



Nematicidal activity of biopesticide against *Musa basjoo* root disease

K Rubini¹, D Prema¹, V Prabhu²

¹ Department of Biochemistry, Holy Cross College, Tiruchirappallai, Tamil Nadu, India

² Assistant Professor, Department of Botany, Selvamm Arts and Science College, Namakkal, Tamil Nadu, India

Abstract

Banana is one of India's and the world's most important foods and economic crops. *Meloidogyne* sp., a burrowing worm, is a severe threat to banana *Musa* sp. production. *Meloidogyne* sp. resistance is absent in all commercial banana cultivars. The goal was to create a biopesticide for treating *Meloidogyne* infection on banana roots. Plant-parasitic nematodes are parasitic nematodes that feed on plants. *Meloidogyne* sp. was the most common plant-parasitic nematode in the Trichy and Karur districts. Biopesticide remains effective in preventing *Meloidogyne* sp. infection in a concentration-dependent manner. We used biopesticides derived from *Cascabela thevetia*, *Datura stramonium*, *Calotropis gigantean* and *Abrus precatorius* to suppress the *M. incognita* infection in bananas. This herbal biopesticide had high mortality rate in 500 µg/ml concentration.

Keywords: banana *Meloidogyne* sp, biopesticides, medicinal plants

Introduction

Bananas and plantains (*Musa* sp.) are grown in many countries, particularly in tropical countries. According to Ploetz *et al.*, 2015 these crops rank among the world's most valuable primary agricultural commodities. According to FAO 1999, bananas and plantains together serve as a staple food for at least 400 million people globally. These food crops are the fourth most valuable food after rice, wheat, and milk (Ploetz 2001). Edible bananas (*Musa* spp. Musaceae) are perennial herbs naturally derived from inter/intraspecific hybridisation between *Musa acuminata* Colla and *Musa balbisiana* Colla.

They originated in Southeast Asia and the Western Pacific, where wild bananas can still be found in natural forests (Robinson and Galan Sauco, 2010) ^[1]. Bananas are now grown in 150 nations throughout the world's tropical and subtropical areas. After rice, wheat, and milk, it is the second most widely grown fruit crop and the fourth most important global food item. In many countries, such as Honduras, Thailand, Panama, Cameroon, Germany, Brazil, France, China, Spain, and India, banana is grown not only as a subsistence crop for food or as a source of income, but also as a cash crop (Suryaprabha and Satheesh kumar, 2015) ^[2]. It is the first report on a banana in 1891 from Fiji (Cobb, 1915) ^[3] and is distributed in banana plantations throughout the world and cause drastic yield reduction (Gowen and Queneherve, 1990; Marin, Sutton, and Barker, 2000) ^[6]. *Meloidogyne* sp., is a migratory endoparasite which feeds and kills the cortical cells of the roots. Reddish-brown or dark brown lesions arise from cell death, and later death regions or rot or decay on the roots and corm diminish anchoring. As a result, it has a direct impact on bunch weight by lowering plant performance or uprooting plants during rainy and windy weather, especially during the bunch maturation stage. Chlorosis, dwarfing, reduction in pseudostem girth, yellowing, and drying leaves with little bunches are all symptoms of *R. similis* infection (Das *et al.*, 2010; Gowen and Queneherve, 1990) ^[6].

Organophosphate or carbonate is used to control the nematodes and needs a repeated application to maintain population density below the threshold levels (Seenivasan, 2017). The aim is to control the *M. incognita* nematode infection in bananas using biopesticides from medicinal plants such as *Cascabela thevetia*, *Datura stramonium*, *Calotropis gigantean*, and *Abrus precatorius*.

Materials and Methods

Collection of nematodes

Meloidogyne incognita nematode was collected from National Research Centre for Banana, Trichy and maintained at Holy Cross College, Department of Biochemistry Trichy, Tamil Nadu India.

Isolation of *M. incognita*

M. incognita was isolated from the root of the Banana. We collected the egg masses of *M. incognita* using sterile forceps from the highly infected roots. The egg masses were washed three times with distilled water and then placed in petri dishes containing sufficient water to keep the eggs moist. The hatched juveniles were harvested every 24 hrs for inoculation, and freshwater was added to the petri dish to prevent the eggs from drying.

Nematicidal activity of Biopesticide against *M. incognita*

We analysed the nematicidal activity against *M. incognita* at various concentrations, in the even populations. The plates with different concentration were maintained at 28°C for ten days, and at the interval of two days, we noted the death rate of nematode.

