Global Medical and Health Communication

Online submission: https://ejournal.unisba.ac.id/index.php/gmhc
DOI: https://doi.org/10.29313/gmhc.v11i1.8322

GMHC. 2023;11(1):16–21
pISSN 2301-9123 | eISSN 2460-5441

RESEARCH ARTICLE

The Use of Ovitrap and the Female *Aedes* sp. Density in the Tamansari Vilage of Bandung City

Siti Annisa Devi Trusda,[1] Ratna Dewi Indi Astuti,[2] Cice Tresnasari[3]

[1]Department of Biochemistry, Nutrition and Biomolecular, Faculty of Medicine, Universitas Islam Bandung, Bandung, Indonesia, [2]Department of Parasitology, Faculty of Medicine, Universitas Islam Bandung, Bandung, Indonesia, [3]Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Universitas Islam Bandung, Bandung, Indonesia

Abstract

Dengue hemorrhagic fever (DHF) incidence in Indonesia, which become one of the mortality causes, is relatively high. Therefore, the government launched the mosquito nest eradication (MNE) movement with an indicator of the larva-free rate to reduce the incidence of DHF. Another effort in vector control is using ovitrap to break the life chain of dengue vectors. This study aimed to determine the effect of using ovitrap on the female *Aedes* sp. density in the Tamansari village area of Bandung city. This quantitative experimental study was conducted on 60 houses in two neighborhood associations in the Tamansari village area. Both community groups were assessed for ovitrap index and the number of eggs trapped on ovitrap filter paper before and after treatment. The treatment group consisting of 30 houses was given one ovitrap inside and one ovitrap outside the house for four weeks. Ovitrap is changed every five days. The second group is the control community. The data obtained were analyzed using the Wilcoxon and chi-square tests with a degree of confidence of 0.05. In this study, the ovitrap index of this area was found between 0.67–0.80, which indicates that this area is at high risk of DHF transmission. Statistical tests showed that the use of ovitrap did not affect female *Aedes* sp. density as assessed by the ovitrap index. The results showed that using ovitrap could not control the population of *Aedes* sp.

Keywords: *Aedes* sp., density, ovitrap, ovitrap index

Introduction

Dengue hemorrhagic fever (DHF) is still an infectious disease in Indonesia. Dengue virus, the cause, is spread through its vector: *Aedes* sp.[1–3] Efforts to reduce the incidence of DHF are to control the population of vector that spreads the disease. DHF vector population in the environment can be controlled by breaking the chain of life, mosquito nest eradication (MNE), and using insecticides. The government is promoting the MNE movement with the national target of achieving a larva-free rate of 95% in endemic areas, but in 2017 this target still needs to be achieved.[1] The use of insecticides to eliminate adult mosquitoes encounters resistance constraints; *Aedes* sp. is no longer sensitive to certain classes of insecticides.[4–11]

Other efforts in controlling dengue vectors have been widely studied recently, including ovitrap. It is a trap for female mosquitoes *Aedes* sp. to lay eggs in these places, which can break the life chain of the *Aedes* sp. at the egg stage, causing cessation of egg development into adults. Previous studies have shown that ovitrap is effective in reducing the population density of *Aedes* sp. larvae.[12,13]

Ovitrap is a black water container equipped with a stick or filter paper to trap for mosquitoes to lay eggs. The color chosen for the ovitrap is black because *Aedes aegypti* mosquitoes tend to lay their eggs in black water containers.[14,15] Wooden sticks or filter paper are absorbent media for attaching mosquito eggs, which the mother lays on the water surface. Mosquito eggs will stick to the media and can be observed further. Ovitrap is distributed, collected, inspected, and destroyed every five days so that the trapped eggs do not develop into adult mosquitoes.[12–19]

Ovitrap is commonly used in vector surveillance to detect vector density by calculating the ovitrap index. The ovitrap index was calculated by dividing the number of egg-positive ovitraps by the number of ovitraps distributed.[16–21] The ovitrap index was more sensitive than the larval index (breteau index, house index, and container index), which monitored the presence of larvae.[16,22,23]

Received: 9 August 2021; Revised: 30 April 2023; Accepted: 30 April 2023; Published: 30 April 2023

Correspondence: Siti Annisa Devi Trusda. Department of Biochemistry, Nutrition and Biomolecular, Faculty of Medicine, Universitas Islam Bandung. Jln. Tamansari No. 22, Bandung 40116, West Java, Indonesia. E-mail: nu.uing4fun@gmail.com

This study aims to determine the effect of using ovitrap on the density of female *Aedes* sp.

