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Surveillance of Mosquito Species Abundance and Composition in Azare, Katagum Local Government of Bauchi State, Nigeria

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Abstract: *The distribution and abundance of mosquitos' species in Azare, were studied between March to October, 2016. Mosquito species were sampled monthly from five (5) clusters randomly distributed across the city using dippers. The habitats sampled include containers, stagnant pools, domestic run-offs, footprints, vehicle tyres, and reservoirs and gutters. The larvae collected were preserved in 70% ethanol and identified microscopically to species level using standard morphological keys. The pupal collections were kept till emergence and identified as adults microscopically, with the aid of morphological keys. A total of 4,871 mosquito immature stages comprising 6 species were sampled from 5 randomly selected clusters of Azare town. The predominant species, constituting about 91.38% of the total collection of mosquito species, were Culex quinquefasciatus (57.89%), Cx. molestus (25.87%) and Cx. pipiens (7.62%). While Aedes aegypti, Aedes vittatus and Anopheles gambiae s.l. Species rarely occurred constituting 5.11%, 2.69% and 0.82% of the total collection respectively. The distribution of mosquito species in the study area indicated that 6 species occurred in 4 clusters; GRA, Fatara, Kakudi, and Matsango, while 5 species occurred in Kafin Kuka. There was no significant difference ($p>0.05$) in the occurrence of mosquito species composition among the clusters in the study area. The occurrence of Aedes, Anopheles and Culex is suggestive of the prevalence of vector-borne diseases such as malaria, yellow fever, dengue fever, filariasis and Arbovirus diseases in the area. Therefore, effective vector control programmes and public enlightenment especially on human activities that encourage mosquito breeding are recommended.*

I. Introduction

Mosquitoes are small, midges-like flies belonging to the order Diptera (flies), sub-order Nematocera and family Culicidae. They exhibit complete metamorphosis with a life cycle of egg to larva to pupa to adult, in which the first 3 stages are aquatic (Jupp, 2004). They exploit almost all types of lentic aquatic habitats for breeding. Larvae of mosquitoes have been found to thrive in aquatic bodies such as fresh or salt water marshes, mangrove swamps, rice fields, grassy ditches, small, temporary rain pools, edge of streams and rivers. Many species prefer habitats with vegetation while some breed in open, sunlit pools (Joseph *et al.,* 2013).

Mosquitoes are widely distributed worldwide utilizing various breeding sites which were influenced by various environmental conditions and factors (Ajayi *et al.,* 2010). Ecological and environmental modifications as a result of agricultural activities and urbanization contribute to the breeding of various mosquitoes' species. The distribution of mosquito of mosquito activity can be highly variable even in the same geographical area (Martha *et al.,* 2013). This suggests that mosquito distribution is influenced by a number of factors which in turn affect emergence and re-emergence of diseases.

Mosquito species belonging to three genera (*Anopheles, Culex,* and *Aedes* species) transmit many dreadful diseases causing serious health problems to human beings and other domestic animals. The females biting habit during their search for blood mean shortly before oviposition increases their propensity to transmit various disease associated with high morbidity and mortality in sub-Saharan Africa (Olayemi *et al.,* 2010). Such disease vectored by mosquitoes include: malaria, bancroftian filariasis, yellow fever and arboviruses in general (okogu *et al.,* 2003) which affect hundreds of millions of people every year, causing immense suffering and hindering development (Joseph *et al.,* 2013).

Nigeria is known for high prevalence of malaria and the disease remains one of the leading causes of childhood and maternal morbidity and mortality, low productivity and reduced school attendance in Nigeria (Aribodor *et al*., 2007). The country is also ranked second highest with lymphatic filariasis (LF) globally (Federal Ministry of Health, FMOH, 2009). Nwoke *et al.,* (2010) reported that bancroftian filariasis, caused by *Wuchereria bancrofti* is widespread in Nigeria and constitutes a major public health problem being the major cause of acute and chronic morbidity. According to Ajayi *et al*., (2010) other mosquito-borne diseases accounted for a lots of economic loss, social disgrace, low productivity, absenteeism, sleeplessness and others.
The heavy burdens exerted by mosquito-transmitted diseases informed the implementation of aggressive control interventions against the mosquitoes and the parasites (Olayemi *et al.,* 2010).

