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Original Article

Study of Hydrophytes in Some Lentic Water Bodies of "Eastern India"

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Abstract

The Physico-chemical characteristic of water, aquatic weeds and bank flora of three water reservoirs located in Krishnagar city (longitude 88033/E, latitude 23024/N) State of West Bengal, were studied for a period of 24 months. Altogether 13 genera of aquatic macrophytes belonging to 10 families, and 24 plant species (bank flora) belonging to 16 families were identified in the present investigation. The Physico-chemical characteristic of pond water was found to be altered due to these aquatic plants. We have found a general relationship between trophic status of a water body and the aquatic plants present there. We have also found the alteration of water quality due to presence of various aquatic plants. Aquatic weeds are treated as nuisance plants in large parts of the world for their rapid vegetative growth and high dispersal rate. In many places they seriously interfere with human activities and decrease fish population. The most spectacular examples of hazards of aquatic weeds come from our subtropical and tropical areas.

Key Words: Physico-chemical characteristic, Hydrophytes, Macrophyte, Bank flora, Weeds.

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Introduction

Fresh water is an important driving force, cycling minerals and nutrients around the terrestrial environment and has been defined as those systems comprising human communities, socioeconomic interactions, and biophysical processes co-occurring in space and time.

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Evaluation of the biological community of a water body provides a sensitive and cost effective means of assessing stream condition (Willmer, 2000). Pollution problem of inland water bodies, especially ponds has at tracted the attention of researchers since long. Many workers have tried to establish relationship between trophic status of water bodies and aquatic plants (Wolverton and McDonald, 1978). Agarkar et al. (1994) stated that eutrophic water bodies are characterized by the presence of aquatic plants (Brönmark and Hansson, 2005). Kaul et al. (1980) opined that aquatic macrovegetation plays important role in maintaining ecological balance by nutrient recycling. Varshney (1981) and Oommachan et al. (1980) are designated certain aquatic plant species as pollution indicators. McVea and Boyd (1975) have reported that an aquatic plant alters the Physico-chemical characteristics of pond water.

Krishnagar city is the district head quarter of Nadia, in the state of West Bengal, an eastern province of India. The sites are situated near the tropic of cancer situated at longitude 88033/E, latitude 23024/N. Water Reservoir-I (Hansadanga beel), Water Reservoir-II (Nowapara beel), and Water Reservoir-III (Kaji beel) were selected for the present study. All the water bodies are perennial. The general characteristics of water bodies are given in (Table 1).

The present investigation was aimed to study the Physico-chemical characteristics of water, aquatic plants and bank vegetation of three ponds of Krishnagar (West Bengal) to find out impact of plants on water quality.

Materials and Methods

Physico-chemical characteristics of water samples of all the three water bodies were analyzed during (January, 2002 to December, 2004) using *APHA* (2005) and Trivedy et al. (1987). Aquatic vegetation was identified by consulting Fasseit (1957) and Gupta (1979).

Water samples were collected once a month from all the nine sites located along the three water reservoirs for Physico-chemical and bacteriological analysis. Sampling was done between 9a.m. to 11a.m. from lentic zones at a depth of 5cm. from the surface. Water samples were collected in plastic containers (volume approx. 2 lit.). Temperature and pH were measured immediately after collection of the sample. Physico-chemical analysis for Water temperature, Turbidity, Dissolved Oxygen (D.O.), Biological Oxygen Demand (B.O.D.) initial, Total Dissolved Solids (TDS), Total alkalinity, Total Hardness calcium hardness, Phosphate, Nitrite and Nitrate were performed in the laboratory on same day or within a week. Analyses of all parameters were done following the *standard methods* as out lined in (*APHA*, 2005). Water samples were also collected in sterilized glass tubes for bacteriological analysis in the laboratory following (APHA, 2005).

Results And Discussion

The Physico-chemical characteristics of water samples of Hansadanga Beel (Water Reservoir-I), Nowapara beel (Water Reservoir-II) and Kaji beel (Water Reservoir-III) are presented in (Table 2).

