BEHAVIOR OF NEMATHORIN NEMATODES IN SOIL PLANTS WITH PEACH TREES AND TOMATO PLANTS INFECTED WITH NEMATODES

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ABSTRACT

Seven genera plant–parasitic nematodes, i.e. Criconemella sp., Ditylenchus spp., Helicotylenchus spp., Meloidogyne spp., Pratylenchus spp, Rotylenchulus spp. and Tylenchorhynchus were recorded in the rihzospher in tomato plants. Such genera differed greatly in their prevalence and levels of abundance. The genera of Helicotylenchus spp., Pratylenchus sp. and, Meloidogyne spp. were dominant. The genera Tylenchorhynchus sp., Rotylenchulus spp., Criconemella sp. and Ditylenchus spp. were the second most important genera. On the other hand, the genera of Meloidogyne spp. and Tylenchorhynchus sp. were the most frequently occurred. Regarding Peach orchards, there were nine genera plant–parasitic nematode, i.e. Criconemella sp., Ditylenchus spp., Helicotylenchus spp., Hemicriconemoides sp. Heterodera spp., Meloidogyne spp., Pratylenchus spp., Rotylenchulus spp. and Tylenchorhynchus spp. The genera Helicotylenchus spp. and Hemicriconemoides sp. were dominant. Genera, however Pratylenchus spp .and Meloidogyne spp. were the most frequently occurred. The environmental behavior of the nematicide residues, fothiazate in sandy loam soils in peach orchards and tomatoe plants were investigated under field conditions. In relation to the degradation pattern in the selected soils, the obtained results indicated that the nematicide residues were dissipated more rapidly in the soil planted with tomatoes compared with peach orchard soils. The calculated half-life periods (t1/2) were 3.7 and 7.4 days for fosthiazate in soil planted with tomatoes and trees of peach.

Key words: Behavior- Nemathorin-Nematodes-soil-Peach Trees-Tomato Plants.

INTRODUCTION

Nematodes are widespread and problematic on tomatoes and peach crops. Producing areas depending on soil type where they can proliferate and cause serious damages. Species of nematodes reported to be associated with tomatoes or peach crops include *Rotylenchulus reniformis, Radopholus similis, Hemicriconemoides mangiferae* and *Meloidogyne spp. (M. incognita* and *M. javanica*). General decline in tree vigor is observed in response to high nematode populations. Among surveyed soil types, sandy loam soil appeared to have population of greater numbers of root-knot nematodes, *Meloidogyne* spp. than clay soil. While, *Helicotylenchus* spp. and *Rotylenchulu* spp. had high density in the clay soils (Townshend, 1972; Prot and Van Gundy, 1981; Windham and Barker, 1985; Jatala, P. 1989; Ismail, 1992; McSorley, 1992; Mohamed, 1998; Tsiropoulos, *et al.* 2005; Korra, *et al.* 2009 and Osborn *et al.* 2009). Fosthiazate is an organophosphate compound that is currently under development as a nonfumigant nematicide. Adsorption and degradation behavior of a pesticide in soil has a strong effect on its environmental fate as well as efficacy for pest control (Qin *et al*., 2004). Pantelelis, *et al.* 2006 investigated the degradation and adsorption of the organophosphorus nematicide, fosthiazate in nine soils with various physicochemical and biological characteristics. Studies revealed the Fosthiazate concentration was strongly correlated with soil organic matter. (Kapouzas, *et al.* 2007) applied fosthiazate is an organophosphorus

nematicide which was recently included that it should be used with special care in soils vulnerable to leaching. Thus, the leaching of fosthiazate investigated in. columns packed with three different soil (Wu *et al.* 2004) determined the resesidue dynamics of fosthiazate in tomato and soil was studied in this paper utilizing liquid chromatography with tandem mass spectrometry (LC-MS/MS).

