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ANTHROPOPHILIC MOSQUITO SPECIES PREVALENCE IN NIBO COMMUNITY, AWKA SOUTH LOCAL GOVERNMENT AREA, ANAMBRA STATE, SOUTHEASTERN NIGERIA.

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ABSTRACT

The prevalent man-biting mosquitoes in Nibo community were studied between May and September 2014. Mosquito larvae were sampled from gutters, discarded tins, plastic containers and ground water pools using ladles, bowls and sieves. Indoor-biting and resting adult mosquitoes were collected using pyrethrum Knock down Collection Method (PKC). Outdoor biting and resting adult mosquitoes were collected using Human Bait Collection (HBC). A total of 1,150 mosquitoes made up of 1022(88.87%) larvae, 70(6.08%) indoor biting adult mosquitoes and 58(5.67%) outdoor biting adult mosquitoes were collected in the study. Five mosquito species including *Anopheles gambiae, Culex quinquefasciatus, Aedes aegypti, Ae. albopictus* and *Ae. Africanus were collected from the study. An. gambiae* was the predominating species among the indoor biting mosquitoes. *Aedes aegypti* was the most abundant species in both larval and outdoor biting adult mosquito collections. The five mosquito species collected were proven vectors of public health diseases and therefore an indication of the people's exposure to various mosquito bites and subsequent disease transmission. Health education to improve the environmental sanitation to reduce mosquito breeding habitat and improve the people's health was suggested.

Keywords: Anthropophilic, Man-biting, Mosquitoes, Nibo community, *Anopheles gambiae, Culex quinquefasciatus, Aedes aegypti, Ae. Albopictus, Ae. africanus*

INTRODUCTION

Mosquitoes are important vectors of human diseases and the most common blood sucking arthropods (Gerald and Larry, 2010). They cause serious biting annoyance, noise nuisance, sleeplessness, allergic reactions and disease transmission through their bites to their victims. Mosquitoes are capable of transmitting diseases such as malaria, yellow fever, dengue, encephalitis and hemorrhagic fever (Onyido *et al*, 2008; Monath, 1985; Gillet, 1972 and Curtis, 2005). Mosquitoes also transmit animal diseases like the fowl pox of poultry, Rift-valley fever of sheep, encephalitis of horses and birds, and heart worm diseases of dogs (Service, 1980; Soulsby, 1982). World Health Organization (2000) estimated that more than a million people die annually from malaria and other mosquito-borne diseases with 300 — 500 million people being affected. It is also estimated that 100 children under one year and 203 children under five years out of 1000

respectively, die annually of malaria in Nigeria. Mosquitoes and mosquitoes-borne diseases are now being imported to many countries that were previously free from the diseases. Post-yellow fever epidemic, entomological investigation conducted in September in Delta State of Nigeria in 1991 yielded eggs of *Aedes albopictus* mosquito that was then unknown in Nigeria (Savage *et al*, 1992 and Ezike *et al*, 2001). Mosquitoes have worldwide distribution and are found in both tropics and temperate regions of the world. *Anopheles, Culex, Mansonia and Aedes* are common in the tropics or warm climates and lay their eggs on the open surface of all sorts of both permanent and temporary water collections or attach them to some partially submerged objects depending on the species. Example of such permanent water collections are fresh water swamps, edges of rivers, marshes, rice fields, slow flowing streams and irrigation dishes while the temporary water collection includes small ponds, tree holes, plant leaf axils, crab holes, puddles and rock pools, Man-made water breeding sites include water collections in vehicle tyres, tin cans, man and animal foot prints, coconuts shells, plastic containers, bamboo stumps, scoops in concrete slabs used in feeding animals, water holding cisterns and tanks, and cassava fermentation pots (Onyido *et al*, 2006a,b; Service, 1980; Iwuala, 1979; Hopkins, 1952). Immature stages of mosquitoes develop only in water (Gerald and Larry. 2010). Nwoke and Nwoke (2006) also observed that littering the environment with discarded containers among urban dwellers provides good breeding sites for mosquitoes.

The general objective of this study was to investigate the man-biting mosquito species and their breeding sites within Nibo community so as to provide data that will be useful for effective control of these mosquitoes. The specific objectives were to determine the breeding sites of the mosquitoes through collection of their immature stages, identify outdoor man-biting mosquitoes through collection of adult mosquitoes with human bait method and to identify indoor biting and resting adult mosquitoes using pyrethrum knock down collection method (PKC).

