Influence of some plant extract, chemical and biological agents on Root-knot nematode *Meloidogyne javanica*

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Abstract:

Three plants extracts, Bio-health as bio-control and common nematicide Vaydate have been assayed to know their effect on Root-knot nematode (*Meloidogyne javanica*). Tomato seedlings used as host for nematode infection. Extract of chopped leaves of oleander (*Nerium oleander*), cloves of garlic (*Allium sativum*) and roots of Taget (*Tagetes erecta*) have been used as natural plant extracts. Results revealed that Vaydate was more effective in decreasing infection criteria. Taget and Garlic extracts, were more effective and reduced egg mass and Root-knot than Oleander extract and Bio-health, they have less effect

Keywords: Plant extract, Chemical and biological control, Meloidogyne javanica.

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Introduction:

The root-knot nematode (*Meloidogyne spp.*) *is* a common plant parasite that thrives in soils around the world and can severely damage root systems, thereby reducing plant health and productivity. As such, these parasitic nematodes cause economic hardships for those involved in the agricultural, horticultural, and other plant-related professions (18). Root-knot nematodes (*Meloidogyne spp*.) are among the most destructive of plant pathogens, and have been reported to account for approximately 50% of the plant damage caused by plant parasitic nematodes (16). They cause formation of root root-knots (knots) which restrict nutrient and water uptake and this subsequently leads to mineral deficiencies, wilting, and generalized reduction in plant growth, as well as a decrease in plant biomass (1).

There are many methods used for controlling, as well as management practices, to reduce the detrimental effects of *Meloidogyne spp.* Pesticides have been a traditional method of nematode control, but there are also biological and management practices that can be used to reduce nematode populations in infested areas.

A new approach that has been suggested to better understand nematode-plant interactions, and possible controlling of root-knot nematodes, includes using of plant extract as a repellant, disturbance or toxic substance against root-knot nematodes. Numerous plant species, representing 57 families, have been shown to contain Nematicides compounds (17).

Materials and Methods

1 - Preparation of extracts**:** Twenty-five gram of thoroughly washed and chopped leaves of oleander (*Nerium oleander*), cloves of garlic (*Allium sativum*), roots of Tagets (*Tagetes erecta),* were putted separately in an electric grinder in 100 mL of distilled water. These were then centrifuged and filtered through a Filter Paper and this was considered (100%). Then 50% of all plants have been used to test their effects on *meloidogyne javanica* nematode. Mixture of equal amount of each plant extract also used as different treatment.

2-Bio-control**:** Biohealth® product is used in this study it contains humic acid combined with a blend of *Trichoderma harzianum* strains, *Bacillus subtilis* and seaweed extract, which suppresses soil borne pathogens used as bio-control.

Figure 1: Biohealth®, Humintech GmbH Am Pösenberg 9-13, 41517 Grevenbroich North Rhine-Westphalia - Germany

3-Chemical control**:**

A- Common nematicide Vydate nematicide (100g oxamyl. L^{-1}): used as chemical control against Root-Knot nematodes.

B- Nematode source: 250 gm of infected tomato roots pure culture *meloidogyne javanica* of including root-knots are added to pods soil to resemble natural infestation in the fields.

C - Soil sterilization**:** Soil was sterilized by Formalin 1% (1liter/m^3) after sieving to discard stones and soil lumps, then it has been put on a thick layer of polyethylene. Formalin was mixed thoroughly with the soil which was covered by other pieces of polyethylene and closed tightly to prevent any escape of formalin. After 48 hours' soil was aerated for a week to overcome the remains of Formalin (12).

D- Tomato Seedling planting**:** Tomato seeds were sowed with peat moss in black plastic tray. The three tomato seedlings were transplanted when reached three true leaves they sowed in pots 20 cm in diameter containing sterilized soil and infested with 250 gm infested root as mentioned before, Pots were placed randomly in greenhouse, they irrigated when needed.

This experiment carried out in a greenhouse of the College of Agriculture, University of Duhok. This trial consisted of 28 experimental units (4 plant extracts + Bio-health + vaydate + control1(infested with nematode) + control2(Non-infested soil) × 4 replicates) conducted in Randomized Complete Block Design (R.C.B.D).

