UNIVERSITI PUTRA MALAYSIA

BIOLOGICAL CONTROL OF FUSARIUM WILT OF ROCK MELON USING EFFECTIVE MICROBES

SALHA IBNOUF ELMAHDI AHMED

FP 2015 43

BIOLOGICAL CONTROL OF FUSARIUM WILT OF ROCK MELON USING EFFECTIVE MICROBES

By

SALHA IBNOUF ELMAHDI AHMED

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirement for Degree of the Doctor of Philosophy

August 2015

COPYRIGHT

DEDICATION

Special dedicate to:

My loving late father, Ibnouf Elmahdi

late mother, Amna Said, late brother Omer,

my affectionate sisters, Amal and Najat

and my brothers

for their love, support and encouragement.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

BIOLOGICAL CONTROL OF FUSARIUM WILT OF ROCK MELON USING EFFECTIVE MICROBES

By

SALHA IBNOUF ELMAHDI AHMED

August 2015

Chairperson: Associate Professor JugahKadir, PhD
Faculty: Agriculture

The use of effective microbes obtained from the rhizosphere to suppress soil borne plant pathogens has received greater attention in recent decades as an alternative to chemical fungicides. This study was conducted to explore the effects of effective microbes (EMs) from the rhizosphere of rock melon as bio- control agents (BCAs) against Fusarium wilt caused by *Fusarium oxysporum* f. sp. *melonis* (Fom). Two EMs namely MKB04 and KB10 were screened from 72 effective bacteria isolated from the rhizosphere soil of rock melon. The isolate MKB04 was identified based on the Biolog system as *Bacillus amyloliquefaciens;* though the isolate MKB10 was unsuccessfully identified using biolog system due probably to the limitation of the methods used. However, 16S rDNA sequencing for MKB04 and MKB10 isolates was confirmed at 100% of sequence similarity to *B. amyloliquefaciens* and *Alcaligenes faecalis*, respectively compared with related bacteria in the GeneBank. The two isolates were proved to be effectious towards Fom in *in vitro* biocontrol assay and showed different mechanisms of action, as they produced antibiotic substances which prevent the fungal growth up to 92.05 and 93.18% for MKB04 and MKB10 respectively compared with control and spores germination by 100%. Antibiotic substances were produced in the form of volatile as well as non volatile metabolites. Pyrrolopyrazine alkaloid compound was detected on GC/MS for both isolates which displayed significant biological activities against tested fungal pathogens. Furthermore, the two isolates produced hydrolytic enzymes that degrade the fungal cell components; and responded positively *invitro* for siderophore and HCN, indole acetic acid (IAA) production, and phosphate solubilisation.*B. amyloliquefaciens* and *Alcaligenes faecalis* bioformulations act as elicitors in the production of inducible compound associated with induced resistance (Peroxidase (PO), polyphenoloxidase (PPO), total phenol and lignin content); that subsequently enhance tolerance of the rock melon to Fusarium wilt based on parameters such as delay the symptoms onset,reduce disease incidence by (25, 33.33 and 33.33%), disease severity (18.83, 20.71 and 22.45%) for *B. amyloliquefaciens* and *Alcaligensis faecalis* as single or in combination respectively; and epidemic rate at 0.007 units day^{-1}.Histological observations revealed that *B. amyloliquefaciens and Alcaligensis faecalis* were able to colonise and produce massive deposition of new structures and products in the tissues of the rock melon, which were used as a defense mechanism against infection by Fom. Furthermore, the two bioformulations enhanced the

vegetative growth as observed by the increased chlorophyll content, dry weight of the root and shoot, shoot height and root length. Fruit fresh weight, firmness, total soluble solid, titratable acidity and ascorbic acid obtained in this study are within the range of quality standard and customer acceptance. Under storage conditions4 and 25 C, the bioformulations performed retaining their viability over a longer period.*In vitro* and *in vivo* activities of the bioformulations of *B. amyloliquefaciens* and *Alcaligensis faecalis* as single or in combination against Fom of rock melon suggested that the bacterium has the potential to be a promising eco-friendly bio-control agent for *F. oxysporum* f. sp. *melonis* as well as plant growth promoters.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

KAWALAN BIOLOGI LAYU FUSARIUM PADA TEMBIKAI WANGI MENGGUNAKAN MIKROB EFEKTIF

Oleh

SALHA IBNOUF ELMAHDI AHMED

Ogos 2015

Pengerusi: Profesor Madya Jugah Kadir, PhD
Fakulti: Pertanian

Penggunaan mikrob efektif diperolehi daripada rizosfera untuk menyekat patogen tumbuhan telah menerima perhatian dalam beberapa dekad kebelakangan ini sebagai alternatif kepada racun kimiakulat. Kajian ini dijalankan untuk meneroka kesan mikrob efektif (EMS) dari rizosfera tembikai wangi sebagai agen biokontrol (BCAs) terhadap layu Fusarium disebabkan oleh *Fusarium oxysporum* f. sp. *melonis* (Fom). Dua EMS iaitu MKB04 dan KB10 telah disaring daripada 72 pencilan bakteria efektif yang berasal daripada rizosfera tanah padatembikai wangi. Pencilan MKB04 telah dikenal pasti berdasarkan sistem Biolog sebagai *Bacillus amyloliquefaciens*; manakala pencilan MKB10 tidak berjaya dikenal pasti menggunakan sistem biolog berkemungkinan disebabkan had kaedah yang digunakan. Walaubagaimanapun, penjujukan16S rDNA untuk pencilan MKB04 dan MKB10 telah disahkan masing-masing pada 100% urutan persamaan kepada *B. amyloliquefaciens* dan *Alcaligenes faecalis*, dibandingkan dengan bakteria berkaitan dalam GeneBank. Dua pencilan terbukti berkesan mereneat Fom di dalam esei*in vitro* dimana kedua pencilan ini menghasilkan bahan antibiotik yang menghalang pertumbuhan kulat masing-masing sehingga 92.05 dan 93.18% untuk MKB04 dan MKB10 berbanding dengan kontroldan percambahan spora pada 100%. Bahan antibiotik telah dihasilkan dalam bentuk meruap dan juga metabolit tidak meruap. Sebatian alkaloid pyrrolopyrazine telah dikesan pada GC/MS untuk kedua-dua pencilan yang mempamerkan aktiviti biologi ketara ke atas patogen kulat yang diuji. Tambahan pula, kedua-dua pencilantelah menghasilkan enzim hydrolitik yang menghancurkan komponen sel kulat; dan bertindak balas positif di dalam *in vitro* untuk siderophore dan HCN, penghasilan indol asid asetik (IAA), dan solubilisasi fosfat. Bioformulasi *B. Amyloliquefaciens* dan *Alcaligenes faecalis* bertindak sebagai elisitor dalam penghasilan kompaun mampu diaruhkan yang dikaitkan dengan rintangan aruhan (peroksidase (PO), polyphenoloxidase (PPO), jumlah fenol dan kandungan lignin); yang seterusnya meningkatkan toleransi tembikai wangi kepadalayu Fusarium berdasarkan parameter seperti melambatkan simptom awal, mengurangkan insiden penyakitmasing-masingpada (25, 33.33 dan 33.33%), keparahan penyakit (18.83, 20.71 dan 22.45%) untuk *B. amyloliquefaciens*,*Alcaligensis faecalis* dan kombinasi masing-masing; dan kadar wabak pada 0.007 unit hari^{-1}. Pemerhatian histologi mendedahkan bahawa *B. amyloliquefaciens* dan *Alcaligensis faecalis* mampu menghasilkan struktur pemendapan dan produk baru dalam tisu tembikai wangi,

yang mana telah digunakan sebagai mekanisme pertahanan terhadap jangkitan oleh Fom. Tambahan pula, kedua-dua bioformulasi meningkatkan pertumbuhan vegetatif seperti yang diperhatikan dengan peningkatan kandungan klorofil, berat kering akar dan pucuk, ketinggian pucuk dan panjang akar. Berat buah segar, keanjalan, jumlah pepejal larut, keasidan tertitrat dan asid askorbik yang diperolehi dalam kajian ini adalah dalam lingkungan piawai mutu dan penerimaan pelanggan. Di bawah keadaan penyimpanan 4 dan 25 C,bioformulasi menunjukkan pengekalan viabiliti mereka dalam tempoh yang lebih lama. Aktiviti *in vitro* dan *in vivo* daripada bioformulasi *B. amyloliquefaciens* dan *Alcaligensis faecalis* secaro individual atau kombinasi ke atas Fom daripada tembikai wangi menunjukkan bahawa bakteria ini berpotensi untuk menjadi agen bio-kontrolmesra alam ke atas *F. oxysporum* f. sp. *melonis* serta penggalak pertumbuhan tanaman.

ACKNOWLEDGEMENTS

I would like to express my appreciation and gratitude to all who made it possible for me to accomplish this work.First and foremost my grateful to the Almighty ALLAH the most merciful who gave me the strength and patience to complete this study.

Really, I am greatly indebted to my supervisor Prof. Dr. Jugah Kadir for his keen supervision, unlimited support, advice, constructive criticisms, guidance and fruitful discussion. Moreover, I would like to acknowledge his understanding and working group for the friendly working atmosphere. Special gratitude extends to my supervisory committee members, Prof. Dr. Mahmud Tengku Muda Mohamed for his close supervision, valuable advices for rendering all possible guidance in carrying out the research work, also great thanks, to Associate Professor Dr. Ganesan Vadamalai, I sincerely thank Prof. Dr. Sariah Meon my former supervisory committee member for her support, and guidance.

Thanks are also extended to all the staff members in the Biocontrol, Plant Pathology, Microbiology Laboratories; Mr. Nazri, Zawawi, Johery, Ms Asmalina, Junina and Mr. Suhimi from Botany laboratory for their kind and technical assistance.

Virtually I am greatly indebted to my friends, colleagues at Bahri University- Sudan; for their valuable assistance, continual encouragement and moral support. Special thanks, to my friends and colleagues (local and international) in Faculty of Agriculture UPM, particularly in biocontrol laboratory for their kindness cooperation and help throughout my study.I feel especially thankful to my Sudanese friends in Malaysia for their continual encouragement, valuable advices, and moral support.

Appreciably thanks also is extended to the key of success of this study, to my beloved sisters, brothers for their pray, blessings, endless love, sacrifice and encouragement during the study period.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirements for the degree of Doctor of Philosophy.
The members of the Supervisory Committee were as follows:

Jugah Kadir, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Mahmud Tengku Muda Mohamed, PhD
Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

Ganesan Vadamalai, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

BUJANG BIN KIM HUAT, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

Declaration by graduate student

I hereby confirm that:

- ¶ this thesis is my original work ;
- ¶ quotations, illustration and citations have been duly referenced;
- ¶ the thesis has not been submitted previously, or concurrently, for anyother degree at t any institution;
- ¶ intellectual property from the thesis and copyright of thesis are fully owned by Universiti Putra Malaysia or as according to the Universiti Putra Malaysia (Research)Rules 2012;
- ¶ written permission must be owned from supervisor and deputy vice -chancellor (Research and innovation) before thesis is published (in theform of written, printed or electronic form) including books, journals,modules, proceeding, popular writings, seminar paper, manuscripts, posters, reports, lecture notes, learning models or any other material as stated in the Universiti Putra Malaysia (Research) Rules 2012;
- ¶ there is no plagiarism or data falsification/fabrication in the thesis and scholarly integrity was upheld as according to Rules 59 in Rules 2003(Revision 2012-2013).Thethesis has undergone plagiarism detection software.

Signature:_____ Date: _____

Name and Matric No: Salha Ibnouf Elmahdi Ahmed, GS28641

Declaration by Member of Supervisory Committee

This is to confirm that:

- ¶ the research conducted and the writing of this thesis was under our supervision;
- ¶ supervision responsibilities as stated in Rule 41 in Rules 2003 (Revision 2012-2013) were adhered to.

Signature: _____
Name of Chairman of Supervisory Committee: Jugah Kadir, PhD

Signature: _____
Name of Member of Supervisory Committee: Ganesan Vadamalai, PhD

Signature: _____
Name of Member of Supervisory Committee: Mahmud Tengku Muda Mohamed, PhD

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATIONS

%	Percent
µ	Micro
AIA	Actinomycetes Isolation Agar
ANOVA	Analysis of Variance
AUDPC	Area Under Disease Progress Curve
BCA	Biological Control Agent
BLAST	Basic Local Alignment Search Tool
bp	Base pair
cfu	Colony forming units
cm	Centimeter
CRD	Completely Randomized Design
DNA	Deoxyribonucleic Acid
dNTPs	Deoxyribonucleoside Triphosphates
DI	Disease Incidence
DR	Disease Reduction
DS	Disease Severity
DMRT	M
EMs	Effective Microbes
FAA	Formalin Acetic Acid
FAO	Food and Agriculture Organization
Fom	*Fusarium oxysporum* f.sp.*melonis*
IR	Induced Resistance
g	Gram
GN	Gram negative
GP	Gram positive
hr	hours
K	Potassium
kb	Kilo base pair
L	Liter
LCB	Lacto phenol Cotton Blue
LM	Light Microscope
LTGA	Lignolithoglycolic Acid
M	Monit
m	Meter
mg	Milligram
min	Minute
MKB	Makmal Kawalan Biologi
ml	milliliter
mm	Millimeter
mM	Millimolar
MPB	Malaysian Pepper Board
N	Nitrogen
NA	Nutrient Agar
NB	Nutrient Broth
NCBI	National Center for Biotechnology Information
nm	Nanometer
OD	Optical Density

P	Phosphorus
PCR	Polymerase Chain Reaction
PDA	Potato Dextrose Agar
PDB	Potato Dextrose Broth
PIRG	Percentage Inhibition of Radial Growth
PO	Peroxidase
PPO	Polyphenoloxidase
PVP	Polyphenyl Pyrrolidone
rpm	Revolutions per minute
s	Seconds
SDW	Sterile Distil Water
SEM	Scanning Electron Microscope
TE	Tris-EDTA
U	Unit
UV	Ultraviolet
V	Volts
V/V	volume / volume
vol	Volume
wt	Weight

CHAPTER 1

INTRODUCTION

1.1 General

Melon (*Cucumis melo* L.) is among the most important cultivated cucurbits. It is mainly cultivated for its fruit, which has a typically sweet pulp and pleasantly fragrant flavour (Villanueva *et al*., 2004).Melon is important also for its richness in vitamin A and C content (Wehner and Maynar, 2003). The global production of melon has doubled within the last two decades to 26 million tons in 2007 (FAOSTAT 2007). In Malaysia, rock melon is commonly cultivated under the rain-sheltered and open planting structure using the drip fertigation method. It is a popular fruit among locals compared to cereals or vegetable crops and Glamour r d r d r is the most favourite choice among the commercial growers (UK assay). Rockmelon is an economically important crop that has become an export commodity (Alang *et al*., 1990; Cantliffe *et al*., 2001; Shaw *et al*., 2000) for South East Asia, Central China and East Africa (Norlia, 1986; Jelaska, 1986; Dong *et al*., 1990). Muskmelons r r r d d d r r exports in term of revenue (Abbas, 2004; AOAD 2008).

