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## EFFECT OF SOURSOP BARK EXTRACT (*ANNONA MURICATA* L.) AS A BOTANICAL INSECTICIDE ON COCKROACH (*PERIPLANETA AMERICANA* L) MORTALITY

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### ABSTRACT

The American cockroach (*Periplaneta americana*) be an insect which are disease vectors for humans. The control of American cockroaches be often carried out by the community by using synthetic insecticides, however the use of synthetic insecticides can have a negative impact on both humans and the environment. Therefore, natural alternatives are needed that are safer for the environment and humans by using vegetable insecticides. Soursop bark contain active compounds that have potential as vegetable insecticides. This study aim to determine ability of soursop bark extract as vegetable insecticide on mortality of adult American cockroaches, to determine LC50 value of soursop bark extract, and to determine compounds present in soursop stem bark. This research conduct from August 2022 to February 2023. Research this research use experimental method with Completely Randomized Design (CRD) with 5 treatments (control (-), 1%, 3%, 5%, and control (+)) and 5 repetition. Average American cockroach mortality calculate after 24th, 48th, and 72nd hours. Data that obtain analyze using One Way ANOVA. Results show that soursop bark extract be effective as nabatic insecticide against American cockroach mortality with LC50 value of 2.89%. Bioactive compounds that contain in soursop bark extract be alkaloids, flavonoids, saponins, steroids, and tannins.

### KEYWORDS

Nabatic Insecticide, Soursop Bark, American Cockroach.



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## INTRODUCTION

The American cockroach (*Periplaneta americana*) is one of the most common types of cockroaches found in residential areas in Indonesia. Cockroaches have a role in disease transmission, including as an intermediate host by several worm species and as a mechanical vector by several pathogenic microorganisms such as *Streptococcus*, *Salmonella*, and other pathogenic microorganisms that can cause cholera, diarrhea, dysentery, hepatitis A virus, and polio in children. The secretions produced by cockroaches in the form of saliva and feces can cause allergies in humans such as dermatitis on the skin, itching, and swelling of the eyelids (Wahyuni and Anggraini, 2018). People often use synthetic insecticides to control cockroaches, but synthetic insecticides have a negative impact on humans, the environment and other organisms. Synthetic insecticides will have a negative impact on humans by causing acute poisoning and polluting the environment by contaminating water, air and soil (Wahyuni and Muktitama, 2019). Safe and environmentally friendly pest control is needed to reduce the impact of pollution caused by the use of synthetic insecticides, namely by switching to using vegetable insecticides. Botanical insecticide is an insecticide made from plants, has easy degraded in nature so that it is safe for the environment, humans and livestock (Ali et al., 2020). Plants that have potential as a vegetable insecticide, one of which is soursop (*Annonamuricata* L.). This plant has active compounds that have the ability to control pests. The components of active compounds found in soursop plants include alkaloids, anthraquinones, phenols, flavonoids, glycosides, coumarins, lactones, phytosterols, tannins, terpenoids, and saponins. These active compounds can function as vegetable insecticides which have various ways of working. Some are antifeedants, interfere with communication between pests, damage or disrupt metamorphosis, and inhibit reproduction (Amrullah and Herdiati, 2020). Compounds in soursop plants that have potential as insecticides are found in the leaves, stem bark, seeds, roots, and fruit skin of the soursop plant (Siswarni et al., 2016). The ability of soursop plant extracts as vegetable insecticides has been reported by Amrullah and Herdiati (2020) that soursop seed and soursop leaf extracts have proven to be effective in controlling walangsangit pests in rice plants. The death of the stink bug is caused by the presence of compounds in soursop leaf and seed extracts which act as antifeedants which cause temporary or even permanent cessation of pest feeding activities, depending on the concentration of these compounds. The concentration used in the manufacture of vegetable insecticides has an effect on mortality. Insect pests, generally insects will experience death at high concentrations. Based on research conducted by Astuti and Soekardi (2014) entitled "Effect of soursop leaf extract on mortality of adult American cockroaches" using experimental methods in their research with various concentrations of soursop leaf extract of 3%, 4% and 5%. Soursop leaf extract concentration of 5% has the highest effectiveness in killing American cockroaches by 80% with an LC50 value of 5.23% after 6 hours of treatment time.

