World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 5.088

COLOUR PREFERENCE FOR OVIPOSITION BEHAVIOR OF GRAVID FEMALE *AEDES AEGYPTI* IN LABORATORY CONDITION

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Article Received on 28/06/2018 **Article Revised on 19/07/2018** **Article Accepted on 09/08/2018**

ABSTRACT

Aedes aegypti and *Aedes albopictus* are the principal mosquito vectors of DF and DHF viruses Globally. For oviposition preference of *Aedes aegypti* mosquitoes, different colours of papers were lined in 30ml amounts of distilled water in hundred ml plastic beakers. The ovitraps were placed 1cm interval between each other in 500 gravid *Aedes aegypti* mosquito released cage. In the cage, the coloured traps were placed alphabetically such as black, blue, brown, green, pink, purple, red, white and yellow in insectary of Medical Entomology Research Division, Department of Medical Research. The traps were carefully observed after 24 of next day. All laid eggs papers were carefully took off and placed in white tray as well as allowed to dry for 5 hours in room temperature. Eggs were counted under 20X dissecting microscope and number of eggs was recorded individually according to the colours. Monthly oviposition test was done for 7 months (Seven replicated). All the beakers were carefully observed and counted remaining eggs of mosquitoes. Result revealed that the highest preference of oviposition of gravid *Aedes aegypti* female against different colours were observed 13154 in Black ovitrap followed by Red coloured ovitrap 8297 and lowest eggs were observed 1302eggs in Yellow trap. All 7 replications of test, over 1000 eggs were laid 6 times in Black traps, 4 times in Red trap, and one time in white and pink traps. In conclusion, Black and Red coloured ovitraps were most preference and white was less preference for oviposition of gravid *Aedes aegypti* mosquitoes. Till now, *Aedes* mosquito control is the only option to stop dengue virus transmission. The study recommended that, based on these findings, control tools and strategies could be possible to design and develop suitable ovitraps for the control of *Aedes* mosquito vectors.

KEYWORDS: *Aedes aegypti*, Ovitraps, Oviposition, Preference, Colours, Microscope.

INTRODUCTION

Some mosquito genera include as *Aedes, Anopheles, Culex* and *Mansonia* are responsible for the transmission of the diseases.[1] These mosquitoes are known to transmit diseases such as malaria, yellow fever, filariases, dengue, Zika, chikungunya etc. They cause high risk of health and fatal of human lives. These mosquitoes are mostly found around human dwellings. Southeast Asia Region and Western Pacific Region in the World which bear nearly 75% of the current global disease burden due to dengue.[2] Dengue fever (DF) and Dengue hemorrhage fever (DHF) are increasingly becoming serious public health problems in Myanmar especially among the 5-10 and 11-15 years old age groups and now noted 15 years above, a vast majority of the cases occur in 5-8 years old age group.[3,4] In Myanmar, the highest numbers of DHF cases were reported from Yangon, regions.[5] *Aedes aegypti* are one of the world's most widely distributed mosquitoes and is of considerable medical importance as vectors of dengue, Zika, chikungunya and yellow fever.[6]

Selection of an oviposition site by the female mosquitoes is one of the most important behavioural components of their survival.[7] A female mosquito chooses oviposition sites by a combination of visual and chemical cues. Ovipositing mosquitoes taste the water in a potential oviposition site to detect chemical cues.[7] Further, mosquitoes may also select oviposition sites based on the availability of larval food.[8] Normally a female does not lay her entire batch of eggs in one location but rather distributes them in multiple water-filled containers, a behaviour called skip-oviposition.[9] Very few cases have been examined to explain the role of container shape and size in oviposition site selection. *Aedes* mosquitoes are usually day active mosquitoes and might be relying more

on optical cues like the contrast between dark container openings for selection of resting and oviposition sites than night active mosquito species.[10]

Most of the oviposition attraction studies observed specific odors generated from microbial agents that are responsible for attracting gravid females to a potential oviposition site; Although, site selection is also dependent on tactile and visual cues with vision possibly as important as olfactory cues in site selection among some mosquito species.[7] Active artificial-container breeders such as *Aedes aegypti* (L.) vision undoubtedly influences oviposition site selection; however, little is known about the degree of visual parameters of color and contrast influence oviposition site selection of the specie. Diurnally active mosquitoes are believed to have better developed color sensitivity than crepuscular or nocturnally active species.[11] *Aedes aegypti* prefer to oviposit in late afternoon.[12] Thus, color and/or contrast could play an important role for oviposition choice of among gravid females of *Aedes* mosquitoes. Present study expected that differences in the frequency and/or number of eggs deposited by *Aedes aegypti* on different colours of oviposition traps in laboratory.

