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تقييم تأثير مستحلبات الزيوت النباتية ضد نيماتودا تعقد الجذور التى تصيب نباتات الموز

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الملخص العربى

ثبتت فعالية إستخدام مخلوط الزيوت النباتية المستخلصة لكل من الكافور و الخروع و الفلفل الحار و كذلك الخردل الابيض كمبيدات نيماتودية مقارنة بالنيماكور المحبب % ١٠ (معاملة كيميائية مقارنة) ضد نيماتودا تعقد الجذور من النوع ميلودوجينا انكوجنيتا والذى يصيب نباتات الموز، كما اثبت ايضآ ان هذه الزيوت لها القدرة على تحسين نمو النباتات مقارنة بالمعاملة الكنترول. إن إستخدام مخلوط المستحلبات السابقة عند تركيز ٥٠% يعتبر من اكثر التركيزات تفوقآ فى تخفيض العدد الكلى النهائى للنيماتودا فى نهاية التجربة مقارنة بالكنترول. والعكس من ذلك فإن إستخدام هذه المستحلبات عند كل من التركيزين ٢٥ و ١٢.٥% اثبت فعاليتها فى تحسين نمو النباتات مسجلة زيادة فى وزن الساق ٦٤.٨ و ٧١.٩% على التوالى.

EVALUATION EFFICACY OF PLANTS EMULSIFIER OILS AGAINST ROOT-KNOT NEMATODE INFECTING BANANA PLANTS

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ABSTRACT: *Nematicidal activity of emulsifier oils mixture of Eucalyptus, Castor, Hot pepper and White Mustard as well as Nemacur 10%G (Chemical nematicide) significantly reduced root-knot nematode infection caused by Meloidogyne incognita and improved growth of banana plants as compared with untreated control. Emulsifier oil at level 50% concentration surpassed the other tested materials in reducing final population of nematode compared with untreated infected plants. Adversely, the emulsifier oils at level 25 and 12.5% was the best treatments showed maximum shoot weight recorded 64.8 and 71.9%, respectively.*

Key words: *Emulsifier oil, Root-knot nematode, Meloidogyne incognita, banana.*

INTRODUCTION

Banana (*Musa* spp.) is grown in around 150 countries across the world on an area of 4.84 million ha. producing 95.6 million tones (Kumar *et al*., 2010). The economic threshold level for chemical control of plant parasitic nematodes is 10,000 per 100 g of root (Davide, 1992). While chemical control can reduce the impact of nematode infestations, effective nematicides are too expensive for poor farmers with limited resources. In addition, their prolonged use can be hazardous to human health and the environment and may lead to pest resistance. Nemato-toxic compounds of the neem plant against nematode pests, especially the azadirachtins, are released through volatilization, exudation, leaching and decomposition (Akhtar, 2000; Natalli *et al.,* 2009). Also, Oka *et al.,* (2000) found that essential oils of *Carum carvi*, *Foeniculum vulgare, Mentha rotundifolia*, and *Mentha spicata* showed the highest nematicidal activity among the *in vitro* tested oils, like *Origanum vulgare*, *O. syriacum*, and *Coridothymus capitatus*. Relatively few studies of the neem oil cake was effective compared to other oil cakes used and there was a synergistic effect when the neemcake was coupled with carbofuran 3G in the management of *Pratylenchus delattrei* Jothi *et al*., (2004). High nematicidal activity against nematodes of *B. xylophilus* was achieved with essential oils of *Paeonia moutan*, *Perilla frutescens*, *Boswellia carterii* and *Schizonepeta tenuifolia*, all of which caused 100% mortality at 2 mg ml^{-1} Choi *et al.,* (2007). In fact, curative application of neem formulations significantly reduced the number of egg masses and eggs per egg mass of root-knot nematode as compared with the control (Javed *et al.,* 2007a; Javed *et al.,* 2007b; Javed *et al*., 2008). Additionally, some treatments (e.g., *Acacia nilotica* (L.), *Argemone mexicana* L., and *Azadirachta indica* A. Juss) had statistically lower Root Knot Index (RNI) than the control Elbadri *e al.,* (2009). Several reports of the essential oil, *in-vitro* growth chamber experiments revealed that eucalyptus oil was the most efficient (100% mortality in 6 h with 1000 µl l^{-1} oil and in 30 h with 125 µl l^{-1} oil), followed by the ajwain oil Gupta *et al.,* (2011). Higher plants have yielded a broad spectrum of active compounds antagonistic plant-parasitic nematode, including polythienyls, isothiocyanates, glucosinolates, cyanogenic glycosides, polyacetylenes, alkaloids, lipids, terpenoids, sesquiterpenoids, diterpenoids, quassinoids, steroids, triterpenoids, simple and complex phenolics, and several other classes

(Chitwood 2002; Echeverrigaray *et al.,* 2010; Kosma *et al.,* 2011). Also, analysis of the oil of *Mentha pulegium* L. revealed the presence of piperitone (38.0%), piperitenone (33.0%), -terpineol (4.7%), and pulegone (2.3%) as the major components Mahboubi and Haghi (2008). The purpose of this study was determining the efficacy of essential oils against *M. incognita* affecting banana plants.

