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Aquatic Entomofauna diversity in Lower Manair Dam, Karimnagar Dt. Telangana state, India

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Abstract

An investigation was carried out to study the Aquatic Entomofauna of their diversity and distribution in Lower Manair Dam for a period of two years from August 2016 to July 2018. The diversity of aquatic insect fauna of a total 3647 individuals representing to classified under 22 families and 37 Taxa in seven orders were recorded. The aquatic insects were sampled systematically and randomly in station-wise habitats, using the standard protocols. Among the collected insects recorded order Hemiptera dominated with eight families which contributed to (36.36%) followed by Odonata (18.18%), Coleoptera, Ephemeroptera each with (13.64%), Trichoptera, Megaloptera each with (4.55%) and Diptera (9.09%). Recorded genera out of 37 species, Hemiptera were contributed to (37.84%), Odonata (27.03%), Coleoptera (16.22%), Diptera (5.41%), Ephemeroptera (8.11), Trichoptera and Megaloptera each with (2.70%). The month and season wise Entomofauna density calculated by using Shannon -Wiener diversity index from the number of population was represented.

Keywords: Entomofauna, aquatic insects, habitat, shannon -wiener diversity, seasonal

Introduction

India is one of the mega diverse countries, with a notable diversity of aquatic habitats of about 3,166,414 Km² with significant variations in rainfall, altitude and latitude topography. About 7, 51,000 known species of insects, consists three-fourths of all species of animals on the earth. Most of the insects are terrestrial and their diversity also includes many species that are aquatic in habit ^[1]. Insects are the most of the species have successfully invaded virtually all aquatic habitats and often high diversity ^[2]. The larval stages are constitute the principal nutritive fauna of fish ^[3-4]. In aquatic environment substratum is one of the vital factors that govern the population dynamics of the aquatic insects. Over 95% of the total individual in fresh water particularly streams comprise of these immature life stages of aquatic insects. They play an important role in food chain of stream ecosystem. Some freshwater insects have specific requirements regarding their nutrients, water quality, substrate and vegetation. The estimation was about 5,000 species of aquatic insects in inland wetlands of India ^[5].

Aquatic insects are common subjects of ecological and environmental monitoring assessment. Insects are food for fish, amphibians, and wildlife and their important contributors to energy and nutrient processing, including capturing nutrients and returning them to terrestrial ecosystems and purifying water. The main food resources consumed by the fish fauna are originated in the aquatic system, such as aquatic insects and other invertebrates. Very few studies on aquatic insects in Telangana State have been reported so far, due to limited knowledge of the taxonomy and distribution of aquatic insects in the country and most of the studies have been confined to supra-specific taxonomic levels. The study is aimed at compiling the first inventory of the aquatic insect diversity of Lower Manair Dam.

Materials and Methods

Study Area

Lower Manair Dam (LMD) is situated in Karimnagar District of Telangana state. This is a large new impoundment of Godavari basin with medium productive potential. The Lower Manair Dam is built across the Manair River, a tributary of the Godavari River. The construction of the dam was started in 1974 and was finished in 1985. The Lower Manair Dam is situated at Kakatiya Canal about 146.00 km to 234 kms and Distributaries D 84 to D 94 and DBM 1 to DBM2. Full capacity of reservoir is 0.68 TM Cusmecs and water spread area is 81.024 sq. km. The total area of the reservoir is about 8,103 hectare and maximum depth is 21.9m (Fig 1).



Fig 1: Lower Manair Dam

Methodology

Aquatic insect samples were collected from different corners of the dam by nylon pond net method^[5] between 6.30 am and 11.00 am on every fortnight from June 2016 to May 2018. The insects were sorted, counted and identified by using standard keys^[6-10]. For identification, only two or three specimens were used and the rests were returned to the dam sites after counting.

