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Study on the diversity of aquatic edible insects in Baksa district of Assam with reference to Hemipteran species (Bellostomatidae and Nepidae).

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Abstract

Most aquatic insects to reflect changes in their environment coupled with their high distribution when compared to other macro-invertebrates. The comprehensive account of aquatic insect diversity of Baksa district, Assam is mainly based on the personal interview of the inhabitants in the study area. Diversity and abundance of aquatic insect species are significantly different in different locations and in different sampling habitats Out of these 6 aquatic edible insect species, order Hemiptera shared with maximum number with 3 species. Amongst the hemipteran species *Lethocerus indicus* was the highest in density and abundance. All the hemipteran species found in the study area are popular human dish. Rural women usually sell these edible insects in daily local markets. Diversity indices were computed using Past3 software for data analysis of insect diversity.

Keywords : Abundance, Diversity, Hemiptera, Macro-invertebrate.

1. Introduction

Insects are the most diverse and abundant groups in animal kingdom, because they are able to live in and adapt to diverse habitats of air, water and land, possess the high reproductive capacity and can live on different kinds and qualities of food. Insects have the wide range of adaptation and they can adjust in any environmental conditions, prevailing at high temperature and altitude. Diversity of aquatic insects is a good criterion for judging the health of aquatic ecosystem. The ability of most aquatic insects to reflect changes in their environment coupled with their high distribution when compared to other macro-invertebrates. It has therefore contributed to their functional role as a tool for monitoring the effect of human activity on water quality. For instance, the presence of nymphs of dragonflies, damselflies in water bodies show that the water is moderately polluted while the occurrence of midge larvae, water boatman and backswimmers (pollution-tolerant) in water bodies is a proof that it is polluted (De Moor, Day, & De Moor, 2003). The invertebrate fauna of lentic ecosystems showed the correlation to species habitat relationship with regard to the environmental variables (Compin & Cerghino, 2003; Azrina *et al.,* 2006). . The use of aquatic insects as bio indicators provides data to estimate the degree of environmental impact and its potential effects on other living organisms (Wahizatul, *et al.,* 2011). In Nigeria, the use of aquatic insects as monitoring tool along with physico-chemical parameters to determine water quality has proved to be very successful (Arimoro & Muller, 2010; Efe, Kokoette, & Alex, 2012). The ethnic people in the study area consume aquatic insects such as water giant bug (Bellostoma), water scavengers, Water beetle and Larvae of diving beetle etc. Most of the larvae of aquatic insects are actually live under water until they are ready to emerge into adults that then live near the water, but not in the water.The present study tries to access the diversity and abundance of aquatic hemipteran edible insects commonly eaten by tribal people of the study area.

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2. Material and methods

2.1 Study area

The study area of the present study is 'Baksa Distrct', Assam, India. The latitude and longitude of the study area is 26.6935° N, 91.5984° E. The Baksa district, Assam is one of the 27 districts in Assam of the north- eastern India. The total geographical area of the study area is2400 square kms. The districtis bounded by Bhutan Hill in the North, Udalguri district in the East, Barpeta, Nalbari and Kamrup districts in the Southand Chirang district in the West. According to the Population Census in 2011, the Baksa District had a population of 953,773 of which male were 484,825 and 468,948 were female. The population of Baksa District constituted about 3.06 % of total population of Assam. The population density of Baksa district is 475 people per sq. km.

2.2 Collection of aquatic insects

Extensive field survey was conducted from October 2013 to February 2014 by performing interviews using questionnaire format. The most commonly used method for sampling aquatic insects in standing water was hand netting. Besides nets, most of the aquatic insects were trapped through local traditional equipment like Jakoi, Saloni etc. from the different aquatic habitats. The comprehensive account of edible insect diversity of Baksa district, Assam is mainly based on the personal interview of the inhabitants in the study area.

Fig-1: Sampling collection site (AFH)

Fig-2: Sampling collection site (SAH)

Fig-3: Sampling collection site (FBH)

Fig-4: Sampling collection site (OFH)

2.3: Data analysis of insect diversity

Diversity indices were computed using Past3 software for data analysis of insect diversity. SHE analysis was used to test whether the data conform mostly to MacArthur's broken stick model using Estimates' (MacArthur and MacArthur 1961). Three indices were used to obtain the estimation of species diversity, species richness and species evenness using Microsoft Excel 2007. Species diversity was determined following Shannon Wiener's Index (Shannon and Weaver, 1963, Ludwig and Reynolds, 1988).

