RESEARCH ARTICLE

Evaluation of the Occurrence and Colour Preferences for Oviposition by Mosquitoes in Man-Made Containers in Owem Imo State

Nwagbaraocha Melvina Amarachukwu[1], Nwoke BEB[2], Ajero Chigbo[2], Ezenwa Maureen Chika[3] Nnodim Johnkennedy[1]

[1]Department of Medical Laboratory Science, Imo State University Owerri, [2]Department of Animal and Environmental Biology, Imo State University Owerri, [3]Department of Microbiology Imo State University Owerri

ABSTRACT

This study was conducted to determine the occurrence and colour preferences for oviposition by mosquitoes in man-made containers under field conditions in Owem between the months of February to June 2015. A total of six (6) different colours of 2 litre size plastic containers were used as artificial mosquito oviposition containers. They were filled with equal amounts of water from a known source and placed in six different sites in Owerri Municipal, Imo State. The containers were observed for seven (7) days for mosquito larvae. A total of 611 larvae belonging to two genera, Aedesand Culex were co-habiting/colonizing in the study sites. The highest occurring species was Aedesaegypti (49.0%) followed by Culexquinquefasciatus while the least recorded was Ae. Albopictus (3.3%). The colour preference of mosquitoes revealed significant difference in relative abundance and was in this order: red 33.2% (187), blue 24.4% (149),Green 15.9% (97), Red 12.8% (78), Yellow 10.3% (63) and White 6.1% (37). The mosquito species encountered oviposited in containers of all the different colours, however, the pattern of distribution of larvae in the study sites showed that Aedesaegypti preferred black and yellow containers, Aedesalbopictuspreferred red and green while Culexquinquefasciatus preferred blue and green. This result reveals that mosquitoes have colour preference for laying of their eggs and subsequent metamorphosis to adult mosquitoes. The information is invaluable in the larval control of these mosquito vectors of human diseases.

Key words: occurrence, colour preferences, oviposition, mosquitoes, man-made containers, Owem

INTRODUCTION

Mosquitoes are member, of a family of nematocer a flies; the culicidae. They are widely spread insects which transmit serious human diseases. More than 2,500 species of mosquito have been described worldwide. The female biting habit during their search for blood meal shortly before air position increase their propensity to transmit various diseases such as malaria, yellow fever, filariasis and dengue associated with high morbidity and mortality. A yearly regular surgery for a period of six years (2000 – 2006) in Imo State revealed an overall malaria prevalence of 23.8% and mortality of 1.2% calculated over the year.

Nigeria is the third most lymphatic filemasis endemic country is the world with 22.1% of the population thought to be infected (7).

The most common debilitating disease of LF is hydrococle. Between 1985 and 2000, sporadic outbreaks of yellow fever plaqued some parts of oyo, Ekiti, Delta, Imo, Anambra, Cross River, Lagos and Benue States of Nigeria.

Address for correspondence:
Nwagbaraocha Melvina Amarachukwu, Department of Medical Laboratory Science, Imo State University Owerri, Nigeria.

DOI: 10.33309/2639-8605.040202

It took 10 years to control the transmission of the virus in the population. Given the low recore coverage of children less than 14 years old, the number of children at risk in Nigeria has been estimated at 23 million, for those children in urban areas only [1].

In Nigeria, these diseases constitute the number one public health challenge imparting negatively on the country's economic development to the tune of more than 1% growth penalty per year [2]

Researchers have shown that mosquitoes are principally the source of dengue fever, yellow fever, elephantiasis, filariasis, malaria amongst others (Aede, albopicties, acdesegypti, culexquinquefasciatus, Anopheles gambiae, Anopheles funestus, Anophalesrivulorum lesson etc are some mosquito species (11). Mosquitoes have preference for ariposition site, providing three broad categories of breeding habitats for mosquitoes. These are; permanent water, temporary pool and artificial container. Artificial containers can be trash, tree holes, coconuts, bromeliads, rock holes or fallen leaves [3].

Females follow visual or olfactory cues to appropriate water collections and guided by chemical cues and physical factors in the water and assess the quality of the water before making a decision to lay their eggs (10). The ability of gravid mosquito females to distinguish among potential oriposition sites that will or will not support the growth, development and survival of their offspring are critical to the maintenance of the mosquito population and disease transmission.

An understanding of the biology of the mosquito is imperature in successful elucidating mosquito species composition, abundance and detibution in larral breeding habitats [4, 5, and 6]. Except for [7] report in Sokoto, none of the researcher's knowledge was aimed at reveling colour preference of mosquitoes for breeding sites. This study reports the occurrences of ovipositor in man-made habitats under field conditions by female mosquitoes found is the Owerri Municipality.

