Contributions of Central Research Institute for Agriculture
Vol. 17, No. 4, October 2023, pp. 111~116
ISSN: 2962-9217, DOI: 10.35335/ccria
Published by: Central Research Institute for Agriculture (CeRIA)

Testing the Effectiveness of Pandan Wangi Leaf Extract (Pandanus amaryllifolius Roxb) as an Insecticide against House Flies (Musca domestica)

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Article Info

Article history:

Received : Aug 17, 2023
Revised : Sept 25, 2023
Accepted : Oct 27, 2023

Keywords:

Fragrant Pandan Leaf Extract
Vegetable Insecticides
Biopesticides
Vector Control
House Flies.

ABSTRACT

One of the causes of poor environmental conditions is the increasing number of infectious diseases caused by vectors. Flies are vectors that act as intermediaries for disease transmission, so their presence needs to be controlled. Therefore control is really needed, one of the controls that can be done is vegetable pesticides. This biopesticide consists of active ingredients that are environmentally friendly because their contents are biodegradable. This research aims to determine the effectiveness of fragrant pandan leaf extract as an insecticide against house flies. This type of research is pure experimental research with a Posttest Only Control Group Design, which is a design that does not use a pretest on the sample before treatment. The results of this study show that the lowest Musca domestica mortality rate was at a concentration of 5%, namely 1 animal (15%) and the highest mortality was at a concentration of 15%, namely 13 individuals. The ANOVA test results show that p-value = 0.000 ($p<0.05$) so Ha is accepted. And the LC50 probit analysis results were 90.8657 ppm < 1000 µg/mL (ppm). The parameters observed in this study were the death of adult flies after being exposed to fragrant pandan leaf extract with each concentration in percent (%) and the death of flies in the control group. Fly death is characterized by not moving or not responding to stimuli. Observations were carried out every 60 minutes until the 24th hour after treatment in accordance with WHO standards, namely regarding standards for research on insects. Based on the description above, testing the effectiveness of the botanical insecticide fragrant pandan leaf extract against house flies has been carried out for approximately 4 months. So it can be concluded that fragrant pandan leaf extract is toxic to house flies, requiring further research regarding the concentration of related things, which is the most effective and efficient in killing house flies.

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1. INTRODUCTION

Environment, lifestyle behavior, genetic factors and health services are four factors that can influence human health(Adliyani, 2015). These four factors influence each other, each of which is very important, especially environmental factors. This environment includes the physical and sociocultural environment which includes the economy, education and work. Physical

environmental factors play a very important role in the process of spreading disease which originates from the poor quality of sanitation in the surrounding area(Adliyani, 2015).

Social environmental factors relate to people's understanding of the importance of maintaining sanitation and are conditioned by the economy of a community(Eliana et al., 2016). Poor environmental conditions can cause the spread of disease. One of the causes of poor environmental conditions is the increasing number of infectious diseases caused by vectors(Sumampouw, 2017). Flies are vectors that act as intermediaries for disease transmission, so their presence needs to be controlled(KENCANA, 2014). According toIndasari S, 2020, flies are one of the main vectors for the spread of various types of diseases that are transmitted mechanically, such as diarrhea, myasis, dysentery, cholera, typhoid and other digestive tract diseases. Based on data, diarrhea is an endemic disease in Indonesia and is also a potential outbreak disease which is often accompanied by death. According to the 2007 Riskesdas results, diarrhea is the number one cause of death in infants 31.4 and in toddlers 25.2, while in all age groups it is the fourth cause of death 13.2 Ministry of Health 2015.

In Indonesia, the highest incidence of diarrhea in 2012 was in South Sumatra with the number of sufferers being 292, the number of deaths was 8 CFR 2.74, in 2013 the highest was in Central Sulawesi with the number of sufferers being 167, the number of deaths was 4 CFR 2.40, in 2014 the highest case of diarrhea was in NTT with number of sufferers 2,089 number of deaths 23 CFR 1.10. The latest data for 2014, the highest incidence of diarrhea in South Sulawesi was in Kab. Enrekang with a total of 44 cases, there was 1 death Ministry of Health 2014. Typoid fever is one of the diseases most often found in endemic areas such as Indonesia.

