyle spp.*	Apiaceae
10	*Cassia tora*	Caesalpinaceae
11	*Eclipta procombens*	Asteraceae
12	*E. Alba*	Asteraceae
13	*E. Prostrata*	Asteraceae
14	*Euphorbia hirta*	Euphorbiaceae
15	*Euphorbia prostrata*	Euphorbiaceae
16	*Heliotropium indicum*	Boraginaceae
17	*Heliotropium spp.*	Boraginaceae
18	*Caesulia axillaris*	Asteraceae
19	*Ipomoea aquatica*	Convulvulaceae
20	*Ipomoea spp.*	Convulvulaceae
21	*I. cornea*	Convulvulaceae
22	*Justicia simplex*	Acanthaceae
23	*Cleome gynandra*	Capparidaceae
24	*Ceratophyllum demersum*	Ceratophyllaceae
25	*Ageratum conizoides*	Asteraceae
26	*Boerhaavia diffusa*	Nyctagenaceae
27	*Lippia nodiflora*	Verbenaceae

28	*Malvestrum tricuspidatum*	Malvaceae
29	*Nelumbo nucifera*	Nelumbonaceae
30	*Oxalis carniculata*	Oxalidaceae
31	*Panthenium hyterophorus*	Asteraceae
32	*Polygonum glaberum*	Polygonaceae
33	*P. Plebejam*	Polygonaceae
34	*Polygonum barbatum*	Polygonaceae
35	*Rumex dentatus Linn.*	Polygonaceae
36	*Phyllanthus niruri*	Euphorbiaceae
37	*Phyllanthus spp.*	Euphorbiaceae
38	*Ranunculus scleratus*	Ranunculaceae
39	*Scoparia dulcis*	Lamiaceae
40	*Trapa bispinosa Roxb.*	Trapaceae
41	*Tridex procumbens*	Asteraceae
42	*Trianthema monogyna*	Aizoaceae
43	*Utricularia spp.*	Lentibulariaceae
44	*Lemna purpusilla*	Lamnaceae
45	*Lemna valdivians*	Lamnaceae
46	*Nymphaea stellata*	Nymphaeaceae
47	*N. Nonchali*	Nymphaeaceae
48	*Nelumbo nucifera*	Nymphaeaceae
49	*Justissia repens*	Onagraceae
50	*Sesbania spp.*	Onagraceae

Table 3: AquaticMacrophytes Monocots

Sr. No.	Species	Family
1	*Commelina benghalensis Linn.*	Commelinaceae
2	*Commelina nudiflora Lin..*	Commelinaceae
3	*Aponogetan natans Linn.*	Aponogetonaceae
4	*Arum maculatum*	Araceae
5	*Amorphophallus titanum*	Araceae
6	*Colocacia esculenta*	Araceae
7	*Hydrilla verticillata*	Hydrocharitaceae
8	*Vallisneria natans*	Hydrocharitaceae
9	*Carex hirta*	Hydrocharitaceae
10	*Cyperus papyrus*	Hydrocharitaceae
11	*C. Aritculatus*	Hydrocharitaceae
12	*C. Alternifolus*	Hydrocharitaceae
13	*Cirpus articulatus*	Hydrocharitaceae
14	*Eleocharis dulsis*	Hydrocharitaceae
15	*E. Palustris*	Hydrocharitaceae
16	*C. Esculentus*	Hydrocharitaceae
17	*C. Deformus*	Hydrocharitaceae
18	*C. Longus*	Hydrocharitaceae
19	*Cyperus bulbosus*	Hydrocharitaceae
20	*C. Esculentus*	Hydrocharitaceae
21	*C. Rotundus*	Poaceae
22	*Cynodon dactylon*	Poaceae
23	*Carex hirta*	Poaceae
24	*Phragnites karka*	Poaceae
25	*Sacchanum munja*	Poaceae
26	*Sacchanum spontenum*	Poaceae
27	*Sacchanum glagantum*	Poaceae
28	*Sacchanum officinarum*	Poaceae
29	*Setaria verticillata*	Poaceae
30	*Eragrotis cynosuroides*	Poaceae
31	*Eicchornia crassipes*	Pontederiaceae
32	*Potamogeton crispus*	Pontederiaceae
33	*Potamogeton nodons*	Pontederiaceae
34	*Potamogeton pectinata*	Pontederiaceae
35	*Pisita stratiotes*	Araceae
36	*Scirpus tuberosus*	Cyperaceae
37	*Scerpus spp.*	Cyperaceae
38	*Najas graminea*	Najadaceae
39	*Najas numor*	Najadaceae
40	*Colocasia gigantea*	Araceae
41	*Colocasia spp.*	Araceae

