

Larval abundance, distribution and species composition of mosquitoes in Obio-Akpor Lga, Rivers state, Nigeria

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Abstract

This survey was carried out to determine the larval distribution, abundance and their habitat in Obio-Akpor local government of Rivers State. Larval sampling was carried out weekly in the four communities selected in Obio-Akpor local government for three months both in natural and man-made habitats. For standardization, ten dips were collected during sampling in natural habitats using the dipper while hand pipettes and ladders were used for sampling in man-made containers. The larvae collected were raised to the fourth and pupated with each mosquito cage containing a single collection from a particular type of breeding sites. A total of 1180 larvae were collected in the study. The abundance and distribution of mosquito larvae across the study period showed October had the highest number of larvae ($n=690$) followed by September ($n=305$) while November had the least ($n=185$) and was statistically significant difference in mean amount of larvae in the months ($P>0.01$). Across location, Choba (134.3 ± 33.0) had the highest mean abundance of larvae followed by Rumuokoro (91.3 ± 39.01), Alakahia (90 ± 32.10), and Ozuoba (77.7 ± 22.8) had the least and it was not statistically significant difference ($P>0.773$). Mosquito species identified included four species of *Anopheles*: *An. gambiae* s.l., *An. funestus*, *An. coustani* and *An. nili*; three species of *Culex*: *Cx. quinquefasciatus*, *Cx. poicilipes* and *Cx. tigripes* and three species of *Aedes*: *Aedes aegypti*, *Ae. albopictus* and *Ae. africanus*. *An. gambiae* s.l. was the most abundant (17%) and dispersed in all the sampling sites followed by *Cx. quinquefasciatus* (15%). The finding that mosquito species breeds in natural and man-made containers give concern and calls for urgent larval control. Proper health education and awareness on environmental management is necessary to discourage people from creating breeding sites.

Keywords: Obi-Akpor, *Anopheles gambiae*, man-made containers

Introduction

Mosquito are well known group of insect vector that transmit a dreadful disease that causes serious health problem in human beings. These diseases they transmit have accounted for huge economic loss, mortalities, low productivity and social discrimination in many developing countries (Adeleke *et al.*, 2010) [2]. They belong to the Culicidae family within the order Diptera, and consist of about 3,500 species distributed worldwide. Within this numerous species only a few within the *Anopheles*, *Aedes*, and *Culex* genera have been well described owing to their medical significance (Minard *et al.*, 2013a) [15]. The medical and socio-economic impact of the diseases caused by mosquitoes has caused many control measures to emerge.

Malaria is one of the major public health problems in Nigeria, contributing more than a quarter of the malaria burden in Africa (WHO, 2015) [33]. *Anopheles* mosquitoes are the most important in Africa while in Nigeria is *Anopheles gambiae* s.l. This is one of the known vectors of malaria in the sub-Saharan because of its predominant role in the transmission of the most dangerous *Plasmodium falciparum* (Coetzee and Goos, 2013) [6]. The number of new cases has declined by 25% globally and deaths from malaria have fallen by 42% (WHO, 2015) [33] because of emphasis on vector control tools (Indoor residual spraying and long lasting insecticidal net).

The often spectacular black-and-white-patterned mosquitoes

in the genus *Aedes* are vectors of the yellow fever virus, dengue and zika virus. The last outbreak of yellow fever in the country occurred in the year 2000 and it took 10 years to control the transmission of the virus in the population (WHO, 2014) [32]. Today the most important disease *Aedes* species transmit is dengue fever, which is becoming an increasing problem in the tropics and semi-tropics (Gibbons and Vaughn 2002; Simmons *et al.*, 2012) [9, 27]. Dengue is endemic in Nigeria, with sero-prevalence of about 73% in some areas (Ayukekbong, 2014) [15]. In Nigeria most cases of dengue are undiagnosed, misdiagnosed as malaria or referred to as fever of unknown cause (Ayukekbong, 2014) [15].

The *Culex* species are vector of the nematodes (*Wuchereria* and *Brugia*) that causes filarial elephantiasis (Hotez *et al.*, 2007) [13]. Lymphatic filariasis is caused by parasitic worms that are transmitted by mosquitoes. In Africa, the major vectors of *W. bancrofti* are mosquitoes of the genera *Anopheles* and *Culex* (WHO, 2010). The burden of Lymphatic filariasis is heaviest in Nigeria, Democratic Republic of Congo, India, Indonesia, and Bangladesh (WHO, 2011) [11].

As Nigeria is undergoing rapid urbanization of settlements, areas that were formerly referred to as rural are rapidly attaining urbanization. This has resulted in some areas being densely populated. In the bid to attain urbanization, constructions of the surface run-off (gutters/culverts), the provision of open or partially covered soakage pits for houses,

abundance of larvae followed by Rumuokoro (91.3±39.01), Alakahia (90±32.10), and Ozuoba (77.7±22.8) had the least.

There was no significant difference (P=0.773) between the mean abundance of the location.