## RESEARCH METHODOLOGY

### Time and place

This research was conducted from August 2022 to February 2023. The extraction stage was carried out at the Genetics and Biotechnology Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Sriwijaya University. Identification of soursop bark extract compounds was carried out at the Laboratory of Chemical Analysis and Testing Instrumentation, Department of Chemistry, Faculty of Mathematics and Natural Sciences, Sriwijaya University. While the testing phase was carried out at the Laboratory of Animal Biosystematics, Department of Biology, Faculty of Mathematics and Natural Sciences, Sriwijaya University.

## Tools and materials

The tools used in this study were stationery, aluminum foil, stir bar, blender, glass bottles, spray bottles, separatory funnel, stopwatch, Erlenmeyer, beaker glass, measuring cup, hair dryer, hot plate, camera, filter paper, maintenance box. cockroaches, drip plates, dropper pipettes, rotary evaporators, gloves, test tubes, and scales. Material The materials used in this study were distilled water, ammonia, anhydrous acid, sulfuric acid, ethanol, 1% FeCl<sub>3</sub>, 2N HCl, synthetic insecticide, American cockroach, chloroform, soursop bark, methanol, 10% NaOH, and dragendorf reagent. Ways of working - Making Simplicia Soursop bark was taken from several trees in the Maskarebet Complex, Alang-Alang Lebar District, Palembang City as much as 3 kg, dried without direct sunlight for 7 days. Then pulverized using a blender until smooth and obtained simplicia weighing 750 grams. - Extract Making Simplisia as much as 750 grams is soaked with 3 liters of methanol at room temperature and stirred for 2-3 minutes and left for 3x24 hours. The residue from maceration was macerated again with 3 liters of methanol. After 3 days the extract can be filtered using filter paper and then concentrated using a rotary evaporator with a temperature of 50°C and a rotation of 600 rpm to obtain a thick extract. The thick extract obtained was evaporated with a hair dryer to obtain a thick extract. The viscous extract obtained was put into a sterile bottle and covered with aluminum foil. The prepared methanol extract was then weighed and the percent yield calculated formula as follows:

Percentage of Yield is the weight of simplicia divided by weight of extract and multiplied by 100%. (Dewitasari et al., 2017)

## Animal target Preparation

Object animal be obtained by direct capture in gutters, trash bins and wall cracks at Pondok Palem Indah Housing Complex, Palembang City. After the cockroaches are collected, they are then put into the container provided, given food and water. Prior to treatment the cockroaches were fasted for one day (Erwana and Nukmal, 2014). Cockroaches are placed in the Animal Biosystematics Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Sriwijaya University. - Test of Vegetable Insecticides of Soursop Bark Extract Testing of soursop bark extract was carried out by spraying the extract onto adult American cockroaches as much as 3 ml for each concentration. After spraying, cockroach mortality was observed at 24, 48 and 72 hours (Hanina and Baringbing, 2020). The percentage of cockroach mortality can be calculated using the formula:

$$\text{Percentage of Mortality} = \frac{\text{death cocroach number}}{\text{All sampling animal}} \times 100 \%$$

Identification of Bioactive Compounds of Soursop Bark Extract Alkaloid Test Soursop bark extract was mixed with 5 ml of chloroform and 5 ml of ammonia, then heated, shaken for 1 minute and filtered. 5 drops of 2 N sulfuric acid were added to the filtrate, then shaken and allowed to stand. The top of the filtrate be taken and tested with dragendorf reagent. The formation of a brick red precipitate indicates alkaloids (Nur and Rahmawati, 2019).

