DIVERSITY OF MOSQUITO LARVAE IN KWARE LOCAL GOVERNMENT SOKOTO STATE OF NIGERIA

Hafiz Abubakar
College Of Agriculture Wurno, Sokoto State
Kasimu Abubakar Shagari, Nasiru Modi
Email: kasimushagari88@gmail.com
Shehu Shagari College of Education Sokoto

ABSTRACT
The study investigates the occurrence and abundance of mosquito larvae in Kware Local Government, Sokoto State. The mosquito larvae were collected using Simple Scoop Method and Larvae were identified to generic level using morphological features. The mosquito larvae observed belong to three genera- Aedes, Anopheles, and Culex. The Anopheles spp had the highest occurrence with 54.76% abundance followed by Culexspp with 44.38% abundance while Aedesspp has the least occurrence with 0.864% abundance. The study provided evidence to support mosquito control operation within the study area.

Keywords: Diversity, abundance, Occurrence, Mosquito, and Larvae

INTRODUCTION

Mosquitoes play a predominant role in the transmission of malaria, dengue fever, yellow fever, filariasis and several diseases which are today among the greatest health problems in the world. Mosquitoes are one of the most medically significant vectors, and they transmit parasites and pathogens, which continue to have a devastating impact on human beings and other animals (Elumalaiet al., 2013a,b).According to Kline (2002) mosquitoes are insects which belong to the kingdom Animalia, phylum Arthropoda, class Insecta, order Diptera, suborder Nematocera, InfraorderCulicomorpha, superfamily Culicoidea, family Culicidae and consist of 3-subfamilies; Anophelinae, Culicinae, and Toxorhynchitinae. He added that mosquitoes consist of 41 genera.Several mosquito species belonging to genera Anopheles, Aedes and Culex are the vectors for the pathogens of various diseases and contribute significantly to poverty and social debility in tropical countries (Jiang et al., 2009).

Aedes species are important vectors of yellow fever, dengue, encephalitis viruses, and many other arboviruses, and in a few restricted areas, they are also vectors of Wuchereriabancrofti and Brugiamalayi, (Kandaswamyet al., 2012).

*Anopheles is a genus of mosquito that is best known for transmitting malaria. This genus contains over 420 known species of mosquitoes**.** Human malaria is transmitted by the bite of infected female Anopheles mosquitoes (Mishvaret al., 2014)**.**Larvae of the Anopheles species are generally found in distinctly different habitats and are nocturnal, crepuscular in nature and also transmit the filarial worm causing filariasis(Dean, 2001).*

Culexquinquefasciatusis one of the medically important species of mosquitoes occurring in tropical and warm temperate regions of the world (Nikkonet al., 2011). Culexquinquifasciatusisa dominant and important species of the large Culexgenus, with 768 species. The species is a vector of Wuchereriabancrofti the parasitic filarial nematode, responsible for causing human lymphatic filariasis, in endemic parts of the world (Lima et al., 2003). The species is the most dominant urban nuisance mosquito in Nigeria known for its nocturnal discomfort and allergies caused as a result of its human-biting activities

Mosquitoes are widely distributed throughout the world and they utilize different waterbodies for their breeding (WHO, 1982). Many species of mosquitoes breed in both artificial and natural containers such as pools, gutters , coconut shell, tree holes, bamboo strip, leaf axils, septic tank and so on (Mafiana, 1989; Aigbodion and Anyiwe, 2005). The distribution of mosquitoes is influenced both directly and indirectly by climatic and environmental factors (Mafiana, et al., 1998).Mosquito prefers an environment with certain resources (food, shelter, favorable temperature, suitable humidity) in sufficient amount and at an appropriate time for survival and development (Romoser and Staffolano,1998).

Hopkins (1990) outlined the various factors which affect the condition of waterbodies and consequently make it suitable or unsuitable for mosquitoes breeding. These factors are complex and often difficult to measure but some work has been done along these lines (Foy, 1989), the most important factors affecting the condition of water bodies are; salt or other dissolved inorganic matter such as NO_3, OH, S_2O3, PO_4, HCO_2 and NH_3, dissolved organic matter, suspended mud, presence or absence of temperature, light and shade, nitrogenion concentration and food substances.

According to Clement (1992), mosquitoes require water to complete their life cycle and they are poikilothermic (cold-blooded) animals, thus, their rate of development and other aspects of their physiology are temperature dependent, as the temperature increases time required for development is shortened. Clement (1962) also reported that mosquitoes undergo four stages in their life cycle which are – egg, larva, pupa, and adult stages. The first three stages are aquatic and last fora period of 5-14 days depending on the species and ambient temperature.

