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Study of Malaria Vectors Density Using Artificial Breeding Container in Yola-South L.G.A of Adamawa State

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Abstract: *Mosquitoes are vectors for many pathogens with catastropic effects on global heath. A total of 1806 mosquitoes were sampled from earthen pots and examined under a microscope. Distribution of malaria vectors density by sites of location revealed that Mbamba Mission had a total malaria vector density distribution of 0.47(27.98%), Mopol Barrack, 0.37(22.02%), Upper Benue Staff Quarters 0.16(9.52%), Rumde Jabbe,0.33(20.00%) and Anguwan Fulani,0.35(20.83%). Mbamba Mission had the highest, malaria vector density while Upper Benue staff Quarters had the lowest. However a statistical analysis showed no significant difference in the distribution of malaria vector density based on location in the study area (p=0.199). Distribution of malaria vectors density according to months revealed that month of July had a total malaria vectors density distribution of 0.65(38.69%), August, 0.68(40.48%) and September, 0.35(20.83%) and there was a significant difference in the distribution of malaria vector density based on months (p=0.047). The distribution of malaria vector density based on their abdominal condition revealed that freshly blood fed malaria vectors had density distribution was 0.48(28.57%), gravid, 0.43(25.59%), half-gravid, 0.46(27.38%) and unblood fed, 0.31(18.45%). However there was no significant difference in the distribution of malaria vector density based on abdominal condition in the study area (p=0.775)*

Keywords: *Distribution,Health , Malaria, Mosquitoes, Vectors*

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I. Introduction

Mosquitoes are the most important group of insect's vectors of human diseases such as malaria, filariasis, dengue and Japanese encephalitis. The aquatic habitats in which they breed include pools, swamps, paddy-fields and water-holding containers. The containers habitats have unique ecolological properties and these habitats could be natural such as tress holes and leaf axis or artificial such as tyres, plastic cups, earthen pots and water tank. With regards to vector abundance, human activities are responsible for the creation of a mosquitoes breeding site; man is directly or indirectly creating such a condition [5]. Artificial containers, such as tires, bottles, buckets and cups can provide a large number of mosquito breeding sites and must be removed to reduce a disease outbreak [9]. Mosquitoes alone transmit diseases to more than 700 million people annually. Various species of mosquitoes have a world-wide distribution occurring throughout the tropical and temperate regions where they cause considerable annoyance due to their bites, and are important disease vectors due to the poor socio economic conditions and favourable environmental and climatic conditions that favours the breeding of mosquito vectors [3]. Various species of mosquitoes have long been recognized as vectors of a numerous human infections both in sub Saharan Africa and in the tropics (Adeleke, 2008). *Anopheles* species is known to transmit human malaria parasite *(Plasmodium*), *Aedesaegypti*and some other species transmit yellow fever and dengue fever, while *Culexquinquefasciatus*have been known to transmit lymphatic filariasis [14]. Blood sucking habits of adult mosquitoes make them susceptible to acquiring pathogens and parasites from the vertebrate host. This is seen in the unique feeding habits of mosquitoes whereby only the females bite man and other animals, while the males feed on plant juices only. After feeding on their host, either outside or inside houses, mosquitoes seek resting place in which to shelter during digestion of their blood meals. Malaria is one of the major mosquitoes borne diseases with an estimated two million children worldwide dying of it yearly [17].

II. Material and Methods

This study was conducted in Yola-South Local Government Area of Adamawa State, Nigeria. Yola has a geographical coordinates of 9°12'0" North and 12°29'0" East. It is the capital city of Adamawa State, located on the River Benue. It has a population of 194,607 [10]. The study area lies within the Sudan savannah zone with marked dry and wet seasons. Yola has an annual rainfall from the months of April to October and a dry season from the month of November to March. Temperature drops in the rainy season especially in the month of July to October. The movement of the inter-tropical discontinuity (I.T.D.), and associated zones of rainfall during the course of the year, is the major factor controlling rainfall and temperature variation in the study area. Temperature rises slightly after the rainfall ceases in the months of March-May and that could reach as high as 42°C. In the months of December-February, the dry harmattan weather characterizes the area, which is cold and dusty. The soil of the study area is loamy and it drains easily when it rains. The vegetation of Yola-South consists of short grasses and medium shrubs, more especially in the months of August and September during which the area records higher amount of rainfall. Agriculture is the mainstay of about 70% of the inhabitants of the State. The ecological condition of the state permits cultivation of root crops, cereals and rearing of livestock in large numbers.

