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RESEARCH ARTICLE

Prevalence of Yellow Fever Vectors in the Forested area of Bekwarra, Southern Nigeria

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Abstract

The prevalence of yellow fever vectors in the forested area of Bekwarra, Southern Nigeria was carried out from Sep 2013 to Nov 2013. A total of 372 larval species were collected from temporary water habitat in Ukparibu village, Bekwarra, Southern Nigeria. Out of the 372 larval species collected, 332(88.70%) were *Aedes* sp. and 42(11.29%) were *Culex* sp. while the adult mosquito species collected from various locations, in Ukparibu village of Bekwarra, 233(54.95%) were *Aedes* sp., 10(2.36%) were *Culex* sp. and 172(40.33%) were *Anopheles* sp. These mosquitoes are vectors of different parasites responsible for diseases in humans and animals. Species of *Anopheles* observed are important vectors of malaria parasite *Plasmodium* sp. Species of *Aedes* observed are important vector of yellow fever virus. Other side of the Africa, species of *Aedes* is responsible for dengue fever. Other species observed was *Culex* which is also a disease vector of encephalitis, except *Culex titrips* which is not important in disease transmission. The distribution of these mosquitoes and the species is affected by temperature fluctuation and availability of breeding site and host.

Keywords: Prevalence, yellow fever, Bekwarra, *Anopheles, Aedes, Culex*, disease transmission.

Introduction

Malaria remains an important public health parasitic disease in both tropical and subtropical countries in Africa where, it is mostly seasonal with its major incidence occurring in the rainy season (Oesterholt *et al*., 2006). Despite decades of control efforts, malaria continues to be a major public health concern throughout the world. It is estimated that there are 300-500 million new cases every year, with 1.5 to 2.7 million deaths worldwide particularly in Africa (WHO, 1992) where about 90% of the global cases are recorded (Breman *et al.*, 2004). Children under five years and pregnant women are affected most (WHO, 2008). In Nigeria, the risk of malaria infection exists throughout the country. Malaria is endemic and stable, being a major cause of morbidity and mortality, resulting in 25% infant and 30% childhood mortality (FMH, 2005a). More than 90% of the total population is at risk of malaria and at least 50% of the population suffers from at least one episode of malaria each year. Beyond the impact on children and pregnant women, it affects the general population (RBM, 2005; FHM, 2005b). The disease is the commonest cause of outpatient attendance across all age groups with about 66% of clinic attendance due to malaria (FMH, 2000) and thus, constituting a great burden on the already depressed economy. The enormous loss of life, days of labour, absenteeism in schools and cost of treatment of patients brought on by malaria make it a major social and economic burden in Nigeria.

Malaria parasites, *Plasmodium* sp. are generally transmitted by female *Anopheles* mosquitoes. The prevalence, intensity and regularity of malaria differ from location to location depending on factors such as rainfall patterns and proximity of human dwelling places to vector breeding sites among others (Onyido *et al.,* 2009a). *Anopheles gambiae*, the principal transmitter of malaria in Nigeria is closely associated with sunlit water collections close to human dwellings while *A. funestus,* another important malaria vector tends to breed more in cool, clear, shaded, permanent water bodies in rural areas relatively undisturbed by man (Onyido *et al.,* 2009b). Yellow fever occurs only in Africa and South America, sporadic infection occurs almost exclusively in forestry and agricultural workers due to occupational exposure in or near forest (Okon and Asor, 2003). Several studies on the pattern of yellow fever in Nigeria have been carried out but these were mostly concentrated in urban and sub-urban communities than in rural communities (Aribodor *et al.,* 2003). This study is intended to extend and intensify research on yellow fever among rural dwellers that are mostly at risk. Specifically the study is carried out in the rural community of Ukparibu village in Bekwarra Local Government Area of Cross River State. The objective of this study is to determine prevalence of yellow fever vectors in the forested area Ukparibu village, Bekwarra local Government Area.

