

## IMPACT OF CERTAIN PLANT OIL PRODUCTS AND OXAMYL ON *MELOIDOGYNE INCOGNITA* INFECTING SUNFLOWER PLANT

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### ABSTRACT

Greenhouse as well as micro plot (out door) experiments on the efficacy of certain plant oil extracts i.e. garlic 1%, sesame 5% and Egyptian lupine 1% or sesame oil cake applied singly and/or mixed with oxamyl for controlling *Meloidogyne incognita* infecting sunflower c.v. Iroflora revealed that all treatments improved sunflower growth, and reduced root galling. Sesame either at 5% or oil cake singly achieved the highest values of percentages of increase for whole plant fresh weight and shoot dry weight that were accounted to 40.0% and 31.6% for greenhouse plants; and 24.17 and 32.4% for micro-plot ones, respectively. Concomitant treatments using any plant oil extracts tested or sesame oil cake integrated with oxamyl showed better increase of plant growth parameters than those of oxamyl alone.

Sesame 2.5% plus oxamyl at recommended (half dose) application surpassed other plant oil extracts applied singly or with oxamyl in suppressing of juveniles (J2) number per 250 g soil as well as nematode galls with percentage reduction of 91.9 and 80.7%, respectively.

Moreover, great suppression in number of nematode galls per root system of sunflower was recorded with sesame oil cake mixed with oxamyl (74.3%) for micro-plot plants. Obviously, seed weight/head, weight of 100 seeds and seed oil percentage were significantly increase in micro-plots receiving concomitant treatment with values of 75.0, 160.91 and 22.8% as compared with single application, respectively.

**Keywords:** integrated control, *M. incognita*, oil cake, plant oil extracts, sunflower plant.

### INTRODUCTION

Root-knot nematodes, *Meloidogyne* spp. are considered to be one of the most important major nematode pests of plants all over the world. They are widely distributed in the cultivated areas of Egypt causing appreciable crop losses especially with sunflower yield. The wide host range of such nematodes and the favorable environmental conditions provoked suitable control measures to achieve satisfactory results. An effective integrated pest management program is quite suitable for those plant parasitic nematodes.

The nematicidal activity of certain plants applied to soil as dried leaves, powders, oil extracts and oil cakes against plant parasitic nematodes have been widely studied by many workers (El-Sherif, 1984; Farahat *et al.*, 1999; Cannayan and Rajendran, 2001; El-Sherif *et al.*, 2001; and Devi, 2002).

In India, Anver and Alam (1996) reported that oil seed cakes of *Azadirachta indica*, *Ricinus communis*, *Brassica campestris* and *Eruca sativa* reduced single and concomitant inoculation with *M. incognita* and *Rotylenchulus reniformis* on okra. In Egypt, El-Sherif *et al.*, (2001) found that *Vinca rosea* powder mixed with oxamyl showed better performance in

concomitant treatments using two components tested as compared with nematode or any component alone (Table 1).

Sesame 2.5% integrated with oxamyl (half dose) treatment proved to be better in the fresh weight of whole plant, and shoot dry weight increase percentages followed by garlic mixed with oxamyl and then E. lupine + oxamyl treatments. These percentages of increase were 45.4 and 54.2%, 42.3 and 52.6%, and 42.30 and 38.4%, respectively.

Moreover, concomitant treatments using any of the plant oil extract tested, integrated with oxamyl (half dose) showed better increase of the plant growth parameters than those of oxamyl alone (Table 1).

Obviously, sesame 5% application singly gave better in fresh weight of whole plant percentage of increase than that of oxamyl alone with values of 40 and 39%, respectively.

However, non significant differences were obtained between all treatments except that of nematode alone, plant free of nematode and untreated with any plant oil extract.

