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Entomopathogen Effectiveness to Control Uret *(Lepidiota Stigma F.*) Attacks of Pests on Cornut *(Arachis Hypogaea L.)*

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Abstract

Peanut (Arachis hypogaea L.) is one of the food plants that is a protein source for Indonesians and has quite a high economic value. As well as having fat and protein content, can be found in peanut plants. In Indonesia, peanuts have been used as the main source of protein and vegetable fat. Uret (Lepidiota stigma F), an insect of the order Coleoptera which causes damage to peanut plants, is one of the pests. Which has the potential to cause more than 50% root damage to peanut plants. This study aims to determine how the entomopathogens Metarhizium anisopliae, Beauveria bassiana, and Verticillium lecanii affect the level of urethral pest attacks. This study used a randomized block design (RBD) which consisted of 5 treatment levels with 5 replications. Based on the results of the study, Metarhizium anisopliae with a concentration of 7 grams/liter of water was able to withstand the attack power of urethra (Lepidiota stigma F.) by 47.47% and was

equivalent to artificial zinc poison with the active ingredient Carbofuran.

Keywords

Peanuts (Arachis hypogaea L.); Uret pest (Lepidiota stigma F.); Metarhizium anisopliae; Beauveria bassiana; Verticillium lecanii

Introduction

Peanut (*Arachis hypogaea* L.) is a food-crop commodity that has become one of the proteins for the people of Indonesia and has quite a high economic value. Peanuts also contain fat and protein. These peanuts have been used as the most important source of vegetable protein and fat in Indonesia (Ministry of Agriculture, 2012: Vitasari, 2021).
The need for these peanuts is always increasing every year with the increase in population and the improvement in income per capital Below is a table of data on area, production, and peanut productivity from 2016-2018 according to data from the Central Bureau of Statistics:

Table 1. Area, production, and productivity of peanuts.

Year	Harvested Area (Ha)	Production (Tons)	Productivity (Ku/Ha)
2016	81,395	109,204	13,42
2017	64,529	91,232	15.77
2018	63,342	86,600	14.07

Source: Central Bureau of Statistics (2020).

Based on Table 1 above, the production and productivity of peanut plants fluctuate because, in the cultivation of peanut plants, several factors can affect the growth and development of peanut plants such as poor quality seeds, and plant disturbing organisms (OPT) such as weeds, diseases, and pests. One of the pests that damage peanut plants is the urethra (*Lepidiota Stigma* F), this pest belongs to the order *Coleoptera*. which can damage the roots of peanut plants and cause more than 50% damage. Endemic urethral pests are found in dry land, and moor soil with a light and sandy structure (Basri, 2017). Urethral pests are polyphagous which can cause heavy damage or attack various parts of the plant. The mechanism of this pest is to eat the pods so that the pods become damaged and damage the roots and lower stems which cause the peanut plants to wither and die (Cybext, 2019).

The synthetic insecticide that is often used and most widely sold is the synthetic insecticide with the active ingredient Carbofuran because it has a powerful power to kill insect pests more actively than other synthetic insecticides (Julita, 2017). Farmers in Margaasih village often use carbofuran-based insecticides to control urethral pests, because they can control them relatively quickly. However, these synthetic chemical insecticides can hurt the environment if used continuously, such as the presence of synthetic insecticide residues which can lead to a decrease in soil fertility and the emergence of pest resistance which can lead to pest populations and kill natural enemies. Therefore, there is a need for an alternative way that can control grub attacks on peanut plants that are environmentally friendly (Healthy

Agricultural Institute, 2008; Ulya et al, 2016).

One way to control pests that have good prospects and is environmentally friendly is by utilizing the entomopathogens *Metarhizium anisopliae*, *Beauveria bassiana,* and *Verticillium lecanii*. The entomopathogen *Metarhizium anisopliae* can control pest attacks and can produce a *cyclic peptide toxin* called *Destruxin* which can attack organs in insects causing effects such as dysfunction of the middle stomach, hemocytes, malpighian tubules, and muscle tissue in the host. *Destruxin* has also been used as a new generation of insecticides (Tampubolon et al, 2013: Athifa, 2017).

According to research by Baehaki and Novianti (1993); Hidayah et al (2019) control of pests from the orders Coleoptera, *Hemiptera*, *Lepidoptera*, and *Isoptera* can use entomopathogenic biological agents. The application of this entomopathogen is very potential for urethral pest control.

