The Ability of Leaf Crude Extract from Several Plants in Increasing Systemic Induced Resistance (SIR) of Tomato Plant to Against Early Blight Disease (*Alternaria solani* Sor.)

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ABSTRAK

Percobaan yang bertujuan untuk mendapatkan air perasan daun tumbuhan yang mampu menginduksi ketahanan sistemik tanaman tomat terhadap penyakit bercak coklat (*Alternaria solani*) telah dilaksanakan di rumah kaca Jurusan hama dan Penyakit Tumbuhan, Fakultas Pertanian, Universitas Padjadjaran, Jatinangor.

Penelitian dilakukan dengan menggunakan Rancangan Acak Kelompok yang terdiri dari delapan perlakuan yaitu enam jenis tumbuhan (*Amaranthus spinosus, Clerodendrum paniculatum, Mirabilis jalapa, Orthosiphon aristatus, Euphorbia hirta, Leucaena glauca*), benzothiadiazole, kontrol. Setiap perlakuan diulang tiga kali. Akar semai tomat berumur ± satu bulan direndam dalam larutan perlakuan yang diuji selama 24 jam. Spora *A. solani* diinokulasi pada tanaman dua hari setelah perendaman dengan kerapatan spora 10^5 spora/ ml.

Dari hasil percobaan didapatkan bahwa air perasan daun tumbuhan yang diuji mempunyai kemampuan dalam menginduksi ketahanan penyakit bercak lambat (*A. solani*) pada tanaman tomat. Air perasan daun *O. aristatus* merupakan bahan penginduksi terbaik dengan persentase penghambatan 71,23%.

Kata kunci : Ketahanan Sistemik Tumbuhan, air perasan daun, *A. solani*

ABSTRACT

An experiment to obtain leaf extract from plants which have ability to increase the systemic induced resistance of tomato plant against early blight (*Alternaria solani* Sor.) was carried out in the glasshouse of Department of Plant Pest and Disease, Faculty of Agriculture, University of Padjadjaran, Jatinangor.

The experiment has arranged in the Randomized Block Design with eight treatments and four replications. The treatments were leaf crude extracts from six species, *Amaranthus spinosus, Clerodendrum paniculatum, Mirabilis jalapa, Orthosiphon aristatus, Euphorbia hirta, Leucaena glauca*, benzothiadiazole and control (aquades). The root of 1-month tomato plants were soaked in the leaf crude extract for 24 hours. The plants had inoculated with *A. solani* spores for two days after treatments with spore density 10^5 spores/ ml.

The result of experiment showed that, the leaf crude extract of *C. paniculatum, . jalapa, O. aristatus, E. hirta, A. spinosus*, *O. aristatus* and *L. glauca* had ability as systemic induce resistance agents on tomato plants against early blight disease (*A. solani*). A leaf crude extract of *O. aristatus* had better capability as an inducer agent than the other species of with inhibition percentage 71,23 % compare to the control.

Key words : Systemic Induced Resistance, Leaf crude extract, *A. solani*

INTRODUCTION

Alternaria solani is the causal agent of early blight disease of commercially produced tomato. Early blight may affect foliage, stem, and fruits of infected plants and is the most common leaf spot disease of tomato in Indonesia. If disease incidence is high, the fungus can cause extensive defilation, leading to reduction of economic fruit yield (Jones et al., 1991). The effect of this disease causes the loss of yield up to 40 % (Rukmana, 1995).Control of early blight disease has been accomplished primarily by the application of chemical fungicides, long crop rotation, pasteurizing seedbeds with steam or fumigation (Jones et al., 1991), and efforts directed toward breeding resistant tomato cultivars (Mash and Gardner, 1988 In Spletzer and Enyedi, 1999). The lack of single-gene resistance and the complex patterns of inheritance have resulted in availability of no commercial tomato cultivar that possesses adequate levels of resistance to *A. solani* (Mash and Gardner, 1988 In Spletzer and Enyedi, 1999).

The effect of this disease causes the loss of yield up to 40 % (Rukmana, 1995). Farmers usually used fungicide to control *A. solani*. While now, many reports tell that fungi resistance to fungicide. Resistant cultivars is the way of controlling *A. solani*, which is non polluting, cheaper and easy to applied by the farmers. According to Spletzer (1999), the rareness of single gene, which is resistant and has complex pattern caused inexistence resistance of tomato plant to *A. solani*.

Beside cultivation program, inducing the resistance of the plant using inducer agent can also make a cultivar resistant of plant. Resistance of the plant which is come from inducing way, known as Systemic Induced Resistance (SIR) (Kuc, 1987).

