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The Effectiveness of Mimosa Extract, Garlic, and Galangal Against White Rust Disease (Puccinia Horiana Henn.) in The Nursery Plants of Chryns (Chrysanthemum Sp.)

Bernadeth V. Montong[1], Max M. Ratulangi[2], Sandra O. K. Kalrengsang[3]
[1, 2,3]*Faculty of Agriculture, Universitas Sam Ratulangi, Manado, Indonesia*
montongvivi@unsrat.ac.id

Abstract: *Chrysanthemum (Chrysanthemum sp.) is an ornamental plant that produces flowers that have high economic value. Chrysanthemum flowers have the potential to be developed because they are in great demand by the public in terms of beautiful shapes and colors. One of the important stages in chrysanthemum cultivation is seeding. The main problem in chrysanthemum farming is the attack of white rust caused by a fungus (P. horiana) starting from seedling to harvesting. The use of plant extracts as alternative pesticides has many advantages and benefits. Plants that have the potential to be used as botanical pesticides include mimosa, garlic and galangal. This study aims to determine the effectiveness of giving the mimosa, garlic and galangal extracts in chrysanthemum plant nurseries to suppress white rust disease caused by the fungus P. horiana. This research was carried out using an experimental design, namely a completely randomized design (CRD) which consisted of 4 (four) treatments and 4 replications, namely K (control), P1 (20% mimosa extract), P2 (20% garlic extract), and P3 (20% galangal extract). Based on the results of observations of the symptoms of white rust (P. horiana) the upper surface of the leaves at first in the form of yellow spots which gradually changed color to dark brown, then on the lower surface of the leaves can be seen the presence of pustules that are pink, and long Over time the pustules will get bigger and then turn white.*
Keywords: *effectiveness, extract, mimosa, garlic, galangal, chryns, white rust disease*

I. Introduction

The chrysanthemum plant (Chrysanthemum sp.) is an ornamental flower-producing plant that can be used as cut flowers, decorations and potted flowers. Chrysanthemum flowers have high economic value with the selling price for cut flowers being IDR 5,000/stem and potted flowers being IDR 15,000/pot. Chrysanthemum flowers have the potential to be developed because they are in great demand by the public in terms of their beautiful shapes and colors (Purwono et al., 2014).

The chrysanthemum harvest area in North Sulawesi in 2018 was recorded at around 66,008 m2, with a production of 4,750,606 stalks. The chrysanthemum production area in North Sulawesi is in Tomohon City, Sangihe Islands Regency, Kotamobagu City and Southeast Minahasa Regency, of the four chrysanthemum producers in North Sulawesi, the largest production area is Tomohon City. Tomohon City's chrysanthemum flower production experienced a decline from 2016 to 2018, as can be seen in table 1.1

Table 1. Chrysanthemum Production Table 2016-2018 (Anonymous, 2018).

	Production (Stalk)		
Regency/City	2016	2017	2018
Tomohon city	5.748.451	5.955.594	4.750.410

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To meet market demand, chrysanthemum production and quality must be increased. One of the important stages in cultivating chrysanthemums is seeding. Chrysanthemums can be propagated by cuttings, seedlings, seeds and grafting, but the most commonly used are cuttings and suckers. Sapling seeds generally produce plants whose morphology is not uniform, using cuttings is one way to get uniform chrysanthemum seeds (Rahayu, 2016).

According to Zulkarnain (2009), good quality ornamental plant products will support the creation of good market prices as well. This is because quality determines the price of cut flower products more than quantity, which includes good appearance, attractive, healthy and free from pests and diseases.

The main problem in chrysanthemum farming is the attack of white rust disease which attacks from seeding to harvest and damage to agricultural land due to the continuous use of chemical fertilizers and pesticides. White rust disease caused by the fungus Puccinia horiana Henn. is the most important disease in chrysanthemum plants because this disease damages the leaves and reduces the quality of the flowers. Attacks on leaves around flowers reduce the ethical and commercial value of flowers by up to 100% (Ellis, 2007).