Data Analysis

By using statistical tools of Shannon-Weiner index^[11] were determined to analyze the species diversity and component of dominance respectively. The mathematical expression of Shannon - Wiener Diversity Index is

Shannon-Wiener Index denoted by

$$H = -\text{SUM} [(p_i) \times \ln(p_i)]$$

SUM = summation

p_i = proportion of total sample represented by species i

Divide no. of individuals of species i by total number of samples

S = number of species, = species richness

$H_{\max} = \ln(S)$ Maximum diversity possible

$E = \text{Evenness} = H/H_{\max}$

Results and Discussions

The present study recorded the diversity of aquatic insect fauna at Lower Manair Dam, a total of 3647 individuals representing to classified under 22 families and 37 Taxa in seven orders from August 2016 to July 2018. Identified order Coleoptera was highest represented to four families Dytiscidae, Elmidae, Elmidae and Hydrophilidae had six taxa. Order Diptera represented to two families Chironomidae and Sciomyzidae with two taxa. Order Ephemeroptera represented to three families Baetidae, Ephemerellidae and Leptophlebiidae with three taxa. The similar observations were Bijita and Gupta (2015) stated that 21 species of aquatic insects belonging to 14 families and 7 orders in Bakumari stream^[12]. Abhijna *et al* (2013) reported to 60 species classified under 37 families and 8 orders were identified at Vellayani Lake^[13]. Anjana Choudhary and Janakahi (2015) explained an aquatic insects belonging to 4 orders, 10 families, 12 genera and 12 species were collected from the Sagarlake^[14].

Order Hemiptera represented to eight families Belostomatidae, Gerridae, Helotrephidae, Pleidae, Naucoridae, Nepidae, Notonectidae and Microveliidae with highest fourteen taxa. Order Megaloptera represented to one family Corylladidae with one taxa. Order Odonata represented to four families Coenagrionidae, Libellulidae, Gomphidae and Corduliidae with ten taxa. Order Trichoptera represented to one family Leptoceridae with one taxa (Table 1). The insect fauna of Ajmer freshwater lake observed that the diversity was more than 18 families belonging to Dytiscidae Helonidae, Hydraenidae, Hydrophilidae, Psephenidae, Corixidae, Gerriidae, Nepidae, Notonectidae and Validae^[15-16].

A total of 37 taxa in the Lower Manair Dam freshwater reservoir contains order Hemiptera highest with 37.84%, followed by Odonata with 27.03%, Coleoptera with 16.22%, Ephemeroptera with 08.11%, Diptera with 05.41%, Trichoptera and Megaloptera each with 02.70% noted Table 2 and Fig 2. A total of 22 families order Hemiptera highest with 36.36%, followed by Odonata with 18.18%, Coleoptera and Ephemeroptera each with 13.64%, Diptera with 09.09%, Trichoptera and Megaloptera each with 04.55% in the total population (Table 2, Fig 2). The similar observations represented to order Hemiptera was dominant with 10 families which contributed to 37.04% of the total taxa followed by Coleoptera, Ephemeroptera and Odonata each contributed to 14.82%, Diptera and Trichoptera 07.41% and Megaloptera 03.70%^[16]. The dominance of the diversity and distribution of aquatic insects from Sothuparai reservoir was contains Hydrometridae, Notonectidae, Nepidae, Ranatridae, Belastomidae, Corixidae and Naucoridae^[17-18].

Recorded families Libellulidae, Gomphidae and Hydrophilidae highest with 08.11% taxa contributed in the total population, followed by Coenagrionidae, Corduliidae, Nepidae, Pleidae, Belostomatidae, Gerridae, Notonectidae, Helotrephidae and Dytiscidae each with 5.41%. Families Naucoridae, Microveliidae, Elmidae, Leptoceridae, Chironomidae, Sciomyzidae, Baetidae, Ephemerellidae, Leptophlebiidae and Corylladidae each with 2.70% (Table 3, Fig 3). The similar observations were explained the number and percentage composition of taxa under various families were Hydrophilidae dominated in Kondakarla Lake (46%) was the dominant followed by the order Coleoptera (22%)^[16]. The stated information on diversity of aquatic insects in Karamana River, Southern Western Ghats, India^[19-20]. Dharitri Choudhury and Susmita Gupta (2015) reported to 31 species belonging to 18 families of 5 orders. Record of 17 species and 8 families of the order Hemiptera showed that it is the largest order in aquatic insect diversity followed by order Coleoptera having 7 species and 5 families in Deepor beel at Assam^[21].

