NEMATICIDAL EFFECT OF GARLIC AGAINST *MELOIDOGYNE* INFECTING TOMATO

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Abstract

Different concentration of smashed garlic, *Allium sativum* were tested to control *M.incognita* infecting tomato, under greenhouse conditions. A negative correlation was noticed between garlic dosages and each of nematode galling, number of J2 in soil and number of eggs / plant. The percentages of reduction of these three parameters ranged from 20% to 72%, from 23.2% to 90.7%, and from 23.6% to 74.2 % respectively. Shoot growth of the nematode-infected plants were progressively increased due to the successive increase of garlic conentration, except with the highest one. The percentage increase of shoot weight ranged from 5.9% to 23.5% as a result of garlic treatments. The optimum concentration of garlic was 15 g / pot in which it led to a considerable nematicidal action and the most improvement to plant growth of the nematized plants.

INTRODUCTION

Instead of the traditional chemical tratments used for nematode control, workers have recently been involved with safer and nonpolluting management methods. Antagonistic or toxic plants and plant substances are considered among such methods, although they have been known for long period of time. Nematicidal activity has been demonstrated in some plants like *Brassica* (Triffit 1929, 1930 and Ellenby 1951), Tagetes (slootweg 1956, and Oostenbrink et al. 1958), Asparagus

(Rohde and Jenkins 1958), *Polygonum* (Sukul 1970) and ginger and chilli pepper (sukul et al 1974).

In spite of infecton of garlic by *Ditylenchus* and *Pratylenchus* (Thorne 1961, and Kirjanova and krall 1980), it greatly restricted reproduction and multiplication of the root-knot nematode *Meloidogyne* spp. Ahuja and Muchopadhyaya (1985) found that garlic was resistant *M.incognita* which resulted in 0-10 % infection. David (1985) reported that garlic affected the build - up of *Meloidogyne* spp. and other species of nematodes when it had rotated in tomato fields. In a similar study, garlic could reduce the root-knot damage in potato fields after being introduced in cropping system (Raymundo 1985).

Redgrove (1988) stated that the antimicrobial garlic properties were attributed to allicin diallyl disulphide oxide. Uchida et al. (1975) mentioned that allicin was the active product from the inactive allin by allinase enzyme. Although less investigations were published in respect to direct nematicidal effect of garlic, Sukul et al (1974) reported that garlic extracts showed strong nematicidal action, *in vitro* studies by killing *M.incognita* and other species of nematodes in 40 minutes, and reduced nematode population and root-galling of plants growing in treated pots. Aqueous extract of garlic suppressed egg hatching of *M.incognita* by 88.8 - 89% when egg-masses were dipped in 0.05 - 10.0 percent concentration of gartic extract for 10 days (Gupta et al 1985).

This experiment was aimed to investigate the effect of smashed garlic on *M.incognita* infectivity and reproducion on tomato plants and corresponding plant growth reponse.

MATERIALS AND METIODS

One month - old seedlings of tomato, cv. Pritchard were each trasplanted in 20 cm diam. plastic pots previously filled with steam sterilized sandy loam soil. Each seedling was inoculated with 3000 J2 of *M.incognita*, poured in three homogeneous 3 cm furrows. J2 were obtained by hatching eggs extracted from galled tomato roots (Mc Clure et al. 1973) *M.incognita* pure stock culture were reared from one single egg-mass . Smashed cloves of garlic were tested at the rates of 5,10, 15 and 20 g per pot. The tested dosages were incorported individually at planting time with soil of pots either nematode infected plants or not. Application of Vydate 24% L. at

the rate of 2L / feddan was used as a standard treatment for comparison . Each treatment and check was replicated four times . Pots were kept in greenhouse in completely randomized design and watered as needed. Three months later, plants were uprooted. Nematode counts were made in 250 g soil (J2) after being extractd by Oostenbrink elutriator (Goody 1963) and estimated by Hawksley counting slide. Number of galls in roots and number of eggs / plant were deterimined. In addition, heights of shoots were also measured. Root gall index (R.G.I) was estimated according to Taylor and Sasser (1978) as follow : 0 = none, 1 = 1-25 , 2 = 26 - 50 , 3 = 51-75, 4=76-100 and 5 = more than 100 gall / plant. Statistical analysis of data were mode according to L.S.D. method at P = 0.05.

