# A seasonal study of phytoplanktons diversity of Gomti river Lucknow, (U.P.) India : A pollution indicator

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## Abstract

**Gomti**: One of the important river of Indo-gangetic system and perennial river of Awadh plains and run across the major part of U.P. covering nine districts and 940 Km stretch area. A study was carried out to observe phytoplankton diversity, density and distribution in three different seasons summer, monsoon and winter during 2012-13 at five different sites. Various genera of algae belonging to chlorophyceae viz. Chlamydomonas, Spirogyra, Oedogonium, Ulothrix, Hydrodictyon, Vaucheria, Scenedesmus, Desmidium, Zygnema, Mongeotia spp., Microspora spp., Gonium sociale, Pediastrum, Ranunculus aquatilis, Seven genera of bacillariophyceae viz. Stauroneis- pusilla ,Cosmarium –formosuhum, Micrasterias desmids, Synedra- ulna, Navicula- sphaerophor, Nitzschia stagnorum, Synura**,** Myxophyceae viz. Volvox aureus ,Oscillatoria ,Stigonema have been recorded. Phytoplanktons are significant formal natural occupier of all water bodies. Monitoring programmes of phytoplanktons are very important. They may provide information on possible new introductions and may serve as early warning system to detect the pollution level. Chlamydomonas , Ranunculus aquatilis Microspora spp, Volvox aureus were the most abundant followed by Ulothrix, Hydrodictyon, Desmidium. High concentration of diatoms at Daliganj bridge and Nishatganj bridge indicate polluted zone of the river. Oscillatoria and Stigonema spp. at polluted sites can be used as an indicator of organic pollution in the river. In the present study role of planktons as bioindicator in aquatic health as well as their role in survival of aquatic taxa of animals in river Gomti has been discussed. Proper biological and chemical treatment of domestic sewage and industrial effluents before discharge to river system is suggested.

**Key words: Phytoplanktons, River Gomti, Bio-indicator**

## Introduction

Environment pollution is a serious problem now a days affecting all ecosystems including aquatic ecosystem. Therefore the conservation of fresh water environment and its monitoring is highly essential (Nafessa *et.al*.,2010; Mohapatra and Rengarajan,1995). Algae play an important role in the biosynthesis of organic matter (primary production) in aquatic system, which directly or indirectly serve all the living organism of a water body as food ( Anjana and Kanhere,1998). The bacillariophyceae or diatoms are unicellular algae characterized by having a cell wall of silica. The wall consist of two valves that have more or less flat surfaces, held together by a band or girdle. They are found in fresh water and marine habitates and also on moist soil surface. There are only few published record on the systematic account of fresh water diatoms flora of the Indian river. Till date a total number of 173 species of diatoms belonging to 24 genera have been reported from various region of India ( Kant and Gupta,1998; Sinha ,1997, Mrutyunjay Jena *et.al.,*2006). However all these work have been confined to certain specific

localities of western and southern India. So far there has been little record on the fresh water diatoms of Gomti river . Unlike other algae all the common bloom forming blue green algae contain gas vacuoles, which can impart positive buoyancy to the algae under certain condition. Some species of blue green algae aggregate and make a colony floating over the surface forming the bloom. Water bloom besides imparting color to the water also gives a disagreeable smell and taste to it. Algae and diatom species distribution shows wide variation due to the differential effect of hydrographical factors on individual species and serve as good indicators of water quality pollution ( Nafeesa Begum *et.al*. 2010, Gouda *et.al*,1996). Algae of pond ecosystem were studied by Hosmani and Bharat,1980 , Bhatt and Negi,1985, Verma and Mohanty,1995 and several studies on phytoplankton diversity was made in India and abroad on the pond,lakes and reservoirs ( Senthikumar and SivaKumar, 2008 , Tas and Gonulol,2007). In this paper an attempt has been made to study the seasonal changes on diversity of algae and diatoms.

