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Floristic Diversity of Wetlands of Aravalli Ecosystem : A Survey of Anasagar Lake of Ajmer

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ABSTRACT

Physico-chemical characteristics and phytoplankton diversity of polluted and unpolluted sites of Lake Anasagar was studied. Different sites showed marked differences in some of the characteristics like pH, Cl, Ca, Mg, Total N, P, Free Co_2*, DO, TDS, DOM. In all 123 algal species belonging to 60 genera were recorded for this wetland. Out of these Achnathes hungarica, Ankistrodesmus falcatus, Chlorella vulgaris, Chlorococcum infusionum, species of Euglema, Microcystis aeruginosa, species of Navicula and Oscillatoria, Pandorina morum, Pediastrum tetras, Scenedesmus quadricauda and Stigeoclonium tenue were recorded as indicators of pollution. The floristic diversity may be utilized for trophic assessment of this wetland.*

Key words: *Physico- chemical characteristics, Phytoplankton, Wetland, Pollution, Trophic assessment.*

INTRODUCTION

Ajmer, a centrally located district of Rajasthan is characterised by many shallow water bodies surrounded by Aravalli Hills. These water bodies have both microphytic and macrophytic vegetation which react variedly towards pollutants coming from various sources of human activities. The diversity and density of algal components in an aquatic ecosystem serve as reliable indices for biomonitoring of pollution load (Venkateswarlu, 1981). As a major component in aquatic biota, the algal community often exhibits dramatic changes in response to fluctuations in the physico-chemical properties of the aquatic environment. A number of workers have reported that many algae serve as indicators of pollution (Palmer, 1959; Cairns and Lanza, 1974; Venkateswarlu, 1981). Assessment of algal flora of freshwater bodies of Ajmer has been made earlier by Yadav and Bhardwaja (1979) and Sharma (1991) however they did not mention about the periodic fluctuations and water quality of wetlands. The present study was thus taken up to observe the algal diversity at polluted sand unpolluted sites alongwith various physico-chemical characteristics of Anasagar lake.

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SITES OF STUDY

The study was conducted at Anasagar – a prominent perennial freshwater lake situated in the heart of Ajmer city ($26^0$25' and $26^0$29' N lat., $74^0$38' and $74^0$42' E long.). The lake is surrounded mainly by housing colonies and being gradually deteriorated due to addition of pollutants from various sources like sewage and wastes from urban colonies, regular washing of clothes which adds detergents, automobile washing and agricultural practices. The pollutants from these sources affect the composition of algal flora of the lake, North – Eastern margin of this lake is polluted mainly due to urban sewage-waste discharge and cloth-washing activities (Polluted site) while its western margin has comparatively clear waters (Unpolluted site). These two sites were identified for the present survey of algae.

MATERIAL AND METHODS

Water samples were taken from polluted and unpolluted sites during winters (October to December) in acid washed plastic bottles and chemical analysis was done following 'Standard Methods' (APHA, 1975). Algal samples were collected in the acid washed plastic collection tubes and preserved in 5% formalin from both the sites during different months between August to July next year. The collected algae were identified with the help of monographs (Prescott, 1951; Desikachary, 1959; Randhawa, 1959).

RESULTS AND DISCUSSION

Data on physico-chemical characteristics of water are presented in table 1. There are marked differences in physico-chemical characteristics of polluted and unpolluted waters. Most of the parameters showed their peak values during December and minimum during October at both the sites. Low value of Dissolved oxygen were recorded at unpolluted site. It may be due to increased amount of decomposition of organic matter while high value of Dissolved oxygen at polluted site is due to increased algal mass favoured by discharge of sewage. Fluctuations in physico-chemical parameters may be correlated with water quality and affect the floristic diversity in the lake.

