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A Prelimnary Survey on TheAbundance of Mosquito Species and Transmission of Plasmodium to Humans in Bille, Oporoama, Sama and Tema Communities of Rivers State, Nigeria

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Abstract: *This research was conducted between June and August to determine the abundance of mosquito spp and to relate their abundance to their involvement in the transmission of Plasmodiumto human population in Bille, Oporoama, Sama, and Tema communities of Rivers State. The mosquitoes were caught in residential houses, using a locally manufacture insecticide, whose potency has been proven. The highest number of Mosquito spp was caught in Sama, followed by Tema, Oporoama, and then Bille community. The most abundant spp in Bille community is Anopheles arabiensis, while in Oporoama, Culex quinquefasciatus is the most abundant, Mansonia spp and Anopheles funestus are the most abundant in Sama and Tema communities respectively. This result shows that Bille and Tema communities will have the highest number of transmission of Plasmodiumspp.*

Key Words: *Malaria; Transmission; Anopheles arabiensis; Anopheles funestus; Culex quinquefasciatus.*

I. Introduction

The increase in Mosquito population following changing weather conditions poses major threat to humans because of mosquito's ability to carry disease-causing pathogens. In areas with reservoirs of disease, information on mosquito abundance helps to identify the areas at higher risk of disease transmission. Using a geographic information system (GIS), mosquito abundance is predicted across Bille, Oporoama, Sama and Tema Communities in Kalabari District of Rivers State. The mosquito abundance model uses mosquito light trap counts, habitat suitability, and dynamic environmental variables to predict abundance of the species. The predicted mosquito abundance values are compared to vulnerable population indices to determine the spatial distribution of risk of the disease transmission.

In 2008, there were 247 million cases of malaria caused by Plasmodium spp and nearly one million deaths mostly among Children living in Africa. In Africa a child dies every 45 seconds of malaria, which accounts for 20% of all childhood deaths. [1].

Plasmodium parasites are spread to people through the bites of infected Anopheles mosquitoes called "malaria vectors" which bite mainly between dusk and dawn.

There are about six (6) species of *Plasmodium* namely:-

(1) Plasmodium falciparium
(2) Plasmodium vivax
(3) Plasmodium malariae
(4) Plasmodium ovale
(5) Plasmodium knowlesi
(6) Plasmodium moucheti

In man, five species of *Plasmodium* are known to cause malaria disease condition, which includes *Plasmodium falciparium, P. malariae, P. vivax, P. ovale* and *P. knowlesi*.

Plasmodium falciparium is the most common and virulent in Nigeria. It infects humans of all sexes and social classes, with its attendant economic impact on the working population.

Plasmodium spp still ranks as the number one disease causing parasites that kills a child somewhere in the globe every 30 seconds, children, pregnant mothers, people in emergency situations and people living with HIV/AIDS are particularly vulnerable to the parasites.

Diseases caused by *Plasmodium* spp accounts for up to a third of all children under the age of five (5) in Africa.

There are up to 800,000 infantile deaths and a substantial number of miscarriages as well as very low birth-weights babies per year due to diseases caused by *Plasmodium* spp.

In regions where these parasites are prevalent, people may have the disease but due to immunity they have few or no symptoms. Severity of the disease symptoms can also vary depending on the individual's general

health. The severity and duration of the parasite attack in endemic areas depend on many factors including nutritional status of the host, virulent of the infecting strain, development of resistance or immunity in the infected host, age, occupation and environmental factors.

Plasmodium spp cause acute febrile illness. Symptoms appear seven days or more (usually 10-15days) after the infective mosquito bite. The first symptoms are fever, headache, chills and vomiting which may be mild and difficult to recognise as malaria (disease condition caused by *Plasmodium* spp). If not treated within 24 hours, *P. falciparium* can progress to severe illness often leading to death. Children in endemic areas with severe disease, frequently develop one or more of the following symptoms, which include severe anaemia, or cerebral malaria. In adults, multi-organ involvement when infected with *Plasmodium* is also frequent. In *P. vivax* and *P. ovale*, Clinical relapses may occur weeks to months after the first infection, even if the patient has left the malaria area. These new episodes arise from "dormant" larval forms (absent in *P. falciparium* and *P.malariae*) and special treatment targeted at these larva stages is mandatory for a complete cure.

II. Materials and Methods

Study area.

