The Potential of Fermented Oyster Mushroom Filtrate(Pleorotus ostreatus) as Host-Seeking Attractant of Aedes aegypti Mosquito

by Demes Nurmayanti

The Potential of Fermented Oyster Mushroom Filtrate (*Pleorotus ostreatus*) as Host-Seeking Attractant of *Aedes aegypti* Mosquito

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ABSTRACT

The fermented oyster mushrooms filtrate contains attractant chemical like octenol, lactic acid, fatty acids and CO_2 which can attract mosquitoes. The aim of this research was to analyze the potential of fermented oyster mushroom filtrated as *Aedes aegypti* mosquito attractant. This research was a pure experiment with posttest only with control group design. The concentration of oyster mushroom filtrate fermentation as independent variable; number of trapped *Aedes aegypti* mosquitoes as dependent variable; temperature, humidity, and length of exposure as control variables. The fermented oyster mushroom filtrate solution was divided into 6 treatment groups (control (0%), 20%, 30%, 40%, 50%, 60%) and was repeated 4 times. The research had been analyzed using Kruskal-Wallis test and advanced test (Mann-Whitney and Independent Sample-T test). The results showed significance difference averages ($p<0.05$) between control group and treatment group and did not show significant difference ($p>0.05$) between each treatment group. The highest average rank was found at a concentration of 60% with a catch of 36% mosquitoes for 24 hours. The fermented oyster mushroom filtrate has potential as *Aedes aegypti* mosquito attractant. For further researchers, may to carry out further research with variations on the length of exposure, concentration, and attractant methods.

Keywords: Mosquito Attractant, *Aedes aegypti*, Oyster Mushroom Filtrate.

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is an infectious disease which is still a public health problem in Indonesia. Dengue virus causes dengue infection. The dengue virus is transmitted by the *Aedes sp* mosquito to humans. *Aedes sp.* as carriers of dengue virus can transmit to humans regardless of age level. Of the many species of Aedes sp., *Aedes aegypti* is one of the main vectors that transmit dengue to humans (1).

Based on WHO (2), the global incidence of dengue cases has increased in the last few decades. Half of the world's population is estimated to be at risk of developing dengue disease. It is also estimated that around 100-400 million of the world's population are infected with dengue fever every year. According to the Indonesian Ministry of Health (3), the incidence of dengue cases per 100 Indonesian population in 2019 has increased compared to 2018. In 2018 the incidence of cases was around 24.75 and in 2019 it increased to 51.48. Although the incidence of DHF has increased, Indonesia's CFR has decreased slightly from 0.71% in 2018 to 0.67% in 2019.

Now, people prefer to use chemical control because chemical control is considered more effective at killing adult mosquitoes. Chemicals that are used continuously can cause negative impacts such as damaging the environment and nature. Natural control is recommended as an alternative because it is environmentally friendly (4).

Mosquito attractant can be used as a control mosquito method. Mosquito attractant is a substance that attracts mosquitoes to come to the substance (5). Mosquitoes use their sense of smell to detect their hosts. The attractant substance works by emitting an odor that is adapted to the pleasure of mosquitoes. Attractant compounds such as carbon dioxide, lactic acid, ammonia, and carboxylic acids (6). One of the natural ingredients that can be used as a mosquito attractant is oyster mushroom (*Pleurotus ostreatus*) (7). In the study of Chaiphongpachara et al. (7), oyster mushroom extract at concentrations of 5%, 10%, and 20% has attractiveness to mosquitoes. This is because mushrooms contain octenol compounds. Octenol, lactic acid, CO_2, hexanoic acid are some of the compounds that can attract mosquitoes when looking for a host (8).