**Table (1): Sunflower growth as influenced by certain plant oil extracts single or in combination with oxamyl on controlling *M. incognita* under greenhouse conditions.**

Treatments	Plant growth response *							
	Length (cm)		Fresh weight (g)		F.wt. plant (g)	Inc. %	Shoot D.wt. (g)	Inc. %
	Shoot	Root	Shoot	Root				
Garlic 1%	23.67 c	13.33 abc	6.03 a	0.60 b	6.63	27.5	2.07 bc	8.9
Sesame 5%	32.00 b	14.67 ab	6.63 a	0.65 b	7.28	40.0	2.50 b	31.6
E. Lupine 1%	29.33 b	11.0 bc	6.37 a	0.58 b	6.95	33.7	2.33 bc	22.6
Garlic + Oxamyl	23.33 c	10.0 c	6.90 a	0.50 b	7.40	42.30	2.90 bc	52.6
Sesame + Oxamyl	29.00 b	12.67 abc	6.97 a	0.59 b	7.56	45.40	2.93 bc	54.2
E. Lupine + Oxamyl	29.30 b	14.0 ab	6.80 a	0.60 b	7.40	42.30	2.63 bc	38.4
Oxamyl	33.0 b	13.0 abc	6.63 a	0.60 b	7.23	39.04	2.53 bc	33.2
N alone	20.60 d	9.67 d	4.80 b	0.40 a	5.20	—	1.90 d	—
Plant free of N and untreated	35.00 a	16.00 a	6.40 a	1.67 c	8.07	—	4.80 a	—

N = *M. incognita* (6 eggmasses).

\* Each value presented the mean of three replicates.

Means in each column followed by the same letter did not differ at p<0.05 according to Duncan's multiple range test.

Moreover, significant reduction in number of nematode galls and juveniles (J2) of *M. incognita* / 250 g soil was achieved with all treatments that applied singly or integrated with oxamyl (Table 2), when compared with nematode alone. Concomitant applications using any plant oil extract plus half dose of oxamyl showed better reduction in nematode galls and population density (J2) in soil than single application, whereas oxamyl at the recommended dose alone gave the least value of juveniles (J2) of *M. incognita* number / 250 g soil (59.7%). Among plant oil extracts treatments tested singly or in combination with half dose of oxamyl, sesame applications surpassed all other treatments in percentage reduction of gall number as well as number of juveniles / 250 g soil with values of 76 and 89.9%, and 80.7 and 91.9%, respectively.



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with reduction percentage of 74.3%, followed by sesame oil cake (45.7%) and then oxamyl (39.05%), respectively.

Moreover, seed weight / head weight of 100 seeds and seed oil percentage were significantly increase in micro-plots receiving concomitant treatment with values of 75, 160.87 and 22.8% as compared to single one, respectively (Table 4).

Apparently, the influence of sesame as oil extract at 5% or oil cake alone or mixed with oxamyl on plant growth parameters of sunflower infected with *M. incognita* indicated that sesame at both forms tested in combination with oxamyl caused significant and better increment in plant growth criteria than did alone. Moreover, number of galls / root system for both forms as well as number of *M. incognita* (J2) per 250 g soil for oil extract only were significantly suppressed. These findings are in accordance with those reported by Walker and Melin (1996) who found that the oils namely, geraniol, eugenol, linafoal and peppermint reduced the number of galls caused by *M. arenaria* and *M. incognita*. The present findings also agreed with those reported by El-Sherif (1984) in respect to oil-cakes.

**Table 4: sunflower yield and oil percentage as influenced by *M. incognita* infection treated with sesame oil cake singly or integrate with oxamyla under outdoor condition.**

Treatments	Sunflower yield and oil percentage*							
	Head wt. (g)	Inc. (%)	No of Seeds /hed	Inc. (%)	100 seeds wt.	Inc. (%)	Oil %	Inc. %
Sesame	18.25 b	46.00	255.0 b	21.4	13.0 a	126.00	26.26 d	2.38
Sesame + oxamyle	21.90 a	75.20	350.0 a	66.67	15.0 a	160.87	31.50 a	22.8
Oxamyl	15.00 b	20.00	300.0 ab	42.7	6.00 b	4.43	27.00 c	5.26
N alone	12.50 b	---	210.0 ab	---	5.75 b	---	25.65 cd	---
Free plant of N and untreated	15.00 b	20.00	220.0 ab	4.76	7.0 b	23.4	29.19 b	13.8

N = *M. incognita* at 1500 eggs/ plant.

\* Each figure represents the mean of 4 replicates.

Means in each column followed by the same letter did not differ at p<0.05 according to Duncan's multiple range test.

Obviously, results of the present investigation agreed with the findings of El-Sherif *et al.*, (2001) who reported that the mixing of *Vinca rosea* with oxamyl showed better performance in sunflower growth infected with *R. reniformis* as compared to single application. Moreover, they also stated that seed weight per head as well as seed oil percentage were significantly increased in micro plots receiving concomitant treatment as compared to nematode alone with percentage of increase 82.11% and 22.02%, respectively.

