Nature Environment and Pollution Technology Vol. 2 No. 3 pp. 277-281 2003
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STUDY ON BIODIVERSITY OF SOME MACROPHYTE INFESTED LAKES FROM THANE CITY, MAHARASHTRA

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ABSTRACT

Different species of flora and fauna exhibit variation in their response to any alteration in the environment and have indicator values. Hence, the high degree of aquatic pollution results in dominance of pollution tolerant species, which leads to change in biodiversity of the specific lake. The three lakes studied showed abundance of three different species of macrophytes namely Lemna minor, Pistia stratiotes and Eichhornia crassipes. High fluctuation in DO (1.53- 9.69 mg/L), CO_2 (0-28.16 mg/L), PO_4-P (0.0029-0.3000 mg/L) and NO3-N (0.086-0.330 mg/L) were found. Similarly, from total 35 species of phytoplankton observed, 19 were common to uninfested and infested lakes but 16 species were seen only in infested lakes and 12 only in uninfested lakes. Similarly, among the zooplankton rotifers, which are considered the pollution indicators, 10 species were found in infested lakes out of which 4 were common to infested and uninfested lakes, proving the change in biodiversity.

INTRODUCTION

Certain ecological factors of the environment have pronounced influence in determining the habitat. In freshwater bodies nutrients play a major role, as excess of them lead to eutrophication. The macro-phytic vegetation is indicative of the eutrophication status of any water body.

Dense monospecific patches of macrophytes are known to control discharge conditions, regulate carbon and mineral influx, and abundance of invertebrates and fishes (Sand Jenson et al. 1989). Macrophytes exert a multisided effect on the development of the littoral macrozoobenthos. The changes induced in water by macrophytes affect the growth and development of other organisms. The submerged portion of emergent macrophytes and the submerged aquatics may form an enormous substrate for colonization.

Changes in the plant species affect the aquatic vegetation directly and indirectly its associated organisms. These aquatic plants also form an important component of food web. In Thane city out of 15 to 16 existing lakes, few are heavily infested with macrophytes, while others have comparatively clear water due to some remedial measures taken. Some researchers have surveyed these clear lakes for the phytoplankton and zooplankton abundance. However, no survey has been conducted in macrophyte infested lakes. Hence, it was thought to be essential to study the flora and fauna associ- ated with these macrophytes.

MATERIALS AND METHODS

The three lakes namely Ambegosale, Makhmali and Rewale were selected, which show he dominance of three different macrophytes. The water samples from these lakes were collected fortnightly; the data were pooled together and represented seasonally. The physico-chemical analysis of water samples was performed as per the procedures described in the Standard Methods (APHA 1981) and Trivedy and Goel (1984). The samples for phytoplankton and zooplankton were collected and preserved in 4% Lugol's iodine for further analysis. Macrophytes from above three lakes were also noted down.

RESULTS AND DISCUSSION

The data on physico-chemical properties of the three lakes are given in Table 1, while Tables 2, 3, 4 provide the occurrences of macrophytes, phytoplankton and rotifers in these lakes. Aquatic macro-phytes contribute considerable to the productivity of lakes and play an important role in regulation of the metabolism of aquatic ecosystems (Pieczynska 1976, Marshall & Westlake 1978). The macro-phytes increase diurnal variability of ecologically important physico-chemical variables.

The seasonal variation show that the pH of Lake Ambegosale and Lake Rewale was more towards alkaline side than Lake Makhmali. The DO fluctuations in all the three lakes were greatly varied. In Lake Ambegosale, the DO was comparatively higher than other two lakes, i.e. 3.06 to 9.69 mg/L, while in Lake Makhmali it varied from 1.53 to 3.72 mg/L and in Lake Rewale from 2.43 to 7.04 mg/L. In summer The free CO_2 was very low in all the lakes, but in other seasons it was very high, ranging from 12.20 to 28.16 mg/L (except in monsoon in Lake Ambegosale).

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Silicates of all three lakes were comparatively towards higher side. Overall silicates of these lakes were lower in monsoon, but in other seasons fluctuations of silicates were more in Lake Ambegosale and Makhmali than in Rewale. Phosphates were much higher in Lake Ambegosale (ranging from 0.01000-0.3000 mg/L) than other two lakes under study (Makhmali-0.0029-0.0074 mg/L and Rewale 0.0380-0.1840 mg/L). Nitrates were at high range in Makhmali lake (0.150-0.330 mg/L) compared to Lake Ambegosale (0.086-0.160 mg/L) and Lake Rewale (0.085-0.150 mg/L).