Rock melon is vulnerable to Fusarium wilt that is caused by (*Fusarium oxysporum* f. sp. *melonis* abbreviated as Fom) a seed and soil born fungus that is specific to melon. Fusarium wilt is a destructive vascular disease that leads to substantial economic losses especially when crops are planted in the same field without rotation (Martyn and Amador, 1987; Champaco *et al*., 1993; Soriano-Martin *et al.*, 2006)).As the natural conditions in Malaysia and Sudan favour fungal growth, Fusarium wilt has been reported to cause severe destruction of commercial melon crops in Sudan, which can account for more than 40% loss (Mohamed *et al*., 1994, 1995; AOAD, 2008).

Many management strategies have been tried to control Fusarium wilt of rock melon, but none has been able to generate acceptable results. However, resistant cultivars are promising and have been the primary choice of researchers and growers but time and cost factors limit its feasibility which is uncertain. Fungicides have been proposed to contain this pathogen but they are not perceived as the ideal long-term solution for the problem; this is because resistance development in pathogen may overwhelm the effect of these synthetic fungicides over time (McGrath, 2001 and Fernàndez *et al*., 2006). On the other hand, the soil-borne pathogens are very d r r d rvive for several years as chlamydospores in soil or as mycelium in the plant vascular system which makes it urgent for alternative control strategies to be identified.

Recently biological control of Fusarium wilt has become a popular alternative for disease management fuelled by public and environmental concerns as chemicals and pesticides have been banned (Alabouvette, 1993; Conway *et al*., 2004). There have

been many reports of the successful use of biological control of Fusarium which may eventually play a crucial role in improving overall crop productivity.

The idea of using effective microbes (EM) in Malaysia and Sudan is enticing, especially as the natural condition favour microbial growth; and due to the fact that pesticides technology resulted in a number of health and environmental hazards and socioeconomic problems. In addition to the increase in market demand for non-chemically treated rock melon plants; that free from pathogens as well as chemical residues and any other contaminants impairing its superior fruit quality, high yield as export cash crop. Moreover, no systemic and extensive works on Fusarium wilt of rockmelon plant have been done in Malaysia; also there is a lake of information on the use of EM in controlling Fusarium wilt of rock melon plant and as bio fertilizer as well (Zulkarami *etal.*, 2010). However, as to our knowledge no attempts in Sudan have been made for the management of Fusarium wilt by using the EM.

Therefore, this study was undertaken to establish the effect of effective microbe as BCAs of Fusarium wilt and the mechanism of action of the disease suppression directly through antagonism (antibiotics or inhibitory compounds production) towards Fom, and induces of plant resistance as well, or either indirectly through increased or promotion of plant growth yield and fruit quality.

1.2 Objectives of the Study

The main objective of this study was focused on the biological control of Fusarium wilt pathogens on rock melon and this can be achieved through the following specific objectives:-

1. Isolation and Identification of promising effective microbes involved in biocontrol of *Fusarium oxysporum f. sp melonis;*
2. Studying the mechanisms of action of disease control by antagonistic microbiota;
3. Investigating the impact of bioformulations of effective microbes against *Fusarium oxysporum f.sp.melonis* on rock melon under glasshouse condition.

1.3 Hypothesis

Hypothesis of this study are:

- *Fusarium oxysporum f. sp. melonis* thecausal agent of Fusarium wilt of melon can be controlled by using effective microbiota.
- Effective microbial communities in the rhizosphere of melon can be manipulated by mixing them with non- treated growth medium for improving the plant growth and bio control of the disease.

REFERENCES

Abbas, A.M. 2004.Exportation Chances for Sudanese Horticultural Commodities. ymposium of European Community Standards for Horticultural Commodities, udanese Standards and Measurements Corporation (SSMC), Khartoum, Sudan (3):3-57.

Abbasi, P.A., Miller, S.A. Meulia,T. Hoitink,H.A.J. and Kim., J.M.1999. Precise etection and tracing of *Trichoderma hamatum* 382 in compost amended potting ixes by using molecular markers. *Applied and Environmental Microbiology* 5:542.

Adams, RP.2007. Identification of Essential Oil Components by Gas hromatography Mass Spectroscopy, 4th ed.; Allured Publ. Crop. Carol Stream, U.S.A.

Adeline, S.Y., Sariah, M., Kadir, J. Son, R. and Singh, G. 2009.Induced host resistance by non-pathogenic Fusarium endophyte as a potential defence mechanism in Fusarium wilt management of banana. *Pest Technoloy* 3:67-72

Adeline, T.S.Y.2005.Endophytic Microorganisms for Improvement of Banana Vigour and Tolerance to Fusarium Wilt.PhD Thesis, Universiti Putra Malaysia, Serdang, Malaysia.

Adeline, T.S.Y., Sariah, M., Jugah, K., Anuar, A.R. 2003.Potential use of suppressive soil in managing Fusarium wilt of banana seedlings. *INFOMUSA* 12: 33-34.

Adesina, M. F., Lembke, A., Costa, R., Speksnijder, A., and Smalla, K. 007.Screening of bacterial isolates from various European soils for in vitro antagonistic activity towards Rhizoctonia solani and Fusarium oxysporum: Site-dependent composition and diversity revealed.*Soil biology and biochemistry*, 39(11): 2818-2828.

Agosin, E., Aguilera, J.M., 1998. Industrial production of active propagules of richoderma for agricultural uses .In: Harman, G.E., Kubicek, C.P. (Eds.), richoderma and Gliocladium-Enzymes, Biological Control and Commercial Applications. Taylor and Francis Ltd, London, Great Britain, pp. 205 227.

Agrios, G.N. 2005.Plant Pathology, 5th Edition, Elsevier Academic Press Inc. New York. 922pp.

Ahmad, F., Ahmad I. and Khan M. S. 2008. Screening of free-living rhizospheric acteria for their multiple growth promoting activities. *Microbiology* 163:173-181.

Ajit NS, Verma R, Shanmugam V. 2006. Extracellular chitinases of À*uorescent pseudomonads* antifungal to *Fusarium oxysporum f. sp. dianthi* causing carnation wilt. *Current Microbiology* 52:310 316.

M d r r
hydrolases of strain *Bacillus* sp. 739 and their involvement in the lysis of micromycete cell walls. *Microbiology* 76: 413-420.

Alabouvette, C. and Y. Couteaudier. 1992. Biological control of Fusarium wilts with nonpathogenic fusaria, p. 415-426, In E. C. Tjamos, *et al* ., eds. Biological Control of Plant Diseases. Plenum Press, New York.

Alabouvette, C. 1986. Fusarium wilts suppressive soils from the Chateaurenard region: review of 10-year study. *Agronomie* 6:273-284.

Alabouvette, C., Rouxel, F. and Louvet, J. 1979. Characteristics of Fusarium wilt suppressive soils and prospects for their utilization in biological control, p. 165-182. In B. Schippers and W. Gams, eds. Soil-Borne Plant Pathogens.Academic Press, New York.

Alabouvette, C., Lemanceau, P., Steinberg, C. 1996. Biological control of Fusarium wilts: opportunities for developing a commercial product. In: Hall, R. (Ed.), Principles and Practice of Managing Soil borne Plant Pathogens. APS Press, St Paul, United States, pp.192 212.

Alabouvette, C., Lemanceau, P., Steinberg, C. 1993. Recent advances in the biological control of Fusarium wilts. *Pesticide Science* 37:365-373.

Alam, M.S., Cui, Z.J., Yamagishi, T. and Ishii, R. 2001. Grain yield and related physiological characteristics of rice plants (*Oryza sativa* L.) inoculated with free-living rhizobacteria. *Plant Production Sciences* 4: 125 130.

Alang, Z.C., Zulaini, I., Faridal, S., Khalip, A.R and Lim E.S.1990 Regeneration of muskmelon (Cucumis melo) from cotyledon nodes and leaf disc. In: Symposium on Treand in Biotechnology in the Pacific Region held in Kuala Lumpur. 31 July-2 Aug, 1990: Proceedings edited by Alang Z.C.

Alfred C. Andrews, 1956. Melons and Watermelons in the Classical Era, *Osiris*, Vol. 12: pp. 368 375.

Alvarez, M. F. Castro, A. Príncipe, G. Borioli, S. Fischer, G. Mori, E. Jofré 2012.The plant-associated *Bacillus amyloliquefaciens* strains MEP218 and ARP23 capable of producing the cyclic lipopeptides iturin or surfactin and fengycin are effective in biocontrol of sclerotinia stem rot disease. *Journal Applied Microbiology* 112: 159 174.

Alvindia DG, Natsuaki KT. 2009. Biocontrol activities of*Bacillus amyloliquefaciens*DGA14 isolated from banana fruit surface against banana crown rot-causing pathogens. *Crop Protection* 28:236 24.

Anguelova, V.S., van der Westhuizen, A., Pretorious, Z.A. 1999. Intercellular roteins and b-1, 3-glucanase activity associated with leaf rust resistance in wheat. *Physiology of Plant* 106 (4): 393 401.

Anith, K.N., Radhakrishnan, N.V. and Manomohandas, T.P. 2003. Screening of ntagonistic bacteria for biological control of nursery wilt of black pepper (*Piper nigrum*). *Journal of Microbiological Research,* 158: 91-97.

Anonymous, 2007. Metop-A satellite measures ozone hole [Online]. Available by The Ozone Hole Inc. http://www.theozonehole.com/metop.htm (verified 02 April).

AOAD, 2008. Arab Agricultural Statistics Year book.Arab Organization for Agricultural Development (AOAD), Khartoum, Sudan.

Armstrong, GM., Armstrong JK. 1981.*Formae specialis* and races of *Fusarium oxysporum* causing wilt diseases. In: Fusarium: Diseases, Biology and Taxonomy, Pennsylvania State University Press, University Park (US) pp 391-399.

Arnnok, P., C. Ruangviriyachai, R. Mahachai, Techawongstien S. and Chanthai,S. 2010. Optimization and determination of polyphenol oxidase and peroxidase activities in hot pepper (*Capsicum annuum* L.) pericarb. *International Food Research Journal* 17: 385-392.

Arrebola, E, Jacobs R, Korsten L. 2010. Iturin A is the principal inhibitor in the biocontrol activity of *Bacillus amyloliquefaciens PPCB004* against postharvest fungal pathogens. *Journal of Applied Microbiology* 108:386 395.

Ashrafuzzaman, M., Farid Akhtar Hossen, Razi Ismail, M. MD Anamul Hoque,Zahurul M. and Sariah, M. 2009. Efficiency of plant growth promoting rhizobacteria (PGPR) for the enhancement of rice growth.*African journal of Biotechnology* 8: 1247-1252.

Austin, B. 1989.Novel pharmaceutical compounds from marine bacteria.*Journal of Applied Bacteriology* 67:461-470.

Avis, TJ, Bélanger RR. 2001 Specificity and mode of action of the antifungal fatty acid cis-9-heptadecenoic acid produced by *Pseudozyma flocculosa*.*Applied and Environmental Microbiology* 67:956-960.

Avis, TJ. 2007Antifungal compounds that target fungal membrane: application in plant disease control. *Canadian Journal of Plant Pathology*.29:323-329.

Baayen, R.P., and Elgersma,D.M. 1985. Colonization and histopathology of susceptible and resistant carnation cultivars infected with *Fusarium oxysporum f.sp.dianthi. European Journal of Plant Pathology* 91:119-135.

Babu, M.N., Sharma, L. and Madhavan, V. 2012.Synthesis and Antimicrobial Activity of Some Novel Pyrrolidine Derivatives. *Synthesis* 4(3): 903-909.

Bailén, G., Guillén, F., Castillo, S., Serrano, M., Valero, D., and Martínez-Romero, D. 2006. Use of activated carbon inside modified atmosphere packages

tomaintain tomato fruit quality during cold storage. *Journal of agricultural and food chemistry* 54(6): 2229-2235.

Baker, K.F., and R.J. Cook. 1974. Biological Control of Plant Pathogens Freeman, San Francisco.

Baker R, Elad Y, Sneh B. 1986. In: Iron siderophores and plant diseases, Swinburne TR (ed.), Plenum Press, New York, 77-84.

Baker, R A. and Tatum, J. H. 1998. Novel anthraquinones from stationary cultures of *Fusarium oxysporum*.*Journal of fermentation and bioengineering* 85(4): 359-361.

Bano N, Musarrat J. 2003.Characterization of a new *Pseudomonas aeruginosa* strain NJ-15 as a potential biocontrol agent. *Current Microbiology* 46: 324-328.

