EFFICACY OF SOME BIOAGENTS, PLANTS AND HUMEX IN CONTROLLING *TYLENCHULUS SEMIPENETRANS* ON OLIVE IN EGYPT

Journal

J. Biol. Chem. Environ. Sci., 2008, Vol. 3(1): 223-241
www.acepsag.org

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ABSTRACT

This study was conducted to determine the susceptibility of seven olive cultivars to citrus nematode, control citrus nematodes; *Tylenchulus semipenetrans* under both greenhouse and field conditions. In addition to determine the olive yield (cv. Picual) in Egypt.

Data showed that picual cultivar is the most susceptible cultivar; whereas Dolsy cultivar is the least susceptible cultivar to the citrus nematodes under greenhouse conditions.

Seven treatments (suspension of *Psudomonas fluorescens*, suspension of *Arthrobotrys oligospora,* suspension of dry peels powder of *Punica granatum*, suspension of dry leaves powder of *Mentha piperita*, suspension of dry leaves powder of *Eucalyptus globules*, at different concentrations, humex (10%) and oxamyl) were used to control *T. semipenetrans* under both greenhouse and field conditions on olive.

The most effective treatments in controlling citrus nematodes; *T. semipenetrans* are humex (10%) and *Psudomonas fluorescens* whereas the least effective is suspension of dry peels powder of *Punica granatum* under both greenhouse and field conditions.

Humex (10%) was more effective in reducing numbers of developmental stages ,egg laying females, number of eggs/ egg-mass and number of second stage larvae, whereas the suspension of dry

peels powder of *Punica granatum* was the least effective under both greenhouse and field conditions.

Under greenhouse conditions all treatments led to increase the total fresh weight of shoots and roots of olive seedlings especially at the highest concentration. Using three times of application every week of each treatment achieved high decrease in nematodes population in both roots and soil under both greenhouse and field conditions. Also, increased the yield of olive under field conditions.

Key words: efficacy, cultivar, citrus nematodes, *T. semipenetrans*, humex, *Psudomonas fluorescens*, *Arthrobotrys oligospora, Eucalyptus globules*, *Mentha piperita*, *Punica granatum,* oxamyl and olive.

INTRODUCTION

Olive tree, *Olea europaea L.* became in Egypt in the last decade, one of the major fruit crops of global importance and cultivated mainly in the new land of the desert. The citrus nematode, *Tylenchulus semipenetrans* is a rather specialized sedentary plant nematode attack olive and has been shown to inhibit olive growth (McKenry, 1994). In the recent years, the awareness of the nematicides hazards to human and environment has directed the attention towards soil-borne antagonists and the natural plants as an alternative method to chemical control. Biological control and natural plants are gaining an increasing role throughout the world for decreasing nematode population.

Psudomonas fluorescens has been reported as a biocontrol agent against nematodes (Hanna *et. al.*, 1999; Devi and Upma, 2002; Hamid *et. al.*, 2003; Mahapatra and Mohanty, 2003; Rao *et. al.*, 2004 and Siddiqui & Shaukat, 2005) as well as *Arthrobotrys oligospora* has been mentioned by (Sankaranarayanan *et. al.*, 1998; Bandyopadhyay *et. al.*, 2001; Duponnois *et. al.*, 2001; Singh *et. al.*, 2001 and Khan *et. al.*, 2002 and El Gendy & Shawky, 2006).

Eucalyptus; *Eucalyptus globules* has nematicidal effect on nematode population according to (Chhabra *et. al.*, 1988; Sabira *et. al.*, 2000 and Shaukat *et. al.*, 2003). Pomegranate; *Punica granatum* (Naz *et. al.* 2007). Peppermint; *Mentha piperita* has a lethal effect on nematodes according to (Niranjan, 1999 and Kanta *et. al.*, 2002).Humex (10%) has nematicidal effect (Kesba and Al-Shalaby (2008).

The aim of this work determine the suitability of seven olive cultivars to citrus nematode and evaluation of different treatments on controlling citrus nematodes; *Tylenchulus semipenetrans* on olive under both greenhouse and field conditions in Egypt.

MATERIALS AND METHODS

These experiments were conducted under greenhouse conditions. The field experiment was conducted in a naturally infested field with *Tylenchulus semipenetrans* on olive trees in Sadat city.

I- Greenhouse experiments:-

1-Host susceptibility of some olive cultivars to the citrus nematode; *T. semipenetrans*:-

Six months old olive seedlings of seven cultivars obtained from Horticulture Research Institute, Agricultural Research, Center, Giza, Egypt were examined for their relative susceptibility to the infestation of citrus nematode; *T. semipenetrans*. Theses cultivars were Egazy, Tofahy, Picual, Carotina, Frantoio, Manzanillo and Dolsy. Six months old of each cultivar were planted in 25 cm. diameter clay pots filled with sandy loamy soil (18% clay, 10% silt and 72% sand) steam sterilized soil.

Each pot was inoculated with 3000 newly hatched larvae of *T. semipenetrans* around the roots one week after planting. All cultivars received the same agricultural treatments. Each cultivar replicated five times as well as five seedlings for each cultivar were kept without inoculation to serve as a check. All pots were arranged in completely randomized design, and kept under greenhouse conditions at about 25-28 C^{o}.

