Original Research Article

NEMATICIDAL ACTIVITY of *Aloe vera* EXTRACT/EXUDATES ON ROOT-KNOT NEMATODES (*M. incognita)* ASSOCIATED WITH TOMATO *(Lycopersicun esculentum*) PLANT GROWTH PARAMETERS.

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ABSTRACT- Nematicidal activity of *Aloe vera* plant at different concentration treatments were evaluated to determine its effect on root-knot nematode. The study was conducted in the Federal College of Forestry Jos, Plateau State of Nigeria between March and May, 2017. Nematicidal activity of *Aloe vera* was tested on tomato associated with *M. incognita* using 80mg/ml, 70mg/ml, 60mg/ml, 50mg/ml and 40mg/ml. Three (3) blocks in area of about $300m^2$ partitioned into five (5) plots with 1m alley each in-between plots and blocks and each plot was about $50m^2$ for one (1) treatment between the tested nematicidal extract. Modified Baermann Funnel Method was used for nematode extractions and 70% ethanol was used for *Aloe vera* analysis. A complete randomized design (CRD) was used and data collected were analyzed using analysis of variances (ANOVA) to determine the significant differences. The results showed that there was a significant different at $p \leq 0.05$

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level in nematode population and improved tomato growth and yield, the highest concentration in reducing the population numbers of the *M. incognita,* improving tomato plant growth parameters is the 80mg/ml and the order of performance are 80mg/ml > 70mg/ml > 60mg/ml > 50mg/ml > 40mg/ml respectively. 80mg/ml treatments on tomato plant height in week one results in (18.00) which was higher in week three (26.00) when compared with 40mg/ml treatments in week one (8.00) and week three (13.00). Finally, the results obtained could be an outcome of the nematicidal contents of the extracts in inhibiting nematodes, *Meloidogyne incognita* proliferation and can be used as a bio-control agent.

INTRODUCTION

Tomato *(Lycopersicun esculentum*) is an edible red fruit of *Solanum lycopersicum*, belongs to the nightshade family Solanaceae, one of the most important tropical vegetable crop widely used throughout the world. In recent years, root-knot nematodes *Meloidogyne* spp. problem has become a threat to tomato cultivations. Yield loss due to nematode cause diseases to nearly all plant crops of Economic importance with estimated losses of US $125 billion per year World-Wide [3]. They can cause significant plant damage ranging from negligible injury to total destruction of plant materials. Nematodes had long been known to attack crops but had been studied less than the insects, this is because of their minute nature [9]. Control of root-knot nematodes has been primarily accomplished through chemical nematicides. However, indiscriminate use of chemical pesticides causes great threat to human being, animals, vegetation and to the environment as a whole due to their non target effect, hazardous nature and besides they are expensive.

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So with the increasing awareness of possible deleterious effects of the chemicals, biological controls of plant pathogen have received considerable attention [4]. Leaf of *Aloe vera* extracts apply directly to the soil will tend to offer a more nematode control, environmentally friendly and chemical-free possibilities as there is an urgent need to replace pesticides with alternative means of control that are less toxic and more environmentally friendly. Many investigators had managed root-knot nematodes by using some plant dried powder of certain ornamental plants [5]; [2]; [6]; [1], studied the nematicidal effect chopped pine-apple (*Annanas cosmos*) leaves used as organic amendment against *Meloidogyne* spp. Some of the plant species and parts antagonistic to *Meloidogyne* spp. are the leaves and flowers of marigold (*Tagetes* sp).

In this research, activity of the leaf extracts of *Aloe vera* is study as nematicides for the control of root-knot nematodes, *Meloidogyne incognita* attacking tomato.

Statement of the Problem

Root-knot nematodes are very distinctive because of the galls or swelling produced on roots and underground portion of stems. These deformations can often completely ruin crops for sales and consumption. If infested when young, the following will be observed: stunted growth, more susceptible to draught, stress and show symptoms of nutrients deficient. Large and small roots may be affected with swelling varying from round shaped sphere-like galls to elongated spindle from large numbers of individual galls growing together. Nematode management is generally based upon chemical treatments (Soil fumigation) but environmental concern and Governmental regulations are now resulting in a strong interest on nematicides of natural origin.