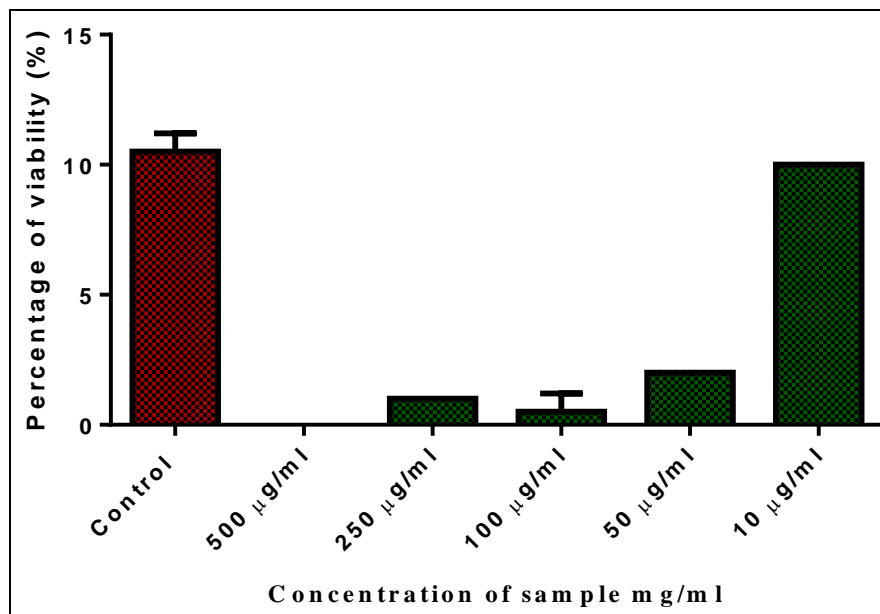
Results and Discussion

Nematicidal activity of biopesticide

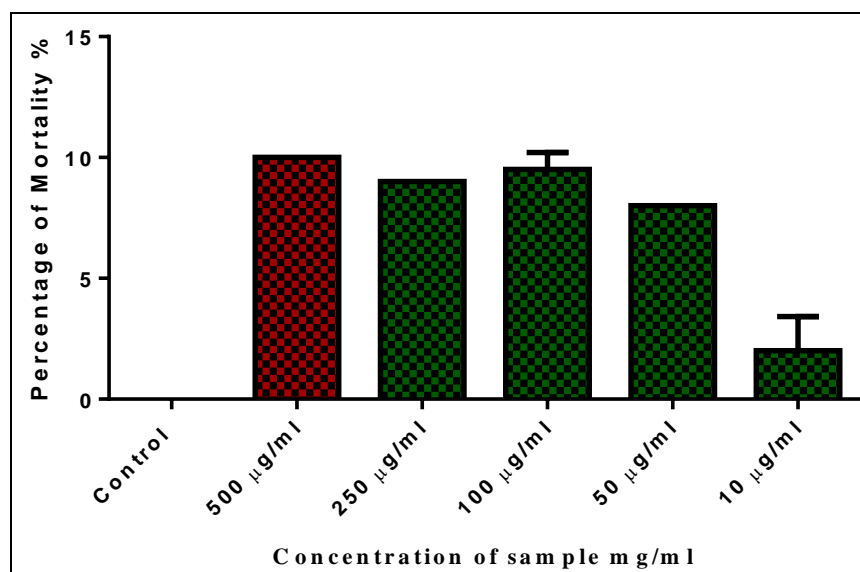
The nematicidal activity of biopesticide was investigated using *M. incognita*. Our biopesticide showed a dose-dependent inhibition. Plate 2 and Graphs -1 and 2 demonstrate this. Table -1 and Plate -1 reveal the highest nematicidal activity at doses of 500 and 100 g/ml, with 100% mortality.

Table 1: Test sample polyherbal formulation concentration $\mu\text{g/ml}$

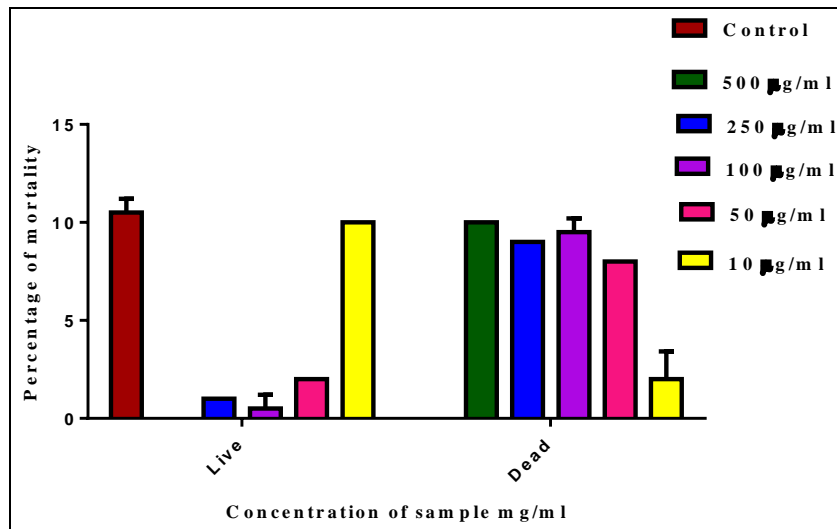
S. No	Test sample concentration $\mu\text{g/ml}$	Live	Dead	% of mortality
1	Control	10	0	100
2	500	-	10	100
3	250	1	9	90
4	100	-	10	100
5	50	2	8	80
6	10	10	1	10