MATRIALS AND METHODS

Nematode cultures:

Eggs of *Meloidogyne incognita* were extracted from the root of tomato (*Lycopersicon esculentum* cv. Castle Rock) infected with the nematode using 0.5% sodium hypochlorite solution (Hussey and Barker 1973). Second-stage juveniles (J2) were collected daily from eggs and stored at 15°C. The juveniles used in the experiments were less than 5 days old.

Plant emulsifier oils:

Essential oils of Eucalyptus, Castor, Capsicum (Hot Pepper) and White Mustard (Harraz Company, Attaba, Cairo, Egypt) were used for the current study. Essential oil solution (10% ethanol, vol/vol) were diluted with water containing (0.3% Tween80 vol/vol. Four concentrations were prepered of the previous oils (50%, 33.3%, 25% and 12.5%) and four concentrations were prepared of the previously mentioned oils and tested on root-knot nematode (*M. incognita*) infecting banana cv. Grande-Naine.

Effect of emulsifier oils on nematode development:

Two months old plants, obtained from banana tissue culture (GEBRI*) were planted in 30 cm diameter plastic pots containing a mixture of 1:2 sterilized clay/sandy soil. Twenty four pots were inoculated with *M. incognita* juveniles at the rate of 2000 (J2) per pot at the planting time. Ten days later, 16 pots were treated with 2 ml of previously concentrations. The remaining four inoculated pots served as untreated controls, and also previous numbers were treated by chemical control 5g "Nemacur 10% G" per pot. Emulsions were adding to the soil by a pipette in a hole around roots in soil then followed by water. The plants were treated by previously concentration of emulsion every month for three months. The treated plants were removing after treatment for previously period. Weights and lengths of root and shoot as well as weight of suckers were determined. Nematode population in soil and developing stages in roots were counted. The data was statistically analyzed according Dancans multiple range test.

RESULTS

The *in vivo* studies (Table 1) reverded that application of all treatments of emulsifier oils at the different concentrations of (Eucalyptus, Castor, Hot Pepper and White Mustard) or a compared with Nemacur 10% G. gave significant reduction in galls number, nematode invaded, females number and females with egg-masses. The same finding were noticed on the juveniles number in soil and total population number of nematodes as well as the rate of development compared with untreated-infected plants .

Results indicated indicated also thattable that the emulsifier oil at 50% conc. was the best effective materials used in reducing of *Meloidogyne incognita* (80.3%) followed by 33.3% conc. (78.9%) , Nematicides (74.6%), 25% conc. (65%) and finally, 12.5% (43.6) reduction.

Data on plants growth parameters based on weights and lengths as well as weight of suckers are presented in table 2 and fig.1 . Most treatments successes in improving the plant growth parameters as compare to check with nematode. Statistical analysis of data showed that all emulsifier oils significantly ($p \leq 0.01$) increased plant growth parameters. For instance, shoot weight of those plants were recorded much higher then those of the untreated check. The growth rate of shoots weights were recorded increasing at all treatments which ranged between 39.3 and 71.9% as a compared to check treated with nematode. Variable response of root growth parameters was also detected. No remarkable increase in root weight, root length or sucker weight was noticed in plants of most treatments.

In general, all treatments of tested materials but few as well as "Nemacur 10%G." caused remarkable increase in the plant growth criteria, adversely, roots and suckers weight.

Table (1): Efficacy of various concentrations of emulsifier oils against root-knot nematode *M. incognita* on banana cv. Grande-Naine in pots.

Treatments	Galls number	Number per root			Juveniles no in soil	Total*	% Decrease	Rate of development
		Nematode invaded	Females	Females with egg-masses				
50%	20 c	1 b	190 b	160 b	3130 c	3481 c	80.3	1.7 b
33.3%	48 c	22 b	424 ab	193 b	3086 c	3725 c	78.9	1.9 b
25%	88 bc	1 b	347 b	363 b	5484 bc	6195 bc	65	3.1 b
12.5%	142 b	20 b	380 ab	243 b	9330 b	9973 b	43.6	5 ab
Nemacur 10%G.	22 c	4 b	256 b	312 b	3876 c	4448 c	74.9	2.2 b
Control with infection	331 a	181 a	786 a	872 a	15855 a	17694 a	_	8.9 a

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

*Total population including nematode invaded + females + females with egg-masses + juveniles number in soil. Rate of development = pf (final population / initial population) Norton, 1978.

Table (2): Effect of various concentrations of emulsifier oils on growth of banana plant cv. Grande-Naine infected with *M. incognita* in pots.

