e- ISSN: 2394-5532
p-ISSN: 2394-823X
General Impact Factor (GIF): 0.875
International Journal of Applied And Pure Science and Agriculture
www.ijapsa.com

# FAUNAL DIVERSITY AND COMMUNITY STRUCTURE OF AQUATIC INSECTS IN SINGANULLUR LAKE, COIMBATORE, TAMILNADU.

**Susheela P[1] , Radha R[2]**

[1,2]*Department of Zoology, PSGR Krishnammal College for Women Coimbatore, Tamilnadu.*

## ABSTRACT

***Aquatic biodiversity is one of the most essential characteristics of an aquatic ecosystem for maintaining stability and a means of coping with any environmental change. The presence or absence of certain families of aquatic insects can indicate whether or not a particular body of water is healthy or polluted. Studying life cycles of aquatic insects and their relationships with other organisms and their own environment can give insight into many different areas of ecology, including population dynamics, competition and predator-prey interactions. An inventory was carried out to study the aquatic entomo-fauna, their diversity and distribution in the Singanallur lake of Coimbatore district for a period of four months from April to July 2014 from the three sampling sites of the lake. A total of 1633 aquatic insects were recorded. Insects belonging to the orders Hemiptera and Coleoptera showed higher species richness followed by those belonging to Odonata, Trichoptera and Ephemeroptera respectively. This study re-emphasized the potential of the Singanullur lake as an important area of biological diversity.***

***Keywords: Aquatic insects, faunal diversity, community structure, Singanullur lake, biological indicators.***

## I. INTRODUCTION

Wetlands generally harbour large number of diverse biological components including aquatic insects which constitute about less than one percent of all biological species (Pennak, 1978). Insects are the earth's most diverse organisms, accounting for about half of the described species of living things and about three-quarters of all known animals, and it is estimated that more species of insects than known at present remain to be discovered .All over the world about 45000 species of insects are known to inhabit diverse freshwater ecosystem (Balaram, 2005). Truly aquatic insects are those that spend some part of their life-cycle closely associated with water, either living beneath the surface or skimming along on top of the water (Resh and Rosenberg, 1984).

Most aquatic insects are considered benthic because they are found associated with the bottom or with a substrate, but they occupy virtually every possible niche within their habitat. Aquatic insects belong to different functional feeding groups such as shredders, scrapers, filter feeders and predators that form important links in the nutrient recycling. Primarily the aquatic insects process wood and leaf litter that reaches the wetland from the surrounding landscape. The nutrients thus processed by the aquatic insects are in turn degraded into absorbable form by the microbial action. The nutrient soup is thus absorbed by the plants in the riparian zone through the wetlands. Adding to this significant function, aquatic insects also form the primary source of food for fishes and amphibians. Their removal or loss can cause negative effects in the eco-systems stability and diversity (Krishnan, 1988).

Freshwater insects have important roles in the ecology of running waters. They are vital for riparian and flood plain food webs, processing organic matter and transporting energy along stream channels, laterally to the flood plains and even vertically down into the stream bed. In many forest streams aquatic insects break down leaf litter, supplying nutrients, carbon and energy to the stream and associated ecosystems, may be lake, river and estuaries.

 

Around 5000 species of aquatic insects are estimated to inhabit the inland wetlands of India, represented predominantly by mayflies (Ephemeroptera), dragonflies (Odonata) and caddiesflies (Tricoptera) (Subramanian and Sivaramakrishnan, 2007a). Some recent studies in the field of aquatic entomology have been carried out by Sharma and Rai (1991), Sivaramakrishnan et al. (1995, 1996, 2000), Thirumalai (1999), Anbalagan et al. (2004), Subramanian and Sivaramakrishnan (2005), Anbalagan and Dinakaran (2006), Dinakaran and Anbalagan (2007). Aquatic insects of West Bengal has been investigated by Bhattacharya and Gupta (1991), Srivasatava and Sinha (1995), Bal and Basu (1994a,b), Biswas et al. (1995a,b), Biswas and Mukhopadhyay (1995), Choudhury and Chattopadhyay (1997), Bhattacharya (2000), Pal et al. (2000),Alan(1995)Saha et al. (2007).Due to the importance of aquatic organisms in environmental impact studies and biomonitoring of freshwater habitats, there is an urgent need for comprehensive study of the biodiversity of aquatic insects in Singanullur lake in Coimbatore. Therefore the present study was carried out to investigate the aquatic insect assembly in Singanullur lake, Coimbatore.