The study of larval habitat and their physicochemical characteristics contributes information about the distribution and abundance of adult mosquito population (Forattini, 1962) and helps to appropriate larval control strategies. At the same time, the classification of mosquito species on the basis of common features of their habitats increases the knowledge about mosquito biology during the immature stage, several investigations have been conducted to characterized mosquito larval habitats and cluster the species based on common habitats for development. For active (1962)distinguished habitats according to diapause period required for some mosquito species, making the first differentiation based on the permanence of water in breeding sites, classifying water collection as permanent or temporary is useful because mosquitoes species in the genera Aedesand Psorophora require a period of diapauses before hatching. In contrast, the Mansonia, Coquilletides genera are always associated with aquatic vegetation because larvae

and pupae obtain oxygen from plant parenchyma, which is always found in permanent water habitats, such as lagoons (Forattine, 1962; Garcia-Avilla, 1977).

Rejmankovaetal. (1991; 1992) classified the larval habitat ofAnopheles species on thebasisof aquatic vegetation. Rubio-Palisetal.(2005) studied the physicochemical and biotic featuresofAnopheline larvalhabitat and concluded that lagoons are the most favorable habitat forimmature Anopheles development in Venezuela.

Among the studies on larval habitat conducted in Argentina, (Toraleset al., 1972) studied some of the physicochemical characteristics of water contained in bromeliad in the province of Corrientes. The water chemistry of ditches in province of Buenos Aires and the Anopheline larval habitats were studied (Compos etal., 1993; Campos, 1997;Almiron and Brewer, 1996)characterized a variety of habitat collected in province of Cordoba on their physicochemical, biological, morphometric features and classified mosquitoes species according to the similarity of their habitat.

There are 3,500 species of mosquitoes found throughout the world. In some species of, the females feed on human blood and vector many pathogens. Nigeria has demonstrated the abundance of many mosquitoes species, they include mosquito of the genus;Anopheles, Aedes, and Eretmorphodes (Inuwa, 1979; Subra, 1981; Igbodionsa. 1989; Nwoke etal.,1993).However, in Sokoto between July and November 2010.The breeding sites and mosquito species were studied during the severe flood in five different habitats in the study area. Three general and four species of mosquito larvae were identified. The most abundant species was Anophelesgambiae (39.2%), followed by Aedesaegypti (25%), Culexquinquefasciatus (21%) and Anophelesfunestus (14.8%) (Lawalet al., 2010).

STATEMENT OF THE PROBLEM

Mosquitoes are the important single group of insects in terms of public health importance, which transmit a number of diseases, such as malaria, yellow fever,filariasis, dengue, Japanese encephalitis, etc. causing millions of death every year (Jeyasankar*et al*., 2012). According to the latest World malaria report, released on November 2018, there were 219 million cases of malaria in 2017, up from 217 million cases in 2016. The estimated number of malaria deaths stood at 435 000 in 2017, a similar number to the previous year, Nigeria contributes to 25% of global malaria cases and 19% of deaths. (WHO, 2018).

Justification

Having known that mosquito is vectors of many pathogens causing diseases which can be either fatal or not, resulting to life threatening problems and it also suppresses the immunity in the infected man and thus, providing a chance for opportunistic parasites to attack. It is of great significance to study mosquitoes at larval stage being it one of the developmental stages in the life cycle of the mosquito and an effective stage to control mosquito.

Aim and Objectives

The aim of the research is to determine the diversity of mosquito larvae in Kware Local Government, Sokoto State. The aim will be achieved through the following objectives:

1) To determine the Occurrence and abundance of mosquito larvae within the study area
2) To determine the mosquito species with the highest occurrence in the study area
3) To suggest the types of mosquito-borne diseases that people of Sokoto are at risk of based on the type of mosquito vectors observed.

MATERIALS AND METHODS

Sampling Area

Sokoto state is located in the extreme northwest of Nigeria, near the confluence of Sokoto river and river rima. It has an estimated population of 4.2 million.

Sokoto is located in the savannah zone; with a land area of 28,232.37 sq kilometer. It's located between longitudes 11 30" to 13 50" East and latitude 4 to 6 North. It's bordered on the north by Niger Republic, Zamfara state to the North and Kebbi state to the south and west (C-GIDD, 2008).

SAMPLE COLLECTION

Samples were obtained at Jatau Bridge, UDUS (inactive breeding sites) using "simple scoop method". Simple scoop, a technique of larval collection also referred to as the standard dipping procedure. The technique involves scooping a dipper full of water out of habitat (Kiseleu*et al.*, 2007). The Dipper used consists of aluminum cup attached to a long handle. Once in the dipper, larvae were transferred into a beaker containing 70% alcohol (Ethanol) using a pipette (eyedropper) for killing the larvae (Walker *et al*., 1987).