MATERIALS AND METHODS

Materials

Baygon aerosol insecticide and white cloth sheets measuring 2.2 m x 2.2 m obtained from the local market. Test tube vials, Petri dish, ladles and specimen bottles obtained from the laboratory of the Department of Parasitology and Entomology, Nnamdi Azikiwe University.

Study Area

Nibo community is a suburban town in Awka South Local Government Area (LGA), Anambra State, Nigeria. It has geographical coordinates of approximately latitude 6°, 10" North and longitude 7°, 04" East of Greenwich Meridian. It has a land area of about 4km^2. Nibo lies at an altitude of 138 metres above sea level. It has two marked seasons, the dry and wet seasons. There are about 8 months (April — November) of wet season and four months (November — March) of dry season. It has typical rain forest vegetation made up of tall forest trees although most have been cleared for construction of residential homes and industries. The land is fertile and about 35% of the inhabitants are farmers, while 30% are civil servants and approximately 35% are traders. Major food crops grown by the people include plantain, yam, cassava and cocoyam. Their cash crops include; the bread fruit (ukwa), kolanut, coconut, palm wine, palm oil and palm kernel. There is a good road transportation system which enables people and goods get to their destinations within and outside the community. The town has one hospital and a health centre, primary and secondary school, electricity, and borehole for water supply although people still visit the local streams to carry out their domestic chores. Nibo community has a population of 26,663 inhabitants (NPC, 2006).

Ethical considerations

Advocacy visit to the traditional ruler and opinion leaders of Nibo community with a letter of introduction from the Head of Department of Parasitology and Entomology of Nnamdi Azikiwe University was used to obtain permission to carry out the study in the community. Inhabitants were mobilized through town meetings, notices in the church, schools and markets. The occupants of the compounds and houses used were properly informed of the nature of the study and their consent obtained. Volunteers for the collection of the outdoor man-biting mosquitoes were educated on the nature of the work and were all vaccinated with yellow fever vaccines for at least ten days to the onset of the studies. Their health needs were taken care of throughout the time of the studies.

Collection of outdoor biting mosquitoes

Outdoor biting adult mosquitoes around houses in Nibo community were collected using human bait collection methods (HBC), between 17.00 and 20.00 h local time

(5.00-8.00pm). Materials used were torchlight, test tube vials, cotton wool, wrist watches for time keeping, pens and papers for recording the time of collections, cellophane bags for collation of catches and low stools. All catches made were recorded at quarter hourly intervals. Three households from each village were selected for human bait collection of outdoor biting adult mosquitoes. Nine volunteers, three per household, were involved in the collections. All the human volunteers had the sleeves of their shirts and pairs of trousers rolled to their elbows and knees respectively to expose the hands and legs to mosquito bites. Each volunteer sat on a low stool, and put off the foot wears. The volunteers sat at about a pole distance from each other and carefully and consistently searched for alighting mosquitoes all over their bodies, especially their extremities. Mosquitoes alighting on their bodies to suck blood were just allowed to settle before being collected with a test-tube vial and sealed with a ball of cotton wool. The time of each collection was recorded and grouped into quarter-hourly collections.

Collection of indoor biting and resting mosquitoes

Indoor biting and resting mosquitoes were collected using pyrethrum based insecticide knockdown collection method (PKC). It was carried out early in the morning between 6:00 — l0.00am. White cloth sheets measuring 2.2m x 2.2m were used to cover the floor of each room. The cloths were laid from wall to wall and overlapping at the middle to avoid escape of falling mosquitoes. The windows and doors were properly closed. The whole rooms were sprayed with Baygon aerosol obtained from the market. The rooms were left for 15 to 20 mins to allow the insecticide sufficient time to knock down the mosquitoes. The white sheets were then folded starting from the edges and with gentle jerking to ensure that all fallen mosquitoes concentrated at the centre. The white sheets were taken to the open space outside each house where it was opened and all the knocked down mosquitoes were collected into a damp Petri dish prepared with cotton wool soaked in water and covered with filter paper.

