WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
Coden USA: WJPRAP Impact Factor 8.63
Volume 15, Issue 5, 574-582. Research Article ISSN 2277–7105

ENTOMOLOGICAL SURVEILLANCE OF MOSQUITOES (DIPTERA CULICIDAE) IN *EL-OBEID CITY, NORTH KORDOFAN STATE, SUDAN*

[1]*Hassan Yousif Adam Regal, Mawada Mahadi Makkawi Mansour[2], Najla Abdalmalik Abdu Ibrahim[2], Nuha Omer Adam Ahmed[2], Musa Adam Osman Mohammed[3], Halima B. G. Tigaidi[4]

*[1]Department of Parasitology, Faculty of Medical Laboratory Sciences, University of Kordofan.
[2]Department of Entomology, Faculty of Public and Environmental Health, University of Kordofan.
[3]Department of Epidemiology, Faculty of Public and Environmental Health, University of Kordofan.
[4]Department of Environmental Health, Faculty of Public and Environmental Health, University of Kordofan.

Article Received on 29 Jan. 2026,
Article Revised on 18 Feb. 2026,
Article Published on 01 March 2026,
https://doi.org/10.5281/zenodo.18797156

***Corresponding Author**
Hassan Yousif Adam Regal
Department of Parasitology, Faculty of Medical Laboratory Sciences, University of Kordofan.

How to cite this Article: [1]*Hassan Yousif Adam Regal, Mawada Mahadi Makkawi Mansour[2], Najla Abdalmalik Abdu Ibrahim[2], Nuha Omer Adam Ahmed[2], Musa Adam Osman Mohammed[3], Halima B. G. Tigaidi[4] (2026). Entomological Surveillance Of Mosquitoes (Diptera Culicidae) In El-Obeid City, North Kordofan State, Sudan. World Journal of Pharmaceutical Research, 15(5), 574–582.

ABSTRACT

Background and Objective: Mosquito are important vectors which causes several diseases in worldwide this disease led to morbidity and mortality of peoples. A study aimed to classify the genes of mosquitoes in Agricultural Research Area, El-Obeid city during one month in 2024. **Methods:** This household base descriptive cross-sectional study was conducted. It covered 22 houses. Data will be collected by using form and equipment. It targeted mosquito genus such as Anopheles, *Aedes* and *Culex*. All data was entered, processed and analyzed using the statistical package for social sciences (SPSS) version 23, and Microsoft excel software (2010) and results presented in tables and figure. All data collected will be securely stored on personal computer. **Results:** The survey revealed that the commonest of mosquito was *Culex* (57.4%) followed by *Anopheles* (40.9%) and *Aedes* (1.7%). It findings that the mosquitoes in adult stage were 91%, while in the larva stage was 9%. The density of adult was 8.23, and Larva was 0.24. **Conclusion:** Continuous entomological surveillance and integrated vector control measures are essential to mitigate the public health risks associated with mosquito-borne diseases.

KEYWORDS: Entomological, Surveillance, Anopheles, Aedes, Culex, El-Obeid.

1. INTRODUCTION

There are some 3530 species of mosquitoes, which are traditionally placed in 43 genera, all contained in the family culicidae. However, some mosquito experts recognize a different classification that has many more (113) genera.[1] Mosquitoes are vectors of many infectious diseases caused by parasitic and viral agents such as *lymphatic filariasis*, *chikungunya* and *Zika*, which cause important pathologies in humans and animals.[2]

World Health Organization (WHO) reported that 247 million people became ill in 2006 and about one million people died from mosquito-borne disease. although approximately three quarters of all mosquito species occur in the humid tropics and subtropics, mosquitoes are a problem not only in these regions. They also cause considerable nuisance or can occasionally transmit pathogens to humans in temperate latitudes, for example, the west Nile virus epidemic in the USA, or the outbreak of chikungunya fever in Italy in 2007.[3]

The North Africa countries, including Algeria, Egypt, Libya, Morocco, and Tunisia, suffer less from mosquito-borne diseases (MBDs).[4] As a result, several outbreaks of MBDs such a Dengue fever (DF), yellow fever (YF), and Rift Valley fever (RVF) occurred in some regions of the world as in Sudan between the years 2005 and 2015.[5] For example, an epidemic of RVF that occurred during the year 2019 th Eldamar area, in northern Sudan has resulted in 1,129 cases and 19 deaths.[6]

Despite its contributions, the study has certain limitations. Seasonal variations were not fully accounted for, which may influence mosquito density and species composition. Additionally, the study relied primarily on morphological identification, which may be subject to misclassification, particularly among closely related species. Molecular identification techniques could enhance accuracy in future studies.[7]

2. MATERIAL AND METHODS

2.1 Study design

A descriptive cross-sectional study was done to classify the genes of mosquitoes in Agricultural Researche Area, El-Obeid city during one month in 2024.

