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EFFECT OF SOME RESISTANCE INDUCERS, BIO-AGENT AND FUNGICIDES ON THE INCIDANCE OF ROOT- ROT AND WILT OF FABA BEAN

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ABSTRACT: *Root-rot and wilt are very common and serious diseases on faba bean in Egypt. They cause considerable losses in plant survival which due to significant effect on seed production. Therefore, serious trials have been carried out to manage the incidence of both diseases using different approaches. In the course of this study different methods of disease control were followed. The first method was the use of different resistance inducers i.e. Salicylic acid & Chitosan and Bion were tested in pot experiment under greenhouse conditions. The results obtained revealed the significance of using such chemicals and Bion in controlling root-rot disease. Treating seeds by all of them led to a significant decrease in disease incidence as damping-off. Also, the use of some bioagents i.e. Bio-Zeid, Bio-ARC and Clean-root gave considerable results in controlling the disease. The obtained results were compared to the use of some fungicides i.e. Rhizolex-T, Uniform and Sumiselex which were tested under the same condition.*

Key words: *Faba bean, root-rot, resistance inducers, bioagents and chemical control.*

INTRODUCTION

Faba bean (*Vicia faba* L.) is one of the most important food legume crops in Egypt. In the early decades of last century, faba bean was an important export crop, principally to the UK as a food for horses. Faba bean plants are infected with many fungal pathogens which cause considerable yield losses (Mahmoud, Nagwa, 1996). Root-rot ranked as the most important fungal diseases affecting faba bean production in Egypt (Bond *et al.,* 1985 and Abou-Zeid *et al.,* 1997).

Akem and Bellar (1999) found, through survey in the main faba bean growing regions of Syria, that the wilt / root-rot complex (*Fusarium oxysporum* and *Macrophomina phaseolina*) was the most important and widespread fungal disease observed at many locations. Kurmut *et al.* (2002) found that most isolates of wilt and root-rot which isolated from wilted and rotted plants of *Vicia faba* from different localities in Sudan proved to be pathogenic to *Vicia faba*. Disease severity varied between 28 – 100%. El-Sayed, Sahar (2006) isolated *Fusarium oxysporum*, *Rhizoctonia solani, Fusarium solani, Fusarium moniliforme* and *Verticillium alboatrum* which cause wilt and root-rot to faba bean plants.

Application with some chemicals, such as Salicylic acid (SA) and 2, 6-dichloroisonicotinic acid (INA), potassium salts, amino butyric acid (BABA) and Bion were reported to reduce the disease incidence in plants (Oostendorp *et al.,* 2001). Prachi and Singh (2002) reported that salicylic acid (SA) was used to induce resistance in the callus cultures of Zingiber officinal against culture filtrate (CF) of *Fusarium oxysporum* f. sp. *zingiber*, as exogenous application of SA resulted in increased activity of peroxidase and β-1, 3 glucanase enzymes in the callus.

Mazen (2004) also found that application of biotic inducers under field conditions as seed treatment or foliar treatment resulted in a significant increase in crop parameters of faba bean compared to the untreated control. Ahmed (2001) recorded that infection with *C. dematium* resulted in an increase of peroxidase and polyphenol oxidase activities during examined periods in all tested cultivars compared to the healthy ones. The highest increase in the enzyme activity was recorded in the resistant and

moderately susceptible cultivars compared to the susceptible one. Zheng and Sinclair (2000) showed that *Bacillus megaterium* is a potential bacterial biocontrol agent against *Rhizoctonia solani*. Jensen *et al.* (2002) evaluated the effect of *Bacillus subtilis* and *Trichoderma harzianum* alone or in combination with Captan 400 and Vitavax 200 as biocontorl treatments against the dry bean root-rot pathogens. They recorded that seed application of both biocontrol agents increased plant biomass and decreased disease severity, under greenhouse conditions. Cigdem and Merih (2003) showed that the filtrates of *Trichoderma harzianum* were effective against the plant pathogens, *Fusarium colmarum, Fusarium oxysporum, Fusarium moniliforme* and *Rhizoctonia solani*.

This research work aimed to study the effect of some resistance inducers, bio-agents and fungicides on controlling root-rot of faba bean and to identify some associated biochemical changes in the treated plants.

MATERIALS AND METHODS

1. Disease survey of faba bean root-rots in different governorates:

Survey was carried out in three different governorates in Egypt namely Minufiya, Beheira and Giza during the two successive seasons (2008/2009 and 2009/2010). Faba bean diseased plants showing root-rot symptoms were also collected from faba bean growing fields. The average percentage of disease incidence was calculated as the number of rotted faba bean plants relative to the total number of examined plants.