Methods

It was an experimental quantitative study in two community groups of neighborhood association (*rukun tetangga*, RT) in the Tamansari village area in April 2021. One community group comprising 30 adjacent houses was treated with ovitrap placement for four weeks. They were replaced every five days, and the other group consisting of 30 houses, acted as controls. The village staff recommends conducting research in certain RT areas because those were the highest incidence of dengue fever in Tamansari; previous research found that the Tamansari village has a high container and ovitrap index. Ovitrap is made from a small black bucket with walls covered with filter paper and filled with well water as high as 3 cm. Ovitrap was stored for five days, both inside and outside the participants' houses. The eggs attached to the filter paper on the ovitrap were counted to determine the number of eggs and the ovitrap index. The ovitrap index was calculated by dividing the number of positive ovitraps by the total number of ovitraps. The effect of ovitrap on female *Aedes* sp. density assessed by the ovitrap index was analyzed using the Wilcoxon and chi-square tests with a degree of confidence of 0.05. This study also conducted a survey of the presence of larvae in containers of participants' houses with the larva-free number parameter, which was the 1–container index. The container index is calculated by dividing the number of positive containers for larvae by the total number of containers inspected.

Results

The number of positive larvae containers obtained from larva surveys on clean water containers in 60 houses in RW 7, Tamansari village, Bandung Wetan sub-district, Bandung city, are listed in Table 1. The container index for all samples is 3%, and the larva-free rate is 97%. Containers that were positive for larvae were buckets of used paint in the yard, clothesline, and water tank. The larva-free rate of houses in RW 7, Tamansari village, Bandung Wetan sub-district, Bandung city, has reached the target set by the government, which is more than 95%.

Female *Aedes* sp. density was assessed from the ovitrap index, which was the number of positive ovitraps for *Aedes* sp. compared to the number of ovitraps distributed. The higher the ovitrap index, the higher the density of female mosquitoes. Although the larva-free rate of this area has reached the national target, which is above 95%, this area still needs to be free of *Aedes* sp. females. The ovitrap index of this region is between 0.67–0.80, indicating that this region is at high risk of dengue transmission. The ovitrap index in RW 07 Tamansari, Bandung city, is described in Table 2.

In this study, the number of eggs in the ovitrap

Table 1 Number of Larvae-Positive Clean Water Containers

Groups	Number of Positive Containers	Number of Containers Inspected	Container Index	Larva-free Number
Treatment	0	58	0	1
Control	3	57	0.05	0.95
Total	3	115	0.03	0.97

Table 2 Ovitrap Index

Groups	Number of Positive Ovitrap	Ovitrap Index
Treatment		
Before treatment	40	0.67
After treatment	47	0.78
Control		
Before treatment	46	0.77
After treatment	48	0.80

was calculated to monitor the number of eggs produced by female *Aedes* sp., which can describe the number of female mosquitoes roughly because the age of the mosquito also influences the number of eggs produced by females, the amount of blood sucked, and others. The average number of eggs in the treatment group before and after treatment was 53.25 and 64.83, while the average number in the control group was 62.07 and 83. In this study, there was no decrease in the number of eggs in the treatment and control groups after treatment with ovitrap. The number of eggs trapped in the ovitrap of the treatment and control groups is shown in Table 3.

The use of ovitrap for four weeks is expected to break the chain of mosquito breeding and reduce the density of female *Aedes* sp. The effect of using ovitrap was analyzed by comparing the number of positive ovitraps in the treatment and control groups (Table 4), comparing the mean number of eggs before and after treatment in the treatment and control groups (Table 5), and comparing the mean difference in the number of eggs before and after treatment in the treatment and control group (Table 6).

The statistical test results showed that the use of ovitrap did not affect female *Aedes* sp. density, assessed by the ovitrap index and number of eggs.

Table 3 The Number of Eggs of *Aedes* sp.

