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Mosquito Species Composition and Abundance in Students' Hostels in Three Campuses of The University of Uyo, Akwa Ibom State, Nigeria

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Abstract

Mosquitoes are among the most significant vectors of human diseases, transmitting pathogens responsible for malaria, lymphatic filariasis, and various arboviral infections. This study investigated the abundance, sex composition, and spatial distribution of mosquitoes within student hostels across the three campuses of the University of Uyo, Nigeria. Sampling was conducted from March to June 2025 using Centre for Disease Control Light Traps (CDC LTs). Two hostels were selected from each campus, and collections were carried out simultaneously indoors monthly between 6:00 p.m. and 6:00 a.m. Mosquito specimens were identified using standard pictorial and taxonomic keys. A total of 277 adult mosquitoes were collected over the four-month period. The Main Campus recorded the highest number (188; 67.87%), followed by the Annex Campus (66; 23.80%) and the Town Campus (23; 8.30%). Four mosquito genera were identified, with *Culex* being predominant (267; 97.10%), while *Aedes* (1; 0.40%), *Anopheles* (2; 0.70%), and *Mansonia* (5; 1.80%) occurred in much smaller numbers. Monthly variation showed the highest abundance in March (85; 30.69%) and the lowest in June (53; 19.13%). Sex composition analysis revealed a clear predominance of females (203; 73.29%) over males (74; 26.71%). The dominance of female mosquitoes across all hostels underscores a potential public health concern due to their role in blood feeding and disease transmission. These findings provide valuable baseline data for future mosquito surveillance and support the need for targeted vector control strategies particularly improved sanitation practices to eliminate breeding sites and thereby to reducing the risk of mosquito-borne diseases within the University of Uyo hostels.

Key Words: Surveillance, Diseases, Mosquitoes, Hostels.

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INTRODUCTION

Mosquitoes are small dipteran insects belonging to the family *Culicidae*. The term "mosquito" is derived from the Spanish and Portuguese words *mosca* (fly) and the diminutive suffix *-ito*, meaning "little fly" (Harbach, 2007). They are characterized by slender, segmented bodies, a single pair of wings, three pairs of long legs, and a prominent proboscis. In females, this specialized piercing and sucking mouthpart is adapted for blood feeding on vertebrate hosts

(Clements, 2012). Taxonomically, mosquitoes are classified under the class Insecta, order Diptera, and family Culicidae.

Mosquitoes pose a significant threat to human and animal health. Beyond being a nuisance due to their bites and the characteristic buzzing sound of species such as *Culex*, they serve as vectors of several serious diseases. These include lymphatic filariasis, transmitted by *Culex*, *Anopheles*, *Aedes*, and *Mansonia* species; malaria, transmitted by *Anopheles* species; and various forms of mosquito-borne encephalitis reported in different regions (Millet *et al.,* 2021; Wei *et al.,* 2026). Although considerable efforts have been made to control mosquito-borne diseases through interventions such as insecticide-treated bed nets and indoor residual spraying, complete eradication has not been achieved due to various operational and biological challenges. Mosquitoes flourish in diverse ecological zones across Nigeria, from the mangrove swamps of the Niger Delta to the Sahelian regions of the North, where temporary pools of water create favourable breeding habitats (Adeyekun *et al.,* 2026). Understanding mosquito diversity is vital for developing effective vector control strategies. In urban settings, including university hostels, human activities such as poor waste management, stagnant water accumulation, and dense vegetation create favourable breeding sites for mosquitoes (Adeyekun *et al.,* 2026). Mosquito surveys are crucial to understand population dynamics, species distribution and their role in disease transmission. These studies can aid in identifying breeding habitat, monitor species composition and evaluate the risk of vector borne disease across different regions (Umohata *et al.,* 2025). By providing data for mosquito abundance and infection rates, local health authorities are able to tailor interventions to curb disease outbreaks. (Van de Straat *et al.,* 2021).

