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Diversity of Invertebrate Fauna and Its Abiotic Features in A Desert Pond Near Churu, Rajasthan

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Abstract

The Thar desert lies in North-West part of the state is characterized by extreme environmental conditions. Water is always the most important limiting factor for existence and distribution of biotic communities. Aquatic ecosystem offer typical physical-chemical conditions. Under harsh and hostile environmental conditions, a variety of fauna species is found. The present study explores the diversity of invertebrate fauna and its abiotic features in a desert pond (Sethani Ka Johra) near Churu, Rajasthan. The study was undertaken monthly in the Johra for a period of 12 months (from July, 2012 to June, 2013). Water has been analyzed for the selected parameters including transparency, temperature, pH, electrical conductance (EC), total dissolved solids (TDS), dissolved gases (oxygen and carbon dioxide), total alkalinity and hardness. In sediment pH, EC, TDS and organic matter were analyzed.

The faunal composition was rich in Johra represented by 55 species (48 adult genera and seven larval forms) belonging to Phylum Protozoa, Rotifera, Annelida and Arthropoda. In the present study the order of diversity of different faunal group was noted as: Arthropoda > Protozoa > Rotifera > Annelida. Phylum Protozoa represented by 13 species belonging to two classes: Mastigophora and Ciliata. Phylum Rotifera was represented by eight species of class Monogonota. Phylum Annelida was represented only by one species belonging to class Oligochaeta. Phylum Arthropoda was represented by 33 species belonging to classes- Crustacea (nine species) and Insecta (24 species). The ecology of johra was also explored.

Keywords: Fauna, Diversity, Zooplankton and Abiotic features

Introduction

The Thar desert lies in North-West part of the state is characterized by extreme environmental conditions. Water is always the most important limiting factor for existence and distribution of biotic communities. Natural or man-made, both types of small, intermittent ponds, tanks, reservoirs and johra are often the only source of water. Aquatic ecosystem offer typical physical-chemical conditions. Under harsh and hostile environmental conditions, a variety of fauna species is found. The present study explores the diversity of invertebrate fauna and its abiotic features in a desert pond (Sethani Ka Johra) near Churu, Rajasthan. The study was undertaken monthly in the Johra for a period of 12 months (from July, 2012 to June, 2013). Water samples were collected from three study stations of Johra.

Aim of the Study

1. To ascertain the faunal diversity of 'Sethani Ka Johra', Churu in the Indian desert as they provide unique environment with respect to physical, chemical biological conditions.
2. To study the ecology of such invertebrate faunal component which is exposed extreme environmental conditions of desert and is isolated.

Study Area

'Sethani ka Johra' is situated in the west of Churu city at triangle of Ratangarh and Sardarshahar roads. It was made as relief project during the terrible "Chhapana Akal" the famine 1899 A.D. (V Samvat 1956). This is a man-made seasonal pond which receives rain water during monsoon (July to October).

Materials and Methods

Analysis of Physical-Chemical Parameters

Water has been analyzed for the selected parameters including transparency, temperature, pH, electrical conductance (EC), total dissolved

solids (TDS), dissolved gases (oxygen and carbon dioxide), total alkalinity and hardness. In sediment pH, EC, TDS and organic matter were analyzed. For parameters like temperature, pH, EC and TDS respective meters were used.Transparency was recoded with the help of a standard Secchi disc. Chemical analysis was made following APHA-AWWA-WPCF (1981) in laboratory.

Collection of Fauna

The planktonic fauna from water were collected with plankton net made up of bolting silk (No. 25, 0.3 mm mesh size). A quadrate used to collect the mud samples. Benthic fauna was collected by sieving the mud samples.

Identification of invertebrate fauna was made following Edmondson (1966), Needham & Needham (1978), Tonapi (1980) and Subba Rao (1989), Daglish (1952), Borrer & Delong (1957), Vazirani (1964), Mc Caffetry (1981) and Subramanian & Sivaram Krishan (2007).

Results and Discussions

Physical-chemical limnology of the studied biotope revealed that the pond was shallow with alkaline, hard and well oxygenated water. The ranges of abiotic variables of water during the study period were noted as-

Transparency: 0.25 to 0.50 m, temperature: 17.5 to 31.0 ^{0}c, pH: 7.1 to 9.4, EC: 0.10 to 0.38 mmho/cm, TDS: 100 to 380 mg/l, DO: 2.93 to 8.78 mg/l, free CO_2: nil to 100mg/l, total alkalinity: 40 to 94 mg/l and hardness: 96 to 200 mg/l.

The ranges of abiotic variables of sediments during the study period were noted as-

pH: 6.6 to 9.6, EC: 0.15 to 0.41 mmho/cm, TDS: 150 to 410 mg/g and organic matter: nil to 73.32 mg/g.

The faunal composition was rich in Johra represented by 55 species (48 adult genera and seven larval forms) belonging to Phylum Protozoa, Rotifera, Annelida and Arthropoda. In the present study the order of diversity of different faunal group was noted as: Arthropoda > Protozoa > Rotifera > Annelida.

