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ORIGINAL RESEARCH ARTICLE

Diversity and Seasonal Abundance of Phytoplankton in Govardhan Das Pond Chapra, Bihar

Ravindra Kumar Singh*, Rakhi Kumari and Manoj Kumar Pandey

P.G. Dept. of Zoology, J.P University, Chapra, Bihar, India

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ABSTRACT

Present research work was carried out between March 2011 to February 2012 in order to analyze the diversity and abundance of Phytoplankton in Govardhan Das pond, Chapra. The water sample was collected in morning between 7.00 am to 9.00 am during March 2011 to February 2012. Temperature and PH was recorded in the field. The phytoplankton samples collected by collecting 10 liters of water from two sites from the water body and filtered through plankton net (mesh size No 20) a total of 26 phytoplankton genera recorded belonging to four classes. Chlorophyceae, Bacillariophyeae, Cyanophyceae and Euglenophyceae, out of which Chlorophyceae found most dominated group represented by 10 genera.

Key words: Phytoplankton, Chlorophyceae , Cyanophyceae, Euglenophyceae.

INTRODUCTION

In order to obtain an insight into the causative factors involved in the rhythmic and seasonal fluctuations in the total plankton production in a water body it is essential to follow closely the seasonal history and abundance of the different planktonic groups. Each plankter is directly or indirectly subject to a complex of influences in the physico-chemical regime of water brought about by changes of seasons.

Phytoplankton abundance and species composition can have significant implication with regard to both the water clarity and quality of any given body of water.

Thus, for any scientific utilization of water resources a prior knowledge of phytoplankton in time and space and of environmental condition which determine its abundance biodiversity in essential. Since data on the phytoplankton and the physico-chemical features of Govardhan Das pond are lacking completely. This study was carried in order to determine some physico-chemical features of water as well as the phytoplankton distribution and diversity of the pond.

MATERIALS AND METHODS

Study Area:

Goverdhan Das pond is located nearly by the national highway 101 beside Shivajee temple north of Chapra city, Bihar, India. The pond collects water from rain and culverts.

The pond is a big with catchments of 4.98 acres. It provides water for bathing to people living around it. The pond is an important ecosystem in the region supporting local agriculture and tourism. During the past 40 years, the ecosystem of Govardhan Das pond sustained many activities such as irrigation sediment deposit and input of agriculture and domestic sewage causing serious problems in its trophic state.

METHODS

The surface water samples collected once in a month (From March 2011 to February 2012) from two sites A and B using wide mouthed clean iodine treated PVC container for the study of various physico-chemical parameters. Physico-chemical parameters of water done by standard methods (APHA 1992). The average value of various parameters are calculated and presented as mg/l except temperature and PH. Phytoplankton samples collected by collection 10 liters water from two sites of the water body and filtered throughplanktonnet(MeshsizeNo.20)phytoplankton species were preserved by Lugols iodine solution as preservative. Preserved phytoplankton species were placed on slide with a drop of 4%

***Corresponding Author:** Dr. Manoj Kumar Pandey**, Email:** manoj_pandey45@yahoo.com

glycerine to keep material fresh and wet. In order to save time to achieve a reasonable accuracy in abundance of phytoplankton of the collected sample has been reduced to 100ml. One ml of reduced sample was applied to segdwick rafter cell (plankton counting cell) by wide mouth pipette. The chamber area was magnified under the research microscope to identify and count the phytoplankton by using different magnification depending upon size of the phytoplankton.

RESULTS AND DISCUSSION

Physico- chemical parameters

Water in nature is not pure and it contains dissolved salts and buffers nutrients etc. The physico chemical properties of Govardhan Das pond is presented in (Table 1). Air temperature varied between 21^0C in winter to 38.4^0C in summer 2011-12. Water temperature was observed to be highest during summer 2011-12 from site II and lowest during winter 2011-12 (17.2^0C) from site I. The highest pH as 8.1, alkalinity of 252 mg/l and dissolved solids of 265 were recorded in summer of 2011. The highest pH was due to low water levels and increased photosynthetic activity (Kumar A Sharma L.L 2009). The highest Co_2 of 31.2 mg/l was noticed during monsoon months of 2011. The maximum concentration of Co_2 was due to influx of water into the water body due to raining and increases in number of grazing micro organisms (Nautiyal R Nautiyal P and H.R singh 1996). The highest oxygen value of 7.2 mg/l was observed in winter season of 2011-12 and the lowest value of 4.2 mg/l was observed in summer 2011-12. The peak value of oxygen during winter was also observed by (Kolekar 2006, Uypadhyay and Dwivedi 2006).

