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The use of mixed domestic waste compost and *Trichoderma harzianum* growth and effective control medium against *Rhizoctonia oryzae* on organic paddy seedling.

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ABSTRACT

Damping-off disease caused by *R.oryzaei* is one of the most important diseases on paddy. One of control methods on the disease is the use of antagonistic microbe *T. harzianum*. Appropriate growth medium is needed for optimal growing of this fungus. This research was aimed to test the possibility of domestic waste compost as growth medium of *T. harzianum* so that can be used as organic paddy seedling growth medium and provide suppression of damping-off disease on paddy seedling.

The experiment was arranged in Randomized Block Design consisted of 9 treatments and 4 replications. The treatments were mixed composition dosages between compost and *T. harzianum* that grown in mass culture medium of dedak and serbuk gergaji. Inoculation of *R.oryzae* that growth in rice mass culture medium (dosage of 10 g/bamboo box) was in the same time of *T. harzianum* application.

The results showed that application of compost combined with *T. harzianum* in all tested mixed composition dosages suppressed the disease incidence of damping-off on paddy seedling with the effectiveness level above 80%. Mixed composition of 100% compost and pure culture of *T. harzianum* gave the highest conidial density of *T. harzianum* and suppressed the disease up to 95.94%.

Key words : domestic waste compost, *T. harzianum, R. oryzae,* paddy seedling.

BACKGROUND

Organic paddy is one of organic plant that is much more developed currently. Nevertheless, many constrains are encountered in growing organic paddy include the availability of suitable organic matter as seedling growth media and the incidence of pathogen attack. *R. oryzae* is one of the most important pathogens on paddy that grown traditionally or organically. The fungus caused damping-off disease that may occur on pre- or post-emerged of paddy seedling and may destroy the seedlings rapidly (Winarsih and Syarifudin, 2001).

The use of antagonist microbes can be applied in controlling *R. oryzae*. Meantime, *Trichoderma* sp. is known well as an effective microbe in controlling plant diseases. *T. harzianum* was reported to be effective to control *R. solani* (Elad et al., 1980;

Winarsih & Syarifudin, 2001; Suwahyono, 2000; Andayaningsih, 2002), *Plasmodiophora brassicae* on cruciferae (Djatmiko, 1997; Hadiwiyono, 1999), *Pythium* sp. (Suwahyono, 2000), *Fusarium oxysporum* (Wahyudi & Nugroho, 2000, Ambar, 2002), *Alternaria solani* (Hersanti, 2003), dan *Rigidoporus lignosus* (Wahyudi & Suwahyono, 2000).

Domestic waste can be used as a source of organic matter that used as fertilizer. Several microbes that been used in organic matter decomposition to produce compost include *Trichoderma pseudokoningii*, *Cytopaga* sp. and 'pelapuk putih' fungus. These microbes were also have roles as control agents against soil-borne pathogens (Isroi, 2006). Increasing the economic value of domestic waste can be gained through the utilization of the composted waste as organic matter source and as growth medium of beneficial microbes (Christopher, 1998 cit. Shiddeqy, 2005).

This recent research was aimed to get ideal mixed composition dosages of compost and *T. harzianum* that can be used as a source of organic matter for plant, microbe growth medium, and suppress damping-off disease on organic paddy seedling.

MATERIAL AND METHOD

The research was arranged in experimental method with Randomized Block Design consisted of 9 treatments and 4 replications. The treatments were as follow:

A. 75% of compost + 25% of mass culture medium of *T. harzianum*
B. 60% of compost + 40% of mass culture medium of *T. harzianum*
C. 50% of compost + 50% of mass culture medium of *T. harzianum*
D. 40% of compost + 60% of mass culture medium of *T. harzianum*
E. 25% of compost + 75% of mass culture medium of *T. harzianum*
F. 100% of *T. harzianum*
G. 100% of compost + pure culture medium of *T. harzianum*
H. Positive control (without application of compost and *T. harzianum*; *R. oryzae* inoculation)
I. Negative control (without application of compost and *T. harzianum*; non inoculation of *R. oryzae*)

T. harzianum was grown in a mass culture medium prepared from mixed of sterilized serbuk gergaji and dedak. Mass culture medium of *T. harzianum* was applied on 14 days after incubation. A number of 50 paddy seeds were sowed on the bamboo box

contained mixed of pasteurization soil and treatment mixes (1:1). This growth medium was inoculated by 10 g of *R. oryzae* that was grown in rice mass culture medium with approximately 10^5 /ml of conidial density.

The assessments were made on the conidial density of *T. harzianum* after 8 days incubation, incubation period, and disease incidence that assessed when plants were 10 days old after sow.

Disease incidence of damping-off was measured as follow:

$$\mathbf{P = a/b \times 100\%.}$$

P = Disease incidence.
a = number of diseased paddy seedling.
b = number of assessed paddy seedling.

Efficacy level (effectiveness) of assessed treatments on damping-off disease suppression on paddy seedlings was measured as follow:

$$TE = (IS_K - IS_P)\,(ISK)^{-1} \times 100\%$$

TE = Efficacy level
IS_K = Disease incidence on control treatment
IS_P = Disease incidence on assessed treatment

RESULT AND DISCUSSION

Trichoderma harzianum conidial density

Assessment on conidial density of *T. harzianum* was made after assessed treatments were incubated for 8 days. The results showed that the higher percentage of compost the higher *T. harzianum* conidial density.