Beckman, C.H. 1987. The Nature of Wilt Diseases of Plants American Phytopathological Society, St Paul, Minnesota.

Beckman, C.H. 1990. Host responses to the pathogen, p. 93-105, In R. C. Ploetz, ed. Fusarium Wilt of Banana.The American Phytopathological Society, St. Paul, Minnesota.

Beckman, C.H., Halmos, S. and Mace M.E.1962. The interaction of host, pathogen, and soil temperature in relation to susceptibility to Fusarium wilt of bananas. *Phytopathology* 52:134-140.

Benhamou, N., Rey, P., Picard, K. and Tirilly, Y. 1999. Ultrastructural and cytochemical aspects of the interaction between the mycoparasite *Pythium oligandrum* and soil borne plant pathogens.*Biochemistry and Cell Biology* 89(6): 506-517.

Bernan, VS, Greensterin M, Maisese WM. 1997. Marine microorganisms as a source of new natural products.*Advance Applied Microbiology* 43:57-90

Bertrand, H., Nalin, R., Bally, R. and Cleyet-Marel, J.C. 2001. Isolation and identification of the most efficient plant growth-promoting bacteria associated with canola (*Brassica napus*). *Biology and Fertility of Soils* 33: 152-156.

Bharathi, R., R. Vivekananthan,S. Harish, A. Ramanathan and R. Samiyappan, 2004. Rhizobacteria-based bio-formulations for the management of fruit rot infection in chillies. *Crop Protection* 23: 835-843.

Boddey, R.M., and S.Urquiaga, B.J.R. Alves, and V.Reis.2003.Endophytic nitrogen fixation in sugarcane: present knowledge and future applications. *Plant Soil* 252:139-149.

Bollen, G.J., and G. Scholten. 1971. Acquired resistance to benomyl and some other systemic fungicides in a strain of *Botrytis cinerea* in cyclamen. Netherlands *Journal of Plant Pathology* 77:83-90.

Bolwerk, A., Lagopodi, A. L., Wijfjes, A. H., Lamers, G. E., Chin, A. W., Lugtenberg, B. J. and Bloemberg, G. V. 2003. Interactions in the tomato rhizosphere of two *Pseudomonas* biocontrol strains with the phytopathogenic fungus *Fusarium oxysporum* f. sp. *radicis-lycopersici*.*Molecular Plant-Microbe Interactions* 16:983-993.

Booth, C. 1971. *The Genus Fusarium*.Commonwealth Agricultural Bureaux.

Booth, C. (1977).*Fusarium.Laboratory guide to the identification of the major species*. Commonwealth Mycological Institute.

Bora, T., Ozaktan, H. Gore, E. and Aslan, E. 2004. Biological control of *Fusarium oxysporumf. sp. melonis* by wettable powder formulation of the two strain of *Pseudomonas putida*. *Journal of Phytopathol* 152: 471-475.

Borrero, C., Ordovás J., Trillas M.I., Avilés M. 2006 Tomato Fusarium wilt suppressiveness. The relationship between the organic plant growth media and their microbial communities as characterised by Biolog, *Soil Biology and Biochemistry* 38:1631 1637.

Borriss, R. 2011. Use of plant-associated *Bacillus* strains as biofertilizers and biocontrol agents, p 41 76. In Maheshwari DK (ed), Bacteria in agrobiology: plant growth responses. Springer Verlag, Heidelberg, Heidelberg, Germany.

Boughalleb, N., Tarchoun, N., El Mbarki, A. and El Mahjoub, M. 2007. Resistance evaluation of nine cucurbit rootstocks and grafted watermelon (*Citrullus lanatus* L.) varieties against Fusarium wilt and Fusarium crown and root rot. *Journal of Plant Sciences* 2: 102-107.

Boulter, J.I., Boland,G.J.and Trevors, J.T. 2000. Compost: a study of the development process and end-product potential for suppression of turf grass disease. *World Journal of Microbiology Biotechnology* 16: 115-134.

Bourne, M. 2002. *Food texture and viscosity: concept and measurement*. Academic press.

Bower, J., Holford, P., Latché, A. and Pech, J.C., 2002. Culture conditions and detachment of the fruit influence the effect of the ethylene on the climateric respiration of melon. *Postharvest Biology and Technology*26:135 146.

Boyetchko, S., Pedersen, E., Punja, Z., and Reddy, M. 1999.Formulations of biopesticides. Pages 487-508 in: Methods in Biotechnology, Vol. 5: Biopesticides: Use and Delivery. F. R. Hall and J. J. Menn, eds. Humana Press, Totowa, NJ.

Bradford, M. A. 1976. "A Rapid and Sensitive Method for the Quantification of Microgram Quantities of Protein Utilizing the Principle of Protein-Dye Binding," *Annals of Biochemistry* 72:248-254.

Brain,L. C., Haarmann, D., and Lynne, A. M. 2011.Use of blue agar CAS assay for siderophore detection.*Journal of microbiology and biology education: 12*(1): 51.

Brannen, P. M. and Kenney, D. S. 1997. Kodiak a successful biological-control product for suppression of soil-borne plant pathogens of cotton.*Journal of Indian Microbiology and Biotechnology* 19:169 171.

Brantlee, SR, Kelly L, Wei S, Benson DM. 2011. Cellulase Activity as a Mechanism for Suppression of Phytophthora Root Rot in Mulches. *Phytopathology* 101(2): 223-230.

Brimner, T., Boland, G., 2003. A review of the non-target effects of fungi used to biologically control plant diseases. *Agriculture Ecosystem and Environment* 100:3 16.

Browning, M, Dawson, C, Alm, S R, Gorres, J H. and Amador. J A. 2004. Differentialeffects of butyric acid on nematodes from four trophic groups. *Applied SoilEcology* 27: 47 54.

Browning, M, Wallace D B, Dawson C, Alma S R and Amador J A. 2006. Potential of butyric acid for control of soil-borne fungal pathogens and nematodes affecting strawberries; *Soil Biology and Biochemistry* 38:401 404.

Burgess, L, W., Summerell, B. A., Bullock, S., Gott, K. P and Backhouse, D. 1994. Laboratory manual for Fusarium research.3rd edition.Fusarium Research Laboratory, Department of Crop Sciences, University of Sydney.

Buyer, J.S., D.P. Roberts, and E. Russek-Cohen. 1999. Microbial community structure and function in the spermosphere as affected by soil and seed type. *Canadian Journal of Microbiology* 45:138-144.

Cabello, M.J. Castellanos M.T., Romojar M r -Madrid, F. Ribas. 2009. Yield and quality of melon grown under different irrigation and nitrogen rates. *Agriculture Water Management* 96:66 874.

Caldeira.RL, Mendonça CLG, Goveia CO, Lenzi HL, Graeff-Teixeira C, Lima WS, Mota EM, Pecora IL, Medeiros AMZ, Carvalho OS 2007. First record of molluscs naturally infected with *Angiostrongylus cantonensis* (Chen, 1935) (Nematoda: Metastrongylidae) in Brazil. *Memórias do Instituto Oswaldo Cruz 102*: 887-889.

Callac, P., and G. Mata. 2005 "*Agaricus tollocanensis*, une nouvelle espèce de la section Xanthodermatei, trouvée au Mexique."*Documents Mycologiques* 33.132: 31-35.

Campbell. CL, Madden LV. 1990 Introduction to plant disease epidemology. John Wiley and Sons, New York.

Campbell, R. 1989. Biological control of microbial plant pathogens. Cambridge University Press, Cambridge: 218 pp.

Canbolat, M. Y., Barik, K., Cakmakci, R. and Ahin, F. 2006.Effects of mineral and biofertilizers on barley growth on compacted soil.*Soil and Plant Science* 56: 324-332.

Cantliffe,D.J.,Shaw,N.,Jovicich,E., Rodriguez, J.C., Secker,I., Karchi, Z. 2001. Passive ventilated high-roof greenhouse production of vegetables in a humid, mild winter climate.*Acta Horticulture*559:195 201.

Cao, L., Qiu, Z., You, J., Tan, H. and Zhou, S. 2005. Isolation and Characterization of endophytic streptomycete antagonists of Fusarium wilt pathogen from surface-sterilized banana roots. *FEMS Microbiology Letters* 247: 147-52.

Cappuccino, J. G. and Sherman, N. 1992: Biochemical activities of microorganisms. In: Microbiology, A Laboratory Manual. The Benjamin / Cummings Publishing Co. California, USA.

Cartieaux, Persello F., Nussaume, L. and Robaglia, C. 2003.Tales from the underground: molecular. *Plant, Cell and Environment* 26:189-199.

Castric, P. A. 1975. Hydrogen cyanide, a secondary metabolite of *Psuedomonas aeruginosa.Canadian Journalof Microbiology* 21:613-618.

Cavaglieri, L, Orlando J, Rodriguez MI. 2005. Biocontrol of *Bacillus* subtilis against Fusarium verticillioides in vitro, at the maize root level. *Research in Microbiology* 156:748-754.

Cebolla, B., Busto, J., Ferrer, A., Miguel, A., Maroto, J.V., 2000. Methyl bromide alternatives on horticultural crops.*Acta Horticulture* 532: 237 242.

Chakravarty, HL.1982.Fascicles of Flora of India.*Fascicle 2*.Cucurbitaceae.Howrah: *Botanical Survey of India*; pp. 30 38.

Champaco, E.R., Martyn, R.D., Miller, M.E., 1993. Comparison of Fusarium solani and *Fusarium oxysporum* as causal agents of fruit rot and root rot of muskmelon. *Horticultural Science* 28:1174 1177.

Champion, R.1997. Identify fungi transmitted by seeds.INRA, Paris (FR) (in French) Chavez, C.M. 2001. Polinización en Cucurbitaceaes. Folleto Numero 23. INIFAPSAGAR, Hemosillo, Sonora, Mexico.

Chen, XH, Koumaoutsi A, Scholz R, Borriss R. 2009. More than anticipated-production of antibiotics and other secondary metabolites by *Bacillus* amyloliquefaciens FZB42.*Journal ofMolecular Microbiology Biotechnology 16*:14 24.

Chet, I and Inbar, J. 1994.Biological control of fungal pathogens.*Applied Biochemistry and Biotechnology* 48:37-43.

Chiou, A.L. and Wu, W.S. 2001.Isolation, identification and evaluation of bacterial antagonists against*Botrytis elliptica* on Lily.*Journal of Phytopathology* 149: 319-324.

Chupp, C and Sherf, A.F.1960. Vegetable diseases and their control.The Ronald press company. New York. pp 534-566.

Ciotola, M.A., DiTommaso, A., Watson, A.K., 2000. Chlamydospores production, inoculation methods and pathogenicity of *F. oxysporum* M12-4A, a biocontrol for *Striga hermonthica*.*Biocontrol Sciences and Technology* 10: 129-145.

Clay, R. P., Bergmann, C. W. and Fuller, M. S. 1997.Isolation and characterization of an endopolygalacturonase from *Cochliobolus sativus* and a cytological study of fungal penetration of barley.*Phytopathology*87(11): 1148-1159.

Cohen, R., Y. Burger, C. Horev, A. Porat and M. Edelstein, 2007. Performance of Galia-type melons grafted on to *Cucurbita* rootstocks in *Monosporascus cannonballus* infested and non-infested soils. *Annals of Applied Biology* 146: 381-387.

Compant, S., Duffy B, Nowak J, Clement C, Ait BE. 2005. Mini review -Use of plant growth-promoting bacteria for biocontrol of plant diseases: principles, mechanisms of action, and future prospects. *Applied Environmental Microbiology* 71(9): 4951-4959.

Conway, W. S., Leverentz, B., Janisiewicz, W. J., Blodgett, A. B., Saftner, R. A. and Camp, M. J. 2004. Integrating heat treatment, biocontrol and sodium bicarbonate to reduce postharvest decay of apple caused by *Colletotrichum acutatum* and *Penicillium expansum*. *Postharvest Biology and Technology* 34(1): 11-20.

Cook, RJ. 1993. Making greater use of introduced microorganisms for biological control of plant pathogens. *Annual Review of Phytopathology* 31:53 80.

Cook, R.J., and K.F. Baker. 1983. The Nature and Practice of Biological Control of Plant Pathogens the American Phytopathological Society, St. Paul, Minnesota.

Coombs, J., Hind, C.G., Leegood, L.L., Tieszen, L.L. and Vanshak, A. 1987. Analytical techniques. In *Techniques in bioproductivity and photosynthesis*, ed Coombs, J., Hall, D.O., Long, S.P. and Scurlock, J.M.O. Pergamon Press: Oxford. pp 224-226.

Cotxarrera, L., Trillas-Gay, M.I., Steinberg, C., Alabouvette, C. 2002.Use of sewage sludge compost and *Trichoderma asperellum* isolates to suppress fusarium wilt of tomato.*Soil Biology and Biochemistry* 34:467 476.

Crowley, D. 2001. Function of siderophores in the plant rhizosphere. In: Pinton, R., Z. Varanini, P. Nannipieri. Editors. The rhizosphere: Biochemistry and organic substances at the soil-plant interface. New York: Marcel Dekker, Inc. pp. 223-261.

Dahiya, N., Tewari, R. and Hoondal G. S. 2006. Biotechnological aspects of chitinolytic enzymes: a review. *Applied Microbiology and Biotechnology* 71:773-782.

Daniel,. S. Egel and R. D. Martyn. 2007. Fusarium wilt of watermelon and other cucurbits. The Plant Health Instructor. DOI: 10.1094/PHI-I-2007-0122-01.

Das, IK, Indira S, Annapurna A, Prabhakar, Seetharama, N. 2008. Biocontrol of charcoal rot in sorghum by fluorescent Pseudomonads associated with the rhizosphere. *Crop Protection* 27: 1407-1414.

