ANIMAL RESEARCH INTERNATIONAL

Volume 4 Number 2 (2007)

An International Journal Publishing Original Research Involving the Use of Animals and Animal Products

ISSN: 159-3115 **Website: zoo-unn.org**

QUALITATIVE STUDY OF ANOPHELES SPECIES IN KONDUGA LAKE AREA OF BORNO STATE, NIGERIA

KALU, Kalu Mong., NDUKA, Florence Onyemachi and ETUSIM, Paschal Emeka
Medical Entomology and Parasitology Unit, Department of Animal and Environmental Biology, Abia State University, Uturu Nigeria

Corresponding Author: Kalu, K. M. Medical Entomology and Parasitology Unit, Department of Animal and Environmental Biology, Abia State University, Uturu Nigeria. Email: kmkabsu@yahoo.com Phone: 08057963136

ABSTRACT

The investigation on Anopheles species in Konduga lake area, Borno State of Nigeria, was carried out to identify various Anopheles species prevalent in the area and to determine their relative population densities. Six Anopheles species were recorded, namely, A. gambiae, A. funestus, A. ziemanni, A. squamosus, A. pharoensis, and A. maculipalpis. The relative population densities of various species were higher during rainy season than during the dry season. The population densities of female Anopheles were higher than those of the males. With the exemption of A. maculipalpis, all the other Anopheles species recorded during the study are known transmitters of human malaria. A. gambiae of the A. gambiae complex was dominant in the study area. The periodic occurrence of Anopheles explains periodicity of malaria epidemiology in the study area. The high population of the female Anopheles predisposes inhabitants of the study area to incessant contact with the malaria vectors. Lake Konduga and its environments seem to satisfy the basic requirements of Anopheles mosquitoes growth and survival.

Keywords: Tropical lake, Anopheles species, Malaria vectors

INTRODUCTION

Mosquitoes are perhaps the best known of all insects in the tropical and temperate regions of the world because of their aggressiveness not only to humans but to other animals as well. This is due to their painful bites and to the fact that they are vectors of causative agents of several dangerous diseases of man and his domestic animals. The most important man-biting mosquito species belong to the genera *Anopheles, Aedes, Gules, Haemogogus, Mansonia, Psorophora* and *Sabethes* (Service, 1980).

Breading sites of mosquitoes vary depending on species. The sites include freshwater, such as edges of streams, permanent still water bodies, such as gutters, discarded containers, tree holes, leaf axils and others.

Generally, *Anopheles* species thrive well in habitats where nice and deep freshwater, with good amount of vegetation of provide food and shelter is available. They thrive best in habitats where they are protected from extreme heat. The adults are, thus, adapted to definite ranges of temperature and variations in humidity. Konduga lake seems to possess these qualities for breeding of anophelines.

Anopheles is a gnus which is, among other mosquito genera, easily identified, *Anopheles* adults possess, in common, speckled wings with dark and pale-coloured scales, and the scutella are single-lobed, among other distinguishing features. Female palps are almost as long as the proboscis. When resting or biting the abdomen of an *Anopheles* is usually held up at an angel from the surface on which it is resting, forming a straight line with the proboscis. Cohen (1982) observed that *Anopheles* females tend to fly quietly and bite less painfully, and so their approaches are seldom noticed.

Female anophelines are important vectors responsible for the maintenance and spread of causative agents of human and animal malaria. Besides spreading malaria and other diseases, they cause irritation and annoyance by their bites and buzzing sound. Generally, when a disease is spread by a vector, it is simpler, cheaper, and more cost effective to attack the vector rather than the pathogen, thus a study of the ecology of the vector is necessary. This study is designed to contribute towards solving the problem in Konduga lake area of Borno State.

The study mainly attempts to provide qualitative data on relative population densities of *Anopheles* species incident in Konduga lake area. It also attempt to provide baseline information for subsequent assessment of probable cause of malaria epidemiology in Konduga and so ensure the proper planning of control measures.