2.1 Collection and Identification of Mosquitoes

Mosquitoes were collected using a hand net from the breeding containers once in a week by covering the breeding containers with tray and spraying insecticide heavily and the pots were relocated to other houses within the study sites for re-sampling of mosquitoes. Sampled mosquitoes were mounted on glass slides and viewed under simple Olympus (dissecting) microscope for identification using relevant taxonomic keys [6]. *Anopheles* mosquitoes were identified by the palp which is as long as the proboscis and pointed and by the number, length, and arrangement of the dark and pale scales on the veins of the wings [6]. Male and female *Anopheles* mosquitoes were identified by examination of antennae, in which those with feathery (plumose) appearance are males and those with only short and inconspicuous antennal hairs (pilose) are females [6]. Other mosquito species identified were *Culex*and *Aedes*. The *Culex*genus has transparent wings while the *Aedes*genus has silvery shining stripes on the head region [6].

2.2 Determination of Malaria Vectors Blood Meal Status (Abdominal Condition)

Anopheles species were grouped based on their abdominal conditions into unfed, freshly fed, half gravid and gravid.

i. Unfed-The abdomen is flattened.

ii. Freshly fed- The abdomen appears bright or dark red from the blood in the midgut. The ovaries occupy only a small area at the tip of the abdomen.

iii. Half gravid- The abdomen is dark in colour almost black and occupies three to four segments on the ventral surface and six to seven on the dorsal surface of the abdomen.

iv. Gravid-The blood is reduced to a small black patch on the ventral surface or may be completely digested. The ovaries occupy all the rest of the abdomen.

2.3 Determination of Malaria Vector Density

The malaria vectors density were calculated as follows according to [4].

Total number of malaria vectors (female *anopheles*) collected

Total number of containers

2.4 Statistical Analysis

The data obtained were analyzed using chi-square ($\chi 2$) statistical analysis. $P<0.05$ was regarded as an acceptable level of significance and results obtained were represented in graphs.

III. Results

A total of 1806 mosquitoes were sampled to determine the distribution of mosquitoes based on species and sex in the study area. The distribution of malaria vector density (female *Anopheles* mosquitoes' density) by sites of location indicated that Mbamba Mission had a total malaria vector density distribution of 0.47(27.98%), Mopol Barrack, 0.37(22.02%), Anguwan Fulani, 0.35(20.83%), RumdeJabbe, 0.33(20.00%), Upper Benue Staff Quarters, 0.16(9.52%), with Mbamba Mission having the highest malaria vector density followed by Mopol Barracks while Upper Benue staff Quarters had the lowest vector density (Fig.1). Chi-Square statistical analysis showed that there was no significant difference in the distribution of malaria vector density based on location in the study area (p=0.199).

Distribution of malaria vectors density (female *Anopheles* mosquitoes' density) based on months indicated that July had a total malaria vectors density distribution of 0.65(38.69%), August, 0.68(40.48%) and

September, 0.35(20.83%) (Fig.2). Statistical analysis showed that there was significant difference in the distribution of malaria vector density based on month in the study area (p=0.047)

The distribution of malaria vectors density (female *Anopheles* mosquitoes density) according to their abdominal condition (blood meal status) revealed that freshly blood fed malaria vectors density was 0.48 (28.57%), gravid, 0.43 (25.59%) and half-gravid was, 0.31(18.45%) (Fig.3). However there was no significant difference in the distribution of malaria vector density based on abdominal condition(blood meal status) in the study are (p=0.775).

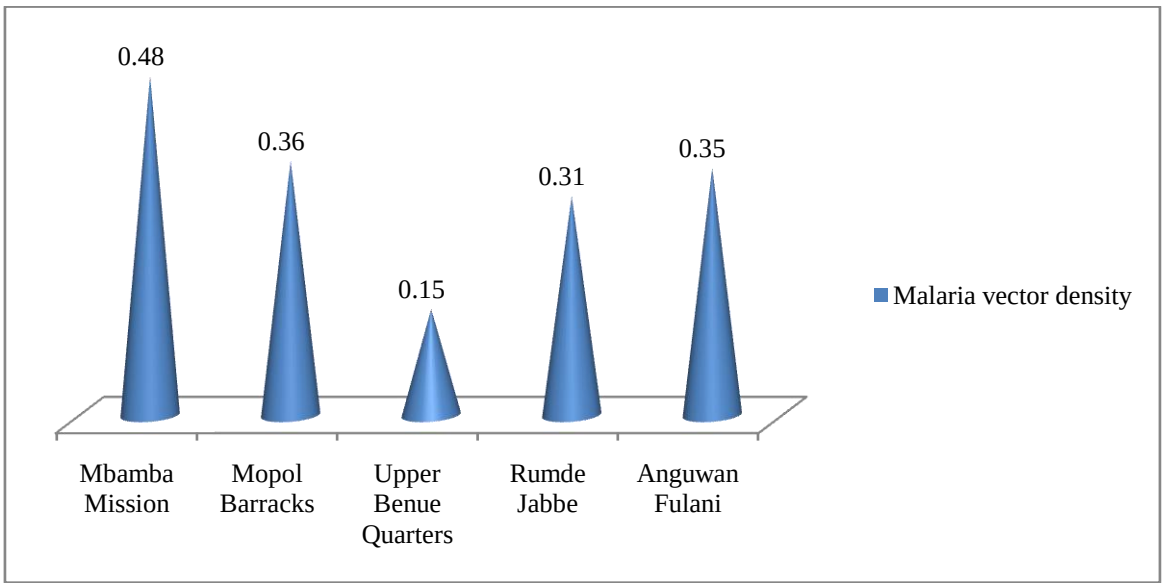

Figure 1: Distribution of malaria vectors density (female anopheles) based on locations

