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ECOLOGY AND DISTRIBUTION OF DIATOMS IN KONANDUR POND OF THIRTHAHALLI TALUK, KARNATAKA

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ABSTRACT

Diatoms are the indicators of water quality. Ecology and Distribution of Diatoms in Konandur pond of Thirthahalli taluk (Karnataka) has been discussed. A total of 16 species and 09 genera of Bacillariophyceae were recorded. Navicula and Cymbella were represented by 4 and 3 species. While, Pinnularia and Synedra were consists of 2 species and rest of the genera consists of single species of diatoms The physico-chemical parameters were estimated as per standard methods. The study revealed that, pond water was not much polluted. In the light of standard of water quality recommended by BIS , the pond water should be used for human consumption and cooking after proper treatment.

Key Words: Diatoms, Water quality, Konandur pond

I. INTRODUCTION

Diatoms are unicellular, although they can form colonies in the shape of filaments or ribbons (e.g. *Fragilaria*), fans (e.g. *Meridion*), zigzags (e.g. *Tabellaria*), or stars (e.g. *Asterionella*). The first diatom formally described in scientific literature, the colonial *Bacillaria paradoxa*, was found in 1783 by Danish naturalist Otto Friedrich Müller. Diatoms are producers within the food chain. A unique feature of diatom cells is that they are enclosed within a cell wall made of silica (hydrated silicon dioxide) called a frustule (More on Diatoms". *University of California Museum of Paleontolog)*. .These frustules show a wide diversity in form, but are usually almost bilaterally symmetrical, hence the group name. The symmetry is not perfect since one of the valves is slightly larger than the other, allowing one valve to fit inside the edge of the other. Fossil evidence suggests that they originated during, or before, the early Jurassic period. Only male gametes of centric diatoms are capable of movement by means of flagella. Diatom communities are a popular tool for monitoring environmental conditions, past and present, and are commonly used in studies of water quality (https://en.wikipedia.org/wiki/Diatom).

Phytoplankton plays a role in regulating atmospheric temperature via photosynthesis. Wetland ecosystems of Karnataka have attracted the attention of number of scientists leading to the studies on ecology and distribution of phytoplankton and their importance as indicator of pollution and tropic status of the water body (Hegde & Bharati, 1985; Puttaiah & Somashekar, 1987; Verma and Mohanty, 1995; Ravikumar & Puttaiah 1996; Hosmani et al., 1999; Vengadesh Perumal et al., 2009; Bhosale et al., 2010a; Murulidhar and Yogananda Murthy,2015).

Available literature reveals that, limnological work on Konandur pond ecosystem has not been done so far. Hence, an attempt has been made to study the seasonal variations of Diatoms population in relation to certain physic-chemical characteristics of present water body.

II. MATERIALS AND METHODS

Study area

Konandur pond is located in Theerthalli taluk of Shimoga district, Karnataka situated between 13° 27' and 14° 39' North latitude and between 74° 38' and 76° 4' East longitude. This pond is located at a distance of 80 km from Shimoga surrounded by agricultural fields which is utilized by the local people for drinking, irrigation and, fishing etc.

Water quality analysis

Water was sampled on monthly basis, between 8 to 10 am from June 2001 to May 2003. This water samples were collected in good quality polythene bottles. Water temperature was recorded at the sampling site itself. Dissolved oxygen was fixed on the spot itself in BOD bottles. Remaining water quality parameters were estimated as per the standard methods (APHA, 1998).

The water has undergone moderate changes in its physico-chemical properties due to ecological degradation, overflowing of water from adjacent paddy fields and other excessive human activities. In the present investigation, an attempt has been made to assess the suitability of water for human consumption and domestic purposes.

Diatom Analysis

Diatomic forms were collected by using a plankton net made of bolting silk cloth of meshes of 10 µm fixing a glass bottle of 100 ml at a narrow end. For taking the samples of qualitative analysis, the net was towed for 5 minutes just below the surface of water (Green and Holden, 1960). Tows were restricted to a small area around each sampling point. The samples were immediately transferred to other bottles and preserved by adding 4% formalin as per the practice of Welch (1948). The qualitative estimation was done by taking one ml of sample from the stock samples at each time and repeated 5 times. Uniform distribution was made by agitating the samples thoroughly. Qualitative identification of planktonic organisms was done with the help of monographs and diatoms are identified upto species level (Adoni et al., 1985 ; Bharathi and Hegde ,1982 ; Hegde and Bharathi (1985).

