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Controlling damping-off diseases of lupine using eight essential oils belonging to Umbelliferae plants

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ABSTRACT

Eight plant essential oils namely; anise, caraway, celery, coriander, cumin, dill, fennel and parsley were *in vitro* tested for their activities on the growth of three seed-borne fungi, *Fusarium oxysporum*, *F. solani* and *Rhizoctonia solani* isolates which caused damping-off for lupine plants. Anise oil showed the highest inhibitory effect against *R. solani* (100%), *F. oxysporum*, (66.12%), *F. solani* (52.92%) and at 4 ml/L, however, celery and caraway oils showed the least effect. Volatile substances from anise oil were completely inhibited mycelial growth of fungal isolates (100% inhibition). All tested oils were significantly reduced dry weight of the tested fungi. However, anise oil was the most effective one, it reduced dry weights of *R. solani*, *F. oxysporum* and *F. solani* isolates with percent reduction of 98.01,98.07and 94.74, respectively. *In vivo* tests indicated that, anise oil as seed soaking significantly decreased the total mortality by (46.67-100%) in *R. solani*, (33.40-100%) in *F. oxysporum* and (13.34-25%) in *F. solani*. Moreover, Anise oil significantly increased fresh and dry weight of shoot and root of lupine plants (56.3-52.6%) (18.6-34.5%), respectively.

Key words: *Fusarium oxysporum*, *F. solani*, *Rhizoctonia solani*, control, Essential oils, seed treatment, lupine plants.

INTRODUCTION

Lupine (*lupinus termis* L.) is an old legume crop in Egypt, having high protein content. So, it is important for human and animal nutrition as well as medical and industrial purposes. In addition, lupine is among the useful crops for maintaining soil fertility and reclaiming new areas for its efficient nitrogen fixation system (Shaalan *et al.*, 2003).

Seed-borne fungi such as *Fusarium oxysporum* Schlecht emend. Snyd & Hans, *Fusarium solani* Mart. Sacc. and *Rhizoctonia solani* Kühn. The incitant pathogens of damping off, root rot and wilt diseases, were causing tremendous quantitative and qualitative losses for the lupine yield (Abdel-Kader, 1983; Osman *et al.*, 1983 and Sahab *et al.*1985). Biological and chemical control were applied as the main strategy for controlling damping -off diseases (EL- Said *et al.*, 1975; Fahim *et al.*, 1983 and El-Barougy and El-Sayad 2003).

Recently, there is an increase preference for natural fungal toxicants which are generally believed to be safe for human and environment. The essential oils and their constituents present in various spices are known to have antifungal properties which *in vitro* inhibit fungal growths.

Current literatures provides examples of the essential oils that have inhibited the development of fungi *in vitro* and *in vivo*. Bang (1995) found that caraway oil has reduced infection of *R. solani* in potato tuber. Nakaboyashi and Fukuda (1999) reported that fennel oil was effective in protecting the melons (*Cucumis melo*) plants from infection by *F. oxysporum* f.sp.*melonis* and also improved crop yield. This essential oil showed no phototoxic effect on plants and seed germination. Similar results were reported by many investigators, Chaudhary *et al.*, (1995) dill oil on sugarcane ; Pandey and Pant (1997) cumin, fennel and coriander oils on

okras; El-Sherbieny *et al.*, (2002) used dill, coriander and cumin for controlling *F. solani* and *R. solani* causing cotton seedling damping-off; Singh *et al.*, (2003) used dill, caraway, coriander, fennel and anise oils as strong antifungal activity against *F. oxysporum*, *F moniliforme* and *R. solani* in sugarcane.

Thus, the present study aimed to evaluate the *in vitro* and *in vivo* antifungal activity of some essential oils belonging to Umbelliferae plants on lupine fungi; *F. oxysporum*, *F. solani* and *R. solani*

MATERIALS AND METHODS

Source of fungi: Two isolates of each *F. oxysporum* and *F. solani* were previously isolated by Hemeda *et al.*, (2001) from lupine seeds, according the standard agar method (ISTA, 1985), were used in the study. Four isolates of *R. solani* (1,2,3 and 4) were currently isolated from lupine roots. The isolated fungi were purified, then identified in Plant Pathology Dept., Faculty of Agriculture, Alexandria University and in Agriculture Research Center, Ministry of Agriculture, Cairo, Egypt.

Source of essential oils: Eight plant essential oils namely; anise, caraway, celery, coriander, cumin, dill, fennel and parsley were collected from commercial dealers.

***In vitro* tests:**

1- Effect of essential oils on linear growth of fungi isolates: Antifungal activity of eight essential oils were carried out in Petri dishes (9 cm diam.), containing PDA. Each double filtrated essential oil was dissolved individually in Tween 80 (0.1%) then added to PDA medium immediately

before solidifying and gently agitated to ensure even distribution of the oil in the medium. Three concentrations, (1.0, 2.0 and 4.0 ml/L) were used for each essential oil. The fungal isolates were inoculated by placing a (7 mm diam.) disk of 7-days-old mycelial cultures at the center of the plates. Five replicates were used per each treatment. The Petri dishes were kept at a temperature of 20-25°C for 5 days for *Rhizoctonia* isolates and 7 days for *Fusarium* isolates. Fungitoxicity was expressed in terms of inhibition percentage of mycelial growth and calculated according to the formula of Pandey *et al.*, (1982) :

$$\text{Inhibition \%} = \frac{dc - dt}{dc} \times 100$$

Where:dc = average diameter of fungal colony with control.

dt = average diameter of fungal colony with treatment.