Farmers in Indonesia generally control white rust disease on chrysanthemum plants using synthetic chemical fungicides. The impact of using synthetic pesticides is that it can cause soil damage, resistance and resurgence in target pathogens, as well as leaving residues that endanger the health of those cultivating chrysanthemums and have negative impacts on the environment (Djatnika et al., 2015). Utilizing natural ingredients to control pests is the right choice to reduce the use of chemicals in the agricultural sector. Indonesia is a tropics country which are rich in biodiversity which can be utilized optimally as pest control (Subagiya, 2013).

The use of plant extracts as alternative pesticides, such as plant extracts, has many advantages and benefits compared to other types of pesticides (Sudarmo & Mulyaningsih, 2014). One of the plants that have potential as a vegetable pesticide is the Putri Malu plant (Mimosa pudica L.). According to Setiawati et al., (2008) M. pudica L. contains chemical compounds including mimosine, pipecholinic acid, tannins, alkaloids, saponins, triterpenoids, sterols, polyphenols and flavonoids. This compound content is then used as a vegetable pesticide. Maluku research has shown anti-fungal activity against two pathogens. Anti-fungal is a substance that contains compounds that can inhibit the growth of fungi. The anti-fungal activity test of Putri Malu extract showed positive results against Aspergillus flavus and Trycophyton rubrum (Tamilarasi & Ananthi, 2012). Apart from that, the botanical pesticide Putri Malu has been able to inhibit the growth of the fungus Colletotrichum sp. causes anthracnose disease in chilies (Septianing, 2017).

Garlic (Allium sativum) also has anti-fungal properties because it contains organic sulfur compounds, namely alliin, which is synthesized from the amino acid cysteine (Kulsum, 2014). Research conducted by Supriyono (2016) shows that garlic extract is able to control the fungus S. rolfsii which causes disease in soybeans. Garlic extract is also effective in suppressing the incidence of downy mildew in corn plants (Giofanny et al., 2014)

The use of galangal extract to control pests and diseases, especially fungi, is also considered environmentally friendly. Based on research by Yurhamen and Nurbalatif (2002) it shows that there is activity inhibiting microbial growth by essential oil and methanol fraction of galangal rhizome on several species of bacteria and fungi. Galangal extract has also been proven to be the most effective against the fungus A. flavus (Sitepu et al., 2012).

Based on the description above, it is hoped that the extracts of Putri Malu, garlic and galangal will be effective in inhibiting the growth of the fungus P. horiana which causes white rust disease on chrysanthemum plants.

Research

This research aims to determine the effectiveness of giving the extract of Putri Malu, garlic and galangal to chrysanthemum plant nurseries in order to suppress white rust disease caused by the fungus P. Horiana

Benefits of research

From the results of this research, it is hoped that it can provide information and knowledge to the public regarding the effectiveness of giving Putri Malu, garlic and galangal extracts as a botanical pesticide in suppressing white rust disease on chrysanthemum plants.

II. Research Methods

2.1 Time and Place of Research

The research was carried out for two months from August to September 2021. The research location was at the Tomohon Tourism Seed, Nursery and Agrowidya Center. Kakaskasen Village, North Tomohon District, Tomohon City.

Research Materials and Tools

Ingredients used include: Chrysanthemum cuttings, root stimulants, mollusk plants, garlic, galangal, water, detergent.

The tools that will be used in this research are: Scissors, Rulers, Cutters, Blenders, Scales, Containers, Hand Sprayer, Sieve, Cloth, Measuring Cups, Stationery, Camera.

2.2 Method research

a. This research was carried out using an experimental design, namely a Completely Randomized Design (CRD) consisting of 4 (four) treatments and 4 replications, so there were 16 plots. In the implementation of 1 plot, there are 15 plants with a total of 240 plants. The treatments used are as follows:

K = No treatment

P1(20%) = 20 ml Putri Malu Extract + 80 ml Water

P2(20%) = 20 ml Princess Onion Extract + ml Water

P3(20%) = 20 ml Galangal Extract + ml Water Working Procedure

The stages carried out in carrying out this research are as follows:

Preparation

The initial activity carried out in this research was preparing the materials and tools used.

Making Vegetable Pesticides

The stages carried out in carrying out this research are as follows:

Making Extracts, to make extra k we will use the extraction method, namely extracting fresh ingredients for the Malu princess extract, garlic extract and galangal extract.

