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Impact of human activities on the breeding of mosquitoes of human disease in Owerri metropolis, Imo state

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Abstract

This study x-rays the impact of human activities on the breeding of mosquitoes of human disease in Owerri metropolis, Imo State with a view to p[r]offering practical solutions, and ensuring overall reduction of the consequent nealth, social and economic implications of mosquito diseases in general and malaria in particular in Owerri metropolis. The study was a descriptive survey involving mosquito larval collection and identifications carried out at 3 different oreeding sites within Owerri metropolis. The breeding sites were surveyed in a deliberately non random fashion to maximize sensitivity of collections using standard procedures. The habitats were categorized into five groups according to the similarity of the habitats into gutters/drains, ground pools, used tyres, domestic containers and refuse dumps, The results showed that a total of 749 iiosquito larvae were harvested from the breeding sites belonging to 13 different mosquito species of Anopheles, Culex and Aedes genera. The contribution of human activities and increasing environmental modification to the breeding of human disease vector mosquitoes is of importance. It is recommended that selective vector control measures including larvidding as well as enlightening the populace on human environmental factors that contribute to breeding of mosquitoes of human disease as well as the various control measures.

Keywords: Human Activities, Breeding of Mosquitoes, Human Disease, Owerri Metropolis

Introduction

Mosquitoes constitute the most important single family of insects from the standpoint of human health. Mosquitoes are members of a family of *nematocerid flies:* the culicidae (from the *latin* culex, genitive culicis meaning midge or gnat). The word Mosquito is from Spanish and Portuguese for little fly. Superficially, mosquitoes resemble crane flies (family *Tipulidae)* and *chironomid flies* (family *Chironomidae),* and as a result casual observers seldom realize that there are important differences between their habits. In particular many species of female mosquitoes are blood sucking pests and dangerous vectors of diseases, whereas members of similar-looking *Chironomidae* and *'Tipulidae are* not. There are 41 genera of mosquitoes, containing approximately 3,500 species. Human malaria is transmitted only by females of the genus *Anopheles.* Of the approximately 430 *Anopheles* species, while

over 100 are known to be able to transmit malaria to humans only 30-40 commonly do so in nature. Mosquitoes in other genera can transmit different diseases, such as yellow fever and dengue for species in the genus *Aedes*. Since breeding and biting habit differ considerably between species, species identification is important for control programme.

Mosquitoes can act as vector for many diseases - causing viruses and parasites. Infected mosquitoes carry these organisms from person to person without exhibiting symptoms themselves. Mosquito-borne diseases include: -the viral diseases such as yellow fever, dengue fever and Chikungunya, transmitted mostly by the *Aedes aegypti;* -the parasitic disease such as malaria carried by the genus *Anopheles;* - lymphatic filariasis(the main cause of elephantiasis) which can be spread by a wide variety of mosquito species (World Malaria Report, 2010).

Malaria is a mosquito-borne infectious disease of humans and other animals caused by eukaryotic protists of the genus *Plasmodium.* The disease results from multiplication of *Plasmodium* parasites within red blood cells causing symptoms that typically include fever and headache, in severe cases progressing to coma or death. It is widespread in tropical and subtropical regions including much of sub-Saharan Africa, Asia and the Americas. Malaria is prevalent in these regions because of the significant amounts of rainfall and consistent high temperatures; warm, consistent temperatures and high humidity, along with stagnant waters in which their larvae mature, provide mosquitoes with the environment needed for continuous breeding (Prothero and Mansell, 1999). The cause of the diseases is a protozoan discovered in 1880 by Charles Louis Alphonse Laveran; while he was working in the Military Hospital in Constantine, Algeria, he observed the parasite in a blood smear taken from a patient who had just died of malaria (Nobel Foundation). The disease results from the multiplication of malaria parasites within red blood cells, causing symptoms that typically include fever and headache, in severe cases progressing to coma, and death. Five species of plasmodium can infect and be transmitted by humans. Severe disease is largely caused by *Plasmodium falciparum.* Malaria caused by *Plasmodium vivax, Plasmodium ovale* and *Plasmodium malariae* is generally a milder disease that is rarely fatal. A fifth species, *Plasmodium knowlesi*, is a zoonosis that causes malaria in macaques but can also infect humans (Fong *et al.*, 1971).

Malaria transmission can be reduced by preventing mosquito bites by distribution of *mosquito nets* and *insect repellants*, or by mosquito control measures such as spraying *insecticides* and draining standing water (where mosquitoes breed). The challenge of providing a widely available *vaccine* that provides a high level of protection for a sustained period is still to be met, although several are under development (Kilama and Ntoumi 2009). A number of medications are also available to prevent malaria in travelers to malaria-*endemic* Countries *(prophylaxis).*

A variety of *antimalaria medications* are available. Severe malaria is treated with intravenous or intramuscular quinine or, since the mid 2000s, the *artemisinin* derivative *artesunate* which is superior to *quinine* in both children and adults (Dondorp *et al.*, 2010). Resistance has developed to several antimalaria drugs, most notably *chloroquine (Wellems*, 2002).

