

Short Note

Resistance Test of Several Tomato Varieties to Bacterial Wilt Diseases Caused by *Ralstonia solanacearum*

Uji Ketahanan Beberapa Varietas Tomat terhadap Penyakit Layu Bakteri yang Disebabkan oleh Ralstonia solanacearum

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Tomato is an important plant on the economic horticulture farmer. One of the obstacles on tomato production is bacterial wilt diseases caused by *Ralstonia solanacearum*. This disease is widely distributed around the world and being the cause of the decent production on several horticulture plant (Hayward, 1991). The disease can cause losses production on solanaceaeous crops up to 100% in the field (Goto, 1992). On tomato, symptom seen on the field start from several old leaves or plant wilt but the leaves still green just like healthy plant but lossing its turgor. The pathogen enter to the plant through root and colonized vascular tissue (xylem) that distrub water transportation and plant nutrient (Arwiyanto, 2013). Several controlling efforts have been done by many researchers with using biological agents and proved can lower diseases intensity (Prihatiningsih *et al.*, 2010; Rosyidah *et al.*, 2013). However, the most efficient and effective way on controlling diseases on agriculture plant was by using resistance varieties (Agrios, 1996). However, tomatoes resistance on commercial varieties are local specific and easily broken by *R. solanacearum*. Grafting with resistant rootstock can reduced the infection of bacterial wilt caused by *R. solanacearum* (Arwiyanto *et al.*, 2015a; Arwiyanto *et al.*, 2015b). Therefore it is necessary to explore rootstocks for tomato grafting as one of control measures againts this notorious pathogen. This study report screening of several varieties of tomato available in the market in Indonesia.

The commercial tomato varieties in the market do not always include description of resistance against bacterial wilt caused by *R. solanacearum* in its packaging. Moreover, recently there are many

seed seller online offer exotic seeds imported from abroad (including tomato seed) which the permit importation and distribution is not known. While the planters (including farmers) have opportunity to get qualified and cheap price of tomato seed, there is a potential threat of introducing new disease into an area.

When several tomato seeds were purchased and tested its resistance againts bacterial wilt caused by *R. solanacearum* (Ras 1, Biovar 3, phyllo type 1) the results were varied. Almost all varieties showed the wilt symptom start from 5 to 8 days after inoculation (Table 1). The fastest incubation period was observed on Money Maker with 5 days after inoculation. Meanwhile the longest incubation period was observed on H-7996, Melinda, and Amelia with 8 days after inoculation. Almost all tomato varieties showed the wilt symptom on 6 days after inoculation, except for Tomboy, Garden Pearl, and King Kong with 7 days after inoculation. All treatment showed wilt symptom started from the upper leaves and later spread to lower leaves part. Finally the plant losses turgor and died.

Diseases Intensity

Rewako F1 varieties showed the best resistance against bacterial wilt disease, followed by Amelia, Kaliurang, Melinda, and Servo. Rewako F1 varieties with 7% of disease intensity classified as moderately resistant (listed in Table 2, Janaki & Putturaju, 2012). Rewako F1, Amelia, Kaliurang, Melinda and Servo were local commercial varieties developed by private companies. From four varieties that are known to have resistance to *R. solanacearum* was only varieties Kaliurang (Anonymous, 1999). While three other

Table 1. Incubation period, diseases intensity, dan resistance level

Varieties	Incubation Period (day) ^{na}	Diseases Intensity (%) ^a	Resistance Level
Tomboy	7	70a	Susceptible
Marta F1	6	46b	Moderate Susceptible
Yellow Pear	6	46b	Moderate Susceptible
Precious	6	45c	Moderate Susceptible
Money Maker	5	44d	Moderate Susceptible
Garden Pearl	7	41e	Moderate Susceptible
Permata	6	39f	Moderate Susceptible
King kong	7	36g	Moderate Susceptible
Mawar	6	23h	Moderate Susceptible
H-7996	8	22i	Moderate Susceptible
Kendedes	6	22i	Moderate Susceptible
Servo	6	19j	Moderate Resistant
Kaliurang	6	17k	Moderate Resistant
Melinda	8	16l	Moderate Resistant
Amelia	8	11m	Moderate Resistant
Rewako F1	6	7n	Moderate Resistant

Remarks: na = not analyzed; a = analyzed. Means followed by the same letter(s) are not significantly different based on the Duncan's Multiple Range Test (DMRT) ($p \leq 0.05$)

Table 2. Resistance level against bacterial wilt diseases (*Ralstonia solanacearum*)

Diseases intensity (%)	Resistance Level
0	Highly Resistant
1–5	Resistant
5–20	Moderate Resistant
21–51	Moderate Susceptible
>51	Susceptible

Source: Janaki & Putturaju (2012)

varieties have not been tested for resistance to *R. solanacearum*. H-7996 has diseases percentage of 22% and classified as moderately resistant. H-7996 was introduced line from AVRDC (Asian Vegetable Research Development Center), which was a line recommended as rootstock resistant to *R. solanacearum* (Genova *et al.*, 2013). However, based on experimental results obtained this line was not better than the local commercial varieties. According to Deberdt *et al.* (2014), H-7996 are known resistant, after inoculated strains IIB which is “emerging ecotype” become sustainable. Agrios (1996) explained that a new race of a pathogen causing breakage resistance of a variety. Varieties with vertical resistance (resistance is determined by a single gene or a few genes and only effective against some strains of the pathogen) need replacement every few years (3, 5 or 10 years) depending on the pathogen genetic plasticity, a certain gene, or a combination involving gene, as well as environmental match conditions on the development of the disease.

Varieties Resistance

The results showed that Tomboy varieties has a susceptible resistance with a high diseases intensity by 70%. While on Marta F1, Yellow Pear, Money Maker, and Precious has disease percentage > 40% and classified as moderately susceptible. Tomboy, Yellow pear and Money maker was a varieties of commercial managed by foreign companies. While Marta F1 was a variety from local commercial farmers cultivated especially suitable to be planted on a high land with the results up to 60–80 tonnes/hectare (Anonymous, 2002). According Semangun (2006), resistance and susceptibility of varieties vary due to environmental influences and pathogens race. *R. solanacearum* was still difficult to control because of the genetic variants of the bacteria. It is known that these pathogens could attack more than 200 species of plants. The emergence of a new host plant indicate a genetic plasticity of these pathogens (Arwiyanto, 2013). *R. solanacearum* has a series of processes required in the pathogenicity of colonization and eventually can cause wilting in plants. Various factors such as lytic enzymes, EPS, HRP genes, gene protein effector through a type 3 secretion system, and other genes influence the pathogenicity (Jyothi *et al.*, 2012). It showed the complexity of this pathogen to cause strain or new races. Bacterial wilt disease can be controlled by grafting with resistant rootstock (Arwiyanto *et al.*, 2015a; 2015b). With the discovery of several tomato varieties

resistance it can be used as one of the candidates in the program rootstock grafting. Similarly to the susceptible varieties that have been identified can be used in bacterial wilt disease control programs as has been proposed by Arwiyanto *et al.* (2011).

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