De Boer, M., van der Sluis,I., van Loon, L.C. and Bakker, P.A.H.M. 1999. Combining fluorescent *Pseudomonas* spp. strains to enhance suppression of Fusarium wilt of radish. *European Journal of Plant Pathology* 105: 201-210.

De Cal, A., 1995. Biological control of Fusarium oxysporum f. sp. lycopersici.*Plant Pathology* 44:909 917.

De Cal, A., García-Lepe, R., Melgarejo, P. 2000. Induced resistance by *Penicillium oxalicum* against of *Fusarium oxysporum f. sp. lycopersici*: histological studies of infected and induced tomato stems.*Phytopathology* 90: 260 268.

De Cal, A., Pascual, S., Melgarejo, P. 1997. Involvement of resistance induction by *Penicillium oxalicum* in the biocontrol of tomato wilt.*Plant Pathology,* 46: 72-79.

De costa, D.M. and H.R.U.T. Erabadupitiya. 2005. An integrated method to control postharvest diseases of banana using a member of the *Burkholderia cepacia* complex.*Postharvest Biology and.Technology* 36:31-39.

Deacon, J.W. 1994. Rhizosphere constraints affecting biocontrol organisms applied to seeds, p. 315-326, In T. Martin, ed. Seed Treatment: Progress and Prospects. British Crop Protection Council, Farnham, UK.

Défago, G. and Haas. D. 1990. Soil Biochemistry Vol. 6 (eds Bollag, J. M. and Stotzky, G.) 249 291 Marcel Dekker, New York.

Dhillon, NPS, Monforte AJ, Pitrat M, *et al.* 2012. Melon landraces of India: contributions and importance.*Plant Breeding Reviews*.35:85 150.

Dhingra, O.D. and J.B. Sinclair. 1995. Basic Plant Pathology Methods. 2nd Edn. Lewis Publishers, Boca Raton, pp: 434.

Dhingra, O.D., R.A. Coelho-Netto, F.A. Rodrigues, J.G.J. Silva, and C.B. Maia. 2006. Selection of endemic nonpathogenic endophytic *Fusarium oxysporum*

from bean roots and rhizosphere competent fluorescent Pseudomonas species to suppress Fusarium-yellow of beans. *Biological Control* 39:75-86.

Dikin, A., M.A. Sijam, Z. Abidin, H.M. Zakaria and A.S. Idris. 2002.Interaction between *Schizophyllum commune* and antagonistic bacteria isolated from rotted fruits of oil palm. Proceedings of 25th Malaysian Microbiology Symposium and 5th UNESCO National Workshop for the Promotion of Microbiology in Malaysia, Towards Commercialization of Microbiology Research, Sept. 8-9, Kota Bahru, Kelantan Darul Naim, Malaysia.

Dixon,RA, Harrison MJ and Lamb CJ. 1994. Early events in the activation of plant defence responses. *Annual Review of Phytopathology* 32:479-501.

Dominguez, J., Negrin, M.A. and Rodrigues, C.M.. 2001. Aggregate water-stability, particle size and soil solution properties in conducive and suppressive soils to Fusarium wilt of banana from Canary Islands (Spain). *Soil Biology and Biochemistry* 33:449-455.

Dong, I.Z. Yang M.Z., Jia and Chua, N.H. 1990. Transformation of melon (Cucumis melo L.) and expression from the cauliflower Mosaic virus 35S promoter in Transgenic Melon Plant. *Biotechnology* 9: 858-863.

Duijff BJ, Pouhair D, Olivain C, Alabouvette C, Lemanceau P.1998. Implication of systemic induced resistance in the suppression of*Fusarium*wilt of tomato by *Pseudomonas fluorescens* WCS417r and by non-pathogenic *Fusarium oxysporum*Fo47.*European Journal of Plant Pathology*104: 903 910.

Duineveld, B.M., A.S. Rosado, J.D. van Elsas, and J.A. van Veen. 1998. Analysis of the dynamics of bacterial communities in the rhizosphere of the chrysanthemum via denaturing gradient gel electrophoresis and substrate utilization patterns. *Applied andEnvironmental Microbiology* 64:4950-4957.

Dunn, C., Crowley, J.J., Moënne-Loccoz, Y., Dowling, D.N., de Bruijin, F.J. and r r *Pythium ultinum* by *Stenotrophomonas maltophilia* W18is mediated by an extracellular proteolytic activity. *Microbiology* 143: 3921-3931.

El Hassni, M., El Hadrami A., Daayf F., Chérif M., Ait Barka E., El Hadrami I. 2007. Biological control of bayoud disease in date palm: selection of microorganisms inhibiting the causal agent and inducing defense reactions. *Environment Experimental Botany* 59 (2): 224 234.

Elad, Y. 2000. Biological control of foliar pathogens by means of *Trichoderma harzianum* and potential modes of action.*Crop Protection* 19:709 714.

Elad, Y., and I. Chet. 1987. Possible role of competition for nutrients in biocontrol of Pythium damping off by bacteria. *Phytopathology* 77: 190-195.

El-Hassan, S.A., Gowen, S.R. 2006. Formulation and delivery of the bacterial antagonist *Bacillus* subtilis for management of lentil vascular wilt caused by *Fusarium oxysporum f. sp. lentis*.*Phytopathology* 154:148 155.

El-Naggar, M. M. A., Gomaa S., Gohar Y. M., Barakat K. I. and Soliman M. K., 2007: Bio-control of some fish pathogens using marine *Burkholderia cepacia* by-product. In the proceeding of the MEDCOAST 2007 International Conference, Vol- *Marine Biology, Chemistry and Biochemistry* - 353.

El-Tarabily, K.A., Soliman, M.H., Nassar, A.H., Al-Hassani, H.A., Sivasithamparam, K., McKenna, F. and Hardy, G.E. 2000.Biological control of Sclerotinia minor using a chitinolytic bacterium and actinomycetes.*Plant Pathology* 49: 573-583.

Ensminger, Audrey H. 1995. *The Concise Encyclopedia of Foods and Nutrition.* CRC Press

Erturk, Y., Ercisli, S., Haznedar, A. and Cakmakci, R. 2010. "Effects of Plant Growth Promoting Rhizobacteria (PGPR) on Rooting and Root Growth of Kiwi frui (*Actinidia Deliciosa* *Biological Research* 43: 91-98.

Erwin, D.C. 1981. Chemical control, p. 563-600, In M. E. Mace, *et al.*, eds. Fungal Wilt Diseases of Plants. Academic Press, New York.

Essays, UK.November 2013. Background of Rock Melon Biology Essay. Retrieved 17February 2014 from http://www.ukessays.com/essays/biology/background-of-rock-melon-biology-essay.php?cref=1.

Fan, B., Chen, X. H., Budiharjo, A., Bleiss, W., Vater, J., and Borriss, R. 2011. Efficient colonization of plant roots by the plant growth promoting bacterium *Bacillus* amyloliquefaciens FZB42, engineered to express green fluorescent protein. *Journal of Biotechnology* 151:303-311.

FAO. 2008. Food and Agriculture Organization of the United Nations. Homepage available at: www.fao.org. Accessed in: April 2011.

FAOSTAT. 2007. Statistical Databases. Retrieved 14 July 2011 from URL. http://faostat.fao.org/.

Fatima, Z., Saleemi, M. Z. I. A., Zia, M., Sultan, T., Aslam, M., Rehman, R., and Chaudhary, M. F. 2009. Antifungal activity of plant growth-promoting rhizobacteria isolates against *Rhizoctonia solani* in wheat. *African Journal of Biotechnology* 8(2): 219-225.

Feng'an Jia; Chen Liang; Chen Li; Chen WuLing. 2010. Isolation and characterization of antagonistic bacteria against three major fungal pathogens of greenhouse melon. *Acta Phytophylacica Sinica* Vol. 37 (6):505-510.

Fernàndez- Ortunõ, A., Pérez- r -Ruiz, F., Romero, D., de Vicente, A., Torés, J.A. 2006. Occurrence and distribution of resistance to QoI fungicides in populations of *Podosphaera fusca*in south central Spain.*European Journal Plant Pathology* 115:215 222.

Fernando, W. D., Ramarathnam, R., Krishnamoorthy, A. S., and Savchuk, S. C. 2005. Identification and use of potential bacterial organic antifungal volatiles in biocontrol.*Soil Biology and Biochemistry* 37(5): 955-964.

Ferrante, A., Spinardi, A., Maggiore, T., Testoni, A. and Gallina, P. 2008. Effect of nitrogen fertilization levels on melon fruit quality at the harvest time and during storage *Journal of Science Food Agriculture* 88: 707 713.

Fishal, E. M. M., Meon, S., and Yun, W. M. 2010. Induction of tolerance to Fusarium wilt and defense-related mechanisms in the plantlets of susceptible berangan banana pre-inoculated with Pseudomonas sp.(UPMP3) and Burkholderia sp.(UPMB3). *Agricultural Sciences in China* 9(8): 1140-1149.

Flaishman,MA., Eyal ZA, Zilberstein A, Voisard C, Hass D. 1996. Suppression of Septoria tritci blotch and leaf rust of wheat by recombinant cyanide producing trains of *Pseudomonas putida*.*Molecular Plant-MicrobeInteractions* 9 (Suppl 7): 642 645.

Flores, B.J., Martínez-Madrid, M.C., Sánchez-Hidalgo, F.J. and Romojaro, F. 2001. Differential rind and pulp ripening of transgenic antitense ACC oxidase melon.*Plant Physiology and Biochemistry* 39**:**37 43.

Fravel, DR. 2005. Commercialization and implementation of biocontrol. *Annual Review of Phytopathol* 43: 337 359.

Fravel, D. R. 1988. Role of antibiosis in the biocontrol of plant diseases.*Annual Review Phytopathology* 26: 75 91.

Fravel, D., Olivain, C. and Alabouvette C. 2003.*Fusarium oxysporum* and its biocontrol.*New Phytopathologist* 157:493-502.

Fukumoto, 1943. "Studies on the production of bacterial amylase. I. Isolation of bacteria secreting potent amylases and their distribution".*Journal of the Agricultural Chemical Society of Japan*, 19:487 503.

Gamliel, A., and Stapleton, J.J. 1995. Improved soil disinfestations by biotoxic volatile compounds generated from solarized organic-amended soil. *Acta Horticulturae* 382:129-137.

Gamo, M. and Shoji, T. 1999. A method of profiling microbial communities based on a most-probable-number assay that uses BIOLOG plates and multiple sole carbon sources. *Appliedand Environmental Microbiology* 65:4419-4424.

Garret, S.D. 1970.Pathogenic Root-Infecting Fungi.Cambridge University Press, London, UK.

Gaur, A. C. 1990.Phosphate solubilizing microorganisms as biofertilizers, Omega Scientific Publishers, New Delhi, p. 176.

Geiser, D. M., M. D. Jimenez-Gasco, S. C. Kang, I. Makalowska, N. Veeraraghavan, T. J. Ward, N. Zhang, G. A. Kuldau, and K. O'Donnell. 2004. FUSARIUM-ID v. 1.0: a DNA sequence database for identifying Fusarium. European Journal of Plant Pathology110:473-479.

Gerlach, W., and Nirenberg, H. 1982. The Genus Fusarium-A Pictorial Atlas Paul Parey, Berlin and Hamburg.

Getha, K., and Vikineswary, S. 2002. Antagonistic effects of Streptomyces violaceusniger strain G10 on Fusarium oxysporum f. sp. cubense race 4: indirect evidence for the role of antibiosis in the antagonistic process. *Journal of Industrial Microbiology and Biotechnology*,28(6), 303-310.

Gkargkas, K., Mamma, D., Nedev, G., Topakas, E., Christakopoulos, P., Kekos, D., and Macris, B. J. 2004. Studies on a N-acetyl- -D-glucosaminidase produced by Fusarium oxysporum F3 grown in solid-state fermentation. *Process Biochemistry* 39(11): 1599-1605.

Glick, B.R. 1995. The enhancement of plant growth by free living rhizobacteria. *Canadian journal of Microbialogy* 41:109-117.

Gomez, K.A. and Gomez, A.A. 1984. Statistical procedures for agricultural research, 2nd ed. John Wiley: New York.

Gong, M., Wang, J.D., Zhang, J., Yang, H., Lu, X.F., Pei, Y., Cheng, J.Q. 2006. Study of the antifungal ability of *Bacillus* subtilis strain PY-1 in vitro and d r *Acta Biochimica Biophysica Sinica* 38: 233 240.

Gonzalez-Mendoza, D., Argumedo-Delira, R., Morales-Trejo, A., Pulido-Herrera, A., Cervantes-Diaz, L., Grimaldo-Juarez, O., et al. 2010.A rapid method for isolation of total DNA from pathogenic filamentous plant fungi. *Genetics* a*ndMolecular Research* 9: 162 166.

Gooding, P.S., Bird, C. and Robinson, S.P.2001.Polyphenol oxidase activity and gene expression in the fruit of Goldfinger banana (AAAB, FHIA01) *INFOMUSA* 10: 17-20.

Goodman, R.N., Kiraly,Z. and Wood, K.R. 1986. *The biochemistry and Physiology of Plant Disease*. Colombia: University of Missouri Press pp 433.

Gordon,T.R. and Martyn,R.D. 1997. The evolutionary biology of *Fusarium oxysporum*.*AnnualReviewPhytopathology* 35: 111-128.

Guetsky, R., Shtienberg, D., Elad, Y., Fischer, E. and Dinoor, A. 2002.Improving biological control by combining biocontrol agents each with several mechanisms of disease suppression.*Phytopathology* 92(9): 976-984.

Gupta, V.K. and Utkhede, R.S. 1986. Factors of affecting the production of antifungal compounds by *Enterobacter aerogenes* and *Bacillus subtilis*, antagonists of *Phytophthora cactorum*.*Journal of Phytopathology* 117: 9-16.

Haas, D., Defago G. 2005. Biological Control of Soil-Borne Pathogens by Fluorescent Pseudomonads.*Nature Review of Microbiology* 3(4): 307-319.

