



## RESEARCH ARTICLE

# STUDIES ON THE DIVERSITY OF AQUATIC INSECT FAUNA OF JOYSAGAR TANK, ASSAM, INDIA

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### ABSTRACT

In the present investigation where the ecology of aquatic insects in Joysagar Tank was conducted for a period of six months, it was observed that the insects recorded an increase tendency of abundance in the spring seasons. The results revealed that the aquatic insects belonged to five major orders of Hemiptera, Ephimeroptera, Odonata, Coleoptera and Diptera. Hemiptera was found to be the most dominant group among all the orders. Seasonal variation of insects might have been influenced by temperature and rainfall.

**Key words:** Joysagar Tank, Insect Fauna, Species Diversity.

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### INTRODUCTION

Insects constitute about four-fifth of the world fauna and considered to be the most diversified and successful group in the Animal Kingdom. Being arthropods, insects possess a body plan that is superior to that of other invertebrates. They are generally small and able to fly. Usually they have high reproductive capacity, often coupled with a life history that is short and contains a pupal stage. Insects are more prevalent in shallow water because of their partial adaptation to aquatic life. They constitute a significant part of biota of aquatic community. The study of aquatic insects is of great importance as the ecological factors exert a profound influence on the aquatic organisms such as fishes, aquatic flies, water bugs, planktons, water birds etc. The freshwater of the earth, i.e., rivers, streams, lakes and ponds harbor a great variety of insects from many different groups and orders. Some of these aquatic insects live there throughout their life, while the others spend only their larval or pupal stages in water. Although less than 4% of the total number of insects are important components of any fresh water ecosystem. Aquatic insects constitute an important source of food for both the culturable and game fishes. Immature stages of most of these insects are of outstanding importance in the food-chain of freshwater leading to fish production. This is mainly due to the great extent they convert plant material into animal tissues, i.e., utilization of carnivorous food and game fishes.

Ecology of freshwater insects had attracted the attention of workers from different world for a long time with the results that over the years, a large body of knowledge had been accumulated. Sharp (1882), Needham and Betten (1901), Blunk (1914) and Saha et al. (2007) were among the pioneering workers of freshwater insects. Experimental studies on aquatic insects indicated that temperature is a major factor in regulating the changes in nymphal growth rate (Nebeker, 1971 and Brittain, 1976). Seasonal fluctuation of immature stages of several species of mosquitoes was found to be closely related to rainfall (Tonapi, 1959). Roonwal (1989) estimated that insects constitute two-thirds of the total fauna in India and comprise nearly 1, 00,000 species, of which about half remain yet to be studied. Annandale (1919) was the earliest worker to study the ecology of aquatic insects in India. Hora (1923, 1927 and 1930) made detailed study on the adaptation and ecology of aquatic insects of torrential streams. A number of workers have studied the taxonomic peculiarities of different aquatic insects. Krishna Mitra and Kuldip Kumar (1988) have studied about the classification of aquatic insects.

### STUDY AREA

The Joysagar Tank is located at Joysagar (26°57'8"N 94°37'23"E), about 5 Km away from the historic town Sivasagar in Assam, India. Historical records reveal that the man-made tank was excavated in 45 days in 1697 by Ahom

king Swargadeo Rudra Singha in memory of his mother Joymoti. It is the largest man-made lake ecosystem in India. The rectangular tank has a total area of 318 acres, with an average depth of 2 meters. However, the central part of the pond is much deeper and has an underground water source. The pond has rich flora of aquatic macrophytes which include the following species: *Ceratophyllum* sp., *Pistia* sp., *Eichhornia* sp., *Lemna* sp., *Nymphaea* sp., *Vallisneria* sp. and *Hydrilla* sp. The pond is visited by a good number of migratory birds during the winter months.

**MATERIALS AND METHODS**

The materials for the present investigation were collected from Joysagar Tank. The collections were made from the month of April, 2012 and continued till September, 2012. All the collections were made between 7 am to 8am, on each sampling date.

**SAMPLING OF AQUATIC INSECTS**

Sampling of aquatic insects was done with a rectangular pond net having an opening of 24 cm long and 20 cm wide and netting with 1mm mesh. The insects were sampled at four predetermined area were which are representative of the pond. Samples were taken by sweeping of the net over a distance of 1m. Four such sweeps form a single integrated sample. Efforts was made to keep the sampling procedure constant throughout the period of study. Samples were preserved in 6% formalin in collection bottles at room temperature. In the laboratory, they were identified and as far as possible grouped into species or higher taxonomic categories.