3. Result and discussion

Table -1 shows the diversity of aquatic edible insects consumed by the ethnic people in Baksa district, Assam. The diversity and abundance on aquatic edible insects of the order Hemiptera were the most dominant amongst the aquatic insects found in fresh water habitat in Baksa district.

Table 1 : Taxonomy with seasonal availability of aquatic edible insects in Baksa district

Sl. No.	Scientific name	Order	Family	English name	Seasonal availability	Edible part	Mode of eating
1	*Lethocerus indicus*	Hemiptera	Belos-tomatidae	Giant Water bug	Whole Year	Adult	Fried or Smoked
2	*Laccotrephes ruber*	Hemiptera	Nepidae	Waters corpion	Jun-Oct	Adult	Fried or Smoked
3	*Hydrophilus olivaceus*	Coleoptera	Hydrophilidae	Water Scavenger	Whole Year	Larvae & Adult	Fried or Curry
4	*Eretes stictus*	Coleoptera	Dytiscidae	Larvae of diving beetle	Whole year	larvae	Fried
5	*Ictinogomphus rapax*	Odonota	Gomphidae	Dragon fly	March-August	Nymph	Fried
6	*Diplonychus rusticus*	Hemiptera	Belos-tomatidae	Water beetle	May-Sep	Adult	Fried or curry

Out of these 6 aquatic edible insect species, order Hemiptera shared with maximum number with 3 species. A brief description of order Hemipteran species found during the investigation is described as follows:

A total of 1154 numbers of individuals of edible insect were counted among the four different habitats (Table No -2). The edible hemipteran insect species with a total of 93 number of individuals was recorded from agricultural field habitat, 14 number of edible insect was in forest and backyard forest habitat, 29 number of insect was in open field habitat and 1018 number individuals was recorded in swampy area habitat during the time of field observation in four different sites. Most of insects were found in two or three habitats during the study period.

Table-2: Diversity and abundance of Hemipteran species in different habitats

Order	Family	Species	AFH	FBH	SAH	OFH	Total
Hemiptera	Belostomatidae	*Diplonychus rusticus*	11	5	88	0	104
	Nepidae	*Laccotrephes ruber*	24	3	255	4	286
	Belostomatidae	*Lethocerus indicus*	58	6	675	25	764
		Total	93	14	1018	29	1154