2. Isolation and identification of the causal pathogens:

The infected roots were carefully washed with tap water, sterilized with sodium hypochlorid solution (1%), then dried between two sterilized filter papers. Fragments were then placed on potato dextrose agar medium in Petri dishes and incubated at 25°C for 7 days. The developed fungal colonies were picked from the edges of growing colonies and the purified colonies were then transferred onto PDA slants. Colony characteristics, spore morphology were described and identified, according to the description of Plates and Vandler (1981). The identification was confirmed by Mycology Research Plant Disease Survey Dept., Plant Pathol., Res. Inst., Agric. Res. Centre, Giza, Egypt.

3. Pathogenicity test:

Pathogenicity test was carried out using the more frequent three isolated fungi i.e. *Fusarium oxysporum, Fusarium moniliforme* and *Fusarium solani*.

This test was conducted in the greenhouse at Sers El-Layian Agricultural Research Station in 2010 growing season. All fungal isolates which were isolated from rotted roots of faba bean were tested for their pathogenic potentialities on the susceptible cultivar Giza 40 under greenhouse condition in order to select the highly pathogenic isolates. Pots (25 cm in diameter) were sterilized by immersing in 5% formalin for 15 minutes, then left to dry-off for 10 days. Soil sterilization was accomplished with 5% formalin solution, and covered with polyethylene sheets for 15 days then left uncovered for 10 days to evaporate formalin. The pots were filled with the sterilized soil (3 kg / pot). Fungi were individually grown of sand-barley (SB) medium (25 g clean sand, 75 g barley and enough water to cover the mixture). Flasks contained sterilized medium were inoculated with each particular fungus and incubated at 25°C for two weeks. Soil infestation was carried out by adding the fungal inocula to the sterilized soil at the rate of 3% of soil weight (Mazen, 2004). Soil of control treatment (pots) was mixed with the same amount of sterilized sand-barley (SB) medium. Potted soil was watered daily for a week to enhance the fungal growth.

Ten faba bean seeds were surface sterilized using sodium hypochlorite 5% for 2 min., washed several times with sterilized water and then sown in each pot. Three replicates were used for each particular treatment. Data were recorded as percentages of pre- & post-emergence damping-off and survival plants. The disease assessment was estimated using the next formula according to El-Helaly *et al.* (1970):

$$\text{Pre-emergence damping-off (\%)} = \frac{\text{Number of non germinated seeds}}{\text{Total number of sown seeds}} \times 100$$

$$\text{Post-emergence damping-off (\%)} = \frac{\text{Number of dead seedlings}}{\text{Total number of sown seeds}} \times 100$$

$$\text{Survival plants (\%)} = \frac{\text{Number of survival plants}}{\text{Total number of sown seeds}} \times 100$$

Pathogenic fungi were re-isolated from infected plants and Koch's Postulates were followed.

4. Effect of soaking faba bean seeds in some resistance inducers on controlling root-rot under greenhouse conditions:

This experiment was carried out in sterilized pots (25 cm in diameter) containing sterilized soil in the greenhouse. Both pots and soil were sterilized with 5% formalin solution. Soil was infested with *Fusarium oxysporum, Fusarium moniliforme* and *Fusarium solani* as mentioned before.

Faba bean seeds (cv. Egypt 1) were soaked, before sowing in solutions of three resistance inducers, salicylic acid, chitosan and Bion for 2 hr at the rate 10 Mm, 15 g / L water and 250 ppm, respectively. Ten seeds were sown in each pot and three replicates were used for each treatment. Percentage of pre- & post-emergence damping-off and healthy survival plants were recorded.

5. Effect of bio-agents on controlling root-rot under greenhouse conditions:

This experiment was carried out in sterilized pots (25 cm diameter) containing sterilized soil in the greenhouse. Both pots and soil were sterilized with 5% formalin solution. Soil was infested with *Fusarium oxysporum, Fusarium moniliforme* and *Fusarium solani* as mentioned before.

Faba bean seeds (cv. Egypt 1) were treated with the tested bio-agents, Bio-ARC, Bio-Zeid and clean root (Table 1) after treatment with 4% solution of carboxymethyl cellulose (CMC) as sticker. The same aforementioned methods were used without bio-agents as control. Ten seeds were sown per pot, and three replicates were used for each treatment. Percentage of pre- & post-emergence damping-off and healthy survival were recorded.