Aim of the study

The aim of this study is to evaluate the efficacy of nematicidal effect of *Aloe vera* on root-knot nematodes affecting tomatoes

The specific objectives are;

i. To extract and identify parasitic nematodes associated with tomato

ii. To determine the nematicidal effect of *Aloe vera* extract on root-knot nematodes associated with tomato on plant height, root length, shoot weight, yield and nematode populations

MATERIALS AND METHODS

The study was carried out in chemistry laboratory of Federal College of Forestry, Jos.

The materials used are as: tomato (infested), roots (galled), soil, *Aloe vera* (60g), seedlings of tomato, funnel, cotton wool, masking tape, test tubes with connecting pipe, beakers, table with perforated holes for connecting pipe attached unto test-tubes, collecting beakers, centrifuge machines, microscope, microscopic slides, teasing pins, petri-dish and Cover slips. Suspected tomato plant was collected from farms, transplanted and planted in the nursery. The nematode were extracted and identified. The infested young plant which showed sign of stunted growth and scanty leaves were used for the nematode extraction. The extraction of the root-knot Nematodes was done using the Modified Baermann Funnel Method [8]. Nematodes were identified under the electron microscope. Leaf extracts was prepare from fresh *Aloe vera* plant and line from healthy living plants, they were cut vertically as reported by [7]. Varied concentrations of 80, 70, 60, 50 and 40mg/ml of the leave Extracts were prepared. There were three blocks in area of about

92 300m^2 partitioned into five (5) plots with 1m alley. Each plot was 50m^2 for one treatment
93 between the tested nematicidal extract. This treatment was added at one rate of
94 applications, each of the *Aloe vera* plants extract of varied concentrate 80mg/ml, 70mg/ml,
95 60mg/ml, 50mg/ml, 40mg/ml, control and four hundred (400) total numbers of the
96 estimated nematode extract were thoroughly mixed with the soil to which the transplanted
97 tomatoes were planted.

98 **RESULTS AND DISCUSSION**

99 The results in Table 1 shows the characteristics features for the identifications of both
100 juvenile and adult (male and female) root-knot nematodes *Meloidogyne incognita* when
101 viewed under the microscope.

102 **Table 1: Identification of nematodes**

Nematode	Features of nematode seen on microscope
Juvenile	- Head not offset with truncated cone shape when viewed laterally. - Stylet knob is prominent and rounded.
Adult male nematode	- The head is not offset with a high truncate cone shape. - The head cap is clearly annulated. - The head cap is with stepped outline in lateral view. - Annule number behind head cap very variable usually 1-3 on sub-lateral head sector. - Conus of stylet longer than shaft. - Stylet knob is prominent usually of greater width than length with flat concave or toothed anterior.
female Adult nematode	- The body is spherical with projecting neck. - Head with 2 or 3 annule behind the head cap. - The cuticle thickening at base of relaxed stylet. - Stylet knobs are drawn out laterally. - Dorsal arch is high and rounded.

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The results in Table 2 shows the effect of *Aloe vera* extract on tomato plant height for week 1 to 3, highest mean value was recorded with 80mg/ml whose performance was taller at week 1 (18.00) and week 3 (26.00) when compared with control at week 1 (7.00) and week 3 (12.00).

Table 2: Nematicidal effect of *Aloe vera* extract on tomato plant height for week 1-3

Treatment (mg/ml)	Plant height (cm)		
	Week 1	**Week 2**	**Week 3**
80	18.00[a]	21.00[a]	26.00[a]
70	13.00[b]	20.00[a]	24.00[a]
60	12.00[b]	17.00[b]	19.00[b]
50	10.00[bc]	15.33[b]	17.00[bc]
40	8.00[c]	11.00[c]	13.00[cd]
Control	7.00[c]	10.00[c]	12.00[e]
SE±	**1.00**	**0.79**	**1.41**

Mean followed by the same superscript in a column are not significantly different from each other.

