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Ecology and Protozoan Community of Lentic and Lotic Fresh Water Ecosystems in Rajasthan: A Comparative Study

Deepti Srivastava
Associate Professor,
Deptt. of Zoology,
Govt. Dungar College,
Bikaner, Rajasthan

Abstract

Fresh water ecosystem is divided into two groups- lentic (standing or still water habitat) and lotic (running water habitat). The present study aimed to compare the ecology and protozoan community of lentic and lotic fresh water ecosystems in Rajasthan. The study was undertaken in 'Sethani Ka Johra'(a lentic ecosystem), Churu ($28^0$19' N, $75^0$01'E) and 'Sadul Branch' of Sirhind feeder canal (a lotic ecosystem), Hanumangarh ($29^0$35'N, $74^0$19'E).

The period of study was from July, 2017 to June, 2018. Ecology of studied water bodies revealed that both the waters were alkaline, hard and well oxygenated. In Johra transparency showed more fluctuations while in canal it was constant throughout the study. Water of canal was less alkaline than water of Johra.

In canal water average values of electrical conductance, total dissolved solids, dissolved oxygen and hardness were higher than water of Johra. Protozoans are the members of zooplanktonic community of a water body. They form an important component of natural food web in aquatic ecosystem. In all, 16 protozoan species were documented from two water ecosystems, 13 species from Johra water (four mastigophores, nine ciliates) and nine species from canal water (four mastigophores, four ciliates, one sarcodine). Among them only six species were common in both waters. Thus, the protozoan community differed to some extent in two waters.

Keywords: Ecosystem, Ecology, Lentic, Lotic.

Introduction

Inland fresh water bodies support rich biodiversity, play vital role in food web and nutrient recycling and act as perfect home for different biological activities for various micro and macroorganisms. Fresh water ecosystem is divided into two groups- lentic and lotic. The term lentic is used for still waters of lakes and ponds, which offer typical environmental conditions. The lotic water represents running water where water moves in definite direction. Current is a major controlling and limiting factor in running water. Running water contain an abundant supply of oxygen. An aquatic ecosystem maintains existence by interdependent and inter-related physico-chemical and biological factors. The protozoans are unicellular organisms. These are primary consumers and connect primary producers and higher consumers in aquatic food chain.

Objectives of the Study

The present study aimed to compare the ecology and protozoan community of lentic and lotic fresh water ecosystems in Rajasthan. The main objectives of the study were:

1. To study the physical features of lentic and lotic ecosystems.
2. To study the chemical features of both the waters.
3. To compare the physical and chemical characteristics of Johra and canal waters.
4. To ascertain the diversity of protozoan fauna of lantic and lotic ecosystems.
5. To compare the protozoan diversity of both the waters.

Review of Literature

Limnological work flourished greatly in Europe and the United States and reaches full swing in the last decade of 19th century. During 20th and current century limnological researches greatly flourished in

different parts of world. Fresh water animals of India and their ecology was studied by Tonapi (1980). Hydrobiological studies of a tributary of Sirhind canal at Sangrur (Punjab, India) was carried out by Jindal & Vasisht (1981). Khare (2005) studied physico-chemical characteristics in relation to abundance of plankton of Jagatsagar pond, Chattapur, India. Saxena (2008 a) presented an exhaustive and illustrated account of the protozoan diversity of the wet lands of the Indian desert. Sharma *et al*. (2008) studied trophic status and zooplankton diversity of lake Jaisamand in relation to its physico-chemical characteristics. Sharma (2009) compared physical-chemical limnology of some water sheets in the desert region around Bikaner. Planktonic diversity in the holy lake Pushkar (Ajmer) was explored by Khanna & Yadav (2009). Basu *et al*. (2010) observed seasonal abundance of net zooplankton correlated with physico-chemical parameters in a fresh water ecosystem. Sharma *et al.* studied limnology of two water sheets in the Thar desert with special reference to invertebrate diversity. Bali *et al.* (2014) investigated diversity and seasonal variation of zooplankton in Jaisamand lake. Bishnoi& Sharma (2016) investigated planktonic variations in a lotic water body of Sri Ganganagar, Rajasthan. Sharma (2017) studied biodiversity and ecology of Sadul branch of Srihind feeder canal (Hanumangarh, Rajasthan).

Study Area

The study was undertaken in Sethani Ka Johra, Churu which is a lentic ecosystem and 'Sadul Branch' of Sirhind feeder canal, Hanumangarh which is a lotic ecosystem. Hanumangarh is the northern most district of Rajasthan (29^{o}35'N, 74^{o}19'E). Sadul branch is situated near Jorkian village in district Hanumangarh (Rajasthan) and Sethani Ka Johra is situated in the west of Churu city (28^{o}19'N, 75^{o}01'E) at triangle of Ratangarh and Sardarshahar roads.This is manmade seasonal pond which receives rain water during monsoon.

Materials and Methods

The study was undertaken monthly in the period from July, 2017 to June, 2018. Water samples were collected from three study stations at both Johra and canal. Water was examined for the selected parameters including temperature, transparency, pH, electrical conductance, total dissolved solids, dissolved oxygen, hardness and total alkalinity. For parameters like temperature, pH, electrical conductance and total dissolved solids, respective meters were used. Other parameters were analyzed in laboratory by using as per the standard method APHA-AWWA- WPCF (1981) and Saxena (1989) Transparency was recorded with the help of a Secchi disc.