2-Effect of volatile substances of essential oils on linear growth of fungal isolates: The activity of volatile substances which liberated from essential oils has been studied according to the method of Dennis and Webster (1971). Petri dishes (7 cm diam.) containing 10 ml of PDA medium were inoculated at the center with (7mm diam.) disks of each fungal isolate. Another dishes contained 0.5 ml of each essential oil were carried out. Bottoms of Petri dishes were sealed together with parafilm and kept at 20-25 °C for 5 days for *Rhizoctonia* isolates and 7 days for *Fusarium* isolates. The bottoms containing essential oils were always at the lower side and those of the fungi isolates were at the upper side of each pair.

Check was treated similarly but the lower bottom without essential oils and the upper bottom received inoculum of fungus. The treatments were quadruplicated. The colony diameter of each fungal isolate was measured

and compared with the check . The percentage of inhibition of mycelial growth was calculated as described above.

3- Effect of essential oils on dry weight of fungal isolates: To determine the effect of these essential oils on the dry weight of the tested fungal isolates, one ml of each oil was added to 20 ml of PD broth medium in 100 ml Erlenmeyer flask. A set of similar flasks containing oils-free medium served as control. A single disk (7mm diam.) of each fungal isolate was transferred to the medium surface in each flask. Four flasks were used as replicates for each treatment. Inoculated flasks were incubated at 20-25 °C for 7 days. Fungal growth was collected on filter paper, washed with distilled water and dried at 70 ± 2 ° C. The average weight of tested fungi was recorded for each treatment. The reduction percentage in dry weight was calculated according to the following formula:

$$\text{Reduction \%} = \frac{\text{control} - \text{treatment}}{\text{control}} \times 100$$

II- *In vivo* tests:

To study the effect of anise oil in controlling damping – off of lupine plants, autoclaved clay pots (15 cm diam.) were filled with autoclaved aerated sand loam soil (1kg/pot) and inoculated with 50 ml of fungal suspension. The fungal suspension of each isolate was prepared by growing each isolate for 15 days at 20-25 °C on conical flasks (250ml) filled with 50ml PD broth. Each mycelium growth was gently washed, blended in 100 ml sterilized water and then fifty ml of hyphal and /or spore suspension was used as soil drench for each pot. After 7 days, lupine seeds (cv.Giza1) were sown at the rate of 5 seeds/pot. The seeds were treated with three different treatments for 24 hours, the first treatment; seeds were soaked in crude anise oil, the second; seeds were dressed with anise oil with Talk-powder (5ml

oil/100g Talk-powder), the third; seeds without treatment served as control. The fungicide, Vitavax (5,6 dihydro -2- methyl -1-4- oxathum -3-carboxanilide) was used for comparison at the rate of 3 g/kg seeds. Treatments were arranged in a complete randomized block design with five replicates in a glasshouse. Percentage of damping off and survival of plants were calculated 2,4 and 8 weeks after sowing, however fresh weights and dry weights of both root and shoot systems were recorded at harvest.

Statistical analysis :

Data were statistically analyzed according to the SAS program (Anonymous, 1980). The percentages of pre, post-emergence damping-off and survival plants were angularly transformed before statistically analyzed.

RESULTS AND DISCUSSION

1- Inhibitory effect of essential oils on linear growth of fungal isolates :

The inhibitory effect of the tested essential oils on linear growth of *F. oxysporum*, *F. solani* and *R. solani* isolates was presented in Table (1). The results indicated that the inhibitory effect of essential oils was enhanced by increasing their concentrations. Also, essential oils were differed between each other in their activity on reducing fungal linear growth. Anise oil showed the highest inhibitory effect against the isolates of *F. oxysporum* (66.12%), *F. solani* (52.92%) and *R. solani* (100%) at 4ml/L. These results are in harmony with the results of Gangrad *et al.*, (1991); Hasan, (1994); Chaudhary *et al.*, (1995); Müller *et al.*, (1995); Singh *et al.*, (1998); Soliman and Badeaa (2002); Bauiomy (2003) and Singh *et al.*, (2003). Celery and caraway essential oils showed the least effect on the linear growth of fungal isolates, where the inhibition percentages accounted 35.20,

Table (1): Effect of eight essential oils at three concentrations on the linear growth of three tested fungal isolates (*F. oxysporum, F. solani, R. solani*) .

Essential oils	Conc. (ml/L)	Inhibition % *										
		F. oxysporum			*F. solani*			*R. solani*				
		Iso. 1	Iso. 2	Mean	Iso. 1	Iso. 2	Mean	Iso. 1	Iso. 2	Iso. 3	Iso. 4	Mean
Anise	1 ml	38.53	27.48	33.01	33.33	6.80	20.07	82.70	97.40	97.53	97.03	93.67
	2ml	35.97	27.07	31.52	40.20	25.33	32.77	100.00	100.00	100.00	98.63	99.66
	4 ml	62.23	70.00	66.12	47.67	58.17	52.92	100.00	100.00	100.00	100.00	100.00
Cumin	1 ml	13.33	19.00	16.17	36.57	29.87	33.22	14.47	22.57	32.77	28.23	24.51
	2ml	17.33	27.70	22.52	45.43	47.73	46.58	48.00	25.20	51.93	52.67	44.45
	4 ml	35.90	31.83	33.87	53.40	54.20	53.80	63.43	25.20	53.63	62.67	51.23
Dill	1 ml	4.60	7.23	5.92	32.33	2.77	17.55	38.10	11.10	20.47	23.63	23.33
	2ml	9.73	44.23	26.98	39.87	12.03	25.95	43.20	23.70	28.37	37.93	33.30
	4 ml	39.17	59.60	49.39	50.80	29.40	40.10	61.67	28.53	52.53	55.53	49.57
Coriander	1 ml	11.10	23.63	17.37	27.17	14.07	20.62	24.07	5.67	20.00	32.53	20.57
	2ml	36.90	28.10	32. 50	42.73	19.03	30.88	56.10	6.57	11.37	34.67	27.18
	4 ml	49.10	32.53	40.82	64.47	34.30	49.39	63.63	9.00	49.33	44.00	41.49
Parsley	1 ml	3.61	10.23	6.92	12.27	3.33	7.80	22.93	1.48	12.53	27.20	16.04
	2ml	10.67	13.77	12.22	48.70	10.30	29.50	22.56	8.80	20.00	38.43	22.45
	4 ml	38.33	46.33	42.33	66.50	22.83	44.67	53.33	23.27	32.17	41.20	37.49
Fennel	1 ml	44.30	31.47	37.89	15.33	8.07	11.70	22.700	18.60	11.50	15.27	17.02
	2ml	55.37	43.37	40.37	40.40	22.67	31.54	27.67	25.47	19.37	24.63	24.29
	4 ml	59.50	42.83	51.22	49.40	23.57	36.49	35.47	22.100	54.40	34.53	36.63
Celery	1 ml	23.33	12.73	18.03	25.90	12.90	19.40	17.97	21.10	21.47	22.43	20.74
	2ml	27.77	17.40	22.59	34.90	15.10	25.00	33.37	30.73	27.20	28.47	29.94
	4 ml	50.00	20.40	35.20	50.23	30.67	40.45	53.43	35.90	29.77	28.50	36.90
Caraway	1 ml	40.37	6.03	23.20	7.13	6.37	6.75	5.20	8.53	4.57	6.70	6.25
	2ml	41.70	6.90	24.30	28.37	623	17.30	14.43	11.10	6.67	43.67	18.97
	4 ml	41.13	23.67	32.40	35.83	15.10	25.47	42.20	25.60	24.07	51.53	35.85

