© 2017 IJSRST | Volume 3 | Issue 8 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Monitoring water body: Seasonal variations in Density and Species Richness of Euglenophyta of Yashwant Lake,Toranmal (M.S.) India

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ABSTRACT

The density of Euglenophyta shows significant seasonal variations, it was maximum in post-monsoon, while it was minimum in winter. Maximum species richness of Euglenophyta was recorded in postmonsoon, while minimum species richness was recorded in summer at Yashwant lake Toranmal. The Euglenophyta structure depends on a variety of environmental factors that include biotic as well as various abiotic factors. The Pearson correlation was calculated by keeping Euglenophyta as dependent variable while biotic and abiotic factors as independent variables.
Keywords: Toranmal, Euglenophyta, Seasonal variation, density, species richness, correlation, abiotic factors.

I. INTRODUCTION

The dominant genera in algal groups change not only spatially (vertically and horizontally within a lake) but also seasonally in response to seasonal changes in physical, chemical and biological conditions of the water body. Hence a general pattern of seasonal succession of phytoplankton of many lakes has been correlated with environmental factors. The precise reasons for many of these changes are not well known (Wetzel, 2001). These seasonally changing microhabitats, influence the phytoplankton communities seasonally. Hence, the study of phytoplankton distribution is important in understanding the ecology (because they are important source of fish diet) and their role as pollution indicator, as they project the trophic status of the water body (Naik and Neelkanthan, 1990).

The euglenophyta is the fifth and relatively smaller group of aquatic form occuring in the Yashwant Lake. When conditions are favourable, the euglenoids develop great profusion. Almost all of them are unicellular, lack a distinct cell wall and possess one, two or three flagella that arise from an invagination in the cell membrane. Most of euglenoids are pigmented. The unpigmented euglenoids are able to ingest solid particles (phagotrophic) and are treated as Protozoa. The pigmented ones are photosynthetic and facultatively heterotropic (Wetzel, 2001). This free swimming microalgal group of wide geographical distribution is found worldwide, occurring predominantly in small freshwater bodies, with high organic content (Round, 1985; Wetzel, 2001; Sandra et al., 2007). Several species are known as indicators of organically polluted environments (Kaur et al., 2001; Tiwari and Chauhan, 2006; Hafsa and Gupta, 2009; Nandan and Mahajan, 2003). Due to the significance of the euglenophyta as organic pollution indicator it is essential to document the information about them with their environmental preferences.

II. MATERIAL AND METHODS

The plankton (both phytoplankton and zooplankton) along the periphery of Yashwant lake were collected during each biweekly visit at the three stations namely YLA, YLB and YLC. Ten litres of water was filtered through the plankton net No. 25 of bolting silk with mesh size 64 micron. Net was washed with the water by inverting it to collect the plankton attached to the net and the volume of sample was made to 100 ml. The samples were taken in separate vials and fixed in the field with 1 ml of 4 % formalin and 1 ml of Lugol's Iodine at the collection site. 10 ml of sample from each station was

further concentrated by centrifuging at 2000 RPM for 10 min. For quantitative estimation of plankton, one ml well mixed sample was taken on 'Sedgewick Rafter Cell'. To calculate density of plankton the averages of 5 to 10 counts were made for each sample and the results are expressed as numbers of organisms per litres of sample. Qualitative study of phytoplankton and zooplankton were carried out upto the genus/species level using the standard keys given by Edmondson (1963), Philipose (1967), Sarode and Kamat (1984), Battish (1992) and APHA (1998). Hence, species richness of each group of plankton is considered as number of species of each group observed per visit. The number of species present in a region may be considered as its 'species richness' a frequently used measure. Species richness can be correlated positively with some measures of ecological diversity (Hurlbert, 1971).

