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Study of Seasonal assessment of phytoplankton diversity in the Gomti river at Lucknow

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Abstract

The increasing human activities and natural causes affect the aquatic ecosystem. The present study documents the distribution and diversity of phytoplankton of Gomti River during pre-monsoon, monsoon and post monsoon season. A total of 34 species were noticed during the study period. Only 5 planktonic classes were reported such as *Bacillariophyceae*, *Chlorophyceae*, *Cyanophyceae*, *Dinophyceae* and *Euglenophyceae*. The study confirms 6 species belonging to *Bacillariophyceae*, 19 were *Chlorophyceae*, 04 belonging to *Cyanophyceae*, 02 were belonging to *Dinophyceae* and 03 were belonging to *Euglenophyceae*. Among these *Chlorophyceae* was the most dominant class in the phytoplankton followed by *Bascilleriophyceae Cyanophyceae* and *Euglenophyceae*. The prevalence percentage is 55.88% *Chlorophyceae*, 17.64% *Bascilleriophyceae*, 11.76% *Cyanophyceae*, 5.88% *Dinophyceae* and 8.82% *Euglenophyceae* respectively. The main pollution source of the river were discharges of municipal and industrial waste, human excreta and burning of fossil fules. Nutrient enrichment of the river altered the structure of plankton community.

Keywords: River Gomti, phytoplankton, pollution, pre-monsoon, post-monsoon.

Introduction

Rivers are important system of biodiversity and are the most productive ecosystems on the earth because of the favorable condition that supports the number of flora and fauna, urbanization, expansion of irrigation and increasing trends of industrialization has contributed towards the demand for water (Komala *et. al;* 2013).

River is significant for all human being as well as flora and fauna. Phytoplankton is ecologically an important group of aquatic ecosystem because they play a key role as primary producers (Ali *et. al;* 2009). The riverine ecosystem are in a critical stage of ecological transition as evidenced from thick to very thickened of macrophytes, indicating advanced stages of eutrophication. Diversity indicates the degree of complexity of community structure. Abundant growth of plankton in polluted habitats resulted in bad tastes and odour problems, besides death of aquatic fauna and deterioration in the quality of water. The quality and quantity of phytoplankton along with their seasonal pattern are determined by a complex of chemical, physical and biotic factors in polluted and clean water (Nasar, 1977).

Plankton in the water body reflects the ecological characteristics and therefore plankton organisms may be use as indicator of water quality (Saha *et. al;* 2000 and Angadi *et. al;* 2005). A considerable rich work has been done in fresh water bodies in relation to phytoplankton by (Bhatt *et. al;* 1999, Lande, 2004, Nath & Ray, 2006).

The present study has been under taken on the River Gomti which is considered as one of the most important tributaries of river Ganga in Eastern U.P. The present study has been carried out for the assessment of phytoplankton diversity were collected from six sampling stations of the river Gomti at Lucknow U.P. Present study concluded that phytoplankton diversity varies with the seasonal variation.

Materials and Methods

The present study was carried out for a period of one Year from January 2017 to January 2018 for the observation and analysis of phytoplankton. The samples were collected from six different sites of river Gomti from the Lucknow district region *viz*. S1 (Gau ghat), S2 (Kudiya ghat), S3 (Pakka pul), S4 (Daliganj bridge), S5 (Hanuman setu), S6 (Nisatganj bridge) during pre- mansoon, monsoon and post- monsoon respectively. For phytoplankton estimation the method followed by Sheshodia (1988) was adopted. The phytoplankton samples were collected by filtering about 25 liter of water through plankton net of bolting silk no. 25. The samples were preserved in 4 % formaline solutions which were prepared from the stock solution. The samples were observed in the laboratory into Sedywick Rafter cell with the help of microscope and counted all the phytoplankton present in the cell by moving it horizontally and vertically. Counting of phytoplankton was done by applying the following formula.

$$N = n \times v/V$$

Where:

N = Total number of organism/litre of water filtered.

n = Total number of organism counted in 1 ml of plankton sample.

v = Volume of concentrated plankton sample (ml).

V = Volume of total water filtered.

Results and Discussion

The phytoplankton community of the river river at six sampling sites were represented five planktonic classes. A total number of 34 species of algae belonging to 6 species of *Bacillariophyceae*, 19 were *Chlorophyceae*, 04 species belonging to *Cyanophyceae*, 02 were belonging to *Dinophyceae* and 03 were belonging to *Euglenophyceae*.