* Mean of five replicates (plates)

L.S.D. at $P \leq 0.05$ between oils = 1.6982

L.S.D. between fungi x oils = 4.8125

L.S.D. between oil × concs = 2.94712

L.S.D. at $P \leq 0.05$ between fungi = 1.6982

L.S.D. between concs = 1.0399

L.S.D. between fungi × concs = 2.94712

L.S.D. between fungi × oil × concs = 8.3359

32.40 for *F. oxysporum*; 40.45, 25.47 for *F. solani* and 36.90, 35.80 for *R. solani*, respectively. Dill, cumin, coriander, parsley and fennel oils have moderate effect. The obtained data supported those found on different other fungi by Crison and Hadison, (1977); Kishore *et al.*, (1988); Singh and Upadhyay, (1991) Jain *et al.*, (1992); Afifi *et al.*, (1994) Zedan *et al.*, (1994); Pandey and Pant, (1997); Eid *et al.*,(2002); El-Sherbieny *et al.*, (2002); Minija and Thappil, (2002); Soliman and Badeaa (2002) and Bauiomy, (2003).

The antifungal activity of the previous essential oils most probably due to the phenolic compounds and other inhibitor substances present in the essential oil (Bauiomy 2003). Maruzzella (1962) arranged the active principles of volatile oil according to their antimicrobial activities in the decreasing order as follows: aldehyde, phenols, alcohols, ketones, hydrocarbons, esters which is also agreed with those mentioned by Moussa (1998).

2- Inhibitory effect of volatile substances of essential oils : Table (2) showed that the volatile substances which liberated from all essential oils inhibited the mycelial growth of fungal isolates at different degrees. Essential oil of anise completely inhibited the mycelial of fungal isolates (100% inhibition). These results support the findings of Maruzzella and Liquri (1958) who reported that volatile oils such as anise had pronounced activities on the growth of many fungal genera. Saksena and Tripathi (1985 and 1987) reported that volatiles from cumin and anise oil inhibited spore germination of some plant pathogenic fungi.

Table (2): Effect of volatile substances of eight essential oils on linear growth of three tested fungal isolates (*F. oxysporum, F. solani, R. solani*) .

Essential oils	Inhibition % *										
	F. oxysporum			*F. solani*			*R. solani*				
	(iso. 1)	(iso. 2)	Mean	(iso. 1)	(iso. 2)	Mean	(iso. 1)	(iso. 2)	(iso. 3)	(iso. 4)	Mean
Anise	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Caraway	21.67	14.00	17.84	20.74	2.40	11.57	70.97	100.00	39.93	45.63	64.13
Celery	2.56	25.33	13.95	11.90	53.37	32.64	34.77	27.60	64.67	50.10	44.29
Parsley	12.53	48.67	30.60	29.60	29.33	29.47	14.70	21.33	54.40	13.93	26.09
Dill	5.63	10.33	7.98	7.64	45.00	26.32	15.43	55.17	34.80	45.50	37.73
Cumin	0.94	11.33	6.14	0.77	30.23	15.50	35.27	45.80	11.57	20.40	28.26
Fennel	2.60	10.80	6.70	32.10	17.70	24.90	0.31	18.33	16.20	38.10	18.24
Coriander	12.13	11.33	11.73	7.80	12.00	9.90	50.00	7.57	2.80	21.87	20.56

* Mean of four replicates (plates)
L.SD. at $P \leq 0.05$ between fungi = 3.8592
L.SD. at $P \leq 0.05$ between oil = 3.8592
L.SD. at $P \leq 0.05$ between fungi × oil = 10.9296

The least effective essential oils on this respect were cumin fennel and coriander which gave percent inhibition of 6.14, 6.70 and 1 1.73 in *F. oxysporum*; 15.50, 24.90 and 9,90 in *F. solani* as well as 28.26, 18.24 and 20.56 in *R. solani*, respectively. On the other hand, El-Sherbieny et al (2002) found that the vapors of cumin oil completely suppressed the mycelial growth of F. solani and R. solani which causing cotton seedling

damping-off. In the present study, volatile substances from caraway and celery oils were having moderately antifungal activity against fungal isolates.

