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A study on insect fauna of a desert pond near Bikaner, Rajasthan (India)

Meera Srivastava & *Kailash Kumar Swami

*Laboratory of Entomology,

P.G. Department of Zoology Govt. Dungar College,

Bikaner - 334 001, Rajasthan, India

Abstract

Arthropods represent the largest animal phylum and its members are known to show diverse biology, habits and habitat. Insects, included in this phylum are hardy, a character responsible for their occurrence and survival in a wide range of conditions which may not be tenable for many other animal groups. Desert waters are peculiar aquatic ecosystems in themselves. Despite of stressed conditions, desert waters are inhabited by a number of tolerant animal species chief being insects. Present study deals with the insect fauna of littoral sediments of a desert water body, which are rich in benthic population. The pond was rich in terms of diversity. Members belonging to five orders viz., Ephemeroptera, Odonata, Hemiptera, Coleoptera and Diptera were reckoned. Ephemeroptera was represented by only May-fly larvae (*Callibaetis* sp.: Baetidae), while Odonata comprised of larvae and nymph belonging to four families namely Lestidae, Coenagrionidae, Libellulidae and Aeshnidae. Members belonging to eight families of Hemiptera were recorded which included *Notonecta glauca*, *N. undulata*, *Laccotrepes maculates* (Notonectidae), *Plea pallula* (Pleidae), *Nepa* sp. (Nepidae), *Lethocerus* sp. (Belostomaidae), *Sigara* sp., *Corixa lima* (Corixidae), *Gerris remigis* (Gerridae), *Ranatra nigra* (Nepidae) and *Microvelia* (Veliidae). Coleoptera was represented by members belonging to Haliplidae (*Haliplus* sp.), Hydrophilidae (*Berosus nigriceps* adult and larvae), Dytiscidae (*Laccophilus flexosus*, *Herophydrus musicus*, *Hydaticus fabricii*, *Hyphydrus flavicans* and *Agabus* larvae). Diptera was represented by larval forms only, which included *Chaoborus* larvae (Chaoboridae), *Chironomomus* (Chironomidae) larvae and Culicine (Culicidae) larvae.

Introduction

Arthropods represent the largest animal phylum and its members are known to show diverse biology, habits and habitat. Insects, included in this phylum are hardy, a character responsible for their occurrence and survival in a wide range of conditions which may not be tenable for many other animal groups. Desert waters are peculiar aquatic ecosystems in themselves. As on land, the conditions in water are also equally harsh. Such waters are often ephemeral, get dried over long summer periods. Shallow water, exposed to intense solar radiation, is subjected to great evaporative loss.

Despite of above stressed conditions, desert waters are inhabited by a number of tolerant animal species mostly belonging to phylum Arthropoda, chief being crustaceans and insects. Insects with their abundance and

diversity dominate fresh water ecosystem. All over the world about 45000 species of insects are known to inhabit diverse freshwater ecosystem (Balaram, 2005). Class Insect has many potential representatives that can be used as environmental bioindicators, among which are from the Coleoptera, Diptera, Lepidoptera, Hymenoptera. Aquatic beetles are a diverse group and are excellent indicator of habitat quality, age and naturalness. Aquatic insects are used as indicators of water contamination. They are indicator of ecological diversity and habitat characteristics (Eyre & Foster 1989; Sanchez-Fernandez, 2004). Therefore, ecological study on aquatic insects can provide information about ecology of insects in an area for any decision making. Conservation of natural resources and biodiversity has become urgent issues in recent years for attaining an environmentally sustainable future.

Less than 3% of all species of insects have aquatic stages in some freshwater biotopes, the biomass produced by immature insects may comprise over 95% of the total individual or species of macro-invertebrates. They play important ecological roles in keeping freshwater ecosystems functioning properly (New 1984: Yen & Butcher, 1997). They form an important component of the food chain and energy flow pathways and comprise of a high proportion of biomass in fresh water. Studies have shown that between 1% and 57% of the biomass produced by immature aquatic insects (i.e secondary production of aquatic insects) emerges from the aquatic system in the form of adult insect (Jackson & Fisher, 1986). Many aquatic insects, such as various predatory hemipterans in the families Nepidae, Notonectidae, and Corixidae eat Chironomidae in their aquatic phases. So do predatory water beetles in families such as the Dytiscidae and Hydrophilidae. The Chironomidae are important as indicator organisms, i.e., the presence, absence, or quantities of various species in a body of water can indicate whether pollutants are present.