Hall, T. A. 1999, January. BioEdit: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. In*Nucleic acids symposium series*(Vol. 41, pp. 95-98).

Hallmann, J., Rodrìguez-Kábana R., Kloepper J.W. 1998. *Chitin mediated changes* in bacterial communities of the soil, rhizosphere, and internal roots of cotton in relation to nematode control. *Soil Biology and Biochemistry* 31: 551 560.

Hammerschmidt, R. 1984. Rapid deposition of lignin on potato tuber tissues as a response to fungi non pathogenic on potato.*Physiology and Plant Pathology* 24: 33 42.

Hammerschmidt, R. and Kuc, J. 1995. *Induced Resistance to Disease in Plants*.Kluwer Academic Publishers, Dordrecht, The Netherlands, p.182.

Hammerschmidt, R., Nuckles, E.M., Kuc, J., 1982. Association of enhanced Peroxidase activity with induced systemic resistance of cucumber to *Colletotrichum lagenarium. Physiology and Plant Pathology* 20: 73 82.

Hankin, L., Zucker, M., and Sands, D. C. 1971.Improved solid medium for the detection and enumeration of pectolytic bacteria.*Applied microbiology* 22(2): 205-209.

Hansen, H.N., and Smith, R. E. 1932. The mechanism of variation in imperfect fungi: *Botrytis Cinerea. Phytopathology* 22: 953-964.

Hassi, M., David, S., Haggoud, A., El Guendouzi, S., El Ouarti, A., Ibn Souda, S., and Iraqui, M. 2012. In vitro and intracellular antimycobacterial activity of a *Bacillus pumilus* strain.African Journal of Microbiology Research. 6(10):2299-2304.

Helman, Y., Burdman, S., and Okon, Y. 2011. Plant growth promotion by rhizosphere bacteria through direct effects. In *Beneficial Microorganisms in Multicellular Life Forms* (pp. 89-103). Springer Berlin Heidelberg.

Hervas, A., Linda, B., Datnoff, L.E., Jimenez-Diaz, R.M. 1998.Effect of commercial and indigenous microorganisms on Fusarium wilt development in chickpea. *Biological Control* 13: 166 176.

Higa, T. 1991. Effective microorganisms: A biotechnology for mankind. In: Parr JF, Hornick SB, Whitman CE (Eds) Proceedings of the First International Conference on Kyusei Nature Farming. U.S. Department of Agriculture, Washington, D.C., USA.Pp.8-14.

Higa, Teruo and Kanal Anja. 1998. An Earth Saving Revolution II: *EM- Amazing application to agricultural, environmental, and medical problems*, first edition, Sunmark Publishing Inc.,Sunmark Bldg.,1-32-13, Takadanobaba, Shinjuku-ku, Tokyo, Japan. 367pp.

Higa, T. and Wididana, G.N. 1991a. The concept and theories of effective microorganisms. p. 118-124. In Parr, S.B. Hornick, and C.E. Whitman (ed.) Proceedings of the First International Conference on Kyusei Nature Farming. U.S. Department of Agriculture, Washington, D.C., USA.

Hoitink, H.A.J., Stone, A.G., Han, D.Y. 1997. Suppression of plant disease by composts.*Horticultural Science* 32: 184 187.

r r M
Determinative Bacteriology, 9th Ed.Williams and Wilkins, Baltimore, MS, USA, 1994.

Honda, M. and Kawakub, Y. 1998. Control of*Fusarium* basal rot of rakkyo *Allium chinense* by non-pathogenic *Fusarium moniliforme* and *Fusarium oxysporum*. *Soil Microorganisms* 51: 13-18.

Hopkins, D.L., Larkin, R.P.and Elmstrom, G.W. 1987.Cultivar-specific induction of soil suppressiveness to Fusarium wilt of water melon. I77:607-611.

Howell, CR. 2003. Mechanisms employed by Trichoderma species in the biological control of plant diseases: the history and evolution of current concepts. *Plant Dis* 87: 4 10

Hsieh, F.C., Lin, T.C. Meng, M. and Kao, S.S.2008.Comparing methods for identifying *Bacillus* strains capable of producing the antifungal lipopeptide iturin A.*Current Microbiol*ogy 56: 1-5.
http:// www agromasportal.com (Accessed May 2011).

Huang, CJ, Wang TK, Chung SC, Chen CY. 2005. Identification of an Antifungal Chitinase from a Potential Biocontrol Agent, *Bacilluscereus* 28-9. *Journal of Biochemistry and Molecular Biolology* 38(1): 82-88.

Huber, D.M., Andersen, A.L. and Finley, A.M. 1966. Mechanisms of biological control in a bean root rot soil. *Phytopathology* 56: 953-956.

Husen, E. 2003.Screening of soil bacteria for plant growth promotion activities in vitro.*Indonesian Journal of Agricultural Sciences*, 4 (Suppl 1): 27-31.

Ibrahim, M. D. 2005. Delivery system of Trichoderma inoculants for the control of Rhizoctonia diseases in *Brassica rapa*. PhD. Thesis Universiti Putra Malaysia.

Idriss, EE. Iglesias DJ, Talon M, Borriss R. 2007. Tryptophan-Dependent Production of Indole-3-Acetic Acid (Iaa) Affects Level of Plant Growth Promotion by *Bacillus amyloliquefaciens* Fzb42. *Molecular Plant Microbe* 20(6): 619-626.

Intana, W, Yenjit P, Suwanno T, Sattasakulchai S, Suwanno M, Chamswarng C. 2008. Efficacy of antifungal metabolites *Bacillus* spp. for controlling tomato damping-off caused by *Pythium aphanidermatum*. *Walailak Journal ofScience and Technology* 5(1):29-38.

Jaroszuk-Scisel, J., Kurek, E., Winiarczyk, K., Baturo, A., and Lukanowski, A. 2008. Colonization of root tissues and protection against Fusarium wilt of rye (Secale by nonpathogenic rhizosphere strains of *Fusarium culmorum. Biological Control* 45:297-307.

Jayaraj, J., Radhakrishnan N.V., Velazhahan R. 2006. Development of formulations of *Trichoderma harzianum* strain M1 for control of damping off of tomato caused by *Pythiumaphanidermatum.Phytopathology and Plant Protection*. 39 (1): 1 8.

Jayanth, K, Jevasekaran G, Shakila RJ. 2001.Biocontrol of fish bacterial pathogens by the antagonistic bacteria isolated from the coastal waters of Gulf of Mannar, India. *Bulletin of the European Association of Fish Patholohist* 21(1):12-18.

Jeffrey, C. 1980. Appendix.An outline classification of the Cucurbitaceae.Pages 449 463 in: D.M. Bates, R.W. Robinson, and Jeffrey, C. (Eds).Biology and utilization of the Cucurbitaceae.Cornell University Press. Ithaca, New York.

Jelaska,S. 1986. Cucurbits: In Y.P.S. Bajaj(ed) Biotechnology in Agriculture and Forestery 2. Crops i. Berlin: Springer- verlay. pp. 371-386.

Ji, G. H., Wei, L. F., He, Y. Q., Wu, Y. P. and Bai, X. H. 2008. Biological control of rice bacterial blight by *Lysobacter antibioticus* strain 13-1. *Biological control* 45(3): 288-296.

Jinantana, J. and M. Sariah. 1998. Potential for Biological Control of *Sclerotium* Foot Rot of Chilli by *Trichoderma* spp. *Pertanika Journal of Tropical Agriculture Science* 21 (1): 1-10.

Jinantana, J.and M. Sariah.1997.Antagonistic effect of Malaysian isolates of *Trichoderma hanianum* and *Gliocladiwn virens* on *Sclerotium rolfsii. Pertanika Journal of Tropical Agriculture Science* 20:35-41.

Johnson, D.W. and B. Zak. 1977. Effects of soil treatments on fungal populations and ponderosa pine seedling survival in an Oregon nursery. *Plant Disease Reporter* 61:43-47.

Johnson, L. F. and Curl, E.A. 1972. Methods for research on the ecology of soil-borne plant pathogens. Burgess Publishing Company. Pp 1-208.

Joseph, B., Patra RR, Lawrence R. 2007. Characterization of plant growth promoting rhizobacteria associated with chickpea (*Cicer arietinum L.*). *International Journal of Plant Production* 1(2): 141-151.

Juanda, J. I. H. 2005. Screening of soil bacteria for Plant Growth Promoting Activities in vitro.*Journal Agriculture Sciences* 4:27-31.

Jung, H. W., and Hwang, B. K. 2000. Pepper ge d -1, 3-glucanase is differentially expressed in pepper tissues upon pathogen infection and ethephon or methyl jasmonate treatment.*Plant Science*159 (1): 97-106.

Kalbe, C., Marten, P. and Berg, G. 1996. Strains of genus *Serratia* as beneficial rhizobacteria of oilseed rape with antifungal properties. *Microbiological Research*, 151: 433-439.

Kandhari, J., Majumder, S., Sen, B. 2000. Impact of *Aspergillus niger* AN27 on growth promotion and sheath blight disease reduction in rice. *Pest Management Science* :21 22.

Katan, T., Katan J., Gordon T. R., and Pozniak D. 1994. Physiologic races and vegetative compatibility groups of *Fusarium oxysporum f. sp. melonis in Israel.Phytopathology*, 84:153-157.

Katan, J. 1980. Solar pasteurization of soil for disease control: status and prospects. *Plant Disease* 64:450-454.

Katan, J., DeVay, J.E., 1991. Soil Solarization. CRC Press, Boca Raton, USA.

Katiyar, V, Goel R. 2004. Siderophore mediated plant growth promotion at low r r r d d *Plant Growth Regulator* 42:239 244.

r d M d r d r r d r d d d *International Journal of Pest Management* 38(4): 372-375.

Khalid, A., Arshad, M., Zahir, Z.A. and Khaliq, A. 1997. Potential of plant growth promoting rhizobacteria for enhancing wheat (*Triticum aestivum* L.) yield. *Journal of Animal and Plant Science* 7: 53-56.

Kim, G. H., Lim, M. T., Hur, J. S., Yum, K. J., and Koh, Y. J. 2009. Biological control of tea anthracnose using an antagonistic bacterium of *Bacillus subtilis* isolated from tea leaves. *Plant Pathology Journal* 25*:* 99-102.

Kim, Y.M., Farrah, S. and Baney, R.H. 2007. Structure-antimicrobial activity relationship for silanols, a new class of disinfectants, compared with alcohols and phenols. *International Journal of Antimicrobial Agents* 29: 217 222.

King, S.R., Davis, A. R., Liu, W. and Levi, A. 2008.Grafting for disease resistance.*Horticulture Science43* (6): 1673-1676.

Kleinschmidt, G.D., and Gerdemann, J.W. 1972. Stunting of citrus seedlings in fumigated nursery soils related to the absence of endomycorrhizae. *Phytopathology* 62:44753.

Kloepper, JW, Ryu C-M, Zhang S. 2004. Induced systemic resistance and promotion of plant growth by *Bacillus* spp. *Phytopathology* 94:1259 1266.

Kloepper, J., Leong, J. Teintze, M. and Schroth, M. 1980. Pseudomonas siderophores: A mechanism explaining disease-suppressive soils. *Current Microbiology* 4:317-320.

Knudsen, I.M.B., Hockenhull, J., Jensen, D.F., Gerhardson, B., Hökeberg, M., Tahvonen, R., Teperi, E., Sundheim, L. and Henriksen, B. 1997.Selection of biological control agents for controlling soil and seed-borne diseases in the field.*European Journal of Plant Pathology* 103: 775-784.

Kokkinakis, D.M and Brooks, J.L. 1979.Tomato Peroxidase Purification, characterization and catalytic properties.*Plant Physiology* 63(1):93-99.

Kroon, B.A.M., Scheffer, R.J. and Elgersma, D.M. 1991. Induced resistance in tomato plants against Fusarium wilt invoked by Fusarium oxysporum f.sp. *dianthi*. *Netherlands Journal of Plant Pathology* 97:401-408.

Kuc, J. 1982. Induced immunity to plant disease.*BioScience 3*2:854-860.

Küçük, C., H.M. Kivanc, 2005. Effect of formulation on the viability of biocontrol agent, *Tri choderma harzianum* conidia.*African Journal of Biotechnology*4: 483-486.

Lamb, R., Dixon, R.A., 1997. The oxidative burst in disease resistance.*Annual Review of Plant Physiology and Plant Molecular Biology* 48: 251 275.

Landa, B.B. l. 1997. Antagonistic Activity of Bacteria from the Chickpea Rhizosphere against *Fusarium oxysporum f.sp.ciceris.Phytoparasitica* 25(4):305-318.

Landa, B.B., Navas-Cortes, J. A. and Jimenez-Diaz, R.M. 2004. Influence of temperature on plant-rhizobacteria interactions related to biocontrol potential for suppression of Fusarium wilt of chickpea, *Plant Pathology* 53: 341 352.

Larena, I., Sabuquillo, P. Melgarejo, P. De Cal, A. 2003. Biocontrol of Fusarium and Verticillium wilt of tomato by *Penicillium oxalicum* under greenhouse d d d *Phytopathology*, 151: 507 512.

Larkin, RP. Fravel DR. 1998. Efficacy of various fungal and bacterial biocontrol organisms for control of Fusarium wilt of tomato. *Plant Disease* 82, 1022-1028.

Larkin, R.P., Hopkins,D.L. andMartin,F.N. 1996. Suppression of Fusarium wilt ofwatermelon by nonpathogenic *Fusarium oxysporum* and other microorganisms recovered from a disease-suppressive soil. *Phytopathology* 86:812-819.

Leppik, E. 1966. Searching gene centres of the genus Cucumis: Through host parasite relationship. *Euphlica* 15:323-326.