Collection of immature stages of mosquitoes

Mosquito larvae and pupae were collected from different mosquito breeding sites such as ground water pools, coconut shells, discarded tins, plastic containers, water tanks, clay pots, and polluted water in gutters around homes. The collections were done between 10.00 am to 12.00 noon. Materials used were plastic bowls and buckets, ladles (dippers), sieves, and specimen bottles. Ladles were used in collecting mosquito larvae and pupae from large water bodies or containers into the plastic bucket and sieved into another bucket in order to remove debris. Larvae and pupae in small containers were collected by overturning the container into the collecting bowls, and then sieved. The larvae and pupae were transferred into specimen bottles with a little water from their breeding ground.

Rearing of larvae to adults

The collected larvae were placed in white enamel cups and reared in the mosquito cage to adults. The larvae were fed with a mixture of yeast and biscuits (10% yeast and 90% low fat biscuits). The adults that emerged from the larvae were kept in the cage and fed with 10% glucose solution in cotton wool in place of plant nectars.

Identification and preservation of reared adult

All the adult mosquitoes reared from the larvae, or collected through indoor and outdoor collection methods were transported to the Laboratory of National Arbovirus and Vectors Research Centre Enugu, for proper identification. All the mosquitoes were killed by chilling in a refrigerator before they were identified to species level using their characteristic morphological features.

RESULTS AND DISCUSSION

A total of 1,150 mosquitoes were collected from the studies. Of this number, 1022(88.86) were larvae, 70(6.08%) were indoor-biting adult mosquitoes and 58(5.67%) were outdoor biting adult mosquitoes. This is an indication that mosquitoes are breeding and biting in the community. Mosquitoes are wide in distribution from tropics to the temperate regions of the world and the poles. Wilocks and Mason-Bahr (1978) wrote that mosquitoes are not confined to the tropical regions but many genera including *Anopheles* are found even within the Arctic Circle and the females of most species suck the blood of mammals and birds.

Of the 1022 larvae collected from different mosquito breeding sites (Table 1) The mosquito species collected were *Aedes aegypti,* 688(67.32%), *Culex quinquefasciatus* 326(31.90%) and *Aedes albopictus* 8(0.78%). 173(16.93%) were collected from water in coconut shells, 527(51.57%) from tin cans, plastic containers and metal drums, 21(2.06%) from water collections in discarded tyres, 78(7.63%) from polluted

water in gutters, 200(19.57%) from polluted water in clay pots, drums and metal tanks, and 23(2.25%) from dirty ground water pools. Discarded tin cans, plastic containers and metal drums yielded the highest number of mosquito larvae 527(51.57%) while dirty ground water pools 23(2.25%) yielded the least number of mosquitoes. Statistical analysis showed that there was no significant differences in the larval vary from different breeding sites (p = 0.05).

Table 1: Mosquito larva collected from different habitats.

Breeding sites	Mosquito species			Total
	Aedes aegypti	*Culex quinquefasciatus*	*Aedes albopictus*	
Clear water in coconut shell	173 (100.0%)	0	0	173 (16.93%)
Discarded tin cans, plastic containers, metal tanks and drums	500 (94.88%)	25 (4.74%)	2 (0.38%)	527 (51.57%)
Water in tyres	15 (17.43%)	0	6 (28.57%)	21 (2.06%)
Polluted water in gutters	0	78 (100.0%)	0	78 (7.63%)
Polluted water in clay pots, drums and metal tanks	0	200(100.0%)	0	200 (19.57%)
Dirty pools of water	0	23 (100.0%)	0	23 (2.25%)
Total	688 (67.32%)	326 (31.90%)	8 (0.78%)	1,022 (100.0%)

The high number of mosquito larvae collected indicates prolific breeding of mosquitoes while the abundance of different breeding sites is an indication of suitable breeding groungs in the community. The result corroborate the findings of Mbanugo and Okpalaononuju (2003) who noted that the preponderance of mosquitoes in Awka metropolis was due to prevailing mosquito habitats in the area. Onyido *et al* (2009) and Onyido *et al* (2011) observed that in Nigeria and most developing countries, the urban landscapes are littered with garbage, plastic and tin cans, bottles, disposable cups and discarded vehicle tyres and discarded earthen wares which form breeding grounds for mosquitoes especially during the wet season.