In another study by Suyudi et al. (9), entitled "Effectiveness of Soaking Red Chili, Straw, Jengkol Skin Powder as an Attractant Against *Aedes aegypti* Mosquitoes" it was concluded that an effective mosquito attractant contains a mixture of ammonia, CO_2, lactic acid, octenol and high in fatty acids. In a study by Lala et al. (10), entitled "Fermentation of Young Coconut Water as *Aedes aegypti* Mosquito Attractant", it was concluded that fermented young coconut water has the potential to attract *Aedes aegypti* mosquitoes because it contains CO_2, lactic acid, fatty acids, octenol, and ammonia. This study found that the concentration of 15% more attracted mosquitoes with a catch of 42%. Fermentation of young coconut water for 5 days aerobically contains attractant compounds such as CO_2 by 4.15%, lactic acid by 3.03%, fatty acids by 2.56%, octenol by 2.11%, and ammonia content by 1.08. %.

From the preliminary study, fermented oyster mushroom filtrate for 5 days contained 9.52% octenol, 9.05% CO_2, 18.98% lactic acid, 1.30% fatty acid and 0.18% ammonia. The results of the preliminary study showed that Aedes aegypti mosquitoes were more attracted to a 20% attractant concentration with a catch of 12% at 6 hours of exposure. Based on this, the researchers were interested in conducting experimental research using fermented oyster mushroom filtrate with variations in concentration of 0% (control), 20%, 30%, 40%, 50%, 60% in variations of 6 hours and 24 hours of observation.

METHODS

This research is a pure experimental research with posttest only design with control group. The purpose of using the type and design of the study was to see whether or not there was a potential for fermenting oyster mushroom filtrate as an attractant for the *Aedes aegypti* mosquito by comparing the results with the control group. This research using 25 *Aedes aegypti* test mosquitoes for each treatment. The criteria for the test mosquitoes were female mosquitoes that have mated, aged 3-5 days who were starved of blood and were in sugar starvation for 24 hours (11). The attractant uses white oyster mushrooms harvested from mushroom farmers. The attractant was made in a ratio of 1:1 (w/v) oyster mushroom with distilled water. Oyster mushrooms were cut into small pieces and mashed, then mixed with distilled water as much as the amount of oyster mushrooms were weighed. Add yeast as much as 1.1% of the weight of oyster mushrooms. Stir the solution until homogeneous ± 5 minutes and covered with a lid. After 5 days, filter the mixture and use the filtrate. The mosquito trap is made from a 1.5 liter bottle which is divided into two, top, bottom (1:3) and the top is installed upside down above the bottom. The required volume of attractant is 200 ml per trap with distilled water as a solvent (12). The traps were placed in mosquito cages and exposed to 25 test mosquitoes. The expected output is the number of mosquitoes trapped for 6 hours and 24 hours (10).

The data were analyzed statistically with a significance level of 5%. The normality test of the data used the Saphiro-Wilk test, with the null hypothesis (H0) the data was normally distributed. Differences in group average were analyzed using the Kruskal Wallis test, with H0 there was no difference between groups. The analysis was continued for each pair of groups, to determine which pair of groups had a significant level of difference. The analysis was carried out using the Mann-Whitney test in the non-normally distributed group and Independent Sample T-Test in the normally distributed group, with the statement H0 that there was no difference in the average between the two groups. The H0 statement is accepted if the significance value is more than the critical limit ($p>0.05$).

RESULTS

Temperature and Humidity Observation

Temperature and humidity were measured using a room thermohygrometer. The results of measurements of temperature and humidity during the research are in Table 1 below.

Table 1. Temperature (°C) and Humidity (%) Measurement

Hour-	1st Replication	2nd Replication	3rd Replication	4th Replication
0	29°C / 74%	27°C / 70%	27°C / 74%	27°C / 74%
1	29°C / 74%	29°C / 72%	29°C / 72%	29°C / 72%