MATERIALS AND METHODS

Study design: Laboratory descriptive study design was done with different colours preference effect on gravid *Aedes aegypti* mosquitoes.

Study site and study period: The study was done in Medical Entomology Research Division, Department of Medical Research from June 2017 to March 2018.

Procedure of the study

For oviposition preference of *Aedes aegypti* mosquitoes, different colours of (3cm wide x 10cm length) papers were lined in hundred ml plastic beakers and were filled with 30ml amounts of distilled water and placed 1cm interval between beakers in 11cm x11cmx 11cm sized mosquitoes cage. The colours were placed alphabetically as follows; black, blue, brown, green, pink, purple, red, white and yellow. Then 500 gravid *Aedes aegypti* mosquitoes were released in the cage at 10am in *Aedes* rearing insectary of Medical Entomology Research Division, Department of Medical Research. The traps were carefully observed after 24 of next day at 10am in the laboratory (27ºC, RH 76%). All laid eggs papers were carefully took off and placed in 35cm x 26cm white tray and dried for 5 hours in room temperature. All dried egg papers were examined and counted under 20X dissecting microscope and Number of eggs were recorded individually according to the colours. Monthly oviposition test was done for 7 months (Seven replicated). All the beakers were carefully observed and counted remaining eggs of mosquitoes.

Analysis of data: Seasonally collected entomological data will be analyzed and compared with both study areas.

Monthly collected entomological data were analyzed by Microsoft excel software.

Table 1: Colour preference against oviposition of gravid *Aedes aegypti* in laboratory.

Sr. No.	replicates	White (Control)	Orange	Light pink	Yellow	Blue	Red	Green	Pink	black
1	1st	703	441	490	163	550	1544	417	983	2081
2	2nd	1285	854	249	47	243	763	432	329	2038
3	3rd	564	735	466	321	264	1110	619	1318	3013
4	4th	333	334	875	134	406	654	443	718	1835
5	5th	933	546	544	111	915	2315	564	812	1350
6	6th	929	322	283	235	635	1154	204	659	1385
7	7th	257	273	340	291	163	757	672	753	452
Total		4504	3505	3247	1302	3176	8297	3351	5572	13154
Mean		643.43	500.71	463.86	186	453.71	1185.29	478.71	796	1879.14
±SD		364.46	222.45	212.28	99.86	265.24	585.32	156.55	303.45	585.97

Table 1. shows that oviposition of gravid *Aedes aegypti* in colour paper lined ovitrap against colour preference in laboratory. The highest preference of oviposition of gravid *Aedes aegypti* female against different colours was found Black followed by Red and lowest preference was observed Yellow. The highest total number of *Aedes* mosquitoes eggs were observed 13154 in Black ovitrap followed by Red coloured ovitrap 8297 and lowest eggs were observed 1302eggs in Yellow trap. According to 7 replications of test, over 1000 eggs were laid 6 times in Black traps, 4 times in Red trap, and one time in white and pink traps. Highest mean number of eggs was found 1879.14± 585.97 in Black traps followed by 11850.29±585.32 in Red trap and lowest mean eggs was observed 186±99.86 in Yellow traps.

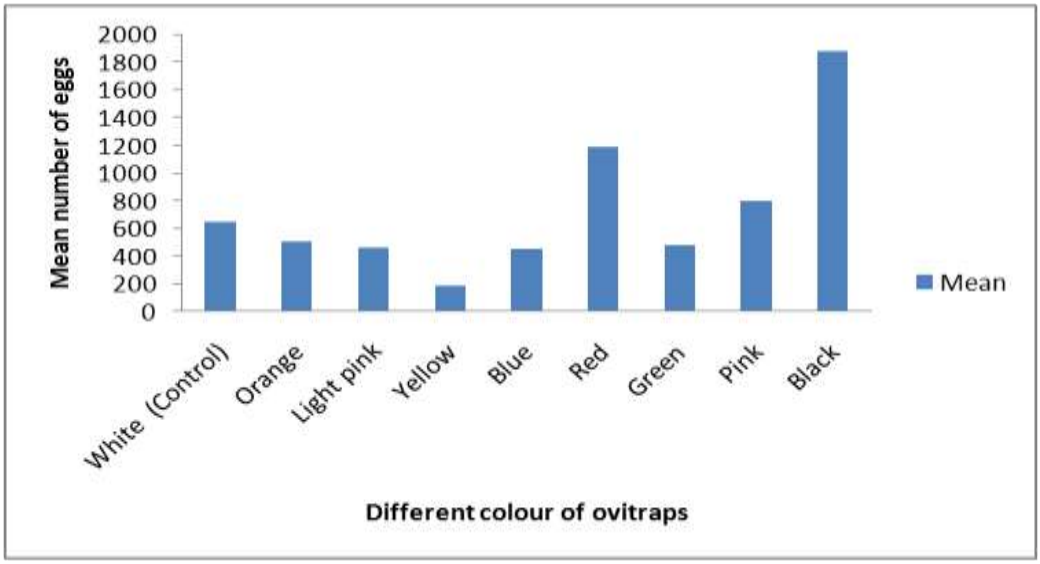

Fig 1: Mean number of eggs laying in different colour of ovitraps by gravid Aedes aegypti mosquitoes.