The species richness ranged from 31 to 34, which is the highest in monsoon season (35%), Pre-monsoon (34%) and lowest in post-monsoon period (31%) Fig 4. The Shannon-Wiener Index (H) ranged from 1.12 to 1.75, the highest in monsoon season (39%), post-monsoon period (31%) and lowest in Pre-monsoon (30%) Fig 5. Shannon-Wiener diversity index (H') values were found to be greater than 1 in all the seasons indicating clear waters at all corners of reservoir water. The results of Diversity indices analysis showed that all the corners were good diversity (>1) of insects fauna. Some of the investigators suggested that the analysis of Aquatic Insects' and various biodiversity indices to benthic macroinvertebrate in various aquatic communities^[22-23]. The Maximum diversity possible $\ln(S)$ ranged from 3.40 to 3.53,

the highest in Pre-monsoon season (34%), lowest in post-monsoon and Monsoon each with 31% (Fig 6). The Evenness (E) ranged from 0.32 to 0.50, the highest in monsoon season (39%), post-monsoon period (31%) and lowest in Pre-monsoon (30%) Fig 7; Table 4. The similar observation of

Evenness was identified in aquatic insects at Karamana River, Southern Western Ghats ^[19]. The diversity and distribution of aquatic insects observed in Aghanashini river of Central Western Ghats of India ^[24].

Table 1: Identified order, family and taxa in Lower Manair Dam

Order	Family	Sl. No	Taxa	
I. Coleoptera	Dytiscidae	1	<i>Cybister sp.</i>	
		2	<i>Hydroporus sp.</i>	
	Elmidae	3	<i>Stenelmis sp.</i>	
		4	<i>Helochaeres sp.</i>	
	Hydrophilidae	5	<i>Amphiops sp.</i>	
		6	<i>Allocotocerus sp.</i>	
II. Diptera	Chironomidae	7	<i>Chironomus sp.</i>	
	Sciomyzidae	8	<i>Sepedon sp.</i>	
III. Ephemeroptera	Baetidae	9	<i>Baetis sp.</i>	
	Ephemerellidae	10	<i>Ephemerella</i>	
	Leptophlebiidae	11	<i>Habrophlebiodes</i>	
IV. Hemiptera	Belostomatidae	12	<i>Belostoma sp.</i>	
		13	<i>Spherodema sp.</i>	
	Gerridae	14	<i>Gerris sp.</i>	
		15	<i>Halobates Sp.</i>	
	Helotrephidae	16	<i>Nanotrepes sp.</i>	
		17	<i>Helotrepes sp.</i>	
	Pleidae	18	<i>Paraplea sp..</i>	
		19	<i>Neoplea sp.</i>	
	Naucoridae	20	<i>Naucoris sp.</i>	
		Nepidae	21	<i>Ranatra sp.</i>
		Notonectidae	22	<i>Laccotrepes sp.</i>
			23	<i>Micronecta sp.</i>
	Microveliidae	24	<i>Micronecta sp.</i>	
		25	Microveliidae	
V. Megaloptera	Corylladidae	26	<i>Corydalus</i>	
VI. Odonata	Coenagrionidae	27	<i>Cercion sp.</i>	
		28	<i>Ischnura sp.</i>	
	Libellulidae	29	<i>Nannophya sp.</i>	
		30	<i>Hydrobasileus sp.</i>	
		Gomphidae	31	<i>Urothemis sp.</i>
			32	<i>Melligomphus sp.</i>
		Corduliidae	33	<i>Heliogomphus sp.</i>
			34	<i>Paragomphus sp.</i>
			35	<i>Somatochlora sp.</i>
			36	<i>Epitheca sp.</i>
IV. Trichoptera	Leptoceridae	37	<i>Leptocerus sp.</i>	

Table 2: Number and percent composition of families and Taxa of insects under various orders

S. No	Orders	Families	Taxa	% of families in an order	% of genera in an order
1	Odonata	04	10	18.18	27.03
2	Hemiptera	08	14	36.36	37.84
3	Coleoptera	03	06	13.64	16.22
4	Trichoptera	01	01	04.55	02.70
5	Diptera	02	02	09.09	05.41
6	Ephemeroptera	03	03	13.64	08.11
7	Megaloptera	01	01	04.55	02.70

