THE ROLE OF BIOTIC AND ABIOTIC AGENTS IN CONTROLLING TOMATO EARLY BLIGHT DISEASE

By

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B.Sc. Agric. Sci. (Plant Protection), Fac. Agric., Cairo Univ., 2005
M.Sc. Agric. Sci. (Plant Pathology), Fac. Agric., Cairo Univ., Egypt, 2012

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SUPERVISION SHEET

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ABSTRACT

The objectives of the present work were designed to isolate and identify the causal organism of tomato early blight disease and evaluate its pathogenic ability to induce disease incidence. Some biotic, *i.e*. *Trichoderma harzianum* and *T. viride* or antagonistic bacteria, *Bacillus subtilis* and *Pseudomonas fluorescens* and aboitic factors, *i.e.* essential oils, mineral salts, organic acids, chitosan and fungicides were *in vitro* evaluated against the growth of the pathogen in order to find out the most suitable and applicable biological and chemical methods for controlling early blight disease of tomato under field conditions. The obtained results proved that all tested bio-agents drastically reduced the linear growth of *A.solani*. Whereas, *T. harzianum* and *B. subtilis* showed superior inhibitory effect on fungal growth compared to *T. viride* and *P. fluorescens*. All evaluated essential oils, mineral salts, organic acids, chitosan and fungicide's concentrations significantly reduced the fungal linear growth. Chitosan caused complete reduction in linear fungal growth at concentration of 2 g/l. All tested essential oils had inhibitory effect on fungal growth, as well as the *in vitro* determined secondary metabolites with fungicidal or fungistatic activity, since they allow the use of natural origin compounds that are generally species specific, have low environmental persistence, and are biodegradable. Plastic house results revealed that all the applied treatments reduced both disease incidence and severity, compared with untreated control. Chitosan, Salicylic acid, Lemon grass oil and/or *T. harzianum* had superior significant effect on reducing both disease incidence and severity, followed by Thyme oil, Citric acid, potassium sorbate, *T. viride* and *B. subtilis*, respectively. Under artificial infestation with disease incident, reduction in both disease incidence and severity was observed when all treatments were sprayed before inoculation under plastichouse conditions (protective) and/or after inoculation under plastichouse conditions (curative). Under natural infection, the lowest appearance of Early blight disease incidence and severity were observed when treatments were applied as foliar spray with the best traetments of biotic, *i.e. T. harzianum* and antagonistic bacteria, *i.e. B. subtilis* and aboitic factors, *i.e*. Thyme, Lemon grass, Potassium sorbate, Chitosan, Salicylic acid, Citric acid and Ridomil Gold MZ. The activity of Catalase, Glutathione Reduced, Chitinase, Glutathione peroxidase and Total Antioxidant Capacity enzymes were highely increased in tomato plant naturally infested with *A. solani* in response to three times of foliar spray with different treatments of biotic and abiotic agents.

Application of biotic and abiotic factors considered active against disease incidence as well as safe, cheap, easily applicable methods, in addition they avoid environmental pollution.

Key words: Abiotic agents, *Alternaria solani*, Biotic agents, Chitosan, Early blight, Essential oils, Mineral salts, Organic acids, Tomato.

DEDICATION

I would like to dedicate this work to whom my heartfelt thanks; to my late mother, my father, my wife, my children, my brothers for their encouragement and patience during my post-graduate studies.

Also, I dedicate this work to all of my friends.

WITH MY GRATITUDE AND LOVE

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INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is the most popular, important and widely-grown vegetable food crop in the world because of its taste, color, protective and high nutritive value, as well as, its diversified daily use. Tomato belongs to the family Solanaceae. It is a diploid plant with 2n = 24 chromosomes (Ahmed *et al*., 2010). It is the world's largest vegetable crop after potato and sweet potato, as it tops the list of canned vegetables. In addition, in some countries, the tomato plant is considered one of the main food crops produced and consumed (Akila *et al*., 2012 and Itako *et al.,* 2013).

Tomato is one of the important plants, which contribute in maintaining human health and vigor. It is considered as highly nutritious because of its high contents of vitamin A, B, C, β-carotene, and important mineral (*e.g*., phosphorus and calcium), organic acids, antibiotic properties, fibers, as well as calories. It is also characterized by its high content of lycopene, a natural antioxidant, which is not found in the other solanaceous crops. It also has niacin 0.712 mg, calcium 31 mg and water 94.28 g per 100 g weight. It is a good source (Ahmed *et al*., 2010; Akila *et al*., 2012; Anuj *et al.,* 2015 and Chohan *et al*., 2015).

Tomato production accounts for 14% of the total fruit and vegetable production worldwide, *i.e*. about 152.9 million tons; $74.1 billion (Babu *et al*., 2000; Agrios, 2005 and Selim, 2015). The global tomato production area covers approximately 4 million hectares (Ahmed *et al*., 2010; 2014 and Selim, 2015). Noteworthy, tomato is the most important vegetable crop in Egypt, and Egypt is among the top 10