MATERIALS AND METHODS

Study Area: Sampling was carried out in Low Cost Housing Estate of Borno State Housing Corporation, Konduga. Konduga is the headquarters of Konduga Local Government Area in Borno State, Nigeria. Konduga lies on latitude 11^{o}40” N and longitude 13^{o}15” E and is located about 32 kilometers from Maiduguri Urban and along Maiduguri-Bama road.

Mosquito Sampling: Indoor and outdoor resting adult mosquitoes were randomly collected once weekly with an oral aspirator between the hour of 4.00 and 7.00 am for a standard period of one hour

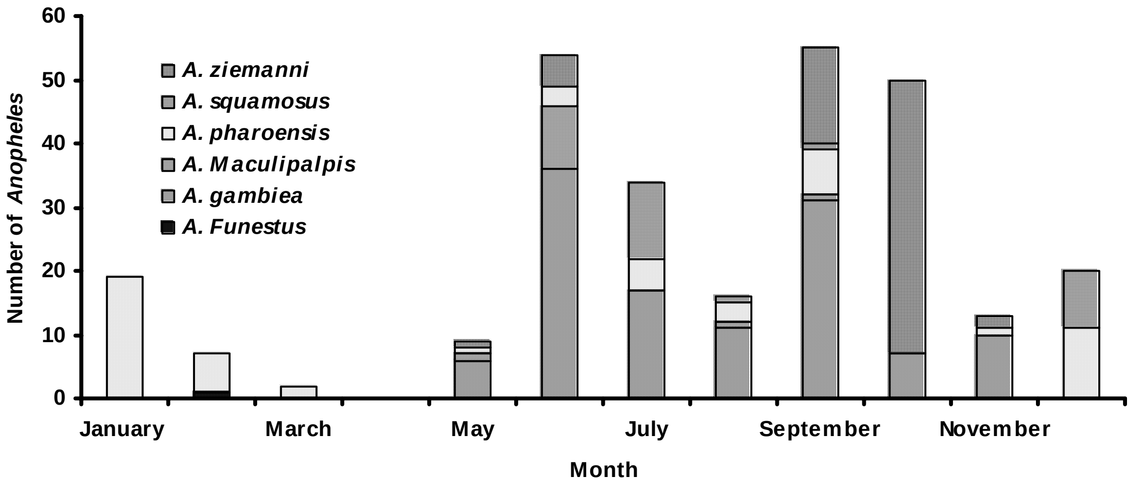

Figure 1: Monthly disribution of *Anophles* species in Konduga lake area

per sampling. Captured mosquitoes were gathered alive in large specimen glass tube with finely perforated cover to allow aeration, and taken to the laboratory on the same day. In the laboratory, the mosquitoes were paralysed with chloroform on top of the perforated specimen tube cover and allowed to stand for some time. The paralysed mosquitoes were, thereafter, identified using a dissecting microscope into culicines and anophelines, then the later were further identified into species and sexes, all in line with identification of mosquitoes by Service (1980). Collection of mosquitoes was carried out for a period of twelve months.

Climatic Data Collection: Atmospheric temperatures in Konduga lake area were recorded thrice daily throughout the survey period using a "maximum and minimum thermometer". Readings were taken in the morning by 4.00 to 7.00 am, at noon by 2.00 to 3.00 pm, and in the night by 8.00 to 9.00 pm. Relative humidities were calculated thrice daily. With the maximum temperature (Tmax) and minimum temperature (Tmin) readings of the thermometer, wet-bulb depression (WBD) was calculated by applying the equation. Tmax – Tmin = WBD. Using the Tmax and WBD values, Relative Humidities were read off from Psychromatic tables.

Data Analysis: Chi-square statistic was used to compare the monthly anopheline mosquito populations while analysis of species catches was done by using student's t-test.

