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RESEARCH ARTICLE

STUDIES ON PHYTOPLANKTON POPULATION AND SPECIES DIVERSITY IN THREE WETLANDS OF COIMBATORE, TAMIL NADU, INDIA

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ABSTRACT

The present study concerns monthly variations of phytoplankton species composition, population density, species diversity during September 2012 to March 2013 in Ukkadam, Kuruchi and Singanallur Lakes Coimbatore, Tamil Nadu, India. The total of 20 (Ukkadam Lake), 34 (Kuruchi Lake) and 26 genera (Siganallur Lake) were identified under phytoplankton diversity in studied three lakes. Present study revealed maximum species composition of Chlorophyceae (15 species), Bacillariophyceae (12 species) and Euglenophyceae (6 species) were recorded at Kuruchi Lake. When compared genera wise, Euglenophyceae group were rarely found in both Ukkadam Lake and Singanallur Lake during the study period, it was indicated that these lakes were polluted by organic components. The present baseline information of the phytoplankton distribution and abundance would form a useful tool for further ecological assessment and monitoring of these lakes of Coimbatore.

INTRODUCTION

Wetlands are major resource of fresh water and it was very essential part of human life, mainly for drinking and domestic purposes. The rapid increasing of human population and industrialization has created problems of disposal of waste water products. The undesirable and toxic substances are regularly discharged into the wetlands through surface run of that degrades the water quality (Lawson *et al*., 2011). This Environmental disturbance can induce changes in biological systems and it was reflecting the occurrence, distribution and diversity of biotic communities (Radhakrishnan and Sugumaran, 2010). Phytoplanktons are microscopic unicellular aquatic plants and it was converts solar radient energy into biological energy through photosynthesis. This energy is transferred to higher organisms through food chain (Tiwari and Chauhan, 2006; Shashi Shekher *et al*., 2008). Apart from the primary production, these play an important role in the climate changes and regulating the atmospheric level of O_2 and CO_2, vital gases for life. Without phytoplankton there would be no life to speak of in any aquatic environment (Shinde *et al*., 2011). The study of phytoplankton abundance and diversity of fresh water ecosystems are good indicator for pollution of lake environments. Many studies have highlighted the significance of the torphic relationship between zooplankton and phytoplankton in aquatic ecosystems. Noor Alam (2001) reported that due to rising of human population the per capita water needs increased to a great extent. The lentic water sources such as ponds, tanks, lakes, situated near human settlements are getting polluted as they constantly receive solid and liquid wastes. Limnological studies of such water bodies reveal interaction of parameters influencing the productivity of aquatic ecosystems as was stated by Ganapati (1941), Das (1961), Musharaf Ali and Khan (1985), and Balkhi *et al*. (1987).

Coimbatore is an important industrial city of India, ranking 11th in terms of population. It is located in Tamil Nadu with a latitude of 10° 55' and 11°10'N, and longitude of 77°10' and 76° 50'E at an approximate altitude of 333 m. There are more than 30,000 small, medium and large industries including textile mills and foundries in the city employing about 40% of the population. The growing industrial sector and ensuring immigration of people pose heavy burden on the city infrastructure that did not grow in proportion. Till date no integrated sewage system is in operation in the city. The city does not have facilities for treatment of industrial, municipal, domestic and hospital wastes. The prevailing drainage and sewage are of open type joining the lakes, wetlands and the river Noyyal without appropriate treatment (Ezhili *et al*., 2013). Moreover, this lake water has been used as irrigation

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purposes for agricultural and fish culturing by local farmers. Little information is available about phytoplankton in eutrophication of aquatic ecosystems. Therefore, the present investigation is aimed to study the abundance and diversity of phytoplankton community in water of selected three lakes namely Ukkadam Lake, Kuruchi Lake and Singanallur Lake of Coimbatore city, India.

MATERIALS AND METHODS

Description of the study areas

Coimbatore city is surrounded with a number of wetlands and they were the important sources of water for drinking and irrigation. These wetlands are presently deteriorated and cannot be used as a source of drinking water. Therefore, in this study three lakes were selected namely Ukkadam Lake, Kuruchi Lake and Singanallur Lake in Coimbatore city and investigated the abundance and diversity of phytoplankton community.

