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Efficacy of some Bioagents, Algal Species and Plant Extracts in Controlling *Meloidogyne Incognita* on Yield of Grape Vines in Egypt

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Abstract

These experiments were conducted to control the root-knot nematodes, *Meloidogyne incognita* under both greenhouse and field conditions in superior seedless vineyards and its reflection on yield. The field experiment was carried out in a private vineyard (El Wady El Faregh) in Alexandria-Cairo road (kilo 78). Seven treatments were used as follows: two bioagents *(Bacillus subtilis* and *Trichoderma harzianum),* two blue green strains algal species (Cyanobacteria) (*Spirulina platensis* and *Oscillatoria* sp.) and two plant aqueous extracts (*Ambrosia maritime* and *Eucalyptus globules)* at three concentrations, and in comparison with oxamyl (24% EC) were used to control *Meloidogyne incognita* on superior seedless vineyards on grapes under both greenhouse and field conditions. Bioagents, algal species and plant extracts were added to the soil under vines one time weekly for three weeks after bud burst under both greenhouse and field conditions.

The most effective treatments in controlling root-knot nematodes; *Meloidogyne incognita* were both *Spirulina platensis* and *Oscillatoria* sp whereas the least effective was suspension of *Eucalyptus globules* under both greenhouse and field conditions. Both *Spirulina platensis* and *Oscillatoria* sp acheived the highest reduction effect on number of 2^{nd} stage juveniles in soil, numbers of galls, developmental stages, females, egg masses, egg numbers/egg mass in roots and final population *Meloidogyne incognita* on grape plants, whereas the suspension of *Eucalyptus globules* was the least effective treatment under both greenhouse and field conditions. In addition all treatments increased fresh weight of the whole plant over control under greenhouse conditions.

Results showed that all the treatments had a significant effect in reducing the total population and build up of root – knot nematodes, *Meloidogyne incognita* in both soil and roots especially after three months from the time of application. In addition, all treatments had increased the yield of superior seedless grapevines under field conditions.

Keywords: *Meloidogyne incognita*, control, superior seedless grapevines, bioagents, algal species and plant aqueous extracts.

Introduction

Grape (*Vitis vinifera L.*) is considered as one of the most important, favorable and economic fruits in the world. Also, it is one of the most economic fruit crops in Egypt. Earlier ripening cultivars in Egypt are suitable for export purposes. Superior seedless grapes are preferred to European, Arab and Asian countries, besides its earliness in markets. Superior seedless grapevines is one of the most leading group cultivars in Egypt and in the world.

Nematode problems are considered one of the greatest challenges facing expansion of viticulture plantations in Egypt. Root- knot nematodes, *Meloidogyne* spp., are considered one of the most economically important and complex group of plant parasitic nematodes causing damage and high yield losses on most cultivated plants throughout the world especially in the developing countries. In Egypt, severe nematode infestations forced grape growers to uproot their grape vines and obliged them to let the land lie fallow for many years before its replanting. The world estimated losses due to nematode damage ranges from 12.5 to 20.0% of vine growth and productivity **(Kesba, 1999).** Also, **(El Gendy & Shawky 2006 and Ali *et al.*, 2012)** reported that *Meloidogyne incognita* cause damage to superior and Thompson seedless grapevines.

Nowadays, nematologists all over the world are keeping searching for alternative control measures to avoid soil pollution with nematicides. Also, in recent years, the awareness of the nematicides hazards to human and environment has directed the attention towards soil-borne antagonists as an alternative method to chemical control. In addition, use of chemical nematicides is prohibited in organic farming. Therefore, there is a need to develop alternative, environmentally friendly management tactics for plant-parasitic nematodes (**Noling and Becker, 1994).** Application of microorganisms antagonistic to *Meloidogyne* spp., or compounds produced by the microbes, could provide additional opportunity for managing the damage caused by root-knot nematodes to grapes crops.

Recently, numerous research papers have focused on biological control agents with the objective of controlling the parasitic nematodes and to overcome the nematode damage by using *Trichoderm harzianum* act through different mechanisms including mycoparasitism, and through production of antibiotic substances and also act through production of destructive enzymes i.e, chitenase **(Faruk *et al.,* 2002; Siddiqui and Shaukat, 2004;Shawky & Abd El- Moneim, 2005; Sahebani & Hadavi, 2008; Abd El- Moneim *et al.,* 2010 and Ali *et al.,* 2012).** *Bacillus subtilis* is reported as a bio-control agent against root-knot nematodes. *Moreover it* act through production of number of antibiotics as bacterocin and subitisin antibiotics **(Ferreira, 1991; Farahat,1998; Khan *et al.*, 2002; Shawky & Abd El- Moneim, 2005 and Shawky *et al.*, 2010).**

Blue green strains algal species (Cyanobacteria) (*Spirulina platensis* and *Oscillatoria* sp.) with some algae strains showed a remarkable reduction in the nematode population*; M. incognita* and improved the fresh weight and cucumber yield under greenhouse **Shawky *et al.,* 2009)**.

