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Study of Man Biting Rate of Mosquito (Diptera Culicidae); A Case Study of Gombe State University of Nigeria

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Abstract – *Mosquitoes (Diptera Culicidae) are the most prominent of the numerous species of blood sucking arthropods that annoy man and other worm blooded animals. Their ability to transmit disease is seen as an important factor causing human mortality. Indoors spray of chemical is one of the common way to kill mosquitos, however with the ability to determine the man biting rate of mosquito, this chemical method can be improved. This study was carried out to determine the man biting rate of mosquitoes in Gombe State University. 50 rooms were randomly selected out of which 20 were from staff quarters and 30 from student hostel. Sample of mosquitoes' species collected were identified using suitable identification keys. The man biting rate of Culicine mosquito in staff and student hostel was determine to be 1.05. This study concluded that, the man biting transmission is low, as such there are less risk of mosquito posting serious danger on human. In addition, important recommendations suggested on how to reduce mosquito abundance in Gombe State University in order to provide healthy environment for conducive learning.*

Keywords: Mosquito, diseases, mortality, healthy environment

1.0 INTRODUCTION

Mosquitoes are small slender-bodied insects which viciously hunt their host especially man for blood meal. Most mosquitos are worldwide in distribution and are found in trophic and temperate region of the world [1]. Mosquitoes are regarded as public enemies because of their biting, annoyance, noise, nuisance, sleeplessness allergic reaction and disease transmission due to their bites [15]. One of their most economic important is that, they transmit human disease such as malaria, yellow fever, dengue haemorrhagic fever and encephalitis [2]. They also transmit animal disease like fowl pox of poultry myxomatisis of rabbits, rift-valley fever of Sheep's encephalitis of horses and birds, and heart worm disease of dogs [3]. The infection cause by the above mention diseases resulted in high morbidity and mortality rate in human and animal's population as well as leading to huge economic loss [14].

The breeding system of mosquitos occur in a variety of habitat especially where there is stagnant water such as swamp, edges of river, slow flowing streams, tin cans, plastic containers of all sort of water holding cisterns and tanks, coconut shells, foot print of animals and man, sand excavation ditches stone quarry sites, motor and scoops in concrete slaps used for feeding animals and cassava fragmentation pot [4]. Depending on species, most mosquito exhibit complex life cycle mechanism. Since female anoplex mosquito is responsible for malaria transmission, the adult female returns to water for a brief period to lay their egg in batch. Mosquitoes species vary in their breading habit biting behaviour host preference and flight range [5].

The mechanism of malaria transmission in human involved the biting activities of adult female species [15]. Their head is equipped with a projecting proboscis which conceals and protects the long piercing and sucking mouth part [6]. Subsequent to the sucking and biting activity, the female mosquito takes in blood meal and injects anticoagulant (anti-clothing chemical) into the host to keep the victim's blood flowing [7]. The female which takes blood meal can carry diseases from one animal or human to another; they feed on the host and rest inside the room for the blood to digest before finding a place to lay their eggs [8]. Host localization is mainly achieved by sight, smell and warmness of the body [9]. Not all mosquitoes' species bite human but transmission of some disease depend on their biting rate [10].

Therefore, looking at the devastating effect of mosquito as it is attributed to transmission of several diseases, by determining the man biting rate of mosquitoes, the knowledge will be of immense benefit in giving credible advises to the ongoing and future indoor residual spray programmed especially in Gombe State where mosquitos are endemic.

species of phytoplankton in a community respond differently in term of behavioural, intrinsic and extrinsic factors. Slight alteration of those factor due agricultural and anthropogenic activities might have a direct effect on the species distribution and abundance, that is why research on the recent investigations have been directed to species diversity indices. Phytoplankton is a collective term referring to both organism plants and animals which are unable to resist movement of water current (drifters) [1]. Based on the taxonomic schemes, phytoplanktons consist of 24 classes and about 26,000 species were identified [2]. The interaction between of physical, chemical and biological properties of water often determined their production, while their distribution, composition and diversity is also structured by these factors [3]. Phytoplanktons in tropical reservoir ecosystem are often important in estimating potential fish yield [4], water quality [5], energy flow [6], food chain [1], and pollution assessment [7]. The use of macro (e.g. fish) or micro phytoplankton (e.g. microalgae) for assessment of water quality was reported in many instances [8].

