Ecological Studies of Algae in River Burhi Gandak at Samastipur, Bihar

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KEYWORDS

ABSTRACT

In the present investigation the algal biodiversity of river Burhi Gandak at Samastipur, Bihar was studied with reference to the algal spectrum and population density of phytoplankton for a period of two years at two Years. Two sites (I and II) were selected for the present study. Altogether 41 algal taxa at site I and 39 at site II were detected. The members of the algal taxa belonged to the three different classes viz. Cyanophyceae, Chlorophyceae and Bacillariophyceae. The annual mean average of population density of these algal taxa was found as 4035.44±435.5 u/lit at site I and 2036.16±660.25 u/lit at site- II. The continuous presence of some pollution tolerant algal taxa in river water indicates that the river water is getting rapidly polluted.

Introduction

In the present investigation, the river Burhi Gandak at Samastipur, Bihar has been selected for the ecological studies in order to know its trophic status. The river recivis pollutant from some big industries like juite meal, Sugar meal and from few small industries in addition to cattle bathing, clothes washing, sewage disposal, agrochemical from adjoining fields and unburnt remains of dead bodies from burning Ghats.

Phytoplankton are microscopic, unicellular to multicellular aquatic organisms forming the prime component in the food chain of aquatic ecosystem. Phytoplankton can be used as bioindicator since they reflect even the slightest change taking place in their immediate environment by changing their species composition, biomass, community structure, chlorophyll content and productivity. Some organisms are also good indicator of water quality including pollution (Walsh and Merril, 1984, Rajshree, 1993). Phytoplankton abundance and its composition in aquatic ecosystem are regulated by abiotic factors and biotic trophic interaction. Hence, in the present investigation, algal community structure was studied with reference to spectrum and population density of three classes of algae viz. Cyanophyceae, Chlorophyceae and Bacillariophyceae.

Materials and Methods

Ecological studies of river Burhi Gandak was studied from Jan 2020 to Dec. 2021 for two years. The water and algal samples were collected from two different sampling sites which were 10 km apart from each other in every month to analyse algal species. On the basis of structure and measurements, algal species were identified with the help of standard books and monographs (Fritsch; 1935, Chapmann;1962, Phillipose;1967, Prescott; 1982, Desikachary;1985). The density of algae in a sample was estimated by adopting Drop count method (Trainor; 1978).

Results

The algal spectrum of the river water at both sites I and II has been presented in table 1 and 2 respectively Altogether 41 algal taxa were observed in the river water at both sites. Out of these, 41 taxa at site I and 39 at site II were identified. At site I, out of 41 taxa, a maximum of 28 taxa were observed during January and June and a minimum of 14 taxa were observed during August to October. Similarly, at site II a maximum of 28 taxa were observed during June and a minimum of 12 taxa were observed during October.

The population density of river water at both sites has been presented in table 3 and 4 respectively. The annual mean average of total phytoplankton population density has been ascertained as 4035.44±435.5u/lit at site I (Table-3) and 2036.16±660.25 u/lit at site-II (Table-4). The three classes viz. Cyanophyceae, Chlorophyceae and Bacillariophyceae contributed 1045.68±83.40 u/lit, 1656.93±185.90 u/lit and 1332.83±166.11u/lit at site I and 308.83±108.56 u/lit, 500.83±139.15 u/lit and 1226.50±412.54 u/lit at site-II. Population density of all three classes of algae were found higher at site-I than the population density found at site-II.

Discussion

A total of 41 algal taxa at site-I and 39 at site-II were observed during the course of investigation. At site-I, out of 41 alga taxa, 11 were from Cyanophyceae, 16 from Chlorophyceae and 14 from Bacillariophyceae, but at site-II, 11 were from Cyanophyceae, 15 from Chlorophyceae and 13 from Bacillariophyceae. While working on limnology of different rivers, Pahwa and Mehrotra (1966), Rai (1978), Dad (1981), Rao (1981), Venketeshwarlu *et al.* (1990), Nandan and Jain (2002) Nandan and Aher (2002, 2005), Verma *et al.* (2012) etc. found mostly three classes of algae. The three classes of algae were never recorded simultaneously at a time but in different numbers in different months of the year. The spectrum size was recorded larger during January and June at site-I and only in October at site-II. (Table-1 and 2). The spectrum size of different classes of algae also varied significantly in different months during the course of investigation. As regards cyanophycean spectrum, its number varied from a minimum of four (4) taxa in October to a maximum of ten (10) taxa during May- June at site-I (Table 1). Similarly, at site-II, the minimum number of three (3) taxa was observed during October-November and maximum of nine (9) were observed during June (Table-2). Spectrum size of Chlorophycean members varied from 4 (August to September) to 12 (January) at site-I (Table-1) and from 3 (August-September) to 7 (January and June) at site-II (Table2). The minimum size of Bacillariophycean spectrum was found Five (5) during April and August-October and a maximum of nine (9) taxa during May-June at Site - I (Table1) while a minimum of five (5) taxa during October and a maximum of twelve (12) taxa during June were recorded at site-II (Table-2).