Table 1: Physico- chemical parameter of Govardhan das pond during March 2011 – Feb 2012

S. No	Parameters	Site I			Site II		
		Winter	Summer	Monsoon	Winter	Summer	Monsoon
1	Air temperature (^{0}C)	24.0	37.2	31.4	21	38.4	36
2	Water temperature (^{0}C)	17.2	31.4	30	18.4	32.9	30.2
3	PH	7.4	7.9	6.8	7.2	8.1	6.9
4	DO (mg/l)	7.2	4.9	5.4	6.2	4.2	5.2
5	Alkalinity (mg/l)	144	244	110	196	252	130
6	Co_2	8.8	2.2	31.2	16.1	29.1	30.1
7	Hardness (mg/l)	156	196	160	170	205	132
8	TDS (mg/l)	205	265	235	216	254	222
9	Conductivity (Ms/cm)	0.32	.49	.30	.37	.42	.31
10	Chloride (mg/l)	160	232	124	149	221	142
11	Nitrate(mg/l)	2.16	4.49	2.11	222	4.56	2.33
12	Phosphate (mg/l)	2.78	352	2.21	2.63	3.61	2.11

Table 2: List of Phytoplankton observed during the year March 2011 – Feb. 2012

S. No	Phytoplankton	Site I			Site II		
	Chlorophyceae	Winter	Summer	Monsoon	Winter	Summer	Monsoon
1	*Ankistrodesmus*	105	11	2	110	21	9
2	*Apninocapsa*	103	30	11	135	4	12
3	*Chara*	104	20	5	120	10	11
4	*Chlorella*	110	5	45	130	-	10
5	*Pediastrium*	40	50	9	145	60	15
6	*Spirogyra*	115	45	32	135	42	95
7	*Volvox*	125	60	3	120	40	8
8	*Zygnema*	1.3	11	5	115	-	10
9	*Pandorina*	115	"	-	-	5	4
10	*Hydrodactyon*	120	-	-	112	-	-
11	*Oocystis*	115	35	-	112	50	16
	Cyanophyceae						
12	*Mycrocystis*	103	-	22	127	11	09
13	*Oscillatoria*	104	22	6	122	41	9
14	*Spirulina*	100	50	30	80	50	20

15	*Chroococum*	33	12	75	133	74	11
16	*Synechoccus*	21	16	4	11	14	5
	Bacillariophyceae						
17	*Synedra*	104	7	7	17	9	8
18	*Fragillaria*	110	19	19	110	7	51
19	*Navicula*	105	125	4	130	11	6
20	*Pinnularia*	104	11	31	111	19	47
21	*Nizschia*	77	47	7	15	10	45
22	*Asterionella*	-	-	5	-	-	3
23	*Bacillaria*	105	80	21	40	60	-
	Euglenophyceae						
24	*Euglena acus*	31	5	4	27	11	9
25	*Lepecincils*	55	11	3	21	9	3
26	*Phacus*	27	-	-	35	-	7
	Total	**2234**	**682**	**422**	**2213**	**488**	**408**

Dissolved oxygen shows a significant negative relation with temperature alkalinity total hardness, nitrate, phosphate, and chloride. The observed high value of dissolved oxygen in winter due to high solubility at low temperature and less degradation of organic matter.

The electrical conductivity values of water samples ranged between 31-49 ms/cm. (Table-I) with a maximum value in summer and minimum in monsoon Conductivity of water depends upon the concentrations of ions and its nutrient status and the variation in dissolved solid content. Dilution of water during the rains causes a decrease in electrical conductance.

Total alkalinity values in our observations ranged between 110-252 mg/l (Table-I), indicating that the water is hard. Alkalinity was high during the summer season (252 mg/l) followed by steep fall in the monsoon period (110mg/l). The low alkalinity during the monsoon may be due to dilution Jain *et. al*. (1990) also reported similar finding in his study in Halai Reservoir.

The total hardness of this pond water was observed to be high (205mg/l) during the summer season which may be due to evaporation of water and addition of calcium and magnesium salts. Kanan (1991) has classified water on the basis of hardness values in the following manner:

0-60ml/l = soft
61-120 mg/l= moderately hard
121-160 mg/l= hard and
> 180 mg/l = very hard

Using these criteria the water of the Govardhan Das pond can be included in the very hard category. The higher values in summer season were noticed possibly due to washing of clothes, bathing and cleaning of animals. Chloride levels of the pond water were found to be high (232 mg/l) during the summer period. The higher concentration of Cl is considered to be an indicator of higher pollution due to higher organic water of animal origin. Munawar (1970) observed a direct correlation between Cl concentration and pollution level in fresh water ponds of Hyderabad.

