



## DIVERSITY AND DISTRIBUTION OF AQUATIC INSECTS IN POND ECOSYSTEM IN CHEYYAR, THIRUVANNAMALAI DISTRICT OF TAMIL NADU, INDIA

SUBBARAYALU ARUMUGAM<sup>1\*</sup> AND SUBRAMANIAN ATHIKESAVAN<sup>1</sup>

<sup>1</sup>P. G. and Research Department of Zoology, Arignar Anna Govt. Arts College, Cheyyar, Tamil Nadu, India.

### AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Author S. Arumugam designed the study, wrote the protocol and wrote the first draft of the manuscript. Author S. Athikesavan proofread the manuscript. Both authors managed the literature searches, read and approved the final manuscript.

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### ABSTRACT

Aquatic insects are the most diverse group of organisms in freshwater bodies such as lakes, ponds, rivers, streams, reservoirs, etc. A pond ecosystem is a body of standing water and very important habitats for so many various types of animals such as fishes, crustaceans, insects and amphibians. Aquatic insects are good bioindicators of water quality for assessment of pollution in short and long-term pollution events. The less or more aquatic insects are providing data to estimate the degree of environmental impact and its potential effects on other living organisms. In this study reveals diversity and distribution of aquatic insects from the pond ecosystem in the Kilpudupakkam, Cheyyar, Thiruvannamalai District for a period from August 2017 to January 2018. The aquatic insects were collected with the help of scoop net and hand nets. Later they were identified using of original literature. The insects identified for following 7 orders viz., Hemiptera, Coleoptera, Odonata, Ephemeroptera, Trichoptera, Diptera and Lepidoptera. Order Hemiptera (33.63%) is the largest population of pond ecosystem and compare with other orders and diversity indices were calculated. The order followed by Hemiptera were Coleoptera (27.21%), Odonata (14.98), Ephemeroptera (8.56%), Trichoptera (7.64%), Diptera (5.50%) and Lepidoptera (2.44%).

**Keywords:** Aquatic insects; diversity; distribution; bioindicators; pond ecosystem; order.

### 1. INTRODUCTION

The various freshwater ecosystem consists of ponds, lakes, streams, reservoirs, rivers, temporary puddles,

swamps, thermal springs and pool. There are two types of inland water habits are lotic (flowing) and lentic (stagnant). The lotic system encompasses rivers and streams. A river is essentially a water retaining

\*Corresponding author: Email: s\_aru11@yahoo.co.in, drarumugam85@gmail.com;

system and the major influence of groundwater level. Lentic systems comprise lakes and ponds [1,2,3]. Among different ecosystems, freshwater constitutes one of the most important ecosystems for the man offering numerous regulating services [4]. Biodiversity helps to know whether living organisms is threaten or not and thus help to conserve them through the consciousness of human [5]. Ponds often constitute biodiversity “hot spot” within a region or a landscape, challenging conventional applications of species area models in practical nature conservation [6,7]. There are many kinds of insects that live in the water. These are called aquatic insects and they have a different habitat such as puddles, ponds, lakes, ditches, streams and rivers [3,8,9]. Aquatic insects a group of Arthropods, live their life cycle in water bodies and are found in or on the surface of the lentic or lotic waters [10]. Insects are the most diverse group of organisms in freshwater. Estimates on the global number of aquatic insect species derived from the freshwater ecosystem are about 45,000 sps. of this about 5000 species of aquatic insects are estimated to inhabit inland wetlands of India [3,11,12]. Annandale [13] was the earliest worker to study the ecology of aquatic insects in India. A number of workers have studied the taxonomic peculiarities of different aquatic insects [14]. Aquatic insects are belonging to 12 orders, viz., Ephemeroptera, Odonata, Plecoptera, Trichoptera, Megaloptera, Hemiptera, Diptera, Coleoptera, Hymenoptera, Lepidoptera, Neuroptera and Orthoptera [1,14,15,16,17].