Owerri, the study area being an urban area where commercial activities are predominant and anthropological activities such as open drainage system and liffering of environments with various peridomestic containers is common encourages the breeding of mosquito and consequent increase in mosquito borne diseases. There is a high incidence of yellow fever, malaria and filariasis in Imo State as a result of the high percentage occurrence of mosquitoes. An effective means of mosquito control is therefore needed to reduce the infectivity rate.

With the ever increasing guest for cheaper mere effective and environment friendly mosquito control measures over the last decades, research emphasis have shifted to strategies that make humans less attractive to mosquitoes and on mosquito behavior and their ecology [8]

Reports on the behavior of oripositing female mosquito species is lacking in Imo State, though plenty in other parts of the country. This study is therefore necessary to bridge this gap and to inform people on the choice of container colour to keep around the house, the colour of clothes to wear and the colour to paint their houses especially in mosquito endemic areas to reduce the impact of mosquitoes on people and to help government know where to channel scarce resources in sighting mosquitoes and how best to get mosquitoes for research purpose.

MATERIALS AND METHODS

Description of the Study Area

The study area is Imo State. It is located at the South Eastern part of Nigeria which lies without latitudes 4°45'N and 7°15'N and longitude 6°50'E and 7°25'E. Imo State is bounded in the South by Rivers State in the North, by Abia State in the East and Anmbra State in the West.

The study is carried out in five villages (Umuororonjo, Amawom, Umuonyeche, Umuodu and Umuoyima) of Owerri Municipal, Imo State.

Imo State is in the eastern part of Nigeria and is made up of twenty seven (27) local government areas. Owerri is the headquarters and consists of three local government areas namely; Owerri Municipality, Owerri North and Owerri West. It has an estimated area of 40.15sq miles (104km^2). It has a population of 119711 and lies within coordinates; latitude 5°28'59" N and longitude 7°01'49"E with an elevation above sea level of 71m = 232ft. it has an area of 58km square and a population of 127,213 (Census 2006).

SAMPLE AND SAMPLING TECHNIQUE

Two liter plastic bowls of different colours (yellow, green, blue, and red, black, white) were bought from the market for use man-made breeding habitats. Sand paper was used to rub the inner surface of the bowls to create a friction for the attachment of mosquito eggs.

The bowls were all placed at the same time in a particular spot on the stud sites. A replicate was made. They were all filled with equal quantity of water from a particular borehole whose physiochemical parameter was analyzed at the biochemistry laboratory of Imo State University to ensure that its parameters fall within he WHO acceptable limit for water.

The containers were observed daily for seven days in search of mosquito larvae. All the six containers and their replicates were observed at once before gain to another site.

Preliminary identification for the species of the collected larvae was made based on the morphological characteristics of the larvae. Some of the 4th stage instar larvae were placed in a Petridis from where they were picked one after the other with a forceps and placed on a glass slide. A drop of normal saline was added and it was covered with a cover slip. The larvae were then observed under a dissecting microscope by their morphology using keys given by [9, 10, and 11]

Mosquito collection and identification on observation of the pupal stage, about half a yard of mosquito netting was used to secure the mouth of each container in such a way that emerged mosquitoes are trapped and collected for further identification.

The mosquitoes are got by holding the net closely together and lifting it away from the container. An insecticide was used to kill the mosquitoes before putting them in a screw cap container for transportation to the entomology laboratory of the Arbovirus center for research, Enugu in Enugu state for final identification.

A total of 715 mosquito larvae were reared in this research but only 611 emerged and so were taken for the final identification after the preliminary larval identification in the animal and environmental biology laboratory, Imo State University using a dissecting microscope.

STATISTICAL ANALYSIS

The results were expressed in percentages.

RESULTS

Table 1. Species and composition of mosquito larvae in each container

Container	**Relative Abundance of Species**			
Colours	**Ac. Aegypti(%)**	**Aealbopictus (%)**	**Cxquiquafasciatus (%)**	**Total**
Red	43(55.1)	5(6.4)	30(38.5)	78(12.8)
Blue	43(28.9)	4(2.7)	102(68.5)	149(24.4)
Black	120(64.2)	5(2.7)	62(38.2)	187(32.2)
Yellow	41(65.1)	0(0.0)	22(34.9)	63(10.3)
Green	23(23.7)	6(6.2)	68(70.1)	97(15.9)
White	28(75.7)	0.(0.0)	9(24.3)	37(6.1)
Total	**298(49.0)**	**20(3.3)**	**293(48.0)**	**611(100)**

