STUDIES ON THE INTERACTION BETWEEN PHYLLOSPHERE MICROFLORA AND *HELMINTHOSPORIUM* SP. THE CAUSAL ORGANISM OF MAIZE LEAF SPOTS AND BLIGHTS

By

ABD-EL-RAHMAN ESSA ABD-EL-NABY
B.Sc. Agric. Sci. (Plant Pathology), Fac. Agric., Zagazig Univ., Egypt, 1992.

THESIS
Submitted in Partial Fulfillment of the Requirements for the Degree of

Master of Science

In

Agricultural Sciences
(Microbiology)

Department of Agricultural Microbiology
Faculty of Agriculture
Cairo University
EGYPT

2008

APPROVAL SHEET

STUDIES ON THE INTERACTION BETWEEN PHYLLOSPHERE MICROFLORA AND *HELMINTHOSPORIUM* SP. THE CAUSAL ORGANISM OF MAIZE LEAF SPOTS AND BLIGHTS

M.Sc. Thesis
By

ABD-EL-RAHMAN ESSA ABD-EL-NABY
B.Sc. Agric. Sci. (Plant Pathology), Fac. Agric., Zagazig Univ., Egypt, 1992.

Approved by:

Dr. ABDOU MAHDY MOHAMED MAHDY……...
Professor of Agric. Plant Pathology, Fac. Agric., Benha University.

Dr. MOHAMED ABDEL-ALIM ALI ……..
Associate Professor of Agric. Microbiology, Fac. Agric., Cairo University.

Dr. MOHAMED ZAKARIA SEDIK ……..……
Professor of Agric. Microbiology, Fac. Agric., Cairo University.

Date: / /2008

SUPERVISION SHEET

STUDIES ON THE INTERACTION BETWEEN PHYLLOSPHERE MICROFLORA AND *HELMINTHOSPORIUM* SP. THE CAUSAL ORGANISM OF MAIZE LEAF SPOTS AND BLIGHTS

M.Sc. Thesis
By

ABD-EL-RAHMAN ESSA ABD-EL-NABY
B.Sc. Agric. Sci. (Plant Pathology), Fac. Agric., Zagazig Univ., Egypt, 1992.

SUPERVISION COMMITTEE

Dr. MOHAMED ZAKARIA SEDIK
Professor of Agric. Microbiology, Fac. Agric., Cairo University.

Dr. GALAL MAHMOD KHALAF-ALLAH
Professor of Agric. Microbiology, Fac. Agric., Cairo University.

Dr. ALI ZEIN EL-ABEDEEN MOHAMED
Head Researcher of Plant Pathology,
Plant Pathol. Res. Instit, Agric. Res. Center, Giza, Egypt

Name of Candidate: Abd-El-Rahman Essa Abd-El-Naby **Degree:** M.Sc.
Title of Thesis: Studies on The Interaction Between Phyllosphere Microflora and *Helminthosporium* sp. The Causal Organism of Maize Leaf Spots and Blights
Supervisors: Dr. Mohamed Zakaria Sedik, Dr. Galal Mahmod Khalaf-Allah and Dr. Ali Zein El-Abedeen Mohamed
Department: Agricultural Microbiology **Approval: / /2008**

ABSTRACT

Corn (*Zea mays* L.) is one of the most important cereal crops all over the world. Leaf blight disease caused by *Helminthosporium turcicum* is an important foliar disease of maize in temperate areas of the world. Seven strains, obtained from 7 governorates in Egypt, tested against two maize cultivars, Three Way Cross 320 (resistant) and Giza 2 (susceptible), varied in their virulence with strain No. 6 being the most aggressive.

Twelve maize hybrids were evaluated for resistance reaction to *H. turcicum* in greenhouse at Giza Experimental Station under artificial infection and in Nubariya Experimental Station under natural infection. Three Way Cross (TWC) 310 was susceptible and TWC 321 was resistant.

Counts of bacteria, actinomycetes, fungi and spore-formers isolated from, phyllosphere of TWC 321 were higher than those from TWC 310. Out of 299 microbial isolates (232 bacteria, 44 actinomycetes and 23 fungi), 163 were proved to be antagonistic against *H. turcicum* **(**126 bacteria, 37 actinomycetes) The isolated fungi have no antagonistic activity.Different concentrations of both bioagents (*Bacillus* sp. No. 9 and *Streptomyces* sp. No. 5) filtrates "singly or in combination" showed different antagonistic reaction against *H. turcicum* with the mixture (1:1 v/v) being the best followed by *Bacillus* sp. and *Streptomyces* sp. respectively.

