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INFLUENCE OF PHYSICOCHEMICAL CHARACTERISTICS ON THE PERIODICITY OF ALGAL FLORA IN A FRESH WATER LAKE

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Physico-chemical characteristics influencing the algal periodicity of Anasagar Lake at Ajmer have been studied. A total of 62 algal species belonging to four major groups viz; Chlorophyceae, Bacillariophyceae, Euglenophyceae, and Cyanophyceae have been reported. The study indicate that the availability of nutrients, pH, temperature, nitrates etc. have profound influenc on the availability and distribution of algae during different seasons of the year. The study also reveals that Monsoon season appeared to be most favourable for their abundance in the lake under investigation.

Keywords : Algal flora; Fresh water; Periodicity.

Introduction

The freshwater bodies namely lakes, ponds and reservoirs constitute an important source of water, but their indiscriminate exploitation by man influence the biotic community along with the physico-chemical environment of the lake also gets affected (Venkateshwarlu 1981). Though some work on the algal flora of Rajasthan was reported by Bhandari (1952), Goyal (1964), Gupta and Kumar (1968, 1972) and Vyas (1968), no detailed investigation on a lake situated in the heart of the city, subjected to various anthropological activities has been carried out yet. Therefore, the present study was directed towards the detailed investigations on the algal flora and their correlation with physicochemical characters of Anasagar lake of the Ajmer city.

Material and Methods

The lake under study is situated in the municipal limits of the city and is highly polluted as a result of various biotic activities. A detailed survey of the lake was conducted at monthly intervals. During the period (1989-90), extensive field studies and regular sampling from the selected sites of the lake were carried out. It was supplemented with laboratory investigations including physicochemical

analysis and identification of various groups of algae from water.

The planktonic algae were collected by planktonic nets. Routine methods of preservation (5% Formalin or F.A.A.) were employed. The methods recommended by Senger *et al.* (1985) were followed for the isolation, characterization and identification of various groups of algae. Techniques of Johansen (1940) were used for taxonomic enumeration of diatoms.

The water samples were collected by water sampling bottle and then stored in sterile polythene bottles for further analysis. Parameters like pH, Temperature, Dissolved oxygen were studied in situ, other parameters including Nitrogen, Phosphate, Chloride, Alkalinity, Total dissolved solids, conductivity, % Transmission and Free carbon dioxide were estimated according to the methods recommended by Goltermann (1969) and A.P.H.A. (1985).

Results and Discussion

Algae collected from Anasagar lake have been identified. Qualitative composition of algae is given in Table 1. Only four major groups of algae were recorded from the lake water viz. Chlorophyceae, Bacillariophyceae, Euglenophyceae, and Cyanophyceae. The total number of algal species encountered from the lake water during the period of study showed a definite seasonal fluctuation (Table 1). The physicochemical characters of the lake water also exhibit a periodic fluctuation (Table 2).

A definite correlation between physicochemical characteristics and algal populations was observed.

1. CHLOROPHYCEAE. This class was represented by 19 species belonging to 16 genera. Out of these *Chlorella vulgaris*, *Stigeoclonium tenue*, *Mougeotia* sp. and *Closterium parvulum* were found throughout the investigation period, whereas some sp. like *Scenedesmus obligus* and *Microspora* sp. were found only in the Monsoon season. Chlorophyceae was at its peak in winter. This observation corroborates with the views of Singh and Swarup (1979).

Correlation between the occurrence of the members of Chlorophyceae and different physicochemical factors showed that low-Temperature, pH, conductivity, Phospate and high Dissolved oxygen enhanced the availability and distribution of Chlorophyceae. These findings are similar to those of Singh and Swarup (1979) and Pandey and Tripathi (1990) found that high-Temperature, Turbidity, Chlorides, Total dissolved Solids favoured the growth of green algae.