Thus, all the three lakes, though situated in nearby localities, show a large variation in the physico- chemical parameters including nutrients. The nutrients from any waterbody decide the type of macro-phytes occurring in them. The macrophytes absorb large quantities of inorganic nutrients for their growth and thereby control the nutrient loading of the waterbody. With decay these contribute to the organic detritus pool.

The macrophytes listed in these lakes are given in Table 2. All the three lakes show the dominance of different macrophytes. Lake Ambegosale is predominantly covered by *Pistia stratiotes* while *Ipomoea aquatica* forms the subdominant group. Makhmali Lake shows predominant infestation of *Eichhornia crassipes* while lake Rewale shows predominant growth of *Lemna minor*.

These macrophytes are found to be widespread in India as observed by Sharma & Singhal (1988), Tripathi (1992), Patil (1996), Salaskar (1998), Dahiya (2000) and Rose (2002).

Macrophytes also compete with phytoplankton for nutrient requirement and their presence may result in change in phytoplankton community. During the present study 28 genera and 35 species of phytoplankton were identified belonging to 4 classes (Table 3). These phytoplankton were compared

Table 1: Physico-chemical parameters of Lake Ambegosale, Lake Makhmali and Lake Rewale.

	Summer			Monsoon			Post Monsoon			Winter		
	A	M	R	A	M	R	A	M	R	A	M	R
pH	8.47	7.77.	7.45	7.98	7.92	8.50	8.71	7.21	8.32	8.16	7.23	7.85
DO	5.51	3.72	2.43	9.69	3.06	5.48	7.98	1.53	6.06	0.06	3.26	7.04
Free Co_2	0.51	0.00	0.44	0.77	14.66	20.60	22.00	28.16	12.20	26.40	12.32	22.45
SiO_2-Si	18.15	19.68	32.80	18.25	03.13	08.14	80.67	49.83	27.00	41.98	86.25	49.85
PO_4-P	0.30	0.003	0.062	0.240	0.005	0.038	0.220	0.007	0.184	0.010	0.007	0.055
NO_3-N	0.160	0.310	0.150	0.086	0.264	0.100	0.090	0.330	0.110	0.102	0.150	0.085

A: Lake Ambegosale; M: Lake Makhmali; R: Lake Rewale. All values are in mg/L except pH.

Table 2:
List of Macrophytes.

No.	Name of plant	Habitat
1.	*Alternanthera spp.*	Anchored
2.	*Amaranthus viridis*	Bank Shrub
3.	*Calliandra spp.*	Bank Shrub
4.	*Chloris spp.*	Bank Weed
5.	*Chorchorus capsularis*	Bank Herb
6.	*Crtrullus*	Climber, Trailer
7.	*Cynodon spp.*	Bank weed
8.	*Eclypta alba*	Bank weed
9.	*Eichhornia crassipes*	Floating
10.	*Euphorbia hirta*	Bank weed
11.	*Ficus religiosa*	Bank tree
12.	*Heliotropium indicum*	Herb on a bank
13.	*Holoptelea integrifolia*	Tree on a bank
14.	*Ipomoea aquatica*	Floating
15.	*Lemna minor*	Floating
16.	*Malachra capitata*	Herb
17.	*Pedalium spp.*	Bank weed
18.	*Pistia stratiotes*	Floating
19.	*Portulaca oleracea*	Trailing herb
20.	*Rhoeo discolor*	Bank herb
21.	*Solanum xanthocarpum*	Bank herb
22.	*Tagetes spp.*	Bank herb
23.	*Urena lobata*	Bank herb

formed on lakes with clear water or uninfested lakes. Out of total genera observed, 19 were common in macrophyte in-fested and uninfested lakes, while 11 were seen only in macrophyte infested lakes during the present study.