The survey was conducted in Kalabari district of Rivers State Nigeria. It is located between Latitude 4^{o} 20'N and 4^{o} 50'N and Longitude 6^{o}30'E and 7^{o} 5'E. It is bounded at the North by Emohua Local Government Area, south by Bonny Local Government Area, and East by Bayelsa State and west by Okrika Local Government Area. The study area covered Bille, Oporoama, Sama and Tema communities. Their main occupation is fishing. Trading and occasional farming are however practiced in some of the villages. Non-functional pipe borne water is available in these communities; though in addition to the pipe borne water, wells and rain waters are also used for drinking. Generally, the people defecate into the marine water by building "hanging toilets" over these waters. This habit is necessitated by the limited availability of land. Although, few private houses have enclosed toilet system. There are poor drainage systems in these areas as the area is flooded immediately after heavy rainfall during the rainy season. The study area has tropical mangrove climate type.

This area has monsoon climate with lengthy and heavy rainy season and very short dry season, the region's heaviest precipitation is seen during the months of July, August and September with an average approximate rainfall of 370mm.

December and January are the driest months of the year with an average rainfall of 20mm;temperature throughout the year in the district is relatively constant measuring between 25^{o}C-28^{o}C.

The ecology of the district provides good habitat, breeding sites and high rate of survival for the different species of mosquitoes for the transmission of Plasmodiumspecies.

Mosquito Collection

Sampling was done between June and August between the hours of 20.00-22.00 hours, Collections were made in Bille, Oporoama, Sama and Tema in five (5) houses per day in each of the communities but prior to the spraying of the insecticide (Otapiapia), white sheets were spread on the floor of each room.

Mosquito species were collected in five different universal specimen bottles per day in each of the communities. Collections were done indoor, by spraying and picking techniques. The rooms were spread with insecticide (Otapiapia) with windows and doors shut/ and left for 35 minutes. The fallen mosquitoes were then picked and preserved in formaldehyde (Formalin, 70% Conc.)

Morphological Identification of mosquitoes

The collected samples were identified with the aid of a dissecting microscope in the laboratory based on the keys of [2] and [3].

Anopheles gambiae
Palps: Smooth and as long as the proboscis
Thorax: Nearly black with scale
Scutellum: No lobe
Wings: Spotted with pale or dark patches on costa
Legs: Irregular specked (only just visible)
Abdomen: Dark and hairy

Anopheles nili
Palps: Smooth and dark except for pale tip.
Thorax: Tuft of white scales at front end, otherwise scales.
Wings: Mainly dark-scaled with pale interruption of costa few and short (Pale areas more extensive in some Congo species)

Legs: Dark except for pale spots at tips of tibiae and occasionally at tips of femora as well.
Abdomen: No Scales
Aedes aegypti
Proboscis: Dark
Palps: Short and Dark
Thorax: Silver-white on dark background
Scutellum: Trilobed
Wings: Dark-scaled without conspicuous spots
Legs: With white and black bands
Abdomen: Pointed, black with white bands

Culex pipiens fatigans
Palps: Dark and long
Thorax: Nearly black with scale
Palps: Dark and short
Thorax: Pale brown
Wings: Narrow dark scaled
Abdomen: Distinctly blunt at tips; with white bands along the base of each tergit
Scutellum: Trilobed

Statistical Methods
Chi-square was used to determine the differences in abundance of mosquito species; 5% ($P < 0.05$) was regarded as an acceptable level of significance.

III. Results

A total of 438 Mosquitoes were collected in the four communities. The most abundant species in Bille and Tema is *Anopheles arabiensis* with a total of 82. 42 (51.2%) was collected from Bille and 40 (48.8%) was collected from Tema. Other species were also collected as follows; Total of 98 mosquitoes were collected in Bille community [*Aedes aegpyti* 14(14.3%), *Anopheles arabiensis*> 42(42.9%), *Anopheles funestus* 28(28.6%), *Anopheles gambiae* 14(14.3%)]; A total of 102 mosquitoes were collected in Oporoama Community [*Aedes aegypti* 4(3.9%), *Aedes africanus* 4(3.9%), *Anopheles funestus* 4(3.9%), *Anopheles gambiae* 4(3.9%), *Anopheles nili* 8(7.8%), *Anopheles punctipennis* 14(13.7%), *Culex quinquefasciatus* 64(62.7%)]; A total of 128 mosquitoes were collected in Sama community [*Aedes aegypti* 24(18.8%), *Anopheles gambiae* 24(18.8%), *Culex quinquefasciatus* 32(25%), *Mansonia* spp 48(38%)]; A total of 110 mosquitoes were collected in Tema community [*Aedes aegypti* 15(13.6%), *Anopheles arabiensis* 40(36.4%), *Anopheles gambiae* 20(18.2%), *Anopheles nili* 10(9.1%), *Mansonia* spp 25(22.7%)].

Table 1.Percentage abundance of Mosquito species in the selected Communities of Rivers State, Nigeria.

