Diversity of aquatic macrophytes from River Mula Pune City, MS, India

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ABSTRACT

The present study deals with the aquatic macrophytes diversity of river Mula from Pune city. Macrophytes were studied during the year October 2007 to September 2008. During present study three different sampling stations were selected, total 74 species of plants were recorded from Mula river flowing through the Pune City. Species among plant, indicative of organic enrichment as *Eichhornia crassipes*, *Pistia stratiotes*, *Alternanthera sessilis*, *Persicaria glabra*, *Cyperus compressus* and *Amaranthus tricolor were* found in large population at station II and III at Mula river. *Eichhornia crassipes* and *Pistia stratiotes* as weeds was predominant at sampling stations which are the most tolerant and could be regarded as pollution tolerant aquatic macrophytes and be used as a biological indicator for water pollution. It indicates that, aquatic macrophytes species are specific to the environmental quality and therefore can be used as agent in bioremediation.

Key words: Aquatic macrophytes, Mula river, biological indicator, diversity, water pollution.

INTRODUCTION

Macrophytes are important component and play a major role in primary productivity of the aquatic ecosystem. Aquatic macrophytes used nutrient and thus influences water quality. It also controls water quality by exuding various organic and mineral components. Aquatic communities reflect anthropogenic influence and are very useful to detect and assess human impacts (Solak *et al*., 2012). Macrophytes are considered as important component of the aquatic ecosystem not only as food source for aquatic invertebrates, but also act as an efficient accumulator of heavy metals (Devlin, 1967; Chung and Jeng, 1974).

Aquatic macrophytes reflect the nutrient status of their immediate habitat by their presence/absence and abundance and thus can be effectively used as biological indicators (Suominen, 1968). Several works relating to aquatic and wetland flora have been carried out by several workers in various parts of the country (Mirashi, 1954; Sen and Chatterjee, 1959; Subramanyam, 1962; Vyas, 1964; Mishra, 1974; Unni, 1971;Singh and Tomar, 1982; Srivastava *et al*., 1987; Billore and vyas, 1981; Biswas and Calder, 1984; Samant *et al*., 1988; Baruah and Baruah 2000; Dhote and Dikxit 2007;Kar and Barbhuiya,2007; Deshkar,2008; Chandra *et al.,* 2008).

In India, increase in population resulting into increase of waste generation, which in turn leads to pollution of aquatic ecosystems. The river Mula is originating in the Western Ghats of Maharashtra. This river flow through the Pune city and hence receives waste.A huge quantity of untreated domestic sewage significantly alters the physico-chemical parameters of its water (Kshirsagar and Gunale, 2011). This influences the biological imbalance both qualitatively and quantitatively.The purpose of present study was to know diversity and the use of aquatic macrophytes as bioindicator to determine the quality of river Mula from Pune.

MATERIALS AND METHODS

Study area and sampling stations

Pune is located 560 m above MSL (180 31' N, 730 51' E) and on the western margin of the Deccan Plateau spread on the banks of the rivers Mula and Mutha. The river Mula originate along the Western Ghats, Maharashtra, India.

The Mula enters in the Pune metropolitan's area near Wakad and it merges with the river Mutha in the Pune city. For present study, Mula river water were collected from three sampling stations between upstream at Wakad and downstream at Dapodi in Pune city on the basis of drainage pattern and activities in its catchment, station I (Wakad), station II (Aundh) and station III (Dapodi) (**Fig.- 1**).

Collection and analysis of aquatic macrophytes

In the present study monthly survey was done by quadrate method was employed by the methods of Raunkaier, (1934) and Stromberg, (1993) for collecting aquatic macrophytes from October 2007-September 2008 at the selected sampling stations I, II and III.The identification of aquatic plants was done with the help of standard books and monographs like, Singh and Karthikeyan (2000 and 2001), Biswas and Calder (1953).The data collected was used to analyse and diversity indices were calculated.