Three species including, Ae. aegypti 688(67.32%), *C. quinquefasciatus* 326(31.90%) and *Ae. albopictus* 8(0.78%) were collected through larval collection method, with Ae. aegypti predominating. In a similar study by Mbanugo and Okpalaononuju (2003) in Awka metropolis, a few kilometers from Nibo community, *Culex quinquefasciatus* and *Aedes aegypti* were the predominant species. The studies at Nnamdi Azikiwe University permanent site by Onyido *et al* (2009b) shows that *C. quinquefasciatus* and *Aedes aegypti* were the predominant species collected as larvae. *Ae. Aegypti* larvae were collected in small water collections in tin cans and discarded tyres while *Culex* larvae were collected in polluted water in gutters. This is an indication that Nibo community practice indiscriminate discarding of refuse including tin cans which support mosquito breeding. More so, *C. quinquefasciatus* is known to breed in waters polluted with decaying organic material (Service, 1980).

Although *Anopheles gambiae* adults were collected both in indoor and outdoor catches, none was collected as larvae. It could be that our searches for the mosquito breeding sites excluded the inaccessible fresh water swamps located in parts of the community. Generally *Anopheles* mosquitoes are selective breeders and oviposition exclusively in sunlit flood pools or swamps (Service 1980).

Of the 70 indoor-biting and resting adult mosquitoes collected (Table 2), *Anopheles gambiae* were 28(40.0%), *Aedes aegypti* 18(25.71%) and *Culex quinquefasciatus* 24(34.29%). *Anopheles gambiae* 28(40.0%) was the most abundant followed by *Culex quinquefasciatus* 24(34,29%). The highest number of indoor biting mosquitoes were collected at Ezeoye village 26(37.14%) and the least from Ezeawulu 11(15.71%). Statistical analysis showed that there was no significant difference in the number of the mosquitoes collected from the villages (p = 0.05).

Table 2: Indoor Biting and resting adult mosquitoes collected at Nibo community using PKC method.

Village	Mosquito species			Total
	Anopheles gambiae	*Culex quinquefasciatus*	*Aedes aegypti*	
Ezeawulu	5 (45.46%)	1 (9.09%)	5 (45.46%)	11 (15.71%)
Umuanum	6 (35.29%)	9 (52.94%)	2 (11.77%)	17 (24.29%)
Ifite	7 (43.75%)	6 (37.50%)	3 (18.75%)	16 (22.86%)
Ezeoye	10 (38.46%)	8 (30.77%)	8 (30.77%)	26 (37.14%)
Total	**28 (40.0%)**	**24 (34.29%)**	**18 (25.71%)**	**70 (100.0%)**

Culex and *Anopheles* mosquitoes are night biters and usually enter houses to bite their victims while asleep (Service, 1980). *Aedes* usually bite and rest out-doors. Important vectors of mosquito-borne diseases are those which show a close association with man and prefer man to other animals as source of food (Gordon and Lavoipierre, 1976), hence these mosquitoes were collected indoors were they bite their victims while asleep.

Of the 58 outdoor-biting adult mosquitoes collected outside the three households selected from each village in Nibo Community (Table 3), *Ae. aegypti* were 22(37.03%), *Ae. albopictus* 7(12.07%), *Ae. Africanus* 9(15.52%), *Culex quinquefasciatus* 11(18.97%) and *Anopheles gambiae* 9(15.52%). *Ae. aegypti* 22(37.93%) was the most abundant and *Ae. albopictus* 7(12.07%) the least. *An. gambiae* 9(15.52%) which is mainly an indoor-biting mosquito was collected in substantial quantity in outdoor collections.

Table 3: Out-door biting adult mosquitoes collected through human bait method at Nibo community

Mosquito Species	No Collected	% Collected
Aedes aegypti	22	37.93
Aedes africanus	9	15.52
Aedes albopictus	7	12.07
Culex quinquefasciatus	11	18.97
Anopheles gambiae	9	15.52
Total	**58**	**100.0**

With the exception of *Culex quinquefasciatus* and *An. gambiae* which bite mainly indoors but occasionally bite outdoors, the rest were *Aedes* mosquitoes which are diurnal and crepuscular insects (Onyido *et al,* 2008). This means that they mainly bite man in the day and also in the twilight hours when their victims are relaxing after the day's activities and may transmit arbovirus infection to them.