Entomopathogens *Metarhizium anisopliae*, *Beauveria bassiana,* and *Verticillium lecanii* are known as entomopathogens that have a wide host range, are not toxic to the environment, and are long-lasting.

Beauveria bassiana is effective for application because it can control species of pests in the order *Coleoptera*, Lepidoptera, *Hemiptera*, *Homoptera*, *Orthoptera,* and *Diptera*. Beauveria *bassiana* is capable of producing mycelium and conidium (spores) which are white and capable of causing *whitemuscadine disease* in insect pests (Rosmianti et al, 2018).

Verticillium lecanii is also useful for controlling pests or diseases in plants. a type of toxin produced by *Verticillium lecanii*, namely *Cyclosporin* A. An antibiotic can disrupt the function of hemolymph and insect nuclei, which can cause swelling by hardening the bodies of infected insects (Kusuma et al, 2019).

According to research by Fauzana and Fadilla (2022), the entomopathogen *Metarhizium anisopliae* with a concentration of 75 grams/liter of water can be categorized as a bioinsecticide, because it has achieved total mortality of *Oryctes rhinoceros* L. larvae from the order *Coleoptera* of 72.5% because it is effective in killing these larvae. According to Riza's research (2017), a concentration of 40 grams/liter of water from the entomopathogen *Beauveria bassiana was able to suppress the Bemisia tabaci* pest population. Meanwhile, according to research by Kusuma et al (2019), *Verticillium lecanii* with a concentration of 1 gram/1.4 liters of water can suppress the population of several pests such as stem borers, ladybugs, stink bugs, and green leafhoppers.

Based on the problem of how to control urethra (*Lepidiota stigma* F.) on peanut plants which still use synthetic insecticides which can harm the environment, it is necessary to carry out research and utilization of these three entomopathogens which aim to determine their effectiveness in controlling uret pest (*Lepidiota stigma* F.) on peanut plants (Nuryatiningsih, 2022).

This study aims to determine the effectiveness of entomopathogens, *Beauveria bassiana*, *Metarhizium anisopliae,* and *Verticillium lecanii* in suppressing the intensity of urethral pest attack (*Lepidiota stigma* F.) on peanut plants (*Arachis hypogaea* L.).

ISSN 2029-0454
2023

Research Methods

The research was conducted on agricultural land in Margaasih Village, Cicalengka District, Bandung Regency, West Java Province, at an altitude of 860 meters above sea level the soil is of the Inceptisol type and the rainfall is around 1,500 mm to 4,000 mm/year. This research was carried out from the beginning of planting around 90-100 days or approximately 3 months in 2023.

During the research process, the tools used were: boots, stationery, gloves, calculator, bucket, scale, hose, heater, sack, raffia rope, hoe, tape measure, sprayer, zinc plate/gutter stake, phlox, hammer, *nails*, scissors, sieves, funnels, and documentation tools. During the research, the materials used were peanut seeds, chicken manure, urea, ZA fertilizer, KCL fertilizer, SP-36 fertilizer, synthetic insecticides with the active ingredient Carbofuran and bioinsecticides with the active ingredients of the entomopathogens *Metarhizium anisopliae*, *Beuveria bassiana*, *and Verticillium lecanii*.

This study used a randomized block design (RBD) method consisting of 5 treatments and 5 replications so that there were 25 plots, one plot consisting of 24 plants. With a total plant population of 600 plants.

The 5 treatments are as follows

1. P1=Control.
2. P2 = Carbofuran 3% (5 grams/plant).
3. P3 = entomopathogen *Metarhizium anisopliae* (7 grams/liter of water).
4. P4 = entomopathogen *Beuveria bassiana* (5 grams/liter of water).
5. P5 = entomopathogen *Verticillium lecanii* (20 ml/liter of water).

The linear method for Randomized Block Design (RBD) according to Wati, HD, et al (2022) is as follows:

$X_{ij} = \mu + t_j + r_j + \varepsilon_{ij}$

The description is:

X_{ij} = Observation value (response) from the 1st treatment to the jth repetition.

μ = True mean value.

r_j = The value of the effect of the jth treatment.

t_i = Effect of the Ith treatment

ε_{ij} = The effect of random factors on the 1st jth treatment.

Seed Preparation

Quality seeds determine the quality of peanuts. To get maximum results, it is better to use superior seeds, choose peanut varieties that can adapt to field conditions, according to needs, meet seed quality standards, and have fast and uniform body strength. A place for planting peanuts must be prepared like the land that has been cultivated.