Aquatic insects form an important component of the food chain and energy flow pathways and comprise of a high proportion of biomass in freshwater ecosystems [18,19]. Aquatic insects belong to the different functional feeding groups such as shredders, scrapers, filter feeders and predators that form important links in the nutrient recycling and significant function. 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. Aquatic insects also form the primary source of food for fishes and amphibians [12]. The aquatic insect's biodiversity in ponds is affected by many abiotic and biotic factors. Pollutants are polluting water and affected different species diversity [20]. Water quality assessment of small waterbodies of the wetlands are of immense importance in the management of fisheries water and irrigation [4]. So, biomonitoring is the systematic use of living organisms or their responses to determine the health of aquatic ecosystems [1]. Aquatic insects are considered as a very good indicators of physical, chemical and biological nature of water bodies because of their wide range of environmental

tolerances to a number of water quality parameters such as dissolved oxygen concentration, pH, temperature, nutrient levels (such as phosphorus and nitrogen) etc. [12,21] and some of these aquatic insect may be beneficial to human beings, while few others may be quite harmful [22]. This study clearly explained about diversity and distribution of aquatic insects and water pollution.

## 2. MATERIALS AND METHODS

Kilpudupakkam pond (latitude: 13.09385°N, longitude: 80.29235°E) located in Kilpudupakkam village, 2 km away from Cheyyar, Thiruvannamalai District of Tamil Nadu was fixed as the sampling area with a total area of 2.5 hectares. The usage of pond water is drinking the water of cattle and domestic use and the number of aquatic plants survived. The samples were collected from August 2017 to January 2018. By using D- frame aquatic net, scoop net, hand net and hand picking methods. These nets were used where the vegetation was disturbed and a dragged around vegetation for a one minute during early morning and afternoon hours. Collected samples were preserved in 70% ethyl alcohol. They were later identified using original literature as [1,2,14,15,16,17,23,24,25,26]. Diversity indices provide more information about community composition and diversity in this way is an important tool for biologists trying to understand community structure. The samples were analyzed for species diversity indices such as Shannon-Weiner, Margalef, index of dominance and index of evenness by using PAST Software.

## 3. RESULTS

The study of Kilpudupakkam pond, the presence of 19 species of aquatic insects belonging to 7 orders and 16 families (Table 1). The following 7 orders of aquatic insects were collected in this pond as Hemiptera (33.63%), Coleoptera (27.21%), Odonata (14.98%), Ephemeroptera (8.56%), Trichoptera (7.64%), Diptera (5.50%) and Lepidoptera (2.44%) (Fig. 1). The freshwater Hemiptera commonly known as ‘aquatic bugs’ are secondarily adapted to aquatic ecosystems [27]. The population of order Hemiptera is dominant and contains 7 species belonging to 6 families compared with other orders. Particularly Notonectidae and Corixidae family species are highly available in order Hemiptera. In this study, Coleoptera was the second dominant order. Aquatic coleopteran constitutes an important part of the macroinvertebrates of freshwater habitats. The dominance of order Coleoptera has 4 families and 5 species with compared others. Hydrophilidae family species were highly collected. Odonates are

characterized as an excellent bioindicator of water pollution in aquatic habitats. The existing of two suborders Anisoptera and Zygoptera belonging to order Odonata in this study. In moderately available of Ephemeroptera, Trichoptera, Diptera and Lepidoptera were followed by order Odonata. The dominance of Hemiptera and coleopteran insect suggested that the pond ecosystem is relatively less polluted Table 2. Represents the diversity indices of

