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# BIOLOGICAL AND CHEMICAL CONTROL OF DAMPING –OFF OF PEPPER CAUSED BY *Sclerotium rolfsii* Sacc.

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## ABSTRACT

A large number of diseases has been reported to attack pepper plants in Egypt; of these, damping - off caused by *Sclerotium rolfsii* Sacc. (The sclerotial state of *Athelia rolfsii* Curtz) is the most common. Four fungi, *i.e*. *Fusarium solani* Mart, *Fusarium oxysporum* Schlecht, *S. rolfsii* and *Rhizoctonia solani* Kuhn were isolated from rotted roots of pepper plants. Pathogenicity test indicated that 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. In vitro* studies showed that *Trichoderma harzianum* Rifai and *Bacillus subtilis* Ehrenberg caused clear inhibition to *S. rolfsii* growth. *In vivo* studies, treatment of pepper seeds with either *T. harzianum* or *B. subtilis* showed a significant decrement in the infection of pepper plants by *S. rolfsii*. Some fungicides, *i.e*., Vitavax- Thiram, Rizolex T, Tashgarin and Moncerin completely inhibited the growth of *S. rolfsii* at 100 ppm concentration. *In vivo* studies, treatment of pepper seeds with any of the aforementioned fungicides at the recommended dose caused significant decrement in the infection of pepper plants by *S. rolfsii*.

***Key words****: Bacillus,chemical control, damping-off, pepper, root-rot and Trichoderma.*

## 1. INTRODUCTION

Genus *Sclerotium* is one of the most important soil –borne fungi spreading in Egypt as well as in other parts of the world (Attia and Abada, 1994; Okereke and Wokocha, 2006 and Daami *et al.*, 2007).

*S. rolfsii* Sacc. has been reported as the causal organism of damping – off, root-,stem-, pod-rots and reduce of fresh and dry weight of Solanaceous plants (Okereke and Wokocha, 2007; Abiaa and Muhammed, 2008 ; Jin- hyeuk *et al.,* 2008 and Maurya *et al.*,2008).

Biological control of plant pathogens is an attractive alternative method of modern agriculture. It does not depend on chemical fungicides which cause environmental pollution and development of fungicide resistant strains. *T. harzianum and B. 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 and root rot of Solanaceous plants was also investigated by some researchers (Attia and Abada, 1994; Abd El-Kareem *et al.,* 2004; Yaqub and Saleem, 2005; EL-Mohamedy *et al.,* 2006; Palaiah *et al.,*2007 and Maurya *et al.,* 2008).

The present investigation was carried out to throw light on the causes of pre- and post emergence damping –off and root-rot of pepper. In addition, attempts to minimize infection with the aforementioned diseases were investigated.

## 2. MATERIALS AND METHODS

### 2.1. Isolation, purification and identification of the isolated fungi

Samples of naturally infected pepper plants showing the typical symptoms of damping-off, wilt, stem-rot and root-rot were collected from the Agricultural Experiments and Research Station of Faculty of Agric., Cairo Univ. Rotten roots were cut into small pieces, surface sterilized with 2% sodium hypochlorite for 3 min, rinsed in sterilized water, dried between sterilized filter papers and transferred on PDA plates. The plates were incubated at 25˚C and daily examined. Resulting fungi were picked up and purified using the hyphal tip technique. The purified fungi were identified according to their morphological features to the genus and/or the species level using the descriptions of Snyder and Hansen (1940); Gilman (1957); Booth and Waterston (1964); Booth (1971) and Barnett and Hunter (1971). Pure

cultures were kept in a refrigerator on PDA slants at 5-10°C for further studies.

