

STUDY OF SOME LIMNOLOGICAL FEATURES OF RIVER GANGA (RASOOLABAD GHAT) OF THE DISTRICT ALLAHABAD

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ABSTRACT

The present study relates to some limnological features in certain physico-chemical factors of river Ganga (Rasoolabad) at Allahabad from may 1985 to April 1986 in relation to percentage frequency of dominant macrophytes. The dominant macrophytes were Hydrilla verticillata, Hydrilla major, Ceratophyllum demersum, Nelumbo species. The species of Hydrilla were found very susceptible to the temperature. Due to this H. verticillata was found maximum in winter season while the H. major was found minimum in winter and vice-versa in summer season.

Keywords: *Limnological, Physico-chemical factors, Macrophytes*

INTRODUCTION

Limnology by Welch (1948) is the branch of science which deals with biological productivity of inland waters and with all the casual influences which determine it. Biological productivity includes qualitative and quantitative features and its actual and potential aspects. The aquatic environment in India is subjected to increasing pollution because of increasing industrialization and urbanization. Clean water is necessary not only for drinking purposes but also for the existence and health of aquatic fauna and flora. Some hydrological data on Ganga have been collected at specified points like Delhi (Mathur 1965), Kanpur (Saxena et al 1966), Allahabad (Pahwa and Mehrotra 1966), Varanasi (Lakshmi-Narayana 1959), and Bhagalpur (Bilgrami and Dutta Munshi 1979). These are however too fragmentary to draw

any clear picture about the dynamics of this riverine ecosystems.

Unfortunately this important aspect has not received much attention. In India, only few workers Sinha (1979), Unnik sankaran (1972), Bilgrami and Dutta Munshi (1979) studies the role of macrophytes in productivity. From Allahabad district which is rich for neutral perennial water bodies of various dimensions. The present investigation presents the study on some limnological features like- the changes in some physico-chemical features, their interrelationship, and their influence on the percentage frequency of certain macrophytes present in Rasoolabad ghat at Allahabad.

MATERIAL AND METHODS

For analysis of chemical factors, samples in (triplicate) were collected from surface water from fixed spots of the river Ganga (Rasoolabad) at monthly intervals, from (9.00 AM to 12.00 Noon). The values incorporated in the tables are average values. Amongst The physical factors, the water temperature was recorded by a, 0-100°C good grade thermometer and the transparency was noted with the help of a Secchi disc. The oxygen was fixed at the spot by Winkler's method and the pH was measured by a digital pH meter model CP 901. The nitrate and available phosphate was analyzed by method outlined by Adoni (1985). The analysis of other chemical factors and the percentage frequency of

aquatic macrophytes were made through osborne sampler according to Anonymous (1985).

RESULTS

Table 1 represents the data of physico-chemical factors and table 2 the seasonal changes in percentage frequency of dominant macrophyte of different plant communities of the river Ganga at Rasoolabad ghat of Allahabad. A brief account of the seasonal changes in the physico-chemical factors, their relationship and influences on the distribution of some dominant macrophytes of the river Ganga is given below.

Table-1

Seasonal changes in physico-chemical conditions of river Ganga(Rasoolabad) in Allahabad from 1985-April 1986