Typhoid is an enteric infection caused by Salmonella enterica serovar Typhi or Paratyphi A(Nelwan, 2012), most cases are caused by S. Typhi(Ristiansyah et al., 2018). Salmonella Thyphi bacteria are often found in contaminated food(Nuruzzaman & Syahrul, 2016). According to the World Health Organization WHO, it is estimated that there are 17 million cases of typhoid worldwide with an incidence of 600,000 deaths each year. In Indonesia itself, these cases are spread evenly across all provinces with an incidence in rural areas of 385,100,000 population per year and in urban areas of 760,100,000 population per year or around 600,000 out of 1.5 million cases per year. The situation of typhoid fever in South Sulawesi in the last three years has fluctuated. In 2011 the number of typhoid cases decreased to 17. 287 cases IR 2.07 population, CFR 0.16. In 2012 the number of typhoid cases increased again, with the number of cases reaching 24.

Diseases experienced by people generally come from an unclean environment and are spread through insects that land on foodstuffs such as food and drinking water. The spread is usually carried out by insects such as flies, which are insects belonging to the order Diptera which is the largest order of insects with high species diversity.(Ashar, 2020). The term "Diptera" indicates that this group of insects has two pairs of wings during the embryonic period. The rear pair of wings changes shape and function to become a balance tool called a dumbbell, while the other pair of wings becomes true wings(Kartini, 2019)which we usually call house flies. House flies (Musca domestica) generally have body characteristics including gray-black or yellowish-black bodies.(Hastutiek & Fitri, 2007). Male Musca domestica has a body length of 5.8 – 6.5 mm and female flies have a body length of 6.5 – 7.5 mm or the size of a peanut, on the back there is a black longitudinal stripe.(Rahmi et al., 2019). Houseflies have a very fast life cycle so what is usually left behind in the food are fly eggs.

The growth of flies is quite fast and numerous, so by using materials that are easy to find, they can be used, such as pandan leaves. Indonesia as a tropical country can be said to have various plants that can be utilized. Since ancient times, Indonesian people have known and used plants that have various benefits. Fragrant pandan leaves Pandanus amaryllifolius Roxb. is one of the plants whose properties can be used as herbal medicine(Tasia & Widyaningsih, 2014; Yunitasari, 2018). Wangi pandan leaves are a type of monocotyledonous seed plant and belong to the pandanaceae family. An important component and often used in Indonesian cuisine and other Asian countries is the leaves. The following are the names of fragrant pandan leaves in several regions, including Pandan Wangi Java, Pandan Rampe, Pandan Jau, Seuke Bangu, Pandan Rempai Sumatra, Pondan Sulawesi, Ormon Foni, Pondak Maluku and Pandan Arum Bali Muhimmah, 2014. Pandan fragrant grows a lot in the yard or gardens in tropical areas. Although it is not uncommon to find it growing wild on riverbanks, swamps, pandan leaves also grow in places that are slightly damp. Fragrant pandan leaves have no problem growing from areas around the

coast to plain areas as high as 500 meters above sea level. This plant usually grows around 1-2 m with branching, spreading growth.

2. METHOD

This research is quantitative research using pure true experimental methods whose results will be analyzed bivariately. Quantitative research is a type of research that is objective, includes collecting and analyzing quantitative data using statistical testing. Meanwhile, the experimental method is a research method that tries to find the influence of certain variables on other variables with strict control. This research uses a pure experimental approach (true experiment) with a Posttest Only Control Group Design, which is a research design that does not use a pretest on the sample before treatment. In this design there are two groups (control group and treatment group with different concentrations for each) which have been chosen randomly (randomization), these groups are considered the same before treatment is carried out. Because cases had been randomized to either the experimental group or the control group, the groups were considered the same before treatment. This research design measures the effect of treatment on the experimental group by comparing the group with the control group. If there is a significant difference between the experimental group and the control group then the treatment given is significant with 3 treatments in this study with repetition of each treatment.

Table 1. Replication (Replication) of Treatment

TREATMENT	TEST					
	I	II	III	IV	V	VI
C	CI	CII	CIII	CIV	CV	CVI
X1	X1I	X1II	X1III	X1IV	X1V	C1VI
X2	X2I	X2II	X2III	X2IV	X2V	X2VI
X3	X3I	X3II	X3III	X3IV	X3V	X3VI

Information :

C: Group of house flies tested with fragrant pandan leaf extract (Pandanus amoryllifolius Roxb) (Control)

X1: Test house flies group with the administration of fragrant pandanus leaf extract (Pandanus Amoryllifolius Roxb) at a concentration of 5 %.

