
The Effect Of Wuluh Starfruit (*Averrhoa bilimbi*) and Srikaya Fruit (*Annona squamosa*) Leaf Extracts On The Death Of House Cockroach (*Periplaneta americana*)

Pengaruh Ekstrak Daun Belimbing Wuluh (*Averrhoa bilimbi*) dan Daun Srikaya (*Annona squamosa*) terhadap Kematian Kecoa Rumah (*Periplaneta americana*)

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Article Info

Article history

Received date: 2022-12-12

Revised date: 2022-12-09

Accepted date: 2022-06-14



Abstract

Cockroaches are residential pests that disturb the comfort of human life. Belimbing wuluh leaves and srikaya leaves can be used as natural bioinsecticides for cockroaches because they contain saponins, tannins, and alkaloids. Flavonoid compounds when inhaled can affect cockroach breathing and cause weakness in the nerves. This study aimed to determine the effectiveness of srikaya and belimbing wuluh leaf extracts on the death of house cockroaches. This type of research is Pre-Experimental. The research design is After Only Design. The samples used were 200 house cockroaches. There were 19 containers and 1 control each container containing 10 house cockroaches. The concentrations of belimbing wuluh and srikaya leaf extracts used were 30%, 35%, and 40%. The results of the T-test did not find a significant difference between c with a p-value = 0.638. The conclusion of this study, is that there is no difference between the use of starfruit leaves and srikaya leaves in the death of house cockroaches. Both extracts are equally effective in killing house cockroaches. Further research can be continued with other leaf extracts.

Keywords:

Cockroaches; Starfruit Leaves (*Averrhoa bilimbi*); and Srikaya Leaves (*Annona squamosa*)

Abstrak

Kecoa merupakan hama pemukiman yang mengganggu kenyamanan hidup manusia. Daun belimbing wuluh dan daun srikaya dapat dijadikan bioinsektisida alami untuk kecoa karena mengandung senyawa saponin, tannin dan alkaloid. Senyawa flavonoid apabila terhirup maka dapat mempengaruhi pernapasan kecoa dan menyebabkan kelemahan pada syaraf. Tujuan dari penelitian ini untuk mengetahui efektivitas ekstrak daun srikaya dan belimbing wuluh terhadap kematian kecoa rumah. Jenis penelitian ini merupakan Pra-Eksperimen. Desain penelitian yaitu *After Only Design*. Sampel yang digunakan sebanyak 200 ekor kecoa rumah. Terdapat 19 wadah dan 1 kontrol setiap wadah berisi 10 ekor kecoa rumah. Konsentrasi ekstrak daun belimbing wuluh dan daun srikaya yang digunakan ialah 30%, 35% dan 40%. Hasil uji T-test tidak menemukan perbedaan signifikan antara c dengan nilai-p=0,638. Kesimpulan dalam penelitian ini, bahwa tidak ada perbedaan antara penggunaan daun belimbing wuluh dan

daun srikaya terhadap kematian kecoa rumah. Kedua ekstrak tersebut sama-sama efektif dalam membunuh kecoa rumah. Penelitian selanjutnya dapat dilanjutkan dengan ekstrak daun lainnya.

Kata Kunci:

Kecoa, Belimbing Wuluh (*Averrhoa bilimbi*), Daun Srikaya (*Annona squamosa*)

INTRODUCTION

Vectors are living organisms that can transmit disease agents from animals or humans. One of the most important vectors in the transmission of specific parasitic or viral diseases is the arthropod[1]. Cockroaches belong to the arthropod class Insects of the order Dictyoptera or Blattodea. Cockroaches are residential pests that often interfere with the comfort of human life by leaving unpleasant odors, spreading various disease pathogens, causing allergies, and polluting walls, books, and household utensils[2]

Cockroaches are in homes or buildings, damp, warm, dark places, and have the food that cockroaches need. Generally, cockroaches are nocturnal animals. During the day cockroaches hide in hidden holes or crevices. Cockroaches that are a problem in human health are cockroaches that often breed and live around dead living things. Cockroach activity mostly roams indoors through walls, pipes, and open drains. Cockroaches can emit a substance that smells bad so we can detect where they live. When viewed from the habits and place of life, it is very possible that cockroaches can transmit diseases to humans. Disease germs attached to his body brought from dirty places will be left behind or attached to the place he landed[3]

Efforts to control cockroaches can be done in various ways, such as sanitary, biological, mechanical, and chemical. In general, chemical methods are mostly used by the community, such as spraying or fumigating, because they are considered more practical. The fumes from spraying containing insecticides can spread throughout the room in the house and poison the occupants of the house. In addition, this

method can also leave residues that are harmful to humans[2].

