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Seasonal Changes in Phytoplankton Community in Papnash Pond, Bidar, Karnataka Along With Physico-Chemical Characteristics of Water

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Abstract

An investigation of abundance of phytoplankton community such as Cyanophyceae, Chlorophyceae, Euglenophyceae and Bacillariophyceae in relation to physico-chemical characteristics like atmospheric and water temperature, pH, dissolved Oxygen, Carbon dioxide, Alkalinity, hardness, Calcium, Magnesium, Chlorine, Nitrite, Phosphate, Silicate, Sulphate, total solids and Organic matter of water body has been carried out in the Papnash Pond, Bidar. It is situated near to the Papnash temple, which is used by pilgrims and surrounding people for domestic uses. Such activities increasing pollutant load in the water body. Analysis and assessment of pond water has been carried out for two years from February 2002 to January 2004. Phytoplankton were identified, enlisted, counted and correlated with physico-chemical factors to note the influence of change in aquatic environment on the population of phytoplankton. Correlation coefficient matrix has shown significant correlation between Atmospheric temperature and Phosphate with Cyanophyceae, Atmospheric temperature and pH with Euglenophyceae and Chlorine and Phosphate with Bacillariophyceae. The observations indicated fluctuation of various physico-chemical parameters in relation to seasons and by intervenes of the people.

Key words: correlation, water pollution, water bodies, algal community

Introduction

The phytoplankton is one of the important components of the aquatic ecosystem. Growth depends on the availability of solar energy, macro and micronutrients as well as promotive organic substances in the water body. Simple changes in any physico-chemical factor of the water body directly or indirectly cause great variation in phytoplankton species diversity and abundance. Many researchers have worked on different type of fresh water bodies to note changes in the seasonal abundance of phytoplankton in relation to physico-chemical condition of the water body [1-5]. Such study in Northern part of Karnataka was limited to Gulbarga region only. However, except one record no such reports on the water bodies of Bidar are available [6]. The present paper is deals the study of abundance of phytoplankton in relation to physico-chemical condition of the Papnash pond, Bidar, Karnataka. Bidar is a district head quarter lies at 17°55' North latitudes and 77°32' East longitude, located above 551m mean sea level. It represents semi arid climatic condition and temperature varies between 9°C and 44°C. The total rain fall of 1875.9 mm was recorded during the study period. The selected Papnash pond for the study is perennial is situated at the Western side of the city near Papnash temple. It covers an area of 0.25 sq. km. The mean depth of water in pond is 2.1m with a maximum depth of 4 m during rainy season and minimum being 0.75 m during dry season. This pond is being exploited by pilgrims and surrounding people for

various domestic activities, such as bathing, washing of clothe, disposing of sacred waste and bathing of cattle. Similar water later supplied to agriculture fields for various crops.

Experimental

The surface water samples collected once in a month (from February 2002 to January 2004) from two sites, A & B (Figure 1) by using wide mouthed clean Iodine treated Poly Vinyl Chloride container for the study of various physico-chemical factors. All collections and observations were made between 8.30 AM to 10.00 AM during the study. The water samples were analysed by following standard methods mentioned in the literature [7-9]. The average values of various parameters are calculated and presented as mg/l except temperature and pH. Phytoplankton samples collected by collecting 10 litres of water from 10 sites of the water body and filtered through plankton net (Mesh size No. 20). Phytoplankton samples ware preserved in 100 ml plastic bottle by using Lugol's Iodine solution as preservative. Preserved algal samples are placed on slide with a drop of 4% glycerin and gently spread with needle and placed on cover slip to keep material fresh and wet. Algae screened under research microscope and measured the size of cell and filament/colony of the alga in micrometer by using ocular and stage. Algal taxa identified with the micrometry readings by using Algal keys and literature[10-13]. In order to save time and to achieve a reasonable accuracy in abundance of phytoplankton of the collected sample has been reduced to 100 ml. One ml of sample was transferred to Segdwick-rafter cell by wide mouth pipette. The chamber area was scanned under the research microscope to count phytoplankton by using different magnification depending upon size of the phytoplankton[14]. Ten sub samples were counted and mean numbers of phytoplankton of each class were recorded.