The aquatic macrophytes of all three water bodies studied during present investigation are listed in (Table 3) along with their families. In all, 13 genera were identified, belonging to 10 families (Notocaceae-1, Characeae-1, Cyperaceae-1, Hydrocharitaceae-3, Convolvulaceae-1, Myxophyceae-1, Pontederiaceae-1, Hallorrhagaceae-1, Nymphaeceae-2, and Alismataceae-1). In Water Reservoir-I and Water Reservoir-III *Hydrilla verticillata* dominated. In Water Reservoir-II Mycrocystis dominated over other weeds. In the present study Water Reservoir-I was found covered fifty percent

with macrophytes and water Reservoir-III was found covered twenty percent with macrophytes.

Bank side flora (Table 4) of water bodies studied consisted of 24 species of plants belonging 16 families (Mimosaceae-3, Annonaceae-2, Meliaceae-1, Bombaceae-1, Fabaceae-1, Asclepiadaceae-1, Sapindaceae-1, Myrtaceae-1, Moraceae-3, Ulmaceae-1, Convolvulaceae-1, Anacardiaceae-1, Apocynaceae-4, Palmae-1, Caesalpiniaceae-1 and Rhamnaceae-1). In Water Reservoir-I, *Mangifera indica* and *Pithecellobium dulce* dominated. In Water Reservoir-II, *Azadirachta indica*, *Butea monosperma* and *Ficus bengalensis* dominated. In Water Reservoir-III, only two plants *i.e., Azadirachta indica* and *Mangifera indica* were found among bank side flora.

Macrovegetation in and around the water body plays important role in determining its hydrobiological characteristics. Normally lakes and other surface waters are classified into oligotrophic and eutrophic. According to Agarkar et al. (1994) eutrophic conditions can be generally characterized by increasing number of aquatic plants in water body can cause further eutrophication.

Kaul et al. (1980) have stated that the Macrovegetation is useful in maintaining ecological balance by deriving nutrients from the water in benthic zone. Varshney (1981) have pointed out that certain aquatic macrophytes like *Lemna, Eichhornia, Utricularia, Myriophyllum, Nuphar* and *Potamogeton* can be used as pollution indicators. Oommachan et al. (1980) also reported *Potamogeton pectintus*, P. *crispus, Utricularia* sp. *Trapa bispionsa*, *Marsiles polygonum* and *Cyperus salopecuroides* as pollution indicators. In the present investigation *Myriophyllum* was found only in Water reservoir-I.

McVea and Boyd (1975) stated that aquatic plants change the quality of water by lowering the temperature, pH, bicarbonates, alkalinity and dissolved oxygen and increase the free CO_2, B.O.D. and nutrient levels. In the present study this statement was found to be true except for alkalinity which has comparatively higher value.

Table 1: General characteristics of three water body in the city of Krishnagar, of West Bengal, an eastern province of India:

Character-istics	Water Reservoir-I	Water Reservoir-II	Water Reservoir-III
Area	33.10 Hectare	37.24 Hectare	13.15 Hectare
Sediment Colour	Dark black	Dark black	Grey
Source of Water	Natural rains, public sewage	Natural rains, public sewage	Rains
Condition	Perennial	Perennial	Perennial
Maximum Depth	2.10 meter	2.0 meter	1.8 meter

Table 2: Mean Physico-chemical characteristics of three water bodies in the city of Krishnagar, of West Bengal, an eastern province of India:

Parameter	Water Reservoir-I		Water Reservoir-II		Water Reservoir-III	
	W	S	W	S	W	S
Water temperature (^{0}C)	15±0.51	28±0.53	15.1±0.55	28±0.58	16±0.56	29±0.65
Turbidity	49±7.8	66±6.7	25±7.1	48±8.5	39±8.3	76±6.8
p^H	8.71±0.16	9.3±0.20	8.55±0.18	9.98±0.24	8.69±0.15	9.90±0.19
Total Dissolved Solids (TDS)(mg.ℓ$^{-1}$)	90±8.6	130±7.8	75±6.8	139±8.1	84±9.4	106±7.7
Dissolved Oxygen (D.O.) (mg.ℓ$^{-1}$)	7.4±0.65	7.2±0.71	6.5±0.61	7.0±0.66	7.9±0.68	6.5±0.63
Biological Oxygen Demand (B.O.D) (mg.ℓ$^{-1}$)	2.6±0.43	1.8±0.49	1.2±0.39	2.2±0.46	2.8±0.55	3.4±0.48
Total Hardness (mg.ℓ$^{-1}$)	99±9.8	89±8.5	110±8.6	101±7.9	139±9.2	89±8.6
Total Alkalinity (mg.ℓ$^{-1}$)	109±13.6	73±11.8	77±12.6	51±10.3	84±10.4	67±11.5
Nitrite (mg.ℓ$^{-1}$)	Nil	0.195±0.0068	Nil	0.222±0.0047	Nil	0.220±0.0079
Nitrate (mg.ℓ$^{-1}$)	0.120±0.013	0.092±0.009	0.172±0.006	0.061±0.003	0.123±0.006	0.103±0.008
Phosphate (mg.ℓ$^{-1}$)	0.10±0.009	0.18±0.006	0.12±0.006	0.20±0.015	0.09±0.013	0.16±0.089

W= winter, S= summer.

