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Using Various Types of *Lethal Ovitrap* to Control *Aedes sp* in Endemic Dengue Hemorrhagic Fever (DHF)

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ABSTRACT

Introduction: *Dengue Hemorrhagic Fever (DHF) every year always strikes all districts in Indonesia which frequently becomes an extraordinary occurrence. The vector control conducted yet has not yielded optimal results.*

Objective: *One of Aedes sp control methods without insecticides is using egg traps (lethal ovitrap). The purpose of this study was to determine the effectiveness of lethal ovitrap in controlling the dengue vector (Aedes sp)*

Methods: *This research is an experiment in the field in the district of Banyumas, Central Java, Indonesia. The study was conducted at the home of DHF patients in endemic areas by placing lethal ovitraps on 108 homes studied and data were analyzed by using analysis of variance.*

Result: *The results of this study indicated that the number of Aedes sp (egg, larva, pupa, adult) trapped in the can lethal ovitrap using attractants hay infusion were 638 (19%), the lethal ovitrap plastic glass were 1.646 (50%) and the lethal ovitrap bamboo cuts were 1.037 (31%). Anova test results show the value of p (sig.) was 0.404 > 0.05 indicating the acceptance of Ho accepted meaning there is no difference in the number of Aedes sp trapped in various types of lethal ovitrap. However descriptively, lethal ovitrap plastic cups with hay infusion attractants are the most effective for trapping Aedes sp Mosquitoes.*

Conclusion: *The lethal ovitrap plastic cup with hay infusion attractant can be applied together with other Mosquitos Nest Elimination program done routinely with the cadres to reduce the number of Aedes sp and installation of the ovitrap can be carried out simultaneously in dengue endemic areas. Lethal ovitrap can be ovistripped with white color on top of it as medium for mosquitoes lay their eggs and to make easier to count the number of eggs.*

Keywords: *Lethal ovitrap, Aedes sp' Dengue Hemorrhagic Fever (DHF), Mosquitos Nest Elimination.*

Introduction

One of Aedes aegypti control methods without insecticide them is Ovitrap. This equipment used to detect the presence of Aedes aegypti mosquitoes has successfully decreased the vector density in some countries including in Singapore. Ovitrap is used to detect mosquito manifestations to new areas that have previously been eradicated. This tool was developed by Fay and Eliason in 1966 and disseminated by Centers for Disease Control and Prevention (Sayono et al, 2010).

Attractant -based ovitrap will attract the attention of Aedes sp mosquitoes to lay eggs on the ovitrap so that the mosquitoes are expected not to lay eggs

elsewhere. After the mosquitoes lay eggs on the ovitrap, then the mosquito eggs can be destroyed. Thus, the activity is one of the controls of Aedes sp mosquitoes especially the eggs.

The use of attractant like hay diffusion in the ovitrap proved to attract mosquitoes to lay their eggs (Arif Widyanto, 2015). The other types of ovitrap material used are cans of milk or plastic cup and also a natural ovitrap like bamboo cuts (Director General of PPM and PLP MOHRI, 1992).

The government of Banyumas regency of Central Java has determined the extraordinary incidence of dengue hemorrhagic fever (DHF) in 2016 as the number of casualties is reported to increase to seven people resulting from the increased transmission of dengue fever transmitted by Aedes aegypti mosquitoes.

The incidence of DHF in Banyumas Regency is still quite high based on data from Banyumas District Health Office from 2010-2015. The incidence of DHF in 2010 was 696 cases (7 deaths) with Incidence Rate (IR) of 42.6 / 100,000 and Case Fatality Rate (CFR) of 1.01%. In 2011 as many as 201 cases (3 people died) with IR of 12.31 / 100.000 and CFR of 1.49%. In 2012 a decrease was recorded with 200 cases (4 deaths) with IR of 11.78 / 100.000 and CFR of 2.01%. In 2013, there were 543 cases (4 deaths) with IR of 32.14 / 100,000 and CFR of 0.74%. In 2014, dengue cases were decreased by 209 cases (4 deaths) with IR of 12.89 / 100.000 and CFR of 1.91%. However, DHF cases have increased again in 2015 with 231 cases (1 person died) until October 2015 with IR of 14.14 / 100.000 and CFR of 0.43%.

