Laporan Hasil Penelitian

COMPARING EFFECTIVENESS OF HAY INFUSION AND SUGAR FERMENTATION SOLUTION AS OVITRAP'S ATTRACTANTS TO AEDES AEGYPTI

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Submitted : Januari 2018 | Accepted : Mei 2018 | Published : Juli 2018

ABSTRACT

Dengue Hemorrhagic Fever (DHF) is still one of the major public health problems in the world and Indonesia. There are several methods of mosquito vector control, one of them is the use of ovitrap and the addition of attractants which is a compound that may attract gravid mosquitoes to lay eggs. Some examples of attractants are hay infusion and sugar fermentation solution. This research aimed to compare the effectiveness of hay infusion and sugar fermentation solution as *Aedes aegypti* attractants. This research type was a true experimental laboratory with a complete randomized design which is divided into three groups of ovitrap containing aquades as control, 20% hay infusion and 20% sugar fermentation solution. Ovitraps with those attractants were put into a mosquito coop containing 25 gravid female mosquitoes. Mosquito's eggs counting was done after two days with nine times repetition. The data were then analyzed using Kruskal-Wallis and Mann-Whitney test. The difference of mosquito's eggs number in the ovitrap containing the fermentation solution of sugar and hay infusion had a significance value of 0.000 (p> 0,05). It means that hay infusion is more effective compared to sugar fermentation.

Keywords : DHF, ovitrap, attractant, hay infusion, sugar fermentation solution
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ABSTRAK

Penyakit Demam Berdarah Dengue (DBD) masih merupakan salah satu masalah kesehatan masyarakat yang utama di dunia dan Indonesia. Terdapat beberapa metode pengendalian vektor nyamuk, salah satunya adalah dengan pemanfaatan ovitrap dan penambahan zat atraktan yang merupakan media atau bahan yang dapat menarik nyamuk betina gravid untuk bertelur. Beberapa contoh atraktan adalah air rendaman jerami dan larutan fermentasi gula. Tujuan penelitian ini adalah untuk mengetahui perbandingan efektivitas air rendaman jerami dan larutan fermentasi gula sebagai atraktan nyamuk *Aedes aegypti*. Jenis penelitian yang digunakan adalah *true experimental laboratories* dengan rancangan acak lengkap yang terbagi menjadi tiga kelompok ovitrap yang berisi kontrol berupa aquades, air rendaman jerami 20% dan larutan fermentasi gula. Ketiga media tersebut dimasukkan ke dalam satu kandang nyamuk yang berisi 25 ekor nyamuk betina gravid. Penghitungan telur nyamuk dilakukan setelah dua hari dengan pengulangan sebanyak sembilan kali. Data kemudian

dianalisis menggunakan uji *Kruskal-Wallis* dan uji lanjut *Mann-Whitney* dan didapatkan hasil bahwa perbedaan jumlah telur nyamuk pada ovitrap berisi larutan fermentasi gula dan air rendaman jerami memiliki nilai signifikansi sebesar 0,000 (p > 0,05). Hal ini berarti air rendaman jerami merupakan atraktan yang lebih efektif dibandingkan dengan larutan fermentasi gula.

Kata kunci **:** DBD, ovitrap, atraktan, air rendaman jerami, larutan fermentasi gula
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PENDAHULUAN / INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is still one of the major public health problems in the world and Indonesia. Data from around the world shows Asia ranks first in the number of DHF patients each year. Meanwhile, from 1968 to 2009, the World Health Organization (WHO) noted Indonesia as the country with the highest dengue fever case in Southeast Asia (Depkes RI, 2010). According to a report from Section P2 Health Department of Jember District, dengue fever case from year to year tends to fluctuate. The area with the highest number of Dengue Hemorrhagic Fever cases in Jember is Puskesmas Puger, Kaliwates, and Sumbersari where those areas are the region with high population and mobility, thus facilitating the spread and transmission of Dengue Hemorrhagic Fever in the community (Nurdian and Lelono, 2007).

There are several methods of mosquito vector control, either chemically or naturally. Various preventive methods such as the movement of Jum'at clean and counseling that regularly conducted in the area of Jember Regency proved not effective in reducing the *Aedes aegypti's* larva index (Nurdian, 2003; Nurdian and Lelono, 2008). Also, larvacides and insecticides have been used to kill adult larvae and mosquitoes, but the active ingredients or synthetic chemical compounds used as insecticides will cause resistance to mosquitoes due to frequent exposure or misuse in their applications. Therefore, one of the innovations of controlling the dengue vector which is widely developed is by utilization of ovitrap (Astuti, 2008). Modification of ovitrap by adding an attractant substance has been shown to increase the number of trapped eggs (Polson et al., 2002).