Graph 1: Shows live nematode



Graph 2: Shows dead nematode



Graph 3

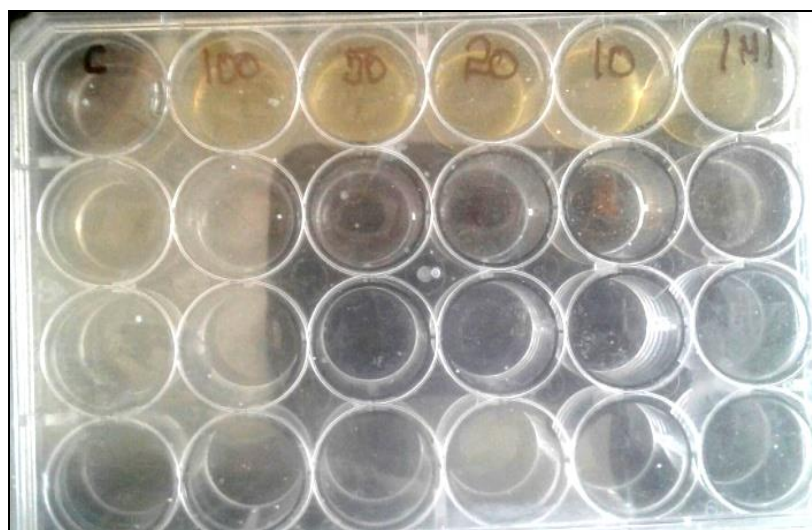
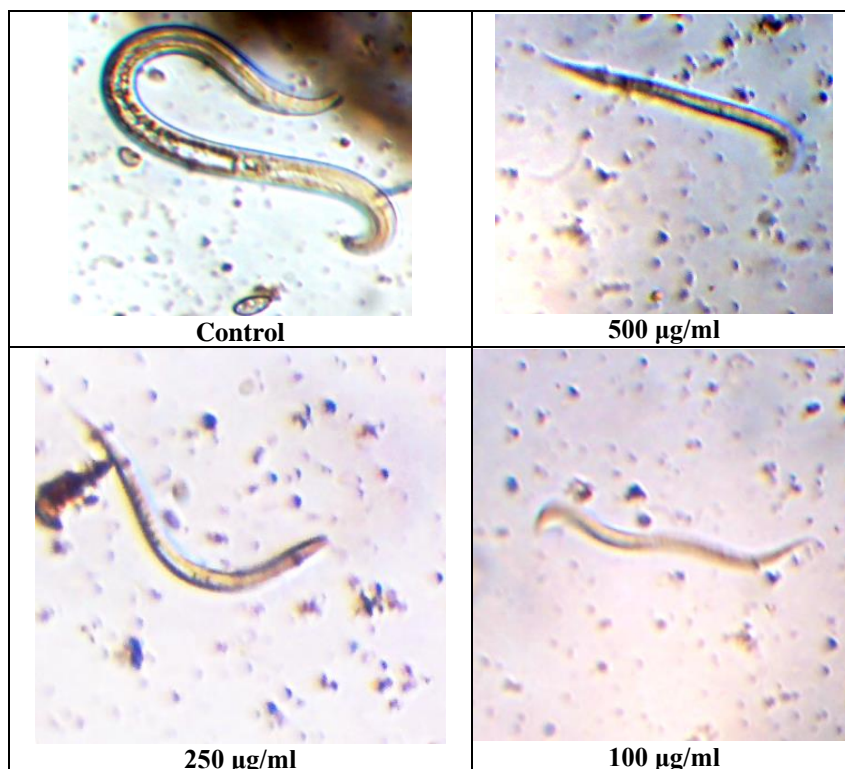