Algae constitute the most common photosynthetic plankton and they are described as large heterogeneous assemblage of plants which are diverse in habitat, size, organization, physiology, biochemistry and reproduction. The population of plankton varies seasonally both in number and species composition. Plankton distribution and abundance are affected by season [9]. For example, the variation of species richness in checklist of the tropical West African algae both fresh and brackish water form [10]. The productivity of any aquatic water body depends on the abundance of plankton present. In addition, physical and chemical parameters also were found to be the factors affected their distribution, sequential occurrence

and species diversity [11]. Human factors such as agriculture irrigation, farming and logging of forest tree for fire wood causes variation in phytoplankton species distribution seasonally [12]. Such diversity changes are common community respond to environmental alteration.

Balanga dam present an important opportunity for studying phytoplankton periodicity respond to ecological succession and species richness. In the recent years, attention has been focused on the use of phytoplankton species for combine bio-assessment and multivariate statistical analysis to identify water quality impact on the phytoplankton and epiphyte community distribution [12]. However, Balanga dam is a very large dam of economic importance, the survey of the phytoplankton species available in the dam and their interaction with physicochemical parameters will provide a good base for research especially on the pollution related issues, this is one the biomonitoring technique that will provide a healthy ecological integrity of the dam. Therefore, the current study aimed to determine the diversity and abundance of phytoplankton species and its relationship to physio-chemical factors that affect their succession in Balanga dam.

2.0 METHODOLOGY

2.1 Study Area

The survey was carried out in the Gombe State University Campus which is located in Tudun-wada ward of Gombe town, the area lies between latitude N10^0 18' 19.8' and longitude E11^0 10' 36.1' of the northern part of Gombe metropolis. Gombe is generally warm with average maximum temperature during the hot season, not exceeding 30^{o}C. There are two distinct seasons: the dry season (November – March) and wet season (April – October) with average annual rainfall of 850mm [11].

Figure 1: Map of the study area (Gombe State University at 2009)

2.2 Method of Data Collections

Fifty rooms were randomly selected in the conduct of the research. 20 rooms from staff quarters represent 25% of the mosquito population and 30 rooms from male hostel also represent 25% of the mosquito population. It is believed that the total percentage will provide the suitable representative of the general population of mosquitoes. The justification for selecting this sample is for the researcher to get a representative sample.

One room was selected in each category for the collection of the adult mosquitoes. In each house, the total number of the occupant sleeping in the house and rooms were recorded. Collection of mosquitoes was done between the hours of 6:00am – 9:30am. This is the time when mosquitos are resting actively in houses. All marked rooms were sprayed with insecticide (Rambo) after spreading a white sheet of cloth and left for about 10 minute.

All dead mosquitoes in each of the rooms were collected and placed on a label Petri-dish for further identification to generic level in the laboratory with the helped of hand lens. Mosquitoes were sorted out into genera using the key given by [2]. From the mosquitoes collected in each room, the man biting rate was determined. These was done by dividing the number of female blood fed mosquitoes caught in the rooms over the number of people sleeping in the rooms according to world health organization (WHO) [12]. These method uses spread sheet collection to estimate the man biting rate (MBR). The man biting rate (per night) is obtained by dividing the total number of fed mosquitoes by the number of human occupants who spend the night in the houses or room used for collection of mosquitoes.

Man Biting Rate (MBR) = f / w

where,

f = Total No. of freshly fed mosquitoes of a particular species;
w = Total No. of human occupants in houses used for collection per night.

The above estimation of man biting rate (MBR) implicit two assumptions by [12]:

i. All fed mosquitoes found in the house use for collection took their blood meals from the human occupants of the same houses; and

ii. No fed mosquitoes left the houses after taking their meals until the time of collection.

3.0 RESULTS AND DISCUSSION

The result of the study shows that no Anopheline or Aedes mosquitoes were encountered. A total of about 142 culicine were collected from staff quarters out of which 80 were males and 62 were females (Table 1). 30 rooms from student hostel were visited and a total of 286 culicine mosquitoes were collected of which 128 were males and 158 were females (Table 2).