MATERIAL AND METHODS

Nematode survey and extraction:

To determine the infestation level with plant parasitic nematodes infecting peach trees and tomato plants in the present study, survey of plant parasitic nematodes associated with tomato plants or peach orchards (age of tree peach about10 years) in Elhakmia village, Meet gamr destricte at El-Dakahlia governorate was carried out during 2010. Forty six samples from tomato plants and twenty two from peach trees were randomly collected from the rizhosphere using a stainless steel half-tube. The samples were kept in poly-ethylene bags and put in ice box, then transferred directly to the laboratory for nematode extraction. About 300-400 ml. of water was added to each of the soil sample (250 gm) in plastic pan for 15 min. The mixture was agitated by fingers. After a few seconds, the suspension was sieved through 200 and 400 mesh sieves (Goodey, 1957). Nematodes present in the suspension were obtained from the 400 mesh and extracted for 72 hours by the modified Baerman pans technique (Goodey, 1963). The final volume of extracted suspension was adjusted to about 50 ml. The nematodes were counted using (Hawksely) counting slide and light microscope. Nematodes

were identified to genetic level according to Mai & Lyon, 1975. Population density per 250 gm of soil and Percentage of Frequency Occurrence genera in relation to surveyed soil type sites was calculated according to (Norton ,1978) as follows:-

Population density (P.D) = Total number of individuals of genus

Number of samples containing this genus

Frequency Occurrence% (F.O %) = Number of samples containing a genus X 100

Number of collected samples

Pesticide Used:

The Nematicides, i.e., Nemathorin (S-sec –butyl 0-ethyl 2 –oxo-1, 3-thiazolidin-3-ylhosphonothioat) (fosthiazate) as organophosphate compound were used in this study in form of commercially granules (10%G) formulation.

Soil type:-

Sandy loam soil was used in this investigation as soil type. The mechanical and physical and chemical characteristic of the studied soil are presented in Tables (1-2). Soil samples were period of June, analyzed according to (Dewis, J. and Freitas, F. 1970).

Table (1): Mechanical analysis of sandy loam soil

Soil Type	Measured parameters (%)					
	$CaCO_3$	Coarse sand	Fine Sand	Clay	Silt	Salt
Sandy Loam	3	4.6	42.13	35	15	0.27

Table (2): Values of Cationic and anionic content of used soils

Soil Type	Soluble Captions' meq/L				Soluble Anions meq/L				Soil pH
	Mg^{++}	C	K	Na^{+}	SO_4^{-2}	Cl^{-}	HCO_3^{-}	CO_3^{--}	
Sandy Loam	0.43	.94	0.03	2.8	1.37	0.39	0.17	--	7.8

Pesticides application:

The pesticide application was conducted in separate areas each composed of 1600 m^2 of the mentioned peach and tomato locations during the period of June; 2010 each area divided into four plots each of 400 m^2. For each one treatment it was distributed in a complete randomized design with three replicates. The pesticide applications was carried out by prod casting of Fosthiazate (10%G) at rate 30 kg/Fedden, Three plots were left without treatment as control. The treated soil was ploughed after pesticides application and irrigated after application by regular irrigation system (each 15 days) during the season.

Soil Sampling technique:

After application, forty five samples were taken from the upper 0-10 cm layer of each plot using shovel. The samples were taken after an hour, 1, 3, 9, 16, 25, 33, 48, 63 and 78 days from pesticide application. Each sample was about two kilograms which was mixed thoroughly and three representative sub-samples (each of 100 g) were taken and then transferred to the laboratory. The collected samples were left to air dryness and passed through sieves of meshes to maintain a uniform particle size and stored in clean plastic bags at (-20^{o}C) until residue analysis. .

Extraction of fosthiazate

Method described by Nelsen and Cook (1979).

Clean-up: The clean-up of fosthiazate from soil extracts, the dry extract was then subjected to the clean up procedure suggested by Mills *et al* (1972).