Table 1: Distribution and Abundance of mosquito larvae across the months and locations

Month	Mosquito larvae collected				Total	Mean ± SE
	Alakhia	Choba	Ozuoba	Rumokoro		
Sept ^a	80	95	60	70	305	76±7.7
Oct ^b	150	250	123	167	690	172±27
Nov ^a	40	58	50	37	185	46±4.8
TOTAL	270	403	233	274	1180	

Monthly collections showed October with the highest collection (51.3±5.6) followed by September (18.5±4.3) while November (12.75±1.3) had the lowest mean abundance. The study showed statistically significant difference (F=25.105, P=0.00) in abundance between the months and not between locations.

The distribution and abundance of mosquito pupae by location showed that Choba (31.3±15.4) had the highest mean abundance of pupae, followed by Alakahia with (30.0±11.5) and Rumuokoro (28.0±14.5) while Ozuoba (20.7±7.86) had the least.

Table 2: Distribution and Abundance of mosquito pupae across the months and locations

Month	Alakhia	Choba	Ozuoba	Rumokoro	Total	Mean ± SE
Sept ^a	30	19	10	15	74	18±4.3
Oct ^b	50	62	36	57	205	51±5.6
Nov ^a	10	13	16	12	51	12±1.3
Total	90	94	62	84	330	

Means with the same superscript are statistically significant at the 0.05 level

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Three groups of mosquitoes emerged to adult in this study. The species comprises of *An gambiae* sl, *Cx. quinquefasciatus*, *Ae aegypti*, *Cx tigripes*, *Cx poicilipes*, *An funestus*, *Ae. albopictus*, *An nili* and *An coustani* in their order

of abundance. Within the groups, three species of *Culex* mosquitoes occurred uniformly in all the sites, while 2 species of *Aedes* occurred in Alakahia and Ozuoba, and 3 species occurred in Choba and Rumuokoro respectively. The species abundance of *Anopheles* mosquito also showed similar pattern to *Aedes* in which 2 species of *Aedes* occurred in Alakahia and Ozuoba, and 3 species occurred in Choba and Rumuokoro respectively, although there was no significant difference in the mean distribution (P=0.933).

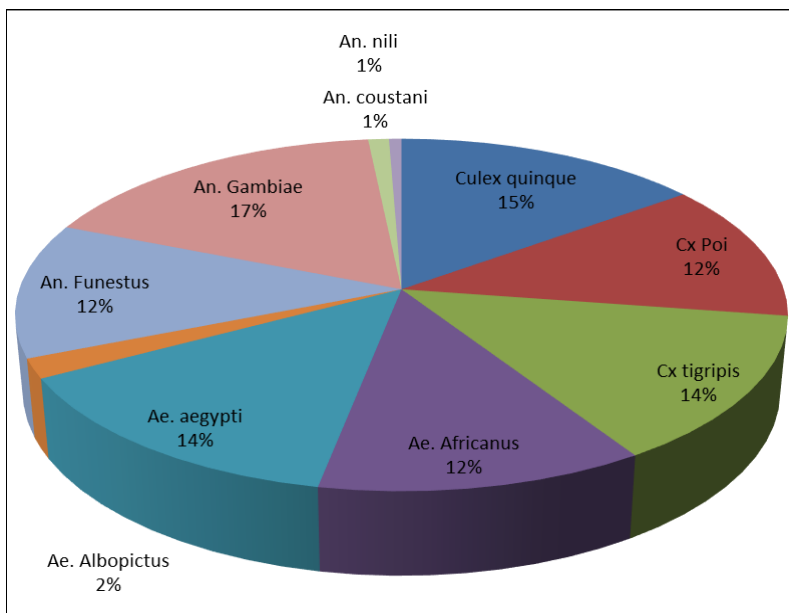


Fig 2: Species Composition in Obi Akpor Lga

The mosquito species collected in the studied areas showed

that *An. gambiae* (23) had the highest occurrence in Alakahia,

followed by *Ae. aegypti* (21) while *Ae. albopictus*, were not collected. In Choba, *Cx. quinquefasciatus* (33) occurred most

in Ozuoba while *Cx. poicilipes* (30) had the highest occurrence, while in Rumukoro, *Cx. tigripes* occurred most.