In most species, the nymphs are herbivores or detritivores, feeding on algae, diatoms or detritus, but in a few species, they are predators of chironomid and other small insect larvae and nymphs (Gattolliat & Sartori, 2000; McCafferty & Provonsha 1986). Insects often act as primary consumers in both grazing and detritus type of food chain and in turn provide food to the higher trophic levels. They also present striking features in periodicity of occurrence, life cycle and great adaptability to the environmental stress. Present study deals with the insect fauna of littoral sediments of a desert water body, which are rich in benthic population.

Material and method

Study area

The physiography and climatology of any region has close bearing on its land as well as aquatic ecosystems. The Harsolao village pond under study are situated 5 km west of Bikaner city, which occupies almost a central position in the Indian desert (28°N and 78°18' E). The present investigation was made during six months (November to April). The maximum depth of the pond is 5 m and the pond covers an area of 1500 m2. This is a Kaccha pond and is rain-fed. Pond water is used by the people for washing and bathing, water faces a great deal of disturbance. The pond water has large amount of algal bloom floating on the surface, making the water green in colour. Water birds are also seen wading in the pond.

Methodology

The sampling was carried out from November to April at fortnightly intervals during morning hours of the day (8.00 to 10.00 h). The surface water samples were collected in duly labeled polythene bottles. The animal forms were mechanically sorted and picked up and as described by preserved in 4% formaldehyde. The fauna collected was identified following Edmondson (1966), Hutchinson (1940, 1993), Paiva & Cedric (1922), Tonapi (1980) and Vazirani (1970).

Results and discussion

The study was carried out over six month's period. The insect fauna recorded has been presented in Table 1.

The pond was rich in terms of diversity. Members belonging to five orders viz., Ephemeroptera, Odonata, Hemiptera, Coleoptera and Diptera were reckoned. Ephemeroptera was represented by only May-fly larvae (*Callibaetis* sp.: Baetidae), while Odonata comprised of larvae and nymph belonging to four families namely Lestidae, Coenagrionidae, Libellulidae and Aeshnidae. Members belonging to eight families of Hemiptera were recorded which included *Notonecta glauca*, *N. undulata*, *Laccotrepes maculates* (Notonectidae), *Plea pallula* (Pleidae), *Nepa* sp. (Nepidae), *Lethocerus* sp. (Belostomaidae), *Sigara* sp., *Corixa lima* (Corixidae), *Gerris remigis* (Gerridae), *Ranatra nigra* (Nepidae) and *Microvelia* (Veliidae). Coleoptera was represented by members belonging to Haliplidae (*Haliplus* sp.), Hydrophilidae (*Berosus nigriceps* adult and larvae), Dytiscidae (*Laccophilus flexosus*, *Herophydrus musicus*, *Hydaticus fabricii*, *Hyphydrus flavicans* and *Agabus* larvae). Diptera was represented by larval forms only, which included *Chaoborus* larvae (Chaoboridae), *Chironomomus* (Chironomidae) larvae and Culicine (Culicidae) larvae.

The presence of chironomid larvae here seems to be indicative of high organic enrichment in the pond. Pandey et al. (1992) also recorded very high *Chironomus* sp. (perhaps larvae) in the water with moderately high BOD, COD, chlorides, phosphates, sulphates and bicarbonates. Jakher (1986) and Mehrotra (1988) also recorded chironomid larvae in their macrobenthic studies in the semi-arid region.

Tak and Sewak (1987) and Tak (1996) reported 27 species of aquatic beetles from Jodhpur and Sikar districts belonging to families Haliplidae, Gyrinidae, Dytiscidae and Hydrophilidae. Studies have also been carried out on general entomo-fauna of some specific wetlands from taxo-ecological view point which includes the work of Bhattacharya (2000), Bal and Basu (1994a, b) and Tonapi (1959), Tonapi & Ozarkar (1969), Deepa & Rao (2010) and Deepa (2010).

Beetle *Hyphydrus flavicans* has not been documented in earlier studies from the region (Jakher, 1986; Mehrotra, 1988; Garg, 1995), excepting for one by Jain (1996) in a temple tank. Garg (1995) recorded the stray appearance of bug *Corixa lima* only during December. The same species was not documented in later work of Jain (1996) on insect fauna of some waters in the Indian desert. 80 genera and 275 species accommodated in 16 major families of aquatic and semi aquatic Hemiptera are known from India (Thirumalai, 2002).

