The Effectiveness of Bagasse, Red Chili, And Seashell in Ovitrap as a Trapping for Aedes Aegipty Mosquito

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Abstract

Dengue fever case in Surabaya in every year was found. Until recently, there was still no effective way for overcoming this dengue fever because there was still no anti dengue virus drug. Population control of the mosquito mechanically could use trapping for the effort of reducing mosquito population which was as the cause of dengue fever by using attractant media. Furthermore, this research aimed at knowing the difference of the total of mosquito that was trapped in ovitrap based on the type of trap media, the observation time, and the dose of attractant. This research was quasi-experimental research by the design of posttest only control group. The subject of this research was Aedes Aegypti mosquito that was trapped by several media (red chili, bagasse, and seashell with the dose of 5 gr,10 gr,15 gr, and 20 gr). The procedures of this research were water media that was filled by media with the prescribed dose and it was observed in 2,3,4, and 5 weeks. Then, it was calculated the total of live larvae in the trapping. The data was processed descriptively, then, it was analyzed by using Anova test. Ovitrap that used attractant of red chili with the dose of 5 gram and it was observed until 3,4 weeks was very good for being applied in controlling activity of dengue fever through the control of Aedes Agypti vector. Meanwhile, ovitrap with the attractant of bagasse with the dose of 5 gram also gave contribution in developing Aedes Agypti mosquito. The use of simple ovitrap with the attractant of red chili and bagasse could be recommended for controlling dengue fever vector in society, hence, it could reduce the occurrence of dengue fever.

Keywords: bagasse, red chili and seashell, ovitrap

1. INTRODUCTION

Dengue fever was one of several infectious diseases and still became a problem, particularly in developed country such as Indonesia. Female mosquitoes could live in less than 3 weeks, meanwhile, the male mosquitoes usually could live in around 1 week, and mostly, their eggs hatched in water reservoir. In addition, the eggs would hatch and become larvae. The larvae breathed through its tube behind of its tail and ate microscopic organism, such as bacteria. Therefore, most of the larvae of mosquito needed the water that contained organic material. In a week, the larvae grew and developed to be pupa that shaped coma (Enny, 2009).

The number of dengue sufferers increased more and more in every year and often caused death for the sufferers. Dengue fever in Indonesia firstly was found in Surabaya, East Java in 1968 with the case total in 58 persons and 24 persons died (*CFR* 41,5%). In next year, dengue case spread to other cities in area of Indonesia and it was reported increase in every year. The Extraordinary Incident (*Kejadian Luar Biasa (KLB)*) of dengue fever was occurred in most of urban area and several rural areas (Soegijanto, 2004).

In last 5 years based on annual report in Health Office in Surabaya City in 2014, the highest dengue fever case was occurred in 2010 with 3.379 cases and it decreased to be 1.008 cases in 2011. In 2012, dengue fever case increased again to be 1091 cases and in 2013, it also increased to be 2.207 cases. Meanwhile, in 2014, it decreased to be 816 cases.

Several efforts had been done either for chemical control or natural control and it had been done in several areas. Several larvacides and insecticides had been used in order to kill larva and adult mosquito, however, the active material / synthetic chemical compound that was used as insecticide would cause resistance for the mosquito due to the frequent exposure or frequent use in its application (Astuti, 2009).

The modification of ovitrap by adding the attractant of water immersion of straw or water immersion of shrimp shell had been proved that it increased the total of the trapped eggs based on Suyono's research (2008), meanwhile, according to conducted research by Siti Rahayu (2015), she stated that red chili in the concentration of 15% was the best concentration for catching *Aedes aegypti* mosquito in trapping.

The result of other conducted researches regarding the effectiveness of trapping tool by attractant of fermentation of sugar water and yeast by Astuti (2009) showed that the emulsion of yeast and sugar was 1 : 50 gram which was effective for catching *Aedes aegypti* mosquito. Molasses was one of byproducts of sugar cane factory which still had sufficient economic value due to high content of the sugar in around 52 percent based on dry material of bagasse that consisted of component C (*Carbon*) 47 %, H (*Hydrogen*) 6,5 %, O (*Oxygen*) 44 %, and *Ash* 2,5 %. According to Pritzelwitz formula, every kilogram of dregs with the content of sugar around 2,5 % would have heat in 1.825 kkal. Dregs was burnt easily because in the inside of it was contained of water, sugar, fiber, and microbe, hence, if it was piled up, it would be fermented and it released the heat (*https://sharingactivemotional.wordpress.com/2012/11/24/tanaman-tebu-dengan-sejuta-manfaat/*).

