



Species Diversity of Arthropods Found in Refuse Dumpsites in Ifite Awka, Anambra State and Its Public Health Risk

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A survey of some refuse dumpsites in Ifite, Awka, Anambra, Nigeria State were carried out for 5 weeks to determine the arthropod vectors associated with those refuse dumps and their relative abundance per site and species diversity. Five refuse dumpsites were randomly selected based on their composition and human activities within the environment. The sampled sites are Commissioners Quarters (site A), Second Market (site B), Miracle Junction (site C), Star-Lodge Junction (site D) and Wintess Hotel (site E). Fourteen species of arthropods were collected in eight orders and eleven families namely; Muscidae, Culicidae, Blattidae, Calliphoridae, Formicidae, Elateridae, Xystodesmidae, Polydesmidae, Acrididae, Lygaeidae and Selonopidae. The most abundant vector species encountered in all five study sites was *Musca domestica*, the dominant species, followed by *Aedes*. spp., and *P. americana* which occurred in all study sites except site A. Site A, *M. domestica* 12 (38.71%), followed by *A. aegypti* 6 (19.35%), site B, *M. domestica* 15 (25.42%), followed by *A. aegypti* 12 (20.34%) and *P. Americana* 10 (16.95%), site C, *M. domestica*

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17 (28.89%), followed by *A. aegypti* 7 (15.56%) and *P. Americana* 5 (11.11%), site D, *M. domestica* 17 (27.42%), followed by *A. aegypti* 11 (17.74%) and *P. americana* 7 (11.29%), site E, *M. domestica* 30 (32.26%), followed by *A. spp.*, 17 (18.28%) and *P. Americana* 16 (17.20%). The abundance of these vectors suggests the prevalence of arthropod vector borne disease in Ifite, Awka environment. Proper disposal of refuse dumps and public enlightenment on the dangers of indiscriminate dumping of refuse to the general public is highly recommended to avert health and environmental problems associated with these arthropod vectors.

Keywords: Arthropods; species diversity; dumpsites; public health risk; vector-borne disease.

1. INTRODUCTION

Refuse is generated universally and is a direct consequence of all human activities. The rapid population growth and human activities including industrialization, urbanization, commercial and household activities lead to the generation of enormous refuse/wastes in the environment. Due to the high rate in industrial growth and migration of people from villages to cities, the urban population is increasing rapidly. The increasing growth of cities, therefore, has implications for municipal waste management among other social services required in the urban communities [1]. Indiscriminate refuse dumping endangers public health and diminishes environmental quality. Waste generation has been observed to increase annually in proportion to the rise in population and urbanization. Waste management is the collection, transport, processing, recycling or disposal of waste materials; and can be regarded as one of the most challenging areas of modern environmental management [2]. Uncollected solid waste blocks drains, and causes flooding and subsequent spread of water-borne diseases. Solid wastes that are not properly disposed of, especially excreta and other refuse from households and the community are a serious health hazard and which can lead to the spread of infectious diseases. Unattended waste lying around attracts flies, rodents and other creatures that in turn spread disease. This leads to unhygienic conditions and thereby leading to a rise in the health problems. At the same time, the risk of zoonosis has increased with urbanization and immunologically naïve populations are newly at risk for vector-borne disease. Uncollected wastes often clog drains and cause the stagnation of water, the breeding of mosquitoes or the contamination of water bodies from which the population normally takes water for consumption, cooking and cleaning. Other high-risk group includes population living close to as waste dump and those whose water supply gets contaminated. Uncollected solid waste also

increases risk of injury and infection. Most notable is the correlation between inadequate sanitation, poverty and disease. Diarrhea causes more than 2.5 million deaths annually [3]. These refuse dumps are aesthetically unpleasant, constitute eyesores, produce unpleasant odour in the vicinity. These refuse dumps thus constitute a habitat for arthropod vector and other nuisance organisms capable of transmitting or causing diseases in humans and livestock. Despite the increasing urbanization and globalization, many unsanitary practices are still going on in some areas in Awka environment and other places in developing countries [4,5]. At the same time so many food items are displayed uncovered in the open markets by unhygienic vendors thereby making disease transmission by these arthropods very easy.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in Ifite Awka, Nigeria and the coordinate of the study area is giving thus: 5° 6'25" N and 7° 8'30" E.