There were an estimated 225 million cases of malaria worldwide in 2009 (WHO report 2010), killing around 781,000 people each year according to WHO report 2010, accounting for 2.23% of deaths worldwide. The majority of deaths are of young children in sub-Saharan Africa (WHO Report, 2010). Ninety percent of malaria-related deaths occur in sub-Saharan Africa. Malaria is commonly associated with poverty and a major hindrance to economic development.

Symptoms of malaria include fever, shivering, arthralgia (joint pain), vomiting, anemia (caused by *hemolysis)*, hemoglobinuria, retinal damage (Beare *et al.*, 2006) and convulsions.

Aim

The study was aimed at determining the impact of human activities on the breeding of mosquitoes of human disease as well as identifying different mosquito species thereby providing a baseline for the control of mosquitoes in Imo state and also to emphasize public awareness, prevention and monitoring methods of controlling malaria.

Methodology

Study area

The study was done in Imo State which derives its name from Imo River, which takes its course from the Okigwe/Awka upland.

Sample Selection

The breeding sites were surveyed in a deliberately non-random fashion to maximize sensitivity of collection using standard procedures (Bogh *et al*., 2003).

Study Design

This study is a descriptive survey involving mosquito larval collections and identifications at the medical parasitological and entomology laboratory, faculty of sciences Imo State University.

Results

Table 1 Habitat: Ground Pools

S/N	Species	Number	% Occurrence
1.	*An. gambiae*	143	50.00
2.	*An. punctipennis*	31	10.84
3.	*Ae. aegypti*	59	20.63
4.	*Ae. albopictus*	14	04.90
5.	*Cx. quinquefasciatus*	11	03.85
6.	*An. funestus*	25	08.74
7.	*Cx. Perfuscus*	03	01.05
Total		286	

Total (%) occurrence in the study = $\frac{286}{1} \times \frac{749}{749} \frac{100}{} = 38.18\%$

Table 2: Gutters/Drains

S/N	Species	Number	% Occurrence
1.	*An. punctipennis*	63	52.50
2.	*Ae. aegypti*	19	15.83
3.	*Cx. quinquefasciatus*	21	17.50
4.	*An. funestus*	08	6.67
5.	*Cx. Perfuscus*	09	7.50
	Total	120	100

% occurrence in the study = $\frac{120}{1} \times 749 \frac{100}{} = 16.02\%$

Table 3: Domestic Containers serving as flower vessels

S/N	Species	Number	% Occurrence !
1.	*An. gambiae*	83	57.24
2.	*Ae. taylori*	16	11.03
3.	*Ae. albopictus*	08	05.52
4.	*Ae. aegypti*	07	04.83
5.	*Ae. simpsoni*	10	06.90
6.	*Cx perfuscus*	15	10.34
7.	*Cx. quinquefasciatus*	06	04.14
	Total	145	100

Total of occurrences during the study

145 x 100 = 19.36%

749

Table 4: Used Tyres

S/N	**Species**	**Number**	**% Occurrence**
1.	***Ae, vittatus***	**10**	**28.57**
2.	***Ae. albopictus***	**08**	**22.86**
3.	***Ae. aegypti***	**04**	**11.43**
4.	***Cx.decens***	**06**	**17.14**
5.	***Ae. africannus***	**07**	**20.00**
	Total	**35**	**100**

% occurrence in the study = 35 x 100 = 749% 1

749

Table 5: Refuse Dumps

S/N	Species	Number	% Occurrence
1.	*An. gambiae*	69	42.33
2.	*An. funnestus*	37	22.70
3.	*Ae. aegypti*	23	14.11
4.	*Ae. simpsoni*	11	06.75
5.	*Cx. trigripes*	08	04.91
6.	*Cx. perfuscus*	06	03.68
7.	*Cx. Decens*	09	05.52
	Total	163	100

% occurrence in the study = 163 x 100 = 21.76%

749 1

Table 6: Monthly Rainfall Recorded During the Study

S/N	Month	Amount of Rainfall (mm)
1. 2. 3. 4. 5. 6.	March April May June July August	180.2 186.0 208.0 200.0 215.0 196.0
	Total	1,185.2

Average monthly rainfall=197.5mm.

Table 7: Genera Abundance According to the Study

S/N	Species	Number	% Occurrence
1. 2. 3.	*Anopheles Aedes Culex*	470 188 91	62.75 25.10 12.15
	Total	749	100

Table 8: Total Relative Abundances of Mosquito Genera at different months of the study (March to August 2011).