Phylum Protozoa represented by 13 species belonging to two classes: Mastigophora and Ciliata. Ciliates show more diversity than mastigophores. Class Mastigophora represented by three species: Euglena acus, E. spirogyra and Peranema trichophorum. Class Ciliata included 10 species: Paramecium caudatum, P. bursaria, Coleps hirtus, Cyclidium glaucoma, Stentor coeruleus, Chaetospira muelleri, Chilodonella cucullulus, Nassula ornata, Litonotus fasciola and Dileptus species. Phylum Rotifera was represented by eight species of class Monogonota namely Keratella quadrata, K. cochlearis, K. valga, Brachionus bidentata, B. calyciforus, Filinia longiseta, Trichocerca longiseta and Lecane bulla. Phylum Annelida was represented only by Tubifex tubifex belonging to class Oligochaeta. Arthropods were represented by two classes: Crustacea and Insecta. Insecta show more diversity than crustaceans. Crustaceans represented by nine species (eight adult genera and one larval form). Class Crustacea was belonging to three orders Copepoda, Cladocera and Ostracoda. Order Copepoda represented by three species Cyclops sternus, Eucyclops species and Diaptomus glacialis. Cladocera represented by two species Daphnia carinata and Bosmina longicornis. Ostracoda included three species Cyclocypris species, Eucypris species and Stenocypris malcomsoni. Nauplii, the larval forms of many crustaceans were also found. Class Insecta was represented by 24 species, belonging 18 adult genera besides six larval forms.The adult insects belonged to two orders Coleoptera (beetles) and Hemiptera (bugs). Beetles were represented only by 12 species (including one larval form) and bugs were represented by seven species. Order Diptera, Odonata and Ephemeroptera were represented only by larval forms.

Among insects, beetles show maximum diversity and represented by five families: Dytiscidae (six species), Helodidae (one species), Hydrophilidae (three species), Psephenidae (one species) and Carabidae (one species). Bugs were represented by five families: Corixidae (two species), Notonectidae (two species), Gerridae (one species), Veliidae (one species) and Nepidae (one species). Order Diptera, Odonata and Ephemeroptera were represented by three species, one species and one species respectively.

Saxena (2008) recorded 41 species of protozoans from the wetlands of the Indian desert region. Mahajan (1969, 1971, 1977 a,b) listed 82 protozoans species in Rajasthan. Srivastava (2009) reported 10 species of protozoans in some village pond ecosystems in the Indian desert pond around Bikaner. Saxena (2001) studied rotifer fauna in the Indian desert and documented 17 species belonging to 11 genera. Sharma (2017) reported seven species of rotifers in Sadul branch of Sirhind feeder canal, Hanumangarh. Roonwal (1982) in his review of the fauna of Indian desert also reported Oligochaeta and Hirudinarea from the Indian desert. Saxena (2008), Srivastava (2009) and Chandra (2015) also recorded Tubifex tubifex among aquatic invertebrates of Rajasthan. Tonapi (1980) reported 45 species of cladocerans from India. Saxena (2008) documented 22 cladocerans species and two ostracodon species among common aquatic invertebrates of Rajasthan. Sharma et al. (2008) reported total nine species of copepods, 23 species of cladocerans and five species of ostracods from lake Jaisamand, Udaipur. Earlier Vazirani (1964), Tak & Sewak (1987), Tak (1996), Saxena (2008), Srivastava (2009) and Tak (2015) studied aquatic insects of the desert region of Rajasthan.

Conclusion

It is concluded that surface waters are stressed resources in desert region. In hard environmental conditions they show specific physical, chemical and biological features. Higher value of species diversity of the 'Sethani Ka Johra' Churu depicts the favourable conditions in terms of physico-chemical conditions and food availability. Although faunal species exists under a wide range of environmental conditions, yet many species are limited by DO, temperature and other physico-

chemical factors. Different faunal species showed their abundance according to the favourable conditions.

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Table 1. Physical-chemical variables at 'Sethani Ka Johra', Churu during July, 2012- June, 2013. Values are averages of three study station and are expressed mg/l in water and mg/g in sediment, except otherwise mentioned

Variable		Range		Annual Average
		Minimum	Maximum	
Water	Transparency (m)	00.25	00.50	00.45
	Temperature (^{o}C)	17.5	31	23.50
	pH	7.1	9.4	8.17
	EC (mmho/cm)	00.10	00.38	00.19
	TDS	100	380	192.5
	DO	2.93	8.78	05.31
	Free CO_2	NIL	100	18.33
	Total Alkalinity	40	94	71.92
	Hardness	96	200	133.08
Sediment	pH	6.6	9.6	7.93
	EC (mmho/cm)	0.15	00.41	00.26
	TDS	150	410	259.16
	Organic Matter	NIL	73.32	27.47

Table 2. Diversity of invertebrate fauna at 'Sethani Ka Johra', during July, 2012 to June, 2013.
'+' indicates the presence and '-' indicates the absence of species.