As is evident from table-1 and 2, the algal spectrum size was recorded larger during summer and winter months and smaller during monsoon or post monsoon months. The present observation is in accordance with the observation of Pahwa and Mehrotra (1966), Raghubanshi et al, (2011), Khanna *et al.* (2012) etc.

The annual mean average of total phytoplankton population density was computed as 4035.83±43.50 u/lit at site-I and 2036.16 ± 660.25 u/lit at site-II. The minimum of population density was recorded as 2396.70 u/lit in the month of march and maximum (6301.20 u/lit) in the month of June at site-I (table-3). Similarly at site-II, the minimum (375 u/lit) population density was found in October and maximum 10955.0 u/lit) in June (Table-4). Rishi and Awasthi (2012) also found minimum population density in august and maximum in June in river Ganga at Kanpur as found in the present investigation. The annual trend of variation showed an increasing trend from march to June after which it declined till August and then increased upto January at site-I. The annual trend of variation at site II exhibited an increasing trend from January to March thereafter it decreased during April and again exhibited an increasing trend upto June.

From June it showed a decreasing trend till October after which it exhibited an increasing trend. The maximum population of phytoplankton during summer months may be due to increased temperature. The lower population density during monsoon months may be due to increased turbidity causing low penetration of light affecting the growth of alga and also dilution of river water due to rains. The observed variations in different seasons as regards the maxima and minima of phytoplankton population density as described may be attributed to inherent variations in abiotic and biotic components of the river water.

While comparing the total population density and algal spectrum, it was found that higher number of spectrum coincides with the higher phytoplankton density in the river water as reported earlier by

Vyas and Kumar (1968) who stated that maximum development of phytoplankton with respect to spectrum as well as density was found in Indrasagar tank.

The present findings show that certain number of algal species which are tolerant to organic pollution are found in the river water during longer period of time indicating that the river water is rapidly turning towards eutrophication.

Table 1. Month wise variations in the algal spectrum

Class	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cy	8	8	7	7	10	10	6	5	5	4	6	5
Ch	12	9	6	5	8	9	9	4	4	5	6	9
Bac	8	6	6	5	9	9	6	5	5	5	6	8
Total	28	23	19	17	27	28	21	14	14	14	18	22

Cy- Cyanophyceae, Ch-Chlorophyceae, Bac- Bacillariophyceae

Table 2. Month wise variations in the algal spectrum

Class	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cy	5	5	5	6	8	9	6	4	4	3	3	4
Ch	7	5	6	5	5	7	4	3	3	4	6	6
Bac	7	8	8	10	10	12	8	6	6	5	6	6
Total	19	18	19	21	23	28	18	13	13	12	15	16

Table 3. Month wise variations in Algal Population Density (u/lit) at Site-I

Month	**Cyanophyceae**	**Chlorophyceae**	**Bacillariophyceae**	**Total**
Jan	1220.00	2197.80	1540.10	4957.90
Feb	875.10	1860.00	1249.80	2984.90
Mar	1031.70	870.40	494.60	2396.70
Apr	1280.00	664.70	674.50	2619.60
May	1585.10	2572.30	1539.90	5697.30
Jun	1250.90	2880.20	2170.10	6301.20
Jul	1190.40	2630.10	1295.00	5115.50
Aug	510.00	895.80	1374.70	2744.50
Sep	694.60	1019.90	1170.10	2884.60
Oct	870.10	1231.90	1475.10	3577.10
Nov	1139.30	1411.70	1449.90	4000.90
Dec	901.00	1684.40	1559.80	4145.20
M.V.	**1045.68**	**1656.93**	**1332.83**	**4035.83**
S.E.(±)	**83.40**	**185.90**	**166.11**	**435.50**

Table 4. Month wise variations in Algal Population Density (u/lit) at Site-II

Months	**Cyanophyceae**	**Chlorophyceae**	**Bacillariophyceae**	**Total**
Jan	158.00	380.00	158.00	696.00
Feb	167.00	410.00	344.00	921.00
Mar	310.00	1260.00	235.00	1805.00
Apr	190.00	162.00	623.00	975.00
May	1296.00	380.00	3465.00	5141.00
Jun	855.00	2016.00	8084.00	10955.00
Jul	170.00	475.00	802.00	1447.00

Aug	98.00	185.00	250.70	533.00
Sep	85.00	109.00	245.00	439.00
Oct	85.00	120.00	170.00	375.00
Nov	62.00	38.00	182.00	382.00
Dec	230.00	375.00	160.00	765.00
M.V.	**308.83**	**500.83**	**1226.50**	**2036.16**
S.E. (±)	**108.56**	**139.15**	**412.54**	**660.25**

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