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Zooplankton Fauna and its Ecological features in a Desert pond Ecosystem at Churu, Rajasthan, India

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Abstract

Rajasthan is endowed with different topographic characters. In northwest part of the state, the Thar desert lies, where extreme condition like scarcity of water, low rainfall, high temperature fluctuations, dust storms, poor vegetation and animal life prevail. In the adverse conditions of desert water is the most important limiting factor for existence and distribution of biotic communities. In the Indian desert fewer but varied bodies of water are present in the form of ponds, tanks, reservoirs, tanka, naadis, johra, beri and bawari and few perennial lakes etc. The present study was carried out during September 2012 to February 2013 to investigate the diversity and population density of Zooplankton at 'Sethani ka Johra' in Churu district (27^0 24'N to 29^0 00' N latitude and 73^0 40'E to 75^0 41'E longitude). Physical – Chemical limnology of the studied biotopes revealed that the pond was shallow with turbid, alkaline, hard, slightly saline and well oxygenated water. The zooplankton fauna was represented by Protozoans, Rotifers and Arthropods. Protozoans include thirteen species belonging to two classes- Mastigophora and Ciliata. Rotifers represented by eight species. Arthropods were represented by two classes – Crustacea and Insecta. Crustacea includes eight species belonging to three orders – Ostracoda, Cladocera and Copepoda. Nauplii, the larval forms of many Crustaceans, occurred in pond during the study period. Aquatic insects include ten species belonging to two orders - Coleoptera and Hemiptera. Order Diptera and Odonata were represented only by larval forms.

Keywords: Zooplankton, environment, johra, phisico-chemical parameters, population density.

Introduction

Rajasthan is a largest state of India. It extends between 23^0 03' N to 30^0 12' N latitude and 69^0 30' E to 78^0 17' E longitudes. Rajasthan is endowed with different topographic characters. In North West part of the state, the Thar Desert lies, where extreme conditions like scarcity of water, low rainfall, high temperature fluctuations, dust storms, poor vegetation and animal life prevail. In the adverse conditions of desert water is the most important limiting factor for existence and distribution of biotic communities. In the Indian desert fewer but varied bodies of water are present in the form of ponds, tanks, reservoirs, naadis, Johra, beri and bawari and few perennial lakes etc.

Aquatic ecosystems have abundance of planktons. Plankton includes Phytoplankton and Zooplankton. Phytoplankton are floating microscopic autotrophic whose movements are more or less depended on current. While Zooplankton are heterogeneous assemblage of minute floating animal forms found in water. They may bear some locomotory structures but are not capable of moving against the water current. Zooplankton is intermediate link between primary producers (phytoplankton) and higher consumers (like carnivore fish) in aquatic food chains. Zooplanktons are very sensitive to environmental changes and their spatial and temporal distribution is governed by a number of environmental features.

The present study was proposed to investigate the diversity and population density of zooplankton at 'Sethani ka Johra' at Churu in the Indian desert as they provide unique environment with respect to physical, chemical, biological and meteorological conditions.

Study area – 'Sethani ka Johra': Churu(27^0 24'N to 29^0 00'N latitude and 73^0 40'E to 75^0 41'E longitude), where the study was carried out, it is situated in sand dunes which is the entrance of Thar desert. The "Sethani ka Johra" is situated in the west of Churu city at triangle of Ratangarh and Sardarshahar roads. This is man-made seasonal pond which receives rain water during monsoon. It retains water for the whole year.

Material and Methods

Phisico-Chemical analysis: The study was undertaken monthly in the period of September 2012 to February 2013. Both water and sediment samples were collected from three study stations. Water was examined for major ecological variables including transparency, temperature, pH, electrical conductance, total dissolved solids, dissolved gases (oxygen, carbon dioxide), alkalinity and hardness. The sediment

samples were examined for pH, electrical conductance, total dissolved solids and organic matter. The chemical analysis was made following APHA-AWWA-WPCF[1]. For physical-chemical parameters like temperature, pH, electrical conductance and total dissolved solids respective meters were used. The transparency of water was measured in the field, using Secchi-Disc.

Biological analysis: Zooplankton samples were collected by using plankton net made of bolting silk (No. 25, .03mm mesh). With the help of plankton net both macroscopic and microscopic forms were collected. Identification of zooplankton was done with the help of standard references[2-5]. Insect fauna was especially identified using authenticated monographs[6-8].