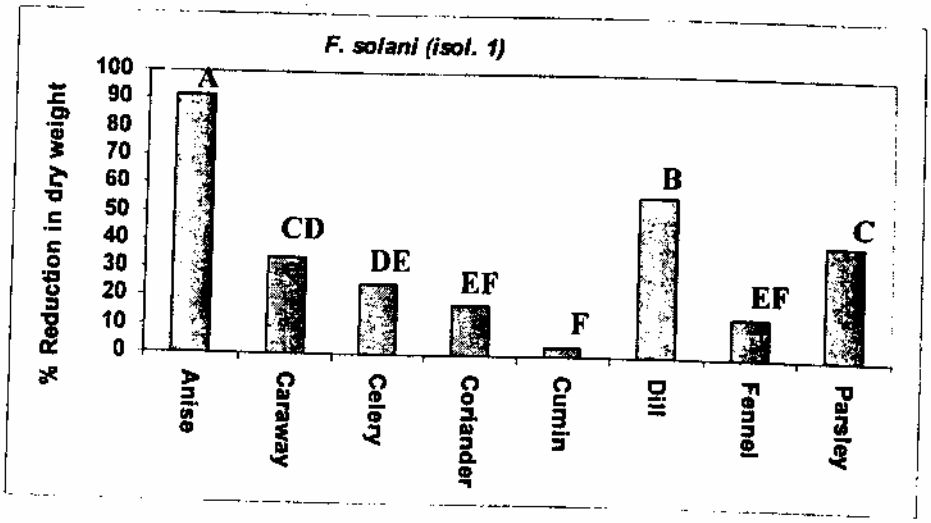
C- Effects on the dry weight of fungal isolates:

Fig (1 & 2) showed that all tested essential oils reduced the dry weight of all tested fungi. Anise oil was the most effective one, it reduced dry weights of *R. solani*, *F. oxysporum* and *F. solani* isolates with percentages of 98.01,98.07and 94.74, respectively.

Celery, caraway, dill, cumin, parsley and coriander oils showed moderate reduction on dry weight, meanwhile, fennel oil was the least effective one which caused 33.7, 14.12, 18.01% reduction for *F. oxysporum*, *F. solani* and *R. solani*, respectively.

The main component of anise oil is anethol (phenolic ether) in great quantity reached to 50.2% but it had more effect than the other phenolic compounds. However, cumin oil is characterized by a great amount of cuminaldhyde which had a powerful activity as an antifungal agent. As far as celery oil, although it contained hydrocarbons terpenes but it was poor in the other terpenes. Fennel oil is characterized also by anethol, but in a smaller quantity than anise oil (Eid *et al.*, 2002).

The variations of antifungal activity of essential oils may be due to the capability of the oil to penetrate into the fungal cell, alternate the fungal metabolism by the mutagenic activity of it's constituents (phenolic, esters, etc) or both action together. Many investigators mentioned the effects of various essential oils as antifungal agents (Müller *et al.*, 1995; Zambonelli *et al.*, 1996; Jaspal and Tripathi 1999; El-Shazly 2000 and Bauiomy, 2003)



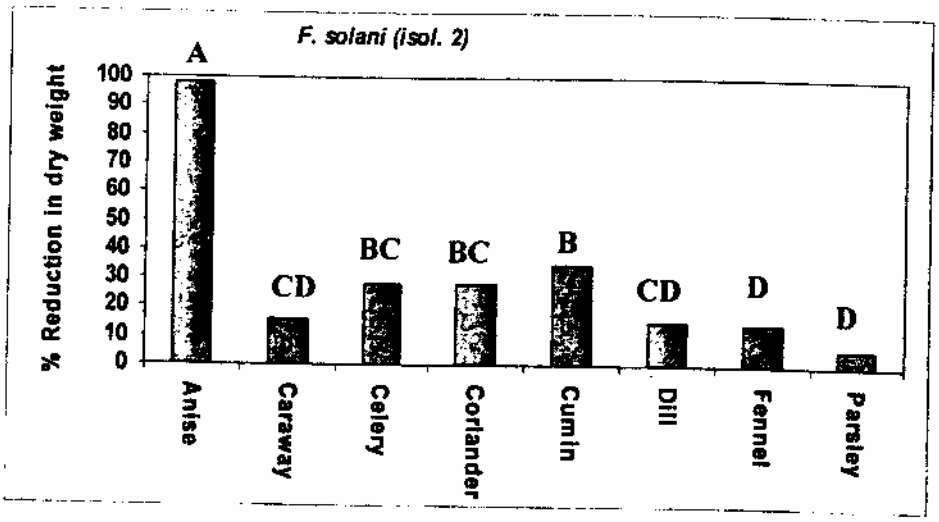
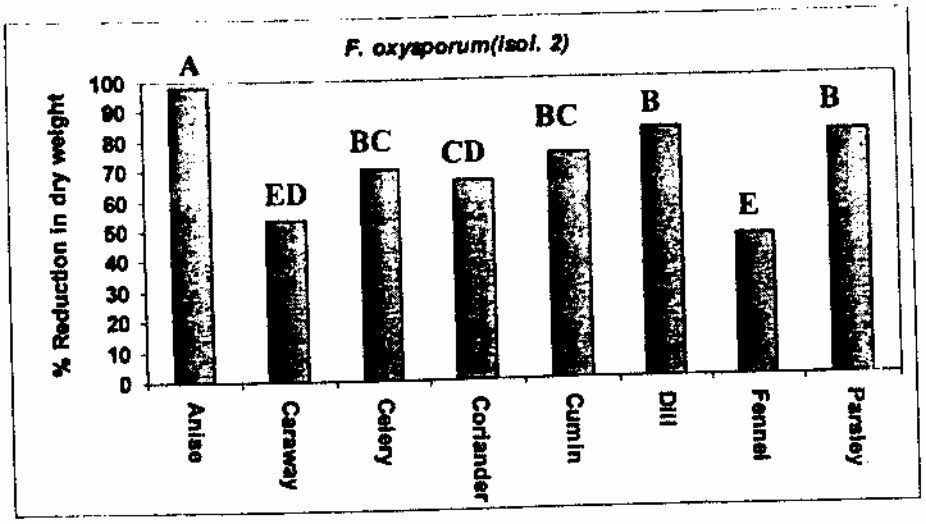