Fig. 1. Shows that the highest mean number of eggs was laid by *Aedes aegypti* mosquitoes in Black colour paper trap followed by Red colour paper trap and lowest mean number of eggs was laid in Yellow colour paper trap.

DISCUSSION

Vision plays an important role in adult mosquito biology, including location of hosts, food sources, mates, resting sites, and oviposition sites.[11] A great many studies have examined the visual parameters of shape, size, contrast, light intensity, texture, and color attraction to host seeking mosquitoes, while few studies have explored which of these parameters are attractive to gravid adult females.[13] In the present study *Aedes aegypti* eggs was significantly highest in Black colour paper lined ovitrap followed by Red colour lined ovitrap significantly lowest eggs was found Yellow colour lined ovitrap. Same result has been found by Panigrahi et al.,[14] in India, experiments were conducted to determine egg laying preference for any specific colour of the ovistrip and black ovistrip was found to be most preferred and followed by Red colour trap by both *Aedes aegypti* and *Aedes albopictus* species, and lowest oviposit of eggs was found in White coloured trap. But in present study observed that Yellow paper lined trap was the lowest eggs and he was also observed that the maximum number of eggs was laid in ovitraps containing distilled water followed by tap water.[14]

Other researchers revealed that the breeding preference was highest in tires in field condition which are black or dark coloured.[15,16] The dark surface of the containers served as the initial and long range attractant to breeding sites.[17] A researcher group in field area observed that container colour was important in influencing the oviposition choices of some female mosquitoes breeding in artificial containers in Usmanu Danfodiyo University permanent site Sokoto. They found that Red being the most attractive colour, followed by brown, black, blue, purple, pink, yellow and white with no larva recorded.[18] Although present study observed that black coloured ovitrap was most preference for oviposition and yellow was lowest preference.

Aedes spp. can display sundry oviposition strategies depending upon circumstances.[19] Females often avoid laying eggs in surfaces containing conspecific eggs, including their own[20] and this tendency often reinforces the occurrence of skip oviposition.

However, electroretinographic examination of host-seeking *Ae. aegypti* by Muir et al.,[21] indicated that females were sensitive to light ranging from 323 nm (UV) light (lowest frequency tested) to 621 nm (orange light). Sensitivity maxima occurred at 333 nm (UV) and 523 nm (green). Because of the similar daytime biting habits and species relatedness of *Ae. albopictus* and *Ae. aegypti*, visual sensitivity may be similar between these species.

Researchers also revealed that the highest ovitrap positivity on Day 1 was recorded for black color (21.8%), which on D2 and D3, in case of red color (37.5 and 26%). However, on D4, D5 and D6 highest number of positive ovitraps was recorded in orange colored (12.5, 21.9 and 31.3%, respectively) and on D7 highest numbers of positive ovitraps were recorded in transparent (21.9%), followed by green colored ovitrap (20.8%). The overall location-wise ovitraps positivity revealed that highest positivity was recorded among the ovitraps installed inside bathrooms (92.0%), followed by bedrooms (85.0%), lobby (66.7%) and stores (48.3%).[22]

Hoel et al.,[23] observed that traditionally used black ovitraps to produce superior results, same results has been observed in another study, the black colored ovitraps proved to be the fastest attracting color for ovipositing females of *Ae. albopictus* and red colored ovitrap for *Ae. aegypti* in outdoor and white coloured

ovitrap proved to be fastest attracting colour for ovipositing females *Ae. aegypti* in indoor.[24]

In conclusion, Black and Red coloured ovitraps are most prevalence for oviposition of gravid *Aedes aegypti* mosquitoes. *Aedes aegypti* and *Aedes albopictus* are the principal mosquito vectors of DF and DHF viruses in Myanmar. Till now, *Aedes* larvae control is the only option to stop dengue virus transmission through *Aedes a*dult mosquitoes. Understanding various factors that favour mosquito population abundance is paramount for implementing successful mosquito vector control programs. Our recommendation here is that, based on these findings, control tools and strategies could be possible to design and develop suitable ovitraps for the control of these mosquito vectors.

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