As a cornerstone of entomological surveillance, mosquito surveys enable researchers and health authorities to map breeding sites, track seasonal population trends, determine levels of insecticide resistance and assess the effectiveness of control measures (Namias *et al.,* 2021; Aryaprema *et al.,* 2023; Jaffal *et al.,* 2023). University environments can experience significant mosquito infestations, posing health risks to students and contributing to absenteeism from vector-borne diseases. However, there is limited information on mosquito diversity and infestation levels within student residential areas, including hostels at the University of Uyo. Conducting a mosquito diversity survey in such settings would generate essential data on species composition and distribution, thereby supporting the development of targeted and effective control measures. Given that students live in close quarters in university hostels, high mosquito densities can elevate the risk of malaria and other mosquito-borne infections, underscoring the importance of regular surveillance and appropriate vector management strategies. The aim of this study therefore was to assess the composition, diversity, abundance, and distribution of mosquito species across in student's hostels in the three campuses of the University of Uyo, Nigeria.

MATERIALS AND METHODS

Description of Study Area

The study was conducted in student hostels across the three campuses of the University of Uyo, Akwa Ibom State, Nigeria. Uyo is located within the humid tropics of West Africa, between latitudes 5°01′N and 5°05′N and longitudes 7°55′E and 8°00′E. Sampling was carried out at the three campuses of the University: the Main Campus along Nwaniba Road as well as the Town and

Annex Campuses along Ikpa Road, all within Uyo. Three sampling sites selected were the Niger Delta Development Commission (NDDC) Hostels at the Main Campus, the M2 and F2 Hostels at the Annex Campus, and the Hall 6A and Hall 2B Hostels at the Town Campus (Figure 1). The NDDC Hostels are situated at latitude 5.0395647°N and longitude 7.9818198°E, in a largely forested environment. Vegetation around this site includes trees, shrubs, herbs, and understorey ground cover. The M2 and F2 Hostels at the Annex Campus, located between 5°01′N–5°05′N and 7°55′E–8°00′E, were surrounded by patchy vegetation, with numerous potential mosquito breeding sites such as stagnant water in clogged gutters and containers, leaking pipes, abandoned receptacles, and poorly managed waste disposal areas. In contrast, the Hall 6A and Hall 2B Hostels at the Town Campus, located at latitude 5.0421°N and longitude 7.9241°E, were in relatively well-maintained surroundings, with a cleaner environment and minimal litter.

