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# Parity and Infective Status of Anopheles Mosquito in Nasarawa State University Main Campus Keffi, Nasarawa State Nigeria

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## Abstract

Malaria still remains among major global health problems especially in developing countries that fall on tropic and subtropical regions. This study was aimed at determining the parity and infectivity status of anopheles mosquito in Nasarawa State Main campus, Keffi. About 495 Mosquito samples were randomly collected indoor from 30 houses using a pyrethrum spray catches collection method. Out of the number of sample collected, 219(44.24%) were identified as anopheles species from which 120 were engorged female anopheles. Abdominal portion and salivary glands of the engorged female were dissected to examined the parity status of the mosquitoes and the presences of sporozoid (infective stage of plasmodia species) respectively. Total number of parous (Parity) female anopheles 71(59.16%) was recorded, high parity rate 21(67.74%) was in Boys' hostel followed by 19(63.33%) in Anguwan lambu (off Campus), 16(53.33%) was in high court (off campus) while the least parity rate 15(51.72%) recorded in Girls' hostel. The total infectivity rate (presence of sporozoid in mosquitoes' salivary gland), recorded was 44(36.66%), with high rate 15(48.38) in boys' hostel while least 7(24.13%) was in Girls' hostel. From the dissected mosquitoes (120), parity rate was recorded higher compare to the infectivity rate however statistically, there is no significant different between the parity and infectivity (P>0.05). It was observed that

mosquito found on Nasarawa State University main campus, Keffi still harbored sporozoid stage of plasmodium the cause malaria. Therefore there is a need by the management to provide some strategies on how to disrupt mosquito breeding habitats by improving environmental hygiene within the institution premises.

# Introduction

Malaria still remain one of the public health challenge especially in developing countries along tropic and subtropics regions. Mosquitoes are the vectors responsible in transmission of malarial parasite, mosquito-transmitted diseases remain a main source of illness and death (CDC, 2015). Mosquitoes are arthropod insect that belong to the family Culicidae in the order diptera. About 60 different genera of mosquitoes are found worldwide (Harbach, 2014) Of these genera, members of the *Anopheles*, *Culex, Aedes*, *Hemagogus* and *Mansonia* complexes are most common and important pests in Nigeria (Oyewole *et al*., 2005). Mosquitoes not only inflict biting pains on man but also suck human blood and transmit disease pathogens. The female mosquito bites humans and animals in the process of blood meal for the development of eggs (Coetzee *et al.,* 2013). The haematophagous habit of the female mosquitoes is of public health importance. Various parasitic and viral diseases are transmitted through the biting mosquito including plasmodia parasites which in turn cause malaria (a disease that has huge public health relevance particularly in sub Saharan Africa). Human malaria parasites are transmitted by female mosquitoes of the genus *Anopheles* which include 465 species of which approximately 70 are able to transmit malaria (WHO, 2018). In Africa, *Anopheles gambiae* sensustricto (s.s) and sensulato (s.l) are the major vectors of malaria parasites (Awolola *et al.,* 2002).

Mosquito-borne diseases are increasingly becoming a very intense challenge globally, with many of its burdens in developing and underdeveloped countries of the world (WHO, 2016). Climate change have greatly contributed to the rises in incidences of mosquito-borne diseases even in regions where they were previously not in existence (Clements, 2000; Coetzee, 2013).

Despite decades of malaria control efforts, malaria continues to be a major worldwide public health issue with 3.3 billion persons at risk in 106 countries and territories in the tropical and subtropical areas (Kyalo *et al*., 2017). It is one of the significant reasons for maternal and childhood morbidity and mortality, including low birth weight, stillbirths, and early infant death in sub-Saharan Africa (Smith, 2004).

Mosquitoes are found almost in every part of the world and they make use of different water bodies for their breeding (Ebube *et al.,* 2018). A vast majority of species make use of both artificial containers and natural sources like holes of trees, shells of coconut,

leaf axils, septic tanks, bamboo stumps, pools, gutters, septic tanks etc. for breeding (Aniedu, 1992).

Presently, there is no effective prophylactic anti-malarial vaccine and no suitable preventive measure other than vector control (Saotoing *et al.,* 2014). Thus, protection from mosquito bites is one of the best approaches to reduce the disease incidence.

