Distribution and abundance of mosquito species in Otuoke, Ogbia Local Government Area, Bayelsa State, Nigeria

Ezenwaka, C. O[1]*., Ailogie, T. E.[1]

[1]Department of Biology, Faculty of Science, Federal University Otuoke, Bayelsa State.
*Corresponding author: Ezenwaka, Chinonye Oluchi chyladyn@yahoo.com

© 2023 **Zoological Society of Nigeria**

Abstract

The distribution and abundance of mosquito species in Otuoke community of Ogbia Local Government Area, Bayelsa State, Nigeria was studied between April and July 2021. Indoor mosquito collections were carried using the Pyrethrum spraying method. Six (6) locations were sampled, consisting of Federal University Otuoke (FUO) female hostel and five other streets mapped out randomly within the community. The results of the study revealed 112 individual mosquitoes belonging to two genera; *Anopheles* and *Culex. Culex* species (83.93%) was significantly (p<0.05) more abundant than *Anopheles* (16.07%). All the *Culex* mosquitoes were identified as *Culex pipiens (*83.93%) Two species of anopheles, *Anopheles gambiae* 16(14.28%) and *Anopheles funestus* 2(1.76%) were identified morphologically. Nine (9) out of the 112 mosquitoes collected had slightly damaged genitals and were identified into genera and species but could not be differentiated into sexes. The total number of mosquitoes identified into sexes in the study was 103, out of which 13 (12.62%) were males and 90 (87.38%) were females. There was a significant difference between the sexes (p<0.05). Development of efficient mosquitoes' control strategy by the government and local communities is recommended. Also, regular sanitation and proper waste disposal should be undertaken by the residents.

Introduction

Mosquitoes are known vicious biters and their bites constitute nuisance, allergic reactions, skin irritations, scratching, restlessness and sleepless nights (Onyido *et al* 2009). Several mosquito vectors in different genera and species have been incriminated with the transmission of serious diseases to man and animal alike. Mosquitoes are estimated to transmit such deadly diseases as malaria, yellow fever, filariasis, dengue and various forms of viral encephalitis (Ukpai and Ajoku 2001) to more than 700 million people annually and responsible for the death of about 1 in 17 people (WECM and WHO 2000). All these diseases cause high death toll on both human and animal populations and lead to poor socio-economic development of many countries. Successful contact between female mosquitoes and their hosts is required for effective transmission of mosquito-borne diseases (Xu *et al* 2014). These contacts are established whenever mosquitoes by means of a feeding behavior, locate the host by responding to chemical, physical and visual cues emanated by the host from which they obtain blood meals necessary for egg development (Service 2004). The factors that attract mosquitoes to a human or animal host are complex and numerous and they are not fully understood. Mosquitoes use visual, heat and olfactory stimuli to locate a host.

Olfactory cues may be the most important as a mosquito nears the host but visual stimuli seem important in flight orientation, particularly over wide ranges. For daytime biters, movement of the host may initiate orientation towards that person or animal (Rueda *et al* 2001).

The diversity and abundance of mosquitoes within all geopolitical zones of Nigeria had been affirmed by several authors in their studies (Nwosu *et al* 2011; Ebenezer *et al* 2013; Afolabi *et al* 2019). Otuoke, which happens to be a deltaic community has many mosquitoes that are resident, although the abundance, distribution and species diversity had not been studied and recorded, hence it becomes imperative to take an in-depth view into the distribution and species abundance of mosquitoes in this area to provide baseline information.

Materials and Methods

Study area

The study was conducted at Otuoke, a rural community in Ogbia Local Government Area, Bayelsa State in the Niger Delta region of Nigeria. Located approximately at Latitude 4°49' North and Longitude 6°20' East, Otuoke is bounded to the East by Emeyal 1 and Kolo, to the West by Onuebum and Otuogori and to the South by Otuaba and Ewoi communities, all in Ogbia Local Government Area

of Bayelsa State. The average elevation of the Otuoke community is about 6m above sea level. The highest elevation within the study area is 12m, while the lowest elevation is -1m. The study area lies in the high rainfall belt of Nigeria, which is characterized by short dry season from November to March, and rainy season from April to October, with slight variations from year to year. The area has an inadequate waste disposal system and is in dearth of good water supply. The residents of the community comprise indigenes (who are predominantly farmers and fishermen) and non-indigenes who are basically Civil servants, traders, artisans and students.