AFH: Agricultural Field, FBH: Forest/Backyard, SAH: Swampy area, OFH: Open field

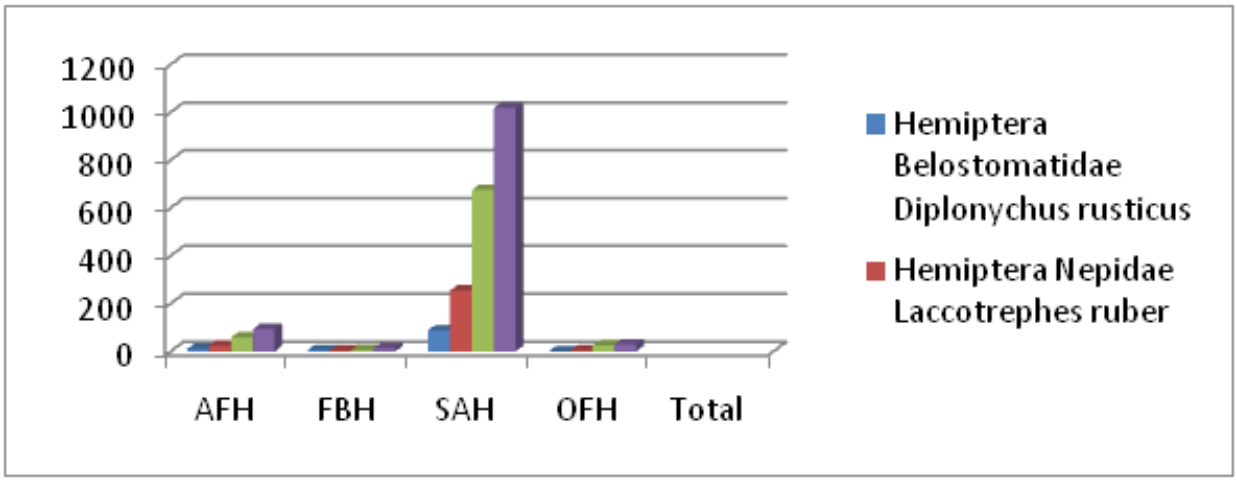

Fig-5: Graphical representation of diversity and abundance of Hemipteran species

Table-3 shows the density of hemipteran edible insects in four different habitats found during the field study. In Agricultural Field habitat, the *Lethocerus indicus* was the highest density (0.27) and the lowest was *Diplonychus rusticus*(0.05). In Forest and backyard habitat the highest density found in *Lethocerus indicus* (0.03) and lowest was in *Laccotrephes ruber* (0.01). In Swampy area habitat the highest density of hemipteran species was also in *Lethocerus indicus* (3.13) and lowest was in *Diplonychus rusticus* (0.41). In Open field habitat the highest density was also in *Lethocerus indicus* (0.12) and no *Diplonychus rusticus* was found in Open field habitat.

Table 3: Density of hemipteran insects in different habitats in the study area.

Species	Density in AFH	Density in FBH	Density in SAH	Density in OFH
Diplonychus rusticus	0.05	0.02	0.41	0
Laccotrephes ruber	0.11	0.01	1.18	0.02
Lethocerus indicus	0.27	0.03	3.13	0.12

AFH: Agricultural Field Habitat, **FBH:** Forest/Backyard Forest Habitat,
SAH: Swampy area, **OFH:** Open Field Habitat

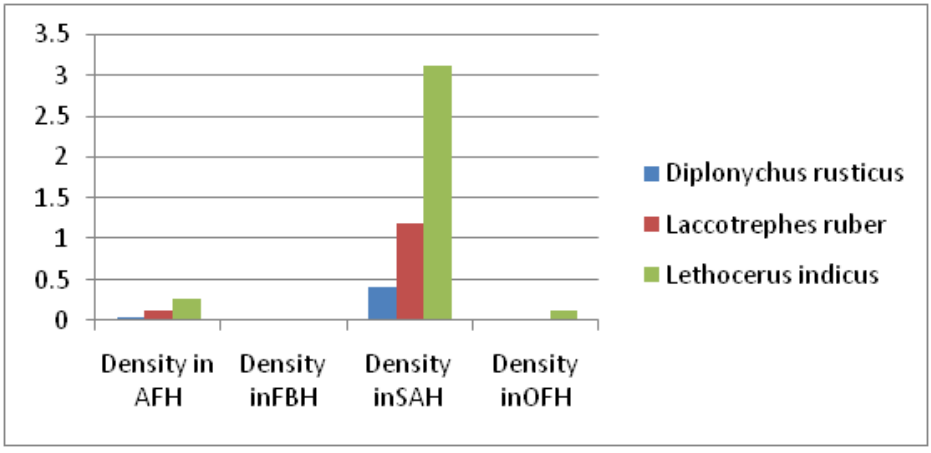

Fig 6: Density of hemipteran insects in different habitats

Table-4 shows the relative abundance of hemipteran edible species in selected habitats. *Lethocerus indicus* has the highest relative abundance (5.23%) and the least relative abundance insect species is *Diplonychus rusticus* (0.71%)

Table-4: Relative abundance of hemipteran edible insect species (species-wise).

Order	Family	Species	Relativeabundance
Hemiptera	Belostomatidae	*Diplonychus rusticus*	0.71
	Nepidae	*Laccotrephes ruber*	1.96
	Belostomatidae	*Lethocerus indicus*	5.23