6. Effect of the tested fungicides on the disease incidence in pots:

This experiment was carried out in sterilized pots (25 cm diameter) containing sterilized soil in the greenhouse. Both pots and soil were sterilized with 5% formalin solution. Soil was infested with *Fusarium oxysporum, Fusarium moniliforme* and *Fusarium solani* as mentioned before.

Faba bean seeds (cv. Egypt 1) were treated with the tested fungicides. Rhizolex-T 50 (Tolelophose methul + thirom), Uniform (Azoxystrobin + Mefenoxam, Syngenta, Canda) and Sumisclex (Procymid one) at the rate of 3 g / kg seed by shaking them gently in glass container containing glue suspension (supper film 70) as a sticker material / kg seeds. The same aforementioned methods were used without fungicides as a control. Ten seeds were sown per pot and three replicates were used for each treatment. Percentage of pre- & post-emergence damping-off and healthy survival were recorded.

Table (1): Bio-agents used as seed treatment, trade name, bio-agent and rate of application.

Biocide (trade name)	Bio-agent (density / ml)	Dose	
		Per L medium	Per kg / seed
Bio-ARC	*Bacillus megaterium*, 2-5×10^7 cfu/ml	2.5 g	2.5 g
Bio-Zeid	*Trichoderma album*, 3 × 10^7 cfu/ml	2.5 g	2.5 g
Clean root	*Bacillus subtilis*, 3 × 10^7 cfu/ml	5.0 g	5.0 g

7. Effect of some resistance inducers, bio-agent and fungicides on the biochemical changes of faba bean plants grown in soil infested by *Fusarium oxysporum*:

After 15 days from planting, fresh samples were taken from plants of treated and untreated faba bean seeds and extracted according to Goldschmidt *et al.* (1968). Then the extracts were used for assaying biochemical change associated with the different treatments. The activities of peroxidase (Allam and Hollis, 1972) and Polyphenoloxidase (Snell and Snell, 1953) were determined.

8. Field experiments:

Effect of resistance inducers, bio-agent and fungicides on root-rot incidence and some growth characters:

These experiments were conducted in naturally infested soil at Sers El-Layain Agric. Res. Stat., during 2010/2011 and 2011/2012 growing seasons. The experimental layout was in randomized complete block design. The plot was divided into equal sub-plots each one consisting of 5 rows (3 × 3.5 m). The recommended agricultural practices like soil preparation, irrigation, fertilization etc. were applied as usual.

Seed treatment:

Faba bean seeds (cv. Egypt 1) were treated with the six treatments (5.0 ml / L) i.e. salicylic acid (10 µ m), chitosan (15 g / L water) while Bio-Zeid (2.5 g / L water), Clean-root (5.0 ml / L), Rizolex-T (50 wp) and Uniform at the rate (3 g / kg). Faba bean seeds (cv. Egypt 1) without chemical inducers, bio-agent and fungicides were used as control. Three replicates were used for each treatment. Disease assessment and yield components were recorded and estimated as mentioned before.

Pre and post emergence damping-off were recorded after 15 and 30 days respectively, from sowing and then survival plants were estimated. Yield components were recorded as mentioned before.

Statistical analysis:

Statistical analysis of all previously designed experiments were carried out according to ANOVA (Clarke and Kenpson, 1997). Treatment means were compared by the least significant difference test "L.S.D." at 5% level of probability.

RESULTS

1. Survey of faba bean root-rot in different governorates:

Faba bean plants naturally grown in Giza, Minufiya nad Beheira governorates during 2008/09 – 2009/10 growing seasons. The percentage of disease incidence ranged from 10.0 to 23.0%. The mean percentages of infection were 18.0 and 23.0% in 2008/09, respectively as shown in Table (2). The incidence of the disease was higher in Giza governorate than the other governorates.

Table (2): Percentage of naturally infected faba bean plants in three governorates during two successive seasons (2008/09 and 2009/10).

Governorate	Root-rot incidence / season (%)	
	2008/09	2009/10
Minufiya	13.0	10.0
Beheira	18.0	15.0
Giza	23.0	21.0
Mean	18.0	15.33

2. Frequency of fungi isolated from diseased plants:

Fungi were isolated with different frequencies from the infected roots of the plants collected from the inspected governorates.

