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INSECT SPECIES COMPOSITION AND ABUNDANCE IN THE NIGER DELTA UNIVERSITY AND AMASSOMA COMMUNITY

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Abstract:
This study investigates the composition and relative abundance of insect species inhabiting the ecosystems of Niger Delta University and the surrounding Amassoma community, located in Bayelsa State, Nigeria, over a period of five months from May 15 to October 15, 2020. A total of 7,225 individual insects were collected using five sampling methods: sweep nets, aerial nets, pitfall traps, light traps, and direct collection by hand, across four sites. The collected insects were identified into 8 orders, 24 families, and 32 species. Among the most abundant species, Anopheles (Diptera: Culicidae) represented 58.74% of the total, followed by Dorylus (Diptera: Formicidae), which constituted 26.12%. Six insect species, including *Libellula pulchella* (Odonata: Libellidae), *Danaus plexippus* (Lepidoptera: Nymphalidae), and *Spodoptera exampta* (Lepidoptera: Noctuidae), had relatively low abundances ranging from 1.24% to 1.68%. Twenty-six families showed even lower species numbers, with *Hypenas cabra* (Erebidae), *Labidomera clivicollis* (Chrysomelidae), and *Coccinnella sp.* (Coccinellidae) being among the least abundant, with populations ranging from 0.043% to 0.05%. The study confirms the rich insect biodiversity within the Niger Delta University and its host community, providing a baseline for future studies on the impact of environmental pollution, particularly from oil activities, on insect species richness in the region.
Keywords: Insect Biodiversity, Niger Delta, Environmental Pollution, Species Composition, Amassoma Community

Introduction

Insects are the most diverse group of animals on Earth, inhabiting almost all types of ecosystems, from tropical forests to arctic tundras, and accounting for more than 75% of the world's biodiversity (Samways, 1995; Gibson et al., 2004). They are integral to the functioning of ecosystems, providing a range of ecological services that sustain both natural environments and human societies. Insects perform crucial roles in various processes such as pollination, nutrient recycling, and pest control. Their high abundance and species diversity are key indicators of ecological health, making them vital components of biodiversity assessments. Despite their importance, insects remain underexplored in many regions of the world, including Nigeria, where limited research exists on the composition and role of insect species in diverse ecosystems.

Insects are considered indispensable for the sustainable management of the environment due to their ecological services. One of the most significant roles they play is in pollination. Bees, butterflies, and other insects pollinate a wide variety of plants, including many agricultural crops. Pollination by insects is essential for the reproduction of more than 75% of flowering plant species, and it is responsible for the production of a substantial portion of the world's food (Berenbaum et al., 2006). In addition to crop pollination, insects produce valuable resources such as honey and silk, which have important economic significance. Furthermore, insects serve as food for many animals, including birds, fish, and small mammals, thereby contributing to the food web.

Termites, often overlooked, are another example of beneficial insects that play an essential role as soil engineers. They contribute to the decomposition of plant material, enriching the soil and facilitating nutrient cycling. Termites also help to aerate the soil, improving its structure and promoting plant growth. Additionally, they have been identified as agents of biological control for a variety of agricultural pests, reducing the need for chemical pesticides. Insects like these are crucial for maintaining ecosystem balance and ensuring the health of soil and vegetation. Their role in nutrient cycling, specifically in the degradation of leaf litter, wood, and dung, is pivotal to maintaining soil fertility and preventing the buildup of organic matter.

However, not all insects are beneficial. Some species, especially those associated with crops and stored products, become pests, causing significant economic losses. Agricultural pests such as locusts, aphids, and caterpillars can devastate crops, resulting in reduced food production and loss of income for farmers. Additionally, certain insects are vectors of diseases, transmitting pathogens that affect both humans and animals. Mosquitoes, for example, are responsible for transmitting diseases such as malaria, dengue, and Zika virus, which continue to be major public health challenges worldwide. As a result, while insects are an indispensable part of natural processes, they can also pose threats to human health and agriculture.

