EFFECT OF FUNGICIDAL METHANOL EXTRACT OF KIRINYUH LEAVES (*Eupatorium odoratum* L.) AND NONI LEAVES (*Morinda citrifolia* L.) AGAINST MOLD *Fusarium oxysporum* ON TOMATOES

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ABSTRACT

Tomato plants are one of the leading horticultural commodities that are easily attacked by disease. Plant wilt disease is one of the diseases that often attacks tomato plants which is caused by *Fusarium oxysporum.* The use of chemical fungicides causes many losses, so there is a need for plant-based fungicides made from natural ingredients. Kirinyuh leaves and Noni leaves are natural ingredients that can be used as a vegetable fungicide to control fungi *Fusarium oxysporum.* The experiment was carried out alive and prepared using a Completely Randomized Design with 6 treatments and 6 replications. Data obtained from observations will be analyzed using the Duncan test at the 5% level. The concentrations used by each extract were 20%, 40%, 60%, and 80%, negative control (*Aquadest*), positive control (dithane M-45). The results showed that the Noni leaf extract fungicide with a concentration of 60% had the most effective effect in inhibiting the fungal growth zone *Fusarium oxysporum on* tomatoes.

Keywords**:** Fungicides, kirinyuh, noni, methanol, tomatoes, *Fusarium oxysporum*

A. INTRODUCTION

Tomato plants, according to the Directorate General of Horticulture, are one of the leading domestic horticultural commodities based on their economic and strategic value (Fajri *et al.,*2022). So this must be supported by increasing the number of harvests on tomato plants, to meet market needs. However, tomato plants are a horticultural crop that is easily attacked by disease. According to BPP Sedayu (2017), the productivity of tomato plants decreased due to various environmental factors and Plant Pest Organism (OPT) factors such as septoria leaf spot (36.16%), green aphids (29.18%), thrips aphids (27.16%), anthracnose disease (23.20%), wilt disease *Fusarium* (22.77%) and fruit flies (12.90%).

Djamaludin *et al* (2022) added that diseases caused by pathogenic fungi are still a major problem today because controlling and preventing the development of these diseases has not been effective. This is due to the characteristics of the fungus which can spread through the soil or air, so it spreads very quickly. One of the fungi that easily spreads in the soil is *Fusarium oxysporum.* This fungus is a pathogen that has a self-defense system, namely chlamydospores, which allows this fungus to live in the soil even though it does not have a host. Mold *Fusarium oxysporum* often infects through injured plant roots (Heriyanto, 2019).

Mold *Fusarium oxysporum* will enter the roots through injured roots, root tissue and lateral roots. The fungus will grow in the vascular bundles, until the mycelium reaches the xylem vessels. The status of the xylem which carries water and nutrients throughout the plant body will also carry mycelium from fungi. After the mycelium spreads throughout the body, the plant will wilt. After that, the entire body of the tomato plant will wilt until it dies (Aji & Rohmawati, 2020).

Death of tomato plants will result in significant losses for farmers. So farmers carry out fungus eradication *Fusarium oxysporum* using chemical fungicides. The use of chemical

fungicides is considered the quickest and easiest way to eradicate various fungi and diseases. According to Aji & Rohmawati (2020) the use of chemical fungicides will pollute the environment, causing plants, microbes and animals around them to die. Apart from that, the fruit obtained will also carry residue from fungicides, so it will not have a good impact on human health. Therefore, other alternatives are needed to replace chemical fungicides, namely vegetable fungicides or fungicides derived from plants and other natural ingredients.

According to Harahap *et al* (2022) Vegetable fungicides will be safer to use to kill fungi. This is because vegetable fungicides will only kill the target fungus and not other organisms. Apart from that, the use of vegetable fungicides will reduce the residue that is produced after using fungicides and is easily decomposed so that the surrounding environment will not be easily polluted. The materials used in making fungicides also tend to be easier to find in the environment.