According to Verma et al. (1996), extract from some plants are able to induce systemic resistance of plant to against disease. Some plants have potency as inducer agents. They are thorny spinach (*Amaranthus spinosus*) to control *Colletotrichum lagenarium*, *Cercospora* sp. in rice plant, CMV in chilli (Doubrava *et al*., 1988; Suganda *et al*., 2002; Hersanti, 2003), *Mirabilis jalapa* to control CMV in red chilli plant (Somowiyarjo et al., 2001; Hersanti et al., 2003), *Clerodendrum paniculatum*, *Orthosiphon aristatus*, *Euphorbia hirta* also to control CMV in red chilli plant (Hersanti, 2003).

This experiment studied the ability of some plant extracts as Systemic Induce Resistance agents to tomato plants against early blight disease.

MATERIAL AND METHOD

An experiment has carried out in the glasshouse of Department of Plant Pest and Disease, Faculty of Agriculture, Universitas Padjadjaran, Jatinangor.

The experiment has arranged in the Randomized Block Design with eight treatments and four replications. The treatments were six leaf crude extract from :

A. Bayam berduri (*A. spinosus*)

B. Bunga Pagoda (*C. paniculatum*)

C. Bunga pukul empat (*M. jalapa*)

D. Kumis kucing (*O. aristatus*)

E. Patikan kebo (*E. hirta*)

F. Lamtoro (*L. galuca*)

G. Benothiadiazole (0,05%)

H. Control (Aquadest)

The concentration of leaf extract that is used is 50% from part of attenuated test crop leaf with mortal and enhanced one part of aquadest, later filtered with muslin material.

The root of one month tomato plant were soaked for 24 hours in the leaf crude extracts. Afterwards tomato planted inside the polybag, which contain 5 kg pasteurized mixtures of ground and animals fertilizer. *A. solani* were inoculated one day after planting, by spraying the suspense of spores to all part of the tomato leaf with density 10^5 spores/ ml. Fertilization and conservation done until tomato plant enter the generative phase. The parameters for this observation were the incubation period and intensity of early blight with observation interval 4 days. After the data of intensity found, The Area Under Disease Progress Curve (AUDPC) and the percentage of inhibition were calculated. The intensity of Early Blight Disease calculated with :

$$I = \frac{\Sigma(n\,x\,v)}{N\,xV} x100\%$$

Notes :

I : disease Intensity
n : number of plant with each category
v : Score of each category
V : the highest score
N : total number of sample

Scoring ::
0 = no symptoms
1 = ± 10 blight symptoms were found in the sample of tomato leaf
2 = ± 50 blight symptoms were found in the sample of tomato leaf
3 = Blights were found in most part of the leaf, but still has green appearance
4 = ± 50 % leaf had damage
5 = Damage leaf had 50 – 70 % brown appearance
6 = Damage leaf more than 75 % or stem and point of the plant were dead

The graphic of disease development made from all intensity data of early blight disease. According to Louws, et. al. (1996), the Area Under Disease Progress Curve (AUDPC) were counted with the formula :

$$\text{AUDPC} = \sum_{i}^{n-1} \left[\frac{yi + yi+1}{2} \right] (t_i + 1 - t_i)$$

Notes :

Y_{i+1} = Observation data at i+1 t_{i+1} = Observation time at i+1
Y_i = Observation data at 1 t_i = Observation data at 1

The percentage of early blight inhibition caused by application extract plant calculated based on formula:

$$P = \left(1 - \frac{AUDPC\ treatment}{AUDPC\ control} \right) x 100\%$$

RESULT AND DISCUSSION

The observation result of incubation period of early blight in tomato plant showed in Table 1.

Table 1. Incubation Period, AUDPC Rate, and The Percentage of Early Blight (*A. solani*) Inhibition in Tomato Plant, which Induced with several Leaf Crude Extract.

Treatment	Incubation periode (DAI)	AUDPC	Inhibition (%)
A. Bayam berduri (*A. spinosus*)	8	145.520 ab	39.79
B.Bunga pagoda (*C. paniculatum*)	4	143.380 ab	40.68
C. Bunga pukul empat (*M. jalapa*)	12	109.520 a	54.69
D Kumis kucing (*O. aristatus*)	12	69.530 a	71.23
E. Patikan kebo *(E. hirta*)	12	184.035 ab	23.86
F. Lamtoro (*L. galuca*)	4	120.545 ab	50.13
G. Benzothiadiazole (0.05%)	12	107.545 ab	55.56
H. Control (Aqaudest)	8	241.695 b	0

Notes : The numbers which showed in the same letter is not significant based on
Duncan's Multiple Range Test at 5 % level.
DAI : days After Inoculation

On the Table.1 we can see that the fastest incubation period happened in four days after inoculation on the plant which induced with *C. paniculatum* and *L. glauca*. According to Mehrota (1998) incubation period of early blight in the optimum condition showed in the 2-3 days after inoculation. The latest incubation period of early blight on tomato plant happened in the treatment with *M. jalapa, O. aristatus, E. hirta*, and Benzothiadiazole, 12 days after inoculation / 12 DAI. This condition assumed because those leaf extract plants have ability to induce the resistance of the tomato plant that affect on inexistence of disease symptoms. The differences of the ability of tested-extract plants because of chemical contain, species of the plant, pathogen and the period of plant to have resistance respond to the pathogen. Agrios (1997) told that need specific period to make resistance genes on some plants that induced to increase PR-protein (Pathogenesis Related-protein) forming.