The data of the two years (from December-2006 to November-2008) was pooled and separated for three months and analysed for seasonal variations, with respect to winter (December, January, February), Summer (March, April, May), Monsoon (June, July, August) and Postmonsoon (September, October, November). Further, the Mean, Standard Error of Mean (SEM) and One-Way ANOVA with No post test for various parameters for four seasons was performed using Graph Pad Prism version 3.00 for Windows (Graph Pad Software, San Diego California USA). The correlation between the abiotic factors and the plankton density was calculated. The Pearson correlation was calculated by keeping plankton as dependent variable and other biotic factors as independent variables with the help of SPSS 7.5 for Windows.

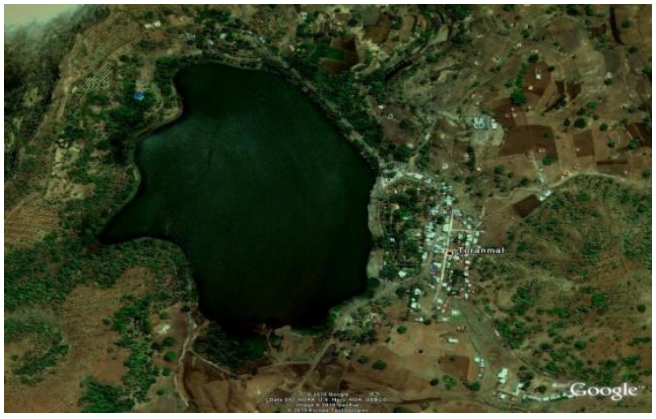

Figure 1. Google satellite image of Yashwant lake

III. RESULTS AND DISCUSSION

The abundance of Euglenophyta was poorest. Its biannual percentage densities were 3.34, 3.7 and 2.95 % at YLA, YLB and YLC respectively.

The densities of euglenophyta (Table 1) were low at YLA with 45 ± 10 ind./L in winter, 42.50 ± 5.7 ind./L in summer, 53 ± 10.89 ind./L in monsoon but increased significantly in postmonsoon to 214.3 ± 15.69 ind./L. At YLB it was low at 35.17 ± 2.4 ind./L during winter and 57.5 ± 6.24 ind./L in summer but increased to 133.8 ± 2.84 ind./L in monsoon and was highest 205 ± 11.50 ind./L in post monsoon. However, at YLC it increased from 38.33 ± 1.97 ind./L of winter to 50.17 ± 1.16 ind./L of summer and 94.50 ± 15.39 ind./L of monsoon reaching maximum 186.8 ± 12.23 ind./L in postmonsoon with significant variations at $P < 0.0001$.

Biannual percentage species richness of Euglenophyta were 6.07, 5.45 and 4.07 % at YLA, YLB and YLC respectively Maximum species richness was observed in postmonsoon with 2.8 ± 0.2, 2 ± 0 and 1.7 ± 0.2 respectively (Table.1). It was 1 ± 0.2 to 1.33 ± 0.21and 1.16 ± 0.16 at the three stations in winter, while minimum 0.7 ± 0.2, 1 ± 0 and 0.8 ± 0.2 in summer. It increased in monsoon to 1.3 ± 0.2, 1.3 ± 0.2 and 1 ± 0 at YLA, YLB and YLC respectively.

Table1. Seasonal Variations in density and species richness of Euglenophyta (ind./L) at YLA, YLB and YLC of Yashwant Lake during December 2006 to November 2008

Parameters	Stations with F value	Winter	Summer	Monsoon	Postmonsoon
Eugle. Density.	YLA $F_{3\ 20}$ 63.80	45 ± 10.4	42.50 ± 5.784	53 ± 10.89	214.3 ± 15.69
	YLB $F_{3\ 20}$ 88.79	35.17 ± 2.04	57.50 ± 6.24	133.8 ± 2.84	205 ± 11.50
	YLC $F_{3\ 20}$ 46.39	38.33 ± 1.97	50.17 ± 1.167	94.50 ± 15.39	186.8 ± 12.23

Eugle. Species Richness	YLA $F_{3\ 20}$ 19.95	1.0 ± 0.25	0.66 ± 0.21	1.33 ± 0.21	2.83 ± 0.16
	YLB $F_{3\ 20}$ 7.91	1.33 ± 0.21	1.0 ± 0.0	1.33 ± 0.21	2.0 ± 0.0
	YLC $F_{3\ 20}$ 5.18	1.16 ± 0.16	0.83 ± 0.16	1.0 ± 0.0	1.66 ± 0.21