After 90 days, all plants were carefully uprooted and fresh root and shoot systems were weighted. Nematode populations in soil (number of juveniles/ 250g. soil) were determined according to (Franklin & Goodey, 1957) Roots were stained by acid fuchsin in acetic acid according to (Byrd *et. al.*1983), and examined for number of developmental stages and egg laying females/1g. root. Eggs /egg-mass of *T. semipenetrans* were extracted by using sodium hypochoride (NaOCl) method as described by (Husssey and Baker, 1973).

2-Efficacy of some concentration of some bioagents, plants and humex in controlling citrus nematode; *T. semipenetrans*:-

In this study seven different treatments were used:-

1-Suspension of *Psudomonas fluorescens* (PS).
1-Suspension of *Arthrobotrys oligospora* (AO).
2-Suspension of dry peels powder of *Punica granatum* (PG).
3-Suspension of dry leaves powder of *Mentha piperita* (MP).
4-Suspension of dry leaves powder of *Eucalyptus globules* (EG).
5-Humex (10%).
6-Oxamyl (24% EC).

The concentrations of both *Psudomonas fluorescens*, *Arthrobotrys oligospora* were (1×10^5,1×10^8,5×10^8 cfu)/ pot. While, the dry powder of the plants were prepared by using three concentrations; (C1)10g./100ml. sterilized distilled water, (C2)15g./100ml. sterilized distilled water and (C3) 20g./100 ml. sterilized distilled water/ pot against *T. semipenetrans*.

The *Psudomonas fluorescens* was taken from Microbiology Department, Soils, Water and Environment Research Institute, Agriculture Research Center. *Arthrobotrys oligospora* was taken from Plant Pathology Department, Faculty of Agriculture, Cairo University. Suspension of humex (10%) as recommended concentration (8L/feddan) and oxamyl (4L/feddan) as recommended concentration were used.

Six months old of olive seedlings, picual cultivar were transplanted individually in 25 cm. diameter clay pots each pot filled with sandy loamy soil (18% clay, 10% silt and 72% sand) steam sterilized soil. Each pot was inoculated with 3000 newly hatched larvae of *Tylenchulus semipenetrans* around the roots.. All treatments received the same agricultural treatment. Each treatment replicated five times. All pots were arranged in completely randomized design, and kept under greenhouse conditions at about 25-28 C°.

The olive seedlings were treated with each mentioned concentration/ pot of the treatments suspension of (*Psudomonas fluorescens* and *Arthrobotrys oligospora*), suspension of (dry peels powder of *Punica granatum*, dry leaves powder of *Mentha piperita*, dry leaves powder of *Eucalyptus globules*), plus the treatment with both humex (10%) and oxamyl (24% EC). Also, five olive seedlings were treated with newly hatched larvae of *T. semipenetrans* alone as check.

After 90 days, all plants were carefully uprooted and fresh root and shoot systems were weighted. Nematode populations in soil (number of juveniles/250g. soil) were determined according to (Franklin & Goodey, 1957). Roots were stained by acid fuchsin in acetic acid according to (Byrd *et. al.*1983) and examined for number of developmental stages and egg laying females/1g. root. Eggs /egg-mass of *T. semipenetrans* were extracted by using sodium hypochoride (NaOCl) method as described by Husssey and Baker (1973).

3- Efficacy of number of application of some bioagents, plants and humex in controlling *T. semipenetrans* on olive cv. picual:-

Olive seedlings (*Olea europaea,* picual cultivar), six months old were planted in 25 cm. diameter clay pots each pot filled with sandy loamy soil (18% clay, 10% silt and 72% sand) steam sterilized soil. The treatments were designed in five replicates (one seedling for each pot).

This experiment was conducted to determine the effect of number of application (interval period) in controlling *T. semipenetrans* with the previous treatments using the highest concentration of both suspension of bioagents at concentration (5×10^{8} cfu) and the dry powder of plants at concentration (20g./100 ml. sterilized distilled water) under greenhouse conditions at about (25-28°C).

Olive seedlings were divided in to six groups:-

1- The first group received one soil drench (100 ml/pot) (pots were treated only one time (W1)).
2- The second group received one soil drench (100 ml/pot) (pots were treated two times (W2)).
3- The third group received one soil drench (100 ml/pot) (pots were treated three times (W3)).
4-The fourth group was treated with humex (10%) at the recommended concentration (8 L/ feddan)
5-The fifth group was treated with oxamyl (24 %EC) at the recommended concentration (4L/feddan).
6- The sixth group was inoculated with only newly hatched larvae of nematodes as check control.

After 90 days, all plants were carefully uprooted and fresh root and shoot systems were weighted. Nematode populations in soil (number of juveniles/ 250g. soil) were determined according to (Franklin & Goodey, 1957) Roots were stained by acid fuchsin in acetic acid according to (Byrd *et. al.* 1983), and examined for number of developmental stages and egg laying females/1g root. Eggs /egg-mass of *T. semipenetrans* were extracted by using sodium hypochoride (NaOCl) method as described by Husssey and Baker (1973).

II- Field experiments:-

Efficacy of some bioagents, plants and humex in controlling citrus nematode; *T. semipenetrans*:-

This experiment was conducted in naturally infested sandy soil to determine the efficacy of some bioagents, plants treatments to control *T. semipenetrans* under field conditions at the high concentration (20g./100 ml) for plants and at the high concentration (5×10^{8} cfu) for the bioagents with three time application for each treatment weekly. Humex (10%) was used as recommended concentration (8L/Feddan), also oxamyl (4L/Feddan) was used as recommended concentration. All treatments were replicated three times (every replicate was ten trees of olive).

