Mosquito species compositions in Oba, Idemili South Local Government Area of Anambra state

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Abstract: Studies were carried out between November 2010 and June 2011 to determine the composition mosquito species in Oba, Idemili South Local Government Area of Anambra State. Two villages of Umumpamma-Aborji and Isu-Umuabu were surveyed using standard entomological procedures. A total of two thousand three hundred and nineteen (2319) mosquito larvae were collected and subsequently reared to adults. Nine hundred and sixty one (961) emerged as adults comprising four genera; *Aedes, Anopheles, Culex,* and *Toxorynchites*. They were identified up to eight species level including *Anopheles gambiae* (14.78%), *An. funestus* (0.94%), *Aedes aegypti* (27.99%), *Ae. albopictus* (18.11%), *Ae. africanus* (2.60%), *Culex quinquefasciatus* (32.99), *C. tigripes* (1.98%) and *Toxorynchites viridibasis* (0.62%). Umumpamma-Aborji and Isu-Umuabu contributed 55.02% and 44.98%, respectively to the total number of mosquito samples in Oba. It is interesting to note that *An. funestus* and *T. viridibasis* were present only in Umumpamma-Aborji but none in Isu-Umuabu. The continued presence of *Anopheles* sp. and *Culex* sp. would ensure endemicity of malaria and filariasis in Oba, while presence of *Aedes* sp. points towards the potential risks of yellow fever and arbo-virus diseases in the area.
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1. Introduction

More than three thousand, five hundred mosquito species are distributed all over the world in a great variety of environment and most are found in the tropical and sub tropical regions of the world with Nigeria inclusive (W.H.O., 1989).

In a study at Awka Metropolis, Anambra state, South-Eastern Nigeria, Mbanugo and Okpalaononuju (2003) collected; *Ae. albopictus*, *Ae. aegypti*, *An. gambiae*, *An. funestus*. Similarly Onyido et al (2009) reported five species of Culicine mosquitoes (*Ae. aegypti, Ae. africanus, Ae. albopictus Ae. luteocephalus* and *Mansonia africana*) in Enugu Municipality, South-Eastern Nigeria. While Anosike et al (2007) recorded sixteen mosquito species (*Ae. aegypti, Ae. africanus, Ae. simpsoni, Ae. albopictus, Ae. stokesi, Ae. taylori Ae. apicoargenteus, C. quinquefasciatus, C. nebulosus, C. trigipes, C. decens An. gambiae, An. funestus, An.coustani* and *T. viridibasis*) in Imo state, Southeastern Nigeria.

In a survey of mosquitoes in Midwestern Nigeria, Okogun et al (2005) reported seventeen mosquito species. These include; eight *Aedes* species; (*Ae. albopictus, Ae. luteocephalus, Ae. simpsoni Ae. africanus, Ae. palpalis, Ae. aegypti, Ae. unlingeatus and Ae. vittatus*), six *Culex* species; (C. *fatigans, C. pipiens, C. albovitrolus, C. perfuscus C. decens and C. quinquefasciatus). Anopheles* species collected include (*An. gambiae, An. pseudopunctipennis, An. funestus*). In Abeokuta, Ogun state, Nigeria, ten species of mosquitoes was encountered namely *M. africana, M.uniformis, C. quinquefasciatus, Ae. aegypti, Ae. albopictus, Ae. vittatus, C. tigripes, An. gambiae s.l., An. funestus and E. clnysogaster* (Adeleke et al, 2008).

Onyido et al (2008) collected nine mosquito species namely; *Ae. aegypti, Ae. africanus, Ae. vittatus, Ae. luteocephalus, C. quinquefasciatus, Coquilletidia metallica, Eretmapodites quinquevittatus, E. inormatus* and *E. chrysogaster* in Jos North-central, Nigeria. While Oguoma and Ikpeze (2008) encountered eighteen mosquito species in North central Nigeria and they included: *An gambiae* complex, *An. funestus* complex, *An. pharoensis*, *An. coustani*, *An. rhodesiensis*, *C. quinquefasciatus*, *C. pipiens fatigans*, *C. pipiens pipiens*, *C. tigripes*, *Ae. aegypti*, *Ae. albopictus*, *Ae. africanus*, *Ae. taylori*, *Ae. luteocephalus*, *Ae.vittatus*, *Ae. simpsoni*, *Mansonia* and *Psorophora species*. In Yola, Northern Nigeria, Umaru et al (2006) collected *An. gambiae* complex, *An. funestus* complex, *An. pharoensis*, *An. rhodesiensis*. *C. quinquefasciatus C. pipiens fatigans, C. tigripes*. While Bunza et al (2010) recorded four mosquito species; *An. gambiae*, *C. pipiens*, *An. arabiensis* and *An. funestus* in Kastina metropolis, Katsina state, Nigeria.

