Lafia Journal of Scientific & Industrial Research (LJSIR), Vol. 2(2), 2024
p-ISSN: 3026 – 9288 ; e-ISSN: 3027 – 1800; pages: 134 – 138
https://lafiascijournals.org.ng/index.php/ljsir/index ⇒ Published by the Faculty of Science,
Federal University of Lafia, Nasarawa State, Nigeria

Entomological Collections and Identifications of Mosquito Faunas in Selected Area Councils of Nigeria Federal Capital Territory

Oluwaseun Adegbola Adesoye[1,2], Tolulope A. Oyeniyi[2], Ayodele S. Babalola[2], Olalekan E. Olagundoye[2], Romoke T. Izekor[2], Oluwakemi O. Adetunji[2], Israel O. Akinsete[3], Adeniyi Kamoru A.[4], Callistus A. Akinleye[5], Adewale D. Adediran[2], Chidinma Isaac[2] & Adedapo O. Adeogun[2]*

[1]Department of Biological Sciences, University of Abuja, Abuja, Nigeria
[2]Molecular Entomology and Vector Control Research Laboratory, Nigeria Institute of Medical Research, Yaba, Lagos, Nigeria
[3]Department of Animal Biology, Federal University of Technology, Minna, Nigeria
[4]Department of Biological Sciences, Federal University, Dutse, Nigeria
[5]Department of Community Medicine, Osun State University, Osogbo, Nigeria

Abstract

Mosquito survey and identification are foundational elements of an effective vector management plan. The present study therefore aimed to collect and identify various mosquito species in some selected Area Councils in the Federal Capital Territory (FCT), Nigeria. Larval of various species of mosquitoes were collected and identified in different breeding sites across selected Area councils in the FCT. The collected larvae were raised to adult stage and were further identified using morphological keys. Data obtained were analysed using SPSS version 27.0 and p-value was set at 95%. Samples were collected from Abuja Municipal, Gwagwalada and Bwari area councils. The study identified *Anopheles funestus*, 150(9.8%), as the least mosquito species collected and *Culex quinquefasciatus*, 307 (20.1) was the most abundance species in the study areas. Mosquito species co-exist in various breeding sites with *Anopheles* species mostly associated with temporary breeding. The study provides a baseline data concerning mosquito vector population and composition in the FCT. This information thus informs the public and vector management officials about the risks and the need to scale-up preventive measures against human-vector contact.

Keywords: Mosquito species, FCT, public health, breeding sites

Article History

Submitted
April 18, 2024

Revised
July 30, 2024

First Published Online
August 2, 2024

Corresponding author
A. O. Adeogun ✉
dapoadeogun@hotmail.com

doi.org/10.62050/ljsir2024.v2n2.341

Introduction

Mosquitoes pose significant public health and economic challenges in Nigeria due to their role as vectors for various infectious diseases [1, 2]. In terms of public health, *Anopheles* mosquito species transmits malaria which is a major public health problem in Nigeria, accounting for a significant proportion of morbidity and mortality, especially in children under five and pregnant women. Some other mosquito species such as *Culex* and *Aedes* species are vectors of Dengue fever, yellow fever, Lymphatic filariasis etc. which are endemic and emerging public healththreat in the country [2, 3]. Economically, the aforementioned diseases impose a heavy economic burden due to healthcare costs leading to poor feeding, lost productivity, and negatively impact on household general wellbeing [4, 5].

As cases of mosquito borne disease such as malaria and lymphatic filariasis has been recently reported in Nigeria [6, 7] and especially in the Federal Capital Territory (FCT), Abuja [8, 9], mosquito vector control and managementis needed to reduce the transmission risk of vector-borne diseases. Proven, cost-effective vector control tools that could be employed include long-lasting insecticidal nets (LLIN), indoor residual spraying, space sprays, larvicides, molluscicides and environmental management for specific target vectors [6, 10-15].

Identifying specific mosquito species allows for the implementation of mosquito control and management interventions, such as larviciding or adulticiding, which can be more efficient and cost-effective [16]. Moreso, by identifying mosquito species and understanding their distribution patterns, aid the development of more appropriate and effective control strategies [17]. Surveys help identify breeding sites and ecological preferences of mosquito species, aiding in habitatmodification and source reduction efforts [18]. Despite several recompenses of mosquito survey towards curbing the menace of mosquito borne diseases, there is significant paucity of information regarding the distribution of various mosquito fauna in FCT. Hence, the present study was designed to collect and identifyvarious mosquito species in some selected AreaCouncils in the Federal Capital Territory (FCT), Nigeria.