The distribution of algal forms in water body depends upon the natural changes in environmental conditions, seasonal variation, water quality and the relative adaptability of species. Algae recorded during present investigation from both the sites belong to Chlorophyceae, Bacillariophyceae, Euglenineae and Cyanophyceae. In all, 123 species of 60 genera were collected and out of this 86 species belonging to 38 genera were from polluted site and 74 species of 48 genera from unpolluted site were categorised. A total number of algal species encountered from both the sites have been given in table 2, which showed monthly fluctuations in number of algal species. Periodical occurrence of total algal population at both the sites recorded its maximum during late winter (November – December) followed by next highest peak during summer (May). Such algal periodicity support the observations recorded by Singh and Swarup (1979) and Zutshi *et al*. (1984). Chlorophyceae was represented by 30 species belonging to 16 genera at polluted site and 43 species of 25 genera at unpolluted site. *Chlorella vulgaris*, *Chlorococcum infusionum*, *Pediastrum tetras* and *Stigeoclonium tenue* showed its continuous occurrence throughout the year at polluted site. Kumar *et al*. (1974) observed that green algae such as *Chlorella* is a dominant form found in waters rich in nitrogenous compouns. Gunale and Balakrishnan (1979) showed *Stigeoclonium tenue* as indicator of pollution. Only two species i.e. *Protococcus viridis* and *Rhizoclonium hieroglyphicum* were collected throughout the year from unpolluted site. Both sites showed their maximum algal population during November followed by December while lowest during July.

Bacillariophyceae was represented by 16 species belonging to 9 genera from polluted site and 12 species of 11 genera from unpolluted site. Sreenivasan (1981) has also indicated the presence of members of Bacillariophyceae in the sewage polluted waters. *Navicula* with its seven species was reported as a dominant at polluted site. No Diatom species showed continuous periodicity throughout the year at both the sites, majority of them were collected during most part of the year i.e. *Navicula cryptocephala*, *N. cuspidata*, *N. simplex*, *Nitzeschia palea* at polluted site and *Cycotella meneghiniana*, *Cymbella cymbiformis*, *Navicula cryptocephala*, *N. cuspidata*, *Nitzschia palea*, *N. recta*, *Pinnularia viridis* at unpolluted sites. Diatom showed their maximum population during December (16 species) followed by November (15 species), October (13 species) and September (12 species) at polluted site while maximum during October, November and December (12 species) followed by September (11 species) at unpolluted stie. Kant and Kachroo (1974) and Sharma and Sharma (1992) have also recorded peak of Diatoms during late monsoon and winter seasons.

Euglenineae was represented by two genera at both the sites i.e. *Englena* and *Phacus*. Maximum eleven species were recorded at polluted site while only four species were recorded from unpolluted site. Hutchinson (1957) also reported the majority of species of *Euglena* and *Phacus* from water bodies which often have high organic contents. At polluted site two species viz. *Englena acus* and *E. viridis* showed continuous periodicity throughout the year which was not observed at unpolluted site. Englenoids showed their peak diversity during August (10 species) followed by September, December and April (9 species) at polluted site while November was peak period at unpolluted site. High phosphate values at polluted site increase the number of Euglenineae, as reported earlier (Munawar, 1970; Singh and Swarup, 1979).

