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Effect of Extract *Euphorbia hirta* Linn. Against Leaf and Fruit Pests on Plants Cucumber (*Cucumis sativus* Linn.)

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Abstract— *Euphorbia hirta which is commonly known as "patikan kebo" is small herb which gives milky latex. This study aims to determine the effect of E. hirta extract in reducing the intensity of leaf and fruit pest attacks on cucumber plants Cucumis sativus Linn. The results of this study showed that all treatments with this extract were able to suppress the intensity of pest attacks on cucumber plants and had a significant effect on reducing the intensity of pest attacks on cucumber plants. The best concentration that can reduce the intensity of these pest attacks is the treatment of 10% can reduce the intensity of leaf pest attacks on cucumber plants up to 4.64%. The intensity of pest attacks on cucumbers only occurred in the control and 2% extract treatment with percentages of damage intensity to cucumbers of 9.38% and 3.13%.*

Keywords— ***extract, intensity, organic pesticide, pest attack, percentages***

I. INTRODUCTION

Cucumber is one type of fruit vegetable that has many benefits and uses, including as a food ingredient, medicinal ingredient, and cosmetic ingredient. Based on data obtained from the Badan Pusat Statistik (2020) cucumber production in Indonesia from 2015 to 2020 has experienced fluctuations in productivity, 447,696, 430,218, 424,917, 433,931, 435,975, and 441,286-ton ha^{-1}, meanwhile, cucumber production in South Borneo from 2019 to 2020 has decreased in productivity, 4,680 and 4,290-ton ha^{-1}. The decrease in cucumber production can be caused by several factors and one of them is attack by pests and plant diseases.

Pest attacks on cucumber plantings can result in decreased productivity of cucumber plants both in terms of quality and quantity, if these pest attacks are not controlled, they can make farmers suffer losses and even crop failure. Pests that are often found on cucumber plants are caterpillar pests (*Diaphania indica), Aulacophora* sp., *Bemisia tabaci*, *Epilachna* sp., leafminer flies (*Liriomyza* spp.), and fruit flies (*Bactrocera*). The control used by farmers for pests that attack cucumber plants uses chemical pesticides. The use of chemical pesticides has many negative impacts on the environment and humans.

An alternative way to control pests on cucumber plants without harming environmental and human health is to utilize weeds that have the potential as insecticides. One of the weeds that can be used is *Euphorbia hirta*. Research results from Febrianti *et al.* (2021) showed that pesticides from *E. hirta* can control mustard leaf pests, *Plutella xylostella* L. (Lepidoptera: Plutellidae). According to Situngkir (2018), the secondary metabolites found in E. hirta are tannins, saponins, flavonoids, alkaloids, and steroids, extract can control armyworms (*Spodoptera litura* L.) because these secondary metabolites can be poison to the stomach or contact poison to the larvae. To determine the effect of giving extract *E. hirta* in reducing the intensity of leaf and fruit pest attacks on cucumber plants (*C. sativus*).

II. MATERIAL AND METHODS

The research was carried out from February 2022 to May 2022, in Sungai Kupang Village, Kandangan District, Hulu Sungai Selatan Regency, South Borneo, and at the Basic Laboratory of FMIPA, Lambung Mangkurat University, Banjarbaru. This study used a completely randomized design with 1 factor, namely the concentration of organic

pesticide, which consisted of 7 treatments, with 4 replications so that there were 28 experimental units. So all the plants used are 56 plants in the form of:

KA = Water control (without treatment)

KM = Chemical control of the active ingredient abamectin concentration = 0.1 ml + 49.9 ml of water

A = Extract E. hirta 2% (1 ml + 49 ml water)

B = Extract E. hirta 4% (2 ml + 48 ml water)

C = Extract E. hirta 6% (3 ml + 47 ml water)

D = Extract E. hirta 8% (4 ml + 46 ml water)

E = Extract E. hirta 10% (5 ml + 45 ml water)

2.1. Research Implementation

2.1.1. Preparation of Planting Media

The planting medium for cucumber plants is soil mixed with chicken manure. The soil and chicken manure are stirred and mixed evenly with a 1:1 ratio using a hoe, then put into the experimental polybag, then given a name using a marker according to the name of the treatment. The experimental poly bags used were 56 pieces with a polybag diameter of 20 cm. The ready poly bags were then placed in the experimental field at a distance of 30 x 40 cm.

2.1.2. Direct Investment

Plant the cucumber seeds directly into the planting holes that have been perforated in the previous polybag, which is approximately 3 cm deep with 2 seeds per planting hole then cover the planting holes that have been filled with cucumber seeds using a pinch of rice husk and cover it with banana stems for a few days until the cucumber plants have 2-3 leaves.