III. RESULTS AND DISCUSSION

Water Quality

Table 1 depicted physico-chemical parameters of Konandur pond. The average water temperature of the pond shows 28.3° C and the values were fluctuated between 26 and 35° C. The pH of water is 7.1 which is the neutral condition and it was fluctuated between the circum neutral range (6.8-7.3). The turbidity of the pond water was found in the range between 12-20.8 NTU and the average value was 16.03 NTU recorded in Konandur pond. Conductivity of the pond water was fluctuated between 46.2 and 72.12 µmhos/cm and the average was 61.13 µmhos/cm. The average concentration of dissolved oxygen was 4.83 mg/l and the values were ranged between 3.52-6.88 mg/l. The free carbon dioxide in the Konandur pond was fluctuated between 7.8 and 12.4 mg/1 and the average value of carbon dioxide during the study period is 9.52 mg/l. BOD concentration in Konandur pond was fluctuated between 0.68 to 1.62 mg/l and the average BOD was 1.27 mg/l. The average COD value was 9.52 mg /1 while the values were fluctuated between 6.0-12.8 mg/1. The total hardness of the water was fluctuated between 16-28.6 mg/l and the average hardness value in the pond shows 22.53 mg/l. The average value of the total alkalinity in this pond indicates 42.518 mg/l and the range of the value was between 38.66-49.6 mg/l.

The average value of calcium concentration in this pond was 8.03 mg/1 and the range of this parameter was between 6.4-9.96 mg/l. The magnesium concentration in the pond shows less compared to calcium concentration and the average magnesium was 2.46 mg/l and the range of this parameter was between 1.2-3.2 mg/l. The average sulphate concentration shows 6.55 mg/1 and the range of the sulphate from this pond was between 3.6-9.3 mg/l. The average chloride concentration was 12.83 mg/1 and the range of this parameter was between 10-17.6 mg/l. The ammonical nitrogen was 1.22 mg/land the range of this parameter was between 0.6-2.1 mg/l. The nitrate nitrogen of the pond water was fluctuated between 0.12-1.5 mg/l and its average value 0.816 mg/1 recorded. The concentration of the phosphate in the study pond was fluctuated between 0.12-1.6 mg/l and the average value was 0.85 mg/l. The total dissolved solids recorded in this pond and the average value was 55.32 mg/1 and the range of the parameter was found between 48.0-64.2 mg/l (Table 1).

Table 1. Physico-chemical characteristics of Konandur pond with Mean, Standard Error and Range (mg/l, except pH and temperature)

Parameters	2001-2002		2002-2003	
	Mean ± S.E.	Range	Mean ± S.E.	Range
Air temperature (° C)	31.66 ± 9.4	27 – 35	30.33 ± 8.75	28 – 36
Water temperature (° C)	28.5 ± 8.22	26 – 32	28.16 ± 8.13	26 – 35
pH	7.05 ± 2.04	6.8 – 7.3	7.11 ± 2.05	6.8 – 7.5
Turbidity (NTU)	15.92 ± 4.59	12.2 – 20.2	16.13 ± 4.65	12 – 20.8
Conductivity (µmhos/cm)	59.72 ± 17.24	46.2 – 72.12	62.53 ± 18.05	56.4 – 70.4
Dissolved oxygen (mg/l)	4.97 ± 1.43	3.82 – 6.88	4.65 ± 1.34	3.52 – 5.98
Free carbon dioxide (mg/l)	9.94 ± 2.86	8.82 – 12.4	9.10 ± 2.62	7.8 – 10.2
Biological oxygen demand (mg/l)	1.23 ± 0.36	0.92 – 1.58	1.27 ± 0.36	0.68 – 1.62
Chemical oxygen demand (mg/l)	9.5 ± 2.74	6.4 – 12.2	9.54 ± 2.75	6 – 12.8
Total hardness (mg/l)	22.64 ± 6.54	16 – 28.6	22.40 ± 6.46	16.4 – 26.5
Total alkalinity (mg/l)	43 ± 12.41	40.44 – 49.66	42.02 ± 12.13	38.66 – 47.7
Calcium (mg/l)	7.75 ± 2.23	6.4 – 9.2	8.31 ± 2.39	6.8 – 9.96
Magnesium (mg/l)	2.07 ± 0.59	1.2 – 2.84	2.83 ± 0.81	2.2 – 3.2
Sulphate (mg/l)	6.68 ± 1.93	4.8 – 8.6	6.40 ± 1.84	3.6 – 9.3
Chloride (mg/l)	13.26 ± 3.82	10.4 – 17.6	12.40 ± 3.58	10 – 15.2
Ammonical nitrogen (mg/l)	1.4 ± 0.41	0.8 – 2.1	1.02 ± 0.29	0.6 – 1.88
Nitrate-Nitrogen (mg/l)	0.75 ± 0.21	0.12 – 1.58	0.87 ± 0.25	0.33 – 1.22
Phosphate (mg/l)	0.78 ± 0.22	0.12 – 0.98	0.91 ± 0.26	0.36 – 1.6
Total dissolved solids (mg/l)	53.7 ± 15.50	48 – 64.2	56.93 ± 16.43	52.2 – 62.4