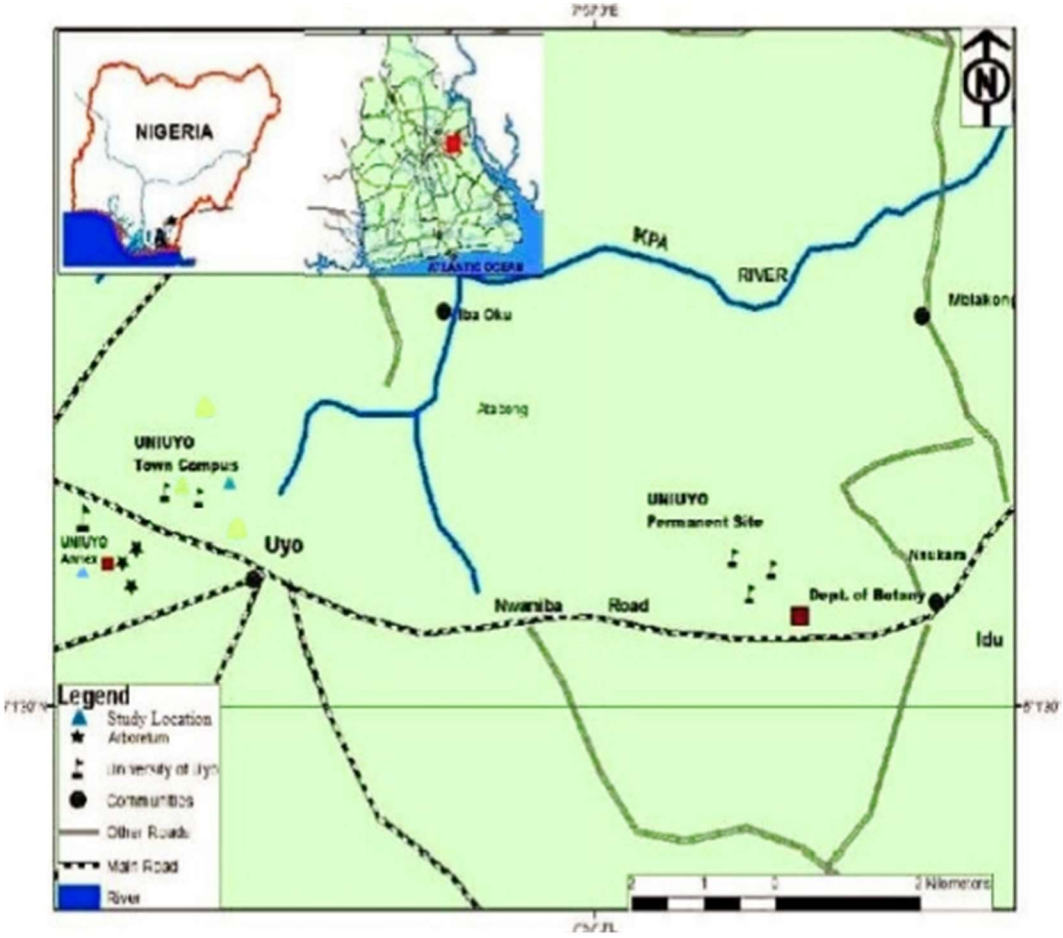

Figure 1: Map showing sampling sites in the University of Uyo, Uyo, Akwa Ibom State.

Ethical Consideration

Approval for the study was granted by the University of Uyo management through the Student Affairs Division, which authourized the use of hostels for mosquito sampling. Verbal informed consent was obtained from students whose rooms and beds were selected for trap placement. Participants were briefed on the objectives and procedures of the study, and their voluntary participation was ensured. Confidentiality, privacy, and personal space of all participants were strictly respected throughout the study.

Collection of Mosquitoes

Adult mosquitoes were collected indoors from student hostels located at the Main, Town, and Annex campuses of the University of Uyo, Nigeria, between March and June 2025. At each campus, two hostels (one male and one female) were randomly selected, except at the Town campus where only female hostels were available. A minimum distance of 50 meters was maintained between selected hostels within each campus, following the procedure described by Alves *et al.* (2024). Prior to sampling, the procedure was explained to hostel occupants, and their consent was obtained. Collections were conducted using CDC light traps (Model 512; John W. Hock Company, Gainesville, FL, USA), which were operated overnight once per month in six rooms across the three hostels. On each sampling night, a particular room was used in each hostel selected throughout the period of sampling. Traps were installed approximately 150 cm above the ground at the foot end of sleeping areas where occupants slept under untreated mosquito nets, as described by Alves *et al.* (2024).

To reduce ant interference, trap bases were moistened with water and the suspending strings greased with Vaseline, following Amusan *et al.* (2005). Traps were switched on at 18:00 h (6:00 p.m.) and switched off at 06:00 h (6: 00 a.m.) the following morning, after which collection bags were sealed. Mosquitoes attracted to the light were drawn into the trap by a downward air current generated by the motor fan and retained in a mesh funnel. Collected mosquitoes were retrieved from the bags using an aspirator, preserved individually in Eppendorf tubes containing silica gel, and labelled with collection details. Specimens were then transported to the laboratory for identification.

Mosquito Identification

Mosquitoes were identified based on the morphological characteristics such as their maxillary palps. Identified mosquito genera were sexed by examining the presence or absence of plumose (feathery) antennae. Mosquito were morphologically identified using a dissecting microscope, following the taxonomic keys of Gillies and De Meillon, (1968); Gillett and Smith (1972) and Gillies and Coetzee (1987). Identification was based on the scales and colouration of the palps, wing spot patterns, thoracic markings, terminal abdominal segments, and leg scales. Mosquitoes were morphologically identified to genus level and were preserved singly in 1.5ml Eppendorf tubes containing desiccated silica gel and stored in Ziploc bags and labelled according to the species, location and month of collection as described by Atting and Akpan, (2016).

Data Analysis

Data obtained from this study was subjected to simple percentages. To assess diversity and species heterogeneity within

each hostel type, the Shannon-Wiener Diversity Index (H') was calculated.