In Nigeria, the insect biodiversity within the natural ecosystems of the Niger Delta remains largely unexplored, despite the critical role insects play in ecological health and environmental sustainability. The Niger Delta, located in the southern region of Nigeria, is home to a rich and diverse range of ecosystems, including mangrove swamps, tropical rainforests, and coastal wetlands. These ecosystems support a variety of species, including numerous insect species that contribute to the biodiversity of the region. Niger Delta University (NDU), located in Amassoma, Bayelsa State, was established in 2000, but there has been limited research into the biodiversity of insects in the university's immediate surroundings or the broader Amassoma community. This lack of research has resulted in a knowledge gap that hinders effective conservation efforts and the understanding of the ecological functions of insects in the region.

In recent years, however, environmental degradation caused by human activities, such as crude oil spills, gas flaring, and deforestation, has had profound effects on the ecosystems of the Niger Delta. These activities introduce pollutants into the environment, threatening the health and stability of both plant and animal species. For example, the bioaccumulation of toxic pollutants in the larvae of the African Palm Weevil (Rhynchophorus phoenicis) has been documented as a result of exposure to gas flares and oil spills in the region (Thomas et al., 2022). This bioaccumulation poses risks to the health of local communities who rely on these insects as part of their livelihoods, either through direct consumption or as part of the local food web.

Although the Niger Delta is home to a rich diversity of insect species, the impacts of environmental pollution on insect populations have not been adequately studied. Insects are often the first organisms to show signs of

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environmental stress, and their response to pollution can provide valuable insights into the overall health of an ecosystem. By investigating the composition of insect species in the Niger Delta University and the surrounding Amassoma community, researchers can begin to assess the impact of human activities, such as oil exploration and gas flaring, on local biodiversity. Furthermore, understanding the dynamics of insect populations in these areas can serve as a baseline for future studies on the effects of environmental pollution on species richness and ecological function.

Insects, as one of the most abundant and diverse groups of organisms, serve as important bioindicators of environmental health. Their populations respond to changes in habitat quality, the availability of resources, and the presence of pollutants. The composition of insect species in an area can reveal much about the state of the ecosystem, including the effects of climate change, land use practices, and pollution. By studying the insect populations in the Niger Delta University and the Amassoma community, researchers can gain a better understanding of the local biodiversity and the potential threats posed by environmental degradation.

Moreover, insect biodiversity has far-reaching implications for the local communities that depend on these ecosystems. Insects support local economies through their roles in agriculture, food production, and even traditional medicine. The presence of pollinating insects ensures the continued production of food crops, while the destruction of these populations could lead to reduced crop yields and food insecurity. Additionally, the degradation of insect populations could have cascading effects on other species in the ecosystem, further disrupting local food webs. The loss of insect biodiversity could, therefore, have direct and indirect consequences for the livelihoods of the people living in the Niger Delta region.

This study aims to address the gap in knowledge regarding the composition and diversity of insect species in the Niger Delta University and Amassoma community. By investigating the insect populations in these areas, this research seeks to provide a comprehensive understanding of the local insect biodiversity and its role in the broader ecological context. The findings of this study will not only contribute to the scientific understanding of insect biodiversity in the Niger Delta but will also provide valuable information for local communities and policymakers involved in conservation and environmental management. The research will also serve as a reference point for future studies that explore the effects of environmental pollution on insect populations and the broader implications for biodiversity conservation in the region.

