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ROOT-ROT OF GUAVA AND IT'S CONTROL IN EGYPT

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ABSTRACT A survey was carried out during three successive seasons (1999-2001) to define fungal species associated with root rot of guava seedlings growing at Alexandria, Behera, Kalubiya and Demiatta Governorates. Isolation from diseased roots showed the presence of *Botryodiplodia theobromae*, *Fomitopsis penecola* Karsk., *Fusarium semitectum*, *F. solani*, *Macrophomina phaseolina*, *Rhizoctonia solani*, *Pestalotiä psidii* and *Pythium splendens*.

Pathogenicity tests indicated that, these fungi were pathogenic to guava seeds, causing pre-and post emergence damping off. Also, they were pathogenic to guava seedlings. *Botryodiplodia theobromae*, *M.phaseolina* and *R. solani* were the most destructive pathogens causing 100% infection to guava seedlings. While, *F.solani*, *F.semitectum* and *P.psidii* caused 60% of root-rot of infection.

Natural products (plant essential oils) and some fungicides were tested *in vitro* as to investigate their effects on mycelial growth of the six root-rot pathogens at different concentrations. Essential oils of *Majorana hortensis* herb or *Persed americana* leaves were the most effective inhibiting growth of *R.solani*, *F.semitectum* and *F.solani*. While, Vitavax Thiram at 50 ppm was the most effective inhibiting growth of all the tested fungi.The controlling agents which showed the higher activity *in vitro* were tested *in vivo* as seed and soil treatments. Low percentages of pre-and post emergence damping-off was recorded with *M.hortensis* essential oil or Topsin M as seed treatment. While, Rizolex T, as soil drench at the rate 3g/L. water was superior against *R.solani* infection. Also, Vitavax Thiram was the best against *B.theobromae* and *M.phaseolina* infection.

INTRODUCTION

Guava (*Psidium guava* L.) are tropical and belonging to family *Myrtaceae*. It has been grown for many decades in different Governorates of Egypt. The fruit are freshly eaten and use to prepare very important foods and industrial commodities (Bremn-ess, 1994). Since it considered an important source of vitamin C (Mrfinh, 1993), the cultivated area of guava in Egypt reached 26927 feddan, produced 21456 tons of fruits (El-Shrif *et al.*, 2000).

The plant was found to be susceptible to several fungi causing destructive diseases including root-rot (Nath, 1976; Adisa, 1983; Zentmyer *et al.*, 1986; Patel and Patel, 1989 and Pandey, 1990). The same authors recorded some seed rot and seedlings root rots and wilts as serious diseases on guava plants. The severe outbreak of seedlings root rots causing considerable losses to guava plants in Alexandria, Behera, Kalubiya and Demiatta Governorates.

Therefore the disease survey was carricd out to determine its importance, isolation, identification and pathogenicity tests of the fungal isolates as well as field disease control was also studying using chemical and plant essential oils treatments.

MATERIALS AND METHODS

I- Isolation and identification of root-rot fungi:

Samples of diseased guava seedlings were collected from Alexandria, El-Behera, El-Kalubiya and Demiatta Governorates during seasons 1998, 1999 and 2000. Roots were washed before cuttings into small pieces, then surface sterilized with 3% sodium hypochlorite solution for 3 min. Pieces were rinsed several times in sterile water, then placed on PDA medium and incubated at 25°C. for one week. Hyphal tip or single spores were transferred to PDA slants. The isolated fungi were identified by Mycol. Res. Dis.and Syrvey Dept., Pl. Pathol. Res. Inst., ARC, Giza. Identification was based on morphological and cultural characters according to Gilman, (1957); Barnett and Hunter, (1972) and .Booth, (1971)

II- Pathogenicity tests:

Soil infestation was carried out using barley meal medium inoculated with each of the

isolated fungi, i.e. *Botryod-*iplodia theobromae*, *M.phase-olina*, *R.solani*, *F.semitectum*, *F.solani*, *Pestalotia psidii*, *Fom-itopsis penecola* and *Pyth-ium splendens*. Pots of 25 cm. diameter were sterilized with 5% formalin solution and filled with autoclaved clay soil. The soil was infested with each single fungus at the rate of 5% soil weight. The inoculum was thoroughly mixed with the upper surface of the soil ,and watered regularly for 7 days before planting. Control treatment was applied by using the same amount of barely meal medium (uninoculated) as control.