The attractant is a mosquito repellent to come to a place. Some research indicates that the use of oviposition attractant shows a good enough prospect for monitoring dengue vector density. Among the several types of plants that have been tested and showed significant results as an attractant is the hay infusion. In previous research, hay infusion proved more influential on female mosquito oviposition and had better Egg Density Index (EDI) compared to other attractants (Nurdian and Lelono, 2010). Another attractant that has been studied is a solution of sugar fermentation. A sugar fermentation solution is known to produce a CO_2 substance that can attract sensory responses from *Aedes aegypti* mosquitoes (Supreme et al., 2015). Based on that, the author is interested to compare the effectiveness of hay infusion and sugar fermentation solution as ovitrap's attractants to *Aedes aegypti.*

METODE PENELITIAN / METHODS

The type of this research is laboratory experimental with a complete randomized

design that was done in Zoology Laboratory Faculty of Mathematics and Natural (FMIPA) of Jember University. This research used three treatments, which is aquades as control, water of 20% hay infusion and sugar fermentation solution as the attractant of *Aedes aegypti* mosquito. The water of the hay infusion is made from 2 kilograms of hay that soaked in 10 liters of water in a bucket, closed and left for seven days. While the sugar fermentation solution is made by mixing 40 grams of white sugar in 200 milliliters of hot water, afterward, the mixture is poured into the ovitrap and sprinkled with 1 gram of bread yeast evenly. The three media were put into a mosquito coop containing 25 female mosquitoes obtained from mosquito colonization at Zoology Laboratory of FMIPA Universitas Jember. The egg counting was done after two days using a counter with nine times repetition.

Data were analyzed using computerized SPSS 16 software. Before the statistical test, the data normality was tested using Shapiro Wilk test because the total sample size is less than ≤50. The result of Shapiro Wilk test showed that the data was not normally distributed. Because the data were not normally distributed, Kruskal-Wallis test was chosen to determine whether there are differences in the number of eggs between groups. After that, Mann-Whitney test was performed to determine which groups had significant differences.

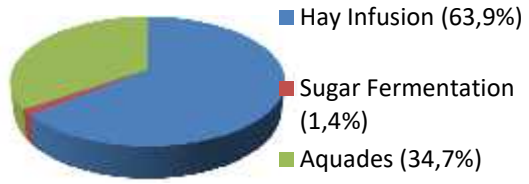
RESULTS

After 24 hours of treatment, there were several eggs attached to the ovitrap, but the calculation was done on the second day after treatment to avoid undisturbed oviposition process. Based on the calculation results there were a total of 2222 eggs. The highest number of eggs was found in the ovitrap containing the hay infusion as much as 1419 eggs or equal to 63.9%, while the sugar fermentation solution as much as 31 eggs or equivalent 1.4% and control has 772 eggs or equal to 34.7% of the total number of eggs. The number of trapped mosquito eggs in each ovitrap group contains aquades, sugar fermentation, and hay infusion with nine times repetition shown in Graphic 1, while for the mean and standard deviation of each group shown in Table 1.

TABEL 1. The mean and standard deviation of the mosquito eggs trapped on the filter paper of each ovitrap

Media	Number of Eggs	Mean ± Deviation Std.
Aquades	772	85,78 ± 70,48
Sugar Fermentation	31	3,4 ± 7,8
Hay Infusion	1419	157,67 ± 128,43

Total Eggs Distribution



Gambar 1. The number of mosquito eggs trapped on the filter paper of each ovitrap

Because the data were not normally distributed, Kruskal-Wallis test was used to determine whether there are differences in the number of eggs between groups. In the Kruskal-Wallis test obtained p results is 0.01. The Kruskal-Wallis test showed that there were differences in the number of eggs trapped in at least one pair of ovitrap containing the aquades as controls, sugar fermentation solution, and hay infusion. The data were then analyzed using the Mann-Whitney test to find out which of the ovitrap group pairs had significant differences. Based on Mann-Whitney test result, a difference of mosquito egg number on ovitrap containing aquades and fermentation solution has a p-value <0,05, that is 0,005. This means that the fermentation

solution of sugar and aquades has a significant difference in the number of eggs with more eggs in the aquades. The second Mann-Whitney test performed showed the difference of the number of mosquito eggs in the ovitrap containing aquades and the hay infusion had a p-value of 0.200 (p> 0.05), this means that there was a less significant difference between the aquades and hay infusion attractiveness. Mann-Whitney test results between hay infusion and sugar fermentation solution showed the difference of the number of mosquito eggs has a significance value of 0.000 (p> 0.05). This means that hay infusion and sugar fermentation has a significant difference in the number of eggs.