Materials and Methods

The study was conducted in the area shown in the map (Fig. 1)

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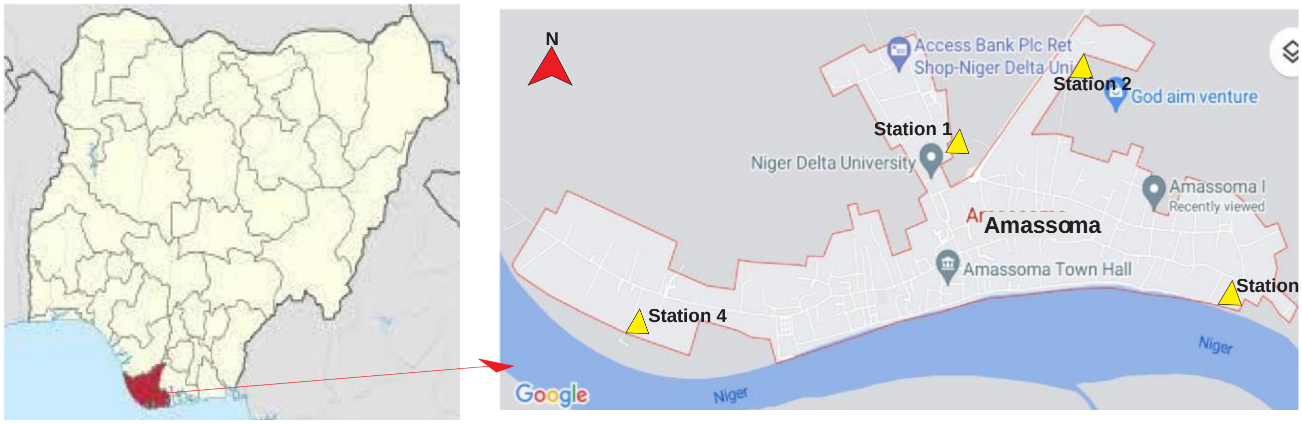

A B

Figure 1**A:** Map of Nigeria showing Bayelsa State. **B.**GoogleMap of Niger Delta University and Environs of Amassoma Community in Bayelsa State, Nigeria

Description of sampling stations:

Four (4) sampling points were established for the collection of insects. Sampling point 1 was behind the biology laboratory in the permanent site of Niger Delta University, Wilberforce Island, Nigeria, which had GPS coordinates of longitude N4^{0}58^{1}42.006 and latitude E6^{0}06^{1}19.6236". This area had thick vegetation of tall trees, palm trees, plantain and cassava plantations and different species of grasses. The second sampling point was taken at OgbopinaAma along the expressway which had longitude N4^{0}58^{1}42.006" and latitude E6^{0}06^{1}19.6236" as coordinates. This area also had a dense wetland forest with few tall trees and grasses because it was an old refuse dump site. The third sampling station was taken at Ebitimikondei Pele which was close to the bank of the river, with coordinates of longitude N4^{0}58^{1}01.1676" and latitude E6^{0}07^{1}23.4228". This area had dense vegetation of trees, plantain and cassava farms, paw-paws and grass fields. The fourth sampling station was taken at the College of Health Sciences of Niger Delta with longitude N4^{0}58^{1}07.368" and latitude E6^{0}05^{1}07.386" as its coordinates. This area also comprised of dense tropical vegetation with few trees, palm trees, paw-paws, plantain and tall shrubs and grasses

Sample Collection Procedures

In this study, four (4) sampling methods used in collecting insects included sweep nets, light traps, pitfall traps and direct hand picking. In each of the sampling points, a light trap which consisted of a white cloth which was suspended in front of a bright light was put between 7-9 pm and kept till 7 am of the next morning, so that the insects that were attracted by the light and fell on the white cloth were carefully wrapped and put into a killing jar. The aerial net was swung through the air to collect flying insects such as houseflies, butterflies, dragonflies, grasshoppers and others. Once an insect was caught, the end of the net was quickly flipped over to prevent the insects from escaping. The sweep net was used similarly to the aerial net, except that it was used to collect insects

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from grasses, leaves and stems of flowering parts of crops and plants without damaging the crops. The insects caught in the net were put into killing bottles which contained alcohol. The pitfall traps were used to collect ground-dwelling insects such as ground beetles, cockroaches, spiders, ants, termites and others which crawl on the ground. The pitfall trap which consisted of a sizeable plastic container with a killing agent and preservatives such as ethyl alcohol and formalin was buried on the ground at specific points such that insects crawl into it and died. The number of insects was counted within 24 hours. The samples were collected daily from May 2020 – October 2020. They were sorted into different orders and preserved in 70% alcohol in plastic containers and labelled for identification using taxonomic keys (Medler, 1980) at the University of Port Harcourt, while some specimens were sent to the University of Ibadan.

