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The Effect of Weed Solution Type and Concentration to Control Aphid Pests in Chrysanthemum Plants

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ABSTRACT

Among various flower varieties, chrysanthemum (Chrysanthemum sp.) is one of the most significant decorative flower commodities. Along with Aphis sp., which may do a great deal of harm, Thrips sp. pests pose a serious risk to chrysanthemums. The use of organic, non-toxic materials, such as plant-based biopesticides, is one substitute for managing Thrips sp. The purpose of this study is to ascertain which weed extract solutions, and at what doses, are most efficient at managing aphid pests on chrysanthemum plants. Two factors were included in the research design, which used a Factorial Randomized Block Design in a greenhouse setting: the type of weed extract solution and its concentration. Analysis of Variance (ANOVA) was used to examine the production data; at a 5% significant level, a Duncan or LSD test was then performed. The quality of the chrysanthemums was then compared to the Indonesian National Standard (SNI) 01-4478-1988. Aphid population, aphid mortality, flower diameter at full bloom, and percentage of flower damage (derived by dividing the number of damaged petals by the total number of observed petals) were among the observed variables. The findings showed that the chrysanthemums grown in the Ageratum conyzoides weed extract solution had the maximum growth and flower production, along with the lowest percentage of diseased leaves. Furthermore, the 300 grams/liter concentration demonstrated greater efficacy in impeding pest attacks, resulting in increased chrysanthemum development and a reduced proportion of leaf infection. For chrysanthemums to develop as best they can, the study advises applying a solution of Ageratum conyzoides weed extract at a dosage of 300 grams/liter.

1. INTRODUCTION

Chrysanthemum or Seruni (Chrysanthemum sp.) is an ornamental flower plant commodity with high economic value. The community of chrysanthemum users spreads all over the world, from tropical and subtropical regions to cold areas. Chrysanthemums are widely known as ornamental plants and complements for various decorations. This commodity has many uses, including room decoration, flower vases, tea, flower arrangements, and traditional medicine. Chrysanthemums are categorized into two types: spray and standard [1]. The spray type has 10-20 small flower buds on a single stem, while the standard type has only one large one. The forms of chrysanthemums that can be cultivated as cut flowers are single, Anemone, Pompon, Decorative, and large flowers [2]. An important value for marketing cut chrysanthemums is the length of the stem, just like with other cut flowers [3]. The most sought-after cut flowers are in full bloom, with a healthy and fresh appearance and sturdy and robust stems. However, the chrysanthemums produced by farmers in Indonesia are of low quality [4].

Thrips sp is one of the main pests of chrysanthemum flowers, alongside Aphis sp. Aphids can cause significant losses. Aphid attacks can lead to direct damage to leaves, reduce plant growth, and affect flower quality[5][6][7][8][9]. Therefore, controlling this pest is essential to maintain the productivity and quality of plants. The presence of Thrips sp is very damaging to the

development of chrysanthemum flowers, and plant control has not been implemented so far [7].

Conventional pest control methods, such as the use of chemical insecticides, can have negative impacts on the environment, and human health, and can lead to pest resistance to these chemicals. Therefore, there is a need to seek more environmentally friendly and sustainable alternatives. One alternative for controlling Thrips sp pests is to use natural materials that are harmless, such as biopesticides made from plant ingredients. Several studies have attempted to use plant extracts from various plants to control Thrips sp. According to Syahbani [10], the application of soursop leaf extract at a concentration of 250g/l of water, applied every two days, has not been effective in controlling aphid pests (Aphis sp) in the field, with a mortality rate of 29.10% and an efficacy rate of 23.43%. There have been many studies on the use of plants as biopesticides.

Biopesticides are natural pesticides made from plants that can be used to control pests and diseases in crops. Some examples of plants that can be used to make biopesticides are betel leaf, soursop, and papaya [11]. Soursop leaves contain active compounds such as annonacin and resin that are effective in controlling pests like aphids and blast disease pests, while papaya leaves contain a group of cysteine protease enzymes such as papain and chymopapain, as well as terpenoids, flavonoids, and non-protein amino acids. acid that is toxic to plant-eating insects [12].