In Nigeria, vector control strategy is focused mainly on measures targeted on adult mosquitoes including, the promotion of the use of insecticide-treated bed nets and indoor residual spraying (FMOH, 2004). These tools have enormous potentials to reduce morbidity and mortality due to mosquito-transmitted diseases when applied properly (Hawley, 2003), however, these control tools have their imperfections, such as insecticide resistance (Zaim and Guillet, 2002) and difficulties in attaining adequate population coverage (Eisele, 2006), and hence may not be sufficient to achieve the World Health Organization's (WHO) targets regarding mosquito-transmitted diseases. Additional vector control interventions, particularly, those that will complement existing adulticiding measures, such as larval control measures are therefore required to build integrated mosquito-vector control programs where these diseases are prevalent (Sogoba, 2007). However, successful larval control requires a good knowledge of the breeding ecology of mosquitoes including, types of and preferences for larval habitats, spatial and temporal distribution of breeding sites, as well as, the physical, biological and chemical characteristics of the habitats.

Therefore, effective mosquito vector control, in areas of high disease burdens, must be predicated on a good understanding of the occurrence of specific important vector specie composition, their abundance, and hence, potential for disease transmission in the area. This information is scanty for many parts of Northern Nigeria particularly, in Bauchi state, Azare inclusive. It is pertinent therefore, the need of continuous updating of information on the mosquitoes species composition, and abundance in Azare town to complement efforts towards effective and integrated vector control studies.

II. Materials And Methods

The distribution and abundance of mosquitoes in Azare, were studied between March to October, 2016. Immature stages of mosquitoes were sampled from the five clusters randomly distributed across the city. The habitats sampled include containers, stagnant pools, domestic run-offs, footprints, vehicle tyres, reservoirs and gutters.

Study Area:

Azare is an administrative capital of Katagum Local Government Area of Bauchi State, Nigeria. It is located at 11°40′27″N 10°11′28″E, at an elevation of 436 meters. The population has grown from 69,035 at the 1991 census to its 2007 estimated value of 110,452. In the last five years, the population has grown by more than 20%. It is also the largest growing town in the state and region.

The town is located on the northern bank of the Jama'are River, which is a tributary of the Hadejia. Chief agricultures include peanuts (groundnuts), sorghum, millet, rice (especially in the riverine fadamas, or "floodplains"), cowpeas, cotton, indigo, and gum arabic. Livestock include horses, cattle, goats and sheep.

Sampling Techniques:

Samples of all mosquito immature stages (all larval instars and pupae) were collected monthly from available breeding sites, such as: containers, stagnant pools, domestic run-offs, footprints, vehicle tyres, and reservoirs and gutters. Samples were collected using a plastic dipper. For standardization, 10 dips of the water were made at each sampling habitat (Yayock, *et al.*, 2014). The mosquito immature stages (larvae) collected were preserved in 70% ethanol, covered in a labeled specimen tubes (Service, 1993) and placed in a cool box. All samples were carefully transported to the Laboratory in the Department of Biology, School of Science, Aminu Saleh College of Education, Azare, for identification of larval specimens. The identification was done microscopically with the guide of keys by Hopkins (1952) and Gillies & Coetzee (1987). The mosquito species identified were recorded according to the clusters from where they were sampled. The pupal collections were kept till emergence and identified as adults microscopically, with the aid of keys adapted from Hopkins (1952) and Gillies & Coetzee (1987) and Koekemoer et al. (2002).

Data Analysis

The abundance of species with respect to the clusters was computed as the number of species per cluster out of the total number of mosquitoes collected and expressed as a percentage. The difference between of species composition among the clusters was determined using Analysis of Variance (ANOVA).

