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ANTAGONISTIC POTENCY ASSAY OF ANTIANTHRACNOSE PRODUCING BACTERIA AGAINST SEVERAL PHYTOPATHOGENIC FUNGUS

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ABSTRACT

Phytopathogenic fungus are the main obstacles in crop cultivation. The infection effect could lead to yield loss. The utilization of synthetic fungicides in controlling these fungus is harmful for the environment. Biological control using antagonistic bacteria offers an alternative choice to reduce that negative effect. The aim of this study was to test the antagonistic activity of antagonistic rhizobacteria and phyllobacteria isolates against several species of phytopathogenic fungus. Antifungal activity of four antagonistic bacteria isolates (UBCF_001, UBCF_013, UBCR_012, and UBCR_036) was assayed against three species of pathogenic fungus (*Colletotrichum gloeosporioides, Fusarium oxysporum, and Sclerotium rolfsii*). Antagonistic assay was conducted using paper diffusion method by applying 20 µl of culture onto whatmann filter paper. Bacterial inhibition against fungus was determined by comparing the growth rate of both treated and untreated fungus. Broad spectrum of antifungal activity was shown by rhizobacteria isolates (UBCR_012 and UBCR_036). Of those two isolates, UBCR_012 exhibited the highest antagonistic acitivity up to 51% against *C. gloeosporioides* isolated from dragon fruit. In contrast, phyllobacteria isolates (UBCF_001 and UBCF_013) showed specific inhibition against *C. gloeosporioides* only indicating its narrow spectrum of antifungal activity. Bacteria showing antagonistic activity against various pathogenic fungus offers promising prospect to be developed as biocontrol agents due to its high application value.

Keywords:

antifungal, antagonistic, pathogenic fungus,rhizobacteria, broad spectrum biopesticida

INTRODUCTION

Fungi are heterotrophic organisms whose lives depend on other organisms. These organisms are generally parasitic, live and develop by absorbing nutrients from the surrounding environment or

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from other organisms. Many of the fungi that cause losses in cultivated plants. Fungi that cause harm to plants are called phytopathogenic fungi [3].

Some of the phytopathogenic fungi that very often attack plants and are very detrimental to farmers include *Colletotrichum gloeosporioides*, *Fusarium oxysporum* and *Sclerotium rolfsii*. The three species of fungi attack host plants with a very wide range and are soil born fungi with losses of up to 100% [4].

Colletotrichum gloeosporioides is a phytopathogen that causes anthracnose disease which has a very wide host range including mangoes, avocados, strawberries, chilies, guavas, papayas and oranges (Swart, 1999). Recent research results state that the fungus *Colletotrichum gloeosporioides* also attacks dragon fruit, this phytopathogen attacks dragon fruit orchards in Batang Anai District, Padang Pariaman, West Sumatra, with an attack severity index reaching 99.5%[5].

Fusarium oxysporum is a phytopathogenic fungus that damages banana plants in 15 provinces in Indonesia. The fungus attacks more than 100 types of plants. The fungus *Fusarium oxysporum* also attacks red chilies, tomatoes, long beans, potatoes, cabbage, cucumbers, eggplants [1].

The fungus species *Sclerotium rolfsii* is known as a fungus that causes wilt, especially on legumes such as peanuts. This fungus also has a very wide range of host plants, including potatoes, tomatoes, soybeans, cabbage, onions, celery, sweet corn, lettuce, cotton, tobacco, and plants from the Cucurbitaceae family [2].

The main problem in cultivation is the attack of phytopathogenic fungi which are difficult to control. Control by using chemicals has a negative impact on the environment. Research on the potential of several bacterial isolates as in vitro biocontrol agents in suppressing growth.

The fungus *C. gloeosporioides* causes anthracnose has been carried out. However, its ability to suppress other phytopathogens is unknown.

Based on the spectrum or range of action, the antianthracnose compounds produced by bacteria can be divided into two, namely: broad spectrum bacteria and low spectrum bacteria, so the question arises whether UBCF_001, UBCF_013, UBCR_012 and UBCR_036 bacteria have a broad spectrum.) or narrow spectrum (low spectrum). Do the 4 isolates have the potential to control other harmful phytopathogenic fungi, namely *Colletotrichum gloeosporioides*, *Fusarium oxysporum* and *Sclerotium rolfsii*.

The results of this study are expected to reduce the use of synthetic biofungida by farmers, so that pollution to the environment can be minimized.

METHOD

Antagonistic assay was conducted using paper diffusion method by applying 20 µl of culture onto Whatmann filter paper. Bacterial inhibition against fungus was determined by comparing the growth rate of both treated and untreated fungus.

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Broad spectrum of antifungal activity was shown by rhizobacteria isolates (UBCR_012 and UBCR_036). Of those two isolates, UBCR_012 exhibited the highest antagonistic acitivity up to 51% against *C. gloeosporioides* isolated from dragon fruit. In contrast, phyllobacteria isolates (UBCF_001 and UBCF_013) showed specific inhibition against *C. gloeosporioides* only indicating its narrow spectrum of antifungal activity.

