CHARACTERIZATION OF SOME EXTRACTED MICROBIAL METABOLITES APPLIED IN BIOLOGICAL CONTROL PROGRAMS

By

OMNIA MOUSTAFA MOHAMED

B.Sc. Agric. Sci. (Biotechnology), Fac. Agric., Cairo Univ., 2003
M.Sc. Agric. Sci. (Agric. Microbiology), Fac. Agric., Cairo Univ., 2012

THESIS

Submitted in Partial Fulfillment of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

In

Agricultural Sciences

(Agricultural Microbiology)

Department of Microbiology
Faculty of Agriculture
Cairo University
EGYPT

2020

Name of Candidate: Omnia Mostafa Mohamed El-Sayed **Degree:** Ph.D

Title of Thesis: Characterization of some extracted microbial metabolites applied in biological control programs.

Supervisors: Dr. Hussein Emam Makboul
Dr. Mona Hussein Sayed Badawi
Dr. Rania Abdo Abdo Hussein

Department: Agricultural Microbiology **Date:** / /

ABSTRACT

The associated fungi were isolated from the roots and fruits of tomato plants from two Governorates *i.e*. Qaliubiya and Banisweif. The isolated fungi were identified as follows, *F. solani*, *F. oxyspoum*, *F. semitectum*, *R. solani*, *S. rolfsii* and *B. cinerea*. The efficacy of three bacterial strains used in biological control were tested against phytopathogenic fungi, these strains were *P. fluorescens*, *S. marcescens* and *B. velezensis*. Bacterial strains effectively inhibited the mycelium growth of all fungi in dual culture test. Also, the culture filtrate at different concentrations reduced the mycelium growth except in case of *B. velezensis* and *P. fluorescens* against *R. solani* and *S. rolfsii*. The culture filtrate at EC_{50} concentration was effective in reducing the total contents of soluble sugars, free amino acids, total proteins and enzymes activities produced by the phytopathogenic fungi. Some compounds were extracted from the filtration of bacterial cultures that showed the highest efficacy in the results against the phytopathogenic fungi. The culture filtrate of *P. fluorescens* was extracted with ethyl acetate solvent and tested for its efficacy against the phytopathogenic fungi. The crude extract from *P. fluorescens* at 100 mg ml^{-1} completely inhibited *F. oxysporum* and *S. rolfsii* and purified by column puriflash and re-tested for antifungal activity. The major compound in the crude extract was characterized by TLC, mass spectrometry and FTIR. All analysis confirms that the antifungal compound in the crude extract is pyrrolnitrin. The prodigiosin pigment was also extracted from *S. marcescens* and purified by the column puriflash and also characterized by TLC, mass spectrometry and FTIR and the pigment was evaluated against pathogenic fungi at different concentrations and the most influenced fungi were the fungi *Botrytis cinerea* followed by *Rhizoctonia solani*. Previous bacterial isolates, filtrates of their bacterial cultures and the compounds extracted from them were all tested against Root-knot nematode *Meloidogyne incognita*, which showed a significant reduction in the number of nematodes under *in vitro* studies. The efficiency of bacterial cultures and their filtrates has also been tested on tomato plants after infection with pathogenic fungi, as well as root-knot nematodes. The treatment has led to most treatments reducing the incidence of pathogenic fungi and nematode-rooted root, as well as increased fresh, dry weights and lengths of tomato plants and the treatments have also led to a reduction in total phenol production and the enzymes of phenol oxidase and poly phenol oxidase for tomato plant leaves.

Key words: Biological control, phytopathogenic fungi, microbial metabolites, root-knot nematode.

CONTENTS

LIST OF TABLES

LIST OF FIGURES