## Materials and Methods

For the estimation of phytoplankton the water samples were collected from five different sites of river Gomti designated as viz. A (Gau Ghat),B(Pakka Pul), C (Daliganj Bridge), D (Nishat Ganj Bridge) and E ( Pipra Ghat). Each sampling site was further marked with 1 (Northern bank), 2 (midstream) and 3(Southern bank) during summer ,monsoon and winter season respectively. For plankton estimation the methods followed by Sheshodia (1988) was adopted. For this purpose about 20 litre of water sample was collected and filtered through plankton net of bolting silk No. 25. The samples were preserved in 4% formaline solution. The sample were taken into Sedywick Rafter cell. Now place the cell under microscope and count all the plankton present in cell by moving it horizontally and vertically. Repeat the process several times. Counting of organism will be 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 1ml of plankton sample
v=Volume of concentrated plankton sample(ml)
V= Volume of total water filtered

## Results and Discussion

The density of phytoplanktons in river Gomti at selected sites are presented in Table-1. In the Gomti river phytoplankton ranged between 65-125 Ind/litre in summer, 18-83 Ind/litre in monsoon and 39-70 Ind/litre in winter season respectively. The site-C was observed lower value i.e. 65 Ind/litre of phytoplanktons followed by Site-A in summer season, while in monsoon and winter season the lowest value recorded at site-E. However, this was no clear trend suggest that, which of the two seasons could be considered as the best. Minimum density were present in monsoon season may be due to flow of water as compared to summer and winter season. Bwala *et.al*.(2010) reported highest count of phytoplankton and zooplanktons in Kainji reservoir of Nigeria during winter and rainy season. Least count of plankton was recorded during dry season. This is due to low content of nutrient and shrinkage of water bodies. These finding are similar to those as recorded in case of river Gomti and ponds of

Lucknow (Tabrez et.al.,2010). During present study a distinct fluctuation of phytoplanktons population in different season was observed. Almost similar observation were noticed by Islam et.al. (2000), Isabella et.al. (2011), Dagaonkar and Prakash (2011), Bhuiyan and Nessa (1998), Nafeesa Begum et.al. (2010) in various habitates. In the river Gomti density of phytoplanktons has been relatively lower than reported by Tabrez et.al. ( 2010) in Gomti river, Biswas and Konar (2000) observed in the stretch of river Ganga at Hathidad, Bihar , India. Our observation are in conformity with the findings of Varshney et.al. (2006) in river Gomti. Phytoplanktons form the major component of fresh water bodies and establish an important link in the food chain. It serve as food for most of the bottom feeding fishes. The knowledge of their composition, abundance and distribution helps to evaluate its significance as fish food. The high population density at Nishatganj bridge was mainly contributed by chlorophyceae viz. Chlamydomonas, Mongeotia spp. , Microspora spp., Ulothrix, Desmidium, Pediastrum. Chlamydomonas, Ranunculus-aquatilis, Volvox-aureus, Microspora spp. were the most abundant at site-A and site-D.

The organic pollution indicator spp. reported in river Gomti are Oscillatoria and Stigonema were observed at Daliganj bridge and Nishatganj bridge. Our observation are supported by the results of Moza and Kolekar (2001) describe organism as indicator of pollution for water quality in river Yamuna. Some species of blue green algae aggregate and make a colony, floating over the surface forming the bloom. Phytoplankton species distribution shows wide spatio-temporal variations due to the differential effect of hydrographical factors on individual species and they serve as good indicators of water quality pollution ( Gouda et.al.1996). Phytoplankton of pond ecosystem were studied by Tabrej et.al. ( 2010), Rashmi et.al. (2011), Misra et.al. (2007), Gaikwad et.al.(2011) and several studies on phytoplankton diversity was made in India and abroad on the ponds, lakes and reservoirs.

## Conclusion

The results indicate that different ecological factors have influenced the phytoplankton abundance. The present study ensures that variation in the abundance of plankton can be best explained, when environmental factors jointly influenced. Thus it may be concluded that ,the density of phytoplanktons is dependent on different abiotic factors either directly or indirectly.

