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RESEARCH ARTICLE

VARIATION IN PHYTOPLANKTON DIVERSITY AND ITS RELATION WITH PHYSICO CHEMICAL PARAMETERS OF A SEMI LENTIC WATER BODY OF GOLAPBAG, WEST BENGAL, INDIA

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ABSTRACT

Our present study include the species diversity of phytoplankton of a semi-lentic water body within the khari of Golapbag campus, the university of Burdwan and its relation with physico-chemical parameters of the water body to establish the occurrence of the various phytoplankton throughout the year. Species diversity index value 3.824, 3.701 and 3.354 in pre-monsoon, monsoon and post-monsoon respectively indicates the quality of the water body. Chlorophycean representatives are dominant mostly and Cyanophycean members are least in representation. Plankton density reaches its maximum level in monsoon time. This work demonstrates changes in phytoplankton diversity and expresses the possibilities of using these minute organisms as an indicator in biomonitoring system to determine the quality of water body.

INTRODUCTION

Phytoplanktons are very important component of water bodies. They constitute the basis of food chain composition in aquatic environment as they play the role of primary producer. They have a short life span and responds quickly to environmental changes (Kawecka and Eloranta 1994, Zębek 2004). The water body under consideration was semi-lentic in nature. It was interconnected with the Khari (water channel) within the Golapbag campus of Burdwan University. Under this work the influence of physico chemical parameters of water on phytoplankton occurrence and their diversity characteristics were studied. It is also possible to use these minute organisms as an indicator in biomonitoring system for determining the quality water body using Shannon-Weaver diversity index (Odum, 1969).

MATERIAL AND METHODS

Collections were made in March, July, and November, 2009 to observe the species diversity of plankton in the water body for pre-monsoon, monsoon and post-monsoon season respectively. Water samples were collected with nylon conical plankton net of 65 mm mesh with a 0.30 m mouth diameter. After separation of zooplanktons remaining phytoplankton were preserved with Lugol's iodine solution. Each collection was done between 10 to 11am to collect best phytoplankton data. Phytoplankton density was calculated by micro-transect method (Lackey, 1938). Sedgewick-Rafter counting cell at 100 magnifications (Sedgewick, 1988) was used to count phytoplankton. Physico-chemical parameter of water was analyzed as per APHA, 1998. Phytoplankton diversity was deciphered by Shannon formula (Odum, 1969) as follows

$$H = \sum_{i=1}^{s} = \frac{ni}{N} \log? \frac{ni}{N}$$

Where, N is the total number of individuals per liter, "s" is the number of species, ni is the number of individuals of each species & H denotes diversity value. Phytoplankton identification was done following standard books. (Smith, 1950; Prescott, 1962; Turner, 1982 and Ling and Tyler, 1986). Pearson correlation matrix (Table 3.) was used to establish the relationship among various environmental variables and phytoplankton density with the help of SPSS 16.0 for windows.

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RESULTS

Phytoplankton diversity study was achieved by using the data of three season of a year namely, Monsoon, Pre monsoon and Post monsoon respectively (Table 1).The phytoplankton members comprised of 33 genera of which 4 belongs to Cyanophyceae,18 to Chlorophyceae,7 to *Euglenophyceae* and 4 to *Bacillariophyceae*. The percentage composition of phytoplankton (Fig 1) showed the dominance of Chlorophycean members (70%, 52.1%and 57.15%) and members of *Cyanophyceae* were (5%, 4.34% and 7.15%) least in representation for above mentioned three seasons. Phytoplankton density and diversity values reached its maximum limit in pre-monsoon and monsoon season respectively. The results of various physicochemical parameters of water are given in Table 3. Phytoplankton density shows its positive correlation with water and air temperature, electrical conductivity, nitrate, phosphate and negative correlation with pH, dissolved oxygen and potassium.

