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Insect Fauna and its Ecologcal Features in Village Pond Ecosystems in the Indian Desert (Western Rajasthan)

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Abstract

Water is the most important limiting factor for existence and distribution of biotic communities in arid and semi arid regions of western Rajasthan. In the region, fewer but varied bodies of water are present. These offer typical physical - chemical conditions including shallow, turbid, well-oxygenated waters which are mostly alkaline, hard and a little saline. The biota of such waters has to be hardy enough to survive under concentration and desiccation condition. The present study was undertaken from September, 2012 to February 2013 to explore insect diversity and its ecology. Aquatic insects were represented by 13 genera besides larval forms of many. The adult insect fauna belonged to only two orders namely Coleoptera and Hemiptera. Coleoptera was represented by four families namely Dytiscidae (5,3 Genera), Hydraenidae (1,1), Hydrophilidae (2,2) and Psephenidae (1,1). Hemiptera was also represented by four families Corixidae (1,0), Nepidae (1,1), Notonectidae (0,1) and Veliidae (1,1 Genera) in the village ponds of Sagar and Devikundsagar respectively in Bikaner District (Western Rajasthan.)

Keywords: Aquatic insects, Western Rajasthan ,Village Ponds, Diversity, Ecology

Introduction

Thar, the Great Indian Desert is characterized by typical arid condition like scanty and irregular rainfall leading to scarcity of water and food, intense radiation influencing variety of adaptations among living being. In these adverse conditions water is the most important limiting factor for existence and distribution of biotic communities in arid and semi arid regions of western Rajasthan. In the region, fewer but varied bodies of water are present in the form of ponds, tanks, reservoirs and a few perennial lakes. Most of which are shallow and ephemeral. They receive rain water, which lasts in them generally for about eight to ten months depending upon the rainfall in the particular year, the depth and spread of water, and the quality of basin. These offer typical physical - chemical conditions including shallow, turbid, well-oxygenated waters which are mostly alkaline, hard and a little saline. The biota of such waters has to be hardy enough to survive under concentration and desiccation condition.

Insects perhaps the hardiest creatures not only occur but flourish in aquatic ecosystems. Insects with their abundance and diversity dominate fresh water ecosystems. Aquatic insects are involved in nutrient cycle and form an important component of natural food web in an aquatic ecosystem. Aquatic macro-invertebrates have been identified as excellent tool for bio monitoring studies as they respond rapidly to the environmental changes. Their abundance, diversity and short life cycle makes them ideal subjects for the assessment of wetland's ecological conditions (Rader *et al.,* 2001). These also act as reliable indicators of ecological characteristics of water. Like other communities in water insects are sensitive to environmental changes and their spatial and temporal distribution is governed by a number of environmental features. The present study was undertaken to explore insect diversity and its ecology.

Study Area

The present study was carried out on two village ponds namely Sagar and Devikundsagar situated about 7 km East of Bikaner city in Bikaner district. (28' N and 73.17' E, MSL 228 m) in western arid region of Rajasthan in India during September, 2012 to February 2013. The ponds are utilized by village people for the various purposes. A number of tankers on bullock and camel carts are filled and transported from here. The clay of

bottom of the pond is used for brick making on the bank sides. Some birds including dab chicks and black-winged stilts are seen.

Materials and Methods

1. Both water and sediment samples were collected from three study stations. The insect fauna from water was collected with suitable nets covering both macroscopic and microscopic forms. A quadrate was used to collect the samples of sandy sediment. Benthic forms were collected by sieving the mud samples. The results are expressed in the No./m^2
2. Water was examined for major ecological variables including 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 analysis was made following APHA-AWWA-WPCF (1981). For parameters like temperature, pH, electrical conductance and total dissolved solids, respective meters were used.
3. Insect fauna were identified following Daglish (1952), Borrer & Delong (1957), Baid (1958), Vazirani (1964), Edmondson (1966), Needham & Needham (1978), Tonapi (1980) and Mc Cafferty (1981).

Results and Discussion

Physical-chemical limnology revealed that the lakes were shallow with turbid, alkaline, hard, slightly saline and well oxygenated. The average values of important abiotic variables of water were observed as Temperature 19.13-21.06ºC, Transparency 0.94 - 0.84 m, pH 8.16 – 8.18, EC 0.31 - 0.18 mmho/cm, DO 7.51 – 11.28 mg/l, Free CO_2 11.66 – 3.33 mg/l, TDS 500 – 600 mg/l, Hardness 114.66-114 mg/l and Total Alkalinity 130 -108.66 mg/l. Sediment analysis revealed the ranges as pH 8.00– 8.26, EC 0.5 - 0.6 mmho/cm, TDS 500– 600 mg/g and Organic matter 6.20- 7.24 mg/g in the ponds of Sagar and Devikund Sagar respectively (Table 1).