Kirinyuh leaves and Noni leaves are examples of natural ingredients that have been widely studied because they have beneficial properties. According to Listiani & Indraswari (2021) Kirinyuh contains secondary metabolite compounds such as phenols, triterpenoids, flavonoids and alkaloids which can be used as antifungals. Likewise, the Noni plant contains various substances such as anthraquinones which function as antimicrobials and flavonoids which can inhibit the growth of conidia in fungi (Utami & Catri, 2021). Kirinyuh leaves and Noni leaves can be converted into vegetable fungicides using several techniques. Therefore, in research The antifungal activity of the methanol extract of Kirinyuh and Noni leaves was tested with concentrations of 20%, 40%, 60% and 80% against fungi. *Fusarium oxysporum* on tomato es*alive.*

B. RESEARCH METHOD

This research was carried out in March 2024. The research was conducted at the Biology Learning Laboratory, Faculty of Teacher Training and Education, Ahmad Dahlan University, Yogyakarta. This research was carried out randomly alive.The treatments carried out were arranged using the RAL (Completely Randomized Design) method with 6 treatments and 6 replications. Treatment consisted of (P1) positive control namely dithane M-45, (P2) negative control, namely distilled water, (P3) extract with a concentration of 20%, (P4) extract with a concentration of 40%, (P5) extract with a concentration of 60%, (P6) extract concentration 80%. Data analysis used the Duncan test with a level of 5%.

1. **Making simplicia of Kirinyuh leaves and Noni leaves**
   Kirinyuh leaves and Noni leaves are taken from parts that don't have insect bite marks. Kirinyuh leaves and Noni leaves are then washed in running water, drained and wiped with a clean cloth. Next, the leaves are placed at room temperature and left to dry. The leaves are cut into smaller pieces and blended until the leaves are smaller.
2. **Making Kirinyuh and Noni leaf extracts**
   The blended leaves were then weighed 200 gr using an analytical balance. Next, the weighted leaves are put into a jar and macerated using 3000 ml of 80% methanol for 3x24 hours and stirred every 1x24 hours. Once the process is complete, it is filtered to obtain a filtrate. Next, distillation is carried out by inserting the filtrate into a 3 neck flask which has previously been assembled and ensured that it is tight. Next, the electric stove

is turned on and the water flow is turned on. Once the distillate droplets begin to decrease, the electric stove can be turned off.

Varying extract concentrations were made using dilution with distilled water. Concentration consists of 20%, 40%, 60%, 80%. Concentration variations are made using the formula P1xV1=P2xV2. The negative control used Aquades (without extract) and the positive concentration used dithane M-45 with a concentration of 5 grams/liter.

3. **Fungal Infection *Fusarium oxysporum on* tomatoes**
   The tomatoes are washed using clean running water, then dried. Next, the tomatoes were sprayed using Bayclin 1% and dried at room temperature. Next, the tomatoes are labeled according to the treatment, on the right side they are sprayed with Noni leaf extract and the left side is sprayed with 1 ml of Kirinyuh leaf extract. Wait until the treatment solution has been sprayed on the tomatoes until the treatment solution has absorbed the tomatoes and the surface is dry. After the tomatoes are dry, the mushrooms are then injected with a Fusarium *oxysporum of* 0.5 ml with a needle depth of 1 mm.
4. **Observation of fungal growth zones *Fusarium oxysporum* on tomatoes**
   Observations were carried out twice, namely at 3 days and 6 days. Observation of fungal growth zones *Fusarium oxysporum* Measure directly using a ruler on the part of the tomato that grows white hyphae on the injured side.

C. RESULTS AND DISCUSSION

Based on research that has been carried out and analyzed by Duncan, it can be seen that the most effective ingredients used in inhibiting fungal growth *Fusarium oxysporum are* Noni leaves, can be seen in Table 1.

