Open Access

SCHOLARENA

Journal of Advancements in Plant Science

RESEARCH ARTICLE

Toxic Effects of Bitter Leaf Powdered (*Vernonia Amygdalina*) Del, on Root-Knot Nematode (*Meloidogyne Incognita*), Affecting Tomato (*Solanum lycopersicum*)

Abolusoro SA[1*], Izuogu NB[2], Abolusoro PF[3], Ige SA[1] and Adebiyi OTV[1]

[1]*Department of Crop and Soil Science, Landmark University, Omu-aran kwara state, Nigeria*
[2]*Department of Crop Protection, Faculty of Agriculture University of Ilorin, Nigeria*
[3]*Department of Agric Education, College of Education Technical kabba, kogi state, Nigeria*

[*]**Corresponding author:** Abolusoro SA, Department of Crop and Soil Science, Landmark University, Omu-aran kwara state, Nigeria, Tel: 08036811527, E-mail: stevabolusoro2005@yahoo.co.uk

Citation: Abolusoro SA, Izuogu NB, Abolusoro PF, Ige SA, Adebiyi OTV (2018) Toxic Effects of Bitter Leaf Powdered (*Vernonia Amygdalina*) Del, on Root-Knot Nematode (*Meloidogyne Incognita*), Affecting Tomato (*Lycopersicon Esculentum*). J Adv Plant Sci 1: 211

Article history: Received: 21 June 2018, **Accepted:** 29 October 2018, **Published:** 05 November 2018

Abstract

The toxic effects of bitter-leaf *Vernonia amygdalina* on root knot nematode (*Meloidogyne incognita*) was tested in screen house at Kabba College of agriculture, kabba kogi state, Nigeria, in July 2015 and repeated at the same time in 2016. Plastic pots 11- litres capacity were filled with stream sterilized sandy loam soil and arranged in the screen house in a complete random manner. Tomato (Var Roma VF was transplanted into each of the plastic pots three weeks after sowing. Each pot was inoculated with 2000 juveniles (j2) of *M. incognita* a week after transplanting. The treatments were made up to four levels 0.5, 1.0, 1.5 and 2.0 tones/ha of bitter leaf powder while there was an untreated control denoted by 0 tones/ha. The treatment was applied as soil amendment two weeks before transplanting. The experimental design was a completely randomized design. The experiment covers a period of six months. The result from the experiment showed that bitter-leaf powder brought about significant increases in growth and yield of nematode infested tomato as compared with the control at 10 and 12 weeks after planting (WAP). The growth parameter (height and leaf) were significantly higher in treated plants compared with untreated control. The nematode multiplication rate and root gall index were significantly reduced in treated plants than in control. Treatment at higher rate appeared to control the nematode more than at the lower rate which resulted in improved growth and yield of the treated plant compared with untreated control. The result of this experiment showed that, bitter leaf powder has a toxic effect on root knot nematode (M.incognita).

Keywords: Root-knot Nematode; Evaluation; Tomato; Bitter-leaf Powder; Growth; Yield

Introduction

Tomato *(Lycopersicion esculentum)* (L) is an important fruit vegetable widely consumed across the globe. The crop has an appreciable protein as well as vitamins A, C and D contents [1]. The yield is high in Europe, America and India but low in Nigeria as result of pest attack notable among which is plant parasitic nematode [2]. Damage on tomato by plant parasitic nematode usually results in serious yield reduction in addition to other visible physiological symptoms associated with the affected plants.

The root-knot nematode is prominent among the parasitic nematodes attacking crop, root-knot nematode are particularly damaging to vegetables in tropics and sub-tropical countries of the world and causes losses of up to 80% in heavily infested fields [3-5]. The attack of root-knot nematode on tomatoes is widespread and devastating, symptoms such as stunting, chlorosis, early senescence culminating in serious yield reduction are common (Richard and Nicola 1990).

Successful management of root-knot nematode with synthetic nematicides have been reported by several researchers, but the resultant consequences of their cumulative effects on plants man and ecosystem are becoming intolerable hence, alternative control of nematodes becomes imperative [6,7]. There is therefore an increasing needs to find a more effective and potent alternative to chemical nematicides to safe the ecosystem from pollutants resulting from the use of synthetic nematicides [8,9].

