



Effect of Various Compositions of Vegetable Insecticide Powder on the Development of "Callosobruchus Chinensis L" and Germination Power in Mung Bean Seeds (Vigna Radiata L.)

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Abstract

Experimental research conducted at the office of the Sub-Unit of Pest and Disease Control Laboratories, Kalijati District, Subang Regency. The altitude of 76-100 m above sea level was carried out from March to July 2021. This study aimed to determine the effect of various compositions of vegetable insecticide powders (turmeric, pepper, Javanese chili) on the development of Callosobruchus chinensis L. and the germination of mung bean (Vigna radiata L.) seeds.). environmental design using a completely randomized design (RAK) basic pattern, consisting of A = no powder/control; B= Turmeric; C= Pepper, D = Chili Java; E= Turmeric+Pepper; F= Turmeric + Javanese Chili; G = Pepper + Chili Java; H = Turmeric + Pepper + Chili Java ; I = Synthetic Insectica. The results showed that the combination of botanical insecticides had a significant effect on mortality at 7 DAP and, the number of eggs aged 7 DAP, 21 DAP, and 35 DAP, the number of imago, the number of larvae, the number of pupae, the percentage of seed damage, the percentage of seed weight and germination. The use of plant-based insecticides in general emphasizes the development of Callosobruchus chinensis L on the observation of mortality at the age of 7 DAP and, the number of eggs aged 7 DAP, 21 DAP, and 35 DAS, the number of imago, the number of larvae, the number of pupae as well as suppressing the level of damage to seeds, seed weight and germination.

Keywords: Mung Beans, Vegetable Insecticides, Callosobruchus chinensis L

Abstract

Penelitian eksperimen yang dilakukan di kantor Balai Penyuluhan Pertanian Bagian POPT, Kecamatan Kalijati, Kabupaten Subang. Ketinggian tempat 76-100 m dpl dilaksanakan bulan Maret sampai Juli 2021. Penelitian ini bertujuan untuk mengetahui pengaruh berbagai komposisi serbuk insektisida nabati (kunyit, lada, cabe jawa) terhadap perkembangan Callosobruchus chinensis L. dan daya kecambah pada benih kacang hijau (Vigna radiata L). Rancangan lingkungan menggunakan rancangan acak lengkap (RAK) pola dasar, terdiri dari A= tanpa serbuk/ kontrol; B= Kunyit; C= Lada, D = Cabe Jawa; E= Kunyit+Lada; F= Kunyit + Cabe Jawa; G = Lada + Cabe Jawa; H =Kunyit + Lada+ Cabe Jawa ; I= Insektisa Sintetik. Hasil penelitian menunjukkan bahwa kombinasi insektisida nabati memberikan pengaruh nyata terhadap mortalitas umur 7 HSA dan, jumlah telur umur 7 HSA, 21 HSA, dan 35 HSA, jumlah imago, jumlah larva, jumlah pupa, persentase kerusakan biji, persentase bobot biji serta daya kecambah. Penggunaan insektisida nabati secara umum memberikan penekanan terhadap perkembangan Callosobruchus chinensis L pada pengamatan mortalitas umur 7 HSA dan, jumlah telur umur 7 HSA, 21 HSA, dan 35

HSA, jumlah imago, jumlah larva, jumlah pupa serta menekan tingkat kerusakan biji, bobot biji serta daya kecambah.

Keywords: Kacang Hijau, Insektisida Nabati, *Callosobruchus chinensis* L

1. Introduction

Green beans (*Vigna radiata* L.) are a source of vegetable protein from the legume group which is widely cultivated by farmers in Indonesia. The need for green beans continues to increase from year to year, on the other hand, production is unstable. Pest and disease attacks (Surya, 2021), (Rahman, 2019), both in the field and in the storage warehouse (post-harvest), often becomes an obstacle for farmers in producing green beans. Problems that often arise in storage warehouses are warehouse pest attacks dominated by insects from the Bruchidae family, order Coleoptera, especially *Callosobruchus chinensis*. (Wagiman, 2019), (Indah, Putra, Endahwati, & Maulana, 2021).

