Minufiya J. Agric. Res. Vol.38 No. 1 (1) : 1 - 10 (2013) "http://www.mujar.net"

STUDIES ON CONTROL OF BEAN PODS WHITE MOLD DISEASE IN EGYPT

Hala R. Ghoniem, M.Z. El-Shanawany and M.E. Mahdy
Faculty of Agric., Minufiya University.

(Received: Oct. 17, 2012)

ABSTRACT: *White rot of bean pods caused by Sclerotinia sclerotiorum de Bary is very important disease which severely affect flowers , leaves , fruits were seemed to be effective in decreasing infection % and infection area % .Significant differences were noticed between the Ca^{++} salts and their concentration as well as the seven pathogen. Isolates that involved in these experiments. The most effective salt was Ca^{++} carbonate 200 ppm conc. The most effective antioxidant was sodium benzoate in 200 ppm, and Significant differences between all tested antioxidants and their conc. as well as all tested isolates. The fungicide teldor in 200 ppm conc. was the greatest effective one in comparing to other three fungicides. Trichoderma harzianum was the most effective bioagent on all pathogen isolates.*

Key words: *Bean pods, white mold, Sclerotinia sclertiorum, Control by Ca^{++} salts, antioxidants, fungicides and bioagents.*

NTRODUCTION

Sclerotinia sclerotiorum is a plant pathogenic fungus and can cause a disease called white mold if condition are correct .*S. sclerotiorum* de Bary is considered among the world's most dangerous fungal plant pathogens due their effects on flowers , leaves, fruits or stems under high humidity or when free moisture is present on the plant surface. (Grishechkina (2003) and Zhou and Boland, 1998) control of this disease which form the great problem facing exporting, marketing and storage of snap bean in Egypt.

Martel and Smith (1977) found that high affinity for Ca2+ is a well-recognized property of oxalate, a second mechanism investigated was related to the chelation by oxalate of extracellular Ca2+. Noyes and Hancock (1981) found that oxalate may be directly toxic to host plants, secretion of oxalate has been suggested to weaken the plant, thereby facilitating invasion. the function of Ca2+-dependent defense responses and to weaken the plant cell wall. Trazilbo *et al*. (2009) reported that both incidence and severity of white mold were significantly reduced with application of CaCl2 and CaSO3. Elad (1992) tested eighteen free radical (antioxidants) for their ability to control white mould in various crops, the antioxidants (tannic acid, ascorbic acid, and dim ethyl sulfoxid) controlled the disease on cucumber fruits that some combinations of antioxidants were found to be more effective than either compound alone. Galal and Abdou (1996) demonstrated that Butyric acid reduced linear growth of *Fusarium o.xysporum*, *F. solani* and *F. moniliforme*. The inhibitory effect of BA was increased with higher concentration. Galal *et al.* (2002) recorded that Ascorbica acid (AA) decreased the growth of potato common scab causal agent, *Streptomyces scabies*. Saber *et al.* (2003) stated that salicylic acid and ascorbic acid gave the best effects as they decreased the incidence and severity of fruit rots and the least effective one was mannitol. Kim *et al.* (2008) stated that oxalic acid (OA) is an important pathogenicity determinant of this fungus *Sclerotinia sclerotiorum*. OA induces a programmed cell death (PCD) response in plant tissue that is required for disease development. Sharma (1987) stated that the best control of *Sclerotinia sclerotiorum* of pea was given by 0.1% carbendazim or 0.2% captan. Spotts and Cervantes (1996) recorded that of 8 fungicides tested only iprodione provided good control of fruit infection by *Sclerotinia sclerotiorum.* Vieira *et al.* (2001) evaluated the effectiveness of four fungicides i.e., benomyl, iprodione, procymidone and fluazinam by applying them through irrigation water to control white mold of common beans (*Phaseolus vulgaris*) in Minas Gerais, Brazil. Benomyl, and procymidone were the most efficient fungicides for white mould control. Mueller *et al.* (2002) studied the efficiency of Thiophanate methyl and other fungicides in chemical control of *S. sclerotiorum* and showed that this fungicide was efficient in chemical control of the pathogen at 7µg/mL. Ram *et al.* (2004) evaluated the efficacy of 7 fungicides, against *Sclerotinia sclerotiorum*, all treatments were significantly superior over the control in inhibiting the growth of pathogen. Vitavax and Bavistin completely inhibited the growth of the pathogen. Girlene *et al.* (2010) observed that three tested fungicides were able to reduce significantly the mycelium growth of four isolates of *S. sclerotiorum*. Sesan (1988) found that *Trichoderma viride* showed strong antagonism to *Sclerotinia sclertiorum* on stored carrot. Deacon and Berry (1992) found that colonies of *T. harzianum*, *T.atroviride* and *T.longibrachiatum* always grew faster than *S.sclerotiorum* in single or mixed culture. Abd El-Moity *et al.* (1993) showed that *T.harziamim* or *T. hamatum* had more antagonistic effect than *Gliocladium* spp., in reducing the growth and sclerotial formation of *S.sclerotiorum* in beans or lettuce plants. Inbar *et al.* (1996) reported that in culture, *T. harzianum* hyphae grew towards and coiled around the *S. sclerotiorum* hyphae. In addition, dense coils of hyphae of *T. horzianum* and partial degradation of the hyphal cell wall were observed in later stage of parasitism. Bolland (1997) tested several agents of biocontrol, including *T. viride* and fungicide benomyl, for controlling white mold in bean plants and noticed no significant difference between these two forms of control. Smolinska and Kowalska (2006) found that *Trichoderma* PBG-1 showed marked antagonistic activity against *Sclerotinia sclerotiorum,* the fungal pathogens of french bean [*Phaseolus vulgaris*].

