

NEMATICIDAL POTENTIALS OF TWO BOTANICALS IN THE MANAGEMENT OF
ROOT – KNOT NEMATODE (*MELOIDOGYNE INCOGNITA*) INFECTING TWO
VARIETIES OF CUCUMBER (*CUCUMIS SATIVUS* L.)

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ABSTRACT

The experimental trial was conducted at the Teaching and Research Farm, Faculty of Agriculture, University of Ilorin in 2015 cropping season to investigate the nematicidal efficacy of *Solanum torvum* and *Tithonia diversifolia* on root-knot nematode infecting two Cucumber varieties; Cucumber – beth alpha and Cucumber Marketmore 76. Initial soil nematode population was increased by incorporation of *Meloidogyne incognita* infected galled root of *Celosia argentea* into the ploughed and harrowed field. The experiment was a factorial type fitted into a Randomized Complete Block Design (RCBD) and replicated four times. Data collection on plant growth commenced two weeks after planting. The fruits were harvested at maturity. Root systems were rated for galling and the initial and final nematode population present in the soil were identified and enumerated. Phytochemical screening was carried out to determine the bio- active ingredients present in the botanicals. All numerical data were subjected to two – way analysis of variance and treatment means separated with Duncan’s multiple range tests at $P < 0.05$. Results obtained revealed that treated plants were performed significantly higher than their control counterparts especially with respect to yield, reduction in soil nematode population and root gall index. Phytochemical result showed that both *Solanum torvum* and *Tithonia diversifolia* contain bio- active ingredients such as alkaloids, tannins, saponin, phenols and terpenoids that are capable of reducing the pathogenicity of root-knot nematode and improving growth and yield.

Key words: *Meloidogyne incognita*, *Solanum torvum*, *Tithonia diversifolia* , Phytochemical screening, Bio-active ingredients.

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is an important vegetable and its production is seriously threatened by root-knot nematodes *Meloidogyne* spp. (Sikora and Fernández, 2005). The root-knot nematode (RKN), *Meloidogyne* spp., is one of the most damaging agricultural pests attacking a wide range of crops (Sahebani and Hadavi, 2008; Wesemael et al., 2011) and it can cause dramatic yield losses, mainly in tropical and sub-tropical agriculture (Kiewnick and Sikora, 2006; Moens et al., 2009). Rootknot nematodes infect economic important plants in Nigeria especially vegetables. General symptoms of nematode infection include chlorosis, wilting, galling of roots and tubers, stunted growth, root lesion and yield loss. RKN is the most common species and perhaps the most damaging pathogen in greenhouses (Dong et al., 2012). RKN has usually been managed with chemical nematicides for decades. However, the negative impact on the environment and humans has led to a total ban or restricted use of most chemical nematicides (Zukerman and Esnard, 1994). With increased pressure on growers to reduce nematicides usage, there is great interest in biological control as a management tool for this destructive pathogen and for sustainable food production. Biopesticides of botanical origin have become the focus of attention nowadays, i.e by facing the nematode problems in an eco – friendly manner (Siddiqui et al., 2005, Izuogu, 2012). The employment of phytochemicals in food production could offer another sustainable management option due to the presence of nematocidal properties in many higher plants (Chitwood, 2002). Many plants and plant products when applied in soil are known to cause reduction in the nematode population below damaging level. The main objective of this study therefore is to evaluate the efficacy of two botanicals (*Tithonia diversifolia* and *Solanum torvum*) in the management of root-knot nematodes on two Cucumber varieties.

MATERIALS AND METHODES

The research was conducted during the 2015 cropping season at Teaching and Research Farm, University of Ilorin, Ilorin, Kwara State, in the Southern Guinea Savanna, ecological zone (8° 29' N 4° 32' E) of Nigeria. The farm land is about 307 meters above the sea level and the area is characterized with wet sandy loam soil and a temperature of 19°C to 33°C. Before planting, there was an initial build up of Inoculum (root-knot nematodes) on the piece of land which was achieved by incorporating M, incognita chopped galled root after ploughing and harrowing the land. Soil samples were taken in zig-zag pattern across the plot from 0 - 20cm depth for initial and final nematode populations. Composite soil samples collected per plot were gently mixed and two hundred grams (200g) sub soil was taken for nematode assay. Using the modified Baermann's technique described by Whitehead and Hemming (1965), nematodes were enumerated and identified and was further taken to International Institute for Tropical Agriculture Ibadan for confirmation. Thereafter, the field measuring 28m× 20m was mapped in a factorial experiment, fitted into a Randomized Complete Block Design (RCBD) and replicated four times. Three seeds were planted per hole at 1.5 cm depth and later thinned to two seedlings per stand at two weeks after planting (2WAP). This was followed by application of aqueous leaf extracts i.e treatments at 50% and 100% levels at first and second months after planting. Cultural practices such as regular weedings were maintained. Phytochemical screening of the two botanicals was conducted standard methods to identify the bio-active compounds of nematocidal importance. Data collection began 4weeks after planting (4WAP) on weekly basis up to the time of harvest. Parameters measured at various periods included initial soil nematode population, vine length, number of fruits, fruit weight, final nematode population and gall rating was done using the method described by Bridge and Page, (1980). The data collected were then subjected to analysis of variance and the significant means were separated using the new Duncan's multiple range test at $p < 0.05$.