## Materials and Methods

### Sample Collection.

The total of 495 mosquitoes were collected using a pyrethrum spray to knock down indoor resting mosquitoes. 2/1 meter white sheets were spread to completely cover the floor and all flat surfaces for the collection of knockdown mosquitoes, all windows and doors were properly closed, the pyrethrum insecticide was then carefully sprayed in a clockwise direction towards the ceiling until the room was filled with a fine mist, The rooms were then closed for about 10 minutes. Beginning from the entrance, the corners of the sheet were lifted and the sheet was taken outside, all knockdown mosquitoes were collected and placed in a labeled Petri-dish (WHO, 2016). Mosquitoes collected in each house were stored in separate Petri-dishes and appropriately labeled as follows: collection date and hour, village, household number, and name of head of household. This study was conducted during the period of October to November, 2023.

### Mosquito Identification and Dissection for Ovaries and Salivary Glands

Adult mosquitoes were identified using mainly their morphological features (WHO, 2016). The identified females' anopheles species, were prepared immediately (within the next 6 hours) for dissection. Ovaries were exposed in order to determine the parity status (whether parous or nulliparous) of each dissected female anopheles. Salivary glands of the dissected mosquitoes were carefully isolated and examined for sporozoites (infective stage of plasmodia species)

### Determination of Parity rate.

The parity rate was determined as the proportion (percentage) of parous female *Anopheles* specie amongst the total number of mosquitoes dissected.

### Determination of Sporozoite rate

This was estimated as the percentage of *Anopheles* mosquitoes that harbored sporozoites in their glands after dissection.

## RESULTS

### Abundance of Mosquito genera from the study areas.

A total of 495 mosquitoes were collected and identified from 30 houses. All the samples were belong to the Anophiline and Culicine sub family. Majority, 276(55.76%) were

*Culex* species, while 219(44.24%) were *Anopheles* species (vector of malaria parasites) as presented in Table 4.1 below.

**Parity Rate of Female Anopheles Dissected**

Out of the total number of samples collected (495), 120 female anopheles mosquitoes were dissected. Mosquitoes from Angwan Lambu have the higher parity rate of 19(70.37%) follow by 15 (62.50%) from girls' hostel. The least parity rate recorded was in high court 16(51.61%) as presented in Table 4.2 bellow.

**Data Analysis**

Data were analyzed using SPSS version 21 to compare the number of vectors in relation to location, type of houses and between nulliparous and parous mosquitoes of the different species. Observed difference was considered significant if P<0.05.

**Table 1**: Relative Abundance of Mosquito Genera Collected During the Study Period.

| Week | Anopheline (%) | Culicine (%) | Total | T-test Value |
|---|---|---|---|---|
| One | 64 (40.51) | 94 (59.49) | 158 (31.91) | 0.263 |
| Two | 58 (42.96) | 77 (57.04) | 135 (27.27) | |
| Three | 97 (48.02) | 105 (51.98) | 202 (40.81) | |
| Total | 219 (44.24) | 276 (55.76) | 495 (100) | |

**P >0.05**

**Table 2:** Parity Rate of Female Anopheles Dissected

| Location | Number of Mosquito Dissected | Number of Parous Mosquitoes (%) |
|---|---|---|
| High Court | 30 | 16 (53.33) |
| Angwan Lambu | 30 | 19 (63.33) |
| Boys Hostel | 31 | 21 (67.74) |
| Girls Hostel | 29 | 15 (51.72) |
| **Total** | **120** | **71 (59.17)** |

**Sporozoite (Infective stage Plasmodium) Rate of Female Anopheles Dissected**

Same female anopheles samples dissected for parity rate (parous) were used for the sporozoite rate recovery. Total of 44 mosquitoes were found positive with plasmodium species, samples from Angwan Lambu have the higher infective rate of 12(44.44%) follow by boys hostel 15(39.47%) and the least infective rate was recorded from girls hostel 7(29.17%). Statistically, there is no significant difference in the sporozoite rate of mosquitoes from the study locations (P > 0.05) as presented in Table 3 below.

**Comparison of Parity and Sporozoite Rate of Female Anopheles Dissected in the Study Areas.**

Table 4 below presented the Comparison of Parity and Sporozoite Rate of Female Anopheles Dissected in the study areas. Total parous mosquitoes 71(59.17) was compared with those found positive with sporozoite stage of plasmodium in mosquitoe's salivary gland 44(36.67) and statistically there was significant difference between the parity and sporozoite rates in the mosquitoes dissected (P < 0.05).

