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The Influence of Kersen Leaf (*Muntingia calabura*)and BetelLeaf (Piper betle Linn)Extract on the Density Level of HouseFly (Musca domestica)

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Abstract

Kersen and Betelleaf has been partially known to be effective in controlling housefly (*Musca domestica*) which was known as one of the disease vectors which causes a widespread health issue. This study aims to understand the influence of the combination of Kersen leaf and Betel leaf extract to the density level of housefly. This is an experimental study using the Kersen and betel leaf extract of different concentration which were 0%-0%; 0%-10%; 10%-0% and 10%-10% and was sprayed to the surface of a fresh prawn and then the effect to the number of the housefly that was perching on the bait was analyzed. Data was analyzed using the Anova test (a=0.05) and if different was continued in advanced using the Turkey HSD test. The result of this study showed that the combination of the Kersen leaf and betel leaf extract with 10%-10% concentration was effective to decrease the number of housefly that perch on the surface of the bait by 48%. The conclusion of this study was that the extract of the kersen leaf combined with the betel leaf extract was effective in controlling housefly.

Keywords: Betelleaf; Kersenleaf; Housefly.

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1. Introduction

Many infectious diseases which was spreading through and insect as it's vector, known as arthropod-borne disease or vector-borne disease has caused a global health challenge, due to its characteristic of fast spreading. Housefly (*Musca domestica*) is the vector for typhoid, other gastrointestinal diseases such as dysentery, diarrhea, cholera and other skin diseases [1]. In the prevention and treatment of the infectious diseases with this vector, the importance of vector control was often taken for granted, because the focus was often in the treatment of the disease. Vector control was supposedly the main consideration in the prevention and treatment of infectious disease especially in vector-borne disease. Mechanical and biological method of controlling the vector is a more environmentally friendly in comparison to chemical method [2]. Insecticide made from plants has the potential to control vector, either in eradicating that larvae or adult fly, because it was made from natural ingredients, this insecticide is more bio-degradable in the nature so that it wont pollute the environment and was relatively save for the human and animal because the residues was degraded easily [2]. In indonesia, *Muntingiacalabura* is known as kersen, kersen leaf contains several compounds such as flavonoid, tannin and saponin [3]. Prior studies showed that kersen leaf had an antibacterial effect [4]. Furthermore, the effectivity of kersen as an insecticide has been proven for *Agrotisipsilon, Spodoptera exiqua* [5] and *Plutellaxylostella* [6]. Prior study conducted by [7] showed that kersen leaf extract (*Muntingiacalibur*) was effective in controlling fruit fly, which furthermore raises a question whether or not this kersen leaf would be effective in controlling house fly (*Musca domestica*). Betel (*Piper betle*L) is a type of vine with green and heart-shaped leaf with unique scent. Betel (*Piper betle*L) contains atsiri oil, tannin, chavicol, flavonoid and terpenoid which may contribute in killing larvae, betel has the potential to be used as natural insecticides. Flavonoid act as contact venom or digestive poison which progressively kills the insect until they stop in feeding (*stop feeding action*). Terpenoid is a toxin for insects. Tannin can block the muscular response of the larvae's cell wall. Atsiri oil is an antifungal, antibacterial and antivirus for certain microbes. Chavicol is an antioxidant component [1]. Prior study conducted by [8] about the effectivity of betel leaf extract (*Piper betle*L) as a larvicide for housefly (*Musca domestica*) larvae raises a question in advance about whether this betel leaf extract would also be used as an affective controller for adult housefly. This study focused in observing the vector and environmental problem, in which the author tried to understand the correlation of betel leaf extract and Kersen leaf as a vector controller for housefly.

2. Materials and Methods

This is an experimental study using the completely randomized design. This study was conducted in the Malaka district regional disaster management agency offices Laboratorium. Kersen leaf and Betel leaf used in this study was obtained from around the author's garden in Malaka. Housefly used as the samples in this study has the characteristic of greyish black color with 4 lines in the back of its chest and one black line in its back abdomen. Using the completely randomized design the housefly was divided into 4 groups with different treatment with 3 times repetition using the kersen and betel leaf with 0%-0%; 0%-10%; 10%-0% and 10%-10% concentration repetitively with 15 houseflies (*Musca domestica*) in each treatment. The process of obtaining the betel leaf and kersen leaf extract starts with the process of selecting the betel leaf and kersen leaf which would then be extracted. Simplicia was performed on the betel and kersen leaf which was then extracted and macerated to

