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Original Research Article

Distribution of Outdoors Mosquito Genera in Six Communities in Ekiti State, Nigeria

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Abstract

Many of mosquito genera are exophagic that bite humans outdoors. Most community members in Nigeria are in the habit of staying outdoors at dusk for relaxation which can expose them to mosquito bites. This necessitated the design of this study with the objectives to examine the distribution of exophagic mosquito genera in six communities in Ekiti State, Nigeria. The communities were selected through a multistage sampling method. Adult mosquitoes were collected outdoors from the six communities by using miniature Centre for Disease Control light traps for twelve months. The collected mosquitoes were sorted into sexes and genera. Data were analyzed by descriptive statistics and chi-square using SPSS. Five hundred and five (505) adult mosquitoes were collected outdoors in the six study communities, females (96.6%) and males (3.4%). Mosquito genera collected were *Culex* (90.5%), *Anopheles* (5.3%) and *Aedes* (4.2%). *Culex* and *Aedes* Population peaked in October but *Anopheles* population peaked in July. Availability of mosquito vectors at dusk in these study communities is an indication that the community members could be at risk of mosquito borne diseases.

Keywords: Mosquito, Ekiti, outdoors, mosquito vectors, periurban, rural, culex, aedes, anopheles.

INTRODUCTION

Mosquitoes are biting insects of the order Nematocera with about three and half thousand species [1]. They are vectors of many disease causing agents such as viruses, protozoans and filariae [2]. Three major genera that are of medical importance namely, *Culex*, *Anopheles* and *Aedes* are widely distributed in the world [2]. The genus *Aedes* contains several species that transmit arboviruses, including yellow fever, dengue, chikungunya, Rift Valley fever and Zika viruses. The genus *Culex* has various species that transmit microfilaria (*Wuchereria bancrofti*) and flaviviruses while various species of *Anopheles* transmit malaria parasites (*Plasmodium*), *W. bancrofti* and arboviruses [2]. Many of these mosquito genera are exophagic that bite humans outdoors [2, 3].

Community people in Nigeria are in the habit of staying outdoors at dusk for relaxation and this habit exposes them to mosquito bites. In a study conducted in six communities in Ekiti State, majority of the community members were said to be staying outdoors at dusk for relaxation before going to bed (Olorunniyi and Idowu, not yet published). The implication of this is that many of these people could be bitten by mosquitoes thereby putting them at the risk of contacting mosquito borne diseases. This necessitated the design of this study with the objectives to examine the distribution of the exophagic mosquito genera in these six communities. The design of this study was to expand the initial work that had been carried out in these six communities on the mosquito avoidance practice (Olorunniyi and Idowu, not yet published). The study areas consisted of periurban and rural communities. Ekiti State is one of the 36 states in Nigeria and it is located in Southwest Nigeria.

MATERIALS AND METHODS

Selection of Study Communities

Six communities were selected through a multistage sampling method [4]. Stage 1 was the selection of all the three senatorial districts in Ekiti State. Senatorial district is a geopolitical division that exists in every state of Nigeria. Each state has three Senatorial Districts and within each of the senatorial district are local government areas (LGAs). Stage 2 was selection of one local government area (LGA) from each of the senatorial district by lottery. Stage 3 involved purposefully selection of one peri-urban

community and one rural community from each of the selected LGA. The criteria for categorizing the communities into peri-urban and rural were based on the characteristics highlighted by Ayorinde [5] and Agbodike [6]. The selected communities were Iye, Iyin, Agbado (periurban) Ewu, Eyio and Ilupeju-Ijan (rural). The geographic location of the communities within Ekiti State is shown in Figure-1.

