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BIODIVERSITY OF ALGAE IN THE MITHI RIVER- A PILOT STUDY

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ABSTRACT

Biodiversity of Algae was studied from along the stretch of Mithi River, beginning from the Vihar Lake to the Mahim Bay. Six locations were narrowed down from the mouth of the river to the point it meets the sea. The focus has been laid on the presence of micro algae including cyanobacteria. The organisms under study were abundantly present and majorly belonged to the following divisions, Cyanophyta, Chlorophyta, Bacillariophyta, Euglenophyta and Dinoflagellata with varying numbers of their families in different seasons.

Key words: Algae, Biodiversity, Diversity index, Mithi River

1. INTRODUCTION

Algae are a group of organisms which bear chlorophyll. They exist in different sizes and shapes. They are important members of the plant world and several of them are significant to man in many ways. They are capable of fixing nitrogen and also in assimilation of carbon. Tropical conditions as the one existing in India are favourable for their growth. In a group or the mat form they could be visually unappealing but they occur in beautiful forms when observed microscopically. They are very useful pollution indicators. An increase in nitrates and phosphorus that is discharged in industrial or domestic wastewaters gives rise to a luxuriant growth of algae, thus playing a very important role as a pollution indicator. The occurrence of algae could vary at different locations due to change in seasons or the amount of pollutants let out through the different sources. Algae are effective bioremediators, they are known to tolerate and bring down metal pollution to some extent; *Nodularia sp*., *Oscillatoria sp*., *Cladophora sp*., Hormidium sp., *Fucus sp*. and *Laminaria sp*., etc., occur in metal-rich waters. These algal forms are probably more capable of combating the toxic levels of heavy metals and this attribute is a result of physiological and/or genetic adaptations, (Rai, et al; 1981). Besides, they offer a great potential tool as organisms for the biotechnological interest such as mariculture, food, feed, fuel, fertilizer and medicine (Borowitzka,1988; Kannaiyan, 1985; Prabaharan, and Subramanian, 1995; Subramanian, and Uma, 1996; Venkataraman, 1981; Venkataraman, 1983). Fresh water algae have been studied recently by researchers to elaborate the characteristics of different water bodies (Mahadik and Jadhav, 2014; Priya Gopinath and Ajit Kumar 2015;Shankaran and Thiruneelagandan,2015).

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The present work was carried out with an objective to understand and give a baseline data on the presence different dominant algal families that were present commonly in most of the locations, throughout the year, based on which specialized studies can be carried out.

2. MATERIALS AND METHODS

2.1 Area Of Study

The Mithi River flows through the suburbs of Mumbai. It originates through the overflow of Vihar Lake and Powai Lake close to the Sanjay Gandhi National park. Due to heavy population and industrialization, the banks of the river has been encroached upon by people, reclaimed and modified for development by authorities and has become a source to empty the pollutants into it through point sources or non-point sources. The river has a steep flow upstream, but due to reclamation and exploitation of the river banks, it is rather flattened downstream resulting in accessibility to dump in wastes and thus accumulation of pollutants until its pushed forwards to the bay where it ends its journey. The Mithi River empties into the Arabian Sea. At its origin, it is not more than 10 Kms. from the Arabian Sea. The area is within latitude 19^o 00' to 19^o 15' and longitude 72^o 45' to 73^o.00' E is covered in the water shed of Mithi River (NEERI, 2011).

2.2 Collection Of Samples

The study was conducted for a period of one year from June 2013 to May 2014. The samples were collected from 6 stations along the river. The collection locations were narrowed down on basis of their accessibility and distance from the previous location. The water was collected using glass wares that were thoroughly cleaned and rinsed in distilled water; they were also dry sterilized at 160^0 C for 2 hours in a hot air oven before use. The samples were fixed in 4% formalin and brought to the laboratory immediately for further analysis.

2.3 Enrichment

The water sample was not treated with any enrichment media. The algae were allowed to grow in the original water samples. The flasks were shaken well using a rotary shaker and incubated with temperature maintained at 29 $\pm 1^o$C. Illumination was provided using cool fluorescent lamps (40 W).

2.4 Incubation And Observation Of Algae

The samples were incubated till the appearance of good growth.The algal samples was observed under high magnification using binocular microscope (Labomed LP-Plan Achro and Labomed SP-Achro). Identification of taxa was restricted to true filaments of green and blue-green algae. The algae were identified based on monographs (APHA, 2005; Prescott, 1964; Desikachary, 1959).

2.5 Occurrence Pattern

The abundance pattern of microalgae was marked in the field of view. Five fields were observed for each of the three replicates. Each time the algae was observed and noted. The frequency of occurrence of a particular division at different locations was analyzed. Mean values of the samples occurring frequently from all the stations was taken and then calculated with Simpsons Index (D) and Shannon- Weiner diversity Index (H) to check the abundance of the algal population and occurrence of the number of families of the divisions of algae in different seasons respectively.

2.6 Diversity Indices

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a. Simpson Diversity Index

The diversity index was derived by Simpson in 1949. The values are between 0-1. However the final result is subtracted by 1 to correct the inverse proportion (Simpson, 1949).

It is denoted by,

$D = N (N-1) \sum n (n-1)$

D = Diversity index

N = Total number of organisms in the community

n = Number of individual in each species

b. Shannon Wiener Diversity Index

The index is applied to biological systems especially when diversity studies are taken up. It was derived by Shannon in 1948 from a mathematical formula. The values are between 1.5 and 4.0 (Mandavile, 2002).