## II. MATERIALS AND METHODS

This study was carried out with objective of accessing the insect diversity in the Singanallur lake of Coimbatore district. The study site is situated in Coimbatore at 10° 59'46" N 77° 01'11" E at an approximate altitude of 470m near Singanallur. Coimbatore is an important industrial city in the southern part of India, ranking eleventh in terms of population. Coimbatore is located at a distance of 500Kms from the state capital Chennai. The city is traversed in the middle by river Noyyal. The area of the water body is 288 acres with maximum depth of 13.95 feet and storage capacity of 52.27 M.cft.

The study was carried out in the Singanallur lake of Coimbatore district for a period of four months from April to July 2014 .A total of three different sampling sites were selected for this study (Figure 1). Two types of sampling strategies were adopted for each site. One is systematic sampling, which is undertaken in the riffle areas employing 1m x 1m quadrates by telescopic nets and D frame aquatic net. The second method used was random survey, which was carried out in selected habitats best suited for collecting insects. The specimens were observed and identified up to the best possible taxonomic level in the field using appropriated keys (Dudgeon, 1999;Merritt and Cummins, 1988; Subramanian and Sivaramakrishnan, 2007; Thirumalai,1999.

## III.RESULTS

As a result of this study, about 1633 aquatic insects belonging to 6 orders, 13 families were collected from the Singanallur Lake. The insects belonging to the orders Hemiptera, Coleoptera, Diptera, Odonata, Trichoptera, and Ephemeroptera were collected,identified and their habitat and characteristic features were studied.

**Order Ephemeroptera**
**Mayfly** (Family: Baetidae )
Habitat of Nymph: Fresh running water of ponds and streams.
Characteristics: Distinguished from other nymphs by seven pairs of gills along the abdomen.
Oxygen is absorbed from water. Nymphs generally have three tails attached to the end of the abdomen. Wing pads are visible on the nymph. Nymphs feed on live and decaying vegetation. Nymphs are a common food source for trout and other fish. Mayfly nymphs require 4 to 10 ppm of dissolved oxygen for survival.Nymphs are up to 2.5 cm long. They have three pairs of segmented legs with one claw at the end of each leg.

 

**Order Odonata**

**Damselfly** (Suborder: Zygoptera)
Habitat of Nymph: Ponds, marshes, and slow moving streams.
Characteristics: In the same order as dragonflies and similar to dragonflies but generally smaller and more delicate. Distinguished by large compound eyes with nearly $360^0$ vision in both the nymph and adult stage. Nymphs have "lips" hinged in two places with grasping pincers on the end for catching prey. Brown and green bodies tend to provide camouflage and allow the nymph to blend in with the aquatic habitat of plants and pond bottoms. Three leaf-like gills at the base of the abdomen obtain oxygen. Damselfly nymphs require 4 to 8 ppm of dissolved oxygen for survival. Damselfly nymphs can be distinguished from dragonfly nymphs by a narrow body with three gills extending in a tripod formation at the end of body. The three pairs of legs are long and spindly. Nymphs are predators and feed on mollusks, other insects, crustaceans, worms, and small fish. Nymphs are a food source for some fish.

**Dragonfly** (Suborder:Anisoptera)
Habitat of Nymph: Ponds marshes and slow moving streams.
Characteristics: Distinguished by large compound eyes with nearly 360-degree vision in both the nymph and adult stage. Nymphs have "lips" hinged in two places with grasping pincers on the end for catching prey. Brown and green bodies tend to provide camouflage and allow the nymph to blend in with the aquatic habitat of plants and pond bottoms. Gills inside the abdomen obtain oxygen. Water drawn into the abdomen and through the gills is expelled to propel the nymph through the water. Dragonfly nymphs require 4 to 8 ppm of dissolved oxygen for survival. They have three pairs of segmented legs on upper part (thorax) of body. Dragonfly larvae can be distinguished from damselfly larvae by a wide to oval abdomen that
may end in wedge shaped extensions. Nymphs are predators and feed on mollusks, other insects, crustaceans, worms, and small fish. Nymphs are a food source for some fish.