2 BACILLARIOPHYCEAE : This class was represented by 8 species belonging to four genera. *Navicula*, *Nitzshia*, *Achanthes* and *Synedra*. *Navicula* was dominant with four species (*N. simplex*, *N. cuspidata*, *N. virdula* and *N. fineola*). Diatoms did not show any continuity during the investigation period but were abundant during Monsoon and declined in summer. The observations supported the findings of earlier workers (Roy 1955; Lakshminarayana 1965; Venkateshwarlu 1969 Zutshi et al. 1984).

Correlation studies showed that high Transmission, Ammonical Nitrogen, Nitrrate Nitrogen, Total dissvoled Solids, Conductivity, low carbon dioxide and chlorides favoured diatom growth. No direct correlation with pH and temperature could be established, in contrast to that of Singh and Swaroop (1979) who observed high temperature Phosphate, Nitrate and Calcium favoured diatom growth in Suraha lake.

3. EUGLENIOPHYCEAE : The class was represented by 7 species belonging to only two genera viz. *Euglena* and *Phacus*. *Euglena virdis* has been found throughout the investigation period. Whereas other forms fluctuated in their appearance. Qualitatively a Winter and Monsoon peak of euglenoids was observed and their abundance declined in Summer.

The correlations with different physicochemical factors showed that high concentration of Ammonical Nitrogen, Total dissolved solids, high conductivity and low Carbon dioxide favoured growth of euglenoids. The abundance of *Euglena virdis* throughout the study period and at all the collection sites is in accordance with the views expressed by Singh and Swaroop (1979)

4. CYANOPHYCEAE : The blue green algae was the dominant flora during summer they were also dominant in comparison to all other algal classes during the entire investigation period in all seasons. The class was represented by 28 species belonging to 15 genera—*Aphanocapsa*, *Chroococcus*, *Merismopedia*, *Aphanothece*, *Microcystis*, *Arthrospira*, *Spirulina*, *Oscillatoria*, *Lyngbya*, *Phormidium*, *Anabaena*, *Rivularia*, *Nostoc*, *Synechoccus*, and *G leocapsa*. Only five species (*Microcystis aeruginosa Oscillatoria amphibia*, *O. subbrevis*, *Anabaena oryzae* and *A. flosaguae*) were found throughout the investigation period in the lake.

Relationship with different physicochemical factors reveals that the high Temperature, pH, Chlorides, Phosphate, Free carbon dioxide, Alkalinity, low % Transmission, Dissolved oxygen favoured cyanophycean growth. The present findings corroborates with the views of Fritsch

Table 1 : Seasonal Distribution of Various Algal Species at Anasagar Lake, Ajmer

Name of the Algae	Winter Season Oct.-Jan.	Spring Season Feb.-Mar.	Summer Season April-June	Monsoon Season July-Sept.
1	2	3	4	5
CHLOROPHYCEAE				
Chlamydomonas sp.	**	*	—	**
Chlorella ulgaris	***	***	**	***
Chlorococcum infusionum	**	*	*	***
Scenedesmus armatus	**	*	—	**
S. bliquiss	—	—	—	**
Ulothrix sp.	***	***	**	***
Microspora sp.	—	—	—	**
Coleochaete scutata	***	***	*	*
C. pulvinata	**	**	—	—
Stigeoclonium tenue	***	***	**	***
Rhizoclonuim hieroglyphicum.	***	***	**	***
Pithophora sp.	**	—	—	**
Oedogonium patulum	***	***	*	*
O. lautumniarum	**	*	—	*
Spirogyra sp.	**	*	—	—
Mougeotia sp.	***	***	***	**
Closterium parvulum	***	***	**	**
Chara fragilis	*	—	—	***
Dinobryon sertularia	**	*	—	**
BACILLARIOPHYCEAE				
Navicula simplix	***	***	*	**
N. cuspidata	—	*	—	**