The aim of this study improve the methods of white mold disease control of snap bean pods using calcium salts , antioxidants and biocontrol agent(s) in comparison with known method of fungicides control.

MATERIALS AND METHODS

Seven isolates of *Sclerotinia sclerotiorum* as well as three isolates of *Trichoderma* spp. representing various bean growing areas in Egypt were involved in these experiments.

1. Calcium salts:

Three Calcium salts i.e., Calcium carbonate, Ca. chloride and Ca. phosphate were applied for controlling rot disease two concentrations i.e., 100 and 200 ppm were prepared for each one of the tested Calcium salts. Healthy snap bean pods cv. Bronco, the pods were inoculated by each one of the seven tested mold isolates. After evaporation hours, the inoculated pods were immersed in the selected concentrations i.e., 200 and 100ppm of each one of the tested Calcium salts and then incubated in foam plates (15 x21 cm). Three replicates were used for each treatment then all foam plates were kept at suitable temperature under fluorescent white light at 20-25°C for 24 hour. Then removed and incubation was maintained for another seven to ten days. All treatments were examined and then the infection percentages as well as the disease severity percentages of infected pods were recorded according to Spalding and Reeder (1974) as follows:

$$\text{Infection percentage} = \frac{\text{Number of diseased pods}}{\text{Total number of inoculated pods}} \text{X100}$$

The infected area was estimated and recorded according to Piskunov (1977) as follows:

$$\text{Infected area} = \frac{3.14\times \text{average width}}{2} \times \frac{\text{average long}}{2}$$

2. Antioxidants:

Antioxidant that used in these experiments were Ascorbic acid (AA), oxalic acid, salicylic acid (SA), sodium benzoate, Two concentrations i.e., 100 and 200ppm were prepared for each one of the tested Antioxidants. Healthy snap bean pods cv. Bronco, the pods were surface sterilized, bean pods were inoculated by each one of the seven tested mold isolates as mentioned before. After evaporation hours, the inoculated pods were immersed in the selected concentrations i.e., 200 and 100ppm of each one of the tested antioxidants and then incubated in foam plates (15 x21 cm). All treatments were examined and then the infection percentages as well as the disease severity percentages of infected pods were recorded as mentioned before.

3. Fungicides:

The effect of some different fungicides i.e., Teldor (50%), Rovral (50%), Folicur (20%) and Thiophanate (38.5%) in controlling snap bean mold fungi and their disorders on pods. Two concentrations i.e., 100 and 200ppm were prepared for each one of the tested fungicides. the inoculated pods were immersed in the selected concentrations i.e., 200 and 100ppm of each one of the tested fungicides and then incubated in foam plates (15 x21 cm) . All treatments were examined and then the infection percentages as well as the disease severity percentages of infected pods were recorded as mentioned before.