Results and Discussion

During the investigation period the temperature was recorded in the range of 17.5^0 to 30.3^0C. The average of transparency of water was 0.48 m and Turbidity was 40 JTU. Transparency of water is inversely proportional to turbidity, which in turn is directly proportional to the amount of suspended organic and inorganic mater[9]. In some cases, low transparency is reported to be linked with rich phytoplankton[10-12]. The Electrical conductance was recorded 0.10 to 0.19 mmho/cm. pH was recorded from 7.2 to 8.5. It increases during day largely due to photosynthetic activity (consumption of CO_2), whereas decreases at night due to respiratory activity. Factor like exposure to air, temperature and disposal of industrial wastes also bring about changes in pH[9]. Total dissolved solids was recorded from 100 to 190 mg/l. CO_2 was absence and dissolved oxygen was 4.23 to 8.78 mg/l. In the absence of free CO_2, the bicarbonates converted in to carbonates releasing CO_2, which is utilized by autographs, thus making the water more alkaline[9]. In some earlier studies in this region no free carbon dioxide was recorded[13-15]. Hardness of water ranged from 98 to 200 mg/l and total alkalinity 40 to 94 mg/l. In natural water carbonates, bicarbonates and hydroxides contribute to the alkalinity. Natural water with high alkalinity is generally rich in phytoplankton[9]. In sediment samples pH was recorded from 7.5 to 8.4. Electrical conductance was 0.15 to 0.41 mmho/cm. and total dissolved solids was 150-410 mg/g. Electrolyte in a solution dissociable in to positive (cations) and negative (anions) ions and impart conductivity. Thus higher the concentration of electrolytes in water, the more is its electrical conductance[9]. TDS is especially an important parameter in the analysis of saline lake, coastal, estuarine and marine waters[9]. The average of organic matter was 16.42 mg/g (table-1).

In the present study the zooplanktonic community was represented by Protozoans, Rotifers and Arthropods. Protozoans include 13 species belonging to two classes-Mastigophora and Ciliata. In Mastigophora 3 species *Euglena acus, Euglena coudatum and Paranema trichophorum* were recorded. Ten species belonging to class Ciliata were *Paramecium caudatum, Paramecium bursaria, Coleps hirtus, Cyclidium glaucoma, Stentor coeruleus, Chaetospiro mulleri, Chilodonella* sp*., Nassula oomate, Litonotus fasciola and Dileptus* sp. Srivastava and Saxena reported 10 protozoan species belonging to Mastigophora (three) and Ciliata (seven) in village pond ecosystem in the Indian desert[16]. Rotifera represented by 8 species *keretella quadrata, keretella cochlearis, keretella valga, Branchionus bidentata, Filinia longiseta, Trichocera longiseta, Branchionus calciforus and Lecane lorica*. Saxena summarized the Rotifer fauna in the Indian desert and documented 17 species belonging to 11 genera from surface waters of diverse nature. Rotifers, in general, prefer organically rich waters which are obviously less alkalines[10]. This fact was also supported by Srivastava[17].

Arthropoda was represented by two classes – Crustacea and Insecta. Crustacea includes 8 species belonging to three orders Ostracoda, Copoepoda and Cladocera. Ostracoda were represented by 3 species *Cyclocypris* sp*., Eucypris* sp. *and Stenocypris malcomsoni.* Cladocera including two species *Daphnia carinata and Alonella sp*. In Copepoda 3 species *Cyclopes sternus, Diaptamus glacialis and Eucyclops* sp. were recorded. Nauplii, the larval forms of many crustaceans, occurred in pond during the study period.

Aquatic Insects were found to be diverse, represented by ten species belonging to 6 species of Coleopters and four species of Hemiptera. Coleoptera belonging to *Hydrophilus olivaceous, Tropisternus lateralis, Hydraticus fabricii, Dytiscus verticalis, Eubranex* sp*. and Laccophilus flexuosus.* Hemipteres includes *Notonecta undulate, Notonecta glauca, Sigara pectoralis and Gerris lacustris.* Order Diptera and Odonata were represented only by larval forms (table-2). Vazirani[18], Tonapi[5], Roonwal[19-21], Tak and Sewak[22], Srivastava and Saxena[23,24,27], Saxena[25], Srivastava[17] and Srivastava and Saxena[16,26,28] also reported Ostracoda, Copepod, Cladocera and Insecta as zooplankton in Indian desert water.

Physical chemical limnology of the studied biotopes revealed that the pond was shallow with turbid, alkaline, hard, slightly saline and well oxygenated water. The total number of zooplankton was recorded maximum in the month of February and minimum number observed in the month of September. Arthropods show maximum population density while Rotifers show minimum population density. The highest diversity was found in phylum Arthropoda and lowest in Rotifera (figure-1).