Guava seedlings (25 days old) obtained from El-Behera Governorate and Horticulture Institute, Agricultural Research Center, Giza Governorate were planting at the rate of three seedlings per pot. Also, ten surface sterilized guava seeds were planted in each pot. A set of five replicates were used for each particular treatment in state of seedlings or seeds.

Disease assessment as pre-emergence damping-off was recorded after two weeks from planting, post-emergence damping-off were also counted 6 weeks from planting for seeds treatments. While, data were recorded after 60 days as the percentages of infection for guava root seedling treatments.

Reisolation was conducted from infected seedlings and compared with the original culture for each isolated fungi.

III-Controlling of root-rot disease of guava:

Four different fungicides, Rizolex T, Ridomil plus, Topsin M and Vitavax Thiram "Table, 1" and Four different plants essential oils, i. e., *Mentha arvensis*, (leaves); *Pelargonium graveolens* (herb); *Majorana hortensis* (herb) and *Persea americana* (leaves) were tested *in vitro* and the highest anti fungal activity of which were tested *in vivo* to study, their effects on guava root-rot diseases incidence.

(A) Effect of fungicides on fungal linear growth:

Different concentrations (10, 50, 100, 200, 400, and 600 ppm) of each fungicides tested were mixed with autoclaved PDA medium before solidification. Each of five replicates of each concentrations

was inoculated with a disc (5 mm. In diam.) of mycelial growth of each fungus obtained from 10-days-old culture and incubated at 25 °C. until fungal growth completely covered the dishes of check treatment (PDA) without fungicide. Linear growth was measured and the percentage of toxicity was calculated according to the formula suggested by (Topps and Wain, 1957) as follows:

$$\text{Toxicity \%} = \frac{A - B}{A} \times 100$$

A = diam. of untreated fungus.
B = diam. of treated fungus.

(B) Effect of plant essential oils:

Activity of plant essential oils was tested using filter paper disc method (Linskens and Jackson, 1991) as follows:

Filter paper (Whattman No. 1) was punched to make discs (6 mm in diam.). Batches of one hundred discs were placed in screw capped bottles. Loosely capped bottles were sterilized in oven at 140 C. for 60 min. They were allowed to cool at room temp., immersed in solution of the known conc. of test essential oil. (2500 and 5000 ppm) Five plates contaning PDA medium were inoculated with three discs (5 mm. in diam.) taken from 7 dayes culture of each pathogenic fungi put in the plates services at trangle shap, the essential oil impergnated disc put in the center of this trangle (Baiuomy, 1997) and incubated at suitable temperature. The percentages of inhibition was calculated as follows:

$$\text{\% Inhibition} = \frac{A - B}{A} \times 100$$

A=The linear growth of the control.
B=The linear growth of the treatment.

To optain the different required conc., the crude essential oils were considered as reperesentative To 100 % concentration, and mixed with sterile distilled water + a drop of Twin X 363 M.

(C) Effect of tested fungicide or essential oils on Guava damping off under greenhouse conditions:

For controlling root-rot disease of guava the experiments were conducted under greenhouse conditions. Seed were treated with each of Rizolex T, Topsin M or Vitavax Thiram at the rate of 2 g/kg seed. Seed-dressing was applied by gently shaking seeds with each fungicide inside polyethylene bags till an even dressing

occurred. Treated seeds were planted in pots filled with soil previously infested with each of the isolated fungus. Untreated seeds were used as control.

Guava seeds were also, soaked in *M.hortensis* essential oil (6000 ppm) concentration for 30 min. before planting and grown in infested soil with each of guava pathogenic fungi. On the other hand, guava healthy seedlings in infested pots were drenched with *M.hortensis* essential oil at the rate 6 ml/L. water + few drops of Twin X 363 M. (200 ml/ pot) and the previous concentration data were recorded. Disease incidence was recorded as mentioned before in pathogenicity test.

Statitical analysis :

Statitical analysis was carried out according to Snedecor and Cochran ,(1982).

RESULTS AND DISCUSSION

Isolation from diseased roots of guava seedlings planted at different localities in Egypt, revealed the occurrence of several fungi, i.e., *B.theobromae, R. solani, F. solani, M. phaseolina, F. penecola, P. psidii, F.semetictum* and *P. splendens* (Table,2). Most of these fugal species were previously reported to be associated with root-rot diseases of guava seedlings (Kehri *et al.*, 1986; Rama *and Govindu,* 1988; Dwivedi, 1990; Adisa, 1993 and El-shrif *et al.*2000). All the previous mentioned species were pathogenic to guava seedlings.