4. Biological control:

The seven virulent isolates of *sclerotinia sclerotiorum* were involved to study the interaction between pathogenic fungal isolates and biological agents. three isolates of *Trichoderma harzianum* (TZ), *Trichoderma hamatum* (TM) and *Trichoderma viride* (TV) were selected for studying the biological control on the bean Pods under laboratory conditions. The preparation of inocula of the pathogenic fungal isolates were done as mentioned before. Preparation of bioagents culture filtrate were done by growing each of them in liquid potato dextrose medium in flasks 200 ml, each contain 100 ml medium and inoculation was done by 5mm disk of three days old culture, then these flasks were incubated at 25^{o}C for 15 days. The mycelial growth mat was discarded after filtration into double layer of tow filter papers (watt Mann No1). The culture filtrates were applied by spraying with manual automizer, 3days after pathogenic fungus inoculation. Three replicates were used for each treatment then all foam plates were kept at suitable temperature under fluorescent white light at 20-25°C for 24 hour. The cover was then removed and incubation was maintained for another seven to ten days. All treatments were examined and then the infection percentages as well as the disease severity percentages of infected pods were recorded as mentioned before.

RESULTS AND DISCUSSION

From Table (1), data indicated that the most virulent isolate (isolate 4) was the most affected isolate by calcium salts treatments and resulted the least % of infection in comparing to the other six tested isolates. The mean percentage of infection within all tested salts and concentrations was 15.00%, followed by isolate No.3 (15.55%).On the other hand, the least affected isolate was isolate No.6 that resulted 32.22% infection within all tested calcium salts.

The results in Table (2) Showed that lowest infection area % had occurred in snap bean pods upon application of 200ppm of Calcium chloride followed by Calcium carbonate treatments at 200ppm while the highest percentage of infection area % was observed on treated snap bean pods by 100ppm of Calcium phosphate (55.89%). Also illustrated that isolate No.1 was the greatest affected isolate by Calcium salts in both tested concentrations .The infection area % was noticed at least level in case of isolate 1(16.28%),followed by isolate No .3 (18.77%) .

Significant differences between all tested Calcium salts and their concentrations. Also, there were significant differences between the seven tested isolates.

Noyes and Hancock (1981), Kolkman and Kelly (2000), Trazilbo *et al.* (2009) observed that White mold (*Sclerotinia sclerotiorum*) is the most important common bean disease during the fall-winter season in Brazil. Different control strategies are necessary to control this disease and increase bean yield in infested areas.

Table (1): Effect of Calcium salts infection (%) by *Sclerotinia sclerotiorum* on snap bean pods cultivar white rot under laboratory condition.

Calcium salts	Ca chloride		Ca carbonate		Ca phosphate		Mean	LSD (0.05)
Cone.(ppm)	100	200	100	200	100	200		
Isolate1	0.00^{c}	0.00^{c}	50.00^{ab}	0.00^{c}	24.45	30.00^{b}	23.88	24.45
2	0.00^{b}	0.00^{b}	46.66^{a}	30.00^{a}	28.128	53.33^{a}	30.61	28.128
3	0.00^{b}	0.00^{b}	20.00^{ab}	26.66^{a}	21.381	20.00^{ab}	15.55	21.381
4	0.00^{b}	0.00^{b}	33.33^{ab}	0.00^{b}	11.86	26.66^{a}	15.00	11.86
5	0.00^{b}	0.00^{b}	40.00^{a}	30.00^{a}	21.788	40.00^{a}	25.00	21.788
6	0.00^{c}	0.00^{c}	100.0^{a}	13.33^{bc}	34.831	33.33^{bc}	32.22	34.831
7	33.33^{a}	0.00^{b}	33.33^{a}	30.00^{ab}	32.48	40.00^{a}	30.55	32.48
Mean	4.76	0.00	46.18	25.99	51.16	34.76	----	----

Within columns, means followed by a common letter do not differ significantly by Least significant difference test (P< 0.05).

Table (2): Effect of Calcium salts on infection area% of snap bean pods inoculated with of *Sclerotinia sclerotiorum*.

Calcium salts	Ca chloride		Ca carbonate		Ca phosphate		Mean	LSD (0.05)
Cone.(ppm)	100	200	100	200	100	200		
isolate 1	0.00^{d}	0.00^{d}	18.23^{C}	0.00^{d}	46.08^{a}	33.35^{b}	16.28	10.903
2	0.00^{c}	0.00^{c}	34.37^{b}	33.74^{b}	62.27^{a}	44.65^{ab}	29.17	18.874
3	0.00^{d}	0.00^{d}	29.56^{b}	3.84^{c}	46.93^{a}	32.28^{b}	18.77	2.9811
4	0.00^{c}	0.00^{c}	38.47^{ab}	0.00^{c}	65.88^{a}	22.98^{bc}	21.27	31.749
5	0.00^{c}	0.00^{c}	36.29^{a}	19.98^{b}	42.40^{a}	18.84^{b}	19.59	14.506
6	0.00^{c}	0.00^{c}	62.27^{a}	19.83^{c}	55.76^{b}	19.85^{c}	34.23	31.332
7	11.92^{cd}	0.00^{d}	44.57^{b}	23.33^{bcd}	71.93^{a}	28.38^{bc}	30.02	25.249
Mean	1.70	0.00	37.68	14.39	55.89	28.62	----	----

Within columns, means followed by a common letter do not differ significantly by Least significant difference test (P< 0.05).

