Studies on phytoplankton diversity in the river Gomti at Jaunpur (U.P.)

S. NAFASAT ALI, M. AKHTAR AND A.K. PANDEY

Asian Journal of Environmental Science (June to November, 2009) Vol. 4 No. 1 : 78-80

See end of the article for authors' affiliations

Correspondence to :
A.K. PANDEY
Biological Research Lab., Department of Botany, Kutir P.G. College, Chakkey, JAUNPUR (U.P.) INDIA

SUMMARY

The paper deals with an ecological study with special reference to phytoplankton (algal) component river Gomti in Jaunpur City. The phytoplankton (algal) community of river was represented by four algal group *viz.*, Cyanophyceae, Chlorophyceae, Euglenophyceae and Bacillariophyceae. Out of 44 algal species, 16 species of Cyanophyceae and Chlorophyceae, 1 species of Euglenophyceae and 11 species of Bacillariophyceae were recorded from different sites of the river. Phytoplankton population showed a positive correlation with pH, DO, alkalinity, phosphate and nitrate and negative correlation with temperature and chloride. Many of the algal species, of the total 44 reported from the river like *Aulosira, Microcystis, Oscillaloria, Chlamydomonas, Chlorella, Pediastrum, Euglena, Cyelotella, Nevicula, Nitzschia* were recognised as pollution indicators. The main source of the river were discharges of municipal and industrial water, human excreta agricultural run off and burning of corpse.

Key words :
Pollution,
Phytoplankton,
Diversity

The river ecosystem receives water from their water sheds, marginal run off and domestic sources. These water contain excess of organic matter, nitrogen, phosphorus, suspended particles and toxicants. They also get lot of other wastes in the form of garbage, effluents and sewage which affect the water quality and biotic community of aquatic body. Phytoplanktons are ecologically an important group of aquatic ecosystem because they play a key role as a primary producers.

Riverine ecosystems have been used extensively for different purposes and exploited recklessly throughout the world. Now-a-days, however, the riverine ecosystem are in a critical stage of ecological transition as evidenced from thick to very thick stand of macrophytes, indicating advanced stages of entrophication.

Diversity indicates the degree of complexity of community structure. It is the function of number of species and abundance diversity has often been related to environmental characteristics of water mass and energy within the community. The biodiversity and production functions in riperian riverine ecosystems are reeling under serious threat and needs proper evaluation, though some reports are available for different riverine system (Michael and Sharma, 1988; Jha and Chandra, 1997; Lande, 2004; Nath and Ray, 2006).

The present study has been undertaken on the River Gomti which is considered as one of the most important tributaries of the Rive Ganga in eastern U.P. The present study has been carried out for the assessment of phytoplankton (algal) diversity and the specimens were collected from four sampling stations of the River Gomti at Jaunpur, U.P.

Accepted :
April, 2009

MATERIALS AND METHODS

Study area :

Jaunpur representing south eastern part of U.P. and lies 82.6^{O}E longitude and 25.7^{O}N latitude embracing an area of nearly 4038 Km^2. Municipal and industrial sewages from different areas of city and industries are discharged into river directly or indirectly. Four experimental sites, *viz.*, Kalichabad ghat (S_1), Hanuman ghat (S_2), Achala Devighat (S_3) and Ram ghat (S_4), were selected for study of algal (phytoplankton) diversity. S_1 site was considered as control assuming lesser pollution, S_2 and S_3 were the mixing zone and S_4 was selected as down stream of the river.

Phytoplankton study:

Plankton samples were collected by using plankton net made up of bolting silled no 25 (mesh size 0.064 mm) from 0-6 meter water column. Specimens were pressured immediately in 5% Formaline solution and identified with the help of relevant monographs (Desikachary, 1959 Frittsch, 1935; Prescott, 1980). Algae were counted by usual method. Algali biomass was estimated by 'Short term harvested method' (Odum, 1960) in second week of each month.

RESULTS AND DISCUSSION

The phytoplankton (algal) community of the rive at four sampling sites were represented by four group of algae. A total number of 35 genera and 44 species of algae, cyanophyceae, 11 genera and 16 species; chlorophyceae, 12 genera and 16 species. Euglenophyceae 1 genus and 1 species and Bacillariophyceae 11 genera and 11 species, were recorded during the period ofJanuary to December 2007. Out of total 44 species 8 species were common to all the four sites while rest were present only at specific site (Table 1). Algal population showed a positive correlation with pH, DO, alkalinity, phosphate and nitrate. A negative correlation was observed with temperature and chloride (Table 2).