**2.1.1. Pathogenicity test**

Pots (25 cm in diam.) filled with sterilized soil were individually infested with 5%(w/w) inoculum level of the desired fungus grown in sterilized bottles 500 ml, containing sand barley medium (25 g clean sand+75g barley grains+100 ml water). Inoculum- free pots were used as control. Seeds (5/pot) of either pepper cv. Baladi or tomato cv. Super Strain B were individually sown in the pots (3/replicates). After two and six weeks from planting, the number of dead plants, as a result of seedlings infection by Pre -and post - emergence damping-off, respectively was recorded and the average percentage was calculated. In addition, the number of dead plants due to infection by root-rot was recorded 60 days after sowing and disease severity was estimated according to Salt (1981). Reisolation was carried out from the artificially infected roots of tested plants to confirm pathogenicity test.

**2.2. Biological control**

**2.2.1.** *In vitro* **studies**

Two methods were carried out using two bioagents, (occasionally isolated during trials from the rotted roots) *i.e. B. subtilis* (provided by Microbiology Dept., Ain Shams Univ.) and *T. harzianum*. PDA plates (90mm) were inoculated at 30°C each with disc of *S. rolfsii* (5 mm in diam.), two days later, either *B .subtilis* (streaking or filtration in wells inside the plates) or disc of *T. harzianum* were put opposite the growth of *S .rolfsii*. Plates inoculated with *S. rolfsii* only were used as a control. Inhibition zones were measured when the fungal growth, in the control plates reached the edge of the plate after four days.

**2.3.** *In vivo* **studies**

This experiment was carried out at the greenhouse of Fac. of Agric., Cairo Univ. Seeds (30 seeds /treatment) for each of the four pepper cvs Sweet pepper, Long Red Cayenne, California Wonder and Anaheim M were coated with either *B. subtilis* (seeds were immersed in 1.0% glue as sticker for 2 min, drained well then soaked in the culture 48 h for 10 min.) or *T. harzianum* (seeds were washed with distilled water for a few sec, air dried, rolling on culture plates then air-dried), sown in the soil infested with *S. rolfsii*. Inoculum-free treatments were used as control. The number of pre- and post -emergence damping -off plants was recorded 2 and 6 weeks after planting, respectively and the average percentage was calculated.

**2.4. Chemical control**

**2.4.1.** *In vitro* **studies**

Six concentrations ( 0, 5, 10, 25, 50 and 100ppm) representing the four fungicides, *i.e.* Rizolex T, Vitavax Thiram, Tashgrin and Moncerin were added to PDA flasks (40˚C) according to their active ingredients (Table 1) and poured in Petri plates (3 replicate plates). Petri plates (90mm) were inoculated at 30°C with disks (5mm in diam) of *S rolfii* (4 days old). Radial growth was recorded when the fungal growth reached the edge of the control.

**Table (1) Active ingredient and rate of using tested fungicides.**

| Trade name | Common name | Rate of using |
|---|---|---|
| **Moncerin 25% WP** | **Pencycuron** | **3 g / kg seed** |
| **Vitavax Thiram 200 75 % WP** | **carboxin+ thiram** | **1-3 g / kg seed** |
| **Rizolex -T 50% WP** | **tolclofos-methyl** | **3 g / kg seed** |
| **Tashgarin 30% SL** | **Hemexazol** | **1 cm / lit.** |

**2.4.2.** *In vivo* **studies**

Seeds of pepper cvs Sweet pepper, Long Red Cayenne, California Wonder and Anaheim M were individually coated, seeds were immersed in 1.0% glue as sticker for 2 min, drained well then mixed with the desired fungicide, *.i.e.* Rizolex- T, Vitavax -Thiram ,Tashgrin (seeds were coated by soaked for 10 min. then air dry)and Moncerin at the recommended dose (Table 1). Seeds (30 seeds/treatment) were sown in speedling trays filled with soil infested with 5% (W: W) *S. rolfsii.* Inoculum- free cells were used as control. Pre- and post -emergence damping - off were recorded 2 - and 6 weeks after planting, respectively.

**Statistical analysis**

The obtained data were statistically evaluated according to Snedecor and Cochran (1967) and the L.S.D. was assessed according to Fisher (1948).