The controlling of mosquito population mechanically could use a trapping. Trapping was a mosquito trap tool as an effort to reduce mosquito population in an effort in order to reduce the population of mosquitoes that caused DHF by using attractant media. Attractant was something that had attractiveness to the insects (mosquitoes) either chemically or physically. The chemical attractant might be an ammonia, CO_2, lactic acid, and actenol. The substances or compounds were from organic materials or the result of metabolic process of the creature that was proved to affect olfactory nerve of Aedes aegypti mosquito (Suyono, 2008).

Modification of trapping-shaped and the using of attractant type with right comparison of concentration was really needed in order to result a trapping tool of the vector of *Aedes aegypti* mosquito that could work maximally, could be done easily, and could be applied in the field. The result of previous research suggested for using dry media so that it made easier in its implementation and could be implemented directly in the field. Moreover, the purpose of this research was to know the difference of the total of trapped mosquito in ovitrap based on the trapping media type, the observation time, and the dose of attractant.

3. RESEARCH METHOD

This research was quasi-experimental research that was conducted in the field with the design of posttest only control group. The subject of this research was *Aedes aegypti* mosquito that was trapped with several medias (red chili, bagasse, and seashells with the dose of 5 gr,10 gr,15 gr, and 20 gr) in the outside of the room. The procedure of this research was the water media that was filled by the prescribed dose and it was observed in 2 weeks, 3 weeks, 4 weeks, and 5 weeks. Then, it was calculated the total of live larvae in the trapping. Furthermore, the data was processed descriptively, then, analyzed by using Anova test.

4. RESULT AND DISCUSSION

The condition of the environment around the trapping place was still found vulnerable places as either hiding place or breeding place of *Aedes aegypti*. In several locations, it was still found piles of used tire, used woods, and the plants which were not cared well. The result of the description of mosquito larvae during observation period as followed:
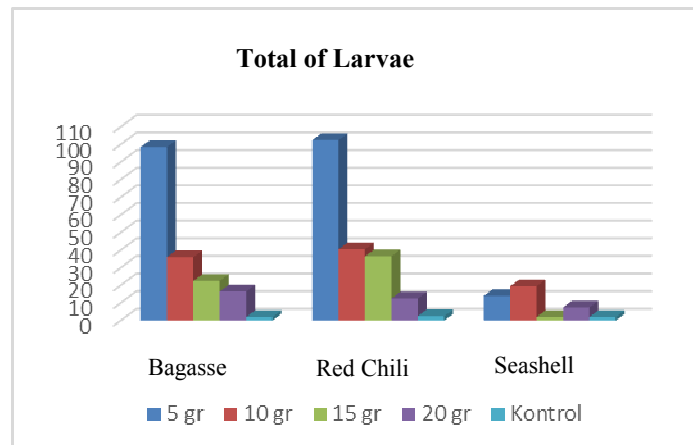

Chart 1. The Result of the Calculation of Larva Total
Figure 1 Calculation Result of the Larvae Total in the Observation of First until Forth Weeks

The analysis result by using Anova test that was a difference of trapped mosquito in 3 types of attractant with the significant degree of 5% showed that there was a significant difference of the mosquito total that could grow from larva to adult mosquito through the attractant of bagasse, red chili, and seashell with the significance of 5 % (p= 0,04).

Table 1 The Analysis Result of Anova

Attractant Type	Significance (p value)
Bagasse	0,007
Red Chili	0,002
Seashell	0,400

In order to know what type of attractant that was different with its control was obtained the result that in the attractant of bagasse, the total of trapped mosquito was different with its control (p=0,007). In attractant of red chili was obtained the result that the total of trapped mosquito was different from its control (p=0,002), meanwhile, in attractant of seashell was obtained the result that the total of trapped mosquito was not different from its control (p=0,400).
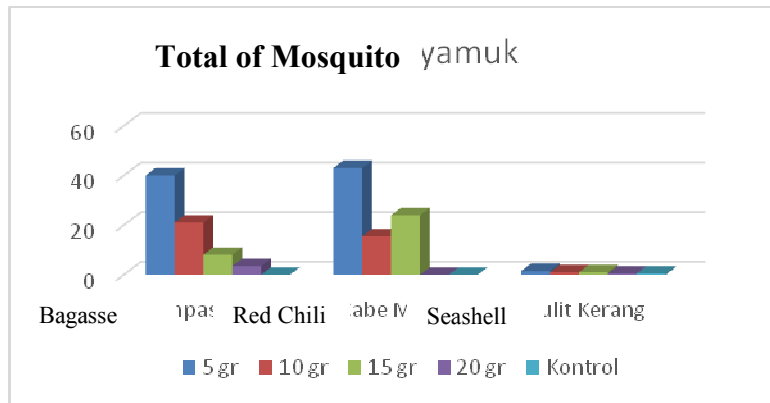
Chart 2: Calculation Result of Mosquito Total

