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STUDY OF HYDROPHYTES IN SOME LENTIC WATER BODIES IN WEST BENGAL, INDIA

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ABSTRACT

The physico-chemical characteristics of water, aquatic weeds and bank flora of three water reservoirs located in Krishnagar city (longitude $88^0 33^/$E, latitude $23^0 24^/$N), West Bengal, India, 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.

Key words: Physico-chemical characteristics, hydrophytes, macrophytes, bank flora, weeds.

INTRODUCTION

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 attracted 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 Hanson 2001). 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) have 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 $88^0 33^/$E,

latitude $23^{0}24^{/}$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.

Table 1. General characteristics of three water bodies in the city of Krishnagar, West Bengal, India.

Characte-ristics	**Water Reservoir-I**	**Water Reservoir-II**	**Water Reservoir-III**
Area (ha)	33.10	37.24	13.15
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 (m)	2.1	2.0	1.8

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 between January 2002 and December 2004 using APHA (2002) 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 three water reservoirs for physico-chemical analysis. Samplings were done between 9 to 11 am from lentic zones at a depth of 5 cm from the surface. Water samples were collected in plastic containers (volume approx. 2 l). Temperature and pH were measured immediately after collection of the sample. Physico-chemical analyse for water temperature, turbidity, dissolved oxygen (DO), biological oxygen demand (BOD) 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 (2002). The monthly data were pooled together (Oct.-Mar.=winter) and (Apr.-Sept.=summer). This divsion was made depending upon occurrence of macrophytes. The macrophytes started growing during April and reached peak in Jul.-Aug.; then gradually diminished after September. During winter, the macrophytes were greatly reduced.

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 (Nostocaceae-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 to 16 families (Mimosaceae-3, Annonaceae-2, Meliaceae-1, Bombaceae-1, Fabaceae-1, Asclepidaceae-1, Sapindaceae-1, Myrtaceae-1, Moraceae-3, Ulmaceae-1, Convolvulaceae-1, Anacardiaceae-1, Apocynaceae-4, Palmae-1, Caesalpiniaceae-1 and Rhamnaceae-1). *Mangifera indica* and *Pithecellobium dulce* were dominating plants on the banks of Water Reservoir 1. On banks of 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* found among bank side flora.

Table 2. Mean Physico-chemical characteristics of three water bodies in the city of Krishnagar, West Bengal, an eastern province of India (S=Summer, W=Winter).

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
pH	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 (DO) (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 (BOD) (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±	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

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

Species	**Family**	**Water Reservoir-I**	**Water Reservoir-II**	**Water Reservoir-III**
Anabaena sp.	Nostocaceae	+	+	–
Chara sp.	Characeae	+	–	+
Cyperus dilutus	Cyperaceae	+	–	–
Hydrilla verticillata	Hydrocharitaceae	+	–	+
Ottelia alismoides L.	Hydrocharitaceae	+	–	–
Vallisnaria spiralis L.	Hydrocharitaceae	+	–	+
Ipomea aquatica Forsk	Convolvulaceae	+	–	–
Microcystis sp.	Myxophyceae	+	+	–
Monochoria hastate Solms	Pontederiaceae	+	–	–
Myriophyllum spicatum L.	Hallorrhagaceae	+	–	–
Nelumbo nucifera Gaertn.	Nymphaceae	+	–	–
Nymphea nouchali Burm.	Nymphaceae	+	–	–
Sagittaria guavanensis	Alismataceae	+	–	–

Area covered by Weed (approximate) 25% – –

Biomass of Weed (Dry weight) 71.0 g/cm^2, 1.25 g/cm^2, 0.50 g/cm^2 in Reservoirs I, II and III.

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, West Bengal, India.

Species	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 around Reservoirs I, II and III.
Dominated plants: *Mangifera indica, Pithecellobium dulce* around Water Reservoir-I;
Azadirachta indica, Ficus bengalensis around Water Reservoir-II;
Annona squamosa around Water Reservoir-III.
+ = Denotes presence of plant; – = Denotes absence of plant.

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 that 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 plants like *Lemna*, *Eichhornia*, *Utricularia*, *Myriophyllum*, *Nuphar* and *Potamogeton* can be used as pollution indicator. Oommachan *et al*. (1980) also reported *Potamogeton pectintus*, *P. crispus*, *Utricularia* sp. *Trapa bispionsa*, *Marsilea polygonum* and *Cyperus salopecuroides* as pollution indicator. 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, BOD and nutrient levels. In the present study this statement was found to be true except for alkalinity which has comparatively higher value.

CONCLUSION

In the present investigation we found considerable macrovegetation when compared with water reservoir-II, reservoir-I, and water reservoir-III. The increased number of macro vegetation indicates that the water quality of these reservoirs is going towards eutrophied condition.

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