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POTENTIAL *ZIKA VIRUS* VECTORS OF KAUGAMA LOCAL GOVERNMENT AREA, JIGAWA STATE, NIGERIA

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ABSTRACT

The *Zika virus* strain responsible for the outbreak in Brazil has been detected in Africa for the first time. This information will help African countries to re-evaluate their level of risk and adopt increase their levels of preparedness. These should include the study of potential vectors responsible for the disease. Identification of potential *Zika virus* vectors in Kaugama revealed the presence of five species of *Aedes* mosquito, *Aedes furcifer* 109 (19.46%), *A. aegypti* 92 (16.43%), *A. africanus* 132 (23.57%), *A. albopictus* 112 (20.00%) and *A. taylori* 115 (20.54%). *Aedes africanus* was the most abundant species encountered. Analysis of species abundance showed no significant difference ($p>0.05$). The abundance of the vectors was suggested to be due to large number of breeding places in the study area and probably improper mosquito control. Detection of *Zika virus* from the collected vectors is of great importance, serological detection of specific antibodies against *Zika virus* from the inhabitants is valuable tool to prove them as vectors and it is good to eradicate the potential vectors from the area.

Keywords: Kaugama, Potential, Species, Vectors, *Zika virus*

INTRODUCTION

Zika virus is an emerging mosquito-borne virus that was first identified in Uganda in 1947 in rhesus monkeys. Its name

comes from Zika forest of Uganda. It was subsequently identified in humans in 1952 in Uganda and the United Republic of Tanzania. *Zika virus* is classified as: Group IV(X) ssRNA, Family: Flaviviridae, Genus: Flavivirus and species*: Zika virus* (Malone *et al*, 2016*). Zika virus* is related to dengue, yellow fever, Japanese encephalitis and west Nile virus (Sikka *et al.*, 2016).

Zika virus replicates in mosquito's midgut epithelial cells and then its salivary gland cells. After 5-10 days, *Zika virus* can be found in the mosquito's saliva which can then infect human. If the mosquito's saliva is inoculated into human skin, the virus infects epidermal keratinocytes, skin fibroblast and the Langerhans cells. The pathogenesis of the virus is hypothesized to continue with a spread to lymph nodes and blood stream (Knipe *et al.*, 2007; Chan *et al.*, 2016).

Zika virus is transmitted to people through the bite of an infected female mosquito from the Aedes genus, mainly *Aedes aegypti* in tropical regions. This same mosquito transmits denque, chikungunya and yellow fever viruses (Sikka *et al.,* 2016). It is also transmitted by *Aedes albopictus, A. furcifer, A. lensilli, Mansonia uniformis and Culex perfuscus* (Hayes, 2009).

However, sexual transmission of *Zika virus* has been described in 2 cases, and the presence of *Zika virus* in semen in additional cases.

Zika virus disease is caused by a virus transmitted by Aedes mosquitoes. *Zika virus* disease usually have symptom that can include mild fever, skin rashes, conjectivitis, muscle and joint

pain, malaise or headache. These symptoms last for 2-7 days. Zika fever in pregnant woman is associated with microcephaly (Knipe *et al.*, 2007; Malone *et al.*, 2016). Recently in Brazil, local health authorities have observed an increase in babies born with microcephaly in northeast Brazil. Agencies investigating the Zika outbreaks are finding an increasingly body of evidence about the link between *Zika virus* and microencephaly.

Outbreaks of *Zika virus* disease have been recorded in Africa, Asia and the Pacific. It was not until 1954 that the successful isolation of a *Zika virus* from a human was published. It was found in the blood of a 10 year old Nigerian female with low grade fever (Dick *et al.,* 1952). So some of the population may already be immune (Sikka *et al.*, 2016). Until the virus was sequenced by scientists in Senegal, it was not certain if the outbreak in Cape Verde was caused by the American or Asian type, which has hit Brazil and the other Latin American countries (Sikka, *et al.*, 2016).

The *Zika virus* strain responsible for the outbreak has been detected in Africa for the first time and it is currently circulating in Cape Verde, an Archipelago off the northwest Coast of Africa. The virus has been circulating at a low rate in African countries for more than fifty years. There have been more than 7,000 suspected cases of *Zika virus* in Cape Verde, with 180 pregnant women thought to have been infected. Three babies have been born brain damaged with microcephaly (British Broadcasting Corporation, 2016).

The true extent of the vector is still unknown in Nigeria since. The *Zika virus* has been detected in many more species of

mosquitoes. Moreover, *A. aegypti* from Nigeria, Senegal and Singapore have been shown experimentally to be competent vectors of *Zika virus* (Marchette *et al.*, 1969).

MATERIALS AND METHODS

Study Area

The study was conducted in Kaugama Local Government Area, Jigawa state, Nigeria latitude 12°46′ N and longitude 10° 05′ E. The area falls within the Sudan savannah zone. The minimum temperature of the area ranges from 15.89°C to 36°C. Rainfall ranges from 491mm to 1186mm (Wikipedia, 2010). More water bodies that harbor breeding of mosquitoes such as streams, gutters, drainages and rice fields were available in the area.

