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Effectiveness of Cocoa Pest (*Conopomorpha cramerella* as) Control with Pruning and Vegetable Insecticide Treatment on Cocoa (*Theobroma cacao* L)

Efektivitas Pengendalian Hama Kakao (Conopomorpha cramerella as) dengan Pemangkasan dan Perlakuan Insektisida Nabati pada Kakao (Theobroma cacao L)

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ABSTRACT

*In an effort to control the main pests on cocoa plants can be done by various techniques, namely control with the use of natural insecticides and control by technical culture in the form of pruning. Natural insecticide is an insecticide whose basic ingredients come from plants that are easily biodegradable in nature, so they do not pollute the environment and are relatively safe for humans and livestock, because the residue is easily lost. Pruning is the act of removing part of the plant organs in the form of branches, twigs and leaves with the aim of obtaining good cocoa plant branches, regulating the distribution of production branches and leaves so that they are evenly distributed, removing unwanted plant parts, stimulating the plants to grow, form new organs, reduce the risk of pest and disease attacks, and increase the ability of plants to form fruit. The purpose of this study was to determine the response of the application of botanical insecticides and pruning to the control of the cocoa pod borer (Theobroma cacao L.**). The experimental design used a non-factorial randomized block design consisting of 7 treatments. The botanical insecticide treatment consisted of 4 levels, namely I0 (Without insecticide = Control), I1 (Vegetable insecticide made from srikaya seeds at a dose of 250 ml/liter of water), I2 (vegetable insecticide made from tuba roots at a dose of 250 ml/liter of water), I3 (vegetable insecticide made from tobacco leaves at a dose of 250 ml/liter of water). The pruning treatment consisted of 3 levels, namely I4 (Without Pruning (Control), I5 (Pruning Interval 7 days after the study) and I6 (Pruning Interval 14 days after the study). Observations consisted of attack intensity, level of damage caused by PBK attack, attack index and production Control of the cocoa pod borer by pruning and botanical insecticides on cocoa plants showed a significant effect on the parameters of attack intensity and damage level at the age of 6 week after plant (wap), and the attack index at the age of 12 wap. 2 wap, 4 wap, 8 wap, 10 wap, 12 wap, and the parameters of the level of damage at the age of 2 wap, 4 wap, 8 wap, 10 wap, 12 wap and plant production parameters at the age of 12 wap showed no significant effect.*

Keywords: *CPB (Cocoa Fruit Borer), Vegetable Insecticides, Pruning*

INTRODUCTION

The sustainability of cocoa production in Indonesia is faced with the problem of the cocoa pod borer pest (*Co. nopomorpha cramerella* Snell.). Losses due to CPB attacks are the result of a decrease in seed weight, an increase in the percentage of low quality seeds, yield losses and increased harvest costs due to the difficulty of separating the infected seeds from the fruit skin. The yield loss occurred due to the fruit that was attacked by CPB, the seeds were sticky and the fat content decreased. CPB attacks cause the death of the seed placental tissue so that the seeds cannot develop completely and become sticky. Attacks on young fruit result in greater yield losses because the fruit will experience early ripening so that the fruit cannot be harvested (Zaenudin, 2010).

Various efforts have been made to overcome the attacks of CPB and *Helopeltis* spp., including overcoming with

insecticides. The use of synthetic chemical insecticides is considered ineffective because it can only kill imago. In addition, spraying which is usually done in the morning will not be effective in killing the imago in the afternoon. In addition, excessive use of chemicals will cause environmental pollution that can endanger all forms of life, including humans. Therefore, it is necessary to develop other effective and environmentally friendly countermeasures. In an effort to control the main pests on cocoa plants, various techniques can be used, namely chemical control or the use of natural insecticides, technical culture and the use of biological agents (Sukamto, 2007).

Natural insecticides are insecticides whose basic ingredients come from plants. This type of insecticide is easily *biodegradable* in nature, so it does not pollute the environment and is relatively safe for humans and livestock, because the residue is easily lost. In the manufacture of natural insecticides can be made from materials such as tobacco, kenikir, basil, garlic, turmeric, cayenne pepper and pandanus (Kardinan, 2002).

Pruning is one of the techniques for controlling cocoa pests in technical culture. Pruning is the act of removing part of the plant organs in the form of branches, twigs and leaves with the aim of obtaining good cocoa plant branches, regulating the distribution of production branches and leaves so that they are evenly distributed, removing unwanted plant parts, stimulating the plants to grow, form new organs, namely young leaves that are potential as food and flower producers, reduce the risk of pests and diseases, and increase the ability of plants to form fruit (Firdausil, et al, 2008). The aim of this study was to examine the response to the application of botanical insecticides and pruning in the control of the cocoa pod borer (*Theobroma cacao* L.).

MATERIALS AND METHODS

The research was carried out in a cocoa plantation that has been producing with a plant age of ± 7 years located in the Village of Sabangan Julu, Padangsidimpuan Hutaimbaru District, Padangsidimpuan City in October-December 2021.

