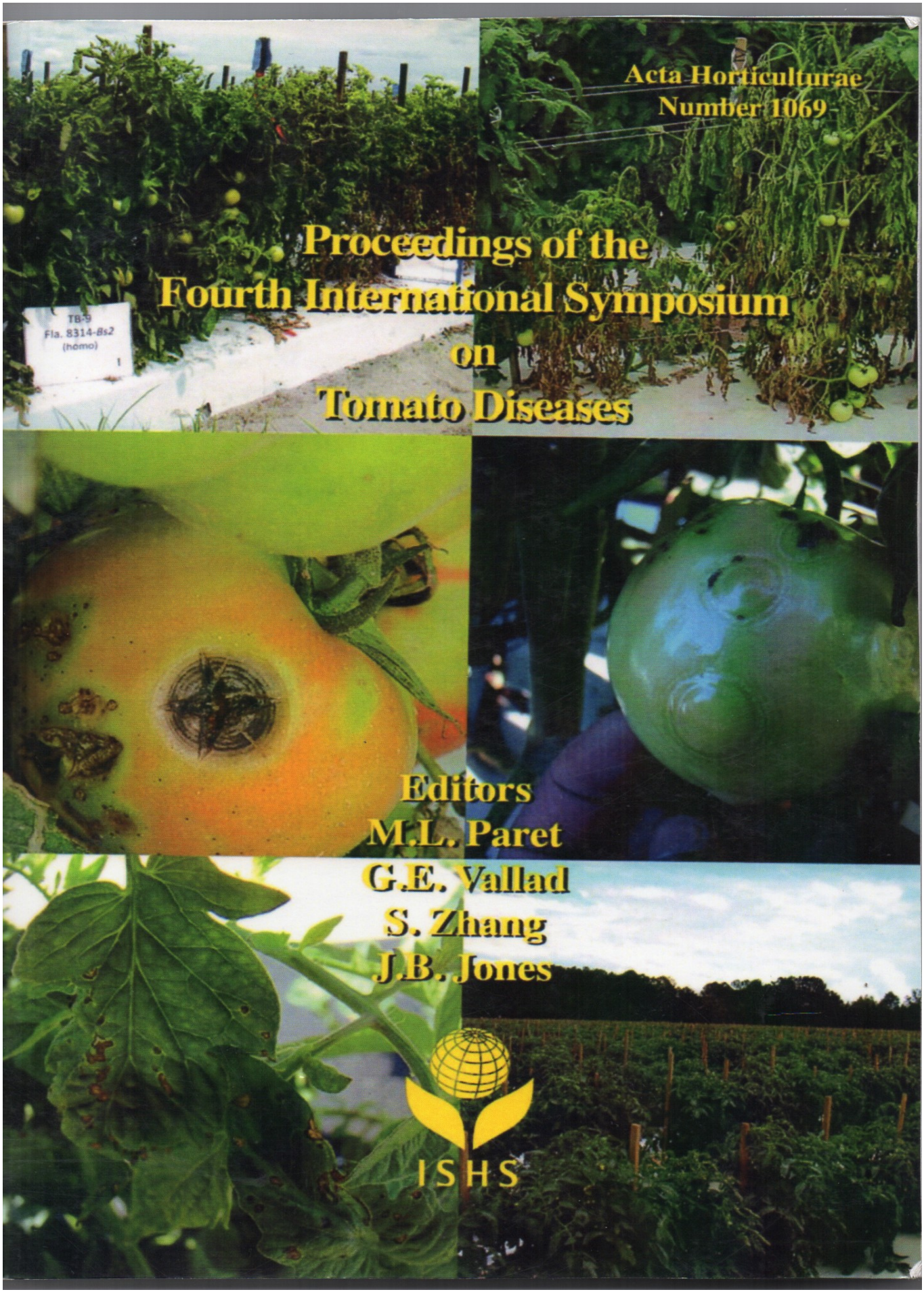
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PROCEEDINGS OF THE IVth INTERNATIONAL SYMPOSIUM ON TOMATO DISEASES