Table 1. Average area of fungal growth zone *Fusarium oxysporum for* 3 HSI and 6 HSI with different material treatments

MATERIALS	INSTALLMENT-INSTALLMENT (cm)		INCREASING THE AREA OF MUSHROOMS
	3 HSI	6 HSI	
Methanol-Noni	0,9375[a]	1,9042[a]	0,9667
Methanol-Kirinyuh	0,8917[a]	2,0250[a]	1,1333
Dithane M-45 (K. Positive)	0,8667[a]	2,7583[ab]	1,8916
Aquades (K. Negative)	0,9583[a]	3,4500[b]	2,4917

Information: The same letter notation indicates that the data are not significantly different in the Duncan test with α 0.05

Based on the results of the Duncan test, it can be seen that the methanol extract treatment of Kirinyuh leaves and Mengkudu leaves was significantly different from the negative control treatment (*Aquadest*). This shows that the methanol extract of Noni leaves and Kirinyuh leaves can inhibit fungal growth *Fusarium oxysporum*. The largest increase in the area of the fungal growth zone with the negative control treatment using distilled water, showed a result of 2.4917 cm. Treatment using Noni leaf extract showed the smallest results, namely 0.9667 cm. Growth *Fusarium oxysporum influenced* by the fungicide used.

Noni leaf extract and Kirinyuh leaf extract can inhibit fungal growth *Fusarium oxysporum* because it contains secondary metabolites. According to Aji & Rohmawati (2020), the results of the analysis of noni leaf extract were positive for containing alkaloid, flavonoid and terpenoid compounds as antifungals. Kirinyuh leaves also contain bioactive compounds including saponins, tannins, alkaloids, phenolics and flavonoids which can be fungicides (Frastika *et al*., 2017).

Flavonoids and phenolics are compounds that have antimicrobial activity by destroying proteins, causing cell walls to become brittle so that they are easily penetrated by bioactive compounds (Gultom *et al*., 2020). Alkaloids are compounds that can inhibit the biosynthesis of fungal nucleic acids, so that fungal cells die because they cannot develop (Jalianto, 2015). Terpenoids which are fungistatic in nature can inhibit the work of certain enzymes which results in disruption of fungal cell metabolism, so that the elongation process of fungal hyphae is hampered and causes fungal cells to be unable to reproduce within a certain time (Putri, 2015).

Saponin can cause microbial cell lysis by disrupting the stability of the cell membrane. Saponin, as a polar surfactant, will reduce the surface tension of the sterol membrane of the fungal cell wall, thereby causing disruption of membrane permeability which results in the entry of necessary materials or substances being disrupted and ultimately the cells swelling and bursting (Putri, 2015). Tannin compounds also have antifungal activity which can shrink fungal cell walls as a result of which the permeability of the fungal cell walls will be disrupted so that the fungal cell walls will not be able to carry out cell metabolic activities (Chismirina *et al*., 2014).

The next observation is the average area of the fungal growth zone *Fusarium oxysporum with* different concentration and material treatments, can be seen in Table 2.

Table 2. Average area of fungal growth zone *Fusarium oxysporum for* 3 HSI and 6 HSI with various concentrations and different ingredients

COMBINATION OF CONCENTRATION AND INGREDIENTS	INSTALLMENT-INSTALLMENT (cm)		INCREASE IN MUSHROOM AREA (cm)
	3 HSI	6 HSI	
M 20%	0,9167[a]	2,0333[ab]	1,1166
M 40%	0,9500[a]	1,7167[a]	0,7667
M 60%	0,7500[a]	1,1167[a]	0,3667
M 80%	1,1333[a]	2,7500[ab]	1,6167
K 20%	0,9167[a]	2,2500[ab]	1,3333
K 40%	0,9000[a]	2,0000[ab]	1,1
K 60%	0,7167[a]	2,0000[ab]	1,2833
K 80%	1,0333[a]	1,8500[ab]	0,8167
Positive (Dithane M-45)	0,8667[a]	2,7583[ab]	1,8916
Negative (*Aquadest*)	0,9583[a]	3,3500[b]	2,3917

Information: The same letter notation indicates that the data are not significantly different in the Duncan test with α 0.05

The area of the fungal growth zone *Fusarium oxysporum for* 3 HSI and 6 HSI with various concentrations and different ingredients can also be seen in Figure 1 and Figure 2.