Groups	Number of Eggs	Average Egg Number
Treatment		
Before		
Outside	1930	64.33
Inside	1265	42.17
Total	3490	53.25
After		
Outside	2360	78.67
Inside	1530	51.00
Total	3890	64.83
Control		
Before		
Outside	2164	72.13
Inside	1560	52.00
Total	3724	62.07
After		
Outside	2910	97.00
Inside	2070	69.00
Total	4980	83.00

Table 4 Comparison of the Number of Positive Ovitraps in the Treatment and Control Groups

Groups	Before	After	p
Treatment	40	47	0.67*
Control	46	48	

Note: *chi-square test, p<0.05 significant

Discussion

The larva-free rate in RW 7, Tamansari village, Bandung Wetan sub-district, Bandung, has reached the target set by the government, which is more than 95%. According to the city government, Bandung has reached the larva-free rate, although previous research says otherwise.[24,25]

In addition, most people use buckets as a water reservoir in the bathroom as a substitute for a water tank. The bucket's volume is smaller than the water tank, so cleaning and replacing the water more frequently was easier. Because the water quality in the area is good, residents rarely have quantities of water containers inside the house. Residents rarely use water dispensers,

Table 5 Comparison of the Number of Eggs in the Treatment and Control Groups before and after Treatment

Groups	Average Number of Eggs	p
Treatment		
Before	53.25	0.342*
After	64.83	
Control		
Before	62.07	0.262*
After	83.00	

Note: *2-way Wilcoxon, p<0.05 significant

Table 6 Comparison of The Difference in The Number of Eggs Before and After Treatment in The Treatment and Control Groups

Groups	Mean of Difference	p
Treatment	−11.58	0.548*
Control	−20.93	

Note: *2-way Wilcoxon, p<0.05 significant

which contain a reservoir for spilled water, often used by mosquitoes to lay eggs.

The area of RW 07 in the Tamansari village is densely populated. Items that can be used as water reservoirs, such as garbage in the yard, and drinking places for birds or other animals, are rarely found in this environment because the houses are tiny, and the yards are narrow or do not exist. The bird's drinking water reservoir can become a nest for mosquitoes.

This area has reached the national larva-free rate target, above 95%, but is not yet free of female *Aedes* sp. Installation of ovitrap in this area still shows the presence of female *Aedes* sp. with ovitrap index ranging from 0.67–0.80. The ovitrap index in RW 07 showed a high risk of DHF transmission because the ovitrap index in this area exceeds the transmission threshold of 0.1.[26] According to the Hong Kong government, the ovitrap index exceeding 0.2 requires additional eradication of mosquito nets, administration of larvicides, and spraying insecticides to reduce the risk of DHF transmission.[27]

The high ovitrap index with a low container index in this area is due to the sensitivity of the ovitrap index being higher than the larva index, such as the container index in detecting the presence and density of *Aedes* sp.[16,22,23] The low container index in people's houses and the high ovitrap index indicate that the mosquito nests are not inside people's houses. Mosquito nets can be outside people's houses, such as plastic waste logged with water, gutters, and water containers in public places such as public buildings, mosques, and schools.[28,29] *Aedes* sp. can fly approximately 50–100 meters so that if a mosquito nest is found, then within that radius, the residents' houses are threatened with DHF transmission even though the environment is clean.[26,30,31] This shows the importance of caring for the environment outside our homes, reminding neighbors to eradicate mosquito nests, and being concerned about cleaning garbage or containers holding water on roads, in vacant houses, or in public places beside concern about eradicating mosquito's nests in our home.

In this study, we assessed the use of ovitrap to control the population of *Aedes* sp. Unfortunately, the result said that the use of ovitrap did not affect the density of female *Aedes* sp.—mosquitoes, which were assessed by the ovitrap index and number of eggs. Previous studies found that ovitrap can reduce the container, house, and breed indexes.[12,13] The treatment of the study by storing ovitrap for a while in people's houses can also make residents more disciplined in eradicating mosquito nests at home, thereby reducing the container, house, and breed index.

The ineffectiveness of ovitrap in breaking the life chain of mosquitoes to reduce mosquito density, which was assessed by the ovitrap index, could be because there are still many mosquito nests besides ovitrap. The mosquito population in the area does not change much by destroying eggs on ovitraps. The ineffectiveness of ovitrap in controlling mosquito population growth in this study can be caused by the short research time, namely four weeks, which can only observe one mosquito life cycle. No method is good enough to control the population of *Aedes* sp. mosquitoes. Therefore, further research to control this mosquito population needs to be done.

The ineffectiveness of breaking the chain using ovitrap on mosquito density assessed by the ovitrap index parameter can be caused by the large number of mosquito nests in the area, which only slightly changes the mosquito population. The use of ovitrap to control mosquito population growth has yet to be observed in this study because the research time is short, i.e., four weeks which can only observe one mosquito life cycle.

Conclusions

Using ovitrap does not affect the female *Aedes* sp. density assessed by the ovitrap index. The best method for controlling the mosquito population has yet to be determined. Therefore, further research is needed.

Conflict of Interest

None declared.