Convener

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Photographs on the front cover:

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1. Spring 2012 Bs2 trial at the Gulf Coast Research and Education Center, University of Florida carried out by John W. Scott. Trial entry on the left is tomato hybrid Fla-8314 containing the pepper *Bs2* gene, conferring *Xanthomonas*-resistance. The entry on the right is a susceptible line, VF36. Bacterial spot disease is evident on VF36 plants as defoliation and reduced fruit set. In this and numerous other trials, *Bs2*-containing plants have negligible defoliation and typically show a doubling of yields. (by courtesy of D. Horvath, Two Blades Foundation).
2. Bacterial wilt disease caused by *Ralstonia solancearum* leading to severe wilting of the plants (by courtesy of M. Paret, University of Florida).
3. Target spot disease caused by *Corynespora cassiicola* causing large cracks on tomato fruit (by courtesy of M. Paret, University of Florida).
4. *Tomato spotted wilt virus* affecting tomato fruit (by courtesy of M. Paret, University of Florida).
5. Bacterial spot caused by *Xanthomonas perforans* causing leaf spots on tomato (by courtesy of M. Paret, University of Florida).
6. Fresh market tomato production in North Florida (by courtesy of M. Paret, University of Florida).

LIST OF CONTENTS

Grafting Local Commercial Tomato Cultivars with H-7996 and Eg-203 to Suppress Bacterial Wilt (*Ralstonia solanacearum*) in Indonesia

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Keywords: bacterial wilt, *Ralstonia solanacearum*, grafting, disease control

Abstract

Bacterial wilt of tomato (*Ralstonia solanacearum*) causes serious losses of tomato production in Indonesia. Currently, proper cultural practices are the only way performed by farmers to combat the disease. While this practice could not effectively prevent infection of *R. solanacearum* to the plant, efforts have been sought to help farmers keep their plants away from bacterial wilt. Grafting of commercial cultivars with available rootstocks is easy to perform and the effectivity of this method in suppressing tomato bacterial wilt has been reported in many countries but not in Indonesia. The objective of this study was to find out whether grafting susceptible commercial cultivars of tomato with resistant rootstocks could suppress the development of bacterial wilt in Indonesia. The grafting was conducted in Yogyakarta region, Indonesia, in 2011 with H-7996 and Eg-203 as rootstocks and three commercial cultivars of tomato ('Permata', 'Lentana', and 'Fortuna') as scions. The results indicated that the rootstocks could afford the existence of population of pathogen in the stem tissue, exhibit lower disease index compared with mock grafted and non-grafted plants. The pathogen could be detected in the stem tissue above soil surface at 21 and 28 days after inoculation in plants grafted with H-7996, but it was detected in non-grafted and in mock grafted plants just in 7 days after inoculation. At 35 days after inoculation the pathogen population in the stem tissue (2 cm above ground) varied from 10^3 (plants grafted with Eg-203) to 10^9 (mock grafted plants and non-grafted plants) cfu/5 mm tissue. The grafted plants exhibited lower disease index, better growth and yield compared with those of mock grafted and non-grafted plants. The result suggests that grafting commercial cultivar tomatoes with either H-7996 or Eg-203 could suppress bacterial growth, bacterial wilt incidence, and enhance fruit production.

INTRODUCTION

Bacterial wilt of tomato caused by *Ralstonia solanacearum* is difficult to control due to genetic variability of the pathogen and lack of durable resistance in plants. Losses of tomato production due to bacterial wilt varied from a few plants infected in the field to 100%. In Indonesia, it has been reported that the disease could devastate the crops and cause harvest failure. In Chinese Taipei, the damage caused losses of 15-55%, and in India 10-100% (Wang and Lin, 2005). In South Carolina, the disease incidence was 15% with losses from 1-15% (Elphinstone, 2005). Control of the disease has been conducted primarily by cultural practices such as crop rotation, soil tillage, proper crop management, and seed treatment. While these practices could not effectively prevent infection of *R. solanacearum* to the plant, efforts have been sought to help farmers keep their plants

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away from bacterial wilt. Grafting of commercial cultivars with available rootstocks is easy to perform and the effectivity of this method in suppressing tomato bacterial wilt has been reported in many countries (Burleigh et al., 2005; Fresco, 2001; Frank et al., 2010) but grafting has not been practiced in Indonesia.