Data in Table (3) indicate that the highest percentage of occurrence was recorded for *Fusarium oxysporum* (18.33%) followed by *Fusarium solani* (16.33%), *Fusarium moniliforme* (15.0%), *Alternaria tenius* (11.0%), *Pythium splendens* (8.73%), *Fusarium semitectum* (7.33%), while *Macrophomina phaseolina* (5.67%) gave the least frequency.

3. Pathogenicity tests:

In these experiments, 14 isolates of three different fungi were tested for their pathogenic abilities. Results presented in Table (4) reveal that all tested isolates could infect the roots of faba bean cv. Giza 40 causing pre- & post-emergence damping-off and reduced the survived plants. The highest pre-emergence percentage of damping-off (23.33%) was recorded by *Fusarium oxysporum* from Giza location followed by *Fusarium solani* from Beheira and *Fusarium moniliforme* from Minoufiya. The infection (%) significantly varied among the pathogens. The disease incidence of these fungi on the plants grown in the infested soil was also affected by source of isolates. Isolates of Giza seemed to be more virulent than the other ones.

4.Effect of soaking faba bean seeds in some resistance inducers agents on controlling root-rot under greenhouse conditions:

Data in Table (5) indicate that all tested chemicals significantly reduced pre- & post-emergence damping-off and root-rot of faba bean plants compared to the control. On the other hand, increases in the survival plants. Chitosan was more effective followed by salicylic acid and Bion.

5. Effect of bio-agents on faba bean root-rot incidence:

Data presented in Table (6) revealed that the three bio-agents reduced significantly pre-emergence damping-off, post-emergence damping-off and survival plants of faba bean plants infected with the causal pathogens comparing to control treatment. However, there was a variation in efficacy of the three tested bio-agents where Bio-ARC was the most effective followed by Bio-Zeid meanwhile, clean-root was the least effective one. The highest reduction percentage in pre-infection was recorded in case of Bio-ARC treatment when used for controlling *Fusarium oxysporum, Fusarium solani* and *Fusarium moniliforme*.

Table (3): Occurrence and frequency of isolated fungi from naturally infected faba bean plants collected from three governorates in Egypt in 2008/09 and 2009/10.

Isolated fungi	Frequency (%)			Mean
	Giza	Beheira	Minufiya	
Alternaria tenius	14.0	10.0	9.0	11.00
Fusarium moniliforme	8.2	13.0	5.0	15.00
Fusarium oxysporum	22.0	18.0	15.0	18.33
Fusarium semitectium	11.0	8.0	3.0	7.33
Fusarium solani	20.0	17.0	12.0	16.33
Macrophomina phaseolina	9.0	5.0	3.0	5.67
Pythium splendens	16.0	18.0	11.0	8.73

Table (4): Pathogenicity test of isolated fungi from damped seedlings of faba bean (cv. Giza 40) as pre- & post-emergence damping-off and survivals.

Isolated fungus	Source of isolate	Pre-emergence damping-off	Post-emergence damping-off	Plant survival (%)
Fusarium oxysporum	Giza	23.33	16.70	59.97
Fusarium oxysporum	Beheira	0.00	6.70	93.30
Fusarium oxysporum	Minufiya	6.70	6.70	86.60
Macrophomina phaseolina	Giza	3.33	3.33	93.34
Macrophomina phaseolina	Beheira	0.00	6.70	93.30
Fusarium semitectum	Minufiya	0.00	3.33	96.67
Fusarium moniliforme	Giza	10.00	10.00	80.00
Fusarium moniliforme	Beheira	6.70	13.33	79.97
Fusarium moniliforme	Minufiya	16.70	13.33	69.97
Fusarium solani	Minufiya	10.00	13.33	76.67
Fusarium solani	Beheira	22.00	13.33	64.67
Alternaria tenius	Giza	6.70	3.30	90.00
Pythium splendens	Giza	3.30	6.70	90.00
Pythium splendens	Beheira	6.70	10.00	83.30
Pythium splendens	Minufiya	6.70	6.70	86.60
Control	-	0.00	0.00	100.00
L.S.D. at 5%	-	13.70	8.90	11.40

Table (5): Effect of resistance inducers on root-rot disease incidence % of faba bean plants (cv. Egypt 1) under greenhouse conditions.