The potentials for nematicidal activity of indigenous plants and their products have been reported by reserachers (Olabiyi etal 2013) [10,11]. The nematicidal principles of plants origin in form of substances such as isothioyanates, thiophenics, glucocides,

alkaloids, phenolics, thiamins and fatty acids have been identified [12]. It is possible that there are plants that are yet to be tested for the presence of nematicidal component in them. This research work is therefore conducted to evaluate the effects of *V. amygdalina* leaf powder on the performance of root-knot nematode infested tomato and on the level of root damage (root gall index) [13].

Materials and Methods

Experimental site and design

The experiment was conducted in a screen house at kabba college of Agricluture, Ahmadu Bello University in the year 2015 between July and December and it was repeated at the same time in the year 2016. Steam-sterilized soil was filled into 11 litre capacity plastic pots and were arranged properly on a concrete floor of the screen house. The experimental design was completely randomized design comprising of five treatments and each replicated four times. Fresh *V. amygdalina* leaves were sun dried and milled into powder form.

Crop establishment

Tomato variety Roma VF was raised in stem-sterilized nursery soil and was transplanted into each of the pots already arranged in the screen house after a period of three weeks. Inoculation followed after two weeks of transplanting while treatment was applied by soil amendment prior to transplanting and incorporated into soil in pots at the rate of 0 (untreated control) 0.5,1.0,1.5 and 2.0 tones/ha. Weeds were controlled regularly by hand pulling while visual observation lasted for 120 days.

Data collection and analysis.

In the two years of the experiment, data were collected on plant height and number of at 8, 10 and 12 weeks after planting (WAP) while number of branches/plants was recorded at 14 WAP. At harvest, plants from each plot were carefully uprooted. Washed of adhering soil particles and rated for galling using infection class index of as described by Taylor and Saaser (1978)

Final nematode population was determine by the whitehead and hemming (1965) from 200g soil sample collected from around the root of plant that were uprooted, nematode population was determined by the method of Byrd *et al*, 1983. Analysis of variance was carried out on all data and where necessary means were separated using Duncan's multiple range test (DMRT).

Results

The effect of various level of leaf powder of *Venonia amygdalina* on the growth and yield of tomato variety Roma VF and on root-knot nematode infested soil are outlined in the Table1. The number of leaves, branches and height recorded were significantly higher ($P<0.05$) in the treated plant than in the control at 10 and 12 week after planting (WAP), while they were not significantly different at 8 WAP.

Bitter-leaf powder concentration	Average plant height 2015						Average number of plant leaves 2016					
t/ha	8WAP		10WAP		12WAP		8WAP		10WAP		12WAP	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
0.5	35.5	33.5	51.3b	56.31b	60.7b	61.0b	10.33a	9.38a	18.3b	12.67a	22.43b	22.31b
1.0	36.1	37.8	66.6bc	66.7c	71.0c	71.2c	10.00a	10.11a	18.67b	18.00b	23.07b	22.70b
1.5	38.1	38.9	68.0c	68.cd	77.7c	72.0c	9.30a	10.00a	20.00bc	20.00bc	24.69bc	24.70bc
2.0	38.7	39.0	70.3d	72.31d	72.3c	75.3d	10.00a	10.33a	22.00c	22.33c	27.03c	27.33c
0 control	35.4	38.1	41.7a	38.1a	45.0a	42.9a	7.33a	8.00a	12.00a	10.33a	13.50a	15.67a
S.E	N.S	N.S	2.173	3.106	2.438	2.593	2.96	2.53	1.96	1.88	1.85	1.89

Means with different alphabets in the same column differ significantly at P = (0.05) according to Duncan's multiple range test

Table 1: Effects of *Venonia amygdalina* (bitter-leaf) powder on the growth of M. incognita infested tomato Var. Roma Vf [21]

Generally, the higher doses of bitter leaf treatment were far more effective in increasing the number of leaves and branches per plant than lower doses (0.5 and 1tone/ha).

