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# Survey of Mosquitoes Larvae at Bayero University, Kano Students' hostels (Old Campus) (Culicidae: Diptera)

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## ABSTRACT

The risk of contracting mosquito-borne diseases upon being bitten by an infected mosquito raises serious health concerns for both staff and students in educational settings. Consequently, a survey was conducted to identify various mosquito species and breeding sites within the old campus hostels of Bayero University, Kano, during January and February 2023. The survey encompassed breeding sites such as stagnant pools of water, drainages, gutters, and discarded containers. Mosquito larvae were sampled using dippers and scoops, and their enumeration was performed with a Pasteur pipette. Three genera were identified: *Anopheles*, *Aedes*, and *Culex* spp. A total of 1,115 larvae were sampled from six locations, per volume of water comprising three each from female hostels and three from male hostels respectively. The prevalence of mosquitoes was higher in female hostels (785 larvae, 69.4%) compared to male hostels (370 larvae, 32.7%). In female hostels, *Aedes sp*. exhibited greater abundance (400, 50.9%) than *Culex sp*. (337, 42.9%), with Anopheles sp. being the least abundant (48, 6.11%). Conversely, in male hostels, *Culex sp*. dominated with 186 (50.2%), followed by *Aedes sp*. with 179 (48.3%), while Anopheles sp. was the least abundant with 5 (1.35%). Consequently, the mean abundance of mosquitoes between male and female hostels demonstrated a significant difference. This study contributes valuable insights into the larval habitats of mosquitoes in the students' hostels of Bayero University, Kano, specifically during the dry season. Factors such as student activities, inadequate sensitization, and poor sanitation were identified as major contributors to the creation of breeding sites for mosquitoes in the hostels.

**Keywords:** Students' hostels, *Aedes;Culex, Anopheles* spp

## INTRODUCTION

The distribution and abundance of mosquito species are influenced by various factors, including environmental breeding habitats, climate, vegetation cover, and human ecology (Okogun *et al*., 2003). The study of the relationship between a mosquito species and its environment is known as mosquito bionomics. This is important for planning mosquito control methods and studying mosquito-borne diseases, as emphasized by Okogun *et al*. (2003). The environment can be altered in ways that impact mosquito species diversity by reducing abundances or causing local extinction of some species. A decline in the population numbers of a particular species creates an empty ecological niche that may be invaded by other species. The new species can be harmful and might result in outbreaks of infectious diseases (Montagner *et al*., 2018). Mosquitoes have successfully adapted to ecological flexibility, including their ability to adjust to various climatic factors and changing environmental conditions.

For example, some species of Aedes, such as *Ae. albopictus* (the Asian tiger mosquito), originally a tropical species, developed photo-periodic sensitivity. This means that when days are shorter in a temperate climate, the photo-periodically sensitive female lays eggs that differ from the eggs she lays when days are longer. The eggs laid during shorter days are dormant, making the Asian tiger mosquito a successful species (Becker *et al*., 2020).

Certain mosquito species adapt to new environments easily due to their high genetic and ecological adaptivity. This adaptation is often observed in urban green areas that contain an abundance of artificial containers for oviposition and plenty of blood sources, leading to changes in the species' natural habitat (Montagner *et al*., 2018). The geoclimatic effects of a tropical environment on the distribution of mosquitoes in North-Western Nigeria include ideal breeding temperatures and two distinct seasons: a dry, harsh, growth-limiting period with higher temperatures and relative humidity (November-February), followed by a wet season with copious amounts of rainfall and flooding (April-October). These conditions support the growth and development of the aquatic larva and pupa stages, as well as the abundant recruitment of young adults (Okogun *et al*., 2003).

While mosquitoes do not exist in Antarctica, they are common throughout the world's tropical and subtropical regions, extending into the Polar Regions. Mosquitoes can be found at altitudes ranging from 550 meters above sea level to 1250 meters below it. Mosquito growth and reproduction are most favorably facilitated in plant-filled shallow-water marshes. The most significant species that favor these environments are those of the genus *Culex*, particularly *C. pipiens* and *C. salinarius, C. tarsalis Coquillett* (Abd, 2020). Recent studies on the biology and larval ecology of mosquitoes are crucial for mosquito control. Such studies help determine the existing and extinct mosquito species, relative population densities, the extent of their distribution, seasonal trends, and disease infection rates (Mfon Akpan and Nwabueze, 2015). *Aedes spp*. Are synanthropic (living near and benefiting from humans and their environmental modifications) and anthropophilic (seeking human hosts over other animals). They are well-known for exploring and occupying a diversity of microhabitats in urbanized environments (Montagner *et al*., 2018).