Quantitaive determination:

All the extracted and cleaned up samples were kept at -20^{o}C until the determination. Quantitative analysis of fosthiazate (10% G) was performed by the gas chromatograph (GC), Hp 6890 serial equipped with flame photometric detector (FPD) operated in the phosphorus mode (529 nm filter) according to the method described by Al-Samariee *et al.* (1988). The extracted samples were dissolved in ethyl acetate and injected under the following conditions: Capillary column PAS-1701 (30 m x 0.32 mm I'd x 0.25 mm film thickness). Detector temp was 250°C, injector temp was 245°C, and the column temperature was programmed 190°C and holds 2min., and rises to 260°C, at a rate of 10°C / min., and holds 8 minutes. Nitrogen carrier gas flow was 4 ml min^{-1}., hydrogen flow was 75ml/min and air flow was 100ml/min.

Under those conditions, the retention times for, fosthiazate were 9.333 min., respectively. A series concentration of, 2.5, 5 and 10 ug per ml of ethyl acetate were prepared from fosthiazate as working standard solutions. The amounts of tested pesticide in the ample were derived from the standard calibration curves concentrated by plotting the peak areas against different concentrations of the active ingredient of each pesticide.

RESULTS AND DISCUSSION

Frequency and population density of recovered nematode genera:

Data in Table (3) revealed the presence of 7 genera plant-parasitic nematode *i.e. Criconemella* sp., *Ditylenchus* spp. *Helicotylenchus* spp., *Meloidogyne* spp., *Pratylenchus* sp., *Rotylenchulu sp* and *Tylenchorhynchus* sp. infecting tomato plants. Such genera differed greatly in their prevalence and levels of abundance. The genera *Helicotylenchus* spp., *Pratylenchus* sp. and, *Meloidogyne* spp. were the most dominant where their population densities were 547,494 and 462 nematodes per 250 gm soil, respectively. The genera *Tylenchorhynchus* spp., *Rotylenchulus reniformis, Criconemella sp.* and *Ditylenchus* spp. were the second most important genera, where their population densities were 378, 280, 216 and 200 respectively. In the other hand, the genera *Meloidogyne* spp. and *Tylenchorhynchus* sp. were the most frequently occurred where their values of percentages of frequency of occurrence were 33.3 and 28.3, respectively. Regarding Peach orchards, there were 9 plant–parasitic nematode genera, *i.e. Criconemella* sp., *Ditylenchus* spp., *Helicotylenchus* sp., *Hemicriconemoides* sp. *Heterodera* spp., *Meloidogyne* spp., *Pratylenchus penetrans, Rotylenchulu sreniformis* and *Tylenchorhynchus* sp. The genera *Helicotylenchu*s spp. and *Hemicriconemoides* sp. were the most dominant where their value of population density was 400 nematodes per 250 gm soil for each. While, the genera *Pratylenchus* and *Meloidogyne* spp. were the most frequently occurred where the values of percentage of frequency of occurrence were 27.3 and 13.6, respectively. These results are in agreement with the findings of Windham and Barker (1985), Ismail (1992) and Korra, *et al.* (2009).

Table (3): Percentage Frequency of occurrence and Population Density in 250gm of plant parasitic nematodes associated with Peach trees and tomato plants.

Host plant	Genera of Nematodes	(%)Frequency of occurrence	Population Density
Peach *Prunuspersica*	*Criconemella* sp.	4.5	180
	Ditylenchus spp.	4.5	160
	Helicotylenchus spp.	9.1	400
	Hemicriconemoides sp.	9.1	400
	Heterodera spp.	4.5	250
	Meloidogyne spp.	13.6	265
	Pratylenchus spp.	27.3	190
	Rotylenchulus spp.	9.1	200
	Tylenchorhynchus sp.	9.1	250
Tomato *Lycopersicone sculentum*	*Helicotylenchus* spp.	8.7	547
	Meloidogyne spp.	33.3	462
	Pratylenchus spp.	10.9	494
	Criconemella sp.	7.9	216
	Ditylenchus spp.	14.3	200
	Tylenchorhynchus spp.	28.3	378
	Rotylenchulus spp.	14.3	280

Determination of the amounts of Nemathorin residue in (sandy loam soil):

