Asian Journal of Biology

9(2): 8-13, 2020; Article no.AJOB.56045
ISSN: 2456-7124

Colour Preference by Mosquitoes in Water Board Station at Runjin Sambo Area, Sokoto

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJOB/2020/v9i230082
Editor(s):
(1) Dr. Md. Abdulla Al Mamun, The University of Tokyo, Japan.
(2) Dr. Jehad M. H. Ighbareyeh, Al-Quds Open University, Palestine.
(3) Dr. Paola Angelini, University of Perugia, Italy.
Reviewers:
(1) José Alejandro Martínez Ibarra, University of Guadalajara, Mexico.
(2) Philip Asumang, Kwame Nkrumah University of Science and Technology, Ghana.
(3) Stella C. Kirui, Maasai Mara University, Kenya.
Complete Peer review History: http://www.sdiarticle4.com/review-history/56045

Original Research Article

Received 02 March 2020
Accepted 09 May 2020
Published 30 May 2020

ABSTRACT

Mosquitoes play an important role in promoting the spread of many zoonotic diseases among vertebrates. Their presence and numbers were influenced by the availability of breeding sites. This study reports the occurrence and colour preferences of oviposition in man-made habitats under field conditions by female mosquitoes found in the Water Board Station at Runjin Sambo Area, Sokoto. A total of nine plastic buckets (2 litres) of different colours were used as artificial oviposition container. The colour chosen was black, blue, brown, pink, purple, red, white, and yellow. The containers were filled with an equal amount of water and placed under a shade at 5 cm interval and observed daily for seven days. Mosquito larvae were emptied into a bowl and counted. The result showed that *Aedes* and *Culex* larvae were oviposited in all the plastic container with high abundance in a red colour plastic container (25.10 and 26.30% respectively) while *Anopheles* larvae were more in the black container (25.5%) and *Mansoni* on brown (23.10%). This suggested that container colour was important in influencing the oviposition choices of some female

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mosquitoes breeding in artificial containers in the Water Board Station at Runjin Sambo Area Sokoto. It is hoped that the study will help in adopting control measures for the respective mosquito species.

Keywords: Colour preferences; malarial disease; anopheline mosquitoes; Sokoto.

1. INTRODUCTION

Mosquitoes are small midge-like flies which comprise the family culicidae [1]. Female of most species are ectoparasites, whose tube-like mouthparts (called a proboscis) pierce the host's skin to consume blood [2]. Mosquitoes have preferential oviposition habits, where water collection activities by humans and behaviour, such as discarding empty containers and planting ornamental plants around houses may potentially encourage the breeding of mosquitoes [3]. Thousands of species feed on the blood of the various kinds of hosts, mainly vertebrates, including mammals, birds, reptiles, amphibians, and even some kind of fish [4,5]. Some mosquitoes also attack invertebrates, mainly arthropods [6]. Though the loss of blood is seldom of importance to the victim, the saliva of the mosquito often causes an irritating rash that is a serious nuisance and sometimes releases malarial parasites along with the saliva [7]. They also play important roles in the spread of diseases such as Malaria, Yellow fever, Chikungunya, West Nile virus, Dengue fever, filariasis, Zika virus and arboviruses, rendering it the deadliest animal family in the world [8,9]. Most of these diseases are much less common with us than they were a few years past, and that is due partially improve sanitary conditions which lessen mosquito breeding in densely populated districts and partly to the much more thorough treatment which a patient now receives from the attending physician [10-12]. Despite several research works on mosquitoes worldwide, more information is required about their colour preferences particularly in the selection of their breeding sites [13,14]. The investigation into the different types of breeding sites and their colour will help us understand the most preferred site for mosquito breeding.

Despite several research works on mosquitoes worldwide, more information is required about their colour preferences particularly here in Nigeria where detailed studies have not been done in this field of interest. The investigation into the different types of breeding sites around the human will help to understand the most preferred site of mosquito breeding.

Mosquitoes have differential colour perceptions. Cameroon (1938) found that insects can discriminate between differences in the intensity of the light reflected from the various surface. William [15] also noted that colour preference by mosquitoes due to their sharp colour vision played a considerable role in host location and selection of oviposition sites in females.

This research aims to study the occurrence and colour preference by mosquitoes in Water Board Station at Runjin Sambo area, Sokoto while the objectives of this research are:

1. To determined colour preference of mosquitoes in Sokoto.
2. To determine the type and relative abundance of mosquitoes in Sokoto.
3. To make appropriate recommendations.