Resistance inducers	*Fusarium oxysporum*			*Fusarium solani*			*Fusarium moniliforme*		
	Pre-emergence damping-off (%)	Post-emergence damping-off (%)	Survival plant (%)	Pre-emergence damping-off (%)	Post-emergence damping-off (%)	Survival plant (%)	Pre-emergence damping-off (%)	Post-emergence damping-off (%)	Survival plant (%)
Salicylic acid	26.33	20.00	53.67	20.00	23.33	56.67	16.70	10.00	73.30
Chitosan	18.50	10.00	71.50	10.00	16.70	73.30	10.00	10.00	80.00
Bion	30.00	26.33	43.67	18.00	16.70	65.30	20.00	16.70	63.30
Control (only pathogen)	30.00	25.00	45.00	30.00	20.00	50.00	24.00	20.00	60.00

L.S.D. at 5% = Resistance inducers = 5.13
Interaction = 11.27

Table (6): Effect of bio-agents on faba bean root-rot incidence under greenhouse condition, (faba bean cv. Egypt 1).

Bio-agent	*Fusarium oxysporum*			*Fusarium solani*			*Fusarium moniliforme*		
	Pre-emergence damping-off (%)	Post-emergence damping-off (%)	Survival plant (%)	Pre-emergence damping-off (%)	Post-emergence damping-off (%)	Survival plant (%)	Pre-emergence damping-off (%)	Post-emergence damping-off (%)	Survival plant (%)
Bio-Zeid	20.00	20.00	60.00	16.70	16.70	66.60	10.00	10.00	80.00
Bio-ARC	10.00	6.70	83.30	10.00	10.00	80.00	6.70	3.30	90.00
Clean-root	10.00	10.00	80.00	16.70	10.00	73.30	3.30	3.30	93.40
Control(Only pathogen)	33.33	20.00	46.67	20.00	20.00	60.00	20.00	25.00	55.50

L.S.D. at 5% = Fungi (F) = 4.32 Bio-agents = 3.45 Interaction = 8.19

6. Effect of different fungicides on faba bean root-rot incidence:

Results in Table (7) reveal the effect of dressing faba bean seeds with fungicides on pre- & post-emergence damping-off infection. All used fungicides reduced significantly the development of tested root-rot pathogens under greenhouse conditions compared to the untreated (control). Uniform and Rizolex-T were the most effective while, sumisclex was the least effective. Healthy survived plants were increased in case of pre-treated seeds of cv. Egypt 1 with fungicides than the untreated plants (control).

7. Peroxidase and polyphenoloxidase activities in treated and untreated plant:

Data presented in Table (8) indicated that faba bean plants of cv. Egypt 1 produced from seeds soaked in different treatments resulted in an increase of peroxidase and poly phenoloxidase activities compared to the control. Uniform gave the highest increment in peroxidase activity followed by Rizolex-T and chitosan. Meanwhile, Bio-Zeid gave the least effect compared to the check treatment. Rhizolex-T gave the highest increase in polyphenoloxidase activity followed by chitosan and Uniform, meanwhile, Bio-Zeid gave the lowest value compared to the check treatment.

8. Effect of treating faba bean plants cv. with resistance inducers, bio-agents and fungicides on root-rot disease under field conditions:

Data in Table (9) clearly show the influence of both used resistance inducers, bio-agents and fungicides treatment on root-rot disease of faba bean under field conditions during two seasons. The results obtained revealed that pre- & post-emergence damping-off were reduced compared to the un-treated plants. Uniform was the best in reducing pre- & post-infection and consequently increased survival of plants. Whereas, Bio-Zeid ranked as the lowest effective treatment.

9. Effect of treating faba bean seeds cv. Giza 1 with resistance inducers agents, bio-agents and fungicides on some yield component / plant under field conditions:

The results in Table (10) obtained in 2010/11 and 2011/12 seasons revealed a significant effect of resistance inducers, bio-agents and fungicides compared to the control on plant height after harvest, number of branches / plant, number of pods and 100 seeds weight of cv. Giza 1. Moreover, Uniform was the best treatment among the tested fungicides. On the other hand, Bio-ARC gave a good performance than that of Bio-Zeid in improving faba bean plant growth and yield component. Chitosan was the best treatment among the tested resistance inducers.

Table (7): Effect of different fungicides on pre- & post-emergence damping-off and survival plants of faba bean (cv. Egypt 1) (pot-experiment).