RESULTS AND DISCUSSION

Data presented in table (1) indicate that a negative correlation was found between dosages of smashed garlic added to *M.incognia* - treated pots and root gall index, number of J2 in soil and number of eggs/ plant. The percentage of reduction for these three nematode parametars ranged from 20 % to 72 % and from 23.2% to 90.7% and from 23.6 % to 74.2% respectively. These results partially confirm the findings of Sukul et al(1974) and Gupta et al. (1985). This inhibitory effect may be attributed to at least one of the following chemical compounds which garlic contains, allicin diallyl disulfied oxide (Redgrove 1933), pyruvic acid and ammonia together with diallyl disulfide (Stoll et al 1950), disulphide and diallyl trisulphide (Amonker et al. 1971) and allicin only (Uchida et al. 1975). A progressive increase in shoot weight of the nematode-infected plants was noticed to correspond to the successive increase in garlic dosages, except with the highest one. The three low and moderate dosages of garlic achieved from 5.9 to 23.5% increase in shoot weight of the infected plants . This effect may be explained by the therapeutic action of garlic against *M.incognita* infection to tomato plants. High dosage provided higher concentrations of such mentioned chemicals that had phytotoxic action or they may have affected the abundant useful mycorrhizal fungi. The highest dosage of garlic, achieved the maximum percent reduction of the infecting nematodes, but greatly damaged the corresponding shoot growth response. Undesirabely, the previously non recommended Vaydate application led to the highest significant reduction to root galling and nematode counts over all the tested garlic concentrations.

Consequently, the moderate concentration of garlic was the most satisfactory

because it resulted in a considerable nematicidal action and enhancement to plant growth in addition to safety and non polluting effects.

Table 1. Effect of garlic and Vydate on control of *M.incognita* on tomato.

Treatments	Nematode Response				Shoot Response			
	Root galling		Eggs/plant		J2 in soil			
	Index.	%Reduction	No.in 1000s	%Reduction	No	%Reduction	Weight (g)	% increase
Garlic (5g) + *M.inco*	4.0	20.0	13.2	23.2	594	23.6	36.0	5.9
Garlic (5g)							48.9	
Garlic (10g) + *M.inco*	2.5	48.0	6.9	62.2	394	49.2	40.0	17.6
Garlic (10g)							47.5	
Garlic (15g) + *M.inco*	2.0	60.0	5.1	70.3	231	70.2	41.8	23.5
Garlic (15g)							44.3	
Garlic (20g) + *M.inco*	1.5	72.0	1.6	90.7	200	74.2	28.5	-17.6
Garlic (20g)							30.3	
Vaydate + M.inco.	0.8	84.0	0.5	97.0	131	83.1	46.4	35.3
M.incognita only	5.0		17.2				34.6	
Ckeck					775		58.0	
L.S.D. (P = 0.05)	0.58		1.79		59.5		2.62	

REFERENCES

1. Ahuja, S. and M.c. Muchopadhyaya. 1985. Varibility in the occurrence of root-knot nematode, *Meloidogyne incognita* infection to various vegetable crops. Bull. Entomol., 26 : 17-24.
2. Amonker, S.A. and A.Benerji. 1971. Isolation and chracterization of larvicidal principle of garlic. Science, 177 : 1343 - 1344.
3. David, R.G. 1985. Summary report on the current status, progress and need for Meloidogyne research in region VI P. 369 - 372 . in : J.Sasser and C.C. Carter eds. An Advanced Treatise on Meloidogye. Vol I Biology and control. Dept Pl. Pathol., N. Carolina Sate Univ. Raleigh USA. 422 pp .
4. Ellenby, C. 1951. Mustard oils and control of the potato root eelworm *Heterodera restochiensis* . Ann. Appl. Biol, 38 : 859 - 875 .
5. Goody, J.B. 1963. Laboratory methods of work with plant and soil nematodes. Tech. Bull. No.2, H.M.S.O. 72 pp .
6. Gupta, R.N.K. Sharma and K. Damanjeet. 1985. Efficacy of garlic as nematicide against *Meloidogyne incognita* (Kofoid and White, 1919) Chitwood, 1949. Indian J. Nematol., 2 : 266 (Abstr) .
7. Kirjanova, E.S. and E.L. Kral. 1980. Plant parasitic nematode and their control. Nauka Publishers, Leningard Section, Leningrad. Transl. Amerind Publishing Co., PVT. LTD., New Delhi .
8. McClure, S.L.F., R.M. Sayre and R.N. Huettel. 1973. A method of obtaining quantities of clean *Meloidogyne* eggs J. Nematol., 5 : 230 .
9. Oostenbrink, M.K.Kuiper, and S. Jacop 1958. Tagetes als fenidpflanzen von Pratylenchus Anten. Nematologica, 2 : 424-433.
10. Raymundo S.A. 1985. Cropping systems research and root-knot nematode control. P 277-281 in J.N. Sasser and C.C. carter eds. An Advanced Treatise on Melodogyne vol. I. Biology and control Dept. PL. Pathol., N. Carolina state Univ., Releigh. USA. 422 pp .
11. Redgrove, H.S. 1933. Species and condiments. Pitman Inc. London UK.
12. Rhode, R.A. and W.R. Jenkins. 1958. The chemical basis of resistance of Asparagus to the nematode *Trichodorus christie* (Abstr.). Phytopathology, 48 : 463 .
13. Slootweg, A.F.G. 1956. Root rot of bulbs caused by *Pratylenchus* and *Hoplolaimus* Spp. Nematologica, 1: 192 - 201.
14. Stoll, A. and E.Seebeck. 1950. Specific constituents of garlic. Scientia Pharm., 18 : 61 .