Leslie, J.F., and B.A. Summerell. 2006. The Fusarium Laboratory Manual Blackwell Publishing, Ames, Iowa.

Leyns, F., Lambert B., Joos H., and Swings J. 1990. *Antifungal Bacteria from Different Crops.*British Library Cataloguing in Publication Data.1990, 437 443.

Li, J.-G., Jiang Z.-Q., Xu L.-P., Sun F.-F., Guo J.-H. 2008. Characterization of chitinase secreted by *Bacillus cereus* strain CH2 and evaluation of its efficacy against Verticillium wilt of eggplant. *Biocontrol* 53: 931-944.

Li. ZY, Hu Y, Huang YQ, Huang. Y. 2007. Isolation and phylogenetic analysis of the biologically active bacteria associated with three South China Sea sponges. *Biomedical Life Science Microbiology* 76 (4):494- 499.

Li, ZY, Peng C, Shen Y, Miao X, Zang H, Lin H. 2008. L,LDiketopiperazines from *Alcaligenes faecalis* A72 associated with South China Sea sponge *Stelletta tenuis*. *Biochemical System Ecology* 36(3):230-234.

Lievens, K. H., van Rijsbergen, R., Leyns, F. R., Lambert, B. J., Terming, P., Swings, J., & Joos, H. J. P. 1989.Dominant rhizosphere bacteria as a source for antifungal agents.*Pesticide science*27(2):141-154.

Lira, R. and Caballero, J. 2002.Ethnobotany of the wild Mexican Cucurbitaceae. *Economic Botany* 56 (4): 380-398.

Liu, S., Weibin R, Jing L, Hua X, Jingan W, Yubao G, Jingguo W. 2008. Biological control of phytopathogenic fungi by fatty acids.*Mycopathologia* 166:93-102.

Liu, J., Zhou, T., He, D., Li, X.Z., Wu, H., Liu, W., Gao, X. 2011. Functions of lipopeptides bacillomycin D and fengycin in antagonism of *Bacillus myloliquefaciens C06* towards *Monilinia fructicola*. *Journal of Molecular Microbiology and Biotechnology* 20: 43 52.

Liu, L., Kloepper, J.W., and Tuzun, S.1995. lnduction of systemic resistance in cucumber by plant growth-promoting rhizobacteria: Duration of protection and effect of host resistance on protection and root colonization. *Phytopathology* 85:1064-1068.

Lorito, M., Peterbauer, C., Hayes, C.K., and Harman, G.E.1994. Synergistic interaction between funga1 cell wall degrading enzymes and different antifungal compounds enhances inhibition of spore germination. *Microbiology* 140: 623-629.

Lugtenberg, B., Kamilova F. 2009. Plant Growth Promoting Rhizobacteria.*Annual Review of Microbiology* 63: 541-556.

Lynch, J. M. 1983. *Microbiological Factors in Crop Productivity*.Soil Biotechnology, Blackwell Scientific Publications.

MacHardy, W. E., and Beckman, C. H. 1981. Vascular wilt fusaria: infection and pathogenesis.*Fusarium: diseases, biology, and taxonomy. The Pennsylvania State University Press, University Park*, 365-390.

Mafia,RG., Alfenas AC, Maffia LA, Ferreira EM, Binoti DHB, Mafia GMV. 2009. Plant growth promoting rhizobacteria as agents in the biocontrol of eucalyptus mini-cutting rot. *Tropical Plant Pathology* 34(1): 10-17.

Magie, R.O., and G.J. Wilfret. 1974. Tolerance of *Fusarium oxysporum f.sp. gladiolii* to benzimidazole fungicides. *Plant Disease Reporter* 58:256-259.

Majtaba,M. and Kazemi,H. 2002.Changes in Peroxidase and Polyphenol activities in susceptible and resistance wheat head inoculated with *Fusarium gramineus* and induced resistance. *Plant Science* 162: 491-498.

Makino, A., Kurosaki, K., Ohmae, M., and Kobayashi, S. 2006. Chitinase-catalyzed synthesis of alternatingly N-deacetylated chitin: A chitin- chitosan hybrid polysaccharide.*Biomacromolecules* 7(3): 950-957.

Malajczuk, N. 1983.Microbial antagonism to *Phytophthora*. In *Phytophthora its biology, taxonomy, ecology and pathology*, ed Erwin, D.C., Bartnicki-Garcia, S. and Tsao, P.H. APS Press: USA.

Manicon, B. Q., Bar-Joseph, M., Rosmer, A., Vigodsky-Haas, H and Kotze, J. M. 1987. Potential application of random DNA probes and restriction fragment length polymorphisms in the taxonomy of the *Fusaria*. *Phytopathology* 77: 669 672.

Maraite, H., and Meyer, J. A. (1971). Systemic fungitoxic action of benomyl against Fusarium oxysporum f. sp. melonis in vivo. *Netherlands Journal of Plant Pathology*,*77*(1), 1-5.

Marois, J.J. 1990. Biological control of diseases caused by Fusarium oxysporum, p. 77-81, In R. C. Ploetz, ed. Fusarium Wilt of Banana.The American Phytopathological Society, St. Paul, Minnesota.

Marois, J.J., and J.C. Locke. 1985. Population dynamics of Trichoderma viride in steamed plant growth medium. *Phytopathology* 75:115-118.

Marois, J.J., D.J. Mitchell, and R.M. Sonoda. 1981. Biological control of Fusarium crown rot of tomato under field conditions. *Phytopathology* 71:1257-1260.

Martínez-Medina, A., Roldán, A., Pascual, J.A. 2011. Interaction between arbuscular mycorrhizal fungi and *Trichoderma harzianum* under conventional and low r d d r r r d Fusarium wilt biocontrol.*Applied Soil Ecology* 47:98-105.

Martyn, R.D., Amador, J. 1987. Fusarium wilt (*Fusarium oxysporum f. sp. melonis* Race 0) of muskmelon in Texas.*Plant Disease* 71: 469.

Mathivanan, N., Kabilan, V. and Murugesan, K. 1998. Purification, characterization, and antifungal activity of chitinase from Fusarium chlamydosporum, a mycoparasite to groundnut rust, *Puccinia arachidis*. *Canadian Journal of Microbiology* 44: 646 651.

McGrath, M.T.2001. Fungicide resistance in cucurbit powdery mildew: expertise and challenges. *Plant Disease* 85:236 245.

McLafferty, F. W.; Stauffer, D. B. 1989 The Wiley/NBSR registry of Mass Spectral Data; Wiley: New York.

Mclnroy, J.A. and Kloepper, J.W. 1995.Survey of indigenous bacterial endophytes from cotton and sweet corn.*Plant Soil* 173: 337-349.

Melo, IS. 2002. Recursos genéticos microbianos. In: Melo, IS; Valadare Inglis, MC; Nass, LL; Valois, ACC. Recursos Genéticos e Melhoramento. Jaguariúna, EMBRAPA Meio Ambiente, p. 743.

Messiaen CM, Cassini R.1981. Taxonomy of *Fusarium* r d d d 445. (The Pennysylvania State University Press: University Park).

Meyer, J. A., and Maraite, H. 1971. Multiple infection and symptom mitigation in vascular wilt diseases.*Transactions of the British Mycological Society* 57(3):371-377.

Meyer, S.L.F. and Roberts, D.P. 2002. Combinations of biocontrol agents for management of plant-parasitic nematodes and soilborne plant-pathogenic fungi.*Journal of Nematology* 34: 1-8.

Mishra, K., Kumar, A., Pandey, K. 2010. RAPD based genetic diversity among different isolates of *Fusarium oxysporum f. sp. lycopersici* and their

comparative biocontrol. *World Journal of Microbiology and Biotechnology* 26: 1079 1085.

Mohamed, ETI, Yousif MT.1994. Indigenous melons (Cucumis melo L.) in Sudan: a review of their genetic resources and prospects for use as sources of disease and insect resistance. *Plant Genetic Resources Newsletter,* 138:36 42.

Monhamed, S. and Caunter, I.G. 1995. Isolation and characterization of *Pseudomonas fluorescens* strain suppressive to *Bipolaris maydis*. *Journal of Phytopathology* 143: 111-114.

Montealegre, J.R., Reyes, R. Perez, L.M. Herrera, R. Silva, P. and Besoain, X. 2003. Selection of bioantagonistic bacteria to be used in biological control of *Rhizoctonia silani* in tomato. *Electron Journal of Biotechnology* 6: 116-127.

Morpurgo, R., S.V. Lopato, R. Afza, and F.J. Novak. 1994. Selection parameters for resistance to *Fusarium oxysporum f.sp.cubense* Race 1 and Race 4 on diploid banana (*Musa acuminata* Colla). *Euphytica* 75:121-129.

Munger, H.M.1942. The possible utilization of first generation musk melon hybrid and an improved method of hybridization.Proceeding of American Society of Horticulture Science 40: 405-409.

Muslim, A.H, Horinouch,Hyakumachi,M.2003. Biological controls of Fusarium wilt of tomato with hypovirulent binucleate Rhizoctonia in green house conditions.*Mycoscience* 44:77-84.

Nair, A.; Juwarkar, A.; Singh, S. 2007.Production and characterization of siderophores and its application in arsenic removal from contaminated soil. *Water, Air, and Soil Pollution* 180(14): 199-212.

Nelson, P.E., Toussoun, T.A. and Marasas, W.F.O. 1983. Fusarium species: *An illustrated manual for identification* Pennsylvania State University Press, University Park, USA.

Nobel, PS. 1991. *Physiochemical and Environmental Plant Physiology.* Academic Press, New York.

r M r r d
Simposium Buah Buahan Kebangsaan held in Serdang- Selangor, 8-9 Apr. 1986: Proceeding edited by Chan, Y.K. Raveendranthan, P., Mahmood Z. Serdang, Mardi pp 198-205.

Nuez-Palenius, H.G., Gomez-Lim, M., Ochoa-Alejo, N., Grumet, R., Lester, L. and Cantliffe, D.J. 2008. Melon Fruits: Genetic Diversity, Physiology, and Biotechnology Features. *Biotechnology* 28: 13-55.

r r r d d
in the suppression of plant root pathogens. *Microbiology Review*56:662 676.

Okomoto, H., Sato, M., Sato, Z. and Isaka, M. 1998.Biocontrol of *Phytophthora capsici* by *Serratia marcescens* F-1-1 and analysis of biocontrol mechanisms using transposon insertion mutants.*Annual Phytopathology Society Japan* 64: 287-293.

Pan, M.J., Rademan, S., Kuner, K., and Hastings, J.W. 1997. Ultrastructural studies on the colonization of banana tissue and *Fusarium oxysporum* f. sp. *cubense* race 4 by the endophytic bacterium *Burkholderia cepacia*. *Journal of Phytopathology* 145:479 486.

Patten,CL., and Glick BR. 1996. Bacterial biosynthesis of indole-3-acetic acid.*Canadian J*ournal of *Microbiology* 42:207 220.

Patten, CL., and Glick BR. 2002. Role of *Pseudomonas putida* indole-acetic acid in development of host plant root system.*Applied Environmental Microbiology* 68:3795 3801.

Paulitz, T.C. Zhou T.and L. Rankin, 1992Selection of rhizosphere bacteria for biological control of *Pythium aphanidermatum* on hydroponically grown cucumber.*Biological Control* 2:226 237.

Pelley, J. 2002. Farmers unprepared for methyl bromide ban Environmental Science and Technology: Technology News October 16, 2002, Vol. 36. American Chemical Society.

Peng, H.X., Sivasithamparam, K. and Turner, D.W. 1999. Chlamydospores germination and Fusarium wilt of banana plantlets in suppressive and conducive soils are affected by physical and chemical factors. *Soil Biology and Biochemistry* 31:1363-1374.

Peng, M. and Kuc, J. 1992. PO generated hydrogen peroxide as a source of antifungal activity in vitro and on Tobacco leaf disk. *Phytopathology* 82:696-699.

Phae, C.G., Saski, M., Shoda, M., Kubota, H., 1990. Characteristic of *Bacillus subtilis* isolated from composts suppressing phytopathogenic micro-organisms. *Soil Science and Plant Nutrition* 36:575 586.

Piggot, P.J., Hilbert, D.W.2004.Sporulation of *Bacillus subtilis Current Opinion in Microbiology*7(6):579-586.

Pimentel, D. 1995. Amounts of pesticides reaching target pests: Environmental impacts and ethics. *Journal of Agricultural and Environmental Ethics,* 8:17-29.

Pimentel, D., L. McLaughlin, A. Zepp, B. Lakitan, T. Kraus, P. Kleinman, F. Vancini, W.J. Roach, E. Graap, W.S. Keeton, and G. Selig. 1991. Environmental and economic effects of reducing pesticide use. *BioScience,* 41:402-409.

Ploetz, R.C. 1992. Fusarium wilt of banana (panama disease). In *Plant Diseases of International Importance*, Vol. III (Eds A.N. Mukhopadhyay, H.S. Chaube, J. Kumar, and U.S. Singh), pp. 270 282. Prentice Hall, Englewood Cliffs, New Jersey.

Ploetz, R.C. 2001.Black Sigatoka of Banana.The most important disease of a most important fruit.The Plant Health Instructor.DOI:10.1094/PHI-I-2001-0126-01.

Ploetz, R.C. 2006.Fusarium-induced diseases of tropical, perennial crops. *Phytopathology* 96:648-652.

Ploetz, R.C. 2006a. Fusarium wilt of banana is caused by several pathogens referred to as *Fusarium oxysporum f.sp.cubense*. *Phytopathology,* 96:653-656.

Ploetz, R.C. 2006b. Fusarium-induced diseases of tropical, perennial crops. *Phytopathology,* 96:648-652.

Podile, AR, Laxmi VDV. 1998. Seed bacterization with *Bacillus subtilis AF1* increases Phenylalanine ammonialyase and reduces the incidence of Fusarial wilt in pigeon pea. *Journal of Phytopathol* 146:255 259.

