

**ANTAGONISTIC BACTERIA FOR CONTROLLING  
FUSARIUM WILT OF TOMATO CAUSED BY  
*Fusarium oxysporum* f. sp. *Lycopersici***

**By**

**MAMAN SUPARMAN**

**Thesis Submitted to the School of Graduate Studies, Universiti  
Putra Malaysia, in Fulfilment of the Requirements for  
the Degree of Master of Science  
April 2004**

## **DEDICATION**

*Special dedication to  
My wife, Noviana and my children,  
Farid Mukhtar Fatah and Nisrina Nurul Fakhriyyah,  
for their understanding, encouragement  
and assistance throughout  
our stay in Malaysia*

Abstract of thesis presented to the Senate of Universiti Putra Malaysia  
in fulfilment of the requirement for the  
degree of Master of Science

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**April 2004**

**Chairman : Associate Professor Kamaruzaman Sijam, Ph.D.**

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Four bacterial isolates, namely *Serratia marcescens*, *Burkholderia cepacia*, *Pseudomonas aeruginosa* 1 and *P. aeruginosa* 2 obtained from the rhizosphere of tomato plants in the field which were antagonistic to the growth of *F. oxysporum* f.sp. *lycopersici* *in vitro*, were evaluated for their ability to suppress Fusarium wilt disease of tomato in the glasshouse. The tomato plants were planted in growth media consisting of Holland RHP® peat grow, coconut peat and perlite in the ratio of 1:1:1 (v/v). Tomato plants were watered using the drip irrigation system for distribution of hydroponics fertilizer solution. Repeated applications of 10 mL of bacterial suspensions were applied at 10 days and 20 days after sowing at a concentration of  $1 \times 10^8$  cfu mL<sup>-1</sup>.

Plants inoculated with all four antagonistic bacteria, individually and in mixture showed increased plant growth. Application of these bacteria significantly increased fresh weight, dry weight, plant height and initial flowering of tomato plants. *B. cepacia* and *P. aeruginosa* 1 were found to suppress disease severity up to 100%, both at seedling stage and standing crops.

Plants treated with mixture of *B. cepacia*, *P. aeruginosa* 1 and *P. aeruginosa* 2 significantly increased the marketable fruit yield in artificially infected plants compared to the control, although there was not significantly difference as between single treatments of the four bacterial isolates.

The experiment carried out in this study indicated that the four antagonistic bacteria functioned as plant growth promoters as well as biological control agents for Fusarium wilt of tomato.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia  
sebagai memenuhi keperluan untuk  
ijazah Master Sains

**BACTERIA ANTAGONIS UNTUK MENGAWAL PENYAKIT LAYU  
FUSARIUM PADA TANAMAN TOMATO YANG DISEBABKAN OLEH  
KULAT *Fusarium oxysporum* f.sp. *lycopersici***

Oleh

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Empat pencilan bakteria iaitu *Serratia marcescens*, *Burkholderia cepacia*, *Pseudomonas aeruginosa* 1 dan *P. aeruginosa* 2 yang telah diperolehi daripada rizosfera tanaman tomato di ladang dan ciri-ciri antagonistiknya keatas pertumbuhan *F. oxysporum* f.sp. *lycopersici* secara *in vitro* dibangunkan di rumah kaca untuk melihat kebolehannya dalam mengawal penyakit layu Fusarium pada tomato ini. Pokok-pokok tomato ditanam didalam media pertumbuhan yang terdiri daripada Holland RHP® peat grow, coconut peat dan perlite dengan perkadaran 1:1:1 (v/v). Kesemua pokok-pokok tomato ini dialirkan secara sistem pengairan titisan untuk menyebarkan larutan baja hidroponik. Aplikasi larutan bakteria antagonis sebanyak 10 mL pada konsentrasi  $1 \times 10^8$  cfu mL<sup>-1</sup>, diulang semasa 10 hari dan 20 hari

selepas menyemai telah berjaya mengawal penyakit dan meningkatkan pertumbuhan tanaman tomato.