Biopesticides have several advantages over chemical pesticides, including not causing harm to the natural enemies of pests, not causing environmental damage, and reducing the risk of pest resistance. Biopesticides are also relatively safe for humans and animals, have low phytotoxicity, and are inexpensive and easy for farmers to produce. Weeds also contain bioactive compounds, making them useful as biopesticides. Several types of weeds, such as Echonocloa crusgali, Panicum repens, Euphorbia hirta, and Ageratum conyzoides, are known to have active compounds with insecticidal properties, such as tannin content [13]. The tannin levels in the weeds Echonocloa crusgali, Panicum repens, Euphorbia hirta, and Ageratum conyzoides are 10884.35 mg TAE/100 grams, 6891.15 mg TAE/100 grams, 2654.18 mg TAE/100 grams, and 5125.32 mg TAE/100 grams, respectively.

Tannin is a macromolecular compound produced by plants that acts as a nutrient repellent (antinutrient) and enzyme inhibitor, resulting in reduced starch hydrolysis and lowering the response to blood sugar in animals [14] . In line with Mardiana's opinion [15] that tannin compounds are phenolic compounds that result from the polymerization of simple polyphenols. This compound is found in almost two groups, namely hydrolysable tannins and condensed tannins. This substance is generally used to lower blood glucose levels by stimulating the metabolism of glucose and fats, as an antiseptic, for burn treatment, and as an antidote in cases of alkaloid poisoning, and it can stop minor bleeding and diarrhea. In addition, the use of tannin compounds can lead to water absorption in the organism's body, which can be lethal to the organism due to a lack of water.

Various types of weeds may contain active compounds with different effects on aphids. In addition, the concentration of the solution can also affect its effectiveness and safety levels. Therefore, it is important to understand this variability to design optimal control methods. In the context of modern agriculture that is evidence-based, in-depth research is needed to provide empirical evidence regarding the effectiveness and safety of using weed solutions in controlling aphid pests on chrysanthemum plants. The novelty of this research lies in identifying the best type of weed solution and the appropriate concentration for controlling aphid pests on chrysanthemum plants.

2. MATERIALS AND METHODS

2.1 Time and Place

The research was conducted in Pancasari Village, Sukasada District, Buleleng Regency, at an altitude of 1,247 meters above sea level and an average temperature of 17°C to 20°C. This study will be carried out at the partner location. The research is planned to take place over one year in 2024. The implementation of the research will begin in February and continue until September 2024.

2.2 Research Design

The research method employs a Nested Randomized Block Design conducted in the field within a greenhouse. This study uses two factors: factor I is the type of weed solution, and factor II is the concentration of the weed solution. The production data obtained are analyzed using Variance Analysis and followed by the LSD 5% distance test, while the quality data of chrysanthemum flowers are compared with SNI 01-4478-1988.

Factor I: Types of Weed Solutions
B1: Echonocloa crusgali weed solution
B2: Panicum repens weed solution
B3: Euphorbia hirta weed solution
B4: Ageratum conyzoides weed solution

Factor II: Concentration of Weed Solutions
K1 = 200 grams/liter
K2 = 250 grams/liter
K3 = 300 grams/liter.

The combination treatment is repeated 3 times, requiring a total of 36 experimental plots. With a plot size of 1.5 x 1.5 m, a distance of 30 cm between plots, and a distance of 50 cm between repetitions, with a total of 10 plant samples.

2.3 Implementation of Research

The implementation of the experiment includes the preparation of planting media, fertilization, planting, treatment application, plant maintenance (watering, replanting, weeding), observation of plant growth and development, harvesting, and data analysis. The plant maintenance carried out involves the application of fungicide with active ingredients azoxystrobin 200 g/l and difenoconazole 125 g/l to prevent rust disease. The application is done every week at a concentration of 1 ml/l. Weeding is performed weekly, while watering is done daily. Additional lighting started from planting, carried out for 4 hours a day for 1 month from 10:00 PM to 2:00 AM continuously using 75-watt incandescent bulbs installed 3 meters apart and 1 meter above the plant canopy. Bioinsecticides were tested to control the infestation of Thrips sp pests at concentrations according to the treatments. The treatment was carried out when the plants were 2 months old by spraying it on all parts of the plants. The application is done once a week in the afternoon until harvest, with a total of four applications.

