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EFFECTIVENESS OF SOURSOP LEAF EXTRACT (*Annona muricata* L.) ON THE MORTALITY OF GRAYCOOL CATERPRISES (*Spodoptera litura*)

Siti Salessy[1*], Ali Awan[1], Syahran Wael[1]

[1]Department of Biology Education, Universitas Pattimura. Jl. Ir. M. Putuhena, Ambon 97233, Indonesia

**Corresponding Author*: siti.salessy@mail.com

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ABSTRACT

Annona muricata extract with a concentration of 20% during the day showed an average value of 29%, the afternoon 1:14%, whereas 40% at a concentration of 29% the morning, during the day 86%, and afternoon 1.14%. Concentration of 60% and 1.14% morning, afternoon and evening 1.43% 1.14%. Results of Kruskal-Wallis statistics on mortality of *Spodoptera litura* showed a significant difference between the P values indicated by early spraying time (0.317), noon (0.254), and late (1,000). With treatment *A.muricata* extract statistical results Kruskal-Wallis P value <0.05. A.muricata extract treatment given to the mustard plant as much as 10 ml each spraying. Based on the observation and analysis of the data it can be concluded that the extract of *A. muricata* at a concentration of 20%, 40%, and 60% can affect the mortality of *Spodoptera litura*.

Keywords: *annona muricata, mortality, spodoptera litura.*

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INTRODUCTION

Soursop (Annona muricata .L.) is a type of plant from the Annonaceae family which has great benefits for human life, namely as a fruit plant that requires nutrition and is a traditional medicinal ingredient that has multi-efficacy. In the food industry, soursop can be processed into fruit jam and fruit juice, syrup and soursop dodol (Jannah, 2010). The soursop plant is widely used as a medicinal plant, because this plant has medicinal properties and is used as a medicine in healing and preventing disease. The definition of medicinal efficacy is that it contains an active substance that functions to treat a particular disease or if it does not contain a particular active substance but contains a synergistic effect from various substances that function to treat it (Flora, 2008). The use of soursop as medicine is actually not something new in Indonesia. For generations, soursop has been used by some Indonesian people to treat several diseases. For example, in the Sunda region, young soursop fruit is used as a medicine to lower high blood pressure and in Aceh soursop fruit is used as a medicine for hepatitis and the leaves as a cough medicine (Mardiana and Ratnasari,

2011). Apart from that, this plant is also used to treat hemorrhoids, diarrhea in babies, boils, lumbago, anyang-anyangan and bladder pain and this plant is also antibacterial, antiparasitic, antispasmodic, anticancer, insecticide, hypotensive, treats stomach aches and is able to expel poison (Mangan, 2009). The soursop plant (Annona muricata L) has potential to be used as a biological pesticide. Soursop leaves contain acetogenin compounds, including asimisin, rondeasin, squamosin, saponins, flavonoids and tannins (Plantus 2008) in Purnomo and Utami, 2012). These compounds are toxic and can kill insects. However, to determine safe limits for insects, it is necessary to carry out bioassay testing, to test the toxicity of toxic chemicals (alkaloids) contained in soursop leaves, or to measure the level of danger of chemical contaminants contained in soursop leaf extracts against insects (Purnomo and Utami, 2012). At high concentrations, the acetogenin compound has the feature of being an anti-feedant. In this case, insect pests are no longer enthusiastic about devouring the plant parts they like. Meanwhile, at low concentrations, it is stomach poisoning which can cause insect pests to die (Nurjannah, 2012).

