HYDROBIOLOGICAL STUDIES ON RIVER NAKATIA OF BAREILLY CITY: PHYSICO-CHEMICAL FACTORS AND PHYTOPLANKTON

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Abstract

Periodicity of plankton in relation to physico-chemical and biological factors of temperate waters, very little is known of tropical water-bodies. The present investigation was carried out to understand the phytoplankton and certain physico-chemical factors of Nakatia river. In the present studies, a portion of the river Nakatia flowing through the Bareilly city, a stretch of about 11 Km, was taken into consideration. The surface samples of the water were collected during the year 2019 for chemical analysis from four fixed sites at monthly intervals between 10 A.M. to 12 noon. Studies of the physicochemical factors of Nakatia river suggest that the various physical and chemical attributes are related to their periodic changes and interdependence. Phytoplanktons belong to several classes had cbserved, It includes 38 species of Cyanophyceae, 27 of Chlorophyceae, 1 of Xanthophycea, 1 of Chrysophyceae, 27 of Bacillariophyceae, 31 of Euglenineae and 4 to Rhodophyceae.

Key words: Phytoplankton, Physicochemical factor, Cyanophyceae, Xanthophyceae

INTRODUCTION

The literature reveals that in contrast to an impressive buildup of literature on periodicity of plankton in relation to physico-chemical and biological factors of temperate waters, very little is known of tropical water-bodies. This is very true of India, where this type of study is comparatively of recent origin and as such warrants further investigation. The planktons constitute the basic link of food chain of aquatic animals and so their role in fishery is important. A good amount of literature is available on hydrobiological studies of freshwater rivers, lakes and ponds of India. However, studies on the freshwater ecosystems of Bareilly district have not yet been made. The present investigation was carried out to understand the phytoplankton and certain physico-chemical factors of Nakatia river.

MATERIAL AND METHODS

A. Site Description

The river Nakatia originates from Kumaon hills and flows throughout the year and is used for fishing. In the present studies, a portion of the river Nakatia flowing through the Bareilly city, a stretch of about 11 Km, was taken into consideration.

B. Sampling and Analysis of Water

The surface samples of the water were collected during the year 2019 for chemical analysis from four fixed sites at monthly intervals between 10 A.M. to 12 noon. The temperature was recorded at the depth of 5 cm and pH was measured. The transparency of the water was measured through "Secchi disc". The chemical analysis of water samples was made according to the standard methods (APHA, 1975). The parameters like water temperature, pH, total alkalinity, chloride, phosphate, sulphate, nitrogen, calcium, total hardness and dissolved solids were studied. The habitats of algae were keenly observed in 4 sites. The quantitative study of algal population was made according to the methods given by Nandan & Patel (1983). Identifications of algae are mostly based on monographs and recent available publications.