In 2016, dengue cases have increased in some areas of health community center in Purwokerto. The highest case is in the area of health community center I Purwokerto Timur. Based on data from Puskesmas I of Purwokerto Timur, dengue fever cases from January to October 2016 were 65 cases with details in Mersi urban village 33 cases, Arcawinangun urban village 20 cases, and Purwokerto Wetan village 12 cases. Considering the most cases was in Mersi Village, it is necessary to research about the use of lethal ovitrap in catching Aedes sp mosquitoes in Mersi Village, East Purwokerto District, Banyumas Regency. The research question is: which type of lethal ovitrap is the most effective in catching Aedes sp mosquitoes among the types of lethal ovitrap made from cans, plastic cups or bamboo cuts?

Materials and Methods

The type of research used is a quasi-experiment with one group design only with Post Test Measurement.

X ----- O

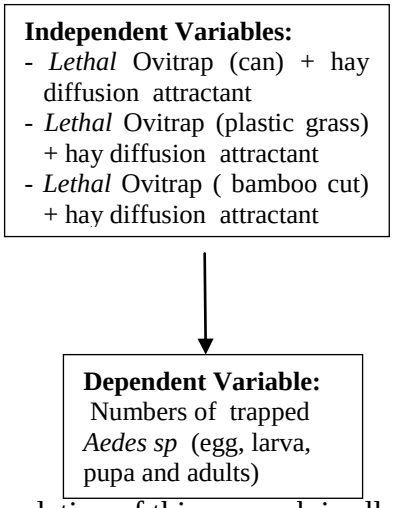
where

X = treatment

O = observation / measurement

The research was conducted in Mersi sub-district of Purwokerto Timur Community Health Center with 36 cases of DHF. The study time from the preparatory stage to completion was conducted from August to November 2016. The research framework is as follows:

Figure Theoretical Framework



The population of this research is all of the dengue sufferers in Banyumas Regency in 2016 with the sample is dengue fever sufferers' houses located in Mersi Village, East Purwokerto District, Banyumas Regency. The total number of houses studied was 108 where installation of lethal ovitraps was placed inside respondents' houses.

After data collected, data analysis was performed by using ANOVA statistical analysis.

The hypothesis of this study is the alternative hypothesis (Ha) that is there are differences in the number of Aedes sp trapped in various types of Lethal Ovitrap.

Results and Discussions

Environmental Condition

Environmental conditions under observation include temperature and humidity. The temperatures at the study site averaged 30 degrees Celsius, while humidity was 71%, with the distance between homes was about 9 meters. Temperature measurements were conducted simultaneously in 108 respondent houses. The average measurement of 108 home respondents examined was 30 °C. The speed of mosquito development depends on the speed of metabolic processes that are partially influenced by temperature. The growth of mosquitoes will stop completely if the temperature is less than 10 °C and more than 40 °C. The optimum average temperature for the development of mosquitoes is 25° to 27°C. (DIT.JEN.PP & PL, 2007a)

The temperature conditions at the study sites allow mosquitoes to thrive due to the influence of temperature that also makes mosquito development in the larval phase faster. The influence of sunlight makes the temperature at the site ideal for mosquito larvae to accelerate the process of skin change or molting making in the study there found pupa already within one week including adult mosquitos.

Air humidity is the amount of moisture content in the air usually expressed in percent (%). If in the air there is a large water shortage, then this air has a large evaporation power. The breathing system in mosquitoes is a spiracle. The existence of an open spiracle without any regulatory mechanism where during low humidity will cause the evaporation of water from within the body of the mosquito that can lead to the drying of fluid in mosquitoes' bodies. One of the enemies of mosquitoes is evaporation. If humidity is less than 60% the mosquito life will be shorter so it is not enough time for the parasitic growth cycle inside the mosquito's body (DIT.JEN.PP & PL, 2007b).

Measurement of the distance of the houses of non-patient respondent's with the patient who has done by the researcher assisted by cadres and field assistants obtained the average distance was as far as 9 meters. The distance of the house affects the spread of mosquitoes from one house to another. The closer the distance between houses the easier the mosquitoes spread to the next house. The construction of the house, the color of the walls and the arrangement of the goods inside the house make the house favored or not by mosquitoes.

Aegypti is a mosquito that its activity is around the settlement and able to fly as far as ± 100 meters from the place of breeding. It is closely related to the existence of humans and animals that act as a source of food. The direction of the adult mosquito flying speed depends on eye stimulation. Stimulation of mosquitoes' eyes guided by odor, saturated air, the temperature will strengthen the feelings of mosquitoes. Factors affecting mosquito activity are temperature, but carbon dioxide can affect activity, orientation, and speed of mosquito motion (Lila Kesuma Hairani, 2009).