Every month nematode populations in both soil and root including number of second stage juveniles/ 250g. soil, and developmental stages, egg laying females and eggs/egg-mass/gm. root were determined after treatments to the harvesting time during the growing season according to (Franklin & Goodey, 1957). Roots were stained by acid fuchsin in acetic acid according to (Byrd *et. al.* 1983) and examined for number of developmental stages and egg laying females/1g. Eggs /egg-mass of *T. semipenetrans* were extracted by using sodium hypochoride (NaOCl) method as described by (Husssey and Baker, 1973). At the end of the experiment the fruit yield of olive were determined.

Statistical analysis procedure:-

All obtained data were subjected to statistical analysis proposed by (Gomez and Gomez, 1984) and treatment means were compared by the Duncan's Multiple Rang Test at 5% level of probability using L.S.D. multiple range test according to (Duncan, 1954).

RESULTS AND DISCUSSION

I- Greenhouse experiments:-

1-Host susceptibility of some olive cultivars to the citrus nematode; *T. semipenetrans*:-

Data in table (1) indicate that olive is a good host for the citrus nematode, *T. semipenetrans* in all cultivars. Picual cultivar was the most susceptible cultivar to the citrus nematode in comparing to other tested cultivars, while dolsy cultivar exhibited some resistance to the citrus nematode. The nematode population in 250g. soil and in root (number of developmental stages, egg laying females and number of eggs/ egg mass) were significantly higher on picual than those on the other tested cultivars($P< 0.05$). Manzanillo, Egazy, Tofahy, Carotina and Frantoio ranked statistically in the intermediate category in nematode population in both soil and roots.

Table (1): Reproduction of citrus nematode, *T. semipenetrans* on some olive cultivars.

cultivars	Nematode population			
	No. of nematodes in soil/250 g.	On 1 g. root		
		No. of developmental stages	No. of egg laying females	No. of eggs /egg-mass
Carotina	1720 E	55 E	23 E	237 E
Dolsy	580 G	27 G	19 F	189 G
Egazy	3240 C	76 C	43 C	292 C
Frantoio	1120 F	43 F	24 E	216 F
Manzanillo	4380 B	82 B	56 B	311 B
Picual	5200 A	93 A	68 A	345 A
Tofahy	2360 D	69 D	36 D	275 D

Numbers followed by the same letter (s) within a column are not significantly different ($P= 0.05$) according to Duncan's new multiple-range test.

Fig (1) showed the reduction of total fresh weights (shoot and root) of the tested infected cultivars with T. semipenetrans compared with non infected cultivar plants. Picual cultivar showed the highest

reduction in total fresh weights (shoot and root), while Dolsy cultivar showed the lowest reduction in total fresh weights (shoot and root).

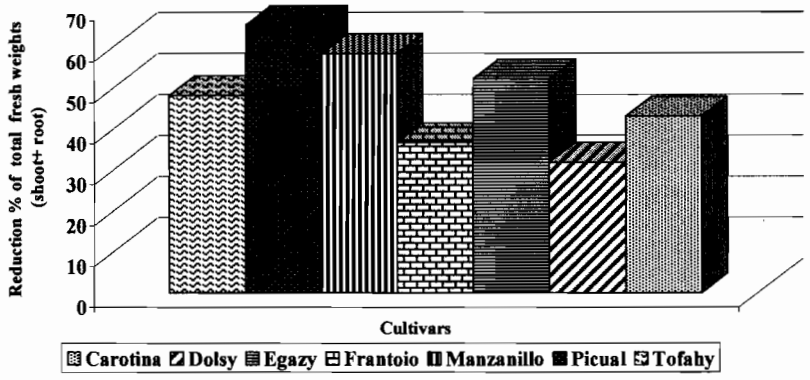

Fig (1) Reduction% of total fresh weights of some olive cultivars infected with *T. semipenetrans* compared with healthy cultivars.

2- Efficacy of some concentration of some bioagents, plants and humex in controlling *T. semipenetrans*:-

A- The effect on nematode population of citrus nematode; *T. semipenetrans*:-

Data in table (2) illustrated that all tested bioagents, plants and humex treatments were effective in controlling citrus nematode; *T. semipenetrans* under greenhouse conditions.

Humex (10%) and *Psudomonas fluorescens* treatments were the most effective treatment than the other treatments whereas the least effective treatment was suspension of dry peels powder of *Punica granatum*. Also, data showed that positive correlation between efficacy of the treatments and concentrations.

Data in table (2) reveled that by using humex (10%) and suspension of *Psudomonas fluorescens* at ($5x10^{8}$) performed the highest decrease in both soil/ 250g. and root (developmental stages, egg laying females, number of eggs/ egg-mass) comparing with the other treatments. Suspension of (*Arthrobotrys oligospora* , dry leaves powder of *Mentha piperita*, dry leaves powder of *Eucalyptus*

globules) occupied the second rank in reducing the nematode populations , whereas suspension dry peels powder of *Punica granatum* (10g. /100 ml. water) resulted in the lowest number of nematode populations in both soil and roots.

