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## INTERACTION OF *MELOIDOGYNE INCOGNITA* AND *FUSARIUM OXYSPORUM* F. SP. *CUBENSE* ON BANANA

by

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**Summary.** Experiments were conducted to study the interaction between *Meloidogyne incognita* and *Fusarium oxysporum* f. sp. *cubense* on banana cv. Rasthali. Synergistic interaction occurred between the pathogens both in concomitant and sequential inoculations, resulting in significant reduction in plant growth. The Panama wilt disease in terms of corm rot was significantly higher when nematode followed fungus and in concomitant inoculations of the pathogens.

Banana (*Musa* spp.) is one of the most important fruit crops grown in India and is ranked second, next to mango, in area and production occupying 332.2 thousand hectares. *Fusarium oxysporum* f. sp. *cubense* causes Panama wilt on banana and is often present with plant parasitic nematodes in India. The root-knot nematode *Meloidogyne incognita* commonly attacks this crop (Rajagopalan and Chinnarajan 1976; Mani *et al.*, 1984). The synergistic interaction of both root-knot nematode and *Fusarium* spp. is known in other crops (Pitcher, 1978; Khan and Nejad 1991; Fazal *et al.*, 1994). Investigation of the interaction of *F. oxysporum* f. sp. *cubense* (Smith) Snyder and Hans, with *M. incognita* (Kofoid *et al.* White) Chitw. on banana is reported here.

### Materials and methods

Banana suckers cv. Rasthali of uniform size, each weighing 750 g were selected, peeled to a depth of 1 cm, treated with hot water (50-55 °C)

for 10 minutes, then dipped in 0.1 per cent mercuric chloride solution and planted in 45x40 cm cement pots each containing 15 kg sterilized mixture of soil, sand and farm yard manure (2:1:1). Thirty days later, the suckers were inoculated with *M. incognita* and/or *F. oxysporum* f. sp. *cubense*, as indicated in Table I. There were five replications in each treatment. The experiment was undertaken in 1993 and repeated in 1994.

Root-knot nematodes collected from a banana grove and identified on the basis of perineal patterns (Eisenback *et al.*, 1981) were cultured on tomato plants. Egg masses collected from the tomato plants were placed in Petri dishes containing distilled water into which air was bubbled every two hours to accelerate hatching. The freshly hatched J2 were inoculated at the rate of 15,000/pot.

The fungus was isolated from a diseased banana, cv. Rasthali, infected with *F. oxysporum* f. sp. *cubense*. Infected corm pieces were washed in sterile water and then in 0.1 per cent mercuric chloride. The washed corm pieces were cultured

on potato-dextrose agar (PDA) medium kept in test tube slants. Growth of the fungus was observed after ten days and the purity of the culture was ascertained. The fungus from the pure culture was seeded into Petri dishes containing PDA medium and incubated at room temperature ( $28 \pm 2$  °C) for 15 days. The mycelial mat from the Petri dishes was carefully removed and blended in 10 ml distilled water for 15 seconds to obtain a concentrated suspension to serve as fungal inoculum (Harris and Ferris, 1991). The sporangial suspension was inoculated at the rate of  $1 \times 10^6$  spores/g soil. Inoculations of both nematode and fungus were made by carefully removing the soil at the root zone of the plants.

Plants were uprooted 90 days after the treatments. Measurements were made of plant height, pseudostem girth, shoot weight, root length and weight. The root-knot and corm rot indices were estimated on 1-5 and 0-5 scales, respectively.

## Results and discussion

*M. incognita* and *F. oxysporum* f. sp. *cubense* individually caused significant reduction in plant height, pseudostem girth, number of leaves, shoot weight, root length and weight. Inoculation of nematode alone resulted in the highest gall index. Significant reduction in gall index was observed in concomitant and sequential inoculation of the two pathogens. This may be due to the inhibitory effect of the fungal pathogen on the nematode. With the fungus alone the root system had a corm rot index of 4.

When both pathogens were inoculated concomitantly or sequentially, the decline in plant growth parameters were greater than with either pathogen alone (Table I).

The wilt disease development in terms of corm rot was significantly higher in both nematode followed by fungus and in concomitant in-

TABLE I - Interaction of *Meloidogyne incognita* and *Fusarium oxysporum* f. sp. *cubense* in banana.

Treatment	Plant height (cm)	Pseudostem girth (cm)	No. of leaves/plant	Shoot weight (kg)	Root		Root-knot index (1-5 scale)	Corm rot index (0-5 scale)
					length (cm)	weight (g)		
Nematode alone (N)	47.3	12.7	5.6	0.57	50.6	443.6	5.0	0.0 (0.7)
Fungus alone (F)	45.5	13.8	5.8	0.59	51.8	456.0	1.0	4.0 (2.1)
Concomitant inoculation of N + F	43.7	12.3	5.0	0.47	38.7	421.2	3.6	5.0 (2.3)
N 15 days before F inoculation	42.8	12.2	4.6	0.45	38.3	425.8	4.4	5.0 (2.3)
F 15 days before N inoculation	44.7	13.5	5.2	0.50	39.5	433.2	3.8	4.2 (2.2)
Uninoculated control	75.4	16.1	7.8	1.12	68.2	931.2	1.0	0.0 (0.7)
SEM	0.7	0.2	0.2	0.02	0.8	5.5	0.2	0.03
CD at 5%	2.0	0.5	0.5	0.05	2.5	14.8	0.5	0.09

Figures in parentheses are  $\sqrt{X + 0.5}$  transformed values: root-knot index 1 = No galls, 2 = 1-25% galling, 3 = 26-50% galling, 4 = 51-75% galling, 5 = 76-100% galling per root system; corm rot index 0 = free from rotting, 1 = 1-15% rotting, 2 = 16-30% rotting, 3 = 31-45% rotting, 4 = 46-60% rotting, 5 = >60% rotting.



Fig. 1 - Longitudinal sections of banana corms: T2 to T5 infected by *Fusarium oxysporum* f. sp. *cubeense* showing internal symptoms; T1 - nematode alone; T2 - fungus alone; T3 - concomitant inoculation of nematode and fungus; T4 - nematode 15 days before fungus inoculation; T5 - fungus 15 days before nematode inoculation; T6 - uninoculated control.

oculation of both pathogens which recorded the highest corm rot index of 5 (Fig. 1). The synergistic interactions observed in the present study between wilt fungus and the root-knot nematode in banana suggests that the *M. incognita* predisposes banana plants to *F. oxysporum* f. sp. *cubeense* and enhances the severity of the Panama wilt disease.

The results of the experiment repeated in 1994 were precisely similar to those obtained in 1993.

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