It is denoted Shannon-Wiener Index denoted by $H = -\sum [(pi) \times \ln(pi)]$

H= Diversity index

pi = proportion of total sample represented by species i.

3. RESULTS AND DISCUSSION

Abundance and occurrence in the diversity of algae belonging to the different divisions were observed along the Mithi River. The most abundant division was chlorophyta throughout the different seasons (Figure 1, 2 and 3). Similar observations were also noted in other water bodies (Shrivatava et.al.2014; Mahadik and Jadhav, 2014). The most frequent genera among chlorophyta were *scenedesmus, microcystis* and *chlorella*. The occurrence of the different families under their respective divisions in a comparative format is given in (Table 1).

The different small scale industries and outlets of pollutants change the physico chemical characteristics of the water making it favorable for some and unfavorable to different algal communities. Pollutants in unchecked amount are emptied into the Mithi River each day. It is loaded with pollutants and treated as an open drain (NEERI, 2011).The seasons have an impact on lotic water bodies since it changes the parameters of water during the different seasons. In any ecosystem, not a single species grows independently and indefinitely, because all the species are interlinked and has cyclic transformation of nutrients (Makandar and Bhatnagar, 2010)

The families under chlorophyta, cyanophyta, bacillariophyta and euglenophyta appear in all three seasons. Dinoflagellates have been abundant during monsoon (Table.2).The Shannon- wieners index characterizes the diversity in the algae at different seasons. The values infer higher diversity during winters, followed by monsoon and summer. The Simpson's index shows the abundance of algal diversity throughout all the three seasons irrespective of the different types (Table.3).

A total of four dominant divisions of algae were found in the Mithi River. It unfolds the abundance of life in the river. The study of biodiversity of algae in the water body forms the base of a food chain. Studies carried over various water bodies shows differences in the dominance of the algal divisions (Makandar and Bhatnagar, 2010; Rajurkar and Dalal,

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2014). In the current study, the diversity amongst the algal division is high, but the overall occurrence of algae in different seasons does not show much difference.

FIGURES AND TABLES

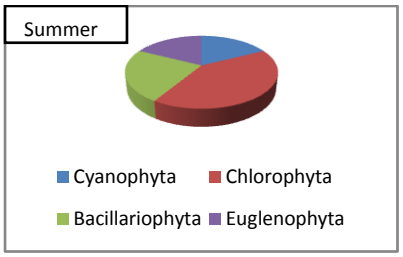

Fig1.Algal diversity- Summer

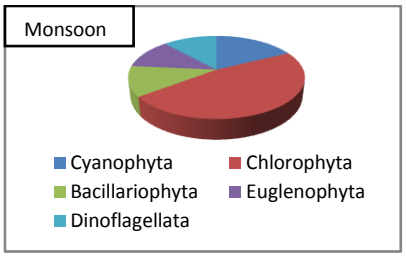

Fig 2. Algal diversity-Monsoon

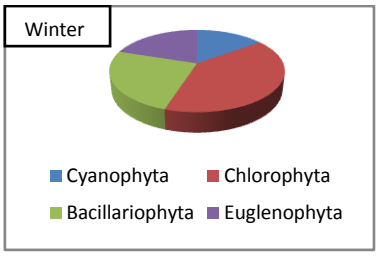

Fig.3 Algal diversity- Winter

Table 1. Occurrence of algal divisions in various seasons.

No. of families in the given division/ Seasons	Cyanophyta	Chlorophyta	Bacillariophyta	Euglenophyta	Dinoflagellata
Summer	3	7	4	3	-
Monsoon	3	8	2	2	2
Winter	3	8	5	4	-

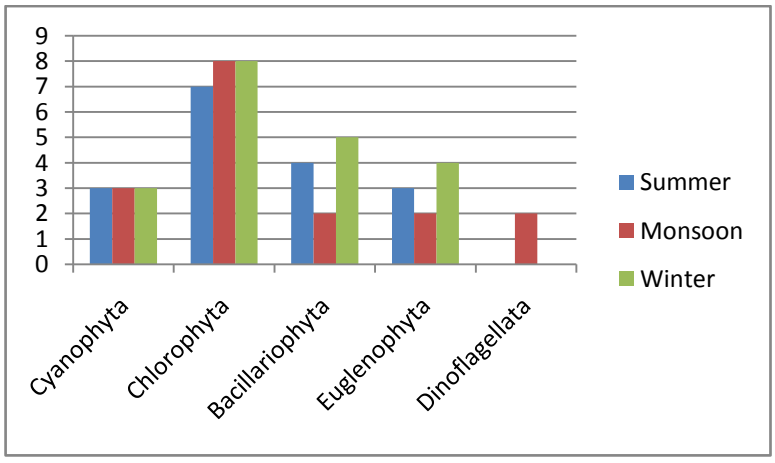

Fig 4: Variations of the occurrence of algae in different seasons.

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Table 2. Occurrence of algae with respect to seasons using Simpson's diversity index and Shannon- Weiner diversity index.

MAJOR DIVISION SHOWING THE NO.OF FAMILIES	SEASONS		
	SUMMER	MONSOON	WINTER
CYANOPHYTA	3	3	3
CHLOROPHYTA	7	8	8
BACILLARIOPHYTA	4	2	5
EUGLENOPHYTA	3	2	4
DINOFLAGELATA	-	2	-
SIMPSONS DIVERSITY INDEX	0.8	0.7	0.8
SHANNON WIENER DIVERSITY INDEX	1.29	1.37	2.99

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