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EFFECT OF INTERACTION OF MELOIDOGYNE INCOGNITA AND FUSARIUM SOLANI ON THE GROWTH OF PAPAYA AND NEMATODE REPRODUCTION

by
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Summary. *Meloidogyne incognita* alone caused greater suppression in plant growth than *Fusarium solani*, but greatest plant growth suppression was caused by their simultaneous inoculation followed by the sequential inoculation of nematode 15 days prior to fungus and of fungus 15 days prior to nematode. *F. solani*, whether inoculated simultaneously or sequentially, reduced the rate of reproduction but increased the rate of rootrotting. The symptoms were more pronounced when both were present concomitantly than any one of them separately.

Meloidogyne species attack papaya plants in tropical and subtropical regions (Inserra and Cartia, 1977; Ray and Das, 1980; Khan, 1989). Concomitant infection of root-knot nematode, *Meloidogyne incognita* (Kofoid et White) Chitw. and the root rot fungus *Fusarium solani* (Mortius) Appel and Wollenweber was observed to cause severe root-rotting and ultimate death of *Carica papaya* L. plants over a large area in the regions of Tikarh, Chattarpur and Panna, Madhya Pradesh, India. Therefore, studies were undertaken to investigate the effect of the two pathogens, alone or in combinations on the growth of papaya seedlings and the development of the disease.

Materials and methods

Two week old seedlings of papaya cv. Honey Dew were transplanted singly into 30 cm earthen pots containing 2 Kg sterilized soil + river sand + farm yard manure (3:1:1) mixture. After one week the pots were inoculated with 2000 juveniles of *M. incognita* and 2.5 g fungal suspension (mycelium + spores) of *F. solani* either individually, concomitantly or sequentially (with an interval of 15 days). Inoculation was made by pipetting the nematode or fungal suspension over the root surface carefully exposed earlier and then covered with soil. Uninoculated plants served as control. Each treatment was replicated five times and randomized on a glasshouse bench.

Plant growth (length and dry weight of shoot and root), number of galls/root system, percentage of root-rot and nematode reproduction were recorded at the termination of the experiment three months later. Juvenile nematodes were extracted from the soil in each pot by a modified Baermann Technique. The reproduction factor was calcu-

lated by the formula $R = \frac{P_f}{P_i}$ where P_f represented the final and P_i the initial populations of the nematode in the soil. To estimate nematode numbers in the roots, 1 g from each replicate was macerated with a small quantity of water in a Waring blender for 30 seconds.

Results

Papaya plants suffered significant suppression of growth when the seedlings were inoculated with either *M. incognita* or *F. solani* or both concomitantly or sequentially with nematode 15 days prior to fungus or with fungus 15 days prior to nematode (Table I). Individually, *M. incognita* caused more growth suppression than *F. solani*. However, the greatest suppression in plant growth was caused by the simultaneous inoculation of *M. incognita* with *F. solani* followed by the sequential inoculation of nematode 15 days prior to fungus and of fungus 15 days prior to nematodes. The percentage of root-rot was 17,55,48 and 36 in fungus alone, nematode with fungus simultaneously, nematode prior to fungus and fungus prior to nematode, respectively. However, there was no significant difference in the plant growth suppression and root-rot between the concomitant and sequential inoculations of nematode 15 days prior to fungus. Therefore, the damage appears to be almost equal in simultaneous and sequential inoculation.

Nematode reproduction was maximum ($R = 6.2$) when *M. incognita* was present alone but was 5 when nematodes were inoculated prior to fungus, 4 when inoculated simultaneously with fungus and 3 when the fungus was inoculated prior to the nematode. *M. incognita* alone formed

TABLE I - Effect of individual, concomitant and sequential inoculation of *Meloidogyne incognita* and *Fusarium solani* on plant growth, root-rotting and nematode multiplication

Treatments	Plant Length (cm)		Plant Dry Weight (g)		Nematode Population				R = $\frac{P_f}{P_i}$	Number of galls/ root system	Percentage rotting/ root system
	Shoot	Root	Shoot	Root	No. Juvenilis/ 2 Kg soil	No. females/g root	No. eggs/g rot	Total Population			
Control	110.2	20.7	67.7	11.2	—	—	—	—	—	—	—
<i>M. incognita</i> (Mi)	89.1	17.0	49.3	8.7	11333	260	830	1242	6.2	75	—
<i>F. solani</i> (Fs)	99.1	19.1	57.5	9.3	—	—	—	—	—	—	47
Mi + Fs	58.6	10.3	32.1	5.1	7532	180	270	7982	3.9	46	55
Mi → Fs	66.7	11.0	34.1	5.9	9133	286	610	10029	5.0	68	48
Fs → Mi	78.5	14.5	43.6	8.7	5666	103	186	5955	2.9	37	36
L.S.D. at 5% level	8.54	1.37	2.42	0.92					0.97	10.75	7.63
L.S.D. at 1% level	11.52	1.87	3.30	2.62					1.38	15.18	10.78

N.B.: → indicates the sequence of *Meloidogyne incognita* or *Fusarium solani* 15 days prior; + indicates the simultaneous inoculation.

root galls at the stem base were larger in size than galls produced on the root system. The tap root growth was suppressed (i.e. blinding of the main tap root) but lateral root growth was profuse. Infected plants were dwarfed and developed few, small leaves with chlorotic patches.

Fusarium solani by itself caused no appreciable reduction in plant growth or blinding of the tap root but caused root-rot in a small portion of the root system.

Discussion

Increase in the suppression of plant growth and root-rot due to simultaneous or prior presence of nematodes suggest that nematode infection in the roots paved the way for increased colonization by *F. solani* either by causing mechanical injury or changing host physiology to the advantage of the fungal pathogen (Owens and Specht, 1966). On the contrary, fungus inoculation followed by nematode inoculation caused less plant growth reduction, probably because the fungus made the roots less favourable for nematode attack. These findings are in agreement with those of Inagaki and Powell (1969) and Khan and Husain (1988), but at variance with those of Negrón *et al.* (1982). Poor nematode multiplication in the presence of *F. solani* might be due to its detrimental effect on nematode development due to change in host physiology (Ryder and Crittenden, 1965; Littrel and Johnson, 1969; Jorgenson, 1970; Khan *et al.*, 1984; Khan and Husain, 1988; Ciancio *et al.*, 1988).

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