2	29°C / 74%	29°C / 74%	29°C / 72%	29°C / 72%
3	29°C / 74%	29°C / 72%	29°C / 70%	29°C / 72%
4	30°C / 72%	29°C / 72%	29°C / 68%	30°C / 72%
5	30°C / 72%	29°C / 72%	29°C / 68%	30°C / 70%
6	30°C / 72%	29°C / 72%	29°C / 68%	30°C / 70%
24	29°C / 72%	29°C / 72%	29°C / 72%	29°C / 72%
Average	29.38°C / 73%	28.75°C / 72%	28.75°C / 70.5%	29.13°C / 71.75%

Based on the table above, the minimum room temperature during the study was 27°C and the maximum temperature was 30°C. The average room temperature during the study has a range of 28.75°C - 29.38°C. The minimum humidity in the room during the study was 68% and the maximum humidity was 74%. The average humidity of the room during the study had a range of 70.5% – 73%.

Number of *Aedes aegypti* Mosquitoes Trapped on Attractants

This study used as many as 6 kinds of concentrations as treatments, including 20%, 30%, 40%. 50%, 60%, and control (0%). The experiment was repeated 4 times. The trapped mosquitoes were observed every 60 minutes for 6 hours and 24 hours. The results of the observations are below.

Table 2. Observation Results of Average Number of *Aedes aegypti* Mosquito Trapped on Attractants for 6 Hours

Concentration	Replication				Mosquito Average for 6 hours	Percentage
	1st	2nd	3rd	4th		
0% (Control)	0	0	0	0	0	0%
20%	1	3	2	2	2	8%
30%	1	2	3	2	2	8%
40%	2	4	3	4	4	16%
50%	1	2	4	4	3	12%
60%	1	4	3	4	3	12%

The table above contains the results of the average number of Aedes aegypti mosquitoes trapped at each concentration of attractant fermented oyster mushroom filtrate. At concentrations of 20% and 30%, the average number of mosquitoes trapped for 6 hours after exposure was around 2 mosquitoes (8%). At concentrations of 50% and 60%, the average number of mosquitoes trapped for 6 hours after exposure was around 3 mosquitoes (12%). The 40% attractant concentration had a higher average number of trapped mosquitoes than other concentrations, which was around 4 mosquitoes (16%), while the control group had the smallest range (0%).

Table 3. Observation Results of Average Number of *Aedes aegypti* Mosquito Trapped on Attractants for 24 Hours

Concentration	Replication				Mosquito Average for 24 hours	Percentage
	1st	2nd	3rd	4th		
0% (Control)	0	1	0	0	1	4%
20%	1	6	5	6	5	20%
30%	3	6	8	7	6	24%
40%	3	9	6	7	7	28%
50%	1	9	11	10	8	32%
60%	1	13	9	11	9	36%

Based on the table above, the average number of trapped mosquitoes showed an increase in proportion to the high concentration of attractants. Attractant fermented oyster mushroom filtrate with a concentration of 60% can attract 36% of 25 mosquitoes. Concentration of 0% (control) can attract fewer mosquitoes than other concentrations (4%).

Analysis Average Differences of Number *Aedes aegypti* Mosquitoes Each Attractant Concentration

Table 4. Results of Average Number Differences of *Aedes aegypti* Mosquitoes Trapped at 6 Hours and 24 Hours

Observation Lenght	Concentration	Data Total	Mean Rank	Significant Value (p)
6 Hours	0 %	4	2,50	0,025
	20 %	4	11,50	
	30 %	4	11,50	
	40 %	4	17,75	
	50 %	4	15,25	
	60%	4	16,50	
24 Hours	0 %	4	2,88	0,034
	20 %	4	10,13	
	30 %	4	13,38	
	40 %	4	13,88	
	50 %	4	17,00	
	60 %	4	17,75	

The table shows the number of mosquitoes trapped for 6 hours has a significant value (p) of 0.025 and 0.034 for 24 hours. Both significant values are less than 0.05 as the critical limit ($p < 0.05$), therefore it can be concluded that there is an average difference in two or more groups. The results of the mean rank show that for 6 hours of observation, concentrations that have an average rating from high to low are concentrations of 40% (17.75), 60% (16.50), 50% (15.25), 20 % and 30% (11.50) and 0% (2.50). Results of Mean Rank in 24 hours of observation, concentrations that have an average rating from high to low are concentrations of 60% (17.75), 50% (17.00), 40% (13.88), 30% (13, 38), 20% (10.13), and 0% (2.88).