The results in Table 3 shows the effect of *Aloe vera* extract on tomato root length for week 1 to 3 highest mean value was recorded with 80mg/ml whose performance was longer at week 1 (9.00) and week 3 (12.00) when compared with control at week 1 (1.27) and week 3 (4.00).

Table 3: Nematicidal effect of *Aloe vera* extract on tomato root length for week 1 to 3

Treatment (mg/ml)	Root length (cm)		
	Week 1	**Week 2**	**Week 3**
80	9.00[a]	11.00[a]	12.00[a]
70	5.00[b]	8.00[b]	10.00[ab]
60	4.00[bc]	5.00[c]	8.00[bc]
50	2.00[cd]	4.00[cd]	7.00[bcd]
40	2.00[cd]	3.00[cd]	5.00[cd]
Control	1.27[d]	2.00[d]	4.00[d]
SE±	**0.67**	**0.82**	**0.94**

Mean followed by the same superscript in a column are not significantly different from each other.

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The results in table 4 shows the effect of *Aloe vera* extract on tomato shoot weight for week 1 to 3, highest mean value was recorded with 80mg/ml whose performance was higher at week 1 (0.40) and week 3 (0.80) when compared with control at week 1 (0.11) and week 3 (0.30).

Table 4: Nematicidal effects of *Aloe vera* extract on tomato shoot weight for week 1-3

Treatment (mg/ml)	Shoot weight (g)		
	Week 1	**Week 2**	**Week 3**
80	0.40[a]	0.70[a]	0.80[a]
70	0.21[b]	0.50[b]	0.60[b]
60	0.11[c]	0.22[c]	0.40[c]
50	0.11[c]	0.21[c]	0.30[c]
40	0.11[c]	0.11[c]	0.30[c]
Control	0.11[c]	0.11[c]	0.30[c]
SE±	**0.02**	**0.34**	**0.06**

Mean followed by the same superscript in a column are not significantly different from each other.

The results in Table 5 shows the effect of *Aloe vera* extract on tomato yield for week 1 to 3, highest mean value was recorded with 80mg/ml whose performance was good at week 1 (6.00) and week 3 (6.00) when compared with control at week 1 (6.00) and week 3 (6.00).

Table 5: Nematicidal effect of *Aloe vera* extract on tomato yield for week 1 to 3

Treatment (mg/ml)	Yield		
	Week 1	**Week 2**	**Week 3**
80	6.00[a]	6.00[a]	6.00[a]
70	4.00[ab]	4.00[ab]	4.00[ab]
60	4.00[ab]	4.00[ab]	4.00[ab]
50	3.00[ab]	3.00[ab]	3.00[ab]
40	2.00[b]	2.00[b]	2.00[b]
Control	6.00[a]	6.00[a]	6.00[a]
SE±	**1.00**	**1.00**	**1.00**

Mean followed by the same superscript in a column are not significantly different from each other.

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The results in table 6 show the effect of *Aloe vera* extract on tomato nematode population for weeks 1 to 3, highest mean value of mortality rate of nematode population with sample treated with 80mg/ml in week 1 (120.00) and week 3 (0.14) when compared with control of week1 (0.14) and week 3 (0.14).

Table 6: Nematicidal effect of *Aloe vera* extract on tomato nematode population for weeks 1 to 3

Treatment (mg/ml)	Treatment at weeks 1 to 3		
	Week 1	**Week 2**	**Week 3**
80	120.00[c]	60.00[e]	0.14[e]
70	150.00[c]	120.00[d]	40.00[d]
60	250.00[b]	150.00[c]	108.00[c]
50	300.00[b]	288.00[b]	150.00[b]
40	401.00[a]	350.00[a]	300.00[a]
Control	0.14[d]	0.14[f]	0.14[e]
SE±	**20.00**	**9.04**	**7.27**

Mean followed by the same superscript in a column are not significantly different from each other.

Conclusion

The results obtained could be an outcome of the nematicidal content of the extracts which killed nematodes, the effect of the different extracts of the botanical on the performance of tomato was significantly different at 5% level of probability. Tomato crop treated with different concentration recorded taller plant, longer root, higher shoot weight, high yield and higher mortality rate of nematode recovered from soil due to the nematicidal or nemostatic effect of the extract.

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