1. Ukkadam lake

The Ukkadam lake is situated between latitude of 100 59' 05.9", longitude of 760 57' 22. 1". Catchments free area is 10. 752 sq. km. Water spread area is 12. 95 sq. m. Number of slices are 4 and capacity is 1.970m. Lowest sill level is 10.64 m. Registered Ayacut area is 14.25 acres. Maximum flood discharge is 62.88m^3 / sec and the depth is 12.75 feet.

2. Kuruchi Lake

The second study site, the Kuruchi wetland has a water spread area of 343.96 acres and holds the least water storage capacity because of its shallowness. In the tank, 9.50 acres is encroached by about 200 huts on the bund and 274 abutting the channels. This wetland receives municipal sewage and is a site for dumping garbage from inhabitations around its vicinity.

3. Singanallur Lake

The third study site, the Singanallur Lake is highly affected by eutrophication and is almost filled up with *Eichhornia crassipes*. Although *Eichhornia crassipes* is praised for its ability to sequester nutrients and other chemicals from water, it is considered undesirable for wetlands. It is located within the geographical coordinates of 10° 56'46'' latitude and 77°01' 11'' longitude. The lake is divided into two equal halves, but connected by a railway line running through it. South part of the lake mainly received freshwater only during the rainy season from the Noyyal River and north part of lake receives industrial waste water, domestic sewage and urban soiled wastes (Shanthi *et al*., 2003).

Sample collection

Water samples were collected monthly (September 2012 to March 2013) from three sampling stations at an interval of 500 m from each lake. Water samples were collected in pre cleaned plastic bottles and labeled. The samples for plankton analysis were collected early in the morning before 6. 00 am by plankton net of silk bolting cloth size of 25 µ and preserved in Lugol's Iodine for phytoplankton analysis. Identification of the specimens was carried with the help of standard woks of Subrahmaniyan (1946), Prescott (1954), Steidinger and Williams (1970).

Quantitative analysis

For quantitative estimation of plankton 50 liters of water was filtered through the plankton net and was concentrated in the centrifuge. The plankton samples were counted as per the methods of Lackey (1938).

RESULTS AND DISCUSSION

Monthly variations in phytoplankton species composition, population density, species diversity were documented from September 2012 to March 2013 at all the three lakes. In the present study, the population density of phytoplankton in all the three lakes varied totally 20 to 34 respectively, were recorded in during the studied months (Table 1, 2 and 3). When compared lake wise, abundance the highest value was recorded in Kuruchi Lake which was more in December 2012 and less in the same lake during March 2013.

Chlorophyecae

Chlorophyceae as categorized the second highest genera among phytoplankton group (Khenari, 2010). The present finding shows that 38 species were identified in all the three lakes. The maximum (15 specie) was recorded in Kuruchi Lake compared to other two lakes. In the same lake the Chlorophyceae population density was higher in October 2012 and lower in February 2013 (Table 1, 2 and 3). Shukla *et al*., (2013) was reported that the total of 42 genera and species of phytoplankton belonging to five groups of algae has been observed in the Maheshara Lake during the study period. Out of 48 species, 16 species are belonging to Chlorophyceae 02 species of Cyanophyceae, 14 species of Bacillariophyceae, 01 species of Euglenophyceae and 02 species of Dinophyceae.

Bacillariophyceae

Bacillariophyceae was the most dominated group of phytoplankton in respect of abundance and number of species. In this investigation 30 species were identified in all the studied lakes. A totally 9 species were recorded in Ukkadam Lake and Singanallur Lake. The maximum (12 species) Bacillariophyceae abundance was showed in Kuruchi Lake. Saravanakumar *et al*., (2008) studied that totally 104 species of phytoplankton were identified in sites along the western mangrove of Kachchi. Among them 82 species diatoms (Bacillariophyceae), 16 species dinoflagellates (Dinophyceae), 3 species blue greens (Cyanophyceae) and 2 species were green algae.