Analysis of Optimal Attractant Concentration of Each Treatment

Advanced tests were used to analyze which concentrations had significant differences each concentrations. From the analysis, the pairs of groups that have a significant average difference are the control group with the concentration treatment group (20%, 30%, 40%, 50%, 60%). The significance value of each group is (p) <0.05 as the critical limit, which means that there is a significant difference between the two groups. The analysis results of the average difference between each concentration group showed a significance value (p) > 0.05 as the critical limit, then H0 was accepted. It means that there is no significant difference between each concentration group (20%, 30%, 40%, 50%, 60%). Thus, it can be interpreted that fermented oyster mushroom filtrate has the potential to attract *Aedes aegypti* mosquitoes, but further research is needed on optimal concentrations.

DISCUSSION

Number of *Aedes aegypti* Mosquitoes Trapped in Attractants

This study aims to analyze the potential of fermented oyster mushroom filtrate as an attractant for the *Aedes aegypti* mosquito. This study used 25 female *Aedes aegypti* mosquitoes as test animals. The attractant in this study was oyster mushroom filtrate which was fermented for 5 days with baker's yeast added as a catalyst. This study used 6 different concentration treatments, including concentrations of 20%, 30%, 40%, 50%, 60% and control (0%) which were replicated 4 times. Observations were every 60 minutes for 6 hours and 24 hours.

Based on Table 2 and Table 3, it shows different catches. The attractant exposed for 6 hours is less effective than 24 hours can be caused by several possibilities. In this study, it is possible that CO_2 gas is reduced when making treatment concentrations. CO_2 gas is one of the products of fermentation. The attractant is made through a fermentation process with baker's yeast. The microbe contained in baker's yeast is *Saccharomyces cerevisiae*. Bread yeast can convert glucose into ethanol and CO_2. Fermentation using baker's yeast also produces organic acids (13).

The attractant was exposed for 24 hours attracted more mosquitoes because there was a substrate breakdown process that took place compared to 6 hours. The substrate breakdown process produces organic compounds and CO_2 gas. According to Watentena et al (14), the presence of CO_2 gas is an important component for mosquitoes so that they can find out where there are organic compounds needed by mosquitoes. The gas has a role as an attractant guide in the presence of heat or heat released. The gas is not effective if it becomes a mosquito attractant without a combination of other attractant substances. Thus, CO_2 gas is one of the factors in which exposure to fermented oyster mushroom filtrate attractants for 24 hours attracts more *Aedes aegypti* mosquitoes than exposure for 6 hours.

According to Moede et al (15), pH, temperature and duration of the fermentation process by the yeast Saccharomyces cerevisiae also affect the content of the resulting product. The yeast can grow well in facultative anaerobic conditions at a pH of 4.0 – 4.5 with a temperature of 30°C. Based on Nasrun et al (16), the amount of yeast and the length of fermentation also affect the results obtained. A large amount of yeast with a long fermentation process can produce large amounts of bioethanol, but if the fermentation process continues, bioethanol will tend to decrease because the microbes enter the death phase.

Based on the explanation above, the fermentation process requires optimal pH, temperature, yeast dose, and fermentation time as well as the need for sufficient fermentation media to obtain maximum product yields. Oyster mushrooms contain high carbohydrates and protein depending on the medium and how to grow it. Yeast Saccharomyces cerevisiae can break down carbohydrate substrates and use the breakdown product, namely glucose, for other breakdowns. This yeast can also break down proteins with protease enzymes. The largest fermentation product with Saccharomyces cerevisiae is converting glucose into ethanol and CO_2. The fermentation process also produces by-products including high alcohol, organic acids, esters, acetaldehyde, glycerol, phenol (17).