Parameter/ months	May	June	July	Aug	Sep	Oct.	Nov.	Dec.	Jan.	Feb.	Marc h	April
Temp (0)	32.2	33.5	30.1	29.8	30.2	28.4	24.5	15.1	16.2	18.6	20.2	21.1 7
pH	8.32	8.33	7.50	7.10	7.12	8.16	8.17	8.15	8.18	8.11	8.64	9.18
Light Penetration(cm)	8.25	14.4 2	4.60	11.1 2	10.4 2	20.6 6	15.3 9	15.4 0	14.0 2	15.6 9	13.91	27.0
Specific conductivity(mho)	710	750	800	840	320	270	210	170	430	780	850	950
chloride(ppm)	15.2 3	16.1 5	16.1 9	19.2 5	21.4 3	23.4 9	22.5 0	21.2 9	20.9 2	19.3 1	19.12	18.9 7
dissolve oxygen(ppm)	4.52	4-67	5.89	5.67	5.45	5.21	7.15	8.26	4.35	1.65	2.15	2.64
CO ₂ (ppm)	8.97	9.95	11.4 8	8.43	6.23	4.74	2.54	1.58	1.15	1.06	-	-
BOD(ppm)	1.15	1.75	1.91	9.40	.850	0.41	2.49	4.89	2.15	0.91	1.23	1.46
COD(ppm)	4.94	5.43	6.69	5.58	4.98	4.20	4.31	4.50	16.4 2	26.7 9	7.56	3.7
Available phosphate(ppm)	0.97	1.39	1.63	1.92	2.62	2.75	3.54	4.87	6.37	7.34	4.51	3.39
nitrate(ppm)	14.3 3	16.5 7	21.3 7	17.5 4	14.2 5	11.0 0	12.5 6	14.4 3	16.1 2	17.8 6	6.83	3.93

Table-2

Seasonal changes in percentage frequency of dominant macrophytes of different communities of river Ganga at Allahabad from May 1985-April1986

Months/ Plants	Hydrilla major	Ceretophyllum sps.	Hydrilla verticillata	Nelumbo sps.
May	16.0	16.0	4.0	12.0
June	12.0	12.0	-	16.0
July	12.0	12.0	-	8.0
Aug.	-	4.0	4.0	4.0
Sept.	-	8.0	4.0	-
Oct.	8.0	4.0	8.0	-
Nov.	4.0	-	8.0	8.0
Dec.	4.0	8.0	12.0	8.0
Jan.	-	12.0	20.0	8.0
Feb	4.0	4.0	12.0	12.0
March	8.0	16.0	12.0	4.0
April	12.0	12.0	8.0	12.0

PHYSICO-CHEMICAL FACTORS

A-Water temperature- The water temperature of the river varied from 15.1 to 33.5°C, minimum in the month of January and maximum in the month of June. The observed pattern of temperature fluctuations in the Ganga is very similar to those observed by Chakraborty et al (1959) in Yamuna and Shetty et al (1961) in the Hoogly

B- Hydrogen-ion concentration: The pH value of the water is found in the alkaline range of 7.10-9.18. Similar observations have been recorded for the Ganga near Allahabad by Pahwa and Mehrotra (1966).

C- Light penetration (cm): The value of light penetration is low (4.60-8.25 cm) during summer and monsoon months (May and July). It increases and attains its maximum value (27.0 cm) during April and 15.40 cm during December.

D-Specific conductivity (mho): The value of specific conductivity is low (170 mho) during December and it attains its maximum value (950 mho) in the month of April.

E-Chloride (ppm): The chloride contents of this river station fluctuated from 14.23 to 23.49 ppm.

F-Dissolved oxygen (ppm): The oxygen content of Rasoolabad ghat of Ganga river ranges from 1.65 to 8.26 ppm. It is minimum in February and maximum in December. The minimum and maximum of oxygen content in water was also recorded by Pahwa and Mehrotra (1966), Singh (1972), Bigrami and Dutta Minshi (1979).

G-Free CO₂ (ppm) : the Free CO₂ was detected from May'1985 to February'1986 which indicates its influx in carbonic form through the rain water (Chakraborty et al 1959). The same was not observed in the month of March and April'86. Its absence in rest part of the year could be due to its utilization by bottom and phytoplankton in carbon assimilation and for its conversion into mono or bicarbonates. Its presence in the rest part of the year is possibly due to the effect of local rainfall in the areas.

H- The BOD value of this riverine ghat fluctuates from 0.41 to 4.89 ppm. The maximum value of BOD is recorded at this ghat during December and minimum during October.

I- COD (ppm): The COD value of this ghat is fluctuated between 3.7-26.79 ppm. Maximum value of COD recorded in the ghat during February and minimum during April.

J-Available Phosphate (ppm) : The Phosphate content of water varies From 0.97 to 7.34 ppm in the month of May and February respectively. The values of phosphate contents of water during monsoon months go on increasing.