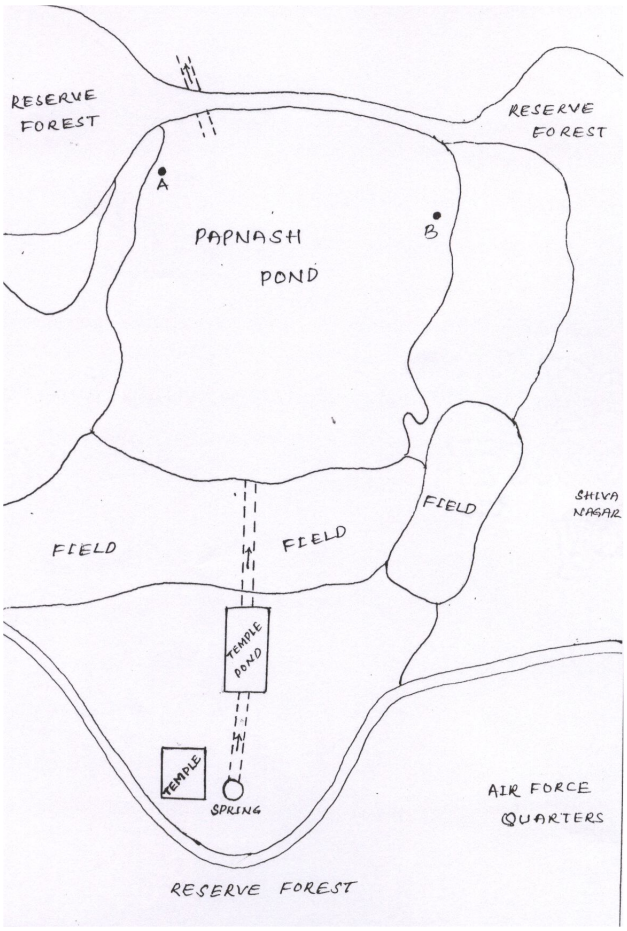

Figure 1 The Map of Papnash Pond

Results and Discussion

Physico-chemical parameters

Water in nature is not pure and it contains dissolved salts, buffers, nutrients etc. The exact concentrations are dependent on local conditions. The physico-chemical characteristics of Papnash pond water is presented in Table-1. The highest pH as 8.6, alkalinity of 233 mgl^{-1} and total solids of 208 mgl^{-1} were recorded in summer month of 2002. The highest pH was due to low water levels and increased photosynthetic activity[15]. Later maximum evaporation was noticed in the water body and leads the increase of total solids of 208 mgl^{-1} [16]. The highest CO_2 of 319 mgl^{-1} and silicon of 22.8 mgl^{-1} were noticed during monsoon months of 2002. The Maximum concentration of CO_2 was due to influx of water in to the water body due to raining and increases in number of overgrazing microorganisms [17]. It is also noticed that decrease in diatoms due to death and decomposition leads the increase in silicon content of 22.8 mgl^{-1} [18]. The maximum nitrite of 0.813 mgl^{-1} was recorded in the winter months of 2002 due to more inflow of water and dilution effect and also by eutrophication [16]. The maximum organic matter of 6.73 mgl^{-1} was recorded during the summer month of 2003 due to eutrophication of algal bloom [16]. The maximum dissolved oxygen of 6.4 mgl^{-1}, hardness of 323 mgl^{-1}, calcium of 87.8 mgl^{-1}, chlorine of 39.8 mgl^{-1} and sulphate of 20.3 mgl^{-1} were recorded in monsoon months of 2003. The maximum hardness due to runoff carried from the surrounding areas. The similar effect was also seen with calcium, chlorine and sulphates[17, 19-20]. The increase of magnesium of13.4 mgl^{-1} and phosphate of 0.22 mgl^{-1} were recorded in summer months of 2003. The highest

Table 1 Physico-chemical factors of Papnash pond, Bidar

Parameters	Summer	Monsoon	Winter	Summer	Monsoon	Winter
Atmospheric temperature (°C)	29-35	24.8-29.5	24-25	28-38	25.5-29.5	26-31.5
Water temperature (°C)	21-25.3	24.5-25.3	18.5-23.8	23.5-28	25.8-26.3	20.5-28.5
pH	7.8-8.6	7.2-8	7-7.9	7.6-8.2	7.1-7.5	7.1-7.4
Dissolved oxygen	4.2-5.9	1.8-3.7	1.2-2.4	1.2-3.7	4.3-6.4	4.9-6.3
Carbon dioxide	16.4-28.8	4.4-31.9	8.8-26.4	23.1-29.1	7.7-24.2	12.1-28.6
Alkalinity	155-233	110-210	115-212.5	198-225	130-135	113-125
Hardness	171-203	164-197	139-170	179-208	126-323	129-169
Calcium	42.1-46.5	49.3-56.1	43.3-57.7	28.1-48.9	37.3-87.8	34.5-55.7
Magnesium	14.1-21.3	9.5-18.1	6.4-15.2	14.9-26.6	8.1-25.4	6.4-13.4
Chlorine	19.9-30.5	24.2-37	24.1-32	27.7-39.1	19.2-39.8	16.4-32
Nitrite	0.012-0.504	0.005-0.141	0.014-0.813	0.018-0.143	0.002-0.265	0.030-0.375
Phosphate	0.009-0.036	0.047-0.072	0.010-0.025	0.039-0.102	0.255-0.465	0.14-0.22
Silicon	14.9-22.5	16.2-22.8	12.3-18.1	13-20	9-21	6.8-15.7
Sulphate	1.2-11.3	2.65-16.5	1.1-5.8	2.9-9	5.5-20.3	3.3-11.4
Total solids	54-208	68-172	80-148	101-143	43-172	50-85
Organic matter	0.14-2.29	0.87-3.74	0.76-2.59	1.07-6.73	2-5.71	0.43-2.55

All values are in mgl^{-1} except pH, atmospheric temperature and water temperature

magnesium content was due to high atmospheric temperature which leads eutrophication in the water body and increased the phosphate concentration[17]. The highest water temperature of 28.5°C recorded in winter month 2003 due to clear sky.