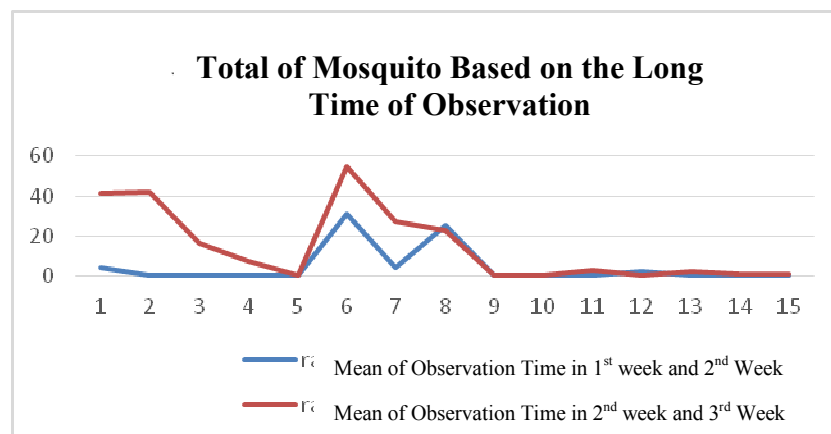Figure 2 Calculation Result of Mosquito Total in First until Forth Observation

Figure 3 The Calculation Result of Mosquito Total based on Observation Time

Notes:

1.bagasse in 5gr	6.red chili in 5gr	11. Seashell in 5gr
2.bagasse in 10gr	7 red chili in 10gr	12. Seashell in 10gr
3.bagasse in 15gr	8.red chili in 15gr	13. Seashell in 15gr
4.bagasse in 20gr	9.red chili in 20gr	14. Seashell in 20gr
5.control	10.control	15.control

In this research, Ovitrap with 3 types of attractants, which were bagasse, red chili (*Capsicum Anum*), and seashell and the control was set up nearby. Moreover, in the field, the research was as a visualization of the use/ the real application for ovitrap. Thus, it was not conducted in laboratory without controlling several factors which perhaps influenced against the activity of mosquito in entering into the trapping.

The mosquito, which was trapped and entered into the ovitrap that was set up inside and outside the house (residential neighborhood as the research area), was calculated for all of the mosquitoes which were trapped in 6 ovitraps in each types of attractant. The obtained data included the data of larva and adult mosquito. Based on the research result, below was the illustration of table analysis descriptively regarding the total of larva and mosquito, which were trapped by ovitrap that was specified based on the difference of attractant type and dose. Besides, it was checked in 1st, 2nd and 3rd,4th week in table as followed:

Table 2 Tabulation of the total of Larva and Mosquito which were trapped in Ovitrap in 1st, 2nd week and 3rd, 4th week based on attractant types and its dose.

Type Media	Dose(gr) Attractant	Total of Larva			Total of Mosquito		
		1st, 2nd Week	3rd, 4th Week	Total	1st, 2nd Week	3rd, 4th Week	Total
Bagasse	5	105	92	197	4	41	45
	10	39	33	72	0	42	42
	15	22	23	45	0	16	16
	20	7	26	33	0	7	7
	Control	0	4	4	0	0	0
Red Chili	5	105	100	205	31	55	86
	10	42	39	81	4	27	31
	15	37	36	73	25	23	48
	20	10	15	25	0	0	0
	Control	0	5	5	0	0	0
Seashell	5	13	15	28	0	3	3
	10	22	17	39	2	0	2
	15	2	2	4	0	2	2
	20	3	12	25	0	1	1
	Control	1	3	4	0	1	1

The Difference of the Total of Trapped Mosquito in Ovitrap based on the Type of Attractant

Descriptively, based on the data in table 2 and chart 3, it showed that the total of larva that grew from the change of eggs which were from the mosquito that entered into the trapping in the attractant of red chili with the dose in 5 gr was the highest, then, it was followed by bagasse with similar dose. In addition, its total decreased as long as the increase of the attractant dose of either red chili or bagasse. Meanwhile, in the attractant of seashell, the total of larvae in dose of 5 gram that increased its dose showed a tendency of decrease or increase. Its total tended to be up and down or unstable and its total was low (4-39), and in the control ovitrap was also there larva (4). In the control in 1st and 2nd week was 0 for attractant type of bagasse and red chili, meanwhile, in seashell was 1. In 3rd and 4th week, the control of bagasse and red chili and seashell were filled for each in 5,4, and 3. This showed high attractiveness from the mosquito in order to do not enter into the trapping outside the control. Hence, there was attractiveness from the ovitrap that filled attractant.