Materials and Methods

Study areas

The research was conducted in 3 area Councils in the FCT, Abuja, Nigeria, namely Abuja Municipal (AMC), Gwagwalada (GW) and Bwari area councils with three communities (locations) randomly selected from each area. Using standard procedure [19], larvae of mosquitoes were collected from permanent and temporary breeding sites [1, 7] which includes river, drainage, gutters, tyre tracks, ponds, and ditches in the selected communities (Fig. 1). Prior to mosquito larval collections, Informed consent was obtained from residents in the study areas, and a local contact from each location helped identify suitable collection sites.

A = Stream, **B** = Abandoned wheel-tires, **C** = Swamp, **D** = Drainage, **F** = River

Figure 1: Some identified mosquito breeding sites in FCT Area Councils, Abuja, Nigeria

Examination of mosquito larvae

Larvae were identified based on their horizontal positioning on the water surface [20]. Nature of breeding sites and geographical area were also examined. The larvae were then transported to laboratory, where they were reared to adulthood following standard procedure [14]. Species of mosquitoes were further confirmed at adult stage using entomological key [21].

Statistical analysis

Information obtained on geographic area, nature of breeding sites and, distribution of mosquito species was analysed using descriptive statistics and Analysis of Variance (ANOVA), with a significance level set at test at $P<0.05$.

Results and Discussion

A total of 1520 mosquitoes were collected in the study from the 3 selected area councils of which Bwari area council accounted for the greatest share of 49.3% (Table 1). *An. funestus* has the least number of identified mosquito species in the study and may be accounted for the malaria incidence together with *An. gambiae*s L. 188(12.3%), in the FCT. *Culex quinquefasciatus* and *Aedes aegypti* has the largest proportion of mosquitoes, 307 (20.1%) in the present posing a significant (P=0.02) public health together with other species in the study areas.

Table 2 presents the information on the variations and distribution of mosquito samples collected from Abuja Municipal Council (AMC). The location is an urban settlement with majority number of temporary breeding sites. *Anopheles gambiae* mosquitoes has the highest population, 81 (24.5) and *Culex pipiens*, 41 (12.4), being the least identified in the AMC.

Table 1: Distribution of mosquito species across the selected Area Council in FCT, Abuja

Area Council	*An. gambiae*s L. N (%)	*An. funestus* N (%)	*Cx. quinquefasciatus* N (%)	*Cx. pipiens* N (%)	*Ae. aegypti* N (%)	*Ae. albopictus* N (%)	Unknown N (%)	Total N (%)	P-value
AMC	81 (5.3)	52 (3.4)	50 (3.1)	41(2.6)	50 (3.2)	45 (2.9)	11 (0.7)	330(21.7)	0.02
Gwagwalada	45 (2.9)	51 (3.4)	91 (5.9)	93(6.1)	82 (5.4)	71 (4.7)	7 (0.4)	440 (28.9)	
Bwari	62 (4.0)	47 (3.0)	166 (10.9)	120 (7.8)	175 (11.5)	170 (11.1)	10 (0.6)	750 (49.3)	
Total	188(12.3)	150 (9.8)	307 (20.1)	254 (16.7)	307(20.1)	286 (18.8)	28 (1.8)	1520(100)	

Table 2: Distribution of mosquito samples collected in Abuja Municipal Council (AMC)

A.C	Location	*An. gambiaes* L. N (%)	*An. funestus* N (%)	*Cx. quinquefasciatus* N (%)	*Cx. pipiens* N (%)	*Ae. Aegypti* N (%)	*Ae. Albopictus* N (%)	Unknown N (%)	Total N (%)	P-value
AMC	Airport	37(11.2)	25 (7.5)	12 (3.6)	9 (2.7)	24(7.2)	14 (4.2)	4 (1.2)	125(37.8)	0.87
	Uniabuja	21 (6.3)	15 (4.5)	23 (6.9)	18 (5.4)	14(4.2)	10 (3.0)	2 (0.6)	103(31.2)	
	Lugbe	23 (6.9)	12 (3.6)	15 (4.5)	14 (4.2)	12(3.6)	21 (6.3)	5 (1.5)	102(30.9)	
	Total	81(24.5)	52(15.7)	60 (18.1)	41(12.4)	5015.1)	45 (1.3)	11 (3.3)	330(100)	