Table 1. Summary of larval species collected from temporal water habitat in various locations of Ukparibu village, Bekwarra during the study period (Sep 2013 to Nov 2013).

Habitat	Locations							
	Tree holes around forest edge		Abandoned pot around home		Rock pool within forest area		Total	%
Months	Sep 2013		Oct 2013		Nov 2013			
Period of sampling of larval species	1st week	2nd week	1st week	2nd week	1st week	2nd week		
Aedes aegypti	60	30	90	17	-	-	197	52.95
Culex sp.	20	12	5	5	-	-	42	11.24
Aedes simpsoni	-	-	-	-	100	33	133	35.75
Total	90	42	90	17	100	33	372	100

Table 2. Prevalence of adult mosquito species in various locations of Ukparibu village, Bekwarra during the study period (Sep 2013 to Nov 2013).

Habitat	Locations							
	Tree holes around forest edge		Abandoned pot around home		Rock pool within forest area		Total	%
Months	Sep 2013		Oct 2013		Nov 2013			
Period of sampling of larval species	1st week	2nd week	1st week	2nd week	1st week	2nd week		
Aedes aegypti	-	-	-	-	30	80	110	25.94
Culex sp.	-	-	4	2	2	2	10	2.36
Aedes simpsoni	33	100	-	-	-	-	133	31.37
Anopheles sp.	-	-	30	40	53	28	171	40.33
Total	33	100	54	42	85	110	424	100

Materials and methods

Description of study area: This study was carried out in Ukparibu village of Bekwarra located in the northern Cross River State, Nigeria with the longitude of $6^0$41''38N, 8^0 58''3E and latitude $6^0$69''89N, $8^0$96''50E. It has an area of 306 km^2 and a population of 105,822 at the 2006 census.

Collection of mosquito larvae: The larval sampling of all accessible breeding sites was carried out in Ukparibu village, Bekwarra, bi-weekly between 7.00 am to 11.00 am for three months (Sep 2013 to Nov 2013). The breeding sites were grouped into five; tree hole around forest edge, abandoned pot around home and rock pool within the forested area. The mosquito larvae were collected with plastic scoopers and sieves of about 0.55 mm mesh-size into labeled containers and transferred to the laboratory for analysis.

Larval identification: All larvae collected were identified with the aid of dissecting microscope using the keys described by Gillett (1972). Some larvae were allowed to emerge into adult inside mosquito cage and identified using the keys described by Gillett (1972).

Experimental procedure: Adult mosquitoes within human home were killed using sheltox insecticides. This was done during the day and repeated at night. All mosquitoes found on the ground were carefully picked with the aid of forceps into specimen bottles containing 70% ethanol for preservation.

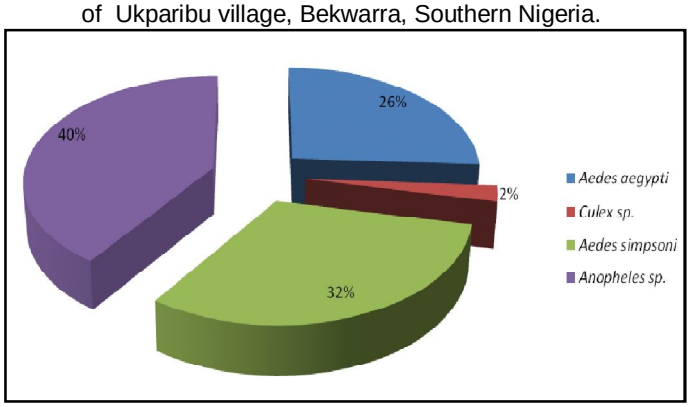
All the mosquitoes caught from all the locations were put in their individual specimen bottle and marked by its respective site code.

Data analysis: The data generated from this study were subjected to factorial experiment, using the randomized completely blocked design (RCBD) to evaluate whether or not there were associations between the prevalence of yellow vectors and the subjects' variables. GenStat computer software (Version 4 Edition) was used for this analysis. Confidence level was set at $P<0.05$.