The data on algal biomass are presented in Table 3. The total biomass of Cyanophyceae ranged from 2.0-650x10^3 mg.l^{-1} at S_1; 4-1214x10^3 Mg.l^{-1} at S_2; 6-1975x10^3 Mg.l^{-1} at S_3 and 3-580x10^3 Mg.1^{-1} at S_4 while the biomass of Chlorophyceae at S_1, S_2, S_3 and S_4 ranged from 25-5675x10^3 mg.l^{-1}; 16-5035x10^3 Mg.l^{-1}; 32-3595x10^3 Mg.l^{-1} and 28-1950x10^3 Mg.1^{-1}, respectively. Euglenophyceae and Bacillariophyceae also followed the similar trend and they ranged from 1.0-680x10^3 mg.l^{-1} at S_1; 2.5-540x10^3 Mg.l^{-1} at S_2; 4.0-1155x10^3 Mg.l^{-1} and 3.0-35x10^3 Mg.1^{-1} at S_4 and 12-1025x10^3 mg.l^{-1} at S_1; 105-1420x10^3 Mg.l^{-1} at S_2; 50-1750x10^3 Mg.l^{-1} at S_3 and 250-1930x10^3 Mg.1^{-1} at S_4, respectively. With regard to group biomass, the chlorophyceae remained at number one followed by Cyanophyceae, bacillariophyceae and Euglenophyceae at all the sites (Table 3). Similar observations have also been reported by (George) 1976, Jackson, (1971).

Table florestic composition of water bodies showed different levels of pollution of algal composition as the indicator of the level of pollution (Hutchinson, 1967). The natural enrichment of the river is usually not sufficient to produce polluting conditions but the pressure of the human activities can influence the river water quality to a great extent. River Gomti seems to be victim of increasing antoropogenic pressure at Jaunpur because of which water has become quite unsuitable for various purposes. Out of 44 species, 8 species of different groups of genera were found common at all the sites including high pollution tolerant species. Pressure of more cyanobacterial population at S_2 and S_3, suggested for high pollution load due to nutrient rich condition. Franklin (1972) suggested that cyanobacteria are general indicators of entrophy of water. Green algae (Chlorophyceae) were also to be the indicator of higyhly polluted water (Rama Rao *et al*., 1978). Presence of diatoms and euglenoids at sites with increased number at S2 and S3 is suggesting for nutrient

Table 1 : Florestic composition of phytoplankton (algae) at different sites of river Gomati at Jaunpur

	Algal flora	Sampling sites			
		S_1	S_2	S_3	S_4
A.	Cyanophyceae				
	Ananaena variabilis	+	-	+	+
	A. doliolum	+	-	-	-
	Anamaena sp.	-	+	+	+
	Aulosira fertilissima	+	+	+	+
	Chroococcus turgidis	+	-	+	-
	Cylinderospermum sp.	+	-	+	+
	Lyngbya sp.	-	-	+	+
	Microcystis aeruginosa		+	+	+
	Nostoc sp.	+	+	+	+
	N. linckia	-	-	-	+
	Oscillatoria furmosa	+	+	+	-
	O. princeps	+	+	+	+
	O. tenuis	+	+	+	+
	Phormidium calcicola	-	-	+	+
	Plactonema sp.	+	+	+	-
	Rivularia sp.	+	+	+	+
B.	Chlorophyceae				
	Chlamydomonas mirbili	+	-	-	+
	C. subsala	+	-	+	+
	C. plactonica	+	+	+	+
	Chlorella vulgaris	+	+	+	+
	Cladophora glomarata	+	-	+	-
	Cosmarium sp.	+	-	-	+
	Hydrodictyon reticulatum	+	-	+	+
	Oedogonium sp.	+	-	-	+
	Pediastrum duplex	+	+	+	+
	Scenedesmus aruensis	+	-	-	+
	S. quadriquada	+	+	+	-
	S. acuminatus	+	-	+	+
	Spirogyra singularis	+	-	+	+
	Ulothrix zonata	-	+	-	+
	Volvox	+	-	-	-
	Zygnema sp.	+	+	-	+
C.	Euglenophyceae				
	Euglena viridis	+	+	+	+
D.	Bacillariophyceae				
	Achnanthes clevei	+	+	+	-
	Bacellaria	+	-	-	+
	Cocconeis placentula	+	+	-	-
	Cyelotella glomarata	+	-	+	+
	Cymbella sp.	+	-	-	-
	Diatoma vulgare	-	-	+	+
	Gyrosigma vulgare	-	-	+	+
	Navicula halophia	-	+	-	-
	Nitzschia gracilis	-	-	-	+
	Pinularia sp.	+	-	-	+
	Synedra tabulata	-	-	+	+
	Total number of genera	29	18	24	26
	Total number of species	35	19	29	32

Note : (+) Present, (-)= Absent

Table 2 : Correlation coefficient between plankton (algal) density and physio-chemical factors