Data in Table (4) and illustrated in Figures (1, 2) represent the detected residues of Nemathorin in sandy loam soil, from both the soil plants of tomatoes and Peach trees. The initial residues of nemathorin in sandy loam soil from soil Peach trees was 373.05 ppm. After the three days of application decreased rapidly to 206.9 ppm showing 44.53% loss. The decline in residual amounts were continued after 9, 16, 25, 33, 45, 63 and 78days to reach 184.58, 110.41, 98.16, 93.81, 82.93, 56.68, and 44.53 ppm with 50.52, 70.40,

73.69, 74.85, 77.77, 84.81 and 88.06 % loss, respectively. Also, the obtained results represent the residues of Nemathorin in sandy loam soil from soil plant of tomatoes. Indicated that the initial amount residue residues of Nemathorin after 3 days were 98.74 ppm

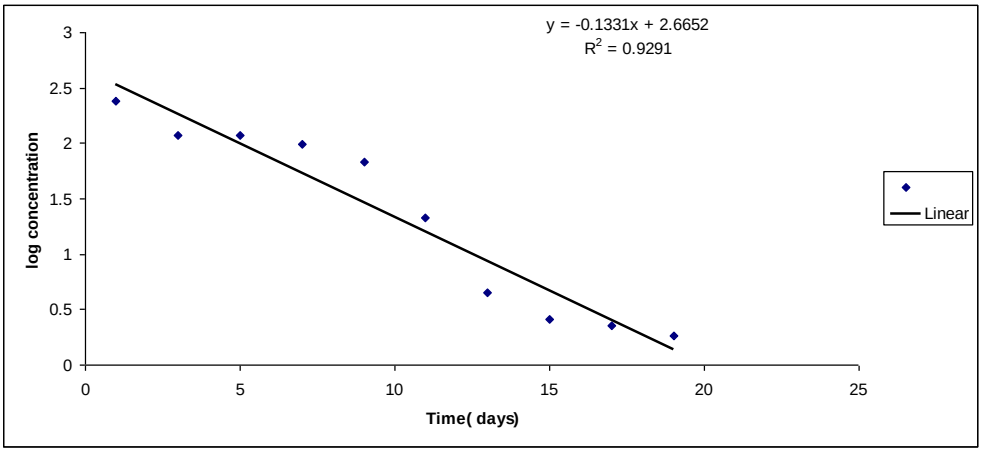

Fig. (1): Residues of (fosthiazate) in soil planted with tomatoes

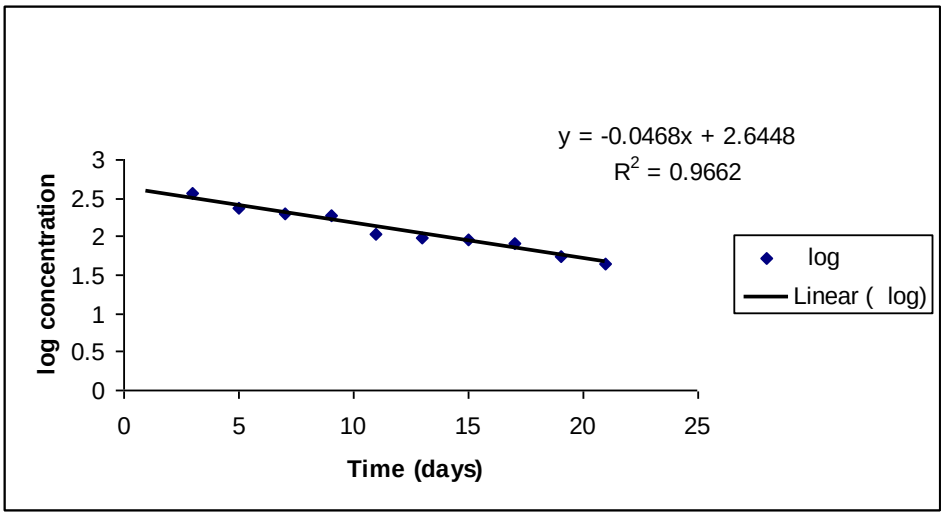

Fig. (2): Residues of(Fosthiazate) in soil planted with peach

Table (4): Fosthiazate residues in treated sandy loam soil cultivated with tomatoes and trees of peach after several time of application

