

# Periodic Research

## Diversity and Population Density of Entomofauna in Two Sacred Lakes of Rajasthan

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### Abstract

Anthropogenic pressures, holy rituals and tourism have adverse impact on the water quality of the sacred lakes. The aquatic insects including their larval forms play vital ecological role. These are involved in nutrient recycling and form an important component of natural food web in aquatic ecosystem. As of land, the community of aquatic ecosystems in the semi arid and arid zone is supposed to be characteristic. The present study was undertaken during the first half of the year 2013 *i.e.* January to June to compare the entomofauna and their ecology in the sacred lakes of Pushkar, Ajmer (semi arid zone) and Kolayat, Bikaner (arid zone)

Physical-chemical limnology revealed that the lakes were shallow with turbid, alkaline, hard, slightly saline and well oxygenated. Insects were represented by adult as well as larval forms. The adult insect fauna belonged to only two orders namely Coleoptera (beetles) and Hemiptera (bugs). Coleoptera was represented by five families namely Dytiscidae (4,4 Genera), Helodidae (1,1), Hydraenidae (1,1), Hydrophilidae (3,2) and Psephenidae (1,1). Hemiptera was also represented by five families Corixidae (1,1), Gerriidae(2,1), Nepidae (2,2), Notonectidae (1,0) and Veliidae (1,1 Genera) in the lakes of Pushkar and Kolayat respectively. Apart from these orders Diptera, Odonata, and Plecoptera were represented only by larval forms. Order Ephemeroptera (Mayfly larva) was recorded exclusively in Pushkar lake. The lake in semi-arid area scored over the lake in arid area both in diversity and population density.

**Keyword** Aquatic insects, Semi- arid zone, Arid zone, Physical-chemical limnology

### Introduction

Anthropogenic pressures, holy rituals and tourism have adverse impact on the water quality of the sacred lakes. A lot of Pilgrims visit Pushkar and Kolayat every day. Both the lakes are venue for the annual fair held in the month of Kartik (October- November) when the thousands of devotees are gathered to take a sacred dip in the holy waters on the Purnima (Full moon day) with the belief that all their sins will be washed off. The bones and ashes are flowed in these sacred lakes. Thus the lakes are significantly affected by human interaction. The region north west to the Aravalli range constitutes the major part of the Indian desert while the south-east plains are relatively fertile lands. Making a fringe between two diverge land ecosystems, Aravalli acts as an ecotone representing a blend of flora and fauna of both the regions (Saxena, 1997). As of land, the community of aquatic ecosystems in the semi arid and arid zone is supposed to be characteristic.

The aquatic insects including their larval forms play vital ecological role. These are involved in nutrient recycling and form an important component of natural food web in 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). As these organisms are easy to collect and identify, and tend to stay in one area unless environmental conditions change. Some aquatic insects are highly sensitive to pollution, while others tolerate it, these serve as bioindicators. The present study was undertaken during the first half of the year 2013 *i.e.* January to June to compare the entomofauna and their ecology in Pushkar lake, Ajmer and Kolayat lake, Bikaner.

# Periodic Research

## Study Area

Pushkar (Coordinates 26°29'14" N, 74°33'15" E) is situated 14 kms on the North-west of Ajmer in the semi-arid area of Rajasthan. Kolayat (27°50'32"N, 72°57'10" E) is situated 51 kms on south-west of Bikaner. It is situated in the middle of the Thar desert and is characterized by typical arid conditions.

## Materials And Methods

- 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 quadrat 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<sup>2</sup>
- 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.
- Insect fauna were identified following Daghli (1952), Borror & DeLong (1957), Baid (1958), Vazirani (1964), Edmondson (1966), Needham & Needham (1978), Tonapi (1980) and McCafferty (1981).

## Results And Discussions

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 27.11-24.45°C, Transparency 0.48 - 0.46m, pH 7.58 - 7.9, EC 0.373 - 0.383 mmho/cm, DO 10.91 - 10.02 mg/l, Free CO<sub>2</sub> 27.33 - 38.33 mg/l, TDS 373.33 - 383.33 mg/l, Hardness 150.33-154.67 mg/l and Total Alkalinity 65.33 -85.67 mg/l. Sediment analysis revealed the ranges as pH 9.62 - 9.98, EC 0.336 - 0.36 mmho/cm, TDS 336.67- 360 mg/g and Organic matter 49.93-52.69 mg/g in the lakes of Pushkar and Kolayat 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). During the present study insects were represented by adult as well as larval forms. The adult