Class	Genus	Lake
Chlorophyta	*Chlorella* spp.	A
	Crucigenia spp.	R
	Kirchneriella spp.	A-R
	Monoraphidium spp.	A-R
	Pediastrum tetras	A-M-R
	Pediastrum boryanum	A-M
	Scenedesmus quadricauda	R
	Scenedesmus acuminatus	A-M-R
	Tetrastrum spp.	A
	Koliella spp.	R
	Gonium spp.	A-M
	Spirogyra spp.	M
	Mougetia spp.	R
	Closterium spp.	A-R
Cyanophyta	*Merismopedia* spp.	R
	Microcystis spp.	A-M-R
	Anabaena spiroides	A-M-R
	Spirulina spp.	A-M-R
	Oscillatoria spp.	R
Bacillariophyta	*Cyclorella* spp.	A-R
	Thalassiosira spp.	A-M-R
	Melosira spp.	R
	Fragilaria spp.	A
	Synedra ulna	A-M-R
	Cocconeis spp.	A-M-R
	Navicula spp.	A-M-R
	Nitzschia acicularis	A-M-R
	Nitzschia hungarica	R
	Nitzschia linearis	R
	Nitzschia paradoxa	R
	Gomphonema spp.	R
	Pinnularia spp.	A
Euglenophyta	*Euglena viridus*	A-M-R
	Phacus longicauda	A-M-R
	Phacus pleuronectes	A-M

A-Ambegosale, M-Makhmali, R-Rewale.

Table 4 : List of Rotifers.

Family	Genus	Lake
Philodinidae	*Philodina* sp.	A-M-R
Filinidae	*Filinia* sp.	A-M
Testudinellidae	*Testudinella* sp.	A-R
Synchaetidae	*Polyarthra* sp.	M
Gastropodidae	*Ascomorpha* sp.	M-R
Asplanchnidae	*Asplanchana* sp.	A-M-R
	Harringia sp.	A
Brachionidae	*B. budapestinensis*	R
	B. calyciflorus	A-M-R
	B. diversicornis	M
	B quadridentatus	M
	B. rubens	R
	B. patulus	M
	B. plicatilis	R
	Euchlanis sp.	M
	Keratella sp.	A
Colurinae	*Lapadella* sp.	M-R
Lecaninae	*Lecane* spp.	M-R
	Monostyla sp.	A-M-R

A-Ambegosale, M-Makhmali, R-Rewale.

Palmer (1969) has listed 60 most pollution tolerant genera of phytoplankton (Trivedy & Goel 1984) found in eutrophicated water bodies. Out of the total phytoplank ton found in these three lakes almost all genera are included in this except 6 namely Thalassiosi Kirchneriella, Monora-phidium, Tetrastrum, Koliella and Mougeotia indicating high eutrophicated state of lakes. Class Xanthophyceae and Dinophyceae, which were noted by Somani (2002) in uninfested lake, were not seen during the present study. Thus, the total classes of phytoplankton were found to be less during the present study, proving that the diversity of species reduces in eutrophicated waters. Due to pollution, number of species decreases drastically while the number of few species, which are pollution tolerant, increases (Trivedy & Goel 1984).

The macrophytes provide a food source and refuge for aquatic animals. They harbour microorganisms thereby protecting them from excessive light and predatory enemies besides serving as the primary link of energy transfer in an aquatic ecosystem. Increased butrients in waterbody often results directly in increase in bacterial association with macrophytes which in turn increase the food for zooplankton.

During the present study zooplankton observed were mainly from 4 groups namely Rotifera Cladocera, Copepoda and Ostracoda. However, species diversity was mainly found in group Rotifera with 19 species belonging to 9 genera. In the study of uninfested lakes from Thane, Somani (2002) observed total 10 species belonging to 6 genera, out of which only 4 genera were common in the present study.

Thus, it can be seen that the phytoplankton as well as rotifer population varies in the eutrophic and meso/oligotrophic lakes. The pollution tolerant genera increase in the eutrophic lakes changing the diversity. By regular monitoring of lakes for physico-chemical parameters, flora and fauna of the indicator species can be noted which would help in some remedial measures to be taken (Trivedy & Goel 1984).

ACKNOWLEDGEMENT

The authors are thankful to TMC authorities to allow the collection of water samples. Authors also wish to express their thanks to Principal and staff of Department of Zoology, B N. Bandodkar College of Sceience for their constant encouragement and help.

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