The various levels of bitter-leaf (*V.amygdalina*) treatment brought about varied soil population which in turn determines the multiplication rate, the various treatments levels also brought about varied population and gall indices (Table 3). The *V.amygdalina* treatments at 1.5 and 2.0 reduced the soil and root populations significantly compared with lower concentration of 0.5 and 0 1.0t/ha. Multiplication rate and gall index were also lower in soil with 1.5 and 2t/ha and significantly different from the treatments at lower concentrations. Final nematode population, multiplication rate and gall index were significantly less in all treated plants than in the untreated control.

Bitter-leaf powder concentration	Average number of fruit		Average yield per plant(g)		Yield (t/ha)	
t/ha	2015	2016	2015	2016	2015	2016
0.5	8.06b	8.50b	183.00b	194.67b	9.63b	8.74b
1.0	10.34bc	10.26c	236.67c	240.00c	10.39b	10.47c
1.5	10.68bc	10.44cd	259.37cd	262.00d	12.24bc	12.27d
2.0	11.12d	11.34d	278.33d	281.00e	13.20c	13.34e
0 control	4.79a	5.18a	49.99a	70.45a	2.40a	3.05a

Means with different alphabets in the same column differ significantly at P= (0.05) according to Duncan's multiple range test

Table 2: Effects of bitter leaf powered on yield component of *M. incognita* infested tomato (Var Roma Vf)

Neem concentratio	Initial nematode (pi) Population		Final nematode (pf0) population		Nematode (pf/pi×100) Multiplication rate		Root gall index Juvenile in 5g root		Juvenile in 5g root	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
0.5	2000	2000	783.33b	763.67b	38.60	37.50	2.70b	2.93b	13.67b	15.00b
1.0	2000	2000	737.33c	705.67c	35.06	35.01	2.60b	2.83b	11.67bc	13.00c
1.5	2000	2000	599.60	616.33d	29.06	30.06	2.47b	2.47b	9.00c	10.00d
2.0	2000	2000	503.67e	495.33e	25.30	24.98	2.37b	2.43b	7.00d	7.60e
0 (control)	2000	2000	2447.1a	2260.50a	123.00	117.2	4.50a	4.00a	27.00a	26.60a

Means with different alphabets in the same column differ significantly at P= (0.05) according to Duncan's multiple range test.

Table 3: Initial root-knot nematode population and effect of different levels of bitter leaf powder (*Venonia amygdalina)* leaf on the final nematode population, nematode multiplication and gall index of *M. incognita* infested tomato

Discussion

The result from this experiment showed that the root-knot nematode *M.incognita* affects the performance of tomato adversely as it brought about reduction in the number of leaves, branches and height of the untreated control plants compared with the treated ones. The improved growth observed in treated plants is a manifestation of the reduction in the adverse effects of the nematode (*M.incognita)* as a result of reduced population due to toxicity of *V. amygdalina* on nematode which in turn will reduce the adverse effects of the nematode on the plant promoting growth and development. The observed improvement on the growth and yield of *M. incognita* infested tomato treated with V. amygdalina may be due to negative effects of the plant materials on *M. incognita* this negative effect brought about positive growth index on *M. incognita* infested tomato. These type of control effects of V. amygdalina on the nematode pest of plants have been reported by many workers including oyedunmade (2004) Abolusoro(2006) Olabiyi ,*et al*., *Oyedunmade, et al.*, Abolusoro, *et al.* [2,14-16].

The negative relationship observed between nematode population and root gall index and those of growth and yield suggested that the damage was due to nematode density and their activities in plant tissue. Firoza and Maybool (1996), Abolusoro (2006) reported laboratory ovicidal action of *V. amygdalina* leaf extract which may be related to low nematode population build up in the field [15,16]. The active ingredient in bitter-leaf have been reported as Flavonoid (Bose, *et al.* 1973) sequiterpene lactone, steroid including lactone pyridine,quinolone and diterpnoid type, and alpha [18,19]. It is evident that the alkaloids, flavonoids and acid mentioned above from *V. amygdalina* leaves incorporated into the root-knot endemic soil suppressed population buildup of nematode and decomposition of plant materials will also improve soil fertility which could encourage crop growth and yield [20].

The significance of this study thus underscores the potency of V. amygdalina leaf as a viable alternative to synthetic chemicals for the control of root-knot nematode pest on susceptible crop.

