DISTRIBUTION AND SEASONAL ABUNDANCE OF ANOPHELINE MOSQUITO SPECIES IN NGURU, YOBE STATE, NORTH-EASTERN NIGERIA

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ABSTRACT

The essence of this study was to identify Anopheles mosquito species in Nguru, Yobe State and to determine their distribution and relative abundance in the months of the year. Insecticide and aspirator were used to collect mosquitoes in human dwellings and preserved in 2% formalin for identification using dissecting microscope. Anopheles gambiae (1145); Anopheles funestus (1220) and Anopheles arabiensis (827) were the major anopheline species prevalent in the town. The results obtained showed that An. gambiae were mostly abundant in wet months, followed by Anopheles funestus at the end of the rainy season, and Anopheles arabiensis in drier months. Based on the observation of Anopheles monthly distribution and supported data on malaria prevalence, the three species seem to complement one another and sustain the endemicity of malaria in the town. The study demonstrates the occurrence of malaria vectors all year round due to the favourable environmental conditions associated with Nigerian arid zone.

Keywords: Malaria, Mosquito species, Distribution, Prevalence, Seasons, Arid savanna zone, Nigeria

INTRODUCTION

Malaria has been described as the most devastating parasitic disease bedeviling mankind, especially in tropical and sub tropical regions. Factors that determine the occurrence of malaria are those that influence the three components of malaria life cycle viz: *Anopheles* mosquitoes presence, contact with human and ability to complete the invertebrate half of their life cycle (Service, 1980). The degree of endemicity in any region is determined by species of indigenous anopheline mosquitoes, relative abundance, feeding, resting behaviour and their individual suitability as hosts for *Plasmodium*, among others. (Martin, 1976).

Malaria parasites are transmitted by the bite of infected female *Anopheles* mosquito. (Service, 1980). In many endemic areas the disease is becoming increasingly difficult to control because of the resistance to anti-malarial drug and poor vector control measures. The ecological balance between man and his environment is easily upset by parasites, pests, vectors and their likes there by making their effects more pronounced (Anthony and Mike, 1983). The arthropod vectors often find the warm and humid tropics most favourable for rapid breeding and development (Anthony and Mike, 1980).

The distribution of malaria in the World is determined by the distribution of the various species of anopheline mosquitoes in which the malaria parasite *(Plasmodium*) undergo the phase of sexual reproduction (Clegg and Clegg, 1980). The genus *Anopheles* contains about 380 species. The most important of which in Africa south of the Sahara are An. *gambiae*; *An. arabiensis* and *An*. *funestus*. Others of minor importance are *An. nili; An. moucheti*; An*. hargreavesis and An. hankcoki. Anopheles gambiae* being anthropophilic and endophagic species have more frequent contacts with humans and thus an extremely effective vector of malaria, especially in tropical Africa (Service, 1980).

The World Health Organization (WHO, 1996) estimates that malaria affects some 300 – 500 million people killing 1.5 - 2.5 million every year. The Federal Ministry of Health, Abuja admits that Nigeria has lost over ₦132 billion to the treatment of malaria, which contribute to childhood and maternal death (Joel, 2007).

A number of studies have been carried out on anopheline mosquito species. Examples are studies of Wanji *et al.* (2003) on mount Cameroon and Okafor (1991) in human dwellings in the Obafemi Awolowo University, Ile-Ife, South West Nigeria. Okafor (1991), found *An. gambiae An. funestus* and *An. nili* present in the campus and the neighbouring villages. This present study in Nguru, North-Eastern Nigeria is aimed at identifying anopheline species and their monthly distribution. This will serve as a reference source for more research work and contribution to the vector control strategy for effective malaria control in North-eastern Nigeria.

Table 1: Monthly distribution and abundance of mosquito species in Nguru, North -eastern Nigeria

Month (2006)	Total catch	Number and percentage catch of different mosquito species		
		Anopheles	***Culex***	***Aedes***
January	328	112(34.1)	106(33.5)	110(33.5)
February	289	109(37.7)	89(30.8)	91(31.5)
March	489	177(36.2)	160(32.7)	152(31.1)
April	750	299(39.8)	230(30.7)	221(29.5)
May	700	280(40.0)	216(30.8)	204(29.2)
June	726	296(40.8)	168(23.1)	272(37.6)
July	1126	450(40.0)	360(32.0)	316(28.1)
August	1284	512(39.9)	425(33.1)	347(27.0)
September	1178	472(40.0)	364(30.9)	342(29.0)
October	375	128(34.1)	150(40.0)	97(25.9)
November	528	165(31.2)	214(40.5)	149(28.2)
December	483	192(39.7)	152(31.5)	139(28.8)
Total	8256	3192(38.6)[a]	2634(31.9)[b]	2440(29.5)[c]

[a, b and c] *significantly different abundance of anopheles mosquito species (P= 0.05)*

Table 2: Monthly distribution and abundance of *Anopheles* mosquitoes in Nguru, North-eastern Nigeria

Month (2006)	Total catch	Number and percentage catch of different mosquito species		
		An. gambiae	***An. funestus***	***An. arabiensis***
January	261	73 (28.0)	80 (30.6)	108 (41.4)
February	241	67 (27.8)	77 (31.9)	97 (40.3)
March	228	70 (30.7)	68 (29.8)	90 (39.5)
April	221	73 (33.0)	70 (31.7)	78 (35.3)
May	271	99 (36.5)	106 (39.1)	66 (24.4)
June	250	107(42.8)	103(41.2)	40(16.0)
July	236	118(50.0)	90 (38.1)	28(11.9)
August	293	178 (60.7)	87 (29.7)	28 (9.6)
September	294	108 (36.7)	158 (53.7)	28 (9.5)
October	315	96 (30.5)	171 (54.3)	48 (15.2)
November	294	80(27.2)	107(36.4)	107(36.4)
December	288	76 (26.4)	103 (35.8)	109 (37.9)
Total	3192	1145(35.9)[a]	1220 (38.2)[b]	827(25.9)[c]