Acknowledgment

We want to thank the Lembaga Penelitian dan Pengabdian kepada Masyarakat (LPPM) Universitas Islam Bandung for the grant funding of this research.

References

1. Pusat Data dan Informasi, Kementerian Kesehatan Republik Indonesia. Situasi penyakit demam berdarah di Indonesia

tahun 2017 [Intenet]. Jakarta: Kementerian Kesehatan Republik Indonesia; 2018 [cited 2020 December 28]. Available from: https://www.kemkes.go.id/article/view/19011500007/situasi-penyakit-demam-berdarah-di-indonesia-tahun-2017.html.
2. Pusat Data dan Surveilans Epidemiologi, Kementerian Kesehatan Republik Indonesia. Demam berdarah dengue di Indonesia tahun 1968–2009. Bul Jendela Epidemiol. 2010;2:1–14.
3. Bhatia R, Dash AP, Sunyoto T. Changing epidemiology of dengue in South-East Asia. WHO South East Asia J Public Health. 2013;2(1):23–7.
4. Astuti RDI, Ismawati, Hanum L. The resistance of *Aedes aegypti* to permethrin 0.25% insecticide, malathion 0.8%, and transfluthrine 25% in the Universitas Islam Bandung Tamansari campus. GMHC. 2019;7(3):213–7.
5. Kasai S, Komagata O, Itokawa K, Shono T, Ng LC, Kobayashi M, et al. Mechanisms of pyrethroid resistance in the dengue mosquito vector, *Aedes aegypti*: target site insensitivity, penetration, and metabolism. PLoS Negl Trop Dis. 2014;8(6):e2948.
6. Melo-Santos MA, Varjal-Melo JJ, Araújo AP, Gomes TC, Paiva MH, Regis LN, et al. Resistance to the organophosphate temephos: mechanisms, evolution and reversion in an *Aedes aegypti* laboratory strain from Brazil. Acta Trop. 2010;113(2):180–9.
7. Stenhouse SA, Plernsub S, Yanola J, Lumjuan N, Dantrakool A, Choochote W, et al. Detection of the V1016G mutation in the voltage-gated sodium channel gene of *Aedes aegypti* (Diptera: Culicidae) by allele-specific PCR assay, and its distribution and effect on deltamethrin resistance in Thailand. Parasit Vectors. 2013;6(1):253.
8. McAllister JC, Godsey MS, Scott ML. Pyrethroid resistance in *Aedes aegypti* and *Aedes albopictus* from Port-au-Prince, Haiti. J Vector Ecol. 2012;37(2):325–32.
9. Lidia K, Levina E, Setianingrum S. Deteksi dini resistensi nyamuk *Aedes albopictus* terhadap insektisida organofosfat di daerah endemis demam berdarah dengue di Palu (Sulawesi Tengah). MKM. 2008;3(2):105–10.
10. Sunaryo, Ikawati B, Rahmawati, Widiastuti D. Status resistensi vektor demam berdarah dengue (*Aedes aegypti*) terhadap malathion 0,8% dan permethrin 0,25% di Provinsi Jawa Tengah. J Ekol Kesehat. 2014;13(2):146–52.
11. Widiarti, Heriyanto B, Boewono DT, Widyastuti U, Mujiono, Lasmiati, et al. Peta resistensi vektor demam berdarah dengue *Aedes aegypti* terhadap insektisida kelompok organofosfat, karbamat, dan pyrethroid di propinsi Jawa Tengah dan Daerah Istimewa Yogyakarta. Bul Penelit Kesehat. 2011;39(4):176–89.
12. Zuhriyah L, Baskoro TST, Kusnanto H. Efektifitas modifikasi ovitrap model Kepanjen untuk menurunkan angka kepadatan larva *Aedes aegypti* di Malang. JKB. 2016;29(2):157–64.
13. Rahayuningsih, Suryono, Haryanti T. Efektifitas pemasangan ovitrap dalam menurunkan indeks entomologi (container index dan breteau index) di Desa Karangasem wilayah kerja Puskesmas Bulu Kabupaten Sukoharjo. Jurnal Ilmu Kesehatan Masyarakat Berkala. 2019;1(1):49–53.
14. Hoel DF, Obenauer PJ, Clark M, Smith R, Hughes TH, Larson RT, et al. Efficacy of ovitrap colors and patterns for attracting *Aedes albopictus* at suburban field sites in north-central Florida. J Am Mosq Control Assoc. 2011;27(3):245–51.
15. Marin G, Mahiba B, Arivoli S, Tennyson S. Does color of ovitrap influence the ovipositional preference of *Aedes aegypti* Linnaeus 1762 (Diptera: Culicidae). IJMR. 2020;7(2):11–5.
16. Hasnan A, Dom NC, Rosly H, Tiong CS. Quantifying the distribution and abundance of Aedes mosquitoes in dengue risk areas in Shah Alam, Selangor. Procedia Soc Behav Sci. 2016;234:154–63.
17. De Las Llagas LA, Tyagi BK, Bersales LGS. Aedes dengue vector ovitrap surveillance system: a framework for mosquito density prediction. Southeast Asian J Trop Med Public Health. 2016;47(4):712–8.
18. Farida A, Ahmad AH, Hadi UK, Hambal M, Fahrimal Y, Shafitri R. Ovitrap use in an epidemiology study of *Aedes aegypti* and *Aedes albopictus* in Kuta Alam sub-district Banda Aceh Indonesia. Proc Ann Int Conf Syah Kuala University. 2011;1(1):213–6.
19. Hidayati L, Hadi UK, Soviana S. Pemanfaatan ovitrap dalam pengukuran populasi *Aedes*