The materials used in this study were srikaya seeds, tuba roots, tobacco leaf and plastic rope. While the tools used are knives, machetes, scissors, gloves, Solo spray, blender, filter, bucket, wood and stationery.

This research was conducted using a non-factorial randomized block design with 7 treatments:

I0 = No use of insecticide (Control)
I1 = Vegetable insecticide made from srikaya seeds at a dose of 250 ml/liter of water.
I2 = Vegetable insecticide made from tuba roots with a dose of 250 ml/liter of water.
I3 = Vegetable Insecticide made from tobacco leaves at a dose of 250 ml/liter of water.
I4 = No Pruning (Control)
I5 = Trimming interval 7 days after the study
I6 = Pruning interval 14 days after the study

Each treatment was repeated 4 times. Each treatment was tested on 4 plants, so the total number of plants for the experiment was 112 plants. The research carried out includes: making experimental plots, determining sample plants, application of vegetable insecticides and pruning.

Parameters observed were attack intensity, level of damage caused by CPB attacks, attack index and production.

RESULTS AND DISCUSSION

Intensity of attack

From the results of statistical data analysis, observations on the intensity of fruit borer attacks with vegetable insecticides and pruning treatments on cocoa plants showed a significant effect at the age of 6 wap. This is because of the height of pruning and the application of vegetable insecticides that can reduce humidity. According to Kardinan (2002), srikaya seeds contain annonain chemical compounds consisting of squamosin and asimisin which are toxic to insects.

The pruning treatment showed no significant effect due to the observed fruit size of less than 15 cm. CPB pest attacks greatly affected cocoa bean production. It is suspected that at this size the female imago has laid her eggs so that they hatch, these

larvae hoist in the cocoa pods (Maya et al 2006).

Pruning is done to reduce moisture in the cocoa plant so that it can prevent female moths from laying eggs. How to control with pruning Plants on fruit conditions that are 7-10 cm long. Pruning plants in this condition very effective (95-100%) for the control of cocoa pod borer, *Helopeltis sp*. disease attack *Phytoptora palmivora*, and rat pest attack (Shakir, 2010).

Table 1. Intensity of Fruit Borer Pests on Cocoa Plants Due to Plant Insecticide Treatment and Pruning At Age 2 wap, 4 wap, 6 wap, 8 wap, 10 wap and 12 wap.

Treatment	Attack Intensity					
	2 wap	4 wap	6 wap	8 wap	10 wap	12 wap
I0	8.33 ab	8.33 ab	8.33 bc	8.33 ab	12.50 cd	12.50 bc
I1	0 a	12.49 bc	8.33 bc	8.33 ab	8.33 bc	4.16 a
I2	0 a	8.33 ab	4.16 ab	4.16 a	8.33 bc	20.83 cd
I3	0 a	0 a	0 a	4.16 a	4.16 ab	8.33 ab
I4	4.16 ab	20.83 cd	24.99 e	20.83 cd	16.66 dc	24.99 de
I5	4.16 ab	20.83cd	24.99 e	12.49 bc	12.49 cd	8.33 ab
I6	4.16 ab	12.49 bc	0 a	8.32 ab	0 a	8.33 ab

Description: Numbers followed by the same letter in the column and row show no significant difference according to the DMRT 5% test.

Meanwhile, the observations are 2 wap, 4 wap, 8 wap, 10 wap, 12 wap showed no significant effect, this was because at the time of the research the rainfall was very high, causing this CPB insect to easily breed and causing the intensity of the attack to increase. The high rainfall also causes the washing of the applied vegetable insecticides and the occurrence of humidity.

Adult CPB pests are in the form of moths that actively fly, mate and lay eggs at night, from 18.00 – 07.00 the next day. During the day the moth hides in a place protected from the sun, namely at the bottom of a horizontal branch. Based on observations, about 63.43% of CPB imago liked horizontal branches with a diameter of 5.1–10 cm. Meanwhile, horizontal branches with a diameter of 0 -5 cm and > 20 cm are not preferred as resting places (Sulistyowati, 2010).

Larvae *Conopomorpha cramerella* cause damage by grinding the cocoa pods so that the fruit flesh becomes rotten. After the fruit is left by the larvae, the growth of the seeds is disrupted because the seeds stick together which in the end the seeds turn black and wrinkled. When the fruit is attacked by the larvae, you will see a number of brown burrows on the inside of the fruit skin and flesh. The seeds clump together. The losses due to the fruit borer are enormous, both in terms of quality and quantity. Fruit attacked by the fruit borer only produces a third of the actual yield that can be achieved by healthy fruit (Djoko Widodo, 2008).