## MATERIALS AND METHODS

### Study Area and Sampling Sites

The survey was conducted at Bayero University, Kano (Old campus), North-West of Nigeria. Sample was carried out in the male and female hostels.

### Larvae Collection and Morphological Identification

Larvae were collected from their breeding sites which included domestic containers, stagnant pools of water, drainages and gutters within the hostel area using 350 ml dipper and scoops early morning and evening. The collected larvae were carefully washed using tap water and strainer made of nylon net to retain the larvae and avoid killing them. This method was adopted by Okogun *et al*. (2003). The specie of the larvae was identified by insect taxonomist in the Department of Biological Sciences, Bayero University, Kano.

### Data Analysis

Analysis of variance (ANOVA) was used to identify significant differences in mosquito breeding sites to compare the mean between male and female hostel sample. Shannon's index formula was used for entropy and estimates species diversity. The index takes into account the number of species living in a habitat (richness) and their relative abundance (evenness).

## RESULTS AND DISCUSSION

A total of 1,115 larvae were sampled from six locations: three from the female hostels and three from the male hostels of the old campus. The distribution of species showed that *Aedes* species were predominant in the female hostels. The most prevalent species of mosquito larvae collected was *Aedes*, followed by *Culex* species, with Anopheles species being the least abundant. The composition of mosquito species in the male students' hostels of Bayero University, Kano (Old Campus) revealed that 370 mosquito larvae were collected. The species with the highest number was *Culex* sp. (186 larvae, 50.2%), followed by *Aedes* sp. (179 larvae, 48.3%), with Anopheles sp. being the least abundant (5 larvae, 1.35 %) (see Table 1). Consequently, there was a highly significant difference in mosquito larvae abundance between BKH (Block K) and AIH (Block Q) (P= 0.00445).

Table 1: Number of abundance of mosquito species in male student hostels of BUK (Old Campus)

| MALE HOSTELS | | | | |
|---|---|---|---|---|
| Species | BKH (Block K) | AIH (Block Q) | BK (Block J) | Total (%) |
| *Anopheles Sp.* | 0 | 0 | 5 | 5 (1.35) |
| *Aedes Sp.* | 57 | 96 | 26 | 179 (48.3) |
| *Culex Sp.* | 49 | 79 | 58 | 186 (50.2) |
| Total | 106 | 175 | 89 | 370 |

BKH = Bello Kagara Hall, BK = Bello Kagara; AIH = Attah Ibrahim Hall;

A total of 785 larvae of mosquito were collected from the Female students' hostels of BUK which belong to *Anopheline* and *Culicine* groups that spread across three species namely: *Anopheles, Aedes* and *Culex sp.* At female hostel, *Aedessp*. 400 (50.9%) is more abundant than *Culex sp.* 337 (42.9%) while *Anopheles sp.* has the least abundance with 48 (6.11%) (Table 2). However, abundance of mosquitoes larvae between the three species showed a high significant difference (P=0.009). Comparison of Mosquitoes Abundance in relations to Hostels at BUK old campus has indicated that mosquitoes were more in female hostel 785 (69.4%), than male hostel 370 (32.7%) as presented in Figure1. Therefore, the mean abundance of mosquitoes between male and female hostels showed a significant difference.

Table 2: Number of Abundance of mosquito species in female student hostels of BUK (Old Campus)

| FEMALE HOSTELS | | | | |
|---|---|---|---|---|
| Species | NH (Block S) | NH (Block D) | NH (Block A) | Total (%) |
| *Anopheles sp.* | 15 | 5 | 28 | 48 (6.11) |
| *Aedes sp.* | 167 | 132 | 101 | 400 (50.9) |
| *Culex sp.* | 134 | 105 | 98 | 337 (42.9) |
| Total | 316 | 242 | 227 | 785 |

NH= Nana Hall (Block S; D; A)

Table 3: Mean comparison of mosquitoes larvae abundance in Hostels at BUK (Old campus)

| Species | Male Hostel | Female Hostel |
|---|---|---|
| *Anopheles* sp. | 28±16.5 | 5±37.5 |
| *Aedes* sp. | 101±63.5 | 58±26.5 |
| *Culex* sp. | 98 ±23.5 | 26±17.5 |

Mean ±SD: Standard Deviation; the mean abundance of mosquitoes between male and female hostels showed a significant difference (P=0.0036).