Systemic Induced Resistance (SIR) on some of the plant to against pathogen caused by induced agent application forming from Peroksidase, kitinase, β-1,3 glukanase, β-1,4 glukosidase, and salicylic acid as showed in the activity and doses improvement (Wei *et al.*, 1996).

The observation result of Attack Intensity of Early Blight Disease on induced tomato plant can be see on the Picture 1., while the AUDPC result and the percentage of inhibition showed on Table 1.
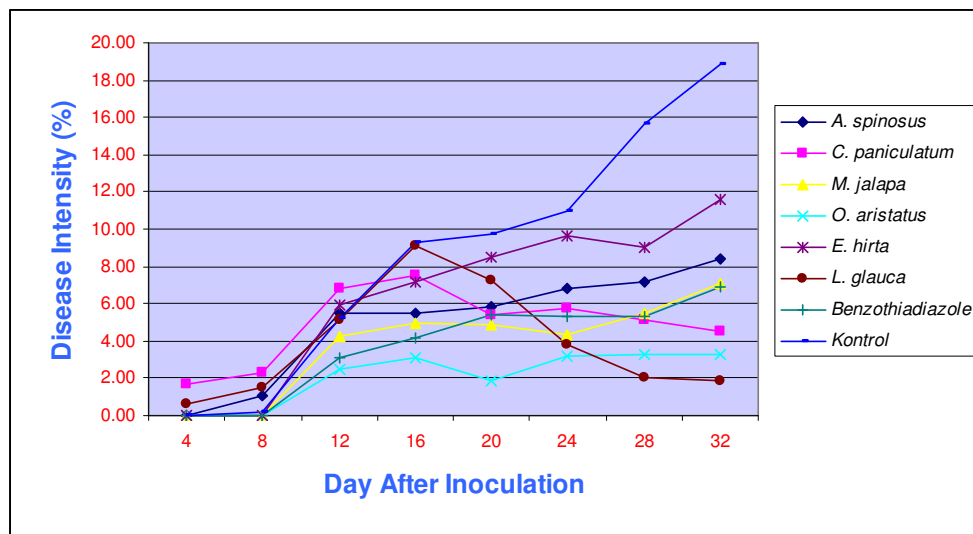
Picture 1. Graphic of Development of Intensity *A. solani* Attack on Tomato Plant

The intensity of *A. solani* attack on 4 DAI is still low and it only happen on the treatment with *C. paniculatum* and *L. glauca*. The increasing number of A. solani attack happen on the 16 DAI. On 20 DAI found some treatments that had decreasing intensity of *A. solani* attack, they were the treatments with *O. aristatus* leaf extract, Pagoda flower and lamtoro. Increasing of of *A. solani* attack happened in the control until 32 DAI. The intensity of *A. solani* attack in all treatment more stable and some of them are decreasing.

The intensity of *A. solani* attack could be increasing and decreasing, it is happened because of resistance that is come from induced extract plants does not give permanent resistance. This situation support with the Kuc and Tuzun (1991) statement that generally induced resistance can affect during four and six weeks.

AUDPC rate of early blight on the induced plant is lower and significant to the control. The lower AUDPC rate the more inhibition percentage. The low AUDPC

on the crude extract showed that six tested species have ability to induce resistance on the tomato plant against *A. solani* attack. In former observations, the six tested species have ability as induced agents in some plants against virus and fungi pathogen attack (Verma, et *al*., 1996; Suganda et al., 2002, Hersanti, 2003). The lowest percentage of inhibition found in the tomato plants that induced with leaf crude extract *E. hirta* is 28,23%, while the highest percentage of inhibition found in the treatment with leaf crude extract *O. aristatus* is 71,23%.

CONCLUSION

The result of experiment showed that, the leaf crude extract of *C. paniculatum, . jalapa, O. aristatus, E. hirta, A. spinosus*, *O. aristatus* and *L. glauca* had ability as systemic induce resistance agents on tomato plants against early blight disease (*A. solani*). A leaf crude extract of *O. aristatus* had better capability as an inducer agent than the other species of with inhibition percentage 71,23 % compare to the control.

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