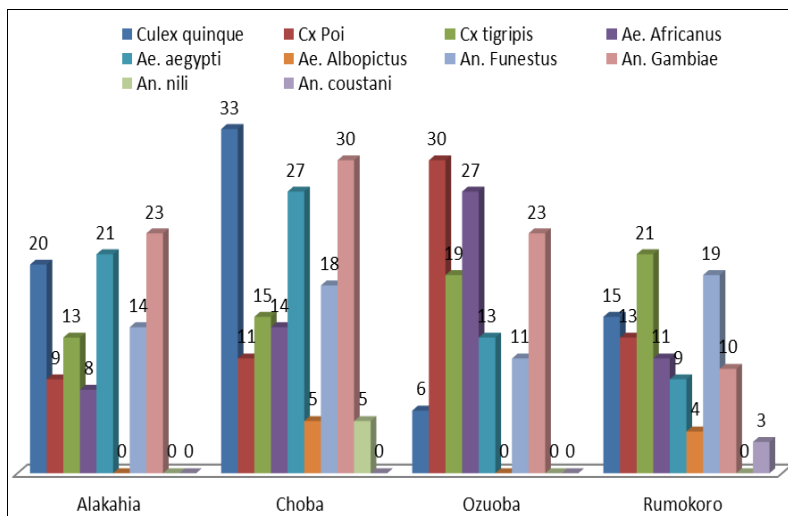


Fig 3: Distribution and occurrence of mosquito species in the studied sites

Discussion

The public health importance of the disease vectors collected in the study area is capable of causing disease outbreak like dengue, yellow fever and malaria. The species collected in this study had previously been reported in the study of Ogbalu *et al.* (2015) in Kalabiri, and in Port-Harcourt Metropolis by Ogbalu and Onwuteaka (2016) [4, 20] both in River State, Nigeria.

Mosquitoes were collected in the entire site sampled and this suggests that mosquito breeding occurs in these communities. This study provides evidence of the potential wide adaptability of different mosquito groups in microhabitats previously not considered favorable. The likely adaptation of the three mosquito groups to the wide range of habitats is a result of significant environmental and demographic changes. Mukhurl *et al.* (2002) [17] stated that the occurrence and abundance of mosquito larvae in different habitats reflect the egg laying preference of females as well as the ability of the immature mosquito to survive under the prevailing conditions. The high proportion of the mosquito during wet season could be associated with the increased breeding sites created by rainfall. This possibly account for more vector-borne disease during rainy season. Decrease in mosquito abundance during dry season (November) could be attributed to drying out of the mosquito breeding site.

The four Anopheline species collected in the study (*An. gambiae* s.l, *An. funestus*, *An. nili* and *An. coustani*) have been reported to be in close association with human (Russell *et al.*, 2011). The main vectors of malaria as reported by Service, (1970) and Ukpai and Ajoku, (2001) belong to the members of *Anopheles gambiae* s.l and *An. funestus* group and these were the major malaria vectors collected from the study. In the study, *An gambiae* s.l was the highest and the species has been incriminated as the most efficient malaria vector in Africa (Onyabe and Conn, 2001).

An nili is usually responsible for a high nuisance to humans in villages along rivers, and abundance rapidly decreases within

a few kilometers from the breeding sites (Le Goff *et al.*, 1997). The description of the geographic terrain above describes the study site as rivers surround the site. The species is considered a secondary malaria vector in Nigeria (Molineaux and Gramiccia, 1980) [16]. The relative abundance of *An. gambiae* s.l proves to be strongly influenced by climatological factors, especially precipitation (Lindsay *et al.*, 1998) and the study of Ezihe *et al.*, (2017a) [8] confirms the influence of rain on the abundance of the species.

Cx. quinquefasciatus has been described as the main vector of bancroftian filariasis (Service, 2008) [24]. The abundance and the widely distribution of this species in the study area supports the findings of Okiwelu *et al.* (2014) that the species exists in high numbers in the bordering communities. The high number of the species encountered in this study is an indication that there is increasing distribution of the species from urban areas to colonized pocket as seen in the studies of Okiwelu and Noutcha, (2012) [21]. The proliferation of *Cx. quinquefasciatus* in all the breeding sites shows that most of the breeding sites are polluted since the species had been known to breed in polluted water (Mullen and Durden, 2009) [18]. Other species of *Culex* (*Cx poicilipes* and *Cx tigripes*) were collected in high numbers.

Aedes aegypti is the most proficient vector for arboviruses because it is highly anthropophilic, frequently bites, and thrives in close proximity to humans (WHO, 2009) [29]. It is the vector of Yellow fever, dengue fever and dengue hemorrhagic fever in almost all countries (Were, 2012) [32]. The species of *Aedes* collected in the study (*Ae. aegypti*, *Ae africanus* and *Ae. albopictus*) have all been implicated in outbreaks of Zika virus and other arboviral diseases (Dick *et al.*, 1952; Gard *et al.*, 2007 and Hennessey *et al.*, 2016) [7, 10, 11]. The abundance of these *Aedes* genera could be as a result of discarded container such as sachet water and tyres which were observed to be a good habitat for mosquito breeding in the study area compared to other habitats. The present result is in agreement with that reported elsewhere in Nigeria (Mafiana

et al., 1998 and Adeleke *et al.*, 2013) [14, 3].

The finding that mosquito species breed in natural and man-made containers gives concern and calls for urgent larval control. From the study, more collections were made from man-made containers which suggest that human encourages the breeding of mosquitoes around the homes. Storage of water over a long period should be dissuaded as the ambient relative humidity and temperature provides oviposition opportunities for mosquitoes. Proper health education and awareness on environmental management is necessary to discourage people from creating breeding sites. Regular surveillance is also needed to monitor the upsurge of mosquito population in the area in order to reduce disease transmission.

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