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Control of Anthracnose Disease in Chili (*Capsicum annum L.*) with Several Doses of Noni Leaf Extract (*Morinda citrifolia L.*)

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Abstract

Background: Chili is one of the important commodities and is very needed for household needs in Indonesia. The production of chili is greatly influenced by natural factors, production can decrease due to pests and plant diseases. Some diseases that greatly affect anthracnose, whose symptoms cause circular spots on the fruit. Safe control alternatives are tried using plant material as a vegetable fungicide. Noni leaf (*Morinda citrifolia L.*) is known to have ingredients that are vegetable fungicides. The purpose of this study was to determine the effect of the dose level of noni leaf extract and the percentage of anthracnose disease control emphasis. The research method is by planting chili directly in the experimental field, giving a dose level of noni leaf extract. Using a single randomized block design (RBD) experiment design, namely 5 (five) doses of noni leaf extract with 4 (four) replications, so that there were 20 experimental units. The results showed that noni leaf extract had an effective influence on anthracnose disease control. The higher concentration of Noni leaf extract gives a better effect. The dosage of 16 (sixteen) ml of Noni leaf extract / 100 ml of distilled water can reduce the attack of anthracnose up to 12.75%.

Keywords: Chili, Noni Leaf, Anthracnose, Vegetable Fungicide.

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I. Introduction

One horticultural crop commodity that has an important role in Indonesia and has a high selling value is chili (*Capsicum annum L.*). This chili is very necessary and always must be present in every household. This chili production can sometimes go down, depending on natural and environmental factors [1]. The causes of the low production of chili include pests and diseases. Some diseases can attack chilli plants, but a very important and very widespread disease is anthracnose, which is caused by the fungus *Colletrichum capsici* [2,3]. This disease attacks on several important plants and fruits that are planted throughout the year [4]. Losses that occur due to the attack of this anthracnose disease on chili are very large, every planting season many farmers experience losses up to 25-40%. It can even reach 50-75% which causes crop failure.

Alternative [control with plant materials that are vegetable fungicides and contain lots of anti-fungal ingredients need to be developed for environmental preservation [5]. A natural ingredient that can be used and is thought to have efficacy as a vegetable fungicide is noni (*Morinda citrifolia L.*). Noni plants, especially noni leaves, contain flavonoids and anthraquinone contained in noni leaves, are believed to be active as anti-microbial properties [6, 7].

Research purposes

1. determine the effect of noni leaf extract on the intensity of anthracnose disease attack on chili plants.
2. To find out the best concentration of noni leaf extract in suppressing the intensity of anthracnose disease on chili plants.
- 3.

II. Materials And Methods

Materials and tools used are noni leaves, chilli seeds, aquades, ethanol, basic soap, manure, NPK fertilizer, polybags, scale blenders, flour sifter, rotary evaporator, handsprayer, erlenmeyer, glass beaker.

Place and time, the study was conducted at the Integrated Laboratory of Agroecotechnology, Faculty of Agriculture, Basic Chemistry Laboratory, Faculty of Mathematics and Natural Sciences, Lambung Mangkurat University, Banjarbaru. Experimental field in Gunung Kupang Banjarbaru Indonesia Village, conducting research from July - November 2019.

6. Research methods

This study used a randomized block design (RBD) with five treatments and four replications to obtain 20 experimental units [1]. The treatment given is as follows:

M0 = Control (0 ml Noni leaf extract)

M1 = Noni leaf extract 4 ml / 100 ml distilled water

M2 = Morinda citrifolia leaf extract 8 ml / 100 ml aquades

M3 = noni leaf extract 12 ml / 100 ml aquades

M4 = noni leaf extract 16 ml / 100 ml aquades

Making Noni Leaf Extract

Noni leaves used are young noni leaves and old leaves, then the leaves are washed with running water and drained. The leaves are cut into small pieces and then dried without being exposed to direct sunlight. After drying, the leaves are blended until smooth called simplicia and ready to be macerated. Maceration is done by immersing symphysis (powder) in 96% ethanol solvent until completely submerged for 1 x 24 hours, then filtered with filter paper. The resulting maceration extracts are collected and evaporated. To separate the solvent, evaporation is carried out using a Rotary Evaporator at a temperature of 45-50 °C, until the solvent is completely evaporated to obtain a thick extract of noni leaves [8].