According to study rich contents of nitrates were observed with maximum of 4.56 mg/l in summer 2011-12 and minimum of 2.11 mg/l during high evaporation which increase the concentration during summer (Sharma 2007).

Nitrate showed positive relation with Temperature, pH, alkalinity, total hardness, TDS, electrical conductivity, chloride, phosphate and negative relation with dissolved oxygen. Present study observed maximum orthophosphate content of 3.61 mg/l during summer 2011-12 and minimum of 2.11 mg/l during monsoon 2011-12. Higher values of phosphate during summer months because of high temperature can evaporate which leads to eutrophication in the water body and increased the phosphate concentration (Nautiyal. R. Nautiyal. P and Singh H.R. (1996).

Environmental parameters (Biotic):

A Total of 26 phytoplankton genera were identified in the study area. These genera belonged to four divisions, which include 11 genera of Chlorophyceae, 5 genera of Cyanophyceae, 7 genera of Bacillariophyceae and 3 genera of Euglenophyceae (Table-2)

Chlorophyceae was dominant in terms of the number of genera and abundance in winter summer and Monsoon. Cyanophyceae was the

second dominant class followed by Cyanophycea and Euglenophyceae.

Highest abundance of Chlorophyceae (1155 Ind/l-from site-I and 1234 ind/l from site-II) in winter while the lowest abundance was recorded in monsoon. Similar dynamic of phytoplankton was observed by Razzaque *et. al* (1995).

The most phytoplankters during the study were *spirogyra sp, volvox sp, pediastrum,* from group Chlorophyceae while *chrococum sp* and *oscillatoria* sp dominated Cyanophyceae. As it is clear from the study, Chlorophyceae dominated over Bacillariphyceae followed by Cyanophyceae and Euglenophyceae.

Thus, it was observed that Chlorophyceae group flourished during the winter and summer seasons, Tiwari *et al* (2001) sanap *el al* (2008) also found similar results.

Fig 1: Percentage distribution phytoplankton genera in Govardhan das pond during march 2011 to February 2012

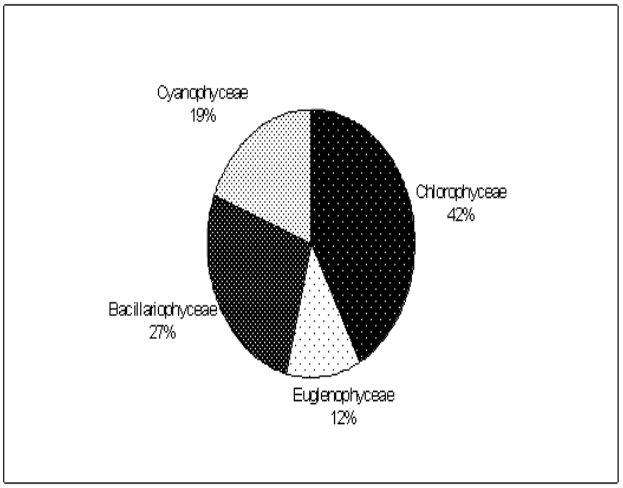
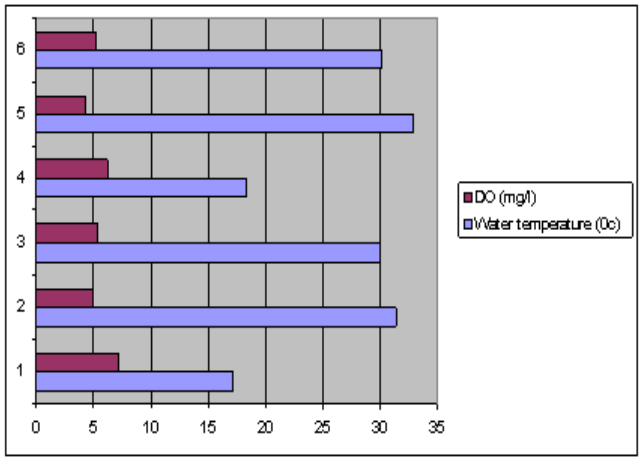


Fig 2. Relationship between water temperature and DO



Bacillariophyceae (Diatom) were found abundantly in winter due to low level of dissolved solids. Euglenophyceae group were abundantly occurring due to organic Pollution. The occurrence of certain pollution tolerant species such as *oscillatoria, ankistrodesmus microcystis, fragilaria* clearly indicates organic pollution. (Hutchinson 1967)

Taking general phytoplanktonic features of the pond into consideration, summarily, the Govardhan Das pond was nutritionally rich and Limnologically pond waters had reached to eutrophication stage. Therefore, it is pointed out that pollution of this pond should be minimized otherwise it may reach an irrepairable form in due course.

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