obtain thick extraction. Aquadest was then used as the solution to create each concentration which will be used in this study. After betel leaf and kersen leaf extract was obtained, randomization of the samples was performed. Fifteen Housefly was selected randomly to be included in each group of treatment. These houseflies were obtained from the collecting stall randomly. After the housefly has been moved to the testing stall, the temperature and humidity of the stall was measured before the treatment was performed. After measuring the temperature and humidity, we continued with exposing the housefly with fresh prawn which has been sprayed with combination of betel leaf and kersen leaf extract with different concentration as a bait. After the bait was sprayed with the extract it was then put into the stall and then left for 1 minute before then the number of times the housefly touches the bait was observed and noted for 30 minutes. The data obtained was analyzed using the ANOVA analysis with the alfa = 0.05. if the result showed a significant difference, the data will be analyzed in advanced using the Tukey HSD analysis.

3. Results

Prior to the observation of exposing the housefly to the bait which has been sprayed with betel and kersen leaf extract, temperature and humidity was measured to ensure that the temperature and humidity was effective for the experiment

Table 1: Measurement of Temperature and Humidity

Repetition	Room temperature (^{o}C)	Humidity (%)
I	30	72
II	31	70
II	31	72
Mean	31	72

Table 1. above showed that the mean temperature in this study for 3 times repetition was 31^{o}C and the mean humidity was 72%. These temperature and humidity measurement were effective to be used for the study. Furthermore, the process of exposing the housefly to the sprayed bait was performed 3 times repetitively for each concentration.

Table 2. Showed the average times of perching of the flies to the bait with the first extract combination was 27 times. This number will be used as a control to measure the repelling ability for the available extract combination. In table 4.2 it was shown that the highest number of perch was in the second extract combination: betel 0% and kersen 10%, with the average of 23 housefly perch. On the other hand, the lowest number of perch was in the ninth combination: betel 10% kersen 10% with the average of 14 housefly perch. This finding will be analyzed in advanced using the Two-Way ANOVA to see if there was a significant difference between each combination of extract. The author also measured the repelling ability of the extract combination by counting the mean perch count in the control group as standard.

Table 2: The number of flies that perch on to the prawn during the number I, II and III of repetition in the duration of 30 minutes

No	Combination of extract's concentration	Repetition	Times the flies in Contact with the bait (Times)	Mean
1	S_0K_0	I	28	27
		II	27	
		III	26	
2	S_0K_{10}	I	23	23
		II	24	
		III	22	
3	$S_{10}K_0$	I	17	17
		II	17	
		III	18	
4	$S_{10}K_{10}$	I	15	14
		II	14	
		III	14	
Mean				20

Table 3: The result of mean repelling ability (%) of the combination of betel leaf and kersen leaf extract to housefly (*Musca domestica*).

No	Combination of extract's concentration	Times the flies in contact with the bait	Thrust (%)
1	S_0K_0	27	0%
2	S_0K_{10}	23	15%
3	$S_{10}K_0$	17	37%
4	$S_{10}K_{10}$	14	48%
Mean		20	30%

Table 3. Showed that the strongest repelling ability was found in the group with a combination of 10% betel and 10% kersen leaf, with 48% repelling ability. On the other hand, the lowest repelling ability was in the group with a combination of 0% betel extract and 10% kersen extract, with 15% repelling ability.

3.1. The Influence of Betel and Kersen Extract Combination to the Repelling Ability of Housefly (Musca domestica)

- ***Two-way ANOVA Test***

Table 4: The result of Two-Way ANOVA Test

Variable	F Value	Significant
Betel extract	732.000	0.000
Kersen extract	56.333	0.000
Combination of Betel and Kersen extract	6.500	0.001
R Squared	0.986	

Table 4. Showed that there was a correlation between betel extract, kersen extract, and the combination of both extract to the number of housefly perch to the bait. The correlation can be found in both of the group tested with the significant value of 0.05 (p=0.000). R squared value also showed that the multiple determinants of all independent variables in which the closer the value to one the strongest the correlation is.

- ***Post Hoc Test***

After finding that there was a significant difference in both of the data, the result was then analyzed in advanced using the Post hoc test using Tukey to see which of the group differ.