Statistical Analysis

The sample size (N) was the total of all individual species collected in the study.

N= ($n_1+n_2+n_3+n_4+$-------- $+n_i$), where 1, 2, 3, 4-------- and i are index numbers of individual species collected. The relative abundance of each species was calculated as the percentage of several individual species relative to the total number of individual species of insects collected in the study:

$$\text{Relative Abundance} = \frac{}{\Sigma(n1+n2+n3+n4+\text{---------}+ni)} \quad \frac{}{N} \quad \frac{n}{1} \times 100\% \quad \text{or} \quad n \times 100\%$$

where: N= Total number of individual insects collected in this study n= Number of the individuals of a particular species that was counted

Results

Species Composition and Relative Abundance of various Insect groups:

The results (Table 1) showed that, out of a total of 7,225 insects collected, 7,220 insects were identified under eight orders, 24 families and 32 species, while 5 insects were not identified.

Of the 7,220 identified insects, 61.13% (4,736 insects) were Diptera (flies), while Hymenoptera constituted 27.63% (1,809 wasps and ants); Lepidoptera were 4.41% (279 butterflies and moths); Orthoptera were 2.53% (177 locust and grasshoppers); odonata were 2.32% (147 dragonflies and damsel flies); Hemiptera were 0.47% (31 bugs); Coleoptera were 0.37% (26 beetles and weevils) and blattoidea were 0.32% (21 cockroaches).

The order Diptera was the largest group of insects with 61.31% of flies which were identified under five families: Culicidae were 58.74% individuals with 3,846 anopheles mosquitoes; psychodoidae were 1.23% with 81 individual species of Clogmia spp; Muscidae (Musca domestica) were 0.67%, while Chrysopidae (Chrysoperla carnea) was 0.21%. The order Hymenoptera was the second largest group of insects which constituted 27.63% with Dorylus sp having 26.12%, belonging to the family Formicidae. The others were the Apidae which were the honey bees (Apis mellifera) constituted 0.47%, Camponotus spp were 0.51%; Monomerium pharaonic 0.35% and Formica ligniperda was 0.183%. The order Lepidoptera which constituted 4.76% was dominated by 1.57%

of Spodoptera exampta belonging to the family Noctuidae. It was followed by nymphalidae which constituted 1.66% with Danaus plexippus as the common species; Geometridae were 0.412% with Lemographa species; nolidae were 0.17% with Nola cucullatela species. There was a single species of Hyphenas cabra which belongs to the family erebidae(0.015%), while there were 12 individual species of Caenurgina erechtea. The family Pieridae had 34 individuals of Pieris rapae was 0.52%. The order orthoptera which constituted 2.53% was classified into three families, Acrididae 0.52% represented by Schistocerca americana (0.58%), Melanoplus spp (0.595%), and Dendeotetti squercus (0.519%). The family Gryllidae was 0.50% with gryllus bimaculata and Acheta domestica as common species found in the environment. The family Gryllotalpidae was 0.34% with Gryllotalpa brachyptera as the common species collected in the ecosystem.

The order Odonata constituted 2.32% of the insects under two families: the caenagrionidae which constituted 0.56% was identified as Ischnura elegans, while the Libellulidae which constituted 1.68% was identified as Libellule pulchella. The order hemiptera was the sixth group of insects which constituted 0.47% was identified as Nezera viridula which belongs to the family pentatomidae. The order Coleoptera was the seventh group which constituted 0.37% of the total insect population was classified into four families: carobidae was 0.20% with Brachinus spp as the common species. The Tenebrionidae were 0.09% with Aphitabius sp as the common species. The Coccinellidae were 0.05% with Coccinella sp, while the Chrysomelidae constituted 0.03% with Labidomera clivicollis as the common species. The order blattoidea which constituted 0.32% had the cockroach (Periplaneta americana) as the typical species found in the study area.