**Order Hemiptera**

**Giant Water Bug (** Family: Belostomatidae)
Habitat: Ponds and slow moving streams.
Characteristics: The Giant Water Bug gets oxygen through a snorkel like breathing tube that
extends to the water surface. They have three pairs of jointed legs. The front pair has a modified hook for catching and holding prey. Giant Water Bugs may be up to 8 cm in size. True predators in the aquatic environment, Giant Water Bugs will attack prey that are 20 times larger in size.

**Backswimmer** (Family: Notonectidae)
Habitat: Ponds, running water of streams and intertidal marshes.
Characteristics: Backswimmers have middle and hind legs covered with long swimming hairs like water boatman but swim on their back.

**Water Scorpion** (Family: Nepidae)
Habitat: Ponds and slow moving streams.
Characteristics: Water Scorpions get oxygen through long breathing tubes at the base of the
abdomen. They look more like sticks than like insects. They are up to 10 cm in length. They have three pairs of jointed legs. The front pair has a set of single hooks for capturing and holding prey.

**Water Boatman (**Family: Corixidae)
Habitat: Ponds, running water of streams and intertidal marshes.
Characteristics: Water Boatmen have middle and hind legs covered with long swimming hairs.They eat decaying matter as well as other animals. Because they rely on atmospheric oxygen many

 

species are tolerant of pollution and can live in oxygen-poor environments. Atmospheric oxygen is trapped as an air bubble beneath microscopic hairs.

**Water Strider** (Family: Gerridae)
Habitat : Ponds and slow moving streams.
Characteristics: Water striders appear to skate across the water surface. Their legs can pick up vibrations of other organisms. Oxygen is absorbed by spiracles or specialized holes in their skin surface.

**Order Trichoptera**
**Caddisfly** (Family:Lepidostomatidae)
Habitat of Larvae: Streams and ponds
Characteristics: Many caddisfly larvae can be recognized by soft bodies which are covered by tube like cases that the larvae build from twigs, leaves, grasses, pebbles and sand grains. Some larvae do not build cases where the current is not strong such as ponds. Larvae maybe up to 4 cm in length. They have three pairs of segmented legs on the upper - middle part of the body and two small fleshy extensions at the end of the abdomen that end in a small hook. Filamentous gills may be present on the underside or the end of the abdomen. They have a characteristic motion know as the "Caddisfly Dance" of wiggling back and forth and up and down. Different species have different feeding habits. Some live on dead leaves and decaying
matter, others feed on plants, and some prey on other organisms. Oxygen is absorbed through the body surface. Larvae and the pupae are common food sources for trout and other fish.

**Order Coleoptera**
Water beetle (Family: Dytiscidae)
Habitat : It inhabits in dense vegetation, at the edges of lakes or in non-flowing waters and deep ponds.
Characteristics: *Dytiscus latissimus* is one of the largest representatives of the predaceous diving beetles of the genus Dytiscus. It can reach a length of about 38–44 millimetres (1.5–1.7 in). The species is usually easy to recognize by the extensions on both sides of the shield. The elytra and the pronotum are dark brown with yellow sides. The head is black, while the legs are yellow. The male's wing cases are shiny, while those of the female are finely grooved. This voracious predator hunts a wide variety of prey, including other insects, tadpoles, and small fish. Before they dive, they collect air bubbles in their wing cases which goes through the spiracles.

Water Scavenger beetle(Family: Hydrophilidae)
Habitat : Mostly aquatic; Some adults are scavengers and feed on dead plant and animal material, others are predatory. Larvae often predatory. Some terrestrial species feed on various decaying matter and associated maggots.

Characteristics: Clubbed antennae, metasternal spine are present, hind legs move alternately. Carry a bubble of air on their abdomen and their heads do not hang down like the Dyticids.Aquatic forms may superficially resemble Dysticidae but can be easily distinguished by antennae. Many have keeled sterna. The adults come up for air head first, and move hind legs alternately (Dysticidae come up for air tail first and move hind legs together, like oars)

Burrowing Water beetle(Family: Noteridae)
Habitat : Found around plants, burrowing through ponds and marsh substrate.