Euglenophyceae

Euglenophyceae was the least dominant group of phytoplankton in respect of abundance. This group was rarely

Table 1. Monthly variations and Phytoplankton population in Ukkadam Lake from September 2012 to March 2013

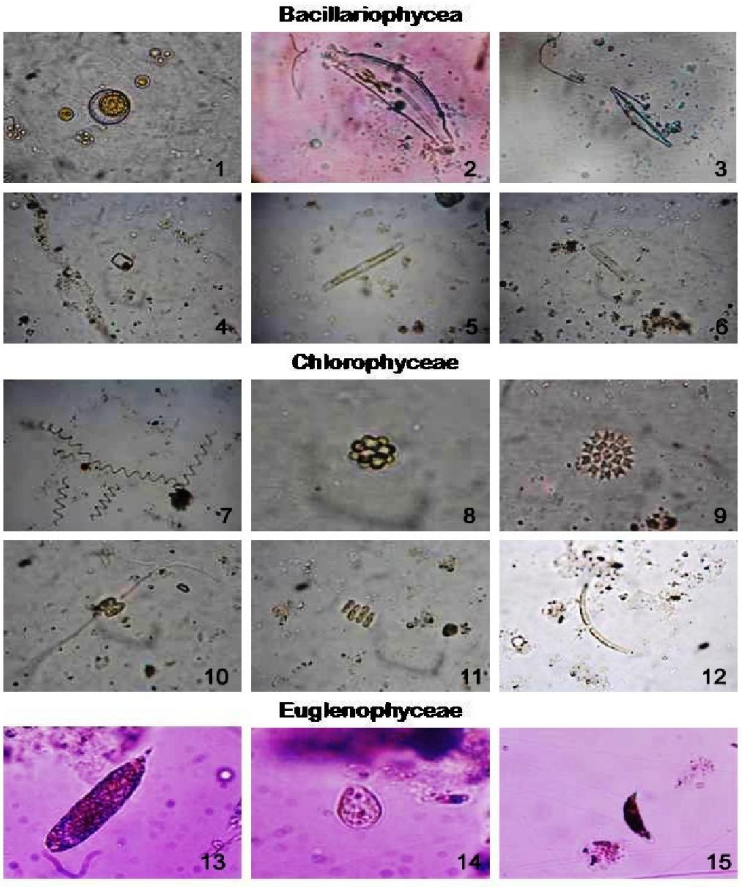
Phytoplankton	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Chlorophyceae							
Scenedesmus quadricau	4	1	2	1	2	-	1
Scenedesmus obliqus	2	2	1	1	1	1	-
Closterium	-	-	5	3	1	1	1
Selenastrum	-	-	1	2	2	1	-
Ankistrodesmus	1	1	2	1	-	1	1
Pediastrum	2	1	1	2	1	-	-
Coccochloris aerugino	3	5	4	1	2	1	1
Agmenellum thermale	-	2	-	1	-	1	1
Anacystis Montana	5	3	-	1	1	-	-
Chlamydonanas	2	6	-	1	1	2	1
Bacillariophyceae							
Nitzschia palea	2	1	3	2	-	1	-
Cyclotella meneghiana	5	4	9	5	2	2	1
Cyclotella hyalodiscus	3	5	6	3	2	1	-
Cyclotella girdie	3	2	7	4	1	-	1
Asterionella	-	-	1	-	1	1	1
Meridion	-	-	2	1	-	1	-
Synedra	1	2	3	2	2	-	-
Pinnularia gibha	-	-	1	1	-	1	1
Navicula	1	4	2	1	-	-	-
Euglenophyceae							
E. gracilis	1	1	-	-	-	1	1

Table 2. Monthly variations and Phytoplankton population in Kuruchi Lake from September 2012 to March 2013