Table-1
Physical-Chemical variables at 'Sethani ka Johra', Churu during September 2012 to February 2013. Values are averages of three study stations and expressed as mg. /l and mg. /g in sediment, except otherwise mentioned

	Variables	Months						
		Sep. 2012	Oct. 2012	Nov. 2012	Dec. 2012	Jan. 2013	Feb. 2013	Average
Water	Temperature (^{0}c)	30.3	20.1	19.8	19.1	17.5	18.0	20.80
	Transparency (m)	0.40	0.50	0.50	0.50	0.45	0.50	00.48
	Turbidity (JTU)	40	40	40	40	40	40	40.00
	Ph	8.2	7.9	7.2	7.5	8.5	8.7	08.00
	EC (mmho/cm)	0.10	0.17	0.10	0.10	0.19	0.17	00.14
	TDS	100	170	100	100	190	170	138.33
	DO (mg/l)	5.52	4.23	3.58	8.78	4.88	6.18	05.53
	Free CO_2	NIL	NIL	NIL	NIL	NIL	NIL	NIL
	Total Alkalinity (mg/l)	78	72	40	42	94	66	65.33
	Hardness (mg/l)	98	152	162	200	150	160	153.67
Sediment	pH	7.8	8.4	7.5	8.0	8.4	8.2	08.05
	EC (mmho/cm)	0.18	0.41	0.21	0.31	0.15	0.18	00.24
	TDS	180	410	210	310	150	180	240
	Organic Matter (mg/l)	NIL	NIL	15.32	18.02	21.73	43.46	16.42

Table-2
Population density of zooplankton at 'Sethani ka Johra', Churu during September 2012 to February 2013. Values are averages of three study stations and expressed as No. /l.

Fauna Species	MONTHS						Total Zooplanpton
	September 2012	October 2012	November 2012	December 2012	January 2013	February 2013	
Protozoa	170	400	410	500	620	700	2800
Rotifera	130	120	290	320	130	180	1170
Arthropoda	320	290	280	490	670	880	2930
Total Zooplankton	620	810	780	1110	1420	1760	6500

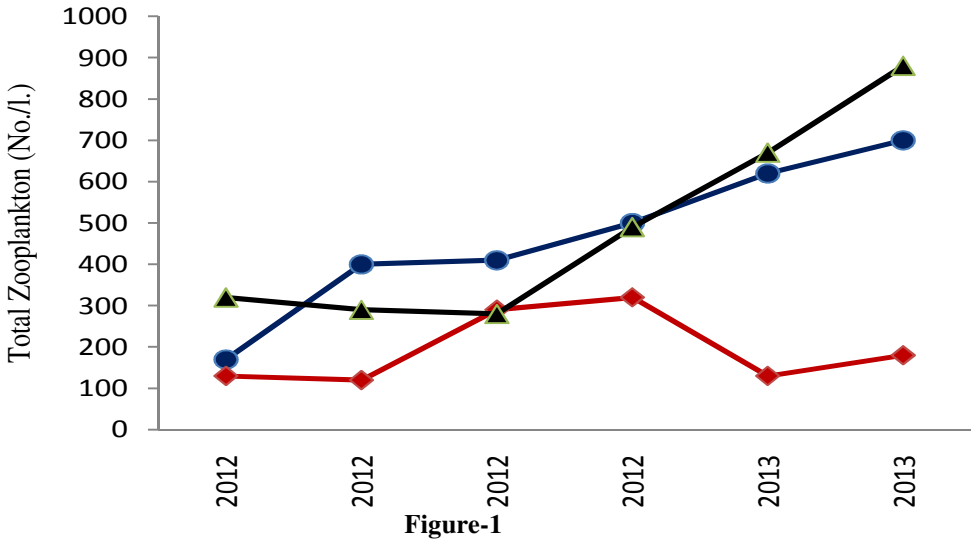

Figure-1
Total zooplankton at 'Sethani ka Johra', Churu during September 2012 to February 2013. Values are averages of three study stations and expressed as No. /l.

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Conclusion

It is concluded that while a few zooplankton were sensitive with limited distribution in space and time, most others were hardy enough to withstand stressful conditions. The pond offers a suitable biotope for aquatic plants and animals. Thus a study on zooplankton diversity was become a reliable source to provide the picture of environmental status and influence of changing limnology of fresh water concerned.

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