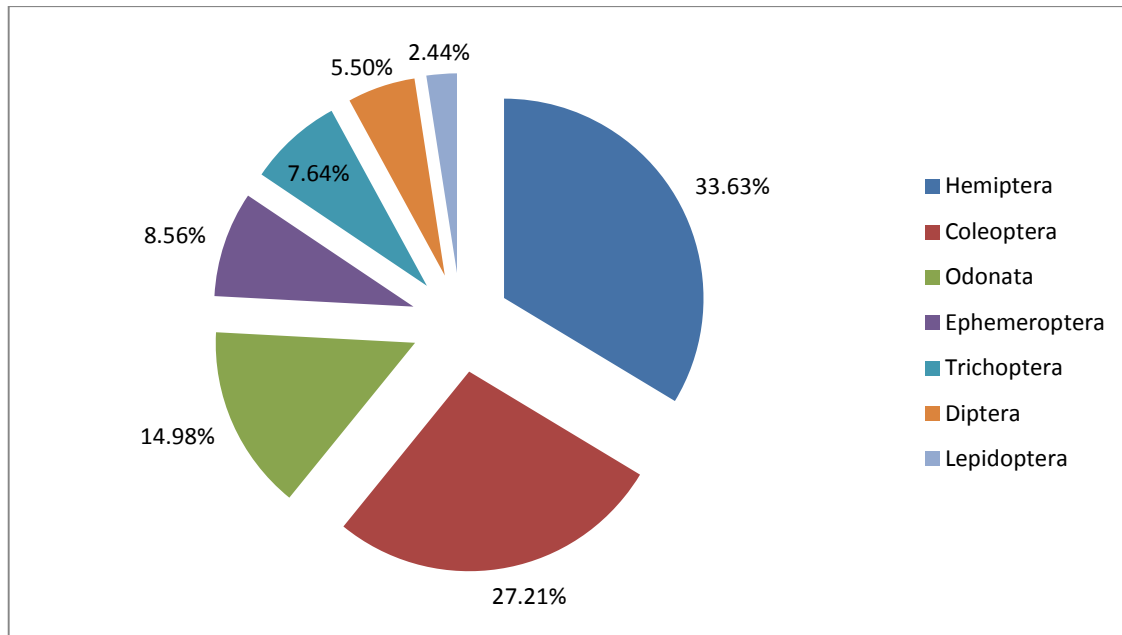
each order of aquatic insects collected from the study area. Shannon index (H) is a sensitive indicator of pollution and order Hemiptera has the highest Shannon diversity index of 1.761 while order Trichoptera showed the lowest value of 1.562 (Fig. 2). The highest index of dominance, evenness and Margalef index was Trichoptera (0.235), Hemiptera (0.969) and Lepidoptera (2.404) respectively.

**Table 1. Aquatic insects collected from Kilpudupakkam pond during the study period**

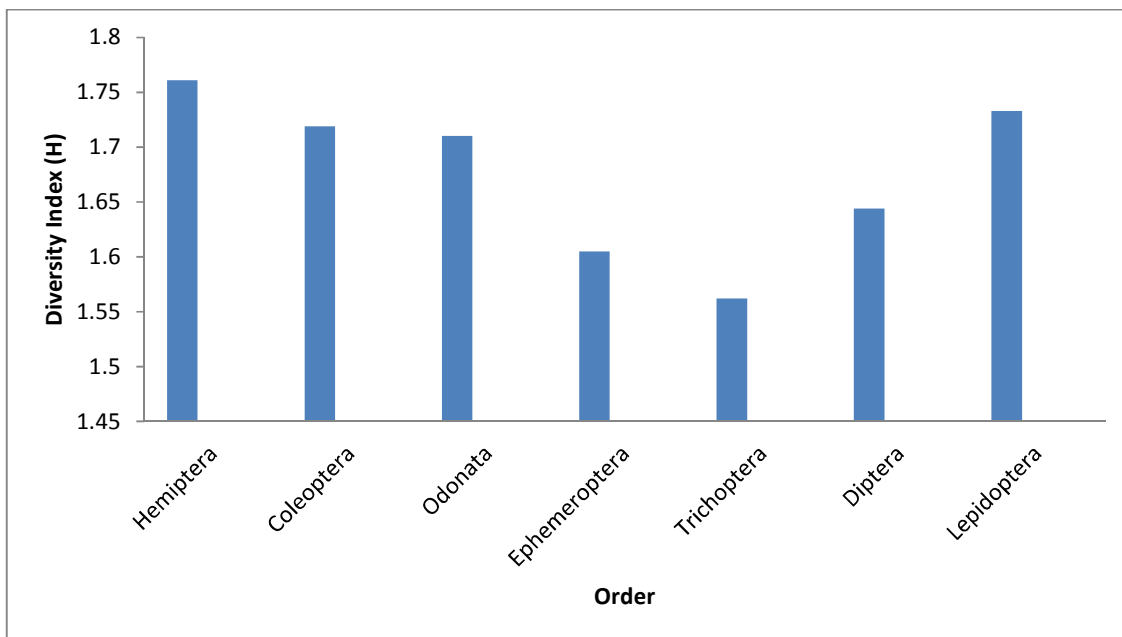
Sl. No	Order	Family	Common Name	Genus with Species	Species Total
1	Hemiptera	Nepidae	Water Scorpion	<i>Ranatra elongata</i>	110
		Belostomatidae	Giant water Bug	<i>Diplonychus rusticus</i>	
		Notonectidae	Backswimmers	<i>Enithares sps.</i>	
		Corixidae	Water Boatman	<i>Micronecta sps.</i> <i>Corixa sps.</i>	
		Gerridae	Water Striders or Pond Skaters	<i>Limnometra fluviorum</i> <i>Limnogonus nitidus</i>	
		Hydrometridae	Water Measurers	<i>Hyderometra greeni</i>	
2.	Coleoptera	Hygobiidae	Screech Beetles	<i>Hygrobia sps.</i>	89
		Gyrinidae	Whirligig Beetles	<i>Dineutus indicus</i>	
		Hydrophilidae	Water Scavenger Beetles	<i>Berosus indicus</i>	
		Dytiscidae	Predaceous Diving Beetles	<i>Sandrocattus sps.</i> <i>Laccophilus sps.</i>	
3.	Odonata	Libellulidae (Anisoptera)	Dragonflies	<i>Leucorrhinia sps.</i>	49
		Coenagrioidae (Zygoptera)		<i>Pseudagrion sps.</i>	
4.	Ephemeroptera	Baetidae	Mayfly	<i>Beatis sps.</i>	28
5.	Trichoptera	Philopotamidae	Caddisfly	<i>Gunungiella sps.</i>	25
6.	Diptera	Ceratopogonidae	Biting Midges	<i>Culicoides sps.</i>	18
		Chironomidae	Non Biting Midges	<i>Chironomous sps.</i>	
7.	Lepidoptera	Pyalidae	Aquatic Moth	<i>Nymphula sps.</i>	8

