UTILIZATION OF SOME SOIL MICRO-ORGANISMS FOR MANAGEMENT OF ROOT-KNOT NEMATODES ON CUCUMBER PLANTS

By

HANAN MOHAMED ZAKARIA

B.Sc. Agric. Sc. (General Branch), Zagazig University, 1996

M. Sc. Agric. Sc. (Plant Pathology), Ain Shams University, 2006

A thesis submitted in partial fulfillment

of

the requirements for the degree of

DOCTOR OF PHILOSOPHY
in
Agricultural Science
(Plant Pathology)

Department of Plant Pathology

Faculty of Agriculture

Ain Sham University

2012

Approval Sheet

UTILIZATION OF SOME SOIL MICRO-ORGANISMS FOR MANAGEMENT OF ROOT-KNOT NEMATODES ON CUCUMBER PLANTS

By

HANAN MOHAMED ZAKARIA

B.Sc. Agric. Sc. (General Branch) , Zagazig University , 1996

M. Sc. Agric. Sc. (Plant Pathology) , Ain Shams University , 2006

The thesis for Ph. D. degree has been approved by:

Dr. Samia Ibrahem Massoud ……..

Prof. Emeritus of Plant Pathology and Nematology , Faculty of Agriculture , Suez Canal University

Dr. Mohamed Nagy Shatla ……...

Prof. Emeritus of Plant Pathology , Faculty of Agriculture , Ain Shams University

Dr. Abdalla Shehata Mohammed Kassab ……

Prof. Emeritus of Agricultural Zoology , Faculty of Agriculture , Ain Shams University

Dr. Madih Mohamed Aly .....

Prof. Emeritus of Plant Pathology , Faculty of Agriculture , Ain Shams University

Date of Examination: 25/6/2012

استخدام بعض ميكروبات التربة في مكافحة نيماتودا تعقد الجذور على نباتات الخيار

رسالة مقدمة من

حنان محمد زكريا

بكالوريوس علوم زراعية (شعبة عامة) ، جامعة الزقازيق ، 1996

ماجستير علوم زراعية (أمراض نبات) ، جامعة عين شمس ، 2006

للحصول على

درجة دكتور فلسفه في العلوم الزراعية
(أمراض نبات)

قسم أمراض النبات

كلية الزراعة

جامعة عين شمس

2012

صفحة الموافقة

إستخدام بعض ميكروبات التربه في مكافحة نيماتودا تعقد الجذور على نباتات الخيار

رسالة مقدمة من

حنان محمد زكريا

بكالوريوس علوم زراعية (شعبة عامة) ، جامعة الزقازيق ، 1996

ماجستير العلوم الزراعيه (أمراض نبات) ، جامعة عين شمس ، 2006

للحصول على

درجة دكتور فلسفة في العلوم الزراعية

(أمراض نبات)

وقد تمت مناقشة الرسالة والموافقة عليها

اللجنـــــــة:

د. سامية إبراهيم مسعود .....

أستاذ أمراض النبات والنيماتودا المتفرغ، كلية الزارعة، جامعة قناة السويس

د. محمد ناجي شتلة .....

أستاذ أمراض النبات غير المتفرغ، كلية الزراعة، جامعة عين شمس

د. عبد الله شحاته محمد كساب .....

أستاذ الحيوان الزراعي المتفرغ، كلية الزارعة، جامعة عين شمس

د. مديح محمد علي .....

أستاذ أمراض النبات المتفرغ، كلية الزارعة، جامعة عين شمس

تاريخ المناقشة 2012/6/25

UTILIZATION OF SOME SOIL MICRO-ORGANISMS FOR MANAGEMENT OF ROOT-KNOT NEMATODES ON CUCUMBER PLANTS

By

HANAN MOHAMED ZAKARIA

B.Sc. Agric. Sc. (General Branch) , Zagazig University , 1996

M. Sc. Agric. Sc. (Plant Pathology) , Ain Shams University , 2006

Under the supervision of:

Dr. Madih Mohamed Aly
Prof. Emeritus of Plant Pathology, Department of Plant Pathology, Faculty of Agriculture, Ain Shams University (Principal Supervisor)

Dr. Abdalla Shehata Mohammed Kassab
Prof. Emeritus of Agricultural Zoology , Department of plant protection Faculty of Agriculture , Ain Shams University

Dr. Muhammad Shamseldean Mostafa Shamseldean
Prof. of Entomology , Department of Zoology and Agricultural Nematology , Faculty of Agriculture , Cairo University

Dr. Mona Mansour Mahmoud Oraby
Associate Prof. of Microbiology , Department of Microbiology , Faculty of Agriculture , Ain Shams University

ABSTRACT

Hanan Mohamed Zakaria: Utilization of Some Soil Microorganisms for Management of Root-knot Nematodes on Cucumber plants Unpublished Ph. D. Thesis, Department of Plant Pathology, Faculty of Agriculture, Ain Shams University, 2012.

