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Biological and Chemical Management of Burrowing Nematode (*Radopholus similis* (Cobb, 1893) on Banana

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Abstract

Banana is the fourth ranked agricultural crop in the world and first among fruits. Plant parasitic nematodes comprise a primary production constraint in banana. Study was conducted to reduce nematode infestation of banana using carbofuran (25 g), *Trichoderma harzianum* (25 g), *Pseudomonas fluorescens* (25 g) and *Verticillium chlamydosporium* (25 g) under field conditions. The sampling was done twice, before and after treatment. The nematode population was estimated per 200 g of soil. Among the treatments carbofuran was found to be more efficient chemical treatment to control borrowing nematode in banana field, as this treatment resulted in the reduction of the nematode population from 266.66 to 193.33 (25.98% decrease) followed by *Trichoderma* which resulted in the decrease of nematode population from 273 to 208.5 (23.63% decrease) when compared to control, which resulted in the increase of nematode population from 278.8 to 295.3 (5.92%). However, *Pseudomonas fluorescens* and *Verticillium chlamydosporium* were found to be moderately effective with 18.01 and 8.94% reduction innematode population respectively.

Key words : Biological management, Chemical management, *Radopholus similis*, Burrowing nematode.

The burrowing nematode, Radopholus similis, is the most important nematode pest of bananas in the South Pacific. It was first found on banana plants from Fiji in 1891. It probably now occurs in the regions wherever bananas are grown, having been distributed in infested planting material. The disease caused by this nematode is variously known as *Radopholus* root rot, blackhead, toppling disease or decline. Burrowing nematode is the most devastating problem in banana cultivation. It is an endoparasite, completing its entire life cycle inside the root system and causing decay of the whole root cortex (Fig.1) (1). Roots damaged by nematodes cannot supply the water and nutrients to the plant. This can reduce plant growth, lengthen the time to fruiting, reduce bunch weight, and decrease the productive life of the farm (2). Radopholus similis is a common cause of banana plants falling over, a condition known as "toppling disease" (Fig. 2). This nematode can also burrow from the roots into the rhizome. Because of the small black spots it produces sometimes its also called as "blackhead disease". Hot water treatments have been used to control the burrowing nematode. Immersion of roots at 55 C for 20 minutes is effective. Maas (3) also showed that flood fallowing for 5—6 months eliminated R. similis. Control of the burrowing nematode has been achieved using phorate or phenamiphos (4). Due to high incidence of burrowing nematode and its damage on banana, study was carried out to assess the sensitivity of the nematode against the chemical and bioagents in a way to reduce the nematode population and also the loss caused by it.

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Methods

Research was conducted in 2007 at University of Agricultural Sciences Bangalore. The total number of nematodes in the soil was estimated in banana field

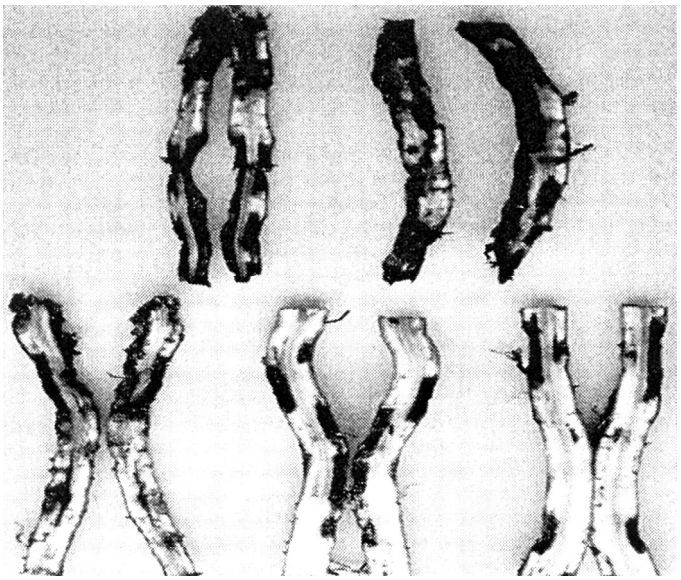

Figure 1. Reddish-black necrosis of root cortes caused by *R. simils.*

and sampling was done twice, before and after treatment. Each treatment was replicated four times and the experimental design used was randomized complete block design.

The systemic nematicide like carbofuran and bioagents (*Trichoderma harzianum, Pseudomonas fluorescens* and *Verticillium chlamydosporium*) were tested for their efficacy against burrowing nematode under field conditions.

