

Entomological Survey of Indoor Mosquitoes in Three Male Hostels at Nasarawa State University Main Campus, Keffi, Nigeria

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ABSTRACT

An entomological survey of indoor mosquitoes was carried out to determine the abundance and distribution at Nasarawa State University, Keffi Male hostels between May to August 2024. A total of 270 mosquitoes comprising *Anopheles* sp 160(59.3%) and *Culex* sp 110 (40.7%) were collected using PSC and CDC- LTs techniques. Out of the overall mosquitoes recorded, 77(28.5%) were males with females having 193(71.5%). Each collection was done at the interval of two weeks from 6:00pm to 6:00am. Identification of mosquito was done with the aid of magnifying lens using pictorial key based on morphological features. The results of the study revealed that New hostel has the highest abundance 101(37.4%) followed by the Main hostel 86(31.9%), while Mande had the least number 83(30.7%). The abundance of mosquitoes may be due to the prevailing weather conditions during the time of collection and the bush surroundings of the hostels favour their breeding. Chi-square (χ^2) analysis indicate significant association ($P < 0.05$) in the overall abundance and distribution of mosquitoes. Therefore, the findings of this study will be useful for the University's Medical Centre to develop effective strategies for elimination of mosquitoes and malaria on the campus.

Keywords: Entomological survey, indoor mosquitoes, malaria, abundance, male hostels

1.0 INTRODUCTION

The university environment relatively free of mosquito vectors will go a long way in improving the well-being of students, staff and the generality of university communities for effective learning and community service. High density of mosquitoes on the university campus will expose students to high risk of human-vectors interactions that may result in malaria transmission and other mosquito-borne diseases which will subsequently lead to poor student's performance (Chandra *et al.*, 2023).

Mosquitoes are medically important insects (Kittichai *et al.*, 2023) widely distributed in almost all types of habitats (Becker *et al.*, 2020; González *et al.*, 2021; Avramov *et al.*, 2024; Singh *et al.*, 2024). They transmit various diseases such as malaria, yellow fever, filariases, dengue which remains the most global important health challenges, affecting mostly people in developing countries, particularly in sub-Saharan Africa (WHO 2015; Okoro *et al.*, 2023). An entomological monitoring and surveillance, as well as research, intervention efforts and drug administration recorded limited success (Hemingway *et al.*, 2024). WHO (2015) reported that more than 840 million people are at risk of malaria infection, with most of them living in Africa where it is the most leading cause of mortality. The disease kills people more than any other communicable disease except

tuberculosis with the global prevalence of approximately 219 million mostly occurred in developing countries, resulting in the death of estimated 435,000 people of which 266,000 were infants (WHO, 2017). The most common mosquito genera responsible for such diseases include *Aedes*, *Anopheles*, *Culex* and *Mansonia* (Bamou *et al.*, 2021; Wilkerson *et al.*, 2021) mostly found around human settlements which causes morbidity, mortality and socio-economic loss (Patricia *et al.*, 2014; Mudi *et al.*, 2024; Joseph *et al.*, 2024).

The most common risk factors responsible for causing an alarming increase and expanding the abundance and distribution of mosquitoes that carry malaria, yellow fever, and dengue fever include deforestation, industrialized farming and climate change there by putting millions of people at risk (Patel *et al.*, 2012, WHO, 2017; Wu *et al.*, 2023; Aliaga-Samanez *et al.*, 2024; Lehmann *et al.*, 2024; Lowe *et al.*, 2024). Although, there has been a remarkable increase in funding for malaria control, disease reduction targets set by the Roll Back Malaria and National Malaria Control Programs still remain unachieved in many countries due to lack of adequate data on local disease eco-epidemiology required to inform program implementation and management strategies.

To achieve effective malaria control programs, an entomological study, monitoring disease vectors as well as interactions of the vectors – pathogens- human hosts and the environment will help to understand and gather data on transmission dynamics for possible control and elimination of malaria (Patricia *et al.*, 2014; Savi, 2022; Cuenca *et al.*, 2023; Wu *et al.*, 2024). An entomological transmission index used to determine indoor resting density (IRD) of female mosquitoes collected by PSC method per room per night is calculated as Indoor Resting Density (IRD) = (number of females mosquitoes ÷ number of houses) ÷ number of nights (Williams and Pinto, 2012; Hien *et al.*, 2020; Nebbak *et al.*, 2022; Sarkar *et al.*, 2024). The aim of this study is to conduct an entomological survey of indoor mosquitoes in students' male hostels of Nasarawa State University main campus, Keffi, Nigeria.

2.0 METHODS

2.1 Study Area

This study was carried out at the Male hostels of Nasarawa State University Main Campus, Keffi, Nigeria during the rainy season (May to August, 2024) corresponding to high vector density and high malaria transmission period. Keffi is a town located between latitude 8°50'N and longitude 7°52'E and about 50km² from the Federal Capital Territory (FCT) Abuja. The area has marked dry and rainy seasons. The dry season starts from November to February while rainy season starts from March to October. The male student hostels were selected for this research because of the frequent complaint of high density of mosquitoes and malaria transmission by the students.

