SCREEN-HOUSE EVALUATION OF THE NEMATICIDAL POTENTIAL OF BITTER-LEAF (*Vernonia Amigdalina*) DEL, ON ROOT-KNOT NAMATODE MELOIDOGYNE INCOGNITA ON TOMATO, (*Lycopersicon Esculentum*) (L) MILL

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ABSTRACT

The toxic effects of Bitter-leaf Veronica amygdalina on tomato were tested in screen house at Kabba college of Agriculture Kogi State Nigeria in July 2002 and repeated at the same time in 2003. Plastic pots 11-litre capacity was filled with steam sterilized sandy loam soil and arranged in the screen house. Tomato Var Roma VF were transplanted into each of the plastic pots 3-weeks after planting. Each pot was inoculated with 2000 juveniles of Meloidogyne incognita. The treatments were made up of four levels 0.5, 1.0, 1.5, and 2.0 tonnes/ha. The experimental design was a complete randomization. It lasted for 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 the control. Application of treatment at higher rates appears to control the nematode than lower rate which results in improved growth and yield of the treated plant compared with untreated control.

Key Words: *Root-knot, nematode, tomato, bitter-leaf powder growth,yield.*

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INTRODUCTION

Tomato, *Lycopersicon esculentum* (L) mill is a very important vegetable crop and it is widely eaten all over the world and it is grown for its edible fruits which can be eaten raw or cooked for stews, salads and processed into puree, soup, and ketchups. After processing oil can be extracted from the seed and the residual seed cake used for animal feeds, the average ripe fruit had been reported to contain 90 kilocalories of energy, 1.0g of crude protein, 24mg of phosphorous 0.4mg of riboflavin, 0.05mg of thiamin and 0.1mg of Niacin (Signund & Gustav, 1991).

In Nigeria, the yield of tomato is low as a result of attack by many pests notable among which are the root-knot nematode belonging to genus Meloidogyne (Verma & Anwar, 1997; Fatoki, 2001). There is an urgent need to increase tomato production in order to meet its dietary supply for the ever-increasing population all over the world. There is the need to contend with the menace of the root-knot nematode in tomato production.

The most effective and most rapid control for nematode is achieved by the use of chemical known as nematicides. However, this approach is responsible for significant ecological damage, serious human health problems and spiraling cost of production (Schillhorn Van Veen *et al*, 1997; Keemore (1996); Mumford & Stonehouse, 1994). There are several attractive alternatives which are subject to research and some have already been incorporated into commercial agriculture (Marrone, 1999; Dent & Waage, 1999). Besides their safety and specificity, some of these natural products offer an additional advantage of allowing farmers to maintain or produce their own pest control products rather than depending on out-side markets.

Maqbool *et al* (1987); Alam *et al* (1980); Derrico & Diamai (1980) have suggested the use of organic amendment for controlling nematode. Hoan and David (1979) have also suggested the use of plant extract for the control of root-knot nematode *Meloidogyne incognita.* Plant extracts and other related plant products are cheap and are readily available compared with conventional nematicide. Their environmental safety (Oyedunmade *et al,* 1995; Zurren & Onayemi, 1981), in an environmentally conscious world holds promise for their acceptability and use by resource constraint farmers. Natural plant products are at present in the focus of research efforts because of their ability to produce environmentally less harmful but efficacious chemical substances (Schmulterea, 1990). This would greatly minimize the use of toxic synthetic chemicals (Jackai *et al,* 1992).

This research work is therefore conducted to evaluate the effects of power leaf of *Veronica amygdalina* on the growth and yield of root-knot nematode infested tomato *Lycopersicon esculentum* Var Roma VF and on the root

and soil population as well as gall index of infested tomato growing in the medium treated with powder leaf of *Veronica amygdalina.*

EXPERIMENTATION

The experiment was conducted in a screen house at Kabba College of Agriculture Ahmadu Bello University in the year 2002 between July and December and it was repeated at the same time in year 2003. Steam-sterilized soil was filled into 1 litter capacity plastic pots and were arranged properly on a concrete floor of the screen house. The experimental design was complete randomization comprising 5 treatments and each treatment replicated 4 times.

Tomato Roma VF was raised in steam-sterilized nursery soil and was transplanted into each of the pots already arranged in the screen-house after a period of 3-weeks. Inoculation with 2000 juveniles of *M. incognita* followed after 2 weeks of transplanting while the powder leaf of *Veronica amygdalina* was applied by banding and incorporated into the soil in pots at the rates of 0 (untreated control), 0.5, 1.0, 1.5 and 2.0 tonnes/ha. Weeds were controlled regularly by hand pulling, while field observation lasted for 120 days. Plant height and number of leaves were recorded at 8, 10 and 12 weeks after planting (WAP) while number of branches/plants were recorded at 14 WAP. At harvest, plants from each plot were carefully uprooted, washed of adhering soil particles and rates for galling using infection class index of 0-5 described by Taylor and Sasser (1978).

Final nematode population was determined by the method of Whitehead and Hemming (1965) from 200g soil sample collected from around the root zone of plants that were up rooted. Root nematode population was determined by the method of Byrd *et al* (1993). Analysis of variance was carried out on all data where necessary, means were partitioned using Duncan's multiple range test (DMRT).