2. MATERIALS AND METHODS

The study was conducted in Water Board Station at Runjin Sambo area, Sokoto. This place was chosen because of the vegetation and constant flow of water. A total of nine plastic buckets (2 litres) of different colours were used as artificial oviposition container. The colour chosen was black, blue, brown, pink, purple, red, white, and yellow. The containers were filled with an equal amount of water and placed under a shade at 5 cm interval. The containers were observed daily for seven days. A single set of nine plastic containers was used in collecting the sample. The content of each container was taken and poured into a clean empty bowl. The total number of larvae were then counted and recorded. After counting, a pipette was used to transfer all the 4^{th} stage in star larvae into a separate Petri dish containing some water. All the Petri dishes were transferred to the laboratory for the identification of larvae.

3. PROCESSING IDENTIFICATION OF MOSQUITO LARVAE

After all, the Petri dishes containing the larvae were transferred to the laboratory, the larvae. All were left until they develop into the fourth (4^{th}) stage (Adult mosquito) for proper identification the fourth (4^{th}) stage larvae movement in each

Petri dish was noted after which the larvae in each Petri dish were picked one by one placed on a clean glass slide. A drop of water was added and cover with a coverslip. The larvae were then observed under a dissecting microscope. The larvae were identified using their morphological feature as described by [16]. The Anopheles mosquitoes were differentiated from the culicine by the absence of elongated air tube. While various genera under the culicine were differentiated based on the number of pectin spines and sub ventral tufts on the siphon.

4. RESULTS AND DISCUSSION

The result shows that *Aedes* Larvae is prepared red colour container with (22), followed by blue with (10), brown with (9), black and green containers with equal numbers (7) and purple and pink containers with (3) and yellow with (2). While the white colour container is not showing any larvae. From the Fig. 1, it was indicated that the *Aedes* larvae were oviposited in all the plastic container, but show high abundance in a red colour plastic container having the highest percentage of (25.10%).

The result shows that AnophelesLarvae is prepared black colour container with (24), followed by purple with (10), brown and red containers with equal numbers (7), blue and pink containers with equal numbers (6) and green container with (4). While yellow and white containers are not showing any larvae.

From the Fig. 2, it was indicated that the Anopheles larvae were oviposited in all the plastic container, but show high abundance in a black colour plastic container having the highest percentage of (25.50%).

The result shows that *Culex* Larvae is prepared red colour container with (25), followed by the green container with (8), black, blue, brown and purple containers with equal numbers (6), the pink container with (5) and yellow container with (4). While the white container is not showing any larvae.