Table 1: Composition of insect orders, families and species and their relative abundance in Niger Delta University and Amassoma Community

S/N	Orders	Families	Species	Number counted	% Abundance
1.	Diptera	culicidae	*Anopheles spp*	3,846	58.74
		psychodoidae	*Clogmia spp*	813	1.324
		muscidae	*Musca domestica*	44	0.67
		tabanidae	*Hybomitra micans*	18	0.28
		chrysopidae	*Chrysoperla carnea*	15	0.21
			Sub-total	**4,736**	**61.134**
2.	Hymenoptera	formicidae	*Dorylus sp*	1,710	26.12
		apidae	*Apis mellifera*	31	0.47
			Camponotus spp	33	0.504
			Monomerium pharaonis	23	0.35
			Formica ligniperda	12	0.18
			Sub-total	**1,809**	**27.631**
3.	Lepidoptera	noctuidae	*Spodoptera exempta*	103	1.57
		nymphalidae	*Danaus plexippus*	100	1.66
			Lemizenitis archippus	17	0.21
		erebidae	*Hypenas cabra*	1	0.015
		nolidae	*Nola cucullatela*	12	0.18
		geometridae	*Lomographa sp*		0.18
			Caenurgina erechtea	12	0.18
		pieridae	*Pieris rapae*	34	0.52
			Sub-total	**279**	4.41
4.	Orthoptera	acrididae	*Dendeotettis squercus*	34	0.52
		gryllidae	*Gryllus bimuculatus*	22	0.34
		gryllotalpidae	*Grylotalpa brachyptera*	22	0.34
			Acheta domestica	22	0.17
			Schitocerca americana	38	0.58
			Melanoplus spp	39	0.60
			Sub-total	**177**	**2.53**
5.	Odonata	caenagrinoidae	*Ischura elegaus*	31	0.56
		libellulidae	*Labella pulchella*	110	1.68
		ni	*Un-identified*	5	0.08
			Sub-total	**146**	**2.32**
6.	Hemiptera	pentatomidae	*Nezara viridula*	31	0.47
			Sub-total	**31**	**0.47**
7.	Coleoptera	carobidae	*Brachinus spp.*	15	0.20
		tenebrionidae	*Aphitabius sp*	6	0.09
		coccinellidae	*Coccinella sp*	3	0.05
		chrysomelidae	*Labidomera clivicollis*	2	0.03
			Sub-total	**26**	**0.37**
8.	Blattoidea	blattodae	*Periplaneta americana*	21	0.32
			Sub-total	**21**	**0.32**
	Total			**7,225**	**99.185**

Ranking of the Relative Abundance of Insect Species

The results (Table 2) showed that *Anopheles* species (Diptera: Culicidae) were the most abundant insects with 58.74% (3.846 individuals); *Dorylus* sp was the second most abundant with 26.12% (1,710 individuals). Four

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insects which were sparingly found in the study were Libellula pulchella (Odonta: Libullulidae); with 1.68% (110 individuals) Danaus plexippus (Lepidoptera: nymphalidae) with 1.66% (109 individuals); Spodoptera exampta (Lepidoptera: Noctuidae) with 1.57% (103 individuals) and Clogmia sp (Diptera: psychodoidae) with 1.24% (81 individuals). The next group comprised fourteen (14) insect species which were within close range of 0.31% - 0.67% and comprised of 39 – 44 individuals, namely: Musca domestica, Schistocera americana, Ischnura elegans, Pieris rapae, Dendeotettis squercus, Apis mellifera, Nezera viridula, Lamographa sp., Monomerium pharaonis, Gryllus bimaculatus, Gryllotalpa brachyptera, Periplaneta americana, Camponotus spp and Melanoplus spp. The fifth group comprised seven different insect species which also had close relative abundance values ranging from 0.17% - 0.28% (11- 18 individuals): Hybomitra micans, Chyrysoperla carnea, Limenitis archippus, Formica ligniperda, Nola cucullatella, Caenurgina erechtea and Acheta domestica. The sixth group was made up of five insect species which had the lowest numbers collected and varied from 0.015-0.09% with 1-6 individuals: Brachinus spp.; Alphitabius sp; Coccinella sp; Labidomera clivicollis and Hypenas cabra. Five insects were Not Identified (NI)