Student hostels account for high percentage of culicine mosquito of about 67% of the total number of mosquito collected. The least was 33% from the staff quarters (Figure 2). For student hostel, the percentage female culicine was found to be 55% while that of male cuclicine are 45% (Figure 3). Staff quarters produces percentage of male culicine of 56% as compared to the females with percentages of 44% (Figure 4). Considering the overall male and female mosquitoes caught in both staff quarters and students' hostels, it was found out that 51% of the mosquitoes are females, while 49% are males (Figure 5). General survey

shows that the overall male and female mosquitoes caught in student hostel are greater than those caught in the staff quarters (Figure 6). The statistical analysis of difference between the number of mosquitoes collected in the staff quarter and students' hostels shows a significant value of p=0.05 in favour of students hostels.

The man biting rate of mosquitoes culicine species caught were determine for both staff quarters and students' hostels using equation.

Man Biting Rate (MBR) = f / w

$w = 152 + 58 = 210$
$f = 62 + 158 = 220$
$= 220/210 = 1.05$

Therefore, the man biting rate of culicine mosquitoes in staff quarters and students' hostels was computed to be 1.05.

Table 1: Pyrethrum spray collection (PSC) activity in Gombe State University staff quarters

House No.	Total number of occupant/ house	Number of occupant sleeping/room	Anopheles		Culicine		Total	Used insecticide
			Male	Female	Male	Female		
1	4	2	0	0	11	10	21	X
2	2	1	0	0	10	0	10	X
3	3	2	0	0	8	1	9	X
4	3	2	0	0	8	4	12	X
5	5	3	0	0	6	2	8	X
6	4	2	0	0	0	0	0	/
7	2	1	0	0	0	0	0	/
8	2	1	0	0	0	0	0	/
9	5	2	0	0	0	0	0	/
10	3	2	0	0	6	4	10	X
11	2	2	0	0	9	5	14	X
12	3	2	0	0	4	8	12	X
13	2	2	0	0	0	0	0	/
14	3	2	0	0	0	0	0	X
15	4	1	0	0	6	7	13	X
16	2	2	0	0	2	1	3	X
17	3	1	0	0	3	4	7	X
18	2	2	0	0	4	7	11	X
19	3	1	0	0	3	5	8	X
20	1	2	0	0	3	1	4	X
Total	58	34	0	0	80	62	142	X

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Table 2: Pyrethrum spray collection (PSC) Activity in Gombe State University students' hostels

House No.	Total number of occupant/house	Number of occupant sleeping/room	Anopheles		Culicine		Total	Used insecticide
			Male	Female	Male	Female		
1	6	4	0	0	7	4	11	X
2	5	3	0	0	5	3	8	X
3	6	4	0	0	7	7	14	X
4	4	2	0	0	5	2	7	X
5	4	3	0	0	3	5	8	X
6	6	4	0	0	9	11	20	X
7	5	4	0	0	7	4	11	X
8	6	4	0	0	3	3	6	X
9	5	2	0	0	7	4	11	X
10	4	4	0	0	4	6	10	X
11	5	3	0	0	4	5	9	X
12	5	4	0	0	3	3	6	X
13	5	2	0	0	1	5	6	X
14	6	3	0	0	5	4	9	X
15	6	2	0	0	6	7	13	X
16	6	2	0	0	2	7	9	X
17	6	4	0	0	11	5	16	X
18	5	2	0	0	2	5	7	X
19	4	4	0	0	3	5	8	X
20	4	2	0	0	4	2	6	X
21	6	3	0	0	2	7	9	X
22	4	1	0	0	1	8	9	X
23	5	2	0	0	1	3	4	X
24	6	3	0	0	1	7	8	X
25	5	2	0	0	2	5	7	X
26	5	3	0	0	2	6	8	X
27	6	3	0	0	3	7	10	X
28	4	2	0	0	2	8	10	X
29	6	4	0	0	3	5	8	X
30	2	2	0	0	13	8	21	X
Total	152	89	0	0	128	158	286	X

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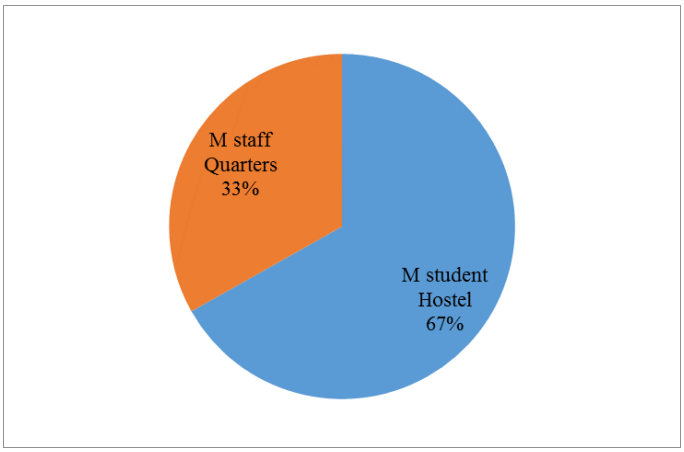