The impact of aqueous plant extracts on plant parasitic nematodes has been reported by several authors. Plant extracts of Eucalyptus*; Eucalyptus globules* has nematicidal effect on nematode population according to **(Shaukat *et al.*, 2003**; **2006; Ali, *et al.*, 2012 and Shawky & Al-Ghonaimy, 2015)**. *Ambrosia maritima* (damsisa) as intercropped plants with soybean (Glycine max) cv. Giza 21 infected with *Meloidogyne incognita*, significantly ($P \leq 0.05$ and 0.01) reduced nematode numbers on soybean as indicated by the percent reduction of galls, developmental stages and egg masses in roots and juveniles (J2) in soil. Addition of chopped green leaves of *A. maritima* to the soil planted to soybean significantly ($P \leq 0.05$ and/or 0.01) reduced *M. incognita* reproduction and development. *A. maritima* also had an adverse effect on soybean plant growth (**El-Hamawi, *et al*.**, **2004)**. Also, *Ambrosia maritime* includes thogene, flanders, glicocin, lambrosen, acassese, arthmin **(Gad-El-Rab, 2000 and Khalil & Shawky, 2008).**

The present work was also carried out to throw some light on the impact of some non-chemical materials control agents namely: bioagents (*Bacillus subtilis* and *Trichoderma harzianum*)*,* two blue green strains algal species (Cyanobacteria) (*Spirulina platensis* and *Oscillatoria* sp.) and two plant aqueous extracts (*Ambrosia maritime* and *Eucalyptus globules*) in comparison with oxamyl (24% EC) as a nematicide in controlling root knot nematode; *Meloidogyne incognita* in superior seedless grapevines, as well as their effect on vine yield fruit quality.

Materials and Methods

1. Efficacy of some bioagents, algal species and plant extracts in controlling *Meloidogyne incognita* on grape under greenhouse conditions:

In this study seven different treatments were used as follows:

Bioagents micro-organisms *(Trichoderma harzianum* and *Bacillus subtilis*)

B**lue green strains algal species (Cyanobacteria)** (*Spirulina platensis* and *Oscillatoria* sp.).

Plant aqueous extracts (*Ambrosia maritime* and *Eucalyptus globules*)

Oxamyl (24% EC) as nematicide

Check treatment with nematode only.

The isolate of *Trichoderma harzianum* was obtained from Central Laboratory of Organic Agricultural Research Center, Giza, Egypt. The concentrations of *Trichoderma harzianum* were (1×10^5,1×10^8,5×10^8 cfu)/ ml. The isolate of *Bacillus subtilis* was obtained from Soils & Water and Environment Research Institute, A.R.C., Giza, Egypt. The concentrations of *Bacillus subtilis* were (1×10^5, 1×10^8, 5×10^8 cells/ ml).

The isolates of *Spirulina platensis* and *Oscillatoria* sp. were obtained from Algae Department, Soils & Water and Environment Research Instiute, A.R.C., Giza, Egypt. The concentrations of both *S. platensis* and *Oscillatoria* sp were 1, 2 and 3% from the filtrate.

Fresh leaves of two plants were collected and transferred to Nematology Laboratory of Plant Pathology Res. Inst., A.R.C., for extraction. The tested plants were *Ambrosia maritime* and *Eucalyptus globules*. Standard leaf extracts were prepared by crushing and dissolving 10, 15 and 20 g. of leaves in 100 ml distilled water separately. The result solution was then centrifuged at 5000 rpm for five minutes. The supernatant was filtered through a layer of muslin cloth, and dilution was used.

Grape vine seedlings (*vitis vinifera L.*) superior seedless variety, six months old were planted in 25cm diameter clay pots each containing 3 Kg steam –sterilized soil with the rates (1:2) loam and sand respectively. The treatments were designed in five replicates. Each pot was inoculated with 3000 active juveniles by making 3 holes at different depths (2-3 cm) around the roots and immediately after inoculation the roots were covered with soil. Bioagents, algal species and plant extracts were added to the soil at three concentrations under vines one time weekly for three weeks under greenhouse conditions. All treatments received the same agricultural treatment such as amount of water seedling /pot and amount of fertilizers. All pots were arranged in completely randomized design, and kept under greenhouse conditions at about 25-28 degree. The rate of application for all treatments in each concentration was added as (100 ml./seedling). Oxamyl (vydat; 24% EC) as nematicide at the recommended concentration at the rate of application (5L / 600 L water /fed). All treatments were added one time weekly for three weeks at the same concentration whereas oxamyl (24% EC) was used once at the recommended concentration.

Sixty days after inoculation, all plants were carefully uprooted. Root and shoot systems were weighted. Nematode populations in soil / 250 g. and on roots were recorded according to **(Franklin & Goodey, 1957).** Roots were stained by acid fuchsin in acetic acid according to **Byrd *et al.*** (1983), and examined for counting number of developmental stages and females/ root. Egg-masses, eggs/egg-mass of *M. incognita* were extracted by using sodium hypochoride (NaOCl) method as described by **(Hussey and Barker, 1973)**.