AMC: Abuja Monicipal Council; **A.C:** Area council

Table 3: Distribution of mosquito samples collected in Gwagwalada (GW) Area Council

A.C	Location	*An. gambiaes* L. N(%)	*An. funestus* N (%)	*Cx. quinquefasciatus* N (%)	*Cx. pipiens* N (%)	*Ae. Aegypti* N (%)	*Ae. Albopictus* N (%)	Unknown N (%)	Total N (%)	P-value
GW	Giri	11(2.5)	24 (5.4)	21(4.7)	32(7.2)	23(5.2)	30(6.9)	3(0.7)	144(0.7)	0.52
	Zuba	13(2.9)	11(2.5)	31(7.0)	25(5.6)	24(5.4)	23 (5.2)	3 (0.7)	130()	
	Gw	21()	16(3.6)	38(8.6)	39(8.8)	38(8.6)	18 (4.1)	1(0.2)	166 ()	
	Total	45(5.8)	51(12.6)	91(21.7)	93(21.1)	82(19.1)	71(16.1)	7(2.0)	440(100)	

A.C: Area Council; **GW**: Gwagwalada

Table 3 presents the distribution of mosquito samples recovered from Gwagwalada (GW) area council. There were more of temporary breeding across the location of larval collection. *Culux pipiens* contributed the highest number of mosquitoes collected with *An. gambiae* (5.8%) being the least collection contributor.

A relatively developing Bwari Area Council ofthe FCT contributed most significantly (P = 0.41) to the mosquito sample collected in the present study. Kubwa, an urban settlement has 5.3%, highest *An. gambiae* species identified in the area. On the other hand, Dutse Alhaji (semi-urban settlement) has the greatest identified *Cx. pipiens* (6.8%) in Bwari Area Council (Table 4).

In general, greater population of *An. gambiae*s.l and *An. funestus* are found in areas that are well developed with temporary breeding sites. On the other hand, *Culex* and *Aedes* mosquito species are much more abundant in developing communities and this is synonymous with permanent and semi-permanent mosquito habitats.

Table 4: Distribution of mosquito samples species collected in Bwari Area Council

A.C	Location	*An. gambiaes* L. N(%)	*An. funestus* N (%)	*Cx. quinquefasciatus* N (%)	*Cx. pipiens* N (%)	*Ae. Aegypti* N (%)	*Ae. Albopictus* N (%)	Unknown N (%)	Total N (%)	P-value
Bwari	Dutse	9(1.2)	11(1.4)	97(3.6)	51(6.8)	36(0.48)	23 (3.0)	4 (1.2)	231(30.8)	0.41
	Barago	13(1.7)	20(2.6)	97(12.9)	42(5.6)	76(10.1)	78 (10.4)	3 (0.4)	286(38.1)	
	Kubuwa	40(5.3)	16(2.1)	54(7.2)	27(3.6)	63(8.4)	69 (9.2)	3 (0.4)	133(17.7)	
	Total	62(8.2)	47(6.2)	15(2.0)	120(16.0)	175(23.3)	170 (22.6)	10 (1.3)	750(100)	

A.C: Area Council

Information on mosquito diversity, distribution and nature of their habitants is of great significant towards the development of targeted and more efficient vector management [1, 7, 11, 21]. The present study has been able to present such a baseline data concerning mosquito fauna in 3 selected area council of Nigeria Capital Territory. Two major groups of malaria mosquito complexes were identified during this study. This is in line with some previous studies that implicated *An. gambiae* complex as the major malaria vector group in Nigeria and in some sub-Sahara African countries [22-24].