Damage Level

From the results of statistical analysis of the effectiveness of PBK control using the Pruning and Vegetable Insecticide method on cocoa plants, it showed a significant effect on the damage level parameter at 6 wap. While the parameters of the level of damage at the age of 2 wap, 4 wap, 8 wap, 10 wap, 12 wap, showed no significant effect, due to too long treatment intervals coupled with too high rainfall conditions so as to reduce the effectiveness of control by pruning and giving insecticides. According to Sulistyowati (2010), the condition causes the CPB population to increase, this is in line with the opinion of Sulistyowati (2010) which explains that the lifespan of a female moth is 5-8 days and each female moth is able to produce 100-200 eggs.

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Table 2. Damage Level of Cocoa Fruit Borer Pests Due to Treatment of Pruning and Vegetable Insecticides at Age 2 wap to 12 wap.

Treatment	Damage Level					
	2 wap	4 wap	6 wap	8 wap	10 wap	12 wap
I0	6.66 bc	9.99 bc	9.99 de	6.66 ab	9.99 bc	9.99 cd
I1	0 a	9.99 bc	6.66 cd	6.66 ab	0 a	3.33 ab
I2	0 a	6.66 ab	3.33 ab	3.33 a	6.66 bc	9.99 cd
I3	0 a	0 a	0 a	3.33 a	3.33 ab	6.66 bc
I4	3.33 ab	16.66 cd	19.99 f	16.66 cd	16.66 cd	19.99 de
I5	3.33 ab	16.66 cd	19.99 f	9.99 bc	9.99 bc	9.99 cd
I6	3.33 ab	9.99 bc	3.33 ab	6.66 ab	0 a	0 a

Remarks: Numbers followed by the same letter in columns and rows show no significant difference according to the DMRT 5 % test.

Plant-based insecticides that decompose quickly and have to be applied more often, have low toxicity (does not kill insects immediately/has a slow effect). Larvae *Conopomorpha cramerella* cause damage by grinding the cocoa pods so that the fruit flesh becomes rotten. After the fruit is left by the larvae, the growth of the seeds is disrupted because the seeds stick together which in the end the seeds turn black and wrinkled. When the fruit is attacked by the larvae, you will see a number of brown burrows on the inside of the fruit skin and flesh.

Attack Index

From the results of statistical analysis of the effectiveness of controlling cocoa pod borer pests with pruning methods and vegetable insecticides on cocoa plants, the attack index parameter at the age of 12 weeks showed a very significant effect.

Table 3. Index of Cocoa Fruit Boring Pests Due to Pruning and Vegetable Insecticide Treatment 12 wap.

Treatment	Attack Index
	12 wap
I0	0.87 bc
I1	0.50 ab
I2	0.41 a
I3	0.71 bc
I4	1.04 e
I5	0.74 cd
I6	0.87 bc

Description: Numbers followed by the same letter in the column and row indicate that there is no significant difference according to DMRT 5% test

This is due to an increase in yield from each harvest, usually the factors that reduce CPB attacks after the attack index are observed are frequent, simultaneous and regular harvests aimed at eliminating and killing CPB larvae that are in the fruit and have not had time to come out (Sukamto, 2007).

Production

From the results of statistical analysis of the effectiveness of PBK control with pruning methods and vegetable insecticides on cocoa plants with production parameters, the effect is not significant, due to the treatment interval being too long coupled with too high rainfall conditions, thereby reducing the effectiveness of the application of vegetable insecticides, This condition causes the CPB population to increase, this is in line with the opinion of Sulistyowati (2010) which explains that the life span of a female moth is 5-8 days and each female moth is able to produce 100-200 eggs.

Table 4. Average Cocoa Fruit Production Due to Pruning and Vegetable Insecticide

Treatment	Production
I0	124.90
I1	187.42
I2	196.35
I3	17.85
I4	254.31
I5	182.96
I6	22.31

Larvae *Conopomorpha cramerella* cause damage by grinding cocoa pods so that the fruit flesh becomes rotten. After the

fruit is left by the larvae, the growth of the seeds is disrupted because the seeds stick together which in the end the seeds turn black and wrinkled. When the fruit is attacked by the larvae, you will see a number of brown burrows on the inside of the fruit skin and flesh. The seeds clump together. The losses due to the fruit borer are enormous, both in terms of quality and quantity. Fruits that are attacked by fruit borer only produce a third of the results that can actually be achieved by healthy fruit (Zaenudin, 2010).

CONCLUSION

Cocoa pod borer control with pruning and botanical insecticides on cocoa plants showed a significant effect on the parameters of attack intensity, the level of damage at 6 weeks of age, and very significant on the parameters of attack intensity of 12 weeks of age. While the attack intensity parameters at the age of 2 wap, 4 wap, 8 wap, 10 wap, and the damage level parameters at the ages of 2 wap, 4 wap, 8 wap, 10 wap, 12 wap and the production parameters did not show a significant effect. The best treatments were found in treatments I5 (Pruning Interval 7 days after the study) and I3 (vegetable insecticides made from tobacco leaves at a dose of 250 ml/liter of water).

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