RESULTS AND DISCUSSION

Present investigation was done on three sampling stations of Mula riverThe increase in free CO_2, COD, BOD, chloride, nitrate, phosphate, TH and TA; whereas decrease in concentration of DO at station II and station III as compare to station I indicate increased with discharge of wastewater in river Mula (Kshirsagar and Gunale, 2011; Kshirsagar *et al*., 2012).Of the 74 species of macrophytes found during the present study at Mula river flowing through the Pune City (**Table-1**). Frequently species recorded from sampling stations of river Mula, such as *Acacia nilotica, Cassia marginata, Ficus racemosa, Pongamia pinnata, Persicaria glabra, Phyllanthus reticulates, Thpha angustifolia, Alternanthera sessilis, Amaranthus spinosus, Commelina forsskalaei, Eichhornia crassipes, Lemna perpusilla, Pistia stratiotes, Passiflora foetida etc.*

Fig. 1: Map showing geographical localities of sampling stations (station I, II and III).
Map is only representative and distances are not to the scale

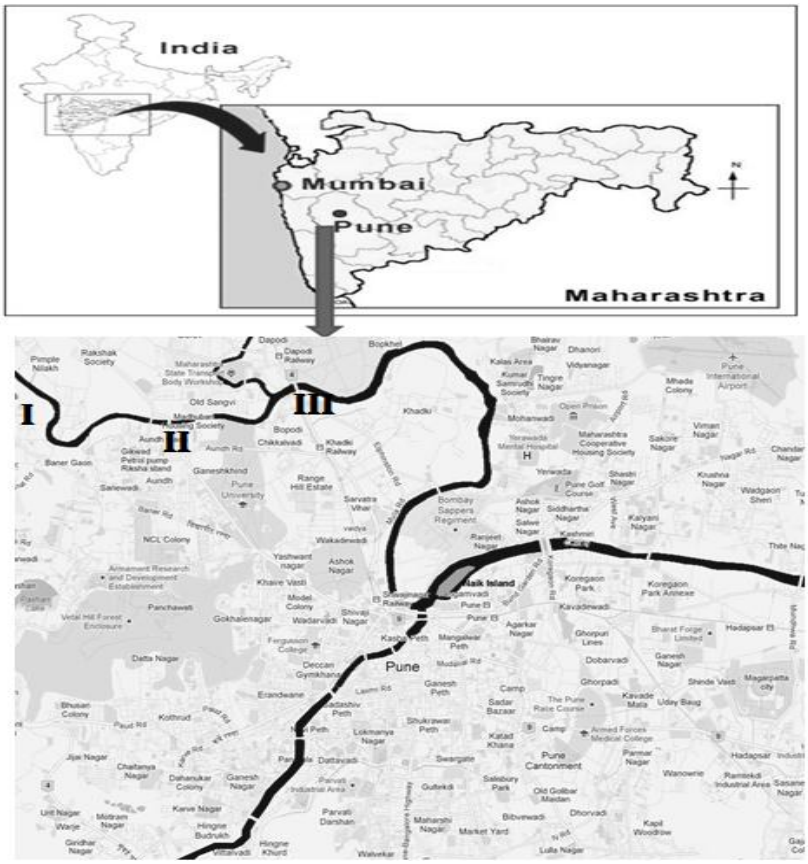
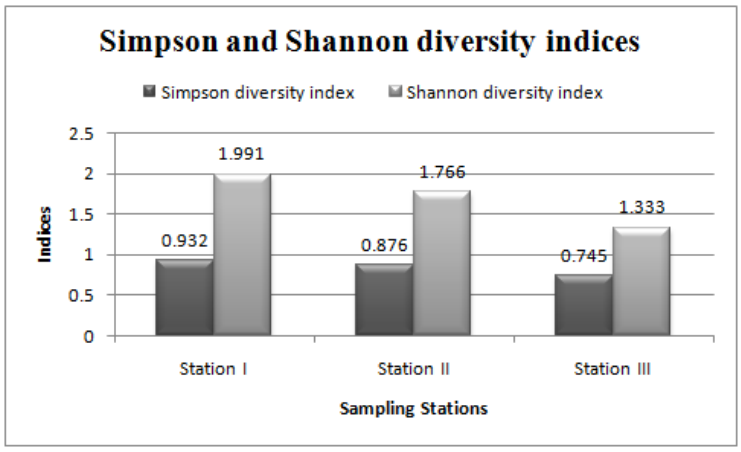


Fig.2: Simpson and Shannon diversity indices in sampling stations (station I, II and III)