The objective of the present study was to evaluate bacterial wilt incidence and fruit production of tomato influenced by grafting. Local commercial cultivars of tomato in Indonesia were grafted with H-7996 and Eg-203 and planted in the field inoculated with highly virulence of *R. solanacearum*. The results indicated that the practice could suppress the development both of the pathogen and the disease.

MATERIALS AND METHODS

A highly virulent strain of *R. solanacearum* (strain Te2011, race 1 biovar 3, phylotype 1) was used as a challenge pathogen for the experiment. The isolate was streaked on the surface of Casamino-acid Peptone Glucose medium (Kelman, 1954) and incubated for 48 h at room temperature before used. Rootstocks (H-7996 and Eg-203) and scion ('Lentana', 'Fortuna', 'Permata') were separately sown in a sterile medium (top soil:compost:rice-hull:sand = 2:3:1:1). The grafting was conducted according to the method developed by Black et al. (2003). The grafted plants were transplanted to the field at 30 days after grafting and inoculated by pouring with a water suspension of *R. solanacearum* into the stem base (50 ml/plant, 10^8 cfu/ml).

The experiment was arranged as a randomized complete block with three replications. Experimental plots consisted of a double row of 5 m long and 1.4 m width, with between row spacing of 0.8 m, 0.4 m between plant, and the distance between plot was 0.5 m The plants were transplanted in each block as one treatment consisting of 24 plants; 12 plants for disease index observation and 12 plants for destructive samples for determination of rhizosphere microbes. The dynamic population of *R. solanacearum* in tap root of tomato was determined every week by plating the phosphate buffer suspension of crushed cutting-root in Casamino-acid Peptone Glucose medium. The disease index (Arwiyanto et al., 1994) was observed every week for 5 weeks.

RESULTS AND DISCUSSION

'Permata' tomato is the most tolerant cultivar against *R. solanacearum* compared with other cultivars tested. In the plant grafted with H-7996 (HP), *R. solanacearum* was detected at 28 days after inoculation while in the mock grafting (grafted against itself, PP), it was detected at 7 days after inoculation as well as for non-grafted plant (P) (Table 1). At 35 days after inoculation however, the population of the pathogen increased regardless the treatments. The pattern of population dynamics of *R. solanacearum* in the stem tissue of 'Lentana' and 'Fortuna' was similar with that in 'Permata' (data not shown). The grafted plants delayed the initial development of the pathogen in their stem tissue compared with those of mock grafting and non-grafted plants. The pattern of population dynamics of the pathogen in the stem tissue of tomato plants grafted with Eg-203 was quite similar compared to that of grafted with H-7996. The distinct difference was that the development of the disease in the plants grafted with Eg-203 was much slower than that in the plants grafted with H-7996 (Table 1) may be Eg-203 more tolerant to bacterial wilt.

Disease symptoms in grafted plants were observed starting 7 days after inoculation until 105 days after inoculation. The first symptom was delayed considerably in the plants grafted with H-7996, i.e., at 56 days after inoculation while in the non-grafted plants the first symptom was observed only at 21 days after inoculation (Fig. 1). Development of disease in non-grafted plants occurred rigorously and almost all plants wilted at 63 days after inoculation. The disease development in the plants grafted with H-7996 was much slower compared with that of non-grafted plants. In contrast, the disease development in the tomato plants grafted with Eg-203 was very low indicating that Eg-203 has a higher level of resistance against *R. solanacearum* (Fig. 2).