1	2	3	4	5
N. viridula	—	—	—	**
N lineola	**	*	*	**
Nitzschia palea	**	**	**	**
N. recta	**	*	—	*
Synedra ulna	***	**	*	**
Achanthes hungarica	*	*	—	*
EUGLENIOPHYCEAE				
Euglena viridis	***	***	**	***
E. Stellata	**	**	**	**
E. acus	**	**	**	**
Phacus curvicauda	**	*	*	**
P. rbicularis	*	—	—	**
P. longicauda	*	**	—	**
P. caudatus	**	—	—	—
CYANOPHYCEAE.				
Oscillatoria amphibia	***	***	***	***
O. subbrevis	***	***	***	***
O. tenuis	***	***	**	***
O. obscura	***	***	*	***
O. chlorina	—	**	**	***
Microcystis aeruginosa	***	***	**	***
M. marginata	***	***	**	***
M. bengalenis	**	**	**	***
M. flos aquae	***	**	**	**
Spirutina subsalasa	**	**	*	**
S meneghiana	—	*	*	**
Nostoc sp	**	**	**	**
Anabaena oryzae	***	**	**	***

1	2	3	4	5
A. flos aquae	**	**	**	***
A. circinalis	***	**	—	***
A. rientalis	**	**	**	***
Synechococcus aeruginosbls	**	*	**	**
Chrococcus minor	—	—	**	**
C. acrococcus	**	*	**	**
Gleocapsa aeruginosa	**	*	*	—
Aphanocapsa pulchra	—	—	**	**
Lyngbya martensiana	**	**	*	**
Rivularia aquatica	**	**	**	*
Aphanothece pallida	—	—	**	***
Arthrospira intermedia	—	—	**	**
A. jenneri	—	—	**	—
Phormidium ambiguism	**	**	*	**
Merismopedia glauca	**	**	**	***
Total nnmber of species	51	51	44	57

—ABSENT, * RARE, ** COMMON, *** ABUNDANT.

Table-2 : Seasonal Variation in Physico-Chemical Characteristics of Lake Water

Parameters	Winter	Spring	Summer	Monsoon
pH	7.1(6.8-7.4)	7.8(7.0-8.5)	8.0(7.0-9.0)	7.2(6.5-8.0)
Temperature(°C)	22.0(20.0-25.0)	26.7(22.3-32.0)	30.7(22.0-38.0)	28.7(25.0-34.0)
Transmission(%)	75.0(65.0-83.0)	81.12(66.0 91.0)	70.0(40.0-91.0)	79.0(73.0-92.0)
Dissolved Oxygen	7.18(4.55-11.6)	6.9(6.2-8.6)	5.0(1.50-8.60)	5.3(2.3-9.2)
Ammonical Nitrogen	21.0(0.0-35.0)	18.78(0.0-42.0)	35.17(14.0-42.0)	85.43(56.0-112.0)
Chloride	144.4(139.13-151.46)	172.64(136.32-215.80)	299.8(136.32-854.80)	52.78(32.66-95.10)
Total Dissolved Solids	2350(2000-2800)	3775(2600-5800)	4383(2400-6200)	8545(2000-28,000)
Electrical Conductivity (mhos)	136.87(123.0-147.18)	278.24(201.80-334.80)	393.15(252.0-807.4)	818.75(302.8-1715.7)
Phosphate	105.8(87.70-116.24)	228.68(111.85-438.80)	379.16(116.24-877.60)	257.67 (109.70-438.80)
Free Carbon dioxide	4.1(2.2-6.6)	3.9(0.0-6.6)	5.3(2.2-13.2)	3.8(0.0-10.2)
Alkalinity	253.18(130.0-395.0)	453.12(350.0-520.0)	514.68(350.0-710.0)	253.18(130.0-395.0)

Average values of 4 sites are expressed in mg/l except pH, temperature, Electrical conductivity and transmission.

(1907), Prescott (1938), Gonzalves and Joshi (1946), Philipose (1959), Singh and Swarup (1979), Parmasivan and Sreenivasan (1981).

The following conclusions can be drawn from the above study. That the algal flora of lake are influenced directly by the changing physico-chemical characters which show fluctuation in different seasons of the year. Qualitatively and Quantitatively the maximum availability and distribution of algae was during Monsoon. This is because of the inflow of rain water from the surrounding areas (Residential areas, Agricultural fields, Recreational and human activities sectors) in the lake which bring a lot of nutrients in the form of Organic matter and minerals. These nutrients favour the luxuriant growth of algae.

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