2.2 Study of the Refuse Dumpsites

The refuse dumps were closely studied to understand their compositions and it was observed that some of the large deposits of refuse dump have been accumulated over years while the smaller ones were recently accumulated. The five strategic sites were selected based on their refuse compositions, and the human activities going on in the area.

2.3 Experimental Design

The study lasted for five weeks. The field investigations were carried out in five strategic sites namely: Commissioners Quarters, Second Market, Miracle Junction, Star-Lodge Junction and Along Wintess Hotel Avenue.

2.4 Sampling Methods

Three sampling methods were used to collect arthropods from the different survey sites namely: water traps, sweep nets and handpicking with the aid of forceps and hand gloves as prescribed by [4].

2.5 Sorting of Arthropods

Arthropods collected from various survey sites were recorded in order to study the relative abundance and diversity of the species found in each dumpsite. The arthropods were placed in specimen bottles before taken to the laboratory for identification and preservation.

2.6 Preservation and Identification of Collected Arthropods

The larger arthropods were kept in specimen bottles containing 70% ethanol solution while mosquitoes were kept in a petri dish, on a filter paper, placed on moist cotton wool. They were later sent to Zoology Laboratory for identification.

2.7 Statistical Analysis

Shannon Weiner diversity Index was used to statistically analyse the result.

3. RESULTS

A total of 290 arthropods were collected from all five study sites. In site A (Commissioners Quarters), a total of 31 arthropods were collected. In site B (Second Market), a total of 59 arthropods were collected. In site C (Miracle Junction), a total of 45 arthropods were collected. In site D (Star-Lodge Junction), a total of 62 arthropods were collected while in site E (Along Wintess Hotel Avenue), a total of 93 arthropods were collected. A total of fourteen species of arthropods were collected from all five survey sites, in eight orders and eleven families.

4. DISCUSSION

Out of the fourteen arthropods' species collected from the dumpsites, *M. domestica*, and *Aedes* spp., were encountered in all five study sites while *P. americana* occurred in all study sites

except site A (Commissioners Quarters), this result is in line with the findings of [4] but contradicts the result of [6,7] which states that *P. americana* were encountered in all study sites. A possible reason for their absence in site A, was because of the dump compositions and human activities in the area. Housefly (*M. domestica*) was the most abundant species encountered in all study sites. This analysis demonstrates a correlation with the findings of [6,4], where they reported the predominance of *M. domestica*, a mechanical transmitter of filth diseases such as cholera, amoebiasis, typhoid, dysentery, diarrhoea, and certain helminth infections. These flies are usually associated with decomposing substrate of solid urban wastes which probably account for their dominance in this study. Mosquitoes (*Aedes* spp) was another arthropod vector with the most abundant species encountered, and it was found in all five study sites. This report that mosquito breeds in refuse dumps builds on existing evidence of the studies carried out by [8,7,4,5]. The relative abundance of mosquitoes breeding in water holding containers and dirty stagnant water found close to the refuse dump is an indicative that disease such as filariases, and numerous viral diseases such as dengue fever, yellow fever virus, and other mosquitoes borne diseases will be prevalent in the area, this result also corresponds with the findings of [6]. *Aedes* mosquitoes was the only species encountered in this study, this result is in agreement with the findings of [8] but contradicts with the results of [7] where they reported that *Anopheles* mosquitoes were the only species encountered in their study. A possible reason for their absence could be the absence of water holding containers for the female to lay eggs. American cockroach (*P. Americana*) another arthropod vector with most abundant species encountered during the course of this study. They are involved in the mechanical transmission of various pathogens, viruses, protozoa and helminthes [4]. They are proven carriers of the organisms causing diarrhea, dysentery, cholera, leprosy, plague, typhoid fever and viral diseases. They are known to feed on human faeces and transmit diseases such as amoebiasis caused by *Entamoeba histolytica* as well as Giardiasis through dissemination of cysts [8,9]. This study showed that residents living close to refuse dumpsites has a significantly higher risk of having the above-mentioned diseases due to the heavy infestation of these vectors in those areas.