Postma, J., Willemsen-De Klein, M. and. van Elsas, J.D. 2000. Effect of the indigenous microflora on the development of root and crown rot caused by *Pythium aphanidermatum* in cucumber grown on rockwool. *Phytopathology* 90:125- 133.

Pottorff, L.P., and S.E. Newman. 2006. Greenhouse Plant Viruses (TSWV/INSV). http://www.ext.colostate.edu/pubs/Garden/02947.html.

Priest,FG., Goodfellow M, Shute LA and Berkeley RC. 1987.*Bacillus amyloliquefaciens*sp. nov., nom. rev. International Journal of Systemic Bacteriology 37: 69 71.

Punja, ZK and Utkhede RS. 2003. Using fungi and yeasts to vegetable crop diseases. *Trends Biotechnology* 21: 400 407.

Purseglove, J.W.1986 .Tropical crops. Dicotyledon, Singapore: Longman Group Ltd. Vol 1 pp. 110-1138.

Raaijmakers, J.M., van der Sluis, I., Koster, M., Bakker, P.A.H.M., Weisbeek, P.J., Schippers, B. 1995. Utilization of heterogous siderophores and rhizosphere competence of fluorescent *Pseudomonas* spp. *Canadian Journal of Microbiology* 41: 126-135.

Rahman, M.A., Kadir, J. Mahmud, T.M.M. Abdul Rahman, R. and Begun, M.M. 2007. Screening of antagonistic bacteria for biocontrol activities on *Colletotrichum gloeosporioides* in papaya.*Asian Journal of Plant Science* 6: 12 20.

Rai,B. and Upadhyay, R.S. 2002. Compatitive saprophitc colonization of pigeon-pea substrate by Fusarium udum in relation to environmental factors, chemical treatment and microbial antagonism.*Soil Biology and Biochemistry* 15(2): 187-191.

Ramamoorthy, V., R. Viswanathan, T. Raguchander, V. Prakasam, and R. Samiyappan. 2001. Induction of systemic resistance by plant growth promoting rhizobacteria in crop plants against pests and diseases. *Crop Protection* 20:1-11.

Ramirez, C. A. and Kloepper, J. W. 2010.Plant Growth Promotion by *Bacillus* amyloliquefaciens FZB45 Depends on Inoculam Rate and P-Related Soil Properties.*Biology and Fertility of Soils* 46:835-844.

Ramos, B., García, J. A. L., Probanza, A., Barrientos, M. L. and Gutierrez Mañero, F. J. 2003. Alterations in the rhizobacterial community associated with European alder growth when inoculated with PGPR strain *Bacillus licheniformis*. *Environmental and Experimental Botany* 49: 61-68.

Rani, M. S., Lakshmi, K. V., Devi, P. S., Madhuri, R. J., Aruna, S., Jyothi, K., and Venkateswarlu, K. 2008.Isolation and characterization of a chlorpyrifos degrading bacterium from agricultural soil and its growth response.*African Journal of Microbiology Research2*: 026-031.

Ranganna, S.1977. Manual of analysis of fruit and vegetable product.Tata McGraw-Hill, New Delhi, India.

Raupach, G.S. and Kloepper, J.W. 1998. Mixtures of plant growth-promoting rhizobacteria enhance biological control of multiple cucumber pathogens. *Phytopathology* 88: 1158-1164.

Reuveni, M. Shimomoni and Z. Karachi and Z. Kue.1992. PO activity as a biochemical marker for resistance of musk melon (*Cucumis melo*) to *Pseudoperonospora cubinsis*.*Phytopathology*, 82: 749-753.

Rey, M.W., Ramaiya, P., Nelson, B.A., Brody-Karpin, S.D., Zaretsky, E.J., Tang, M., Lopez de Leon, A., Xiang, H., Gusti, V., Clausen, I.G., Olsen, P.B., Rasmussen, M.D., Andersen, J.T., Jorgensen, P.L., Larsen, T.S., Sorokin, A., Bolotin, A., Lapidus, A., Galleron, N., Ehrlich, S.D. and Berka, R.M. 2004. Complete genome sequence of the industrial bacterium *Bacillus licheniformis* and comparisons with closely related *Bacillus* species. *Genome Biology*, 5: R77.

Risser, G. Z. Banihashemi, and D.W. Davis. 1976. A proposed nomenclature of *Fusariu oxysporum f. sp.melonis* races and resistance genes in *Cucumis melo*. *Phytopathology* 66:1105-1106.

Ristaino, J.B. and Thomas, W. 1997.Agriculture, methyl bromide and the ozone hole.*Plant Disease* 81: 964-977.

Roberts, W. K., and Selitrennikoff, C. P. 1988. Plant and bacterial chitinases differ in antifungal activity.*Journal of General Microbiology*,134(1): 169-176.

Rohringer, R. and Samborski, D.J. 1967). Aromatic compounds in the host-parasite interaction. *Annual Review of Phytopathology* 5:77-86.

Rojo, F.G., Reynoso, M.M., Ferez, M., Chulze, S.N., Torres, A.M., 2007.Biological control by Trichoderma species of Fusarium solani causing peanut crown r r d r d d *Crop Protection* 26:549 555.

Rosales, A.M., Vantomme, R., Swings, J., Deley, J. and Mew, T.W. 1993. Identification of some bacteria from paddy antagonistic to several rice fungal pathogens.*Journal of Phytopathology* 138: 189-208.

Ross, I. L., Alami, Y., Harvey, P.R., Achouak, W., Ryder, M.H. 2000. Genetic diversity and biological control activity of novel species of closely related pseudomonads isolated from wheat field soils in South Australia. *Applied Environmental Microbiology* 66:1609 1616.

Rosselló-Mora, R., Amann, R. 2001.The species concept for prokaryotes.*FEMS microbiology Review* 25:39 67.

Rowe, R.C., and J.D. Farley. 1978. Control of Fusarium crown and root rot of greenhouse tomatoes by inhibiting recolonization of steam-disinfested soil with a captafol drench. *Phytopathology* 68:1221-1224.

Roy, A, Bal SS, Fergany M, *et al*. 2012. Wild melon diversity in India (Punjab State) *Genetic Resources and Crop Evolution*59:755 76.

Rückert, C., Blom, J., Chen, X., Reva, O., and Borriss, R. 2011. Genome sequence of B. amyloliquefaciens type strain DSM7T reveals differences to plant-associated *B. amyloliquefaciens* FZB42.*Journal of Biotechnology* 155:78-85.

Sabry, S. A. 1992.Microbial degradation of shrimp-shell waste.*Journal of Basic Microbiology32*(2): 107-111.

Sabuquillo, P., De Cal, A., Melgarejo, P. 2006. Biocontrol of tomato wilt by *Penicillium oxalicum* formulations in different crop conditions. *Biological Control* 37: 256 265.

Saharan BS, and Nehra V. 2011. Plant growth promoting rhizobacteria: A Critical Review. *Life Science of Medical Research* 21:1-30.

Sajitha, K.L., Florence,E.M.,and Dev, S. A. 2014.Screening of bacterial biocontrols against sapstain fungus *Lasiodiplodia theobromae Pat*.of rubberwood *Heveabrasiliensis Muell. Agri*culture*Research in Microbiology*165(7): 541-548.

Salleh, B. and Sulaiman, B. 1984.Fusaria associated with naturally diseased plants in Penang.*Journal of Plant Protection in the Tropics*1(1): 47-53.

Samuel, S. and Muthukkaruppan, S.M. 2011. Characterization of plant growth promoting rhizobacteria and fungi associated with rice, mangrove and effluent contaminated soil. *Current Botany* 2(3):22-25.

Santos,SN., Oliveira LKX, de Melo IS, da Silva Velozo E, de Abreu Roque MR 2011. Antifungal activity of bacterial strains from the rhizosphere of *Stachytarpheta crassifolia*.*African Journal of Biotechnology* 10(25): 4996-5000.

Sariah, M. 1994.Potential of *Bacillus* spp. as a biocontrol agent for anthracnose fruit rot of chilli. *MalaysianApplied Biology* 23: 53-60.

Sayyed, R.Z., Badgujar, M.D., Sonawane, H.M., Mhaske, M.M., Chincholkar, S.B. 2005. Production of microbial iron chelators (siderophores) by fluorescent pseudomonads. *Indian Journal of Biotechnology* 4:484-490.

Sayyed, R.Z., Gangurde, N.S., Patel, P.R., Joshi, S.A., Chincholkar, S.B. 2010.Siderophore production of *Alcaligenes faecalis* and its application for growth promotion in *Arachis hypogaea*.*Indian Journal of Biotechnology* 9:302-307.

Scher, F.M., and R. Baker. 1980. Mechanism of biological control in a Fusarium suppressive soil. *Phytopathology* 70:412-417.

Scher, F.M., and R. Baker. 1982. Effect of Pseudomonas putida and a synthetic iron chelator on induction of soil suppressiveness to Fusarium wilt pathogens. *Phytopathology* 72:1567-1573.

Schneider, R.W. 1984. Effects of nonpathogenic strains of Fusarium oxysporum on celery root infection by *F. oxysporum f.sp.apii* and a novel use of the Lineweaver-Burk double reciprocal plot technique. *Phytopathology* 74:646-653.

Schoch, C. L., Sung, G. H., López-Giráldez, F., Townsend, J. P., Miadlikowska, J., Hofstetter, V. and Sugiyama, J. 2009. The Ascomycota tree of life: a phylum-wide phylogeny clarifies the origin and evolution of fundamental reproductive and ecological traits. *Systematic biology*, syp020.

Schroeder, W.T., and R.Provvidenti.1969.Resistance to benomyl in powdery mildew of cucurbits.*Plant Disease Reporter*, 53:271.

Schulz, B., Christine, B., Draeger, S., Römmert.A-K.and Krohn, K. 2002. Endophytic fungi: a source of novel biologically active secondary metabolites.*Mycological Research* 106: 996-1004. doi:10.1017/S0953756202006342.

Schwyn, B., Neilands JB. 1987. Universal Chemical Assay for the Detection and Determination of Siderophores. *Analytical Biochemistry* 160(1): 47-56.

Sebastian, P., Schaefer H, Telford IRH, Renner SS. 2010. Cucumber (*Cucumis sativus*) and melon (*C. melo*) have numerous wild relatives in Asia and Australia, and the sister species of melon is from Australia. Proceedings of the National Academy of Sciences of the USA. 2010; 107: 14269 14273.

Serra-Wittling,C., Houot, S. and Alabouvette, C. 1996.Increased soil suppressiveness to Fusarium wilt of flax after addition of municipal solid waste compost.*Soil Biology and Biochemistry* 28:1207-1214.

Shali, A., Ghasemi S., Ahmadian G., Ranjbar G., Dehestani A., Khalesi N., Motallebi E., Vahed M., 2010. *Bacillus pumilus* SG2 chitinases induced and regulated by chitin, show inhibitory activity against *Fusarium graminearum* and *Bipolaris sorokiniana*. *Phytoparasitica* 38: 141 147.

Sharaf,E.F., Farraq A.A. 2004.Induced resistance in tomato plants by IAA against*Fusarium oxysporum lycopersici. Polish Journal of Microbiology*53 (2):111 116.

Sharma, A., Johri, B.N. 2003. Growth promoting influence of siderophore-producing *Pseudomonas* strains GRP3 and PRS9 in maize (*Zea mays* L.) under iron limiting conditions. *Microbiology Research* 158 (3):243-248.

Shaw,N .L ., D .J. Cantliffe , J .C . Rodriguez, S. Taylor and D .M. Spenser .2000. Beit alpha cucumber and exciting new greenhouse crop.*Proceeding Florida State Horticultural Society* 113:247-253.

Siddiqui, I.A., Shaukat, S.S., Hussain Sheikh, I., Khan, A. 2006.Role of cyanide production by *Pseudomonas fluorescens* CHAO in the suppression of root-knot nematode, *Meloidogyne javanica* in tomato. *World Journal of Microbiology and Biotechnology* 22:641-650.

Simmonds, N.W. 1966. Bananas. 2nd edition.Longmans. London. 512 pp.

Singh,JS., Pandey VC, Singh DP. 2011. Efficient Soil Microorganisms: A New Dimension for Sustainable Agriculture and Environmental Development. *AgriculturalEcosystem Environment* 140(3-4): 339-353.

Singh, J. S., and Singh, D. P. 2013. Plant Growth Promoting Rhizobacteria (PGPR): Microbes in Sustainable Agriculture.In*Management of Microbial Resources in the Environment* (pp. 361-385).Springer Netherlands.

Smit, E., P. Leeflang, B. Glandorf, J. Dirk van Elsas, and K. Wernars. 1999. Analysis of review of 10-year study. *Agronomie* 6:273-284.

Smith, S.N., and W.C. Snyder. 1971. Relationship of inoculum density and soil types to severity of Fusarium wilt of sweet potato. *Phytopathology* 61:1049-1051.

Sn M r r M d r
systematic bacteriology, vol 2. Williams and Wilkins: Baltimore.

Sneh, B., Pozniak, D., and Salomon, D. 1987. Soil suppressiveness to Fusarium wilt of melon, induced by repeated croppings of resistant varieties of melons.*Journal of Phytopathology* 120(4): 347-354.

Snyder, W.C., and Hansen, H.N. 1940. The species concept in Fusarium. American *Journal of Botany,* 27:64-67.

Soriano-Martin, M.L., Porras-Piedra, A., Porras-Soriano, A., 2006.Use of microwaves in the prevention of *Fusarium oxysporum f. sp. melonis* infection during the commercial production of melon plantlets.*Crop Protection,* 25: 52 57.

Soylu, E.M., Soylu, S. and Kurt, S. 2005. Antimicrobial activities of the essential oils of various plants against tomato late blight disease agent *Phytophthora infestans.Mycopathologia* 161: 119-128.