1. Prepare the Malu Princess to be washed or cleaned. Then cut into pieces and weigh 1kg in 1 liter of water.
2. Add 2 grams of detergent (as an emulsifier) then mash or blend.
3. The extract is filtered with a filter (filter cloth) and placed in a container then covered and left for 12 - 24 hours.
4. The extract is diluted with distilled water according to the concentration to be used
5. The extract is ready to be applied with application times in the morning at 07.30 – 09.00 or afternoon 16.00 – 17.30.

b. Garlic

1. Prepare the Garlic then wash it or cleaned then cut into pieces and weighed 1kg in 1 liter of water.
2. Add 2 grams of detergent(as an emulsifier) then mashed or blended.

3. The extract is filtered with a filter (filter cloth) and placed in a container then covered and left for 12 - 24 hours.
4. The extract is diluted with distilled water according to the concentration to be used
5. The extract is ready to be applied with application times in the morning at 07.30 – 09.00 or afternoon 16.00 – 17.30.

c. Galangal

1. Prepare the galangal rhizome, wash or clean it, then cut it into pieces and weigh 1 kg in 1 liter of water.
2. Add 2 grams of detergent (as an emulsifier) then mashed or blended.
3. The extract is filtered with a filter (filter cloth) and placed in a container then covered and left for 12 - 24 hours.
4. The extract is diluted with distilled water according to the concentration to be used
5. The extract is ready to be applied with application times in the morning 07.30 – 09.00 or in the afternoon 16.00 – 17.30.

Preparation of Chrysanthemum Cuttings and Planting Media for Cuttings

The chrysanthemum cuttings used in this research were shoot cuttings of the kulo variety. For this reason, we need to prepare the cuttings with the following steps:

1. Preparation of cutting media for planting
2. Rice husks that have been burned and have become husk charcoal are moved to the rooting rack in the greenho use.
3. Tidy up the husks by flattening them with your hands.
4. Then flush the husks that have been prepared on the root rack with water.
5. Preparation of chrysanthemum cuttings
6. The cuttings taken are 6 weeks old, have a minimum length of 10cm. Taking cuttings material by cutting the chrysanthemum motherplant.
7. Then do the cutting or take the old leaves, as well as the leaves that are attacked by pests, leaving the top 3 leaves at the shoot.
8. After that, the process of cutting the chrysanthemum stems is carried out with a size of 7 cm measured from the top of the plant using a cutter, with the aim of ensuring that the plant height is the same.
9. Next, soak the chrysanthemum cuttings in root stimulant for 5 minutes

2.3 Planting Chrysanthemum Cuttings

The previously prepared cuttings are then planted in roasted husk media with a planting distance of 4 cm and a distance between plots of 6-7 cm, with a depth of 1-2 cm. After planting, a label or name is given to each plot. Chrysanthemum cuttings will root approximately 3 weeks after planting.

2.4 Application of Vegetable Pesticide Extracts

Putri Malu, Garlic and Galangal extracts with a concentration of 20% each were sprayed on chrysanthemum plants 10 sprays on the surface of the leaves once a week in the afternoon. Asian application is carried out after the cuttings are planted until the cuttings are ready to be transferred to the land.

Plant Maintenance, Plant maintenance includes watering which is done once every 1-2 days, watering time in the morning or evening with the aim of meeting the plant's water needs, maintaining temperature stability, media humidity and the plant environment.

Observation, Observations were carried out every 1 week after the first extract application until the plants were ready to be moved to the field. Data collection was carried out for 7 days after application of the vegetable pesticide extract. To calculate the percentage

of disease, use the following formula
Information :
P = Attack Percentage
n = Number of Infested Leaves on Infested Plants
N = Total Number of Plant Leaves Data analysis

The research data obtained was analyzed using Microsoft Excel. Analysis of the significant influence between test parameters using the Two Way ANOVA (Analysis of Variance) method, if they are significantly different, continue with the BNT test.