2.2 Study area

El-Obeid is the biggest city in the North Kordofan state. El-Obeid is one of the most important cities in North Kordofan, the importance lies in its state capital. El-Obeid is the capital of North Kordofan state. Its area has been estimated by 81 square kms and the distance from Khartoum is about 560 km. El-Obeid is connected to Khartoum by asphalt motorway, a railway and air flight. Bordered by three towns and two states, these are Um keridem the north-west, Bara from the north, El-Rahad from the east, and West Kordofan State from the west and south Kordofan State from the south. There are 32 hospital and 233 health centers in El-Obeid city. Agricultural Research Area is near to University of Kordofan from north, Elgalaa North from south and the east and Arafat from the west. The total area is 3.900x 1 Kilometer Squire. The number of houses is 44 and number of populations is 264.

2.3 Sampling and Sample Techniques

2.3.1 Sample size

This study targeted (44) houses, actually it covered (22) houses, as some of households' owners refused entry due to pesticide allergies, and some were also closed. A total specimens of mosquitoes collected was (181) adults and (18) larva.

2.3.2 Sample techniques

This study conducted for gathering mosquitoes in adult stage from houses and leave stage from breeding site (water sources). Knock down (Spray Catch) was applied according the following steps: a) obtain consent from houses occupants and explain the process, b) spraying with pyrethrum indoors and around eaves, c) quickly leave the room and keep all windows and doors closed for about 10 – 15 minutes to allow mosquitoes to get knock down, d) Re-enter and carefully gather the sheets, e) used forceps or an aspirator to pick up individual mosquitoes and transfer them to labeled collection cups or petri-dishes. Mosquitos' larvae stage samples were collected larvae by scooped from different water resources and screen it then takes larvae by pipette and preserve in tubes.

2.4 Data collection

Data collected for one month. The researchers used a form and the following equipment. Because of the incredible diversity of insects, we must select an appropriate tool and an appropriate way for collection.

2.4.1 Equipment

- An appropriate tool and equipment used for collecting larvae:

1. Used four pipettes for collect larvae.
2. Forcipes.
3. Scooping or catch larvae from different breeding resource.
4. Used tube for preserve sample.
5. Used screening for collect larvae.
6. Used petri dish.

- An appropriate tool and equipment used for collecting adults:

1. Used respirator for collect a live adult.
2. Used silica gel self-indicating (Coarse-Blue) to preservation sample.
3. Used sheet tope white colure, long (4x4m and 5x5m) for collect adult.
4. Used hudson pump (10 L) for spraying.
5. Used insecticides (cypercel 25% EC and permethrin 25% EC) diluted with water L per 100 m.
6. Used cotton to preserve sample.
7. Used light microscope with lens size 10 to test sample.
8. Used lamp to view sample.
9. Used stop watch to know time

2.5 Data processing and analysis

All data were checked and cleaned carefully. Data were entered, processed and analyzed using the Statistical Package for Social Sciences (SPSS), version (23.0).

3. RESULT

The commonest of mosquito was *Culex* (57.4%) followed by *Anopheles* (40.9%) and *Aedes* (1.7%), as showed in **Fig. 1.** It findings that the mosquitoes in adult stage were 91%, while in the larva stage was 9%, (see **Fig. 2).**

n= 181

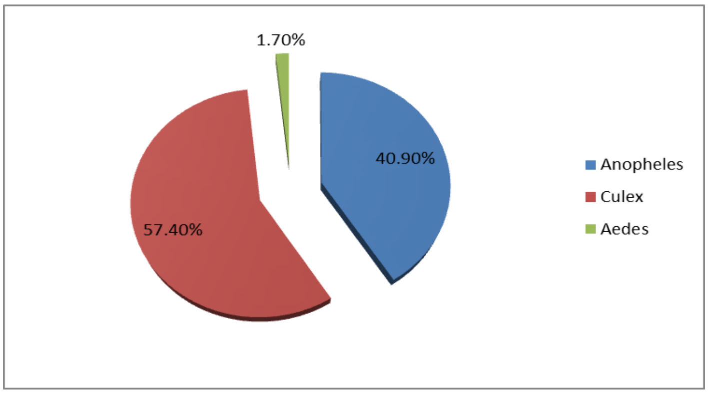

Fig. 1: Distribution of mosquito samples according to mosquito genus in the adult stage.