## 3. RESULTS

**3.1. Isolation, purification and identification of the isolated fungi**

The isolated fungi were purified and identified to the genus and/or the species level according to their morphological characters. Results (Table 2) indicate that *Sclerotium rolfsii* Sacc. was the most dominant followed by *Fusarium solani* (Mart.) Sacc., *Fusarium oxysporum* Schlecht and *Rhizoctonia solani* J.G. Kühn. The corresponding percentages of their frequency were 23.61,15.28,13.89 and 13.89 %, respectively. Fungi belonging to the genera *Alternaria, Aspergillus, Pythium* and *Trichoderma* were also

isolated. Accordingly, fungi which showed high frequency were tested for their pathological potentialities. Meanwhile, *T. harzianum* was used in the biological control experiments.

**Table (2): Occurrence and frequency of the fungi isolated from pepper plants showing damping-off and root-rot symptoms collected from the Agricultural Experiments and Researches Station, Fac. of Agric., Cairo Univ.**

| Isolated fungi | No. of isolates | Frequency, % |
|---|---|---|
| *Alternaria* sp. | **9** | **12.50** |
| *Aspergillus niger* | **4** | **5.56** |
| *Aspergillus flavus* | **2** | **2.78** |
| *Fusarium* sp | **2** | **2.78** |
| *F. oxysporum* | **10** | **13.89** |
| *F. solani* | **11** | **15.28** |
| *Pythium* sp | **6** | **8.32** |
| *Rhizoctonia solani* | **10** | **13.89** |
| *Sclerotium rolfsii* | **17** | **23.61** |
| *Trichoderma harzianum* | **1** | **1.39** |
| **Total** | **72** | **-** |

**3.2. Pathogenicity tests**

Data in Table (3) show that the highest percentages of pre- and post -emergence damping -off were recorded on pepper and tomato plants sown in soil infested with any of the three fungi, *i.e., S .rolfsii, R. solani* and *F .solani.* On the other hand, the highest percentages of disease severity were recorded on pepper and tomato plants sown in a soil infested with *S. rolfsii, F. oxysporum, F. solani* and *R. solani.* Plants grown in the soil infested with *T. harzianum*, or in the control treatment were healthy. Due to the high pathogenic potentialities, of *S .rolfsii* it was selected for further studies**.**

**3.3. Biological control**

**3.3.1.** *In vitro* **studies**

**3.3.1.1.** Antagonistic effect of *Bacillus subtilis.*

Data in Table (4) show that the largest inhibition zone (15 mm) was recorded in plates inoculated with *S. rolfsii* and streaked with *B. subtilis* compared to those inoculated with filtration of *B. subtilis*.

**3.3.1. 2. Antagonistic effect of** *T. harzainum*

Data in Table (5) indicate that *T. harzianum* reduced the growth (24mm) of *S. rolfsii* as compared to the treatment inoculated with *S. rolfsii* only (90mm).

**3.4.** *In vivo* **studies**

**3.4.1. Antagonistic effect of** *B. subtilis*

Data in Table (6) show that sowing seeds of four pepper cvs. coated by *B. subtilis* decreased the incidence percentages of damping- off on pepper plants, especially var. California Wonder' and 'Anaheim M' compared to the treatments inoculated with S. *rolfsii* only.

**3.4. 2. Antagonistic effect of** *T. harzianum*

Data in Table (7) show that coating seeds of pepper cultivar with *T. harzianum* decreased the percentages of damping –off of pepper plants of the tested cultivars, especially cv. 'California Wonder' and 'Anaheim M' compared to the treatment inoculated with *S. rolfsii* only.

Data also, show that all the tested pepper cvs. were susceptible to infection by *S rolfsii.* Sweet pepper and Long Red Cayenne were the most susceptible cvs. to the infection by *S rolfsii.* Meanwhile, the varieties 'California Wonder' and 'Anaheim M ' showed the lowest infection (Tables 6.7).

