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LEMONGRASS EXTRACT *(Cymbopogon Nardus. L)* AS PLANT INSECTICIDE AMERICAN COCKROACHES *(Periplaneta Americana)*

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Abstract

Cockroaches are organisms that often disturb comfort by leaving unpleasant odors, spreading various disease pathogens and causing allergies. Safe and environmentally friendly control, one of which is by using insecticides derived from plants such as citronella. This study aimed to analyze the ability of citronella extract as a natural insecticide for American Cockroaches. This research was an experimental type with a sample of 600 American cockroaches and given treatment with variations in doses of citronella plant extract, namely 1%, 5%, 10%, 15% and 20%, observing their death after 24 hours. The results showed that the average mortality of American cockroaches at all concentrations was at a concentration of 1% death 10%, 5% death concentration 35%, 10% death 54%, 15% death 63% and 20% death 70%. There was a significant difference in the number of dead American cockroaches with all doses of the addition of citronella plant extract with P=0.000. Lemongrass extract was recommended as a natural insecticide to kill cockroaches.

Key words: *Lemongrass extract, insecticide, cockroach, Cymbopogon Nardus. L, Periplaneta Americana*

INTRODUCTION

Cockroaches can act as vectors of disease, because cockroaches prefer damp, dark and dirty places. This can carry germs that stick to the body and will be left behind or attached to the place it passes. Diseases transmitted by cockroaches include dysentery, cholera, typhoid, diarrhea and others related to poor environmental sanitation conditions (Bapelkes, 2004). Diarrhea is reported to be the second highest position as the most dangerous disease in children under five, killing 4 million children every year in developing countries. The incidence of diarrhea in Indonesia is still a public health problem. Based on data from Indonesia's health profile in 2010 the number

of diarrhea cases found was around 213,435 patients with 1,289 deaths and most of them (70-80%) occurred in children. (Ministry of Health RI, 2010).

The control of the number of insects by using insecticides. The use of synthetic insecticides does not always kill all insects exposed to insecticides because there are also resistant insects. Insects that do not die will multiply and pass on their ability to be resistant to synthetic insecticides to the next generation (Ahmad, 2011). Seeing the disadvantages in the form of side effects caused by synthetic insecticides, an effort is needed to get natural insecticides that are more environmentally friendly, safe for humans. One of the natural insecticides includes plants as insecticides (Novizan, 2002), one of which is citronella *(Cymbopogon Nardus. L).*

Lemongrass has a distinctive and strong aroma. This aroma is obtained from the citronella compound contained in citronella essential oil, the aroma is not liked and is highly avoided by insects including cockroaches. Citronellal compounds can be used as natural insecticides, have contact toxic properties and can cause death (Hayakawa, 2012). This study aims to determine the ability of citronella plant extract as a natural insecticide for the cockroach *(Periplaneta Americana)*.

METHOD

Research Design and Subject

The design in this study used a quasi-experimental. American cockroach population with a sample of 600 cockroaches with details of 5 treatments x 5 repetitions x 20 cockroaches per test cage + 5 controls x 20 cockroaches. Citronella was extracted by evaporation and diluted using 70% ethanol to get a concentration of 1%, 5%, 10%, 15%, 20% then sprayed onto the Periplaneta Americana cockroach in the test cage, then observed its death after 24 hours.

Instruments and Data Analysis Procedures

The data obtained were tested for normality assumptions using the Kolmogorov-Smirnov test and for the different test each concentration was tested with One-Way Anova.