The prevalence percentages were 55.88% to *chlorophyceae*, 17.64 % *Dinophyceae* and 8.82 % *Euglenophyceae* respectively. Among these *Chlorophyceae* was the most dominant followed by *Bascillariophyceae*, *Cyanophyceae* and *Euglenophyceae* during the period of July 2016 to July 2017. The diversity of phytoplanktons in the river Gomti at Lucknow region from selected sites are existing in Table-1. In the Gomti River phytoplankton ranged between 220-310 Ind/lit in pre-monsoon, 142-192 Ind/lit in monsoon and 117-210 Ind/lit in post monsoon season respectively. The site S4 was observed lower value i.e. 220 Ind/lit of phytoplankton in pre-monsoon season followed by site S3 in summer season while in monsoon and post monsoon season. Still there is no evidence that which of the two seasons is best consider for the plankton density and diversity. Due to increased flow of water in monsoon season also affect the plankton density becomes low as compared to summer and winter season.

Table-1: Phytoplanktons density (Individuals/litre) in Gomti River during summer, monsoon and winter season

Site	Seasons		
	Pre-mansoon	Mansoon	Post-mansoon
S1	295.00	181.00	129.00
S2	310.00	192.00	210.00
S3	270.00	142.00	121.00
S4	220.00	151.00	117.00
S5	285.00	182.00	157.00
S6	269.00	163.00	186.00

S1=Gau ghat, S2= Kudia ghat, S3= Pakka pul, S4= Daliganj, S5= Hanuman Setu, S6= Nishat ganj

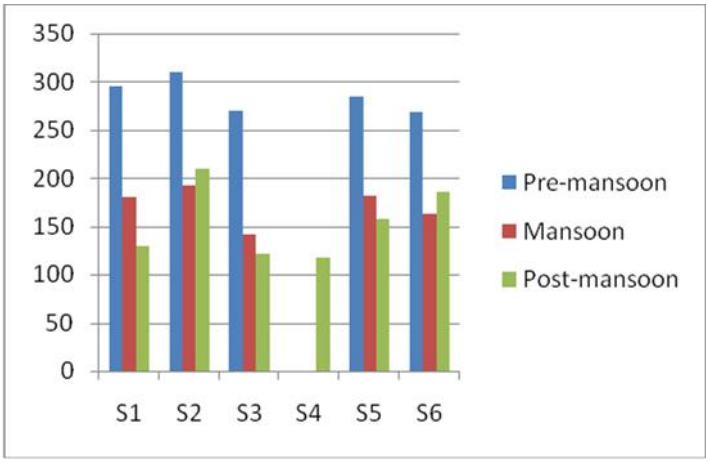

Fig: 2- Phytoplanktons density (Individuals/litre) in Gomti River during Summer, monsoon and winter season

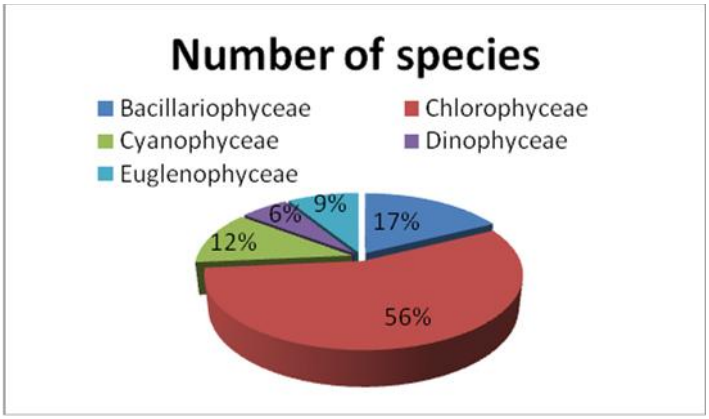

Fig- Prevalence percentage of Phytoplankton density during Pre-Monsoon, Monsoon and Post Monsoon in River Gomti at Lucknow region

Bwala *et. al;* (2010) reported highest count of phytoplankton and Zooplankton Kainji reservoir of Nigeria during winter and rainy season. This is due to little amount of nutrient and decrease water body. Approximately related observation was noticed by Islam *et. al*, (2000) and Isbella *et. al;* (2011) in various habitats. Our findings are similar to those as recorded in case of river Gomti and ponds of Lucknow (Ahmad *et. al;* 2010). In the river Gomti density of phytoplankton has been relatively lower due to anthropogenic activities and increasing rate of pollution day by day. Now a day there is so many changes are responsible for the variety and quantity of phytoplankton. Phytoplankton species distribution shows wide variations due to the differential effect of hydrographical factors on individual species and they serve as indicators of water quality and pollution (Gouda *et.al;* 1996). Green algae (*Chlorophyceae*) were also to be the indicator of highly polluted water (Rama, Rao *et.al;* 1978). Being and index of trophic status, phytoplankton reflects the overall environmental condition of system and its potentiality. Algae are common and normal inhabitants of the surface layer in water bodies exposed to sunlight (Trivedy 1986). *Myxophyceae* and *Bacillariophyceae* were shown to be correlated with intensity of pollution (Palharyga and Malviya, 1988). Phytoplanktons are of great importance in biomonitoring of pollution (Davies *et.al;* 2009).