Table 5: The Result of Post Hoc Test Using the Tukey HSD Test

No	Combination of extract's concentration		Mean difference	Significance	95% CI	
					Lower	Upper
Group 1 (Contact of flies with the bait in the first 30 minutes)						
1	S_0K_0	S_0K_{10}	4.000*	0.000	25.856	28.144
2		$S_{10}K_0$	9.667*	0.000	20.523	22.810
3		$S_{10}K_{10}$	12.667*	0.000	16.190	18.477

Table 5. It was shown that there was a difference in all of the groups based on the mean value and the higher the concentration of the extract either for the betel or kersen leaf the higher the difference will. This means that there was an indication of increasing effectivity of both extract to the repelling ability for the housefly. Based on the difference of mean value with the control, the author concluded that the betel and kersen leaf concentration 10%-10% was the most effective to be used as housefly repellant in house.

4. Discusion

Generally, efforts of controlling fly as one of the animals that is causing unsettlement for the society and also a vector for many diseases can be done in 3 ways which is modifying the environment, chemical, and biological [9]. Biological control method is an alternative method which is currently advancing in these last decades. Not only because it was safer for the environment, this method is also very easy to apply because it uses tools that was easy to find around the house. This method uses bioinsecticides such as bacteria or fungi which was known

to produce toxin for housefly [10]. Other than bacteria or fungi, several extracts was also believed to have the ability to repel or to kill fly, such as betel leaf, kersen leaf, soursop leaf [11], Cengkeh leaf [12], screwpine [13] and basil leaves [14]. This study found that the use of betel and kersen leaf as a main bioinsecticide especially for housefly was consistent with prior studies. Experimental data from this study showed an increased concertation of betel and kersen from 0-10% is directly proportional with the number of flies that perch in which the higher the concentration of betel and kersen extract, the fewer is number of flies that perch on the bait. This study was similar with previous studies in which betel leaf is not only effective as a bioinsecticide for housefly [8], [12] but also for other insects such as mosquito (*Aedes aegepti*) [15] and also subterranean termite (*Coptotermescurvignathus*H.) [16]. Some of the compounds found in the betel leaf has long been identified to have a poisonous effect for insects which repel insects like housefly. These compounds were atsiri oil, tannin, flavonoid, terpenoid, chavicol, etc. The kersen leaf extract in this study was also found to be effective as a bioinsecticide which may repel housefly. These findings were similar with previous studies in which the betel leaf extract has been proven to decrease the number of housefly pupa [7]. Several experimental studies that uses kersen leaf extract found that this plant was more effective in controlling bacteria overgrowth, such as *Staphylococcus aureus, Escherichia coli* [17], and *Klebsiella pneumoniae* [18]. Other than insect and bacteria, some other studies also observe the ability of kersen leaf extract to control other pests such as land worm (*Agrotisipsilon*), beet armyworm (*Spodoptera exiqua*) [5] and Diamondback moth (*Plutellaxylostella*) [6]. Some of the compounds found in the kersen leaf that functions as an insecticide was tannin, flavonoid and saponin. The combination of kersen and betel leaf extract has been proven to be effective as a housefly repellant in household settings. This finding will furthermore need an advanced detailed laboratorial examination to map the compounds found in both of these extracts and its correlation to the repelling ability for vectors such as housefly, mosquito, etc. The weaknesses of this study were, firstly, the combination of the extract concentration was limited to 0-20% in which higher concentration might still be needed to be tested to find the most effective concentration for both of these extract in repelling an insect. Secondly, this study was limited in laboratorial experiment in which the side effect of the use of this insecticide for the change of taste for the food/drink and if there is any change of nutritional content after adding these extracts to the food/drink, assuming that the use of this bioinsecticide was to repel housefly that is commonly perc hon food/drink, must be considered. Thirdly, further studies are needed specially to map the compounds found in the betel and kersen leaf more comprehensively not only for housefly but also for other insects. This study strengthens the use of bioinsecticide by using resources that were easy to be found around the household in order to control diseases with insect as its vectors. By understanding more resources/plants that may be indicated to be able to repel insects, then the community will have more option to choose for controlling insect that causes the diseases. On the other hand, the use of natural bioinsecticide should suppress the use of chemical bioinsecticide which harm the environment and may also causes health issues. Furthermore, the use of bioinsecticide should decrease the cost of disease's vector control and increase the effectivity of the prevention and controlling program.

5. Conclusions

Kersen leaf extract combined with the betel leaf extract was effective in repelling housefly which affect the density of the housefly in the house; The most effective concentration of betel and kersen leaf for increasing the repelling ability for housefly is the combination of 10%-10% betel leaf extract and kersen leaf extract.

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