



Assessment of mosquito species composition and abundance in Misau metropolis, Misau Local Government Bauchi State, Nigeria


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Abstract	Article History
<p>The distribution and abundance of mosquito species in Misau Metropolis were studied monthly between April and September, 2021. Mosquitoes were sampled monthly from five (5) clusters randomly distributed across the city using dippers. The mosquito habitats sampled include domestic containers, bowl, used vehicle tyres, gutters, containers, footprints and stagnant waters around the study area. The larvae collected were kept until adult emergence and identified microscopically using standard morphological keys. A total of 3730 mosquitoes species belonging to three genera were collected. Out of these, <i>Culex quinquefasciatus</i> were the predominant species with 58.81%. The month of August recorded the highest number of mosquitoes with the peak value of 877 mosquitoes. The composition of mosquito species in the study area indicated that Three (3) species occurred in all five clusters with the highest number of mosquitoes found in GRA. The presence of these mosquitoes in the study may cause mosquito borne diseases such as malaria and yellow fever in the area. Therefore, there is need for effective mosquito control and public enlightenment on the need to prevent mosquitoes from breeding because presence of these mosquito species in the study area may expose the community to mosquito borne diseases such as malaria and yellow fever.</p>	<p>Received: 27/03/2023 Accepted: 09/08/2023 Published: 29/09/2023</p>
<p>How to cite this paper: Aliyu, U., Omar, A.A. and Tukur, Z. (2023). Assessment of mosquito species composition and abundance in Misau metropolis, Misau Local Government Bauchi State, Nigeria. <i>Gadau J Pure Alli Sci</i>, 2(2): 162-166. https://doi.org/10.54117/gjpas.v2i2.78.</p>	<p>Keywords Cluster; Composition; Distribution; Larvae; Malaria; Mosquito</p> <p>License: CC BY 4.0*</p>  <p>Open Access Article</p>

1.0 Introduction

Mosquitoes are small slender biting insects that belong to the order Diptera, sub order Nematocera and family Culicidae, with an approximate number of three and half thousand species (Ikram and Muhammad, 2013). In the modern classification of Culicidae as adopted by Knight and Stone (1977), there are three sub families: Culicinae (with thirty genera), Anophelinae (with three genera) and Toxorhynchitinae (with one genus). Sub family Culicinae, being the largest and most diversified is further divided into a number of tribes: Aedini, Culicini, Culisetini, Mansonini, Ficalbiini, etc. The tribe Aedini consists of several genera including Aedes and Armigeres. The sub family Anophelinae includes the most important genus

“Anopheles” several species of which are malaria vectors (Ikram and Muhammad, 2013).

Mosquitoes serve as hosts for different organisms including nematodes, viruses and sporozoans, but humans are lucky because not all the above mentioned parasites are pathogenic to man. Even those that are certain parasites are constant threats to man by manifesting different diseases including malaria, yellow fever, filariasis and dengue (Ikram and Muhammad, 2013).

Malaria is a mosquito-borne disease which causes major health problems in Nigeria and other part of Sub-Saharan Africa. Malaria accounts for 660,000 deaths worldwide. Every year, more than 200 million cases occur (Barde *et al.*, 2019). According to the

WHO world malaria report released in 2022, there were an estimated 247 million malaria cases in 84 malaria endemic countries in 2021, an increase of 2 million cases as compared with 2020 (WHO, 2022). This report indicated that Africa has about 92% of the world malaria cases with 93% of malaria deaths. In Nigeria, up to 60% of outpatient attendance in health facilities is due to malaria and 30% of all hospital admissions. It is estimated that malaria is responsible for 25% infant mortality, 30% childhood mortality and is associated with 11% maternal deaths. Malaria is estimated to cause about ₦132 billion lost annually in terms of treatment costs, prevention, loss of man hours (Barde *et al.*, 2019). Most of the deaths due to malaria infection occur at home hence are not reported (Rugemalila *et al.*, 2016). The disease can be entirely linked to the mosquitoes *Anopheles gambiae*, *An. arabiensis* and *An. funestus*, three of the most efficient malaria vectors in the world. All live almost exclusively in close association with humans and feed on blood, primarily from humans (Collins and Besansky, 1994).