In this study, the oyster mushroom filtrate fermented attractant was made using yeast at a dose of 1.1% and stored for 5 days at room temperature and was facultatively anaerobic. To make maximum results on fermentation process, there must be a determination of the optimal size used. In this study, it has the disadvantage of not conducting research on the effect of the conditions of the fermentation process on the yield of attractants. Then, when making the attractant fermentation by the yeast *Saccharomyces cerevisiae*, the researchers used aquadest as a solvent. The content of distilled water is pure H_2O without any minerals, while the fermentation process runs well if it is supported by media rich in minerals, especially metal ions, which can improve fermentation performance (17). Thus, the condition of the fermentation process is possible to be one of the less influential attractants of oyster mushroom filtrate fermentation and it is hoped that further researchers will conduct further research on this matter.

Temperature and Humidity Measurement

Environmental temperature and humidity are the most important factors in the survival of adult mosquitoes. Based on the measurement of room temperature and humidity in this study, the results showed that the average room temperature ranged from 28.75°C–29.38°C and humidity ranged from 70.5%-73%. The average optimum temperature for mosquito growth is 25°C-27°C, and will stop when the temperature is <10°C or >40°C (18). Based on the literature, the room temperature in this study was not optimal for mosquito growth. In line with that concluded by Reinhold et al (19), the minimum temperature limit for *Aedes aegypti* around 10°C, the mosquito will become paralyzed and unable to move if it is below that temperature and will die at 40°C. Mosquito *Aedes aegypti* females are able to fly continuously at a temperature of 15°C-32°C with the best flight temperature <27°C and the most active sucking blood at a temperature of 28°C. The *Aedes aegypti* mosquito has the highest distribution rate in the rainy season. The preferred humidity is more than 60% with a temperature in the range of 24°C–31°C (19). Thus it can be concluded that the temperature measurement results in this study are not optimal, but are still included in the normal temperature for mosquito movement. Likewise with humidity that exceeds the optimum humidity (> 60%).

Analysis of Fermented Oyster Mushroom Filtrate as *Aedes aegypti* Mosquito Attractant

Based on the analysis in Table 4, it can be seen that the number of mosquitoes trapped with a 6-hour observation period has a significance value (p) of 0.025 and a 24-hour observation period has a value of 0.034. The two significance values are less than 0.05 as the critical limit ($p < 0.05$), therefore it can be stated that there is an average difference in two or more groups. The results of the follow-up test showed that there was no significant difference in the average of each treatment at concentrations of 20%, 30%, 40%, 50%, and 60%. Meanwhile, there was a significant average difference between the control group and each treatment group. However, the Mean Rank column in Table 4. shows that there is a group that has the highest average rating during 6 hours of exposure, which is a concentration of 40% with an average rating of 17.75. At 24 hours of exposure, the concentration that had the highest average rating was the concentration of 60% (17.75). Thus, the concentration of 40% attractant for 6 hours and 60% concentration of attractant for 24 hours had the highest rating for attracting mosquitoes compared to other concentrations, although the difference was not significant.

The results of this study are same as research by Lala et al (10) entitled "Fermentation of Young Coconut Water as an Attractant for the *Aedes aegypti* Mosquito". In this study, there were significant differences ($p < 0.05$) between the control group and the concentration group (15%, 25%, 35%) but there was no significant difference between each concentration group. The study observed the effect of attractants every 60 minutes for 6 hours with 50 mosquitoes tested in the laboratory. Based on this research, the less significant effect of each concentration is caused by the fluctuation of temperature and humidity in the research room, which affects the air flow, as well as the lack of duration of the fermentation process.