2.1.3. Maintenance

Plant maintenance during the implementation of the research included watering the cucumber plants every day in the morning and evening if there was no rain, weeding done on weeds or other disturbing plants that grew around the cucumber plants, applying *E. hirta* extract, and observations made every 4 days. Once as well as collection of observational data.

2.1.4. Making Patikan Kebo Extract (*Euphorbia hirta*)

Making extract using the Febrianti *et al*., method (2021) modified. The leaves and stems of *E. hirta* taken from the field are cleaned of dirt with water and then drained and air dried. The leaves and stems of the dried are chopped and mashed using a mortar and blender. The leaves and stems of *e. hirta* have been finely macerated by soaking the powder in 96% ethanol solvent. The powder solution is soaked for 24 hours at room temperature while occasionally stirring with a stirring rod. The solution was filtered using a filter cloth and filtered again using filter paper. The filtered filtrate is then evaporated with a rotary *evaporator* at a temperature of 55°C until the extract is obtained. The extract is ready to apply.

2.1.5. Fertilization

Fertilize cucumber plants using NPK fertilizer by sprinkling the fertilizer around the roots of cucumber plants at a dose of 40 g/cucumber plant, NPK fertilizer application starts from plants aged 10 DAPs, and fertilization is done once a week.

2.1.6. Installation of Bamboo Stake and Gawar Rope

Install a bamboo stake with a length of approximately 150 cm and a width of 3 cm next to the cucumber plants when the cucumber plants are 14 DAP, then attach a gawar rope so that the bamboo stakes support the plants more firmly.

2.1.7. Application of Patikan Kebo Extract (*Euphorbia hirta*)

The application of the *Euphorbia hirta* was carried out by spraying it on cucumber plantings using a hand *sprayer* with a dose of concentration of extract, 15 ml in one repetition for the total treatment. At the time of spraying, a barrier was given in the form of a modified plastic and bamboo barrier so that the spraying would not affect other plants. For the treatment of *E. hirta* extract, 0.025 ml of adhesive was added The application of the extract in the field was carried out from cucumber plants aged 7 DAP at intervals of 4 days until the plants were 51 DAP so that the application was carried out 12 times.

2.1.8. Observation

Observations in this study included the intensity of pest attacks on cucumber leaves and fruit as well as observations of pest attack populations on cucumber plants. Observation of the intensity of pest attacks on cucumber leaves was carried out 13 times. Observation of pest populations was carried out by observing the entire cucumber plant. Observation of the intensity of pest attacks on cucumbers was carried out from the beginning of harvest until the plants were 55 DAP (Day After Planting). The number of pest populations and types of pests that attack cucumber plants are counted every time the observation. Observations were made simultaneously with the application of *E. hirta* organic pesticide, so observations and applications were carried out on the same day. Cucumber harvesting is done at the time of observation. The observed samples were 28 plants, a total of 56 test plants.

Leaf attack intensity is calculated by the formula (Minarno & Ika, 2011):

$$IS = \sum_{N=4}^{n} \frac{(n\ x\ v)}{(z\ x\ N)}\ x\ 100\%$$

Description:

IS = Attack intensity (%)

n = Number of leaves indicating scale

v = Score of damage

N = Number of leaves observed

Z = Highest score (4)

Table 1. Leaf damage score

Damage Score	Information
0	**0% leaf area affected/damaged**
1	**≤ 25% of affected**
2	**> 25% – < 50% affected**
3	**> 50% – < 75% affected**
4	**≥ 75% – 100% affected**

Observation of the intensity of attack on cucumber fruit is calculated by the formula:

$$\textbf{IS} = \frac{a}{b} x\ 100\%$$

Description:

IS = Attack intensity (%)

a = The number of infected fruit

b = The total number of fruits observed

2.1.9. Data analysis

The data obtained will be analyzed using Bartlett's homogeneity test. If the data is homogeneous then continue with *Analysis Of Variance* (ANOVA). If the results of the analysis of variance have a significant effect, then proceed with the average difference test with a BNT of 5% (Smallest Significant Difference) to see the differences between treatments.

III. RESULT AND DISCUSSION

3.1. Observation of cucumber plant pests

The results of the observations showed that the pests that attacked the cucumber plants and the symptoms they caused were seen in the third observation (15 DAP). Pest attacks on cucumber plants cause cucumber leaves to become damaged such as rolling, wrinkled and with holes. Several types of pests found attacking cucumber plants in this study were caterpillar pests (*Diaphania indica*), *Aulacophora* sp., *Bemisia tabaci*, *Epilachna* sp., leafminer flies (*Liriomyza* spp.) and fruit flies (*Bactrocera*). The main pests that attacked cucumber plants at the time of the study were caterpillar pests (*D. indicates*) with symptoms of damage that can be seen in (Figure 1).