Table (2): Effect of concentration of some bioagents, plants and humex on nematode population of *T. semipenetrans* on olive (cv. Picual).

Treatments	Concentration / pot	Nematode population			
			On 1 g. root		
		No. of nematodes in soil/250 g.	No. of developmental stages	No. of egg laying females	No. of eggs /egg-mass
Psudomonas fluorescens	1×10^{5} cfu	630 EF	39 G	35 EF	167 J
	1×10^{6} cfu	430 G	32 F	28 F	149 K
	5×10^{3} cfu	240 I	26 H	23 G	135 L
Arthrobotrys oligospora	1×10^{5} cfu	720 E	49 EF	39 E	226 H
	1×10^{6} cfu	580 F	42 F	33 EF	202 HI
	5×10^{3} cfu	320 H	36 F	29 F	189 I
Eucalyptus globules	10 g./100 ml. water	940 D	69 D	47 D	255 F
	15 g. /100 ml. water	820 DE	61 D	41 DE	235 G
	20 g. /100 ml. water	680 EF	55 E	32 E	229 G
Mentha piperita	10 g./100 ml. water	1140 C	79 C	55 C	262 E
	15 g. /100 ml. water	960 D	73 C	49 D	246 F
	20 g. /100 ml. water	880 F	62 D	46 D	233 G
Punica granatum	10 g. /100 ml. water	1920 B	83 B	72 B	324 B
	15 g. /100 ml. water	1780 BC	76 C	67 B	295 C
	20 g. /100 ml. water	1220 C	65 D	53 C	277 D
Humex (10%)		220 IJ	22 HI	14 H	124 LM
Oxamyl (24% EC)		180 J	18 I	10 I	107 M
Check control (nematodes only)		5260 A	112 A	88 A	352 A

Numbers followed by the same letter (s) within a column are not significantly different (P= 0.05) according to Duncan's new multiple- range test.

B- The effect on total fresh weights (shoot and root):-

All the treatments provoked the total fresh weight of treated seedlings compared with the infected seedlings with; *T. semipenetrans*. The obtained results in fig. (2) revealed different response in total fresh weight of shoots and roots by using different concentrations. The maximum increasing % at the highest concentrations (5×10^{8} cfu in the bioagents and 20g. /100 ml. water in the plants) was obtained on the olive seedlings. Also, humex (10%) expressed as increasing % in the total fresh weight reached to (75.1), suspension of *Psudomonas fluorescens* increasing % the total fresh weight reached to (62.2%) while, the suspension of dry peels powder

of *Punica granatum* was (29.3%) by using three times. Suspension of (*Arthrobotrys oligospora,* dry leaves powder of *Mentha piperita, Eucalyptus globules*) ranked in the intermediate position.

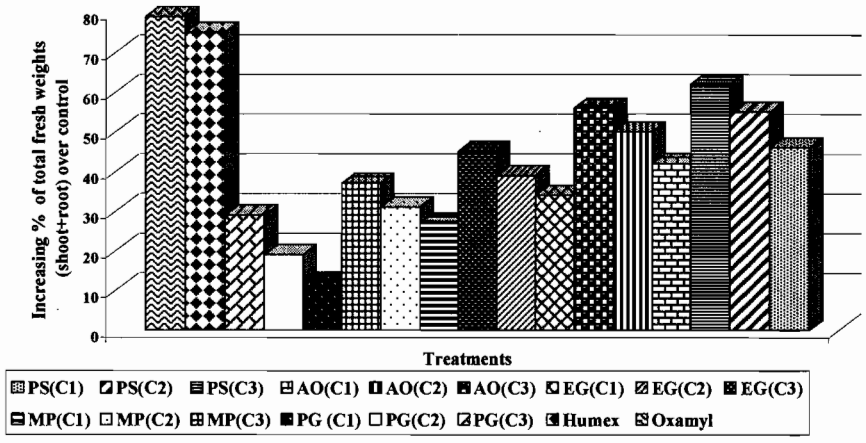

Fig. 2. Efficacy of some bioagents, plants at different concentrations and humex on increasing % of total fresh weights of olive seedlings infected with *T. semipenetrans*.

3- Efficacy of number of application of some bioagents, plants and humex in controlling *T. semipenetrans* on olive cv. Picual under greenhouse conditions:-

A- The effect on nematode population of citrus nematode; *T. semipenetrans*

Data in table (3) illustrate that all tested biogents (suspension of *Psudomonas fluorescens* and *Arthrobotrys oligospora* at concentration $5x10^{8}$ cfu), plants (suspension of dry peels powder of *Punica granatum*, suspension dry leaves powder of *Mentha piperita*, dry leaves powder of *Eucalyptus globules* at concentration (20g./100 ml. water) and humex (10%) treatments were effective in reducing nematode population of citrus nematode; *T. semipenetrans* in both soil and. roots especially after three weeks doses. Humex (10%) and suspension of *Psudomonas fluorescens* ($5x10^{8}$) were the most effective treatment whereas the least effective treatment was

suspension of dry peels powder of *Punica granatum* (20g. /100 ml. water). Suspension of *Arthrobotrys oligospora*, suspension of dry leaves powder of *Mentha piperita*, suspension of dry leaves powder of *Eucalyptus globules* treatments occupied an intermediate position.