RESULTS

A total of 277 adult mosquitoes were collected over the four-month sampling period from six hostel rooms across the three campuses of the University of Uyo, Akwa Ibom State, using CDC light traps (Table 1). The Main Campus accounted for the highest proportion, with 188 mosquitoes (67.87%), followed by the Annex Campus with 66 individuals (23.80%). The Town Campus recorded the lowest catch, with 23 mosquitoes (8.30%).

Four mosquito genera were identified from the collections (Table 1). *Culex* was the most dominant, representing 267 individuals (97.10%) of the total catch. The least abundant was *Aedes* with only one individual (0.40%), while *Anopheles* (2; 0.70%) and *Mansonia* (5; 1.80%) were represented in very low numbers. The Main Campus recorded a higher species diversity compared to the other campuses. Notably, only *Culex* species were collected at the Town and Annex campuses during the study period (Table 1).

Table 1: Abundance of Mosquitoes across Three Hostels of the University of Uyo

Species	**Main Campus (%)**	**Town Campus (%)**	**Annex Campus (%)**	**Total (%)**
Culex	180 (65.00%)	23 (8.30%)	66 (23.80%)	269 (97.10%)
Anopheles	2 (100.00%)	0 (0.00%)	0 (0.00%)	2 (0.70%)
Aedes	1 (100.00%)	0 (0.00%)	0 (0.00%)	1 (0.40%)
Mansonia	5 (100.00%)	0 (0.00%)	0 (0.00%)	5 (1.80%)
Total	**188 (67.87%)**	**23 (8.30%)**	**66 (23.80%)**	**277 (100.00%)**

Monthly Distribution of Mosquitoes

The monthly distribution and mosquito abundance is presented in Table 2. The highest mosquito density was recorded in the month of March, with 85 individuals (30.69%) collected across the three hostels while the month of June recorded the lowest abundance with 53 individuals (19.13%) collected across the three hostels. The monthly percentage distribution of mosquito genera is shown in Table 2. Throughout the study period, *Culex spp* was consistently the most abundant species in all months in the three hostels (Table 2)

Table 2: Monthly Distribution of Mosquitoes across Hostels of the Three Campuses of the University of Uyo

	March			**April**			**May**			**June**			
Species	**M.C**	**T.C**	**A.C**	**M.C**	**T.C**	**A.C**	**M.C**	**T.C**	**A.C**	**M.C**	**T.C**	**A.C**	**Total**
Culex	49	8	28	51	8	10	58	2	8	22	5	20	269
Anopheles	0	0	0	0	0	0	1	0	0	1	0	0	2
Aedes	0	0	0	1	0	0	0	0	0	0	0	0	1
Mansonia	0	0	0	0	0	0	0	0	0	5	0	0	5
Total	**49**	**8**	**28**	**52**	**8**	**10**	**59**	**2**	**8**	**28**	**5**	**20**	**277**
	85 (30.69%)			**70 (25.27%)**			**69 (24.91%)**			**53 (19.13%)**			**(100%)**

Note: M.C.: Main Campus, T.C.: Town Campus, A.C.: Annex Campus

Sex-specific analysis showed a markedly higher abundance of female mosquitoes compared to males during the study period. A total of 203 females (73.29%) were collected across the three hostels, while males accounted for only 73 individuals (26.71%) (Table 3). The Main Campus contributed the highest number of females (145), whereas the Town Campus recorded the lowest (19) (Table 3).

Table 3: Abundance of Male and Female Mosquitoes across Hostels of the University of Uyo

	Main Campus		**Town Campus**		**Annex Campus**		**Total (%)**	
Species	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Culex	43	137	4	19	27	39	74	195
Anopheles	0	2	0	0	0	0	0	2
Aedes	0	1	0	0	0	0	0	1
Mansonia	0	5	0	0	0	0	0	5
Total	**43**	**145**	**4**	**19**	**27**	**39**	**74 (26.71%)**	**203 (73.29)**

Notes: M: Male, F: Female

The Shannon–Wiener diversity index (H′) was used to quantify the diversity of mosquito species across the three sampling sites. Analysis of the data revealed that the NDDC hostels (Main campus) recorded the highest diversity, with four mosquito species identified (*Culex*, *Anopheles*, *Aedes*, and *Mansonia*). The Shannon–Wiener index for this site was H′ = 0.85, indicating a moderate level of diversity. In contrast, both the Hall 6A, Hall 2B (Town Campus) hostels and the M2, F2 (Annex campus) hostels recorded only a single species (*Culex)*, resulting in an index value of H′ = 0.00, which denotes an absence of diversity. The comparative values are presented in Table 4.

