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Seasonal variation in frequency and distribution of phytoplanktons in a Gahari river of Madhepura district

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Abstract- Phytoplankton study was conducted in river Gahari of Phulaut, Madhepura district during March-2019 to February-2020. Frequency and abundance of phytoplanktons were recorded. Altogether, 6 genera and 8 species were identified from Cyanophyceae, 11 genera and species from Chlorophyceae, 3 genera and 4 species from Euglinophyceae and 9 genera from Bacillariophyceae. Abundance of phytoplankton was maximum during the month of May and minimum during the month of December. In Chlorophyceae, maximum frequency was observed in *Hydrodictyon reticulatum* and *Chlamydomonas angulosa* (46.66%). Among Cyanophyceae, maximum frequency was observed in *Oscillatoria tenuis* (53.33%). In Euglinophyceae, maximum frequency was observed in *Euglina polymorpha* and in Bacillariophyceae, maximum frequency was observed in *Arthrodesmus* (53.33%).

Key words: Abundance, Frequency, Chlorophyceae, Cyanophyceae, Euglinophyceae, Bacillariophyceae

INTRODUCTION

Phytoplanktons are microscopic algal communities of water bodies which is pioneer to aquatic food chain. Study of phytoplankton is very useful for the assessment of water quality and productivity of aquatic ecosystem.[1] The quality and quantity of phytoplankton in a water body is good indicator of water quality. According to report of NASA 2009, phytoplanktons account half of the all-photosynthesis activity on the Earth. Phytoplankton include several thousands of microalgae belonging to the class Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglinophyceae. Phytoplankton quickly response to the environmental change so they may be used to assess the ecological status of water bodies. Phytoplanktons are also good indicator of water pollution.[2] Phytoplanktons also play an important role in the biosynthesis of organic matter in aquatic ecosystem.[3,4] Some phytoplanktons belonging to the class Cyanophyceae such as *Microcystis, Oscillatoria, Lyngbya, Nodularia, Aphnizomenon, Nostoc, Anabaena* etc. producing toxin. This toxin is harmful to aquatic animals. *Hetercystus* members of class Cyanophyceae are able to fix atmospheric nitrogen. The most common of them are *Nostoc, Anabaena, Rivularia, Calothrix, Scytonema*, etc.. Excess development of phytoplankton in a water source is known as algal bloom. Recently phytoplankton study has been used to observe and understand changes in the aquatic ecosystem because it seems to be strongly influenced by climatic features.[5] Species composition of phytoplankton community is an efficient bio-indicator for water quality assessment. The use of phytoplankton as indicator of aquatic environment have long been documented.[6,7] Higher density of phytoplanktons in a water body causes water bloom due to which death of many fishes occurs.[8]

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MATERIALS & METHODS

Phytoplankton samples were collected regularly in each month from March 2019 to February 2020 from different spots of Gahari river. The river Gahari passes through phulaut block of Madhepura district. Samples were filtered through Plankton net of bolting silk cloth with mesh size 0.03 to 0.04mm. Samples were collected in plastic container and preserved in Lugol's solution. Phytoplankton were collected in morning hours. Preserved samples were kept undisturbed for 24 hours after which supernatant was discarded and the final volume of concentrate was made 50ml.

Slides were prepared from each sample and examined under microscope. Phytoplanktons were identified with the help of standard literature.[4,9] Phytoplankton count was done by Lackey's drop method (1938) and Phytoplankton unit/l was calculated by the formula:

$$Phytoplankton\ {}^{unit}/_{l} = \frac{n\ X\ C}{V}\ X\ 1000$$

Where, N= No. of phytoplankton counted in one drop (0.1ml)