In Nigeria, there is an increase in the number of human activities which include agricultural development, construction of dams for irrigation and domestic consumption, construction of human habitation and deforestation. All these anthropogenic activities have the potential to provide breeding sites for mosquitoes and therefore increase the range of mosquitoes in all geographical areas of Nigeria (Barde *et al.*, 2019).

Most of the mosquitoes control strategies are targeted on adult mosquitoes including, the promotion of the use of insecticide-treated bed nets and indoor residual sprays (FMOH, 2004). These methods are very good in reducing the mortality because of various mosquito-transmitted (Hawley, 2003). However, these control strategies may have their limitations like insecticide resistance by the vector (Zaim and Guillet, 2002) and difficulties in attaining adequate population coverage (Eisele, 2006), and hence may not be sufficient to achieve the World Health Organization's (WHO) targets regarding mosquito-transmitted diseases. Additional vector control interventions, particularly, those that will target the larval mosquitoes are required (Sogoba, 2007). Successful larval control requires accurate knowledge of the larval habitat and distribution of the breeding sites. Therefore this study was designed to Survey the Distribution and Abundance of Mosquito Species in Misau Metropolis, Misau Local Government, Bauchi State, Nigeria.

2.0 Materials and Methods

2.1 Study Area

The study was conducted in Misau Metropolis, Misau Local Government, Bauchi State between April – September, 2021. Misau is an administrative capital of Misau Local Government Area of Bauchi State,

Nigeria. It is located at 11°40'27"N 10°11'28"E, at an elevation of 436 meters. The population has grown from 69,035 at the 1991 census to its 2007 estimated value of 110,452. Misau has an estimated temperature of 30 – 35° in the dry season and 26 – 28° in the cold days (November – January) while it is fluctuating during the rainy days. The area is surrounded by *Acacia nigrescens*, *Azadirachta indica* and many other trees. River flows downstream in many parts of the area thereby creating a wide wetland with a profusion of suitable breeding sites for mosquitoes. Samples were collected from five clusters namely, Mangari, Kesala, Rufa'I Quarters, main market, G.R.A all at nearly the same distance of about 6km

2.2 Sampling Techniques

Mosquito larvae were collected monthly from Five (5) randomly selected breeding sites, such as: containers, stagnant pools, domestic run-offs, footprints, vehicle tyres, and reservoirs and gutters. Samples were collected using a plastic dipper. The larvae collected were carefully transported to the Department of Biological Sciences, Bauchi State University, Gadau. Larval samples were fed with grounded biscuits until adults emergence. Adults were morphologically identified using microscope with the aid of key adapted from Hopkins (1952), Gillies and Coetzee (1987) and Koekemoer *et al.* (2002).

2.3 Data Analysis

The abundance of species with respect to the clusters was computed as the number of species per cluster out of the total number of mosquitoes collected and expressed as a percentage. The difference between species composition among the clusters was determined using Analysis of Variance (ANOVA).

3.0 Results

3.1 Mosquitoes Composition and Abundance

Results obtained from this study shows that three thousand seven hundred and thirty (3730) mosquitoes were collected from April to September, 2021. Out of which, 2231 (59.81%) were *Culex quinquefasciatus*, 1050 (28.15%) were *Culex molestus*, 231 (6.19%) were *Culex pipiens*, 106 (2.84%) were *Aedes aegypti*, 72 (1.92%) were *Aedes albopictus* and 40 (1.07%) were *Anopheles gambiae* (Table 1). Monthly abundance of different mosquito species in the study area is presented in Table 2. The month of August recorded the highest number of number of mosquitoes with the peak value of 877 mosquitoes while the month of April recorded the lowest number of mosquitoes with 424 mosquitoes.

3.2 Composition of Mosquitoes Sampled in Misau Metropolis, Misau Local Government, Bauchi State

Mosquito species and their abundance at various collection sites within Misau Metropolis, Misau Local Government Bauchi State is presented in Table 3. It is

evident that *Culex* species collected from different collection sites were more abundant than other species (*Aedes* and *Anopheles*). However, GRA sampling site recorded the highest number of mosquitoes collected (1049) followed by Main market (859) and State Low cost (636) respectively. Moreover, *Culex quinquefasciatus* recorded the highest number of

mosquitoes (2231) in all the sampling sites followed by *Culex molestus* (1050) and *Anopheles gambiae* has the lowest number of mosquitoes (40) in all the collection sites (Table 3). The variation in the species abundance across the study areas were found to be not significantly different from each other.