Research by Sa'adah et al., entitled "Solution of Cassava Tape (*Manihot utilissima*) as a Mosquito Attractant" has similarities because it uses an attractant from a fermented solution. In contrast to the results of the study of Sa'adah et al., the results of the study showed that there was no significant difference (p-value 0.406 > 0.05) from the attractant of cassava tape solution with concentrations of 0% (control), 10%, 30%, 50% and 70%. In the study of Sa'adah et al., mosquito traps were installed for 72 hours in residents' homes. According to the study, the factors that contributed to the absence of the attractant effect on the captured mosquitoes were the humidity temperature at the time of installation of the tool, the lack of sugar content in the cassava tape solution, and less than optimal in making the cassava tape solution (20).

In a study by Widya et al., with the title "Comparative Test of the Potential for Adding Tape Yeast and Bread Yeast in Sugar Solution as an Aedes sp Mosquito Attractant." has similarities with the research that the researchers did, namely the use of yeast in the fermentation process as an attractant. Some of the groups tested were the group with 20% sugar solution, the negative control group, the 20% sugar solution group with tape yeast, and the 20% sugar solution group with baker's yeast. From the research of Widya et al., it was found that there was a significant difference between the control group and the treatment group in the test mosquitoes in the laboratory which were observed for 6 hours of exposure. The results of this study are in line with the research conducted by the researchers, namely that there are significant differences between the control group and the treatment group. The results of the study also showed that the 20% sugar solution group with baker's yeast was thought to have greater potential as an attractant than other groups (21).

Based on research by Lala et al (10) and Sa'adah et al (20), it can be concluded that the possibility of no significant difference between concentration groups with one another is caused by temperature, humidity and less than optimal results of fermentation products. From the research of Sa'adah et al., it shows results in the field that mosquitoes have no interest in the attractant of cassava tape solution (20). From the statistic analysis of the attractant fermented oyster mushroom filtrate, it showed potential as an attractant because there was a significant difference between the treatment group and the control group which was carried out in the laboratory. Therefore, the researcher hopes that further research will carry out testing with positive controls or carried out in the field.

Research from Widya et al., shows that baker's yeast is more effectively used in sugar solutions (21). In the research on attractant fermentation of oyster mushroom filtrate that the researchers did, fermented products with baker's yeast were effective in producing attractant content if there was sugar in it. In the attractant that the researchers did, there was less sugar content in oyster mushrooms, so baker's yeast did not give results as in the study of Widya et al (21). Thus, the researcher hopes that further researchers will conduct research on the effect of adding sugar on oyster mushroom attractants.

Mosquito attractant is a substance that can attract or attract mosquitoes to come and land on the substance. Compounds that can become attractants include: octenol, CO_2, lactic acid, ammonia, and carboxylic acids. When these compounds combine, they produce strong attractants (6). In this study, the attractant used was oyster mushroom filtrate which was fermented for 5 days. Based on preliminary studies, the fermented oyster mushroom filtrate contains attractants such as octenol 9.52%, CO_2 9.05%, lactic acid 18.98%, fatty acids 1.30% and ammonia 0.18%.

Octenol compounds are volatile compounds that can be obtained from mushrooms (commonly known as mushroom alcohols). The compounds such as CO_2, lactic acid, and ammonia are the product compounds of the fermentation process (22). Carbon dioxide has been known to be one of the compounds that is a stimulus to attract mosquitoes when looking for a host. Respiratory products from animals and humans contain high levels of carbon dioxide, so that they become a marker or signal for the presence of a host for mosquitoes. The lactic acid compound is a compound that can be obtained through the process of fermentation or glycolysis. Lactic acid is a by-product of the glycolysis process produced by pyruvic acid under anaerobic conditions. Lactic acid compounds efficiently act as mosquito attractants when synergized with carbon dioxide or other compounds, but lactic acid will be more efficient at attracting *Aedes aegypti* mosquitoes if it is not mixed with other ingredients. In contrast to ammonia compounds, these compounds will be more addictive to attract mosquitoes when synergized with other compounds such as lactic acid and carbon dioxide. Likewise with fatty acids, these compounds have been shown to provide an attractant effect for the *Aedes aegypti* mosquito (23).