We discovered that Anopheline species are predominant in urban settlements where majority of the breeding sites are temporary. This accounts for the highest number of *An. gambiae* found in AMC. This affirms that malaria vectors prefer breeding sites that are relatively neat and close to human dwellings [25]. *Culex* and *Aedes* mosquito species are more abundant and synonymous with permanent breeding sites in the present in the present study. This is in accordance with the report of Li *et al.* [26]. However, the present study showed that *Anopheles* mosquitoes co-inhabit with other groups of mosquitoes such as *Culex* and *Aedes* and this supports our previous findings in Suleja metropolis [1].

The highest number of mosquito samples were recovered from Bwari area council. This could be because the area is still developing. Increased in population in such locationsdue to rural-urban drift results in urbanization with aconsequential increase in flooded areas. The flooded environment could provide ample opportunities for waterborne diseases and create conducive breeding sites for mosquitoes [27, 28].

Conclusion

This research work serves as a warning and emphasizes the importance of taking preventive measures such as using mosquito nets, insect repellents, and other strategies to reduce the risk of contracting mosquito-borne diseases.Identification and removal/destruction of mosquito breeding was one of the recommended means of controlling mosquito and curb transmission of mosquito borne diseases. Further studies (molecular identification) are required to determine which of the members of each complex is more predominant in the FCT.

However, this study encourages larval source management programs that will target both permanent and temporary habitats and collaborate closely with land and homeowners. Residents should also be educated about mosquito breeding areas and the importance of eliminating them.

Conflict of interest/financial disclosure: The authors declare no conflict of interest, and no financial support was received for this study.

Acknowledgements: We appreciate members of the communities where mosquito samples were collected for their cooperation and assistance.

References

[1] Adesoye, O. A., Oyeniyi, T. O., Olagundoye, E. O., Izekor, R. T., Adetunji, O. O., Babalola, A. S., Adeniyi, K. A., Akinsete, I., Oyeniran, O. A., Akinleye, C. A., Isaac, C. (2023). Implications of larval breeding sites on diversity of mosquito species in Suleja Metropolis, Northcentral Nigeria. *DUJOPAS*., 10(1), 20-28.

[2] World Health Organization. World Malaria Report 2023. Geneva: WHO, 2023. [Accessed 10/07/2024].https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2023

[3] Adesoye, O. A., Adeniyi, K. A., Adeogun, A. O., Oyeniran, O. A., Akinsete, I. O., Akinleye, C. A., Alaje, O. M., Ezeonuegbu, B. A. & Bello, Z. T. (2024). Malaria prevalence and its associated factors among pregnant women attending antenatal clinic at General Hospital, Dutse, Gigawa State. *DUJOPAS*., 10 (2b), 220-219.

[4] Soladoye, O., Adesoye, O. A. & Olugbile, O. (2021). Assessment of the socio-economic impact of the lockdown aimed to curb the spread of Coronavirus on residents of Osun State, Nigeria. *Anale Seria Information*, 18, 218-226.

[5] Adesoye, O. A., Adeogun, A., Adeniyi, A. K. & Ande, A. T. (2023). Nutritional composition of house cricket (*Acheta domesticus*) and dung beetle larva (*Oryctes boas*) in Osun State: Implication to dietary improvement in Nigeria. *Pajols.*, 7(1), 662-667.

[6] Oduola, A. O., Adesoye, O. A., Ande, A. T., Omojasola, F. P., Adelaja, O. J. & Ahmed El Imam A. (2017). Impact of Serial Dilutions of VectoMax® on *Bacillus* sp. Colony Progression in the Larval Gut of Culexquinque fasciatus Mosquitoes. *W. J. Biomed. Res*., 4(2), 55-61.

[7] Adeniyi, K. A., Adesoye, O. A., Muzammil, W. S., Akinsete, I., Shuaibu, T. & Adeogun, A. (2023). Species composition and abundance of indoor adult resting mosquitoes in the male students' Hostel at Federal University Dutse, Jigawa State, Nigeria. *DUJOPAS*., 9(4), 320-328.

[8] Okoroiwu, G. (2021). Assessment of malaria parasitaemia among the residents of Abuja Municipal Area Council (AMAC), FCT, Abuja, Nigeria. *J. Appl. Sci. Environ. Manage*., 25(5), 787-792.