In conclusion, integrated control of *M. incognita* infecting sunflower either in greenhouse or micro-plot (out door) using two components of biocontrol agents with minimizing of nematicides proved to be better than single application.



magnification and recorded. Plant growth criteria i.e. plant length, plant fresh (shoot and root) weight and shoot dry weight were measured and recorded.

The second experiment was carried out to determine the influence of sesame oil cake integrated with oxamyl at half dose (0.15 g/ plant) on *M. incognita* galls/ root system and the resulting effect on plant growth of sunflower c.v. Iroflora in micro-plot under outdoor conditions. Fifteen concrete bins, 60-cm diam. and 100 cm deep were used in this experiment. Each concrete bin was filled with 20 kg of sandy loam (1:1) / plot that was covered with plastic for ten days to be sterilized by solarization technique (Katan, 1981) against any soil borne pests.

Seeds of sunflower c.v. Iroflora were planted in each concrete bin and thinned to three plants per concrete bin after two weeks from germination. Sesame oil cakes amendments 3 g/plant were incorporated into the soil of each concrete bin as undecomposit organic amender and irrigated with water. Nematode inoculation containing 1500 eggs of *M. incognita* per plant which was previously prepared according to Vrain technique (1972) was added one day after oil cake application and twenty one days from seeds germination.

Oxamyl as nematicide was applied at recommended dose (0.3 g/plant) in a single and at half one in mixed application along with the oil cake under study.

Plants were harvested 120 days after nematode inoculation. Data dealing with length and weight of fresh shoot and root were determined and recorded. Shoot dry weight head weight, seeds number/head, one hundred seeds weight and oil percentage were recorded. Seed oil percentage was determined by the usual soxhet extraction method according to A.O.A.C. (1980). Average number of nematode galls / root system of sunflower plant for each treatment was also recorded.

Data of both experiments were subjected to analysis of variance (ANOVA) (Gomez and Gomez, 1984) and means were compared by Duncan's multiple range test (Duncan, 1955).

## RESULTS AND DISCUSSION

### **1. Impact of certain plant oils applied either singly or mixed with oxamyl on *M. incognita* infecting sunflower plant under greenhouse conditions.**

The influence of three plant oil extracts i.e. garlic 1% sesame 5% and E. lupine 1% single or in combination with half dose of oxamyl on controlling *M. incognita* infected sunflower was presented in Table (1 and 2). It was evident that all treatments improved sunflower growth exceeded that of nematode alone. Among single application, sesame 5% achieved the highest values of percentages of increase for whole plant fresh weight and shoot dry weight with 40.0 and 31.6%, respectively, followed by E. lupines 1% application, whereas, garlic 1% revealed the least values for these two criteria. These values were recorded to be 33.7 and 22.6 for E. lupine, and 27.5 and 8.9% for garlic, respectively (Table 1).

Concerning fresh weight of the whole sunflower plant as affected by *M. incognita* infection, a high percentage of increase was recorded with

sunflower growth with percentage of increase 62.08% and suppression in nematode population of *R. reniformis* reached to 90.61%. Moreover, oil cakes of neem, mustard, and linseed at 100 and 400 kg/ha were also effective in controlling *Heterodera cajani* population as well as improving plant growth parameters of arhar and moong bean plants (Devi, 2002).

The present investigation was undertaken to determine the influence of certain plant oil products in the form of plant oil extracts i.e. garlic 1%, sesame 5% and Egyptian lupine 1% either separately or integrated with oxamyl on *M. incognita* infecting sunflower under greenhouse conditions and then to evaluate sesame as oil cake added either singly or mixed with oxamyl on *M. incognita* infecting the same host plant grown in micro-plots under outdoor conditions.

## MATERIALS AND METHODS

**Nematodes:** Eggmasses of *Meloidogyne incognita* were obtained from a pure culture of *M. incognita* that was propagated on coleus plants in the greenhouse of Nematological Research Unit, Agricultural Zoology Department, Faculty of Agric., Mansoura University, Egypt.