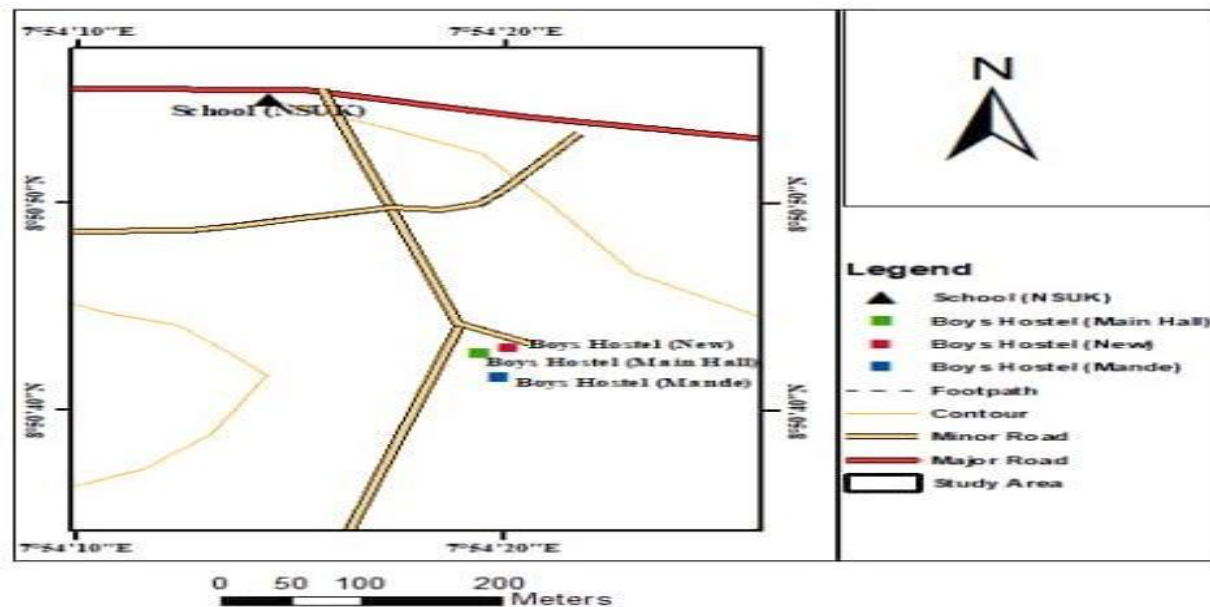


Fig. 1: Map showing the study area

2.2 Collection of mosquitoes

Indoor resting adult mosquitoes were collected from the Male hostels usually between the hour of 6:00pm to 6:00am daily using PSC and CDC-LTs techniques (Anosike *et al.*, 2015). A total of 30 rooms were sampled during the study and students were informed prior to collection.

2.2.1 Pyrethrum Spray Catches (PSC)

A white sheet material (3m × 3m) was spread on the floor of the selected rooms and ensure that foodstuffs were removed from the rooms with all doors and windows environment closed. The rooms were sprayed with Pyrethrum (Bygone) in a clockwise direction towards the ceiling of each room for the fine mist to cover the whole

room. All catches were done indoors between 6.00pm to 5:00am weekly. Knocked down mosquitoes were collected after 15minutes by means of a pair of forceps and placed into labeled Petri-dishes and brought to Entomology and Insectary Laboratory, Nasarawa State University, Keffi and stored for further study.

2.2.2 CDC Light Traps

The CDC trap utilizes light bulb as the sole attractant. Sampling host seeking mosquitoes was done by fixing the traps in the sample rooms at the foot end of the bed with the light source positioned at approximately 70 cm from the ground (Mboera, 2005). Collections were done between 6:00 to 6:00hr. The traps were fixed only in bedrooms where a student sleeps under poorly protected

untreated bed nets. The traps were removed the next morning by tying the collection cup and then disconnecting a 6-volt battery to avoid trapped mosquitoes from escaping. The live trapped mosquitoes were transferred into labeled paper cups and brought to the Entomology and Insectary Laboratory for analysis.

2.2.3 Identification of mosquitoes

The collected adult mosquitoes were sorted and counted at the Entomology and Insectary Laboratory, Nasarawa State University, Keffi. The specimens were identified by species and gender with the aid of magnifying hand lens (Anosike *et al.*, 2015). The identified adult mosquitoes were recorded accordingly.

2.2.4 Data Analysis

Data collected were subjected to descriptive statistics using Microsoft Excel for Window 11. Chi-square (χ^2) test was applied to determine the association between mosquito abundance and sex at 0.05 probability level.