Spadaro, D.and Gullino ML. 2005.Improving the efficacy of biocontrol agents against soil borne pathogens.*Crop Protection* 24: 601 613.

Spence, J. 2001. Plant histology. In *Plant Cell Biology: practical approach*, ed Hawes, C. and Satiat-Jeunemaitre, Oxford University Press: Oxford.

Sticker-Mani, B., Métraux JP.1997. Systemic acquired resistance. *Annual Review of Phytopathology* 35:235 270.

Suárez-Estrella, F., Vargas-Garcia, C., Lopez, C.M.J., Capel, J.M., 2007. Antagonistic activity of bacteria and fungi from horticultural compost against *Fusariumoxysporum f. sp. melonis. Crop Protection* 26:46 53.

Subba Rao, N.S. 1999. Soil microbiology.4th edition. Science Publishers, Inc.: U.S.A. Pp. 277-297.

Summerell, B.A., Salleh, B. and Leslie, J.F. 2003.A utilitarian approach to identifying *Fusarium* species.*Plant Disease* 87:117-128.

Syed Mohmed, S.I. 1992. Effect of Paclobutrazol Fertilizer and planting density on yield of muskmelon.In symposium of intensification of research priority Area. Kementerian Sains, Technology dan Alam Sekiter. Kuala Lampur. Pp.225-229.

Szafranska, K.; Fusari, F.; Luongo, L.; Ferrarini, A.; Polverari, A.; Delledonne, M.; Ficcadenti, N.; Sestili, S.; Belisario, A. 2008. Fusarium wilt infection in melon: a transcriptomic approach to characterize the genetic dialogue between host and pathogen. Book chapter; Conference paper: Cucurbitaceae. Proceedings of the IXth EUCARPIA meeting on genetics and breeding of cucurbitaceae, Avignon, France, 21-24 May 2008. pp. 615-620

Tamietti, G., and D. Valentino. 2006. Soil solarization as an ecological method for the control of Fusarium wilt of melon in Italy. *Crop Protection* 25:389-397.

Tamietti, G., L. Ferraris, A. Matta, and I. Abbattista Gentile. 1993. Physiological responses of tomato plants grown in Fusarium suppressive soil. *Journal of Phytopathology* 138:66-76.

Tamura, K., Peterson D, Peterson N, Stecher G, Nei M, and Kumar S. 2011. MEGA5: Molecular Evolutionary Genetics Analysis using Maximum Likelihood, evolutionary Distance, and Maximum Parsimony Methods. *Molecular Biology and Evolution* 28: 2731-2739.

Tarig, E.A.S. 2003.Induced resistance using non pathogenic *Fusarium oxysporum* for biological control of banana Fusarium wilt. PhD thesis .Universiti Putra Malaysia.

r r d d r
r d r d r dr
and seed treatments.Assiut Univ. *Bulletin of Environmental Research* 7:47 63.

Tello, J. C., and Lacasa, A. 1988. [Foot and root rot caused by Fusarium oxysporum f. sp. radicis-lycopersici, a new disease in the Spanish tomato (Lycopersicum esculentum Mill.) culture]. *Boletin de Sanidad Vegetal. Plagas (Spain).*

Tian, B., Yang J and Zhang KQ 2007 Bacteria used in the biological control of plant-parasitic nematodes: populations, mechanisms of action, and future prospects. FEMS *Microbiology and Ecology*, 61: 197 213.

Tian, S. 2002. The Research of Biodiversity of Phosphate-Solubilizing and Nitrogen Fixing Bacteria Between Two Kinds of Soil Ecosystems. Chinese Agriculture University. pp. 17 18.

Tiedje, J.M., S. Asuming-Brempong, K. Nüsslein, T.L. Marsh, and S.J. Flynn. 1999. Opening the black box of soil microbial diversity. *Applied Soil Ecology* 13:109-122.

Tilak, KVBR, Ranganayaki N, Pal KK, Saxena AK, Nautiyal CS, Mittal S, Tripathi
r r r d r
r *Current Science* 89: 136-150.

Toyota, K., and Kimura, M. 1993. Colonization of chlamydospores of *Fusarium oxysporum f. sp.raphani* by soil bacteria and their effects on germination. *Soil Biology and Biochemistry 25*(2): 193-197.

Toyota, K., and Kimura, M. (1993). Colonization of chlamydospores of *Fusarium oxysporum* f. sp. *raphani* by soil bacteria and their effects on germination. *Soil Biology and Biochemistry*, *25*(2), 193-197.

Tripathi, CKM., Bihari V, Tyag RD. 2000. Microbial production of Damino acids. *Process Biochemistry* 35: 1247-1251.

Tripathi, C. K. M., Bihari, V., and Tyagi, R. D. (2000). Microbial production of D-amino acids. *Process Biochemistry*, 35(10), 1247-1251.

USDA. 1980. *Agricultural Statistics 1980* US Government Printing Office, Washington, DC.

Vaidya, RJ., Shah IM, Vyas PR, Chhatpar HS. 2001. Production of chitinase and its optimization from a novel isolate *Alcaligenes xylosoxydans*: potential antifungal biocontrol. *World Journal of Microbiology and Biotechnology* 17:62-69.

Validov,S., Mavrodi,O., De La Fuente,L., Boronin,A., Weller,D., Thomashow,L., and Mavrodi,D. 2005. Antagonistic activity among 2,4-diacetylphloroglucinol-producing fluorescent Pseudomonas spp. *FEMS Microbiology Letters* 242: 249-256.

Van der Plank, JE. 1963. Plant Diseases: Epidemics and Control. Academic Press, New York.

Van Dijk,K. and Nelson, E.B. 2000. Fatty acid competition as a mechanism by which *Enterobacter cloacae* suppresses*Pythium ultimum* sporangium germination and damping-off. *Applied Environmental Microbiology* 66: 5340 5347.

Van Peer, R., Niemann, G.J. and Schippers, B. 1991. Induced resistance and phytoalexin accumulation in biological control of Fusarium wilt of carnation by Pseudomonas sp. Strain WCS 417 r. *Phytopathology* 81:728-734.

Vassilev, N., Vassileva M, Nikolaeva I. 2006. Simultaneous p-solubilizing and biocontrol activity of microorganisms: potential and future trends. *Applied Microbiology and Biotechnology* 71:137 144.

Vidhyasekaran, P. and M. Muthuamalin. 1999. Evaluation of powder formulation of *P. fluorescens* Pf 1 for control of rice sheath blight. *Biocontrol Science and Technology* 9: 67-74.

Villanueva,MJ., Tenorio MD, Esteban MA, Mendoza MC.2004. Compositional changes during ripening of two cultivars of muskmelon fruits. *Food Chemistry* 87: 179185.

Villora, G., Moreno, D. A., Pulgar, G. and Romero, L. 1999. Zucchini growth, yield and fruit quality in response to sodium chloride stress. *Journal of Plant Nutrition* 22(6):855 861.

d M r r r
relationship study of oxygenated aromatic essential oil compounds using data structuring and PLS regression analysis. *Journal of Molecular Modeling* 10: 76-84.

Wada, T.2005. Biofungicides, beginning to see the light? In: Tsuchiya K, Tsushima S (eds) Function of microorganism as a biocontrol agent and its extension. *Phytopathological Society of Japan* pp 1 15

Walker, R., Emsile, K.A. and Allan, E.J. 1996. Bioassay methods for the detection of antifungal activity by *Pseudomonas antimicrobica* against the grey mould pathogen *Botrytis cinerea*. *Journal of Applied Bacteriology* 81: 531-537.

Walter, J.F. and Bruette, T. 1997. A comparison of two microbial biocontrol agents to control zinna damping-off, 1996. In *Biological and Cultural Tests for Control of Plant Diseases*, ed Canaday, C.H., vol. 12. APS Press: St Paul. Pp. 74.

Walter, M. Yuan and I. Don Crawford. 1995. Characterization of *Streptomyces lydicus* WYEC 108 as a potential biocontrol agent against fungal root and seed rots. Applied and Environmental Microbiology 61(8): 3119-3128.

Wang, B., Brubaker, CL., Tate, W., Woods,MJ., Mathesonm BA, Burdon JJ. 2006. Genetic variation and population structure of *Fusarium oxysporum f.sp. vasinfectum* in Australia. *Plant Pathology* 55: 746 755.

Wang, Q., Xie, S. 2012. Isolation and characterization of a high-efficiency soil atrazine-degrading *Arthrobacter sp*strain.*International Biodeterioration Biodegradation,*71: 61 66.

Wehner, T. C.andMaynard, D. N. 2003. Cucurbitaceae (vine crops) *eLS*. Wei, G., Kloeper,J.W. and S. Tuzun. 1996. Induced systemic resistance to cucumber diseases and increased plant growth by plant growth-promoting rhizobacteria under field conditions. *Phytopathology* 86:221-224.

Weller, D.M. 1988. Biological control of soil borne plant pathogens in the rhizosphere with bacteria.*Annual Review of Phytopathology*, 26: 379-407.

Weller, D.M., Raaijmakers, J.M. Gardener, B.B.M. and L.S. Thomashow. 2002. Microbial populations responsible for specific soil suppressiveness to plant pathogens. *Annual Review of Phytopathology*, 40:309-348.

Whipps, J.M. 1997.Developments in the biological control of soil-borne plant pathogens.*Advances in Botanical Research*, 26: 131-134.

Whipps, J.M. 2001.Microbial interactions and biocontrol in the rhizosphere.*Journal of Experimental Botany* 52: 487-511.

White, TJ, Bruns T, Lee S, Taylor J.1990. Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. In: PCR Protocols: a guide to methods and applications. (Innis MA, Gelfand DH, Sninsky JJ, White TJ, ed). Academic Press, New York, USA: 315 322.

Woo,C. J., and Park, H. D. 2003. An extracellular *Bacillus* sp. chitinase for the production of chitotriose as a major chitinolytic product. *Biotechnology letters 25*(5): 409-412.

Yang, J.H., Liu, H.X., Zhu, G.M., Xu, L.P., Pan, Y.L., Guo, J.H., 2008. Diversity analysis of antagonists from rice associated bacteria and their application in biocontrol of rice diseases. *Journal of Applied Microbiology* 104 91 104.

Yasmeen Siddiqui. 2006. Bio-efficiency of compost extracts for the control of choanephora wet rot of okra (*Abelmoschus esculentus*. L). Ph.D. Thesis, University Putra Malaysia.

Yasmin, F., Othman, R., Sijam, K., and Saad, M. S. 2010. Characterization of beneficial properties of plant growth-promoting rhizobacteria isolated from sweet potato rhizosphere. *African Journal of Microbiology Research 3*(11): 815-821.

Yates, S., J. Gan, and S. Papiernik. 2003. Environmental fate of methyl bromide as a soil fumigant, p. 45-122, In G. W. Ware, ed. Reviews of Environmental Contamination and Toxicology, Vol. 178, 1 ed. Springer, New York.

Yiu-Kwok, C., Wayne, A. M. and Keith, A. S. 2003.Characterization of antifungal soil bacterium and its antagonistic activities against Fusarium species. *Canadian Journal of Microbiology* 49: 253-262.

Yoshida, S., Hiradate, S., Tsukamoto, T., Hatakeda, K., Shirata, A. 2001. Antimicrobial Activity of Culture Filtrate of *Bacillus Amyloliquefaciens*Rc-2 Isolated from Mulberry Leaves. *Phytopathology* 91(2): 181-187.

Yousif, F. Mohamed, Gasim, A. Dafalla and Sadig, K. Omara. 1994. Races of *Fusarium oxysporumf. sp.melonis* Causing Wilt of Melons in Central Sudan. *Cucurbit Genetics Cooperative Report* 17:66-68.

Yu, XM, Ai CX, Xin L, Zhou, GF 2011. The Siderophore Producing Bacterium, *Bacillus* Subtilis Cas15, Has a Biocontrol Effect on Fusarium Wilt and Promotes the Growth of Pepper. *European Journal of Soil Biology* 47(2): 138-145.

Yu,G.Y., J.B. Sinclair, G.L. Hartman, B.L. Bertagnolli. 2002. Production of iturin A by*Bacillus amyloliquefaciens*suppressing*Rhizoctonia solani. Soil Biology and Biochemistry* 34:955 963.

Zahir, I., Houari, A., Bahafid, W., Iraqui, M., and Ibnsouda, S. 2013. A novel *Alcaligenes faecalis* antibacterial-producing strain isolated from a Moroccan tannery waste.*African Journal of Microbiology Research* 7(47): 5314-5323.

Zaitlin, M. and Hull, R. 1987. Plant virus host interactions.*Annual Review of Plant Physiology*, 38: 291 315.

Zaiton, S., M. Sariah, M. and M. A. Zainal Abidin. 2008. Effect of endophyticbacteria on growth and suppression of Ganoderma infection in oil palm. *International Journal of Agriculture and Biology* 10:127-132.

Zhao, Q., Shen, Q., Ran, W., Xiao, T., Xu, D. and Xu, Y. 2011. "Inoculation of Soil by *Bacillus* Subtilis Y-IVI Improves Plant Growth and Colonization of the Rhizosphere and Interior Tissues of Muskmelon (Cucumis melo L.)," *Biology and Fertility of Soils* 47: 507-514.

Zitter, T. A. 1998. Vegetable crops: Fusarium diseases of cucurbits fact sheet. *Department of plant pathology.Cornell University. New York*.

Zhu, Z., Zhang, G., Luo, Y., Ran, W., Shen, Q., 2012. Production of lipopeptides by *Bacillus* amyloliquefaciens XZ-173 in solid state fermentation using soybean r d r r r *Bioresources Technology* 112: 254 260.

Zulkarami B., Ashrafuzzaman M., Mohd Razi I (2010) Morpho-physiologicalgrowth, yield and fruit quality of rock melon as affected by growing media and electrical conductivity. J Food, Agric Environ 8: 249 252.