2. Materials and method

2.1. Study area

Oba in Idemili South Local Government Area of Anambra state is a sub-urban inland town, located in the forest zone of South eastern Nigeria. The geographical coordinates are 6°06' N/6°2'5"N latitude and 6°47' E/6°51'E longitude. Oba has various small rivers and streams, especially along the eastern axis which is mostly covered by swamps all year round. Two villages; Umumpamma-Aborji and Isu-Umuabo were selected for the study. The village of Umumpamma-Aborji lies along the southeastern part of the town, near the Ose River (a tributary of River Niger). This is a predominantly swampy area. The other village of Isu-Umuabo is a tableland located about 4km from any water body as river or stream and is located in the centre of Oba town. The vector samplings were concentrated in sites located within 1km of human dwellings.

2.2. Larval sampling

The sampling methods were according to those of Hopkin (1952), Nwoke et al (1993), Service (1993) and Okogun et al (2005). For extensive water bodies, standard (350ml) dippers with long handles were used. The number of dips taken per habitat was determined by the size. This ranged from 10 to 30 dips taken at the rate of 10 dips per 10m length of the water body. The dips were made in places likely to harbour mosquito larvae such as around tufts of submerged vegetation or substrate, edges of water bodies and around floating debris. The water from the dips was collected in a white bowl and carefully observed for the presence of mosquito larvae. Mosquito larvae collected were concentrated in a sieve and carefully picked with dropping pipette into labeled specimen bottles, according to genera, this was to prevent placing predacious larvae with non predacious species. The contents of smaller containers of the same type/group in a compound or area were carefully pooled together into a white bowl. Natural tree hole collections were carried out by means of a bore glass pipette (0.5-1cm) attached to a squeeze bulb rubber.

Larvae and a sample of water from each habitat were placed in plastic bags and transported to the laboratory for further examination. Live larvae collected in plastic bottles were transferred into bowls covered with a fine nylon mesh containing a diet of baker's yeast and mashed Yale® cabin biscuit and subsequently transferred into insectaria where they were reared into adults.

2.3. Identification of mosquitoes

Identification of the mosquito larvae was carried out microscopically with the aid of published keys by Hopkin (1952). Similarly the taxonomic keys of (Gillies and Coetzee, 1987; Gillies and De Meillon, 1968) were used to identify the Anopheline and Culicine mosquitoes to species level. The identification was based on gross external morphological features, appearance of the antennae, palps, proboscis, thorax, terminal abdominal segments, wings, colour of hind legs and striations on the body.

2.4. Statistical analysis

One Way Analysis of Variance was used in the data analysis and means were separated using the critical difference (LSD) values.

Shannon-Weiner Index was used to analyze the species diversity in the study area. It takes account of the total number of species encountered in the sample, expressed as richness, and how the species abundances are distributed among the species, expressed as evenness. It is expressed as $\mathbf{H = (N \log N - \sum n_i \log ni)/N,}$ where n_i is the abundance and N the total number of individuals in the species. Also Simpson's dominance indices was used to evaluate the prevalence of each individual species and it measures the probability of picking two organisms at random that are of different species. It is expressed as $C = \mathbf{\Sigma(ni/N)^2}$ ni = number of individuals of nth species, N = toal number of individuals for all species.(Ogbeibu, 2005).

3. Result

Four genera; *Aedes, Anopheles, Culex* and *Toxorynchites* were present in the sample collection (Fig 1). Generally *Aedes* mosquitoes were the most abundant in both villages and constituted 468(48.69%) of the total collections followed by *Culex* 336(34.96%) and *Anopheles* 151(15.71%) respectively. *Toxorynchites* 6(0.62%) were the least abundant and only present in Umumpamma-Aborji village.

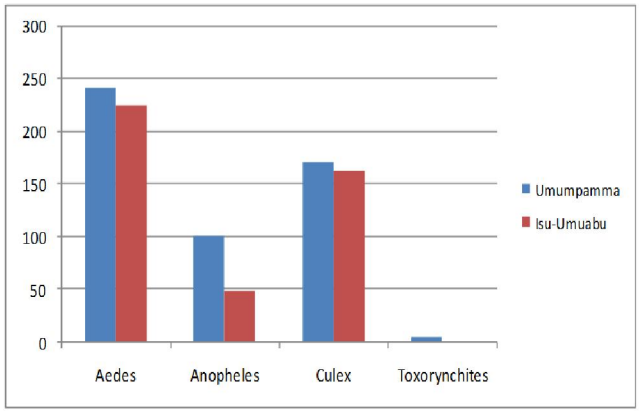

Fig 1: Different mosquito genera collected in the study area

The genera of mosquitoes earlier represented in Fig 1 above were further separated into species groups as shown in Table 1. *An. gambiae*, *Ae. aegypti, Ae. albopictus, Ae. africanus, C. quinquefasciatus* and *C. tigripes* were found in the two villages while *T. viridibasis* and *An. funestus* were found only in Umumpamma-Aborji. Further analysis shows that C*ulex. quinquefasciatus* was the most abundant species with a mean of 158.5 followed by *Ae. aegypti* with a mean of 134.5. *T. viridibasis* was the least abundant but it was not significantly different (P>0.05) from *C. tigripes*, *Ae. africanus* and *An. funestus*. There were no significant difference (P>0.05) in the number of *An. gambiae* and *Ae. albopictus*.

