Indian Journal of Entomology, **81**(3): 000-000 (2019) DoI No.:

SEASONAL VARIATION OF AQUATIC HEMIPTERA AND ODONATA DIVERSITY IN RIVER KANGSABATI, WEST BENGAL

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ABSTRACT

A seasonal study was carried out on aquatic insect diversity of Kangsabati River at three sites, Gandhighat region (site-A), Kangsabati Rail bridge region (site-B), Vidyasagar park region (site-C) of district Paschim Medinipur, near Midnapore town, West Bengal. Nine species of aquatic insects were observed. The order Hemiptera was numerically the most abundant (78.60%), with seven species. Odonata constituted of 21.40% with *Laccotrephes ruber* being the dominant species. *Ranatra elongata* and *Anax guttatus* were similarly present. Five families are Notonectidae, Nepidae, Belostomatidae, Hydrometridae, and Gerridae (Hemiptera) constituted 6%, 75%, 6%, 2%, and 11%, respectively. Families Aeshnidae and Coenagrionidae of the order Odonata constituting 68% and 32%, respectively. Species diversity and evenness of sampling sites when compared, maximum was in site-A and the least in site-B.

Key words: Kangsabati River, Hemiptera, Odonata, *Ranatra elongata, Anax guttatus*, species diversity, aquatic insects

Aquatic insects are a group of arthropods that live or spend part of their life cycle in water bodies (Arimoro and Ikomi, 2008; Pennak, 1978). Over 45000 species of insects are known to inhabit diverse freshwater ecosystem (Balaram, 2005). Diversity and abundance of aquatic insects gives an indication of the overall health of the aquatic environment. The insect order Odonata gives an indication of the richness of others invertebrates. Order Hemiptera can survive in heavily polluted environment. Hemipterans are also used as food for fish and others aquatic wildlife. According to Vinson and Hawkins (1998), aquatic biodiversity is one of the most essential characteristics of aquatic ecosystem for maintaining its stability. According to, Tachet et al. (2003), aquatic ecosystems are under increasing pressure due to disturbances. Abell (2002) concluded that biodiversity loss in freshwater ecosystems is an increasing phenomenon, due to human activities. Such inferences on aquatic insects are many (Saunders et al., 2002; Krishnan et al.,1988).

There is no study on aquatic insects of the river Kangsabati. This river flows from 22°35' N to longitude 87°1' E in district Paschim Medinipur, near Midnapore town, West Bengal. River Kangsabati is also known as the Cossye and the Kasai (not to be confused with the Kasai River in Africa). There are many studies with aquatic fauna from India: Sivaramakrishnan et al. (1995; 1996), Thirumalai (1999), Anbalagan et al. (2004), Subramanian and Sivaramakrishnan (2005), Anbalagan and Dinakaran (2006), Dinakaran and Anbalagan (2007) and Ghosh and Nilsson (2012). In the state West Bengal, aquatic insects had been investigated by Bhattacharya and Gupta (1991), Srivasatava and Sinha (1995), Bal and Basu (1994a, b), Biswas et al. (1995a, b.c), Biswas and Mukhopadhyay (1995), Choudhury and Chattopadhyay (1997), Khan and Ghosh (2001), and Saha et al. (2007).

The present study is on the aquatic insects, particularly order Hemiptera and Odonata in the River Kangsabati, near Midnapore town, Paschim Medinipur, West Bengal.

MATERIALS AND METHODS

The study area is located between 22°24' N and 87°21'E with the sites being Gandhighat region (22°24'00"N to 87°20'10"E), Kangsabati rail bridge region (22°24'33"N to 87°17'46"E), Vidyasagar park region (22°24'23"N to 87°18'16"E), which situated in Midnapore town in the district of Paschim Medinipur, West Bengal. The experiment in site A was from A1 (1.100 km) to A2 (0.85 km) points. The experiment in site B was from B1 (0.26 km) to B2 (0.9 km) and in site-C was from C1 (0.52 km) to C2 (0.5 km) points respectively. The distance from site-B to site-C was 0.94 km and from site-C to site-A was 3.78 km.

Aquatic insects were collected from August 2017 to May 2018. Sampling was carried out between 7.00 to 9.00 am and 3.00 to 5.00 pm. Collection was done seasonally in replicates by a hand net (mesh size: 250µm) using "1 Minute Kick Method". The net dragged through the system for a unit time. Three drags constituted a sample, and these samples placed in a sorting bucket were later preserved in 4% formaldehyde in specimen bottles and labeled according to sample region, description and collection date. These samples were studied at the Department of Aquaculture Management and Technology, after transferred to a large watch glass.

Abundance, relative abundance, species diversity index and evenness index were calculated for community structure analysis. For species diversity analysis, Shannon-wiener diversity index (1963) was applied. Shannon -Wiener diversity index assists in species relative abundance. Evenness index (e) calculated following Pielou (1975). Evenness index (e) applied for the degree to which the abundances are equal among the species present in a sample or community. Coefficient of similarity was calculated following Bray and Curtis (1957).The degree of similarity was deducted on the basis of following scale : <0.3 = strongly dissimilar,0.3-0.4 = moderately dissimilar, 0.4-0.5 = slightly dissimilar,0.5-0.6 = slightly similar,0.6-0.7 = moderately similar, and >0.7 = strongly similar. Dominance statuses of various species described based on relative abundance following Engelmann's scale (1973): RA<one = Subresident, 1.1-3.1% = Resident, 3.2- 10% = Subdominant, 10.1-31.6% = Dominant and >31.7% = Eudominant as stated under Table 1.