Acetogenin is a polyketides compound with a structure of 30–32 unbranched carbon chains attached to a 5-methyl-2-furanone group. The furanone chain in the hydrofuranone group at C23 has cytotoxic activity, and acetogenin derivatives that have cytotoxic functions are asimicin, rondeacin, and squamocin (Nurjannah, 2012). Soursop leaves contain the active ingredients annonain and resin. Soursop leaf vegetable pesticide is effective in controlling thrips pests (Olivia, 2012). The chemical content of the types of the Annonaceae tribe consists of two groups, namely non-alkaloids and alkaloids. The non-alkaloid groups that are known are sucrose, glucose, fructose found in "pulp" and glycerides which can cause death in insects. The group of alkaloids found in this plant includes several compounds from the benzyl-tetrahydro-isoquinoline group and one of them is liriodine which has antitumor, antibacterial and antifungal properties (Rahayu et al., 1993). Furthermore, Mangan (2009) stated that the chemical contents of soursop are saponins, flavonoids, tannins, calcium, phosphorus, charcoal hydrate, vitamins (A, B and C), phytosterols, Ca-oxalate and murisine alkaloids. One of the chemical constituents of soursop that plays an important role in medicine is flavonoids (Sjahid 2008). Apart from flavonoids, soursop chemicals that are also used as medicine are tannins. Tannin is a secondary metabolite compound that is often found in plants. Tannins are astringents, polyphenols, have a bitter taste, can bind and precipitate proteins and are soluble in water (especially hot water) (Subroto and Saputro, 2006). Various types of plants produce secondary metabolites in the form of chemical compounds to defend against attacks by Plant Pest Organisms (OPT). This compound is then taken and used to protect other plants. Soursop is a plant that is well known to the public. Soursop leaves and seeds can act as an insecticide, larvicide, repellent (insect repellent) and anti-feedent (eating inhibitor). Soursop leaf extract can be used to control grasshoppers and other pests (Kardinan, 1999). At high concentrations, the acetogenin compound has the feature of acting as an antifeedant. In this case, insect pests no longer eat the parts of the plant they like. Meanwhile, at low concentrations, it is stomach poisoning which can cause insect death. (Mulyaman, et al 2000).

One of the causes of declining agricultural production is failure to control pests. Armyworm (Spodoptera litura) is a pest that is polyphatic or damages various types of agricultural plants such as soybeans, rice, corn, castor oil and others. Common control of armyworm (Spodoptera litura) pests is by using chemical insecticides. Uncontrolled use of chemical insecticides can have negative impacts on both living creatures and the environment. To reduce the negative impact of using pesticides, Integrated Pest Management (IPM) is carried out, one of which is the use of botanical insecticides through the use of soursop leaves (Annona muricata) which contain the compound annonain, which works as a stomach poison and contact poison and acts as an antifeedant and repellent. Armyworm (Spodoptera litura) is a pest for horticultural crops. Yield losses due to this pest attack reach 40%. Armyworms attack simultaneously and in groups. Heavy attacks cause plant damage because the leaves and fruit are eaten (Marwoto and Suharsono, 2008). Control of armyworm plant pests can be done using natural insecticides derived from plants. In Indonesia, there are 50 plant families that are considered potential sources of natural insecticides, including Meliaceae, Annonaceae, Asteraceae, Piperaceae and Rutaceae. Apart from acting as insecticides, these types of plants also have properties as fungicides, virucides, nematicides, bactericides, miticides and rodenticides (Setiawati et al, 2008). The use of synthetic pesticides is a common method for controlling pests and diseases that attack agricultural plants. Most synthetic pesticides have non-specific properties,

meaning they not only kill the target body but also kill other organisms. Synthetic pesticides are considered the most practical pest and disease control agents, easy to obtain, easy to use and the results are quickly visible. Even though its use often causes problems such as environmental pollution, poisoning of humans and pets and can result in resistance and resurgence for insect pests (Rejesus, 1986; Stoll, 1988; Thamrin and Asikin, 2005). Apart from that, Ahmed (1995) stated that there are more than 400,000 cases of poisoning every year and 1.5% of them are very serious, as well as contamination of water, soil and air which has a negative impact on human health. To reduce the frequency of use of synthetic pesticides, one way is to replace them with pesticides made from plant materials, because several research results show that extracts from plant parts are toxic to pests (Balfas, 1994; Mudjiono et al., 1994).