K-Nitrate (ppm) : in the present riverine ghat the nitrate content is minimum (3.93 ppm) during April and maximum (21.37 ppm) during July.

MACROPHYTIC VEGETATION

The Macrophytic vegetations of the said river ghat comprises members of free floating, attached floating, submerged and attached emerged communities. The free floating community is represented by *Eichhornia crassipes*, *Azolla pinnata* and *Spirodella polyrhiza*. The attached floating community includes *Nymphoides cristatum*, *Trapa bispinosa* and *Nelumbium speciosum* and the submerged community is represented by *Hydrilla verticillata*, *Najas minor*, *Najas graminea*, *Potamogeton crispus*, *P. indicum* and *Vallisneria spiralis*. The dominant macrophytes of these communities are *Hydrilla Major*, *H. verticillata*, *Najas minor* and *Ceratophyllum demersum* respectively. These Plants are present in the riverine ghat all along the year except *H. major* and *H. verticillata* which are found during summer and winter season. *H. Major* is absent in August and September while *H. major* is maximum during summer and *H. verticillata* is maximum during December, January and February. The water temperature seems to retard the growth of *H. verticillata* to some extent. The high value of transparency during the winter months favours the spread of *H. verticillata* but its low value in summer retards its growth as it restrains light penetration.

Discussion: In the above account an attempt has been made to correlate the different physical and

chemical factors with the fluctuations in different and dominant macrophyte plant species. From instant study it is evident that no individual physical or chemical is singly responsible for the fluctuation of macrophytes. According to Chitranshi and Bilgram (1986) no relationship can be deduced among chemical conditions, plankton and macrophytes population at any specific time. It is also supported by studies of Davis (1954), Bilgrami and Dutta Munshi (1979) who also took a number of physical, chemical and biological environmental circumstances acting simultaneously into consideration in understanding the fluctuations of macrophyte populations. According to Allen (1920) and Prasad (1956) water temperature is the determining factor in the seasonal distribution of organisms. However the present study, though one of the maximum is always observed during the high temperature period, the other being during the low temperature period. As such temperature within the observed range does not appear to be sole factor for the macrophyte fluctuations. It has also been observed by Singh and Sahai (1979) that temperature, when compared with certain other factors, has less significance in influencing the abundance of macrophytes. This appears to be true to the extent that the summer maxima are mostly of greater magnitude than the winter maxima.

The hydrogen ion concentrations and temperature of water show inverse relationship as when the value of pH is high, the temperature is low and vice-versa (Table 1). This study does not reveal the same relationship between chloride and phosphate. These observations are in conformity with the observation of Pahwa and Mahotra (1966), Sinha (1969). Light penetration is observed low during summer and Monsoon. It seems due to the production of algae and macrophytes. The Specific conductivity of water shows direct relationship with water temperature. It gives an idea about nutrient pollution (Adoni 1985). The maximum specific conductivity during April gives a confirmatory idea about the maxima of macrophyte in summers. The chloride and nitrate content of any water body give an idea of the organic matter. The maximum value of chloride at

the ghat during October is low as compared to (35.0 ppm) worked out by Singh and Sahai (1979) in Gorakhpur.

The presence of high oxygen content during December could be attributed the high percentage of submerged macrophytes. It is supported by Singh (1972). The study about changes in content of free CO₂ present in water show that it influences the pH of the water. The presence of free CO₂ has inverse relationship with the pH of water. This observation is in the same with that of Zafar (1964). The BOD is found with increase in the values of nitrate, phosphate and macrophytes in the month of November, December and January. The maximum value of COD during frequency is because of the maximum frequency of ceratophyllum species. The value of phosphate content of water during monsoon month is found increasing which can be said due to its influx through rain washing (Mason and Baswell 1950). This soluble phosphorus exists in orthophosphate form. The high value of nitrate during the monsoon can be said due to the rain washing (Ganzalves and Joshi 1946). There exists an indirect relationship between the contents of nitrate and phosphate of the river at Allahabad. The maximum value of nitrate 21.67 ppm of this water body is higher than that of river Ganga at Bhagalpur (Patna to Farakka) by Bilgrami and Dutta Munshi (1985).

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