**Table 2. Diversity index of various aquatic insects collected from Kilpudupakkam Pond**

SN	Order	Diversity Indices			
		Dominance (D)	Shannon-Weiner (H)	Evennes (e)	Margalef speciesrichness (M)
1	Hemiptera	0.176	1.761	0.969	1.064
2	Coleoptera	0.194	1.719	0.929	1.114
3	Odonata	0.192	1.710	0.921	1.285
4	Ephemeroptera	0.224	1.605	0.829	1.501
5	Trichoptera	0.235	1.562	0.794	1.553



**Fig. 1. Percentage composition of Aquatic insect order collected from Kilpudupakkam pond**



**Fig. 2. Diversity index (H) of various orders of aquatic insects**

#### 4. DISCUSSION AND CONCLUSION

Pond ecosystem plays a vital role in the conservation of aquatic biodiversity [28]. Aquatic insects are dominant species of the freshwater ecosystems. Small and temporary water bodies have more species than large and permanent ones [29]. Aquatic insects have

tackled the problem of living in the aquatic environment by evolving various morphological and physiological modifications. Presence or absence of littoral vegetation and depth found to be important factors and that is affecting in the distribution of aquatic insects in the pond ecosystem [30]. The pond ecosystems have contained the number of aquatic

plants, these plants serve as an ideal habitat for the grouping and abundance of population diversity. The aquatic insects play an important role in the ecosystems. Diversity is determined by the number of different kinds of organisms found in the biological community [12]. The diversity of aquatic insects was investigated on two ponds of chatla wetland, Assam. In both the ponds, Hemiptera, Odonata and Diptera were collected and comparatively pond 1 was recorded highest population [4]. Aquatic insects diversity of pond ecosystem in Karwar area were recorded 15 species belonging to 6 orders were found and the highest number of aquatic insects from the order Hemiptera and Coleoptera [30]. The assessment of pond ecosystem with using of aquatic insects, totally 13 species were collected from two ponds in Assam and found EPT (Ephemeroptera, Plecoptera, Trichoptera) as a sensitive group of aquatic insects [21]. The population study of the aquatic insects in the three perennial ponds revealed the fact that aquatic insect population is regulated and governed by both abiotic and biotic factors. The total of 6 order, 13 families and 25 species of aquatic insects were recorded in three permanent ponds of Guwahati, Assam [19]. Aquatic insects are an integral part of the aquatic ecosystem, they have both ecological and economic value [16]. The breeding of aquatic insects is rainy season and thereafter noticed species richness is high and aquatic insects distributed whole part of the pond. Most of the aquatic ecosystems are becoming increasingly polluted by domestic sewage, agricultural runoff, urban waste and industrial effluents [31,32]. The distribution and increase in the number of species generally denotes the better quality of water. Aquatic insects have been exhibit different levels of sensitivity to pollution and considered as significant role in the assessment of water quality therefore, need to be biomonitoring of the aquatic ecosystem with the help of aquatic insects. The proper study of aquatic insect diversity can determine the status of the pond ecosystem. In this study reported, the pond has widely diversified and distributed various order of aquatic insects.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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