Various types of plants are known to contain bioactive compounds, including alkaloids, terpenoids, steroids, acetogenins, phenyl propane, and tannins which can function as insecticides and repellents (Campbell, 1933, Burkill, 1935). At least 2000 plant species from various families have been reported to have a negative effect on plant pest organisms (Grainge and Ahmed, 1988; Prakash and Rao, 1977), of which there are at least 850 plant species that are active against insects (Prakash and Rao, 1977). Over the last decade there has been a great increase in interest in the search for insecticidal compounds from plants (Schmutterer, 1995). The nature of vegetable materials is generally easy to decompose in nature so that the residue does not have a negative impact on the environment. For example, pyrethrin (the active ingredient from pyrethrum flowers which is used as a botanical insecticide) is a substance that degrades quickly in nature, especially when exposed to sunlight, so this substance is not resistant either in the environment or in food (Maciver, 1962).

METHOD

The type of research used in this research is experimental research. The design used in this research was a completely randomized design (RAL). by using 3× treatments, each consisting of 3× spraying, namely in the morning, afternoon and evening. The treatments carried out were various levels of concentration of soursop leaf extract, namely, 20% concentration, 40% concentration, and 60% concentration. The place used in this research was the Biology Education Laboratory Unpatti. The object in this research is Armyworm (*Spodoptera litura)* by fulfilling the Exclusion and Inclusion Criteria, namely

- Don't die in research
- Normal body weight
- Actively moving.

Tools and materials

Blender to puree the soursop leaves, Scissors to cut soursop leaves, Analytical balance for weighing soursop leaves, Measuring cup for measuring water volume, Erlenmeyer to put soursop leaf extract, Volume pipette to take soursop leaf extract, Hand sprayer for spraying soursop leaf extract, Handkerchief for picking up armyworms, Jar to fill armyworms, Aluminum foil to wrap or cover the surface of the Erlenmeyer, Strainer to filter soursop leaf extract, Basin for placing and washing soursop leaves, Plastic bag for collecting soursop leaves

Material

1/4 kg of soursop leaves to make soursop leaf extract, A total of 18 armyworms were the objects observed during the research, by being given soursop leaf extract, A pot containing horticultural plants for the armyworms to be placed in, Aquades to make soursop leaf extract

Procedure

First Stage: Preparation

Collect 18 armyworms (Spodoptera litura), Then keep it in a horticultural pot (mustard greens), Take soursop leaves directly from the tree at BTN (Poka) and put them in a plastic bag, After all the materials are available, the materials are taken to the FKIP Biology Laboratory for research

Second Stage: Making Extract from Soursop Leaves.

Prepare tools and materials, Wash the soursop leaves, Cut the soursop leaves, Put it in a blender, Blend until smooth, Remove from blender, Make concentrations of 20%, 40%, and 60%.

Third Stage: Making the Solution

1. Prepare 100 ml of extraction results.
2. Put the extraction results into a measuring cup
a. Concentration 20% (20 ml extract and 80 ml water)
b. Concentration 40% (40 ml extract and 60 ml water)
c. Concentration 60% (extract 60 ml and water 40 ml)
3. After the ingredients are mixed evenly, put them in the sprayer
Fourth Stage: Sample Analysis
1. Armyworms are placed in a pot containing horticultural plants and given soursop leaf extract by spraying it using a hand sprayer. each repetition ± 10 ml.

Data analysis

Data were analyzed with the SPSS program using kruskal wallis because the data was not normal

DISCUSSION RESULT

The research was carried out at the biology education laboratory. On the first day of the research, there were no dead armyworms. On the second day, two armyworms died in the afternoon with a concentration of 60%. On the third day of the research, four fall armyworms died, at concentrations of 40% and 60% during the day. On the fourth day of the research, six fall armyworms died at a concentration of 20%, two died at a concentration of 40%, two died at a concentration of 40% in the afternoon, and at a concentration of 60% two died in the morning. On the fifth day of the research, two armyworms died at a concentration of 20%, namely during the day. On the sixth day of the research, there were no dead armyworms. And on the seventh day of the research, two armyworms died, at a concentration of 40%, namely in the morning. So, on the seventh day of the study only two caterpillars remained at a concentration of 20%. Meanwhile, at concentrations of 40% and 60%, all gryak caterpillars died. Data from research on fall armyworm (Spodoptera litura) mortality are shown in table 1.