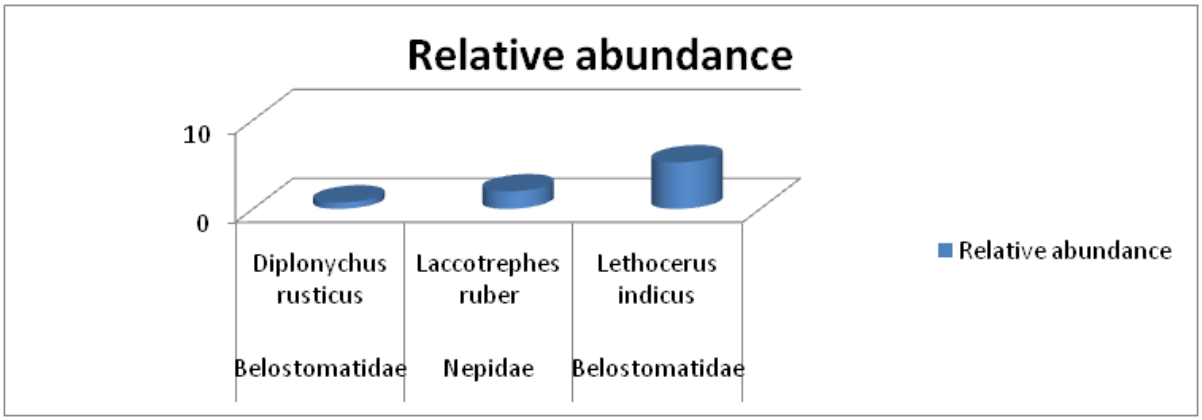

Fig-7: Relative abundance of hemipteran edible insects consumed in Baksa district

The relative abundance and the diversity indices of hemipteran species is shown in the table-5 and figure-8

Table-5: Relative abundance and dominance in different Diversity indices

Order	Relative	Dominance Abundance	Shannon_H	Evenness_e^	Menhinick	Margalef H/S	Equitability_J
Hemiptera	7.90	0.79	0.46	0.40	0.12	0.43	0.33

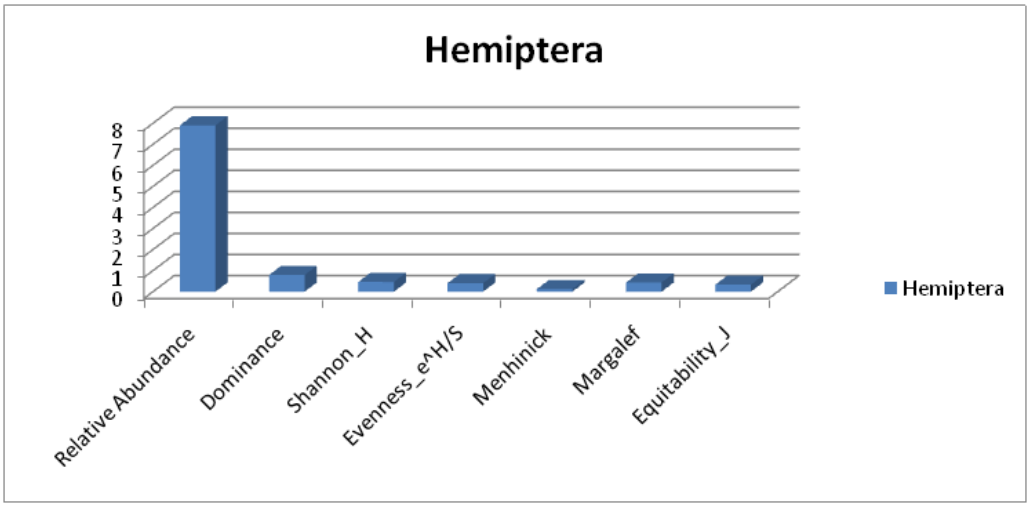

Fig-8: Relative abundance and dominance in different Diversity indices

Among the various groups of aquatic insects, hemipteran insect species are important as bioindicators, predators, biocontrol agents and fish and human food. Out of the three easily and commonly available hemipterans, *Lethocerus indicus* (Bellostomatidae) has the highest diversity, abundance and density in the study area. *Lethocerus indicus*(water giant bug) showed the highest density in four different habitats. Aquatic insects of order Hemipteran found in the study area have high market value and these insects are sold in the local markets in the study area.

4. Conclusion

Diversity of edible insects plays an important role in the creation of a sustainable global food economy as well as food security. The most common species of Hemiptera is *Lethocerus indicus*(water giant bug) which has high market value in the study area.

5. Acknowledgement

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