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Composition, Distribution and Abundance of Aquatic Insects of Otamiri River in Imo State, Nigeria.

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Abstract

The structure, diversity and seasonal variation in abundance of the Aquatic Insects in Otamiri River were studied during the dry and rainy seasons of 2016. Three grab samples were collected from Obinze Otamiri, FUTO Otamiri, and Ihiagwa Otamiri using a 0.1 m^2 Van Veen grab, every month between 9.00 am and 12.00 pm. Artisenal fishing and water hyacinth (*Eichhornia crassipes*) were observed in the locations. The insect species observed were 12 species in the orders Coleoptera, Diptera, Ephemeroptera and Odonata. The dry season collection across three sampling locations recorded more species 12 with more insect numbers 54 (54.55 %) than the rainy season collection with 10 species and 45 (45.45 %) insects. Location comparisons showed that there were significant difference in insect fauna using one-way analysis of variance at P=0.05 level. The Ephemeropterans and Dipterans dominated the community, accounting for 62.6 % of the total number of insect recovered. The diversity was highest at the 3rd location (Ihiagwa Otamiri) followed by the FUTO Otamiri and Obinze Otamiri respectively. The insect community in Otamiri River was typically what is found in other freshwater bodies.

Keywords: Aquatic insects, composition, abundance, diversity, Otamiri River.

1. Introduction

Insects are known to constitute an important component of tropical freshwater ecosystems. They belong to many different families and ecological niches (Brooker & sweeting, 1991). Some like dipterans and odonata fly about helping to pollinate flowers; others keep to various zones in the aquatic environment, feeding on vegetable matters on water surfaces (Chai, Ooh, Quah, & Wong, 2015). Insect in freshwater form one of the major food items of a wide variety of fishes in the habit for continuous sustenance of life. They have acquired various adaptations particularly for floating, swimming, breathing and reproduction (Michelam, Thomas, Mornul, & Carveiho, 2010).

Aquatic insects constitute a major component of the macro-invertebrate communities in water bodies, especially those that have floating macrophytes, where they are food resource for fish and other aquatic fauna (Burton & Pitt, 2002). Aquatic insects have also been used as reliable bio-indicators of aquatic pollution and related perturbations (Chapman, 2006). The earliest investigations on the benthic macro-invertebrate carried out in the other water bodies and harbour sediments have either been on the mulluscs, polychaetes, crustaceans and foraminiferans or at best a generalized treatment of the benthic fauna including the insects (Ajao, 1985; Ajao & Fagade, 2002; Akpati, 1985; Egborage, 1988 & Oyenekan, 1983). With the fishing activities and dragging of sand at the various location in Otamiri river can become a sink for any discharge into river.

This paper therefore call for information about the diversity, community structure and seasonal variation in the abundance of the aquatic insects in Otamiri River and the necessary baseline data provided, since no previous detailed research on aquatic insect fauna of the Otamiri River is available.

2. Materials and Methods

2.1 Study Area

Otamiri is a River surrounding Owerri town located within latitude 6^0 35^1 and 6^0 $40^{'}$ N and longitude 7^0 56^{l} and 7^0 58^{l} E, in Owerri Imo State. The entire area is low-lying and generally less than 10 m above the mean sea level. The river is close to Nwaorie river system. Information on the Otamiri and of the coastal waters are generally scanty. The water is generally acidic (pH 5.65 - 6.85) and fresh throughout the year with electrical conductivity values ranging from 48-122 μScm^{-1}, levels of dissolved oxygen concentrations and percentage oxygen saturation are moderate. The rainy season is from March to August, and the dry season from September to February.

Three sampling stations were designated, for this study. Widths of the River at locations 1 (south), 2 (middle) and 3 (north) were 22, 15 and 12 m, respectively. Interspace between locations in the River was 1km. Artisanal fishing and water hyacinth (*Eichhornia crassipes*, Mart. Solms) were observed in the River.

2.2 Sampling Method and Collection

Dry and rainy seasons sediment samples were collected from Jan. to Dec. 2016, respectively, using a 0.1 m^2 Van Veen grab. Three grab samples were collected from each location and inspected after retrieved for disturbance such as washout. The sample was discarded when significant disturbance was observed. Sediment from the entire grab was collected into a bucket, spread carefully and washed through a set of sieves of mesh size 0.5 and 1.0 mm and the different stages of insects collected were preserved in labelled bottles containing 10 % buffered formalin solution. At each station, floating water hyacinth within an area demarcated by a 0.1 m^2 quadrate, were also collected from the water surface. The roots were vigorously shaken in a bucket containing 10 % formalin and the content filtered through the same sieve and stored separately.

2.3 Laboratory Procedure

In the laboratory, the samples were stained with Rose Bengal and sorted under a binocular dissecting microscope (American Optical Corporation, Model 570). The insects were identified based on taxonomic features of adults and larvae using keys provided by Gillies (1980) & Ogbeibu (1991). Since changes in the environment are reflected in the types and

number of organisms present, diversity indices provide a tool for monitoring temporal and spatial changes.