Table 1. Armyworm (Spodoptera litura) mortality after treatment with soursop leaf extract (Annona muricata. L).

No	Consentration	Spraying time	Number of armyworm mortality rates							Total
			Days							
			1	2	3	4	5	6	7	
1	20%	Morning	0					0		0
		Siang	0				2	0		2
		Sore	0			2		0		2
2	40%	Pagi	0					0	2	2
		Siang	0		2			0		2
		Sore	0			2		0		2
3	60%	Pagi	0			2		0		2
		Siang	0		2			0		2
		Sore	0	2				0		2
	Total		0	2	4	6	2	0	2	16

Table 1 shows that at a concentration of 20% with morning spraying time, no one died. Meanwhile, at a concentration of 40% and a concentration of 60% with spraying times in the morning, afternoon and

evening, all armyworms died. So there are only 2 armyworms left that live at a concentration of 20% with spraying time in the morning. And the number of dead armyworms was 16. Based on the results of research testing the effectiveness of soursop leaf extract (Annona muricata .L.) on armyworm (Spodoptera litura) mortality, it can be seen in table 2.

Table 2 Results of Normality Test Analysis of Soursop Leaf Extract (Annona muricata .L.) on Armyworm (Spodoptera litura) Mortality.

Consentration	Spraying time	Mean (%)	Standard deviation	value
20%	Day	29	0.756	0.000
	Afternoon	1.14	1.069	0.001
40%	Morning	29	0.756	0.000
	Day	86	1.069	0.001
	Afternoon	1.14	1.069	0.001
60%	Morning	1.14	1.069	0.001
	Day	1.43	0.976	0.000
	Afternoon	1.71	0.756	0.000

The results of the fall armyworm mortality test showed that all data had an abnormal data distribution of $p<0.05$ so that the data came from a population that was not normally distributed, so it was continued with the Kruscal Wallis test.

Table 3. Kruskal Wallis Test for Armyworms with Different Concentrations.

Consentration	**N**	**Mean Rank**	**Asymp. Sig**
Morning 20%	6	8.50	
40%	6	10.00	0.317
60%	6	14.50	
	18		
Day 20%	6	8.00	
40%	6	11.00	0.254
60%	6	14.00	
	18		
Afternoon 20%	6	10.00	
40%	6	10.00	1.000
60%	6	13.00	
	18		

no significant differences

The results of the study showed that, the application of soursop leaf extract with spraying times in the morning, afternoon and evening in the Kruskal Wallis statistical analysis showed that there was no significant difference between the spraying times in the morning, afternoon and evening. By administering soursop leaf extract on the first day of spraying, no Spodoptera litura died. This is because the soursop leaf extract has not decomposed. Giving soursop leaf extract during the second to seventh day of spraying resulted in Spodoptera litura mortality. This is because the soursop leaf extract has decomposed so that the performance of the compounds contained in the soursop leaf extract begins to work actively. The toxic substances contained in the extract can enter through the body walls. According to Riyanto (2008) the body