Seedbed nursery

Before sowing the seeds are first soaked in water with a temperature of 30-40°C for 5-10 minutes, the seeds that float when immersed are taken and thrown away. Soaked seeds are placed in a place that has a cloth base that has been given water so that it is moist so that it supports seed germination. Seed that has germinated placed in a small poly bag as deep as 1-1.5 cm. The seed is placed in a hole and then closed again using soil. After the seeds are planted then water them with water using a handsprayer.

Planting Seeds

After the seeds reach the age of 18-21 days (\pm 3 weeks) the seeds already have 3-4 true leaves, then the seeds are ready to be transferred to a poly bag. Seedlings that will be transferred to a poly bag are selected first, healthy seedlings and uniform growth are selected

Fertilization

Fertilization of chili according to the recommendation of dosing of manure in this study was 10 tons / ha (50 g / polybag) and NPK fertilizer 250 kg/ha (1.25 g / polybag) then supplementary fertilizer was given 3 weeks after transplanting. Fertilization is done by leaking on plants and done in the afternoon.

Maintenance

Watering plants depends on the growing season. Because the chili planting in this study was carried out in the dry season, watering was given every day, ie in the morning. If the water given is considered insufficient, it is repeated in the afternoon. Noni Leaf Extract Application Vegetable pesticide applications are given three times with an application period of once every seven days. Application I is carried out when the plant is 60 days after the plant (DAPS), application II is carried out when the plant is 67 DAPS, application III is carried out when the plant is 74 DAPS and application IV is carried out when the plant is 81 DAPS [9].

Observation

The observed variables were the percentage of plants that were attacked by *Colletotrichum capsici* or *Gloeosporium piperatum* by observing the symptoms that occur in the chili fruit. Observation was carried out four times, the first observation was started since the plant was 67 dd or one week after the first application, the second observation was when the plant was 74 dd, the third observation was when the plant was 81 dd, the fourth observation when the plant was 88 dd. The intensity of the attack was calculated by the formula damage is not absolute [1].

$$I = \frac{\sum (n_i \times v_i)}{N \times Z} \times 100\%$$

Information:

I = intensity of attacks (%)

n_i = Number of plants or parts of plants with damage scores v_i

v_i = Score continue score

N = Number of plants or plant parts observed
Z = Highest scoring value

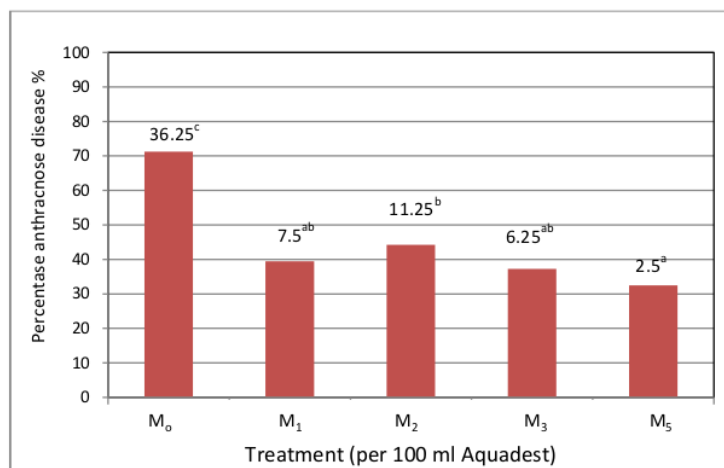
Data analysis

The percentage of attack data was tested for homogeneity using the Barlett variety homogeneity test. If the data are not homogeneous, data transformation is performed. After homogeneous data immediately proceed with analysis of variance (ANOVA). The results of the analysis of variance if significant, then proceed with the LSD test at a test level of 5%.

III. Results And Discussion

Intensity of Damage at Age 74 DAPS

The results of observations on the intensity of damage to chili at 74 days after planting are presented in the following figure 1.



2
Figure 1. Graph of damage intensity of chilies 74 DAPS.

Note: The numbers followed by the same lowercase are not significantly different based on the BNT test level of 5%. Data is processed after being transformed $\sqrt{x + 1}$.