X2: Group of Test House Flies with the Provision of Pandan Fragrant Leaf Extract (Pandanus Amoryllifolius Roxb) at a concentration of 10 %.

X3: Group of Test House Flies with the Provision of Pandan Fragrant Leaf Extract (Pandanus Amoryllifolius Roxb) at a concentration of 15 %.

I: Observation of treatment on house flies in the 10th minute of fragrant pandan leaves (Pandanus amoryllifolius Roxb) at each concentration

II: Observation of treatment on house flies in the 20th minute of fragrant pandan leaves (Pandanus amoryllifolius Roxb) for each concentration.

III: Observation of treatment on house flies in the 30th minute of fragrant pandan leaves (Pandanus amoryllifolius Roxb) for each concentration.

IV: Observation of treatment on house flies in the 40th minute of fragrant pandan leaves (Pandanus amoryllifolius Roxb) for each concentration.

V: Observation of treatment on house flies at the 50th minute uij (Pandanus amoryllifolius Roxb) for each concentration.

VI: Observation of treatment on house flies in the 60th minute of fragrant pandan leaves (Pandanus amoryllifolius Roxb) for each concentration.

Data collection methods are one of the important factors that support the success of research. In this research, the data collection methods used are as follows: Observation is a method of collecting data by means of direct observation in accordance with planned procedures including viewing and recording certain numbers or activities related to the problem under study, such as viewing and systematically recording the symptoms that appear on the object of research. Documentation is a method of collecting data by collecting a number of documents, both in the form of images and writing, as well as analyzing existing documents, to support the preparation of research.

The parameters observed in this study were the death of adult flies after being exposed to fragrant pandan leaf extract with each concentration in percent (%) and the death of flies in the

control group. Fly death is characterized by not moving/not responding to stimuli. Observations were carried out every 60 minutes until 24 hours after treatment in accordance with WHO standards, namely regarding standards for research on insects.

3. RESULTS AND DISCUSSION

3.1 Research results

Research testing the effectiveness of fragrant pandan leaf extract was carried out at the Research Laboratory of the Faculty of Mathematics and Natural Sciences, FMIPA, Makassar State University, UNM, with details of activities as follows: Making the botanical insecticide fragrant pandan leaf extract Pandanus amryllifolius Roxb starting from 21 April to 20 September 2018. Making This fragrant pandan leaf extract uses a method that is in accordance with supporting journals and is supported by adequate laboratory equipment and materials.

Table 2. Secondary Metabolite Test for Active Chemical Content of Pure Extract of Wangi Pandan Leaves

Test Test	Reagent	Test results	The results Obtained
Alkaloids	The sample extract that had been diluted using ethanol was dropped into the drop plate in 3 drops and then 3 drops of Wagner reagent were added as well. The result is positive if a brown color is formed and there is a colored precipitate c	There is a brown precipitate at the bottom of the plate and the extract changes color to brown	+
Saponin	2 mL of sample extract was put into a test tube and 3 drops of water were added and then shaken vigorously for 10 minutes. If it foams,	The surface of the extract after shaking is stable for 15 minutes	+
Tannin	5 drops of 5% FeCl3 solution were added to 1 mL of the extract solution which had been previously dropped on the drop plate. Positive results if the results are dark blue or greenish black.	The solution changes color to greenish black	+
Flavonoids	The solution changes color to greenish black	The solution turns greenish yellow	+

And the result is that the ingredients needed for insecticidal purposes are found in the extract, namely Alkaloids, Saponins, Tannins and Flavonoids. It can be confirmed that it is unlikely that the Musca domestica in this study died due to other ingredients apart from the active ingredients of fragrant pandan leaf extract.