[a, b and c] *significantly different abundance of anopheles mosquito species (P= 0.05)*

MATERIALS AND METHODS

Study Area: The research work was carried out in Nguru, an ancient town in the North-Eastern Nigeria. Nguru is located on latitude 12.58^{o} of equator and longitude 10.28^{o} of Greenwich Meridian. The town being in the semi-arid, Sahel savanna zone has very marked dry (October-May) and rainy (June-September) seasons. Annual rainfall ranges between 250 mm and 550 mm. Mean day temperature vary from 38 ^{o}C to 42 ^{o}C during the hottest months of March, April and May. It also varies from 17 ^{o}C to 22 ^{o}C during the coldest months of December and January.

The relative humidity is about 17 % during the hot dry weather and can reach or even exceed 70 % during the peak of wet season in August.

The study was conducted in three selected communities (areas) of the town: Hausari, Bulabulin and Sabon-Gari Kanuri. Ten homes were visited in each sample areas. The abundance and monthly distribution of *Anopheles* mosquito species was studied from January 2006 to December 2006 using cross-sectional samples.

Method of Collecting and Identification of Mosquitoes: All corners, hidden places and walls of human dwellings in the selected area were sprayed with Mobil insecticide to kill or weaken the mosquitoes. Knock down mosquitoes were picked into sampling bottle containing 2% formalin as preservatives. Mosquitoes were collected alive in the night and morning hours using aspirator and preserved in specimen bottles containing 2% formalin.

The collected mosquitoes were mounted on glass slides and viewed under simple Olympus (dissecting) microscope for identification using relevant taxonomic keys (Service, 1980; Huang, 2001). *Anopheles* mosquitoes were identified by the palp which is as long as the proboscis and pointed and by the number, the length, arrangement of the

dark and pale scales in small blockson the veins of the wings (Service, 1980; Huang, 2001).

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 (Service, 1980). Other mosquito species identified were *Culex* and *Aedes* (Huang, 2001)

Data Analysis: Relative frequencies (percentages) were used for the presentation of data in tables. Analysis of Variance (ANOVA) was used to assess the significance of difference in the proportions.

RESULTS AND DISCUSSION

Monthly Distribution of Mosquito Species: Mosquito species found in Nguru are *Anopheles, Culex and Aedes*. *Anopheles* mosquitoes were dominant in January, February, March, June, July, August, September and December. Total number of mosquitoes collected were 8,256, out of which 3,192 (38.6%) were *Anopheles*; 2634 (31.9%) were *Culex* and 2440 (29.5%) were Aedes. The number of *Anopheles* mosquito was the highest in the months of July, August and September and it fell drastically in the month of October (Table 1). The abundance of *Anopheles* mosquito in July to September was as a result of high rainfall, that contributed to increase in number of breeding sites (tin cans, blocked gutters, stagnant waters), as *Anopheles* species need bright water with adequate oxygen and sunlight for their breeding (Goma, 1966; Service, 1980)**.** Since there is fluctuation in the abundance of *Anopheles* mosquito in the months and seasons, this might be the reason behind the instability of malaria infection in the ancient town (Lamidi, 2008).

Monthly Distribution and Abundance of Anopheline Mosquitoes: Morphological examinations of *Anopheles* mosquitoes show that Nguru is under the influence of three major anopheline species: *An. gambiae*, *An. funestus* and *An. Arabiensis*. The total numbers of anopheline species collected were 3,192. *An. funestus* was the overall most populous species with 1220 (38.2%) followed by *An. gambiae* with 1145 (35.9%) and *An. arabiensis* with 827 (25.9%) (Table 2).

The abundance of *An. gambiae* peaked in August and fell progressively from September through May. *An. funestus* was relatively low in number in rainy months. Its peak abundance occurred in October. *Anopheles arabiensis* had lowest abundance in wet months. Its peak abundance was in December/January (Table 2). The difference observed in the distribution and abundance of anopheline species in different months was statistically significant (P= 0.05).

Different findings have shown that *An. gambiae*; *An. arabiensis* and *An. funestus* are the principal vectors of malaria in African and are widely distributed from South of the Sahara desert to Northern South Africa (Cohuet *et al.* 2004). The common *Anopheles* species found in different ecological zones of Africa are *An. gambiae* and *An. funestus*. Other species are *An. moucheti; An. marshalli*, *An. hankocki; An. nili, and An. arabiensis* (Okafor, 1991; Wanji *et al.,* 2003; Christopher *et al.,* 2005).

The identification of *An. arabiensis* in Kenya (Hong *et al*. 2006) and in Senegal (Cohuet *et al* 2004) together with the two commonest *Anopheles* species in Africa (*An. gambiae* and *An. funestus) was* in line with the present study. This is due to the fact that *An. arabiensis* prefer drier Savanna ecological zone (Service, 1980) and this might be the reason why *An. arabiensis* was more in the Sahelian town (Table 2).

Conclusion: Vector control is one of the approaches to prevention of malaria. The environment must be kept clean and clear of stagnant water. Where stagnant water is present, it is suggested that kerosene or liquid oil should be sprayed on the water to kill the various developing stages of mosquito (Anthony, and Mike, 1983). Adult mosquitoes can be killed with insecticides. The use of mosquito nets which reduce the chances of being bitten by mosquitoes has been found to be effective malaria control strategy (Snow *et al.,* 1988).

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