FAUNAL SPECIES	Jul 2012	Aug 2012	Sep 2012	Oct 2012	Nov 2012	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013
PHYLUM – PROTOZOA												
Class- Mastigophora												
Euglena acus	+	+	+	-	+	+	+	+	+	+	-	+
Euglena spirogyra	+	+	+	-	+	+	+	+	-	-	+	-
Peranema trichophorum	-	+	-	-	-	+	+	+	+	+	+	+
Class- Ciliata												
Paramecium caudatum	-	-	-	-	+	+	+	+	-	-	-	-
Paramecium bursaria	-	-	-	+	+	+	+	+	+	-	+	+
Coleps hirtus	+	-	-	-	+	+	+	+	+	+	+	+
Cyclidium glaucoma	+	-	-	+	+	+	+	+	+	+	-	+
Stentor coeruleus	-	+	-	+	-	-	-	+	+	+	+	+
Chaetospira muelleri	-	-	-	+	+	+	+	+	-	-	-	-
Chilodonella cucullulus	-	-	-	+	+	+	-	-	-	-	+	+
Nassula ornata	-	+	+	-	-	+	+	+	+	+	-	-
Litonotus fasciola	-	-	+	-	+	+	+	+	-	-	-	-
Dileptus species	-	-	-	-	+	+	+	+	-	-	-	-
PHYLUM- ROTIFERA												
Class- Monogonota												
Keratella quadrata	-	+	+	+	+	+	+	-	+	+	-	+
Keratella cochlearis	+	-	-	-	-	+	+	+	-	+	+	-
Keratella valga	-	+	+	-	+	+	+	+	+	+	-	+
Brachionus bidentata	+	-	+	+	+	+	+	+	-	-	+	+
Brachionus calyciforus	-	-	+	-	+	+	-	+	+	-	+	+
Filinia longiseta	-	-	-	+	+	+	-	-	-	-	+	+
Trichocerca longiseta	-	+	+	+	+	+	-	-	-	-	-	-
Lecane bulla	-	+	+	+	+	-	-	-	+	+	-	-
PHYLUM- ANNELIDA												
Class- Oligochaeta												
Tubifex tubifex	+	+	+	+	+	+	+	+	+	+	+	+
PHYLUM-ARTHROPODA												
Class- Crustacea												
Cyclops sternus	-	+	+	-	+	+	+	+	+	-	+	+
Eucyclops species	-	-	+	+	+	-	+	+	-	+	+	+
Diaptomus glacialis	-	-	-	-	+	+	+	+	-	+	+	+

Daphnia carinata	-	+	+	+	-	+	-	-	+	-	-	-
Bosmina longicornis	-	-	-	+	-	+	-	+	+	-	+	+
Cyclocypris species	-	+	-	+	-	+	+	+	+	-	-	-
Eucypris species	+	+	-	+	+	+	-	+	+	+	+	+
Stenocypris malcomsoni	+	-	+	-	+	+	+	+	-	-	-	+
Nauplius larva	-	-	+	+	+	-	-	+	+	+	-	-
Class- Insecta												
Cybister rugulosus	+	+	-	-	-	+	+	-	+	+	-	+
Captotomus interrogatus	-	-	+	-	-	-	-	+	+	+	-	+
Dytiscus verticalis	-	+	+	-	-	+	+	+	+	-	+	-
Hydaticus fabricii	+	+	-	-	-	+	+	+	-	-	+	+
Laccophilus flexuosus	-	+	-	-	+	+	+	+	+	+	+	-
Agabus sp. Larva	-	+	+	+	+	+	-	-	-	-	-	-
Scrites nigropunctatus	-	+	+	+	-	-	-	+	+	+	-	-
Hydrophilus olivaceous	-	+	+	+	+	+	+	+	-	-	-	+
Tropisternus lateralis	-	+	+	+	+	+	+	+	+	-	-	-
Sternolophus rufipes	-	+	-	-	-	-	+	+	+	-	+	+
Eubranax species	-	+	+	+	+	+	+	+	-	+	-	-
Bembidion species	-	-	-	+	-	-	-	+	+	+	+	+
Corixa lima	-	-	+	-	-	+	+	+	-	-	-	-
Sigara pectoralis	+	+	+	+	+	-	+	+	+	-	+	-
Notonecta undulata	-	+	-	-	-	+	+	+	+	+	-	-
Notonecta glauca	-	+	+	-	+	+	+	+	+	-	-	+
Gerris marginatus	-	+	+	+	-	+	+	+	-	-	-	+
Microvelia diluta	-	+	-	+	+	+	-	-	-	+	+	+
Nepa cineria	-	+	+	+	-	-	+	+	-	-	-	-
Anopheles sp. larva	-	+	+	+	-	+	-	-	+	+	-	-
Chironomus sp. Larva	+	+	+	+	+	+	+	+	+	+	+	+
Culex sp. larva	-	+	+	+	-	+	-	-	+	+	-	-
Dragon fly nymph	-	+	+	+	+	+	+	+	+	+	+	+
May fly larva	-	+	+	+	-	-	-	-	-	-	+	+