RESULTS AND DISCUSSION

A total of 1481 adult mosquitoes were collected during the twelve months study period. This number was made up of 1197 culicines and 284 anophelines. Six *Anopheles* species, namely, *A. funestus, A. gambiae, A. maculipalpis, A. pharoensis, A. squamousus,* and *A. ziemanni,* occurred in the study area. Monthly and annual abundance of individual species indicated that *A. gambiae* was the most abundant. This result corroborates with the findings of Mafiana *et al.* (1998) and Amusan *et al.* (2003) in Abeokuta, Nigeria. *A. funestus* was the least abundant species. Out of the 284 anophelines caught 202 were females representing 71.1& of the *Anopheles* population.

Figure 1 is a graphic representation of the monthly occurrence of the various *Anopheles* species recorded during the survey period. The six species that occurred in the area showed monthly and seasonal variations in population densities. Populations were high during rains and low in dry months. This results conforms with Vas *et al.* (2004) and Jude *et al.* (2007) observations in Assam, India, and Central South-West Cameroon respectively. June of the survey period marked the on-set of rains while rains progressed through July and August but ended in September during the period. High *Anopheles* populations were recorded in June, September, and October of the study period with a population peak observed in September; five out of the six recorded *Anopheles* species occurred in this month. Whereas four species occurred in June and August, three occurred in July and October, which was the on-set of dryness, recorded two species. While complete absence of *Anopheles* was observed in April, other dry months witnessed low population densities. The various Anopheles species exhibited diversity in monthly occurrence. In January and March of the study period only *A. pharoensis* occurred. This same species occurred in ten out of the eleven months in which *Anopheles* were captured, being absent in October only. Meteorological records obtained in Konduga during the period of the survey indicate that April months was the warmest. Table 1 shows the monthly mean atmospheric temperature and relative humidities during the period.

The mean relative humidities of 71.9 percent and 70.7 percent recorded in July ad September respectively implicated these months to be most humid during the period, student t-test shows no

Table 1: Monthly mean temperatures and relative humilities at Konduga during the study period

Month	Mean Temperature (^oC)	Mean Relative Humidity (%)
January	22.6	38.4
February	24.5	29.6
March	31.6	28.1
April	34.8	31.1
May	33.5	48.0
June	28.2	65.9
July	27.5	71.9
August	28.4	55.0
September	30.8	70.7
October	31.5	57.3
November	29.1	45.5
December	29.5	46.1

correlation between the mean temperature and relative humidities during the study period (P>0.05). However, there was positive correlation between mean relative humidity and monthly *Anopheles* population whereas there was no correlation between mean temperatures and monthly Anopheles populations.

The study area, being a typical arid zone, is known for lengthy dry season with associated dry winds lasting for about eight months per annum. During the present study the dry and windy period was observed from January to May then October to December during which period a few of the *Anopheles* species occurred with their attendant low population densities probably due to unfavourable breeding conditions caused by dryness of environments. June to September constituted the period of rains. The number of species and their populations apparently increased during this period probably due to favourable breeding conditions. With on-set of rains in June, there was sharp rise in population of *Anopheles* in the month with *A. gambiae* being the most abundant thereby confirming Mattingly (1969) finding that this species appears very rapidly with the on-set of rains.

Gadzama (1980) found that repeated rainfall causes flooding resulting in the temporary flushing of breeding places, especially for *A. gambiae* complex, thus, reducing the population of vector in the area, but the population becomes re-established when favourable conditions are restored. July and August of the study period witnessed repeated rainfall resulting in fluctuations in the populations of the various species, especially of *A. gambiae*. *Anopheles* population peak was recorded in September when favourable conditions were restored. These results conform with Gadzama (1977) finding that early October witnessed the on-set of cold, dry, windy harmattan period in the study area. As the harmattan intensified through December and January the population of *Anopheles* sharply dropped testifying the fact that population of the mosquitoes genus decline in the dry months and increase during the wet months. Exceptions to this variation patterns were *A. pharoensis* and *A. funestus* during the dry and wet months of the study. A similar observation was made by Gadzama (1983) when he studied mosquito vectors of the Sahel savanna.