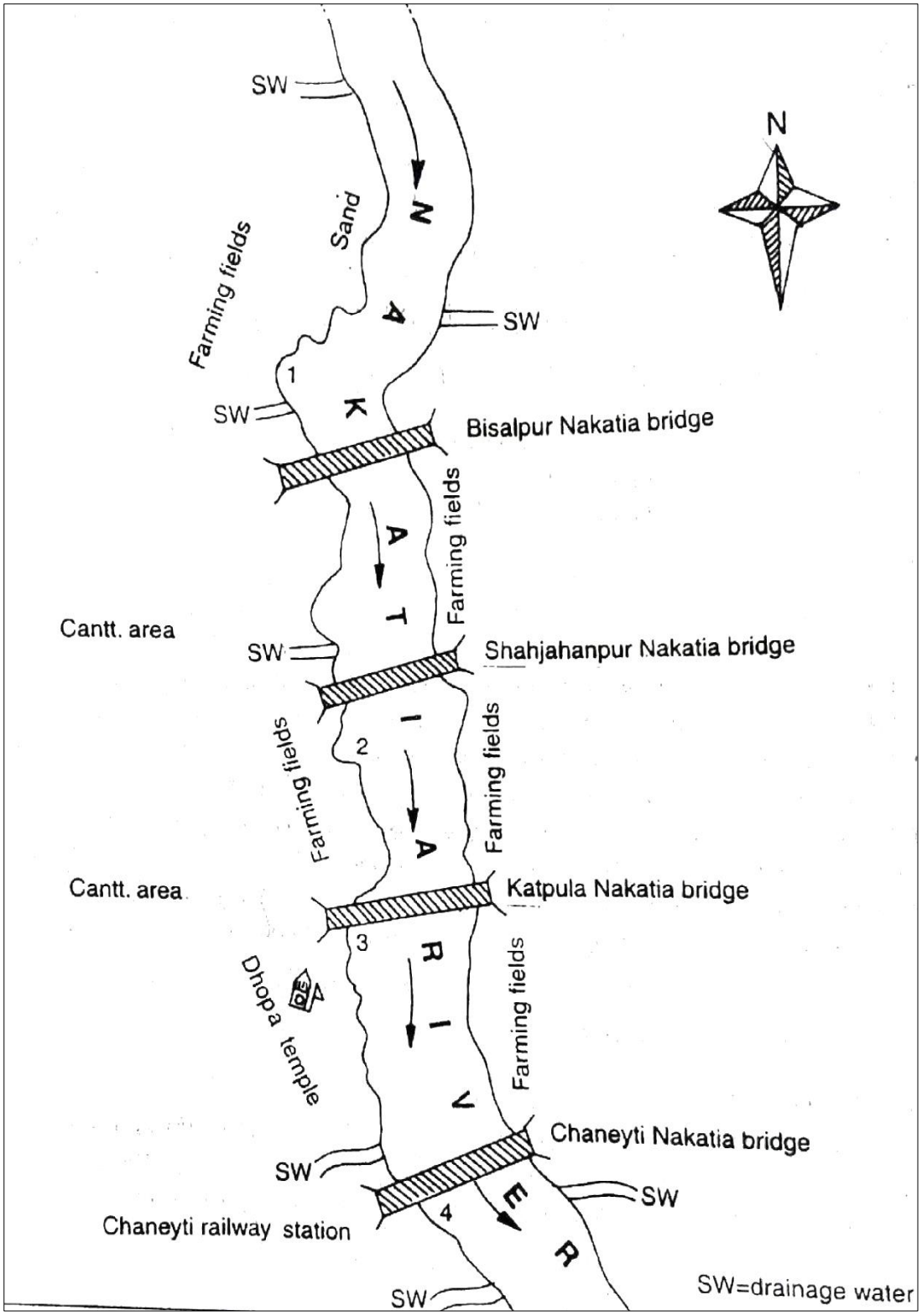
N
SW
Sand
Farming fields
NAKATIA
SW
1
SW
Bisalpur Nakatia bridge
Farming fields
Cantt. area
SW
Shahjahanpur Nakatia bridge
Farming fields
2
Farming fields
Cantt. area
Katpula Nakatia bridge
3
Dhopa temple
RIVER
Farming fields
Chaneyti Nakatia bridge
SW
SW
Chaneyti railway station
4
SW
SW=drainage water

Fig. 1.1. Four sampling stations of Nakatia river at Bareilly district

RESULTS AND DISCUSSION

A. Climatic conditions of the River Area

The mean monthly data of the air temperature and rainfall, recorded during the period of present investigation are presented in Table 1.1.

B. Physical condition of the Lake

Water temperature. The temperature of surface water ranged from 18.3°C (Dec.) to 35.8°C (June).

Transparency (visibility). Transparency was found to vary from 5.62" (August) to 8.02" (January).

Colour of water. Due to heavy rainfall, the water of the river became turbid and was more or less of the colour of tea mixed with milk. During and after the rains, the water was pale green and during summer it was dark green.

C. Chemical conditions :

pH. River water was found to be alkaline throughout the year. pH values ranged between 7.8 (Nov.) to 9.2 (May).

Nitrate. River water was rich in nitrate contents, values ranged from 0.002 ppm (Feb.) to 0.02 ppm (June).

Free and saline Ammonia. The values for free and saline ammonia ranged from 0.0085 ppm (Jan.) to a maximum of 0.0884 ppm (March).

Albuminoid nitrogen. It remained low throughout the year in the river, values ranged from 0.008 ppm to 0.02 ppm (Nov-March).

Silica. The silica content was high during the rainy season and comparatively low during winter and summer seasons. The values ranged from 11.5 ppm (Nov.) to 17.9 ppm (August).