## Steroids Test and Triterpenoids

The bottom layer of chloroform extract was dripped onto the drop plate and allowed to dry. After drying, add anhydrous acid and mix well. Then 3 drops of concentrated sulfuric acid were added. If a blue or green color change indicates the presence of steroids and a red or violet color change indicates the presence of triterpenoids (Nur and Rahmawati, 2019). Flavonoid Test on *periplaneta americana* cockroach mortality. If a significant difference is found, continue with Duncan's test. Data on the

mortality of soursop bark extract on the mortality of adult American cockroaches were analyzed by probit to find the LC50 value.

## RESULT AND DISCUSSION

### Extraction

The result of extraction could be read as below table.

**Table 4.1.** Yield of soursop tree bark extraction

Simplicia weight (g)	Extract weight (g)	Yield (%)
750	140	18.6

Based on table 4.1.shows the results of 750 grams of simplicia obtained extract weighing 140 grams with a yield value of soursop bark extract of 18.6%.Extraction stage of soursop stem bark which has been shaped simplicia was carried out by maceration method using methanol as a solvent for 3x24 hours.According to Indratmoko et al.(2020), the maceration method was chosen in the manufacture of extracts to dissolve all the substances present in the sample and prevent damage to the thermolabile compounds in soursop plants. Selection of the right solvent is an important factor in the extraction stage, as is the case in this study using solvents.According to Verdiana et al.(2018), methanol has the ability to bind active compounds in plants such as flavonoids, saponins, tannins, and terpenoids. The yield results obtained have almost the same percentage with the results of the study by Setyorini et al.(2016), that the extraction results of soursop leaves in three places where it grows, namely Tawangmangu, Pasuruan, and Bogor are not much different with the respective yield values of 19.52%, 17.77%, and 18.94%.RI Ministry of Health (2013), states that the value The yield of soursop leaf condensed extract is not less than 11.4%.The yield value that is higher or lower is caused by differences in the size of the simplicia particles, the length of extraction time and the storage time of the extract

### Test of extract to target animal

Table below tell about the result of mortality and its percentage, after 24, 48 and 72 hours treatments of bark extract concentration.

**Table 4.2.** Means mortality of cockroach after 24, 48 and 72 hours treatment of soursop bark extract.

Concentrati on	24 hours		48 hours		72hours	
	Mortality means	% Mortality	Mortality means	% Mortality	Mortality means	% Mortality
Control (-)	0±0,00	0 <sup>a</sup>	0±0,00	0 <sup>a</sup>	0±0,00	0 <sup>a</sup>
1%	0,6±0,00	12 <sup>ab</sup>	1,0±0,70	20 <sup>b</sup>	1,8±0,44	36 <sup>b</sup>
3%	0,8±0,44	16 <sup>b</sup>	1,8±0,83	36 <sup>bc</sup>	2,6±0,54	52 <sup>c</sup>
5%	1,8±0,83	36 <sup>c</sup>	2,6±0,89	52 <sup>c</sup>	5±0,00	100 <sup>d</sup>
Control (+)	5±0,00	100 <sup>d</sup>	5±0,00	100 <sup>d</sup>	5±0,00	100 <sup>d</sup>

Duncant Least Significance Test be done at 5 % error level.

Based on table 4.2. The average death of American cockroaches at 24 hours after the application of soursop bark extract with a concentration of 1% was able to cause death by 12%, followed by concentrations of 3% and 5%, which caused 16% and 36% death respectively. Whereas in the 48th hour the average death of cockroaches at concentrations of 1%, 2%, and 3% respectively was able to cause the death of American cockroaches by 20%, 36%, and 52%. Application of soursop bark extract after 72 hours at concentrations of 1%, 3%, and 5% resulted in 36%, 53%, and 100% mortality. The 5% concentration treatment has the best ability when compared to the 1% and 3% concentration treatments. The death toll for the American cockroach varies from person to person concentration where the higher the concentration of the extract, the higher the death of the test cockroaches. According to Astuti and Soekardi (2014), the higher the concentration of the extract, the higher the mortality of the test insects. The higher the concentration, the toxic properties of the components in the extract were able to affect the cockroach body more and more and cause growth retardation and even cause death. The higher the concentration of the extract used, the higher the death of the test cockroaches. This was reinforced by Wahyuni and Anggraini's research (2018), concerning testing the effectiveness of srikaya leaf extract on the death of American cockroaches. The highest average death rate for American cockroaches is at a concentration of 30% with a death percentage of 53.33%. American cockroach mortality was lowest at a concentration of 5% with a death percentage of 11.11%. Based on the results of this study, it can be seen clearly that the higher the srikaya leaf extract, the higher the death of the American cockroach.