S/N	Species	March	April	May	June	Duly	Aug.	Total
1. 2. 3.	Anopheles Aedes Culex	40 10 05	56 19 21	68 39 10	97 47 34	92 50 19	117 23 02	470 188 91
	Total	55	96	117	178	162	141	749

Table 9: Total Larvae abundance according to different species during the study

S/N	Species	Number	%
1,	*An. gambiae*	358	47.80
2.	*An. funnestus*	62	08.28
3.	*An. punctipennis*	50	06.68
4.	*Ae. aegypti*	104	13.89
5.	*Ae. taylori*	16	02.14
6.	*Ae. albopitus*	30	04.01
7.	*Ae. vittatus*	10	01.34
8.	*Ae. simpsoni*	21	02.80
9.	*Ae. africannus*	07	00.93
10.	*Cx. quinquefasciatus*	26	03.47
11.	*Cx. trigripes*	18	02.40
12.	*Cx. perfuscus*	32	04.27
13.	*Cx. Decens*	15	2.00
	Total	749	100

Table 10: Monthly abundance of mosquitoes site at Amakohia encountered during at different breeding the study

S/N	Species	March	April	May	June	July	Aug.	Total	%
1.	*An. Gambiae*	14	19	23	22	21	27	126	46.67
2.	*An. Funnestus*	03	04	06	06	08	10	37	13.70
3.	*An. Punctipennis*	01	00	00	01	01	06	09	3.33
4.	*Ae. Aegypti*	02	03	08	08	12	11	44	16.30
5,	*Ae. Taylori*	02	00	01	03	05	00	11	4.07
6.	*Ae. Albopictus*	00	00	01	01	01	01	04	1.48
7.	*Ae. Vitattus*	00	01	03	00	00	00	04	1.48
8.	*Ae simpsoni*	00	00	03	04	00	00	07	2.82
9.	*Ae africannus*	00	00	00	01	00	00	01	0.37
10	*Cx. Quinquefasciatus*	00	03	00	05	01	00	09	3.33
11.	*Cx. Trigripes*	00	00	01	05	00	00	06	2.22
12.	*Cx, perfuscus*	00	00	01	04	01	00	06	2.22
13.	*Cx. Decens*	00	02	01	03	00	00	06	2.22
	Total for the month	22	32	48	63	50	55	270	

Table 11: Monthly relative abundance of mosquitoes larvae species encountered at different breeding sites at works layout during the study

S/N	Species	March	April	May	June	July	Aug.	Total	%
1.	*An. Gambiae*	10	13	17	23	25	31	119	46.12
2.	*An. Funnestus*	02	04	05	07	07	05	30	11.63
3.	*An. Punctipennis*	01	00	00	05	00	00	06	2.33
4.	*Ae. Aegypti*	00	03	06	19	11	05	34	13.18
5.	*Ae. Taylori*	02	00	01	05	05	00	11	4.26
6.	*Ae. Albopictus*	02	04	00	06	06	02	14	5.43
7.	*Ae. Vitattus*	00	01	01	01	00	00	03	1.16
8.	*Ae. Slmpsoni*	00	00	01	03	01	00	05	1.94
9.	*Ae. Africannus*	00	01	00	00	03	00	04	1.55
10	*Cx. Quinquefasciatus*	00	02	00	08	04	00	14	5.43
11.	*Cx. Trigripes*	01	02	00	04	00	01	08	3.10
12.	*Cx. perfuscus*	00	01	01	02	03	00	07	2.71
13.	*Cx. decens*	01	01	01	00	00	00	03	1.16
	Total for the month	19	32	33	65	65	44	258	100

Table 12: Monthly relative abundances of mosquito larvae species encountered at different breeding sites at World Bank Housing Estate, Owerri

S/N	Species	March	April	May	June	July	Aug.	Total	%
1.	*An. gambiae*	09	12	15	27	27	36	126	57.01
2.	*An, funnestus*	00	03	02	04	03	02	14	6.33
3.	*An. punctipennis*	00	01	00	03	00	00	04	1.81
4.	*Ae, aegypti*	02	00	07	07	01	03	20	9.05
5.	*Ae. taylori*	00	02	00	02	03	00	07	3.17
6.	*Ae. albopictus*	00	01	02	01	01	01	06	2.71
7.	*Ae. vitattus*	00	00	03	00	00	00	03	1.36
8.	*Ae. simpsoni*	00	00	03	04	01	00	08	3.61
9.	*Ae. africannus*	00	02	00	00	00	00	02	1.36
10	*Cx. quinquefasciatus*	01	03	00	00	04	00	08	0.90
11.	*Cx. trigripes*	01	02	00	00	06	00	09	4.07
12.	*Cx. perfuscus*	00	03	05	00	00	00	08	3.61
13.	*Cs. decens*	01	02	00	03	00	00	06	2.71
	Total for the month	14	31	37	51	46	42	221	100