Fungicide	*Fusarium oxysporum*			*Fusarium solani*			*Fusarium moniliforme*		
	Pre-emergence damping-off (%)	Post-emergence damping-off (%)	Survival plant (%)	Pre-emergence damping-off (%)	Post-emergence damping-off (%)	Survival plant (%)	Pre-emergence damping-off (%)	Post-emergence damping-off (%)	Survival plant (%)
Rhizolex-T	3.30	6.67	90.03	3.33	3.33	93.34	0.00	3.33	96.67
Uniform	0.00	3.67	96.33	0.00	3.33	96.67	0.00	3.33	96.67
Sumisclex	10.00	10.00	80.00	6.67	3.33	90.00	3.33	3.33	93.34
Control (only pathogen)	30.00	20.00	50.00	26.67	20.00	93.33	20.00	30.00	50.00

L.S.D. at 5% = Fungi (F) = 3.21 Fungicides = 4.13 Interaction = 8.45

Table (8): Determination of peroxidase and polyphenoloxidase activity in faba bean plants cv. Egypt 1 grown from seeds treated in soil infested with *Fusarium oxysporum*.

Treatment	Peroxidase activity (activity / min.)	% to control	Polyphenoloxidase activity (activity / min.)
Salicylic acid	2.39	164	1.73
Chitosan	2.82	194	1.93
Bio-ARC	2.18	150	1.54
Bio-Zeid	2.00	137	1.42
Uniform	3.00	206	1.90
Rhizolex-T	2.90	200	1.96
Control	1.45	-	1.30
L.S.D. at 5%	0.43	-	0.33

Table (9): Effect of resistance inducers agents, bio-agents and fungicides on pre- & post-emergence damping-off, healthy survival and root-rot faba bean plants cv. Egypt 1 under field conditions (2010/11 – 2011/12).

Treatments	2010/2011				2011/2012			
	Pre-emergence damping-off (%)	Post-emergence damping-off (%)	Survival plant (%)	Root-rot (%)	Pre-emergence damping-off (%)	Post-emergence damping-off (%)	Survival plant (%)	Root-rot (%)
Salicylic acid	6.67	3.33	90.00	7.93	6.67	6.67	86.66	10.33
Chitosan	3.33	3.33	93.34	5.00	3.33	6.67	90.00	6.62
Bio-ARC	6.67	10.00	83.33	8.00	10.00	10.00	80.00	8.63
Bio-Zeid	10.00	10.00	80.00	9.31	10.00	16.67	73.33	11.00
Uniform	0.00	0.00	100.00	0.00	0.00	3.33	96.67	2.15
Rhizolex-T	3.33	0.00	96.67	0.00	3.33	3.33	93.34	3.00
Control	16.67	13.30	70.03	19.64	20.00	16.67	63.33	26.66
L.S.D at 5%	2.45	3.72	4.12	2.19	2.42	3.23	4.93	2.53

Table (10): Effect of resistance inducers, bio-agents and fungicides on some vegetative characters and yield component / plant cv. Giza 1 under field conditions (2010/11 – 2011/12).

Treatments	2010/2011				2011/2012			
	Plant height after harvest	Branches / plant	No. of pods	100 seed w. (g)	Plant height after harvest	Branches / plant	No. of pods	100 seed w. (g)
Salicylic acid	98.00	4.00	34.81	80.00	94.74	3.95	32.18	81.00
Chitosan	100.00	4.12	35.67	82.70	95.23	4.03	35.00	82.00
Bio-ARC	93.44	4.00	34.00	82.08	90.16	3.90	33.12	80.22
Bio-Zeid	90.18	3.90	33.00	77.12	88.14	3.70	31.00	75.43
Uniform	103.21	4.82	37.18	88.67	100.00	4.50	35.12	86.70
Rhizolex-T	100.23	4.06	35.51	85.33	98.02	4.00	34.88	83.00
Control	88.06	3.80	31.33	70.00	83.06	3.50	30.13	67.12
L.S.D at 5%	7.82	0.30	2.00	1.37	6.96	0.53	2.70	2.24

DISCUSSION

Faba bean (*Vicia faba* L.) is a leguminous crop with high nutrition value. Soil borne diseases including root-rot cause considerable losses in yield (Hussein, 1982; Wodicka, 1984; Hussein, 1985; Liang, 1986 and 1989; Janccak and Jankowska, 1992; Kroft *et al.,* 1994, Heller, 1998; Akem and Bellar, 1999). In the present investigation, extensive survey was carried out in three Egyptian governorates to determine the occurrence frequency of various fungi associated with diseased faba bean plants. The survey showed differences in the frequency of occurrence of the isolated fungi. In general, *Fusarium oxysporum* was the most frequently isolated fungus. These results were similar to the obtained results by Akem and Bellar (1999) and El-Sayed, Sahar (2006).