Botryodiplodia theobromae, *Macrophomina phaseolina* and *Rhizoctonia solani* were the most virulent pathogens to roots of guava seedlings, whereas, they caused 100% of root rot percentages (Table, 3). While, *Fusarium solani*, *Fusarium semitectum* and *Pestalotia psidii* ranked in the second position (66.67%) as root-rot causal organism (Table, 3). Resultes in Table,(3) also indcate that, *Pythium splendens* was the least virulent fungus as root-rot causal organism (33.34%). These results are in agreement with those obtained by (Lima and Chin, 1987; Pandey and Dwivedi, 1987; Dwivedi *et al.*, 1989; Dwivedi, 1990 and Das, 1993).

Data in Table (4) show the *in vitro* tests of six different fungicides proved that, Vitavax Thiram showed the most inhibitory activity

at a very low concentration (10 ppm). While, Kocide 101 was the least effective fungicide against all the tested fungi (Table, 4). The different responses of each fungus to different fungicides indicated different fungicidal specificity as reported by (Gupta, 1979).The *in vitro* studies gave a preliminary indication about the fungitoxic effects of different compounds before their application in greenhouse or in the field.

Also, the effect of some plant essential oils were tested as antifungal agents against guava pathogenic fungi *in vitro*. The toxicity were 100% at concentration of 2500 ppm with all tested essential oils against *R.solani*. (Table, 5) On the other hand, *M.phaseolina* and *B. theobromae* were the least sensitive fungi to the tested oils (Table, 5). These results are in harmony with results obtained by Singh *et al.*, 1983; Deans and Sviboda, 1990 and Baiuomy, 1997) They reported that, The variation between antifungal activity of the oil and anthor, may be due to the capability of this oil to pentrate the fungal alls . Also, this volatilcs cause reduction in hyphal diameteer that , may be due to alteration in the fungal metabolism caused by the mutagenice activity of the essential oils constitunts as phenols.

The *in vivo* studies, under greenhouse conditions using the best fungicides *in vitro*, tested as seed or soil treatment, indicate that, low percentages of pre and post emergence damping off were obtained by using Rizolex T or Topsin M against all the tested fungi(Table, 6 & 7). Therefore, Rizolex T and Topsin M could be recommended as seed-dressing fungicides in controlling root rot of guava seedlings. Also, using Vitavax Thiram at the rate of 3 g/L. water as soil drench prevented guava seedlings infection with *B.theobromae*, *M.phaseolina* and *P.psidii*. While, Topsin M (3 G/L.) as soil drench was the superior against *R.solani* infection (Table 6 & 7). These results are in accordance with these of Gupta, 1979 and Hilal, 1981 and results could be explained on the basis that , thes chemicals had ceased the progress of the fungi to penetrate the outer lyer of the plant . Also , when this fungicides found in the soil may cause certain ubnormal mycelial forms in fungi or pushing them to dormont states (Rana, 1981; El-Deeb *et al.*, 1985 and Rama., 1988) dealing with

root-rot diseases as seed or soil treatments, could be beneficial in reducing seed-invasion, increasing seed germination and decreasing damping off or percentages of guava root infection. Soil borne pathogens are responsible for heavy losses in different crops. Most of the synthetic fungicides used to control such pathogens are hazardous for the environment, besides having long residual effects. Due to the development of new physiological races of pathogens, many of synthetic fungicides are gradually becoming ineffective. The reefer, using natural products such as plant essential oils are safety alternative of fungicides (Baiuomay, 1997).

Using essential oil of *M.hortensis* herb (6000 ppm) as seed treatment or as drenching of seedlings infected soil at the rate 200 ml/pot, decreased pre and post emergence damping-off with most of the tested fungi.(Table, 8) Also, decreasing the seedlings infection percentages compared with the control (without essential oil treatment). These results are in harmony with the results obtained by (Singh *et al.*, 1983; Deans and Sviboda, 1990; Linskens and Jackson, 1991 ; Baiuomy, 1997and El-Shazly, 2000), whose mentioned that the fungcidal activity of the esseential oils most probably due to the phenalic compound and other in inhibitors present in the oil , so that thay vapours from the treated seeds throught planting and gave highly protection to seedlings stages .