Discussion

Mosquito species use different habitats as source of water for oviposition and breeding. These breeding sites are numerous in Owerri Metropolis due to varied human activities, poor economic conditions, low literacy levels, poor sanitation level and indiscriminate disposal of discarded household materials. The resultant effect is abundance of pools, ponds, puddles, water collections in tins, bowls, drums, clay pots and earthen ware containers of varying sizes used for domestic water collection due to failure of regular water supply system. Their various other domestic uses include those used as cooking pots, drinking pots, food and beverage fermentation bowls, etc. These poor behavioural attitudes and practices are also responsible for indiscriminate disposal of household wastes, abundant number of abandoned construction sites and domestic runoffs.

Thirteen different mosquito species were encountered in the sampling of different breeding sites durig the study, seven species were harvested in ground pools *(An. gambiae, An. punctipennis, An. funnestus, Ae. aegypti, Ae.albopictus and Cx. Quinquefaciatus,Cx. Perfusus),* five species were gotten from gutters/drains *(An.gambiae, An, punctipennis, Ae. aegypti, Cx. perfuscus and Cx.quinquefasciatus},* Seven from domestic containers *(An.gambiae, Ae. taylori, Ae. albopictus, Ae.aegypti, Ae.simpsoni, Cx. perfuscus and Cx. quinquefasciatus).* Five species from used tyres *(An. vittatus, Ae.albopictus, Ae. aegypti, Ae. africannus, Cx. Decens),* seven species were gotten from refuse dumps *(An. gambiae, An. funnestus, Ae. aegypti, Ae. simpsoni, Cx. trigripes, Cx.perfuscus and Cx.decens). An. gambiae* is a potential vector of yellow fever, arboviruses in general and as well as the most important vector of malaria in the study area. *An. funnestus* is also a malaria vector in the study area. This species has been reported as the major malaria vector in the guinea savannah of northern Nigeria. All three Anopheles species encountered in the study are potential vectors of malaria, the most endemic parasitic disease in Owerri.

The contribution of ground pools (puddles) were well documented (Nwoke et al., 1993). In this study also *An. gambiae* and *An. funnestus* were found in large numbers due to indiscriminate human activities.

High relative humidity as observed in the study reduces harsh environmental temperature thereby encouraging mosquito breeding.Since mosquitoes can cause disease and discomfort. It is best to reduce their numbers. The best control method is to source reduction which is removing the mosquitoes breeding sites (Kramer, 1996).

The presence of three genera of mosquitoes; Anopheles, Culex and Aedes were observed in this present study. Similar findings have been reported in previous studies on mosquito fauna in Nigeria (Okorie, 1973; Aigbodion and Odiachi, 2003). The breeding of mosquitoes was observed virtually in all habitats sampled. "Ground pools, gutters, domestic containers and tyres constituted the most important breeding sites for mosquitoes. Amakohia produced the highest number of mosquito larva.

Aedes aegypti breed in all the breeding sites. There indiscriminate breeding habit has long been reported by Okorie (1973), Mafiana *et* al. (1998) and Adeleke (2003). The high occurrence of the *Ae.albopictus* in discarded tyres could probably be due to its adaptable life to this habitat. The widespread of *Ae.albopictus* in Nigeria has been receiving attentions since early 1990s when its presence was first ob- served in some rural areas in Delta State. *Ae.albopictus* is a native of South-Asia countries where it has been known as efficient vector of yellow fever and dengue. The vector was imported to Nigeria through second hand tyres (Mbanugo & Okpalonunuju, 2003). As a result, the preponderance of *Ae.albopictus* is being speculated to be occurring in cities where tyre business booms or where improper management, high relative humidity account for mosquito breeding throughout the year in the study area. Availability of water collections with suitable fauna, flora and physicochemical composition is a limiting factor to mosquito oviposition and breeding.

Conclusion

In conclusion, this study has provided information on impact of human activities on the breeding of mosquitoes via the larval habitats in Owerri Metropolis as well as the mosquito species in Owerri. Since most of the species encountered are potential vectors of one mosquito borne disease or the other of which their high prevalence has been reported in the city or its neighbouring town. It is recommended that the residents of Owerri be enlightened on the environmental factors that contribute to mosquito breeding.

Increased human activities have major implications for malaria epidemiology both in terms of vector population and host vector contact leading to high frequency and dynamics of malaria transmission. Rapid urbanization with its consequent population explosion and increase in the number of slums in Owerri has brought about considerable changes in environmental conditions thereby creating more vector breeding sites. These changes had exerted its tolls on human health most especially on the area of malaria control.

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