Table 4: Shannon-Wiener Diversity Index (H') for Mosquito Species across Three Hostels of the University of Uyo

Hostel	**Species Present**	**Frequency**	**Shannon Index (H')**
Main Campus Hostels	*Culex, Anopheles, Aedes* and *Mansonia*	188	0.85
Annex Campus Hostels	*Culex* only	66	0.00
Town Campus Hostels	*Culex* only	23	0.00

DISCUSSION

A total of 277 adult mosquitoes were collected using CDC light traps during the study. This catch was markedly lower than the 1,150 mosquitoes reported by Onyido *et al.* (2016) in Nibo community, the 516 collected

by Umeanaeto *et al.* (2017) in female hostels at Nnamdi Azikiwe University, Awka South LGA, the 440 recorded by Okeke *et al.* (2024) in the Science Village of Nnamdi Azikiwe University, Awka and the 5592 reported by Umohata *et al.* (2025). The comparatively low abundance observed in this study may be attributed to methodological differences, particularly the shorter sampling duration of four months and reliance on a single collection technique. In contrast, the cited studies employed longer sampling periods (up to six months) and multiple collection methods, which likely enhanced their yield. Furthermore, sampling in the present study was restricted to once per month at six indoor catching points, a factor that may have further limited mosquito captures.

Four mosquito genera were identified (*Anopheles, Aedes, Culex***,** and *Mansonia*) all of which have been documented in previous entomological surveys across Nigeria. For instance, Amusan *et al.* (2005) recorded *M. africana* and *M. uniformis* in Ajana and Ikenne, Ogun State. Species-specific reports include *An. gambiae* and *Ae. aegypti* in Oba, Anambra State (Okonkwo *et al.,* 2014), and *An. gambiae* in Uyo, Akwa Ibom State (Atting and Akpan, 2016; Atting *et al.,* 2019). Onyido *et al.* (2016) also recorded *An. gambiae, Cx. quinquefasciatus, Ae. aegypti,* and *Ae. albopictus* in Nibo community, while Umeanaeto *et al.* (2017) reported *An. gambiae, An. funestus, Cx. quinquefasciatus,* and *Cx. annulioris* in hostels of Nnamdi Azikiwe University, Awka. Also, Umohata *et al.* (2025) recorded *An. gambiae*, *An. atratipes*, *An. bancrofti, Ae. aegypti*, *Cx. pipiens*, *M. uniformis* and *M. africana* species in Essien Udim LGA of Akwa Ibom state. These findings demonstrate that the mosquito genera identified in this study are consistent with those reported across diverse ecological and geographical settings in Nigeria, thereby reinforcing their widespread distribution and epidemiological importance.

All mosquito genera identified in this study *Anopheles, Aedes, Culex***,** and *Mansonia* were found in the NDDC hostel on the Main campus, whereas only *Culex* species were detected in the Town and Annex campus hostels. The occurrence of *Mansonia* in the NDDC hostel may be attributed to its proximity to forested areas, which provide suitable habitats for this genus (Amusan *et al.,* 2025). The predominance of *Culex* species in this study is consistent with reports from Akure South, Ondo State (Afolabi *et al.,* 2019), Science Village, Nnamdi Azikiwe University, Awka (Okeke *et al.,* 2024) and Essien Udim LGA in Akwa Ibom state (Umohata *et al.,* 2025) However, this finding contrasts with observations from Katsina State (Bunza *et al.,* 2010) and North Central Nigeria (Oguoma and Ikpeze, 2008), where *Anopheles* was the most dominant, and with Amusan *et al.* (2005), who reported *Mansonia uniformis* as the prevalent species. Such variations in species composition across regions are likely influenced by environmental conditions and the availability of breeding sites. In this study, the dominance of *Culex* may be explained by the presence of large, blocked drainages and heavily polluted stagnant water, which provide ideal habitats for their proliferation. Similar associations between *Culex* abundance and polluted environments have been documented in Nigeria (Onyido *et al.,* 2016; Umeanaeto *et al.,* 2017; Afolabi *et al.,* 2019).