Sample collection
The study was carried out in six (6) randomly selected locations in Otuoke community between April and July 2021. They include Federal University Otuoke (FUO) female hostel, De-Allarmies, P.A, Highness, Sir Ariolo and Market streets. A total number of 11 rooms were randomly sampled from 5 houses in each of the streets selected during the study. Sampling was done thrice weekly over a 12-week period. Indoor mosquito collections were carried out during the study. Verbal consent was obtained from the inhabitants of the rooms before sampling.

The Pyrethrum spray catch was used. Prior to spraying, the floors of the selected rooms were covered with plain white sheets, all pet animals, food stuff and water were evacuated. Spraying was done between 5-6am using commercial Pyrethroid (Mortein) and the rooms were kept air tight for 15 minutes after spraying. The white sheets spread on the floor were inspected for mosquitoes. Knock down mosquitoes were picked up with fine forceps into labelled petri dishes and preserved with Silica gel prior to identification (Ebenezer and Woyinzuosindor 2019). The samples collected were sorted in the Biology Laboratory of Federal University Otuoke and identified morphologically using standard keys (Gillies and Coetzee 1987).

Data analyses
The abundance of mosquitoes was recorded as percentages in a frequency table. Chi-square (χ^2) test was used to analyze all data statistically using SPSS. The significance of the results was tested at 0.05 levels.

Results

Distribution and abundance of mosquito genera in study area
One hundred and twelve (112) mosquitoes were collected in the study and identified into two genera, *Anopheles* 18(16.07%) and *Culex* 94(83.93%) (Table 1). The abundance of the two mosquito genera varied significantly ($p<0.05$). Two species of Anopheles were morphologically identified as *Anopheles gambiae,* 16(14.28%) *and Anopheles funestus,* 2(1.79%). All the Culex mosquitoes collected were identified as *Culex*

*pipiens (*83.93%) and were the most abundant species in the study area (Table 2).

Table 1: Distribution and abundance of mosquito genera identified in the study area

Genus	Frequency	Percent (%)
Culex	94	83.93
Anopheles	18	16.07
Total	**112**	**100.00**

Table 2: Species abundance of the mosquitoes collected in the study area

Species	Frequency	Percent (%)
Culex pipiens	94	83.93
Anopheles gambiae	16	14.28
Anopheles funestus	02	01.79
Total	**112**	**100.00**

Sex distribution and abundance of the mosquitoes collected during the study
Nine (9) out of the 112 mosquitoes collected were slightly denatured and were identified into genera and species but not into sex due to damaged genitals. The total number of mosquitoes identified into sexes in the study was 103, out of which 13 (12.62%) were males and 90 (87.38%) were females (Table 3). There was a significant difference between the male and female mosquitoes collected ($p<0.05$).

Table 3: Sex distribution of the mosquitoes collected during the study

Status	Frequency	Percent (%)
Male	13	12.62
Female	90	87.38
Total	103	100
Denatured mosquito samples	09	00.00
Grand Total	**112**	**100.0**

Distribution and abundance of mosquitoes genera across sampled locations
The result of this study showed that FUO female hostel had highest number of mosquitoes recorded with 41 (36.61%), followed by De-Allamies with 32 (28.57%) mosquitoes. The lowest abundance of mosquitoes 4 (3.57%), was recorded at Sir Ariolo street. *Culex* mosquitoes were obtained in all the locations, though highest with 32 (28.57%) at De-Allamies, while *Anopheles* mosquitoes were seen only at P.A. street (2),

Sir Ariolo street (1) and FUO female hostel (15, which had the highest occurrence of this genus (Table 4). The distribution and abundance of mosquitoes collected per location did not vary significantly (p > 0.05).

Table 4: Distribution and abundance of mosquitoes genera across sampled locations

Location	Genera		Total (%)
	Anopheles (%)	*Culex* (%)	
De-Allamies Street	00	32	32 (**28.57**)
P.A Street	02	12	14 (**12.50**)
Market Street	00	08	08 (**07.14**)
Highness Street	00	13	13 (**11.61**)
Sir Ariolo Street	01	03	04 (**03.57**)
FUO Female Hostel	15	26	41 (**36.61**)
Total	**18 (16.07)**	**94 (83.93)**	**112 (100.00)**