The use of insecticides must be carried out with caution and with full consideration of public health and the environment, therefore it is necessary to find other safer ways to deal with the problem of cockroaches [4]. Restrictions on the use of chemicals, especially chemical pesticides, have begun to shift to the use of safe pesticides for the environment [5]. Therefore, it is necessary to do other alternatives to control cockroaches from plants that have compounds that can kill insects but have no side effects on the environment and are not harmful to humans. One way that can be done is by using vegetable insecticides derived from plant extracts. Plants that have the potential as vegetable insecticides are srikaya leaves (*Annona squamosa*).

Srikaya leaves (*A. squamosa*) is a plant known by Indonesian people as a traditional medicinal plant to treat various diseases. The leaf part of this plant can overcome coughs, rheumatism, respiratory disorders, digestion and increase stamina, and fever reducer [6]. Srikaya leaves also contain saponins, tannins, and triterpenoids[6]

Wuluh star fruit is a fruit that is found in almost all parts of Indonesia and its utilization in the community itself is still not optimal. Toxic substances that play a role in the death of cockroaches in would starfruit are alkaloids, saponins, and flavonoids. Flavonoid compounds can affect the work of the respiratory system[7]. Tests for the content of flavonoids in star fruit juice have been carried out. It is known that 100 mL of star fruit juice contains 41.0309 mg of flavonoids. Every 2 mL of star fruit juice

contains flavonoids as much as 0.8206 mg. The test for the flavonoid content in whole star fruit has never been done, so it is not known whether the amount of flavonoids in whole star fruit is less or more when compared to star fruit juice[8]. The results of the preliminary phytochemical test on the methanol viscous extract of starfruit fruit were found to be positive for containing flavonoid compounds, saponins, alkaloids, and essential oils[9].

Research conducted by [7] used starfruit leaf extract with 3 solvents namely ethanol, ethyl acetate, and hexane where each solvent used concentrations of 12.%, 25.%, 37.%, and 50.% showed all solvents can kill American cockroaches with the highest mortality of 50% in n-hexane extract. Observation time was carried out after 3 hours of spraying and then the number of dead cockroaches was counted in each experimental box. The death of cockroaches occurred because the leaf extract of starfruit wuluh contains terpenoids and steroids. Furthermore, research by [10] used srikaya leaf extract with 96% ethanol as a solvent with a concentration of 5%, 10%, 20%, and 30% showed that each sugar apple leaf extract could kill American cockroaches. The death of cockroaches occurred because srikaya leaf extract contains flavonoid and tannin compounds.

This study aimed to determine the effectiveness of extracts of Srikaya Leaves and Belimbing Wuluh against the death of house cockroaches (*Periplaneta Americana*). The hypothesis to be proven from this research is that there is a difference between the use of star fruit extract and srikaya leaf extract on the mortality of house cockroaches (*Periplaneta Americana*).

METHOD

The type of research used is *Pre-Experimental*. The design of this research is *After Only Design*. Where in this design the researcher only sees the results without measuring the previous state. However, in this study, a control

group was available even though it was not randomized[11]

The population in this study is the population of cockroaches in the city of Tanjungpinang. The samples in this study were 190 house cockroaches (*Periplaneta Americana*) and there were 19 boxes (boxes) each containing 10 cockroaches. While 1 container is a control. by using a purposive sampling technique that is based on certain considerations made by the researchers themselves based on the characteristics or characteristics of the population that were known previously[11]

Sources of data obtained directly from the results of observations of the use of leaf extract starfruit and srikaya leaf extract with the addition of ethanol on the mortality of house cockroaches (*Periplaneta americana*) and the results of previous studies, books, and research journals. Method of collecting data obtained from experimental observations using observations made on the results of the treatment.

Analysis of the data used in univariate and bivariate analysis, univariate which aims to explain or describe the characteristics of each research variable with a descriptive test. and produce the frequency distribution and the percentage of each variable in the form of tables or diagrams[11]. This analysis was carried out to see the number of deaths of house cockroaches (*Periplaneta americana*) on the concentration of star fruit leaf extract and srikaya leaf extract with concentrations of 30%, 35%, and 40%.