Table 1. Phytoplankton taxa in the study site under post-monsoon, pre-monsoon & monsoon time frame (+ = present, - = absent)

Serial No.	Material	Post-monsoon	Pre-monsoon	Monsoon
1	*Oscillatoria sp.*	-	+	+
2	*Chroococcus sp.*	+	-	-
3	*Merismopedia sp.*	+	-	+
4	*Phormidium sp.*	+	+	+
5	*Pediastrum* sp.	+	-	+
6	*Coelastrum* sp.	+	+	-
7	*Tetraedron* sp.	+	+	-
8	*Mesotaenium* sp.	+	+	-
9	*Characium* sp.	+	+	-
10	*Ankistrodesmus* sp.	+	+	-
11	*Netrium* sp.	-	-	+
12	*Straustrum* sp.	+	-	-
13	*Pandorina* sp.	+	-	-
14	*Roya* sp.	+	-	-
15	*Chlamydomonas* sp.	+	-	-
16	*Spirogyra* sp.	+	-	-
17	*Desmidium* sp.	+	+	-
18	*Kirchneriella* sp.	-	+	-
19	*Spondylosium* sp.	-	+	-
20	*Chlorella* sp.	-	+	+
21	*Euastrum* sp.	-	+	+
22	*Docidium* sp.	-	-	+
23	*Euglena sp.*	-	+	-
24	*Phacus sp.*	+	+	+
25	*Trachelomonas sp.*	+	+	-
26	*Lepocinclis sp.*	-	+	+
27	*Eutreptia sp.*	-	+	-
28	*Cryptoglena sp.*	-	+	-
29	*Euglenomorpha sp.*	-	+	-
30	*Nitzschia sp.*	+	+	-
31	*Synedra sp.*	+	-	-
32	*Cyclotella sp.*	+	+	+
33	*Navicula sp.*	+	+	+

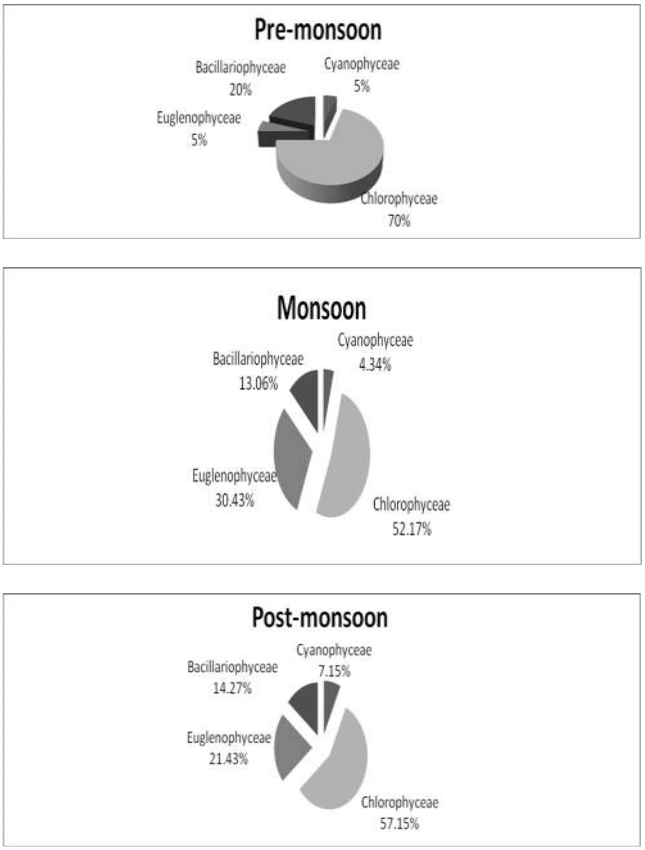

Fig.1. Percentage composition of phytoplankton within the study period

Table 2. Season wise water quality parameters and amount of phytoplankton density/L