The density of a vector species depends much on climatological factors favourable or unfavaourable for its breeding as well as adult survival. For instance, a heavy or repeated rainfall may be favourable for the development of a number of species and yet be detrimental to others. The reduction in population of *A. gambia* and the increases in populations of *A. squamosus, A. pharoensis* and *A. maculipalpis* in the months of repeated or heavy rainfall (July and August) during the present study conform with these facts.

Horsfall (1995) posited that temperatures stimulate mosquito populations in all situations and that tolerance to temperature varies generally from mosquito species to species. The adverse effects of temperature on *Anopheles* populations were clearly observed in dry months of the study period. From Table 1, it could be seen that mean temperature for the month of April was 34.8^oC and the month was observed at the warmest or hottest month of the period. The absence of *Anopheles* of all species in this month (Figure 1) may be due partly to the disappearance of breeding places for the genus caused by rapid evaporation of breeding sites, including Konduga lake, induced by high temperature; and partly to the hibernation or aestivation of members of the genus. Mattingly (1969) reported that climate operates directly in determining the seasonal availability of breeding places and the requirement for hibernation or aestivation on the incidence of various mosquito species. The lowest mean temperature during the study period was recorded in January and only *A. pharoensis* occurred in the month. This species seems to tolerate temperature as low as 22.6^oC, and as high as 33.5^oC. *A. gambiae* seems to tolerate temperature ranges between 28^oC and 33.5^oC. The study result reveals that majority of the Anopheles species tolerate temperature ranges between 27.5^oC and 33.5^oC.

High population of female of the genus recorded during the survey indicates that the breeding places for the *Anopheles* were far away from the sampling sites. Konduga lake, located about 1.5 kilometers away from the sties, is probably the breeding place for most of the *Anopheles* species that occurred in the study area.

REFERENCES

AMUSAN, A. A. S., MAFIANA, C. F., IDOWU, A. B. and OKE, O. A. (2003). A survey of Adult Mosquitoes in the hostels of the University of Agriculture, Abeokuta, Ogun State, Nigeria. *Nigerian Journal of Parasitology, 24:*167 – 172.

COHEN, S. (1982). Malaria. *British Medical Bulletin, 28:* 126 – 148.

GILLETT, J. D. (1972). Common African Mosquitoes and their Medical Importance. William Heinemann Medical Books Ltd, London. 106 pp.

GADZAMA, N. M. (1977). The distribution of adult mosquitoes at Ahmadu Bello University, Zaria, Nigeria. *Savanna: 6(2):* 179 – 189.

GADZAMA, N. M. (1980). Comparative studies on mosquitoes of Zaria and Maiduguri. *Man and Biosphere. Proceeding of a Workshop held at Kainji lake Research Institute, New Bussa, Nigeria.*

GADZAMA, N. M. (1983). Mosquito vectors of the Sahel Savanna and Environmental Development. *Annals of Borno, 1:* 99 – 103.

HORSFALL, W. R. (1955). *Mosquitoes: their bionomics and relation to disease.* The Ronald Press Company. New York. 723 pp.

HORSFALL, W. R. (1962). *Medical Entomology.* The Ronald Press Company, New York. 467 pp.

JUDE, D. B., LUCIEN, M., VINCENT, P.K.T., MAUREEN, C. and ROSE G. F. L. (2007). Malaria vectors and transmission dynamics in Coastal South-Western Cameroon. *Malaria Journal, 6(5):* 1475 – 1875..

MATTINGLY, P. F. (1969). *The biology of mosquito borne disease.* George Allen and Unwin Ltd. London.

MAFIAN, C. F., ANAEME, L. and OLATUNDE, G. O. (1998). Breeding site of larval mosquitoes in Abeokuta, Nigeria. *Nigerian Journal of Entomology, 15:* 136 – 143.

VAS, DEV., SOBBHAN, P., VINOD, P. S. and SURAJI, P. A. (2004). Physiographic and entomological risk factors of malaria in Assam, India. *American Journal of Tropical Medicine and Hygiene, 71(4):* 451 – 456.

SERVICE, M. W. (1980). *A Guide to Medical Entomology.* Macmillan Press, London. 346 pp.

.