Comparative effects of Biological and Synthetic Nematicides in the Management of Nematode Pests of Okra

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TRANSFORMING AGRICULTURE IN AFRICA
AGROECOLOGY and ORGANIC TRADE
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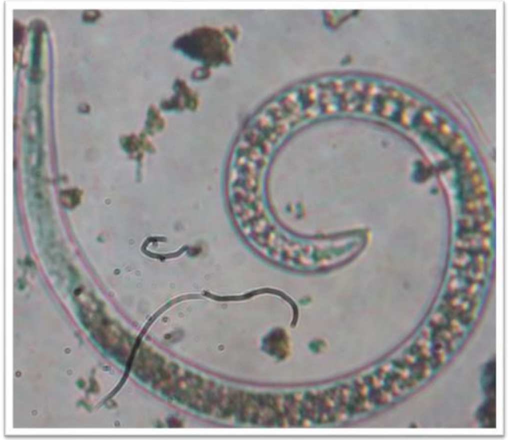
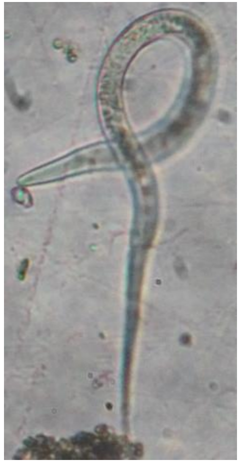
“ Nematode: The Farmers’ hidden enemy ”

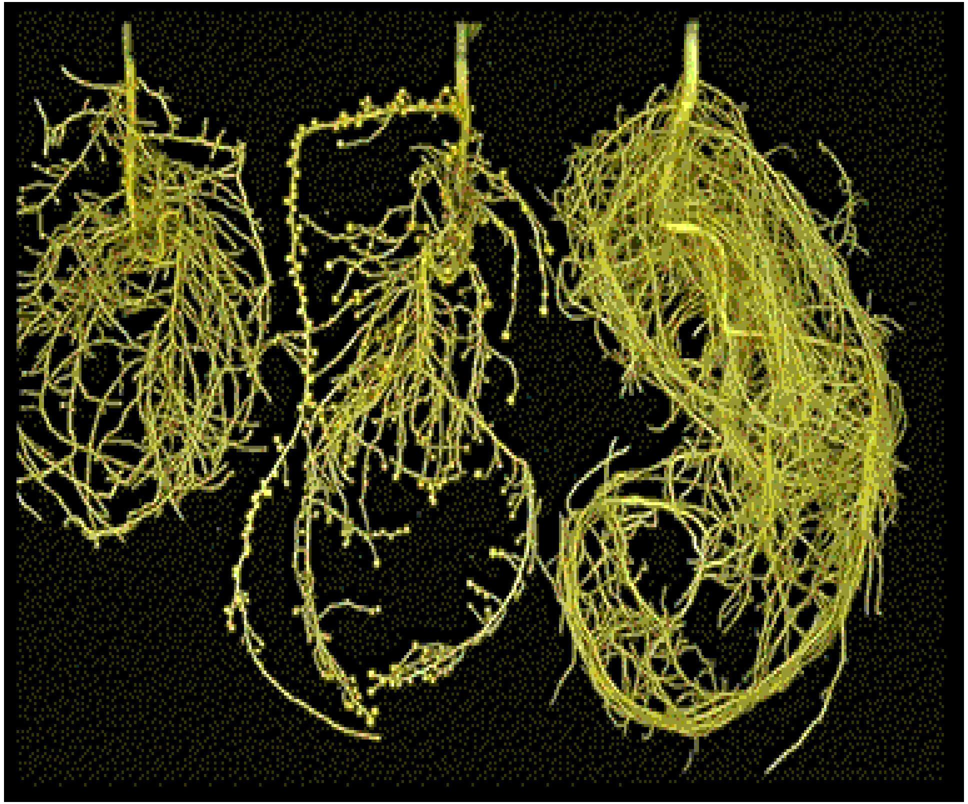


Helicotylenchus multicintus



Meloidogyne incognita

Symtom of the root knot nematode infection



Root knot nematode infection (Advanced stage)

Introduction

- Okra, *Abelmoschus esculentus*, is a fruit and leaf vegetable of the Hibiscus family (Kumar and Vain, 2010).
- Important soups and stews.
- Okra is cultivated in many parts of the world (Akinyele and Temikotan, 2007).
- Crop losses triggered by phyto-nematodes in economic terms is estimated at $157 billion annually and yield losses occurring as a result of root-knot nematodes ranges from 35.0 to 39.7% (Jonathan et al., 2001).