2. Efficacy of some bioagents, algal species and plant extracts in controlling *Meloidogyne incognita* on grape vine under field conditions:

The experiment was conducted in an infested vineyard with *M. incognita* in season 2015 on ten – years old Superior seedless grapevines seedless vines in a private vineyard situated at Cairo- Alexandria desert road (78th kilometer). The chosen vines were ten – year – old grown in a sandy soil in a private vineyard spaced at 1.75 x 2.75 m and irrigated by drip irrigation system where cane pruned and trellised by the Y shape system. Superior seedless grape vines grown in a sandy soil were chosen (8 treatments x 3 replicates x 5 vines/replicate in randomized complete blocks design the mixed pruning system of pruning was applied where vine load was 72 buds (6 canes x 12 buds each). Pruning was carried out at the first week of January. All vines received similar and regular agricultural practices. The treatments were used at the highest concentration one time weekly for three weeks expect the oxamyl (24% EC) was used once at the recommended concentration (5L / 600 L water /fed).

In this study seven different treatments were used as follows:

Bioagents micro-organisms *(Trichoderma harzianum* and *Bacillus subtilis*)

B**lue green strains algal species (Cyanobacteria)** (*Spirulina platensis* and *Oscillatoria* sp.)

Plant aqueous extracts (*Ambrosia maritime* and *Eucalyptus globules*)

Oxamyl (24% EC) as nematicide

Check treatment with nematode only.

Every month nematode populations in both soil and root including number of second stage juveniles/250g. in soil, developmental stages, females, eggs and eggs/egg-mass were determined after treatments up from the bud burst to the harvesting time. The nematode population in an aliquot of 250 g. soil was extracted by sieving and decanting technique **(Barker, 1985)**. Roots were stained by acid fuchsin in acetic acid according to **(Byrd *et al.,* 1983),** and examined for counting number of developmental stages and females/g. root. Egg masses, eggs /egg-mass of *M. incognita* were extracted by using sodium hypochoride (NaOCl) method as described by **(Hussey and Barker, 1973).** The nematode population in both soil and roots was calculated as a nematode reduction (%) according to **Henderson, G.E. and E.W. Tillton, (1955)** formula**.**

Efficacy %= 100 x [1- (Total nematode population of treated vines after application x Total nematode population of check vines before application) / (Total nematode population of treated vines before application x Total nematode population of check vines after application)].

Statistical Analysis

Data were subjected to analysis of variance (ANOVA) **(Gomez and Gomez, 1984)** and means were compared by using L.S.D. at 5% level of significance.

Results and Discussion

1. Efficacy of some bioagents, algal species and plant extracts in controlling *M. incognita* on Superior seedless grapevines plants under greenhouse conditions:

Data in Table (1) illustrated that all tested blue green strains algal species (Cyanobacteria) treatments were effective in controlling root-knot nematode; *M.*

incognita under greenhouse conditions. Oxamyl (24% EC) and both *S. platensis* & *Oscillatoria* sp. treatments were the most effective treatment than the other treatments whereas *T. harzianum* and *B. subtilis* ranked the intermediate position in the efficacy. On the other hand *E. globules* was the least effective treatment. Also, data showed that positive correlation between efficacy of the treatments and concentrations.

Data revealed that by using oxamyl (24% EC) and both *S. platensis* & *Oscillatoria* sp. 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. Both *T. harzianum* and *B. subtilis* occupied the intermediate rank in reducing the nematode populations, whereas *Eucalyptus globules* resulted in the lowest number of nematode populations in both soil and roots.

Data in Fig. (1) showed the number of galls in Superior seedless grapevines plants. oxamyl (24% EC) and both *S. platensis* & *Oscillatoria* sp. treatments were the lowest in number of galls *M. incognita*. *T. harzianum* and *B. subtilis* ranked the intermediate position in number of galls. On the other hand, *E. globules* was the highest in number of galls specially at the highest concentration.

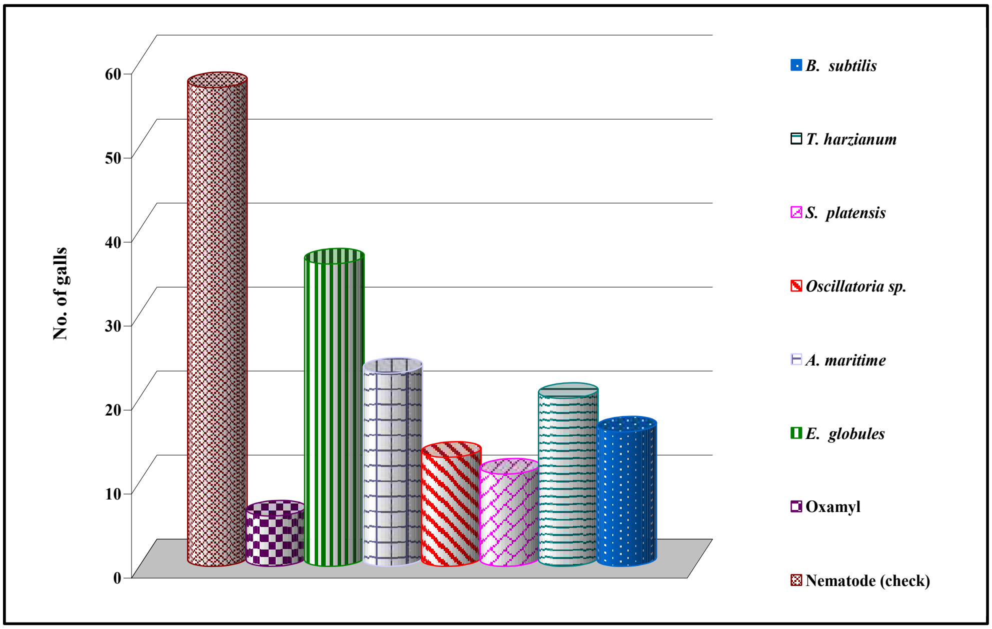

Fig. (1): Effect of some bioagents, algal species and plant extracts at the highest concentrations on number of galls/ root system of *M. incognita* on Superior seedless grapevines plants under greenhouse conditions.