Bivariate analysis is an analysis carried out on two variables that are suspected to be related or correlated[11]. Which was used to determine the effect of leaf extract of star fruit (*Averrhoa bilimbi*) and leaves of srikaya (*Annona squamosa*) on the mortality of house cockroaches (*Periplaneta americana*), with a 95% truth level, value (α): 5% by using the hypothesis test, namely the *t* independent to find out the comparison of

the mean of the two independent data groups, see the comparison of the variations of the two groups of data.

RESULT AND DISCUSSION

Table 1. Number of *Periplaneta Americana* Based on Time At Each Concentration of Starfruit Leaf Extract

Extract Concen tration	K	The average number of cockroach deaths in 90 minutes								
		30 mnt			60 mnt			90 mnt		
		P	P	P	P	P	P	P	P	P
30%	0	2	2	2	0	0	1	4	2	2
35%	0	5	3	3	2	0	0	1	1	2
40%	0	5	4	5	0	0	1	1	1	0

The results showed that when given the starfruit leaf extract, the highest cockroach mortality was at a concentration of 40%, with a percentage of 56.7%. This is because starfruit leaves have active substances, the most contributing to the death of house cockroaches (*Periplaneta Americana*) are flavonoid compounds. The way flavonoid compounds work is flavonoid compounds which are respiratory poisons. The flavonoid compounds inhaled by cockroaches affect the cockroach's breathing so that the body weakens and causes weakness in the nerves. Yunikawati et al[12] explained that flavonoids are respiratory inhibitors with a mechanism that can weaken nerves. Flavonoids are one of the largest natural phenol groups that tend to bind to proteins so that they interfere with metabolic processes. In addition, research conducted in Lampung (B, Setyanigrum, B, & Setyanigrum, 2013)[13] explained that flavonoid compounds will enter the insect's body through the respiratory system in the form of spiracles, causing weakness in the nervous system and damage to the respiratory system which causes death in insects due to not being able to breathe.

Table 1 shows that at different concentrations, the number of dead house

cockroaches (*Periplaneta Americana*) that died was different as well. This shows that the higher the concentration, the higher the mortality rate of American cockroaches. The number of deaths of American cockroaches depends on the number of compounds contained in each concentration, where the higher the concentration, the more insecticide compounds that are toxic to insects [14].

Table 2. Total Cockroach Deaths, Average and Percentage

Concentration	Total			Average	Percentage
	P1	P2	P3		
30%		15		5	50%
35%		17		5,67	56,7%
40%		17		5,67	56,7%

In table 2, the number of house cockroach deaths at a concentration of 30% with an observation time of 30, 60 and 90 minutes the average death was 5 (50%) and at a concentration of 35% with an observation time of 30, 60 and 90 minutes the average mortality was 5.67 birds (56.7%) while at a concentration of 40% with an observation time of 30, 60 and 90 minutes the average mortality was 5.67 birds (56.7%) and in the control, there was no death (0%). Of the three concentrations that killed the most house cockroaches, namely at concentrations of 35% and 40% with an average mortality of 5.67 tails (56.7%) after being given treatment for 90 minutes and in each test container containing 10 house cockroaches *Periplaneta Americana* at every concentration.

Table 3. Number of House Cockroach Deaths by Time At Each Concentration Of Srikaya Leaf Extract

Extract Concentration	K	The average number of cockroach deaths in 90 minutes								
		30 mnt			60 mnt			90 mnt		
		P1	P2	P3	P1	P2	P3	P1	P2	P3
30%	0	1	1	3	0	0	1	2	1	0
35%	0	2	2	4	0	0	0	1	1	2
40%	0	6	4	4	3	1	2	0	1	2

The results of the research conducted showed that when giving sugar apple leaf extract, the highest cockroach mortality was at a concentration of 40%, with a percentage of 76.7%. This is because srikaya leaves have active substances, the most contributing to the death of house cockroaches (*Periplaneta americana*) are tannins and saponins. According to Purwita, Indah, & Trimulyono, 2009 [17] tannins are one type of compound that belongs to the polyphenol group. Tannin compounds can induce the formation of tannin bond complexes to metal ions which can increase their toxicity so that they can damage insect cell membranes. The mechanism of action of tannin is thought to be able to shrink cell walls or cell membranes so that it interferes with cell permeability which causes cells to be unable to carry out living activities so that their growth is inhibited and causes death. Saponins that are eaten by cockroaches cause the cockroach's body to weaken and die because saponin compounds can cause a decrease in nutritional intake. saponin compounds can inhibit and even kill insects, saponins can damage cell membranes and interfere with insect metabolic processes. The mechanism of saponins entering the insect's body is by inhibition of the protease enzyme which results in a decrease in nutrient intake by insects and forms complexes with proteins and causes insects to die.