RESULTS AND DICUSSION

A total of nine species of aquatic insects (both larvae and adult) were observed, with total number being 319. These belong to orders Odonata and Hemiptera. Odonata had only two species and Hemiptera with seven species. The relative abundance of Odonata and Hemiptera was 21.40% and 78.60%, respectively; the families Aeshnidae and Coenagrionidae (Odonata) was 68% and 32%, respectively; and the Hemiptera families Notonectidae, Nepidae, Belostomatidae,

Table 1. Dominance status of aquatic insects in River Kangsabati (Midnapore, West Bengal)

Order/Family/Species	Number	Relative Abundance (%)	Dominance status
Order-Odonata			
Family-Aeshnidae			
Anaxguttatus B.			
Family-Coenagrionidae	46	14.42%	Dominant species
Ischnuraaurora B.			
	22	6.89%	Subdominant species
Order-Hemiptera			
Family-Notonectidae			
Notonectaglauca L.			
Family-Nepidae	16	5.01%	Subdominant species
Ranatraelongata F.			
Laccotrephsrubber L.			
Family-Belostomatidae			Dominant
Lethocerus indicus L.	32	10.03%	species
Diplonychusrusticus F.			
Family-Hydrometridae	155	48.58%	Eudominant species
*Hydrometra vittata*S.			
Family-Gerridae			Subresident species
Gerrisnitida M.			Subdominant species
	1	0.31%	
	15	4.70%	Resident species
	5		Subdominant species
	27	1.56	
		8.46	

According to Engelmann's Scale (1973), Relative abundance <1% =Subresident, 1.1-3.1=Resident, 3.2-10%= Subdominant, 10.1-31.6% = Dominant, >31.7% = Eudominant.

Hydrometridae, Gerridae was 6%, 75%, 6%, 2% and 11%, respectively. The Shannon-Wiener diversity index of the study sites (Site-A, Site-B, Site-C) was 1.83, 1.35, and 1.58. The Evenness index of these sites (Site-A, Site-B, Site-C) was 0.83, 0.62, and 0.72. Total number of aquatic insects declined from October to December, then increased steadily until February before declining thereafter (Figs. 1, 2) Similarity test between sampling sites (AB, AC, and BC) was 0.46, 0.39, and 0.21.

According to Staub et al. (1970), Shannon-Wiener index value < 1 indicates that heavy pollution of water. In this study, Shannon-Wiener index value was always >1. According to Smith (1977), high species diversity indicates that such community has their resources more finely distributed among individuals of many species. According to Mason (1981), diversity index used to measure environmental stress. It was observed that when both species diversity and evenness of sampling sites compared, both values were maximum in site-A and minimum in B; there was lower species diversity in site-B as compared to A and C. Similarity test revealed that site-A, B and C were dissimilar, but dissimilar in faunal composition. Dissimilarity was slight between site-A and B, moderate between site-A and C, and strong between site-B and C.

Minimum and maximum number of insects (N/haul) were observed in December and March, respectively. Odonata was maximum in February and minimum in November. Hemiptera was maximum in February and minimum in December. The maximum number of individuals of insects was in March and minimum in December. These variations might be due to hibernation or due to low temperature. Probably, these keep themselves hidden within mud and woods (rotten). These are difficult to collect by dip net. Other reasons for numerical scarcity of aquatic insects in winter season might also be increased predation, competition for space, lack of availability of food. Odonata group increased in February and not in March. This variation indicates some temporal niche separation. Abundant, aquatic vegetation in the river provides spatial heterogeneity, which enables different species without severe competition in the form of ecological guild. The water of this river under investigation was under stress

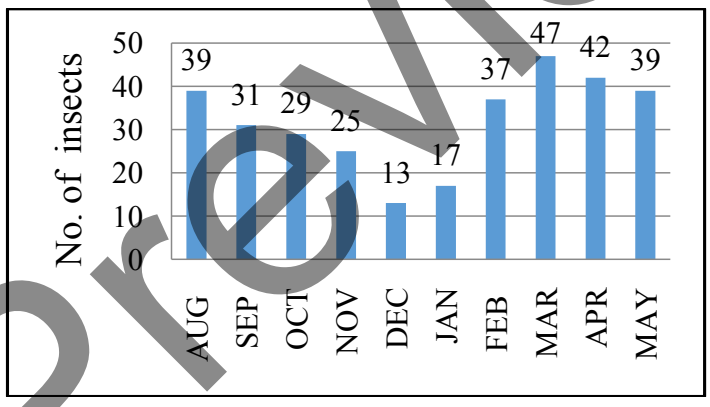

Fig. 1. Abundance of aquatic insects in Kangsabati River

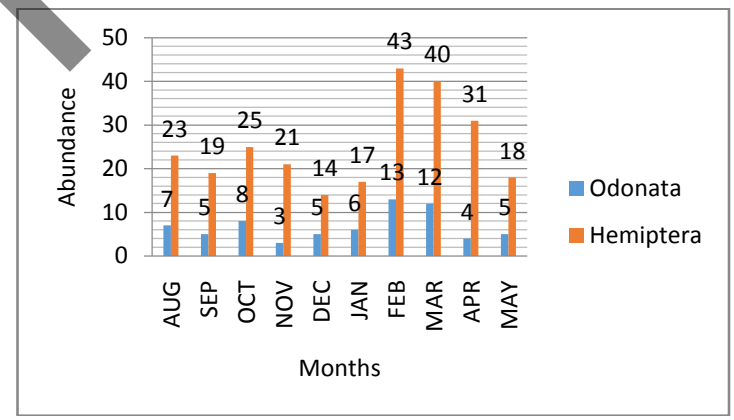

Fig. 2. Abundance of insect orders in Kangsabati River

condition. When Species diversity and evenness indices both decreased, it stated that number of species was low but number of individuals was high.

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(Manuscript Received: January, 2019; Revised: July, 2019;
Accepted: July, 2019; Online Published: July, 2019)