Pathogenicity test of fourteen isolates of the most frequently isolated fungus i.e. *Fusarium oxysporum, Macrophomina phaseolina, Fusarium moniliforme, Fusarium solani, F. semtectum, Alternaria tenius* and *Pythium splendens*. Percentages of pre- & post-emergence root-rot varied according to the fungal isolate.

To avoid the hazards of the use of fungicides, different bio-agents and resistance inducers were used in comparison with the fungicides.

The tested chemicals reduced pre- & post-emergence damping-off and increase the healthy survival plants. The role of chemicals was reported by El-Fiki (1994). Application of SA stimulated biosynthesis of different families of P-R proteins and increasing the activities of chitinase, peroxidase and □-1, 3-glucanase (Oostendorp *et al.,* 2001 and Prachi and Singh, 2002).

In pot experiment and under field conditions, the obtained results showed that seed treatment with bio-agents decreased percentage of pre- & post-emergence damping-off and root-rot and increased percentage of healthy survival plants. Bio-ARC was the most effective followed by Bio-Zeid and clean-root. These results were similar to those obtained by Zheng and Sinclair (2000), Jensen *et al.* (2002) and Cigdem and Merih (2003). Seed treatment with fungicides showed a significant decreased pre- & post-emergence damping-off and increased percentage of healthy survival, in pots Rizolex-T was the most effective fungicide which decreased pre- & post-emergence damping-off, infected plants and increased survival plants. Seed treatment resulted, in most cases, enhanced the yield components of the treated seeds than the control treatment. It can be concluded that the use of such inducers and biological agents were the most effective and safety than bio-agents on the incidence of the disease and can be recommended in Egypt.

REFERENCES

Abou-Zeid, N. M., G. A. El-Morsy, A. M. Hassanein and M. K. Arafa (1997). Identification of fusarium wilt caused by *Fusarium oxysporum* and pathogen variability in faba bean, lentil and chickpea crops in Egypt. Egypt. J. Agric. Res., 75 (3): 529 – 541.

Ahmed, S. S. A. (2001). Future studies on soybean anthracnore disease in Egypt. Ph.D. Thesis, Fac. Agric., Cairo Univ.

Akem, C. and M. Bellar (1999). Survey of faba bean (*Vicia faba* L.) diseases in the main faba bean-growing regions of Syria. Arab Journal of Plant Protection, 17: 113 – 116.

Allam, A. I. and J. P. Hollis (1972). Sulfide inhibition of oxides in rice roots. Phytopathology, 62: 634 – 639.

Bond, D. A., D. A. Lawes, G. C. Hawtin, M. C. Saxena and J. S. Stephens (1985). Faba bean (*Vicia faba* L.). pp. 199 – 265. In: Grain legume crops. (R. J. Summer field and E. H. Roberts eds.), William Collins sons Co. Ltd., 8 Grafton Streel, London, WIX3LA, UK.

Cigdem, K. and K. Merih (2003). Isolation of *Trichoderma* spp. and determination of their antifungal, biochemical and physiological features. Turk. J. Biol., 27: 247 – 253.

Clarke, G. M. and R. E. Kenpson (1997). Introduction to the Design and Analysis of Experiments. Arnold, a Member of the Holder Headline Group, 1st Ed., London,

UK.

El-Fiki, A. I. (1994). Effect of seed dressing and foliar spraying fungicides of severity of root-rot and choecolate spot of broad bean under field conditions. Annuals of Agricultural Science, Moshtohor, 32 (1): 269 – 286.

El-Sayed, Sahar (2006). Use of intercropping and other treatments for controlling faba bean diseases. Ph.D. Thesis, Fac. Agric., Benha University.

Goldschmidt, E. E., R. Goren and S. P. Monselise (1968). The IAA oxidase system of citrus roots. Planta, 72: 213 – 222.

Hussein, M. M. (1982). Major disease problems of faba beans in sudan. Faba bean improvement (Hawtin, G.; C. Webb (Editors)], pp. 227 – 232.

Hussein, M. M. (1985). Root-rot wilt complex, powdery mildew, and mosaic diseases of faba beans and their control. Faba beans, Kabuli chickpeas, and Lentils in the 1980s, pp. 119 – 127.

Janczak, C. and M. Jankowska (1992). Symptoms and harmfulness of fungal diseases of faba bean. Ochronia Roslin, 36 (4): 4.

Jensen, C. Estivez, J. A. Percich and P. H. Graham (2002). Integrated management strategies of bean root-rot with *Bacillus subtilis* and *Rhizobium* in Minnesota. Field Crops Research, 74 (2-3): 107 – 115.