**Nematicide:** Oxamyl (vydate G 10%) [S-methyl1-(dimethyl carbamoyl) N-(methyl carbamoyl) oxy-(thioformimidate)]

In order to study the impact of certain plant oils products on *M. incognita* infecting sunflower two experiments were conducted. The first experiment was carried out to study the efficacy of three plant oil extracts i.e. garlic 1%, sesame 5% and Egyptian lupine 1% either singly or integrated with oxamyl on root knot nematode, *M. incognita* infecting sunflower plant under greenhouse conditions. In this experiment, twenty seven plastic pots 10 cm diam. Filled with steam sterilized sandy loam soil (1:1) (w:w) were planted with three seeds of sunflower c.v. Iroflora / pot, irrigated with water as needed and then thinned at one seedling / pot after two weeks. Twenty four seedlings were then separately inoculated with six eggmasses of *M. incognita*. Five days later the three treated plant oils extracts under study were added at the rate of 100 ml around seedling. Oxamyl at the recommended dose (0.3 g) as well as half concentration of each oil used plus oxamyl at half dose (0.15 g) were applied. Treatments were as follows:

- |  |   |
|--|---|
| 1- N+ garlic oil 1%,                           | 2- N+ garlic oil 0.5%+half dose of oxamyl,    |
| 3- N+ sesame oil 5%,                           | 4- N+ sesame oil 2.5%+half dose of oxamyl,    |
| 5- N+ E. lupine oil 1%,                        | 6- N+ E. lupine oil 0.5%+half dose of oxamyl, |
| 7- N + oxamyl at recommended dose 0.3 g/plant, |   |
| 8- N – alone and                               | 9- plant free of N and any treatments (Ck).   |

Each treatment was replicated three times.

Pots were arranged in a randomized complete block design in a greenhouse maintained at 28±3°C.

Plants were harvested after 45 days from nematode inoculation. Number of galls/ root system of sunflower plant was recorded. Number of *M. incognita* (J2)/250 g soil were extracted from each pot by sieving and modified Baermann-pan technique (Goodey, 1957). Number of nematode juveniles was determined by Hawksely counting slide under 100



Table (2): Number of root galling and juveniles in soil as affected by addition of certain plant oil extracts, either separately or mixed with oxamyl on controlling *M. incognita* infecting sunflower under greenhouse conditions.

Treatments	N of galls *	Reduction %	N. of J2 in 250 soil	Reduction %
Garlic 1%	5.00 b	50.00	10.00 c	79.20
Sesame 5%	2.33 cd	76.00	5.00 ed	89.90
E. Lupine 1%	3.33 bc	66.70	6.00 d	87.92
Garlic + Oxamyl	3.00 c	70.00	9.00 c	81.92
Sesame + Oxamyl	2.00 bcd	80.70	4.00 e	91.90
E. Lupine + Oxamyl	2.33 bcd	76.70	4.00 e	91.92
Oxamyl	3.00 bc	70.00	20.00 b	59.70
N alone	10.00 a	----	49.67	----

N = *M. incognita* (6 eggmasses).

\* Each value presented the mean of three replicates.

Means in each column followed by the same letter did not differ at  $p < 0.05$  according to Duncan's multiple range test.

**2- Integrated control of *M. incognita* infecting sunflower using sesame oil cake and oxamyl in micro-plots under outdoor conditions.**

Data presented in Tables (3 and 4) indicated that all treatments improved sunflower growth parameters as well as seed oil percentage and reduced root galling on roots to certain extent exceeded that of the nematode alone as well as plants free of either nematode or any oil extracts applications.

However, concomitant treatments showed better results more than single one. Moreover, the mixing of sesame oil cake with oxamyl at half dose showed better performance in sunflower growth with percentage of increase 145.8% for whole plant fresh weight and 99.11% for shoot dry weight, respectively, when compared with single application (Table 3).

Table (3): Plant growth response of sunflower infected with *M. incognita* eggmasses as influenced by the addition of sesame oil cake singly or integrated with oxamyl with reference to root galling under outdoor condition.