2.4 Determination of Diversity and Distribution of Species

To characterize, the macrobenthic community structure, the taxa richness was investigated using Margalef's index. The general species diversity was studied using Shannon-Wienner index. To assess the distribution pattern, Evenness index was used. Inter-location comparisons were carried out to test for significant differences in the abundance of insect fauna.

2.4 Data Analysis

Data analysis was carried out using one-way analysis of variance (ANOVA) (Gomez, 1984). T-test was used to compare the faunal abundance during the dry and rainy seasons.

3. Results

3.1 Community Structure, Distribution and Abundance

A total of 99 aquatic insects classified into 12 species in four orders (Table1) were collected from Otamiri River. Mean number of insects / 0.1 m^2 (18.0) was significantly higher (p=0.05) in the dry season than in the rainy season 17.0 (Fig.1). The number of insect larvae per location during the dry season ranged from 9-22 compared to a range from 6-14 in rainy season. During both seasons, (Location 3) had the highest number; and was significantly different (P=0.05) from the numbers found in Locations 1 and 2 in decreasing order of abundance.

Fig. 2 shows the abundance of the major groups of insects. Ephemeropterans accounted for 33.3 % of the collections followed by dipterans (29.3 %), odonates (22.2 %) and coleopterans (13.1 %).

Table 1: Taxonomic composition of aquatic insects collected from Otamiri River in the dry and rainy seasons of 2016

Order	Species	Seasons	
		Dry	Rain
Coleopteran	*Capelatis* sp.		
	Hydroporus sp.	+	+
Diptera	*Chaoborus anomalus*	+	+
	Clinotanypus maculates	+	+
	Corynonmeura sp.	+	+
	Cricotpus sp.	+	+
Ephemeroptera	*Adenophlebiodes* sp	+	+
	Baetis rhodani Leach	+	+
	Caenis moesta Stephens	+	+
	Pseudocloeon sp	+	+
Odonata	*Coenagrion scitullum*	+	+
	Ophlogomphus sp	+	+

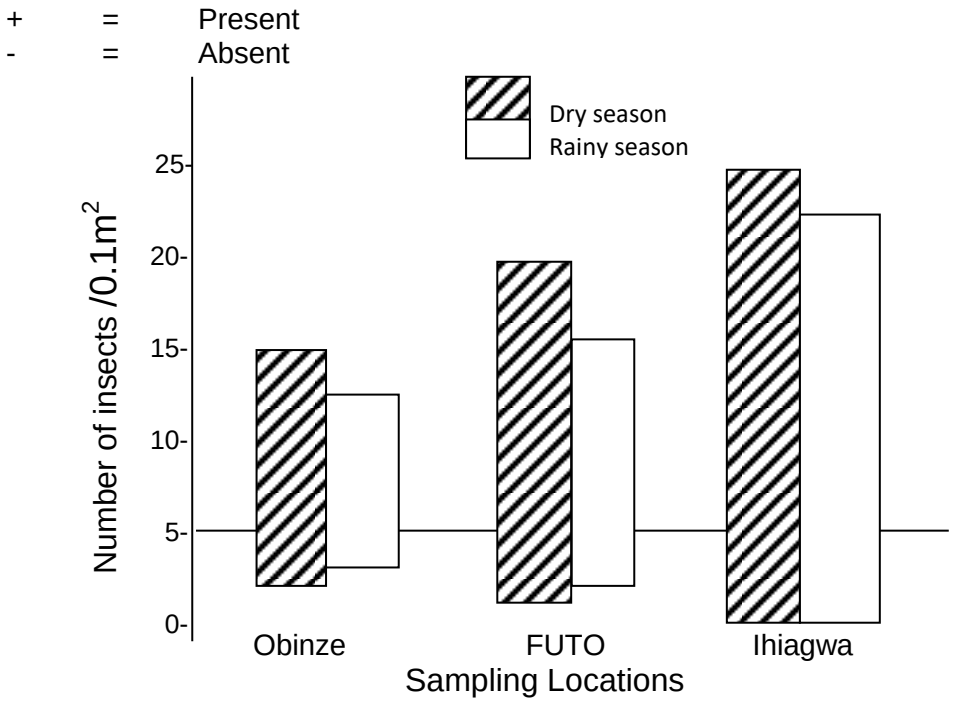

Fig. 1: Seasonal abundance of insects in Otamiri River in 2016.