Kurmut, A. M., H. I. Nirenberg, H. Bochow and C. Buttner (2002). *Fusarium nygamai*. A causal agent of root-rot of *Vicia faba* L. in the Sudan. Meded Rijksuniv Gent Fak Landbouwkd Toegep Biol. Wet., 67: 269 – 274. (C.F. CABI Data Base Abstracts).

Liang, X. Y. (1986). Faba bean diseases in China. FABIS News Letter, 15: 49 – 51.

Liang, X. Y. (1989). Fungal diseases of faba bean in people republic of China. FABTS News Letter. 25: 3 – 4.

Mahmoud, Nagwa M. (1996). Studies on chocolate spot disease of broad bean and loss occurrence. Ph.D. Thesis, Fac. Agric., Minufiya Univ., p. 133.

Mazen, M. M. (2004). Resistance induction against disease of faba bean crop. Ph.D. Thesis, Fac. Agric., Suez Canal Univ., Egypt.

Oostendorp, M., W. Kunz, B. Dietrich and T. Staub (2001). Induced disease resistance in plants by chemicals. Europe. J. Plant Pathol., 107: 19 – 28.

Plates, N. and A. J. Vandler (1981). Monograph of the *Genus Pythium*. Studies in Mycology, 21: 242.

Prachi, S. R. T. and M. B. Singh (2002). Salicylic acid inducd insensitivity to culture filtrate of *Fusarium oxysporum* f. sp. *Zingiberithecelli* of zingiber officinal Roscoe. European J. of Plant Pathology, 108: 31 – 39. (C.F. CABI Data base Abstracts).

Snell, F. D. and C. T. Snell (1953). Cololrimetric Methods of Analysis, Including Some Turbidimetric and Nephelometric Methods. D. Van Nostrand Company Inc., Toronto, New York, London, 111: 606.

Zheng, X. Y. and J. B. Sinclair (2000). The effect of traits of *Bacillus megaterium* on seed and root colonization root-rot of soybean. Biocontrol, 45 (2): 223 – 243.

تأثير بعض مستحثات المقاومة والعوامل الحيوية والمبيدات الفطرية على حدوث الذبول وعفن جذور الفول البلدى

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الملخص العربى :

تم عمل حصر لمرض عفن الجذور والذبول فى الفول البلدى وذلك فى ثلاث محافظات هى المنوفية والبحيرة والجيزة وعزل الفطريات المسببة له وقد تم عزل عدد من الفطريات التى تتبع أجناس فطرية من النباتات المصابة وكان فطر فيوزاريوم أوكسسبوريوم هو الأعلى فى القدرة المرضية وهو أكثر الفطريات تكراراً يليه الفطر فيوزاريوم سولانى ثم فيوزاريوم مونيلفيوم .

وكانت أهم النتائج المتحصل عليها كالتالى :

١-أدى استخدام المستحثات فى تجارب الأصص وتحت ظروف الحقل كمعاملة للبذرة إلى انخفاض ملحوظ فى نسبة حدوث المرض مقارنةً بغير المعامل ، وكان أفضل المستحثات تأثيراً هو الكيتوزان وحمض السالسيلك يليها البيون وذلك فى تجارب الأصص وتحت ظروف الحقل ، وقد وجد أن معاملة البذور بالمستحثات أدى إلى زيادة معنوية فى إنتاجية المحصول.

٢-أدت معاملة البذور بالمبيدات الحيوية إلى خفض نسبة الإصابة مقارنةً بغير المعامل فى تجارب الأصص وتحت ظروف الحقل وكان أكثر هذه المبيدات المستخدمة المبيد الحيوى Bio-ARC ثم Bio-Zeid و Clean root كما وجد أن معاملة البذور الحيوية أدى إلى زيادة معنوية فى إنتاجية المحصول .

٣-وجد أن معاملة البذور بالمبيدات الفطرية أدى إلى انخفاض نسبة الإصابة بالمرض فى تجارب الصوبة والحقل كما وجد أن المبيد يونيفورم كان من أكثر المبيدات تأثيراً يليها Rizolex-T وكان أقل المبيدات تأثير هو السيموسكليكس . كما وجد أن معاملة البذور بالمبيدات الفطرية أدى إلى حدوث زيادة معنوية فى إنتاجية المحصول .

٤-أظهرت الدراسة التغيرات الكيميائية كمؤشرات ناتجة عن الزيادة الكبيرة فى نشاط إنزيمات الأكسدة والاختزال مثل البيروكسيديز والبولى فينول أوكسيديز .