3.0 RESULTS

A total of two hundred and seventy (270) adult mosquitoes were caught using PSC and CDC. Anopheles and Culex mosquito genera represented 67.4% and 32.6% of the total catch (Table 1). The highest number of mosquitoes were recorded in the New hostel 101(37.4%) followed by the Main hostel 86(31.9%), while Mande had the lowest number of mosquitoes 83(30.7%). Therefore, abundance of mosquitoes between the two groups show high significant association ($p < 0.05$).

Table 1. Abundance of Mosquitoes base on Collection Methods at Nsuk Male hostels (May-August, 2024)

Study sites	No. of Room	Collection Method		Total
		PSC	CDC	
Mande hostel	10	52(19.3%)	31(11.5%)	83(30.7%)
Main hostel	10	60(22.2%)	26(9.6%)	86(31.9%)
New hostel	10	70(25.9%)	31(11.5%)	10(37.4%)
Total	30	182(67.4%)	88(32.6%)	179(100)

$\chi^2 = p < 0.05$

Table 2 shows the number of mosquitoes collected with respect to sex. The results showed that New hostel has the highest number of male 30 (11.1%) and female 71(26.3%) mosquitoes. While Mande had the lowest male 23(8.5%) and female 60(22.2%) mosquitoes respectively which indicate significant association at $p < 0.05$.

Table 2. Indoor Mosquitoes Collected base on Sex at Nsuk Male hostels (May- August 2024)

Study sites	Sex	
	Male	Female
Mande hostel	23(8.5%)	60(22.2%)
Main hostel	24(8.9%)	62(23.0%)
New hostel	30(11.1%)	71(26.3%)
Total	77(28.5%)	193(71.5%)

$\chi^2 = p < 0.05$

Table 3 shows the number of mosquitoes collected in relation to species distribution. The highest number of Anopheles of mosquitoes occurred in New hostel 65(24.1%) followed by Main hostel 50(18.5%), while Mande had the least number 45(16.7%). In Mande hostel, 38(14.1%) of *Culex sp* were caught while Main and New hostel hostels recorded 36(13.3%) each *Culex sp*. Therefore, the distribution and abundance of the two species of mosquitoes varied significantly ($p < 0.05$).

Table 3. Species Composition of Indoor Mosquitoes at Nsuk Male hostels (May- August, 2024)

Study sites	Species	% Composition	
	<i>Anopheles</i>	<i>Culex</i>	
Mande hostel	45(16.7%)	38(14.1%)	30.8
Main hostel	50(18.5%)	36(13.3%)	31.8
New hostel	65(24.1%)	36(13.3%)	37.4

Total	160(59.3%)	110(40.7%)	100
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$$\chi^2 = p < 0.05$$

4.0 DISCUSSION

During this study, *Anopheles* and *Culex* were the only species of mosquitoes encountered which represents 59.3% and 40.7% respectively. The result corroborates with previous observations made on the co-existence of these two species in a particular site or area (Patricia *et al.*, 2014). The variation in the abundance of *Anopheles* and *Culex* may be due to the difference in their breeding requirements and probably farming activities around the school environment that may be potential for the development and growth of mosquitoes. *Anopheles* mosquitoes breed in transient habitats such as shallow sun lit fresh water pools or human made habitats, hoof prints and tyre tracks. *Culex* are known to breed in polluted water bodies including open drains, open or cracked septic tanks, flooded pit latrines (Patricia *et al.*, 2014). Similar work conducted in Badagry, six areas in Lagos and LASU student hostels showed that higher number of *Anopheles* were recorded than *Culex* mosquitoes (Okwa *et al.*, 2011, Amusan *et al.*, 2003). This is not in line with the work conducted in students' hostels of University of Agriculture, Abeokuta which indicated that *Aedes* mosquito were the most abundance encountered (Amusan *et al.*, 2003). The work conducted at Lagos State University in south-western of Nigeria shows that more female mosquitoes were recorded in female student hostels than in male hostels (Adeoye *et al.*, 2012). Furthermore, the results of our study did not collaborate with the work conducted at student hostels of University of Lagos and its environment which reported that *Culex quinquefasciatus* was the most abundant mosquito species recorded (Adeoye *et al.*, 2012). The dominant of indoor resting female 193(71.5%) mosquitoes over male 77(28.5%) encountered in our findings confirms that female mosquitoes require more blood meals in order to provide nutrients for the development of their fertilized eggs since it is the female mosquito that bites and transmit malaria. This is a serious public health threat that need to be addressed to prevent students' vectors- contact and malaria transmission in the area. Students should be encouraged to use insecticide treated nets (ITNs).

5.0 CONCLUSION

The identification of the medically important *Anopheles* and *Culex* mosquitoes established the presence and abundance of economically important malaria vectors in the study area. It was observed that PSC and CDC techniques showed comparative trapping efficacy with variation in individual attractiveness to mosquitoes. In conclusion, there is an urgent need for collaboration

between the University management and the University's Medical Centre to ensure that the University environment is kept clean and also encourage the students as well as the University communities to be using Insecticide Treated Net (ITNs) for their well-being.

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COMPETING INTERESTS

The authors have no competing interests.

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