Most of the major orders of insects are found in the Indian desert and many of them present interesting adaptations to the desert environment (Roonwal, 1982). Insects, the most versatile and tolerant group of invertebrates, are especially important faunal component in desert waters, most of which are ephemeral and offer extremely hostile physical and chemical conditions. In spite of the fact that insects are no lesser important denizens of aquatic environment, no sincere efforts seem to have been made on aquatic insects of the desert region of Rajasthan, except the contributions of Vazirani (1964), Tak & Sewak (1987), Tak (1996), Srivastava & Saxena (2004), Saxena (2008) and Srivastava (2009).

Aquatic insects, to which the present study is devoted, were found to be pretty diverse, represented by 13 genera (Table 2) besides larval forms of many. The adult insect fauna belonged to only two orders namely Coleoptera and Hemiptera. Coleoptera was represented by four families namely Dytiscidae (5,3 Genera), Hydraenidae (1,1), Hydrophilidae (2,2) and Psephenidae (1,1). Hemiptera was also represented by four families Corixidae (1,0), Nepidae (1,1), Notonectidae (0,1) and Veliidae (1,1 Genera) in the ponds of Sagar and Devikundsagar respectively. Beetle *Laccophilus anticatus* was present only in Sagar pond, while *Sternolophus rufipes*, *Captotomus interrogates* and *Uvarus* sp. were present exclusively in Devikundsagar pond. Of the four bug species noted, *Corixa lima* was not found in Devikundsagar pond.

Numerically *Hydraena quadricoliis* was the most abundant species followed by *Hydraticus fabricii, Eubranax* Sp*., Laccotrepes maculates, Hydrophilus olivaceous* and *Dytiscus verticalis* contributing considerably to the total insect population (Fig.1)

Apart from Coleoptera and Hemiptera which were represented as adult and larval forms in these waters insect orders Diptera and Odonata were represented only by larval forms. These were found in both sediment and water. Chironomid larvae were recorded throughout the period of study in the mud samples of both the ponds. Mosquito larvae (*Anopheles, Culex*) were also recorded. Rat-tailed maggot of Syrphid fly (Diptera) was recorded only in Devikundsagar pond. Dragonfly larvae were recorded throughout the period of study.

Among beetles, larvae of *Agabus* were recorded throughout the period of study in both the ponds; while *Laccobius* larvae were noted during winters in Sagar pond only.

Conclusion

It is concluded that insects were hardy enough to withstand stressful conditions. The discontinuous distribution of the species is influenced by subsequent survival success and propagation. The range of various physico-chemical parameters is in tune with other records from the desert regions and thus both the ponds offer suitable biotopes for aquatic insects.

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Table 1
Physical-Chemical Variables at Village Ponds of Sagar (S) and Devikund Sagar (D), Bikaner During September 2012 To February 2013. Values are Average of Three Study Stations and are Expressed in Mg/L in Water and Mg/G in Sediment, Except Otherwise Mentioned

	Sept 2012		Oct 2012		Nov 2013		Dec 2012		Jan 2013		Feb 2013		Average	
	S	D	S	D	S	D	S	D	S	D	S	D	S	D
Water														
Temperature (^oC)	33.0	34.0	22.0	24.0	18.4	20.2	13.2	15.2	13.7	16.0	14.5	17.0	19.13	21.06
Transparency	0.75	0.65	1.0	0.75	1.0	0.9	1.0	1.0	1.0	1.0	0.9	0.75	0.94	0.84
pH	7.9	7.7	8.5	8.2	8.2	8.4	7.8	8.4	8.4	8.2	8.2	8.2	8.16	8.18
EC (m mho/cm)	0.1	0.1	0.2	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.31	0.18
TDS	100	100	200	200	400	200	400	200	400	200	400	200	316.66	183.33
DO	10.16	8.94	5.69	10.82	5.69	12.6	8.12	12.6	8.12	11.38	7.30	11.38	7.51	11.28
Free CO_2	10	20	10	Nil	10	NIl	40	Nil	Nil	Nil	Nil	Nil	11.66	3.33
Total Alkalinity	152	120	126	114	126	116	136	110	120	96	120	96	130	108.66
Hardness	80	80	96	110	110	80	120	134	140	134	142	146	114.66	114
Sediments														
pH	7.2	7.9	8.2	8.6	8.1	8.0	8.1	8.2	8.0	8.2	8.4	8.7	8.00	8.26
EC mmho/cm)	0.3	0.4	0.3	0.5	0.3	0.8	0.8	0.8	0.8	0.8	0.5	0.3	0.5	0.6
TDS	300	400	300	500	300	800	800	800	800	800	500	300	500	600
Organic matter	Nil	Nil	Nil	Nil	18.28	5.43	14. 88	4.07	Nil	13.58	4.07	20.37	3.20	7.24

Table 2
Diversity and Population Density of Entomofauna at Village Ponds of Sagar (S) and Devikund Sagar (D), Bikaner During September 2012 To February 2013. Values are Averages of Three Study Station and are Expressed As No/M^2