The seasonal variation of the water quality was represented in Table 2. In this table the two years data was represented separately .Among air and water temperatures in 2001-02 slightly high temperature was recorded in Konandur pond (Table 2). The pH values showed no greater variations among the seasons as well among the years. A little variation among seasons and throughout the study period as found in all the parameters .All other parameters exhibited no significant differences among the comparison of the values.

Table 2. Seasonal variation of physico-chemical parameters of Konandur pond

Parameters	2001-2002			2002-2003		
	Monsoon	Post-monsoon	Pre-monsoon	Monsoon	Post-monsoon	Pre-monsoon
Air temperature (º C)	32.75	29.25	32.25	29.5	29.25	33.00
Water temperature (º C)	29.0	27.00	30.25	27.5	26.75	29.5
pH	7.175	7.05	7.05	7.15	7.15	7.00
Turbidity (NTU)	19.9	14.00	12.45	20.35	15.6	13.875
Conductivity (µmhos/cm)	64.615	53.2325	58.065	68.25	61.275	61.34
Dissolved oxygen (mg/l)	4.735	5.97	4.03	4.63	5.3575	4.225
Free carbon dioxide (mg/l)	11.9	9.19	8.3	9.65	9.355	8.725
Biological oxygen demand (mg/l)	1.08	1.36	1.395	1.105	1.3225	1.3525
Chemical oxygen demand (mg/l)	10.95	8.45	8.705	11.45	8.48	9.1
Total hardness (mg/l)	26.695	23.05	18.85	24.675	23.7	18.2
Total alkalinity (mg/l)	41.035	42.05	44.45	41.58	40.06	45.935
Calcium (mg/l)	8.645	7.025	8.45	9.605	6.875	7.6
Magnesium (mg/l)	2.41	1.57	2.675	2.9125	2.9275	2.24
Sulphate (mg/l)	7.4	5.565	6.975	7.0125	5.225	7.1
Chloride (mg/l)	11.75	14.00	13.15	13.555	10.5	14.05
Ammonical nitrogen (mg/l)	1.925	1.0575	1.13	0.8875	1.02	1.29
Nitrate-Nitrogen (mg/l)	0.1725	1.115	0.8925	0.825	0.9125	0.98
Phosphate (mg/l)	0.535	0.87	0.7275	0.84	1.185	0.935
Total dissolved solids (mg/l)	51.585	53.655	56.85	56.7	57.255	55.9

In the light of standard of water quality recommended by BIS (Table 3), the pond water should be used for drinking and cooking after proper treatment. In order to maintain the healthy status of the tank with respect to water quality it is essential that authorities should take immediate steps i.e., washing of clothes and vehicles should be prevented and people should be advised at least to boil the water to disinfect the pathogens before using the water for drinking purpose.

Table 3. BIS standards for the potability of water

Sl.No.	Parameters	Permissible limit	Maximum limit
1	Turbidity (NTU)	2.5	10
2	pH	7.0-8.5	6.5-9.2
3	Dissolved oxygen (mg/l)	4.0	6.0
4	Total dissolved solids (mg/l)	500	1500
5	Biological oxygen demand (mg/l)	2.0	3.0
6	Total hardness (mg/l)	200	600
7	Chemical oxygen demand (mg/l)	10	-
8	Calcium (mg/l)	75	200
9	Magnesium (mg/l)	30	150
10	Sulphate (mg/l)	200	400
11	Chloride (mg/l)	200	1000
12	Nitrate nitrogen (mg/l)	45	45
13	Phosphate (mg/l)	-	-
14	Conductivity (μmhos)	1000	2250

Source: Central pollution control Board

Distribution of Diatoms

A total of 16 species and 09 genera of Diatoms were recorded. Among genera *Navicula* and *Cymbella* were represented by 4 and 3 species. While, *Pinnularia* and *Synedra* were having 2 species and rest of the genus consists of single species of Diatoms .