wall is the part of the insect's body that can absorb large amounts of toxic substances. Nursal (2005) stated that it is relatively easier for toxic substances to penetrate the cuticle and then enter the insect's body because insects are generally small in size so that the exposed external surface area of the body is relatively larger (in relation to volume) compared to mammals. Apart from that, the cuticle is hydrophobic and lipophilic, so non-polar bioactive compounds easily penetrate the absorbent cuticle. Giving soursop leaf extract at concentrations of 20%, 40% and 60% had an effect on the mortality of fall armyworm (Spodoptera litura). Of each treatment, 20%, 40% and 60%, the one that showed the best results was the treatment with a concentration of 60%. This is because the 60% concentration has an impact on the availability of compounds that have a higher killing rate compared to extracts at other concentrations. So the higher the concentration, the higher the mortality rate for Spodoptera litura. This shows that after application, the poison contained in soursop leaf extract begins to work significantly, causing mortality of Spodoptera litura. So it can be concluded that soursop leaf extract is able to cause mortality of Spodoptera litura. Dadang, (1999) explained that the compounds squamosin and asimisin contained in soursop leaves, apart from inhibiting the growth and development of insects, inhibiting insect eating, can also kill insects. Apart from that, soursop leaf extract also contains high levels of tannin compounds. Panda and Gurdev (1995) explained that tannin is a compound that can block the availability of protein by forming a complex that cannot be digested by insects or can reduce the ability of insects to digest. This compound can inhibit or block the activity of enzymes in the digestive tract, thereby destroying the insect's digestion, and ultimately causing death for the insect.

The tannin component acts as a plant defense against insects in digesting food. Tannins can interfere with insects digesting food because tannins will bind to proteins in the digestive system that insects need for growth so that the process of protein absorption in the digestive system is disrupted. According to Jayaraman (2008) tannins suppress food consumption, growth rate and survival ability. Tannins and saponins have a bitter taste so they can cause a feeding inhibition mechanism in the test caterpillars. The bitter taste can cause the caterpillars not to want to eat so they will starve and eventually die. According to Mulyaman, et al (2000), soursop leaves contain acetogenin compounds including acimicin, rondeacin and squamocin. At high concentrations, the acetogenin compound has the feature of acting as an antifeedant. In this case, insect pests no longer eat the parts of the plant they like. Meanwhile, at low concentrations, it is stomach poisoning which can cause insect pests to die (Nurjanah, 2012). Of the four compounds contained in soursop leaf extract, the compound acetogenin is more influential in the mortality process of armyworms (Spodoptera litura). Because it has the feature of being an antifeedant. By giving the extract to plants, if Spodoptera litura eats the plant, Spodoptera litura will die. This is because the extract given to plants has been absorbed by plant tissue. As a vegetable pesticide, extract from soursop leaves is very useful for killing pests on plants. The higher the concentration given, the greater the death rate for Spodoptera litura. Vice versa.

This is in accordance with research by A. Tenrirawe (2011) which stated that the treatment of soursop leaf extract using Helicoverpa armigera Instar III larvae actually showed a positive correlation between concentration and mortality. Likewise, the results of research by Dewi Artati (2002) showed that treatment with soursop extract had a real influence on the mortality and intensity of attacks by the fruit fly Drosophila melanogaster. Likewise, the results of research by Khoiriyah et al., (2012) showed that extracts from soursop leaves had an effect on grasshopper mortality. Likewise, the results of research by Yos Wahyu et al, (2012), from the results of the research carried out it was concluded that soursop leaf flour can influence mortality and reduce the development of powder beetles (Collosobruchus analyst F.) on green bean seeds (Vigna radiata .L) in storage, as well as can reduce damage and loss of green bean seed weight due to attacks by powder beetles (Collosobruchus analyst F.). (Rislansyah (2000), proved the results of his research, that soursop leaf extract can be used to kill Anopheles aconitus larvae with a death rate of 100%. The method is to mix the soursop leaf extract into a bowl containing Anopheles aconitus larvae with a concentration of 0.130%. This is supported by the research results of Simanjuntak (2007), proving the results of his research, that soursop leaf powder extract can be used to control termite pests. The method is to place termite bait in the house containing soursop leaf powder extract at a dose of 6 grams into a jar containing 20 termite tail.

CONCLUSION

1. The use of soursop leaf extract can affect armyworm mortality.
2. At a concentration of 60%, the highest fall armyworm mortality occurred.

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