Data in Fig. (2) showed the effect of some bioagents, algal species and plant extracts on percent increase in fresh weight of the whole Superior seedless

Table (1): Efficacy of some bioagents, algal species and plant extracts in controlling *M. incognita* on Superior seedless grapevines plants under greenhouse conditions.

Treatments	Concentration	*Nematode population in					**Final nematode population (PF)	Rate of build- up (PF/PI)
		Soil/ Pot	Root					
			Developmental stages	Females	Egg-mass	Eggs/ egg-mass		
B. subtilis	1×10^8 cells/ ml.	500	35	22	19	247	5250	1.75
	3×10^8 cells/ml.	380	26	18	15	222	3754	1.25
	5×10^8 cells/ml.	280	15	16	12	188	2567	0.85
	1×10^8 cfu/ml.	820	42	32	29	288	9246	3.08
T. harzianum	3×10^8 cfu/ml.	580	33	27	22	266	6492	2.16
	5×10^8 cfu/ml.	340	22	20	17	227	4241	1.41
	1% /pot	240	25	17	14	212	3250	1.08
S. platensis	2% /pot	160	20	14	12	187	2450	0.82
	3% /pot	120	13	11	9	172	1692	0.56
	1% /pot	380	28	27	16	232	4147	1.38
Oscillatoria sp.	2% /pot	260	20	19	13	219	3146	1.05
	3% /pot	220	17	13	11	196	2406	0.80
	5 g /pot	980	47	38	32	317	11209	3.74
A. maritime	10 g /pot	900	38	30	26	296	8664	2.89
	15 g /pot	700	27	23	20	282	6390	2.13
	5 g /pot	1220	58	49	45	347	16942	5.65
E. globules	10 g /pot	1160	47	41	40	322	14128	4.71
	15 g /pot	980	42	36	32	310	10978	3.66
Oxamyl (24% EC)		60	8	6	5	154	844	0.28
Nematode (check)/pot		2900	120	57	51	422	24599	8.20
L.S.D(5%)		37.2	1.7	0.9	1.4	12.8	117.3	0.11

* Each value presented the mean of five replicates.

** Final nematode population (PF)= No. of egg-masses x no. of eggs/egg-mass + no. of females +no. of developmental stages+ no. of juveniles in soil/pot.

$$\text{Rate of build-up} = \frac{\text{Final population (PF)}}{\text{Initial population (PI)}}$$

grapevines plants infected by *M. incognita* under greenhouse conditions. The results expressed as increasing % over control. Data indicated that increasing % of fresh weight of the whole plant were greatly improved in oxamyl (24% EC) and both *S. platensis* & *Oscillatoria* sp. at the highest concentration where the percentage of increase reached (88.3, 82.1 and 78.8 %) respectively while, the treatment of *E. globules* was (55.3%) at the lowest concentration.

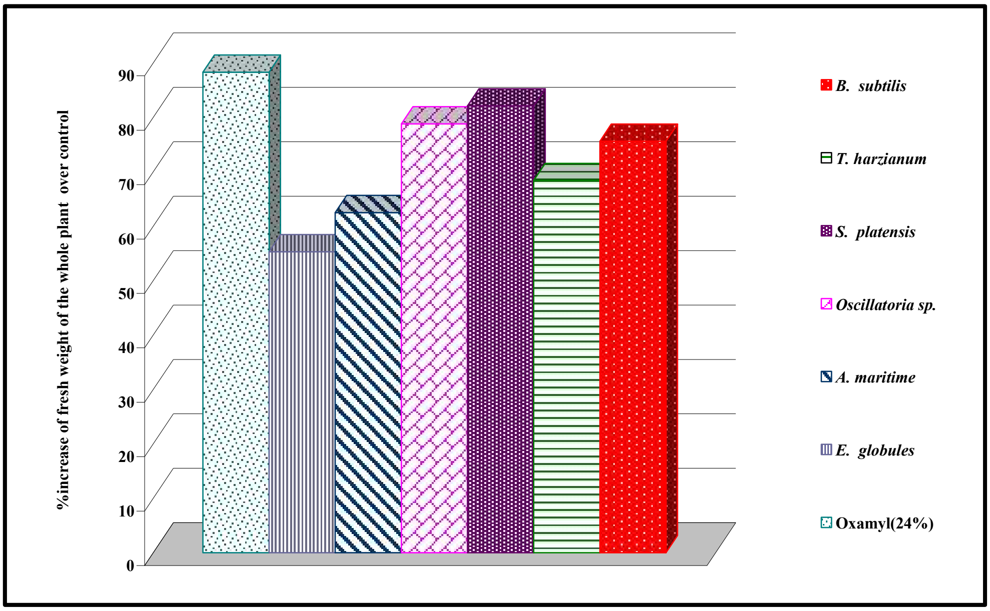

Fig. (2): Effect of some bioagents, algal species and plant extracts at the highest concentrations on percent increase of fresh weight of the whole plant of over control on Superior seedless grapevines plants infected with *M. incognita* under greenhouse conditions.