[9] Emeribe, A., Abdullahi, I., Isong, I., Emeribe, A., Nwofe, J., Shuaib, B., Gwarzo, A., Usman, Y., Sadi, M., Umeozuru, C., Dangana, A., Egenti, B., Mallam, M., Emelonye, A., Aminu, M., Yahaya, H. & Oyewusi, S. (2021). Dengue virus is hyperendemic in Nigeria from 2009 to 2020: A contemporary systematic review. *Infect Chemother*., 53(2), 284-299.

[10] Olagundoye, O. E. & Adesoye, O. A. (2023). Larvicidal efficacy of *Azadirachta indica*, *Ocimumgratissimum* and *Cymbopogon citratus* ethanolic extracts against *Culex quinquefasciatus* larvae. *Pajols*., 7(1), 555-560

[11] Adeniyi, K. A., Abubakar, A. S., Adesoye, O. A., Balogun, J. B., Akinsete, I. O., Adeogun, A. O., Ezeonuegbu, B. A., Akinleye, C. A. & Dogara, M. M. (2024). Knowledge evaluation of mosquito control practices within the central region of Jigawa State, North-West Nigeria. *FJS*., 8(3), 270-276

[12] World Health Organization. Control of Neglected Tropical Diseases. Vector control 2024. [Accessed: 10/07/2024]. https://www.who.int/teams/control-of-neglected-tropical-diseases/interventions/strategies/vector-control

[13] Adeniyi, K. A., Adesoye, O. A., Okunlola, L., Sherif, M., Dauda, H., Akinsete, I. O., Adeogun, A. O., Ezeonuegbu, B. A. & Akinleye, C. A. (2024). Assessment of zoochemical constituents and antiplasmodial potency of crude methanol extract from millipede (Diplopoda: Pachybolidae) in *Plasmodium berghei* infected mice. *BJST, GST*., 8(2), 2536-6041.

[14] Adesoye, O. A., Adeogun, A., Oyeniyi, T. A., Olagundoye, O. E., Izekor, R. T., Adetunji, O. O., Babalola, A. S., Adediran, D. A., Isaac, C., Adeleke, T., Awolola, T. S. & Ande, A. T. (2023). Metabolic resistance mechanisms evident in generations of *Anophelesgambiae* (Kisumu) adults exposed to sub-lethal concentrations of permethrin insecticide. *Pajols*., 7(3), 430-471.

[15] Awodoyin, T. I., Omoloye, A. A., Alabi, O. Y. & Adesoye, O. A. (2024). Growth impact of *Tutaabsoluta* (Lepidoptera: Gelechiidae), Meyrick, on tomato plants and factors associated with the pest longevity in Nigeria. *DUJOPAS*., 10(2a), 206-214

[16] Takken, W. (2022). The mosquito and malaria: Would mosquito control alone eliminate the disease? In: Hall M, Tamïr D, editors. Mosquitopia: The Place of Pests in a Healthy World. New York: Routled Chapter 8. https://doi.org/10.4324/9781003056034-11

[17] Goodwin, A., Padmanabhan, S., Hira, S., Glancey, M., Slinowsky, M., Immidisetti, R., Scavo, L., Brey, J., Sai Sudhakar, B., Ford, T., Heier, C., Linton, Y., Pecor, D., Caicedo-Quiroga, L. & Acharya, S. (2021). Mosquito species identification using convolutional neural networks with a multitiered ensemble model for novel species detection. *Sci. Rep*., 11(1), 13656. https://doi.org/10.1038/s41598-021-92891-9.

[18] Bashar, K., Rahman, M. S., Nodi, I. J. & Howlader, A. J. (2016). Species composition and habitat characterization of mosquito (Diptera: Culicidae) larvae in semi-urban areas of Dhaka, Bangladesh. *Pathog Glob Health*, 110(2), 48-61. https://doi.org/10.1080/20477724.2016.1179862

[19] Russell, T., Staunton, K. & Burkot, T. (2022). Standard Operating Procedure for sampling Anopheles larvae. *Protocols.io.*, 2022, 1-7.