The Numbers of Aedes sp Trapped in Can Lethal Ovitrap

The total number of houses of respondents installed lethal ovitrap is 108 houses for 1-week installation then the number of mosquito eggs, larvae/larvae of mosquitoes, pupa, adult mosquitoes were counted. Ovitrap materials used were 3 (three) types: cans, plastic cups, and bamboos that have been painted black and installed in the respondents' home sheltered from the sun where the lethal ovitrap material was given gauze and attractant in the form of hay diffusion.

The observation of lethal ovitrap mounted on can lethal ovitrap can be seen in the following figure:

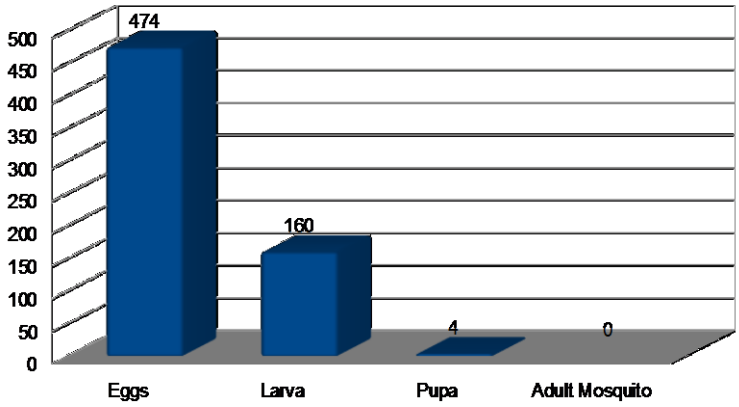


Figure 1. Number of Mosquitoes (Egg, Larva, Pupa, Adult Mosquito) on Can Lethal Ovitrap

A number of Aedes sp Mosquitoes (Eggs, Larva, Pupa, Adult) after 1 week of can lethal ovitrap installation in 108 respondent homes obtained result total of 638 with the highest number was in egg phase = 474, larva = 160 and pupa = 4. The egg phase was the most because ovitrap installation had been done for 1 week, so the development of mosquito had not reached adult mosquito phase. This is closely related to the life cycle of Aedes sp mosquitoes from egg to adult phase that reaches about 9-10 days.

The Numbers of Aedes sp Trapped in Plastic Cups Lethal Ovitrap

The number of mosquito eggs trapped in lethal ovitrap plastic cups can be seen in the picture below:

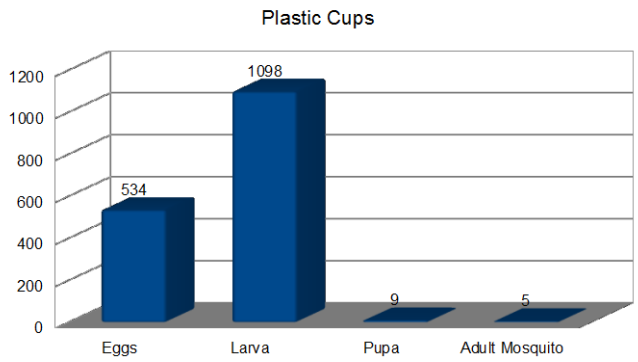


Figure 2. Number of Mosquitoes (Egg, Larva, Pupa, Adult Mosquito) on Plastic Cup Lethal Ovitrap

The number of Aedes sp mosquito eggs trapped in plastic cup lethal ovitrap is 534, larva = 1, 098, pupa = 9 and there had been found 5 adult mosquitoes. The number of Aedes sp mosquitoes in this lethal ovitrap is the most compared to others lethal ovitrap with the total number of Aedes sp mosquitoes (eggs, larvae, pupa, mosquitoes) is 1.646.

The rapid development phase of mosquitoes that after a week's installation had already produced adult mosquitoes could be influenced by physical environmental factors supporting the development of mosquitoes. The supporting physical environment was temperature and sunlight. Sunlight made the temperature around the ovitrap ideal for the development of mosquitoes in the process of molting (change the skin) in instar larvae phase, thus accelerating the process of mosquitoes development.