Abundance of phytoplankton

Interpretations of the temporal aspects of phytoplankton biology are very much dependent on the frequency and regularity of phytoplankton sampling. Available information on these aspects of phytoplankton of studied water body is presented in Table-2. The maximum count of 3500 O/l of Cyanophyceae members observed in summer months 2003 [21]. The highest count of 1780 O/l of Chlorophyceae members were recorded in the winter month of 2002 and 5160 O/l of Euglenophyceae members were noticed during the summer month of 2003. Similarly, 9600 O/l of Bacillariophyceae ware recorded in the summer month of 2003 [22]. It is to note that, appearance of Cyanophyceae and Bacillariophyceae members together indicated as most of the factors are similar for the growth and development in the water body.

Pearson's correlation matrix

Every ecosystem has two important components the abiotic and biotic. Each has its own relationship with one another and among themselves. The study to note the relationships in between and among the physico-chemical factors and abundance of phytoplankton groups in water bodies of Bidar district, Pearson's correlation matrix (two tailed) was followed and results are presented in Table 3. The fluctuations of Cyanophyceae have show very close positive relation with temperature and phosphate [23-24]. The members of Euglenophyceae have shown positive relations with pH and temperature. Euglenophyceae shown the positive relation with pH [22]. Bacillariophyceae members have shown significant positive relation with temperature, chlorine and phosphate [25-26].

Conclusion

The origin of Papnash pond is by a perennial spring near the Papnash temple adds holy faith in pilgrims to take bath. Through an out let of temple tank the polluted water enters in the main pond. This pond is also exploited by the pilgrims and surrounding people for the various domestic activities, such as washing of clothes and bathing of cattle. There is an urgent need to restore the quality of water and proper management of the water body. Concerned authority and surrounding people have to frame rules and regulations for the proper use of water body by the pilgrims. This will definitely help to develop the pond as a recreation

Table 2 Abundance of Phytoplankton of Papnash Pond

Month/year	Cynophyceae	Chlorophyceae	Euglenophyceae	Bacillariophyceae
February-02	0060	0080	0400	0320
March	0600	0140	0580	0020
April	0000	0360	2360	0260
May	0280	0320	0200	0460
June	0840	0060	1100	0680
July	0520	0100	0140	0300
August	0080	0160	0080	0460
September	0480	0020	0340	3100
October	0100	0340	0000	0060
November	0040	1780	0160	0190
December	0020	0240	0020	0140
January-03	0000	0480	0060	0000
February	0000	0040	0280	0020
March	0000	0080	0100	0000
April	0660	0120	5160	7140
May	3500	0240	0200	9600
June	0000	0880	0120	4100
July	0040	0560	0180	0240
August	0940	0780	0260	0060
September	0060	1100	0040	0040
October	0060	0360	0060	0080
November	0000	0440	0000	0000
December	0000	0320	0000	0000
January-04	0020	0400	0020	0020

All values are expressed in O/l

Table 3 Pearson's correlation coefficients between Physico-chemical factors and abundance of Phytoplankton of Papnash pond

Parameters	Cynophyceae	Chlorophyceae	Euglenophyceae	Bacillariophyceae
Atmospheric temperature (°C)	+0.495*	-0.344	+0.581**	+0.517
Water temperature (°C)	+0.004	-0.118	+0.142	+0.172
pH	+0.185	-0.125	+0.565**	+0.184
Dissolved oxygen	-0.122	-0.067	+0.127	-0.063
Carbon dioxide	+0.386	-0.146	+0.272	+0.261
Alkalinity	+0.119	-0.089	+0.278	+0.360
Hardness	+0.137	+0.031	+0.015	+0.141
Calcium	+0.008	+0.121	-0.257	+0.002
Magnesium	+0.065	-0.013	+0.052	+0.051
Chlorine	+0.396	+0.127	+0.082	+0.554**
Nitrite	-0.221	-0.025	-0.011	-0.071
Phosphate	+0.660**	-0.238	+0.358	+0.640
Silicon	+0.352	-0.191	+0.185	+0.441
Sulphate	-0.156	+0.164	-0.252	-0.012
Total solids	+0.244	+0.105	+0.317	+0.222
Organic matter	+0.254	+0.155	+0.309	+0.347

*significant at 0.05 level

centre for both visitors and city people. This pond water can also to be used for fishery and agriculture.

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