Treatments	Plant growth response *									
	Length (cm)		Fresh wt. (g)		Whole Fresh wt. (g)	Incr. %	Shoot Dry. Wt. (gm)	Incr. %	Galls No.	Redu. %
	Shoot	Root	Shoot	Root						
Sesame	68.75 bc	7.00 a	67.50 bc	7.00 a	74.00	24.17	15.05 a	32.40	28.50 c	45.7
Sesame + oxamyl	145.0 a	12.5 a	135.0 a	12.50 a	147.5	145.8	22.60 a	99.11	13.50 c	74.3
Oxamyl	100.0 ab	9.33 a	93.33 b	6.67 b	100.0	66.67	18.67 a	64.5	32.00 b	39.05
N alone	37.5 c	10.25 a	52.00 c	8.00 b	60.0	----	11.35 a	----	52.50 a	----
Free plant of N and untreated	50.0 c	13.25 a	55.00 bc	8.00 b	63.0	5.00	19.75 a	74.00	0.0	----

N = *M. incognita* at 1500 eggs/ plant.

\* Each figure represents the mean of 4 replicates.

Means in each column followed by the same letter did not differ at  $p < 0.05$  according to Duncan's multiple range test.

Obviously, sesame oil cake or oxamyl applied single or in concomitant caused significant reduction in root galling of *M. incognita*. Great suppression in number of nematode galls on root system of sunflower plant was recorded with sesame oil cake integrated with oxamyl

تأثير بعض المستحضرات الزيتية النباتية و الأوكساميل في مكافحة "ميليدوجيني" إنكوجينيتا" على نبات عباد الشمس  
أحمد جمال الدين الشريف<sup>١</sup> و فاطمة عبد المحسن مصطفى<sup>١</sup> وجيهان عوض محمد زاهر<sup>٢</sup>  
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<sup>٢</sup> وزارة العدل.

تم دراسة تأثير إضافة بعض المستحضرات الزيتية لنباتات الثوم ١% والسسم ٥% والترمس المصري ١% مقارنة مع مبيد أوكساميل عند الجرعة الموصى بها أو نصفها مخلوطة مع نصف تركيزات المستحضرات الزيتية المختبرة على نمو نباتات عباد الشمس المضافة إليها عدوى النيماطودا "ميليدوجيني إنكوجينيتا" بعدها بيوم واحد في أصص تحت ظروف الصوبة السلكية وكذلك تم دراسة تأثير إضافة عجينة السسم مقارنة بمبيد أوكساميل عند الجرعة الموصى بها أو مخلوطة عند نصفها مع نصف جرعة العجينة إلى تربة بادرات عباد الشمس في أحواض أسمنتية (نصف حقلية) قبل إضافة عدوى الـ "ميليدوجيني إنكوجينيتا" بيوم واحد أيضا وأسفرت النتائج إلى:

- ١- أن جميع المعاملات المختبرة سواء في الصوبة السلكية أو خارجها أدت إلى تحسن ملحوظ في نمو نباتات عباد الشمس مع نقص واضح في أعداد العقد النيماطودية على جذور نباتات عباد الشمس.
- ٢- سجلت معاملتي مستحضر زيت السسم ٥% أو عجنته منفردة أعلى نسب في زيادة الوزن الرطب الكلي والوزن الجاف للمجموع الخضري لنباتات عباد الشمس بقيم ٤٠%، ٣١,٦% لتجربة الصوبة السلكية و ٢٤,١٧% و ٣٢,٤% لتجربة النصف حقلية على التوالي.
- ٣- سجلت المعاملات المكونة من أي مستحضر زيتي أو عجينة السسم مع المبيد أفضل زيادة في تحسن قياسات نمو النباتات أكثر من مثيلتها بمفردها وكذا معاملة المبيد بمفرده.
- ٤- أدت المعاملة المكونة من مستحضر زيت السسم مع المبيد تفوقا معنويا على مثيلتها لكل المستحضرات الزيتية المختبرة بمفردها أو خلطها مع المبيد في خفض أعداد الطور السيرقي الثاني للنيماطودا لكل ٢٥٠ جم تربة وكذلك أعداد العقد النيماطودية بقيم ٩١,٩% و ٨٠,٧% على التوالي.
- ٥- سجلت معاملة عجينة السسم مع المبيد خفض أعداد العقد النيماطودية / مجموع جذري بدرجة ملحوظة لنباتات تجربة الأحواض الأسمنتية. كما سجلت نفس المعاملة زيادة معنوية ملحوظة في نسب وزن البذور/ قرص عباد الشمس ووزن المائة بذرة وكذا في نسب الزيت للبذور عن مثيلتها الغير معاملة (الكنترول) بقيم ٧٥% و ١٦٠,٨٧% و ٢٢,٨% على التوالي عند مقارنتها بالمعاملة الفردية لهما.