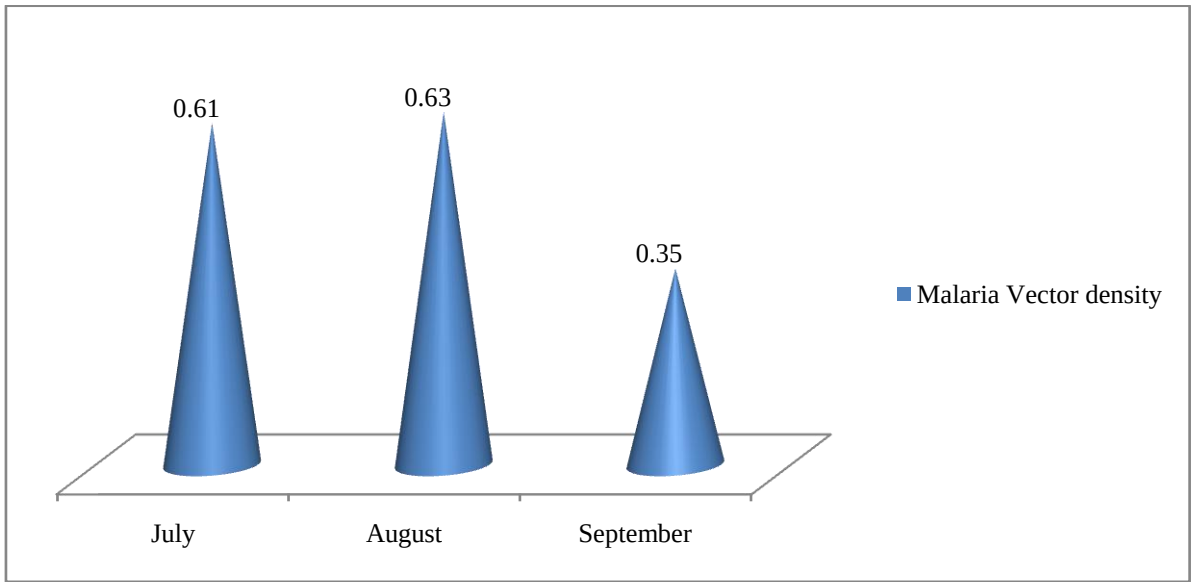

Figure 2: Distribution of malaria vectors density (female anopheles) based on Months

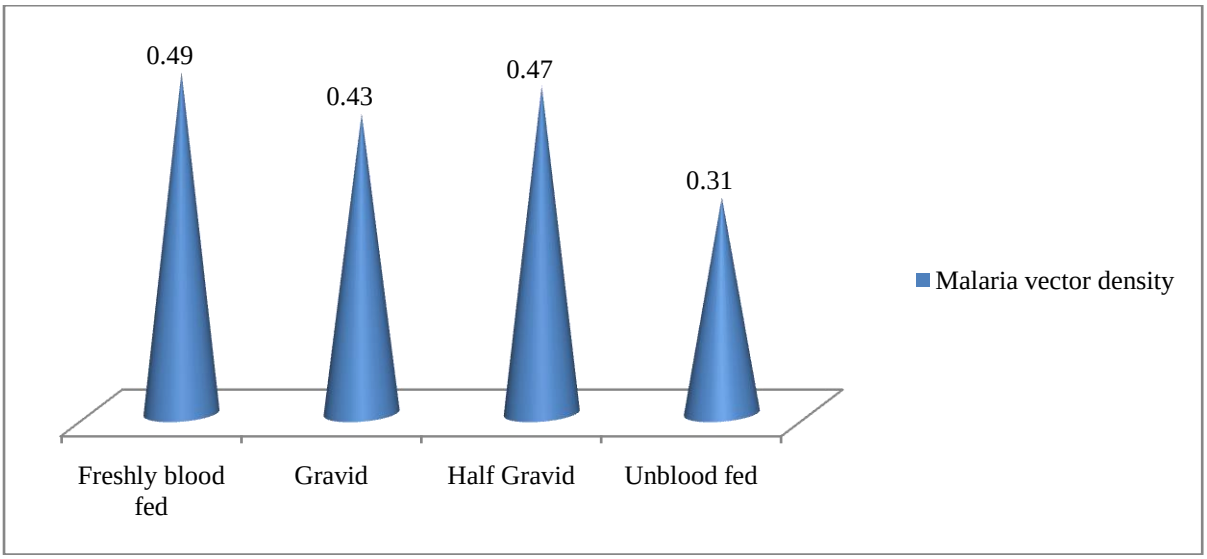

Figure 3: Distribution of malaria vectors density (female anopheles) based on abdominal condition