**3.5. Chemical control**

**3.5.**1. *In vitro* **studies**

Data in Table (8) demonstrate that no growth of *S rolfsii* was recorded when the tested fungicides, *i.e.,* Rizolex -T, Vitavax -Thiram, Tashgrin and Moncerin were added at 100ppm to PDA medium, while fungal growth reached 90mm when 5 ppm concentration was used at 5ppm. On the other hand, the least inhibition of the fungal growth (72 mm) was recorded when Tashgrin was added to PDA medium at 50ppm followed by Vitavax - Thiram and Moncerin at the same concentration.

**3.5.2.** *In vivo* **studies**

Data presented in Table (9) indicate that all the tested fungicides, *i.e*. Rizolex-T, Vitavax- Thiram, Tashgrin and Moncerin decreased pre- and post - emergence damping- off of pepper plants of the tested cultivars. In all cases, Vitavax -Thiram gave the highest decrement of pre- and post- emergence damping -off of all pepper cvs. especially pepper cultivars. 'Anaheim M' and California Wonder' followed by Rizolex-T.

## 4. DISCUSSION

Pepper plants **(***Capsicum annuum* L.) are vulnerable to attacks with serious diseases, among which damping-off and root rot are widespread in Egypt (Attia and Abada, 1994; Abada,1994 and Abd El-Kareem *et al.,* 2004) and in many other countries (Serra & Sliva Gilson, 2005) causing a considerable reduction of either the number of plants or fruit yield.

In the light of the present findings, *Sclerotium rolfsii* Sacc. (The sclerotial state of *Athelia rolfsii* Curtz) showed the highest frequency followed by *Fusarium solani* Mart, *Fusarium oxysporum* Schlecht and *Rhizoctonia solani* Kuhn. All the tested fungi, except *Trichoderma harzianum* Rifai

**Table (3): Effect of some fungi isolated from rotted-roots of pepper on damping – off and root rot diseases of pepper and tomato plants under greenhouse conditions.**

| Tested fungi | Pre-emergence* damping –off, % | | Post-emergence** damping –off, % | | Plant survival, %** | | Disease severity,% | |
|---|---|---|---|---|---|---|---|---|
| | Pepper | Tomato | Pepper | Tomato | Pepper | Tomato | Pepper | Tomato |
| *F. solani* | 26.67 | 33.33 | 33.33 | 13.33 | 40.00 | 53.34 | 50.00 | 41.60 |
| *F. oxysporum* | 20.00 | 20.00 | 40.00 | 20.00 | 40.00 | 40.00 | 58.33 | 41.67 |
| *R. solani* | 33.33 | 33.33 | 20.00 | 26.67 | 46.67 | 40.00 | 33.33 | 16.67 |
| *S. rolfsii* | 40.00 | 33.33 | 26.67 | 26.67 | 33.33 | 40.00 | 58.33 | 58.33 |
| *T. harzianum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Control | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 | 100.00 | 0.00 | 0.00 |
| L.S.D. at 0.05 | 1.35 | 1.19 | 0.57 | 0.80 | 1.25 | 1.77 | 1.26 | 1.79 |

***Assessed 2 weeks after sowing.**
**** Assessed 6 weeks after sowing.**

**Table (4): Antagonistic effect of** *B. subtilis***, used as streaking and filtration against** *Sclerotium rolfsii,* **4 days after incubation at 30 ± °C.**

| Treatments | Inhibition zones (mm) on the plates | |
|---|---|---|
| | Culture | Filtration |
| *S.rolfsii+ B. subtilis* | 15 | 10 |
| *S.rolfsii* | 0.0 | 0.0 |

**Table (5): Antagonistic activity of** *Trichoderma harzianum* **against** *Sclerotium rolfsii***, 4 days after incubation at 30 ± °C.**

| Treatments | Linear growth (mm) of *S. rolfsii* |
|---|---|
| *S. rolfsii+ T. harzianum* | 24 |
| *S. rolfsii* | 90 |

were able to colonize the roots of pepper cv. Baladi and tomato cv. Super Strain B inducing damping – off and root rot symptoms.