ISSN 2029-0454
2023

Soil Processing Process

Land preparation includes cleaning plant residues and weeds around the land, then plowing the soil 20-30 cm deep after that it is left for about a week, after one week than giving chicken manure as much as 1 kg per plot as well as making beds with the size about 2.5 meters long, 0.6 meters wide and 15-30 cm high, and make drainage channels 50 cm wide around the beds to regulate rainwater stagnation. the land needed in the study is approximately 69 m2.

Planting

Planting by digging 2-5 cm deep with a spacing of 30 x 20 cm, then inserting the seeds into the planting hole 1-2 seeds per planting hole, after that the hole is closed again with loose soil without compacting it.

Application of Entomopathogenic Fungi

The application of the entomopathogenic fungi *Metarhizium anisopliae*, *Beaveria bassiana,* and *Verticilliu m lecanii* began 50 days after planting, namely 50 HST, 60 HST, 70 HST, 80 HST, with intervals of 10 days. This application is done by using *a sprayer*, filter, and marker (to stir)

Maintenance

Watering the plants can be done once every 10 days for normal temperatures, for follow-up fertilization of peanut plants at the age of 15 (HST) using ZA fertilizer 9 grams/plot, urea fertilizer 1.6 grams/plot, KCL fertilizer 105 grams/plot, fertilizer SP-36 7.7 grams/plot according to the needs of the plants. The need for fertilizer also needs to be adjusted to the typology of the soil.

Harvest

Harvesting peanut plants can be done when they are 90 days old. Plants that are ready to be harvested are:

1. Peanuts have felt firm or hardened.
2. The leaves of the plants have turned yellow and fallen.
3. The peanut pods are full, so the peanuts are ready to be harvested.

Observation Parameters

Some of the parameters observed from this study are as follows:

Lepidiota Stigma Pest Attack Intensity

Calculating the intensity of damage to peanut plants is done by observing the

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2023

symptoms that appear due to Lepidiota *stigma* attack. The intensity of the damage observed was the death of peanut plants, (Rusyana, 2018) this measurement uses the following formula:

$$\mathrm{I} = \frac{a}{b}\ X\ 100\%$$

The description is:
I: Pest attack intensity (%)
a: The number of infected pods.
b: The number of pods that are not attacked.

Plant height

Aims to determine plant growth. This measurement is carried out to determine the height size from the stem's lower base to the tip of the highest leaf bud. The average plant height is around 30-50 cm for each peanut plant

Peanut Yield (kg/plot)

Aims to determine plant growth. This measurement is carried out to determine the height size from the stem's lower base to the tip of the highest leaf bud. The average plant height is around 30-50 cm for each peanut plant.

Results and Discussion

Attack Intensity of Lepidiota Stigma F. On Peanut Plants

Observe the intensity of this attack on the day of harvest, which is 95 days after planting. Following are the results of the observational analysis test on the average intensity of attacks by the pest *Lepidiota stigma* F.

Table 2. The Intensity of Lepidiota Stigma F. Pest Attack on Peanut Plants

Treatment	**Data on the average intensity of attacks *by Lepidiota stigma* F. 95 HST**
P1 (control)	6.72c –
P2 (carbofuran)	3.86 [a]
P3 (*Metarhizium anisopliae*)	3.53 [a]
P4 (*Beauveria bassiana*)	4.76 [b]
P5 (*Verticillium lecanii*)	6.39c –

Information

1. All treatments were significantly different from P1 (control) except P5 (*Verticillium lecanii*).
2. The data transformation used is the formula P = a/(a+b) x 100%.
3. Based on Duncan's multiple range test at a 5% significance level, the average intensity of pest attack by *Lepidiota stigma* F. all treatments was significantly

different from P1 (Control), whereas treatment P3 (*Metharhizium anisopliae* (Metsch.) showed the same effect in suppressing pest attack intensity with P2 synthetic insecticide with carbofuran active ingredients, with an emphasis of 47.47%. because *Metarhizium anisopliae* produces *Cyclic poison a peptide* called destruction and has been used as a new generation of insecticides (Athifa et al, 2017).