III. Results and Discussion

3.1 Symptoms of White Rust Disease Attack (P. horiana)

White rust disease (P. horiana) on chrysanthemum plants has several symptoms attack. Based on the results of the observations made, it can be seen as in Figure 4.1.1 that the symptoms of white rust disease (P. horiana) first appeared in the first week after the cuttings were planted, with the characteristics being that the upper surface of the leaves first appeared as yellow spots. which over time changes color to dark brown, then on the lower surface of the leaves you can see pink pustules, and over time the pustules will get bigger and then change color to white. This is in accordance with research reported by (Suhardi, 2009) which states that the development of symptoms of P. horiana attacks on chrysanthemum leaves begins with the appearance of yellow spots on the upper surface of the leaves, which is then followed by a change in the color of the center of the spots from white to dark brown. . On the lower surface of the leaves, pustules form which are initially pink, then the pustules enlarge and change color to white.

Figure 1. *Chrysanthemum plant leaves infected with white rust disease (P. horiana*)

The increase in the percentage of white rust disease in nurseries is still lacking, this is because the plants in nurseries are only three weeks old so the height of the plants is still too short and the position of the growing leaves is not yet clear.
too close together because according to Opod et al., (2021) the high percentage of white rust disease obtained can be influenced by the age of the plant, plant height, and leaves that are getting closer together, making it easier for rust spores to spread to other plants.

3.1 Percentage of White Rust Disease Attacks (P. horiana)

Based on the results of observations of the percentage of white rust disease attacks (P. horiana) on chrysanthemum plants, white rust disease attacks were first seen in the first week,

namely on K (Control), then P3 (Galang Extract) was seen in the second week while on P1 (Extract Putri Malu) and P2 (Garlic Extract) were first seen in the third week.

In Figure 4.2.1, the highest attack of white rust disease was seen in the third week, namely at K (Control) at 10.08%, then at P1 (Putri Malu extract treatment) 0.96%, at P2 (Garlic extract treatment).) 4.27% and P3 (Gangal extract treatment) 3.33%.

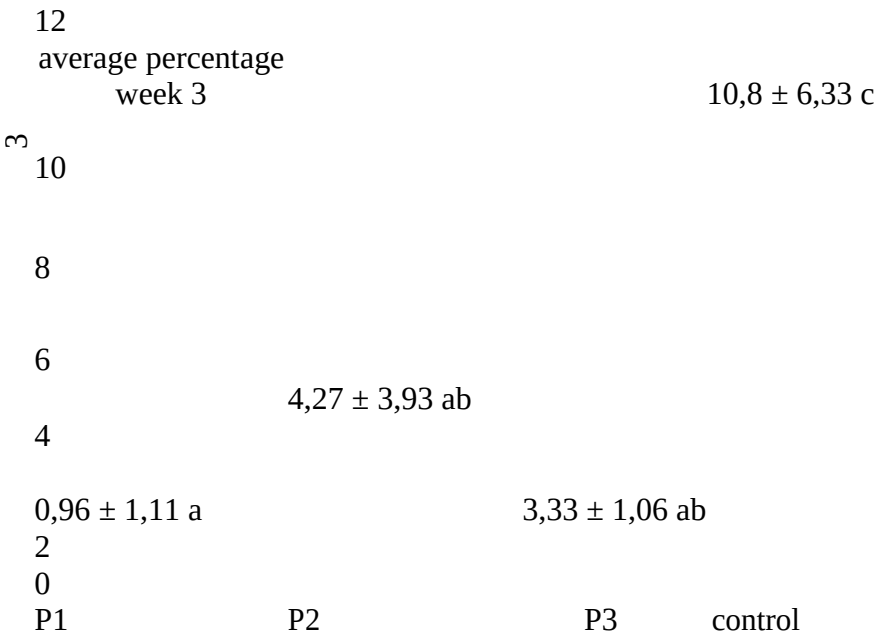

Figure 2. *Percentage of attacks by white rust disease (P. horiana) in the third week. Small letters above the bar indicate no significant difference based on the BNT test at 5%.*