Table 2. The abundance of mosquito species in the different study sites

Sampling Sites	**Relative Abundance of Species**			
	Ac. Aegypti(%)	**Aealbopictus (%)**	**Cxquiquafasciatus (%)**	**Total**
Umuodu	0(0.0)	48(7.9)	58(9.5)	106(17.3)
Amawom	20(100)	0(0.0)	0(0.0)	20(3.2)
Umuoyima	0(0.0)	67(53.2)	59(46.8)	126(20.6)
Umuonyeche	0(0.0)	102(64.2)	57(35.8)	159(26.0)
Umuororonjo	0(0.0)	81(40.5)	119(59.5)	200(32.7)
Total	20(3.3)	298(48.8)	293(48.0)	611

From the results, it is evidence that black containers haboured the most number of mosquitoes 187 (33.2%). This is in the with the findings of other researchers like [12] who reported that Aedes love containers with dark surfaces and Yap and [13] who reported that gravrdalbopictus lard more eggs in black containers. [14, 15, 16, 17] all agreed to black colours of ovitraps or containers more than the other colours

A total of 611 larvae and pupae were collected in all the containers. Black containers attracted the highest number (187) of mosquito larvae representing 33.2% followed by blue containers 149 (22.4%) and green containers 97 (15.9%). Red container accounted for 78 (12.7%) mosquitoes. Yellow container accounted for 63(10.3%) mosquitoes while the least number of mosquitoes 37(6.1%) was observed in the white containers. The overall abundance is there dependent on the colour of the containers ($X^2 = 94.5$ df = 10 $p < 0.05$).

The result of the relative abundance of the various species shows that container colour had significant influence on the oriposition preference of the different species of mosquitoes. ($X^2 = 106.8$ df = 10 $p < 0.05$). Aedesaegypti preferred black (64.2%) and yellow containers (65.1%) Aedesalbopictus preferred red (6.2%) and green (6.1%) while culexquinquefasciatus preferred blue (68.5%) and green 70.0%).

The species abundance of mosquito species retrieved from the different study sites showed that of the 611 mosquito larvae collected 200 (32.7%) the highest, were recovered from Umuororonjo while the least 20(3.2%) was collected in Amawom. The percentage abundance in Umuoyima was 126 (20.6%), Umuodu was 105(17.3%) while in Umuonyeche, it was 159 (26%).

Aedesalbopictus was found only in Amawom. The highest percentage abundance of Aedesaegypti 102(64.2%) was recorded in Umuonyeche while the least was observed in Umuodu. Umuororonjo had the highest abundance of culexquinquefasciatus (59.5%).

There is therefore a significant difference in the mosquito abundance in the six different sites of the study area ($X^2 = 24.43$ df = $p<0.05$).

DISCUSSION

In this study, container colour was found to have a significant effect on the oviposition choices of some mosquitoes. The mosquitoes that oviposited in the containers are Aedesaegypti (49.0%). Aedesalbopictus (3.3%) and culexquinquefasciatus (48.0%). All the mosquito species are artificial breeders as reported by some scientists like [4,] who reported the frequency of occurrence of Aedes larvae in domestic utensils and man-made plastic containers. It was noted that Aedesaqgypti, Aedesalbopictus and Culexquinquifasciatus have adapted well to artificial containers commonly found in sub urban and urban areas and that they do oviposit readily in this man – made containers.

It is instructive that anopheles and other genera and species were not seen. This is probably as a result of the salcium and saline content of the water not good eight for them. Another is that anopheles do not breed in manmade containers but rather prefers natural habitats like tree holes for their breading [12,] It was reported that mansonin breeds in pools where certain water plants grow [7].

The mosquitoes isolated in this research is in line with that of [14] at Abeokuta where out of the nine mosquitoes isolated, Aedesaegypti was the most abundant (78.3%) followed by culexquinquefasciatus (7.92%) and Aedesalbopictus (0.85%). It was reported that on the ecology of drainage breeding mosquito vectors in three urban areas (Owerri, Orlu, Okigwe) and culexquinquefasciatus was also isolated[6]. It was reported in Ekwubbia, Anambra state observed that Aedesaegypti, Aedesalbopictus and culexquinquefasciatus were the most abundant species [10].

From the result of this work, it is evident that black containers labored the most number of mosquitoes 187 (33.2%). This is in line with the findings of other researcher like (12) who reported that Aedes love containers with dark surfaces. [13] That stated that gravid albopictus laid more eggs in black containers, [14, 16, 17] all agreed that Aedes were attracted to black colours of ovitraps or containers more than the other colours.

The order of colour attraction to mosquitoes in the individual sites is in accordance with overall findings in this work. The result from the sites sampled generally follows the same trend except in Umuodu and Umuororonjo where the blue colour attracted the highest number of mosquitoes.