Table 2: Ranking of relative abundance of insect species in Niger Delta University and host Amassoma community in Bayelsa State

Orders	Families	Species	Numbers counted	(%) Abundance	Ranking
Diptera	culicidae	*Anopheles spp.*	3,846	58.74	1st
Hymenoptera	formicidae	*Dorylus sp.*	1710	26.12	2nd
Odonata	libellulidae	*Libellula pulchella*	110	1.680	
Lepidotera	nymphalidae	*Danaus plexippus*	109	1.664	3rd group
Lepidotera	noctuidae	*Spodoptera exampta*	103	1.573	
Diptera	psychodoidae	*Clogmia sp.*	81	1.237	
Diptera	muscidae	*Musca domestica*	44	0.672	
Orthoptera		*Schistocerca americana*	38	0.580	
Odonata	caenagrionidae	*Ischnura elegans*	37	0.565	
Lepidoptera	pieridae	*Pieris rapae*	34	0.519	
Orthoptera	acrididae	*Dendrotettis quercus*	34	0.519	
Hymenoptera	apidae	*Apis mellifera*	31	0.473	
Hemiptera	pentatomidae	*Nezara viridula*	31	0.473	4th group
Lepidoptera	geometridae	*Lomographa sp.*	27	0.412	
Hymenoptera		*Monomerium pharaonis*	23	0.351	
Orthoptera	gryllidae	*Gryllus bimaculatu*	22	0.336	
Orthoptera	gryllotalpidae	*Gryllotalpa brachyptera*	22	0.336	
Blattoidea	blattidae	*Periplaneta americana*	21	0.321	
Hymenoptera		*Camponotus spp.*	33	0.321	
Orthoptera		*Melanoplus spp*	39	0.305	
Diptera	tabanoidae	*Hybomitra micans*	18	0.275	
Diptera	chrysopidae	*Chrysoperla carnea*	15	0.229	
Lepidoptera		*Limenitis archippus*	17	0.210	
Hymenoptera		*Formica ligniperda*	12	0.183	5th group
Lepidoptera	nolidae	*Nola cucullatella*	12	0.183	
Lepidoptera		*Caenurgina erechtea*	12	0.183	
Orthoptera		*Acheta domestica*	11	0.168	
Coleopteran	tenebrionoidae	*Alphitabius sp.*	6	0.092	
Coleoptera	carobidae	*Brachinus spp*	5	0.076	
Not identified	*not known*	*Not Known*	5	0.076	
Coleptera	coccinellidea	*Coccinella sp.*	3	0.046	6th group
Coleptera	chrysomelidae	*Labidomera clivicollis*	2	0.031	
Lepidoptera	erebidae	*Hypenas cabra*	1	0.015	
	Total		**7,225**	**99.185**	