The Numbers of Aedes sp Trapped in Bamboo Cut Lethal Ovitrap

The number of mosquito eggs trapped in bamboo cut lethal ovitrap can be seen in the following figure:

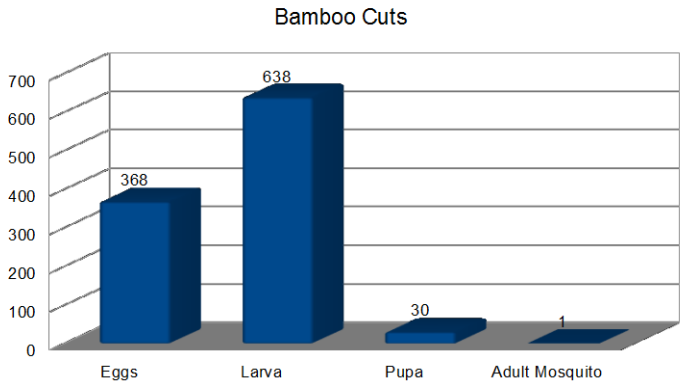


Figure 3. Number of Mosquitoes (Eggs, Larva, Pupa, Adult Mosquito) on Bamboo Cuts Lethal ovitrap

The figure indicated that Aedes sp mosquito eggs trapped in bamboo cut lethal ovitrap is 368, larva = 638, pupa = 30 and there had been found only 1 adult mosquitoes. The number of Aedes sp mosquitoes in this lethal ovitrap is the second largest compared to others lethal ovitrap with the total number of Aedes sp mosquitoes (eggs, larvae, pupa, mosquitoes) is 1,037.

The Most Effective Lethal Ovitrap

The number of mosquitoes (eggs, larvae, pupa and adult mosquitoes) obtained from each type of lethal ovitrap (cans, plastic cups, and bamboo cuts) can be seen in the following table:

Table 1. Number of mosquitoes caught by types of lethal ovitrap

No	Ovitrap Materials	Number of Mosquito	Percentage (%)
1	Cans	638	19
2	Plastic Cups	1,646	50
3	Bamboo	1,037	31
Total		3,321	100

As indicated in Table 1, the number of mosquitoes (eggs, larvae, pupae and adult mosquitoes) obtained from each type of lethal ovitrap installed, plastic cups were the most effective with the number of mosquitoes trapped = 1,646 (50%), second with bamboo = 1,037 (31%) and the last was with cans with the number of 638 (19%).

The result of statistical analysis by using ANOVA test indicated p-value (sig.) = 0.40 > 0.05 indicating the Ho acceptance that there is no significant difference in number of Aedes sp trapped in various types of Lethal Ovitrap.

Various types of lethal ovitrap materials (used cans, plastic cups and bamboo cuts) proved not to affect the preference of Aedes sp mosquitoes to lay. This shows that mosquitoes do not care about the type of containers that exist but if there are containers containing water or puddles then mosquitoes will lay eggs directly. The number of mosquitoes obtained in this study is closely related to the type of attractant used mainly the hay diffusion.

The result of research of Ratna Pramurditya (2016) shows that there is no significant influence of the type of ovitrap material used i.e cans, plastic cups and coconut shell with the number of Aedes sp's eggs, but there is a significant influence on the type of attractant used i.e 20% hay diffusion, 20% sugar water, 20% well water with the number of mosquito eggs obtained. The most preferred type of attractants for mosquito was 20% concentration of hay diffusion.

The hay diffusion water can be considered as an oviposition attractant. A substance is considered as attractant and stimulant oviposition if it causes the female mosquito moves actively toward the source of the substance and is driven to lay eggs there. Other studies using the olfactometer proved that Ae. Aegypti was not interested in volatile chemical components released by the soaking of straw which was caught by the senses of mosquitoes from far away. Volatile compounds were derived from the decomposition of organic substances that occur in facultative and anaerobic conditions by microorganisms. Increased oviposition of Ae. Aegypti is known to be derived from non-volatile chemical content contained on the surface of the water of hay diffusion. When touched by the sensory chemotactic organs of mosquitoes, these chemicals further stimulated mosquitoes to spawn, rather than the odor that attracted mosquitoes from afar. Chemical content possibly came from the activity of microorganisms during the fermentation process. Organic immersion attractiveness was influenced by the growth of bacteria in the immersion which also increased the production of secondary metabolites. (Milana Salim and Tri Baskoro Tunggul Satoto, 2015).

Conclusion

The result of analysis using ANOVA test shows the value of p-value (sig.) 0.404 > 0.05 indicating that in our research there is no difference of a number of Aedes sp trapped in various types of Lethal Ovitrap either made of cans, plastic cups of bamboos. However, descriptively, our simple method indicates that lethal ovitrap plastic cups with hay diffusion as attractant proves to be the most effective in trapping Aedes sp. Mosquito.

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