Sampling was repeated daily for a period of ten days in January 2019.

MOSQUITO LARVAE IDENTIFICATION PROCEDURE

Materials used include; Stereozoom microscope, Glass slide, Ethanol, Distilled water, Dropper, and Beaker. Procedure: the mosquito larvae collected were immersed in 70% ethanol in a beaker to kill the larvae. The larvae killed were then rinsed with distilled water. After that, the larvae were placed on slide. The slides were observed under stereo zoom microscope at x10 objective and the observation was recorded. The larvae were identified to generic level using identification keys as reported by Bruce (2008).

RESULT

The result obtained during the research in Jatau Bridge, UDUS is presented in table 1 below. Based on the research conducted, the sampled area has mosquitoes of the three genera- *Aedes*, *Anopheles*, and *Culex* spp.

In the first day of collection, *Anopheles* mosquito larvae have the highest occurrence with 55.56%abundance followed by *Culex* mosquito larvae with 35.80% abundance and *Aedes* mosquito larvae has the least occurrence with 8.64% abundance.

But on the second day of collection, only *Anopheles* mosquito larvae were observed.

In the 3rd day of collection, *Culex* mosquito larvae have the highest occurrence with 84.37%abundance followed by *Anopheles* mosquito larvae with 15.63% abundance, no*Aedes* mosquito larvae were observed.

In the 4th day of collection, *Culex* mosquito larvae have the highest occurrence with 60% Abundance followed by *Anopheles* mosquito larvae with 40% abundance, no *Aedes* mosquito larvae was observed.

In the 5th day of collection, *Culex* mosquito larvae have the highest occurrence with 65.79% abundance followed by *Anopheles* mosquito larvae with 34.21% abundance, no *Aedes* mosquito larvae were observed.

In 6th day of collection, *Anopheles* mosquito larvae have the highest occurrence with 51.35% abundance followed by *Alex* mosquito larvae with 48.65% abundance, no *Aedes* mosquito larvae were observed.

In the 7th day of collection, *Anopheles* mosquito larvae have the highest occurrence with 68.75% abundance followed by *Culex* mosquito larvae with 31.25% abundance, no *Aedes* mosquito larvae were observed.

In the 8th of collection, *Anopheles* mosquito larvae have the highest occurrence with 84.91% abundance followed by *Culex* mosquito larvae with 15.09% abundance, no *Aedes* mosquito larvae were observed.

In the 9th day of collection, *Anopheles* mosquito larvae have the highest occurrence with 93.75% abundance followed by *Culex* mosquito larvae with 6.25% abundance, no *Aedes* mosquito larvae were observed.

In the 10th day of collection, *Anopheles* mosquito larvae have the highest occurrence with 90.91% abundance followed by *Culex* mosquito larvae with 9.09% abundance, no *Aedes* mosquito larvae were observed.

Table 1: Abundance of Mosquito larvae at Jatau Bridge, UDUS

Period of Collection (Days)	**Types of larvae observed (%)**		
	Aedes spp	***Anopheles spp***	***Culex spp***
1st day	8.64	55.56	35.80
2nd day	-	100	-
3rd day	-	15.63	84.37
4th day	-	40	60
5th day	-	34.21	65.79
6th day	-	51.35	48.65
7th day	-	68.75	31.25

8th day	-	84.91	15.09
9th day	-	6.25	93.75
10th day	-	90.919.09	
	0.864	54.76	44.38

DISCUSSION

From the research conducted, it is evident that Jatau Bridge, UDUS provide a suitable condition for the mosquitoes to breed and thrive. This habitat is temporary in nature and exists for a brief period of time during the year. This habitat also hosts other aquatic organisms many of which are predators of mosquito larvae.

However, in terms of mosquito species, only mosquitoes of the three genera- *Aedes*, *Anopheles*, and *Culex* were observed during the research with *Anopheles* mosquito having the highest occurrence with 54.76% abundance followed by *Culex* mosquito with 44.38% abundance and *Aedes* mosquito has the least occurrence with 0.864% abundance. The differences in the population level of the mosquitoes could be attributed to the environmental variables which might influence the availability of resources in the habitat (Gautam *et al*., 2006).

Presence of all these mosquitoes (genera- *Aedes*, *Anopheles*, and *Culex*spp) indicates that different species of mosquito can breed in the same habitat as observed by Okere (1990);Mafiana*etal*. (1998) and Adeleke (2003).