Table (3) showed that the most effective antioxidant was sodium benzoate in 200ppm (25.23 mm), where the least infection % on snap bean pods Bronco cv. under laboratory conditions, also indicated that there were significant differences between all tested antioxidants and their concentrations. The great effect was noticed in case of Ascorbic acid (200ppm) on isolate4. There were significant differences between all tested isolates and all interactions between isolates x antioxidants and concentrations.

The results in Table (4) showed that lowest infection area% had occurred in snap bean pods upon application of 200ppm of ascorbic acid followed by sodium benzoate treatment at 200ppm.

Generally, all tested antioxidants with the different concentration decreased significantly the infection percentages of white rot causing by Sclerotinia sclerotiorum. The increase of concentrations of antioxidants decreased the percentage of infection.

Table (3): Effect of antioxidants treatments on infection (%) incited with *Sclerotinia sclerotiorum*, the causal organism of white rot disease of snap bean pods cv. Bronco under laboratory condition.

Antioxidants	S. benzoate		Ascorbic acid		Salicylic acid		LSD (0.05)
Cone.(ppm)	100	200	100	200	100	200	
isolate 1	53.33^{ab}	13.33^{c}	53.33^{ab}	36.66^{bc}	50.00^{ab}	70.00^{a}	32.749
2	50.00^{ab}	23.33^{c}	43.33^{abc}	30.00^{b}	66.66^{a}	26.66^{b}	25.506
3	46.66^{ab}	36.66^{b}	36.66^{b}	30.00^{b}	66.66^{a}	26.66^{b}	25.848
4	10.00^{d}	20.00^{cd}	46.66^{ab}	10.00^{d}	60.00^{a}	36.66^{bc}	17.289
5	56.66^{a}	30.00^{b}	40.00^{ab}	33.33^{b}	60.00^{a}	40.00^{ab}	22.581
6	20.00^{b}	10.00^{b}	26.66^{b}	26.66^{b}	63.33^{a}	26.66^{b}	24.45
7	53.33^{a}	43.33^{ab}	43.33^{ab}	23.33^{b}	46.66^{a}	49.33^{a}	20.542
Mean	41.14	25.23	41.42	27.14	59.09	39.37	----

Within columns, means followed by a common letter do not differ significantly by Least significant difference test (P< 0.05).

Table (4): Effect of antioxidants on infection area (%) of white rot disease on snap bean pods cv. Bronco inoculated with of *Sclerotinia sclerotiorum* under laboratory condition.

Antioxidants	S. benzoate		Ascorbic acid		Salicylic acid		LSD (0.05)
Cone.(ppm)	100	200	100	200	100	200	
isolate 1	27.40^{c}	38.65^{b}	50.00^{a}	26.93^{c}	52.13^{a}	50.22^{a}	5.9235
2	53.29^{b}	30.14^{c}	43.33^{b}	30.74^{c}	66.12^{a}	47.58^{b}	11.387
3	56.18^{a}	26.33^{b}	40.00^{ab}	26.95^{b}	53.28^{ab}	46.93^{ab}	28.104
4	19.10^{d}	41.60^{c}	50.00^{b}	16.66^{d}	62.09^{a}	50.88^{b}	4.2967
5	41.47^{c}	25.21^{d}	53.54^{ab}	30.71^{d}	57.98^{a}	44.84^{bc}	9.8337
6	45.86^{ab}	10.00^{c}	30.75^{bc}	30.00^{bc}	65.67^{a}	30.98^{bc}	22.862
7	27.86^{b}	28.84^{b}	61.85^{a}	22.57^{b}	63.60^{a}	28.38^{b}	20.542
Mean	38.74	28.68	47.07	26.36	60.12	42.83	----

Within columns, means followed by a common letter do not differ significantly by least significant difference test (P< 0.05).