Based on chart 3 and the data in table above, the total of trapped mosquito in its growth from larva showed that none of the larva had changed to be mosquito. The change to be mosquito from the eggs in its cycle was in around 14 days, which were occurred in around 42 % for red chili and 23% for bagasse in dose of 5 gr, and the percentage of a change to be mosquito increased as long as with the dose of the attractant, which 65,75% was dose of 15 gr for red chili and 58,3 % was dose of 10 gr for bagasse. This showed that the media of red chili and bagasse had good ability for the growth of *Aedes agypti*. In attractant of red chili with the dose of 5 gram was the highest total of mosquito (86), then, it was followed by the red chili with the dose of 15 gram (48). Meanwhile, for bagasse in the dose of 5 gram (45) was almost similar with the mosquito total in the dose of 10 gram (42). However, this result was in accordance with conducted research by Endang Puji Astuti (2009) regarding the effectiveness of trapping of mosquito vector of DHF with sugar fermentation. Although, it was different media that was used, but it showed a tendency of the decrease of the mosquito total that was trapped by the increase of attractant dose, which was "mean of mosquito that was trapped increased until the giving yeast in 1 gram and decreased in 2 and 3 gram". This showed that there was certain dose that was needed by mosquito for being able to be attracted in the use of certain attractant. In this research, the use of red chili and bagasse in the dose of 5 gram was seen effective to be used to become media or attractant for ovitrap either for mosquito or the growth of the larva.

Total of larvae and mosquito which were trapped gave illustration that attractant of either red chili or bagasse had strong attraction of smell that could attract the mosquito to enter, spawn, and have so many larva (197 - 205) in the dose of 5 gram and it was still high enough although decreased in the increase of the dose, that was 10 gram and 15 gram (red chili was in 81 and 73, meanwhile, bagasse was in 72 and 45). The use of this attractant had control target which was mosquito's sensory organ, such as olfactory organ that was had by the mosquito which shaped sensilla that was spread in all of its body and the most number of sensilla was in mosquito's antenna which was very sensitive with smell.

In contrary, in the ovitrap with attractant of seashell described the mosquito was less attractive although there was still the mosquito that entered into the trap. However, by there was still the larva in control ovitrap, it

could be stated that the attractant of seashell was similar with control because the smallest number of larva in seashell was 4. Meanwhile, in the control for attractant of red chili and bagasse was in the average of 0 although there was its total in 4, the range between the total and the trap that was filled by attractant was far enough.

Analysis result of the difference of mosquito total based on attractant type by using Anova test in one direction with the level of significance in 5% that was obtained p value = $0,04(< α)$. It meant that there was significant difference between the total of mosquito that entered and the mosquito that could grow in the ovitrap by using attractant type of bagasse, red chili, and seashell.

Moreover, in linier test with Mann Withney in the level of significance in 5%, in the difference of mosquito total both in control group and treatment group (dose for each types of attractant) showed p value < α for the use of bagasse in p = 0,007 and red chili in p=0,002, which meant that there was a significant difference between treatment group and control group. Conversely, in seashell, p value was 0,4 (>α), which meant that in the use of seashell, there was no significant difference of mosquito total that was trapped. In the attractant of seashell, the total of *Aedes Aegypti* that was trapped was lower rather than other types, and in control group, it was obtained the larva. This case described that *Aedes Aegypti* did not like seashell and it was back to original habitat although in ACE 2003, seashell also resulted strong smell and there was the content of ammonia excretion compound (NH4) and excretion of CO_2. Nevertheless, this was good content of attractant for *Aedes Agypti* (ACE, 2003).

In addition, it needed to be noticed more regarding other factors that influenced against the trapped mosquito and its growth based on its cycle. The other factors were environment factors, such as the temperature and humidity of the research location, society's behavior in keeping the environment clean regarding the garbage that perhaps piled up and scattered, thus, it could be occurred decomposition that made strong smell and it could make the mosquito attractive to be in the area. Furthermore, if there was the puddle around there, it would become breeding habit for the mosquito and so did the lush residential area. Many blowzy plants would have cool temperature with high humidity and this was a good zone for the growth of mosquito. Thus, the effective attractant type could be used in the ovitrap was red chili, and then, bagasse.