RESULTS AND DISCUSSION

In the present work survey for aquatic higher plants was done in different seasons in the Manika Mann of Muzaffarpur. During survey it was noted that the Mann has different zones in different seasons. During rainy season the entire bed was covered with water and only the banks were without water cover, but they were marshy. During winter water level went down and in between the water cover and the bank there were open land with moisture, the marshy areas and finally the water bed. In summer the marshy areas as well as water bed were much reduced while the upland areas were exposed much. Above conditioned favoured or promoted growth of different kinds of vegetations.

During survey in different season's altogether 91 plants were found in the Manika Mann during different seasons. Among them 4 were members of Pteridophytes, rest were from dicotyledons and monocotyledons. While *Equsetum* and *Marsilea* were collected from marshy areas, *Azolla* was collected from the water body that was floating on the surface of water. In December, complete red coloured free floating plant bodies, which were present in groups were detected, they were plant body of *Azolla*. Similarly, the bushes of *Pteris* were detected in marshy and shady zones of the Mann.

When the Mann was fully flooded during rainy seasons, August to September only floating macrophytes such as, *Ipomoea*, *Eicchornia*, *Pistia* and to some extent *Lemna* near the bank were noted. When the water level came down, rooted submerged and free submerged species were detected. *Hydrilla*, *Vallisneria* and *Ceratophyllum* were commonly found. During October to December the floating macrophytes such as *Trapa* and abundant *Lemna* were detected. It was observed that certain plants such as *Alternanthera sessilis*, *Lipia nodiflora*, *Bacopa monnieri, Polygonum* species, *Caesulia axilaris*, *Ipomoea* species, *Typha*, and *Phragmitis* were found in water logged zone, marshy places as well as in moist shady places. There were upland species which were found in the moist places only.

They were neither found in marshy soil or water logged conditions. Similarly, certain species such as well as in water logged areas of the Mann.

Aquatic species were *Axolla pinnata, Ceratophyllum spp, Scirpus spp, Hydrilla verticillata, Vallisneria natans, Lemna* spp*, Spirodella spp, Najas spp, Nymphae* spp*, Eicchornia* spp*, Potamogeton* spp*, Trapa bispinosa, Utricularia and Nelumbo nucifera.*

The moist aquatic species were, *Sagitaria* spp*, Typha* spp*, Bacopa monnieri, Polygonum* spp*, Phragmites karka, Marsilea quadriolia, Ipomoea carnea, Sagitaria sagitifoia* and *Colocasia*., Gopal and Goel (1993), reported allelopathy among these macrophytes.

Rest species listed here were, aquatic upland or moist upland. Here are species which can adjust water logging but can grow better in upland areas.

DISCUSSION

Aquatic macrophytes are now a day grouped into different categories. Bandhopadhyay and Mukherjee (2005), adopted classification of macrophytes proposed by Cook (1996). There are 8 growth forms such as Epihydate, Hyperhydate, Helphyte, Plankton, Pleustophyte, Rosulate, Tenagophyte and Vittate. All these forms have different adaptations to survive in submerged state, free floating, rooted floating, aquatic moist habitat, and moist upland habitats.

Aquatic macrophytes play an important role in pond ecosystem. They submerged species in rich the water body with oxygen during day time. These macrophytes take nutrients like nitrogen & phosphorus from water and thus dilute the excess of the above two nutrients in the polluted water. Similarly, they also contribute in the cycling of above two nutrients. They influence denitrifying bacteria that inhabit on the roots and shoots of these macrophytes. They also constitute the food chain of the aquatic ecosystem. Selected macrophytes act as the plant indicator, as they grow in particular types of aquatic system and thereby they indicate the health of the pond water. Species of *Ipomoea* also absorb heavy metal like mercury form the mercury polluted water. Death and decay of these macrophytes enrich the water of the pond that promotes growth of different beneficial algae. However, they may cause the basis for water bloom.