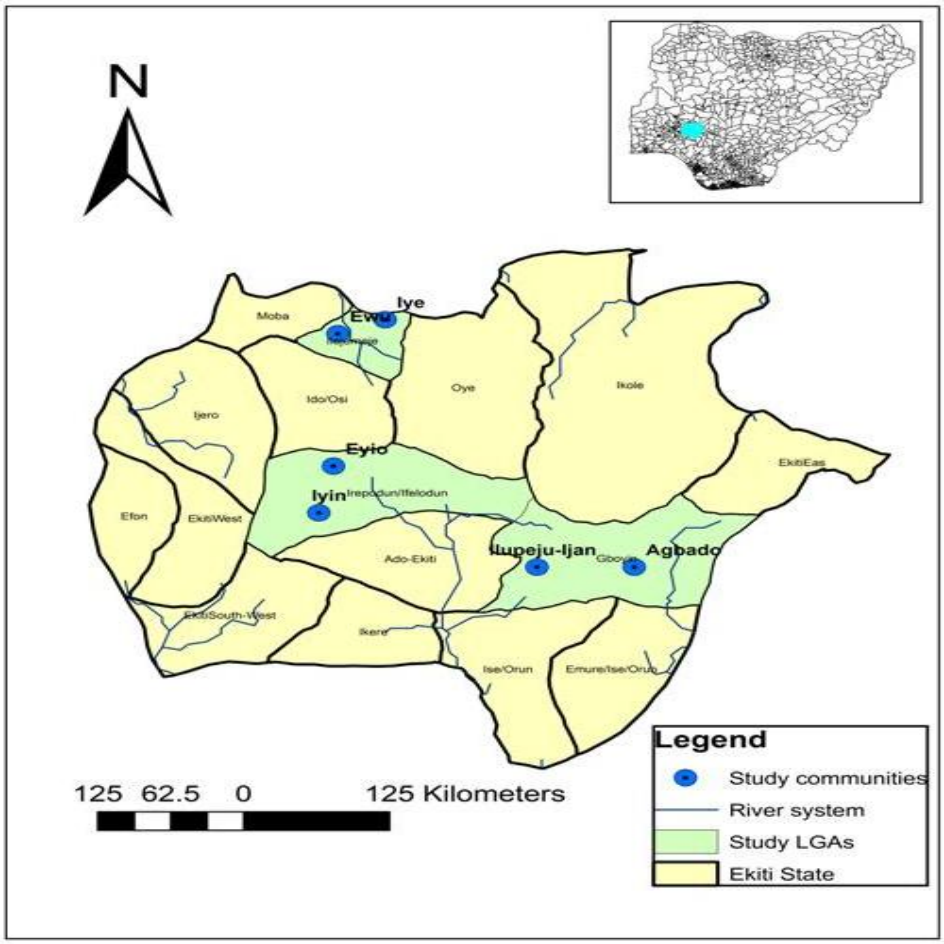


Fig-1: Map of Ekiti State of Nigeria showing the study communities

Collection of mosquitoes in the study communities

Adult mosquitoes were collected for twelve months from these study communities from July 2017 to June 2018. In each of the communities, collection of mosquitoes was done two consecutive days for each month. In order to have a widely distributed collection of mosquitoes in each community the households within the area were divided into sections to generate sampling frames for the random selection of houses representative of the area. A house was selected in each section of the divisions. Mosquitoes were collected from the selected houses using miniature Centre for Disease Control [CDC] light traps [Model 512; John W. Hock Company, Gainesville, FL, USA]. The miniature CDC light traps were positioned next to a person lying on a bench or sitting down in a resting chair under a net in front of the selected houses at each site. Traps were set at 6:00 PM and removed at 9:00 PM which was the usual time the people in the communities used to stay outdoors for relaxation. The captured mosquitoes were sorted into sexes and genera using morphological keys [7].

Data Analysis

Data were analyzed with SPSS version 20. Statistics involved were descriptive and chi-square. A probability value [p-value] of $P < 0.05$ was regarded as significant for inferential statistics.