RESULT AND DISCUSSION

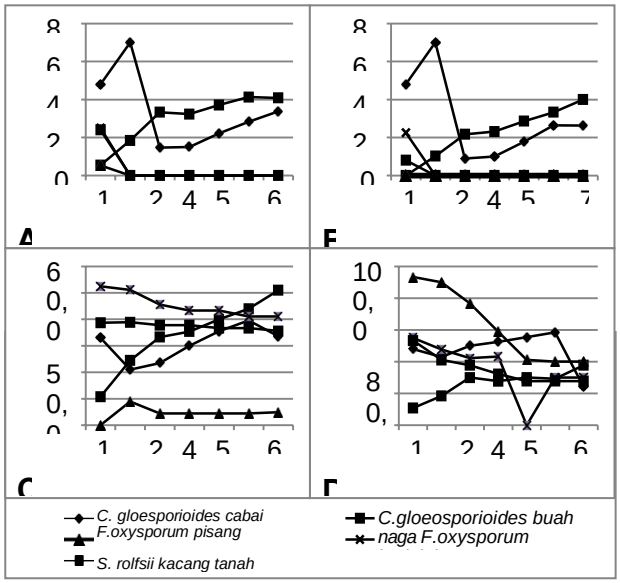
1.1. Dynamics of antagonistic activity of four isolates of antianthracnose

Table 1. The highest suppressive activity of each antianthracnose bacterial isolate on the 7th day after application

No.	Bacterial Isolate	Phytopathogenic Fungi	Host	Inhibitory Power (%)	Notation
1	UBCR_012	*C. gloeosporioides*	Buah naga	51,0 ± 0,3	a
2	UBCF_013	*C. gloeosporioides*	Buah naga	40,8 ± 0,1	b
3	UBCF_001	*C. gloeosporioides*	Buah naga	40,0 ± 0,2	b
4	UBCR_036	F. oxysporum	Pisang	40,0 ± 0,5	c

Each antianthracnose bacterial isolate produces dynamics of activity that is stable, fluctuating, tends to increase or decrease depending on its response to the presence of phytopathogenic fungi. The variation in this activity pattern illustrates that each isolate gave a different response to each phytopathogenic fungus. The bacteria UBCF_001 and UBCF_013 showed maximum ability to suppress the growth of the fungus *C. gloeosporiodes*, the host of chilies. *on day 2 after treatment by 70%.*

Figure 1 Dynamics of antagonistic activity of four isolates of antianthracnose bacteria against each phytopathogenic fungus. A.UBCF_001, B.UBCF_013, C.UBCR_012, D.UBCR_036



Meanwhile the maximum ability of antianthracnose bacteria UBCR_012 and UBCR_036 was seen on the 6th day after treatment, namely 39.6% and 58.5% respectively.

1.2. Potential of Antianthracnose Bacteria in Controlling Phytopathogenic Fungi.

From the results obtained the bacteria UBCF_001, UBCF_013 and UBCR_012 have the potential as biocontrol agents to control the attack of *C. gloeosporioides* fungus on dragon fruit plants. Meanwhile, the UBCR_036 bacteria has the potential to control the attack of the fungus F. oxysporum, the host of banana plants.

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1.3. Antagonistic Activity of Antianthracnose Bacteria in Controlling *C. gloeosporioides* Fungi

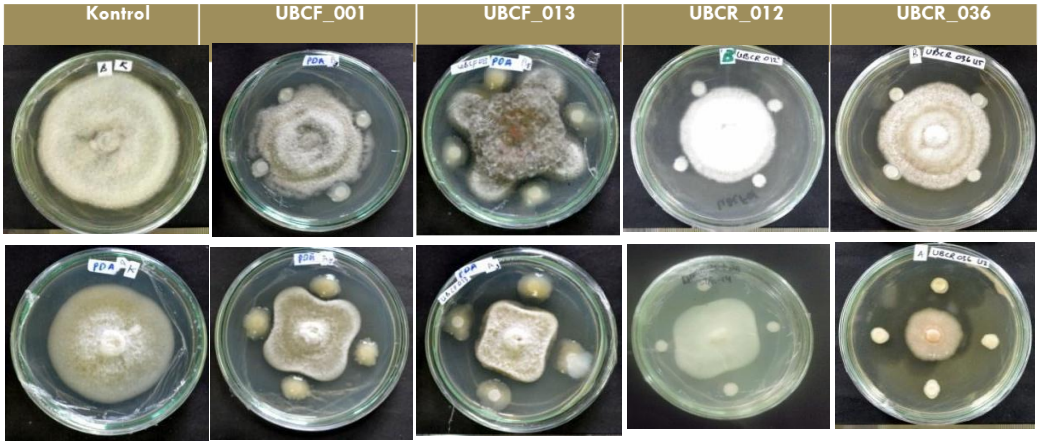

Figure 1. shows that Antagonistic Activity of Antianthracnose Bacteria in Controlling *C. gloeosporioides* Fungi

The antagonistic ability of the four antianthracnose bacteria against the fungus *C. gloeosporioides* have been known from the results of previous studies. The application of extracellular extracts from the four isolates in vitro was able to inhibit the growth of *C. gloeosporiodes* the host of chilies with inhibition values of 30% (UBCF_001), 26.66% (UBCF_013), and 43.3% (UBCR_012 and UBCR_036) [5].