Table (3) Efficacy of number of application of some bioagents, plants and humex on nematode population of *T. semipenetrans* on olive (cv. Picual)

Treatments	Number of application of the concentration	Nematode population			
			On 1 g. root		
		No. of nematodes in soil/250 g.	No. of developmental stages	No. of egg laying females	No. of eggs /egg-mass
Psudomonas fluorescens	one week	280 H	28 F	25 G	142 J
	two weeks	240 I	26 F	22 GH	135 J
	three weeks	220 IJ	24 FG	19 H	129 K
Arthrobotrys oligospora	one week	360 F	39 E	32 EF	210 G
	two weeks	300 F	35 E	29 F	188 H
	three weeks	260 G	30 EF	23 GH	174 I
Eucalyptus globules	one week	760 DE	64 C	42 DE	233 F
	two weeks	640 E	60 CD	36 E	224 FG
	three weeks	560 EF	55 D	30 EF	190 G
Mentha piperita	one week	960 CD	77 BC	51 C	253 DE
	two weeks	840 CD	68 C	47 D	242 E
	three weeks	780 D	56 D	41 DE	230 F
Punica granatum	one week	1320 B	85 B	66 B	286 B
	two weeks	1120 BC	72 BC	53 C	275 C
	three weeks	990 C	65 C	49 D	262 D
Humex (10%)		190 J	22 FG	17 H	122 K
Oxamyl (24% EC)		180 K	19 G	14 I	114 L
Check control (nematodes only)		5890 A	132 A	82 A	344 A

Numbers followed by the same letter (s) within a column are not significantly different (P= 0.05) according to Duncan's new multiple- range test.

B- The effect on total fresh weights (shoot and root):-

All the treatments provoked the total fresh weight of treated seedlings compared with the infected seedlings with; *T. semipenetrans*. The obtained results in fig. (3) revealed different response in total fresh weight of shoots and roots. The results expressed as increasing % over control. Data indicated that fresh weight was greatly improved by using the bioagents and natural plants three times. Humex (10%) expressed as increasing % in the total fresh weight reached to (77.5%), suspension of *Psudomonas*

fluorescens increasing % the total fresh weight reached to (74.3%) while, the suspension of dry peels powder of *Punica granatum* was (35.2%) by using three times. Suspension *Arthrobotrys oligospora,* suspension of dry leaves powder of (*Mentha piperita, Eucalyptus globules*) ranked in the intermediate position.

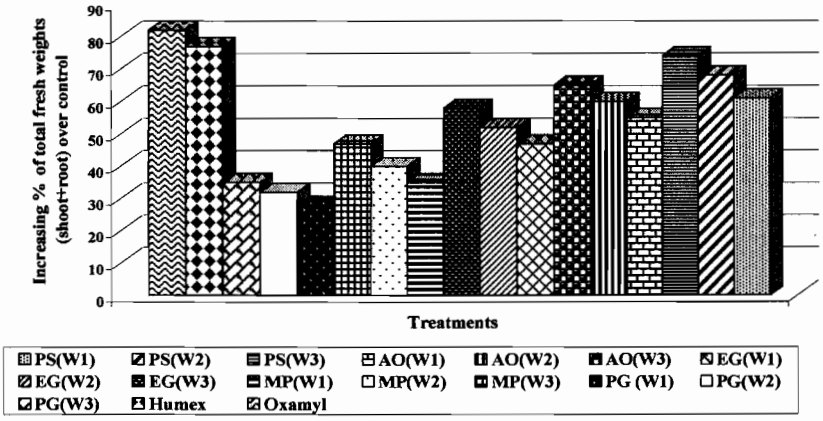

Fig. 3. Effect number of application of some bioagents, plants and humex on increasing % of total fresh weights of olive seedlings infected with *T. semipenetrans*.

II- Field experiments:-

Efficacy of some bioagents, plants and humex in controlling *T. semipenetrans*:-

A- The effect on nematode population of citrus nematode; *T. semipenetrans*:-

This trial was carried out under field conditions. The trial was conducted in sandy soil area whereas the nematode infestation is somewhat homogenized on picual trees. The nematode population were counted throughout the experimental period and documented in table (4). Total nematode population in both soil and root samples revealed the suppressive effect of all materials on the nematode counts. In general, the nematode counts decreased gradually in both soil and root of the treated trees.

Results performed increase in the efficacy percentages of the treatments in decrease total nematode population ranging between (28-63%) one month after treatment. Then, remarkable suppression in nematode counts obtained after two months or more expect the fourth month the total nematode population in both soil and root samples increased. At the end of experiment all the treatments gave satisfactory reduction in the nematode counts performing relatively high percentage of nematode reduction.