The mosquitoes collected indoors in hostels of the University of Uyo raise significant public health concerns, as they are proven vectors of mosquito-borne diseases. *Culex* spp., the most abundant genus, is a recognized vector of lymphatic filariasis (Dyab *et al.,* 2015). This suggests that if lymphatic filariasis parasites were introduced into the hostel environment, transmission

could occur rapidly, placing residents at risk. Other genera detected (*Aedes, Anopheles,* and *Mansonia*) are also epidemiologically important. *An. gambiae, Ae. aegypti,* and *M. uniformis* are all established vectors of *Wuchereria bancrofti*, the causative agent of lymphatic filariasis in Africa (Gyapong *et al.,* 2018). According to WHO (2018), Nigeria remains one of the countries with the highest global burden of the disease. Beyond filariasis, *Aedes* mosquitoes are vectors of yellow fever, dengue, and other arboviruses; *Anopheles* species transmit malaria and filariasis; while *Mansonia* species have been implicated in the transmission of Rift Valley fever in East Africa (Sang *et al.,* 2010). Although their abundance was relatively low in this study, the presence of these genera underscores the potential for multi-vector transmission of mosquito-borne diseases within the University hostels.

Monthly indoor collections revealed that *Culex* spp. exhibited the highest distribution in March, making it the most abundant mosquito genus in the University of Uyo hostels. This finding is of epidemiological importance, as female *Culex* mosquitoes are recognized vectors of lymphatic filariasis. The occurrence of male mosquitoes indoors in the present study is consistent with previous reports that documented the presence of male mosquitoes resting within human dwellings and student hostels (Nambunga *et al.,* 2021; Seang-arwut *et al.,* 2023; Abdullahi *et al.,* 2024). Although male mosquitoes do not blood-feed or transmit pathogens through biting, they are frequently encountered indoors where they seek shelter, resting sites, and opportunities to locate newly emerged females for mating. The indoor presence of males therefore reflects their behavioural ecology and reproductive activities rather than host-seeking behaviour (Nambunga *et al.,* 2021; Seang-arwut *et al.,* 2023; Abdullahi *et al.,* 2024). The predominance of female mosquitoes observed in this study is consistent with their biological requirement for blood meals to support egg development, thereby increasing the likelihood of human–vector contact. Since only females feed on blood, their abundance poses a significant public health concern, as this is the stage during which mosquito-borne pathogens can be transmitted to students residing in the hostels.

The low Shannon–Wiener diversity index value recorded in this study indicates reduced species diversity. This may be attributed to the dominance of *Culex* mosquitoes across the three hostels. This pattern aligns with earlier findings in Nigeria, where Lamidi *et al.* (2017) documented a low diversity index of 0.8753 in Bali, Taraba State. However, this report contrasts the findings of Umohata *et al.* (2025) in Essien Udim LGA in Akwa Ibom state, Nigeria, who reported a higher Shannon Wiener diversity index of 3.683 and 3.047 for indoor and outdoor mosquitoes respectively. These variations in diversity indices may be attributed to complex interplay of environmental, geographic, historical and human driven factors.

CONCLUSION

Mosquito species play a critical role in the transmission of various vector-borne diseases and this underscores the importance of understanding their diversity and abundance within specific ecological settings. Findings from the University of Uyo hostels reveal that *Culex* spp. was the most dominant genus, reflecting its adaptability to polluted and stagnant breeding habitats. Species composition varied across hostels, with the Town Campus and Annex Hostels showing low diversity and exclusive dominance of *Culex*, while the NDDC Hostel exhibited

moderate diversity, including *Culex*, *Anopheles*, *Aedes*, and *Mansonia*. The predominance of female mosquitoes across all hostels further emphasizes the potential public health risk, given their role in blood feeding and pathogen transmission. Overall, these results provide baseline data essential for evidence-based mosquito surveillance and control strategies, and they reinforce the need for targeted interventions such as such as proper sanitation within the hostels environment to eliminate potential breeding sites for mosquitoes and reduce the risk of vector-borne disease transmission in the University of Uyo hostels.

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