Table (1): Distribution of mosquito samples according to the larva stage.

Genus	Frequency	Percentages
Anopheles	9	50%
Culex	9	50%
Aedes	-	-
Total	18	100%

n= 18

The above table shows larva Anopheles were (50%), and Aedes (50%).

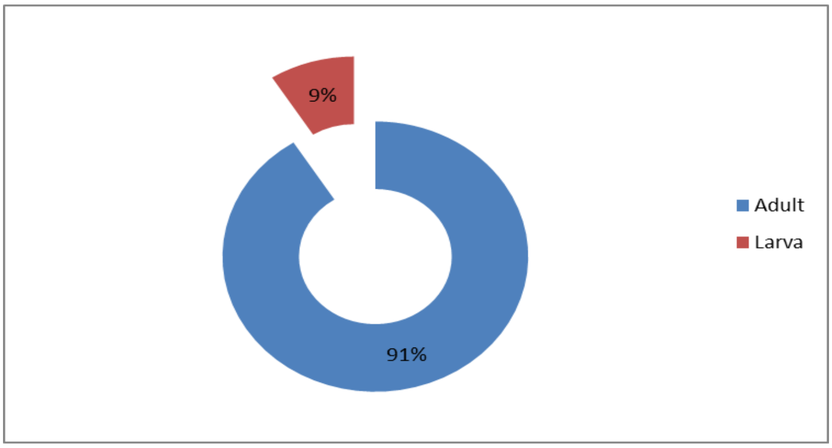

Fig. 2: Distribution of mosquitoes according to different stage.

Table (2): Density of larvae mosquitoes according to genus.

Genus	Total No.	No. of dipping	Density
Anopheles	9	75	3.4
Culex	9		4.7
Aedes	0		0.14
Total	**18**		**8.23**

***Density** = No. of Mosquitoes/No. of dipping

The above table illustrates the density of adult stage. Anopheles 3.4, culex 4.7, and aedes 0.14.

Table (3): Density of adult mosquitoes according to genus.

Genus	No. of mosquitoes	No. of rooms	Density
Anopheles	104	22	0.7
Culex	74		0.0
Aedes	4		1
Total	**181**		**1.7**

*__Density__ = No. of Mosquitoes/No. of rooms

The above table illustrates the density of larva stage; Anopheles was 0.75, Aedes was 1.

DISCUSSION

Our showed the majority of adult were Culex Culex (57.4%). This distribution pattern is consistent with several studies conducted in tropical and subtropical regions, where Culex mosquitoes dominate due to their ecological adaptability and tolerance to polluted breeding habitats.[1,3] A similar study done in southern Sweden number of collected Culex 107 in 2006 and 80 in 2008.[8] Other study done in the River Nile state in Northern Sudan reported that the highest proportion of mosquito catches was Culex (67.5%).[9] The predominance of Culex mosquitoes may be attributed to their ability to breed in stagnant water with high organic content, such as sewage channels and poorly maintained water bodies. Such environments are common in many developing regions and urban-peripheral settings, thereby favoring Culex proliferation over other genera.[10]

Study showed total of adult anopheles' mosquito were (40.9%). While a similar study conducted in Central and Eastern Sudan showed adult anopheline mosquitoes collected from New Halfa (45.9%), Rural Khartoum (12.7%), Senner (33.6%).[11] In River Nile State in Northern Sudan reported Anopheles species (30.9%).[9]

Classification of mosquitoes at the larval stage revealed an equal proportion of Anopheles (50%) and Aedes (50%). This study was higher than a similar study done in different area; in El-Obeid city, North Kordofan State; showed that the number of larvae Aedes counted was 10% stored for species identification.[12] In Republic of Sudan showed that Culex (22.7%) and anopheles (4.6%).[13] This finding contrasts with the adult stage distribution, suggesting differences in survival rates, ecological preferences, and transition success from larval to adult stages among mosquito genera. Anopheles larvae typically prefer clean, sunlit water bodies, while Aedes larvae are well adapted to artificial containers and transient water collections.[14] The equal representation of Anopheles and Aedes larvae indicates the presence of diverse aquatic habitats within the study area. This may reflect variations in water quality, container availability, and micro-environmental conditions. Similar observations have been reported in studies conducted in peri-urban and semi-rural settings where container-breeding Aedes coexist with freshwater-breeding Anopheles larvae.[15,16]

The adult mosquito density showed notable variation among genera. Culex exhibited the highest adult density (4.7), followed by Anopheles (3.4), while Aedes density was remarkably low (0.14). The higher density of Culex adults corroborates their numerical dominance in the study area and aligns with findings from similar ecological zones.[17]

