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Case Study

OCCURRENCE AND TROPHIC STATUS OF AQUATIC INSECTS: A CASE STUDY IN TWO LENTIC WATERBODIES OF CHIKMAGALUR DISTRICT, KARNATAKA

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ABSTRACT

Present study deals with occurrence and trophic status of aquatic insects in Lakkavalli and Rangenahalli tanks, Chikmagalur District, Karnataka during January to August 2011. A total of 1084 individuals of aquatic insects belonging to 11 genera and 4 orders were collected in different sites of two tanks. Shannon Index (H^1) and Simpson Index (D) is highest in Rangenahalli tank as compared to Lakkavalli Tank. Trophic studies reveal that predator dominance followed by grazers and collector.

Keywords: Species Diversity, Aquatic insects, Lentic ecosystem

1. INTRODUCTION

Aquatic insects comprise an ecologically important group of organisms in freshwater system. They are known to play a very important role in the processing and cycling of nutrients, as they belong to several specialist feeding groups such as filter feeders, deposit, collectors, scrapers, shredders as well as predators [1], while their importance as biomonitors or indicators of fresh water pollution has also been amply demonstrated [2,3].

Variety and variability of species approaches in conservation strategies are widely advocated and they offer challenges and opportunities in understanding the impact of anthropogenic activities and environmental disturbances on ecological communities [4]. India being a mega biodiversity centre offers a unique richness in biological diversity due to its geographical locations and accounts for nearly 7% of global faunal diversity. The bio geographical diversity coupled with a rich floral diversity offers favourable niches for insect-diversity in the country. Though insect diversity in India is predominantly associated with terrestrial ecosystems, faunal diversity of aquatic and semi aquatic bugs is remarkable. Out of 8 represented aquatic/semi-aquatic insects in India, Hemiptera ranks fifth in species diversity: Diptera (2319 of species); Trichoptera (812); Coleoptera (558); Odonata (491) and Hemiptera (300) [5]. Aquatic Heteroptera in India is represented by 78 genera and about 269 species under 15 major families [6].

The objectives of the present investigation include the study of variety and trophic categorization of aquatic insects in two lentic water bodies of Chikmagalur District (Karnataka).

2. MATERIAL AND METHODS

For the present study two lentic waterbodies viz., Lakkavalli tank and Rangenahalli tank of Karnataka were selected and are located at 5 km and 12 km away from Kuvempu University Campus. They are situated between 13°42' North Latitude and 75° 40' Eastern longitude. The study was conducted from January to August 2011.

The aquatic insects were quantitatively and qualitatively sampled using a 1 m wide kick-net [7] with mesh size of about 1mm. One person held the net while the other person systematically sampled the 1 m^2 area. Every large boulder or cobble in this area was picked up if it could be lifted and organisms were vigorously washed by hand into the net. The specimens were then carefully picked from the net surface and were preserved immediately in 70% ethyl alcohol. These samples were transported to the laboratory for further processing. All specimens from each of different sampling sites of the two water bodies were sorted and identified with the help of field guide [8, 9]. Physico-chemical parameters of water were recorded during the collection time [10].

Primarily three diversity indices viz., Shannon Weiner index (alpha diversity) and Simpson index (alpha diversity) were worked out.

The Shannon index of diversity (H') was calculated using the following formula

$$H' = \sum_{i}^{s} = 1 \left(\frac{pi}{N}\right) log2 \left(\frac{pi}{N}\right)$$

Where, N is the total number of individuals, pi is the number of individuals in the ith species and the information content or diversity is expressed as a number of bits [11].

Simpson index of diversity was calculated using the equation.

$$D = \sum_{i=1}^{s} Pi^2$$

Where, Pi is the proportion of the ith species [11].

3. RESULTS AND DISCUSSION

A total of 1084 individuals of aquatic insects belonging to 11 genera and 4 orders were collected by semi quantitative net sampling and collections were made in two tanks for 8 months (January to August 2011) in Chikmagalur district of Karnataka (Table 1). Shannon index values are 1.888 and 2.912 for Lakkavalli and Rangenahalli tank. Simpson index is 0.182 in Rangenahalli and 0.108 in case of Lakkavalli tank.