C= Total volume of concentrate

V= Total vol. of water filtered through net

Frequency of phytoplankton was calculated by the formula:

$$Frequency\ (f) = \frac{m}{M}\ X\ 100$$

Where, m= No. of spot where species found

M= No. of all spots examined

RESULT

Phytoplankton study was conducted in Gahari river of Madhepura district during March 2019 to February 2020. Abundance and frequency of phytoplanktons were calculated as per the formula described in Material and Methods. Frequency of each species from all classes was recorded in Table 01, 02, 03 and 04. Altogether, 6 genera and 8 species were identified from Cyanophyceae, 11 genera and species from Chlorophyceae, 3 genera and 4 species from Euglinophyceae and 9 genera from Bacillariophyceae. In Cyanophyceae, maximum frequency was observed in *Oscillatoria tenuis* (53.33%) and minimum in *Anabaena plactonica* (13.33%). Among Chlorophyceae, *Hydrodictyon reticulatum* and *Chlamydomonas angulosa* showed maximum frequency (46.66%) and *Oedogonium crissum* showed minimum frequency (13.33%). Among Euglinophyceae, maximum frequency was observed in *Euglina polymorpha* (46.66%) and minimum in *Lypocinclis playfairiana* (20%). Among Bacillariophyceae, maximum frequency was observed in *Arthrodesmus* (53.33%) and minimum in *Xanthidium* (6.66%). Abundance of phytoplankton was examined from March 2019 to February 2020. Maximum abundance was observed in the month of May (48400/ml) and minimum in December (18400/ml). The result of abundance is mentioned in Fig. 01.

Table 01: Frequency of Phytoplanktons (Cyanophyceae)

Cyanophyceae	m	M	F
Microcystis aeruginosa	6	15	40%
Oscillatoria tenuis	8	15	53.33%
Phormidium ambiguum	4	15	26.66%
Phormidium lucidum	4	15	26.66%
Lyngbya latissima	5	15	33.33%
Anabaena microspora	3	15	20%
Anabaena plactonica	2	15	13.33%
Nostoc linkia	3	15	20%

Table 02: Frequency of Phytoplanktons (Chlorophyceae)

Chlorophyceae	m	M	F
Cldophora glomerata	3	15	20%
Hydrodictyon reticulatum	7	15	46.66%
Ulothrix zonata	6	15	40%
Pediastrum duplex	3	15	20%
Scenedesmus dimorphus	6	15	40%
Stegioclonium sp.	3	15	20%
Chlamydomonas angulosa	7	15	46.66%
Pandorina morum	4	15	26.66%
Chaetophora elegans	3	15	20%
Oedogonium crissum	2	15	13.33%
Spirogyra ellipsospora	4	15	26.66%

Table 03: Frequency of Phytoplanktons (Euglinophyceae)

Euglinophyceae	m	M	F
Euglina elongate	5	15	33.33%
Euglina polymorpha	7	15	46.66%
Phacus anacoelus	4	15	26.66%
Lypocinclis playfairiana	3	15	20%

Table 04: Frequency of Phytoplanktons (Bacillariophyceae)

Bacillariophyceae	m	M	F
Clostridium	4	15	26.66%
Cosmerium	3	15	20%
Xanthidium	1	15	6.66%
Arthrodesmus	8	15	53.33%
Microsterias	6	15	40%
Surirella	5	15	33.33%
Diploneis	3	15	20%
Denticula	3	15	20%
Ceratoneis	4	15	26.66%