**Table 3:** Sporozoite Rate of Female *Anopheles* Dissected among mosquitoes Collected in Nasarawa State University main campus and off campus Keffi.

| Location | Number of Mosquito Dissected | Number of mosquito with Sporozoite | Sporozoite rate (%) | P-value (t-test) |
|---|---|---|---|---|
| High Court | 30 | 10 | 32.26 | 0.280 |
| Angwan Lambu | 30 | 12 | 44.44 | |
| Boys Hostel | 31 | 15 | 39.47 | |
| Girls Hostel | 29 | 7 | 29.17 | |
| Total | 120 | 44 | 36.67 | |

**P >0.05**

**Table 4:** Comparison of Parity and Sporozoite Rate of Female *Anopheles* Dissected among mosquitoes Collected in Nasarawa State University main campus and off campus Keffi.

| Location | Number of Mosquito Dissected | Number of Parous (%) | Sporozoite rate | t-test |
|---|---|---|---|---|
| High Court | 31 | 16 (51.61) | 10 (32.26) | 0.012 |
| Angwan Lambu | 27 | 19 (70.37) | 12 (44.44) | |
| Boys Hostel | 38 | 21 (55.26) | 15 (39.47) | |
| Girls Hostel | 24 | 15 (62.50) | 7 (29.17) | |
| Total | 120 | 71 (59.17) | 44 (36.67) | |

**P <0.05**

**Discussion**

This present study reveal that the relative abundance (495) of mosquitoes found in the study area were majority genus of Culicine 276(55.76%) compared to Anopheline 219(44.24) species. The relative increase abundance of mosquitoes in the study area is in comparable to those of Adeoye *et al.,* (2012), Akwashiki (2022) and Amusan *et al.,* (2003) who collected mosquitoes from student's hostels of University of Lagos; Federal University of Lafiya, and University of Agriculture, Abeokuta respectively.

Consequently, Mistica *et al.* (2019) documented the presence of mosquito species in public schools of Metro Manila in the Philippines

In student hostels especially latrines and some instances where sewages are not properly drained might result to water logs. Culex species was the most dominant species collected possibly due to it resistance and ability to breed in polluted water environments more so, the short proximity between students hostels and houses nearby campus (Anguwan lambu) where a lot of polluted breeding sites are available thereby making it very easy for Culex species to successfully breed and fly to the university environment. This is in accordance with Adeoye *et al.* (2012) who showed that Culex quinquefasciatus was the most abundant mosquito species in students' hostels of University of Lagos and its environment. However Anopheles species was encountered in reasonable amount during the study period could be as a result of climatic conditions (pick breeding time of anopheles is during wet season). This is in comparable with Onyido *et al.* (2008), Madara *et al.* (2013) and Ombugadu *et al.* (2020) showed Anopheles gambiae proportion to be the predominant over other mosquito species in schools and its environs.

The high infection rate and parity of female anopheles mosquitoes in the study area with 44(36.67%) and 71(59.16%) respectively is in line with those Adeleke *et al.* 2010; Arum *et al.* (2015) and Lutomiah *et al.* (2013). The higher proportion of parous vectors may also be a consequence of the suitable climate conditions in the area, such as rainfall and temperature, and also the high relative humidity which largely influence the mosquito biology (Adeleke et al., 2010). There was a significant difference between the infection rate and parity status within the vectors analyzed. The high percentage rate of parity compare to sporozoites infection could be attributed to the students' exposure to mosquito bite in the course of night reading and some of the academic activities and the low utilization of insecticide treated nets by some students as mosquitoe can only be parous if it feed on blood meal of either human or animals (Onuh *et al.,* 2015). It may also be ascribed to the season since the data collection was done in the wet season around September to November. The low infection rate in respect to parity in the study could be attributed to low transmission of sporozoites (plasmodium parasite). However, high infection rate 44.44% was recorded in off campus location (Anguwan Lambu) compare to students' hostel on campus (boys and girls hostels) probably as a result of the nature of houses (mud and block) of which indoor resting mosquitoes prefer mud type of building than block (Meuti and Short, 2019). More so, poor drainage system, temporary water logs could give breeding necessities to mosquito and most of houses where samples collected were windows and doors unscreened with mosquito nets hence could give high tendency of mosquitoes to gain access on human blood.

**Conclusion.**

The lack of good drainage and sewage system in the study area (off campus exclusively) could be one of the factors contributing to the mosquito burden recorded in the area. Health education will go a long way in sensitizing the inhabitants on the importance

of environmental and personal hygiene, and self-protection in mosquito control. The vector mosquito species in Nasarawa State University main campus, Keffi (hostels and off campus site) is dominated by Culex and Anopheles which the later is primary vector of malaria parasites. Control should be targeted at the breeding sites of the mosquitoes. The findings of this study have helped in achieving a better understanding of the epidemiology of mosquito-borne diseases (malaria parasites) in Nasarawa State University main campus, Keffi and this is a pre-requisite for sustainable malaria control. Therefore, intensive vector control programmes and public enlightenment especially on human activities that encourage mosquito breeding is recommended.

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