- Phyto-nematodes destroy the roots of various crops and injured roots become inefficient in the absorption of available moisture and nutrients from the soil leading to reduced physiological functional (Olabiyi, 2005). Also, damaged roots are easy prey on by many types of fungi and bacteria.

  - These harmful effects of nematodes on plant growth result in lowered yields and a general poor quality of crops (Kumar and Jain, 2010).

  - Management of nematode infestation is therefore key to higher yield and improved quality that are projected from the higher cost of crop production (Oyedunmade *et al.*, 2011).

- In Nigeria, farmers have been protecting vegetable crops, like okra from root-knot nematodes by using resistant cultivars, non-host plants and synthetic nematicides

- Today, several microorganisms have been used as enemies of phyto-parasitic nematodes (Akhtar and Malik, 2000).

- Species such as *Trichoderma harzianum* and *Bacillus species* (*Bacillus cereus* and *Bacillus thuringiensis*) have been extensively used as biological agents against plant parasitic nematodes (Meyer, 2003).

Objectives

- To compare the effects of biological and synthetic nematicides in the management of root-knot diseases of okra

- To assess the effects of both synthetic and bio-nematicides on the growth and yield of okra.

Materials and Methods

- The experiment was conducted at the Teaching and Research Farm, Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Nigeria

- A field experiment was conducted in two trials and two seasons, one at the onset of raining season (Early planting season) and the second one at the end of raining season (Late planting season)

- Seeds of okra variety (Clemson spineless) was obtained from National Institute of Horticultural Research (NIHORT), Ibadan, Nigeria.

- The land was ploughed and harrowed and beds of size 2m x 2m were made.

The okra seeds were sown directly to the field at 3 to 4 seeds per hole and was later thinned to 1 healthy plant per stand

The field was divided into 4 blocks and each block comprised of 5 treatments and was replicated four (4) times laid out in Randomized Complete Block Design (RCBD).

A spacing of 0.5 m was made in-between the plots and alley ways of 1 m each in between the blocks which prevented treatment interference, interactions and also served as drainage

The root-knot nematodes was obtained from the infected root galls of *Celosia argentea* which was obtained from NIHORT, Ibadan, Nigeria.

Extraction of nematodes from the galled roots of *Celosia argentea* was done using the method described by Hussey and Barker (1973).

The nematode juveniles in the suspension obtained were counted using a counting slide under a stereomicroscope. The number of juveniles per ml distilled water was standardized to approximately 100 juveniles' concentration.

Inoculation of root-knot nematodes at two weeks after sowing.

This was done by manually digging a 2 cm hole from the okra plant root with care in other not to damage the root and 5 g of heavily chopped root gall of *Celosia argentea* measured with sensitive scale was applied directly to the okra root rhizosphere and was covered with soil.

The bio-nematicides used was an already prepared formulation and had been in use nationwide for over 5 years (Olabiyi, 2011) while the synthetic nematicide (carbofuran) was purchased at Ogbomoso, Nigeria.

Treatments applied 2 weeks after inoculation

Treatment 1: Microbial based bio- nematicides which was prepared with the mixture of the pure culture ($1x10^7$) *Bacillus subtillis* + *Trichoderma harzianum* ($1x10^7$): 50/50 by volume combination.
Treatment 2: Plant based bio-nematicide which was prepared with black soap + pawpaw leaf + bitter leaf + tobacco leaf + neem seed.
Treatment 3: Liquid fertilizer which was prepared with septum leaf + tithonia leaf + cow dung + white sugar + sugar cane.
Treatment 4: Carbofuran (synthetic nematicide)
Treatment 5: Control (no nematicide)

The bio- nematicides were applied at the rate of 10 ml per plant stand directly to the okra root as soil drench while the synthetic nematicides was applied at the manufacturer's prescription of 10 g per 10 m bed.