The increase in temperature, free CO_2, COD, BOD, chloride, nitrate, phosphate, TH and TA; whereas decrease in concentration of DO at station II and station III as compare to station I (Kshirsagar and Gunale 2011). Upstream station I showed weeds like *Commelina forsskalaei and Ammannia baccifera* is commonly growing plants on the bank of river.As the rivers enter into urban influence, inflow of sewage helps to increase plant nutrients, particularly phosphate and nitrates, thereby increasing growth of plants. The *Eichhornia* is slowly replaced by *Pistia i*ndicating changes in water quality resulting in to change in weed formation *(Jafari and Gunale, 2006).* Species among plant, indicative of organic enrichment are *Eichhornia crassipes, Pistia stratiotes, Lemna perpusilla, Azolla pinnata,* and *Amaranthus spinosus.* These species are also found in large population in downstream stations II and III at Mula river.The macrophytes from stations II and III showed high degree of organic pollution and showed the dominance of *Eichhornia crassipes, Pistia stratiotes* throughout the study, which are considered to be indicators of organic pollution.

On the basis of quantitative estimate, overall species number rank order is station-I>station-II>station-III. The Shannon-Weaver and Simpson indices were calculated for all the ten sampling station. Based on the Shannon-Weaver index the sequence among the stations from highest to lowest diversity, station I>station II>station III (Fig. 2). Station I represented as most diverse, it has highest species richness due to relatively less polluted, whereas station II and III were having the least species Shannon diversity index as a result of highly polluted.Low species diversity is correlated with due to change in water level during summer months. The rank has been changed because Simpson's index is heavily weighted towards the most abundant species in the sample while being less sensitive to species richness (Magurran, 1988). The species having wide range of distribution and abundant in occurrence include *Alternanthera sessilis, Ludwigia octovalvis, Eichhornia crassipes, Pistia stratiotes, Lemna perpusilla, Azolla pinnata, Amaranthus spinosus* etc were spread all over downstream station from Mula river from Pune city.

CONCLUSION

Sampling station I, II and III differ in physico-chemical characteristics. On the basis of quantitative estimate, overall species number rank order is station-I>station-II>station-III. As a result we revealed aquatic macrophytes sensitive to water pollution in the case of river Mula. The dominance ofthe macrophytes from stations II and III showed high degree of organic pollution and showed the dominance of *Eichhornia crassipes, Pistia stratiotes* throughout the study, which are considered to be indicators of organic pollution. As result of present investigation all stations were eutrophic the sequence in descending degree of organic pollution would be station III > station II > station I. This result suggests that the impact on aquatic macrophytes flora and water quality of river Mula from Pune city is due to the discharge of domestic and an industrial waste.

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Table- 1: Aquatic Macrophytes recorded during study period at three sampling stations of Mula river, Pune (October 2007-September 2008).