 

Characteristics: Distinct noterid platform - plate between the second and third pair of legs,Smooth oval bodies, Brown to dark reddish in color,Legs are short and stout adapted for digging.Mandibles have enlarged molar portion. Tergites are not flat, expanded projections. Members of Noteridae tend to be broadest near the base of the pronotum and they are relatively convex dorsally and ventrally flattened

**Order Diptera**
**Midges** (Family: Chironomidae)
Habitat of Larvae: Bottom sediments of lakes, ponds, or streams.
Characteristics: Larvae are up to 1.5 cm in length. Larvae bodies are usually thin, slightly curved,and segmented. They have one pair of tiny fleshy prolegs below the head and one
pair at the back end. The end sometimes has tiny tufts or extensions. They feed on smaller larvae, decaying matter, and microorganisms. They are an important component of the aquatic food web. Larvae are a food source for fish. Typically,midge larvae live in the bottom sediments of lakes and streams. Midges can tolerate levels of dissolved oxygen of less than 4 ppm.

## IV.DISCUSSION

The present study recorded six orders-Diptera, Coleoptera, Hemiptera, Odonata, Ephemeroptera and Trichoptera. A total of 1633 aquatic insects belonging to the orders Hemiptera, Coleoptera, Diptera, Odonata, Trichoptera, and Ephemeroptera were collected from April –July 2014 from the three sampling sites of the lake. The variations on the total number of individuals collected among the maximum number of insect were observed during April 2014. Table 1 shows that Hemiptera ranked first with the large population of individuals (943).The orders followed by Hemiptera were Coleoptera (353), Odonata (156), Trichoptera (70),Diptera(66) and Ephemeroptera (45)respectively. Table.2 show the quantity of insects captured by each of the three insect sampling methods namely D-frame, insect telescopic net and hand picking. It was found that maximum insect capture occurred with the D-frame net followed by telescopic insect net and hand picking method.

Insects have the broad range of adaptation and can survive in the extreme environmental conditions, prevailing at high altitudes, so as to counteract the unfavourable effects of the whole complex. Thus insects in general are particularly suited for monitoring landscape change because of their abundance, species richness, ubiquitous occurrence and importance in the functioning of natural ecosystems.( Chetri *et al;*1995), The Class Insecta also has several members, even within one taxon (Hymenoptera) that operate at different trophic levels, therefore providing varied, sensitive indication of changes. Various groups of macro invertebrates have been used in monitoring of water quality and disturbance, the Ephemeroptera and Placoptera groups are particularly sensitive. Mayflies are used for monitoring the water quality. Aquatic insects generally have narrow thermal requirements and vary considerably between species and life stages of the same species.

Aquatic insects are probably best known for their ability to indicate about the water quality in a particular environment. The present base line study reveals that the pollution sensitive taxa , Hemiptera is maximum and this emphasizes the importance of regular monitoring of the lake. Further research has to be carried out regarding the assessment of water quality parameters based on type and number of species present, because pollution status of water bodies are expressed in biological and physiochemical parameters.

 

## BIBLIOGRAPHY

[1] Allan, J.D. 1995. Stream Ecology, Structure and Function of Running Waters. Chapman and Hall, London.

[2]Anbalagan, S, B. Kaleeswaran and C. Balasubramanian.2004. Diversity and Trophic categorization of aquatic insects of Courtallam hills of Western Ghats. *Entomon*., **29,** 1- 6

[3] Anbalagan, S. and S. Dinakaran.2006.Seasonal variation of diversity and habitat preferences of aquatic insects along the longitudinal gradient of the Gadana river basin, South-West Ghats, (India). *Acta Zoologica Bulgarica* **58**, 253-264 .

[4] Chetri, G., M.S. Sheikh, J. Kalita & A. Dutta.1997. Population abundance of aquatic insects in Deepar Beel Assam. *Insect Environment* **3(1)**: 14–15.

[5] Daly, H.V., J.T. Doyen and A.H. Purcell.1998. Introduction to Insect Biology and Diversity. Oxford University Press, New York.

[6] Dinakaran, S. and S. Anbalagan.2007. Anthropogenic impacts on aquatic insects in six streams of south Western Ghats. *J. Insect Science*, **7,** 1-7.

[7] Khan, R.A. and L.K. Ghosh.2001. Faunal diversity of aquatic insects in freshwater wetlands of South Eastern West Bengal. Z.S.I. Kolkata. p. 104.