In the present study, *Aedes* mosquito larvae were only observed during the initial period of collection, but the reason for this unexpected observation is unknown.

Anopheles mosquito is the vector of malaria,(the deadly disease) was found to be high in abundance within the study area as also reported by Lawal (2010).While *Aedes*sppis the vectors of yellow fever and arboviruses. Though yellow fever epidemic has not been reported in Sokoto, the outbreak of the disease had been reported in some state in Nigeria like Ogun State (Mafiana & Opkalaonuju, 2003), the fact that this disease occurs in Sokoto, the need for public health education cannot be over-emphasized.

CONCLUSION

This study had provided information on larval habitat of mosquitoes in Jatau Bridge, UDUS with three genera of mosquito-*Aedes*, *Anopheles*, and *Culex*spp been observed.

RECOMMENDATIONS

Since all of the species encountered are potential vectors of one mosquito-borne disease or the other, of which their high prevalence has been reported in Sokoto both in previous researches and these research, I therefore recommend that the resident of Kware local government, Sokoto state should be enlightened on the effect of these mosquitoes and diseases they transmit and way of reducing mosquito breeding. Sokoto state government should also assist in mosquito control

which can only be achieved by working together with entomologists who have the knowledge of mosquito biology and best ways of controlling mosquitoes.

REFERENCES

Adeleke M. A. (2003) Mosquito species breeding in artificial container in Ikenne farm settlement, Ogun State, Nigeria. BSc Dissertation, University ofAgriculture, Abeokuta 35pp

Aigbodion F.I. and Anyiwe M.A. (2005) Mosquitoes and the Environment: some economic costs of malaria in Nigeria. *Nigeria Journal of Entomology* **22**: 93-107.

Almiron W.R. and Brewer M.E. (1996) Classification of immature stage Habitats of Culicidae (Diptera) collected in Cordoba, Argentina, Institute OswaldoCruz**91**: 1-9.

Bruce A. Harrison October (2008) Field Identification of Adult and larval Mosquitoes 1-9pp

Campos R. E. (1997) Compartment estacional de dos species de*Anopheles*(Diptera: Culicidae) en la Provincia de Buenos Aires, Argentina. Review of Social Entomology, Argentina **56**:31-32.

Campos R. E. (1997). Macia A. and Garcia J.J. (1993). Fluctuaciones estacional deculicidae (Diptera) ysusenemgos natural enzonasurbanas de logalredores de la plata, provincial de Buenos Aires Neotropica**39**:55-66.

Clements A.N.& Chapman G. N. (1992)the Biology of Mosquito*International Journal of Entomology*: **2**: 5-55.

C-GIDD (2008) Canback Global Income Distribution Database.Location of Sokoto State, Nigeria 1-2pp

Dean, M., 2001. Lymphatic Filariasis, the Quest to Eliminate, Bulletin a 4000- Year Old Disease. Publishing Company, Hollis N.H.

Elumalai, D., Kaleena, P.K., Fathima, Mujeera, Nareshkumar, C., 2013b. Phytochemical screening and larvicidal activity of Tridaxprocumbens (L) against Anopheles stephensi (Liston), Aedesaegypti (L) and Culexquinquefasciatus (say). Int. J. Biosci. Res. 2, 1–14.

Forattini O.P. (1962)*Entomologiamedica*parte general Diptera.Anophelinevolume 1, Faculdade de Hygiene esaudePublica, Saopaulo 622pp

Garcia-Avilla I. (1977).*Faunacubanade mosquito* sysuscriaderos-tipicos, Direccionde Publecaciones de la Academia de ciensias de cuba Havana,108pp

Huang Kiamand Walker Edward (2006). Daily temperature profiles in Andaround WesternKenya Larval Habitats of *Anopheles gambiae* as Related to Egg Mortality.*Malaria Journal* **22:**6-87.

Jeyasankar, A., Premalatha and Elumalai, K., 2012. Larvicidal activity of *Phyllanthusemblica* Linn. (Euphorbiaceae) leaf extracts against important human vector mosquitoes (Diptera: Culicidae). *Asian Pac. J. Trop.Dis.*, 2: S399-S403.

Kandaswamy, K., Sengottayan, S. and Arunachalam, G.M. (2012). Biological activity of selected

Lamiaceae and Zingiberaceae plant essential oils against the dengue vector *Aedesaegypti*L. (Diptera: Culicidae). *Parasitology Research*, **110**:1261- 1268

Kiselev, O., Wilson, D. and Stev, s. (2007). Mosquito larvae http;//stason.org/TULARE/animals/aquaria/food/06-mosquito-larvae.htm/(15th march, 2011).