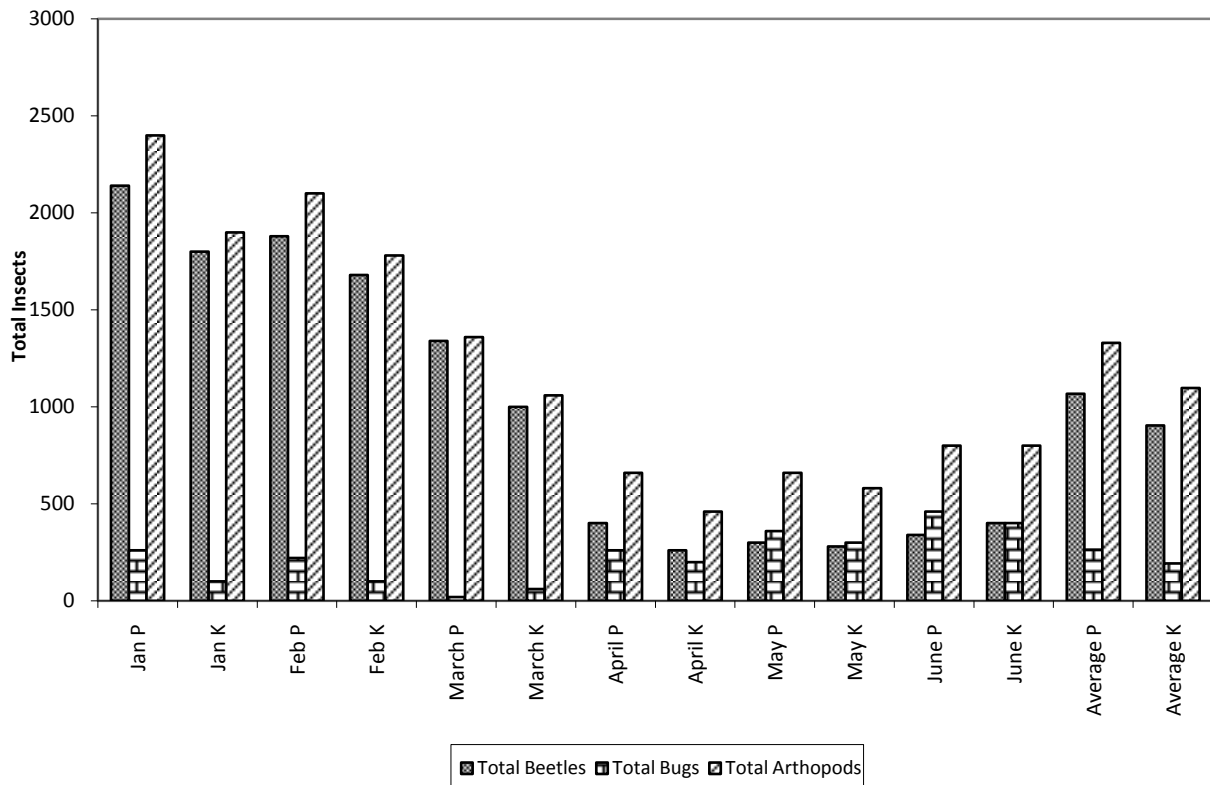
insect fauna belonged to only two orders namely Coleoptera (beetles) and Hemiptera (bugs). Coleoptera was represented by five families namely Dytiscidae (4,4 Genera), Helodidae (1,1), Hydraenidae (1,1), Hydrophilidae (3,2) and Psephenidae (1,1). Hemiptera was also represented by five families Corixidae (1,1), Gerriidae (2,1), Nepidae (2,2), Notonectidae (1,0) and Veliidae (1,1 Genera) in the lakes of Pushkar and Kolayat respectively. Apart from these orders Diptera (Mosquitoes, Flies, and Midges), Odonata (Dragonflies), and Plecoptera (Stoneflies) were represented only by larval forms. Order Ephemeroptera (Mayfly larva) was recorded exclusively in Pushkar lake. The beetles dominated the bugs in both the lakes except in the months of July and August. The number of adult genera recorded in Pushkar lake was 18 where as 15 in the lake of Kolayat. *Enochrus sp.* (O-COLEOPTERA), *Notonecta glauca* and *Limnometra fluviarum* (O-HEMIPTERA) were not observed in Kolayat lake during the study. The same observation was there in the case of larval forms. Hence the lake in semi-arid area scored over the lake in arid area both in diversity and population density (Table 2A, 2B & Fig. 1).

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# Periodic Research

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**Fig. 1: Total insects at the lakes of Pushkar (P) Ajmer and Kolayat (K), Bikaner during January 2013 to June 2013. Values are averages of three study station and are expressed as No/m<sup>2</sup>**

# Periodic Research

Table 1

Physical-chemical variables at the lakes of Pushkar (P) Ajmer and Kolayat (K), Bikaner during January 2013 to June 2013. Values are averages of three study stations and are expressed in mg/l in water and mg/g in sediment, except otherwise mentioned