Cyanophyceae have been represented by 29 species belonging to 11 genera at polluted site and 15 species of 10 genera at unpolluted site. *Microcystis aeruginosa* under blooming condition showed a regular presence at polluted site throughout the year which may be due to its tolerance to polluted waters. At polluted site genus *Oscillatoria* dominated with its seven species followed by *Microcystis* and *Spirulina* with four species. Rai and Kumar (1976) also found *Oscillatoria* as a tolerant genus to pollution. Maximum number of blue green species were recorded during May from both the sites while lowest were recorded during July (10 species) at polluted site and during March (2 species) at unpolluted site. The water of unpolluted site which favours Chlorophyceae and absence of large numbers of Cyanophyceae is an indication of clean water. Similar observation was made by Patrick (1950) and Rafter (1965). Higher phosphate content, dissolved oxygen p^H and low calcium content favours the Cyanophycean growth at polluted site. This observation was in conformity with Singh and Swarup (1979). Species such as *Actinastrun hantzschii*, *Ankistrodesmus falcatus*, *Chlorella vulgaris*, *Chlorococcum infusionum*, *Pandorina morum*, *Pediastrum tetras*, *Scenedesmus obliquus*, *S. quadricauda*, *Stigeoclonium tenue* (all Chlorophyceae); *Achnanthes hungarica*, *Navicula cryptocephala*, *N. cuspidata*, *N. viridula*, *Nitzschia palea*, *N. recta* (all Bacillariophyceae); *Euglena acus*, *E. viridis*, *Phacus longicaua* (all Euglenineae); *Arthrospira jenneri*, *Chroococcus minutus*, *Microcystis aeruginosa*, *M. flos-aquae*, *Oscillatoria chlorina*, *O. subbrevis*, *Spirulina major* (all Cyanophyceae) were found to be indicator species of pollution at Anasagar lake. Sharma and Sharma (1991) calculated Nygaard Trophic State Indices and reported weak eutrophic nature of this lake.

Table 1. Physico-chemical characteristics of water of polluted and comparatively unpolluted sites of Anasagar lake.

Parameters	Polluted Site			Unpolluted Site		
	Oct.	Nov.	Dec.	Oct.	Nov.	Dec.
p^H	7.97	8.06	8.48	8.03	8.42	8.57
Chlaride (mg/L)	167.56	184.60	198.80	170.40	281.16	301.00
Phenolphthalein Alkalinity (mg/L)	5.00	Nil	Nil	5.00	Nil	Nil
Total Alkalinity (mg/L)	215.00	250.00	250.00	220.00	280.00	300.00
Hardness (mg/L)	106.00	126.00	138.00	111.00	150.00	180.00
Calcium (as Ca^{++}) (mg/L)	21.24	27.25	29.65	20.84	32.86	37.67
Magnesium (as Mg^{++}) (mg/L)	12.91	14.13	15.59	14.37	16.56	20.95
Total Nitrogen (%)	0.16	0.16	0.05	0.05	0.02	0.05
Total Dissolved Solids (mg/L)	100.00	760.00	440.00	500.00	560.00	640.00
Free Carbon Dioxide (mg/L)	Nil	13.20	11.00	Nil	13.20	13.20
Dissolved Oxygen (ppm)	4.20	2.10	7.80	3.00	2.80	7.40
Phosphate (mg/L)	0.73	1.68	1.90	0.73	0.40	0.59
Dissolved Organic matter (ppm)	14.00	5.00	2.80	12.80	4.60	6.40

Table 2. Number of algal species encountered at polluted (I) and comparatively unpolluted (II) sites of Anasagar lake.

Group	Site	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Jul.
Chlorophyceae	I	13	16	21	28	27	22	16	14	22	25	16	11
	II	18	18	26	39	38	26	21	27	31	37	26	14
Bacillariophyceae	I	10	12	13	15	16	9	6	6	10	11	8	8
	II	8	11	12	12	12	10	3	2	4	5	7	9
Euglenineae	I	10	9	4	7	9	7	5	7	9	8	4	5
	II	3	3	2	4	3	2	1	2	3	2	3	3
Cyanophyceae	I	13	24	20	25	24	20	15	21	25	26	20	10
	II	5	6	7	10	10	9	6	2	7	12	11	6
Total species	I	46	61	58	75	76	58	42	48	66	70	48	34
	II	34	38	47	65	63	47	31	33	45	56	47	32

CONCLUSION

The Aravalli ecosystem is characterised by only a few temporary and perennial shallow water bodies. Due to vast urbanization and forest disturbances in the region these wetlands became threatened. A case study of Anasagar lake suggests that the type of floristic diversity is an indication of its extinction. Therefore, proper measures should be taken to protect the wetlands for the restoration of Aravalli ecosystem as a whole.

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