Table (4): Efficacy of some Bioagents, plants and humex on nematode population of *T. semipenetrans* on olive (cv. Picual) under field conditions:-

Treatments		Conc./ tree	Initial	After one month		After two months		After three months		After four months	
			Total population in soil and roots *	Total population in soil and roots*	Efficacy	Total population in soil and roots*	Efficacy	Total population in soil and roots*	Efficacy	Total population in soil and roots*	Efficacy
bioagents	*Psudomonas fluorescens*	$5*16^{1}$ cfu	2520 D	1290 F	56	1260 F	66	1200 F	70	1360 F	68
	Arthrobotrys oligospora	$5*16^{1}$ cfu	2640 C	1750 E	43	1610 E	58	1460 E	66	1590 E	64
plants	*Eucalyptus globules*	20 g./100 ml. water	2630 C	1890 D	39	1800 D	53	1690 D	60	1860 D	58
	Mentha piperita	20 g./100 ml. water	2720 B	2100 C	34	1980 C	50	1870 C	57	2080 C	55
	Punica granatum	20 g./100 ml. water	2620 C	2220 B	28	2100 B	45	1970 B	53	2210 B	50
Humex (10%)			2580 D	1260 H	58	1170 H	69	1080 G	74	1250 H	71
Oxamyl (24% EC)			2780 B	1220 G	63	1130 G	72	990 H	78	1240 G	74
Check (nematodes only)			2860 A	3320 A		4100 A		4530 A		4740 A	

*** 250 g. soil + 1 g. roots**

Figures in parentheses indicate percentage of nematode reduction from soil {% efficacy according to Handerson & Tilton formula, (Anonymous, 1981)}

$$\text{Efficacy} = 1 - \left(\frac{\text{Total nematode population of treated trees after application}}{\text{Total nematode population of treated trees before application}} \times \frac{\text{Total nematode population of check trees before application}}{\text{Total nematode population of check trees after application}} \right) \times 100$$

Data in table (4) reveled that by using humex (10%) at recommended dose performed the highest decrease in the total number of nematodes in both soil and root samples in comparing with the other treatments. Suspension of *Psudomonas fluorescens* and suspension of *Arthrobotrys oligospora* at ($5x10^{8}$) by three time of application for each treatment occupied the second rank in reducing the number of total of nematodes, whereas the suspension of dry leaves powder of (*Eucalyptus globules* as well as *Mentha piperita*) occupied an intermediate position in reducing the total number of nematodes in both soil and root samples. Suspension of dry peels powder of *Punica granatum* showed the lowest efficacy in reducing total number of nematodes in both soil and root samples.

B- The effect on yield fruit weights:-

Data in fig. (4) illustrated the effect of different bioagents, plants and humex on % increasing of fruit weights of olive after treatments under field conditions. All the treatments showed remarkable increasing % in fruit weights. Using the treatments humex(10%) and suspension of *Psudomonas fluorescens* were the highest treatments in the increasing % in fruit weights. While, the treatment (suspension of dry peels powder of Punica *granatum*) was the lowest in the increasing % in fruit weights.

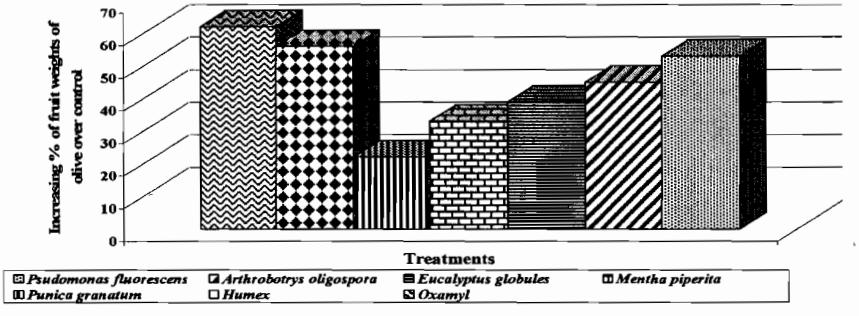

Fig. 4: Efficacy of some bioagents, plants and humex on increasing % of fruit weights of olive trees infected with *T. semipenetrans* under field conditions.

These results may due to that both *Psudomonas fluorescens* and *Arthrobotrys oligospora* has produce various toxin metabolites and different enzymes that improve photolytic activity of the antagonist and control of nematodes (Hanna *et. al.*, 1999; Bandyopadhyay *et. al.*, 2001; Duponnois *et. al.*, 2001; Singh *et. al.*, 2001; Devi and Upma, 2002; Khan *et. al.*, 2002; Hamid *et. al.*, 2003; Mahapatra and Mohanty, 2003; Rao *et. al.*, 2004; Siddiqui & Shaukat, 2005 and El Gendy & Shawky, 2006). Also, *Eucalyptus globules* leaves contain volatile oil contain: (cencol, pinene, phellendrene, terpincol citronellal, piperitone, astringents and bitter princills). These compounds have nematicidal effect on nematode population according to (Chhabra *et. al.*, 1988; Sabira *et. al.*, 2000 and Shaukat *et. al.*, 2003). *Mentha piperita* leaves contain carphone , trepenia materials such as: lemonine, phellendrene and pinene. These components have a lethal effect on nematodes according to (Niranjan, 1999 and Kanta *et. al.*, 2001). *Punica granatum* contain some chemicals (pelargonidin-3-galactose, cyanidin-3-glucose, gallic acid, quercetin, and myricetin). All these compounds exhibited substantial activity against species of pathogens such as: nematodes. Gallic acid showed the highest antibacterial activity. The reason for antibacterial activity of the compounds of pomegranate was attributed to their phenolic structure (Naz *et. al.* 2007). Using the application of nematicides to control citrus nematode in olive was reported (McKenry, 1994). Humex(10%) comprises hydroxyl, carboxylic, phenolic hydroxyl, active group. Also, increase soil fertility, improve their properties, increase retention of sandy soil water, increase in the number and increase the beneficial microorganisms which work to increase fertility and improve plant growth and have nematicidal effect (Kesba and Al-Shalaby, 2008).