CONCLUSION

Aquatic ecosystem promotes growth of different micro algae and macrophytes. Here we get biodiversity and plants growing there may of great economic importance. If unwanted macrophytes are removed or their growth is controlled and species having this extra terrestrial area can be utilized for economic gain. Cultivation of *Trapa* and *Euryale ferox* (Makhana) is the best examples. Kargupta and Jha (1996) reported that from Darbhanga the export of popped Makhana costs more than 10 crore every year. So, the local farmers may get economic support if these two crops are cultivated in Manika Mann. Similarly, local people harvest the wild species of *Poaceae*, which are commonly called as "Gurhan, Munja" for the preparation of huts or for its repair. Most abundantly growing species of *Sesbania* commonly called as "Dhaincha" in water logged area of Manika Mann are used for collection of seeds and

the dried stems are used for fire wood in cooking by the local people. The seeds are sold at good price. These seeds are sown and plants are used for green manure. In this way this water body may be a boon for the locals if it is managed and utilized properly.

ACKNOWLEDGEMENT

The authors are grateful to the Head, Department of Botany for providing laboratory and library facilities during the work.

REFERENCES

Adhikari B.S. and Babu M.M., 2008. Floral diversity of Baanganga wetland, Uttrakhand, India. Check List, **4**(3): 279-290.

Bandyopadhyay and Mukherjee S.K., 2005. Diversity of aquatic and wetland vascular plants of Koch Bihar District, West Bengal. Plant Taxonomy: Advances and Relevance ED. Pandey A.K. , Jun Wen and J.V.V. Dogra pp. 223-244.

Bandyopadhyay N.N. and Kumar A., 2001. Floristic survey of wetland of Patna. Proc. Nat. Symposium on Biodiversity Patna University, Patna, pp. 63-64.

Bhat F.A., Mahdi M.D. and Yousuf A.R., 2007. Macrophytic associations in lotic habitats of Kashmir, Himalaya. J. Res. Dev., **7**: 59-66.

Gopal and Goel, 1993. Competition and allelopathy in aquatic plant communities. Bot. Rev., **59**: 155-210.

Haines H.H., 1920-25. The Botany of Bihar and Orissa, Vol. (I-IV), London.

Kargupta A.N. and Jha V., 1996. Makhana (*Euryal ferox*) an aquatic crop with high potential. The Botanica, pp-47-54.

Kumar A., 2010. Macrophytes of the inland water bodies of Patna. J. Ind. Bot. Soc., **89**(182): 213-216.

Kumar S. and Chelak E.P., 2015. Survey of macrophytic diversity in different ponds of Ongargarh city, Chhattisgarh. J. Env. Sci. Toxicology and Food Technology, **1**(1): 57-59.

Kumar S. and Prabhakaran J., 2013. Aquatic floral populations in Nameanami lake, command area, Tamilnadu, India. Int. Jour. of Curr. Biotech. **6**: 1-8.

Kuldeep R. and Acharya V., 2018. Survey of aquatic plants of Kanker District, Chhattisgarh, India, **33**(1): 51-58.

Mishra S. and Narain S., 2014. Aquatic and Marshy angiospermic diversity of Eastern Uttar Pradesh. Int. Journ. Plant. Sci., **3**(2): 63-65.

Mishra M.K., Panda A. and Sahu D.B., 2012. Survey of useful wetland plants of South Odisha, India. Indian J. of Trad. Knowledge, **11**(4): 658-666.

Narain S. and Mishra S., 2008. A list of aquatic and marshy plants of Bundelkhand region, U.P., India. Indian Journal of Forestry, **31**(2): 301-308.

Paresh L. and F. Bill., 2006. Environmental influences on aquatic plants in fresh water ecosystems. Environ. Rev., **14**: 89-136.

Patel N.B. and Patel K.B., 2016. Floristic account of aquatic and wetland Angiosperms of Sabarkantha, District, Gujrat. Int. Journ. of Bot. Stud., **1**(4): 29-31.

Singh S.M. and Satyanarayan, 2012. Diversity of aquatic and wetland macrophytes in Keetham Lake, U.P., India. Phytotaxonomy, **12**: 181-186.

Singh S.P. and Kumari B., 2017. A preliminary survey of aquatic Angiospermic of district J.P. Nagar, U.P., with special reference to their economic importance. Int. J. of Appl. And Pure Sci. and Agri., **3**(6): 1-6.

Sujana C. and Sivaperuman C., 2008. Preliminary studies on flora of Kole wetland, Thrisur, Kerala. Indian Forester, **134**(8): 1079-1086.

Swamy J., Chandramohan K. and Bhadraiah B., 2016. An inventory of aquatic and wetland plants of Pocharam Lake, Medak District, Telangana. Asian Journal of Plant Science and Research, **6**(3): 87-91.

Thakur L.K., Chaudhary B. and Thakur N.K., 1995. Aqua crops of Darbhanga district in North Bihar and their commercial significance. J. of the Indian Fisheries Association, **25**: 107-111.