Based on Figure 1 above, observing the intensity of damage to the chili plants aged 67 days after planting has not seen symptoms of anthracnose disease. Anthracnosis is one of the main diseases in the chili plants besides the bacterial wilt and Gemini virus. Anthracnosa in chili is caused by the genus *Colletotrichum*, in the anthrax of *C. capsici* and *C. gloesporoides* [5]. Anthracnose disease caused by the fungus *Colletotrichum* sp., can reduce the production and quality of red chili by 45-60%. In adult plants can cause shoot death (dieback), then followed by further infection in the fruit [10]. The initial symptoms of anthracnose disease are small patches such as being splashed with water with blackish spots on the surface of the infected fruit and then the fruit becomes soft rot. The blots immediately develop until they reach the entire surface of the fruit. Maximum spotting expansion forms a curve with a dark red color. Severe attacks cause all the fruit to wrinkle and dry out. Pathogens can infect fruit through wounds or directly, in wet conditions and the presence of rain water is very instrumental in the spread of spores from one plant to another plant [11].

The symptoms of anthracnose disease began to appear at the age of plants 74 days after planting with the highest level of damage found in the control treatment (36.25%), the use of noni leaf extract had a significantly different effect from the effect that was significantly different from the control treatment, based on research [6] that noni leaf extract can control the growth of the fungus *C. capsici* that causes anthracnose. Besides being able to control the noni leaf extract mushrooms can also control bacteria. Substances contained in Noni leaves have strength against groups of infectious bacteria: *Pseudomonas aeruginosa*, *Proteus morganii*, *Staphylococcus aureus*, *Bacillus subtilis* and *Escherichia coli*. In addition, noni also has chemical contents that have anti-fungal and anti-biotic effects, namely Scopletin as an antifungal, Antraquinone to fight bacterial and fungal infections, Terpenes as a bioflavanoid and carotenoid that functions as an anti-fungal and bacterial infection agent, and Xeronine anti fungal infections [12].

Intensity of Damage at the age of 81 DAPs

The results of observations on the intensity of damage to chili at 81 days after planting are presented in Figure 2.

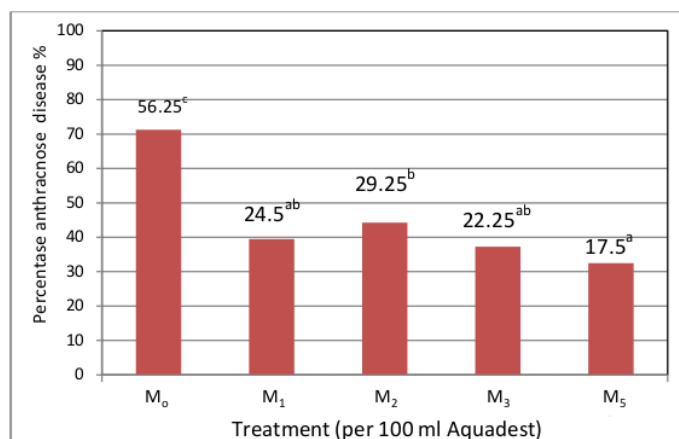


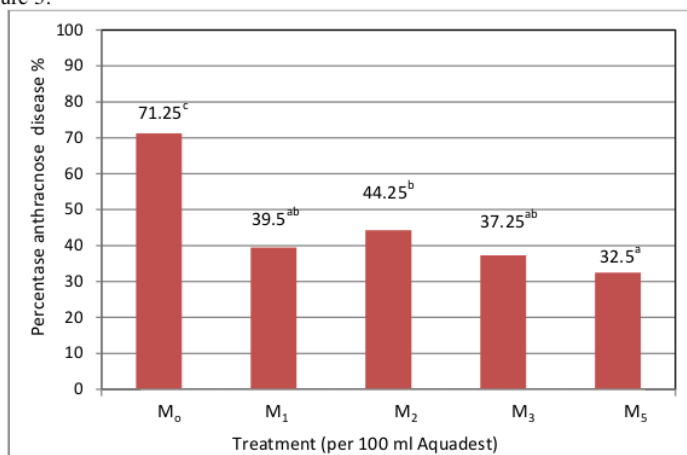
Figure 2. Graphic intensity of damage to chili 81 DAPs.