Data analyzed by SAS program, significantly ($p \leq 0,05$) different according to Duncan's multiple range test.

The criteria measured were as follows **:**

1- Number of root root-knots**:** number of root-knots on tomato root system calculated**.**

2- Root length**:** length of root in each treatment measured.

3- Root fresh weight**:** fresh roots from each experimental unit washed and cleaned well then were weight by using electronic scale.

4- Root dry weight**:** roots washed and cleaned well then were drying in an oven set to (40 C°) overnight then tacking their weight by using the electronic scale.

5- Number of egg mass / root system**:** egg mass stained in food color and calculated.

Results and Discussion:

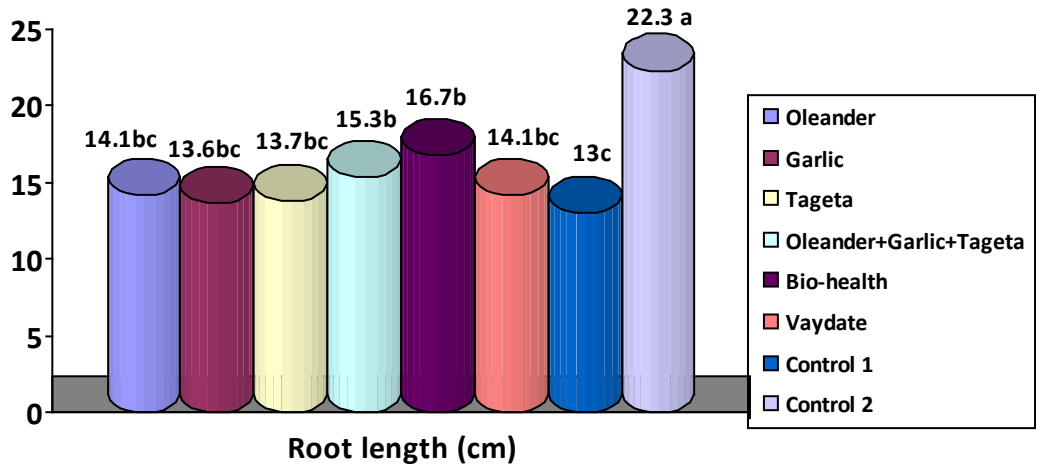
Results in table (1) shows that there are little differences between all treatments in fresh and dry weight of roots, but in general a fresh weight in non-infested control treatment, is less than treatment with infested soil by *Meloidogyne javanica* . Infection with root –knot nematode may cause a cell enlargement and form giant cells, which provide them with the nourishment needed (10). therefore, root size has increased by formation of root –knots. Fresh weight in vaydate treatment was 0.24 which is less than other treatments which were control2 (non-infested) 0. 40g, 0.47g, 0.67g and 0.77g in each of Oleander, Control1 and Tagets respectively. In the case of dray weight, all treatments almost were close to each other except the Vaydate which was recorded 0.07g.

Table 1: Effect of plant extracts, vaydate and bio-health on root fresh and dry weight.

Treatments	Fresh weight	Dry weight
Oleander	0.47	0.1 a
Garlic	1 a	0.17 a
Tagets	0.77 b	0.12 a
Control1	0.67 b	0.14 a
Control2	0.4 bc	0.1 a
O+G+T	1.1a	0.1 a
Vaydate	0.24 c	0.07 b
Bio-health	1.33 a	0.14 a

Figure 3 illustrated the effect of different treatments on root length. Control2 has recorded the highest length of root 22.3 cm because the healthy root can grow and develop without

Figure 3: influence of different control methods on Root length.



effect of nematode. Bio-health with its natural formulation has increased the soil fertility and helped microorganisms to improve soil fertility in combination of *trichoderma* which is consider as a good bio-control against root-knot nematode (5).

Regarding to the effect on root length, control1had less root length this may belong to the fact that the nematode has infected roots and increased population without any retardant.