Based on the explanation above, it is possible that there is no significant difference in the average between each treatment group (20%, 30%, 40%, 50%, and 60%) in this study due to the levels of compounds that are less synergistic with each other. It should also be noted that the content of oyster mushrooms through the fermentation process produces by-products that can reduce the synergy of attractant compounds to attract mosquitoes. Therefore, to obtain maximum attractant results, isolation or extraction of several attractant compounds (such as octenol, CO_2, lactic acid, fatty acids and ammonia) produced by oyster mushroom filtrate fermentation can be carried out for further research.

In addition to being less attractive to attract mosquitoes, there are also some elements in the mosquito that cannot be controlled as living things. Mosquitoes can capture odors or compounds in the air using their olfactory receptors. The olfactory receptor organs that work include the antennae, maxillary palps, and trunk. In this organ there is an ORN (Olfactory Receptor Neuron) which can capture substances in the air. These nerves will send impulses from the periphery to the antenna lobes to be interpreted as information by the mosquito (24).

Mosquitoes can capture olfactory signals by integrating temperature, humidity, mechanosensory, and visual information thus providing the ability for mosquitoes to find hosts, avoid danger, find mates, and find suitable nesting sites. Female mosquitoes of many species depend on blood for essential nutrients for egg development, while their metabolic needs are primarily met through feeding on nectar. Host detection involves sensing and integrating three main cues: CO_2, host body odor and heat, although humidity detection and visual cues are also involved (23).

The criteria for mosquitoes in this study (11) include female Aedes aegypti species that have mate and are in a state of blood thirst for at least 4 days and thirst for sugar for 24 hours. Even though the mosquito criteria were correct, at the time of 6 hours of exposure, it was likely that the tested mosquitoes did not have different levels of hunger and different levels of catching olfactory signals and began to react slightly to attractants at 24 hours exposure. The possibility that occurs is that the test mosquito has not been able to catch the smell of the attractant because of the low CO_2 level at 6 hours of exposure to integrate the contents of several attractants. In addition, there is the possibility of mosquitoes experiencing starvation so that at 24 hours exposure they require nutritional intake from nearby materials. These possibilities are in line with the research of Lala et al (10) and Widya et al (21), mosquitoes have different olfactory signals to integrate attractant content without optimal CO_2 levels. Based on this, the less than optimal attractant to attract mosquitoes can be caused by mosquito habits to different attractants. Thus, the possible drawback of this study is not using positive controls as a differentiator. The researcher hopes that the next researcher will make differences in the variation of attractant types to determine the level of fermented oyster mushroom filtrate attractants with other attractants in attracting mosquitoes.

CONCLUSION

The aim of this study was to analyze the potential of fermented oyster mushroom (*Pleurotus ostreatus*) filtrate as an attractant for the *Aedes aegypti* mosquito. The conclusion that can be obtained from this study is that there is a significant difference in the mean number of *Aedes aegypti* mosquitoes in the traps of each concentration group of 20%, 30%, 40%, 50%, 60% with control (0%) at 6 hours and 24 hours exposure, however. there was no significant difference between each concentration treatment group. This means that the fermented oyster mushroom filtrate has potential as an attractant for the Aedes aegypti mosquito. Based on the mean rank, exposure time of 6 hours with 40% concentration of fermented oyster mushroom filtrate can attract more *Aedes aegypti* mosquitoes in the trap than other concentrations. At exposure time of 24 hours a concentration of 60% fermented oyster mushroom filtrate can attract more *Aedes aegypti* mosquitoes in the trap than other concentrations. The temperature and humidity of the room during the study were fluctuating which could be one of the possible reasons for the less effect of the oyster mushroom filtrate fermenting attractant in this study. As for suggestions, it is hoped that further researchers can change other variables such as length of exposure with variations of more than 24 hours, concentration, and methods of making attractants, and can examine whether there is an effect of additional yeast on making attractants to mosquito attraction.

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