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Trichoderma sp. Antagonist Test Ability as an Inhibitor of Yellow Rot Disease Pathogens of Red Dragon Fruit Plants (*Hylocereus polyrhizus*)

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Abstract. *Dragon fruit plants originating from Central and South America have not been widely cultivated. This plant has only been cultivated intensively in several countries such as: Israel, Colombia, Nicaragua, Vietnam, Thailand, China and Australia. Macroscopic identification showed that the fungi associated with dragon fruit stems had similarities to the colony form of Colletotrichum gloeosporioides sp. Trichoderma is known to have antagonistic abilities against pathogenic fungi. Trichoderma is easily found in soil ecosystems and plant roots. The method in this study is a survey method. Determination of the sample using purposive sampling or Judgmental sampling method, namely purposive sampling is a sampling method that selects objects (vines) that are considered attacked or have symptoms of pathogen attack. Trichoderma sp is also tolerant to stress and able to inactivate pathogenic microbial enzymes. In addition, Trichoderma sp. Able to produce enzymes that hydrolyze pathogenic cell walls which will inhibit the synthesis of pathogenic cell walls and increase their fungicidal activity, as a result of which pathogenic fungi experience a decrease in growth rate.*

Keywords *: Colletotrichum gloesporioides, Trichoderma sp, and dragon fruit plants (Hylocereus polyrhizus)*

1. INTRODUCTION

Dragon fruit plants originating from Central and South America are not widely cultivated. This plant has only been cultivated intensively in several countries such as: Israel, Colombia , Nicaragua, Vietnam, Thailand, China and Australia (Lichtenzveig et al., 20013) . Dragon fruit can be consumed in fresh or processed form. According to (Meidayanti et al., 2015) dragon fruit has a very high water content of around 90.20% of the weight of the fruit. It tastes quite sweet because the sugar in the fruit is quite high. Apart from being cultivated as a fruit plant, dragon fruit is also cultivated as a medicinal plant because it has benefits for human health. These benefits include: balancing blood sugar, preventing colon cancer, protecting oral health, lowering cholesterol, preventing bleeding, and treating complaints of vaginal discharge.

This plant became known and cultivated in Indonesia in 2000. However, the development of this plant cultivation is very slow, even though Indonesia's climate conditions are very supportive for the development of this plant. In 2006, there were only a few areas that cultivated this plant, namely Malang, Kediri, Tawangmangu, Semarang, and Kulon Progo with various planting areas. In recent years, after it was discovered that dragon fruit has medicinal properties, dragon fruit cultivation efforts have continued because it is very profitable.

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However, the cultivation of yellow skin dragon fruit is still rarely done. There are 2 genera of dragon fruit cultivated in Indonesia, namely Hylocereus and Selenicereus. The cultivated dragon fruit is dragon fruit from the genus Hylocereus , namely H. undatus (white flesh), H. polyrhizus (dark red flesh), and H. costaricensis (pink flesh) (Nurhafizhah et al., 2020).

2. LITERATURE REVIEW

Control of plant pathogens currently still relies on the use of synthetic pesticides. However, continuous use of synthetic pesticides can cause various negative impacts. (Prajawahyudo et al., 2022) stated that the use of synthetic pesticides can endanger biological safety including humans and the balance of the ecosystem. Therefore, currently control methods have been directed towards biological control. Trichoderma is known to have antagonistic abilities against pathogenic fungi. Trichoderma is easily found in soil ecosystems and plant roots. This fungus is a beneficial microorganism, avirulent to the host plant, and can parasitize other fungi (Alfizar & Susanti, 2013).

Several relevant government agencies have intervened to overcome the problem of dragon fruit stem rot, but have not yet found the right solution, one of which is the UPTD of the East Kalimantan Horticultural Food Plant Protection Center (TPH), the effort that has been made is the use of the biological agent Trichoderma sp, but has not been able to suppress the development of dragon fruit stem rot disease (Harman et al , 2017). Based on the description above, it is necessary to carry out research regarding effectiveness Trichoderma sp to inhibit the growth of dragon fruit stem rot disease.