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2.3 Observed Variables

The observed variables include: flower stem length, flower stem weight, flower diameter, economic weight of fresh flowers per plant, number of infected leaves, and intensity of attack.

2 RESULTS AND DISCUSSION

The results showed that the type of weed solution had no real effect on all observation variables (Table 1). The concentration treatment of *Echonocloa crusgali* weed solution had a real to very real effect on the variables of flower stalk length, flower stalk weight, flower diameter, and economic flower freshness. In *Panikum repen* weeds, it was seen that concentration treatment had a very real effect on the weight of flower stalks, flower diameter and economic flower freshness. In the treatment of *Euphorbia hirta* weed concentration, there was a real to very real effect on all observation variables. The treatment of *Ageratum conyzoides Weeds* at different concentrations had a real to very significant effect on the variables of flower stalk length, flower diameter, and economic flower fresh weight. Significance of the Results of the Analysis Variation, the influence of the type of weed solution and the concentration to control aphid pests in chrysanthemum plants can be seen in Table 1.

Tabe 1. Significance of Variance Analysis Results of the influence of the type of weed solution and concentration to control aphid pests in chrysanthemum plants

	Variable	Types of Weed solutions (G)	The effect between Concentrations on each Type of Weed Solution			
			K dl Gec	K dl Gpr	K dl Geh	K dl Gac
1	Flower stalk length (cm)	ns	**	ns	**	**
2	Weight of flower stalks (g	ns	*	**	**	ns
3	Flower Diameter (cm)	ns	**	**	*	**
4	Fresh weight of economical flowers (g)	ns	*	**	**	*
5	Number of Infected Leaves (%)	ns	ns	ns	*	ns

Information:

* = significantly different
** = significantly different
ns = non-significant
Gec = *Echonocloa crusgalii* weeds
GPR = *Panikum Repen* weeds
Geh = *Euphorbia hirta* weeds
Gac = *Ageratum conyzoides* weeds

ANOVA showed that the treatment of weed solution type had no real effect on all observation variables. The effect between types of Weed solutions and between concentrations of each type of Weed Solution on the average length of flower stalks (cm), flower stalk weight (g), and flower diameter (cm) can be seen in Table 2.

Table. 2. Effect between types of Weed solution and between concentrations of each type of Weed Solution on the average length of flower stalks (cm), flower stalk weight (g), and flower diameter (cm)

Effects between types of weed solutions			
Treatments	Flower stalk length (cm)	Weight of flower stalks (g)	Flower Diameter (cm)
Gec	80.25a	366.00a	4.33a
Gpr	72.58a	340.00a	4.41a
Geh	77.17a	358.75a	4.31a
Gac	80.25a	396.25a	4.44a
BNT 5%	Ns	ns	ns
The effect between concentrations on each type of weed solution			
K dl Gec			
K1	95.67 b	450.67b	5.33 b
K2	105.33 ab	480.00b	5.73a b
K3	120.00 a	533.33 a	6.27a
K dl Gpr			
K1	94.33 a	413.33b	5.57 b
K2	95.67 a	403.33b	5.63 b
K3	100.33 a	543.33a	6.43 a
K dl Geh			
K1	94.67 b	411.67 b	5.40 b
K2	96.00 b	483.33ab	5.80 b
K3	118.00 a	540.00 a	6.03 a
K dl Gac			
K1	89.67 c	496.67 a	5.50b
K2	100.00 bc	530.00 a	5.90ab
K3	123.33 a	558.33 a	6.37a
LSD 5%	18.441	89.743	0.61

Remarks: The numbers in the same column for each factor followed by the same letter did not differ significantly in the 5% LSD test.