According to Kartasaputra (1987), yield losses due to this pest attack can reach 70%, which includes reductions in quality, quantity, nutritional value and germination which causes the selling price of green beans to drop significantly on the market. Therefore, control of *C. chinensis* attacks (Andayanie, 2016), (Subuat et al., nd). *chinensis* needs attention so that green bean productivity can be maintained according to its potential in an effort to realize food independence in Indonesia. Common methods of controlling *C. chinensis* in storage warehouses are chemical control using powdered insecticide formulations as seed tearing and fumigation. (Budiyanto, 2018), (HAYATI, nd).

Methyl bromide (CH_3Br) is a fumigant that was often used in the past because it has several advantages, including being very effective in killing insect pests, short application time and relatively cheap price. (HAYATI, nd), (AgroMedia, 2008). However, recently its use is no longer permitted because it can damage the ozone layer which has a negative impact on human health. Another alternative fumigant used today is phosphine.

The parts of plants used as botanical pesticides are roots, leaves, stems, seeds and fruit. These materials are processed into various forms, including raw materials in the form of flour, extracts or resins in the form of oil solutions which are the result of taking secondary metabolites from plant parts. (Glio & Tinton, 2017), (Iindriana, 2018). Apart from that, plant parts are burned to extract the ash and use it as a pesticide (Irawati, 2010). Botanical insecticides have the function of killing, repelling or inhibiting the development of insects which become pests in plants and food storage areas. Vegetable insecticides made from natural ingredients do not poison plants and pollute the environment (Djojsumarto, 2020), (Adriel, 2019).

According to Rajapakse (1990), the use of medicinal plants and spices (turmeric, pepper, Javanese chilies) as botanical insecticides is an economical and easy control method because it is almost always available on a household scale. The largest components in turmeric are curcumin and essential oils which function as broad-spectrum antimicrobials (Widaryanto & Azizah, 2018). Essential oils are secondary metabolite compounds that easily evaporate and enter the insect's respiratory tract. Plants from the

Piperaceae family, including pepper and Javanese chili, have considerable potential as botanical insecticides (Nugroho & Hartini, 2021).

2. Materials and Methods

The experiment was carried out at the office of the Agricultural Extension Center POPT Section, Kalijati District, Subang Regency. With a height of 76-100 meters above sea level and carried out from March 2021 to July 2021. The materials used in this research are vegetable insecticides in the form of turmeric, pepper, Javanese chili which have been blended and sifted into a fine powder, beetles *C. chinensis* and vima 3 variety green bean seeds obtained from Balitkabi Malang as test media.

The tools needed for this research are a 350 ml jar/glass container for storing the test media, clear/transparent plastic, a knife for cutting plant material, a blender for grinding plant material, an analytical balance for weighing the mass of test material, an aspirator hose for investing insects. pests, hand counter for counting test insects, gauze to cover the aspirator, writing tools, camera for documentation, and thermometer to measure room temperature.

This experiment was carried out experimentally on a laboratory scale using the Completely Randomized Design method with 9 treatments and 3 replications. The treatment design in this study was A= no powder/control; B= Turmeric; C= Pepper, D = Javanese Chili; E= Turmeric+Pepper; F= Turmeric + Javanese Chili; G = Pepper + Javanese Chili; H = Turmeric + Pepper + Javanese Chili ; I= Powdered Synthetic Insecticide with a concentration of 1% (w/w) in each treatment. Each treatment consisted of 2 jars so that 54 jars were obtained.

Table 1 Analysis of Variance in Completely Randomized Design.