Kline D. L. (2002) Evolution of Various Models of Propane-powered mosquito traps. *Academic Journal of Entomology*1-7pp

Lawal M. D., Gabiyi J. P., Mohammed. A., Alayinde N. O.,MahmudaA.,Usman. And Mohammed I. S. (2010) Department of Parsitology & Entomology Usmanu Danfodiyo University, Sokoto, Nigeria: Prepared Breeding Sites of Different Mosquito species in Sokoto Town Ship and Environment. *Continental Journal of Biological Sciences*; Volume **4**(2) 1p

Lima, G. A., Almeida, W.R., Hurd, H. and Alhuquerque, C. M.(2003). Reproductive aspects of the mosquito *Culexquinquefasciatus* (Dipteria: culicidine) infected with *Wuchereriabancrofti* (Spiruvida: Onchocercidae). MemoriasInstitutoOswaldo Cruz, **98**:217-222.\

Mafiana C. F. (1989) Observation of mosquito species breeding sites oflarval mosquitoes in Abeokuta, Nigeria. *Nigeria Journal of Entomology* **15**:136-143.

Mafiana C.F., Anaeme L.& Olatunde G. O. (1998) Breeding Sites of larval mosquitoes in Abeokuta, Nigeria. *Nigerian Journal of entomology* **15**:136-143.

Mafiana&Okpalononuju, C. N. (2003) Surveillance of mosquito vectorsin some habitats of Akwa Metropolis, Anambra, Nigeria. *Nigerian Journal of Parasitology* **24**:185-190.

Mitchell C. J., Monath T. P., Sabattini M.S., Cropp C. B., Daffner J. F.,CalisherC. H., Jakok W. L. and Christensen H. A. (1985) Arboviral Investigation inArgentina Mosquitoes *American Journal ofTropical Medicine and Hygiene,* **34**: 945-955

Mitchell C. J., Monath T. P., Sabattini M.S., Daffnerj.F., Cropp C. B.(1989) Calisherootic of Western Equine Encephalitis in Argentina *American Journal of Tropical medicine ...and Hygiene,* **36**:107-113.

Nikkon, F., Habib, M.R., Saud, Z.A., Karim, M.R. (2011).*Target eserecta* Linn and its mosquito cidal potency against *Culexquinquefasciatus*. *Asian Pacific Journal of Tropical Biomedicine*, 11:186-188.

Okere T. G. (1970) Breeding site preference of mosquitoes in Ibadan, Nigeria. *Nigerian Journal of Entomology* **1**:71-80

Romoser B. &. Staffolano R.S. (1998) *the science of Entomology*.McGrewHall, London 328-345pp

Rejmonkova E., Savage H.M., Rodriguez M.H., Roberts D. R. andRejmonkovaM.(1992) Aquatic: Vegetation as a Basis of Classification of *Anopheles albamanus*Weideman (Dipteran:Culicidae) Larval Habitats *American Journal of entomology*.**21**:598-603.

Rejmonkova E, savage H.M., Rejmanek M., Roberts D. R. andArredoridoJmenezJ.(1991) Multivariate-analysis of Relationships between Habitats,Environmental Factors and

The occurrence of anopheline Mosquito Larvae (*Anopheles albimanus*, *An.psedopunctipennis*) in Southern Chiapas,*Mexico Journal of Applied Ecology*, **28**:827- 841.

Rubio-Palis Y. Meanare C. Quinto A. M. Magris, AmeristaM (2005).Characterisation de criaderos de anofelions (Diptera: Culicidae)*International Journal of Entomology* **2**:23-36.

Seco M.P., Tenorio A., Almiron W.R. and Contigiari M.S. (2010)Enzootic Activity of Pixuna and Rio Nigro Viruses (Venezuelan Equine Encephalitis Complex) in Neotropical Region of Argentina *Vector Borne zoonotic Diseases* **10**:199-201.

Service M. W. (1986). Lecture Notes on Medical Entomology. Blackwell Scientific PublicationsLondon37-48pp

Torales G.J., Hack W. H. and Tum B. (1972) Criaderos des CulcidosenbromeliadCeasdelNas decorrientes, *Acta Zoological Lilloana* **29**:293-308.

Walker N. B. and Harry G. L. (1987) Practical 5 Slide Preparation of Mosquito Larva. Mosquito larva Collection, Identification and Processing 1-2pp

WHO (1982) Manual on Environmental Management for Mosquito Control with special The emphasis on Malaria Vectors WHO offset Publication **66**:140-148.

World Malaria Report 2018. Geneva: World Health Organization; 2018. License: *CC BY-NC-SA 3.0 IGO*.**:** XII-XIVp