Fig 1(a): Effect of eight essential oils on the reduction percentage of dry weight of *F. solani* isolates.
Columns having the same letter(s) are not significantly different at $p \leq 0.05$



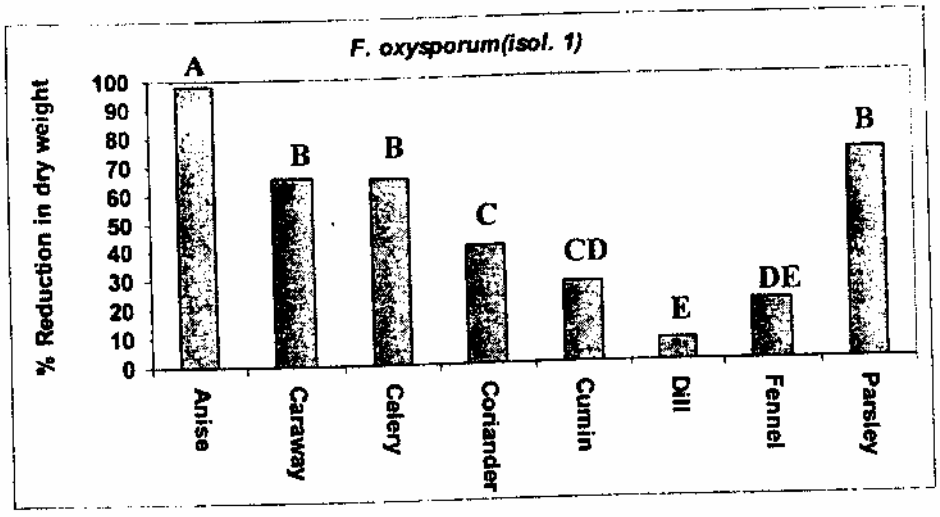
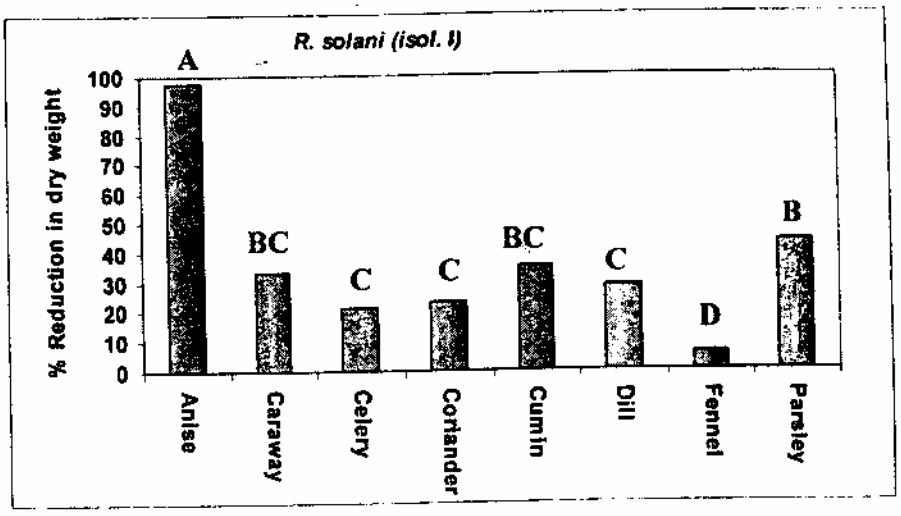


Fig 1(b): Effect of eight essential oils on the reduction percentage of dry weight of *F. oxysporum.*
Columns having the same letter(s) are not significantly different at $p \leq 0.05$



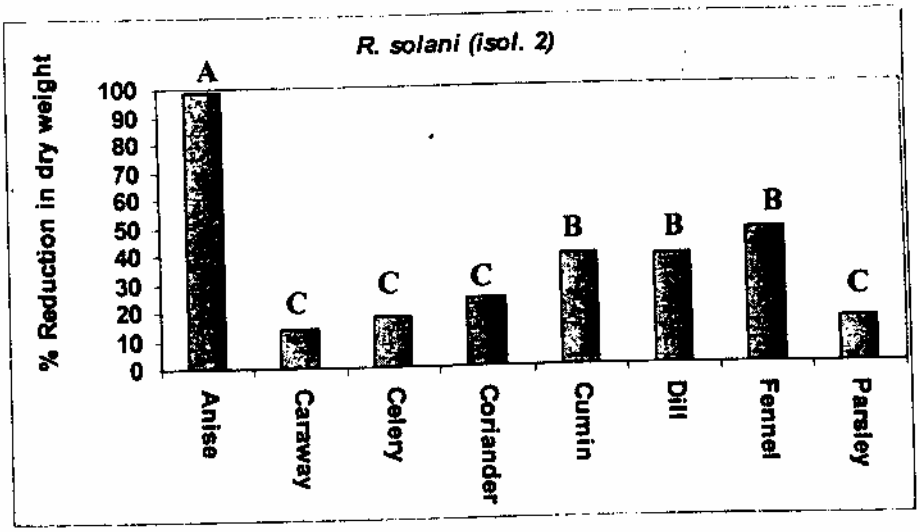
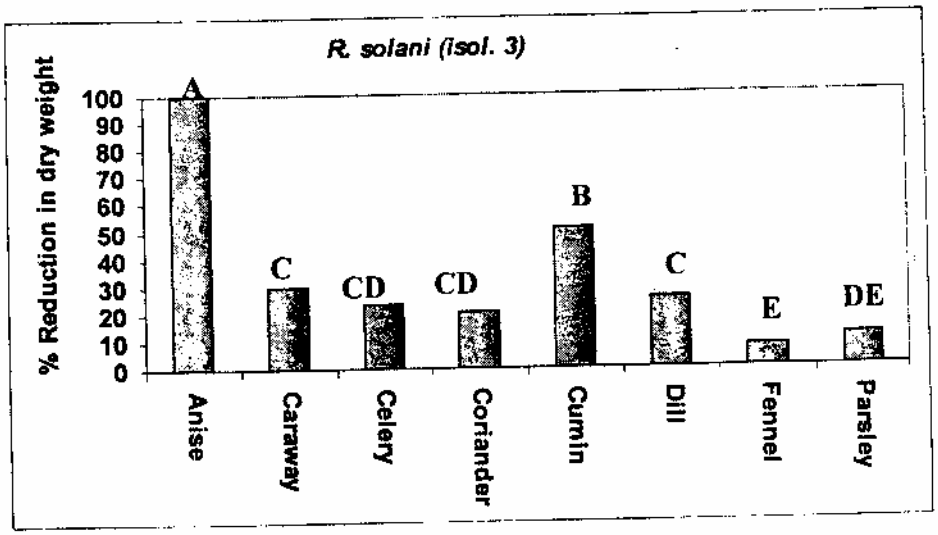