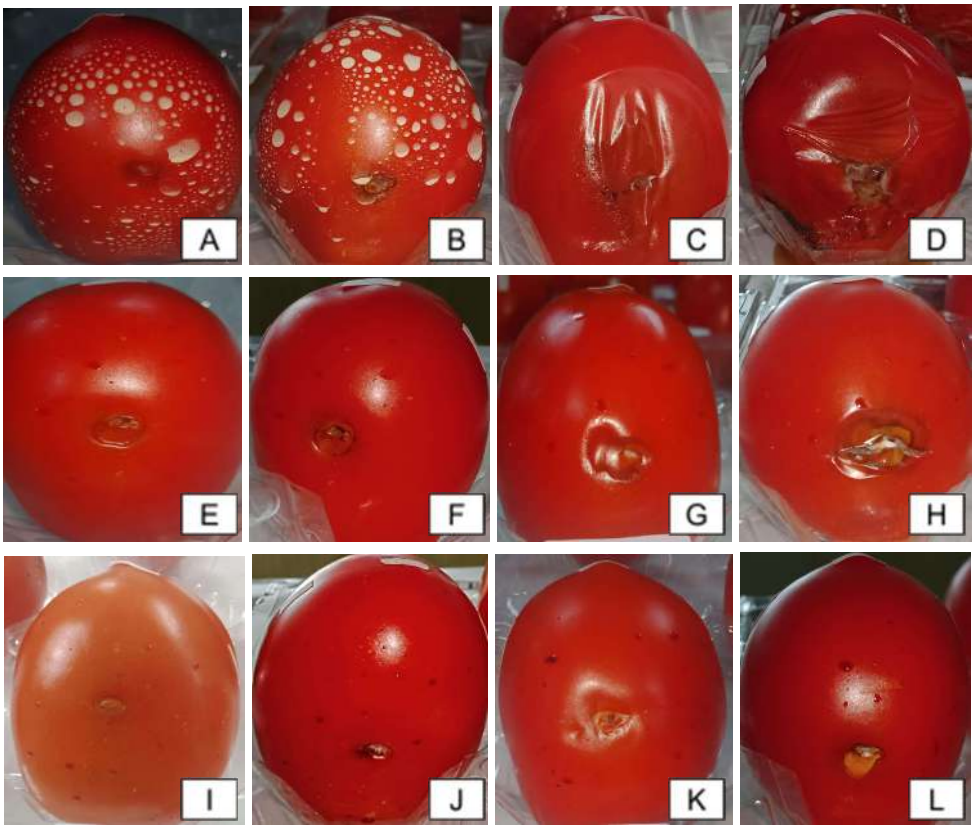
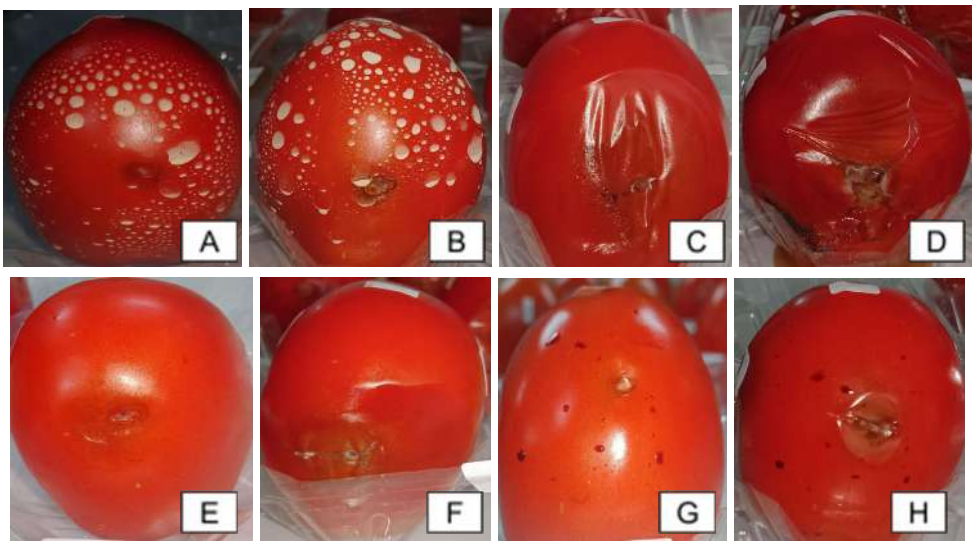