Figure 2: Culicine mosquitoes in student's hostel and staff quarters

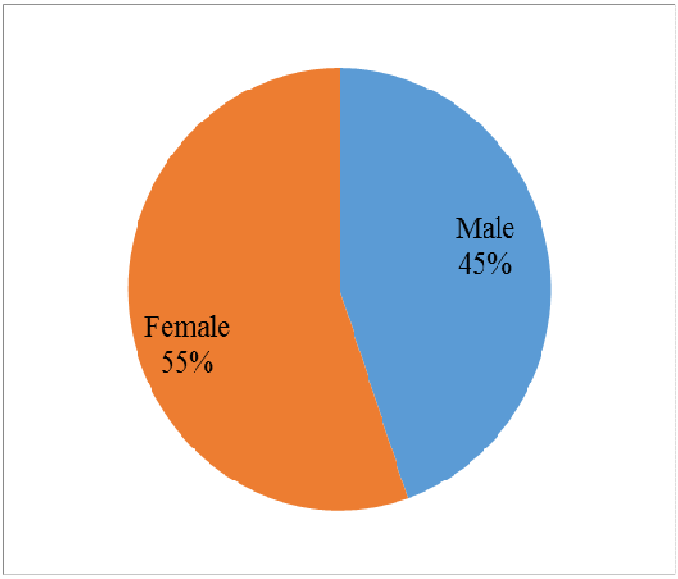

Figure 3: Male and Female mosquitoes caught in student hostels

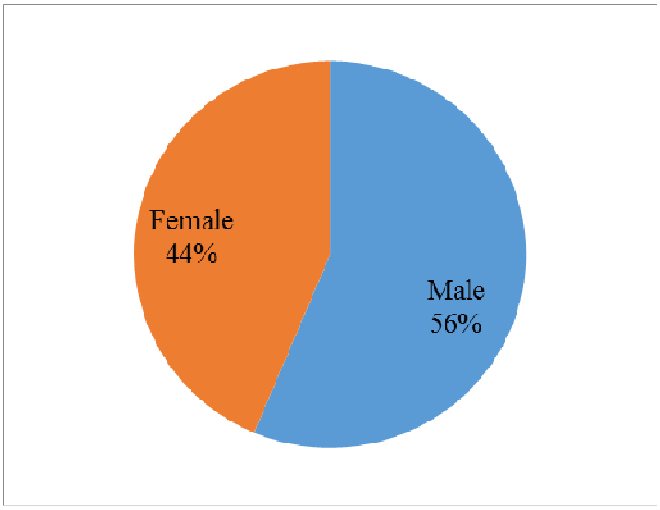

Figure 4: Male and Female mosquitoes caught in staff quarters

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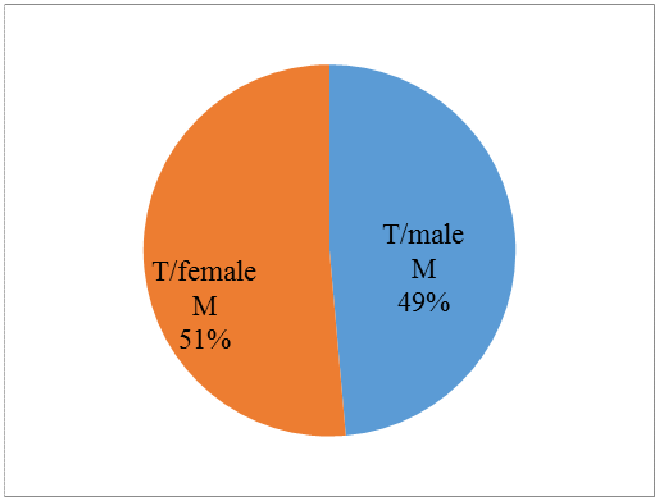