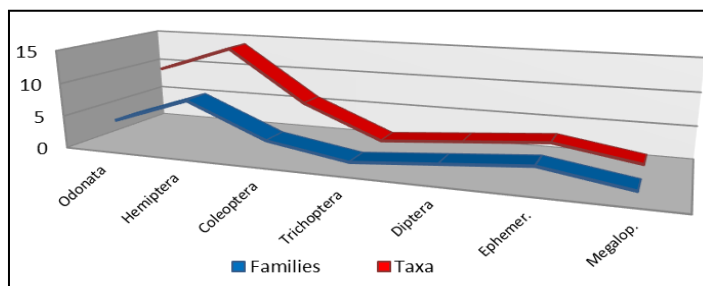


Fig 2: Composition of families and Taxa

Table 3: Number and percentage composition of genera and species under various families

S. No	Families	Taxa	% of Taxa in a family
1	Coenagrionidae	02	5.41
2	Libellulidae	03	8.11
3	Gomphidae	03	8.11
4	Corduliidae	02	5.41
5	Nepidae	02	5.41
6	Pleidae	02	5.41
7	Belostomatidae	02	5.41
8	Naucoridae	01	2.70
9	Gerridae	02	5.41
10	Notonectidae	02	5.41
11	Helotrephidae	02	5.41
12	Microveliidae	01	2.70
13	Elmidae	01	2.70
14	Hydrophilidae	03	8.11
15	Dytiscidae	02	5.41
16	Leptoceridae	01	2.70
17	Chironomidae	01	2.70
18	Sciomyzidae	01	2.70
19	Baetidae	01	2.70
20	Ephemerellidae	01	2.70
21	Leptophlebiidae	01	2.70
22	Corylladidae	01	2.70

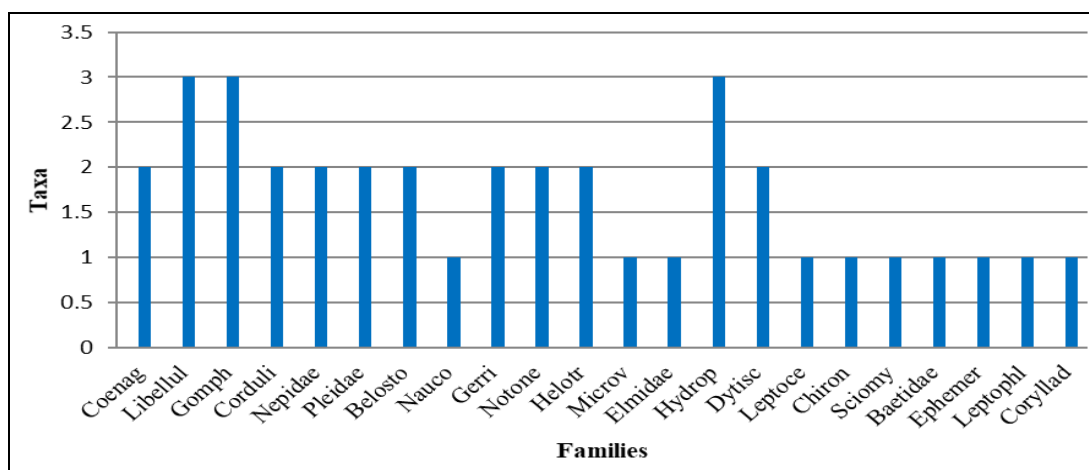


Fig 3: Number and percentage composition

Table 4: Insects Population Diversity Index from 2016-18

Season	Monsoon				Post-monsoon				Pre-monsoon			
Month	Jun	Jul	Aug	Sep	Feb	Mar	April	May	Oct	Nov	Dec	Jan
Species richness	34	34	34	34	31	30	30	30	32	33	33	33
H	1.22	1.36	1.14	1.21	1.42	1.22	1.32	1.12	1.55	1.62	1.75	1.51
ln(S)	3.53	3.53	3.53	3.53	3.43	3.40	3.40	3.40	3.47	3.50	3.50	3.50
Evenness E	0.35	0.39	0.32	0.34	0.41	0.36	0.39	0.33	0.45	0.46	0.50	0.43

