

Study of Phytoplankton Status of Baya River Ghats of Samastipur, Bihar

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ABSTRACT

The water samples collected from three ghats namely Bakhoba ghat, Telia ghat and Gopalpur ghat, throughout two years were studied with reference to phytoplankton population density and their community structure. Average values were taken for the consideration. The study of phytoplankton community structure was restricted on the basis of green algae, blue-green algae, diatoms and rest of the phytoplankton which is termed here as 'other'.

The variations found during the two years of observation at three ghats have been reported in the Table 1 to 3.

Keywords: *Phytoplanktons, Ghats, Population density, Community structure.*

INTRODUCTION

The Baya river is an important river of district Samastipur, Bihar. It emanates from the Gandak a little west of the Muzaffarpur district. It enters the district near Karnaul near Sahebganj block and flows in the southeastern direction almost paralleled to its parent river Burhi Gandak and ultimately joins the Ganga near Bachwara of district Begusarai. Major length of this river flows through the district Samastipur. This river passes with many effluents. The river is situated at an elevation of 84 meters above the sea level (25.6° E 85.5° N – sites of observation). Its annual average depth is 6 – 8 meters at various ghats. It receives pollutants from remains of dead and burnt bodies from burning ghats. Agrochemical are also coming into the stream of river from adjoining areas. River is also being polluted by different human activities such as boating, extensive fishery, human and animal bathing, cloths washing *etc.* The present investigation was studied at three ghats of river near Patori, Samastipur. All three ghats are situated at above 5 km away from each other.

MATERIALS AND METHODS

Phytoplankton analysis in Baya river studied ghats were completed with following process.

Calculation and preservation phytoplankton samples were collected by hauling 150 liters of water through a plankton – net (bolting silk no. 22) with the help of a water sample of known volume. The sample thus collected were presented by adding Lugol's solution. Periphytic algae were collected were collected by scraping submerged stones, sticks, pilings, macrophytes and other available substrates. These were also preserved by adding Lugol's solution was added to 100 ml sample and the preserved samples were kept in the dark. The material from the study preserved of the diatoms was, however, treated differently. The diatoms were cleaned according to Braun's method the material laws first treated with an equal amount of concentration HCl for on 1hr and then thoroughly washed with distilled

water. Then the material was treated with equal amount of concentrated H₂SO₄ with a few crystals of potassium dichromate added to it. It was allowed to stand for 2 to 4 hours. The material was then thoroughly washed with the distilled water and the cleaned diatoms thus obtained were presented in 4% formation added with glycerin. For the microscopic examination of diatoms a drop of alcohol containing the cleaned diatoms was placed on a cover slip and the coverslip was heated from below so that the alcohol tools fire and was allowed to burn out. A drop of Canada balsam was then placed on upside down over it.

Identification of the algae mainly based on the works o Prescott and Scott (1942) and Philipose (1959), whereas the density of the phytoplankton was calculated by the following formula:

$$\text{Phytoplankton, Units /L} = \frac{\text{No. of phytoplank ton in the central chamber} \times 10^4}{\text{Concentration Factor}} \times 100$$

where, concentration factor = volume of water concentrated/volume of water made after concentration.

RESULTS AND DISCUSSION

Phytoplankton community structure of the river Baya was studied at three observed ghats as per the methods described in materials and methods, through the year 2008 to 2009. The sample were collected and analyzed on the basis of its unit per litre and tabulated. Seasonal mean average was calculated and reported in Table 1 to 3.

The detail observation for each phytoplankton group is described below:

Total phytoplankton (unit/liter):

Total phytoplankton of the river Baya ranged from 1420 – 6570 unit/liter among all three observed ghats during the three seasons of 2008-2009 (Table 1 – 3).

It is also evident from the tables cited above the total phytoplankton was observed minimum in rainy seasons and it was observed maximum in summer seasons at all three observed ghats. At Bakhoba ghat (Table – 1) maximum phytoplankton density was observed in the summer season (5750u/l) and minimum in the rainy season (1420 u/l) both in the year 2009. At Telia ghat (Table – 2) and Gopalpur ghat (Table – 3), it was observed maximum 6570 u/l in 2008 & 6080 u/l in 2008 and minimum 2290 u/l in 2009 & 1900 u/l in 2008, respectively. At Telia ghat, phytoplankton density was observed comparatively high among all observed ghats in all seasons.

Green Algae (unit/liter):

It was observed that green-algae of the river Baya has major percentage among all phytoplankton during summer. It was observed maximum in the summer of 2008 (6570 u/l) at Telia ghat and minimum in rainy season of 2009 (250 u/l) at Bakhoba ghat during whole period of study (Table 1 – 3). At Bakhoba ghat (Table – 1) maximum green algae density was observed in summer of 2009 (3200 u/l) and minimum in rainy season of 2009 (250 u/l). Similarly population density of green algae was found maximum 3450 u/l at Telia ghat in summer of 2008 and 3160 u/l at Gopalpur ghat in summer in 2008. Minimum population density was observed 460 u/l at Telia ghat in rains of 2008 and 300 u/l at Gopalpu ghat in rainy season o 2009.