Table 1: Mosquito Species Caught in two Villages of Oba Town

Mosquito Species	Umumpamma-Aborji Village	Isu-Umuabo Village	Total
An. gambiae	93	49	142 (14.78%)
An. funestus	9	0	9 (0.94%)
Ae. Aegypti	142	127	269 (27.99%)
Ae. Albopictus	81	93	174 (18.11%)
Ae. africanus	19	6	25 (2.60%)
C. quinquefasciatus	164	153	317 (32.99%)
C. tigripes	8	11	19 (1.98%)
T. viridibasis	6	0	6 (0.62%)
Total	**522**	**439**	**961**

The total Shannon-Wiener index of diversity was 0.756 while Simpson's index of species abundance was 0.250. *C. quinquefasciatus* was the most predominant and most frequently encountered species (Simpson's index of 0.109; Shannon-Weiner index of 0.159). Next were *Ae. aegypti* (indices of 0.078 and 0.155 respectively), followed by *Ae. albopictus* (indices of 0.033 and 0.134). *An. gambiae* complex had index values of 0.022 and 0.123 respectively for Simpson's and Shannon-Weiner indexes. The least encountered species was *T. viridibasis* with index values of 0.00004 and 0.013 respectively as shown in Table 2.

Further analysis of these data indicates that larger numbers of mosquito species were found in Umumpamma-Aborji (Shannon-Weiner index of 0.703) than Isu-Umuabu (index of 0.631, Table 3). Furthermore the results indicate that some species were more often encountered at Isu-Umuabu (Total Simpson's index of 0.265) than at Umumpamma-Aborji village(Total Simpson's index of 0.250). The quantitative composition of the total abundance and the proportion of each species of mosquito found in the two villages during the period of study are summarized in Table 3. It could be clearly seen that *C. quinquefasciatus* was the most frequently encountered species in both villages, with index values of 0.158 and 0.160, respectively, for Umupamma-Aborji and Isu-Umuabu. The next more frequently encountered was *Ae. aegypti* with index values of 0.154 and 0.156 for Umumpamma and Isu villages respectively. *Ae albopictus* had index values of 0.125 for Umumpamma and 0.143 for Isu-Umuabu. *An. gambiae* complex was more abundant in Umumpamma-Aborji (index value of 0.1334) than in Isu-Umuabu (Index value of 0.106). It should be noted that *An. funestus* and *T. viridibasis* were conspicuously absent in Isu-Umuabu village (index values of zero) although the latter species was the least encountered (index value of 0.0223) in the other village where it occurred.

Table 2: Computations of species diversity and dominance indices for mosquitoes collected from various aquatic habitats in Oba

Mosquito species	Ni	Pi = ni/N	$P^2 = (ni/N)^2$	Pi Log Pi	Shannon-Wiener diversity index	Simpson's dominance index $C=\sum(n_i/N)^2$
An. gambiae	142	0.148	0.022	- 0.123	0.123	0.022
An. funestus	9	0.009	0.0009	- 0.097	0.097	0.0009
Ae. Aegypti	269	0.280	0.078	- 0.155	0.155	0.078
Ae. albopictus	174	0.181	0.033	- 0.134	0.134	0.033
Ae. africanus	25	0.026	0.007	- 0.041	0.041	0.007
C. quinquefasciatus	317	0.330	0.109	- 0.159	0.159	0.109
C. tigripes	19	0.020	0.0004	- 0.034	0.034	0.0004
T. viridibasis	6	0.006	0.00004	- 0.013	0.013	0.00004
Total	**N = 961**	**∑ 1.000**	**∑ 0.250**	**∑ - 0.756**	**H = 0.756**	**C = 0.250**

Key: n_i = abundance of individual species in the ith
P_i = proportion of individuals in the ith species ie n_i/N
N= total number of individuals of all species
C = Simpson's index of dominance
H = Shannon-Wiener index of diversity H = (N log N - $\sum n_i$ logni)/N

Table 3: Summary of Index of Diversity for mosquito species composition in the two villages of Oba