Huang (1983),Tu (1989), Elad (1992), Galal and Abdou (1996), Cubeta *et al.* (1999), Galal *et al.* (2000), Mandavia *et al.* (2000), Galal and El-Bana (2002), Galal *et al.* (2002) were reported results of their studies on the effect of antioxidants on the infection various pathogens to some hosts. Saber *et al.* (2003) recorded that all tested antioxidants; salicylic acid and ascorbic acid; gave the best effects and decreased the incidence and severity of fruit rots and the least effective one was mannitol.

The results in Table (5) illustrated that fungicide Teldor in 200 ppm concentration was the greatest effective one in comparing to other three fungicides in both tested concentrations. Significant differences were noticed between this treatment and other treatments in this trial.

Table (5): Effect of four fungicides on white rot disease incidence of snap bean pods of genotype Bronco incited by seven isolates of *Sclerotinia sclerotiorum* under laboratory conditions as percentage of infection (%).

Bean pods infection%									
Isolate	Teldor		Rovral		Thiophanate		Folicur		LSD (0.05)
	100ppm	200ppm	100ppm	200ppm	100ppm	200ppm	100ppm	200ppm	
1	0.00^{c}	0.00^{c}	26.66^{c}	30.00^{bc}	46.66^{ab}	23.33^{c}	63.33^{a}	53.33^{a}	19.027
2	23.33^{a}	0.00^{c}	13.33^{b}	0.00^{c}	10.00^{c}	0.00^{c}	0.00^{c}	0.00^{c}	7.9004
3	0.00^{c}	0.00^{c}	16.66^{bc}	0.00^{c}	40.00^{ab}	20.00^{bc}	50.00^{a}	0.00^{c}	23.963
4	0.00^{c}	0.00^{c}	13.33^{c}	0.00^{c}	23.44^{b}	0.00^{c}	43.33^{a}	0.00^{c}	8.6545
5	0.00^{b}	0.00^{b}	13.33^{b}	0.00^{b}	30.00^{a}	0.00^{b}	0.00^{b}	0.00^{b}	7.0664
6	0.00^{c}	0.00^{c}	40.00^{a}	16.66^{bc}	53.33^{a}	13.33^{bc}	20.00^{b}	13.33^{b}	18.696
7	20.00^{b}	0.00^{c}	46.66^{a}	30.00^{ab}	46.66^{a}	0.00^{b}	20.00^{b}	20.00^{b}	24.222
Mean	21.66	0.00	24.28	16.66	35.72	13.80	30.95	16.66	----

Within columns, means followed by a common letter do not differ significantly by Least significant difference test ($P< 0.05$).

Fekry *et al.* (2003) and Barnaveta (2004) supported our obtained results. Everts and Zhou (2007) reported that the soil-applied boscalid fungicide reduced the number of white mold –infected pods increased yields of lima and snap beans grown in Maryland and Delaware.

Data in Table (6) indicated that five isolates of the pathogen i.e., 1,3,4,5 and 6 were great affected by Teldor and recorded 0.00 infection area cm %, while isolates No 2 and 7 were resulted infection area % as 33.30 and 15.00 %, respectively. Data in Table (7) illustrated that biological control agents great affected the infection caused by the seven tested isolates *S. sclerotiorum*. *T. harzianum* was the most effective bioagent on all pathogen isolates. The least % of infection was 53.70, whereas the least infection area% was 51.80%as a result T. harzianum within infection of *S. sclerotiorum*. *T. hamatum* came at the second rank of infection % (59.59%), while the most infection %was noticed by *T. viride* (61.18%).

Elad *et al.* (2002) Similar results by using biological control fungi in controlling the same pathogenic fungi in many countries. The antagonistic effect that happened in dual culture, *T. harzianum* parasitized to the pathogen and inhibited mycelial growth, the processes of mycoparasitism including coiling round and attachment to host hyphae, microconidia, and penetration into the hyphae or breaking the septa of hyphae and conidia *T. viride* produced non- volatile antibiotics inhibiting growth of pathogenic fungi but its antagonistic effect of *in vitro* was relatively low. Girlene *et al.* (2010) observed that Chemical control in vitro with fungicides Thiophanate methyl, Iprodione and Carbendazim was also tested. Except *Ulocladium atrum*, all *Trichoderma* isolates showed antagonistic potential against *S. sclerotiorum*, where isolate 3601 presented the best performance.

Table (6): Effect of four fungicides on white rot disease incidence of snap bean pods of genotype Bronco incited by seven isolates of *Sclerotinia sclerotiorum* under laboratory conditions as infection area(cm%).