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Table (1): The commercial, common and chemical names as well as formulation and manufactures of the tested fungicides.

Commercial name and formulation	Common name	Chemical name	Manufactures
Rizolex T 50% WP	20 % tolclofos methyl – methyl+ 30% thiram	O,O–dimethyl–o– (2,6 – dichloro–4– methylphenyl) phosporothioate + tetramethyl thiuram disufide.	Sumitomo Uniroyal Chem. CO .
Vitavax – thiram 75 % wp	Vitavax thiram	Vitavax (37.5 %) + thiram (37.5 %).	
Ridiomil plus	Metalaxyl copperoxy chloride	N –(2.6-dimethyl phenyl) – N . (methoxyacety) – DL – laonine methy enter (CAS).	Syngenta Switzerland
Topsin M 70 % wp	Thiophanate methyl	1 ,2 bis (3-methoxycarbonyl – 2 – thiou redio) benzene (TPM)	NIPPONSODA CO. JAPAN

Table (2): Frequency of fungi isolated from naturally infested roots of guava seedlings collected from different Governorates of Egypt.

Isolated fungi	Frequency %
Botryodiplodia theobromae Pat.	60.71
Rhizoctonia solani Kühn.	55.00
Fusarium solani (Mart.) Sacc.	50.00
Macrophomina phaseolina (Tassi) Goid.	40.00
Fomitopsis penecola Karsk	35.00
Pestalotia psidii de Not.	35.00
Fusarium semetictum Berk .& Rav.	33.00
Pythium splendens Braun	12.00
Aspergillus niger (Van Tiegh)	00.40
Trichoderma viride Pers. ex Fr.	00.38

Table (3): Pathogenicity test of the isolated fungi after 60 days from planting guava seedlings under greenhouse conditions.

The fungi	% of root rot of guava seedlings
B. theobromae	100.00
M. phaseolina	100.00
R. solani	100.00
F. solani	60.00
F. semetictum	60.00
P. psidii	60.00
P. splendens	40.00
T. viride	00.00
F. penecola	00.00
A. niger	00.00
Control (without fungus)	00.00
L. S. D. at 5 %	**0.5**

Table (4): Effect of different concentrations of five fungicides on mycelial growth of guava pathogenic fungi under laboratory conditions.

The test fungi	Conc. ppm	Mycelial linear growth (cm) on PDA with				
		Rizolex T	Ridomil Plus	Topsin M	Vitavax Thiram	Kocide 101
Botryodiplodia theobromae	0	1.0	9.0	9.0	9.0	9.0
	10	1.3	9.0	1.5	0.0	8.0
	50	1.1	9.0	1.0	0.0	4.5
	100	1.0	5.7	0.0	0.0	3.2
	200	0.7	6.0	0.0	0.0	1.0
	400	0.0	4.5	0.0	0.0	0.0
	600	0.0	2.6	0.0	0.0	0.0
Fusarium semitectum	0	9.0	9.0	9.0	9.0	9.0
	10	5.0	9.0	3.1	3.7	7.8
	50	3.8	9.0	2.9	0.5	3.8
	100	3.0	9.0	2.4	0.0	3.5
	200	2.3	8.0	2.0	0.0	1.7
	400	2.0	2.3	0.0	0.0	1.7
	600	1.8	0.0	0.0	0.0	0.0
Fusarium solani	0	9.0	9.0	9.0	9.0	9.0
	10	8.0	9.0	3.1	3.7	7.5
	50	6.0	8.0	2.9	0.5	3.5
	100	5.0	8.0	2.4	0.0	3.3
	200	3.0	8.0	2.0	0.0	1.7
	400	2.2	7.7	0.0	0.0	1.0
	600	1.2	6.5	0.0	0.0	0.0
Pestalotia psidii	0	9.0	9.0	9.0	9.0	9.0
	10	6.0	5.5	0.0	2.0	2.8
	50	5.0	5.1	0.0	0.0	0.5
	100	3.0	6.7	0.0	0.0	0.0
	200	2.0	5.1	0.0	0.0	0.0
	400	1.8	4.2	0.0	0.0	0.0
	600	1.4	3.5	0.0	0.0	0.0
Macrophomina phaseolina	0	9.0	9.0	9.0	9.0	9.0
	10	1.8	9.0	1.0	0.0	9.0
	50	1.1	7.0	0.0	0.0	5.5
	100	0.0	6.6	0.0	0.0	5.0
	200	0.0	6.5	0.0	0.0	4.0
	400	0.0	4.2	0.0	0.0	3.0
	600	0.0	3.7	0.0	0.0	1.5
Rhizoctonia solani	0	9.0	9.0	9.0	9.0	9.0
	10	2.0	9.0	1.5	2.0	9.0
	50	0.0	9.0	0.0	0.0	3.9
	100	0.0	9.0	0.0	0.0	3.0
	200	0.0	9.0	0.0	0.0	2.0
	400	0.0	5.2	0.0	0.0	1.5
	600	0.0	4.5	0.0	0.0	0.0