Table 1. Arthropods species associated with the sampled refuse dumpsites

Order	Family	Genus	Species
Diptera	Muscidae	<i>Musca domestica</i>	<i>M.domestica</i> (housefly)
Diptera	Calliphoridae	<i>Lucilia sericata</i>	<i>L. sericata</i> (greenbottle fly)
Diptera	Culicidae	<i>Aedes spp</i>	<i>Aedes spp.</i> (mosquito)
Dictyoptera	Blattidae	<i>Periplaneta Americana</i>	<i>P. americana</i> (cockroach)
Polydesmida	Xystodesmidae	<i>Sigmoria triamculata</i>	<i>S. trimaculata</i> (millipede)
Polydesmida	Polydesmidae	<i>Polydesmus angustus</i>	<i>P. angustus</i> (millipede)
Hymenoptera	Formicidae	<i>Camponotus pennsylvanicus</i>	<i>C. pennsylvanicus</i> (black ant)
Hymenoptera	Formicidae	<i>Camponotus consobrinus</i>	<i>C. consobrinus</i> (sugar ant)
Hymenoptera	Formicidae	<i>Paratrechina longicornis</i>	<i>P. longicornis</i> (crazy ant)
Coleoptera	Elateridae	<i>Melanotus spp</i>	<i>Melanotus spp.</i> (beetles)
Hemiptera	Lygaeidae	<i>Lygaeus kalmii</i>	<i>L. kalmii</i> (milkweed bug)
Orthoptera	Acrididae	<i>Chorthippus biguttulus</i>	<i>C. biguttulus</i> (grasshopper)
Orthoptera	Acrididae	<i>Chorthippus albomarginatus</i>	<i>C.albomarginatus</i> (grasshopper)
Araneae	Selenopidae	<i>Selonops lindborgu</i>	<i>S. lindborgi</i> (spider)

Table 2. Showing the Number of Arthropods in each Sites and its Relative Abundance

Name of Species	Number of Arthropods					Relative Abundance
	Site A	Site B	Site C	Site D	Site E	
M.domestica	12	15	13	17	30	30.00
L. sericata	-	-	-	3	3	2.07
Aedes spp.	6	12	7	11	17	18.28
P. Americana	-	10	5	7	16	13.10
S. trimaculata	-	-	3	-	8	3.79
P. angustus	-	3	-	-	-	1.03
C. pennsylvanicus	5	6	5	6	8	10.34
C. consobrinus	4	7	2	6	5	8.28
P. longicornis	4	-	3	-	-	2.41
Melanotus spp.	-	3	2	6	-	3.79
L. kalmia	-	-	2	3	5	3.45
C. biguttulus	-	3	-	3	-	2.07
C.albomarginatus	-	-	-	-	1	0.34
S. lindborgi	-	-	3	-	-	1.03
TOTAL	31	59	45	62	93	

Table 3. Arthropods Diversity in the sampled refuse dumpsites

Sites Sampled	Shannon Weiner Diversity Index
Site A	1.47
Site B	1.92
Site C	1.54
Site D	1.87
Site E	1.92

5. CONCLUSION

Refuse dumps could be described as indiscriminate when such materials are disposed of at locations that are unlawful and where it could result in or trigger environmental or health hazards to people and animals alike [10]. These indiscriminate refuses are good contaminants of streams, groundwater especially shallow wells and the entire environment. The problem of improper refuse disposal in the world at large has become extremely large and a dangerous issue in the society. Its consequences cannot be over emphasized.

6. RECOMMENDATION

- i. There should be public enlightenment on the dangers of indiscriminate dumping of refuse to the general public. Environmental education should be introduced and taught at all levels of our educational system.
- ii. Dumpsites should be located at very far distance to where the inhabitants live. This will help to prevent environmental pollution, unpleasant odour oozing from the dumpsite coupled with the regular discharge of effluents into the atmosphere as a result of incineration activities operating on the dumpsites.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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