Time after application (days)	soil planted with tomato			soil planted with Peach		
	Residues (mg kg^{-1})±SD	Loss (%)	Persistence (%)	Residues (mg kg^{-1})±SD	Loss(%)	Persistence (%)
Z	237.40± 6.07	00.00	100.00	373.05±79.87	00.00	100.00
1	117.25±5.70	50.61	49.39	229.05±27.59	38.60	61.40
3	98.74±4.29	58.41	41.59	206.9±12.28	44.53	55.47
9	76.46± 4.50	67.80	32.20	184.58±8.37	50.52	49.48
16	67.74±4.53	71.47	28.53	110.41±7.68	70.40	29.60
25	12.53± 1.4	94.72	5.28	98.16±7.63	73.69	26.31
33	4.47± 2.85	98.12	1.88	93.81±2.78	74.85	25.15
48	2.58±1.68	98.91	1.09	82.93±2.70	77.77	22.23
63	2.22± 1.44	99.06	0.93	56.68±2.17	84.81	15.19
78	1.82±0.47	99.23	0.77	44.53±1.57	88.06	11.94
$\bar{X}$	61.355 b			132.166 a		
HL (day)	3.7			7.4		
K	.1856			.0939		

$\bar{X}$: The mean residues of soil. K: degradation rate.

L.S.$D_{.05}$ between soil planted with tomato and soil planted with peach= 11.26 days

showing 58.41% loss, while after 9, 16, 25, 33, 48, 63 and 78days such residues reached 76.46, 67.74, 12.53, 4.47, 2.58, 2.22, and 1.82, respectively.

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سلوك المبيد النيماتودى نيماثورين في تربه مزروعه بأشجار الخوخ ونباتات الطماطم المصابه بالنيماتودا

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المستخلص

تم حصر أهم اجناس النيماتودا النباتيه الموجوده في تربه طفليه رمليه، بمركز ميت غمر محافظة الدقهليه مزروعه بنباتات الطماطم (قبل المعاملة) ووجد بها ٧ أجناس هي:
Criconemella, Ditylenchus, Helicotylenchus, Meloidogyne, Pratylenchus penetrans, Rotylenchulus reniformis and Tylenchorhynchus .
وهذه الاجناس اختلفت فى النسبه المئويه للتعاقب ومستوى الظهور.
وكانت الأجناس الأكثر سياده وظهوراً في التربة هي:
Helicotylenchus spp., Pratylenchus sp. and, Meloidogyne.
يليها أجناس: Rotylenchulus, Tylenchorhynchus
وفي حالة تربه أشجار الخوخ كانت أهم الأجناس الأكثر سيادة وظهوراً فى التربة هي:
Hemicriconemoides, Helicotylenchus.
بينما أجناس: Meloidogyne, Pratylenchus هي الأكثر سيادة وظهوراً وتعاقباً.
تم إجراء رصد لمتبقيات هذا المبيد وإجراء التحليل الإحصائي والرياضي له بعد التطبيق. أثناء الفتره من شهر يونيه وحتى شهر أغسطس من عام ٢٠١٠. وقد تم إجراء الرصد بعد مرور ساعة زمنية واحدة ،٣ ،٩، ١٦، ٢٥، ٣٣ ، ٤٨، ٦٣، ٧٨ يوم من تطبيق المبيد. وقد أشارت النتائج المتحصل عليها بأنه يوجد فرق معنوي مقداره ١١،٢٦ يوم عند تطبيق المبيد المشار اليه، بالاضافه الي أنه كان أكثر اختفاءاً بالتربه المزروعه بالطماطم، عن التربه المزروعه بالخوخ، وذلك يرجع الى زيادة عدد مرات الرى المستخدمه لنباتات الطماطم، عن عدد مرات الرى المستخدمه لرى اشجار الخوخ.