RESULTS AND DISCUSSION

Population of Mosquitoes Collected in the Study Communities

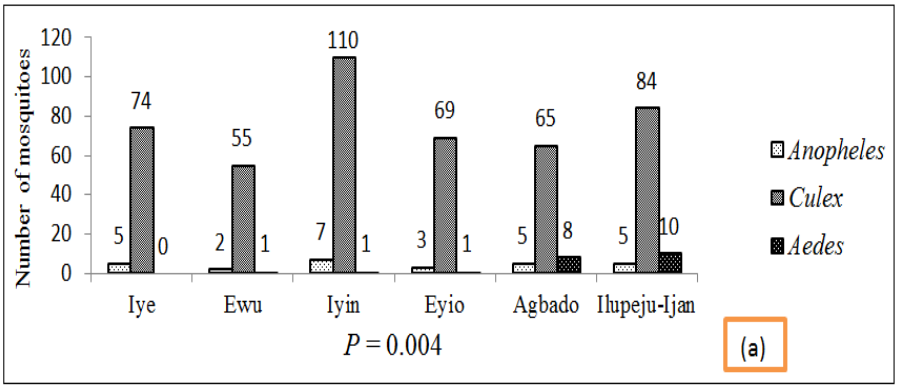
A total number of five hundred and five (505) adult mosquitoes were collected outdoors in the six study communities for twelve months (Table-1). The females were 96.6% while the males were 3.4%. The higher population recorded in females when compared to the males was due to the nature of the sites where the mosquitoes were collected. The mosquitoes were collected around houses where human beings dwell and female mosquitoes are usually found in such places due to their anthropohilic nature. They search for human blood to nurture their oviposition [8]. Male mosquitoes suck plant juice and therefore may not be found around the human dwelling areas. Mosquito genera collected

were *Culex* (90.5%), *Anopheles* (5.3%) and *Aedes* (4.2%). Figure-2 shows the population of mosquito genera collected in the respective communities and also when such communities were grouped into two community types (i.e. periurban and rural). The most abundant population of *Culex* mosquitoes recorded in this study conformed to the result obtained on the study of species composition and distribution of mosquito populations in Ibadan, Nigeria [9]. But the result was contrary to the findings of Amaechi *et al.*, [10] where *Anopheles* mosquitoes were reported to have a higher population density than *Culex*. However, the low population of *Aedes* mosquitoes in this study agrees with their findings. The abundance of *Culex* in this study is most likely due to the biology of the insect. While *Culex* can breed in all types of water collections including temporary or permanent stagnant water bodies such as drains, septic tanks, wet pit latrines, organically polluted sites and puddles [11], *Anopheles* mosquitoes on the other hand breed most often in a natural environment containing clean water which majorly depends on rainfall [12]. This must be the reason why *Anopheles* population increased during the time of high rainfall which was between June and September and the population peaked at July whereas the population of *Culex* and *Aedes* peaked at October (Figure-3). Larvae of *Anopheles* prefer clear, fresh seepage water in sunlight or partially shaded pools [13]. However, some larvae of *Anopheles gambiae* s.l. have been reported to be found in organically polluted water containing human faeces, oil from refinery and sewage pond indicating that *Anopheles* may as well breed in such habitat [14]. Kitching [15] gave some of the breeding sites of mosquitoes. Also, the physico-chemical parameters where mosquito larvae can develop and survive in Nigeria have been given [16, 17]. The low population of *Aedes* (4.2%) in this study could not have been unconnected with the time of collection of these mosquitoes and the nature of the communities. Most *Aedes* mosquitoes are active and bite during the daytime hours and they are mostly found in urban areas [18] whereas the collection of mosquitoes in this study was done at dusk in the periurban and rural areas. There was a significant difference (P=0.004) in the population of the mosquito genera collected across the six study communities (Figure-2a). Although the population of mosquitoes collected was higher in peri-urban than the rural communities but no significant difference (P=0.435) existed in the population of the mosquitoes in the two community types (Figure-2b). The higher in population of mosquitoes recorded in the periurban than the rural communities could be linked with the environmental conditions of the two community types. While most urban and periurban communities in Nigeria are known to have poor drainage system [19] that are capable of providing breeding places for mosquitoes, most rural communities usually lack water drainage system. Generally, mosquito population is usually higher during raining season than dry season in Nigeria [20, 21] which is due to the availability of abundant breeding places. This must be the reason why higher population of mosquitoes was collected during raining season between May to October than during the dry season between November and April in this study (Figure-3). The distribution of the mosquito genera collected across the twelve months in the study communities showed a significant difference (P=0.001).