The number of fruit and fruit weight produced by plants grafted with H-7996 were

greater than mock grafting plants. When the plants were not grafted, the results varied with different cultivars of tomatoes tested. Tomato cultivar 'Permata' performed better compared with other cultivars in term of disease suppression; fruit weight, and fruit number produced when grafted with either H-7996 or Eg-203. However, compared with plants grafted with Eg-203, there was a significant difference both in the number of fruit produced and in the weight of tomatoes harvested. Tomato cultivar 'Permata' produced more fruit when grafted with Eg-203 followed by 'Lentana' then 'Fortuna' whereas mock grafted and non-grafted plants produced less number of fruit. However, 'Fortuna' produced more fruit when grafted with H-7996 compared with those grafted with Eg-203. Tomato cultivar 'Fortuna' grafted with H-7996 produced fruit with highest fresh weight, followed by 'Lentana' then 'Permata'. However, when the tomato plants were grafted with Eg-203, 'Permata' produced more weight compared with other tomato cultivars (Figs. 3 and 4).

These results confirm that grafting tomato plants with either H-7996 or Eg-203 suppressed the growth of *Ralstonia solanacearum*; bacterial wilt of tomato was less develop in the field when the plants were grafted with either H-7996 or Eg-203; and tomato production was enhanced by grafting of local commercial cultivars with either H-7996 or Eg-203.

ACKNOWLEDGEMENTS

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Tables

Table 1. Colonization of tap root by *R. solanacearum* on grafted and non-grafted 'Permata' tomato plants. Values followed by the same number in the same column were not significantly different according Duncan Multiple Range Test.

Rootstock	Distance (mm)	Log population at days after inoculation				
		7	14	21	28	35
Grafted with H-7996	5	-	-	-	3.60a	6.31a
	10	-	-	-	2.95b	5.68a
	15	-	-	-	2.00c	5.15a
	20	-	-	-	2.00c	5.00a
Grafted with Eg-203	5	-	-	-	3.26a	4.08b
	10	-	-	-	2.00c	3.80b
	15	-	-	-	2.00c	3.60bc
	20	-	-	-	2.00c	3.24c
Non-grafted	5	2.00a	3.65a	6.48a	7.26d	9.30d
	10	2.00a	3.24ab	6.30a	7.18d	9.20d
	15	2.00a	3.07b	5.26b	7.00d	8.92de
	20	2.00a	2.44c	5.21b	6.00e	8.17e

- not detected.

Figures

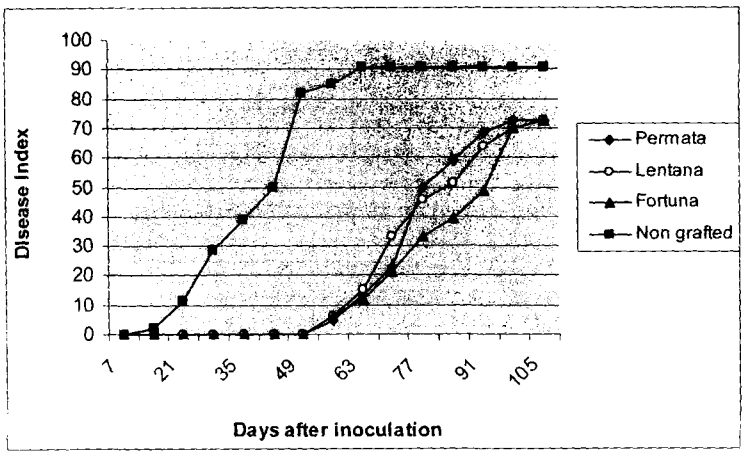

Fig. 1. Bacterial wilt development on tomato grafted with H-7996.