D. indica attack occurred since the cucumber plants were 15 DAP until the end of the observation (55 DAP) and the pest population increased as the age of the cucumber plants increased but the population was still low. This is thought to occur because all phases of cucumber plant growth are favored by this pest and support for its breeding so that its population continues to increase as the age of the cucumber plants increases.

Fig 1. Leaf caterpillar pests (D. indicates) and the symptoms of the attack

Aulacophora beetle or commonly known as ”pumpkin beetle”, attacks result in leaves becoming perforated, these pests eat cucumber leaves by making circles on the leaves and then eating them until they have holes. The eating activity is very fast so the damage caused by their eating activity is quite large. In the observations, there were 2 types of *Aulacophora* pests (Figure 2). The results of the identification showed A, *similis* (figure 2 a) and *A. femoral* (Figure 2b) (Herlinda *et al*., 2020).

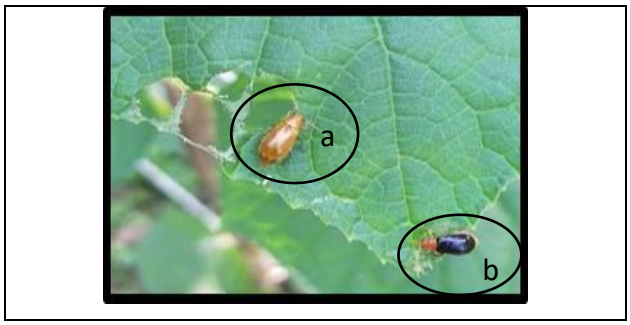

Fig 2. a. A. similis, b. A. femoral

Aulacophora beetle pest attacks occurred since the cucumber plants were 15 DAP until the end of the observation (55 DAP). According to Hasnawati (2019) the greater the beetle population *A. similis*, the higher the intensity level of the attack. An increase in the imago population causes an increase in damage to cucumber leaves.

Symptoms of leafminer fly (*Liriomyza* spp.), there are white lines that are irregular or turning in the form of burrows on the surface of cucumber leaves (Figure 3). This corresponds to Bororing*et al*. (2015) who stated that leafminer fly larvae (*Liriomyza* spp.) slit the leaves and make tunnels that turn irregularly like a spiral and in the end the leaves become dry and die.

Fig 3. Symptoms of leafminer fly pests (Liriomyza spp.)

Symptoms of leafminer fly attack (*Liriomyza* spp.) began to occur when the cucumber plants were 19 DAP, the attacks of leafminer flies continued to increase as the plants got older until entering the generative period the attacks began to decrease or no additional incisions were found on the cucumber leaves. This is presumably because the population of pests on cucumber plants during the vegetative period is high but when entering the generative phase the population decreases.

B. tabaci infestation occurred when the cucumber plants were 23 DAP. At the time of observation, this pest was often found under the surface of the leaf on the leaf buds or on young leaves. Symptoms of damage caused by whitefly infestation are not visible or even non-existent because the population on cucumber plantations is also very small.

Fruits that are attacked by fruit fly pests change color to yellow-brown and the fruit flesh decomposes and there are many larvae on the cucumber fruit. Initial symptoms are marked by the appearance of small black spots from the ovipositor puncture to lay eggs. Furthermore, due to the activity of pests in the fruit, these stains develop and become widespread. The fly larvae eat the flesh of the fruit so that the fruit is rotten before it ripens until the fruit falls. The most damaging fruit fly stage is the larval stage (Suputa *et al*., 2006).

Javelin beetle (*Epilachna* sp.) attacks the leaves of cucumber plants by biting the lower leaf surface so that the symptoms of this beetle attack are visible on the leaves, namely the presence of small holes (Figure 4).

Fig 4. Javelin beetle pests (Epilachna sp.)

3.2. The intensity of the cucumber leaf pest attack

Pest attacks on cucumber plants were not found during the first observation (7 DAP) before the plants were applied extract and attacks were still not found during the second observation (11 DAP), pest attacks on cucumber plants began to appear during the third observation (15 DAP). The percentage of attack intensity of cucumber leaf pests treated with *e. hirta* extract was lower than that of the control plants and the effect of giving extract was almost the same as that of chemical pesticides. Flavonoids, alkaloids and polyphenols which can prevent pests from approaching cucumber plants. According to Samsudin (2008), the content of bioactive compounds including saponins, flavonoids, polyphenols, and essential oils prevent pests from approaching plants (repellents) and inhibit the growth of larvae into pupae. From the results of the last observation, it can be seen that the higher the concentration of the extract given, the stronger the attack intensity of cucumber leaf pests will be (Figure 5).

The results of the analysis of variance showed that the treatment of concentrations of organic pesticide with extract had a very significant effect on the observed intensity of leaf damage due to attacks by cucumber plant pests. The results of observing the percentage of intensity of attack on cucumber leaf pests in the last observation showed that the highest damage percentage was in the KA treatment, which was 8.08%, while the lowest damage percentage was in the E treatment, which was 4.64% (Figure 5).