Table 2. Pearson correlation of Euglenophyta density with Biotic and Abiotic parameters of Yashwant Lake during December 2006 to November 2008

Sr. No.	Parameter	YLA	YLB	YLC
1	Ambient Temp (AT)	-.506*	0.204	-0.395
2	Water Temp (WT)	-.529**	0.035	-.555**
3	Water Cover (WC)	.617**	.426*	.667**
4	Total Solids (TS)	-.622**	0.091	-0.397
5	Total Suspended Solids (TSS)	-0.037	.557**	0.291
6	Total Dissolved Solids (TDS)	-.776**	-0.315	-.722**
7	Transparency	0.344	-.673**	-0.021
8	Acidity	-.744**	-0.22	-.729**
9	Alkalinity	-.731**	-0.257	-.731**
10	Carbon Dioxide (CO_2)	-.520**	0.25	-0.329
11	Dissolved Oxygen (DO)	0.259	-0.289	0.198
12	Chloride	-.729**	-0.395	-.755**
13	Total Hardness (TH)	-0.047	-.581**	-.418*
14	pH	-.540**	-0.061	-.531**
15	NO_2^-	-.434*	.483*	-0.021
16	NO_3^-	-0.083	.540**	0.271
17	PO_4^{-3}	-.456*	.419*	-0.234
18	Total Density Of Zooplankton (TDZ)	-.729**	-0.305	-.763**
19	Total Density of Mollusc (TDM)	0.29	.913**	.538**
20	Total Density of Birds (TDB)	.536**	-0.35	0.27

** The pearson correlation is significant at the 0.01 level (two tailed)

*The pearson correlation is significant at the 0.05 level (two tailed)

Euglenophyta has been considered a significant group in the study of the phycological flora. However, studies concerning both the occurrence of euglenophyta and environmental variables are still scarce (Philipose, 1982). In the present study of Yashwant Lake the abundance of euglenoids showed seasonal variation attributed to temporal variation in physico-chemical parameters. Maximum density of euglenophyta was recorded in post-monsoon, as is also reported by Hafsa and Gupta (2009). As asserted by Round, (1985), Euglenophyta are algal characteristic of environments rich in ammonia. The values of nitrate were also maximum to moderate in monsoon and postmonsoon respectively at Yashwant Lake. According to Duttagupta *et al*., (2004); Bhuiyan and Gupta (2007) and (Munnawar, 1970a,b) Iron, Calcium and Magnesium play a great role in stimulating and maintaining Euglena blooms. Drastic reduction in the population of euglenophyta in winter has been attributed to the use up of essential nutrients during their bloom and bust period in postmonsoon (Duttagupta *et al*., 2004).

As compared to other classes of algae, the members of euglenoid were least in number *i.e.* 3, which belonged to the genera *Euglena* and *Phacus*. Among the three stations, the abundance and species richness of euglenophyceae were higher at YLA, which has maximum anthropopressure due to washing and bathing activities as well as use the area for casual and holy occasions. Though found in small number Euglenophyta is probably better adapted to anthropopressure as is reported by Yusoff and Patimah (1994); Sandra *et al*. (2007). According to these authors Euglenoids are found most often in shallow water rich in organic matter. Pollution indicator species of euglenoid are found in Yashwant Lake, however quantitatively (2.95 to 3.34 %) and qualitatively they were poor as compared to other group of algae. The density and diversity of Euglenophyta also support the warnings that Yashwant lake is having potential for eutrophication and if the care of anthropopressures is not taken it may get

polluted leading to eutrophication as is observed in many lake system including those at higher altitudes.

IV. CONCLUSION

The Euglenophyta are pollution indicator species. But their representation in Yashwant lake both quantitatively and qualitatively very less so Yashwant lake is not yet polluted. If care is not taken about anthropopressure the lake undergo eutrophication and soon get polluted.

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