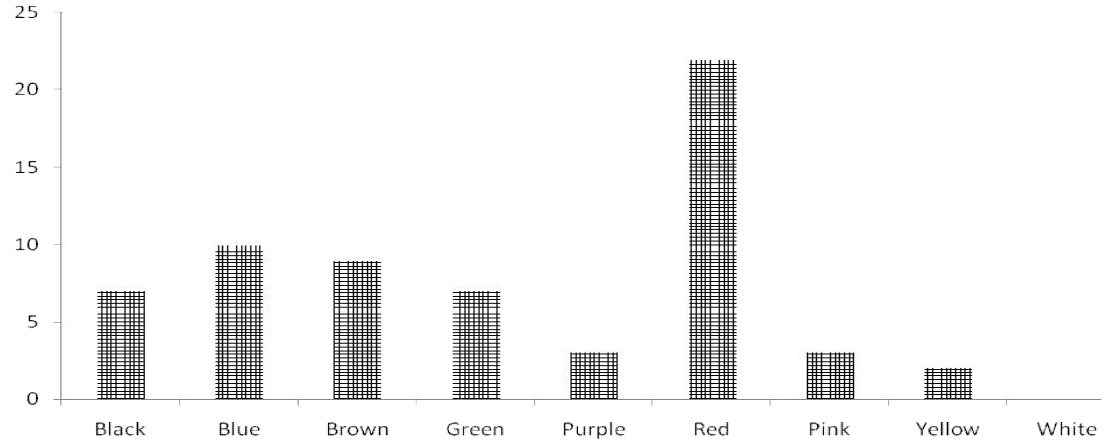

Fig. 1. Number of *Aedes* larvae oviposited in different color plastic container

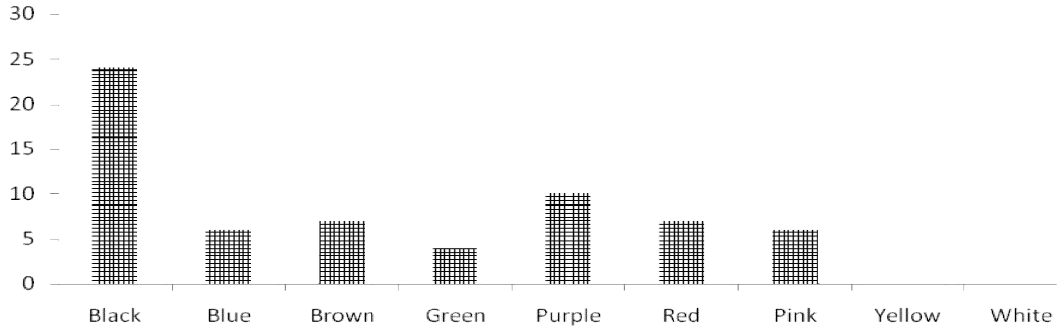

Fig. 2. Number of *Anopheles* larvae oviposited in different color plastic container

From the Fig. 3, it was indicated that the *Culex* larvae were oviposited in all the plastic container, but show high abundance in red colour plastic container having the highest percentage of (26.30%).

The result shows that *Mansonia* Larvae is prepared brown colour container with (21), followed by black container with (9), blue and purple containers with equal numbers (7), green and red containers with (5) and pink container with (4). While yellow and white containers are not showing any larvae.

From the Fig. 4, it was indicated that the *Mansonia* larvae were oviposited in all the plastic container, but show high abundance in a brown colour plastic container having the highest percentage of (23.10%).

The result of this study shows that larvae belonging to four genera, *Aedes*, Anopheles, *Culex* and *Mansonia* were co-habiting/colonizing the Water Board Station. The highest occurring genus was *Culex* with 66 (26.30%) larvae, followed by Anopheles with 64 (25.50%), *Aedes* 63 (25.10%) and *Mansonia* with 58 (23.10%) larvae.

The general distribution of the mosquitoes showed that *Culex* had the highest number of 108 with (33.9%), followed by *Aedes* with the number of 92 (28.8%), *Mansonia* with the number of 79 (24.8%) and Anopheles with numbers of 40 (12.5%).

The colour preference of mosquitoes was in the order of red 23.50% (59), black 18.30% (46), brown 17.10% (43), blue 11.60% (29), purple 10.40% (26), green 9.60% (24), pink 10.40% (18), yellow 2.40% (6) and white 0.00% (0).

It is presently accepted by most researchers that ovipositing mosquitoes do not lay their eggs indiscriminately and that restriction of breeding habitats of a particular species, to a given habitat, is largely a result of selection preference guided by the instinct of the particular ovipositing female mosquito.