Most aquatic body will require significant amount of phytoplankton is the bioindicator of water, pollution appearance, disappearance, density and pattern of distribution depends on biotic and abiotic factors (Escaravage and Prins, 2002), Kauppila *et.al;* 2004; Komala *et.al;* 2013 and Panigrahi & Putra, 2013). Due to their short life span phytoplankton can adopt rapid changes in the structure and physiology with the surrounding, this ability turn influence ecological interactions (Lennon and Martiny, 2008; Litchman *et.al;* 2012 and Lomas *et.al;* 2014).

Table -2: Distribution of Phytoplanktons at different sites in summer and monsoon and winter season

Phytoplanktons	Pre-monsoon						Monsoon						Post-monsoon					
	S1	S2	S3	S4	S5	S6	S1	S2	S3	S4	S5	S6	S1	S2	S3	S4	S5	S6
Bacillariophyceae																		
Stauroneis- pusilla	-	+	+	-	+	+	+	-	-	+	-	+	+	+	-	+	-	-
Cosmarium – formosuhum	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	+	+
Micraasterias desmids	+	+	+	-	+	+	+	-	-	+	-	-	+	-	+	+	+	-
Navicula sphaerophor	-	+	+	+	-	+	-	-	+	+	+	+	+	-	-	+	+	+
Cosmarium nitidulum	-	+	+	-	-	+	+	+	+	-	+	+	-	-	+	+	+	+
Synura	+	+	+	-	-	+	+	+	-	-	-	+	+	-	+	+	+	+
Chlorophyceae																		
Chlamydomonas	+	+	+	+	+	+	-	+	+	-	+	+	-	+	+	+	+	-
Ranunculus aquatilis	+	+	-	-	+	-	+	-	-	+	-	+	+	+	-	-	+	+
Spirogyra	+	+	+	-	-	+	+	+	+	-	-	+	+	-	-	+	+	-
Chara	-	+	-	+	-	+	+	+	+	-	+	+	+	+	-	-	+	+
Pediastrum simplex	+	-	-	+	+	+	+	+	+	-	-	+	+	-	-	+	+	+
Pandorina morum	-	-	+	+	+	-	+	+	+	-	-	+	+	+	-	-	+	-
Cladophora	+	+	+	-	-	-	+	+	+	-	+	-	+	+	-	-	+	+
Vaucheria	-	+	+	+	-	-	+	+	+	+	-	-	+	+	+	-	+	-
Ulothrix	-	-	+	+	-	-	+	+	+	-	-	+	+	+	+	-	+	+
Zygnema	+	+	+	-	+	+	+	-	-	+	+	+	-	+	+	-	-	+
Mongeotia spp.	+	+	+	-	-	+	+	-	-	+	+	+	+	+	-	-	+	+
Microspora spp.	+	+	+-	-	+	+	-	+	+	-	-	+	+	+	-	+	+	+
Oedogonium	+	+	+	-	-	+	+	+	+	+	-	+	-	-	+	+	+	-
Hydrodictyon	+	+	+	-	-	+	+	+	-	-	+	-	-	+	+	+	-	+
Volvox aureus	+	+	+	+	-	+	+	+	-	-	+	-	-	+	-	+	+	+
Chlorella canglomerata	+	+	+	-	+	+	-	-	-	+	+	+	-	-	+	-	+	+
Scenedesmus armatus	-	+	+	+	-	+	+	+	-	-	-	+	+	-	+	+	+	+
Scenedesmus obliquus	+	+	+	-	+	+	+	-	-	+	-	+	+	-	+	+	-	-
Actinastrum	+	+	+	-	-	-	+	-	+	+	+	-	-	+	+	+	+	+
Cynophyceae																		
Microcystis aeruginosa	+	+	-	+	-	-	+	-	-	-	+	+	+	-	-	+	-	+
Spirulina subsala	+	+	+	+	-	-	+	-	-	+	-	-	+	+	+	-	-	-
Spirulina major	-	-	+	+	-	+	+	-	-	-	+	+	-	+	+	+	-	-
Oscillatoria limosa	+	+	+	+	-	+	-	+	+	-	+	+	+	-	-	+	-	+
Dinophyceae																		
Gymnodonium aeruginosum	+	+	+	+	-	+	+	+	-	-	+	+	+	-	-	+	-	+
Gymnodinium stein	+	+	-	+	+	-	-	+	+	+	+	-	+	-	+	+	-	-
Euglenophyceae																		
Euglena granulate	+	+	-	-	+	+	+	+	-	+	+	+	-	+	+	-	+	-
Euglena viridis	+	+	+	-	-	-	+	-	-	+	+	+	-	+	+	-	-	+
Phacus longicauda	+	+	+	-	+	+	+	+	-	-	+	+	-	+	-	+	+	+

Conclusions

The present study provides vital details on phytoplankton distribution and abundance of river Gomti which may unreveal the information on the energy turnover of the river ecosystem. It will serve as a useful tool for further ecological assessment and monitoring of the river ecosystem.

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