Table 1. *T. harzianum* conidial density on assessed treatments

No.	Treatment	Conidia/ml
1	75% compost + 25% *T. harzianum*	77.56 x 10^5 c
2	60% compost + 40% *T. harzianum*	57.66 x 10^5 d
3	50% compost + 50% *T. harzianum*	39.57 x 10^5 e
4	40% compost + 60% *T. harzianum*	31.0 x 10^5 e
5	25% compost + 75% *T. harzianum*	23.26 x 10^5 e
6	0% compost + 100% *T. harzianum*	125.96 x 10^5 b
7	100% compost + pure culture of *T. harzianum*	167.96 x 10^5 a

Numbers followed by the same letter were not significantly different (LSD test at 5%).

The highest conidial density was gained on treatment of 100% compost mixed with the inoculation of pure culture of *T. harzianum*. Treatments that *T. harzianum* prepared as mass culture (serbuk gergaji dan dedak) showed to have high conidial density but lower than and significantly different with 100% compost treatment. There are many factors influence the development of *T. harzianum*, includes soil pH, soil aeration and nutrition sources. It is considered that the compost used in the experiment has optimum condition for the development of *T. harzianum* either on structure or the temperature during the experiment. Assessment result on structure of tested compost showed the compost to have good aeration so that assure rapid colonization of *T. harizianum* and fast spore production. According to Chet (1987), soil pH influences the growth of *Trichoderma* sp. in soil. In low soil pH and high humidity, *Trichoderma* sp. develops optimally. Meanwhile, the optimum temperature and relative humidity range for *Trichoderma* development is $25^0 – 30^0$ C and 70% - 80%.

Incubation Period of Damping-off Disease (*R. oryzae*) on Paddy Seedling

Table 1 shows the data on the assessment of incubation period of damping-off disease on paddy seedling. First symptom appeared on 4 days after sow (DAS) as rot on lowest stem of paddy seedling. The faster incubation period occurred on positive control treatment. The shortest incubation period was on treatment of 100% compost that inoculated by *T. harzianum* in pure culture that was 10 DAS. Generally, the DAS was approximately 6 DAS in all tested treatments.

Table 1. Incubation period of damping-off disease (*R. solani*) on paddy seedling

No.	Treatment	Incubation period (day)
1	75% compost + 25% *T. harzianum*	6
2	60% compost + 40% *T. harzianum*	6
3	50% compost + 50% *T. harzianum*	6
4	40% compost + 60% *T. harzianum*	6
5	25% compost + 75% *T. harzianum*	6
6	0% compost + 100% *T. harzianum*	7
7	100% compost + pure culture of *T. harzianum*	10
8	Positive control (*R. oryzae*)	4
9	Negative control (non *R. oryzae*)	-

The ability of *T. harzianum* in prolong the incubation period of damping-off disease was presumed cause by competition on space and nutrition. The population density of *T. harzianum* on organic paddy was also higher compared to *R. oryzae* (10 g,

conidial density of 10^5/ml) so that the *T. harzianum* initially occupied paddy roots. Results of this experiment supports previous research conducted by Andayaningsih (2002) that mentioned *Trichoderma* sp. growth is faster than *R. solani* on soybean.

Percentage of Damping-off Disease on Paddy Seedling

Percentages of damping-off disease in all tested treatments were lower than and significantly different with control treatment. The lowest percentage was found on the application of 100% compost and pure culture of *T. harzianum* (1,66%). The percentage of the disease incidence on control treatment reached up to 36%.

Table 3. Percentage of damping-off deisease (*R. oryzae*) and efficacy level on paddy seedling

No.	Treatment	Disease incidence (%)	Efficacy level (%)
1	75% compost + 25% *T. harzianum*	6.0 b	83.33
2	60% compost + 40% *T. harzianum*	5.33 b	84.33
3	50% compost + 50% *T. harzianum*	5.,66 b	84.27
4	40% compost + 60% *T. harzianum*	3.33 b	90.75
5	25% compost + 75% *T. harzianum*	2.66 b	93.16
6	0% compost + 100% *T. harzianum*	3.33 b	90.75
7	100% compost + pure culture of *T. harzianum*	1.66 b	95.94
8	Positive control	36.0 a	0
9	Negative control	0 b	0

Numbers followed by the same letter were not significantly different (LSD test at 5%)

The result on efficacy level of *T. harzianum* application showed that the fungus was highly effective with the average of efficacy level was upper than 80%. This condition shows that *T. harzianum* is potential as antagonistic agent of *R. oryzae*. High ability of *T. harzianum* in suppressing the development of damping-off disease is caused by multiple antagonistic mechanisms provided by the fungus. According to Harman (2007) several antagonistic mechanism of *Trichoderma* sp. include mycoparasite, antibiosis, space and nutrition competition, unfavorable condition tolerance, inorganic matter decomposition, induce resistance, and pathogen enzymatic activity disturbance.

CONCLUSSION

Mixed composition of waste compost and *T. harzianum* in all testes dosages suppressed the percentage of damping-off disease (*R. oryzae*) on organic paddy seedling.

Dosage of 100% compost and pure culture of *T. harzianum* gave the highest conidial density of *T. harzianum* and suppressed the disease in efficacy level of 95.94%.

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