The Difference of the Total of Mosquito that was Trapped in Ovitrap Based on the Dose of Attractant.
The descriptively research result such as in chart 2 showed that low dose of attractant which was in 5 gram in either bagasse or red chili had the ability to become trapping for mosquito for growing and breeding and it was seen in the total of larva and total of mosquito. According to result of *Mann Whitney* test above, it was known that there was a significant difference of the total of mosquito that was trapped in control group and treatment group in the use of red chili and bagasse. In order to know which pair of treatment group was the most different by using Mann Whitney test, it showed that it was in group of red chili with either 5 gram or 15 gram (p = 0,033) and there was a significant difference. This meant that there was significant influence of the use of attractant in trapping mosquito. In the group of the dose in either 5 gram or 10 gram (p=0373) and group of 10 gram and 15 gram (p=0,305) did not show any significant difference. In the dose of 5 gram, the total of mosquito was the highest trapped, and it was followed by attractant of bagasse in 5 gram and attractant of red chili in 15 gram. In fact, it was not similar with the result of conducted research by Millati, Nur Aini et al. (2012), who stated that the higher the concentration of attractant, the higher the mean of the total of mosquito eggs which were trapped. This became mosquito's attractiveness to enter into ovitrap to spawn. In the research, the concentration of 15% was effective as attractant and conducted research by Munawir (2009) also used red chili in the concentration of 30% as the best concentration.

The result of either descriptive analysis or analytic analysis focused on similar result, which was the use of red chili in the dose of 5 gram and 15 gram which were effective as attractant for trapping *Aedes Aegypti*, and so did the use of bagasse in the dose of 5 gram. Both of these attractants were liked by the mosquito rather than the control. However, it was not different with conducted research by Siti Rahayu et al. (2015) concerning with the effectiveness test of attractant of *oryza sativa, capsicum annum, and trachisperum roxburgianum* in trapping *Aedes Aegypti*. They stated that red chili was liked more by mosquito.

Thus, the effective attractant based on this research that could be used was red chili in dose of 5 gram because fresh red chili contained ammonia in 0,86 mg/l, CO_2 in 12,4 mg/l, lactic acid in 13,2 mg/l, octenol in 0,6 mg/l, and fatty acid in 22,8 mg/l. These substances could become good attractant that was proved to influence olfactory nerve of *Aedes Aegypti* and this was liked by *Aedes Agypti* rather than clear water such as mineral water (Suyono in Siti Rahayu et al. 2015).

Meanwhile, the bagasse in the dose of 5 gram was also alternative option. The use of bagasse was almost similar with the use of straw that underwent fermentation. If it piled up, it would release heat and result ammonia and CO_2 which were proved to influence olfactory nerve of *Aedes Agypti* to be sensitive due to the content of used organic material for metabolism of creature, that consisted of Carbon 47%, Hidrogen 6,5%, O 44%, and in 1 kg of bagasse contained 2,5% of sugar, which resulted calor in 1825 kkal. If the water content decreased 40%, it would have energy in 2305kkal (*http://sharing active/wrdpass.com/tanaman tebu dan manfaatnya/2012*). This condition was good for the growth of the creature and or microbe because there was water content, sugar content,

and fiber and it was possible to be occurred fermentation (Suyono, 2008). The result of the research indicated that mosquito population had different characteristic geographically in responding the type of attractant, particularly in regarding the mosquito's ability for being attractive to the attractant that resulted strong smell and the material that could become nutrition for its growth.

The Difference of Mosquito Total that was trapped into Ovitrap Based on Observation Time

The result of descriptive analysis described that the total of mosquito that grew in 1st and 2nd week was low and it increased high in 3rd and 4th week (table 2) by using bagasse and red chili as the type of attractant, meanwhile, using seashell as the attractant did not show any significant increase (unstable) as long as the increase of its dose.