Figure4 shows one of most important indicators of infection criteria which is egg mass , it was less with Vaydate 5 followed by Tagets which reduced egg mass to 7.08 which reported to be toxic to plant-parasitic nematodes (15). Also Tagets is known as a nematode allelopatic crop, particularly towards root-knot and has an effective role in the nematode control (3). Garlic also reduced egg to 8.04 comparing with control2, 30 egg mass. The essential oil of garlic and its volatile components that possess fumigant properties against several plant pests and pathogens have also been shown to suppress plant parasitic nematodes (4). Oleander also decreased egg mass to 25 Oleander has nematicidial effect and reducing number of juveniles (9).

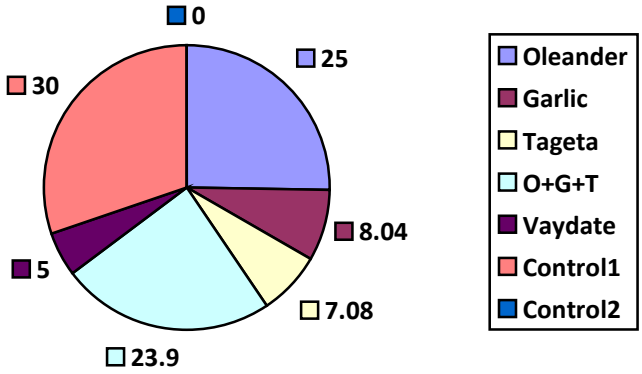


Figure 4: Effect of plant extracts, vaydate, Bio-health on number of egg masses on infected tomato roots.

Effect of treatments on number of root-knot (figure 5) which shows the influence of them on nematode activities and effecting root tissues. Results shows that vaydate was more effective, the root-knot decreased to 10 then Garlic 12.6 followed by Oleander 43.3 and Bio health 51.12.

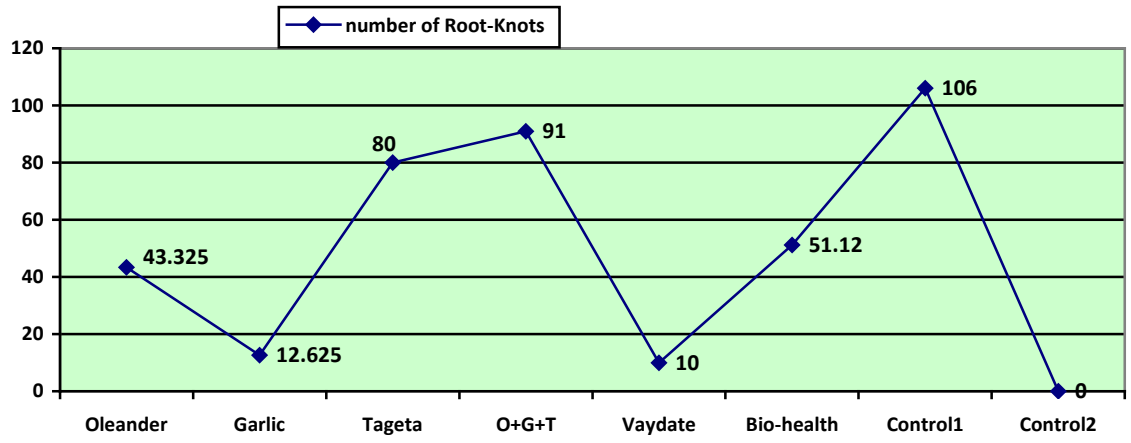


Figure 5: Effect of plant extracts, vaydate, Bio-health on number of root-knot on infected tomato roots.

Mixture of all three plants extract also reduced the number of root-knot to 91 comparing with 106 in control2.

Conclusion:

Results of this research revealed that vaydate was more active as common nematicide, but it should be taken in consideration economical aspect and environmental effect of pesticides. In addition to human health, we can see that plant extract and Bio-control can play an important role in decreasing the effect of Root-Knot nematode with less expenses and more eco- friendly as well as they are very easy to extract. Plant extract assayed

in this research show an effective influence against nematode infection.

References:

1- Abad, P.; B. Favery; M. Rosso and Castagnone P. S. 2003. Root-knot nematode parasitism and host response: molecular basis of a sophisticated interaction. Molecular and Plant Pathology,4:217-224.

2- Annigeri, S.; N.A. Pankaj; S. Kumar and Singh K. 2011. Effect of Jasmonate (Jasmonic acid) foliar spray on resistance in Tomato infected with Root-knot nematode, *Meloidogyne incognita,*. Indian Agricultural Research Institute, 19 (2):446-450.