CONCLUSION

This research is of public health concern as the species of mosquitoes encountered (Aedesaegypti, Aedesalbopictus, culexquinguefasciatus) have been incriminated in the transmission of serious human diseases, of public health interest that has social and economic consequences such as Malaria, yellow fever, filariasis. The result show the mosquito preference with percentage abundance revealing that black containers is the preferred host while white containers is the least preferred host. All the containers of all colours were however bred in. the information is invaluable in generating the protocol for the control of larvae of mosquitoes as a means of controlling the occurrence of malaria and other neglected mosquito borne diseases. The knowledge of colours that influence oviposition will therefore help in rector control as people will know the colours to wear and also use in the environment (containers, house paints) to control mosquitoes.

REFERENCES

1. WHO (2014). Increased risk of urban yellow fever outbreaks in Africa. http://www.who.in/csr/disease/yellowfer/

urbanoutbreaks/en/

2. Alaba A & Alaba O. (2009). Malaria in rural Nigeria: Implications for the Millennium Development Goal. Africa Development Review, 21(1): 73 – 85.
3. Olson, J. (2003). Mosquito class Notes. Texas A. and M. University, Department of Entomology, Medical Entomology Class.
4. Okogun, G.R.A, Betran E.B., Anthony, N., Okere, J.C and Anegbe, C., (2003). Epidemiological Imlications of preferences of breeding sites of mosquito species in midwestern Nigeria. annals of Agricultural Environmental Medicine, 10:217-22.
5. Awolola T. S; Ibrahim K, Okorie, T., Koekemoer, L.C., Hunt, R.R. and Coetzee M. (2003). Species Composition and biting activities of arthropophilic Anopheles Mosquitoes and their role in Malaria transmission in a holoendemic area of South-Western Nigeria. Journal of Africa Entomology; 11(2); 227 – 32
6. Mgbemena, I.C. (2012). Distribution and occurrence of mosquito species in the municipal areas of Imo State, Nigeria. journal: AnaleleUniversitati din Oradea.fasciculabiologie, pp. 93.
7. Michael E., Bundy, D.A.P and Grenfall, B.T. (1996) Re-assessing the global prevalence and distribution of lymphatic filariasis. Parasitology, 112: 409-428.
8. Mark, S.F. (1988). Mosquito and mosquito repellants; A clinician's Guide. Annals of Internal Medicine, 128(11): 931-940.
9. Ukaga, C.N., Obiora, I.E., Nwoke, B.E.B Ezeunala, M.N. Nwachukwu M.I. Ajero, C.M.U and Ekwunife, C.A. (2011). Malaria Morbidity and Mortality in Owerri Hospitals. Nigeria Journal arasitology. 32 (2): 175-180.
10. Bing C.K, Lychua, I.E and Hsiang, K.C. (2004) Differential preferences of oriposition by Aedes mosquitoes in man-made containers under field conditions. Southeast Asian Journal of Tropical Medicine and Public health, 35(3): 599 – 606.
11. Walter, R. (2013). Biosystematics Unit Wrbu.sicedu. https://www.rectorbase.org/useful-links/walter-reed-biosystematics-unit
12. Chua, K.C, Chua, I., Chua L.L. and Chua K.H., (2004). Differential preferences of oriposition by Aedes mosquitoes in Man-made container under field condition" South East Asian Journal of Tropical Medicine and Public Health, 35 (3): 599 – 607.
13. Yap, H.H. and Foo, A.E.S. (1984). Laboratory Studies on the oriposition site preference of toxorhynchitessplendens (Diptera, culicidae). Journal of Medical Entomology. 21:183-187.
14. Collins, L.E. and Blackwell A. (1998). Electo-antennogram studies of potential oriposition attractants for toxorhymchitesmocterzuma and taxorhynchitesamboinensis mosquitoes. Journal of physiological entomology, 23:124-219.
15. Soniran, O.T., Adeleke, N.A., Adeji, A.O. and Amusan A.A.S. (2008). Influence of colour on the oriposition of mosquitoes breeding in artificial containers in Abeokuta, Ogun State, Nigeria. journal of Entomological Research 4:279-281.
16. Colton, Y.M, Chadee, D.D and Severson, D.W (2003). "Natural Skip oripositon" of the mosquito Aedesaegypti as evidenced by dominant genetic markers". Medical and veterinary entomology 1712): 195-201
17. Subrat, K., Panigrahi, J.K., Barik, S.M. and Niraj, K. (2014). Choice of Ovistripcolours for oriposition. Journal of insects http://dx.doi.org//10.IISS/2014/207489

How to cite this article: Amarachukwu N M, BEB N, Chigbo A, Chika E M, Johnkennedy N. Evaluation of the Occurrence and Colour Preferences for Oviposition by Mosquitoes in Man-Made Containers in Owem Imo State. Asclepius Med Res Rev 2022;4(2):04-08.
DOI: 10.33309/2639-8605.040202