2. Efficacy of some bioagents, algal species and plant extracts in on grape infection by *M. incognita* under field conditions:

Data in Table (2) reveal that oxamyl (24% EC) and both *S. platensis* & *Oscillatoria* sp. treatments resulted in the lowest final population of *M. incognita* (PF) compared with the other treatments, whereas the highest final population of *M. incognita* was associated with *Eucalyptus globules* only after two and three but after four months of application the *M. incognita* (PF) increased. Oxamyl (24% EC) and both *S. platensis* & *Oscillatoria* sp. treatments induced resistance in grape roots against *M. incognita.* Results were achieved by (**Khan *et al.*, 2005**) who suggested that the application of algal filtrate helped the plant to resist nematode attack or may played a direct role in the plant defense mechanism. Microorganisms and compounds of microbial origin have been found to induce defense responses and/or resistance in plants towards pathogens.

Table (2): Efficacy of some bioagents, algal species and plant extracts in comparison with oxamyl in controlling *M. incognita* in Superior seedless grapes under field conditions.

Treatments		Conc.	Initial: Total population in soil/ 250 g	After one month: Total population in soil/ 250g+ in root/g	After one month: PF/PI	After two months: Total population in soil/ 250g+ in root/ g	After two months: PF/PI	After three months: Total population in soil/250g + In root/g	After three months: PF/PI	After four months: Total population in soil/250g+in root/ g	After four months: PF/PI
Bioagents	*B. subtilis*	5×10^8 Cells	1800	1140 *(50.7)	0.63	1020 *(72.2)	0.57	960 *(76.7)	0.53	1160 *(73.7)	0.64
	T. harzianum	5×10^8 Cfu	1780	1240 *(45.7)	0.70	1120 *(69.4)	0.63	1090 *(73.2)	0.61	1280 *(70.6)	0.72
Algal species	*S. platensis*	20%	1720	840 *(62.0)	0.49	820 *(76.8)	0.48	810 *(79.4)	0.47	890 *(78.9)	0.52
	Oscillatoria sp.	20%	1790	1020 *(55.6)	0.57	920 *(75.0)	0.51	900 *(78.0)	0.50	1080 *(75.4)	0.60
Plant aqueous extracts	*A. maritime*	100 ml	1800	1380 *(40.3)	0.77	1240 *(66.5)	0.69	1200 *(70.8)	0.67	1390 *(68.5)	0.77
	E. globules	100 ml	1860	1520 *(36.3)	0.82	1380 *(63.9)	0.74	1350 *(68.3)	0.73	1580 *(65.3)	0.85
Oxamyl (24% EC)			1760	640 *(71.7)	0.36	630 *(82.6)	0.36	620 *(84.6)	0.35	690 *(84.0)	0.39
Check (nematodes only)			1840	2360	1.28	3780	2.1	4200	2.28	4500	2.60
L. S. D. at 0.05% level			18.6	56.8	0.05	61.1	0.03	73.3	0.02	69.2	0.01

* Figures in parentheses indicate percentage of nematode reduction in soil according to Henderson & Tillton, (1955).

* Efficacy %= 100 x [1- (Total nematode population of treated plots after application x Total nematode population of check plots before application)/ (Total nematode population of treated plots before application x Total nematode population of check plots after application)

Shawky *et al*., (2009) reported that in the productivity greenhouse experiment, the combination of five algal culture filtrates of *S. platensis*, *Oscillatoria* sp., *A. oryzae*, *N. muscorum* and *P. fragile* with *A. pinnata* and compost extract achieved the highest reduction in the number of the 2nd stage juveniles in soil, the numbers of galls, developmental stages, females, egg masses, egg numbers/egg mass in roots of cucumber plants comparing with the individual treatment and the non treated control. Also, **Shawky *et al*., 2014** resulted that in the productivity greenhouse experiment, the combination of culture filtrates of *Spirulina platensis*, *Anabaena azollae, Azolla pinnata, Pleurotus columbinus* and olive mill waste water achieved the highest reduction in the number of total nematodes in both soil and roots, also in numbers of galls. In addition, all combinations significantly increased the crop yield of banana plants comparing with the individual treatment and the control.

The efficacy of *S. platensis*, *Oscillatoria* sp., *T. harzianum*, *B. subtilis*, *A. maritime* and *E. globules* treatments in comparison with oxamyl were tested under field conditions in an experiment lasted four months. Data in Table 2 showed that all tested treatments were effective in decreasing the final nematode population and rate of build-up of root knot nematode in both soil and roots. 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 treated plants. All treatments decreased in the total nematode population ranging between 640 and 1380 one month after treatment in comparison to the control that reached 2360. Then, remarkable suppression in nematode counts obtained after three months in both soil and root samples. Both *S. platensis* & *Oscillatoria* sp. treatments resulted in the highest decrease in the total number of nematodes in both soil and root samples as soil application and the highest efficacy treatments reached to 79.4, 78.0 % respectively after the three months in comparison with the other treatments after the oxamyl treatment that reached 84.6 % while, *E. globules* was the lowest efficacy treatment that reached 68.3% after the three months. These results agree with (**Shawky *et al*., 2009; Shawky *et al.,* 2010; Soliman *et al*., 2011 and Shawky *et al*.,2014**).