sp. dan penentuan kondisi rumah. JEI. 2017;14(3):126–34.
20. Astuti RDI, Ismawati, Siswanti LH, Suhartini A. Sebaran vektor penyakit demam berdarah (*Aedes aegypti*) di kampus Universitas Islam Bandung. GMHC. 2016;4(2):82–6.
21. Arifin F, Astuti RDI, Hikmawati D. Hubungan profil rumah terhadap keberadaan nyamuk dewasa *Aedes aegypti* di RW 13, 14, dan 20 Kelurahan Tamansari Kota Bandung. Pros Pendidik Dr. 2016;2(1):1019–26.
22. Nascimento KLC, da Silva JFM, Zequi JAC, Lopes J. Comparison between larval survey index and positive ovitrap index in the evaluation of populations of *Aedes* (Stegomyia) *aegypti* (Linnaeus, 1762) North of Paraná, Brazil. Environ Health Insights. 2020;14:1178630219886570.
23. Codeço CT, Lima AWS, Araújo SC, Lima JBP, Maciel-de-Freitas R, Honório NA, et al. Surveillance of *Aedes aegypti*: comparison of house index with four alternative traps. PLoS Negl Trop Dis. 2015;9(2):e0003475.
24. Respati T, Feriandi Y. Breeding places of mosquito larvae and pupae in Bandung city. J Phys Conf Ser. 2020;1469:012119.
25. Kementerian Kesehatan Republik Indonesia. Kendalikan DBD dengan PSN 3M Plus [Internet]. Jakarta: Kementerian Kesehatan Republik Indonesia; 2016 February 7 [cited 2021 July 1]. Available from: https://www.kemkes.go.id/article/view/16020900002/kendalikan-dbd-dengan-psn-3m-plus.html.
26. Nirmani MD, Perera KLNS, Galhena GH. Use of ovitrap surveillance to assess dengue outbreak risks in selected dengue endemic areas in Sri Lanka. SLJB. 2019;4(2):32–46.
27. Food and Environmental Hygiene Department, The Government of the Hong Kong Special Administrative Region. Dengue fever gravidtrap index update [Internet]. Hongkong: Food and Environmental Hygiene Department; 2021 [cited 2021 July 1]. Available from: https://www.fehd.gov.hk/english/pestcontrol/dengue_fever/ovitrap_index.html.
28. Ming LS, Adnan TH, Huck OC, Ibrahim M, Husin D, Abdullah NA, et al. Adult Aedes mosquito and dengue virus surveillance in residential and public areas of Selangor, Malaysia. Southeast Asian J Trop Med Public Health. 2018;49(4):553–65.
29. Gustave J, Fouque F, Cassadou S, Leon L, Anicet G, Ramdini C, et al. The increasing role of roof gutters as *Aedes aegypti* (Diptera: Culicidae) breeding sites in Guadeloupe (French West Indies) and consequences on dengue transmission and vector control. J Trop Med. 2012;2012:249524.
30. Greenberg JA, DiMenna MA, Hanelt B, Hofkin BV. Analysis of post-blood meal flight distances in mosquitoes utilizing zoo animal blood meals. J Vector Ecol. 2012;37(1):83–9.
31. Brown HE, Cox J, Comrie AC, Barrera R. Habitat and density of oviposition opportunity influences *Aedes aegypti* (Diptera: Culicidae) flight distance. J Med Entomol. 2017;54(5):1385–9.