III. Results

A total of 4,871 mosquito immature stages comprising 6 species were sampled from 5 randomly selected clusters of Azare town. The predominant species, constituting about 91.38% of the total collection of mosquito species, were *Culex quinquefasciatus* (57.89%), *Cx. molestus* (25.87%) and *Cx. pipiens* (7.62%). While *Aedes aegypti*, *Aedes vittatus* and *Anopheles gambiae s.l.* species constituted 5.11%, 2.69% and 0.82% of the total catch respectively (Table 1). The distribution of mosquito species in the study area indicated that 6 species occurred in 4 clusters; GRA, Fatara, Kakudi, and Matsango, while 5 species occurred in

Kafin Kuka (Table 2). There was no significant difference ($p>0.05$) in the occurrence of mosquito species composition among the clusters in the study area.

Table 1: Distribution of mosquito species sampled in Azare town, Katagum Local Government, Bauchi state

S/N	Mosquito species	Number caught	% abundance
1.	*Culex quinquefasciatus*	2,820	57.89
2.	*Culex molestus*	1,260	25.87
3.	*Culex pipiens*	371	7.62
4.	*Aedes aegypti*	249	5.11
5.	*Aedes vittatus*	131	2.69
6.	*Anopheles gambiae s.l.*	40	0.82
	Total	4,871	100%

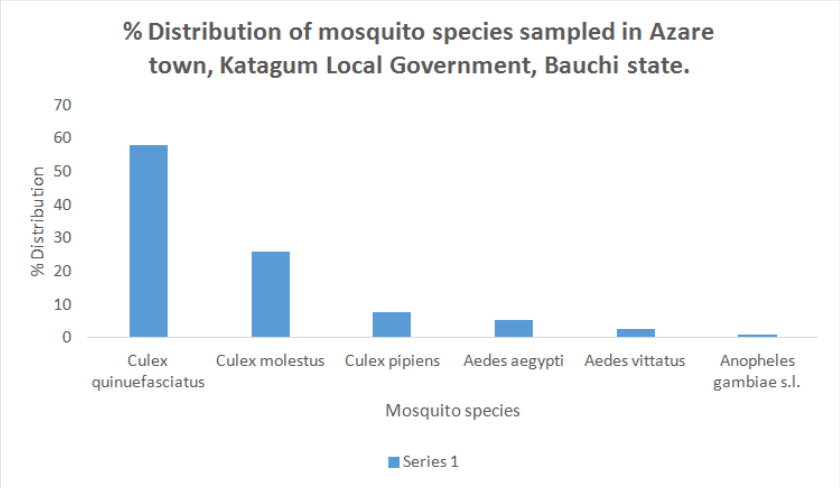
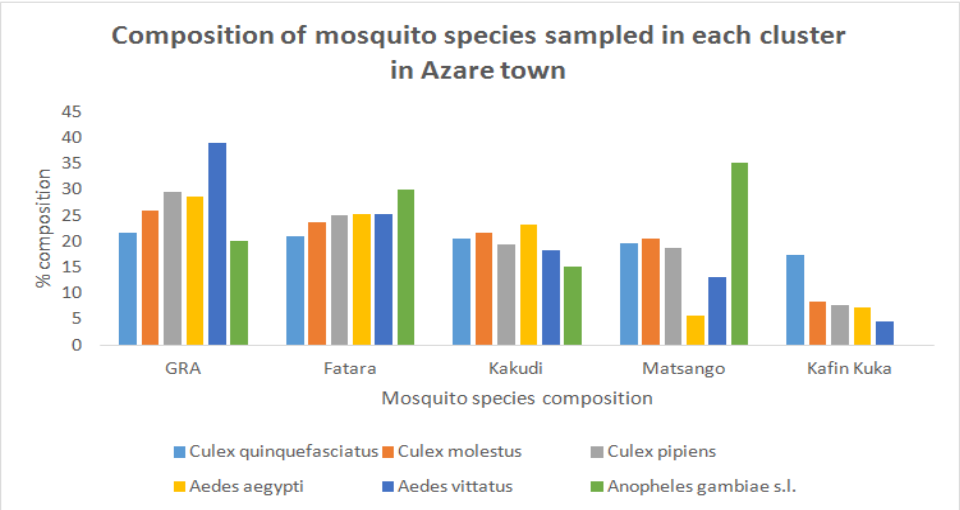


Table 2: Composition of mosquito species sampled in Azare town, Katagum Local Government, Bauchi state.