Yield of grape plants infected with *M. incognita* under field condition is shown in Fig. (3). The yield was highest in both *S. platensis* and *Oscillatoria* sp. treatments in comparison with oxamyl reached to 65 and 60 % over control, while, *E. globules* treatment recorded the lowest percentage increase 23 % over control.

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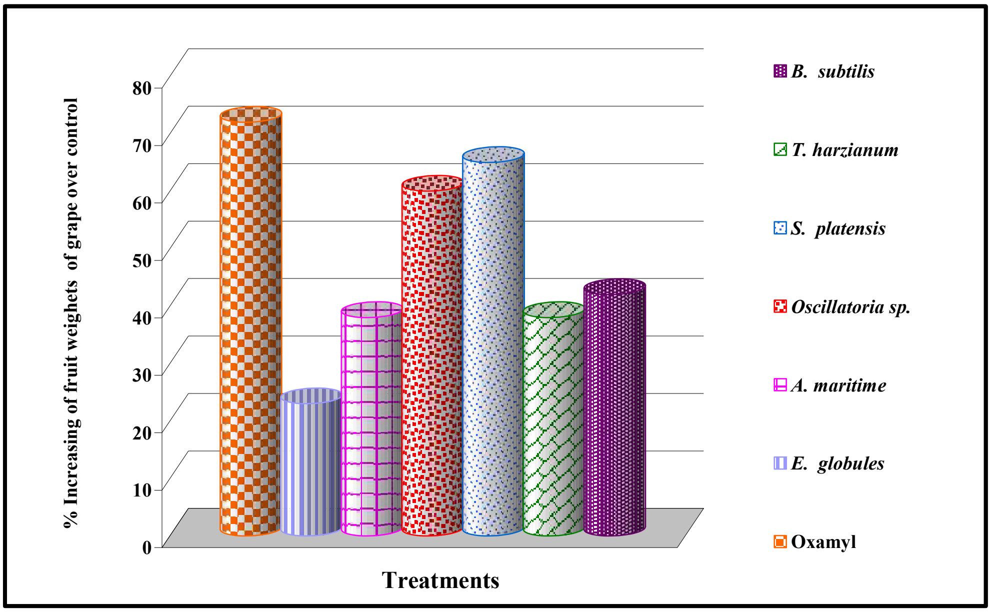

Fig. (3): Effect of Effect of some bioagents, algal species and plant extracts on increase % of yield weight of grape plants infected with *M. incognita* over control under field conditions.

Blue green strains algal species (Cyanobacteria) (*Spirulina platensis* and *Oscillatoria* sp.) with some algae strains showed a remarkable reduction in the nematode population*; M. incognita* and improved the fresh weight and cucumber yield under greenhouse (**Shawky, *et al.*, 2009)**. In the productivity greenhouse experiment, the combination of culture filtrates of *Spirulina platensis*, *Anabaena azollae, Azolla pinnata, Pleurotus columbinus* and olive mill waste water achieved the highest reduction in the number of total nematodes in both soil and roots, also in numbers of galls. In addition, all combinations significantly increased the crop yield of banana plants comparing with the individual treatment and the control (**Shawky *et. al.,* 2014)**.

B. subtilis is reported as a bio-control agent against root-knot nematodes. Moreover it act through production of number of antibiotics as bacterocin and subitisin antibiotics **(Ferreira, 1991; Farahat, 1998; Khan *et al.*, 2002; Shawky & Abd El- Moneim, 2005 and Shawky *et al.*, 2010).**

T. harzianum acts through different mechanisms including mycoparasitism**,** also through production of antibiotic substances **(Banhamoud & Chet, 1993)**.*T. harzianum* acts through production of destructive enzymes i.e., chitenase **(Bolar *et al.,* 2000).** *Trichoderma* spp*.* can produce various toxin metabolites and different enzymes that improve photolytic activity of the antagonist and control of nematodes.

(Sharon *et al.,* 2001; Faruk *et al.,* 2002; Siddiqui & Shawkat, 2004; Shawky & Abd El- Moneim, 2005; Sahebani & Hadavi, 2008; **Abd El- Moneim *et al.,* 2010 and Shawky & Al-Ghonaimy*,* 2015).**

Plant aqueous extracts of both *A. maritime* and *E. globules* decreased the build-up of nematodes **(El-Hamawi *et al.,* 2004 and Khalil & Shawky, 2008).** The impact of aqueous plant extracts on plant parasitic nematodes has been reported by several authors. Plant extracts of Eucalyptus*; Eucalyptus globules* has nematicidal effect on nematode population according to **(Shaukat *et. al.*, 2003**; **Ali, *et. al.*, 2012 and Shawky & Al-Ghonaimy, 2015)**. *Ambrosia maritima* (damsisa) as intercropped plants with soybean (Glycine max) cv. Giza 21 infected with *Meloidogyne incognita*, significantly (P ≤ 0.05 and 0.01) reduced nematode numbers on soybean as indicated by the percent reduction of galls, developmental stages and egg masses in roots and juveniles (J2) in soil Addition of chopped green leaves of *A. maritima* to the soil planted to soybean significantly (P ≤ 0.05 and/or 0.01) reduced *M. incognita* reproduction and development. *A. maritime* also had an adverse effect on soybean plant growth (**El-Hamawi, *et al*., 2004)**. Also, *Ambrosia maritime* includes thogene, flanders, glicocin, lambrosen, acassese, arthmin **(Gad-El-Rab, 2000 and Khalil & Shawky, 2008).**