In addition to differences in antagonistic abilities, the antianthracnose bacteria used also showed diverse activity dynamics against each phytopathogenic fungus.

Visualization of the antagonistic activity of four isolates of antianthracnose bacteria against *C. gloeosporiodes* isolated from dragon fruit hosts (top row) and chili (bottom row).

The four isolates of antianthracnose bacteria showed high suppressive activity against *C. gloeosporioides* fungus cultured with antianthracnose bacteria. The growth of *C. gloeosporiodes* fungal hyphae isolated from dragon fruit and chili hosts was disrupted and stopped. This condition indicates the mechanism of antibiosis. According to Eliza et al., (2007).

Based on this visualization, it can be seen that the diameter of a single colony culture of *C. gloeosporiodes* isolated from dragon fruit and chili hosts is larger than the diameter of the antifungal compounds produced by bacteria generally result in abnormal growth of hyphae (malformations), which is shown with swelling and shortening of the hyphae which results in the hyphae not being able to develop fully.

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1.3. Visualization of the interaction of phytopathogenic fungi to bacteria

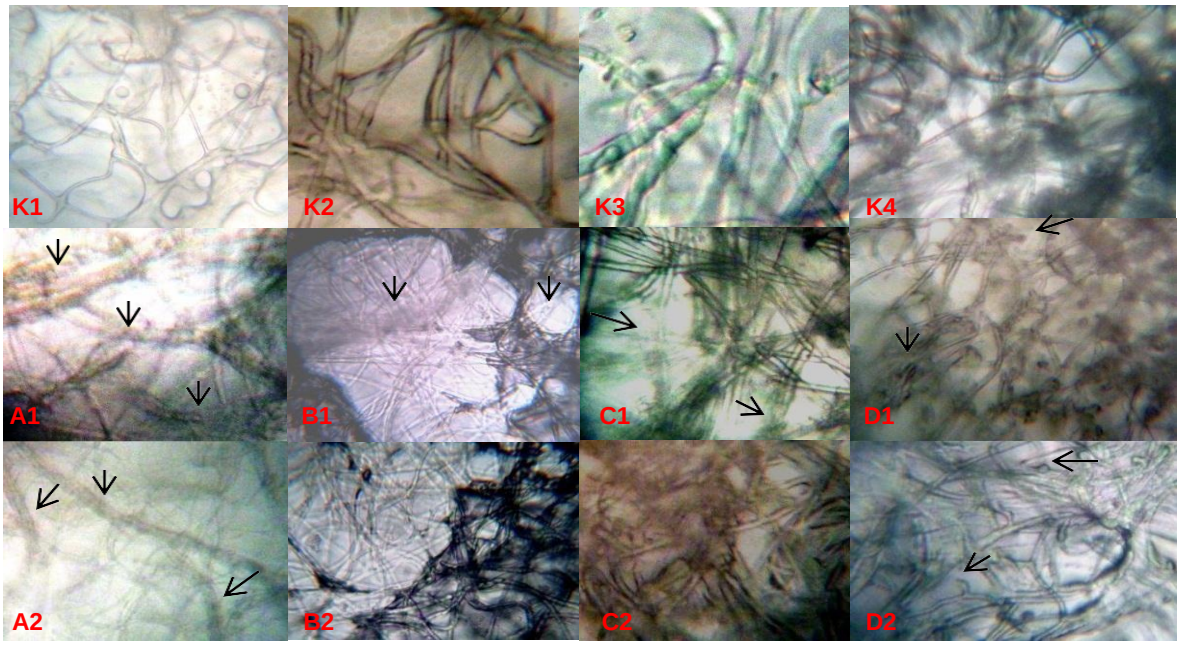

Figure 2. Visualization of the interaction of phytopathogenic fungi to bacteria K1-K4 : Control, A1 : UBCR_012 + *C.gloeosporioides* the chili host A2 : UBCR_036 + *C.gloeosporioides* the chili host B1 : UBCR_012 + *F.oxysporum* the banana host B2 : UBCR_036 + *F.oxysporum* banana host C1 : UBCR_012 + *F.oxysporum* soy host C2 : UBCR_036 + *F.oxysporum* soy host D1 : UBCR_012 + *S. rolfsii* peanut host D2 : UBCR_036 + *S. rolfsii* peanut host

CONCLUSION

the antagonistic ability of antianthracnose bacteria against pathogenic fungi varies. UBCF_001 and UBCF_013 bacteria showed specific antagonistic potential (*narrow spectrum*), namely only *C. gloeosporioides* from chili and dragon fruit plants. Meanwhile, the bacteria UBCR_012 and UBCR_036 showed a wider antagonistic potential on all phytopathogenic fungi (broad spectrum) *C. gloeosporioides* from chili and dragon fruit plants, F.oxysporum banana host, F.oxysporum soybean host and *S. rolfsii* peanut host. Suggestion Antianthracnose bacteria have different potentials to control phytopathogenic fungi.

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