RESULT

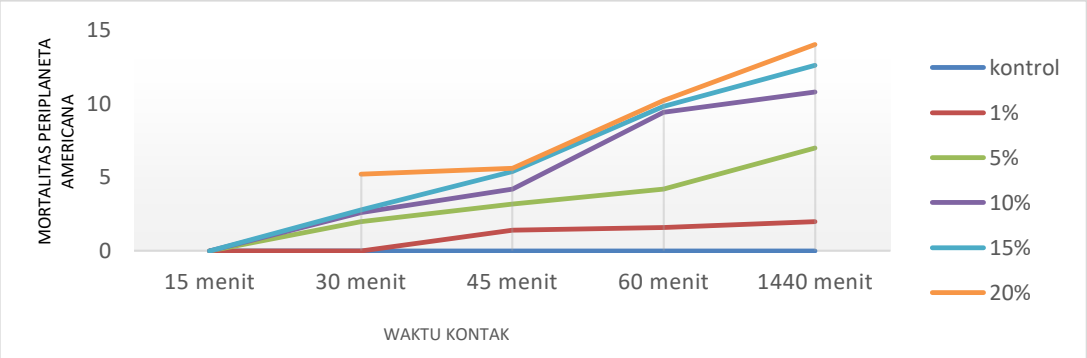
Results of the research can be seen in the following

Table 1. Frequency Distribution of Deaths of Periplaneta America Cockroaches after Addition of Lemongrass (*Cymbopogon nardus. L*) plant extract.

No	Perlakuan	Pengulangan	Jumlah kecoa sebelum perlakuan	∑Kematian Kecoa	Rata-Rata Persentase Kematian Kecoa	Rata-Rata ∑Kematian Kecoa
1.	0% (Kontrol)	1	20	0	0%	0 ekor
		2	20	0		
		3	20	0		
		4	20	0		
		5	20	0		
2.	1%	1	20	3	10%	2 ekor
		2	20	2		
		3	20	0		
		4	20	2		
		5	20	3		
3.	5%	1	20	8	35%	7 ekor
		2	20	6		
		3	20	6		
		4	20	7		
		5	20	8		
4.	10%	1	20	11	54%	11 ekor
		2	20	9		
		3	20	11		
		4	20	12		
		5	20	11		
5.	15%	1	20	12	63%	13 ekor
		2	20	13		
		3	20	12		
		4	20	14		
		5	20	12		
6.	20%	1	20	13	70%	14 ekor
		2	20	16		
		3	20	15		
		4	20	12		
		5	20	14		

The highest average percentage of Periplaneta Americana cockroach mortality and the highest average number of cockroach deaths was in the 10% treatment which reached 54%.

Graphics 1 Average Time of Death of Cockroach Periplaneta Americana against Variation in Dose of Fragrant Lemongrass (Cymbopogon nardus.L) Plant Extract



The longer the contact time of the citronella plant extract, the higher the mortality percentage of Periplaneta Americana cockroaches.

Table 2 Results of Data Normality Analysis in 2019

No.	Perlakuan	Kolmogorov-Smimov		
		Statistic	df	Sig
1	Kontrol	Konstan	Konstan	Konstan
2	1%	0,833	5	0,146
3	5%	0,821	5	0,119
4	10%	0,828	5	0,135
5	15%	0,771	5	0,046
6	20%	0,987	5	0,967

Table 3 Results of the Analysis of Differences in the Number of Cockroach Deaths with Variations in Dosage of Fragrant Lemongrass Extract

Statistic	*Sum of Square*	*Mean Square*	F	*Sig.*
Between groups	827,867	165,573	141,920	0,000
Within groups	28	1,167		
Total	855,867			

Obtained P value = 0.000; where the P value <0.05 so it can be concluded that there is a difference in the number of cockroach deaths with all variations in the dose of citronella extract.

DISCUSSION

Observations showed that the response did not move, the cockroach's legs became stiff and did not move. This is because citronella essential oil enters through the skin on the cuticle layer of cockroaches, citronella toxin which has the potential to kill cockroaches. As a stomach poison, citronellal compounds can enter the digestive tract through a spray of ingested citronella extract. Insecticides will enter the digestive organs of the cockroach and then interfere with the cockroach's metabolism so that it will lack energy for its life activities which will cause the Periplaneta Americana cockroach to die. Essential oils directly penetrate the insect's integument, trachea, or sensory glands and other organs, causing the cockroach's body to stiffen and the energy to be reduced, causing the cockroach to die. This is supported by the statement according to Arimurti, 2017 that citronella has a distinctive and strong aroma. The aroma is obtained from the citronella compound contained in the essential oil of citronella, the aroma is not liked and is highly avoided by insects including cockroaches. Citronellal compounds can be used as natural insecticides, have contact toxic properties and can cause death. In this study, the data obtained showed that the average time the cockroach experienced an immobile or dead response was 16 minutes, the higher the spraying volume of citronella extract, the more citronellal content contained in the citronella extract which can kill cockroaches faster (Arimurti, 2017).

