

Phytoplankton Diversity and Its Ecology in Sadul Branch of Sirhind Feeder Canal (Hanumangarh, Rajasthan)

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Received: 14.01.2016 | Revised: 23.01.2016 | Accepted: 30.01.2016

ABSTRACT

Rajasthan state has a water spread area of 3 lac hectares including large reservoirs, medium reservoirs, tanks in villages, canals, seasonal water, rivers and water logged areas. Water supports a variety of plants and animals.

The study of Phytoplankton are the subject of great interest because of their role as primary producers in an aquatic ecosystem. Phytoplankton are assemblages of heterogeneous microscopic algae forms whose movement is more or less dependent upon water currents. The present study was undertaken to explore the diversity and ecology of phytoplankton in Sadul branch of Sirhind Feeder in Hanumangarh (29°5' to 30°6' north latitude and 74 °3' to 75 °3' east longitudes). The present observations were made for a period of six months. Physical-Chemical limnology revealed that canal was shallow with turbid, alkaline, hard saline and well oxygenated water.

The flora was collected with plankton net. The study revealed the occurrence of 27 species of phytoplankton, among these 12 species of Bacillariophyceae, 9 species of chlorophyceae, 3 species of cyanophyceae and 1-1 species of zygnetaceae, myxophyceae and chaetophoraceae were recorded. The flora was identified following Edmanson⁶, Round¹¹, Chapman & Chapman⁵ and Needham & Needham¹⁰.

Keywords: Phytoplankton, Diversity, Ecology, Canal

INTRODUCTION

Phytoplankton are defined as drifting or wandering plants. They are single celled, normally microscopic (<μm indiameter), autotrophs and belonging to first trophic level. Various factors can promote or inhibit phytoplankton growth. These include sunlight, salinity, temperature, pH, tides water currents and nutrients, such as Nitrogen, Phosphorus, Carbon, Silica, Iron etc. Phytoplankton is normally present in all types of water and very beneficial to the eco-system depending upon their numbers.

These organisms are main producers of the aquatic food web. Phytoplankton are good indicator of environmental changes. Their movements are more or less dependent on currents. These consist of algae (mainly members of chlorophyceae, cyanophyceae and bacillariophyceae) and algae-like green flagellates. Algae are microscopically small, unicellular organisms. Some of these form colonies and reach size visible to naked eyes as minute green particles.

Cite this article: Sharma, M. and Srivastava, D., Phytoplankton Diversity and Its Ecology in Sadul Branch of Sirhind Feeder Canal (Hanumangarh, Rajasthan), *Int. J. Pure App. Biosci.* 4(1): 168-171 (2016). doi: <http://dx.doi.org/10.18782/2320-7051.2190>

The diversity of fresh water biota depends upon the habitat. The fresh water ecosystem are of either lotic or lentic types. Lotic habitats include streams, canals, water falls, rivers and rivulets. The lentic system include the pools, puddles, ponds, reservoirs, lakes and the agricultural fields.

The canals are akin to the rivers emanating from barrages or reservoirs developed across rivers. The canal system are developed primarily to cater irrigational needs of the otherwise water-deficient areas but at the same time these also serve for drinking water, hydroelectricity, navigation and fishery. Lotic habitats differ from the lentic habitat. Here current is a major controlling and limiting factor. Because of abundance of the oxygen, animal life is rich in the lotic habitat. Water supports a variety of plants and animal life. Thus biodiversity component of canal is often distinct and different from the river and reservoir of its origin.

Therefore, the present study was undertaken to explore the diversity and ecology of phytoplankton in Sadul branch of Sirhind Feeder in the desert region where fresh water ecosystems are already merge and among them running water systems are particularly rare. Study of the distribution of phytoplankton in fresh water ecosystem is gaining a momentum for aquaculture.

STUDY AREA

Hanumangarh is the northern most district of Rajasthan (29°5' to 30°6' north and 74°3' to 75°3' east longitude). Sadul branch is situated near by Jorkian village, Distt. Hanumangarh (Rajasthan). It is the part of Rajasthan irrigation system under State government. The Sadul branch begins from Sirhind Feeder at Rajasthan border situated at Punjab. The water of Sutlej river and Ravi Vyas rivers (surplus water) flow in Sadul branch.

MATERIALS AND METHODS

The study was carried out monthly in the period of July 2013 to December 2013. Both water and sediment samples were collected from three study stations. Water was examined for the selected parameters including temperature, pH, transparency, electrical conductance, total dissolved solids, dissolved oxygen, alkalinity and hardness. The sediment samples were examined for pH, electrical conductance, total dissolved solids and organic matter. For parameter like temperature, pH, electrical conductance and total dissolved solids respective meters were used. Transparency was recorded with the help of standard secchidisc. Other parameters were analyzed in laboratory by using as per the standard method APHA-AWWA-WPCF¹. Phytoplankton samples were collected in wide mouthed polythene bottles and fixed with Lugol's iodine solution and 4% of formaldehyde were added to these bottles to fix and preserve the phytoplankton and observed under a compound microscope. The forms were identified and results were expressed in terms of No./l. The flora was identified following Edmondson⁶, Round¹¹, Chapman & Chapman⁵ and Needham and Needham¹⁰.