[8] Pal, S., S.R. Dey, D.K. Bhattacharya, S.K. Das and N.C. Nandi.2000. Macrophyte preference and insect diversity of freshwater wetlands in south-eastern Bengal. Diversity and Environment, Proc. Nat. Seminar on Environ. Biol. (Eds.: A.K. Aditya and P. Haldar). Daya Publishing House, Delhi. pp.165-169..

[9] Peckarsky, B.L., P.R. Fraissinet, M.A. Penton and D.J. Conklin. 1990. Freshwater Macroinvertebrates of Northeastern North America. Cornell University Press, Ithaca, NY.

[10] Pennak, R.W., 1989. Fresh-Water Inverteb rates of the United States: Protozoa to Mollusca. 3rd Edn., John Wiley and Sons Inc., New York.

[11] Resh, V.H. and D.M. Rosenberg, 1984. *The Ecology of Aquatic Insects*. Praeger, New York.

[12] Saha, N., G. Aditya, A. Bal and G.K. Saha.2007. Comparative study of functional response of common hemiptran bugs of east Calcutta wetlands, India. *International Review of Hydrobiology*, **92**, 242-257.

[13] Sharma, U.P. and D.N. Rai.1991. Seasonal Variations and species diversity of coleopteran insects in a fish pond of Bhagalpur. *J. Freshwater Biol*., **3**, 241-246.

[14] Sivaramakrishnan, K.G., H.J. Morgan and R.H. Vincent.1996.Biological assessment of the Kaveri river catchment, South India, and using benthic macroinvertebrates: Applicability of water quality monitoring approaches developed in other countries. *Int. J. Ecol. Environ. Sci*., **32**, 113-132.

[15] Sivaramakrishnan, K.G., K. Venkataraman, R.K. Moorthy, K.A. Subramanian and G. Utkarsh.2000.Aquatic insect diversity and ubiquity of the streams of the Western Ghats, India. *J. Indian Inst. Sci*., **80,** 537-552.

[16]Sivaramakrishnan, K.G., K. Venkataraman, S. Sridhar and M. Marimuthu.1995. Spatial patterns of benthic macroinvertebrate distributions along river Kaveri and its tributaries (India). *Int. J. Ecol. Environ. Sci*., **21**, 141-161.

[17]Subramanian, K.A. and K.G. Sivaramakrishnan.2005.Habitat and microhabitat distribution of stream insect communities of the Western Ghats. *Curr. Sci*., **89**, 976-987.

[18]Thirumalai, G.1999. In: Aquatic and semi-aquatic heteroptera of India, *Indian Association of Aquatic Biologists, Hyderabad*, **7**, 74.

 

## TABLES

***Table1 Total no: of insects collected from Singanallur Lake from April to July 2014***

| Order | Family | Site I | Site II | Site III | Total |
|---|---|---|---|---|---|
| Ephemeroptera | Baetidae | 25 | 15 | 5 | 45 |
| Odonata | Coenagrionidae | 34 | 25 | 22 | 81 |
| | Libellulidae | 25 | 30 | 20 | 75 |
| Hemiptera | Belostomatidae | 90 | 63 | 42 | 195 |
| | Notonectidae | 85 | 55 | 35 | 175 |
| | Nepidae | 68 | 45 | 30 | 143 |
| | Nepidae | 55 | 30 | 15 | 100 |
| | Corixidae | 75 | 50 | 20 | 145 |
| | Gerridae | 90 | 65 | 30 | 185 |
| Trichoptera | Lepidostomatidae | 15 | 25 | 30 | 70 |
| Coleoptera | Dytiscidae | 85 | 75 | 40 | 200 |
| | Hydrophilidae | 48 | 10 | 13 | 71 |
| | Noteridae | 52 | 25 | 5 | 82 |
| Diptera | Chironomidae | 15 | 20 | 31 | 66 |
| Total | | | | | 1633 |

***Table.2 Quantity of insects captured by each of the three insect sampling methods: D-frame, insect telescopic net and hand picking.***

| Sampling Tool | Total number of Insects captured |
|---|---|
| Insect telescopic net | 535 |
| D-frame net | 742 |
| Hand picking | 356 |

 