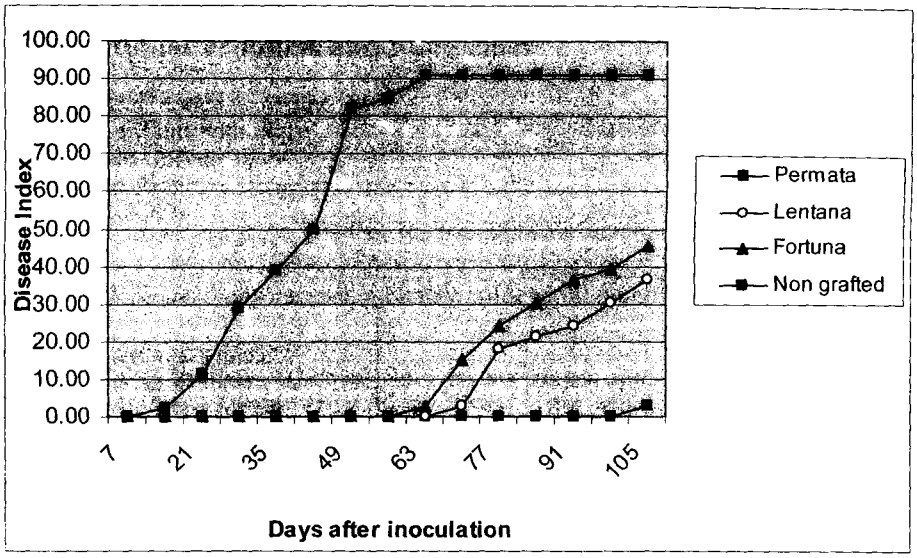

Fig. 2. Bacterial wilt development on tomato grafted with Eg-203.

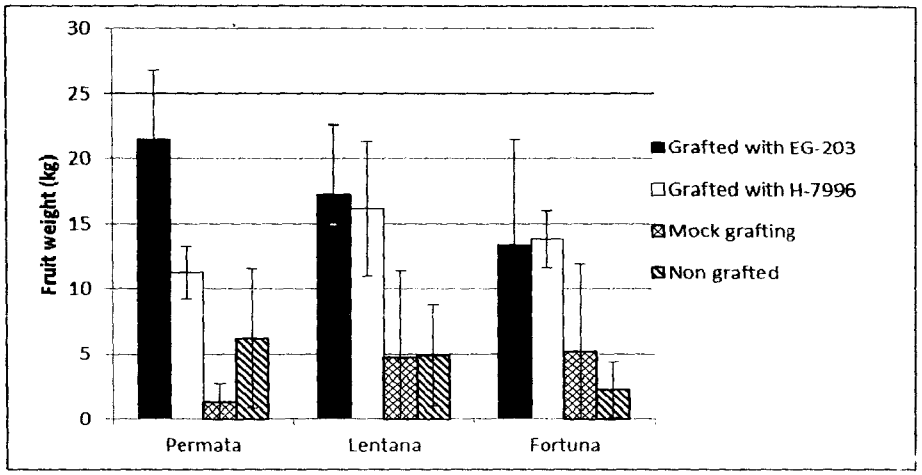

Fig. 3. Production of tomato from grafted and non-grafted plants in a plot.

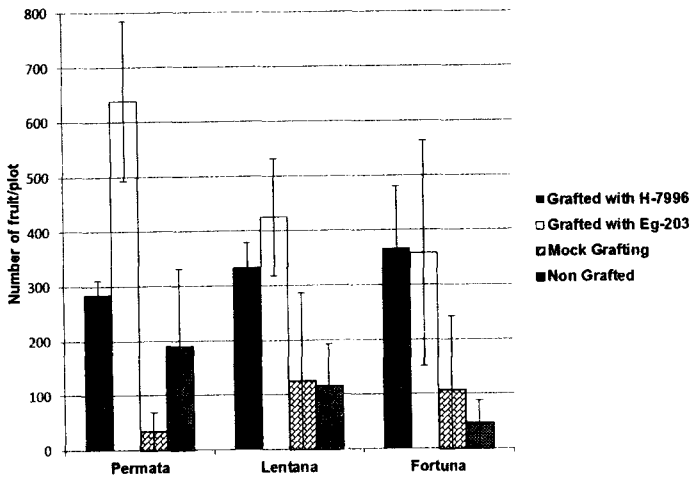

Fig. 4. Number of tomato fruit produced by grafted and non-grafted plants in a plot.