	Correlation coefficient (r)			
	Algal group			
	Cyanophyceae	Chlorophyceae	Euglenophyceae	Bacillariophyceae
Temperature	-0.815	-0.585	-0.135	-0.865
pH	0.740	0.861	0.195	0.752
DO	0.698	0.762	0.511	0.682
Cl	-0.350	-0.628	-0.102	-0.695
PO_4^{-3} P	0.538	0.452	-0.309	0.292
NO_3^- P	0.775	-0.757	0.560	-0.498
Alkalinity	0.766	0.459	0.598	0.195

Table 3: Annual range of biomass* of different algal group at different sites of river Gomati at Jaunpur (Units = 10^3 $Mg.l^{-1}$)

Algal class	Site-I	Site-II	Site-III	Site-IV
Cyanophyceae	2.0-650	4.0-1214	6-1975	3-580
Chlorophyceae	25-5675	76-5035	32-3595	28-1950
Euglenophyceae	1.0-680	2.5-540	4.0-115	3.0-35
Bacillariophyceae	12-1025	105-1420	50-1750	250-1930

* Expressed as fresh weight of biomass

rich condition and low pH and DO as reported earlier for other reverine ecosystem (Rai and Kumar, 1976).

Authors' affiliations

S. NAFASAT ALI, Biological Research Lab., Department of Botany, Kutir P.G. College, Chakkey, JAUNPUR (U.P.) INDIA

M. AKHTAR, Department of Botany, S.N.P.G. College, AZAMGARH (U.P.) INDIA

REFERENCES

Desikachary, T.V. (1959). *Cyanophyceae.* ICAR Publication, New Delhi.

Franklin, T. (1971). First Internat. Symp. on taxonomy and biology of blue-green algae, University of Madras, Madras, 412 pp.

Frittsch, F.E. (1935). *Structure and reproduction of Algae*, Cambridge University Press, London.

George, J.P. (1976). Hydrobiological studies in Lower lake of Bhopal with special reference to productivity of economic Fish. Ph.D. Thesis Bhopal University, Bhopal (U.P.).

Hutchinson, G.E. (1967). *A treatise on limnology*. Vol. III. *Introduction to lake biology and limnoplankton* J. Wiley and Sons, NY.

Jackson, D.F. (1971). Comparative studies on phytoplankton photosynthesis in relation to total alakalinity. *Yer. Int. Ver. Limnol.,* **14** : 125-133.

Jha, B.C. and Chandra, K. (1997). Kusheshwarasthan chaur (North Bihar: Status and prospects of fisheries development. *CIFRI Bull.* No. **71**.

Lande, V.W. (2004). Zooplankton assessment in the costal waters of Kakinada and Mumbai. *Indian J. Env. Ecoplan,* **8** : 75-80.

Michael, R.G. and Sharma, B.K. (1988). Fauna of India : Indian Cleodocera (Crustaceae; Brachipoda; Cladocera). *Zool. Surv. India*. Govt. of India, pp. 262.

Nath, Dilip and Ray, D.C. (2006). Plankton diversity in riverine ecosystem of South Assam and Tripura, India. *J. Curr. Sci.,* **9** (2) : 655-658.

Prescott, G.W. (1980). How to know the aquatiplants ? The picture key, Nature Series, Dubuque, Iowa.

Odum, E.P. (1960). Organic production and turnover in Oldfied Succession. *Ecology* **41**: 34-49.

Rama Rao, S., Singh, U.P. and Mall, L.P. (1978). Pollution of river Ruan (Indore) India. I. Biological assessment of Pollution. *Water Research,* **12** : 555-559.

Rai, L.C. and Kumar, H.D. (1976). Systematic and ecological studies on algae of some habitats polluted with fertilizer factory effluent near Sahupuri, Varanasi, India, *Nova Hedwigia*, **27** : 805-811.

Rai, L.C. and Kumar, H.D. (1977). Studies on the seasonal variations in the algal community of pond polluted with fertilizer factory effluent *In. J. Ecol.* **4** : 124-31.

Reddy, K.R. and Graetz, D.A. (1981). Use of shallow nesenoirs and flodded soil system for waste water treatment; Nitrogen and Phosphorus transformation. *J. Env. Quol*. **10**, 113-119.

Sikandar, M. (1987). Ecology of river Ganga in Varanasi with special referencwe to pollution, Ph.D. thesis, Banaras Hindu University.

Smart, M.M., Jones, J.R. and Sebangh (1985). Stream watershed relations in the Missori Ozark Plateau Province. *J. Env. Qual*. **14** : 77-82.

Welch, P.S. (1952). 'Limnology'. New York Torontor and London. Mc Graw Hill Book Co. 2nd Edition 538.