Table 1: Distribution of Mosquito Species sampled in Misau town, Misau Local Government Bauchi State

S/N	Mosquito Species	Number caught	% Abundance
1.	<i>Culex quinquefasciatus</i>	2,231	59.81
2.	<i>Culex molestus</i>	1,050	28.15
3.	<i>Culex pipiens</i>	231	6.19
4.	<i>Aedes aegypti</i>	106	2.84
5.	<i>Aedes albopictus</i>	72	1.93
6.	<i>Anopheles gambiae</i>	40	1.07
	TOTAL	3,730	100%

Table 2: Monthly Abundance of Difference Mosquito Species in Misau Metropolis

S/N	Month	<i>Culex quinquefasciatus</i>	<i>Culex molestus</i>	<i>Culex Pipiens</i>	<i>Aedes aegypti</i>	<i>Aedes albopictus</i>	<i>Anopheles gambiae</i>	TOTAL
1.	April	200	135	50	24	15	0	424
2.	May	231	140	53	34	22	2	482
3.	June	302	147	40	41	30	10	570
4.	July	441	170	23	3	5	12	654
5.	August	587	258	30	0	0	2	877
6.	September	470	200	35	4	0	14	723
	TOTAL	2231	1050	231	106	72	40	3730

Table 3: Mosquito Species and their Abundance at Different Collection Sites in Misau Metropolis, Misau Local Government, Bauchi state

S/N	Collection Site	<i>Culex quinquefasciatus</i>	<i>Culex molestus</i>	<i>Culex Pipiens</i>	<i>Aedes aegypti</i>	<i>Aedes albopictus</i>	<i>Anopheles gambiae</i>	TOTAL
1.	Mangari	320	156	45	19	16	5	561
2.	Kesala	336	205	52	17	7	8	625
3.	State Low Cost	354	197	38	25	12	10	636
4.	Main Market	576	186	50	22	17	8	859
5.	GRA	645	306	46	23	20	9	1049
	TOTAL	2231	1050	231	106	72	40	3730

4.0 Discussions

This study was designed to describe Distribution and Abundance of Mosquito Species in Misau Metropolis, Misau Local Government Bauchi State, Nigeria. The findings of this study showed mosquitoes species was represented by three (3) species of *Culex*, two species of *Aedes* and One (1) species of *Anopheles* mosquito. This study revealed that *Culex* species were the predominant species in the study area accounted for about 94.5%. This is in agreement with the study conducted by Abdulrashid *et al.*, (2016) within the same ecological zone which reported that about

91.38% of *Culex* species were found in Azare Bauchi State.

The abundance of mosquito population in the study area may be associated with the rainfall pattern. The population mosquitoes increased with the increase in rainfall from April and reduce in September. This could be attributed to the increase in the frequencies of rain falls from August - September that might facilitate the washing away of the developing larvae from their breeding habitats thereby leading to the decline in the population of mosquitoes.

The Present study provide the baseline data on the species abundance and composition of mosquito in

Misau metropolitan area. However, similar studies were conducted in some areas of the country and presented nearly the same results. Abdurashid *et al.* (2016) reported six different of mosquitoes was found in Azare, Bauchi State. Yayock *et al.*, (2021) recorded 13 species which fall within three common genera which comprise of *Culex* (94.19%), *Aedes* species (4.8%) and *Anopheles* 0.10%) in Four communities in Kaduna. Bunza *et al.* (2014) reported three different species of mosquitoes in Katsina. The presence of these mosquitoes which are vectors of malaria, yellow fever, lymphatic filariasis, and arboviruses suggest that the residents of Misau are at the risk of mosquito-borne diseases.

The results obtained from this study showed that *Culex* species are the predominant species over *Aedes* and *Anopheles* species. This may be attributed to the variation of the larval habitat requirement of the species as well as the grievances of the different mosquito larvae in their breeding ecology. *Culex* species prefer breeding in polluted gutters, blocked drains and other water retention habitats with organic matter unlike *Aedes* and *Anopheles* mosquitoes which prefer clean ground pools and man-made containers respectively.