References

1. Van ECKJ, Kirk DD, Walmsley AM (2006) Tomato (Lycopersicum esculentum). Method Mol biolo 343: 459-73.

2. Oyedunmade EEA, Abolusoro SA, Olabiyi TI (2009) Nematicidal activities of Cabofuran and some organic materials on plant parasitic nematode control on tomato. Int J Nematol 19: 96-102.

3. Sikora RA, Fernadez E (2005) Plant parasitic nematodes in subtropical and tropical agriculture. (2nd edn) CABI Publishing 319-92.

4. Alam MM, Ahmed M, Khan AM (1980) Effects of organic amendment on the growth and chemical composition of tomato, egg plant chilli and their susceptibility to attack by Meloidogyne incognita. Plant soil 57: 231-6.

5. Hoan LT, David RG (1979) Nematicidal properties of root extracts of seventeen plant species on Meloidogyne incognite phil. Agric 62: 285-95.

6. Kenmore P (1996) Integrated pest management on rice. In G Parsley, Biotechnology and Intergrated Pest Management, Wallingford, CAB International, UK.

7. Deant D, Waage J (1999) Wanted inventor in biological control. Pesticide news 45: 10-11.

8. Jackai LEN, Inang EE, Nwobi P (1992) The potential for controlling post-flowering pests of cowpea using Neem, Azadirachta indica A. Juss Tropical pest Management 38: 56-60.

9. Munford JD, Stone house JM (1994) Pest management policies and natural products as alternative; outlook on agriculture 78: 149-54.

10. Izuogu NB, Oyedunmade EEA, Usman AM (2012) Toxicity of aqueous and powdered sparrow grass, Asparagus Africanus to Meloidogyne incognita on eggplant. J Organic Agri Res Dev 5: 36-50.

11. Abolusoro SA, Abolusoro PF, Mattew FO, Izuogu NB (2013) Effects of organic and inorganic manures on the growth of root-knot nematode infested ethopian egg plant (Solanum aethiopicum). World J Agri Res 1: 104-7.

12. Fatoki OK, Fawole B (2000) Identification of nemticidal ingredient from neem leaves, siam weeds leaves and roots. African J Plant Prot 10: 33-38.

13. Ajayi VA, Akem CN, Adesiyan SO (1993) Comparison of nematicidal potentials of V. amygdalina leaf extract and yield of root-knot nematode infested soya bean. Afro-Asian J Nematol 3: 119-27.

14. Oyedunmade EEA, Olabiyi TI (2004) Toxic effects of butter-leaf *Vernonia amygdalina* Del to the root-knot nematode M. incognita. Nigeria Soci Exper Biol J 4: 115-21.

15. Abolusoro SA (2006) Nemticidal activities of some selected botanicals on a root knot nematode (Meloidogyne incognita) on tomato Lycopersican esculentum (L) A Ph.D thesis from University of Ilorin, Kwara State.

16. Abolusoro SA, Oyedunmade EEA, Olabiyi TI (2010) Evaluation of sweet orange agueous extracts (citrus sinensis) to root-knot nematode suppressant. J Tropi Agri Food Environ Exten 9: 170-3.

17. Egunjobi OA, Onayemi SO (1981) The efficacy of water extract of neem (Azadirachta indica leaf extracts on population of Pratylenchus brachyrus and the growth and yield of maize nematologica 16: 323-30.

18. Arene EO (1972) Stigmasadien from Vernonia amygdalina. Phytochemistry 11: 2886-7.

19. Okoro CE (1993) Development of HOP substitutes from tropical plants. J Agri Technol 1: 30-5.

20. Olabiyi TI (2004) Assessment of nematicidal properties of extract from tagets erecta, ocimum gratissimum,Hyptis suaveolens and crotalarca retusa. PhD Thesis submitted to department of crop protection, UNILORIN Nigeria 177.

21. Fatoki OR (2001) Comparative effects of Carbofuran and some selected plant on the biology and pathenogenicity of M. incognita on cowpea and tomato. Ph.D. Thesis department of crop protection and environemtal biology university of Ibadan, Ibadan Nigeria.