Collection and rearing of mosquito Larvae/pupae

Larvae of all types of instars or pupae or both were collected from breeding places. These include pools, gutters, rice fields, drainages and pond according to David and Jan (2001). Using a soup ladle, larvae/pupae together with water they were living in was scooped from breeding sites and transfer into a transparent plastic bucket covered with bed netting (1mm x1mm) at the top to allow exchange of gases. They were kept in a cage at room temperature and fed with ground fish diet powder. The adult that emerged were killed using drops of Acetyl acetate placed on large Whattman's filter paper above the cage. They were collected and stored in separate Effendorf tubes for morphological identification (Mark, 1997).

Morphological Identification of Mosquitoes

Using the identification keys of Leopoldo (2000) and the keys of Gilles and Coetzee (1987), the dead adult mosquitoes were identified with the aid of light microscope.

Data Presentation

The data obtained from the morphological identification were presented in table 1 and expressed as percentage abundance. The data was also analyzed by t-test to compare the significant difference among the mosquito species.

RESULTS

A total of 560 potential *Zika virus* vectors t of genus *Aedes* were identified from the study area (Table1) and their percentage abundance was recorded as*: Aedes furcifer* 109 (19.46%), *A. aegypti* 92 (16.43%), *A. africanus* 132 (23.57%), *A. albopictus* 112 (20.00%) and *A. taylori* 115 (20.54%).

Table 1: Potential *Zika virus* vectors Identified from Kaugama Local Government Area, Jigawa State, Nigeria

Potential *Zika virus* vectors	**Number observed**	**Percentage abundance (%)**
Aedes furcifer	109	19.46
Aedes aegypti	92	16.43
Aedes africanus	132	23.57
Aedes albopictus	112	20.00
Aedes taylori	115	20.54
TOTAL	**560**	**100**

SOURCE: Researcher's report, 2016

DISCUSSION

Abundance of five species was reported from the study area. Their abundance could be attributed to abundance of breeding places as observed from the study area and as stated by Jordan and Verma (2011) that mosquitoes breed in ponds, rice fields and grassy ditches.

Another reason for the abundance of the species could also be attributed to poor mosquitoes control in the study area. My observation on the study area showed that there are no mosquitoes control activities in the area. Jordan and Verma (2011) suggested that poor mosquito control leads to emergence and continual breeding of it.

All the five potential vectors reported in this study were members of the gunus Aedes. This has agreed with findings by (Fagbemi, 1964) who reported that *Zika virus* was first isolated in Uganda from a febrile sentinel rhesus monkey and from the mosquito, *Aedes africanus*, in 1947 and 1948 respectively. These initial identifications were followed by detection of the virus infection in humans, mosquitoes and animals in Africa and Asia by virus isolation and serological studies. It has been isolated in urban settings from humans and *A. aegypti*. Moreover, *A. aegypti* from Nigeria, Senegal and Singapore have been shown experimentally to be competent vectors of *Zika virus* (Cornet, *et al.*, 1979).The only genus reported as potential *Zika virus* vector was *Aedes* and this is true for the genus as described by Nene *et al.* (2007) that *Aedes* originally found in Pacific and subtropical zones, but now found in all continents except Antarctica. This showed that the genus is dominating other parts of the world

and many more species of them are potential vectors of *Zika virus*.

The abundance of *A. furcifer* has agreed with what is known about this species as reported by Chan (2016). In Senegal, *A. furcifer* was first reported as *Zika virus* vector in 1968 as the virus was first isolated from it in the Saboya Forest in the western part of the country. Also in southeastern Senegal, more than 400 *Zika virus* strains have been isolated from mosquitoes, mainly *A. furcifer*. *A. africanus*, *A. furcifer*, and *A. taylori* (Cornet *et al.*,1979). Faye *et al.* (2013) reported on isolation of *Zika virus* from *A. taylori* from Senegal in 1990, 1999, and 2000 and from Cote d'Ivore in 1978 and 1992. Recently, Ahmed and Sani (2016) reported the abundance of *A. taylori* from Hadejia which is very close Kaugama.

Even though *Aedes vittatus* is not reported from this area but Diawo *et al.* (2014) reported that *Zika virus* amplification conducted in the Kedougou area, involved several mosquito species as probable vectors, and encompassed all investigated land cover classes except indoor locations within villages. *Aedes furcifer* males and *Aedes vittatus* were found infected within a village, thus these species are probably involved in transmission of *Zika virus* to humans. Similarly, Cornet (1979) reported that natural transmission cycle of *Zika virus* in Africa involves primarily *Aedes* species including *A. furcifer* and *A. luteocephalus*. They further reported *A. furcifer* as vector of *Zika virus* from Senegal in 1994, 1997 and 2000 also from Cote d'Ivore in 1999.

The overall abundance among the species identified was statistically not significant, $p>0.05$

CONCLUSION

Five potential *Zika virus* vectors were reported from Kaugama Local Government Area, Jigawa State, Nigeria, namely *Aedes furcifer, A. aegypti, A.africanus, A.albopictus* and *A.taylori*. *Aedes africanus* was the most abundant while *A*. aegypti was the least. It was observed that all the species identified were members of one genus, *Aedes*.

RECOMMENDATIONS

Transmission of the virus by these vectors is not known in the study area, detection of *Zika virus* from the identified vectors is strongly recommended. Serological test to isolate antibodies against *Zika virus* from the inhabitants' blood is also recommended.

Mosquitoes and their breeding site pose a significant risk factor for *Zika virus* there is need for a vector control in the area to include indoor residual spray and treatment of the breeding places. Prevention relies on reducing mosquito's contact to human body such as by using insect repellent regularly, wearing cloth that covers as much as the whole body.

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