Figure 1. The area of the fungal growth zone *Fusarium oxysporum in* several treatments the methanol extract concentration of Kirinyuh leaves: A. 3 hsi P1, B. 6 hsi P1, C. 3 hsi P2, D. 6 hsi P2, E. 3 hsi P3, F. 6 hsi P3, G. 3 hsi P4 , H. 6 hsi P4, I. 3 hsi P5, J. 6 hsi P5, K. 3 hsi P6, L. 6 hsi P6



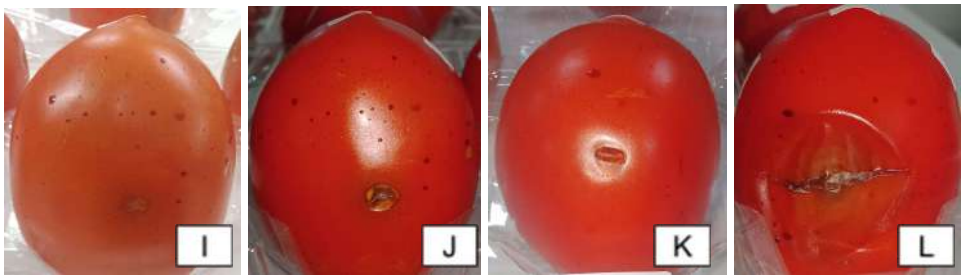


Figure 2. The area of the fungal growth zone *Fusarium oxysporum in* several treatments the concentration of noni leaf methanol extract: A. 3 hsi P1, B. 6 hsi P1, C. 3 hsi P2, D. 6 hsi P2, E. 3 hsi P3, F. 6 hsi P3, G. 3 hsi P4 , H. 6 hsi P4, I. 3 hsi P5, J. 6 hsi P5, K. 3 hsi P6, L. 6 hsi P6

Information:
P1: Positive control (Dithane M-45)
P2: Negative control (*Aquadest*)
P3: Methanol concentration 20%
P4: Methanol concentration 40%
P5: Methanol concentration 60%
P6: Methanol concentration 80%

Based on Table 2, the average area of the fungal growth zone *Fusarium oxysporum with* observations for 3 DAP there were no significant real differences between treatments. Observations at 6 DAP showed that noni leaf extract with concentrations of 40% and 60% was significantly different from the negative control, but not significantly different from other treatments. Increase in the area of the fungal growth zone *Fusarium oxysporum the* smallest was the noni leaf extract treatment with a concentration of 60%, namely 0.3667 cm. Noni leaf extract with a concentration of 60% is effective in inhibiting fungal growth *Fusarium oxysporum*. Meanwhile, for Kirinyuh leaf extract, the smallest increase in fungal area was in the 80% treatment, namely 0.8167 cm.

D. CONCLUSION

Based on the research results, it can be concluded that Noni leaf extract fungicide with a concentration of 60% is more effective than Noni extract fungicide with concentrations of 20%, 40%, 80% and Kirinyuh leaf extract fungicide with concentrations of 20%, 40%, 60% and 80%. Noni leaf extract fungicide is known to control wilt disease caused by fungi *Fusarium oxysporum* on tomatoes.

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