The highest percentages of pre- and post-emergence damping -off were recorded on pepper cv. Baladi and tomato cv. Super strain B sown in soil infested with *S.rolfsii* followed by *F. solani*, *R.solani* and *F. oxysporum.* On the other hand, the highest percentages of disease severity were recorded on pepper and tomato plants sown in soil infested with *S.rolfsii, F. oxysporum* and *F.solani.* The results confirmed those reported by Yaqub and Saleem (2005) and Okereke and Wokocha (2006).

Data of the present investigation showed that all the tested pepper cvs. were susceptible to infection by *S. rolfsii*. Pepper cvs. ʻSweet pepperʼ and ʻLong Red Cayenneʼ were severely infected by damping –off, while cvs ʻCalifornia Wonderʼ and ʻAnaheim Mʼ showed the lowest infection. In an attempt to reduce infection by S. *rolfsii*, some experiments were carried out under the greenhouse conditions using two bioagents, *i.e. B. subtilis* and *T. harzianum*, in addition to four fungicides.

Data obtained herein indicated that the inhibition zone was increased when the culture of *B. subtilis* was used as an antagonistic agent more than when its filtrate was used. The largest inhibition zone (15 mm) was recorded in the plates of *S. rolfsii* streaked with *Bacillus subtilis* compared to those inoculated with S. *rolfsii* and *B. subtilis* used as filtration in wells (5mm). These results are in agreement with Muhammad and Amusa, (2003).

*B. subtilis* inhibited the mycelia growth of S. *rolfsii*. Two mechanisms intrupt that action. One might be the production of biologically active metabolites, which inhibited the growth of the pathogens. The other might be its rapid growth and spread on the moist surfaced agar plates, which prevented the establishment of the pathogens. A lytic factor has been reported to be located in walls of the strains of *B. subtilis.* Young *et al*. (1974) suggested that this might have diffused out into the surrounding medium, causing the zones of inhibition observed.

Coating pepper seeds with *B. subtilis* decreased the percentages of damping- off of the tested cvs. especially cvs. California Wonder and Anaheim M compared to the treatments inoculated with S. *rolfsii* only. These results are in agreement with Palaiah *et al.,* (2007).

In this study, it was clear that *T. harzianum* reduced the growth of *S. rolfsii* compared to the treatments inoculated with *S. rolfsii* only. These results are in agreement with those given by Di Pietro (1995) and Bankole & Adebanjo (1998).

*T. harzianum* is known to produce extracellular cell wall degrading enzymes such as chitinases, β-1, 3-glucanases and cellulases which

**Table (6): Effect of using *B. subtilis* on the incidence of damping -off of some pepper cvs. caused by *S. rolfsii*, greenhouse experiment.**

| Treatments(A) | % Damping- off of cvs.(B) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pepper 'Sweet pepper' | | | Pepper 'Long Red Cayenne' | | | Pepper 'California wonder' | | | 'Pepper Anaheim M' | | |
| | Pre-* | Post-** | Plant ***survival | Pre-* | Post-** | Plant **survival | Pre-* | Post-** | Plant **survival | Pre-* | Post-** | Plant **survival |
| *S .rolfsii+ B. subtilis* | 23.33 | 13.33 | 63.34 | 23.33 | 10.00 | 63.64 | 23.33 | 6. 67 | 70.00 | 23.33 | 6. 67 | 70.00 |
| *S .rolfsii* | 100.00 | 0.00 | 0.00 | 93.33 | 6.67 | 0.00 | 80.00 | 20.00 | 0.00 | 73.33 | 26.67 | 0.00 |
| *B. subtilis* | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 |
| Control (Non -infested soil) | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 |

**L.S.D. (0.05) for:**
**Pre-emergence ( A×B) =0.01** **Post -emergence (A×B) =0.01**
***Assessed 2 weeks after sowing.** **** Assessed 6 weeks after sowing.**