Isolate	Infected area cm								
	Teldor		Rovral		Thiophanate		Folicur		LSD (0.05)
	100ppm	200ppm	100ppm	200ppm	100ppm	200ppm	100ppm	200ppm	
1	0.00^{c}	0.00^{c}	25.54^{bc}	11.51^{c}	42.20^{b}	33.30^{bc}	64.39^{a}	11.90^{c}	3.1378
2	33.30^{a}	0.00^{c}	19.98^{b}	0.00^{c}	0.00^{c}	0.00^{c}	0.00^{c}	0.00^{c}	1.7309
3	0.00^{c}	0.00^{c}	23.33^{bc}	0.78^{d}	33.12^{b}	23.49^{bc}	71.93^{a}	0.00^{c}	2.3622
4	0.00^{c}	0.00^{c}	0.00^{c}	11.92^{c}	23.59^{b}	0.00^{c}	55.70^{a}	0.00^{c}	2.2898
5	0.00^{b}	0.00^{b}	0.00^{b}	0.00^{b}	33.72^{a}	0.00^{b}	11.51^{b}	11.52^{b}	0.7241
6	0.00^{c}	0.00^{c}	36.29^{b}	0.00^{c}	64.4^{a}	11.90^{c}	15.00^{c}	11.77^{c}	2.7749
7	15.00^{b}	0.00^{c}	18.53^{b}	3.70^{b}	34.36^{a}	10.31^{b}	26.26^{ab}	13.76^{b}	3.1904
Mean	6.90	0.00	17.67	3.99	33.06	11.29	34.97	6.99	----

Within columns, means followed by a common letter do not differ significantly by Least significant difference test (P< 0.05).

Table (7): Biological control of *Sclerotinia sclerotiorum* using *Trichoderma* spp under laboratory conditions.

Pathogen isolate	Infection%				Infection area%			
	T. harzianum	*T. hamatum*	*T. viride*	LSD	*T. harzianum*	*T. hamatum*	*T. viride*	LSD
1	59.25b	73.19a	73.12a	5.0279	61.23c	68.29b	80.12a	2.8255
2	50.65b	66.13a	66.75a	4.8938	44.25c	72.12a	55.14b	7.7378
3	30.86c	40.74b	50.55a	4.8938	53.29b	50.62b	60.28a	3.8257
4	42.25b	44.25b	52.64a	3.4605	36.36b	57.44a	55.12a	4.8938
5	49.26a	51.52a	54.14a	4.8938	39.23c	60.22a	49.47b	1.9979
6	73.28a	73.13a	63.90b	5.9937	64.61a	69.45a	66.68a	5.2859
7	70.35b	68.16b	77.14a	3.4605	63.63c	82.11a	70.10b	4.3159
Mean	53.70	59.59	61.18	----	51.80	65.75	62.41	----

Within columns, means followed by a common letter do not differ significantly by Least significant difference test (P< 0.05).

REFERENCES

Abd El-Moity, T.H., K.G.M. Ahmed, A.M.M. Mahdy and F.G. Mohamed (1993). Studies on biological control of Sclerotinia rot disease of some vegetable crops. Annals of Agric.Sc.31:223-237.

Barnaveta, E. (2004). The efficiency of some fungicides in controlling *Sclerotinia sclerotiorum* infecting beans (*phaseolus vulgaris*). Cercetari-Agronomice-in-Moldova.fl/4:35-40.

Bolland, G. J. (1997). Stability analysis for evaluating the influence of environment on chemical and biological control of white mold *Sclerotinia sclerotiorum* of bean. Biological Control, 9: 7-14.

Cubeta, M. A., B. R. Cody and J. Hudynica (1999). Evaluation of fungicides, an antioxidant and a plant activator for managing Sclerotinia head rot of cabbage. Proceeding of the 1998 International Sclerotinia Workshop, Fargo, ND,-9-12-September, 1998. 51-52.

Deacon, J.W. and L.A. Berry (1992). Modes of actions of mycoparasites in relation to biocontrol of soilborne plant pathogens. In: Tjamos E.C. Papavizas G.C. Cook R.J. (eds). Biological control of plant diseases. Plenum Press, New York. pp157-167.

Elad, Y. (1992). The use of antioxidants (free radical scavengers) to control grey mould (*Botryrtis cinered*) and white mould (*Sclerotinia sclerotiorum*) in various crops. Plant Pathology. 41(4): 417-426.