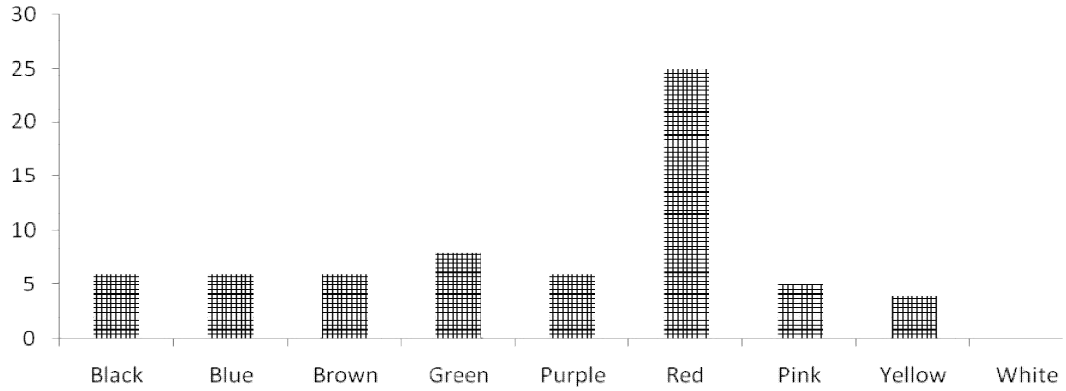

Fig. 3. Number of *Culex* larvae oviposited in different color plastic container

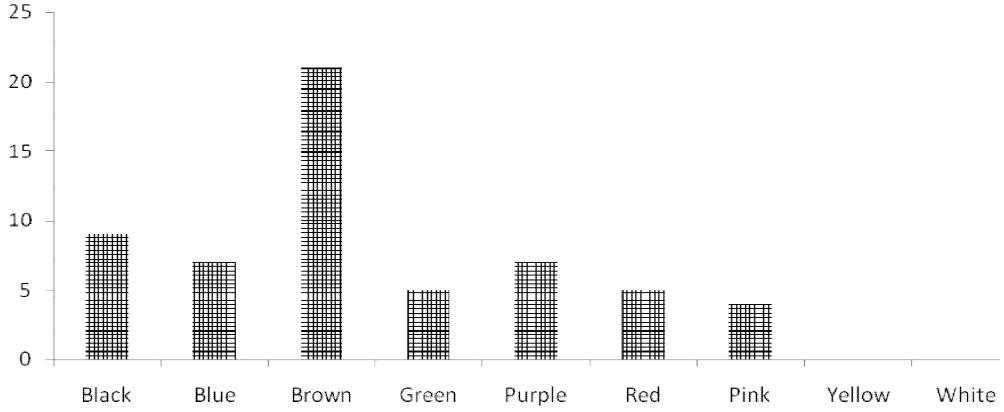

Fig. 4. Number of *Mansonia* larvae oviposited in different color plastic container

In the present study, container colour was important in influencing the oviposition choices of some female mosquitoes breeding in artificial containers in the Water Board Station at Runjin Sambo Area Sokoto.

Red is the most attractive colour, followed by black, brown, blue, purple, pink, yellow and white with no larva recorded. Although many genera colonized more than one coloured container, the general distribution of larvae among coloured containers revealed that *Aedes* and *Culex* frequented red container, *Mansonia* was more attracted to the brown coloured container while Anopheles was attracted to the black container. This agrees with the works of (Bates, 1940) who found some Anopheles mosquitoes to show a pronounced preference for dark background colours and Collins and (Blackwell, 2000) who reported some female mosquitoes to ovipositor more frequently into red containers than into blue, green, yellow or white. Worthy of note is that Beckel (1955) and [17] in laboratory studies, found some *Aedes* females (*Aedes aegyptii*) to oviposit most frequently onto black rather than white surfaces. This present study found that *Aedes* mosquitoes oviposited more in red than in a black container. The difference may be because the above-mentioned researchers used only two colours (black and white) in their studies, while this study involved several colours. It is interesting to note that the preference of mosquitoes to red and Black colours has been reported by (Collins and Blackwell 2000). The explanation, according to their research, was that black and red colours are known to absorb more light across most of the visible spectrum than other colours. These authors found the critical wavelength band for Toxorhynchites mosquitoes to be 300 – 600 mm, and that the mosquitoes can differentiate between red/black and other colours. However, according to them, further studies of the visual physiology and ecology of these and other species of mosquito are required to confirm the observations.

Culex, the potential filariasis vector, was the predominant mosquito species found both in terms of number and occurrence in all the containers (26.30%) followed by the principal malaria carrier Anopheles with 25.50%. This result agrees with the observations of Gadzama, [18], who found *Culex* mosquitoes to be the commonest species that breed abundantly in domestic utensils in Zaria.

Another species with high-frequency distribution is *Aedes*, which transmit dengue and yellow fever. This observation is following Bing et al., [19], who reported the frequent occurrence of *Aedes* larvae in domestic utensils and manmade plastic containers in Nigeria and Asia respectively. Irving-Bell et al., 1987 observed in the Jos area, that species like *Aedes* and *Culex* are highly adapted to container-breeding. Anopheles hardly breeds in man-made containers, but prefer natural habitat for breeding (Horsfall, 1972). Tephen and Anoviak (2001) also showed Anopheles to colonize any available breeding site.

The species with the least occurrence are *Mansonia* with 23.10%. The relatively low abundance may be due to lack of enough substrate for *Mansonia* adult to lay their eggs. This is because *Mansonia* species breed only in pools in which certain water plants grow (Chandler and Read, 1961). Tree holes located in the understory than cups in treefall gaps. Another possible reason for the low abundance of these species may be lack of enough time, in this study, to allow for long breeding and possible adaptation.

5. CONCLUSION

This study reports the occurrence and colour preferences of oviposition in man-made habitats under field conditions by female mosquitoes found in the Water Board Station at Runjin Sambo Area, Sokoto. It can be concluded that different mosquito species occur in the study area and they showed some degree of preference in the selection of their breeding sites.

It is hoped that the study will help the government and the society at large in controlling and eradicating the spread of mosquitoes by informing them of the colours that are attractive to the mosquitoes and also those that are less attractive. Also, it shed light on the choice of colours for day to day activities, this will be helping in selecting less attractive colours to mosquitoes in our houses to reduce the more favourable condition that will enhance the reproductive potentials of the mosquitoes.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/56045