Discussion

The findings of this study revealed that the *Anopheles* mosquitoes were the most abundant insects which constituted 58.74% with 3,846 individuals of the total 7,225 insects collected. This means that humans and some domestic animals living in the Amassoma community and the University were at high risk of endemic malaria disease transmitted by the female anopheles as vectors. The high population of anopheles (culicid) mosquitoes found in the study area had a direct relationship with a high rate of malaria infection among the human populace of Amassoma Community and the students plus staff of the university agreed with earlier studies (Amawulu et al., 2014) which reported that Southern-Ijaw local government (which encompasses the host Amassoma community and Niger Delta University) was rated as a "mesoendemic" ecological zone having moderate prevalent rate for malaria infection in Bayelsa State, Nigeria. Similarly, Ikeh et al. (2021) reported that 5,161 adult species of mosquitoes were identified into four genera, namely *Aedes*, *Culex*, *Anopheles*, and *Toxorhynchites* in Nnewi community in Anambra state, Nigeria. This confirms that mosquitoes are usually the most abundant in tropical forests, especially in the humid freshwater ecosystem of Amassoma in Bayelsa State which usually has high annual rainfall (Coetzee *et al*, 2000). The results also showed that *Dorylus* (order Hymenoptera family Formicidae) were the second most abundant insect found in the study because it constituted 26.12% which was equivalent to 1,710 individuals of the insect population. The high number of *Dorylus* species in this study agreed with an earlier report of Chima et. al. *(*2013) who stated that *Dorylus* species constituted the dominant population of about 70% of insects collected in some farmlands at the University of Port Harcourt campus. The *Libellula pulchella* which is a species of dragonfly (order Odonata: family libellulidae) was the third most abundant insect because it made up 1.68% with 110 individuals, It was closely followed by two species of Lepidoptera known as *Danaus plexippus* (nymphalidae) and *Spodopetera exempta* (Noctuidae*)* with 109 individuals and 1.57% having 103 individuals, respectively. Furthermore, *Clogmia* spp which were Diptera (family psychodoidae) constituted 1.24% of 81 individuals collected in this study.

In addition, Kemabonta et al.*(*2018) also reported that 1002 dragonflies were collected and identified into 20 species, 15 genera and two families (libellulidae and aesnidae) sampled from a fish pond and farm land in parts of Lagos metropolis which shared great similarities with that of Bayelsa State, especially in high annual rainfall and swampy aquatic habitats. The variation observed in the abundance was attributed to the peculiarities in the environmental characteristics of the locations (Dijkstra et al., 2014). The low population of insects observed in the remaining genera of insects was a normal trend in insect populations in Southern Nigeria been attributed to the effect of environmental pollution and the sustained development of infrastructure in the Niger Delta University, coupled with habitat disturbance by the agrarian activities of the Ijaw people who depend on subsistence farming as a source of food and economic survival (Umeozor, 1996; Edward and Ugwumba, 2011; Adakole and Annume, 2003). However, four insects which had the lowest relative abundance of 0.031%- 0.09% included the *Aphitabius sp*., *Brachinus sp*., *Coccinella sp* and *Labidomera clivicolis* as well as *Hypenas cabra* (Lepidoptera) with a single individual having the least relative abundance of 0.015%. This was of great concern because these low numbers could be signals that these insect species could be "endangered" due to adverse effects of chemical pollution from the crude oil exploration activities that had continued since 1968 till date in Bayelsa State. There is a need for further investigation to ascertain the factors responsible for the low numbers and suggest appropriate conservation methods to preserve these insects (Kehinde et al., 2014; Groombridge, 1992). Finally, five species of insects were not identified, while some species were not identified at the family levels in this study due to the dearth of taxonomists which had been a major constraint against insect conservation. Therefore, 20% of insect species only are catalogued in Nigeria (Medler, 1988), while many insects are yet to be identified (Kehinde et al., 2014). To buttress this fact, Chima et al. (2013) reported seventeen (17) unidentified species of insects at the University of Port Harcourt, Nigeria.

Conclusion

The findings of this preliminary study revealed that the Niger Delta University and the surrounding ecosystems of the host Amassoma community had rich biodiversity of insects The *Anopheles spp*. (Diptera: Culicidae) were the dominant species because they had the highest relative abundance of 58.74%, while *Dorylus spp*, had 26.12%. There were low populations of insects in 6 orders: lepideptera (4:41%), orthoptera (2.53%), Odonata (2.31%), Hemiptera (0.47%), Coleoptera (0.37%) and blattoidea (0.32%). The steady decline in numbers could be an indication of the possible existence of threat factors that are affecting their survival and could lead to the extinction of some insects. Therefore, there is a need for further studies to ascertain the causes of the consistent reduction in insect populations and recommend appropriate conservation practices to save the loss of insect species from the environment.

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