The solution treatment of *Ageratum conyzoides* weed tended to produce the highest stalk length, stalk weight and flower diameter, but statistically did not show a significant difference. The types of weeds used in this study are *Echonocloa crusgali*, *Panikum repen*, *Euphorbia hirta*, and *Ageratum conyzoides* are proven to have active compounds that have insecticidal properties such as tannin content [13]. Weeds contain flavonoid compounds, alkaloids, terpenes, chromens, chromones, benzofurans, coumarins, essential oils, sterols and tannins [16]. These bioactive compounds can function as insecticides. Tannin compounds found in weeds can inhibit the growth of pests so that the growth of chrysanthemum plants becomes optimal. Tannin compounds act as plant-based insecticides by inhibiting the growth of adult insects and their larvae. Tannins can reduce the intensity of agricultural diseases such as leafhoppers and walang sangit by inhibiting the growth of adult insects and their larvae [17]. Tannin compounds can also inhibit the activity of enzymes that reduce the work of the digestive tract so that it causes the death of insects [18].

The treatment of 300 grams/liter concentration produced the highest stalk length, stalk weight and flower diameter in all types of weeds. This shows that higher concentrations are able to optimize the growth and yield of Chrysanthemums. Weed solutions with high concentrations contain more active compounds so they are more effective in killing pests/insects. The results of this study are in line with Clarissa et al. [19] who stated

that higher concentrations of bioinsecticides can have a positive effect on the growth of chrysanthemums.

Table 3. Effect between types of Weed solution and between concentrations on each type of Weed Solution on the average fresh weight of economical flowers (g) and the number of infected leaves (%)

Effects between types of weed solutions		
Treatment	Fresh weight of economical flowers (g)	Number of Infected Leaves (%)
Gec	336.85 a	17.25 a
Gpr	306.67a	17.92 a
Geh	338.33a	17.42 a
Gac	372.08a	15.33 a
LSD 5%	ns	ns
The effect between concentrations on each type of weed solution		
K dl Gec		
K1	420.73 b	25.00 a
K2	436.67 b	24.67 a
K3	490.00 a	19.33 a
K dl Gpr		
K1	353.33 b	25.67 a
K2	380.00 b	25.00 a
K3	493.33 a	21.00 a
K dl Geh		
K1	383.33 b	27.67 a
K2	453.33 a b	22.33b
K3	516.67 a	19.67b
K dl Gac		
K1	456.67 b	21.00 a
K2	496.67ab	20.33 a
K3	535.00a	20.00 a
LSD 5%	66.74	4.366

Remarks: The numbers in the same column for each factor followed by the same letter did not differ significantly in the 5% LSD test.

Table 3 shows that the solution of *Ageratum conyzoides* Weeds tends to produce the highest economical flower fresh weight of 372.08 grams, but it is not significantly different from other types of weeds. The application of a weed concentration of 300 grams/liter also produces the highest economical fresh weight of all types of weeds. The variable percentage of the number of infected leaves showed an insignificant difference from the treatment of weed types. Ageratum conyzoides *Weed solution* produced a lower percentage of infected leaves than other weed types, although there was no statistically significant difference. This shows that the type of weed in this study has the potential to be a bioinsecticide. Higher weed concentrations can reduce the percentage of leaves infected with pests/insects. Higher concentrations contain more tannin levels so they are more effective in inhibiting pests/insect attacks on chrysanthemums.

3 CONCLUSION

Based on the results of the study, it can be concluded that the type of solution of Ageratum conyzoides weed produces the highest growth and yield of chrysanthemum plants and the lowest percentage of infected leaves. The use of a concentration of 300 grams/liter is more effective in inhibiting pest attacks so it produces higher growth of chrysanthemums and the lowest percentage of infected leaves. Therefore, the researcher suggested the use of Ageratum conyzoides Weed solution at a concentration of 300 grams/liter to be applied to Chrysanthemum plants so that it can produce optimal growth.

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