15. Sukul, N.C. 1970. Inhibition of nematode infestation of wheat seedlings by *Polygonum hydropiper.* Nature, lond. 226:771-772.

16. Sukul, N.C. P.K. Das and G.C.De. 1974. Nematicidal action of some edible crops. Nematologica, 20 : 187 - 191.

17. Thorne, G. 1952. Control of the sugar beet nematode. U.S. Dept Agric. Farmers Bull., 2054.

18. Triffit. M.J. 1929. Preliminary researches on mustard as a factor inhibiting cyst formation in *Heterodera schachtii.* J. Helminthol., 7 : 8-92 .

19. Triffit. M.J. 1930. On the bionomics of *Heterodera schachtii* on potatioes, with special reference to the influence of mustard on the escape of larvae from the cysts. J.Helminthol., 8 : 19-48 .

20. Uchida, Y.T. Takahashi, N. Sato, and J. Japan. 1975. The characterstcs of antibacterial activity of garlic. Antibiotic, 28 : 638 - 642 .

تأثير الثوم كمبيد نيماتودى ضد الاصابة بالنيماتودا ملودوجين انكوجنيتا للطماطم

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فى تجربة أصص بالصوبة – تم اختبار فعالية اربعة تركيزات مختلفة من مهروس الثوم وذلك مقاومة نيماتودا ملودوجين انكوجنيتا التى تصيب نبات الطماطم .

أظهرت النتائج ان التركيزات المختبرة لمهروس الثوم قد تسببت فى خفض اعداد النيماتودا وان هذا الخفض يتناسب طرديا مع الزيادة فى تركيز الثوم . وقد تراوحت نسبة الخفض فى عدد الانتفاخات النيماتودية واعداد النيماتودا بالتربة واعداد البيض لكل نبات على التوالى ما بين ٢٠٪ – ٧٢ ٪ وما بين ٢٣,٢ ٪ – ١٩,٧٪ وما بين ٢٣,٦٪ – ٧٤,٢٪ وذلك نتيجة المعاملة بالثوم . كما بينت النتائج ايضا التحسن المتزايد فى أوزان المجموع الخضرى للبناتات المصابة بالنيماتودا نتيجة التركيزات المتزايدة فى مهروس الثوم وذلك باستثناء الجرعة العالية (٢٠ جم لكل نبات). وقد تراوح معدل التحسن هذا ما بين ٥,٩٪ – ٢٣,٥ ٪ اضافة الى ذلك فقد ازداد معدل مقاومة النيماتودا زيادة ملحوظة مقارنة بالمعدل الناتج عند عدم استعمال تركيزت الثوم . وكذلك الحال بالنسبة لمعدل الزيادة فى النمو الخضرى للنباتات المصابة. وقد خلصت النتائج الى ان التركيز المتوسط لمهروس الثوم (١٥ جم / نبات) هو التركيز الامثل حيث ادى الى مقاومة النيماتودا بمعدل معقول بالاضافة الى احداث اعلى تحسن فى النمو الخضرى لنباتات الطماطم المصابة.