Parameter	pH	Water temperature (^{0}C)	Air temperature (^{0}C)	Conductivity (µs/cm/sec)	DO (mg/l)	NO_3^- (mg/l)	PO_4^{3-} (mg/l)	K (mg/l)	Plankton Diversity/l
Pre-monsoon	7.4	30	32	244	7.1	1.8	0.37	14	47796
Monsoon	7.2	29	30	262	7.4	1.3	0.31	12	59324
Post-monsoon	7.2	24	25.5	252	6.8	1.1	0.25	18	40996

Table 3. Correlation matrix among the physico-chemical properties and phytoplankton density of the semi lentic water body

	pH	Wtemp (˚C)	Atemp (˚C)	Conductivity (µs/cm/sec)	DO (mg/L)	Nitrate (mg/L)	Phosphate (mg/L)	Potassium (mg/L)	Plankton Density/L
pH	1								
Wtemp (˚C)	0.628619	1							
Atemp (˚C)	0.737043	0.988933	1						
Conductivity (µs/cm/sec)	-0.83224	-0.09198	-0.2387	1					
DO(mg/L)	-0.86603	-0.93326	-0.97622	0.44353	1				
Nitrate(mg/L)	0.960769	0.819656	0.895574	-0.6458	-0.9707	1			
Phosphate(mg/L)	0.866025	0.933257	0.976221	-0.4435	-1*	0.970725	1		
Potassium(mg/L)	-0.18898	-0.8825	-0.80296	-0.3871	0.65465	-0.45392	-0.65465	1	
Plankton Density/L	-0.14731	0.676626	0.559897	0.67097	-0.367	0.132792	0.366969	-0.94	1

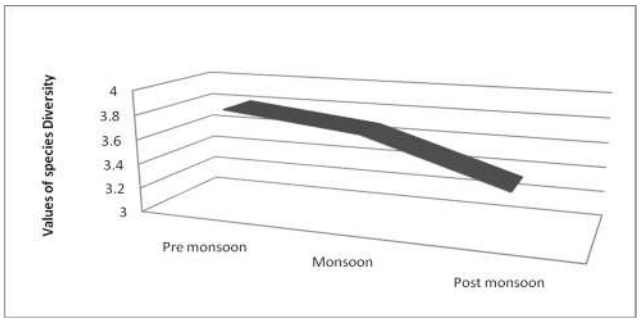

Fig.2. Phytoplankton Diversity values in three seasons

DISCUSSION

Phytoplanktons are of great ecological significance since they comprise the major portion of primary producers in the aquatic environment. They are, like the plants on land, the basic food in the aquatic environment for all consumers such as zooplankton and fish. The algal biomass of phytoplankton can be expressed as numbers of organisms per unit volume but as phytoplankton population vary greatly in their range of size distribution; numbers alone cannot represent the appropriate picture of population dynamics and diversity and structure of the ecosystem. According to Wilhm and Dorris(1966) the water body showed a clean water status. Among the physicochemical parameters temperature plays an important role as it regulates the various biochemical attributes of aquatic environment. The variation in temperature probably may be due to the changes of seasonal influence. Both air and water temperature showed positive correlation with phytoplankton density. The pH of the water varied from 7.2 to 7.4. pH value showed negative correlation with phytoplankton density. Higher value of pH is directly proportional with the water productivity (Khan and Khan, 1985).The maximum conductivity was recorded in monsoon season and lowest in pre monsoon season. This also showed a positive correlation with phytoplankton diversity. The Dissolved oxygen value varied from 6.8 mg/l to 7.1 mg/l. The maximum value was found in monsoon and minimum value in post monsoon. Dissolved oxygen value may be controlled by photosynthetic activity and aeration rate (Gautam, 1993). Our present study shows a negative correlation with DO and phytoplankton density. Nitrate and phosphate establish positive correlation with phytoplankton density and potassium concentration showed negative correlation with phytoplankton density within the study period.

Factors like nitrate, phosphate concentration support huge growth of Cyanophycean members and sometimes produces algal bloom. From the above study it can be said that distribution, occurrence and density of phytoplankton species depends upon various physicochemical parameters of the aquatic environment. This type of study also helps to establish a water quality management system of various water bodies of interest.

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