Treatments	Root		Shoot		Sucker weight (g)
	weight (g)	length (cm)	weight (g)	length (cm)	
50%	41.9 b	27.5 b	76 bc	44.5 b	55 b
33.3%	58.6 b	41.3 ab	72.4 bc	41.3 b	40.9 b
25%	45.2 b	59.3 a	85.7 bc	43.3 b	48.6 b
12.5%	75.2 ab	48.3 a	89.4 b	43.3 b	48.2 b
Nemacur 10%G.	71.1 ab	45.8 ab	80.4 bc	40.3b	39.9 b
Control with infection	79.8 ab	46 ab	52 c	40.8 b	49.3 b
Control without infection	102.9 a	42 ab	128.8 a	51.5 a	72.3 a

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

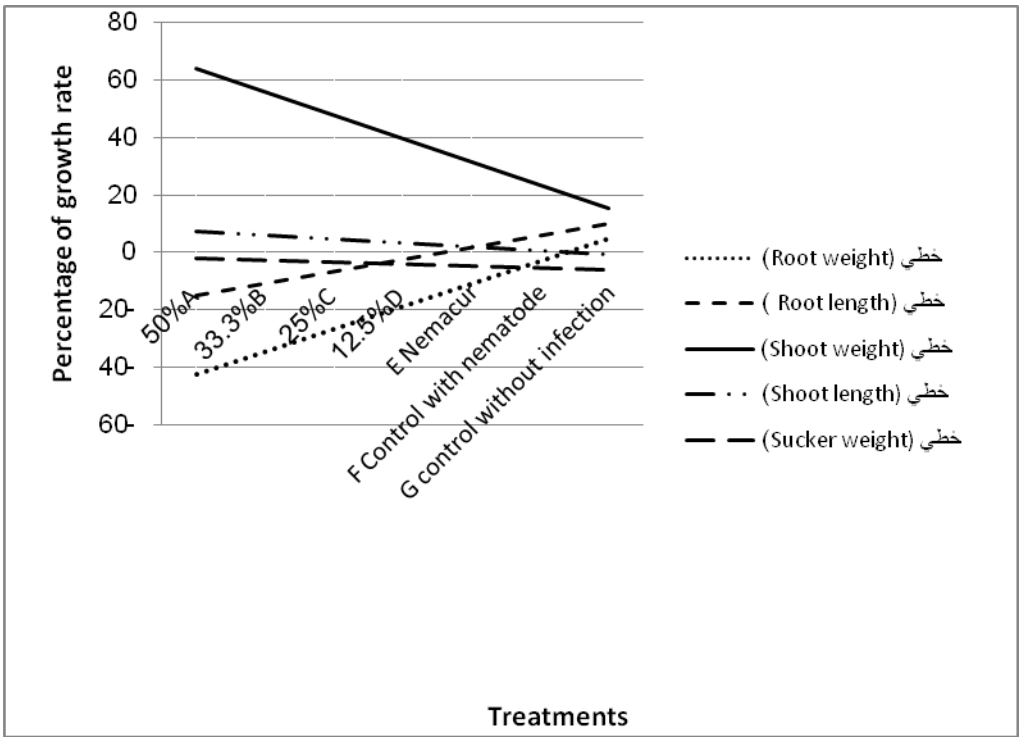

Fig. (1): Relative percentage of growth rate of banana cv. Grande-Naine due to applications of some mixture emulsifier oils concentrations against root-knot nematode

DISCUSSION

Emulsifier oil constituents may act as nematode inhibitors because different constituents of emulsifier oil have been materials like alkaloids, terpenoids and piperitone (Chitwood 2002; Mahboubi and Haghi 2008; Echeverrigaray *et al.,* 2010; Kosma *et al.,* 2011) which possess direct anti-nematode properties that may suppress nematode (Oka *et al.,* 2000; Choi *et al.,* 2007). When the treatments were applied with four dossal rate to control *Meloidogyne incognita* infecting banana plants, they exhibited antagonistic action and most of them affected life cycle of nematode. Total number of galls, nematode invaded, females' number, females with egg-masses juveniles' number in soil (J2), percentage decreases of total nematode number and rate of nematode development were greatly reduced when compared with those of the untreated plants infecting with nematode. These results are in agreement with those reported by Javed *et al.,* 2007a; Javed *et al.,* 2007b; Javed *et al*., 2008. The different treatments but few improved plants growth of banana like shoot weight and shoot length. The effectiveness of emulsifier oil may be explain improving plant growth by presence of some nutrients with directly help to enhance plant growth development, which was finding in waste materials. These finding are in agreement with those of Jothi *et al*., 2004; Kosma *et al.,* 2011. It could be concluded that the reduction in *M. incognita* infestation in this work might be due to root-knot nematode toxic principles present in various organic residual, as a large number of essential oils of plants have been shown to possess nematicidal principles (Echeverrigaray *et al.,* 2010; Kosma *et al.,* 2011; Mahboubi and Haghi 2008).

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