All treatment entomopathogens can cause death in insect pests. However, on observing the intensity of attacks by *Lepidiota stigma* F., P3 was more effective than other treatments. According to Marheni et al, 2012 and Khairunnisa et al, 2014: Lita et al, 2021 the infection mechanism *of Metarhizium anisopliae* can be classified into four etiological stages of insect disease caused by fungi. The first stage is inoculation, which is the contact between the fungal propagules and the insect's body. The second stage is the process of attachment and germination of the fungal propagule on the insect integument. The third stage is penetration and invasion, which penetrates the integument to form a germ tube (*appressorium*). The fourth stage is destruction at the point of penetration and formation of blastospores which then spread into the hemolymph and form secondary hyphae to attack others.

Peanut Plant Height (Arachis hypogaea L.)

Observations can be started when the plants are 25 days after planting. Below are the results of the average observation analysis test of peanut plant height in Table 3. below:

Table 3. Peanut Plant Height (Arachis hypogaea L.)

Treatment	**Data on the Average Height of Peanut Plant (*Aracis hypogaea* L.) in cm**						
	35 HST	45 HST	55 HST	65 HST	75 HST	85 HST	95HST
P1	9.30 $^{a.m}$	13.25 $^{a.m}$	15.77 ^{a}	23.88 ^{a}	27.20 $^{a.m}$	29.80 $^{a.m}$	29.97a –
P2	9.72 ^{a}	12.93a –	16.16 ^{a}	11:38 $^{p.m}$	27.59 $^{a.m}$	31.96a –	31.97a –
P3	10.03 $^{a.m}$	13.01a –	17.55 $^{a.m}$	10:37 $^{p.m}$	28.42 ^{a}	29.73 ^{a}	30.28a –
P4	9.06a –	13.65 $^{a.m}$	16.23 ^{a}	22.91a –	27.76 ^{a}	29.58 ^{a}	25.95 $^{a.m}$
P5	8.60a –	13.22a –	3:75 $^{p.m}$	23.10 $^{a.m}$	28.16 ^{a}	31.40 $^{a.m}$	33.30 $^{a.m}$

Information

1. All treatments stated that they were not significantly different because all entomopathogens did not affect growth.
2. Treatment P1 = control, P2 = carbofuran 5 grams/plant, P3 = *Metarhizium anisopliae* 7 grams/liter of water, P4 = *Beauveria bassiana* 5 grams/liter of water, P5 = *Verticillium lecanii 20* ml/liter of water.

Analysis of the average peanut plant height at 35 HST to 95 HST before and after application showed no significant difference at P1 (Control). This shows that the three entomopathogens used did not affect plant growth.

Peanut Plant Yield (Kg/Plot)

Observation of peanut weight yield was carried out after the plants entered harvest age, which was 95 days after planting. The following are the results of the analysis test for the average weight of peanuts in Table 4, namely:

Table 4. Results of Average Harvest of Peanut (Arachis hypogaea L.)

Treatment	**Average Weight of Peanuts (Kg/Plot)**
P1 (Control Without Treatment)	0.64a –
P2 (Carbofuran 5 gram/plant)	0.89 b
P3 (*Merhizium anisopliae* {Metsch.} 7gram/liter of water)	0.88 bc
P4 (*Beauveria bassiana* {Bals} Vuill. 5 grams/liter of water)	0.81c –
P5 (*Verticillium lecanii* {Zimmermann} 20 ml/liter of water)	0.76c –

Note: All treatments with the same notation show no significant difference according to the test

Duncan's level of significance is 5%

Based on the results of Duncan's multiple range test analysis at a significant level of 5%, it showed that all treatments were significantly different from treatment P1 (control). But each treatment showed the same effect. The highest average yield of peanuts was shown in Karbofuran (P2). This shows that there is a relationship between attack intensity and yield, which in the comparison treatment had the lowest average intensity but was not significantly different from *Metarhizium anisopliae* (P3).

Conclusions and Recommendations

Based on the research that has been done, the following conclusions can be obtained:

1. The entomopathogenic fungi *Metarhizium anisopliae, Beauveria bassiana,* and *Verticillium lecanii* have the effect of suppressing the intensity of uret pest (*Lepidiota stigma* F.) attacks on peanut plants (*Arachis hypogaea* L.).
2. *Metarhizium anisopliae* effectively suppressed the attack intensity of uret pest (*Lepidiota stigma* F.) by 47.47% and was comparable to the synthetic insecticide with the active ingredient Carbofuran.

Based on the results and discussion of the research that has been done, it is advisable to carry out further research with preventive applications so that *Metarhizium anisopliae* has effectiveness in suppressing the intensity of uret pest attacks (*Lepidiota stigma* F.).

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