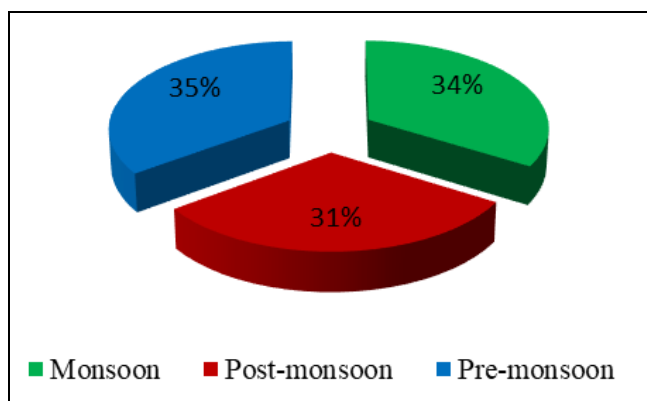


Fig 4: Species richness (n)

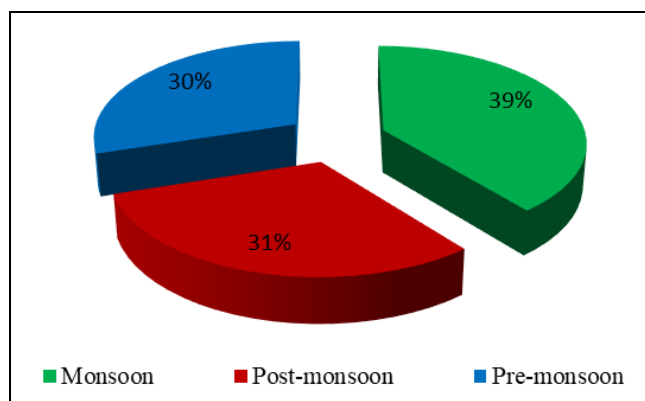


Fig 5: Shannon-Wiener Index (H)

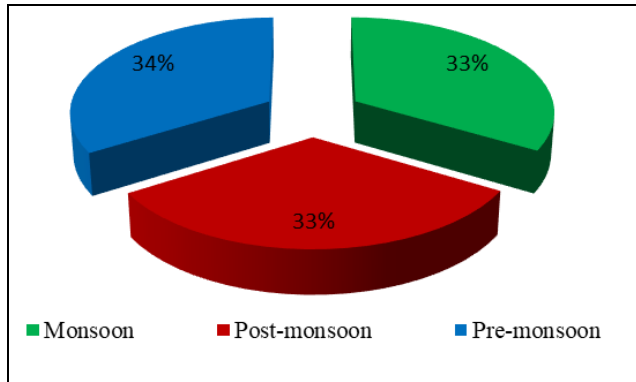


Fig 6: Maximum diversity possible ln(S)

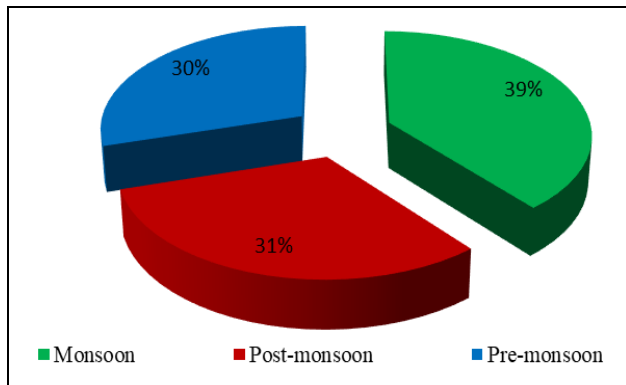


Fig 7: Evenness (E)

Conclusion

The present study recorded the diversity of aquatic insect fauna at Lower Manair Dam classified under 22 families and 37 Taxa in seven orders. Whereas identified insect fauna order Coleoptera was found highest in four families. Order Hemiptera represented to eight families with highest found in fourteen taxa. The species richness (35%), Shannon-Wiener Index (39%) and Evenness (39%) indicated to highest recorded in monsoon season. (H') values were found to be greater than 1 in all the seasons and its indicated clear water of Dam water.

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