Table 1: Effect of treatment levels on the mean vine length of two Varieties of Cucumber in Infected Nematode Field.

Cucumber (Beth alpha) WK8	WK4	WK5	WK6	WK7	
STLE 50% 84.9b	16.33b	36.3b	73.5b	81.9b	
STLE 100%	16.8a	51.3a	74.4b	83.9b	85.3b
TDLE 50%	16.3b	45.0a	71.0b	79.2b	80.5b
TDLE 100%	19.2a	48.0a	88.5a	94.2a	94.0a
Control 0%	14.8b	31.8b	70.5b	75.6b	76.9b
SED	0.596	3.06	2.94	2.64	2.43
Cucumber (Marketmore 76)					
STLE 50% 81.8b	18.00b	35.6b	65.3b	79.2b	
STLE 100%	19.48a	37.0b	74.8b	80.1b	82.9b
TDLE 50% 81.6b	18.68b	40.8b	72.3b	74.7b	
TDLE 100%	20.23a	59.7a	85.6a	92.2a	93.7a
Control 0% 69.1b	17.70b	33.0b	60.0b	66.4b	
SED	0.422	6.27	6.02	5.42	4.98

Figures with the same letter and in the same column are not significantly different. The means are separated using new Duncan’s Multiple range test at P= 0.05

STLE = Solanum torvum leaf extract TDLE =Tithonia diversifolia leaf extract

Table 2: Effect of treatment levels on the mean fruit yield and fruit weight of two Varieties of Cucumber in Infected Nematode Field.

Cucumber (beth alpha)	Number of fruit (Kg)	Fruit weight (Kg)
STLE 50%	9.50b	1.425b
STLE 100%	10.25b	1.675b
TDLE 50%	8.50b	1.400b
TDLE 100%	17.00a	2.775a
Control 0%	7.00c	1.077b
SED 0.567 2.275		
Cucumber (Marketmore 76)		
STLE 50%	5.75b	0.900c
STLE 100%	10.75a	2.775a
TDLE 50%	4.75b	0.650c
TDLE 100%	12.25a	1.650b
Control 0%	3.25c	0.1523cd
SED	0.0235	0.014

Figures with the same letter and in the same column are not significantly different. The means are separated using new Duncan's Multiple range test at $P=0.05$

STLE = Solanum torvum leaf extract TDLE =Tithonia diversifolia leaf extract

Table 3: Initial and Final Nematode populations

TREATMENT	INP	FNP
Cucumber beth alpha treated	190.4a	58.45a
Cucumber beth alpha Control	204.50b	334.5b
Marketmore 76 treated	204.5b	64.70a
Marketmore 76 Control	268.20c	332.50b
SED	0.053	0.001

Figures with the same letter and in the same column are not significantly different.. The means are separated using new Duncan's Multiple range test at P= 0.05

STLE = *Solanum torvum* leaf extract TDLE = *Tithonia diversifolia* leaf extract INP=Initial Nematode Population and FNP=Final Nematode Population

Table 4: Gall rating index

TREATMENT	Gall Rating
Cucumber beth alpha treated	5
Cucumber beth alpha Control	8
Cucumber Marketmore 76	5
Cucumber Marketmore 76 control	8

Means in each column followed by the same letters are not significantly different. The means are separated using new Duncan's Multiple range test at P= 0.05

DISCUSSION AND CONCLUSION

Results show that *Solanum torvum* and *Tithonia diversifolia* leaf extracts significantly increased the growth, yield and reduce Nematode population densities in the soil and roots of the varieties Cucumber when compared with the untreated plants in table 1 and 2, this was buttressed by the findings of (Izuogu et al., 2012) Cucumber beth alpha had performed better in yield than Cucumber marketmore. The untreated control plants recorded significantly higher soil nematode population and root galls at harvest in table 2 and 3.

The reduction in Nematode population in table 3 could be attributed to effect of the aqueous leaf extract used and probably as a result of inhibition of Nematode multiplication by reducing number of eggs by female root-knot nematode due to the nematostatic effect of the botanicals. The higher yield recorded by Cucumber beth alpha could be traced to tolerance of this variety to *M. incognita* and possible higher absorption of nutrient which resulted to sturdy and healthier plants with high yield. Phytochemical revealed secondary metabolites in the two botanicals such as alkaloid, flavonoid, tannin, saponin and phenols. These may have played a reducing role in soil nematode population, consequently improved the growth and yield of Cucumber varieties tested. However, the higher concentration of the treatments gave better results in terms growth and yield. The same trend was followed with respect to reduction of soil nematode population ie the higher the level of treatment the higher the mortality of *M. incognita*. It can be deduced from the study, that of the two treatments, *Tithonia diversifolia* generally performed better than *Solanum torvum* especially if combined with Cucumber beth alpha on nematode endemic locality.

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