L. S. D. at 5% for:

Fungi (F)	= 0.06	F X F U	= 0.14
Concentrations (C)	= 0.06	F U X C	= 0.15
Fungicides (F U)	= 0.06	F X F U X C	= 0.34
F X C	= 0.14		

Table (5): Effect of different plant essential oils at low concentrations against guava pathogenic fungi *in vitro*.

Plant essential oil of (E.O.)	Conc ppm	% mycelial growth inhibition					
		B. theobromae	*F. solani*	*F. semetictum*	*R. solani*	*P. psidii*	*M. phaseolina*
Majorana hortensis (herb)	2500	00.00	51.33	100.00	100.00	100.00	11.11
	5000	60.22	100.00	100.00	100.00	100.00	85.40
Mentha arvensis (leaves)	2500	82.70	48.22	52.70	77.60	62.70	00.00
	5000	100.00	71.60	66.70	100.00	100.00	00.00
Pelargonium graveolens (leaves)	2500	00.00	42.00	54.70	100.00	44.70	00.00
	5000	00.00	77.60	84.60	100.00	53.60	4.33
Persea americana (leaves)	2500	00.00	18.22	41.80	100.00	33.39	00.00
	5000	60.33	50.90	52.40	100.00	60.70	24.40
Control (without E.O.)	0	00.00	00.00	00.00	00.00	00.00	00.00

L.S.D. at 5% for:

Essential oils (E.O.)	= 0.16	E.O. X F	= 0.23
Fungi (F)	= 0.12	F X C	= 0.43
Concentrations(C)	= 0.22	E.O. X F X C	= 0.61

Table (6): Effect of three seed-dressing fungicides on pre-and post emergence damping-off of guava seeds under greenhouse conditions.

Fungi	*B. theobromae*			*M. phaseolina*			*R. solani*			*F. solani*			*F. semitectum*			*P. psidii*		
Fungicide	*	**	***	*	**	***	*	**	***	*	**	***	*	**	***	*	**	***
Rizolex T.	4	14	82	2	11	87	2	10	88	14	10	76	12	13	76	0	6	94
Topsin M	4	2	94	6	3	91	3	6	91	2	6	72	1	9	90	0	3	97
Vitavax T.	8	11	81	0	8	92	11	11	78	16	16	68	13	19	68	2	22	76
No fungicide	4	28	58	8	20	72	40	18	41	22	32	47	26	32	43	6	31	63

* = % Pre emergence. ** = % Post emergence. *** = Healthy survival plants

L.S.D. at 5% for:

Fungi (F)	= 0.5	Fungicides(FU)	= 0.3	F X FU	= 0.11

Table (7): Effect of some fungicides at the rots 2 g/L. water and as soil drench on percentage of guava seedlings infection under greenhouse conditions.

Fungicide	% infection with											
	B. theobromae		*M. phaseolina*		*R. Solani*		*F. semitectum*		*F. solani*		*P. psidii*	
	*	**	*	**	*	**	*	**	*	**	*	**
Rizolex T 50% WP	46	33.3	60.0	00.0	40.0	60.0	00.0	100	00.0	100	00.0	100
Topsin M 70% WP	60	00.0	60.0	00.0	60.0	40.0	40.0	60.0	40.0	60.0	00.0	100
Vitavax T 75% WP	00	100	00.0	100	60.0	40.0	60.0	40.0	60.0	40.0	00.0	100
Control (without fungicide)	00	---	60.0	---	100	---	100	---	100	---	100	---

* = % of infection ** = % decreased relative to the control

Table (8): Effect *of Majorana hortensis* herb essential oil (6000 ppm) as seed treatment or soil drench (seedlings treatment) on pre-and post emergence damping-off of guava seeds or percentage of seedlings infection under greenhouse conditions.