**Table (7) : Effect of treating pepper seeds by *T. harzianum* on the incidence of damping -off caused by *S.rolfsii* .**

| Soil treatments(A) | % Damping -off of cvs. (B) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pepper 'Sweet pepper' | | | Pepper 'Long Red Cayenne' | | | Pepper' California Wonder' | | | 'Pepper Anaheim M' | | |
| | Pre-* | Post-** | Plant** survival | Pre-* | Post-** | Plant** survival | Pre-* | Post-** | **Plant survival | Pre-* | Post-** | Plant ** survival |
| ***S.rolfsii+ T.harzianum*** | 33.33 | 10 | 56.67 | 23.33 | 13.33 | 66.67 | 16.67 | 16.67 | 66.66 | 20.20 | 16.67 | 63.33 |
| ***S.rolfsii*** | 100.00 | 0.00 | 0.00 | 83.33 | 16.67 | 0.00 | 80.00 | 20.00 | 0.00 | 76.67 | 23.33 | 0.00 |
| ***T. harzianum*** | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 |
| Control (Non treated soil) | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 |

**L.S.D. (0.05) for:**
**Pre-emergence (A×B) =0.01** **Post –emergence (A×B) =0.01**
***Assessed 2 weeks after sowing.** **** Assessed 6 weeks after sowing.**

**Table (8): Effect of some fungicides on the linear growth (mm) of *S. rolfsii*, 4 days after incubation at 30 ± °C.**

| Tested fungicides | Linear growth (mm) at the concentrations (ppm). | | | | | | X- |
|---|---|---|---|---|---|---|---|
| | 0.0 | 5 | 10 | 25 | 50 | 100 | |
| Moncerin | 90 | 90 | 90 | 60 | 32 | 0.0 | 60.33 |
| Vitavax/ Thiram | 90 | 90 | 90 | 90 | 45 | 0.0 | 67.5 |
| Rizolex-T | 90 | 90 | 61 | 31 | 28 | 0.0 | 50 |
| Tashgarin | 90 | 90 | 78 | 74 | 72 | 0.0 | 67.33 |
| X- | 90 | 90 | 79.75 | 71.25 | 44.25 | 0.0 | 57.27 |

L.S.D. (0.05) for: Fungicides (F) = 1.13
Concentrations (C) = 1.39 F×C = 2.76

**Table (9): Effect of treatment pepper seeds by some fungicides on the incidence of damping-off caused by *S. rolfsii*.**

| Treatments (A) | % Incidence of damping- off of pepper cvs. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pepper ʿSweet pepperʾ | | | Pepper ʿLong Red Cayenneʾ | | | Pepper ʿCalifornia Wonderʾ | | | Pepper ʿAnaheim Mʾ | | |
| | Pre-* | Post-** | Plant** survival | Pre-* | Post-** | Plant ** survival | Pre-* | Post-** | Plant ** survival | Pre-* | Post-** | Plant ** survival |
| Moncerin | 23.33 | 23.33 | 53.34 | 33.33 | 13.33 | 46. 67 | 23.33 | 13.33 | 63.64 | 20.00 | 20.00 | 60.00 |
| Vitavax Thiram | 20.00 | 20.00 | 60.00 | 16. 67 | 10.00 | 73.33 | 16. 67 | 10.00 | 73.33 | 16. 67 | 6. 67 | 76.66 |
| Rizolex-T | 23.33 | 10.00 | 66.67 | 26.67 | 10.00 | 63.33 | 20.00 | 10.00 | 70.00 | 23.33 | 10.00 | 66.67 |
| Tashgarin | 30.00 | 10.00 | 60.00 | 23.33 | 10.00 | 66.67 | 30.00 | 0.00 | 70.00 | 26.67 | 6. 67 | 66.67 |
| *S. rolfii* | 100.00 | 0.00 | 0.00 | 93.24 | 6. 67 | 0.00 | 89.91 | 10.00 | 0.00 | 83.33 | 16. 67 | 0.00 |
| Control (Non-treated soil) | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 |

L.S.D. (0.05) for: Pre-emergence (A×B) =0.01 Post –emergence (A×B) =0.01
*Assessed 2 weeks after sowing. ** Assessed 6 weeks after sowing.

chitinases, β-1, 3-glucanases and cellulases which are important features of mycoparasites for the colonization of their host fungi (Hadar & Taylor, 1984).