Figure 5: Male and female mosquitoes caught in staff quarters and student hostel

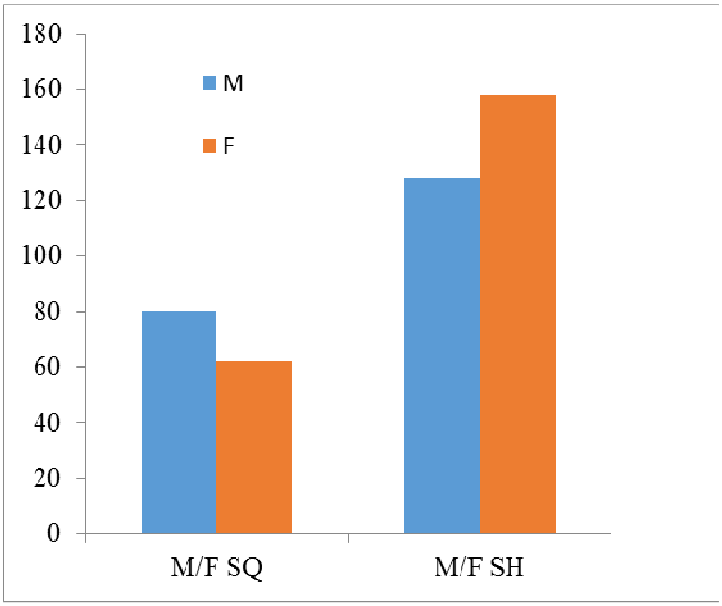

Figure 6: Male and female mosquitoes caught in staff quarters and student hostel

3.1 Discussion

Out of the three expected sub-family of mosquitoes; aedes, anopheline and culicine, culicine mosquitoes were found to be the most abundant in fact the only species in the area. This was due to the fact that anopheles mosquitoes are mostly abundant in the raining season because they breed in fresh water and the study was carried out in the dry season (March – May).

The low number of culicine mosquitoes in staff quarters was as a result of sanitary environment in staff quarters which limit their number in staff quarters compare to student hostels. High number of culicine mosquitoes in staff quarters is an indication that, occupant will have limited conducive moment of sleep. Culicine mosquitoes do not bite but are considered nuisance because they make too much noise at night.

The high number of female culicine species in the student hostels was due to poor sanitary conditions and present of stagnant waters in the hostels which encourages breeding of culicine species. Also the high population of people in student's hostels attracts mosquitoes because of carbon dioxide (CO_2) emitted from different individuals and body odor. Mosquito generally uses body odor and CO_2 as two key mechanisms to trace it host for meal [13]. As stated in the earlier section, numbers of female mosquitoes are higher in student hostels than staff quarters. Since malaria is caused by female mosquitoes, and they do so via biting activities, this indicate that occupant in student hostels are more susceptible to malarial infection than those in staff quarters

Based on the analysis of man biting rate of mosquitoes in Gombe State University, the Culicine species which was estimated to be 1.05 is relatively low compared to the 9.5 man biting rate mosquitoes in tropical zoological garden in Enugu South – Eastern part of Nigeria [1]. This is due to high amount of rainfall received that favours grasses to growth which may also favour the breeding of mosquitoes. Such areas are characterized by gutter and stagnant water in the area which serves as a breeding site of mosquitoes. The presence of grasses and other plantation within the studied area also account for increase in their abundance.

5.0 CONCLUSION

Study of man biting rate of mosquitoes in Gombe State University was carried out for a period of three month. The biting rate of culisine species was found to be 1.05 hence species of such number has high potential of posing danger of infection with relevance diseases reported in the literature. It is however confirmed that, 1.05 man biting transmission is low when compared to the previous study of Onyido [1]. With this number, it is therefore concluded that there is no potential danger that mosquitoes can cause. Considering the fact that, student hostels harbours more number of female mosquitoes than staff quarters, this concluded occupant in student hostels are more susceptible to malarial infection than staff quarters. It can be clearly seen that the environmental cleanness can be determined the occurrence of mosquitoes. When healthy state of student hostels was improved, it will not only prevent malarial infection but provide better environment for conducive learning.

6.0 RECOMMENDATIONS

The following control measures need to be taken;

1. Elimination of the breeding sites of the mosquitoes: this can be done by increasing water flow and simple ditching to provide proper drainage and disposal of empty containers.
2. By using insecticides to eliminate the adult mosquito's population.
3. Spray of oil on the surface of stagnant water will help to kill the mosquito larvae.
4. Ensure good and quality sanitary inspection of gutters and other waterways.

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