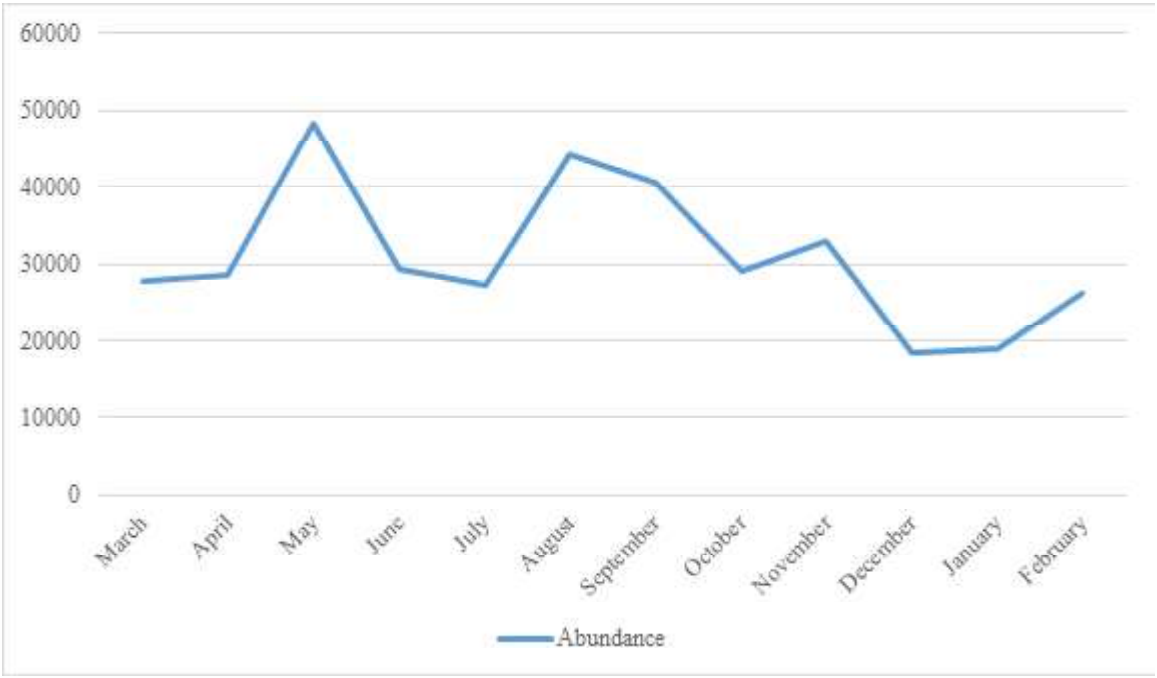

Fig. 01: Monthly variation in abundance of phytoplanktons

DISCUSSION

Environmental change and water quality directly affect diversity and distribution of phytoplanktons. Nutrient concentration, water quality and seasonal variation effect the distribution of phytoplanktons.[10,11] In the present study, it was observed that maximum abundance of phytoplankton occurred in summer season and minimum in winter season. In river water, Chlorophyceae was represented by 11 species, Cyanophyceae by 8 species, Euglinophyceae by 4 species and Bacillariophyceae by 9 species. Thus, the no. of species belonging to class Chlorophyceae were maximum while the no. of species in class Euglinophyceae was minimum. Similar result was mentioned by Gopinath and Ajit (2014)[12] and Ansari *et al.*(2015)[13]. In the present study, it was also observed that the no. of genera and species belonging to class Chlorophyceae were higher in rainy season and lowest in summer season. Korgaonkar and Bharamal (2016)[14] also reported higher no. of Chlorophyceae in monsoon and lowest no. in summer season. In our study, maximum no. of Euglinophyceae was observed in summer season when temperature was high. Jasprica *et al.* (2006)[15] also reported highest no. of Euglinophyceae in fresh water

ecosystem when temperature and nitrate concentration was higher.

CONCLUSION

Present study was conducted during March-2019 to February-2020 in Gahari river. Phytoplanktons were collected at regular intervals and identified. Abundance of phytoplankton was observed in each month from March-2019 to February-2020. Frequency of each species from all classes was recorded which is mentioned in Table 01, 02, 03 and 04. Altogether, 6 genera and 8 species were identified from Cyanophyceae, 11 genera and species from Chlorophyceae, 3 genera and 4 species from Euglinophyceae and 9 genera from Bacillariophyceae. In Cyanophyceae, maximum frequency was observed in *Oscillatoria tenuis* (53.33%) and minimum in *Anabaena plactonica* (13.33%). Among Chlorophyceae, *Hydrodictyon reticulatum* and *Chlamydomonas angulosa* showed maximum frequency (46.66%) and *Oedogonium crissum* showed minimum frequency (13.33%). Among Euglinophyceae, maximum frequency was observed in *Euglina polymorpha* (46.66%) and minimum in *Lypocinclis playfairiana* (20%). Among Bacillariophyceae, maximum frequency was observed in *Arthrodesmus* (53.33%) and minimum in *Xanthidium* (6.66%). Abundance of phytoplankton was examined from March 2019 to February 2020. Maximum abundance was observed in the month of May (48400/ml) and minimum in December (18400/ml). The result of abundance is mentioned in Fig. 01.

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