All concentrations of natural plant oils under test significantly reduced the mycellial growth of *H. turcicum* with different inhibition zones. El-Kanz2000 (1.0 %) is being the best effective treatment followed in descending order by Garlic oil (0.2 %), Jojoba oil (1.5 %), and Castor oil (4.0 %). Control materials showed the highest effect on leaf blight disease incidence under greenhouse conditions at Giza and field conditions at Sakha Experimental Station when they were applied simultaneously followed by both applications (72h. before and 72h. after) *H. turcicum* treatment. Minimum disease incidence and maximum crop yield were achieved under natural infection in Nobariya, when each control treatments were sprayed three times at 45, 60 and 75 days of sowing during 2004 and 2005 growing seasons. With superiority of the mixture of *Bacillus* sp. and *Streptomyces* sp. (1:1 v/v) after the chemical fungicide. Castor oil recorded the least effect.

Key words: Maize, *Helminthosporium*, Bioagents, natural plant oils, *Bacillus*.

DEDICATION

I dedicate this work to whom my heart felt thanks; my parents and my family, especially my dear wife, my lovely son Hamza and my lovely daughter Samar for their patience and help, as well as my brothers for their encouragement, support and endless love.

ACKNOWLEDGEMENT

Prays and thanks to ALLAH, the most merciful for assisting and guiding me. I wish to express my sincere thanks, deepest gratitude and appreciations to Dr. Mohamed Z. Sedik Professor of Agricultural Microbiology, Faculty of Agriculture, Cairo University, Dr. GALAL M. KHALAF-ALLAH, Professor of Agricultural Microbiology, Faculty of Agriculture, Cairo University and Dr. ALI ZEIN El-ABEDEEN, Head Researcher of Plant Pathology, Plant Pathology Research Institute, Agricultural Research Center, Giza for suggesting the problem, close supervision, continued assistance, constructive criticism, valuable advice, vital discussion and keeping interest through this study.

I would like to express my deepest gratitude and warmest thanks to Dr. THANAA F. IBRAHIM, Head Researcher of Plant Pathology, Plant Pathology Research Institute, Agricultural Research center, Giza and Dr. ETTIMAD A. OSMAN, Head Researcher of Plant Pathology, Plant Pathology Research Institute, Agricultural Research center, Giza for their technical advice, fruitful support and creative orientation during the whole of this investigation.

Sincere thanks are presented to all staff members of Agricultural Microbiology Department, Faculty of Agriculture, Cairo University and also to all staff members and colleagues of Maize, Forage and Sugar Crops Res. Dis. Department, Plant Pathology Research Institute, Agric. Res. Center, Giza for encouragement and giving all the facilities that made this work possible.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Maize (*Zea mays* L.) is known to be an important grain crop in Egypt. It ranks as the third crop after wheat and rice. It is used for human consumption and animal feeding, in addition to its uses in several important industries such as starch, extraction of oils and fructose. Recently maize flour is mixed with wheat flour for bread industry.

The cultivated area with maize in Egypt had gradually increased to reach 1.780.000 feddans, located in middle and north of Egypt, with an average yield of 24.62 ardab/feddan in 2007 growing season (Maize Res. Dept., Field Crops Res. Inst., Agric. Res. Center, Giza, Egypt).

Maize fields are ravaged by various diseases that affect drastically the crop yield at different stages of growth, of which leaf blight disease caused by *Helminthosporium turcicum* is an important foliar disease of maize in temperate areas of the world including Egypt. The disease is sporadic in occurrence depending on the environmental conditions (Sangam, 1991). In Egypt, the disease is mostly found in the northern and north western regions of the Delta where favorable weather conditions are prevailing of the year (El-Naggar, 2006).

Bair *et al*. (1990) studied the relationship between turcicum leaf blight disease and yield losses of maize. They found that this disease yields of susceptible hybrids by up to 35 %.

Tefferi *et al*. (1996) reported that when infection became severe, high yield losses can occur when susceptible varieties or hybrids are grown in these areas. The susceptible maize cultivar had the greatest

mean grain yield loss (49.1 %) and kernel weight loss (16.4 %), whereas, the resistant one had only 10.4 and 9.4 % losses in grain yield and weight, respectively.

The disease infections reached destructive proportions where yields were recorded by two-third or more in many areas (Perkins and Hooker, 1981). Evaluation of maize hybrids for resistance to *H. turcicum* was carried out by many investigators.

Long elliptical, grayish-green developing first on lower leaves and later causing severe damage to the upper leaves under moderately warm and moist weather conditions causing premature death and gray appearance of foliage that resembles drought injury are the main symptoms of turcicum leaf blight.

The use of effective biological control as alternative or supplementary approach to the routine use of pesticides and other agrochemicals to restrict commercially important plant disease because of the devopment of resistance of some pathogens as well as the exorbitant cost has a keen interest of many investigators (Barakat *et al*., 2005 and Chincholkar and Mukerji, 2007).

The present investigation aimed to study the interaction between maize phyllosphere and the causal pathogen *H. turcicum* as an approach to the biological control of the disease using the most effective antagonists isolated from the phyllosphere of susceptible and resistant maize plants. Also select a suitable method for applying these antagonists as well as some natural plant oils under field conditions.