Plate 1: Effect of Bio pesticide on *Meloidogyne* Species



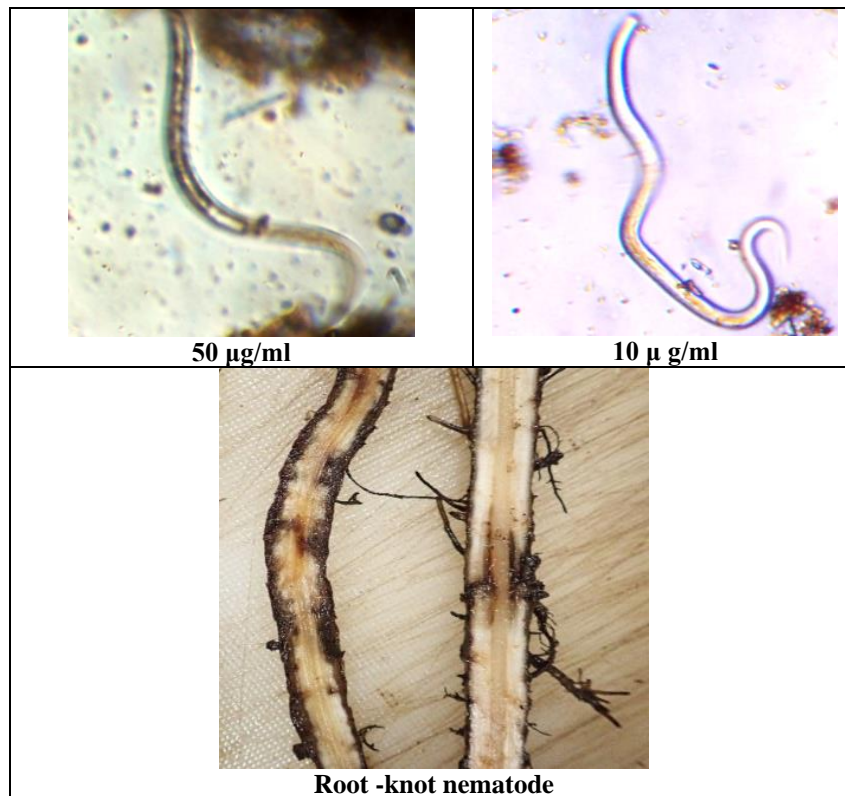


Plate 2: Microscopic view of *Meloidogyne* Species

Discussion

Nematologists are working to find natural enemies and know how to manipulate them so that they can be used as biological control agents. Nematodes' natural enemies include fungi, bacteria, and predatory nematodes. In addition, several fungi in the soil trap and kill nematodes. The most prevalent genera include *Arthrobotrys* spp., *Dactylaria* spp., *Dactylella* spp., *Catenaria* spp., and *Trichothecium* spp. The biological control of root-knot nematode in tomatoes under greenhouse conditions was described by Singh et al., 2001, and Neelima Mittal et al., 1999. Some fungi capture nematodes by adhesion, but many use specialized devices, including networks of adhesive branches, stalked adhesive knobs, non-constricting rings, and constricting rings. This study shows the plant-based formulation, exhibiting a high mortality rate against *M. incognita*. The fungus hyphae grow throughout the nematode body, digesting and absorbing its contents and penetrates its surface. Under favourable conditions, many nematodes may get captured and killed, especially by those fungi that form adhesive networks or hyphal loops. Davide and Zorilla (1985) investigated the biocontrol potential of *P. lilacinus* against *M. incognita* on okra, and the fungus was quite effective and economical. Shahzad and Ghaffar (1984), reported carbofuran at the rate of 1 kg/ha, to be less effective than *P. lilacinus* against *M. incognita*.

Mycorrhiza, is not only a biofertilizer, but its potential role in the biological control of plant-parasitic nematodes is also reported. Sikora (1979) found that the prior presence of VAM fungi *Glomus mosseae* has increased plant resistance against *Meloidogyne* spp. Bacterial parasite of nematodes *Pasteuria penetrans* has received much attention in recent years. *P. penetrans* is probably the most specific obligate parasite of nematodes, with a remarkable life cycle, adapted to parasitism in certain phytonematodes.

It directly parasitizes juvenile nematodes, thus affecting penetration and reproduction. *Pasteuria penetrans* can survive several years in air-dried soil without the loss of viability. Many scientists reported, seed bacterization, soil drenching, and bare root dip application with *Pseudomonas fluorescens*, *Pasteuria penetrans*, *Bacillus subtilis* and *B. polymyxa* effectively controlling plant-parasitic nematodes. Among the predatory nematodes, monarchs may be proved efficient predators because of the effective predatory potential, high rate of the predation, and high strike rate.

Conclusion

The results of our Bio pesticide study demonstrated that the root extract *M. incognita* *Musa* genotypes have strong inhibitory effect against *M. incognita*. Biological control of nematodes, nematologists in all over the world are working very hard to identify and learn to manipulate natural enemies of nematodes so they can be used as biological control agents. Nematodes have many natural enemies, including fungi, bacteria and predatory nematodes. Certain fungi capture and kill nematodes in the soil. *Arthrobotrys* spp., *Dactylaria* spp., *Dactylella* spp., *Catenaria* spp., and *Trichothecium* spp., are the genera most commonly represented. In the present study we developed a biopesticide to control.

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Disclosure statement

No potential conflict of interest was reported by the author.

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