Elad, Y., B. Shakti, Y. Nitzani, D. Rav-David, S. Bhardwaj, Y. Elad (ed.), J. Khol and D. Shtienberg (2002). Biocontrol of *Sclerotinia sclerotiorum* by *Trichoderma* spp. resistance-inducing isolates as modified by spatial, temporal and host plant factors. IOBC-WPRS Working Group 'Biological Control of Fungal and Bacterial Plant Pathogen'. Proceedings of the 7th working group meeting, Influence of abiotic and biotic factors on biocontrol agents at Pine Bay, Kusadasi, Turkey, Bulletin OILBSROP. 25(10): 17-20.

Everts, K.L. and X.C. Zhou (2007). Control of white moid and web Blight on lima and bean grown of processing. J. of Pnytopath., 97: SI74. Fahmy, M.S. (1994): Biochemical studies on some medicinal plants cultivated in Egypt. M.Sc. Fac. Agric., Menofia Univ.

Fekry, W.A., E.H. Abou El-Salehein and F.M. Abdel-Latif (2003). Effect of bioagents, fungicides as well as nitrogen and phosphorus fertilizers on controlling of white mould disease of snap bean plants (*Phaseolus vulgaris*. L.) and its effect on vegetative growth and chemical composition. Annual of Agricultural Science, Moshtohor, 41(4): 1501-1520.

Galal, A. A. and A. A. El-Bana (2002). Inhibition of carpoenic germination of sclerotia of *Sclerotinia sclerotiorum* (Lib.) De Bary by cinnaamic acid deriavatives. Egypt. J. Phytopathol. 30 (1): 67-79.

Galal, A. A. and S. El- Abdou (1996). Antioxidants for the control of fusarial diseases in cowpea. Egypt. J. Phytopathol. 24: 1-12.

Galal, A. A., M. M. N. Shaat and A. A. El-Bana (2000). Sensitivity of *Alternaria radicina* and *Alternaria tenuissima* to some Antioxidant compounds. J. Agric. Sci., Mansoura Univ. 25 (3): 1553-1562.

Galal, A.A., S.H. Gad El-Hak, Y.T. Abd El-Mageed, N. S. Youssef and A. Z. Osman (2002). Effect of gelling agents and Antioxidant treatments on in vitro potato micro-tuberization and on common scab development using virus-indexed plantlets. Egypt. J. Hort. 29(1): 61-82.

Grishechkina, L. D. (2003). Diagnosis of diseases of vegetable crops in greenhouses .(control and protection of plantes). Zashchita -i-Karantin Rastenii, (3): 45-50.

Girlene, S.F., C .F. Lívio, C.N.C. Francinete, Angela Coimbra dos Santosl, F. C. Antonio and T . O. Neiva (2010). Biological and chemical control of *Sclerotinia sclerotiorum* using *Trichoderma* spp. and Ulocladium atrum and pathogenicity to bean plants.

Huang, H. C. (1983). Histology amino acid leakage, and chemical composition of normal and abnormal sclerotia of *Sclerotinia sclerotiorum.* Can. J. Bot. 61:1443-1447.

Inbar, J., A. Meneder and I. Chet (1996). Hyphal interaction between *Trichoderma harzianum* and *Sclerotinia sclerotiorum* and its role in biological control. Soil Biology and Biochemistry 28:757-763.

Kim, K.S., J.Y. Min and M.B. Dickman (2008). Oxalic acid is an elicitor of plant programmed cell death during *Sclerotinia sclerotiorum* disease development. Mol Plant Microbe Interact: 21(5):605-12.

Kolkman, J.M. and J.D. Kelly (2000). Using oxalate to indirectly test for physiological resistance to white mold in common bean, Crop Science,40:281-285.

Mandavia, M. K., IN. A. Khan, H. P. Gajera, J. H. Andharia and M. Parameswaran (2000). Inhibitory effects of phenolic compounds on fungal metabolism in host-pathogen interactions in Fusarium wilt of cumin. Allelopathy Journal. 7(1): 85-92.

Martel, A.E. and R.M. Smith (1977). Critical Stability Constants. Vol. 3. (New York and London: Plenum Press) .

Mueller, D. S., A. E. Dorrance, R. C. Derksen, E. Ozkan, J. E. Kurle, C. R. Gran, J. M. Gaska, G. L. Hartman, C. A. Bradley and W. L. Pedersen (2002). Efficacy of fungicides on *Sclerotinia sclerotiorum* and their potential for control of Sclerotinia stem rot on soybean. Plant Disease. 86(1): 26-31.

