BIOLOGICAL CONTROL OF DAMPING-OFF, ROOT ROT AND WILT DISEASES OF SOME SOLANACEOUS PLANTS

BY

NOURA HASSAN MOHAMED

B.Sc. Agric. Sci. (Plant Protection), Fac. Agric., Cairo Univ., Egypt, 2002

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SUPERVISION SHEET

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ABSTRACT

A large number of diseases have been reported to attack pepper plants in Egypt, of these, damping - off caused by *Sclerotium rolfsii* is the most common. Four fungi, *i.e*. *Fusarium solani ,F. oxysporum, Sclerotium rolfsii* and *Rhizoctonia solani* were isolated from rotted -roots of pepper plants. The highest percentages of pre- and post-emergence damping -off were recorded on pepper and tomato plants sown in soil infested with *S. rolfsii, R. solani, and F. solani.* The percentage of infected pepper plants was increased steadily with the increment of inoculum level in the soil.

All tested hosts, *i.e*. pepper, tomato and eggplant showed the symptoms of damping off disease. The highest percentages of pre- and post- emergence damping - off were recorded for pepper and tomato plants followed by eggplant.

The physiological studies showed that the optimum temperature for growth and formation of sclerotia of *S. rolfsii* ranged from 25 ° to 30°C. RH 95% was the best for growth of *S. rolfsii.* While, pH 4.5 to 6 was the optimum for growing *S. rolfsii.* It's worth to note that *S. rolfsii* could utilize wide range of carbon sources.

In vitro studies, *Trichoderma harzianum* and *Bacillus subtilis* inhibited the growth of *S. rolfsii*. *In vivo* studies, treatment of pepper seeds with either *T. harzianum* or *B. subtilis* caused a significant decrement in the infection of pepper plants with *S. rolfsii*.

In vitro studies, fungicides, *i.e*. Vitavax /Thiram, Rizolex -T, Tachigaren and Monceren completely inhibited the growth of *S. rolfsii* at 100 ppm concentration. *In vivo* studies, treatment of pepper seeds with the aforementioned fungicides at the recommended rate caused a significant decrement in the infection of pepper plants with *S. rolfsii*.

Key words: Pepper, Soil-borne, Pathogenicity test, Biological control, Chemical control.

DEDICATION

I dedicate this work to whom my heartfelt thanks; to my GOD then my father ; my mother ; my sister Eman and Asmaa ; my brothers Mohamed, Alaa and Ahamed ; my husband Yasser and my sweet heart Anassa for their patience , help, and all the support they lovely offered along the period of my post graduation.

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INTRODUCTION

Solanaceae is one of the most important plant families in the world. It's one of the largest families in Plant Kingdom with more than 3,000 species. Also it includes species which are essential for life. There are important edible species such as potato (*Solanum tuberosum* L.), eggplant (*Solanum melongena* L.) tomato (*Lycopersicon esculentum* L.) and pepper (*Capsicum annuum* L.).

Pepper fruits are consumed as a fresh vegetable or dehydrated for use as a spice. People add spice flavoring and colour to food while providing essential vitamins and minerals. Pepper extracts are also used in pharmaceutical and cosmetic products. In addition, peppers are also used as ornamentals in the gardens.

In Egypt, 25,435 Feddans of pepper crop were cultivated that produced 172,927 ton (Department of Agriculture Economics and Statistics, Ministry of Agriculture, 2007-2008).

Soil- borne pathogens significantly reduce yield and quality of vegetable crops. Vegetable crops may be susceptible to several pathogens which may survive in soil for many years. Many diseases caused by soil-borne pathogens are difficult to be predicted, detected and diagnosed. Pepper plants are liable to attack with several pathogens, *i.e*. fungi, bacteria, virus (Domsch *et al.*, 1980; Samuel and Averre, 1986; Abada, 1994; Attia and Abada, 1994; Abd El-Kareem *et al.*, 2004 and Serra and Sliva, 2005).

The genus *Sclerotium* is one of the most important genera that includes many soil –borne fungi spreading in Egypt as well as in other parts of the world (Attia and Abada, 1994 and Okereke and Wokocha, 2006).

S. rolfsii has been reported as the causal organism of root- and stem- rot of some Solanaceaus plants. On the other hand, *S. rolfsii* has been reported to cause pre- and post -emergence damping –off, root-, stem- , pod rots and reduces fresh and dry weights of Solanaceaus plants (Okereke *et al*, 2007; Abida Akram *et al.*, 2008 and Jin- hyeuk *et al*, 2008).

Biological control of plant pathogens is an attractive alternative to the strong dependence of modern agriculture on chemical fungicides, which cause environmental pollution and development of resistant strains. *Trichoderma harzianum and Bacillus subtilis* have long been known for their capacity to reduce plant diseases caused by *Sclerotium rolfsii* (Muhammad and Amusa, 2003 and Muskhazli and Nor Farizan, 2006).