Blue-green-algae (unit/liter):

Maximum phytoplankton density of blue-green algae in the river Baya was found 1600 u/l at Gopalpur ghat in summer of 2009 and minimum 210 u/l at Bakhoba ghat in winter of 2008. At Bakhoba ghat (Table 1) maximum green algae density was observed 3200 u/l in summer of 2009 and minimum 250 u/l in rains of 2009. Similarly population density of blue-green algae was found maximum 1500 u/l at Telia ghat in summer of 2009 and 1600 u/l at Gopalpur ghat in summer in 2009. Minimum population density was observed 300 u/l at Telia ghat in winter of 2008 and 250 u/l at Gopalpur ghat in winter of 2009.

Diatoms (Unit/Liter):

Maximum phytoplankton density of Diatoms in the river Baya was found 3150 u/l at Telia ghat in winter of 2009 and minimum 510 u/l at Bakhoba ghat in rain of 2009 (Table 1 – 3). At Bakhoba ghat (Table 1) maximum Diatoms density was observed 2800 u/l in winter of 2008 and minimum 510 u/l in rain of 2009. Similarly population density of Diatoms was found maximum 3150 u/l at Telia ghat in winter of 2009 and 3010 u/l at Gopalpur ghat in winter in 2008. Minimum population density was observed 850 u/l at Telia ghat in rain of 2008 and 710 u/l at Gopalpur ghat in rain of 2008.

Table 1
Seasonal variation in the phytoplankton population density (unit/litre) of the river Baya at Bakhoba Ghat

Phytoplankton	2008			2009		
	Summer	Rain	Winter	Summer	Rain	Winter
Green Alage	2900	260	1150	3200	250	1160
Blue-green Alage	1400	450	210	1450	440	210
Diatoms	1150	550	2800	1000	510	2700
'Other'	100	250	200	100	220	300
Total Phytoplankton	5550	1510	4360	5750	1420	4370

Table 2
Seasonal variation in the phytoplankton population density (unit/litre) of the river Baya at Telia Ghat

Phytoplankton	2008			2009		
	Summer	Rain	Winter	Summer	Rain	Winter
Green Alage	3450	460	1300	3400	460	1100
Blue-green Alage	1450	700	300	1500	650	300
Diatoms	1450	850	3020	1400	880	3150
'Other'	220	310	280	250	300	350
Total Phytoplankton	6570	2320	4900	6550	2290	4900

Table 3
Seasonal variation in the phytoplankton population density (unit/litre) of the river Baya at Gopalpur Ghat

Phytoplankton	2008			2009		
	Summer	Rain	Winter	Summer	Rain	Winter
Green Alage	3160	310	1150	3100	300	1160
Blue-green Alage	1550	580	250	1600	610	260
Diatoms	1210	710	3010	1200	710	3000
'Other'	160	300	250	150	310	260
Total Phytoplankton	6080	1900	4660	6050	1930	4680

‘Other’ Phytoplankton (unit/liter):

‘Other’ phytoplankton of the river Baya contributes a little to the phytoplankton. It was observed maximum 350 u/l at Telia ghat in the winter of 2009 and minimum 100 u/l at Bakhoba ghat in summer 2008 & 2009 (Table 1 – 3). At Bakhoba ghat (Table 1) maximum ‘other’ phytoplankton density was observed 300 u/l in the winter of 2009 and minimum 100 u/l in the summer of 2008 & 2009. At Telia and Gopalpur ghats it was observed maximum 350 & 310 respectively in winter and rain of 2009 and minimum 220 and 150 u/l respectively in summer of 2008 and 2009.

Relative proportion of Phytoplankton:

The study of phytoplankton community structure was also studied on their relative proportion of different groups of phytoplankton during 2008-2009 of the river Baya. It is evident from the table 1 – 3, that the relative proportion of green algae is pretty higher than that of other groups of phytoplankton in summer at all three observed ghats. On the other hand, diatoms are dominating in rains and summer over other groups of phytoplankton at all three observed ghats. Blue-green algae was found comparatively lower when compared to other phytoplankton group except in rain at Bakhoba Ghat.

The history of the use of animal as an indicator of water pollution is very old but algal indices for predicting the status of any water body is rather recent. In the present paper, the study of phytoplankton community structure was restricted on the basis of green algae, blue-green algae, diatoms and rest of the phytoplankton which is termed there as ‘other’. There is a plethora of literature available on such type of studies in India and abroad (Rao, 1977; Vasisht and Sharma, 1975; Kaul *et al.*, 1978; Kant and Anand, 1978; Venu, 1981; Pandey and Tripathy, 1988; Kumar and Rana, 1989; Alam *et al.*, 2001; Akin-Oriola, 2003; Huang *et al.*, 2004; Angadi *et al.*, 2005; Borges and Train, 2009; Kumar and Choudhary, 2010).

Population may be defined as the assemblage of organisms of the same species occupying a particular space at a given time. Its basic characteristics which are of interest to an ecologist are its size and density. The number of individuals in a population indicates its size and the number of individuals of the population in a unit area or unit volume is its density. Natality, mortality, immigration and emigration of the members affect the size and density of the population. Other characteristics of population study which are of ecological importance are the morphological variability, genetic composition and dispersion of individuals in the population. The relative proportion of the class wise dominance on the basis of their population in the present river has also been ascertained.