RESULTS AND DISCUSSION

The effects of various levels of powder leaf of *Veronica amygdalina* on the growth, yield of tomato Var Roma VF and on root nematode infested field are shown in table 1. The number of leaves, branches and height recorded were significantly higher ($P < 0.05$) in the treated plants than the control at 10 and 12 weeks after planting (WAP), while they were not significantly different at 8 WAP. Generally, the higher concentrations of Bitter leaf treatment (*Veronica amygdalina*) were far more effective in increasing the number of leaves and branches per plant than the lower concentrations (0.5 and 1.0t/ha).

Table 3 shows the analysis of variance on the effects of *V. amygdalina* treatment on the final population of nematode in the soil. The various leaves of Bitter-leaf (*Veronica amygdalina*) treatment brought about varied soil population which in turn determined the multiplication rate. The various treatment levels also brought about varied root population and fall indices. The *V. amygdalina* treatment at 1.5 and 2.0 that reduced the soil and root population significantly compared with lower concentrations of 0.5 and 1.0t/ha. Multiplication rate and gall index were also lower in soil treated 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 a treated plants than in the untreated control.

The observation from this experiment shows that the root-knot nematode *Meloidogyne incognita* affects the growth of tomato adversely as manifested in the number of leaves, branches and height of the untreated control plants compared with the treated ones. The improved growth observed in the treated plants is a manifestation of the reduction of adverse effects of nematode *M. incognita* as a result of reduced nematode. This reduction in adverse effect, in turn promoted growth and yield of the tomato. This observation is at par with that of other researches. Ajayi *et al* (1993). Abdir et al (1996) Egunjobi and Olaitan (1986), Verman and Anwar (1997) reported the importance of various soil amendments and plant materials incorporated into the soil in reducing nematode population build up in the soil and resultant increase in plant yield.

The *Veronica amygdalina* leaf treatment suppressed the root nematode population for treated tomato and gall index while they increased the growth and yield. The negative relationship observed between nematode population and root galling index and those of growth and yield suggests that the damage was due to nematode density and their activities in plant tissue. This observation agrees with Sasser *et al* (1975) who reported that high population of nematode species brought about a high negative correlation for density versus growth – index and yield factor.

The significance of this study thus underscores the potency of *Veronica amygdalina* leaf (Bitter-leaf) as a viable alternative to synthetic nematicide for the control of nematode pest on susceptible crops in all root-knot nematode endemic areas. The agrochemical companies can start extracting the bioactive chemical component present in the leaf and incorporating it into formulating nematicide of botanical origin because of their environmental friendly nature.

CONCLUDING REMARKS

From the result of the findings of this study, it is plausible to conclude that the use of bitterleaf in treating the peculiar disease of tomato is effective. The study proved that the multiplication rate and root fall index were significantly reduced in the treated plant than in the control.

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Table1: Effect of *Venonia amygdalina* (bitter –leaf) powder on the growth of tomato Var Roma VF infected with root-knot nematode *M. incognita*

Bitter leaf Powder Concentration	Average Plant Height						Average Number of leaves Plant					
t/ha	8WAP 2002	2003	10 WAP 2002	2003	12 WAP 2002	2003	8 WAP 2002	2003	10 WAP 2002	2003	12 WAP 2002	2003
0.5	35.5	33.3	54.3b	56.31b	60.7b	61.0b	10.33a	9.38a	18.33b	12.67a	22.43b	22.31b
1.0	36.1	37.8	66.6bc	66.7c	71.0c	712c	10.00a	10.11a	18.67b	18.00b	23.07b	22.70b
1.5	38.1	38.9	68.0c	68.3cd	71.7c	72.0c	9.30a	1.00a	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 same letter in the same column do not differ significantly according to Dunca's multiple range test at P = 0.05

Table 2: Effects of Bitter leaf Powder on yield component of Tomato Var Roma VF infected with *M. incognita*

Bitter Powder Concentration	Average Number of Fruit		Average Yield per Plant		Yield (t/ha)	
t/ha	2002	2003	2002	2003	2002	2003
0.5	8.06b	8.50b	183.00b	194.67b	9.63	8.74
1.0	10.34bc	10.26c	236.67c	240.00c	10.39	10.47
1.5	10.68cd	10.44cd	259.37cd	262.00d	12.24	12.27
2.0	11.12d	11.34d	278.33d	281.00e	13.20	13.34
0(control)	4.79a	5.18a	49.99a	70.45a	2.40	3.05

Figure with same letter in the same column do not differ significantly at p = 0.05 using Dunca's multiple range test

Table 3: EInitial Root-Knot Nematode Population and Effect of different levels of Bitter leaf Powder (*Venonia amygdalina*) leaf on final Nematode Population Nematode Multiplication and Gall Index of infected Tomato Root with *M. incognita*

Neem Concentration	Initial Nematode (Pi) Population		Final Nematode Population (Pf)		Nematode (Pf/Pi x 100) Multiplication Rate		Root Gall Index		Juvenile in 5g Root	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
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	2.83	11.67bc	13.00c
1.5	2000	2000	599.60d	616.33d	29.06	30.06	2.47b	2.47b	9.00c	10.00d
2.0	2000	2000	503.67e	495.33e	25.30	24.8	2.37a	2.43a	7.00d	7.60f
0(control)	2000	2000	244.1a	22.65a	1.23	117.20	4.50	4.00	27.00	26.60d

Means with same letter in the same column do not differ significantly at P = 0.05 according to Dunca's multiple range test