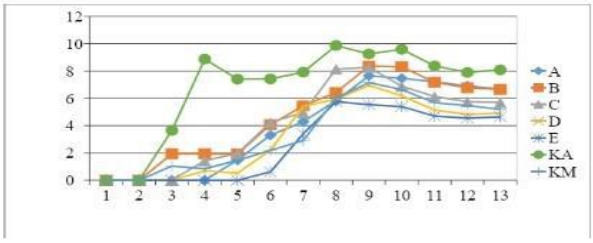

Fig 5. The intensity of cucumber leaf pest attack on all observations

After the LSD test was carried out in the vegetative phase (observation 7), the KM treatment was significantly different from the E, A, C, D, B, and KA treatments, while the D treatment was not significantly different from the B treatment but significantly different from the KM, E, A, C, and KA can be seen in Table 2.

Table 2. LSD test in the vegetative phase

Treatment	Middle value
KM	2,91a
KA	3,40b
A	4,29c
C	4,95d
D	5.41
B	5,45e
E	7,91f

In the generative phase observation test results (last observation) treatment E was significantly different from treatments D, KM, C, B, A, and KA but treatment B was not significantly different from treatment A but significantly different from treatments E, D, KM, C and KA can be seen in (Table 3).

Table 3. LSD test in the generative phase

Treatment	Middle value
KA	4,64a
D	4,91b
KM	5,19c
C	5,70d
B	6,66 e
A	6,68e
E	8,08f

Giving extract to treatment E with a concentration of 5 ml was the best concentration in suppressing the intensity of pest attacks on cucumber leaves, which was 4.64% compared to other concentrations with higher attack intensity because at a concentration of 5 ml *E. hirta* extract was the most effective concentration. height used. This can occur allegedly because the higher the concentration of extract applied, the more suppression of pest attacks on cucumber plants. This is following the results of research from Kholidi (2016) which states that the higher the concentration of organic pesticide is given to a plant, the less likely the plant will be attacked by pests, higher concentrations of organic pesticide can suppress and inhibit pest attacks in plants so that the rate of decline in production in plants can be controlled. Toana (2007) stated that the higher the concentration of the extract applied to the plant, the more active ingredient content of the extract which can be translocated to all plant leaves so that the plant is not consumed by pests. This situation causes the intensity of pest attacks on plants to decrease.

The highest percentage of damage to cucumber plants due to pest attacks was in the control treatment, this occurred allegedly because in this treatment no pesticides were sprayed either chemical or vegetable and only watered with water so that pests could easily attack cucumber plants because there was no protection or any toxic compounds to prevent pest attack on control. According to Febrianti *et al.* (2021), the high rate of damage to control plants is caused by the absence of toxic compounds that can inhibit leaf-damaging pests and the development of various pest populations, as well as weather factors that support pest development. *E. hirta* leaf extract caused rats to produce more urine and more electrolytes (Abuarra *et al.*, 2010).. *E. hirta* exhibits galactogenic, anti-anaphylactic, antimicrobial, antioxidant, anticancer, antifeedant, anti-platelet aggregation and anti-inflammatory, aflatoxin inhibition, antifertility, anthelmintic, antiplasmodial, antiamoebic, antimalarial, larvicidal, and repellent and antifeedant activities against *Plutella xylostella* (Kiran *et al*., 2015). Diwan and Saxena (2010) [2] reported that 3% of *E. hirta* leaf extracts shown 100 per cent mortality of *Callsobruchus chinensis*

3.3. The intensity of attack by cucumber fruit pests

Treatments B, C, D, E, and KM were not attacked by pests and there was no damage to yields in treatments A and KA there was damage to the fruit where the intensity of damage was in treatments A and KA by 3.13% and 9.38%.

Fig 6. a. Leaf caterpillar pests (D. indica), b. Rotten fruit due to fruit fly attack (Bactrocera sp.)

Damage to cucumber fruit caused by fruit fly pests (*Bactrocera* sp.)) where the fruit changes color to brownish yellow and the fruit rots and in the fruit flesh many fruit fly larvae are found while the fruit is attacked by caterpillar pests (*D. indicates*) become holes or there are dry cracks on the skin of the fruit and the fruit becomes abnormal.

IV. CONCLUSION

Euphorbia hirta is a tropical weed with an erect herb and soft stem which usually grows in paddy field yards and roadsides. Leaf extracts were prepared using extraction methods of pressing, boiling, steeping, and macerating extracts with ethanol solvents. *E.hirta* extract can be used

as an organic pesticide because it has the effect of suppressing the intensity of leaf and fruit pest attacks on cucumber plants. The best concentration that can reduce the intensity of pest attacks is 10% extract treatment.

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