Table 4. Total Cockroach Mortality, Average, and Percentage

Concentration	Total			Average	Percentage
	P1	P2	P3		
30%		9		3	30%
35%		12		4	40%
40%		23		7,67	76,7%

In table 4, the number of deaths of house cockroaches *Periplaneta Americana* at a concentration of 30% with an observation time of 30.60 and 90 minutes an average of 3 deaths (30%), and a concentration of 35% with an observation time of 30.60 and 90 minutes on average. The average mortality was 4 birds (40%) while at a concentration of 40% with an observation time of 30.60 and 90 minutes the average death was 7.67 birds (76.7%) and in the control there was no death (0%). Of the three concentrations that killed the most house cockroaches, *Periplaneta Americana* was at a concentration of 40% with an average mortality of 7.67 (76.7%).

To see the normality test of the data above, the Kolmogorov Smirnov test was carried out, and the test results showed = 0.2 ($p > 0.05$) which means that the results of data normality indicate that the data is normally distributed. Meanwhile, to compare the effectiveness of srikaya leaf extract and starfruit leaf extract on the death of the house cockroach *Periplaneta Americana*, an independent t-statistic test can be performed. The results of independent t-statistical tests on the comparison of the effectiveness of star fruit extract and sugar apple leaf extract on the death of the house cockroach *Periplaneta Americana* can be seen in table 5.

Table 5. T-Test Results of Differences between Starfruit Leaf Extract and Srikaya Leaf

No	Extract Type	Mean	Sig
1	Starfruit wuluh	5,33%	0,638
2	Srikaya leaf	4,89%	

Note: significant 0.638 this value is greater than α 0.05

Based on table 5, it was found that the percentage of starfruit leaf extract (5.33%) and sugar apple leaf extract (4.89%). The results of statistical tests using the independent T-test showed that the significant value was 0.638, there was no difference between using starfruit wuluh extract and srikaya leaf for the deaths of cockroaches (*Periplaneta Americana*). Starfruit leaf extract and srikaya leaf extract can be used as vegetable insecticides because these two plants can kill house cockroaches (*Periplaneta Americana*) and have toxic compounds that can kill house cockroaches (*Periplaneta Americana*).

The results of the research conducted showed that when giving sugar apple leaf extract, the highest cockroach mortality was at a concentration of 40%, with a percentage of 76.7%. This is because srikaya leaves have active substances, the most contributing to the death of house cockroaches (*Periplaneta americana*) are tannins and saponins. According to Purwita, Indah, & Trimulyono [17] tannins are one type of compound that belongs to the polyphenol group. Tannin compounds can induce the formation of tannin bond complexes to metal ions which can increase their toxicity so that they can damage insect cell membranes. The mechanism of action of tannin is thought to be able to shrink cell walls or cell membranes so that it interferes with cell permeability which causes cells to be unable to carry out living activities so that their growth is inhibited and causes death. Saponins that are eaten by cockroaches cause the cockroach's body to weaken and die because saponin compounds can cause a decrease in nutritional intake. saponin compounds can inhibit and even kill insects, saponins can

damage cell membranes and interfere with insect metabolic processes. The mechanism of saponins entering the insect's body is by inhibition of the protease enzyme which results in a decrease in nutrient intake by insects and forms complexes with proteins and causes insects to die.

CONCLUSION

The highest mortality of star fruit leaf extract with a percentage value (of 5.33%), occurred at a concentration of 40%, with an average mortality of 5.67 individuals. The highest mortality in srikaya leaf extract with a percentage value (of 4.89%), occurred at a concentration of 40%, namely the average mortality was 7.67 individuals. The number of deaths of house cockroaches (*Periplaneta Americana*) using star fruit extract and srikaya leaf extract with independent *t* obtained a value of 0.638 0.05 then H_a is rejected and H_o is accepted which means there is no difference between the use of star fruit and leaf sugar apple against the death of house cockroaches (*Periplaneta americana*). Both extracts were equally effective in killing house cockroaches (*Periplaneta Americana*).

ACKNOWLEDGMENTS

The authors would like to thank all those who participated in the smooth implementation of this research and who have given permission and the opportunity for the author to conduct research.

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