Banana plantation (each ring) was artificially inoculated with nematode larvae. After few days of inoculation 200g of soil was collected from base of plant and brought into lab and processed by Cobb's sieving and Baerman's funnel technique and nematode

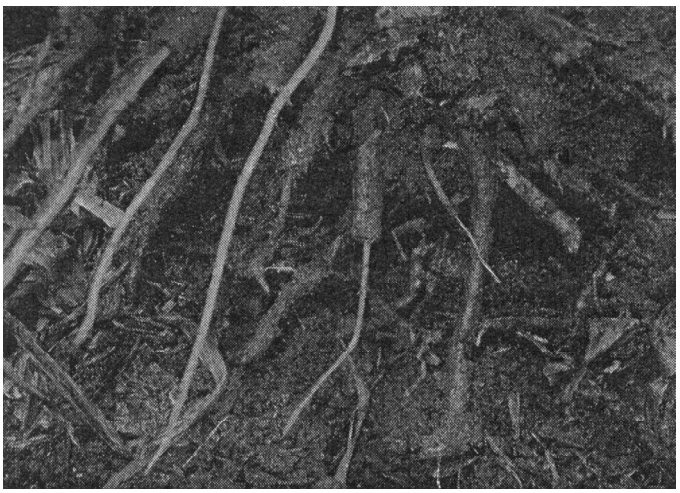

Figure 2. Roots of plant toppled by burrowing nematode. The cortex of most roots have been eaten away leaving the thin, white stele.

Table 1. Total number of nematodes before and after treatments.

Treatments	Total number of nematodes before treatment					Total number of nematodes after treatment					Per cent increase/ decrease of nematode population
	R_1	R_2	R_3	R_4		R_1	R_2	R_3	R_4		
T_1 (Corbofuran)	253	294	262	261	267.5	196	213	187	196	198	26.98
T_2 *(V. chlamydosporium)*	287	253	245	253	259.5	228	298	207	212	236.3	0.8.94
T_3 *(P. fluorescens)*	276	265	259	266	266.5	248	210	195	221	218.5	18.01
T_4 *(T. harzianum)*	266	287	270	269	273	218	194	216	206	208.5	23.63
T_5 (Control)	267	291	279	278	278.8	299	297	287	298	295.3	05.93
SE			6.60 (NS)					11.05*			
CD			20.34 (NS)					34.05*			

population was estimated by using nematode counting disc and stereo binocular microscope (Table 1).

The above treatments were assigned at the dosage rate of 25 gram active ingredient per plant with four replication. Soil sampling was done at 30 days after treatment and nematode population was estimated.

Results and Discussion

The *In vivo* efficacy of nematicide and three bioagents ascertained under field conditions revealed that carbofuran (25 g/plant) resulted in reduction in nematode population from 267.5 to 198.0 (25.98% reduction), among the bioagents *T. harzianum* was found to be effective with reduction of nematode population from 273 to 208.5 (23.63% reduction).

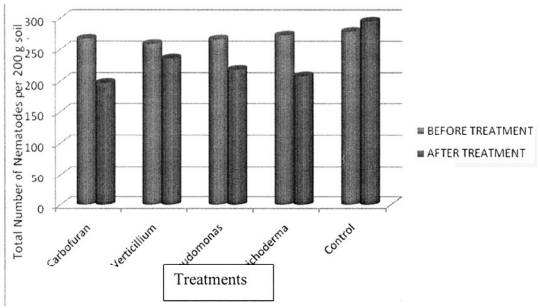

Figure 3. Total number of nematodes before and after treatments.

However, *Pseudomonas fluorescens* and *Verticillium chlamydosporium)* were found to reduce nematode population 18.01 and 8.94%, respectively. But in control there was increase in nematode population from 278.8 to 295.3 (5.92% increase (Fig. 3).

In vivo efficacy of a nematicide and bioagent was quantified through soil application. Carbofuran was found to be more effective which was at par with *T. harzianum* and *P. fluorescens* ; however, V. chlamydosporium found to be moderately effective in reducing nematode population. Similarly Koshy et al. (1) reported that phorate and phenamiphos were effective in reducing the nematode population on banana.

Conclusion

In recent years a number of nematicides and bioagents have been evaluated for use on banana. In this study, carbofuran was found to be more efficient chemical for controlling burrowing nematode in banana field which was at par with *T. harzianum* and *P. fluorescens.*

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