The factor of how long the observation correlated with cycle time of mosquito's growth, which was around 12-14 days. Hence, the observation was conducted in the end of 2nd and 4th week because the mosquito that entered into the trapping and spawned were not in same time. Therefore, the result of mosquito's growth was not occurred in all larva and only several larva grew to be mosquito. For example, the growth of larva to be mosquito was occurred in around 42 % while using red chili as the attractant and 23% while using bagasse by the dose of 5 gram in the end of 4th week. The analysis by using Anova test showed that $p < \alpha$ for bagasse attractant (0,007) and red chili (0,02), which meant that there was a significant difference of the total of mosquito that was trapped based on the observation time. Meanwhile, for seashell attractant did not show any significant difference against observation time for the total of trapped mosquito, $p > \alpha$.

The ability for ovitrap with attractant based on observation time and descriptive analysis result and Anova test showed that ovitrap with red chili and bagasse as the attractant could make *Ae. Aegypti* attractive and needed time in around 14 days in order to make the mosquito was trapped. This was concerned with the total of mosquito that entered into trapping and spawned in different time, thus, the age of the larva varied. When the larva grew to be mosquito, it did not show equal total, for example in bagasse attractant with the dose of 5 gram, the mosquito total in the end of 2nd week was only 4 and in the end of 4th week was 41. If it was looked at the larva total, in 1st week and 2nd week were high (105) and in 3rd week and 4th week were 92 and the larva changed to be mosquito only in few numbers. Thus, it described that not all of larva could grow to be mosquito because its age had not been adequate. Besides, it was also occurred in either red chili attractant or seashell attractant. By using red chili attractant, the percentage of mosquito's growth was higher or faster rather than using bagasse, which was in the dose of 5 gram, 47% (If it was estimated, the larvae in the 2nd week became mosquito in the 3rd and 4th week), meanwhile, by using bagasse, it was in 40%). Another conducted research by Sayono (2008), he stated that it needed to change attractant immersion/ reconditioning in the straw because as long as the time, it would decrease the attractiveness, such as strong smell for *Aedes Agypti*.

All in all, the conclusion was observation time could describe how long the ovitrap was used in order to become mosquito trapping and in this research, the observation time of 3rd and 4th week could give the time for growing the larva to be mosquito that could not fly or being trapped until it was seen the larva there or the mosquito died. The death could be occurred by adding chemical material or insecticide in order to kill them in ovitrap.

The result of Anova test, it was obtained that the total of trapped mosquito in bagasse attractant in the observation that was conducted in the end of 2nd week was different with the total of mosquito in the observation that was conducted in the end of 4th week. The result of Anova test was obtained that the total of trapped mosquito in red chili attractant in the observation that was conducted in the end of 2nd week was different with the mosquito total in observation that was conducted in the end of 4th week. Meanwhile, the result of Anova test was obtained that the total of trapped mosquito in seashell attractant in observation that was conducted in the end of 2nd week was not different with the mosquito total in the observation that was conducted in the end of 4th week.

Modification of Ovitrap as the Trapping Tool for *Aedes Aegypti*

This trapping *(ovitrap)* was using attractant of red chili, bagasse, and seashell which could become trapping for mosquito eggs. Hence, it could be used for Aedes Aegypti surveillance that could be modified for killing population of pre-adult mosquito. Therefore, the mosquito in this stage could not go out from the trap and finally, the mosquito died. Its death could be occurred because of less nutrition as long as the longer the observation and or could use additional insecticide material for killing them, which was the extract of srikaya seed water (*Annona Squamosa*) as in conducted research by Milana Salim et al. (2015), in effectiveness test of attractant in *lethal* ovitrap against the total and hatchability of *Aedes Agypt* eggs.

5.   CONCLUSION

There was a significant difference of the total of trapped mosquito in the ovitrap based on the type of dry media/attractant of bagasse and red chili. Nevertheless, there was no significant difference of the total of trapped mosquito in ovitrap based on media type/attractant type of seashell. There was a significant difference of the total of trapped mosquito in the ovitrap based on the dose of bagasse attractant and red chili attractant. The

significant difference of red chili attractant was between the dose of 5 gram and 15 gram. Meanwhile, in other dose and attractants did not give any significant difference. There was a significant difference of the total of trapped mosquito in the ovitrap based on how long the observation in 1st and 2 week, 3rd and 4th week. Modification of ovitrap as trapping tool of *Ae. Aegypti* was using red chili in the dose of 5 gram and 15 gram with the observation time in 4 weeks, and it was followed by bagasse in 5 gram dose with similar observation time.

6. SUGGESTION

1. The use of simple ovitrap with attractant of red chili and bagasse was recommended for controlling the vector of dengue fever in society, hence, it could decrease the occurrence of dengue fever.
2. The other researchers could conduct further research regarding modification of ovitrap by using bagasse powder in laboratory.

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