✓ Data were collected on growth parameters including:

Plant height measured using tape rule (cm)

Number of physiologically matured leaves

Number of branches were visually counted.

Number of fruits per plant,

Fruit weight per plant

Nematode populations in the soil at harvest were determined

RESULTS PRESENTATION

Table 1: Effects of biological and synthetic nematicides on the growth of okra in the early and late planting seasons, 2017

Planting season	Treatment	Plant Height (cm)	Number of Leaves	Number of Branches
Early planting season	Microbial based bio-nematicide	123.3ab	24.28ab	3.38a
	Plant based bio-nematicide	106.6b	25.45a	3.00a
	Liquid fertilizer	123.78ab	20.88b	2.75a
	Carbofuran	137.68a	26.38a	2.73a
	Control	56.38c	12.25c	1.13b
Late planting season	Microbial based bio-nematicide	82.00a	19.55a	2.95a
	Plant based bio-nematicide	72.20a	17.85a	2.45a
	Liquid fertilizer	78.47a	18.30a	5.20a
	Carbofuran	78.30a	17.65a	2.70a
	Control	34.93b	10.20b	0.50b

Table 2: Effects of biological and synthetic nematicides on the yield of okra in the early and late planting seasons, 2017

Planting season	Treatment	Number of Fruit	Unit weight of fruit (g)	Total fruit Weight (g)
Early planting season	Microbial based bio-nematicide	128.00a	13.05a	1679.25ab
	Plant based bio-nematicide	134.75a	11.25a	1623.25ab
	Liquid fertilizer	119.75a	12.65a	1510.50b
	Carbofuran	136.25a	15.55a	1967.00a
	Control	50.75b	6.23b	314.50c
Late planting season	Microbial based bio-nematicide	112.00a	12.98a	1479.50a
	Plant based bio-nematicides	108.25a	11.60a	1236.25a
	Liquid fertilizer	103.75a	12.53a	1308.75a
	Carbofuran	111.25a	12.20a	1360.25a
	Control	39.75b	6.30b	254.00b

Table 3: Effects of biological and synthetic nematicides on nematode infestation of okra in the early and late planting seasons

Planting season	Treatment	Initial Nematode Population	Final Nematode Population	Gall Index (1-5)
Early planting season	Microbial based bio-nematicide	236.25a	26.25b	1.25b
	Plant based bio-nematicide	215.00a	15.50b	1.25b
	Liquid fertilizer	182.50a	16.75b	1.00b
	Carbofuran	267.50a	7.00b	1.25b
	Control	206.25a	892.50a	3.50a
Late planting season	Microbial based bio-nematicide	262.5a	21.25b	1.25b
	Plant based bio-nematicide	260.50a	19.25b	1.50b
	Liquid fertilizer	262.50a	21.25b	1.25b
	Carbofuran	265.75a	17.75b	1.50b
	Control	237.50a	892.50a	3.25a

CONCLUSION

- The results of this study suggest that the application of plant based bio- nematicide, microbial based nematicide and carbofuran for the management of root-knot nematode effectively decrease the population of the soil nematode in okra farming.
- It was also revealed that virulence of the nematodes varies with season variation; this suggests that the late planting season is suitable for nematode proliferation.
- From the study, it may be concluded that the application of biological nematicides showed nematicidal activities against *M. incognita* were and at par with synthetic nematicide.
- The effectiveness of biological nematicides can be attributed to the presence of various phytochemicals which showed toxic effect on survival of root-knot nematode.
- This research therefore suggests the use of biological nematicides in place of synthetic nematicides in order to prevent environmental hazards, food poisoning, soil degradation and loss of aquatic lives.

Thanks!

Any Questions?

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