Fig 2 (a): Effect of eight essential oils on the reduction percentage of dry weight of *R. solani* isolates (1 &2).



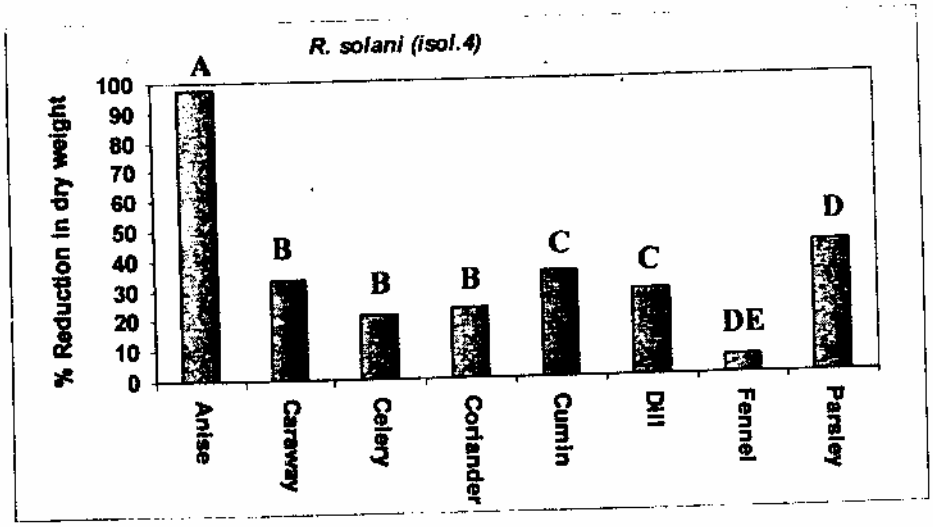


Fig 2 (b): Effect of eight essential oils on the reduction percentage of dry weight of *R. solani* isolates (3 &4)

II- *In vivo* experiment :

The most *in vitro* effective essential oil (anise) was selected for controlling damping-off of lupine plants as *in vivo* seed treatment. Data in Table (3) showed that treating lupine seeds with anise oil as seed soaking gave significantly marked increase in seed protection against infection by *F. oxysporum*, *F. solani* or *R. solani*. In this respect, seeds treated with anise oil was more effective than that of anise oil mixed with Talk-powder. It significantly decreased pre-emergence damping-off from 23.34% to 6.67% for *F. oxysporum* ; from 20% to 13.33% for *F. solani* and from 26.67% to 10% for *R. solani* as compared to control. No significant differences were found among anise oil plus Talk-powder treatment. Anise oil treatment decreased the mortality by (46.67-100%) in *R. solani* isolates, (33.4-100%) in *F. oxysporum* and (13.34-25%) in *F. solani*. However, Vitavax has reduced mortality by 83.33-100%, 66.68-71.44% and 74.99-100%, respectively, with the same fungi. Treating lupine seeds with anise oil plus Talk-powder as seed dressing decreased mortality by (57.1-16.7%) (74.9-25.0%) and (0.0-100%) respectively. These findings are in agreement with those of El-Shazly (2000) who found that anise oil gave highly protection to the maize seedling stages against *F. oxysporum*, *F. solani* and *R. solani* isolates when used as seed dressing grains treated with it. Singh *et al.*, (2003) reported that anise oil showed no adverse effect on seed germination and seedling growth of some crops such as chickpea, it had no adverse effect on the general health of sugarcane plants. Moreover, Chaudhary *et al.*, (1995) reported that anise oil showed no adverse effect on the general health of sugarcane plants and was superior to some of the systemic fungicides. The effect of anise oil on fresh and dry weights of root and shoot systems of lupine plants showed significant increase as compared to the control (Table 4). It significantly increased fresh and dry weights of shoot and root by (56.3-52.6%) and (18.6-34.5%), while, Vitavax (44.3-61.4%) and (10.3-72.4%). On the other hand, anise oil plus Talk-powder increased the weighs by (33.7-33.3%) and (29.3-0.0%), respectively.

Table (3) : Effect of seed treatment with anise oil, anise oil plus Talk-powder and Vitavax on the percentage of pre-and post-emergence damping-off and survivals lupine plants (cv-Giza1) grown in previously infested soil with damping-off fungi.