IV. Discussion

Identification of mosquitoes sampled during the research indicated the presence of both known malaria vectors and non-vector species in the study sites. A total of three species of mosquitoes comprising of *Aedes species, Culex species* and *Anopheles species* were encountered in Yola within all the sampled sites. *Culex species*, 1288 (71.31%) was the most predominant species followed by *Anopheles* 322, (17.82) and *Aedes*, 176 (9.74%) was the least in the five selected study sites. All species of mosquitoes reported in this study have also been recorded by different researchers elsewhere in Nigeria, like those of [8]. The abundance of *Anopheles* mosquito is closely related to the prevalence of malaria most especially in the endemic area. The mosquitoes attracted to man are the major vectors implicated in the transmission of malaria parasite. Yola-South being one of the cities of Adamawa State has the highest human population density with its attendant activities. The presence of basic infrastructural facilities (such as pipe - borne water and electricity) could account for this. However, the occurrence of mosquitoes has been associated with the presence and activities of humans which is high in Yola-South. [12]reported that human activities are responsible for the establishment of vast majority of aquatic habitats which promoted the population of *Culex species* to outshine the other genus. Mosquitoes of the genus *Anopheles* is primary malaria vector worldwide. In Nigeria, the most common are *Anopheles gambiae complex*. This species carry the parasite *Plasmodium falciparum* which causes malaria and has also been associated with the transmission of filariasis. Monthly distribution of malaria vectors showed that there was significant difference ($P<0.05$) in the distribution within the study sites. Highest occurrence of malaria vector density was observed in August 0.68(40.48%) while low distribution was observed in September 0.35(20.83%). The visible variations in the populations of malaria vector density between July and September, the rainy months could be attributed to intense rainfall in the month of August. The amount of rainfall is a principal factor that promotes breeding especially by providing the high humidity which prolongs the longevity of the adult mosquitoes. In this study, rainfall was shown to be positively correlated with malaria vector density. As a result the population peaks occurred during month of August month. Rainy season presents favorable environmental conditions that enhance mosquito breeding and survival, through the proliferation of larval habitats and improved humidity, respectively [7].

Breeding sources might also have affected the abundance of the mosquitoes. Previous reports [13] have shown earthenware material supported breeding of various mosquito species especially *Anopheles species* in parts of Nigeria. The contribution of clay pots and other earthenware materials to malaria endemicity in parts of Nigeria is worthy of note. Clay pots are widely used for storing drinking water especially in cool corners of houses as it is less subjected to environmental temperature changes and keep water cool for longer period where the inhabitant do not have or like the use of refrigerators. The physiochemistry of earthenware containers makes them one of the most preferred habitats by *Anopheles species* in the study area. The indiscriminate disposal of these pots, plastic materials and tins and their domestic uses are contributing factors to the abundance of these mosquitoes [13]. The result of the this study has demonstrated that there was no significant difference in the blood status of the malaria vectors ($P>0.05$). Most of the malaria vectors sampled were either bloodfed, gravid or halfgravid, which means the malaria vectors exhibit high vectoral capacity. In Nigeria, *Anopheles gambiae*has been found to have usually a 48-hour cycle to digest the blood meal and develop the ovaries. For example, females feeding on Monday night will be ready to lay eggs on Wednesday night, and capable of taking

another blood meal on the night on which oviposition takes place [11]. The blood meal status showed that the percentage of fed Anopheles mosquitoes was greater than that of the unfed which is in contrast with the findings of [8] where unfed dominate over the fed Anopheles. This is an indication of the fact that the inhabitants of Yola South LGA of Adamawa State were prone to malaria infection since *Anopheles* has been incriminated as an efficient vector of malaria [2].

V. Conclusion

The result of this study revealed that most of the malaria vectors sampled were either blood fed (28.57%); gravid (25.59%) or half gravid (27.38%).This implies high contact between the malaria vectors and human or other animal host. This is one of the major epidemiological factors that impacts on disease transmission and progression in Nigeria and Africa at large. Since all the mosquitoes were sampled in an earthen pot and it revealed high percentage of blood fed, gravid and half gravid, this implies that earthen pot provide a suitable breeding site for malaria vectors and the practice of burying broken pots and other empty containers should not be ignored.

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