Conclusion

From the foregoing results, it can be concluded that. The most effective treatments in controlling *Meloidogyne incognita* were both blue green strains algal species (Cyanobacteria)(*Spirulina platensis* and *Oscillatoria* sp.), whereas the least effective was *Eucalyptus globules* due to the highest safe best treatments compared with oxamyl (24% EC) the lowest safe in addition to achieve the best yield and fruit quality under both greenhouse and field conditions. All the treatments improved fruit yield of grape under field conditions.

References

Abd El- Moneim Maisa L., Shawky Samaa M. and Soliman Manal M. (2010). Efficacy of some bioagents, chitosan compounds and organic peels extract in controlling *Meloidogyne hapla* on strawberry in Egypt. Minuifiya J. Agric. Res. 35 (3):843-861

Ali, Mervat A.; Samaa M. Shawky and Ghada S.Shaker (2012). Comparative efficacy of some bioagents, plant oil and plant aqueous extracts in controlling *Meloidogyne incognita* on growth and yield of grape vines. Annal Agric. Sci., Ain Shams Univ., Cairo, 57(1)110-222.

Barker T. R. (1985). Nematode extraction and bioassays, pp. 19-35. In: An Advanced Treatise on *Meloidogyne*. Barker T. R.; Carter C. C. and Sasser J. N. (eds.). North Carolina State University, USA.

Benhamoud W. and Chet I. (1993). Hyphal interaction between *Trichoderma harzianum* and *Rhizoctonia solani* ultra structure and Gold cyto- chemistry of mycoparasitic process. Phytopathology, 83: 1026-1071.

Bolar J.P., Norelli J. L., Wong K.W., Hayes C. K., Harman Q. E. and Aldwinckle H. S. (2000). Expression of endochitinase from *Trichodermn harziianum* intransgenic apple increase resistance to apple scab and reduces vigour. Phytopathology, 90: 72-77.

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

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. pp. 264-280, 1st International Egyptian – Jordanian Conference on Biotechnology and Sustainable Development: Current Status and Future Scenarios.

El-Hamawi M. H., **Youssef M. M. A. and Zawam H. S. (2004).** Management of *Meloidogyne incognita,* the root-knot nematode, on soybean as affected by *marigold* and *Aambrosia maritime* (damsisa) plants. J. of Pest Science, 77(2): 95-98.

Gad-El-Rab, S.M. (2000). Studies on the effect of damsisa dry matter (*Ambrosia maritima* L.) as natural material to control nematodes of plastic-houses cucumber in Egypt. J. Hort.,27: 373-383.

Farahat, A. (1998). Biological control of some potato bacterial diseases. Ph.D., Thesis, Fac. Agric. Monofia Univ. 118 pp.

Faruk M. I., Rahman M. L. and Bari M. A. (2002). Management of root-knot nematodes of tomato using *Trichoderma harzianum* and organic soil amendment. Bangladesh Journal of Plant Pathology, 18: (1), 33-37.

Ferreira, J.H.S.;F.N. Matthee and A.C. Thomas (1991). Biological control of Eutypalota on grapevine by an antigonistic strain of *Bacillus subtitis*. Phytopathology, 81: 283-287.

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

Gomez K. W. and Gomez A. A. (1984). Statistical procedures for agricultural research 2 nd Ed. p. 680 John Wiley and Sons inc, New York.

Henderson, G.E. and E.W. Tillton. (1955). Test with acaricides against the brown wheat mite. J. Econ. Entomol.,48:157-161.

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.

Kesba H. H. (1999). Ecological and pathological studies on some plant parasitic nematodes infecting grape, *Vitis vinifera* L. M. Sc. Thesis. Fac. of Agric., Cairo Univ. Egypt.

Khalil A. E. and Shawky Samaa M. (2008). Combination of the nematophagous fungus *Paecilomyces lilacinus* and aqueous leaf extracts in controlling *Meloidogyne javanica* infecting potato. Egypt. J. Agronematol., 6 (2): 185 – 196.

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

Khan Z., Park S.D., Shin S.Y., Bae S.G., Yeon I.K. and Seo Y.J. (2005). Management of *Meloidogyne incognita* on tomato by root-dip treatment in culture filtrate of the blue-green alga *Microcoleus vaginatus*. Bioresource Technology, 96: 1338-1341.

Noling J. W. and Becker J. O. (1994). The challenge of research and extension to define and implement alternatives to methyl bromide. J. Nematol., 26:537-586.

Sahebani N. and Hadavi N. (2008). Biological control of the root-knot nematode *Meloidogyne javanica* by *Trichoderma harzianum.* Journal of Soil Biology &Biochemistry, 40: 2016-2020.

Sharon E., Bar-Eyal M., Chet I., Herrera – Estrella, A., Kleifeld O. and Spiegel Y. (2001). Biological control of the root-knot nematode *Meloidogyne javanica* by *Trichoderma harzianum.*Phytopathology.,91(7): 687-693.