F=3.270, df = 10, p=0.101

Discussion

This study observed that *Anopheles* and *Culex* mosquitoes were abundant in Otuoke community, conforming to results of studies in other localities in Nigeria (Aigbodion and Uyi 2013; Lamidi *et al* 2017; Afolabi *et al* 2019; Ebenezer *et al* 2013). This also affirms the observation made by Onyido *et al* (2009) on the co-existence of these two species in an area or locality. These two species are cosmopolitan and breed indiscriminately in aquatic habitats as opined by Afolabi *et al* (2019). The significant variation in the abundance of *Anopheles* and *Culex* mosquitoes can be attributed to the difference in their requirements for survival (Afolabi and Aladesanmi 2018). *Anopheles gambiae* mosquitoes breed in transient habitats such as shallow fresh water pool or man-made habitats and temporary breeding sites such as hoof prints and tyre tracks (Ombugadu *et al* 2020), while *Culex species* are known to breed in polluted water bodies including open drains, open or cracked septic tanks and pit latrines (Uttah *et al* 2013). *Culex* mosquitoes were more abundantly distributed in the study area, as they were seen in all locations sampled. The reason for higher abundance of *Culex* mosquitoes (83.93%) in Otuoke community is not farfetched. The relative abundance of stagnant water bodies and the abundance of man-made pools due to excavation, coupled with an over flow of damaged septic tanks in this locality explain the high abundance of this species. The fact that the mosquito abundance coincided with period of rainfall in the study area indicates that rainfall plays significant role in mosquito population dynamics due to the availability of breeding sites during this season (Lamidi *et al* 2017). Reports by different researchers from different parts of Nigeria recorded high abundance of mosquito species during the rainy season than during the dry season (Olayemi and Ande 2008; Uttah *et al* 2013; and Oduola *et al* 2013). Surprisingly, varied report by Okorie *et al* (2014) recorded more mosquitoes abundance during the dry months compared to the wet month in Ibadan, Southwestern Nigeria.

The abundance of more female mosquitoes (87.38%) than males (12.62%) agrees with studies by Onyido *et al* (2009); Okwa *et al* (2011); Madara and Abdulraheem (2013) and Ombugadu *et al* (2020) who collected more female mosquitoes than male mosquitoes in their studies. The result of this study buttress the point that female mosquitoes travel far in search of blood meal and need a resting place to cool before they finally feed (Rueda *et al* 2001).

FUO female hostel has the highest mosquito abundance 41(36.61%). This due to the availability of stagnant water bodies, its close proximity to high-rise vegetations and indiscriminate refuse dump, which may serve as breeding ground for these vectors. According to Ombugadu *et al* (2020), the presence of mosquitoes in the students' hostel will possibly expose the students to high risk of human-vectors contact that will result in transmission of mosquito-borne diseases, which will negatively affect students' performance due to loss of both lectures hours and scarce resources meant for upkeep to be used for purchase of drugs. The low mosquito abundance recorded at Sir Ariolo Street could be due to little or no stagnant water and vegetation compared to other sampled locations. The area is also noted for good drainage system, good sanitation, and neatly organized structures due to its closeness to the University entrance gate.

Conclusion

This study revealed that two genera of mosquito were present in the study area. The distribution and abundance of *Anopheles* and *Culex* mosquitoes in the study area suggest that the residents are at risk of mosquito-borne diseases. The results of this study had provided very vital information, which can be used to design a sustainable mosquito control strategy to eliminate transmission and the possibility of outbreak of mosquito-borne diseases in the area.

Acknowledgements

References

Afolabi, O.J. and Aladesanmi, C.O. 2018. Seasonal variation in distribution and abundance of mosquitoes (Diptera: Culidae) in Akure North Local Government Area, Ondo State, Nigeria. *Uttar Pradesh J. Zool. 38*(4): 149-159.

Afolabi, O.J., Akinneye, J.O. and Igiekhum, A.M.A. 2019. Identification, abundance, and diversity of mosquitoes in Akure South Local Government Area, Ondo State, Nigeria. *J. Basic Appl. Zool. 80*: 39. https://doi.org/10.1186/s41936-019-0112-4.

Aigbodion, F.I. and Uyi, O.O. 2013. Temporal Distribution of and Habitat Diversification by Some Mosquito (Diptera: Culicidae) species in Benin City, Nigeria. *J. Entomol. 10*(1): 13-23.

Ebenezer, A., Ben, H.I.B., and Enaregha, E.B. 2013. Atial distribution and indoor resting density of mosquito species in the lowland rainforest of Bayelsa State, Nigeria. *Int. J. Trop. Med. 8*(4): 87-91.

Ebenezer, A. and Woyinzuosindor, S. 2019. Effect of Housing Patterns on the Indoor Resting Density of Mosquitoes Vector in the Rural *Communities* of Sagbama Local Government Area, Bayelsa State, Nigeria. *J. Entomol. Zool. Stud. 7*(1): 1507-1510.

Gillies, M.T. and Coetzee, M. 1987. A supplement to the Anophelinae of Africa South of the Sahara (Afrotropical Region). Publication of the South African Institute of Medical Research *55*: 143.

