Screen House and Laboratory Assessment of Toxic Effects of Brimstone (Morinda Lucida) Leaf to the Root-Knot Nematode Meloidogyne Incognita

[1]Abolusoro,S.A, [2]Oyedunmade, E.E.A,[3] Olabiyi,T.I

Abstract

A screen house study was conducted using 2,0, 1.5, 0.5 and 0 t/ha of Morinda Lucida leaves as soil amendment to a soil infested with root-knot nematode, Meloidogyne incognita on which tomato var Roma UF was planted. A laboratory experiment was also conducted to investigate the effects of graded concentrations (0,25,50,5 and 100%) of the aqueous extracts of Morida lucida on egg-hatch of root-knot nematode, Meloidogyne incognita over a period of 7 days. The 0% concentration was the control. The result of the field experiment shows that Morinda lucida significantly reduced the root-knot nematode population in the soil and tomato root at the end of the experiment while it significantly increased growth(Plant height, number of leaves ad branches) and yield (average fruit weight and fruit yield) of tomato as compared with the control. The result of the laboratory experiment shows that all the different concentrations of Morinda lucida inhibited egg-hatch. The lower concentration 25% of the aqueous extract resulted in 95% egg hatch inhibition as 5% egg hatch was observed at Day 7 of the experiment, while the other concentrations produced 100% inhibition. However, in the control, at Day 7, 92% egg hatch was observed.

Introduction

The use of broad –spectrum chemical pesticides is responsible for significant ecological damage, serious human health problems, and spiraling cost of production, hence there is a need for alternative pests control methods which are farmer –based (Kenmore,1996). These management strategies would be adaptable and sustainable at affordable level of resource inputs at the farmer' disposal.

There have been widely reported instances of reduction of nematode population as a result of addition of large amounts of organic materials to the soil. These nematicidal plant materials include plant extracts (Oyedunmade, 1998, Akhtar and Mahmood, et al,1993).

This present study was therefore undertaken to assess the effects of brimstone Morinda lucida on the eggs of Meloidogyne incognita in the laboratory and to investigate the effects of incorporating the air-dried leaves of Morinda lucida into a root-knot nematode infested soil in the screen house and the consequent effects on the growth and yield of tomato grown on the infested soil.

Materials And Methods

Screen House Experiment

The trial was conducted in a screen house at Kabba College of Agriculture between the months of June and December, 2003. Tomato (cv.Roma) seeds were raised in sterilized nursery soil. The seedling at 3 weeks after planting (WAP) were transplanted into 11 litre-sized plastic buckets each of which was already filled with 15 kg sterilized soil and arranged on stands in the screen house. Each of the buckets contained one tomato seedling. The trial was replicated three times in a complete random manner. Each plant stand was in inoculated with 2000 juveniles 6 weeks after planting (WAP).

Fresh leaves of Morinda lucida were harvested, air-dried and ground into fine powder which was incorporated into each of the stands at 6 WAP as soil amendment at the rate of 0.5/ha, 1.0t/ha, 1.5/ha, 2.0t/ha while untreated control was denoted as 0t/ha. Data were collected on number of leaves, plant height, number of fruits, weight of one fruit, number of nematodes in 200g soil at the end of experiment, number of nematode juveniles in 5 gm root and gall index using a rating scale of 0-5 (Taylor and Saser, (1998). All data were subjected to analysis of variance and means separated by Duncan Multiple Range Test (DMRT).

Laboratory Experiment:

Five hundred grams (500g) of the leaves of Morinda lucida were added to 500ml of distilled water in 1 litre sized round bottom flask which was fixed to a reflux condenser so as to produce the water extract of **M. lucida**. The extraction was carried out for 3 hours. The extract was calculated to be 100% stock solution (500g of powder plant material into 500ml of water). Serial dilution was made with distilled water to produce 75,50 and 25 concentrations. Distilled water only served as 0% extract or control.

Eggs of Meloidogyne incognita were extracted using sodium hypochiorite (Hussey and Barker, 1973) from galled roots obtained from a culture of root-knot nematode M. incognita on tomato Lycopersicon esculentum. One hundred freshly extracted eggs were introduced into each of forty Petri dishes which were arranged in the laboratory at room temperature of 28°C. Twenty millimeters (20 ml) of

each of the concentrations (100,75,50,25 and 0% of the aqueous extract of Morinda lucida were added separately to eggs in the Petri-dishes. Each treatment was replication eight times.

Observations were made on egg hatch every 24 hours for 7 consecutive days. This was done by counting the number of second stage juveniles which emerged from eggs using a stereo-microscope (MIB mode). The data collected were analysed using analysis of variance (ANAVA). And means were separated by Duncans multiple range test.

Result And Discussion

The root knot nematode Meloidogyne incognita used in this study affected the growth and yield of tomato in the screen house (Table 1), Plant height, number of leaves, number of fruits and weight of a single fruit as well as the total fruit yield were significantly higher in the treated plants compared with the untreated control.

Table 1: Effect of Morinda Lucinda lucida leaf amendment on the growth and yield of root-knot nematode infected tomato.

Treatment Concentration	Average Plant height	Average number of Leaves at WAP	Average number of fruits/plant	Average weight of a single fruit (g)	Average fruit yield (t/ha)
2.0	76.0a	27.3a	145a	25.0a	14.2a
1.5	75.5a	26.0a	13.3ab	24.2a	...11.3a
1.0	75.3a	23.0b	11.0b	23.0a	9.4b
0(control)	35.7c	18.0c	3.7c	9.7b	2.0c

Means in the same column followed by different letter are statistically different at P =0.05 according to Duncan's multiple range test.