In both larvae and adult mosquito collections, five mosquito species including *A. gambiae, C. quinquefasciatus, Ae. albopictus*, *Ae. aegypti* and *Ae. africanus*, were all collected. The *Aedes* group are proven vectors of yellow fever and other arboviruses (Gillet, 1972 and Service, 1980), and all have been variously involved in yellow fever epidemics in Nigeria (Lee and Moore 1972; Lee *et al*, 1974; Service 1974; Savage *et al*, 1992). *An. gambiae* is an important vector of malaria and filariasis in Africa especially in rural communities. *Culex quinquefasciatus* is a mosquito responsible for transmission of filariasis, especially *Bancroftian filariasis* (Amusan *et al*, 2003).

Figure 1 shows the quarter-hourly landing patterns of the outdoor biting adult mosquitoes. There were four landing peaks, one major and three minor peaks. The first peak was between 5.15 and 5.30pm. This marked the initial rush of hungry adults which subsided and was followed by a major peak between 5.45-6.00pm. The other peaks were around 6.45-7.00pm and 7.30-7.45pm. the first graph depicted the overall numbers of mosquitoes landing at each moment, the second graph represented the numbers of *Aedes aegypti* landing at each moment while the third gragh represented the numbers of *Ae. albopictus*. The *Ae aegypti* graph closely trailed the overall mosquito numbers graph thereby significantly causing the first three peaks while *Ae. albopictus* majorly contributed the final peak.

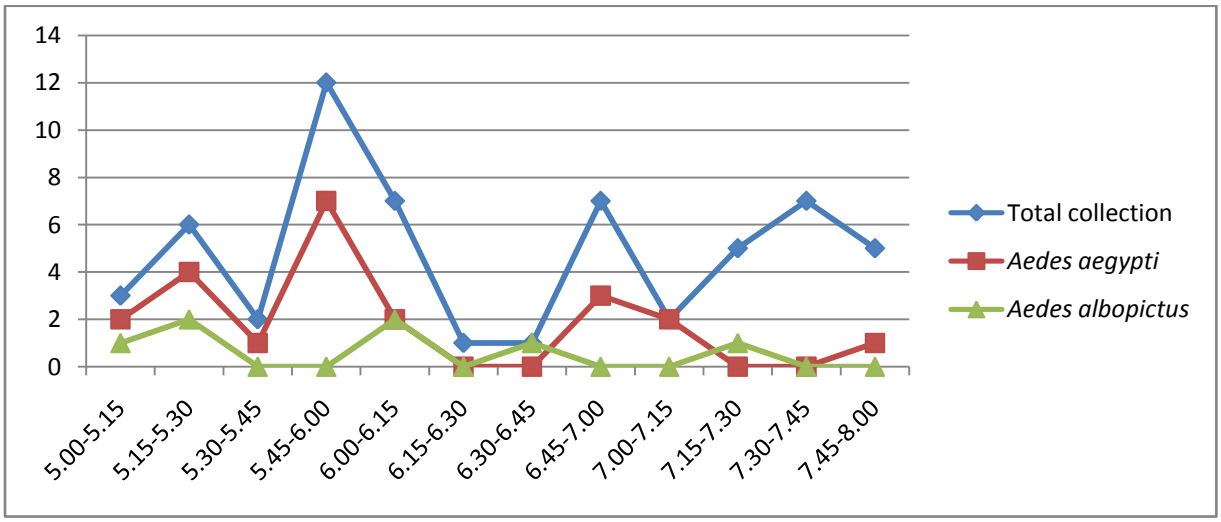

Figure1: Quarter-hourly landing rate of outdoor biting adult mosquitoes collected by human bait.

CONCLUSION

The preponderance of proven mosquito vectors of public health diseases in the community indicates that the community is thus exposed to a variety of mosquito bites and perhaps mosquito-borne diseases. As many villagers may not afford the daily use of insecticide aerosols in their rooms, long-lasting insecticide treated nets (LLITNs) and indoor residual sprays (IRS), it is suggested that these should be provided for the people to reduce mosquito-man contact and avoid disease transmission among the community dwellers. Also, the availability of mosquito breeding sites is an important ecological factor in mosquito abundance and diseases transmission in the community. The community should be educated on mosquito ecology and diseases. They should be enlightened on those factors that contribute to mosquito abundance in their environment and maintenance of a high level of environmental hygiene, including proper disposal of materials that can hold water for the breeding of mosquitoes.

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CONFLICT OF INTEREST

None declared.

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