Mosquito species	Shannon-Weiner Index of Diversity	
	Umumpamma-Aborji village	Isu-Umuabu village
An. gambiae	0.1334	0.106
An. funestus	0.0301	0.000
Ae. Aegypti	0.154	0.156
Ae. albopictus	0.125	0.143
Ae. africanus	0.052	0.026
C. quinquefasciatus	0.158	0.160
C. tigripes	0.0228	0.040
T. viridibasis	0.0223	0.000
Total	**0.703**	**0.631**

Table 4: Summary of Index 0f Dominance for mosquito species composition in the two villages of Oba

Mosquito species	Simpson's Index of Species Dominance	
	Umumpamma-Aborji	Isu-Umuabu village
An. gambiae	0.032	0.013
An. funestus	0.0003	0.000
Ae. Aegypti	0.074	0.084
Ae. Albopictus	0.024	0.045
Ae. Africanus	0.0013	0.0002
C. quinquefasciatus	0.099	0.122
C. tigripes	0.00023	0.0006
T. viridibasis	0.00013	0.000
Total	**0.250**	**0.265**

Table 4 shows the summary of indices of dominance for mosquito species in the two villages. The results indicate that *C. quinquefasciatus* was the most predominant species in either village. The indices of dominance were 0.122 and 0.099 for Isu-Umuabu and Umumpamma-Aborji, respectively, indicating also that the species was more prevalent in Isu-Umuabu than Umumpamma-Aborji. Similarly, *Ae. aegypti* was more prevalent in Isu-Umuabu village (index value of 0.084) than in Umumpamma (index value of 0.074). This same trend could be noticed in the case of *Ae. albopictus* which had high index value of dominance (0.045) for Isu-Umuabu than in Umumpamma (index value of 0.024). In the case of *An. gambiae* complex, this species was more prevalent in Umumpamma-Aborji than in Isu-Umuabu village. The index value was 0.032 and 0.013 respectively. As earlier noted there was conspicuous absence of *An. funestus* and *T. viridibasis* in Isu-Umuabu. However, in Umupamma-Aborji village where both species were encountered their presences were very low, with index values of 0.0003 and 0.00013 for *An. funestus* and *T.viridibasis* respectively.

4. Discussion

All species of mosquitoes reported in this study have also been reported by different researchers elsewhere in Nigeria like those of Mbanugo and Okpalaononuju, 2003; Okogun et al, 2005; Umaru et al 2006 and Oguoma and Ikpeze, 2008; Adeleke, 2008; Onyido et al, 2009; Abdullahi et al, 2010. *Aedes* and *Culex* mosquito species where the most abundant mosquitoes in the study area and this is in agreement with observations made in Awka metropolis (Mbanugo and Okpalaononuju, 2003) and in Midwestern Nigeria (Okogun et al, 2005). However it contrasted with finding from Katstina state Nigeria (Bunza et al, 2010) and Northcentral Nigeria (Oguoma and Ikpeze, 2008) where *Anopheles* species were the most abundant mosquito species.

Most of the species encountered in this study are potential vectors of one mosquito-borne disease or the other of which their high prevalence has been reported in neighbouring towns of Oba; Onitsha (Ozumba *et al*, 2001) Ihiala (Aribodor et al, 2003), Awka (Mbanugo and Okpalaononuju, 2003) and Nnewi (Umeanato and Ekejindu, 2006). The recovery of both *An. gambiae* and *An. funestus* in this study is of epidemiological importance. These are proven and established vectors of malaria and lymphatic filariasis in Nigeria (Okogun et al, 2005).

All the three species of *Aedes* namely; *Ae. aegypti, Ae. albopictus* and *Ae. africanus* encountered in this study are proven vectors of yellow fever and other arbovirus diseases in general. They have been involved in previous yellow fever epidemics in Nigeria, for instance in 1991, *Ae. albopictus* was incriminated in an outbreak of yellow fever in Delta state, which is a neighbouring state (Ozumba and Nwosu 2003). *Culex* species disease vectors identified during the study included *C. quinquefasciatus*. These are known vectors of bancroftian filariasis (Amusan et al, 2003). *Culex* mosquitoes are not only important transmitters of filariasis but also vectors of several of the mosquito-borne encephalitis (Gordon and Larvoiperre, 1976). *Culex tigripes* are known predators of *Anopheles* larvae and *Toxorynchites* larvae species are known to prey on other mosquito species larvae (Anosike et al, 2007). This is a welcome development since these species can serve as effective biological control agents for source reduction of other mosquito species, especially *Toxorynchites,* which does not bite humans.

The availability of *Aedes, Culex and Anopheles*, which are known vectors of urban yellow fever, lymphatic filariasis and malaria suggest that the residents of Oba are at risk of mosquito-borne diseases.

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