Selected Communities:

Species	Bille	Oporoama	Sama	Tema	n(%)
Aedes aegypti	14	4	24	15	13
Aedes africanus	0	4	0	0	0.9
Anopheles arabiensis	42	0	0	40	18.7
Anopheles funestus	28	4	0	0	7.3
Anopheles gambiae	14	4	24	20	14.2
Anopheles nili	0	8	0	10	4.1
Anopheles punctipennis	0	14	0	0	3.2
Culex quinquefasciatus	0	64	32	0	21.9
Mansonia spp	0	0	48	25	16.7
Total	98	102	128	110	100

IV. Discussion

The roles of the principal vectors in malaria transmission were investigated in four communities of Kalabari region, Rivers State. The species distribution suggests that all members of *Anopheles gambiae* and *Anopheles funestus* have sympatric distribution. It is concluded that *Anopheles gambiae* is everywhere in Nigeria because of its indiscriminate breeding habitat such as, domestic water containers, animal drinking places and any other breeding places created by man [4].. It has been described as a highly endophilic and anthropophagous season vector of malaria. It had the highest infectivity rate and was most abundant, when compared to other mosquito vector in this study.

Anopheles arabiensis has been described as a savannah vector in isolated populations, deforested area and predominant in the dry season. It has been stated that wherever Anopheles arabiensis, occur in the rainforest, it is associated with a history of extensive land clearance [5]. It is also reported that there has been an extension in the range of *Anopheles arabiensis* in Nigeria prevailing in arid zones but also in some forest[6].

Anopheles arabiensis and *Anopheles gambiae* coexist over much of their range as in this study. Puzzling shift in species composition of Anopheles arabiensis and Anopheles gambiae have been observed everywhere in Nigeria. In the coastal regions of Rivers State people have utilized indigenous plants for mosquito control [7]. [8] also reported that Anopheles arabiensis could be anthropophagous where there are less animal as observed in this study. Anopheles arabiensis is reported to be a good vector of malaria [9]Edrissan, etal (1985).

Anopheles spp are the dominant vectors in many places in the west coast especially as it is related to sea tides. It was first reported from Lagos, Nigeria as highly anthrophagic, endophilic and breeding in lagoons and tidal swamps. Elsewhere in equatorial Guinea, it was reported that *Anopheles melas* was the main Anopheles vector involved in malaria transmission with similar sporozoite rate like Anopheles gambiae s.s. However, it was reported that it is a less efficient vector being more zoophagic as it was found that it has lowest sporozoite rate [10]. Today *Anopheles funestus* which breeds in sides of slowly running clean-shaded streams or rivers has received little attention this is consistent with its obvious major role in malaria transmission which may be related to the present study.

Most researchers on malaria transmission have focused on members of the Anopheles gambiae complex. According to some authors [11], the *Anopheles funestus* group may be as complex and more problematic than the *Anopheles gambiae* group, through more restricted habitat's choice [11].

In some areas of Nigeria, suitable to the breeding pattern of *Anopheles funestus*, it was noted that it could replace *Anopheles gambiae s.s* as vector of endemic malaria. *Anopheles moucheti* is a complex species and major human malaria vector in villages and towns situated in forest areas and often found in sympathy with *Anopheles gambiae* which may be the only forest vector in some areas. *Anopheles moucheti* was reported as a primary vector in Nigeria but played a lesser role when compared to *Anopheles gambiae* and *Anopheles funestus s.s.* There has been an increased number of infected Anopheline in nature, of which many are zoophilic.

In a research conducted by some workers [12] on studies on malaria transmission in Nigeria, researchers were dumb- founded by the large numbers of mosquito species involved.

The indigenes of the study area are predominantly fishermen, who use canoes and after their fishing activities may keep canoes near human habitations. Rain water may accumulate in these canoes and therefore enhance the breeding of mosquito vectors, which may enhance high prevalence of malaria infection in the area. The poor level of sanitation of the people may contribute to the high prevalence of the vectors. The areas of habitation are always littered with empty cans or containers that can hold water and these provide breeding sites for the parasite vectors.

Also there are a lot of mangrove forest and food crops with much proximity to human habitation; these may act as additional means of microhabitats for mosquitoes [13]. Pulling of canoes due to fishing activities may probably lower individual resistance, thereby increasing the chances of infection following mosquito bites.

Further, the high prevalence of Plasmodium parasite may be linked with the terrain of the area. The flat table land of the area encourages the presence of pools of water, or occasional water-logging as a result of the nature of the soil. These stagnant pools of water are common features of this area during and after the rains.

The abundance of mosquito species may be detrimental to the human population of the study areas. Although, it is noted that the various mosquito species recovered during the study may enhance the transmission of other parasite/diseases.

Indeed, the current effort by World Bank at reducing malaria prevalence is highly commendable. However, it is believed that much is still needed to be done especially in terms of manpower recruitment and better approach adopted in the eradication measure. The terrain of the Niger Delta should be properly surveyed before any effort at reducing malaria disease would yield the needed result.

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