Ephemeroptera, Odonata and Diptera, only nymphs or larvae were collected, the adults being terrestrial or aerial in habit. The seasonal abundance of the five insect orders was carried

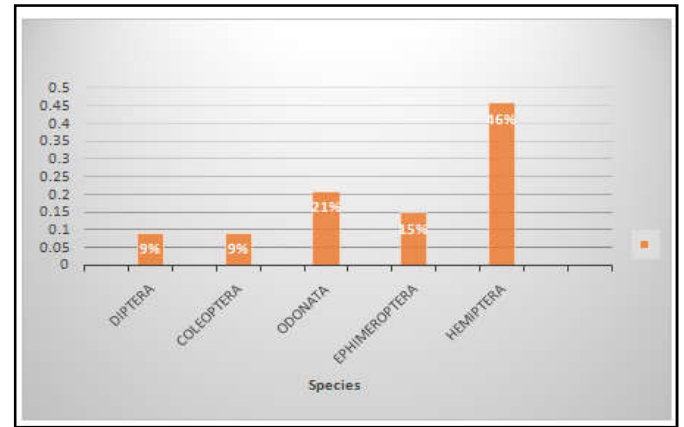


Fig. 1: The percentage composition of insects belonging to five different orders.

at for a period of six months (from April-September, 2012) (Table 1).

**Total Insects**

The mean density of total aquatic insects showed marked fluctuations during the entire period of study. The numbers recorded gradual decrease from April to September, 2012 (Table 2). Then the percentage composition of different insects were calculated, it was found that Hemiptera recorded the maximum percentage (46%) followed by Odonata,

Table 1. The density (per sqm) fluctuation of different insect orders during the study period

| No. | Insect Orders | Spring |     | Summer/Monsoon |      | Autumn |           |
|-----|---------------|--------|-----|----------------|------|--------|-----------|
|     |               | April  | May | June           | July | August | September |
| 1   | Hemiptera     | 58     | 40  | 32             | 45   | 53     | 64        |
| 2   | Ephemeroptera | 14     | 11  | 9              | 15   | 19     | 25        |
| 3   | Odonata       | 23     | 16  | 12             | 21   | 27     | 36        |
| 4   | Coleoptera    | 9      | 5   | 4              | 9    | 13     | 18        |
| 5   | Diptera       | 5      | 4   | 2              | 11   | 14     | 21        |

Table 2. The density of different species of aquatic insects during the study period (April to September, 2012)

| No. | Insect species         | April | May | June | July | August | September |
|-----|------------------------|-------|-----|------|------|--------|-----------|
| 1   | <i>Neogerris</i>       | 17    | 12  | 10   | 14   | 12     | 21        |
| 2   | <i>Anisops</i>         | 39    | 28  | 22   | 31   | 41     | 43        |
| 3   | <i>Diplonychus</i>     | 2     | -   | -    | -    | -      | -         |
| 4   | <i>Cloeon</i>          | 14    | 11  | 9    | 15   | 19     | 25        |
| 5   | <i>Orthetrum</i>       | 9     | 6   | 5    | 8    | 10     | 15        |
| 6   | <i>Ceriagrion</i>      | 14    | 10  | 7    | 13   | 17     | 21        |
| 7   | <i>Laccophilus</i>     | 7     | 5   | 4    | 9    | 13     | 17        |
| 8   | <i>Canthydrus</i>      | 2     | -   | -    | -    | -      | 1         |
| 9   | <i>Chironomus</i>      | 2     | 4   | 2    | 7    | 11     | 7         |
| 10  | <i>Mosquito larvae</i> | 3     | -   | -    | 4    | 3      | 7         |
|     | Total                  | 109   | 76  | 59   | 107  | 126    | 164       |

**OBSERVATIONS AND RESULTS**

The aquatic insects collected during the present investigation at the Joysagar Tank, belonged five major orders. They were Hemiptera, Ephemeroptera, Odonata, Coleoptera and Diptera. In case of Hemiptera and Coleoptera both larvae and adults were present in the sample. However, in the case of

Ephemeroptera, Coleoptera and Diptera in that orders (the last two recorded the sampler percentage) (Fig. 1).