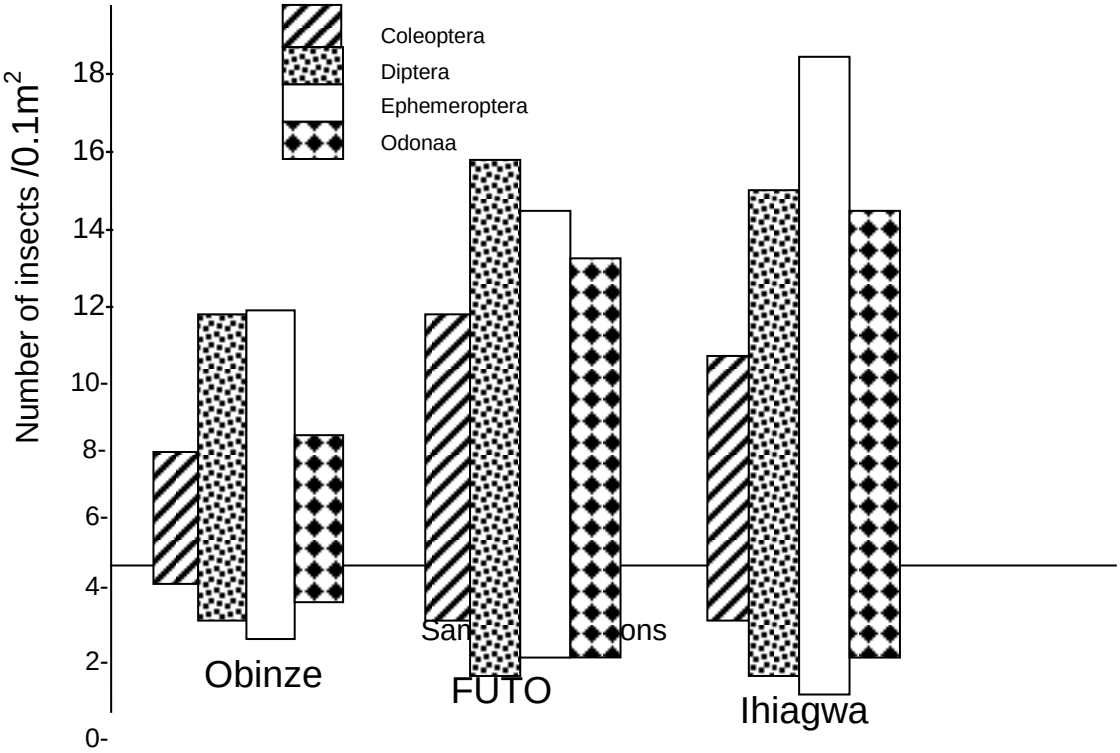

Fig. 2: Abundance of insect orders in Otamiri River in 2016.

3.2 Diversity

The diversity indices for the three Locations were shown in Table 2. Differences in the number of species collected at the three stations were due to random variation, though Location 1 tended to had the lowest number in both dry and rainy seasons. During the dry season, Margalef's species richness was between 4.79 and 2.81, while general diversity (Shannon – Wiener index) was between 3.34 and 2.16. The range of Margalef's species

richness indices during the wet season was between 4.12 and 2.34 while general diversity ranged between 3.14 and 2.10. Evenness index was generally high at all the stations during both seasons (0.88 - 0.76). Location 3 had the highest diversity irrespective of season.

Table 2: Species diversity indices of insects from Otamiri River during the dry and rainy seasons of 2016

		Dry season		
Locations	D	H	E	S
Obinze	2.18	2.16	0.76	10
FUTO	3.62	2.89	0.87	17
Ihiagwa	4.79	3.34	0.88	24
		Rainy season		
Obinze	2.34	2.10	0.76	8
FUTO	3.06	2.55	0.86	13
Ihiagwa	4.12	3.14	0.87	22

D = Margalef's species richness index;

H = General diversity (Shannon-Wiener index);

E = Evenness index;

S = Species number

4.0 Discussion

The insect order collected from Otamiri were similar to those of other fresh water ecosystems in Nigeria and other African countries Ogbeibu & Egborge 1995; Ogbeibu & Oribhabor, 2002; Rotimi & Iloba 2002). The dominant fauna recorded were, however, the ephemeropterans and the dipterans. The community structure did not differed from that of the other fresh water bodies (Ajao & Fahade, 2002) which had preponderance of fresh water species of mollusks, polychaetes and crustaceans basically because of the physical and chemical conditions of the environments. Otamiri is a freshwater habitat. The preponderance of the ephemeropterans indicates the clean nature of the water. Booker and Sweeting (1991) had listed Ephemeroptera and Odonata, among others, as macro-invertebrate Orders that indicate high water quality and richness of aquatic ecosystem.

The relatively high number of the dipterans in the water body is also a reflection of the right conditions provided by the presence of macrophytes and the decomposition of accumulated plant materials.

Association between chironomid larvae and organic matter and particle size have been demonstrated by Chai *et al*. (2015) as the macrophytes serve as refuge and, more critically, as a source of food. Water quality and food availability have also been identified as some of the important factors that govern the abundance and distribution of benthic organisms (Dance & Hynes 1980).

In conclusion, the insect community structure of Otamiri was typical of what is found in freshwater bodies, the dominant groups which were the ephemeropterans and dipterans

indicate the high water quality of the aquatic ecosystem as well as the accumulation of decomposing plant materials.

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