3. METHODS

This research was carried out for ± 1 month, starting in July 2023. The sampling location was in Tanjung Selamat Village, Medan Tuntungan District, Medan Regency. Continued identification and Inhibitory Power Testing at the Tissue Culture and Microbiology Laboratory, Faculty of Science and Technology, Pembangunan Panca Budi University, Medan. The materials used are the symptomatic parts of the stem/tendrils of the dragon fruit plant, Potato media Dextroxe Agar (PDA), 70% alcohol. There are two data observed in this research, namely, primary data and secondary data. Primary data is data obtained directly from the source through direct field observations and laboratory observations, while the pathogen parameters observed are fungi. The method in this research is a survey method. Determination of the sample using the Purposive method sampling or Judgmental sampling, namely purposive sampling, is a method of sampling that selects objects (vines) that are considered to be attacked

or have symptoms of pathogen attack. Meanwhile, samples of tendrils with symptoms are taken by cutting parts of the plant that have symptoms of pathogen attack, putting them in a plastic bag and taking them to the laboratory. The research implementation is; isolation and identification of yellow rot pathogenic fungi of dragon fruit plants, and trichoderma antagonist testing sp against the growth of the yellow rot pathogenic fungus of dragon fruit plants.

4. RESULTS

Condition of Dragon Fruit Plant Stems Attacked by Yellow Rot Disease

Stem rot disease in dragon fruit plants is the main problem for dragon fruit farmers in Tanjung Selamat Village, Medan Tuntungan District, Medan Regency.

Figure 1. Dragon Fruit Stems Infected With Yellow Rot Disease

Isolation and Identification of Pathogenic Fungi on Dragon Fruit

From the results of observations of the isolation of the pathogenic fungus that causes dragon fruit vine rot, macroscopically there is a mycelium consisting of white hyphal threads arranged like feathers, and after a few days the hyphae turn black, visual observation can be seen in Figure 2.

Figure 2. Misellium of *Colletotrichum Gloeosporioides*

Cultivation of *Trichoderma*

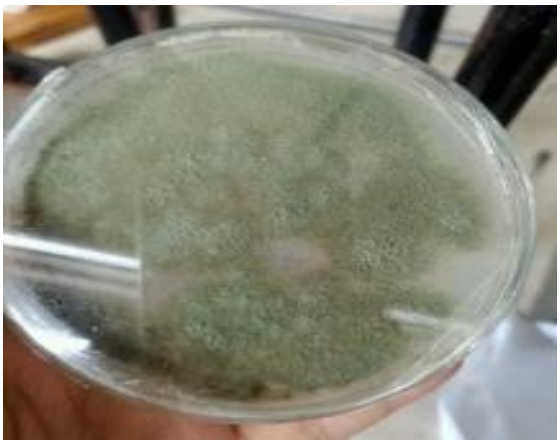

Figure 3. Misellium of *Trichoderma* sp.

Trichoderma* Antagonist Test *sp* Against *Colletotrichum gloeosporioides

The presence of this inhibitory power indicates that the Trichoderma fungus isolate sp has antagonistic properties against Colletotrichum fungi gloesporioides . This is characterized by the occurrence of an inhibitory mechanism in the form of the release of antibiosis and hyperparasite compounds which can be observed by the formation of a clear zone as a growth inhibition zone for Colletotrichum. gloesporioides and growth of Trichoderma hyphae sp which is faster, thereby encouraging the growth of *Colletotrichum gloesporioides*.

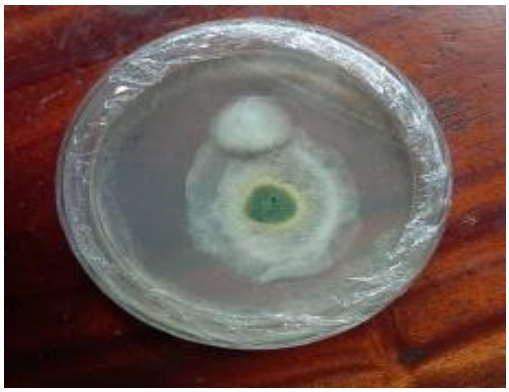

Figure 4. *Trichoderma* sp Antagonist Test Inhibits The Growth Of *Colletotrichum Gloesporioides*