A tremendous improvement was observed in the plant height, number of fruits/plant, weight of a single fruit and fruit yield/ha as a result of amending the soil with Morinda lucida leaves. Plant height at 12 WAP varied from 75.3 – 78.0 in the Morinda lucida treatments as compared with 35.7cm in the contro. Average number of fruits/plants varied from 11.0 – 14.5 in M. lucida treatments while it

was 3.7 in the control. In the control, weight of a single fruit and average fruit yield/ha were 9.7g and 2.0t respectively while weight of a single fruit and average fruit/ha varied from 23.0 – 25g and 9.4 – 14.3t respectively in the M. lucida treatment.

The soil population of Meloidogyne incognita at harvest (final population) and number of juveniles/5g root sample as well as gall index varied significantly (P 0.05) between treatments (Table 2).

Table 2. Initial nematode population in the soil and effects of Morinda lucida leaf amendment on root gall index and nematode populations in the soil and tomato roots.

Treatment Concentration Of Morinda Lucida in (t/ha)	Initial nematode population/pot containing 15kg soil	Final nematode population/200 root	No of juveniles/5g	Gall index
2.0	2000	371a	7a	2.0a
1.5	2000	584a	9a	2.2a
1.0	2000	788c	10a	2.5a
0.5	2000	763c	12.6a	2.7a
0(control)	2000	4441d	24.7b	4.7b

Means in the same column followed by different letters are statistically different at P =0.05 letter according to Dunca, multiple range test.

The Morinda lucida treatments significantly reduced the final population of nematodes in the soil at harvest as well as number of juveniles/5hg tomato root samples and gall index as compared with the untreated control. Nematode population in the soil was 244 in the control, while it was 371,584,708 and 763 in 2.5,1.5,1.0, and 0.5/ha Morida lucida treatments respectively. The number of juveniles obtained rom 5g of rrot varied from 7.0 –12 .6 in the Morinda lucida treatments, while 24.7 juveniles were obtained from 5g of root in the untreated plant. Root gall index varied between 2.0 –2.7 for the M. lucida treatments, while the control recorded an average of 4.7, an indication that the roots were badly damaged.

All the different concentrations of M. lucida had significant levels of inhibitory effects on egg-hatch compared with the control. From Days 3 –7, the lowest concentration of 25% recorded 95% inhibition of egg-hatch while the higher concentrations (50,75 and 100%) of the aqueous extract of M. Lucida did not record a single hatch throughout the period of the experiment. On Days 5 –7, 92% egg hatch was observed in the control.

Table 3: Effects of Morinda lucida aqueous extracts on the egg-hatch of Meloidogyne incognita.

	Percentage egg-hatch						
Days Treatment	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
100	0b	0b	0b	0b	0b	0b	0b
75	0b	0b	0b	0b	0b	0b	0b
50	0b	0b	0b	0b	0b	0b	0b
25	0b	3b	5b	5b	5b	5b	5b
0(control	15.5a	34a	59a	78a	92a	92a	92a

Means in the same column followed by different letters are statistically different at P =0.05 according to Duncan's multiple range test.

Plant height, number of leaves, number of fruits and fruit yield were significantly better in the treated plants than in the control. This may be related to better water and nutrient uptake as a result of nematode control by Morinda lucida. This type of improvement in crop growth as a result of root knot nematode control has been reported by earlier workers including Alam (1975) and Babatola (1988).

The lower root gall indices observed in all the Morinda lucida treated plants and reduction in the number of soil and root populations of M. incognita indicate control of root knot nematodes by Morinda lucida. The observed improvement in the tomato growth and yield may be related to the fewer number of nematodes that were found in the roots and in the treated plants. The reduction of both the root and soil population of the nematode may also be associated with the reported inhibitory effects on the nematode egg-hatch. Similar finding have reported inhibitory effects on the nematode egg-hatch. Similar finding have been reported by Oyedunmade et al 1995.

From this study, Morinda lucida holds promise as a neutral botanical pesticide for the effective control of root knot nematode Meloidogy incognita in M. incognita –endemic areas.

References

Aktar M and M.M Alam (1992) Effect of crop residue amendments to soil for the Control of plant parasitic nematodes. Bio Resources Technology,41.83.

Aktar, M, and T. Mahmood (19945). Impact of organic and inorganic management and Plant based product on plant parasitic and Microbivorous nematode communities Nematol, medit 25;21 –23.

Alam M.M (1975). Inhibitory effect of the root-knot nematode, Meloidogyne incognita In W. Nigeria. Niger J. Agric 1.1, 165 –169.

Babalolaa, J.O (1988) Nematode control in the rehabilitation of plantain. Musa sp. Pak.J Nematol 6:23 –30

Husssey, R.S and K.R Barker (1973). Aa comparison of methods of collecting inocula of M.incognita including a new technique. Plant Disease Rept. 52 1023.

Kenmlre, P.(1996). Integrated Pest Management in rice. In G.persley led Biotechnology And Integrated Pest Management. Walling Ford.CAB International.

Nidiry, E.S,J R.MKhsn and P.P Reddy (1993). Invitro nematicidal activity of Gloriosa Superba seed extracts against M.incognita. Nematal. Medit. 21:127-128.

Oyedunmade, E.E.A (1998). Control of nematoe pests of cowpea with mocap (ethotrop) And leaf residues of neem (Azadirachta indica) rattle weed (Crotalaria retusa) And nitta (Hyptis suavalensis). Centre point 8 (1) 57 – 63.

Oyedunmade E.E.A,J.O Babatola and T.I Olabiyi (1995). The effects of two crop residue on nematodes in cowpea cultivation. Ne,atoll. Nematol. Medit 23 – 64.

Taylor; A.L and J.N Sasser (1998). Biology, identification and control of root-knot Nematode, Meloidogyne species. North Carolina University, Graphic Press, 111p.