Fungi	Treatments	Pre-emergence	Post-emergence	Survival	% of total mortality
F. oxysporum (iso. 1)	Anise oil	0.00	0.00	100.00	0.00
	Anise oil + Talk-powder	20.00	0.00	80.00	20.00
	Vitavax	13.33	0.00	86.67	13.33
	Control	20.00	26.67	53.33	46.67
F. oxysporum (iso. 2)	Anise oil	13.33	13.33	73.33	26.66
	Anise oil + Talk-powder	26.67	6.67	66.67	33.33
	Vitavax	13.33	0.00	86.67	13.33
	Control	26.67	13.33	60.00	40.00
F. solani (iso. 1)	Anise oil	13.33	6.67	80.00	20.00
	Anise oil + Talk-powder	0.00	6.67	93.33	6.67
	Vitavax	0.00	0.00	100.00	0.00
	Control	20.00	6.67	73.33	26.67
F. solani (iso. 1)	Anise oil	13.33	0.00	86.67	13.33
	Anise oil + Talk-powder	20.00	0.00	80.00	20.00
	Vitavax	6.67	0.00	93.33	6.67
	Control	20.00	6.67	73.33	26.67
R. solani (iso. 1)	Anise oil	13.33	6.67	80.00	20.00
	Anise oil + Talk-powder	26.67	6.67	66.67	33.33
	Vitavax	6.07	0.00	93.33	6.67
	Control	26.67	13.33	60.00	40.00

Table (3) : Effect of seed treatment with anise oil, anise oil plus Talk-powder and Vitavax on the percentage of pre-and post-emergence damping-off and survivals lupine plants (cv-Giza1) grown in previously infested soil with damping-off fungi (Continued).

Fungi	treatments	Pre-emergence	Post-emergence	survival	% of total mortality
R. solani (iso. 2)	Anise oil	0.00	0.00	100.00	0.00
	Anise oil + Talk-powder	0.00	0.00	100.00	0.00
	Vitavax	0.00	0.00	100.00	0.00
	Control	13.33	6.67	80.00	20.00
R. solani (iso. 3)	Anise oil	20.00	6.67	73.33	26.67
	Anise oil + Talk-powder	46.67	0.00	53.33	46.67
	Vitavax	0.00	0.00	100.00	0.00
	Control	60.00	13.33	26.67	73.33
R. solani (iso. 4)	Anise oil	6.67	0.00	93.33	6.67
	Anise oil + Talk-powder	6.67	0.00	93.33	6.67
	Vitavax	0.00	0.00	100.00	0.00
	Control	6.67	0.00	93.33	6.67
Control	Anise oil	6.67	0.00	93.33	6.67
	Anise oil + Talk-powder	0.00	0.00	100.00	0.00
	Vitavax	0.00	0.00	100.00	0.00
	Control	6.67	0.00	93.33	6.67
Mean	Anise oil	9.63	3.70	86.66	13.34
	Anise oil + Talk-powder	16.30	2.22	81.48	18.52
	Vitavax	4.44	0.00	95.50	4.50
	Control	22.22	9.63	68.50	31.50

Each figure represents on average of five replicates (pots, 5 seeds each)

Pre-emergence damping-off

L.S.D. at $P \leq 0.05$ between fungi = 11.472
L.S.D. at between treat = 7.6482
L.S.D. at between fungi × treat = 22.9047

Survival plants

L.S.D. at $P \leq 0.05$ between fungi = 12.037
L.S.D. at between treat = 8.0248
L.S.D. at between fungi × treat = 24.032

Table (4) : Effect of seed treatment with anise oil, anise oil plus Talk powder and Vitavax on fresh weight and dry weight of shoot and root of lupine plants (cv-Giza1) grown in previously infested soil with damping-off fungi 8 weeks after sowing.

Fungi	Treatments	Fresh weight gm/plant		Dry weight gm/plant	
		Shoot	Root	Shoot	Root
F. oxysporum (iso. 1)	Anise oil	4.59	3.52	0.82	0.42
	Anise oil + Talk-powder	4.91	3.16	0.73	0.29
	Vitavax	3.88	2.05	0.90	0.75
	Control	2.50	2.37	0.62	0.27
F. oxysporum (iso. 2)	Anise oil	5.85	2.01	0.92	0.25
	Anise oil + Talk-powder	5.00	3.68	1.03	0.32
	Vitavax	6.13	1.91	1.19	0.37
	Control	3.56	2.01	0.58	0.40
F. solani (iso. 1)	Anise oil	5.81	2.73	0.99	0.28
	Anise oil + Talk-powder	4.99	3.50	0.83	0.33
	Vitavax	4.13	3.32	0.71	0.57
	Control	3.33	1.79	0.54	0.31
F. solani (iso. 2)	Anise oil	5.34	2.66	0.82	0.30
	Anise oil + Talk-powder	5.44	2.56	0.76	0.27
	Vitavax	5.54	2.97	0.98	0.44
	Control	3.19	2.24	0.50	0.34
R. solani (iso. 1)	Anise oil	5.99	2.94	0.79	0.79
	Anise oil + Talk-powder	5.93	3.02	1.01	0.43
	Vitavax	5.94	2.14	1.05	0.40
	Control	3.58	2.82	0.37	0.07

Table (4) : Effect of seed treatment with anise oil, anise oil plus Talk powder and Vitavax on fresh weight and dry weight of shoot and root of lupine plants (cv-Giza1) grown in previously infested soil with damping-off fungi 8 weeks after sowing (Continued) .