Phosphate. The values for phosphate ranged from 0.042 ppm (Oct.) to 0.476 ppm (Jan.) in river water.

Iron. The value of total iron (ferric) ranged from 0.014 ppm (Dec.) to 0.23 ppm (March).

Calcium. The annual range of calcium was found to vary from 10.52 ppm (Nov.) to 19.42 ppm (June).

Magnesium. Magnesium content of the river water varied from 0.22 ppm (April) to 0.42 ppm (July).

Total alkalinity. Total alkalinity values ranged from 94.65 ppm (Aug.) to 275.70 ppm (Feb.).

Carbonates. The values for carbonates were found to vary from 26.6 ppm (Jan.) to a maximum of 39.5 ppm (April).

Bicarbonates. Bicarbonate values recorded ranged from 96.2 ppm (July) to a maximum of 245.3 ppm (Feb.).

Free Carbon dioxide. The values ranged from 108.6 ppm (March) to 245.0 ppm (Jan.).

Total hardness. The values ranged from 140.2 ppm (Nov.) to 218.2 ppm (April).

Dissolved Oxygen. The values of dissolved oxygen varied from 5.6 ppm (June) to 10.6 ppm (Nov.).

Dissolved organic matter. The minimum and maximum values of dissolved organic matter recorded were from 3.26 ppm (Sep.) to 7.8 ppm (May).

Chlorides. The chloride content was found to range from 12.62 ppm (Nov.) to 20.82 ppm (August).

Phytoplanktons observation: Phytoplanktons belong to several classes had cbserved, It includes 38 species of Cyanophyceae, 27 of Chlorophyceae, 1 of Xanthophycea, 1 of Chrysophyceae, 27 of Bacillariophyceae, 31 of Euglenineae and 4 to Rhodophyceae. The maximum development of phytoplankton with respect to the number of species as well as density was noted in September. On the whole Xanthophyceae and Chrysophyceae were insignificant. The following 5 groups of algae were studied :

(i) **Chlorophyceae.** This class is mainly represented by species of Pediastrum, Scenedesmus, Coelastrum. Bulbochaete, Oedogonium, Zygnema, Chara and Nitella.

(ii) **Cyanophyceae.** This class is mainly represented by species of Oscillatoria, Microcystics, Lyngbya, Nostoc, Gloeotrichia. Calothrix, Chroococcus, Myxosarcina & Scytonema.

(iii) **Bacillariophyceae.** This class is mainly represented by species of Melosira, Gyrosigma, Navicula, Gomphonema, Cymbella, Nitzschia, Surirella and Epithemia.

(iv) **Rhodophyceae.:** This class comprises only 4 genera viz., Compsopogon, Batrachospermum, Acrochaetium and Thorea.

(v) **Euglenineae.** This class comprises of only 3 genera viz., Euglena, Phacus, and Trachelomones.

DISCUSSION

Studies of the physicochemical factors of Nakatia river suggest that the various physical and chemical attributes are related to their periodic changes and interdependence. During the present study, it was observed that periods of high temperature never coincided with those of low oxygen content. This is not in conformity with the observation of Pearsall (1921), Rao (1955), Vyas and Kumar (1968) and Nandan and Patel (1985).

The oxygen content of water showed an almost inverse correlation with free carbon dioxide, a feature observed by Lakshminarayana (1965) and Pandey et al.,(1989).

The waters of Nakatia river were always alkaline and changes in pH were small andgradual except for the months of June and July, when there was a sudden fall probably due to floods and constant water movement. Blum (1956) and Lakshminarayana (1965) while correlating pH and phytoplankton density stated that waters maintained relatively high pH values, when phytoplankton were generally rich and well developed. During the present studies too, a direct correlation between pH and phytoplankton population was noted.

The maximum values for nitrates and phosphates are possibly due to run-off water, mixing of sewage and natural drainage, as the source of ions.

Nakatia river showed an increase in dissolved organic matter with the onset of summer season, though the maximum values were recorded during the rainy season. The high amount of dissolved organic matter during rains suggests sewage as a source of dissolved organic matter. The increase during the summer months is perhaps due to decay of plant remains caused by the high summer temperatures.

The chemical composition of river water favoured the development of the large number of algal species.

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