NAME OF SPECIES	FAMILY	Stations		
		I	II	III
Alternanthera sessilis(L.)R.Br.ex DC	Amaranthaceae	+	+	+
Alternanthera philoxeroides(Mart)Griseb	Amaranthaceae	+	+	_
Acacia nilotica Lam. Wild	Mimosaceae	-	+	-
Acalypha ciliate L	Euphorbiaceae	-	-	+
Albizia lebbeck L.	Mimosaceae	-	+	-
Amaranthus spinosus L.	Amaranthaceae	-	-	+
Amaranthus viridis L.	Amaranthaceae	-	+	+
Amaranthus tricolor L.	Amaranthaceae	-	+	+
Aeschonemene indica L.	Fabaceae	+	-	-
Argemone Maxicana L.	Papaveraceae	+	-	+
Aponogeton natans L.f	Aponogetonaceae	-	-	+
Azolla imbricata Waxai.	Salviniaceae	+	-	-
Azolla filiculoides Lam.	Salviniaceae	+	+	+
Azolla *pinnata* R.Brown .	Salviniaceae	+	+	+
Ammania baccifera L	Lythraceae	+	-	-
Bacopa monnieri (L.) Wettestin	Scrophulariaceae	-	+	-
Brassica juncea L.(Czern.)	Brassicaceae	-	-	+
Cassia marginata Roxb.	Caesalpinaceae	+	-	-
Cassia siamea Lam	Caesalpinaceae	-	+	-
Cassia uniflora Mill.	Caesalpinaceae	+	-	-
Coix aquatica Roxb.	Poaceae	+	-	-
Cyanodon Sp	Poaceae	-	+	-
Commelina benghalensis L.	Commelinaceae	+	+	+
Commelina hasskarlii C.Comm. Cyrt.	Commelinaceae	+	+	-
Cyperus rotundus L.	Cyperaceae	-	+	-
Cyperus difformis L	Cyperaceae	-	+	+
Cyperus sp	Cyperaceae	-	+	-
*Ceratophyllum demersum*L.	Ceratophyllaceae	+	-	-
Cynodon dactylon(L.)Pers.	Poaceae	-	-	+
Cyathocline purpurea(Buch-Ham. ex D.Don)Oktze	Asteraceae	+	-	+
Delonix regia Bojer ex hook	Caesalpinaceae	-	-	+
Datura metal L	Solanaceae	-	-	+
Eupatorium sp	Asteraceae	-	+	-
Eclipta alba (L) Hassk	Asteraceae	-	-	+
*Elaeocharis capitata*R. Br.	Cyperaceae	+	-	-
Eriocaulan cinereum R.BR.	Eriocaulaceae	-	-	-
Echinocloa calonum(L.) Link	Poaceae	-	+	+
Elaeocharis geniculata(L.)R&S.	Cyperaceae	+	-	-
Eichhornia crassipes(Mart.) Solns.	Pontederiaceae	-	+	+
Fimbristylis miliacea Vahl	Cyperaceae	+	+	+
Ficus racemosa L.	Moraceae	+	+	+
*Gomphrena celosioides*Mart.	Amaranthaceae	+	-	-
Grangea maderaspatana L.(Poir)	Asteraceae	+	-	+

Hydrilla verticillata (L. f.) Royle	Hydrocharitaceae	+	-	+
Ipomoea aquatica Forsk	Convolvulaceae	-	-	+
Ipomea carnea Jacq.	Convolvulaceae	-	+	-
Kyllinga tenuifolia Steud.	Cyperaceae	-	-	+
Lemna perpusilla Torrey	Lemnaceae	+	+	+
Lemna minor L.	Lemnaceae	+	+	+
Limnophylla sessiflora L.	Plantaginaceae	-	+	-
Ludwigia parviflora	Onagraceae	+	+	+
Leucas biflora (vahl)R.Br.	Lamiaceae	-	+	-
Marsilea minuta L.	Marsileaceae	+	+	-
Myriophyllum spicatum L.	Holorhagaceae	+	-	-
Najas minor L.	Hydrocharitaceae	+	-	-
Ottellia alismoides (L.) Pers.	Hydrocharitaceae	-	+	-
Pistia stratioides L.	Araceae	-	+	+
Passiflora foetida L	Passifloraceae	+	-	-
Pongamia pinnata L.	Fabaceae	+	+	-
Potamogeton pectinatus L.	Potamogetonaceae	-	+	+
Persicaria glabra (Willd)Gomez	Polygonaceae	-	+	+
Phyllanthus reticulates Poir	Euphorbiaceae	+	+	+
Protulaca oleracea L	Protulaceae	+	-	-
Polygonum glabrum Willd.	Polygonaceae	-	+	-
Panicum perpurascens Raddi.	Poaceae	-	+	+
Parthenium hysterophorus L	Asteraceae	+	-	+
Ricinus communis L	Euphorbiaceae	+	-	-
Sesbania bispinosa(Jacq.)w.t. wight	Fabaceae	-	+	-
Sopubia delphinifolia(L.)G.Don	Scrophulariaceae	+	-	-
Sphaeranthus indicus L.	Asteraceae	+	-	-
Salvinia auriculata (Mitch) Syn.	Salviniaceae	+	-	-
Sida acuta Burm	Malvaceae	-	-	+
Solanum indicum	Solanaceae	-	-	+
Typha anguistata Bory and Chaub.	Typhaceae	+	+	=
Verbascum chinense (L.) Sant	Scrophulariaceae	-	-	+
Vallisneria spiralis L.	Hydrocharitaceae	-	-	+
Wolfia arrhiza Wimm		-	+	-
Xanthium indicum Koen.	Asteraceae	+	+	+
Ziziphus jujube Mill	Rhamnaceae	+	-	+

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