According to the results of existing observations, it can be seen that the lowest percentage of attacks was in treatment P1, namely 0.96% and the highest percentage of attacks was in treatment K, namely 10.08%. This shows that P1 treatment is the best treatment in suppressing the development of white rust disease (P. horiana) because it is in accordance with research (Syafirah 2020) that this plant can be used as a botanical pesticide through extraction. Putri Malu extract contains chemical compounds such as mimosine, tannin, flavonoids, alkaloids, terpenoids and saponins which have anti-pest, antibacterial and antifungal properties to control plant pest organisms. And it is supported by research from Mycek et al., (2001) that the main ingredient in Putri Malu is mimosine, where mimosine is an alkaloid.

which is a ß-amino acid. As an antifungal, alkaloids cause damage to cell membranes. Alkaloids will bind strongly with ergosterol to form holes that cause cell membrane leakage. This results in permanent damage to the cells and cell death in the fungus. The flavonoid compounds contained in the putri-malu plant act as antifungals, function to damage fungal cell walls and can cause fungal cell death (Obongoya et al., 2010).

In the P2 (Garlic) treatment, the average percentage of white rust disease attacks was 4.27%, while in the control it was 10.08%. This shows that the P2 treatment also has an inhibitory effect on white rust disease in chrysanthemum plant nurseries. According to (Kulsum, 2014) on onions.

White contains essential oils, essential oils can be used as anti-bacterial and anti-fungal. One of the active substances contained in essential oils is allicin. Allicin can combine with proteins and change their structure, the ability to combine with supporting proteins because allicin attacks the proteins of microorganisms and ultimately kills the microorganism.

It can also be seen in the picture, namely the P3 (Gangkuas) treatment in the third week, the percentage of white rust attacks was 3.33% compared to the control which reached 10.08%. This shows that the P3 treatment also has an inhibitory effect on white rust disease because it is based on Yulia et al. ., (2015) galangal can be used as a natural pesticide used to control pests and diseases in plants. The biological activity of this plant extract has been widely reported to inhibit germination of spores, inhibiting the growth and development of pathogens, or completely killing pathogens. According to research reported by Salni et al., (2013), the bioactive ingredients from white galangal rhizomes are found in the n-hexane and ethyl acetate fractions. The N-hexane and ethyl acetate fractions are bioactive ingredients that can be used as medicinal ingredients. The antifungal compounds contained in white galangal rhizomes belong to the phenol group. Phenolic compounds work by denaturing proteins.

IV. Conclusion

The use of Putri Malu, Garlic and Galangal Extracts with a concentration of 20% can suppress white rust disease (P. horiana) on chrysanthemum plants. The best treatment in suppressing white rust (P. horiana) is Putri Malu Extract (P1): 0.96%, followed by Galangal Extract (P3): 4.27% and Garlic Extract (P2): 3. 33%. cells and cell membranes, and is fungistatic or fungicidal depending on the concentration. At concentrations of 0.1-2% phenol is damaging cytoplasmic membrane which causes leakage of metabolites and in addition inactivates a number of enzymes. At high levels of phenol it causes protein coagulation and cell membranes will experience lysis.

Based on the results of the analysis of the percentage of attacks by white rust disease (P. horiana) in chrysanthemum nurseries, it can be seen that the percentage of attacks is significantly different. In Figure 4.2.1, it can be seen that there are real differences between each treatment, where the 20% Putri Malu extract treatment (P1) is significantly different from the control (K), but is not significantly different from the 20% garlic extract treatment (P2) and the 20% garlic extract treatment (P2) and the 20% garlic extract treatment (P2) and the 20% garlic extract treatment (P2). galangal 20% (P3). The 20% garlic extract treatment (P2) was significantly different from the control (K), but not significantly different from the 20% putrimalu extract treatment (P1) and the 20% galangal extract treatment (P3). Then the 20% galangal extract treatment (P3) was significantly different from the control (K) but not significantly different from the 20% putrimalu extract treatment (P1) and the 20% garlic extract treatment (P2).

This shows that the use of putrimalu, garlic and galangal extracts at a concentration of 20% can suppress and be effective in controlling white rust disease (P. horiana) in chrysanthemum plant nurseries.

Suggestion

Further research needs to be carried out regarding the use of Putri Malu, Garlic and Galangal Extracts against white rust disease (P. horiana) in chrysanthemum plant nurseries with higher concentrations and on other varieties of chrysanthemum seeds.

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