Distribution and monthly occurrence of the Diatoms is presented in Table 4 and Figure 1. In Konandur pond the density of diatoms was observed highest in post-monsoon during 2002-03 with 6188 o/l and lowest in monsoon (4104 o/l) during the year 2001-02 (Table 5).

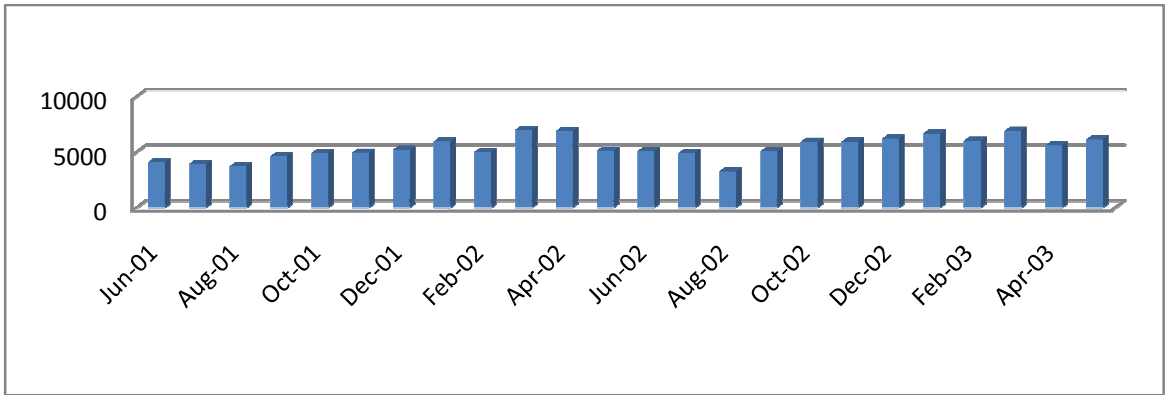

Figure 1.Monthly occurrence of Diatom phytoplankton in Konandur pond (org/l) 2001-2003

Table 4 :Diversity of diatoms in Konandur pond of Thirthahalli taluk during June 2001 to May 2003

Sl.No	Name of the Species	
1	*Cocconies placentula*	+
2	*Cyclotella kuezingiana*	+
3	*Cymbella lanceolata*	+
4	*Cymbella tumida*	+
5	*Cymbella turgidula*	+
6	*Fragillana construens*	+
7	*Gomphonema constrictum*	+
8	*Navicula pupila*	+
9	*Navicula radiosa*	+
10	*Navicula reinhardtii*	+
11	*Navicula gracilis*	+
12	*Pinnularia major*	+
13	*Pinnularia nobillis*	+
14	*Tabellaria flocculosa*	+
15	*Synedra ulna*	+
16	*Synedra tabulate*	+

Table 5. Seasonal variations (o/l) of Diatoms in Konandur pond

2001-2002			2002-2003			2001-2003		
Monsoon	Pre-monsoon	Post-monsoon	Monsoon	Pre-monsoon	Post-monsoon	Monsoon	Pre-monsoon	Post-monsoon
4104	6009	5260	4580	6164	6188	4342	6086	5724

Prasad and Singh (1982) are of the opinion that water temperature ranging from 30º to 35º C enhance the multiplication of diatoms. However, in the present study temperature ranged from 26º to 35º C . This observation clearly indicates that the temperature less than 35ºC but, above 26ºC is highly congenial for diatoms growth and multiplication. This observation however, differs from that of Singh and Swarup (1979) and Venkateswarlu (1986).

The content of dissolved oxygen was higher in Konandur pond and it clearly indicates that dissolved oxygen at higher concentration encourages luxuriant growth of diatoms. This observation is in essential agreement with those of Venkateswarlu (1986), Somashekar (1987) and Unni et al.(1992).

Diatoms play a very important role ecologically as they comprise of major components of producers in wetland ecosystem (Zalewski et al., 1997). Diatoms are ubiquitous, unicellular microorganisms form the basic bulk of planktonic population in freshwaters characterized by siliceous cell wall (Round et al., 1990). Sabata & Nayar (1987) recorded highest number of diatoms during summer coupled with silica. In the present investigation, diatoms reached their peak during post-monsoon coupled with higher temperature of 35º C (Table 1).

IV. CONCLUSIONS

From the present study, it can be concluded that, Konandur pond shows the seasonal variations in water quality. This water body showed 16 species belonging to 09 genera of Diatoms and hence productive. Based on physico-chemical parameters in relation to Diatom distribution and abundance forms a useful tool for further scientific assessment and monitoring of pond.

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