Variety Source	DB	JK	KT	F. Hit	F.0.05
Treatment (P)	8	$\Sigma x_j^2 / r_x \dots 2 / r_t$	JKP/DBP	KTP/KTG	
Error (G)	18	JKT-JKP	JKG/DBG		
Total (T)	26	$\Sigma XIJ.2 - X \dots 2 / r_t$			

Source: Sugandi and Sugiarto, 1994

3. Results and Discussion

Mortality

The effect of various combinations of plant-based insecticide powders on the observed percentage of mortality at the age of 7 DSA and 21 DSA showed a real influence.

Table 2. Effect of Combination of Vegetable Insecticide Powder on Percentage Mortality Age 7 DSA and 21 DSA

Treatment	Average Mortality Percentage (%)			
	7 HSAs		21 HSAs	
A (No Powder)	82.5	a	3.33	a
B (Turmeric)	100	b	64.17	b
C (Pepper)	100	b	70.00	d
D (Javanese Chili)	100	b	88.33	d
E (Turmeric & Pepper)	100	b	50.83	c
F (Turmeric & Javanese Chili)	100	b	60.00	c
G (Pepper & Javanese Chili)	100	b	72.50	d
H (Turmeric & Pepper & Javanese)	100	b	77.50	d

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Chili)			
I (Synthetic Insecticide Powder)	100	b	8.33 a

Note: The averages of 7 HSA, 21 HSA, and 35 HAS followed by the same letters in different column directions are not significant based on the Scott Knott advanced test at a 5% significance level.

Based on Table 2. The effect of insecticide powder combinations on the percentage of mortality aged 7 DSA, shows that all powder application treatments showed significant differences compared to treatments without powder application. Observations aged 21 DSA in the combination of turmeric and pepper and turmeric and Javanese chili treatments showed high mortality rates and were significantly different from other treatments.

Number of Eggs

The effect of various combinations of vegetable insecticide powders on the observation of the number of eggs at the age of 7 DAS, 21 DAS and 35 DAS, showed a significant influence.

Table 3. Effect of a Combination of Vegetable Insecticide Powders on the Number of Eggs at Age 7.

Treatment	Average Number of Eggs (grains)		
	7 HSAs	21 HSAs	35 HSAs
A (No Powder)	132.67 b	136.83 b	120.00 b
B (Turmeric)	59.50 a	67.33 a	47.17 a
C (Pepper)	101.17 b	106.50 b	86.50 b
D (Javanese Chili)	110.50 b	118.17 b	98.00 b
E (Turmeric & Pepper)	70.67 a	79.17 a	59.17 a
F (Turmeric & Javanese Chili)	80.50 a	90.83 a	70.33 a
G (Pepper & Javanese Chili)	116.67 b	122.33 b	102.83 b
H (Turmeric & Pepper & Javanese Chili)	91.50 a	98.17 a	79.33 a
I (Synthetic Insecticide Powder)	123.67 b	128.67 b	113.50 b

Note: Means followed by the same letters in different column directions are not significant based on the Scott Knott advanced test at a 5% significance level.

The table above shows that the effect of the combination of insecticide powder on the observation of the number of eggs aged 7 DAS, 21 DAS and 35 DAS, treatment without powder, pepper, Javanese chili, pepper and Javanese chili, as well as synthetic insecticide powder showed the highest number of eggs and was significantly different from other treatment.

Number of Larvae, Pupae and Imago

The effect of various combinations of vegetable insecticide powders on observations of the number of larvae, pupae and imago showed a real influence.

Table 4. Effect of Combinations of Vegetable Insecticide Powders on the Number of Larvae, Pupae and Imago.

Treatment	Average Number (tail)		
	Larvae	Pupa	Imago
A (No Powder)	39.67 f	4.40 b	196.33 c
B (Turmeric)	13.00 c	2.03 a	40.83 a
C (Pepper)	9.50 b	1.33 a	25.17 a

D (Javanese Chili)	6.17	a	0.80	a	8.83	a
E (Turmeric & Pepper)	21.00	e	2.84	b	70.83	a
F (Turmeric & Javanese Chili)	31.00	f	3.62	b	129.33	b
G (Pepper & Javanese Chili)	26.00	f	3.23	b	97.00	a
H (Turmeric & Pepper & Javanese Chili)	17.00	d	2.37	a	52.83	a
I (Synthetic Insecticide Powder)	36.00	f	4.00	b	151.50	b

Note: Means followed by the same letters in different column directions are not significant based on the Scott Knott advanced test at a 5% significance level.