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.

Shawky, Samaa M.; Azza. A. M. Abd El-All and Ahlam M. Al-Ghonaimy (2014). Comparetive efficacy of some algal species, azolla, pleurotus and olive mill in controlling root knot-nematode on banana. Egyptian Journal of Agronematology, vol. 13, No.2, pp. 23-39.

Shawky Samaa M. and Abd El- Moneim Maisa L. (2005). Non chemical control of root-knot nematode, *Meloidogyne incognita* on grape vines. Minufiya J. Agric. Res. 30(6):1685-1708.

Shawky, Samaa M. and Ahlam M. Al-Ghonaimy (2015). Efficacy of some bioagents and plant extracts in controlling *Tylenchulus semipenetrans* on citrus in Egypt. Egyptian Journal of Agronematology, vol. 14, No.1, pp. 45-61.

Shawky Samaa M., Khalil A. E. and Soliman Manal M. (2010). Non chemical control of root-knot nematode; *Meloidogyne javanica* on peanut in Egypt. Zagazig J. Agric. Res., 37 (1): 185-206.

Shawky, Samaa M., A. E. Khalil and Manal, M. Soliman (2010). Seasonal fluctuation, inoculum levels and control of the root – knot nematodes; *Meloidogyne incognita* on cassava. Minufiya J. Agric. Res., 35 (3): 885-902.

Shawky, Samaa M.; Soha S. M. Mostafa and Azza A. M. (2009). Efficacy of some algal, Azolla and compost extract in controlling root-knot nematode and its reflection on cucumber. Bull. Fac. Agric., Cairo Univ. 60:443-459

Siddiqui, I. A. and Shaukat, S. S. (2004). *Trichoderma harzianum* enhances the production of nematicidal compounds *in vitro* and improves biocontrol of *Meloidogyne javanica* by *Pseudomonas fluorescens* in tomato. Letters in Applied Microbiology, 38(2): 169-175.

Soliman Amira Sh., Shawky Samaa M. and Omar M. N. A. (2011). Efficiency of bioagents in controlling root knot-nematode on *Acacia* plants in Egypt. American-Eurasian J. Agric. & Environ. Sci., 10(2):223-229.

الملخص العربي

كفاءة استخدام بعض الكائنات الحية وأنواع الطحالب والمستخلصات النباتية المائية في مكافحة نيماتودا تعقد الجذور (ميلودوجين انكوجنيتا) وأثرها على محصول العنب في مصر

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تم إجراء تجارب لمكافحة نيماتودا تعقد الجذور (ميلودوجين انكوجنيتا) على العنب (صنف سوبريور سيدليس) تحت ظروف كلا من الصوبة والحقل وتأثيرها على المحصول. تم إجراء التجربة الحقلية بمزرعة خاصة بالوادي الفارغ – بطريق إسكندرية – القاهرة الصحراوي (٧٨ ك). تم اختبار سبعة معاملات اثنين كائنات دقيقة (بكتريا الباسيلس ساتلس وفطر التريكودرما هريزيانم) واثنين من الطحالب (سبيرولينا بلاتنسيس وأسيلاتوريا) واثنين من المستخلصات (المستخلص المائي للدمسيسة والمستخلص المائي للكافور) بثلاثة تركيزات مختلفة بالإضافة لمبيد الأوكساميل (٢٤% سائل) للمقارنة لمكافحة نيماتودا تعقد الجذور (ميلودوجين انكوجنيتا) على العنب (صنف سوبريور سيدليس) تحت ظروف كلا من الصوبة والحقل. تم استخدام معاملات الكائنات الدقيقة والطحالب والمستخلصات كمعاملة تربة على العنب ثلاثة مرات بفاصل أسبوع تحت ظروف كلا من الصوبة والحقل.

كانت أكثر المعاملات فعالية في مكافحة نيماتودا تعقد الجذور (ميلودوجين انكوجنيتا) كلا من (سبيرولينا بلاتنسيس وأسيلاتوريا) بينما كانت المعاملة باستخدام المستخلص المائي للكافور أقلهم فعالية تحت ظروف كلا من الصوبة والحقل. أظهر استخدام كلا من (سبيرولينا بلاتنسيس وأسيلاتوريا) كفاءة عالية في خفض تعداد الطور اليرقي الثاني في التربة وكذلك أعداد كلا من العقد النيماتودية والأطوار الغير مكتملة والإناث وأكياس البيض وعدد البيض/كيس بيض على الجذور والتعداد النهائي لنيماتودا تعقد الجذور (ميلودوجين انكوجنيتا) نباتات العنب وأقلهم تأثيرًا كانت المعاملة باستخدام المستخلص المائي للكافور تحت ظروف كلا من الصوبة والحقل. بالإضافة لزيادة الوزن الخضري الكلى لنباتات العنب المصابة بنيماتودا تعقد الجذور (ميلودوجين انكوجنيتا) تحت ظروف الصوبة.

أظهرت النتائج تأثير معنوي في خفض التعداد الكلى ومعدل تكاثر نيماتودا تعقد الجذور في كلا من التربة والجذور خاصة بعد الشهر الثالث من وقت المعاملة. بالإضافة لزيادة محصول العنب (صنف سوبريور) تحت ظروف الحقل.