Observations made on the density of the phytoplankton during the two years show that the overall range of phytoplankton density in the Baya river 1420 u/l to 6570 u/l (Table 1 & 3). Density of the green algae showed and overall range of 250 u/l to 3450 u/l (Table 1 & 3). The blue green algae showed and an overall range 210 u/l to 1600 u/l (Table 1 & 3).. Density of the diatoms showed and overall range of 510 u/l to 3150 u/l (Table 1 & 3) and the other exhibited an overall range of 100 u/l to 350 u/l only. Many workers have reported association of the blue green algae with high temperature. The present observation in the river Baya closely agrees with the finding of Pahwa and Mehrotra (1966) and Singh and Ahmad (1990). The water of the river Baya may be consider polluted in the months of rains when the presence of blue-green algae become higher than the green algae but in summer the green algae was observed 52 to 54% and blue green algae 22 to 26% which may be

considered as not polluted in this season. This is in accordance with Tiwari and Chauhan, 2006 and Mustapha, 2009. Details of individual algae was not recorded here due to the limitation of the work and in future this work can be explored.

REFERENCE

1. Akin-Oriola, G. A. 2003. On the phytoplankton of Awba reservoir, Ibadan, Nigeria. *Rev. Biol. Trop.*, 51(1):99-106.
2. Alam, M. G., Jahan, N., Thalib, L., Wei, B. and Maekawa, T. 2001. Effects of environmental factors on the seasonally change of phytoplankton populations in a closed freshwater pond. *Environ. Int.*, 27(5):363-371.
3. Angadi, S. B., Shiddamallayya, N. and Patil, P. C. 2005. Limnological studies of Papnash pond, Bidar (Karnataka). *J. Environ. Biol.*, 26(2):213-216.
4. Borges, P. A. and Train, S. 2009. Phytoplankton diversity in the Upper Parana river floodplain during two years of drought (2000 & 2001). *Braz. J. Biol.*, 69(2)Suppl.:637-647.
5. Huang, L., Jian, W., Song, X., Huang, X., Liu, S., Quin, P., Yin, K. and Wu, M. 2004. Species diversity and distribution for phytoplankton of the Pearl river estuary during rainy and dry seasons. *Mar. Pollut. Bull.*, 49(7-8):588-596.
6. Kaul, V., Fotedar, D. N., Pandit, A. K. and Trisal, C. L. 1978. A comparative study of plankton populations in some typical freshwater bodies of Jammu and Kashmir state. *Environ. Ecol. Plants.*, 249-269.
7. Kant, S. and Anand, V. K. 1978. Interrelationship of phytoplankton and physical factors in Mansar lake, Jammu (J & K). *Ind. J. Ecol.*, 5(2):134-140.
8. Kumar, B. N. and Choudhary, S. K. 2010. Phytoplankton species diversity of Jagatpur Wetland, Bhagalpur, Bihar. *J. Ind. Bot. Soc.*, 89(3 & 4):358-363.
9. Kumar, J. I. N. and Rana, B. C. 1989. Variation in primary productivity of the phytoplankton of Tarapur pond, Gujrat, India. *Ind. Bot. Contactor.*, 6(3):95-98.
10. Mustapha, M. K. 2009. Phytoplankton assemblage of a small, shallow, tropical African reservoir. *Rev. Biol. Trop.*, 57(4):1009-1025.
11. Pahwa, D. V. and Malhotra, S. N. 1966. Observations on the fluctuations in the abundance of plankton in relation to certain hydrobiological conditions of river Ganga. *Proc. Nat. Acad. Sci. India.*, 368(2):157-189.
12. Pandey, S. N. and Tripathi, A. K. 1988. Studies of algae of polluted ponds of Kanpur(India):Role of Blue Green Algae. *Phycos.*, 27:38-43.
13. Philipose, M. T. 1959. Freshwater phytoplankton of Indian fisheries. *Proc. Symp. Alogology.*, 272-291.
14. Prescott, G. W. and Scott, A. M. 1942. The freshwater algae of the South United States. Desmids from Mississippi with description of new species and varieties. *Trans. Amer. Micros. Soc.*, 61:1-29.
15. Rao, V. S. 1977. An ecological study of three freshwater ponds of Hyderabad, India. *Hydrobiol.*, 53(1):13-32.
16. Singh, A. K. and Ahmad, S. H. 1990. A comparative study of the phytoplankton of the river Ganga and pond of Patna, Bihar. *J. Ind. Bot. Soc.*, 69:153-158.
17. Tiwari, A. and Chauhan, S. V. 2006. Seasonal phytoplanktonic diversity of Kitham lake, Agra. *J. Environ. Biol.*, 27(1):35-38.
18. Vashist, H. S. and Sharma, B. K. 1975. Ecology of a typical urban pond in Ambala city (Haryana). *Ind. J. Ecol.*, 2:79-86.
19. Venu, P. 1981. A limnological study on lake Kondakararla. PhD Thesis, Andhra University, Waltair.