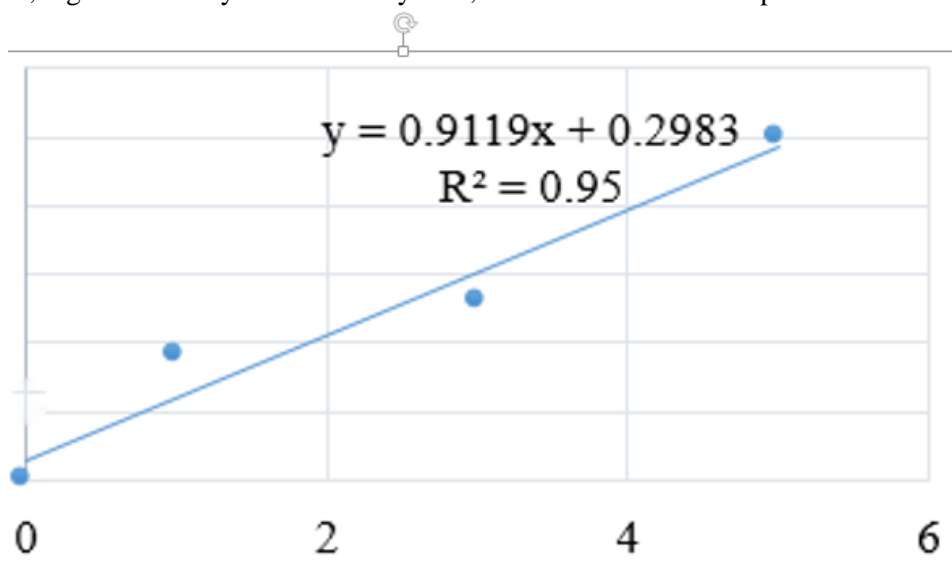
### Determination of LC<sub>50</sub>

The result of lethal concentration of 50 % target animal, could be seen at below table.

**Table 4.3.** The Value of LC<sub>50</sub> after 72 hours.

Treatment	Result (%)
Soursop Tree Bark Extract	2,89

Furthermore, regression analysis of mortality data, could be seen as below picture.



**Picture 1** Regression analysis graphic of LC<sub>50</sub> value of treatments on mortality percentages.

Note: Y axis represent the means death individu (0, 2, 4, 6 , etc) and X axis is treatments concentration (%).

### Morphological Performance

The American cockroach without treatment had a light brown body, while the American cockroach after being treated had a darker and black color with a stiff body with a bad smell. According to Astuti and Soekardi (2014), the changes that occur in cockroaches die because the poison contained in soursop extract damages body tissues. cockroach so that the body color of the cockroach is darker, blacker and more decomposed. The treatment of cockroaches after being sprayed with bark extract has aggressive and uncontrollable movements. According to Puri et al.(2021) , occurrence Changes in cockroach movement after application of the extract were caused by the flavonoid compounds contained in the extract which entered through the inhalation and then disrupted the nervous system in the tested cockroaches.



**Picture 2** Control target animal death performance (left) and treatments view (right).

### CONCLUSIONS

Based on the research that has been done, the following conclusions are obtained: 1. Soursop bark extract in various concentrations has an effect on the mortality of adult American cockroaches with the percentage of cockroach mortality at concentrations of 1%, 3% and 5% respectively, namely 36%, 52% and 100%. 2. LC50 value of stem bark extract soursop by 2.69%. 3. The bioactive compounds of soursop bark extract contain alkaloids, flavonoids, saponins, steroids, and tannins.

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