Clusters	*Culex quinque -fasciatus*	*Culex molestus*	*Culex pipiens*	*Aedes aegypti*	*Aedes vittatus*	*Anopheles gambiae s.l.*	Total number collected	$\bar{X}$	Total number of species encountered
GRA	609 (21.60%)	327 (25.96%)	109 (29.38%)	71 (28.51%)	51 (38.9%)	08 (20.00%)	1,175	235.00	06
Fatara	592 (20.99%)	298 (23.65%)	93 (25.07%)	63 (25.30%)	33 (25.19%)	12 (30.00%)	1,091	218.20	06
Kakudi	579 (20.53%)	271 (21.51%)	72 (19.41%)	58 (23.29%)	24 (18.32%)	06 (15.00%)	1,010	202.00	06
Matsango	553 (19.61%)	259 (20.56%)	69 (18.60%)	39 (5.66%)	17 (12.98%)	14 (35.00%)	951	190.20	06
Kafin Kuka	487 (17.27%)	105 (8.33%)	28 (7.55%)	18 (7.23%)	06 (4.58%)	00 (0.00%)	644	128.80	05
Total	2,820	1,260	371	249	131	40	4,871		05
$\bar{X}$	564.00	252.00	74.20	49.80	26.20	8.00			



IV. Discussion

This study was carried out to determine the mosquito abundance and distribution in Azare, Katagum Local Government Area of Bauchi State Nigeria. The data revealed that mosquito abundance in the study area is dominated by *Culex* sp where it accounted for about 91.38% of the total mosquito collection. All the species encountered in this study are potential vectors of one mosquito-borne disease or the other. The mosquito species reported in this study have also been reported by different researchers elsewhere in Nigeria like those of Olorunniyi, 2016; Okonkwo, 2014; Yayock *et al.*, 2014, Joseph *et al.*, 2013, Olayemi *et al.*, 2010, Ajayi *et al.*, 2010; Anyanwu and Iwuala,1999; Umaru et al 2006 and Abdullahi et al, 2010. The availability of *Aedes*, *Culex* and *Anopheles*, which are known vectors of urban yellow fever, lymphatic filariasis, malaria and arboviruses in general. This study suggest that the residents of Azare are at risk of mosquito-borne diseases.

The results obtained of this study showed composition in mosquito species present at the study area. The predominance of *Culex* species over *Anopheles* and *Aedes* mosquitoes at the area may be associated to the variation in larval habitat requirements of the species. *Culex* species usually breed profusely in polluted gutters, blocked drains and other water retention habitats with organic matter unlike *Aedes* and *Anopheles* mosquitoes which prefer clean ground pools and man-made containers respectively. The study area has many polluted gutters and run offs which could have provided conducive environment for the breeding of *Culex* species.

V. Conclusion And Recommendation

This study suggests that a variety of mosquitoes, most of public health importance thrive in the Azare, Katagum Local Government Area of Bauchi State. Conspicuous species in the samples include *Cx. quinquefasciatus*, *Cx. molestus* and *Cx pepiens*; while the least dominant were *Ae. aegypti*, *Ae. vittatus*, and *An. gambiae*. The composition of species were not significantly different among the total numbers caught in all the clusters. Lack of good drainage and sewage system could be contributing to the abundance of mosquitoes in the study area. Therefore, intensive vector control programmes and public enlightenment especially on human activities that encourage mosquito breeding are recommended.

VI. Limitation

This study relies only on larval sampling once in a month for the period of Eight months running from March to August. The design focused on the distribution and species composition in the human habitations, it had many limitations; first, only immature stages of mosquitoes were collected, while indoor resting mosquitoes were not examined. Secondly, key environmental factors that could determine the occurrence and relative abundance of these mosquitoes were not determined, therefore, in order to explicate the associations between these mosquitos' species, further research should examine more of such factors, including physico-chemical analysis of water contents and the ecology of the mosquito species.

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