5.0 Conclusion

The present study suggests that different mosquito species of public health importance are found in Misau metropolis, Misau Local Government Bauchi State. Lack of proper hygiene and drainage system could be attributed to the abundance of mosquitoes in the study area. Anthropogenic activities are also found to have been reported as factors that contribute to the increase population density of different mosquitoes species in the study areas and therefore there is a need for public enlightenment and good proper hygiene that will prevent mosquitoes from breeding in the area.

Declarations

Ethics approval and consent to participate.

Not Applicable

Consent for publication

All authors have read and consented to the submission of the manuscript.

Availability of data and material

Not Applicable.

Competing interests

All authors declare no competing interests.

Funding

There was no funding for the current report.

References

- Abdulrasheed, D., Aliyu, A.O and Hafsa B. (2016). Surveillance of Mosquito Species Abundance and Composition in Azare, Katagum Local Government of Bauchi State, Nigeria. *Journal of Pharmacy and Biological Sciences*.11 (6):105 -109.
- Barde, A., Aliyu A.O, Sam, M.P., Suwaiba, H., and Abdulrasheed, D. (2019). Studies on the composition and distribution of the different sibling species of *Anopheles gambiae* complex within Katagum area in Bauchi state, Nigeria. *International Journal of Mosquito Research*, 6(3): 01-04.
- Bunza, M.D., Suleiman, A.A., Yusuf, A.M and Bala, A.Y (2010). Relative abundance of Mosquito Species in Katsina Metropolis, Katsina State, Nigeria. *Nigerian Journal of Parasitology*. 31(2).
- Collins, F.H, and Besansky, N.J (1994). Vector Biology and the control of malaria. *Africa Science*, 264:1874-1875.
- Federal Ministry of Health (2009). National framework for monitoring and evaluation of malaria control in Nigeria, Federal Ministry of Health. Abuja, Nigeria, 39.
- Gillies, M.T, and Coetzee, B.A. (1987). Supplementary to Anophelinae of Africa, South of Sahara (Afro-Tropical Region). *Publication of the South African Institute of Medical Research*. 55:1-143.
- Hopkin, G. H. E. (1952). Mosquitoes of the Ethiopian Region. Larval Bionomics of Mosquitoes and Taxonomy of Culicine larvae. *British Museum (Nat. History)*. 8:1-14.
- Ikram, I. and Muhammad, S (2013). Species Composition and Relative Abundance of Mosquitoes in Swat. *Pakistan. International Journal of Innovation and Applied Studies*. 2 (4): 454-463
- Knight, K.L and Stone, A. (1977). "A catalog of the mosquitoes of the world (Diptera: Culicidae)", Thomas Say Foundation. E.S. A, vol.6.
- Rugemalila, J.B., Wanga, C.L and Kilama, W.L (2006). Sixth Africa Malaria Day: How far have we Come after the Abuja Declaration? *Malaria Journal*. 5:102.
- Service, M. W. (1993). Mosquito Ecology: Field Sampling Methods. 2nd Ed. London, UK. Elsevier Applied Sciences. 23pp.
- Sogoba, N., Doumbia, S., Vounatsou, P., Baber, I., Keita, M., Maiga, M., Traore, S. F., Toure, A., Dolo, G., Smith, T. and Ribeiro, M. C. (2007). Monitoring of larval habitats and mosquito densities in the Sudan savanna of Mali: implications for malaria vector control.

- American Journal of Tropical medicine and Hygiene.* 77(1): 82-88
- World Health Organization (WHO). 2022. World malaria report. Who Geneva, 2022. 372p. <http://www.who.int/malaria>.
- Yayock, H.C, Nicholas, O.O., Bitrus, S., Gimba, H.S and Shehu, R. (2021). Survey of Mosquito Species, Composition and Breeding Habitat in Four Communities of Kaduna Metropolis, Nigeria. *FUDMA Journal of Sciences.* 5 (3): 76 - 81.
- Zaim, M and Guillet P. (2002). Alternative insecticides; an urgent need. *Trends in Parasitology.*18: 161-163.