Table 4: Mosquito Density Mosquitoes in relation to Hostels (Male and Female) BUK (Old campus)

| Species | Density | Pi (Density/Total) | ln(Pi) | Pi*lnPi |
|---|---|---|---|---|
| *Anopheles* | 53 | 0.046 | -3.079 | -0.142 |
| *Aedes* | 579 | 0.501 | -0.691 | -0.346 |
| *Culex* | 523 | 0.453 | -0.792 | -0.359 |
| Total | 1155 | | | -0.847 |

According to WHO (1982), a survey of immature mosquitoes is a crucial step in an effective mosquito surveillance and control program. This survey is used to determine the breeding sites, species composition, and population densities of pest and vector mosquitoes.

For the first time, a surveillance of mosquitoes in the hostels of Bayero University, Kano old campus was conducted. The study aimed to identify larval habitats, larval abundance, and the mosquito species composition of the hostels. The presence of three genera *Aedes*, *Culex*, and Anopheles was observed in this study. Similar findings have been reported in previous studies on mosquito fauna in Nigeria, in Lagos state and Delta state (Okogun *et al*., 2003; Obi Sadiatu Sally, 2010; Fagbohun *et al*., 2020).

As previously reported, most potential breeding sites of mosquitoes were of man-made origin, having high larval density (Mahmuda *et al*., 2021; Hanafi-Bojd *et al*., 2018; and Mathania *et al*., 2020), which is also in line with this study. The man-made breeding sites found in this study included domestic containers filled with water and kept open, temporary ground pools created by tanks used for water storage in the study area where activities like laundry take place, and students also pour water nonchalantly leading to stagnant water.

Understanding the breeding sites and distribution of the species will help determine the control measures to prevent the spread of diseases by these mosquitoes. This highlights the need for public health education to control mosquito-borne diseases by avoiding the creation of potential breeding sites. Large numbers of *Aedes* and *Culex*, the vectors of Dengue fever and Elephantiasis, which, according to the World Health Organization, are of great public health concern, were found to breed in gutters filled with dirty waters. These species breed and oviposit more in dirty waters, making them more abundant in the hostels.

In this study, contrary to the findings of Mathania *et al*. (2020), Anopheles larvae were found to also breed in clean water. However, this is in line with what has been reported in the findings of Mahmuda *et al*. (2021), signifying that Anopheles mosquitoes are expanding their niches to polluted habitats. WHO (1982) asserted that *Aedes* are small container breeders, which is contrary to this report because *Aedes* and *Culex* were found to breed in gutters and drainages, which are large waters.

This study also correlates with the findings of Okogun *et al*. (2003) in their study of mosquito ecology in Mid-Western Nigeria, where *Aedes* and *Culex* mosquito species were more abundant in the dry months than Anopheles species. Mosquito larvae were found to be more abundant in the morning when the temperature is low than in the afternoon when the temperature is high, aligning with the findings of Burke *et al*. (2010) and Amini *et al*. (2020).

## CONCLUSION

In conclusion, this study has provided information on the larval habitats of mosquitoes in the hostels of Bayero University, Kano. Three genera were identified: *Anopheles*, *Aedes*, and *Culex* spp. A total of 1,115 larvae were sampled from six locations: three from the female hostels and three from the male hostels of the old campus. The abundance of mosquitoes was higher in the female hostel (785, 69.4%) than in the male hostel (370, 32.7%). At the female hostel, *Aedes* sp. was more abundant with 400 larvae (50.9%) compared to *Culex* sp. with 337 larvae (42.9%), while *Anopheles sp*. had the least abundance with 48 larvae (6.11%). In the male hostel, the number of mosquitoes with the highest species was *Culex* sp. (186, 50.2%), followed by *Aedes* sp. (179, 48.3%), with *Anopheles sp*. being the least abundant (5, 1.35%). Therefore, the mean abundance of mosquitoes between male and female hostels showed a significant difference. This study has provided valuable information on the larval habitats of mosquitoes in the hostels of Bayero University, Kano. Student activities, inadequate sensitization, and poor sanitation are major factors creating breeding sites for mosquitoes in the hostels. There is a strong need to enlighten the students on the dangers of creating breeding sites for these mosquitoes, and they should be advised to employ personal protective measures such as the use of insecticides and mosquito nets to prevent mosquito bites

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