Noyes, R.D. and J.G. Hancock (1981). Role of oxalic acid in the sclerotinia wilt of sunflower. Physiol. Plant Pathol. 18: 123-132.

Piskunov, N. (1977). Differential and integral calculus. I. 439. Ploetz, R. C. (2004). Influence of temperature on Pythium splendens-induced root disease on carambola, Averrhoa carambola. Mycopathologia. 157(2): 225-231.

Ram, P., N. Udit and P. N. Singh (2004). Management of Sclerotinia stem rot of French bean through fungicides and biopesticides. Annals of Plant Protection Sciences. 12(2): 447.

Saber, M.M., K.K. Sabet, S.M. Moustafa-Mahmoud and Iman Y.S. Khafagi (2003). Evaluation of Biological Products, Antioxidants and Salts for Control of Strawberry Fruit Rots. Egypt. J. Phytopathol, 31 (1-2): 31-43.

Sesan, T. (1988). Present State of research on biological control of fungal diseases of legumes probleme de protection plantelor 16:219-236.

Sharma, A. K. (1987). Evaluation of fungicides for the control of Sclerotinia rot of pea. Indian Phytopathology. 40(3): 399-401.

Smolinska, U. and B. Kowalska (2006). The effectivity of plant extracts and antagonistic microorganisms on the growth inhibition of French bean pathogenic fungi. Vegetable Crops Research Bulletin,64:67-76.

Spalding, D. H. and W.F. Reeder (1974). Post harvest control of sclerotinia rot of snap bean pods with heated and unheated chemical dips. Plant Dis. Reporter,58(1): 59-62.

Spotts, R. A. and L. A. Cervantes (1996). Sclerotinia rot of pears in Oregon. Plant Dis. 801:1262- 1264.

Trazilbo J. Paula Júnior1, Rogério F. Vieira1, Hudson Teixeira2 and José Eustáquio S. Carneiro (2009). Foliar application of calcium chloride and calcium silicate decreases white mold intensity on dry beans. Tropical Plant Pathology, 34(3): 171-174.

Tu. J. C. (1989). Oxalic Acid Induced Cytological Alterations Differ in Beans Tolerant or Susceptible to White Mould.New Phytologist. 112(4): 519-525.

Vieira, R. F., J.T.J. Paula, A.P. Peres and J.D.C. Machado (2001). Fungicide application through irrigation water for control of white mould on common beans and seed transmission of the pathogen. Fitopatologia-Brasileira, 26(4): 770-773.

Zhou, T. and G.J. Boland (1998). Biological control strategies for Sclerotinia species. Plant-Microbe Interactions and Biological Control. G.J. Boland and L.D. Kuykendall, eds., Marcel Dekker, Inc., New York, NY. Pages 127-156.

دراسات على مقارنة مرض العفن الأبيض فى قرون الفاصوليا فى مصر.

هاله رجب غنيم ، محمدى زكى الشنوانى ، مجدى السيد مهدى
قسم النبات الزراعى – كلية الزراعة –جامعة المنوفية

الملخص العربى

مرض العفن الابيض فى قرون الفاصوليا والمتسبب عن الفطر سكلوروتينيا سكلوريتيم من الأمراض الهامة والتى تؤثر بشدة على الأزهار والأوراق والثمار والسوق وتسبب خسائر إقتصادية كبيرة .أظهرت أملاح الكالسيوم المختبرة فى هذه الدراسة كفاءة عالية فى مقاومة المرض وتخفيض شدة الإصابة والمساحة المصابة على الجزء المصاب وكانت هناك فروق معنوية بين الأملاح المختبرة وتركيزاتها وكذا بين عزلات الفطر المسبب السبعة المختبرة فى هذه الدراسة وكانت أفضلها الكالسيوم كلورايد بتركيز ٢٠٠ جزء بالمليون أما مركبات مضادة الأكسدة فقد أظهرت فعالية عالية فى مقاومة المرض وكان افضلها تأثيرا بنزوات الصوديوم بتركيز ٢٠٠ جزء/المليون ،كما أظهر المبيد تيلدور بتركيز ٢٠٠ جزء/المليون فعالية عالية عن المبيدات الأخرى المختبرة والتى تباينت جميعها فى رد فعلها ضد عزلات الفطر فى إحداث المرض. كما أثبت كائن التضاد الحيوى ترايكودرما هارزيانيم مقدرة عالية على مقاومة حدوث المرض حيث ظهر تأثيرة على السبعة عزلات المختبرة من الفطر الممرض.