3- Buena, A. P.; M. A. Diez ; J. A. Lopez ; l. Roberton ; M. Escuer and Bello A. 2007. Screening of *Tagetes patula* L. on different populations of *Meloidogyne.* 427. Crop Protection, 27: 96-100. Amsterdam, Netherlands.

4- Deisy X. A.; D. S. Guilherme ; H. F. G . Pedro ; G. C. N. Érica ; D. F. Leonardo; F. C Fernanda ; G. F. Leandro ; A. L. Everaldo and Silamar F . 2017. Effect of essential oils on the root-knot nematode management. Revista Agri-Environmental Sciences,3(1):2525-4804.

5- Edna S.; C. Ilan ; V. Viterbo; B. Meira ; N. Harel ; J. S. Gary and Yitzhak S.2007. Parasitism of *Trichoderma* on *Meloidogyne javanica* and role of the gelatinous matrix. Eur. J. Plant Pathol., 118: 247–258

Edna Sharon Æ Ilan Chet Æ Ada Viterbo Æ Meira Bar-Eyal Æ Harel Nagan Æ

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Edna Sharon Æ Ilan Chet Æ Ada Viterbo Æ Meira Bar-Eyal Æ Harel Nagan Æ

6- Farmer, E. E; Almeras, E. and Krisnamurthy, V.2003. Jasmonates and related oxylipins in plant responses to pathogenesis and herbivory. Curr. Op. Plant Biol.,6:372–378.

Gary J. Samuels Æ Yitzhak Spiege

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7- Gutjahr, C. and U. Paszkowski.2009. Weights in the balance: jasmonic acid and salicylic acid signaling in root - biotroph interactions. Mol. Plant–Microbe Interact., 22(7): 763–772.

8- Holshouser, D.; J Eisenach; P. Phipps and Moore D.2011. Soybean

Nematode Management Guide. Virginia Cooperation Extension, Virginia Tech. USA. pp 25-26.

9- Hussein, S. A.; A. A. Ali; H. Eshak; K. Khamees and Reski B. 2016. Activity of Plant Extracts against the Root-Knot Nematode *Meloidogyne Sp* on Tomato Plants. Directorate of Diyala Agriculture, Ministry of Agriculture, Iraq. Journal of Biology, Agriculture and Healthcare, 6(20):73-76.

10- John J.; G. Godlieve and Carmenl F. 2011. Genomics and Molecular Genetics of Plant–Nematode Interactions. Springer. Berlin. Germany**.** pp83 – 100**.**

Kuc, J. 2000. Development and future direction of induced systemic resistance in plans, Crop Protection, 18:859–861.

11- Mustafee, T. P. and S. B. Chattopadhyay. 1981. Fungicide control of soil inhibiting pathogens. *P*esticides 15:29-31.

12- Nandi, B.; N. C Sukul; N. Banerjee; S. Sengupta; P. Das and Babu, S. P. S. 2002. Salicylic acid enhances resistance in cowpea against Meloidogyne incognita, Phytopathol. Mediterranea, 41:39–44.

13- Naserinasab, F.; N. Sahebani and Etebarian H. R. 2011. Biological control of *Meloidogyne javanica* by *Trichoderma harzianum* BI and salicylic acid on Tomato, African Journal of Food Science,5(3):276 – 280.

14- Riga, E.; J. potter and Hooper, C. 2005. In vitro effect marigold seed exudates on plant 527 parasitic nematodes. Phytoprotection 86: 31–35. Québec, Canada.

15- Sasser, J. N and D. W. Freckman.1987. A World Prospective on Nematology: The Role of the Society, pp: 7–14 (in Vistas on Nematology, by J. A. Veech and D. W. Dickson. Society of Nematologists, Hyattsville, USA).

16- Sukul, N. C. 1992. Plant antagonistic to plant parasitic nematodes. Indian Review of Life Sciences, 12: 23 – 52.

17- Trudgill, D. L and V. C. Blok V.2001. A pomitic, polyphagous root-knot nematodes: exceptionally successful and damaging biotrophic root pathogens. Annual Review of Phytopathology,39:53–77.