Results

Summary of the larval species collected from temporal water habitat and various adult mosquito vectors encountered at the different sampling locations is presented in Table 1 and 2 while the illustration in Fig. 1 shows the prevalence of adult mosquito speceis in Ukparibu village, Bekwarra, Southern Nigeria. A total of 372 larval species were caught in temporary water habitat in Ukparibu village, Bekwarra, Southern Nigeria. *Aedes* sp. accounted for the highest prevalence (88.79%) followed by *Culex* sp. accounted for the lowest prevalence (11.29%) by number. A total of 424 adult mosquito species was also caught in the various locations in Ukparibu village. *Aedes* sp. accounted for the highest prevalence (54.95%) followed by *Anopheles* sp. and *Culex* sp. accounted for 2.36%. The species of mosquito caught in these areas were the same in larval species, except *Anopheles* sp., this was identified in adult species but was not found in larval species.

Fig. 1. Prevalence of yellow fever vectors in the forested area of Ukparibu village, Bekwarra, Southern Nigeria.



There was a significant difference between the number of larval and adult species ($P<0.05$) caught during the study.

Discussion

From this study, it was observed that 330(88.70%) and 42(11.29%) larval species were caught from temporary water habitating Ukparibu village in Bekwarra, southern Nigeria. In the temporary water habitat, out of 330(88.71%) larvae caught, 197(52.96%) were found to be *Aedes aegypti*, while 133(35.75%) were *A. simpsoni* and 42(11.27%) was *Culex* sp. The number of *Culex* larvae species was scanty compared to the numbers of *Aedes* seen. The larvae species found in temporary water habitat are domestic species, that breed in or near houses. The two species are important vectors of yellow fever and *Wuchereria brancrofti*, a filarial responsible for lymphatic filariasis. In the second experiment, larval sample were not collected and identified as in experiment one rather adult mosquito species were caught from various locations. In this experiment, it was observed that the adult mosquito species caught were the same species found in larval species of experiment one except *Anopheles* which was not found in larvae sample. Total of 424 adult species were observed, 110(25.94%) were *Aedes aegypti*, 133(31.37%) were *A. simpsoni*, 10(2.36%) were *Culex* sp. and 171(40.33%) were *Anopheles* sp. This study confirms the presence of *Culex* and *Anopheles* species are capable of transmitting malaria around Ukparibu village, Bekwarra. The predominance of the most efficient vector of malaria in this study is consistent with available data (Alaribe *et al*, 2003; Okwa *et al*, 2007). It was also observed that *Anopheles* sp. which is the main vector of malaria parasite was more populated in living home and its surrounding, where by the female anopheles were gravid and saturated with blood meal in the morning, after night bite. In the aspect temperature fluctuation in Ukparibu village in Bekwarra, the catching increased when the temperature was normal. Ukpariku also have streams and swamps which serve as good breeding sites for mosquitoes.

Studying the effect of temperature on the prevalence of the different species caught, it was observed that at a certain temperature, larval species did not survive at temperature above 44°C and adult species were scanty in their various location, when temperature was below 7°C, this was in accordance with Lardeux and Cheffort (1997) who reported that adult are killed by temperature below freezing point and did not survive well at temperature below 5°C. The relationship between the total number of larvae species and the total number of adult caught was significant during the study period. The high prevalence of *Aedes* species observed in Ukparibu village, suggest possible transmission of yellow fever and a high prevalence of *Anopheles* sp. was also observed.

Conclusion

High number of *Aedes* and *Anopheles* mosquitoes caught indicate the prevalence of this important vector of yellow fever, lymphatic filariasis and malaria in these areas. Presently, there are surveys on prevalence of yellow fever, lymphatic filariasis and malaria in Cross River State Southern Nigeria, this research can be accepted as a rapid assessment of these diseases in this area for determining its public health importance and subsequent planning of control programme.

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