From the foregoing results, it can be concluded that Picual cultivar was the most susceptible cultivar; whereas Dolsy cultivar was the least susceptible cultivar to the citrus nematodes under greenhouse conditions. The most effective treatments in controlling *T. Semipenetrans* were humex(10%) and *P. fluorescens* (at 5×10^8) whereas the least effective was suspension of dry peels powder of *P. granatum* under both greenhouse and field conditions and improved fruit yield of olive under field conditions.

REFERENCES

Abd El-Moity, T.H.; Abd El-Zaher, M.H. and Rabie, A.M. (2006). Effect of some organic and biological treatments on flame seedless grapevine. Egypt. J. of Appl. Sci., 21 (8B) : 581-620.

Anonymous (1981). Manual for field trail in plant protection. Edited and published By Werner Puntener, Agricultural Divion, Ciba-Geigy Li-mited, Basle, Switzerland, 205 pp.

Anwar, S.A.; Gundy, S.D.van (1989). Influence of four nematodes on root and shoot growth parameters in grape. Journal-of-Nematolog,21(2): 276-283

Bandyopadhyay, P.; Kumar, D.; Singh,V.K. and Singh,K.P. (2001). Eco-friendly management of root-knot nematode of tomato by *Arthrobotrys oligospora* and *Dactylaria brochopaga*. Indian-Journal-of-Nematology. 2001; 31(2): 153-156.

Byrd , D.W.; T. Kirkpatrick and K.R. Barker.(1983). An improved technique for cleaning and staining plant tissues for detection of nematodes. J. Nematol., 15(1):142-143.

Chhabra, H.K.; Grewal, P.S. and Singh, A. (1988). Efficacy of some plant extracts on root-knot nematodes (*Meloidogyne incognita*). Journal-of-Tree-Sciences; 7(1): 24-25.

Devi, L.S. and Upma, D. (2002). Effect of *Pseudomonas fluorescens* on root-knot nematode (*Meloidogyne incognita*) of okra plant. Indian-Journal-of-Nematology; 32(2): 215-216.

Duncan, D.B. (1954). Multiple range and multiple F test. Biometrics, 11: 1- 42.

Duponnois, R.; Chotte, J.L.; Sall, S. and Cadet, P. (2001). The effects of organic amendments on the interactions between a nematophagous fungus *Arthrobotrys oligospora* and the root-knot nematode *Meloidogyne mayaguensis* parasitizing tomato plants. Biology-and-Fertility-of-Soils. 34(1): 1-6.

El Gendy, Rafaat, S.S and Shawky, Samaa M. (2006). Efficacy of some natural plants and bioagents to minimize the population of root-knot nematode ; *Melidogyne incognita* in superior seedless vineyards and its reflection on vine growth and yield. 1 st. International Egyptian-Jordanian Conference, pp. 281-293.

Franklin, M.T. and Goodey, J.B. (1957). A cotton-blue lactophenol technique for mounting plant parasitic nematodes. J. Helminthological abstracts; 23:175-178.

Gomez, K.W.; Wanchi, A. and Gomez, A.A. (1984). Statistical procedures for Agricultural research and ED. John Wiley and sons ltd , New York 680P.

Hamid, M.; Siddiqui, I.A. and Shaukat, S.S. (2003). Improvement of *Pseudomonas fluorescens* CHA0 biocontrol activity against root-knot nematode by the addition of ammonium molybdate. Letters-in-Applied-Microbiology; 36(4): 239-244.

Hanna, A.I.; Riad, F.W. and Tawfik, A.E. (1999). Efficacy of antagonistic rhizobacteria on the control of root-knot nematode, *Meloidogyne incognita* in tomato plants. Egyptian-Journal-of-Agricultural-Research. 1999; 77(4): 1467-1476.

Hussey, R. S. and Barker, K. R. (1973). A comparison on methods of collecting inocula of *Meloidogyne spp.* including a new technique. Plant Dis. Reptr., 57:1925-1928.

Kanta, G.; Mehta, S.K.; Malik, M.S.; Malik, O.P. and Walia, R.K. (2001). Toxicity of methanolic leaf extracts and essential oils from various plants to the root-knot nematode *Meloidogyne incognita.* Nematologia-Mediterranea; 29(2): 219-222.

Kesba,Hosny H. and Al-Shalaby, Mona E.M.(2008).Survival and reproduction of *Meloidogyne incognita* on tomato as affected by humic acid.J.of Nematology,Volume 10, Number 2, pp. 243-249(7)

Khan, M.R.; Kounsar, K. and Hamid, A. (2002). Effect of certain rhizobacteria and antagonistic fungi on root-nodulation and root-knot nematode disease of green gram. Nematologia-Mediterranea; 30(1): 85-89.

Mahapatra, S.N. and Mohanty, K.C. (2003). Management of root-knot nematode in brinjal using *Pseudomonas fluorescens* and its compatibility with carbofuran. Proceedings-of-National-Symposium-on-Biodiversity-and-Management-of-Nematodes-in-Croppin-Systems-for-Sustainable-Agriculture,-Jaipur; 135-137.

McKenry, M.V. (1994). Nematodes of olive. In 'Olive Production Manual' p.97-9. Ed. Ferguson, L., Sibbett, G.S., and Martin, G.C. University of California Division of Agriculture and Natural Resources, Oakland. Pub. 3353.