Phytoplankton	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Chlorophyceae							
Scenedesmus quadricau	4	1	2	1	-	-	-
Scendesmus denticulatus	-	-	-	3	1	-	1
Scenedesmus obliqus	2	2	1	-	1	1	-
Closterium dianae	-	-	5	3	1	1	1
Closterium cambricum	-	-	-	2	1	-	1
Selenastrum	-	-	1	1	-	-	1
Ankistrodesmus	1	1	2	1	1	2	2
Pediastrum	2	1	1	1	-	-	-
Coccochloris aerugino	3	5	4	2	1	1	-
Agmenellum thermal	-	2	-	-	-	1	1
Anacystis Montana	5	3	-	1	1	-	-
Chlamydonanas	2	6	-	1	-	1	1
Cymbella turgid	-	-	-	-	2	-	3
Desmidium	-	-	-	1	1	-	1
Chroococcus	1	1	-	-	-	1	1
Bacillariophyceae							
Nitzschia palea	2	1	3	1	1	-	-
Cyclotella meneghiana	5	4	9	1	1	1	1
Cyclotella hyalodiscus	3	5	6	2	-	-	1
Cyclotella girdie	3	2	7	4	2	1	1
Asterionella	-	-	1	1	1	-	1
Meridion	-	-	2	1	1	-	-
Synedra	1	2	3	1	-	1	1
Pinnularia gibha	-	-	1	1	1	-	1
Navicula	1	4	2	-	1	2	1
Staurastrum gracile	2	2	1	1	-	-	-
Staurastrum convolutum	1	1	1	2	1	1	1
Staurastrum bieneanum	-	-	2	1	-	1	2
Euglenophyceae							
E. gracilis	1	1	1	-	-	2	1
E. spirogyra	3	1	1	1	-	1	-
E. van goori	1	-	-	-	1	1	-
Pbacus agilis	1	1	-	-	1	-	-
Tracbelomonas volvocina	-	-	-	2	1	-	1
E. polymorpba	1	-	2	1	2	2	1

Table 3. Monthly variations and Phytoplankton population in Singanallur Lake from September 2012 to March 2013

Phytoplankton	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Chlorophyceae							
Scenedesmus quadricau	4	1	2	1	3	2	-
Scenedesmus obliqus	2	2	1	-	1	1	1
Closterium	-	-	5	2	2	1	-
Selenastrum	-	-	1	3	1	1	-
Ankistrodesmus	1	1	2	1	1	-	1
Pediastrum	2	1	1	2	1	2	1
Spiralina	-	-	-	26	30	12	8
Coccochloris aerugino	3	5	4	1	1	1	-
Agmenellum thermal	-	2	-	1	1	-	1
Anacystis Montana	5	3	-	-	1	1	1
Chlamydonanas	2	6	-	4	1	1	1
Cosmarium phaseolus	-	-	-	3	1	2	-
Coelastrum microporums	-	-	-	3	2	3	1
Bacillariophyceae							
Nitzschia palea	2	1	3	2	1	1	1
Cyclotella meneghiana	5	4	9	4	2	-	-
Cyclotella hyalodiscus	3	5	6	3	1	1	1
Cyclotella girdie	3	2	7	2	2	-	1
Asterionella	-	-	1	3	1	1	2
Meridion	-	-	2	1	1	1	-
Synedra	1	2	3	2	2	1	1
Pinnularia gibha	-	-	1	1	2	1	-
Navicula	1	4	2	2	3	1	1
Euglenophyceae							
E. spirogyra	4	1	2	1	1	1	1
E. van goori	2	2	1	1	-	-	1
Pbacus agilis	1	1	-	-	-	1	1



1. Cyclotella meneghiana, 2. Cymbella, 3. Navicula halophila, 4. Cyclotella 5. Pinnularia gibba , 6. Caloneis bacillum, 7. Arthospira platensis , 8. Coelastrum microporums, 9. Pediastrum, 10. Scenedesmus obliqus, 11. Scenedesmus quadricau, 12. Closterium, 13. Euglena polymorpba, 14. Pbacus agilis and 15. Euglena spirogyra

Fig.1. phytoplankton photos of studied Lakes for the period of September 2012 to March 2013

found in both Ukkadam Lake and Singanallur Lake during the study period. However, the 6 species was recorded in Kuruchi Lake. A similar result was reported by Shukla *et al*., (2013). Euglenophyta species were very view in a number (3 species respectively) and their percent age composition value was low 2.85% respectively in Euphrates River, as also stated by Salman *et al*. (2013).

Conclusion

From this study, it was concluded that the distribution of phytoplankton abundance and diversity was higher in Kuruchi Lake compared to other two lakes, which indicates that these might be polluted by organic substances. The results reveal the need for essential regular monitoring in order to safeguard the health of these lakes. If alternate disposal systems are not adopted in near future, the pollution load will jeopardize the ecological balance completely.

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