Lamidi, B.T., Alo, E.B. and Naphtali, R.S. 2017. Distribution and abundance of *Anopheles* Mosquito species in three selected areas of Taraba state, North-Eastern Nigeria. *Anim. Res. Int. 4*(2): 2730 - 2740.

Madara, A.A. and Abdulraheem, N.O. 2013. Relative Abundance of Adult Mosquitoes in University of Abuja Main Campus, Abuja FCT, Nigeria. *Nig. J. Parasitol. 34*(2): 79-84.

Nwosu L.C., Iwu C.J. and Nwosu U.I. (2011). Assessment of mosquito diversity and evaluation of impact of house treatment with DDT on their population in Amauro, Okigwe L.G.A., Imo State, Nigeria. *Ethiop. J. Environ. Stud. Manag. 4*(3): 51-55.

Oduola, A.O., Olojede, J.B., Oyewole, I.O., Otubanjo, O.A. and Awolola, T.S. 2013. Abundance and diversity of *Anopheles* species (Diptera: Culicidae) associated with malaria transmission in human dwellings in rural and urban communities in Oyo State, Southwestern Nigeria. *Parasitol Res.* 112:3433–3439.

Okorie, P.N., Popoola, K.O.K., Awobifa, O.M., Ibrahim, K.T. and Ademowo, G.O. 2014. Species composition and temporal distribution of mosquito populations in Ibadan, Southwestern. Nigeria. *J. Entomol. Zool. Stud. 2*(4): 164–169.

Okwa, O.O., Bello, B.A. and Olundegun, S.A. 2011. Human host preference of *Anopheles* mosquitoes collected from students hostels in a Nigerian university. *South Asian J. Exp. Bio. 1*(3): 141-146.

Olayemi, I.K. and Ande, A.T. 2008. Survivorship of *Anopheles gambiae* in relation to malaria transmission in Ilorin, Nigeria. *Online J. Health Allied Sci. 7*(3): 1–5.

Ombugadu, A., Maikenti, J.I., Maro, S.A., Vincent, S.O., Polycarp, I.A., Pam, V.A., Samuel, M.D., Njila, H.L., Pam, D.D., Deme, G.G., Adejoh, V.A., Echor, B.O., Attah, A.S., Igboanugo, S.I., Yina, G.I., Ahmed, H.O., Aimankhu, O.P., Luka, J., Ayuba, S.O., Aliyu, A.A., Anyim, J.O., Micah, E.M., Lapang, M.P., Luka, I., Mamot, L.P., Mafuyai, M.J., Nkup, C.D., Angbalaga, G.A., Uzoigwe, N.R. and Mwansat, G.S. 2020. Feeding Behaviour of mosquito species in Mararraba-Akunza, Lafia Local Government Area, Nasarawa State, Nigeria. *Biomed. J. Sci. Tech. Res. 28*(4): 21822-21830.

Onyido, A.E., Ezike, V.I., Ozumba, N.A., Nwankwo, A.C.N., and Nwankwo, E.A. 2009. Yellow fever vectors' surveillance in three satellite communities of Enugu Municipality. *Nig. J. Parasitol 1*: 13-17.

Rueda, L.M., Harrison, B., Brown, J., Whitt, P.B., Harrison, R.Y. and Gardner R., 2001. Evaluation of 1-octen-3-ol, carbon dioxide and light as attractants for mosqueitoes with two distinct habitats in North Carolina. *J. Am. Mosq. Control Assoc. 17*: 61–66.

Service, M. 2004. Medical Entomology for Students (3rd ed.). Cambridge University Press, Cambridge, 285pp.

Ukpai, O.M and Ajoku, E.I. 2001. The Prevalence of Malaria in Okigwe and Owerri Areas of Imo State. *Nig. J. Parasitol. 22*(182): 43-48.

Uttah, E.C., Wokem, G.N. and Okonofua, C. 2013. The abundance and biting patterns of *Culex quinquefasciatus* Say (Culicidae) in the Coastal Region of Nigeria. *Int. Sch. Res. Notices. 2013*: https://doi.org/10.1155/2013/640691.

WHO Expert Committee on Malaria and World Health Organization (WECM and WHO) 2000. WHO expert committee on malaria: twentieth report (No 892). World Health Organization, Geneva.

Xu, T., Zhong, D., Tang, L., Chang, X., Fu, F., Yan, G. and Zheng, B. 2014. *Anopheles sinensis* mosquito insecticide resistance: comparison of three mosquito sample collection and preparation methods and mosquito age in resistance measurements. *Parasit. Vectors 7*: http//doi: 10.1186/ 1756-3305-7-54.