DISCUSSION

The results of this study showed that the attractiveness of the sugar fermentation solution was less than the control. The results of this study contradict the research of Astuti and Nusa (2011) showing the result that a 40 and 50 grams sugar solution with the addition of yeast as much as 1 gram is more effective to attract the arrival of mosquitoes into the ovitrap. The solution with 40-gram sugar and the yeast is thought to have potential as an attractant of the fermentation reaction results in the form of CO_2 gas. The difference number of mosquitoes in the ovitrap is suspected because of the difference in the amount of CO_2 gas produced by each treatment. The production of ethanol and CO_2 can be obtained from sugar by an anaerobic fermentation process of the *Saccharomyces cerevisiae* yeast activities. The process of sugar fermentation occurs after a sugar solution in 200 ml of water was added to yeast as per application concentration. The ineffectiveness of the sugar fermentation solution in this study can be influenced by various factors. One of them can be caused by the degradation of attractant compounds so that the active substance molecules that make up the odor-odor complex in this attractant are decreased, and the mosquito's brain does not recognize them as attractants. Also, in some studies referred, the calculated variable is not the number of mosquito eggs, but the number of mosquitoes in the ovitrap. During the research process, the authors observed that the number of mosquitoes that settle and die on the ovitrap contains sugar fermentation was more than the other two ovitrap. This is probably due to the production of ethanol and CO_2 obtained from sugar by an anaerobic fermentation process that can cause mosquitoes trapped and die before laying eggs so that the number of trapped eggs at the fermentation plant of sugar is much less than the others. *Aedes aegypti* mosquito is also known to like a clean spot, one of them is a fairly clear water like aquades (Rahayu et al., 2015).

Based on previous research, the hay infusion has the potential to attract gravid female mosquitoes to lay eggs on the ovitrap. This happens because the infusion of hay undergoes metabolic processes that produce substances in the form of ammonia and CO_2. The results of statistical tests in this study indicate that although the number of trapped eggs in the ovitrap of hay infusion and controls is quite different, it has not shown significant results. This can be affected by the distribution of data is quite extreme, where in each repetition the number of eggs trapped on ovistrip has an extreme distance of number. That extreme number's distance data can be influenced by several factors, such as temperature stability and humidity of the room. Temperature and humidity will affect the gonotrophic cycle of mosquitoes, i.e. the time for female to take eggs mosquitoes to grow and mature (Marzuki, 2005).

Based on the number of eggs and the statistical test, it can be concluded that the attractiveness of water hay infusion proved more effective when compared with the sugar fermentation solution. The significant difference in the

number of eggs can be caused by several factors, one of them is the content of hay infusion. Hay infusion in the ovitrap secretes ammonia and CO_2, this visual sign was received by the mosquito receptor so that the female gravid mosquito decides to lay eggs on the ovitrap with that attractant. Increased oviposition of *Ae. aegypti* on ovitrap that contain hay infusion was known to be derived from the non-volatile chemical content contained in the water surface of the hay infusion. When received by the sensory chemotactile organ of mosquitoes, these chemicals further stimulate mosquitoes to lay eggs on filter paper (Rahayu et al., 2015). In research conducted by the authors, an attractant that contains ammonia is hay infusion, while the fermentation of sugar does not contain ammonia. Due to the presence of other compounds or ingredients contained in the hay infusion that is not present in the fermentation of sugars makes the hay infusion may attract more female mosquitoes to lay eggs on the filter paper compared to the sugar fermentation solution. This means that the hay infusion proved more effective in attracting female gravid mosquitoes to lay eggs and can be used as an attractant in controlling the *Aedes aegypti* population as a disease vector. The weaknesses of this study are the limited number of mosquito coop and the lack of control of temperature and humidity that can affect the gonotrophic cycle of mosquitoes.

CONCLUSION

Hay infusion is a more effective ~~as~~ attractan compared to the sugar fermentation solution due to greater number of eggs and the difference in the number of eggs between the two is significant.

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