Isolation and identification trials of fungal bio-agents resulted in five isolates of *Trichoderma* spp. and two isolates of *Verticillium* spp. The most effective isolates on percentage mortality and hatching of *Meloidogyne incognita* were identified as *T. harzianum* and *V. chlamydosporium*. Effects of all forms of propagules suspension and culture filtrate were increased by increasing the concentration and incubation period. Two obtained isolates of entomopathogenic nematodes-symbiotic bacteria, *Photorhabdus luminescens* and *Xenorhabdus hominickii* showed high efficiency on mortality and hatching of *M. incognita*. Temperatures regimes and storage periods had a great effect on the shelf life of culture filtrates of *P. luminescens*. Longevity of the chlamydospores of *V. chlamydosporium* was able to persist for 6 months in two forms of formulations, alginate granules and vermiculite paste, which were the most suitable forms. The effect of stored formulated products of *V. chlamydosporium* on mortality and hatching of *M. incognita* was gradually decline by increasing the period of storage, especially under room temperature.

Results from pot experiments revealed that, *V. chlamydosporium*(10^7) + CF of *P. luminescens* caused a decreasing number of galls, females, egg-masses and immature stages per root system and number of IJ_2 in soil and total number of nematodes. Moreover, the same treatment caused a significant positive effect on the high vegetative growth of cucumber plants. All treatments with the various formulated products of *V. chlamydosporium* mixed with kaolin powder, alginate

granule or vermiculite paste resulted a significant reduction in nematode infection parameters compared with control. Also, all treatments resulted an improvement in the high vegetative growth.

Simulated field studies showed the greatest role of the soil treatment with *V. chlamydosporium* and *P. luminescens* (alone or in combination) compared to nematicide treatment with Oxamyl 24% SL, in controlling of root-knot nematode *M. incognita* in cucumber plants. When the soil was applied with *V. chlamydosporium* + *P. luminescens* joining with animal compost (AC), caused the highest reduction effect on all nematode infection criteria followed by the treatment with *P. luminescens* + AC compared with control. All soil treatments with *V. chlamydosporium*, *P. luminescens* and soil different soil amendments (alone or in combination) caused an improvement in top vegetative growth compared with control.

Key Words: Biological control, Nematophagous fungi, *Trichoderma harzianum*, *Verticillium chlamydosporium*, *Photorhabdus luminescense*, *Xenorhabdus* hominickii, Soil amendments *Meloidogyne incognita*.

ACKNOWLEDGMENT

I am highly thankful to Prof. Dr. Madih M. Aly, for his supervision, valuable scientific help, kind advice, valuable discussions during the tenure of investigation and for his assistance in finalizing data, preparing and writing the manuscript.

Deeply thanks to Prof. Dr. Abdalla Shehata Kassab, for his supervision, valuable scientific help, valuable discussions and encouragement during the tenure of investigation and for his assistance in finalizing data, preparing and writing the manuscript.

Whole thanks to Prof. Dr. Muhammad. M. Shamseldean, for his supervision, valuable scientific help, gracious help, useful suggestion and encouragement during the progress of this study and writing the manuscript.

Thanks also due to Dr. Mohamed Youssef Banora, for his valuable scientific help during finalizing data, preparing and writing the manuscript.

I am also thankful Dr. Mona Mansour Oraby, for her supervision and valuable scientific help.

I am also thankful Dr. Emad EL dien Y. Mahmoud, Associate Professor of Plant Pathology, Institute of Plant Pathology, Agriculture Research Center, Giza, Cairo, for his valuable scientific help during the subjection of experimental data to statistical analysis.

Whole hearted thanks for my family for their gracious help and encouragement. Really I am feeling fully indebted to them.

Thanks are also extended to all friends and colleagues in Department of Plant Pathology, Faculty of Agriculture, Ain Shams University and in Department of Zoology and Agricultural Nematology, Faculty of Agriculture, Cairo University for their valuable assistance.

CONTENTS

LIST OF TABLES