Naz, S.; Siddiqi, R.; Ahmed, S.; Rasool, S. A. and Sayeed, S. A. (2007). Antibacterial activity directed isolation of compounds from *Punica granatum*. J. Food Sci; 72(9)M 341-5

Niranjan, D. (1999). Nematicidal effect of organic soil amendments of some latex bearing plants on root-knot nematode, *Meloidogyne incognita*. Crop-Research-Hisar. 18(2): 299-300.

Rao, M.S.; Dhananjay, N. and Shylaja, M. (2004). Bio-intensive management of root-knot nematodes on bell pepper using *Pochonia chlamydosporia* and *Pseudomonas fluorescens*. Nematologia-Mediterranea; 32(2): 159-163.

Sabira, B.; Aneela, W.; Siddiqui, B.S. and Fatima, Qamar (2000).Nematicidal constituents of the aerial parts of *Lantana camara*. Journal-of-Natural-Products; 63(6): 765-767.

Sankaranarayanan, C.; Hussaini, S.S.; Kumar, P.S. and Rangeshwaran, R. (1998). Biocontrol of root-knot nematode (*Meloidogyne incognita*) on sunflower with talc-based nematophagous fungi. International-Journal-of-Tropical-Plant-Diseases; 16(2): 253-260.

Shaukat, S.S.; Siddiqui, I.A.; Ali, N.I.; Ali, S.A. and Khan, G.H. (2003).Nematicidal and allelopathic responses of *Lantana camara* root extract. Phytopathologia-Mediterranea ; 42(1): 71-78.

Siddiqui, I.A. and Shaukat, S.S. (2005). Phenylacetic acid-producing *Rhizoctonia solani* represses the biosynthesis of nematicidal compounds in vitro and influences biocontrol of *Meloidogyne incognita* in tomato by *Pseudomonas fluorescens* strain CHA0 and its GM derivatives. Journal-of-Applied-Microbiology. 2005; 98(1): 43-55.

Singh, K.P.; Dharmendra, K.; Bandhyopadhyay, P. and Singh, V.K. (2001). Predation and performance of two predacious fungi for control of root-knot nematode of brinjal. Journal-of-Mycopathological-Research. 2001; 39(2): 95-100.

Stephan, Z.A.; Hassoon, I.K. and Antoon, B.G. (1998). Use of biocontrol agents and nematicides in the control of *Meloidogyne javanica* root-knot nematode on tomato and eggplant. Pakistan-Journal-of-Nematology; 16(2): 151-155.

كفاءة بعض الكائنات الحية و النباتات و الهيومكس في مقاومة نيماتودا تيلينكيولس سيميبنيترانس على الزيتون في مصر

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أجريت هذه الدراسة لاختبار حساسية سبعة أصناف من الزيتون للإصابة بنيماتودا الموالح (نيماتودا تيلينكيولس سيميبنيترانس)و مقاومتها تحت ظروف الصوبة و الحقل على الصنف الحساس للنيماتودا و كذلك تقدير محصول ثمار الزيتون بعد الحصاد في مصر. أظهرت النتائج أن صنف بيكوال أكثر الأصناف حساسية للإصابة بنيماتودا الموالح (تيلينكيولس سيميبنيترانس) بينما كان الصنف دولسى اقلهم في الحساسية تحت ظروف الصوبة.

تم اختبار سبعة معاملات (بكتريا البسيدومونس فلوروسنس و فطر الارثروبتريتس اوليجوسبورا و مستخلص مسحوق قشر الرمان و مستخلص مسحوق أوراق النعناع و مستخلص مسحوق أوراق الكافور و مركب الهيومكس (10%) بالإضافة لمبيد الاوكساميل (24%) سائل) لمقاومة نيماتودا الموالح (تيلينكيولس سيميبنيترانس) تحت ظروف كلا من الصوبة و الحقل على الزيتون.

كانت أكثر المعاملات تأثيرا تحت ظروف كلا من الصوبة و الحقل في مقاومة بنيماتودا الموالح كلا من مركب الهيومكس (10%) و بكتريا البسيدومونس فلوروسنس بينما كانت المعاملة باستخدام مسحوق قشر الرمان اقلهم فعالية . كان استخدام المعاملة بالهيومكس(10 ٪) تأثيرا فعالا في خفض أعداد الإناث و الأطوار الغير مكتملة النمو و كتل البيض في الجذور و كذلك تعداد اليرقات من العمر الثاني في التربة و اقلهم تأثيرا كانت المعاملة باستخدام مسحوق قشر الرمان.

أدى استخدام جميع المعاملات إلى زيادة في الوزن الخضري و الجذري لشتلات الزيتون في جميع التركيزات خاصة التركيزات العالية.كما أدى استخدام المعاملات بالكائنات الحية و النباتات بمعدل مرة أسبوعيا لمدة ثلاثة أسابيع كفاءة أعلى من استخدام المعاملات مرة واحدة أو اثنتين إلى خفض أعداد النيماتودا في كلا من الجذور و التربة تحت ظروف الصوبة.

كان لاستخدام الكائنات الحية و النباتات بأعلى تركيز و كذلك ثلاثة مرات /مرة كل أسبوع إلى خفض أعداد النيماتودا في كلا من الجذور و التربة و كذلك زيادة وزن محصول الزيتون (صنف بيكوال) تحت ظروف الحقل.