At the micro scale level, factors like light, temperature, food, water, substrate, habitat type, tank size and flow pattern exert major influences in structuring insect diversity. Physico-chemical parameters recorded for both the tanks are presented in Table 1. The list of trophic categories of aquatic insects collected in sampling sites for eight months in two tanks is depicted in Table 2. All the sites of the water bodies show predator (50%) dominance followed by grazer (33.33%) and collectors (16.67%) (Fig.3).

Table 1: Diversity of Aquatic insects in relation to Physico-Chemical parameters of Lakkavalli and Rangenahalli tank

Order / Physic-Chemical Parameters	Lakkavalli tank	Rangenahalli tank
Odonata	*Dragon fly larvae* *Damsel fly larvae*	*Dragon fly larvae* *Damsel fly larvae*
Hemiptera	*Laccotrephes maculates* *Ranatra elongata* *Anisops sp.*	*Laccotrephes maculates* *Ranatra elongata* *Anisops sp.* *Hydrometra vittata*
Coleoptera	*Hydaticus leucozonicus* *H.fabrici* *Hydrophilus olivaceous*	*Hydaticus leucozonicus* *H.fabricii* *Hydrophilus olivaceous* *Dinetutes indicus*
Diptera	*Chironomus sp* Mosquitoe larvae	*Chironomus sp* Mosquitoe larvae
pH	8.9-9.6	9.0-9.5
Temperature	24-31°C	23-29.5°C
Alkalinity	120-240	144-186
Chloride	90-126	60-90
Phosphate	0.9-4.0	0.8-1.4

Temperature is the most apparent factor which affects the seasonal cycle and abundance of insects in aquatic ecosystems [12]. Alkalinity and hardness arc closely related to each other. Waters with higher alkalinity, hardness, chlorides and phosphates are found to be more productive and support rich flora and fauna. Mairs [13] and Moyle [14] have also noted similar phenomena.

The allied group Ranatrids shows an affinity for submerged vegetation such as *Hydrilla* and inserts their eggs in their twigs [15]. *Ranatra elongata* and *Laccotrephes maculatus* were found adhered to *Hydrilla* and *Ceratophyllum* plants. Chironomus larvae were found in the tubes attached to the stones and side walls of the tank. Besides this, mosquitoe larvae and pupae were

collected. Thus in the present study, Rangenahalli tank harbor not only maximum number of insect species but also maximum number of individuals were observed which according to Sarkar and Krishnamurthy [16] is a characteristic of mesotrophic waters. Hence, it can be concluded that these water bodies are moderately polluted.

Hydrophilus olivaceous was found on *Hydrilla* plants. Small Hemipterans were collected from both the tanks due to the presence of fishes, which relish them as their food. *Anisops* species were found feeding on the larvae of Mosquitoes. While, Dragon fly and Damsel fly larvae were found attached to the *Pistia* roots, stones and side walls of the tank.

Table 2: Taxonomic inventory and tropic status of aquatic insects in Lakkavalli and Rangenahalli tank

Order	Habitat	Genus	Trophic category
Odonata	Lentic-limnetic	Dragon fly larvae	Predator
	Lentic-limnetic	Damsel fly larvae	Predator
Hemiptera	Lentic - lotic	*Laccotrephes maculatus*	Predator
	Lentic	*Ranatra elongata*	Predator
	Lentic - lotic	*Anisops sp.*	Predator
	Lentic - limnetic	*Hydrometra vittata*	Predator
Coleptera	Lentic - lotic	*Hydraticus leucozonius*	Grazers
	Lentic - lotic	*Hydaticus fabricci*	Grazers
	Lentic	*Hydrophilus divaceous*	Grazers
	Lentic	*Dinetutes indicus*	Grazers
Diptera	Lentic	*Chironomus Sp.*	Collector
	Lentic	Mosquitoe larve	Collector