Based on Table 4. The effect of the combination of vegetable insecticide powder on the number of larvae shows that the treatment without powder, turmeric and Javanese chili, pepper and Javanese chili as well as synthetic insecticides show a higher number of larvae and are significantly different from other treatments. Observations of the number of pupae in the treatments without powder, turmeric and pepper, turmeric and Javanese chili, pepper and Javanese chili and synthetic insecticides showed that the numbers were greater and significantly different from the other treatments. The number of imago treatments without powder showed the highest number and was significantly different from the other treatments.

Damage Percentage and Seed Weight

The effect of various combinations of vegetable insecticide powders on observing the percentage of damage and seed weight showed a real influence.

Table 5. Effect of Vegetable Insecticide Powder Combinations on Damage Percentage and Seed Weight.

Treatment	Average Percentage (%)	
	Seed Damage	Seed Weight
A (No Powder)	25.98 b	34.45 b
B (Turmeric)	8.35 a	0.00 a
C (Pepper)	6.34 a	0.00 a
D (Javanese Chili)	3.37 a	0.00 a
E (Turmeric & Pepper)	11.86 a	0.47 a
F (Turmeric & Javanese Chili)	18.03 b	13.67 b
G (Pepper & Javanese Chili)	14.68 a	5.21 a
H (Turmeric & Pepper & Javanese Chili)	10,11 a	0.00 a
I (Synthetic Insecticide Powder)	20.54 b	23.19 b

Note: Means followed by the same letters in different column directions are not significant based on the Scott Knott advanced test at a 5% significance level.

Based on the table, the combined insecticide treatment on the percentage of damage and seed weight shows that the treatment without powder, turmeric and Javanese chili, as well as synthetic insecticides showed the greatest percentage and was significantly different from the other treatments.

Germination Power

The effect of various combinations of vegetable insecticide powders on the observation of germination showed a real influence.

Table 6. Effect of Combinations of Vegetable Insecticide Powders on Germination Power.

Treatment	Germination Power (%)	
A (No Powder)	58.00	A
B (Turmeric)	81.33	B
C (Pepper)	80.67	B
D (Javanese Chili)	81.33	B
E (Turmeric & Pepper)	83.33	B
F (Turmeric & Javanese Chili)	80.67	B
G (Pepper & Javanese Chili)	82.67	B
H (Turmeric & Pepper & Javanese Chili)	80.00	B
I (Synthetic Insecticide Powder)	58.00	A

Note: Means followed by the same letters in different column directions are not significant based on the Scott Knott advanced test at a 5% significance level.

Based on the table above, the effect of insecticide powder on observing seed germination shows that all treatments using vegetable insecticides provide high germination capacity and are significantly different from treatments without using powder and using synthetic insecticide powder.

4. Conclusion

Based on the results of research and discussions that have been presented previously, it can be concluded as follows: The application of a combination of vegetable insecticides has a real influence on mortality at 7 DSA and, the number of eggs at 7 DSA, 21 DSA, and 35 DSA, number of imago, number of larvae, number pupae, percentage of seed damage, percentage of seed weight and germination capacity. The use of botanical insecticides generally emphasizes the development of *Callosobruchus chinensis* L by observing mortality at 7 DAS and, number of eggs at 7 DSA, 21 DSA and 35 DSA, number of imago, number of larvae, number of pupae and reducing the level of seed damage, seed weight and germination power.

The use of plant-based insecticides has the potential to suppress the development of the *Callosobruchus chinensis* L pest, however, it is necessary to review the dosage of the plant-based insecticide so that the correct dose is obtained for each plant-based insecticide.

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