Table 3. Room Temperature and Humidity Measurement Results

Repetition	Temperature (oC)	Humidity (%)
I	30	69
II	31	70
III	33	75
Average	31	71

Based on the data in table 3, it shows that the average room temperature at the time of the study was 31 oC and the average room humidity was 71%. According to the Indonesian Ministry of Health, these conditions are still suitable for the development of flies. This temperature and humidity are still within the normal range for Musca domestica. This research was conducted to determine the effect of fragrant pandan leaf extract Pandanus amaryllfolius Roxb on the house fly Musca domestica. The fragrant pandan leaf extract used here is an extract that has been extracted using the maceration method to obtain pure fragrant pandan leaf extract which contains the compounds needed for biopesticides. These fragrant pandan leaves are extracted using the

maceration method. Maceration is an extraction technique used for materials that are not heat resistant by immersing them in a certain solvent for a certain time. Maceration is carried out at room temperature to prevent excessive evaporation of the solvent due to temperature factors. Pretty and Yenie 2017 Meanwhile, the solvent used for the extract here is ethanol. Selection of a suitable solvent is an important factor in the extraction process. The solvent used is a solvent that can filter out most of the secondary metabolites contained in the Simplicia Ministry of Health of the Republic of Indonesia, 2008. Ethanol has the molecular formula C2H5OH, which is non-polar and OH is a polar group, so that the ethanol solvent can attract both polar and polar chemical contents. non-polar. Apart from that, extraction with ethanol solvent is safer than methanol solvent. From a chemical perspective, these biological natural resources are a source of chemical compounds that are limited in type and quantity. Thus, biodiversity can be interpreted as chemical diversity that is capable of producing chemicals, both for the needs of humans and other organisms, such as for medicines, insecticides, cosmetics, and as a basic ingredient for the synthesis of more useful organic compounds (Anggraini et al., 2022).

Based on the phytochemical test, the fragrant pandan leaf extract of Pandanus amaryllifolius Roxb showed that in the Alkaloid test the sample extract that had been diluted using ethanol was dropped into the drop plate in 3-5 drops and then 3-5 drops of Wagner reagent were added. A positive result if a brown precipitate forms at the bottom of the plate. And the test obtained positive results, namely there was a brown sediment at the bottom of the plate. Alkaloids are a class of compounds that are widespread in almost all types of plants. All alkaloids contain at least one nitrogen atom which is usually basic. Alkaloids can be found in the seeds, leaves, twigs and bark of plants(Windari, 2021).

Saponin is a glycoside in plants that resembles soap and can dissolve in water. Saponins can also enter through the respiratory organs and cause cell membranes to be damaged or metabolic processes to be disturbed. The phytochemical test for saponin compounds was carried out by placing 2 mL of sample extract into a test tube containing 3 drops of water and then shaking vigorously for 10 minutes. If there is froth/foam on the edge of the extract then it shows a positive result. The results obtained showed that there was foam on the edge of the extract, so it was positive that saponin was present.

Tannin has a mechanism for precipitating bacterial proteins, resulting in inactivation of enzymes produced by bacteria and inactivating transport proteins in bacterial cell walls, thereby damaging bacterial cell walls.Majid et al., 2022Tannins are plant polyphenols that dissolve in water and can coagulate proteins. If tannins come into contact with the tongue, the protein deposition reaction is characterized by an astringent or astringent taste. Tannins are found in various woody and herbaceous plants, and act as plant defense by preventing insects from digesting food. Tannins can reduce the ability to digest food by reducing the activity of the digestive enzymes protease and amylase and disrupting intestinal protein activity.

Flavonoids are derivatives of phenolic compounds. Flavonoids have antibacterial activity because flavonoids have the ability to combine with bacterial cell membranes and extracellular proteins. Flavonoids are a type of compound that is toxic/aleopathic, a compound made from sugar bound to flavones. Flavonoids have distinctive properties, namely a very sharp odor, bitter taste, soluble in water and organic solvents, and easily decomposed at high temperatures.(Maharani, 2022).

4. CONCLUSION

The lowest average death of Musca domestica was at a concentration of 5%, namely 1 individual, and the highest mortality was at a concentration of 15%, namely 13 house flies tested. And the results of the anova test showed that p-value = 0.000 ($p < 0.05$), then Ha was accepted, which can be stated that there was a significant difference between the 3 treatment concentration groups of Musca domestica with fragrant pandan leaf extract (Pandanus amaryllfolius Roxb). The results of the LC50 probit analysis were 90.8657 ppm < 1000 ppm. So it can be concluded that fragrant pandan leaf extract is toxic to Musca domestica.

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