Chemical control of damping –off of Solanaceous plants was investigated by many researchers (Abd El- Kareem *et al*, 2004; Fouzia and Saleem, 2006 ; EL-Mohamedy *et al*, 2006; Palaiah *et al*, 2007 and Maurya *et al*, 2008).

The present investigation was planned to throw light on the casual organisms of pre- and post- emergence damping-off and root - rot of pepper, host range of the causal organism, biological and chemical control of diseases on pepper seedlings.

REVIEW OF LITERATURE

Soil-borne plant pathogenic fungi cause heavy crop losses in Egypt as well as in other parts of the world. Most Solanaceous plants grown in Egypt are susceptible to infection by diseases caused by soil-borne fungi.

Isolation of the causal organisms of damping-off and root rot diseases of tomato and pepper

Several researchers in Egypt as well as in many parts of the world studied the causal organisms of damping-off and root rot diseases of Solanaceous plants, especially tomato and pepper.

Wokochoa *et al.* (1986) reported that *Fusarium oxysporum, F. equiseti, F. fusarioides, F. acuminatum* and *Sclerotium rolfsii* were the important fungi consistently isolated from tomato and pepper plants infected with basal stem rot.

Zhang *et al*. (1990) recorded that tomato plants affected by damping -off or seedling blight in seedling beds, and plastic houses were infected with 11 species of *Pythium* and *Sclerotium (Corticium) rolfsii.*

Koleva and Vitanov (1990) isolated *F. oxysporum, F. solani* and *F. equiseti* from field-grown peppers [*Capsicum*] showing stunting, chlorosis and root rot in Bulgaria.

Wokocha (1990) and Monaco *et al*. (1991) suggested that *S. rolfsii* and *F. solani* were responsible for damping-off of tomato and pepper.

Rattink (1993) revealed that *F. oxysporum* f .sp. *radicis lycopersici* was the causal agent of tomato crown root rot.

El Shami *et al*. (1993) isolated *F. oxysporum* f .sp. *lycopersici* and *Rhizoctonia solani* from tomato and pepper seedlings showing symptoms of damping-off. Both fungi caused high levels of damping-off on tomato.

Mushtaq and Hashmi (1997) found that many fungi were isolated from roots, stems, leaves and seeds of infected plants of bell pepper (*C. annuum*) and 28 species of fungi were isolated from soil, *F. oxysporum, F. proliferatum, F. solani, Alternaria alternata, Cephalosporium acremonium [Acremonium strictum], Fusarium anthophilum, F. moniliforme [Gibberella fujikuroi], Macrophomina phaseolina, Pythium aphanidermatum* and *Rhizoctonia solani* were predominant in plants showing symptoms of wilting in Pakistan.

Badr *et al*. (1997) isolated some seedborne pathogens, *i.e. S. rolfsii, R. solani* and *F. solani* from seeds of cucumber (*Cucumis sativus*), cantaloupe (*Cucumis melo*), squash (*Cucurbita pepo*), pepper (*Capsicum annuum*) and tomato (*Lycopersicon esculentum*) using blotter, agar plate and sand methods.

Tosi *et al.* (2000) observed a wilt disease on pepper (*Capsicum* spp.) plants during the summer of 1999 in some fields located in central Italy. They added that disease incidence was very high (90%) and *Fusarium* spp were consistently isolated from roots and stem collar zones of the diseased pepper plants (*Capsicum annuum*).

Rahman *et al.* (2001) found that *R. solani* and *F. solani* caused seedling diseases of tomato (*Lycopersicon esculentum*).

El-Abbasi and Satour (2003) mentioned that screening roots and rhizosphere soil pathogens of cotton, tomato, cucumber and peanut plants in 14 governorates resulted in a total of 477 fungal isolates belonging to 6 genera and 13 species of the important fungi and some other minors. Important fungi included some major plant pathogens such as *S. rolfsii, R. solani, M. phaseolina,* and *Pythium* spp., which cause serious plant diseases.

Wokocha and Oparah (2004) isolated *S. rolfsii, F. oxysporum* f.sp. *lycopersici, F. solani, F. equiseti, F. acuminatum, Trichoderma viride, T. harzianum, Mucor hiemalis, Phoma lycopersici* and *Rhizopus microsporus*.on potato dextrose agar (PDA) from wilted tomato plants. They made evaluation of 10 tomato cultivars for disease tolerance which indicated that Fusarium wilt, incited by *F. oxysporum* f.sp. *lycopersici*, showed an incidence of 80-100% and a severity index of 4.0-5.0, and was the most important fungal disease of field-grown tomato in the area.

Andres *et al*. (2005) isolated *S. rolfsii* Sacc., *F. solani* Mart, *R. solani* Kuhn, *Phytophthora capsici* Leonian and *P. nicotianae* Breda de Haan from blighted pepper (*Capsicum annuum* L.) plants in northwestern Spain. They mentioned that *R. solani* was the most commonly isolated pathogen; this was detected on 38% of the farms and isolated from 16% of the pepper plants analyzed.