Table 3: Aquatic weeds (micro and macro) of three water bodies in the city of Krishnagar, of West Bengal, an eastern province of India:

Name of weed	Family	Water Reservoir-I	Water Reservoir-II	Water Reservoir-III
Anabaena sp.	Nostocaceae	+	+	–
Chara sp.	Characeae	+	–	+
Cyperus dilutes	Cyperaceae	+	–	–
Hydrilla verticillata	Hydrocharitaceae	+	–	+
Ottelia alismoides L.	Hydrocharitaceae	+	–	–
Vallisnaria spiralis L.	Hydrocharitaceae	+	–	+
Ipomea aquation Forsk	Convolvulaceae	+	–	–
Microcystis sp.	Myxophyceae	+	+	–
Monochoria hastate Solms	Pontederiaceae	+	–	–
Myriophyllum spicatum L.	Hallorrhagaceae	+	–	–
Nelumbo nucifera Gaertn.	Nymphaceae	+	–	–
Nymphea nouchali Burm.	Nymphaceae	+	–	–
Sagittaria guavanensis	Alismataceae	+	–	–
a. Area covered by Weed (approximate)		25%	–	–
b. Biomass of Weed		710 g/sq feet	Very low	Very low

c. Dominated Weed: Hydrilla verticillata at Water Reservoir-I and Water Reservoir-III; Microcystis sp. at Water Reservoir-II

+ = Denotes presence of weed; – = Denotes absence of weed

Table 4: Bank side flora of three water bodies in the city of Krishnagar, of West Bengal, an eastern province of India:

Name of plants	Family	Water Reservoir-I	Water Reservoir-II	Water Reservoir-III
Acacia nilotica Var.	Mimosaceae	+	+	–
Albizzia procera. Benth.	Mimosaceae	+	–	–
Annona reticulate Linn.	Annonaceae	+	–	–
Annona squamosa Linn.	Annonaceae	+	+	–
Azadirachta indica Juss.	Meliaceae	+	+	+
Bombax ceiba Linn.	Bombaceae	+	–	–
Butea monosperma Kunt.	Fabaceae	+	–	–
Calotropis procera Br.	Asclepidaceae	+	–	–
Dononaea viscose Linn.	Sapindaceae	+	–	–
Eucalyptus citriodora Hook	Myrtaceae	+	–	–
Ficus bengalensis Linn.	Moraceae	+	–	–
Ficus racemosa Linn.	Moraceae	+	–	–
Ficus religiosa Linn.	Moraceae	+	–	–
Holoptelea integrifolia Plan.	Ulmaceae	+	–	–
Ipomoea fistulosa Choisy	Convolvulaceae	+	+	–
Mangifera indica Linn.	Ancardiaceae	+	+	+
Nerium indium Mill.	Apocynaceae	+	–	–
Pithecellobium dulce Benth.	Mimosaceae	+	+	–
Plumeria rubra Sant.	Apocynaceae	+	–	–
Phoenix sylvestris Roxb.	Palmae	+	–	–
Tabernaemontana divaricata Br.	Apocynaceae	+	–	–
Tamarindus indica Linn.	Caesalpiniaceae	+	+	–
Thevetia peruviana Schum	Apocynaceae	+	+	–
Zizyphus jujube Linn.	Rhamnaceae	+	–	–
Total number of plants		30	18	03

Dominated plants: Mangifera indica, Pithecellobium dulce at Water Reservoir-I;
Azadirachta indica, Ficus bengalensis at Water Reservoir-II;
Annona squamosa at Water Reservoir-III.

+ = Denotes presence of plant; – = Denotes absence of plant

Conclusion

In the present investigation only Water reservoir-I and Water reservoir-III have aquatic vegetation. Therefore, these ponds may be considered to be in the process of eutrophication.

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