Fungi	Treatments	Fresh weight gm/plant		Dry weight gm/plant	
		Shoot	Root	Shoot	Root
R. solani (iso. 2)	Anise oil	4.95	3.62	0.80	0.43
	Anise oil + Talk-powder	4.01	2.86	0.68	0.34
	Vitavax	5.99	3.19	0.99	0.45
	Control	3.13	2.59	0.50	0.21
R. solani (iso. 3)	Anise oil	6.87	3.36	0.90	0.45
	Anise oil + Talk-powder	3.86	3.38	0.58	0.18
	Vitavax	4.91	2.72	0.83	0.48
	Control	4.65	2.87	0.70	0.33
R. solani (iso. 4)	Anise oil	5.09	2.58	0.99	0.32
	Anise oil + Talk-powder	4.01	3.05	0.60	0.22
	Vitavax	3.91	2.86	0.71	0.45
	Control	2.80	3.14	0.48	0.27
Control	Anise oil	4.77	2.44	0.82	0.26
	Anise oil + Talk-powder	3.97	2.94	0.60	0.28
	Vitavax	5.05	2.84	0.87	0.59
	Control	3.74	2.00	0.82	0.41
Mean	Anise oil	5.47	2.87	0.87	0.39
	Anise oil + Talk-powder	4.68	3.13	0.76	0.29
	Vitavax	5.05	2.67	0.92	0.50
	Control	3.50	2.42	0.57	0.29

Each figure represents on average of five replicates (pots, 5 seeds each)

Fresh weight of stem

L.S.D. at $P \leq 0.05$ between fungi = 1.0187
L.S.D. between treat = 0.6791
L.S.D. between fungi × treat = 2.0236

Fresh weight of root

L.S.D. at $P \leq 0.05$ between fungi = 0.4906
L.S.D. between treat = 0.3271
L.S.D. between fungi × treat = 0.9571

Dry weight of stem

L.S.D. between fungi = 0.1778
L.S.D. between treat = 0.1186
L.S.D. between fungi × treat = 0.3580

Dry weight of root

L.SD. between fungi = 0.0948
L.SD. between treat = 0.0632
L.SD. between fungi × treat = 0.1895

Treating lupine seeds with anise oil as seed soaking or seed dressing plus Talk-powder gave significantly marked increases in seed protection against infection by fungi. In this respect, seed soaking with anise oil was more effective than that of seed dressing in decreasing the percentages of pre-and post-emergence damping–off, increased percentage of lupine survivals over the control and increased weights of lupine shoot and root systems. Anethol as a major constituent of anise oil may have antifungal activity against fungal isolates when their vapor released from treated seeds throughout planting which may have highly protection to the seedlings stages against the infection by pathogenic fungi (Saksena and Tripathi, 1985 & 1987 and El- Shazly , 2000).

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مقاومة مرض الذبول الطرى للترمس بالزيوت الطيارة التابعة لنباتات العائلة الخيمية

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تـــم إختـــبار 8 زيوت نباتية في قدرتها على تثبيط نمو الفطريات المسببة لمرض مـــوت الـــبادرات وهـــى فـــيوزاريوم اوكسيســـبورم *Fusarium oxysporum* وفيوزاريوم سولانى *F. solani* ورايزوكتونيا سولانى *Rhizoctonia solani* . وقـــد وجـــد أن أفضـــل الزيوت تأثيرا على نمو الفطريات تحت الإختبار هو زيت الينسون حيث كانت نسبة التثبيط(100%) لفطر رايزوكتونيا سولانى ، (66.12%) لفطر فيوزاريوم اوكسيسبورم ،(52.92%) وفطر فيوزاريوم سولانى عند تركيز 4 مل / لتر بينما كان زيت الكرفس والكراوية أقل فاعلية في هذا المجال.

وفـــى تجارب لدراسة تأثير المواد المتطايرة للزيوت على نمو الفطريات المختبرة أوضـــحت النـــتائج ان زيت الينسون ثبط تماما النمو الميسليومى لجميع الفطريات المختبرة بنسبة 100%.

كما أظهرت النتائج أيضا أن الوزن الجاف لميسيليوم الفطريات المختبرة بالمعمل قد أنخفض معنويا بإستعمال الزيوت السابقة وكان زيت الينسون أكثرهم فاعلية فى هذا

المجـــال حيـــث خفض الوزن الجاف لفطر رايزوكتونيا سولانى و فطر فيوزاريوم اوكسيسبورم وفطر فيوزاريوم سولانى بنسب (98.01% ، 98.07 ، 94.74 على التوالى) . وقد أوضحت النتائج أيضا أن غمر بذور الترمس قبل الزراعة فى معلق زيـــت الينســـون أعطى نتائج معنوية فى خفض نسبة الموت الكلى للبادرات لفطر رايزوكتونـــيا ســـولانى بنســـبة (46.67 –100 %) ، (33.40–100%) لفطـــر فـــيوزاريوم اوكسيسبورم ، (13.34–25%) لفطر فيوزاريوم سولانى وكذلك كان لها تأثير إيجابى فى الزيادة المعنوية للوزن الطرى والجاف لكل من الجذر والساق بنسب (52.6–56.3%) للوزن الطرى (18.6–34.5) للوزن الجاف. وكان هناك تأثير إيجابى أيضا لمعاملة البذور بزيت الينسون المحمل على بودرة التلك فى تقدير مقاومـــة المـــوت الكلى للبادرات وفى زيادة الوزن الطرى والجاف للجذر والساق ولكـــن بمعدل أقل من معاملة البذور غمرا فى زيت الينسون. تشير النتائج التى تم الحصول عليها فى هذه الدراسة الى إمكانية إستخدام زيت الينسون كبديل للمبيدات أو قد يوضع فى مخاليط هذه المبيدات لتقليل تأثيرها الضار ويقترح إجراء دراسات إضـــافية فى هذا المجال تحت ظروف الحقل حتى يمكن التوصية بإستعمالها على المستوى التطبيقى بما يضمن التقليل أو عدم تلوث البيئة بالمبيدات.