The protozoans were collected with plankton net made up of bolting silk (no. 25, 0.3 mm mesh size). The collected fauna was preserved in 4% formaldehyde. The fauna was observed under a stereoscopic binocular microscope. The forms were identified and results were expressed in terms of no./l. The identification of fauna was made following pertinent literature including Edmondson (1966), Micheal (1973), Needham & Needham (1978) and Tonapi (1980).

Results and Discussion

Physical chemical limnology revealed that both the waters were alkaline, hard and well oxygenated. Transparency of canal was constant throughout the study, while, in Johra it showed more fluctuations. Water of Johra was more alkaline than canal. In canal water average values of electrical conductance, total dissolved solids, dissolved oxygen and hardness were higher than water of Johra. During the study period the annual averages of important abiotic variables in canal water were noted as: Temperature 31.5^{o}C; Transparency 0.40 m; pH 8.1; EC 0.53 mmho/cm; TDS 530 mg/l; DO 20.52 mg/l; Total alkalinity 58.86 mg/l and Hardness 200.26 mg/l; while in Johra annual averages of these variables were notes as : Temperature 26^{o}C; Transparency 0.44 m; pH 8.8; EC 0.22 mmho/cm; TDS 220 mg/l; DO 6.42 mg/l; Total alkalinity 105.20 mg/l and Hardness 158.84 mg/l. (Table 1).

Water temperature followed the similar thermal trend of hot deserts with wide seasonal fluctuations i.e. high in summer and low in winter. Rathore (2011) recorded maximum DO up to 13 mg/ in desert water. Spence (1967) classified water bodies on the basis of alkalinity viz.; water with 1-15 mg/l as nutrient poor, 16-60 mg/l as moderately nutrient and water with more than 60.0 mg/l as nutrient rich waters. Thus the canal was moderately nutrient and Johra was nutrient rich water body. The alkaline nature of both the waters is a common feature in this arid region. According to the classification given by Kannan (1991) on the basis of hardness the water of Johra was hard (121-160 mg/l) and water of canal was very hard (>160mg/l).

During present study, total 16 protozoan species were recorded. Nine protozoan species were noted in canal water and 13 species in Johra. Protozoans belonging to three classes Mastigophora, Ciliata and Sarcodina. In canal water four species of Mastigophora (*Euglena sociabilis*, *E. acus*, *E.spirogyra*, and *Paranema trichophora*), four species of Ciliata (*Paramecium bursaria*, *P. caudatum,Stentor coeruleus* and *Vorticella campanula*) and one species of Sarcodina (*Amoeba proteus*) were recorded. In Johra four species of Mastigophora (*E. Sociabilis, E. acus, Paranema trichophora and Chilodonella paramecium*) and nine species of Ciliata (*Paramecium busaria*, *P.caudatum*, *Coleps hirtus*, *Cyclindium glaucoma*, *Stentor coeruleus*, *Chaetospira mulleri*, *Chilodonella cucullulus*, *Nassula ornata and Litonotus fasciola*) were noted. Among these only six species were common in both waters. Three species belonging to Mastigophora (*E.sociabilies*, *E. acus* and *Paranema trichophora*) and three species belonging to Ciliata (*Paramecium bussaria*, *P. caudatum* and *Stentor coeruleus*). Johra water showed more diversity and average population density of protozoans than canal water (Table 2).

Saxena (2008 a) recorded 40 species of protozoans from the wetlands of the Indian desert. His records were based on the survey of over 200 bodies of water in the region over a period of about three

decades. Present records of 18 species of protozoans are in common with those of Saxena (2008 a,b) and Srivastava & Saxena (2010).

It is concluded that limnology and protozoan community differed to some extent in lentic and lotic fresh water ecosystems. Lentic ecosystem offers more favourable habitat for protozoans and comparatively high alkalinity of water in Johra makes it more suitable for the existence of protozoan community.

Table-1: **Physical-chemical variables at "Sadul branch of Sirhind Feeder Canal", Hanumangarh and "Sethani Ka Johra", Churu during July 2017- June 2018. Values are annual averages of three study stations in each water body and expressed as mg/l, except otherwise mentioned.**

Variables	Sirhind Feeder Canal	Sethani Ka Johra
Temperature	31.5	26
Transparency (m)	0.40	0.44
pH	8.1	8.8
EC(mmho./cm)	0.53	0.22
TDS	530	220
DO	20.52	06.42
Total alkalinity	58.86	105.20
Hardness	200.26	158.84

Table-2: **Diversity and population density of Protozoan fauna at "Sadul branch of Sirhind Feeder Canal", Hanumangarh and "Sethani Ka Johra", Churu during July 2017- June 2018. Values are annual averages of three study stations in each water body and expressed as No./l.**

Protozoan fauna	Sirhind Feeder Canal	Sethani Ka Johra
Class- Mastigophora		
Euglena sociabilis	32.00	31.33
Euglena acus	28.00	36.67
Euglena spirogyra	28.66	-
Paranema trichophora	21.33	11.33
Chilodonella paramecium	-	23.00
Total Mastiophores	**115.99**	**101.33**
Class- Ciliata		
Paramecium bursaria	30.66	49.33
Paramecium caudatum	22.66	14.00
Stentor coeruleus	32.00	26.00
Vorticella campanula	37.33	-
Coleps hirtus	-	42.67
Cyclindium glaucoma	-	44.67
Chaetospira mulleri	-	16.00
Chilodonella cucullulus	-	17.33
Nassula ornate	-	23.33
Litonotus fasciola	-	16.67
Total Ciliates	**122.65**	**250.00**
Class- Sarcodina		
Amoeba proteus	28.66	-
Total Protozoans	**267.30**	**351.33**

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