The killing power of this citronella extract when compared with the ethanolic extract of garlic, has a better killing power, namely at a dose of 5% garlic ethanol extract was only able to kill 16.7% of cockroaches (Rahmawati, 2021). Then, peppermint leaf extract at a dose of 5% only able to kill 25% (Puri, 2021) while citronella extract can reach 35%. When compared with kaffir lime extract. It is also better, where the LC50 of kaffir lime extract reaches a dose of 58.5% (hanina, 2020) or bay leaf extract LC50 with a dose of 33% (Martha, 2022) while the lemongrass extract is only around 9 -10% only. But when compared with lamtoro seed extract, it turns out that lamtoro seed extract is stronger, with a dose of 6% it can kill 66% or LC50 at a dose of 3.35% (Adelia, 2020). While citronella extract with a dose of 5% can only kill 35%. Likewise, when compared to tuba root extract, tuba root extract is better, namely LC50 only at a dose of 3% (Kinansi, 2018) while citronella extract at a dose of 9-10%.

However, citronella extract still has another advantage, namely that this plant is a household cultivation plant because it is also commonly used for cooking spices, so that in applications by the community it is more likely to be developed. The average time of death of cockroaches is 24 hours with a spraying volume of 10 times. Periplaneta Americana cockroaches did not all die because they used cages, the cages were made of gauze, the gauze was

not covered when spraying so as to allow some of the citronella extract to be carried by the wind. The higher the spraying volume of the citronella plant extract, the more citronella content contained in the citronella extract. If more and more citronella compounds are ingested by cockroaches, it will cause the cockroach to die faster.

When compared with Mustapa's 2015 research on the effectiveness of betel nut juice (Arecha catechu. L) as a cockroach insecticide with concentrations of 50%, 70%, and 90% respectively, the percentage results showed that at a concentration of 50% the number of deaths 25% cockroach mortality, 50% cockroach mortality 70%, and 90% cockroach death 100% with 24 hours. There is a difference in the effectiveness of the dose used to kill cockroaches against the dose of citronella extract, the dose used to kill cockroaches with betel nut juice with the average number of cockroach deaths reaching 50% is with a concentration of 70%, while in the research for the citronella plant, the dose used to achieve 50% cockroach mortality was at a concentration of 10% with 24 hours. This means that the dose of citronella plant is more effective than the dose of betel nut juice, because the active ingredient in citronella, namely the content of citronella essential oil in which there is a citronellal compound which cockroaches do not like when in contact with cockroaches. Areca nut does not contain essential oils and there is no citronella compound, the active ingredient in areca nut, namely, arekoline, a type of alkaloid that can cause paralysis and stop cockroach breathing, but the active ingredient can kill cockroaches in larger doses. (Mustapa, 2015).

People have been using cockroach-killing drugs with chemicals, even though chemical-based cockroach-killing drugs are very dangerous for breathing. Based on the research above, another alternative commonly used to eradicate cockroaches is citronella which is produced through citronella essential oil. Lemongrass essential oil is sprayed onto cockroaches, the cockroach will experience an immobile (dead) response, and the aroma of citronella is very fragrant so cause respiratory problems because its aroma can make us relax, so citronella essential oil can be used as an alternative to exterminator cockroach. In citronella plants, according to Feriyanto, 2013 the extraction of essential oils from the leaves and stems of citronella using the steam and water distillation method with microwave heating, the effect of the part of citronella that produces high quality citronella is in the stem, % citronella lemongrass fragrant on fresh leaves by 67.36%, withered leaves by 44.92%, fresh stems 75.16% and wilted stems 85.73%. (Feriyanto, 2013).

CONCLUSIONS AND SUGGESTIONS

There was a significant difference in the number of dead American cockroaches with all doses of the addition of citronella plant extract. Lemongrass extract was recommended as a natural insecticide to kill cockroaches.

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