Tanaman yang diinokulasikan dengan empat jenis bakteria antagonis tersebut samada secara sendirian atau secara campuran menunjukkan keputusan peningkatan pertumbuhan pokok. Penggunaan keempat-empat bakteria ini telah meningkatkan berat basah, berat kering, ketinggian pokok dan menggalakkan pembungaan awal dengan signifikannya. Selain itu, *B. cepacia* dan *P. aeruginosa* 1 juga didapati dapat mengurangkan keterukan penyakit hingga ke 100%, samada di peringkat semaian atau pada pokok tomato.

Berdasarkan analisa didapati pokok yang dirawat dengan campuran *B. cepacia*, *P. aeruginosa* 1 dan *P. aeruginosa* 2 telah dapat meningkatkan hasil pada pokok yang telah dijangkiti secara artifisial berbanding dengan kawalan, walaupun tiada perbezaan yang signifikan diantara keempat-empat asingan bakteria tersebut secara bersendirian.

Eksperimen yang telah dijalankan didalam kajian ini menunjukkan keempat-empat pencilan bakteria telah berfungsi sebagai bakteria promotor pertumbuhan dan juga sebagai ejen kawalan biologi untuk penyakit layu *Fusarium* pada pokok tomato.

## **ACKNOWLEDGMENTS**

Praises to almighty Allah SWT, the most gracious, the most merciful, whose blessing have enabled the author to complete this project.

I would like to express my deepest and sincere appreciation to my supervisor, Assoc. Prof. Dr. Kamaruzaman Sijam, for his dedicated effort, support, invaluable advice, intellectual guidance and encouragement in conducting my research and in preparation of this thesis. Gratitude is also to my supervisory committee members, Prof. Dr. Sariah Meon and Dr. Inon Sulaiman for their constructive comments, advice and helps on my studies and in the preparation of the final manuscript.

Special appreciation also goes to the Director of Indonesian Agricultural Quarantine Agency and the Manager of Integrated Pest Management for Smallholder Estate Crops Project-Plant Quarantine Component, for their encouragement as well as the grant of scholarship to complete my study at the Universiti Putra Malaysia and also to Mr. Widodo Eko Saputro, the Head of Jambi Plant Quarantine Station for his support.

Acknowledgement is also made for the thesis grant given by the SEAMEO SEARCA of Los Banos, Philippines, which has helped in certain ways to accomplish my thesis.

I gratefully acknowledge Dr. Ibrahim Omar for his technical assistance in glasshouse work at MARDI Research Station, Cameron Highlands, and also Tengku Aziz, Mrs. Nazlin, Mrs. Hamimah and Mrs. Zahra for their helps. I am also indebted to many other members and staff within the Department of Plant Protection. In particular, I would like to thank to staffs in the Microbiology Laboratory: Mrs. Junaina Jafar , Mr. Yusoff Yasin, Mr. Zawawi and Mr. Rozali for their technical assistance and cooperation.

I also would like to express my deepest thanks and appreciation to my mother, Siti Jubaedah and my parents in law, S. Zaenal and Y. Kusmiati for their encouragement, support and endless prayers during my study and also to my late father, Udung. This endeavor would not have been feasible without the sacrifice, patience, understanding and encouragement of my dear wife, Noviana, and my children, Farid Mukhtar Fatah and Nisrina Nurul Fakhriyyah who inspired me to complete my study.

I certify that an Examination Committee met on 14<sup>th</sup> April 2004 to conduct the final examination of Maman Suparman on his Master of Science thesis entitle “Antagonistic Bacteria for Controlling Fusarium Wilt of Tomato caused by *Fusarium oxysporum* f.sp. *lycopersici*” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulation 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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## **DECLARATION**

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

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**MAMAN SUPARMAN**

Date:

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