Table-1: Mosquito genera collected outdoors in the study communities

Mosquito genera	Male	Female	Number collected
Culex	13 (2.8 %)* (76.5 %)**	444 (97.2 %)* (91.0 %)**	457 (90.5 %)**
Anopheles	4 (14.8 %)* (23.5 %)**	23 (85.2 %)* (4.7 %)**	27 (5.3 %)**
Aedes	0 (0.0 %)* (0.0 %)**	21 (100 %)* (4.3 %)**	21 (4.2 %)**
Total	**17 (3.4 %)**	**488 (96.6 %)**	**505**

* = % across the row, ** = % down the column



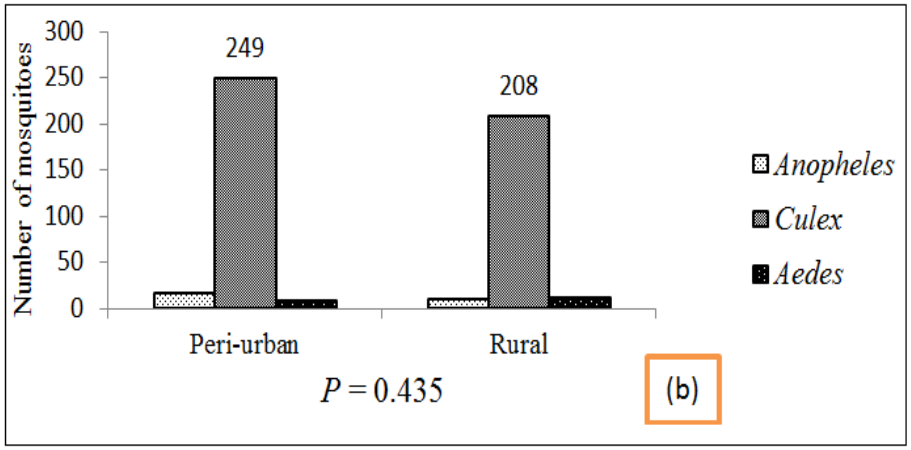


Fig-2: Abundance of mosquito genera collected outdoors (a) Chart showing the six communities (b) Chart showing community types

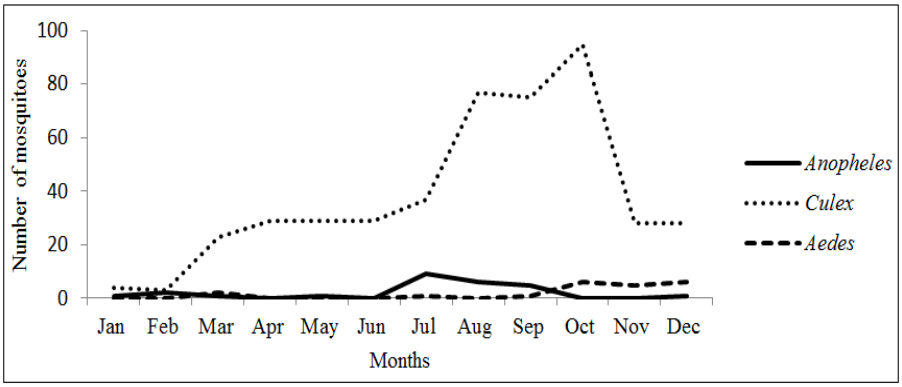


Fig-3: Monthly Distribution of mosquito genera collected in the study communities (*P*=0.001)

CONCLUSION

The collection of the adult mosquitoes in this study suggests that the environmental conditions of these communities support the continual breeding and survival of the mosquitoes especially *Culex* mosquitoes. The availability of these mosquito vectors at dusk when people of these communities may stay outdoors is an indication that the people in these communities may be at risk of mosquito borne diseases.

Ethical Approval

Ethical approval (EKSUTH/A67/07/002) was obtained from Ethics and Research Committee, Ekiti State University Teaching Hospital, Ado-Ekiti, Ekiti State, Nigeria.

Conflict of interest: The author declares no conflict of interest.

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