RESULTS AND DISCUSSION

Physical-chemical limnology revealed that the canal was shallow with turbid, alkaline and well oxygenated water. The monthly range of water temperature were noted as 39°C to 26°C. The transparency of canal was 0.4 m. The average of pH of water was 8.3, EC 0.53 mmho/cm and TDS 530 mg/l. The maximum hardness of water was reported during the month of October and November (304 mg/l.) The average of dissolve oxygen was 19 mg/l. The alkalinity of water was minimum during the month of November (80 mg/l) and maximum during the month of September (108 mg/l). Sediment analysis revealed the ranges of values as pH 8.0-8.5, EC 0.45-0.59 mmho/cm, TDS 450-590 mg/g and organic matter 9.7-10.7 mg/g (Table 1).

Six groups of phytoplanktons were recording during the period of study. They constitute Bacillariophyceae (diatoms), Chlorophyceae (green algae), Cynophyceae (bluegreen algae), Zygnemataceae, Myxophyceae and Chaetophoraceae. Totally 27 species of phytoplankton of which 12 species of Bacillariophyceae, 9 species of Chlorophyceae, 3 species of Cynophyceae and 1-1 species of Zygnemataceae, Myxophyceae and Chaetophoraceae were recorded. The total number of species was found to be in the following order Bacillariophyceae> Chlorophyceae> Cyanophyceae> Zygnemataceae, Myxophyceae and Chaetophoraceae. Therefore diversity wise Bacillariophyceae was superior with more

number of species. Bahura² and Saigal¹³, noted that diatoms dominant desert waters. Chadha⁴, recorded the order of dominance of different Phytoplankton group in temple tank and urban pond was as Diatoms>Blue greens>Greens, and in village pond as: Green>Diatoms>Blue greens. Sharan¹² and Ganai *et al.*,⁷, recorded the dominance of diatoms in respect of diversity and density in desert waters. Manickam *et al.*,⁹ recorded 22 species of phytoplankton belonging to cyanophyceae, chlorophyceae and Bacillariophyceae in irrigational canals of Tamilnadu. Sharan¹² reported planktonic algae as Chlorophyceae (green)>Bacillariophyceae (diatoms)>Cyanophyceae (blue green) in desert waters.

Bishnoi *et al.*,³ studied primary productivity in relation to planktonic biodiversity in a stretch of Gang Canal (Rajasthan) and reported that canal algae were represented by Chlorophyceae, Bacillariophyceae, Myxophyceae and Xanthophyceae. Hosmani & Mruthunjaya⁸ studied distribution of phytoplankton in lakes of Mysore and recorded 8 groups of plankton. They constitute Chlorophyceae, Bacillariophyceae, Cyanophyceae, Desmidiaceae, Chlorococcaeas, Euglenophyceae, Chrysophyceae and Dinophyceae. During present study also maximum diversity of diatoms were observed.

Table 1 : Physical-chemical variables at Sadul branch of Sirhind Feeder

VARIABLE		July	August	September	October	November	December	Average
Air	Temperature (°C)	41°C	33°C	41°C	38°C	29°C	30°C	35.33°C
Water	Depth (Ft.)	9.36	9.36	9.36	9.28	9.28	9.28	9.32
	Transparency (m)	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Temperature (°C)	39°C	30°C	38°C	35°C	26°C	27°C	32.5°C
	pH	8.5	8.2	8.0	8.3	8.5	8.5	8.33
	EC (mmho/cm)	0.53	0.46	0.52	0.59	0.58	0.45	0.52
	DO	20.32	21.54	20.32	19.51	17.07	17.88	19.44
	TDS	530	460	520	590	580	450	521.66
	Hardness	284	186	202	304	304	186	244.33
	Total Alkalinity	104	92	108	96	80	86	94.33
Sediment	pH	7.5	7.3	7.2	7.5	6.9	7.0	7.23
	(mmho/cm)	0.22	0.21	0.22	0.26	0.25	0.27	0.23
	TDS	220	210	220	260	250	270	238.33
	Organic Matter	10.3	10.5	10.7	9.7	9.7	10.0	10.15

Hanumangarh (Rajasthan), during July 2013-December 2013. Values are averages of three study stations are expressed in mg/l in water and mg/g in sediment, except otherwise mentioned.

Table 2 : Diversity of phytoplankton in Sadul branch of Sirhind Feeder, Hanumangarh (Rajasthan)

*Bacillariophyceae	*Chlorophyceae	*Cyanophyceae	*Zygnemataceae	*Myxophyceae	*Chaetophoraeae
Navicula subtilissima	Oedogonium	Spirulina sp.	Mougetia	Rivularia	Chaetophora
Navicula sp.	Hydrodictyon	Anabena varibilis			
Fragilaria crotonesis	Spirogyra rivularis	Nostoc			
Synedra ulna	Ulothrix zonata				
Diatoma	Microspora willenea				
Cyclotella	Chlamydomonas				
Nitzschia palea	Closterium				
Tabellaria	Cosmerium				
Melosira sp.	Scenedesmus				
Stephanodiscus carcenesis					
Surirella sp.					
Cymbella sp.					
12 Species	09 Species	03 Species	01 Species	01 Species	01 Species

CONCLUSION

Phytoplanktons are important biological indicator for the assessment of water quality. In studied canal appreciable number of phytoplankton species were recorded so water of canal is productive and can be utilized for irrigational purpose.

Acknowledgement

Authors are thankful to the Principal, Govt. Dungar College, Bikaner and the Head, Department of Zoology, Govt. Dungar College, Bikaner for providing necessary facilities.

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