Recorded data %	*B. theobromae*		*M. phaseolina*		*R. Solani*		*F. semilectum*		*F. solani*		*P. psidii*		L.S.D. at 5%
	*	**	*	**	*	**	*	**	*	**	*	**	
Pre-emergence	7	16	6	8	16	34	18	26	20	22	6	7	1.7
Post-emergence	18	36	20	20	18	20	20	32	26	31	22	38	4.2
Healthy survival	75	45	74	72	66	46	62	43	60	47	72	57	---
Seedlings infection	60	100	60	100	60	100	60	100	60	100	40	100	6.8
*** Decreasing of seedlings infection	40	---	40	---	40	---	40	---	40	---	60	---	---

* with essential oil.

** without essential oil.

*** Decreasing of infection relative to the control.

مرض عفن جذور الجوافة و مقاومته في مصر

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تم عمل حصر للفطريات المصاحبة لجذور شتلات الجوافة و ذلك للتعرف علي الفطريات المسببة لأعفان جذور هذه الشتلات في مناطق مختلفة في مصر .

عزلت فطريات بترودبلوديا ثيوبروما ، فوميسس بينيكولا، فيوزاريوم سولاني ، فيوزاريوم سميتكتم ، ماكروفومينا فاصولينا ، ريزوكتونيا سولاني ، بيثيم سبلنيدينس ، اسبرجلس نيجر ، بستالونيا بسيدي و الفطر تريكودرما فيردي . كانت أكثر العزلات تكرارا هي الفطر بترودبلوديا ثيوبروما (٦٠,٧١ %) و الفطر ريزوكتونيا سولاني (٥٥%)

والفطر فيوزاريوم سولاني (٥٠ %) بينما كانت أقل العزلات تكرارا هي تريكودرما فيردي (٣٨. %) و اسبرجلس نيجر (٤٠. %) .

أختبرت القدرة المرضية للفطريات المعزولة حيث ثبت أنها ذات قدرة مرضية عالية ماعدا الفطريات أسبرجلس نيجر ، تريكودرما فيردي ، ماكروفومينا فاصولينا ، و ريزوكتونيا سولاني حيث أنها سببت نسبة إصابة شتلات (١٠٠ %) .

اختبرت بعض المبيدات الفطرية في المعمل لدراسة تأثيرها علي النمو الميسليومي للفطريات الممرضة وذلك بتركيزات مختلفة . كان المبيد فيتافاكس ثيرام أكثر المبيدات فعالية حيث أنه أظهر تثبيط عالي عند تركيز ٥٠ جزء في المليون ضد كل الفطريات المختبرة .

كذلك تم اختبار أربعة أنواع من الزيوت النباتية الطيارة بتركيزين (٢٥٠٠ ، ٥٠٠٠ جزء في المليون) ضد النمو الميسليومي للفطريات الستة لشتلات الجوافة ، حيث ثبت أن الزيت الطيار العشب البروتوس أو أوراق الزبدية كانت أكثر الزيوت الطيارة كفاءة ضد نمو ميسيليوم هذه الفطريات ريزوكتونيا سولاني ، فيوزاريوم سولاني و فيوزاريوم سميتكيم .

أختبرت المبيدات التي أظهرت كفاءة مرتبة في المعمل تحت ظروف الصوبة كمعاملة البذور أو غمر التربة . و قد أوضحت النتائج إنخفاض نسبة موت البادرات مع المبيد الفطري توبسن م كمعاملة بذرة و كذلك المبيد ريزولكس تي كغمر للتربة حيث كان أفضل المبيدات في تقليل نسبة اصابة الشتلات بفطري بترودبلوريا ثيوبروما ، ماكروفومينا فاصولينا . كذلك أدي استخدام الزيت الطيار العشب البروتوس تركيز ٦٠٠٠ جزء في المليون لنقع جذور الجوافة أو أوكغمر شتلات الجوافة المنزرعة في تربة معدية بمعدل ٢٠٠ مل / أصيص الي نقص نسبة اصابة البادرات و زيادة نسبة النباتات الحية ماعدا حالة الإصابة بفطر الماكروفونيا فاصولينا و كذلك خفض نسبة اصابة الشتلات في حالة جميع الفطريات تحت الدراسة و بالمقارنة بمعاملة الكونترول بدون استخدام زيت طيار.