[20] Lee, S. C., Kim, J. H. & Lee, S. J. (2017). Floating of the lobes of mosquito (*Aedes togoi*) larva forrespiration. *Sci Rep.*, 7, 43050. https://doi.org/10.1038/srep43050

[21] Kittichai, V., Kaewthamasorn, M., Samung, Y., Jomtarak, R., Naing, K., Tongloy, T., Chuwongin, S. & Boonsang, S. (2023). Automatic identification of medically important mosquitoes using embedded learning approach-based image-retrieval system. *Sci. Rep*., 13(1), 10609. https://doi.org/10.1038/s41598-023-37574-3

[22] Koffi, A., Camara, S., Ahoua, P., Oumbouke, W., Wolie, R., Tia, I., Sternberg, E., Yapo, F., Koffi, F., Assi, S., Cook, J., Thomas, M. & N'Guessan, R. (2023). *Anopheles* vector distribution and malaria transmission dynamics in Gbêkê region, central Côte d'Ivoire. *Malar. J.*, 22(1),192.

[23] Adeogun, A., Babalola, A. S., Okoko, O. O., Oyeniyi, T., Omotayo, A., Izekor, R. T., Adetunji, O., Olakiigbe, A., Olagundoye, O., Adeleke, M., Ojianwuna, C., Adamu, D., Daskum, A., Musa, J., Sambo, O., Oduola, A., Inyama, P., Samdi, L., Obembe, A., Dogara, M., Poloma, K., Mohammed, S., Samuel, R., Amajoh, C., Musa, A., Bala, M., Omo-Eboh, M.E., Sinka, M., Idowu OA, Ande A, Olayemi I, Yayo A, Uhomoibhi P, Awolola S. & Salako B. (2023). Spatial distribution and ecological niche modeling of geographical spread of *Anopheles gambiae* complex in Nigeria using real time data. *Sci Rep*., 13, 13679. https://doi.org/10.1038/s41598-02340929-5

[24] Awolola, T. S., Adeogun, A., Olakiigbe, A. K., Oyeniyi, T., Olukosi, Y. A., Okoh, H., Arowolo, T., Akila, J., Oduola, A. & Amajoh, C. N. (2018). Pyrethroids resistance intensity and resistance mechanisms in Anopheles gambiae from malaria vector surveillance sites in Nigeria. *PLoS ONE*, 13(12), e0205230. doi: 10.1371/journal.pone.0205230.

[25] Chukwuekezie, O., Nwosu, E., Nwangwu, U., Dogunro, F., Onwude, C., Agashi, N., Ezihe, E., Anioke, C., Anokwu, S., Eloy, E., Attah, P., Orizu, F., Ewo, S., Okoronkwo, A., Anumba, J., Ikeakor, I., Haruna, S. & Gnanguenon, V. (2020). Resistance status of *Anopheles gambiae* (s.l.) to four commonly used insecticides for malaria vector control in South-East Nigeria. *Parasites Vectors*, 13, 152. https://doi.org/10.1186/s13071-020-04027-z

[26] Liu, X., Baimaciwang, W., Pengcuociren, G., Cirenwangla, D., Danzenggongga, D., Zhaxisangmu, L., Cirendeji, Z., Sun, J., Wang, J. & Liu, Q. (2019). Breeding site characteristics and associated factors of *Culex pipiens* complex in Lhasa, Tibet, P. R. China. *Int. J. Environ. Res. Public Health*, 16(8), 1407. doi: 10.3390/ijerph16081407

[27] Dejenie, T., Yohannes, M. & Assmelash, T. (2011). Characterization of mosquito breeding sites in andin the vicinity of *Tigray microdams*. *Ethiop. J. Health Sci*., 21(1), 57-66.

[28] Kweka, E., Zhou, G., Munga, S., Lee, M C. & Atieli, H. (2012). Anopheline larval habitats seasonality and species distribution: A prerequisite for effective targeted larval habitats control programmes. *PLoS ONE*, 7, e52084

Citing this Article

Adesoye, O. A., Oyeniyi, T. A., Babalola, A. S., Olagundoye, O. E., Izekor, R. T., Adetunji, O. O., Akinsete, I. O., Adeniyi, K. A., Akinleye, C. A., Adediran, A. D., Isaac, C. & Adeogun, A. O. (2024). Entomological collections and identifications of mosquito faunas in selected Area Councils of Nigeria Federal Capital Territory. *Lafia Journal of Scientific and Industrial Research*, *2*(2), 34 – 138. https://doi.org/10.62050/ljsir2024.v2n2.341