Seasonal abundance and checklist of aquatic bugs and beetles of Keoladeo National Park, Bharatpur was studied by George (1999). *Notonecta glauca* is typically found in inland freshwater ponds, although they can be found in eutrophic (water excessively enriched in nutrients) freshwater bodies near the sea (Kjærstad et al. 2009). *Notonecta glauca* have been observed to prey on the larvae of the mosquito *Culex pipens* (Reynaldi et al. 2011). The common backswimmer prefers environments with lush vegetation in which to hide itself. When aquatic plants are present, the common backswimmer will reside on the edge of the plant, usually mid-way up the plant, a preference not influenced by prey selection (Giller & McNeill 1981).

Ghosh (2011 a) studied aquatic beetles of river Ganges in UP and reported 25 species under 3 families. The author reported that the habitat of the family Dytiscidae is generally in slow moving or stagnant water, such as ponds, lakes, billabongs, dams, and pools at the edges of the streams. He also noticed that Noteridae prefer to live at the bottom of the pond, shallow margins of standing or slow stream, and often in mud or on plants. Hydrophilidae prefers ponds and lakes, near vegetation, slower sections of streams and rivers. He also recorded 18 species belonging to 13 genera and 3 families from Sandi Bird Sanctuary, UP (Ghosh, 2011b). Two new species *Hydrovatus sringeriensis* and *Copelatus wayanadensis* from Western Ghats of South India were reported by Manivannan & Madani (2011).

Although aquatic coleopterans are highly diverse and distributed to nearly 30 families, but only four families namely Dytiscidae, Gyrinidae Hydrophilidae and Haliplidae are chiefly represented in most of the water bodies. Small and temporary water bodies have more species than large and permanent ones (Larson & Pritchard, 1974). Aquatic beetles have their greatest abundance and diversity in temperate regions. These insects are not selective in their choice of water bodies and occur in a wide variety of habitats. Many of them, especially dytiscids and many hydrophilids, are generally found in habitats of small shallow water bodies or on the margin of rivers and marshes, and they occupy the zone of emergent vegetation, mats of plant debris. Devi et al. (2014) studied aquatic beetles and stated that of the 14 families of aquatic coleopterans, a large number of species are of in the family Dytiscidae and Hydrophilidae followed by Noteridae, Chrysomelidae, Elmidae, Curculionidae and Hydraenidae has been found in the Loktak Lake. They reported 11 new records. Ghosh et al. (2015) studied aquatic beetles from Sundarban, West Bengal. They reported some new records from Dytiscidae and Hydrophilidae families. The earlier knowledge and scientific contribution on aquatic beetles (Vazirani, 1969 a,b,c, 1970, 1971, 1972, 1973, 1977,1984; Mukhopadhyay, 2007) are noteworthy to understand the present fauna. Besides, a number of other workers contributed greatly towards the study of beetles, among them are Jach & Balke, 2008, Balfour Browne (1939), Wewalka, 1975. The major studies on aquatic Coleoptera also includes the works from Andhra Pradesh (Mukhopadhyaya, 2007 & Mukhopadhyaya & Ghosh, 2007), West Bengal, (Biswas & Mukhopadhyay, 1995), Sikkim (Mukhopadyaya & Ghosh, 2003).

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Table 1. Insect diversity as noted in Harsolao pond

Insect
Order:Ephemeroptera
Family:Baetidae
Callibaetis sp.(May-fly)larvae
Order:Odonata
Family:Lestidae
Larvae & Nymph
Family:Coenagrionidae
Larvae & Nymph
Family:Libellulidae
Larvae & Nymph
Family:Aeshnidae
Larvae & Nymph
Order:Hemiptera
Family:Notonectidae
Notonecta glauca
N. undulata
Laccotrepes maculates
Family:Pleidae
Plea pallula
Family:Nepidae
Nepa sp.
Family:Belostomaidae
Lethocerus sp.
Family:Corixidae
Sigara sp.
Corixa lima
Family:Gerridae
Gerris remigis
Family:Nepidae
Ranatra nigra
Family:Veliidae
Microvelia
Order:Coleoptera
Family:Haliplidae
Haliplus sp.
Family:Hydrophilidae
Berosus nigriceps
B. nigriceps larvae
Family:Dytiscidae
Laccophilus flexosus
Herophydrus musicus
Hydaticus fabricii
Hyphydrus flavicans
Agabus larvae
Order:Diptera
Family: Chaoboridae
Chaoborus larvae
Family: Chironomidae
Chironomomus larvae
Family:Culicidae
Culicine larvae