	January		February		March		April		May		June		Average	
	P	K	P	K	P	K	P	K	P	K	P	K	P	K
<b>Water</b>														
Temp	17.8	16.6	20.4	18.5	22.6	19.4	27.6	29.4	31.5	32.2	32.8	30.6	27.11	24.45
Transparency	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.45	0.40	0.45	0.40	0.48	0.46
pH	7.4	7.7	7.3	7.8	7.4	7.9	7.8	8.3	7.8	7.5	7.8	8.2	7.58	7.9
EC	0.36	0.42	0.39	0.32	0.34	0.42	0.31	0.37	0.42	0.41	0.42	0.36	0.373	0.383
DO	8.94	7.32	12.60	11.38	15.45	14.63	10.57	10.16	9.35	8.94	8.53	7.72	10.91	10.02
Free CO <sub>2</sub>	38	34	46	52	12	56	28	34	26	46	14	8	27.33	38.33
TDS	360	420	390	320	340	420	310	370	420	410	420	360	373.33	383.33
Hardness	184	168	158	94	126	102	114	144	176	216	144	204	150.33	154.67
Total Alkanity	76	88	62	92	38	78	88	42	86	94	42	120	65.33	85.67
<b>Sediments</b>														
pH	9.8	9.4	9.3	9.7	9.7	9.1	9.6	10.3	9.5	10.6	9.8	10.8	9.62	9.98
EC (mmho/cm)	0.34	0.33	0.26	0.42	0.38	0.32	0.34	0.46	0.27	0.41	0.43	0.22	0.336	0.36
TDS	340	330	260	420	380	320	340	460	270	410	430	220	336.67	360.00
Organic matter	22.27	57.04	66.81	64.36	69.26	21.72	44.54	69.26	61.92	54.32	34.76	49.43	49.93	52.69

Table 2A

Diversity and population density of entomofauna at the lakes of Pushkar (P) Ajmer and Kolayat (K), Bikaner during January 2013 to June 2013. Values are averages of three study station and are expressed as No/m<sup>2</sup>

	January		February		March		April		May		June		Average	
	P	K	P	K	P	K	P	K	P	K	P	K	P	K
<b>O-COLEOPTERA</b>														
<b>F- DYTISCIDAE Predaceous Diving Beetle</b>														
<i>Captotomus Interrogatus</i>	100	180	140	100	140	120	0	0	0	0	0	0	60.00	66.67
<i>Dytiscus Verticalis</i>	220	180	100	80	80	80	0	0	0	0	0	0	66.67	56.67
<i>Hydaticus Fabricii</i>	480	400	540	420	480	360	60	40	40	0	80	60	280.00	213.33
<i>Laccophilus Anticatus</i>	100	120	140	120	80	60	60	80	0	0	0	0	63.33	63.33
<b>F-Helodidae Marsh Beetle</b>														
<i>Scirtes Nigropunctatus</i>	0	0	0	0	0	0	0	0	80	60	80	120	26.67	30.00
<b>F-Hydraenidae Minute Moss Beetle</b>														
<i>Hydraena Quadricollis</i>	800	660	580	680	280	200	0	0	0	0	0	0	276.67	256.67
<b>F- HYDROPHILIDAE Water Scavenger Beetle</b>														

# Periodic Research

<i>Berosus sp.</i>	0	0	0	0	0	0	0	80	60	140	60	180	20.00	66.67
<i>Enochrus sp.*</i>	60	0	100	0	100	0	80	0	0	0	0	0	56.67	Nil
<i>Hydrophilus olivaceous</i>	0	0	0	0	0	0	0	0	60	20	80	40	23.33	10.00
<i>Tropisternus lateralis</i>	240	160	180	160	80	80	80	60	60	60	40	0	113.33	86.67
<b>F- PSEPHENIDAE Riffle Beetle</b>														
<i>Eubranax sp.</i>	140	100	100	120	100	100	120	0	0	0	0	0	76.66	53.33
<b>Total Beetles</b>	2140	1800	1880	1680	1340	1000	400	260	300	280	340	400	1066.67	903.33

Table 2B

Diversity and population density of entomofauna at the lakes of Pushkar (P) Ajmer and Kolayat (K), Bikaner during January 2013 to June 2013. Values are averages of three study station and are expressed as No/m<sup>2</sup>

	January		February		March		April		May		June		Average	
	P	K	P	K	P	K	P	K	P	K	P	K	P	K
<b>O-HEMIPTERA</b>														
<b>F- CORIXIDAE( Water Boatman )(Buge)</b>														
<i>Corixa lima</i>	0	0	0	0	0	0	0	60	60	80	100	80	26.67	36.67
<b>F- GERRIDAE( Water Striders )</b>														
<i>Gerris marginatus</i>	0	0	0	0	0	0	100	80	160	180	140	160	66.67	70.00
<i>Limnometra fluviorum*</i>	0	0	0	0	0	0	0	0	80	0	100	0	30.00	Nil
<b>F-NOTONECTIDAE ( Backswimmers )</b>														
<i>Notonecta glauca*</i>	80	0	40	0	0	0	40	0	0	0	0	0	26.67	Nil
<b>F- NEPIDAE( Water Scorpion)</b>														
<i>Nepa cineria</i>	80	40	60	80	20	0	60	0	0	0	0	40	43.33	26.67
<i>Laccotrepe maculatus</i>	100	60	120	20	0	60	0	60	0	0	40	60	43.33	43.33
<b>F- VELIIDAE ( Riffle Bugs)</b>														
<i>Microvelia diluta</i>	0	0	0	0	0	0	60	0	60	40	80	60	33.33	16.67
<b>Total Bugs</b>	260	100	220	100	20	60	260	200	360	300	460	400	263.33	193.33
<b>Total Arthropods</b>	2400	1900	2100	1780	1360	1060	660	460	660	580	800	800	1330.00	1096.67

\* was recorded only in Pushkar lake