5. DISCUSSION

Macroscopic identification of fungal colonies associated with dragon fruit plant stems was carried out on the third to seventh day after purifying the fungus on new PDA media. Macroscopic observations were carried out directly by looking at the development of the colony, starting from the shape of the fungal colony, the color of the surface of the fungal colony and the color of the bottom of the fungal colony. Trichoderma control mechanism spp. Against plant pathogenic fungi, namely by competition for growth sites and nutrients, antibiosis and parasitism. Antibiotics has an important role in the control process and is almost always related to other mechanisms, namely competition and mycoparatism. One of the inhibitors that Trichoderma has spp cannot act alone to produce significant inhibition. Trichoderma 's antagonism mechanism spp has great potential as a control agent for yellow rot disease on dragon fruit stems (Dwiastuti et al., 2015) .

These antibiotic compounds affect and inhibit many functional systems and make pathogens susceptible. 10 Trichoderma sp is also tolerant to stress and is able to inactivate pathogenic microbial enzymes. Additionally, Trichoderma sp. Capable of producing enzymes that hydrolyze pathogenic cell walls which will inhibit the synthesis of pathogenic cell walls and increase fungicidal activity, as a result, pathogenic fungi experience a decrease in growth rate (Purwantisari et al., 2016). (Octriana, 2016) states that Trichoderma sp suppresses pathogens by four mechanisms, namely it can produce chitinase, β-1,3-glucanase, mycoparasites and competition for the use of nitrogen and carbon.

Fungi *Colletotrichum gloeosporioides*

The initial symptoms of the disease are black spots and a slightly dry surface . On the fourth day the surface began to show a yellowish black color and began to rot and become soft, then after the seventh day it began to show symptoms of soft rot disease on the surface of the plant stem. The attack of disease symptoms is categorized as very fast, almost all plant stems are attacked by yellow stem disease. *Colletotrichum* mushroom *gloeosporioides* sp. form conidia The conidiphores are branched and the conidium is crescent-shaped, small-pedunculated, often in pairs. The mycelium is mainly found in cells, especially in wood vessels, and also forms mycelium between cells, namely in the skin, parenchymal tissue near the infection (Rita et al., 2013).

Antagonist Test of *Trichoderma sp* Against *Colletotrichum gloeosporioides*

Trichoderma fungus *sp* has the ability to act as a parasite and is antibiotic because it produces enzymes that actively degrade pathogenic cells, thereby causing the lysis of pathogenic mold cells and releasing trichotoxins which can kill pathogenic molds (Fazil et al.,

2020) . said that the antibiosis mechanism can occur due to the presence of secondary metabolites produced by microbes which are naturally a microbial defense mechanism to survive or compete. (Lestari et al., 2021) stated that Trichoderma sp suppresses pathogens by four mechanisms, namely it can produce chitinase, β-1,3-glucanase, mycoparasites and competition for the use of nitrogen and carbon.

(Sun et al., 2020) , *Trichoderma sp.* able to secrete antibiotic compounds such as gliotoxin and glioviridine . This statement is confirmed by (Ainy et al., 2015) , who stated that these antibiotic compounds affect and inhibit many functional systems and make pathogens susceptible. 10 *Trichoderma sp* is also tolerant to stress and is able to inactivate pathogenic microbial enzymes. Additionally, Trichoderma sp. Capable of producing pathogenic cell wall hydrolyzing enzymes which will inhibit pathogen cell wall synthesis and increase fungicidal activity, as a result pathogenic fungi experience a decrease in growth rate (B ł aszczyk et al., 2014).

6. CONCLUSION

a. Macroscopic identification shows that the fungi associated with the stems of dragon fruit plants are similar to the colony form of *Colletotrichum. gloeosporioides sp.*
b. Trichoderma sp can inhibit the development of *Colletotrichum pathogens gloesporioides* (Penz .) Ssaac ., with high average resistance.

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