**1. Hemiptera:** The order Hemiptera was found to be the dominant group among all the orders, recording highest density values throughout the period of study. It recorded higher density in April (58/m<sup>2</sup>), but recorded gradual decrease

till July. The density showed increase from September ( $64/m^2$ ). Hemiptera was represented by three families: Notonectidae, Gerridae and Belostomatidae. Notonectidae, represented by *Anisops* species showed the same trend of fluctuations as Hemiptera. It was found to be the most dominant species among all the species of the five orders of insects. It recorded maximum density ( $43/m^2$ ) in September and minimum ( $28/m^2$ ) in June. Finally family Gerridae was represented by *Neogerris* species. It also indicated the same trend of fluctuations as Notonectidae. It recorded the maximum density ( $17/m^2$ ) in April. Belostomatidae represented by *Diplonychus* species was observed only in with lower values.

**2. Ephemeroptera:** Order Ephemeroptera showed trend of fluctuations similar to Hemiptera indicating maximum density values in September ( $25/m^2$ ) and minimum in June ( $9/m^2$ ). Ephemeroptera was represented by a single family Baetidae which recorded the *Cloeon* species.

**3. Odonata:** Order Odonata is next to Hemiptera in abundance. It recorded gradual decrease from April to August but subsequently showed increase, recording peak values ( $36/m^2$ ) in September. Odonata was represented by the two families: Libellulidae and Coenagrionidae was represented by *Ceriagrion* species, which was the dominant of the two species. It recorded maximum value of  $17/m^2$ .

**4. Coleoptera:** Order Coleoptera recorded gradual decrease from April to August, subsequently it indicated peak in density in August ( $13/m^2$ ). Coleoptera was represented by two families: Dytiscidae and Noteridae. The former represented by *Laccophilus* species, recorded maximum density values of  $13/m^2$  in August. Family Noteridae, represented by *Canthydrus* species was recorded only in April and with very low values.

**5. Diptera:** Order Diptera showed very low values from April to August. There after it indicated increase in density values reaching maximum ( $14/m^2$ ) in August. Diptera was represented by two families: Chironomidae and Culicidae. The former was the dominant of the two. *Chironomus* species recorded maximum density values of  $11/m^2$ . Family Culicidae was represented by unidentifiable mosquito larvae indicating lower values.

## DISCUSSION

In the present investigation where the ecology of aquatic insects in Joysagar Tank was conducted for a period of six months, it was observed that the insects recorded an increase tendency of abundance in the spring seasons. It indicated further increase in density in subsequent summer months. When the total insects were broken up into their respective orders, a pattern of similar to the above was observed for the maximum values. It was observed that the aquatic insects belonged to five major orders of Hemiptera, Ephemeroptera, Odonata, Coleoptera and Diptera. Hemiptera was found to be the most dominant group among all the orders. It is realized that the aquatic bugs which make up the order Hemiptera are major component of the freshwater community food web. Hence, their lifecycle pattern and seasonal abundance is synchronous not only with the season, but also with higher and lower trophic levels of the food chain. In addition to this, temperature and rainfall may have same influence on the seasonal variation of aquatic bugs.

The capacity of the bugs to migrate appears to be another important factor causing fluctuations in their populations. Next to Hemiptera, Odonata and Ephemeroptera also recorded considerable abundance. On the other hand, Coleoptera and Diptera showed very low abundance. A total number of ten insect species were observed during the study, *Anisops* species was found to be the most dominant among all the species. It is realized that long term studies are necessary to understand the factors causing fluctuations in the density and abundance of aquatic insects of a freshwater ecosystem pond. The pH level of the pond is found to be within permissible limit ranging from 6.9-7.8.

## Conclusion

The present investigation was undertaken to obtain baseline information on aquatic insects of a freshwater pond. The insects of the pond belonged to five major orders: Hemiptera, Ephemeroptera, Odonata, Coleoptera and Diptera. Although ten species of aquatic insects were recorded during the study. A build-up in population of insects was indicated during the spring months. Order Hemiptera was found to be dominant group. Seasonal variation of insects might have been influenced by temperature and rainfall. In general, the man-made pond has a rich and varied insect fauna.

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