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

| Sites | Summer season | | | Monsoon season | | | Winter season | | |
|---|---|---|---|---|---|---|---|---|---|
| | Northern bank | Midstream | Southern bank | Northern bank | Midstream | Southern bank | Northern bank | Midstream | Southern bank |
| **Site-A** | 75 | 80 | 70 | 79 | 70 | 62 | 60 | 65 | 70 |
| **Site-B** | 90 | 83 | 88 | 76 | 72 | 83 | 58 | 66 | 55 |
| **Site-C** | 65 | 95 | 90 | 78 | 74 | 54 | 56 | 61 | 49 |
| **Site-D** | 115 | 125 | 100 | 46 | 38 | 33 | 48 | 59 | 47 |
| **Site-E** | 100 | 98 | 87 | 65 | 24 | 18 | 40 | 49 | 39 |

Values are mean of three observations

**Table -2: Distribution of Phytoplanktons (Algae) different sites in summer and monsoon and winter season-**

| Phytoplanktons | Summer season | | | | | Monsoon season | | | | | winter season | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **S A** | **S-B** | **S-C** | **S-D** | **S-E** | **S-A** | **S-B** | **S-C** | **S-D** | **S-E** | **S A** | **SB** | **S C** | **S D** | **S-E** |
| **Chlorophyceae** | | | | | | | | | | | | | | | |
| *Chlamydomonas* | + | + | - | - | + | + | + | + | - | + | + | + | - | + | + |
| *Spirogyra* | - | - | + | - | - | - | + | + | + | - | + | + | + | - | - |
| *Zygnema* | + | + | - | - | - | + | + | - | - | - | + | + | + | + | - |
| *Mongeotia spp.* | + | + | + | + | - | + | + | - | + | + | - | - | | - | + |
| *Microspora spp.* | + | + | - | - | + | + | + | + | + | + | + | + | + | + | + |
| *Oedogonium* | + | - | - | + | + | + | + | + | + | + | + | + | - | + | + |
| *Hydrodictyon* | - | + | - | + | - | + | + | - | - | - | + | - | + | + | + |
| *Ulothrix* | + | - | + | - | + | + | + | + | + | + | + | + | + | + | + |
| *Vaucheria* | - | - | + | + | + | + | + | + | + | + | + | + | - | - | - |
| *Desmidium* | + | + | + | - | - | + | + | + | + | + | + | - | - | + | - |
| *Gonium sociale* | + | - | + | - | - | + | + | + | + | + | + | + | + | - | - |
| *Pandorina morum* | - | + | - | + | - | - | + | + | + | + | + | + | - | - | + |
| *Pediastrum* | + | - | + | + | - | + | + | + | + | + | + | - | + | - | + |
| *Scenedesmus* | - | - | + | - | - | + | + | - | - | + | + | + | + | + | + |
| *Ranunculus aquatilis* | - | + | + | + | - | + | + | + | + | + | + | + | + | - | - |
| **Bacillariophyceae** | | | | | | | | | | | | | | | |
| *Stauroneis- pusilla* | + | + | - | + | - | + | + | + | + | + | + | + | + | - | - |
| *Cosmarium –* | + | + | - | + | - | + | + | + | + | + | - | - | + | - | + |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *formosuhum* | | | | | | | | | | | | | | | |
| *Micraasterias desmids* | + | + | - | - | + | + | + | + | + | + | + | + | - | + | - |
| *Synedra- ulna* | + | - | + | + | + | + | + | + | + | + | + | + | + | + | - |
| *Navicula sphaerophor* | + | + | + | + | + | + | + | + | + | + | + | + | - | - | - |
| *Nitzschia stagnorum* | + | + | + | + | + | + | + | + | + | + | + | + | + | - | - |
| *Cosmarium nitidulum* | + | + | + | + | + | + | + | + | + | + | - | - | - | + | + |
| *Synura* | + | + | + | + | + | + | + | + | + | + | + | + | - | - | + |
| **Myxophyceae** | | | | | | | | | | | | | | | |
| *Volvox aureus* | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| *Oscillatoria* | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| *Stigonema* | + | + | + | + | + | + | + | + | + | + | - | + | - | + | - |

Note- Present (+) , Absent (-)

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