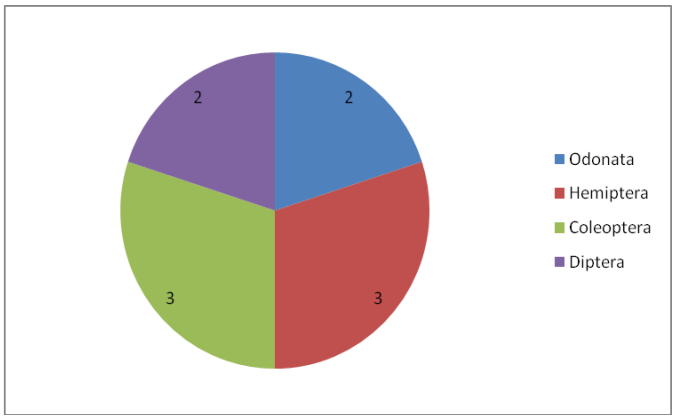

Fig. 1: Number of Aquatic insects in each order in Lakkavalli tank

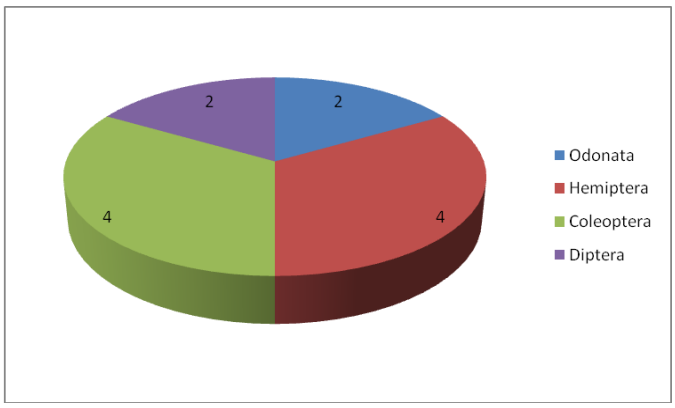

Fig. 2: Number of Aquatic insects in each order in Rangenahalli tank

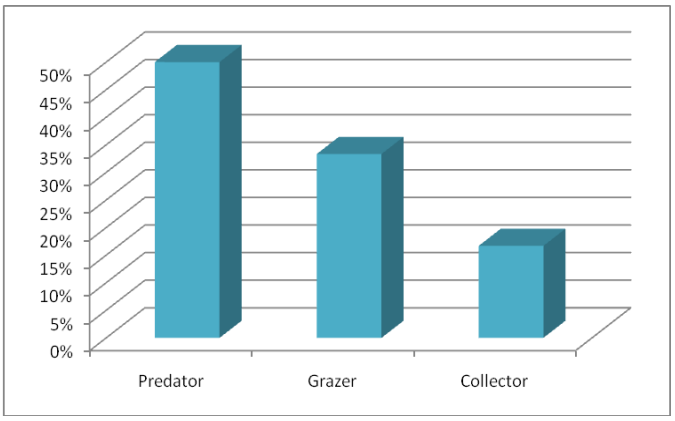

Fig. 3: Trophic category (%) of Aquatic insects in the lentic water bodies of Chikmagalur district,Karnataka

Odonata insects flourished when aquatic macrophytic growth was luxuriant in the waterbody. Hynes [17] and Perry [18] have also remarked that odonata insects are distributed in variety of habitats with rich growth of macrophytes. Similar condition was observed in this study.

Water bugs exhibits distinct diversity in their structural modifications behavioural and physiological adaptation such as predation. Presently there is a great threat to these phenomena due to human interference in fresh water bodies and loss of heterogencity in species richness

of flora and fauna. Despite their painful bites, these bugs may be considered beneficial because they often feed on dipteran larvae. Air water interface is the adaptive zone of Hydrometrids and the following adoptions are essential for such a semi-aquatic mode of life.

- Elongated legs and associated modification of thoracic structure and musculature for movement on surface film [19].
- Diversified life history patterns including differences in wing morphs, wing muscles and diapause regulation [20].
- Complex mating behaviour [21].

Ecology and life histories of most groups of aquatic insects have been little studied with the exception of only a few temperate species. Neither their value nor their harm is well understood. Further, study will show their value in controlling immature mosquitoes far over weighs the harm they do to fisheries and the vertebrates of small water bodies. But such economically important predaceous insects face the threat to shrinkage of population, biodiversity and trophic categorization due to spoilage of freshwater bodies with pesticides, abnormal growth of aquatic plants and inflow of waste water which needs to be verified in the future study.

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