Coating of pepper seeds with *T. harzianum* decreased the percentages of damping –off , especially cvs. California wonder, and ʿAnaheim M compared to the treatments inoculated with *S. rolfsii* only. These results are in agreement with those obtained by Okigbo and Ikediugwu (2000) and Serra and Sliva Gilson (2005).

Further experiments were carried out to test the fungicidal effect of four fungicides on reducing the incidence of damping-off of pepper.

The results demonstrated that no growth of *S rolfii* was recorded when all the tested fungicides, *i.e.,* Rizolex-T, Vitavax Thiram, Tashgrin and Moncerin were added at 100ppm to PDA medium, while the fungal growth reached 90mm when 5ppm concentration was used. On the other hand, the least inhibition of the fungal growth was recorded when Tashgrin was added to PDA medium at 50ppm followed by Vitavax Thiram and Moncerin at the same concentration. These results are in agreement with those obtained by Abada (1994) and Yaqub and Saleem (2006).

The tested fungicides, *i.e.,* Rizolex-T, Vitavax -Thiram, Tashgrin and Moncerin decreased the percentages of damping- off of the tested cvs. Vitavax -Thiram gave the highest decrement of pre- and post- emergence damping -off of all pepper cvs., specially Anaheim M and California Wonder followed by Rizolex-T. These results are in agreement with those given by Biswas and Sen (2000) and Abd El -Kareem *et al.* (2004).

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**المقاومة الحيوية والكيميائية لمرض سقوط بادرات نباتات الفلفل**
**المتسبب عن الفطر *Sclerotium rolfsii* Sacc.**

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**ملخص**

تم جمع عينات من نباتات فلفل مصابة بأعفان الجذور من محطة التجارب والبحوث الزراعية وصوب كلية الزراعه - جامعة القاهرة، تم عزل72عزلة فطرية من هذه العينات ثم تنقيتها و تعريف الفطريات المعزولة . اتضح أن هذه الفطريات تتبع 10 انواع تتبع 7 أجناس ، ومن اهمها فطريات اسكلروشيم رولفزياي و فيوزاريوم سولانى و فيوزاريوم أوكسبسوريم و ريزوكتونيا سولانى، ولقد أختبرت القدرة المرضية لهذه الفطريات على كل من الفلفل والطماطم. نتج عن تجربة العدوى الصناعية بالفطريات المعزولة من نباتات الفلفل المصابة أن الفطر اسكلروشيم رولفزياي كان أكثر الفطريات المعزولة إحداثاً لإصابة كل من الفلفل والطماطم.

فى تجربة المكافحة الحيوية،أظهرت التجارب المعملية أن إضافة أى من *Trichoderma harzianum* أو البكتريا *Bacillus subtilis* إلى البيئة أدى إلى إحداث تثبيط واضح فى نمو الفطر اسكلروشيم رولفزياي . أوضحت نتائج تجارب الصوبة أن معاملة بذور الفلفل بكل من *T. harzianum* و*B. subtilis* أدى إلى إنخفاض كبير فى نسبة الإصابة بمرض سقوط بادرات نباتات الفلفل المتسبب عن الفطر اسكلروشيم رولفزياي .

فى تجربة المكافحة بالمبيدات الكميائية، تم تقييم بعض المبيدات فى مقاومة الفطر اسكلروشيم رولفزياي. أظهرت الدراسات المعملية أن إضافة المبيدات فيتا فاكس ثيرام ، ريزولكس- ت ،تشاجرين، مونسرين بتركيز 100 جزء فى المليون إلى البيئه أحدث تثبيطا كاملا لنمو الفطر اسكلروشيم رولفزياي. أوضحت نتائج تجارب الصوبة أن معاملة بذور الفلفل بأى من المبيدات الفطرية المختبرة بالمعدل الموصى به أدى إلى إحداث انخفاض فى نسبة الإصابة بمرض سقوط بادرات نباتات الفلفل المتسبب عن الفطر اسكلروشيم رولفزياي.

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