2
Note: The numbers followed by the same lowercase are not significantly different based on the BNT test level of 5%.

Based on Figure 2 above, in plants aged 81 days after planting the intensity of anthracnose damage in chili is highest in the control treatment (56.25%), the use of noni leaf extract gives a significantly different effect from this control treatment, based on research [6] which mentions the noni leaf contains alkaloid compounds such as anthraquinone, glycosides, resins that have anti-fungal and anti-microbial properties [6]. According to [13] alkaloids affect fungal cell components by denaturing proteins and damaging cell membranes so that lysis cell membranes die. The use of vegetable pesticides is a way to minimize the use of synthetic pesticides. Vegetable pesticides are pesticides derived from plants which are then extracted, processed, or made into concentrates that do not change their chemical structure [14]. Noni plant extract is one of the vegetable functions that can control anthracnose disease because the noni leaves contain compounds that can suppress disease-carrying pathogens.

Intensity of Damage at 88 DAPs

The results of observations on the intensity of damage to chilli plants at the age of 88 days after planting are presented in Figure 3.



2
Figure 3. Graph of damage intensity of 88 DAPs chili.

Note: The numbers followed by the same lowercase are not significantly different based on the BNT test level of 5%.

Based on Figure 3 above, in 88 days after planting the intensity of anthracnose damage in chili was highest in the control treatment (71.25%), the use of noni leaf extract had a significantly different effect from the control treatment, based on research [6] states that noni leaf extract can inhibit the growth of *Capsicum* allegedly due to the influence of alkaloid compounds. The compounds belonging to the alkaloids have antimicrobial properties that can inhibit the growth of some fungi. Chemical components of alkaloids which are anti-fungal are able to penetrate the fungal cell wall. So that there will be disruption of the process of secondary metabolism that will interfere with cell growth, and at certain concentrations will result in fungal cell death [12]. Environmental factors also affect anthracnose disease, according to Semangun (2004), saying that the development of spotting from anthracnose disease or fungi that cause anthracnose disease develops very rapidly when the humidity is high enough if it is more than 80% with a temperature of 27 °C-30 °C.

Average Damage Intensity of Chili Plant

The results of observations on the average intensity of damage to chilli plants at the age of 67 DAPs, 74 DAPs, 81 DAPs, and 88 DAPs are presented in Table 1.

Table 1. Average intensity of damage to chili plants

Treatment	Damage Intensity (%)	Attack Category
M0 = Control (0 ml of Noni leaf extract)	41.25c	Weight
M1 = Noni leaf extract 4 ml / 100 ml distilled water	18.00 ^{ab}	Is
M2 = Noni leaf extract 8 ml / 100 ml distilled water	21.00 ^b	Is
M3 = noni leaf extract 12 ml / 100 ml aquades	16.50 ^{ab}	Is
M4 = noni leaf extract 16 ml / 100 ml distilled water	12.75 ^a	Light

The average intensity of anthracnose disease attack on plants aged 67, 74, 81, and 88 days after planting, which has been tested showed very significant effect of each treatment of noni leaf extract, the lowest intensity of damage was found in the M4 treatment (12.75%) and the highest in the control treatment (41.25%). In accordance with research [7] states that the higher the concentration of noni juice, the higher the level of active substances such as flavonoids, alkaloids, and antraquinone which acts as an anti-bacterial. Concentrations of plant extracts affect the effectiveness of vegetable fungicides. Extract concentration is related to the number of active compounds contained in the extract that can inhibit the growth of pathogens [15]. According to [16] the greater the concentration of plant extracts the higher the active compounds in it so that the inhibitory power of pathogens is also higher. This is in line with the question Cahyani et al., (2015) which states that the concentration is closely related to the number of active ingredients in the formulation, the higher the concentration of a formulation, the higher the active ingredient contained so that its ability to suppress pathogens will be more optimum. Sunarto et al. [17] states that in general plant extracts can inhibit the growth of mycelium fungi, where the percentage of inhibitors depends on the type and concentration of plant extracts and the types of fungi.

IV. Conclusion

Noni leaf extract effectively suppresses the intensity of disease damage in chilli plants because it provides a significant effect. The best concentration of noni leaf extract is 16 ml / 100 ml of distilled water which can reduce the intensity of anthracnose damage in chili plants by 12.75%.

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