Larval density analysis revealed that Aedes larvae had a higher density (1.0) compared to Anopheles (0.75). This finding highlights the prolific breeding capacity of Aedes mosquitoes, particularly in artificial containers and small water collections. High larval density does not necessarily translate into high adult density, as observed in this study, emphasizing the importance of stage-specific ecological pressures.[18]

The observed species composition and density patterns are broadly consistent with studies conducted in Africa and other tropical regions. Several researchers have reported Culex as the dominant genus in urban and semi-urban environments, while Anopheles remains prevalent in rural and peri-urban settings.[19,20]

CONCLUSIONS

This study demonstrates a clear predominance of Culex mosquitoes at the adult stage, with substantial representation of Anopheles, while Aedes mosquitoes were mainly confined to the larval stage with minimal adult density. These findings underscore the ecological diversity of mosquito populations and their implications for disease transmission. Continuous entomological surveillance and integrated vector control measures are essential to mitigate the public health risks associated with mosquito-borne diseases.

ACKNOWLEDGMENTS

The authors are thankful to the administrations of the Directorate General of Agricultural Research Cooperation Administrative, North Kordofan State for their support throughout. We acknowledge all households' owners for their cooperation and allowing for collecting mosquito samples. We would like to thank the reviewer for the valuable comments in reviewing the manuscript.

ETHICAL CONSIDERATIONS

The research proposal was approved by the Research Committee of the Health and Environmental Health Faculty. The Agricultural Research Foundation Manager was officially contacted, and permission was obtained for visit the households. Verbal consent was also obtained from the households' owners.

REFERENCES

1. Service M. *Medical Entomology for Students*. Cambridge University Press, New York, in the United State of Amerce, 2012; Pp 314.
2. Weaver S. C., Charlier C. and Vasilakis N. Chikungunya and other Emerging Vector-Borne Viral Disease. 69 Annu. *Rev. Med*., 2017; 408-395.
3. Becker. N., Petric D. et al. Mosquitoes and Their Control. second edition. Springer Science and Business Media. Berlin, Heidelberg, Germany, 2010.
4. Blagrove, Caminade et al. Co-occurrence of viruses and mosquitoes at the vector, optimal climate range: An underestimated risk to temperate regions. *PLoS Negl. Trop. Dis*., (2017).
5. World Health Organization. *Investing to overcome the global impact of neglected tropical disease*; third WHO report on neglected tropical diseases, WHO IS BW: 978924156-4861, (2015)
6. Ahmed A. et al. *Unique Outbreak of Rift Valley Fever in Sudan (2019)*. Emerging infection Disease, Sudan., (2020).
7. Foley, D.H. et al. Molecular identification of mosquitoes. Medical Entomology, 2007; 44(3): 382–394.
8. Hesso et a. Surveillance of mosquito vectors in Southern Sweden for Flaviviruses and Sindbis virus, 5;9(1), *Infect Ecol Epidemiol*., (2019)
9. Atia M. and Hassan M. Checklist of Mosquitoes (Diptera:Culcidae) in Northern Sudan. University of Sennar, Sudan., (2024)
10. Farajollahi, A. et al. The role of Culex mosquitoes in disease transmission. Journal of the American Mosquito Control Association, 2011; 27(2): 123–134.
11. Abdelwhab O. et al. Molecular and morphological identification of suspected plasmodium vivax vectors in Central and Eastern Sudan.132. *Malaria Journal*, 2021; 20.

12. Hajhamed, Fadlala, Dabaka et al. Appearance of Aedes Aegypti Mosqito in AlObeid Twon, North Kordofan State. *Journal of Genetic Engineering and Biotechnology Research*, (2018).
13. Mohamed et al. Aedes Mosquitoes in the Republic of the Sudan, With Dichotomous Keys For The Adult And Larval Stages. University of Khartom, Sudan., (2017).
14. World Health Organization (WHO). *Vector surveillance and control*, (2017).
15. Silver, J.B. *Mosquito Ecology*. 3rd Ed., (2008).
16. Rueda, L.M. *Pictorial keys for mosquito identification*, (2008).
17. Takken, W. and Knols, B.G.J. (2009). Malaria vector control. Annual Review of Entomology, 54: 271–293.
18. Nathan, M.B. et al. Integrated vector management. WHO Bulletin, 2006; 84: 715–722.
19. Coetzee, M. et al. Distribution of Anopheles species in Africa. Medical and Veterinary Entomology, 2000; 14(3): 213–219.
20. Hemingway, J. et al. Vector control challenges. The Lancet, 2016; 387(10029): 1785–1794.