	Sept 2012		Oct 2012		Nov 2013		Dec 2012		Jan 2013		Feb 2013		Average	
	S	D	S	D	S	D	S	D	S	D	S	D	S	D
CLASS-INSECTA														
O-COLEOPTERA														
F- DYTISCIDAE (Predaceous Diving Beetle)														
Captotomus interrogatus	00	00	00	00	00	00	00	60	00	80	00	80	00	36.66
Dytiscus verticalis	00	80	20	00	40	40	80	40	80	00	60	20	46.66	30.00
Hydaticus fabricii	60	00	20	00	600	60	1000	40	400	20	200	420	380	90.00
Laccophilus anticatus	00	00	20	00	60	00	60	00	40	00	20	00	33.33	00
Uvarus sp.	00	00	00	00	00	00	00	00	00	00	00	40	00	6.66
F- Hydrophilidae (Water Scavenger Beetle)														
Hydrophilus olivaceous	00	100	00	80	00	100	140	00	120	00	120	00	63.33	46.66
Sternolophus rufipes	00	00	00	00	00	00	00	120	00	140	00	60	00	53.33
F-Hydraenidae (Minute moss beetles)														
Hydraena quadricollis	00	00	00	00	5400	00	6800	00	640	00	280	720	2186.66	120.00
F- PSEPHENIDAE Riffle Beetle														
Eubranax sp.	00	100	60	00	60	40	80	60	120	60	100	80	70.00	56.66

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	Sept 2012		Oct 2012		Nov 2013		Dec 2012		Jan 2013		Feb 2013		Average	
	S	D	S	D	S	D	S	D	S	D	S	D	S	D
O-HEMIPTERA														
F- CORIXIDAE (Water Boatman)														
Corixa lima	20	00	40	00	60	00	60	00	40	00	00	00	36.67	00
F-Nepidae (Water (scorpions)														
Laccotrepes maculatus	40	00	60	00	80	20	100	20	100	40	80	40	76.66	20
F-Notonectidae (Backswimmes														
Notonecta glauca	00	00	00	00	00	00	00	00	00	20	00	40	00	10
F-Veliidae (Broad shouldered water Striders)														
Microvelia diluta	40	00	20	80	20	60	00	60	00	20	00	00	13.33	36.66
Total Insects	**160**	**280**	**240**	**160**	**6320**	**320**	**8320**	**400**	**1540**	**380**	**860**	**1500**	**2906.67**	**560.00**

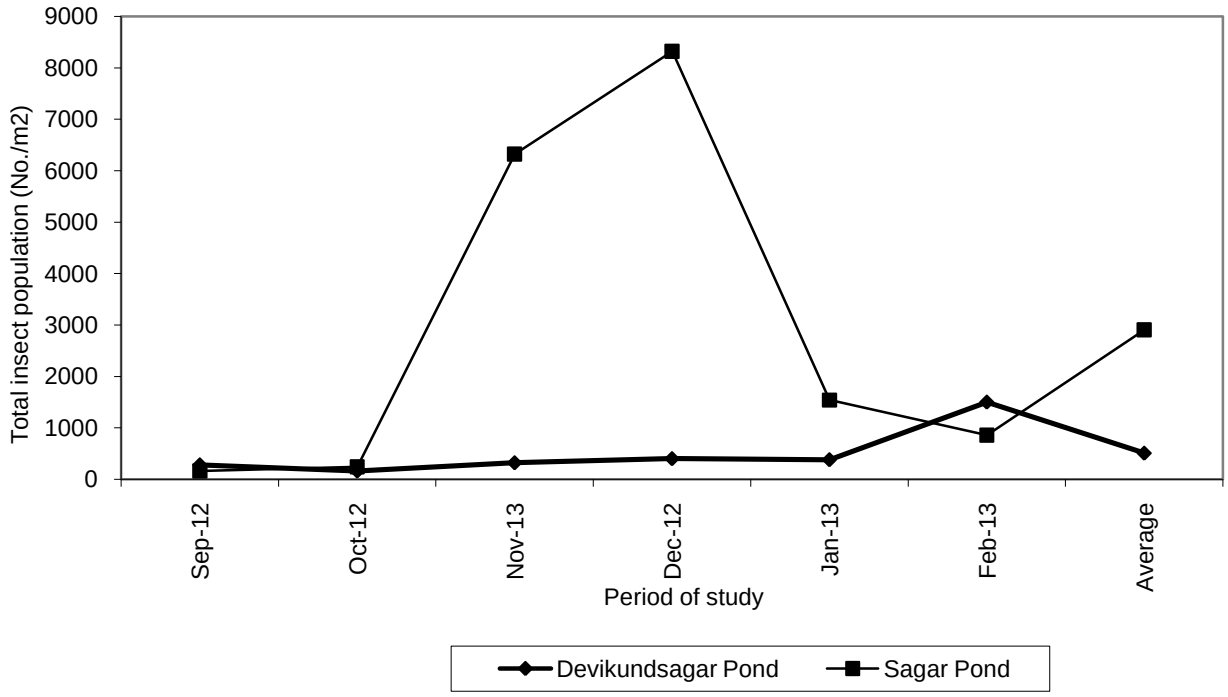

Fig. 1: Total Insect Population at Two Village Ponds