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## INTERACTION BETWEEN *MELOIDOGYNE INCOGNITA* AND *RHIZOCTONIA SOLANI* IN DAMPING OFF OR RHIZOME ROT DISEASE OF CARDAMOM SEEDLINGS

by  
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**Summary.** *Meloidogyne incognita* predisposed cardamom (*Elettaria cardamomum*) seedlings to damping off or rhizome rot disease caused by *Rhizoctonia solani*. Plants were killed when both pathogens were present but not by either nematode or fungus alone.

*Meloidogyne incognita* (Kofoid *et* White) Chitw. and *Rhizoctonia solani* Kuehn were found associated with the roots and rhizome of cardamom (*Elettaria cardamomum* Maton) in nurseries at Karnataka, India. The disease incited by *R. solani* on cardamom seedlings has been called damping off (Wilson *et al.*, 1979) and rhizome rot (Subbarao, 1938). During a survey in 1938, disease incidence was up to 64% in nematode infested nurseries and was a limiting factor in raising quality seedlings. It was, however, not clear whether severity of the disease was influenced by the presence of *M. incognita*. Therefore, attempts were made to study the role of *M. incognita* and *R. solani* in causing damping off and rhizome rot of seedlings.

### Materials and methods

Cardamom seedlings were raised in 20 cm diam plastic pots containing 3 kg of steam sterilized soil. At the 5-6 leaf stage, selection was made for uniform, vigorous seedlings and the excess were thinned out, leaving five seedlings per pot. *R. solani* was isolated from cardamom seedlings showing damping off and rhizome rot symptoms and was mass cultured on rawa meal sand medium (Sasi and Wilson, 1979) and inoculated in the collar region of the seedlings at the rate of 250 mg per seedling. Nematode inoculum was obtained from a single egg mass culture maintained on cardamom and one hundred freshly hatched juveniles of *M. incognita* were inoculated to each seedling. Both pathogens were inoculated singly, simultaneously and sequentially, this last treatment with an interval of 21 days

between inoculations (Table I). Each treatment was replicated five times with the pots arranged in a randomized block layout on benches in a glass house at  $27 \pm 2$  °C.

Weekly observations on the mortality and general health of the seedlings were made until the end of the experiment. After three months, the seedlings were uprooted with intact root systems and washed free of soil. In cardamom, *M. incognita* produces excessive branching near the root tips or all along the entire root at various intervals (withches broom type) instead of galls (Ali, 1983). This excessive branching is readily discernible from other healthy roots (fibrous) as they are devoid of hairs and milky white in colour. Hence, for indexing the root-knot nematode infestation the following scale was adopted. Absence of excessive branching on roots (fibrous roots only) was considered to be without infection (-), while the presence of excessive branching on roots by 10-20% (+), 21-50% (++) and more than 50% (+++) considered to be light, moderate and severe infections, respectively. For fungus infection on roots, root-rot indexing was used on 0-5 point scale.

### Results and discussion

When *M. incognita* preceded *R. solani* by 21 days, discoloration of the collar region of the seedlings was observed at an early stage of growth, while at a later stage the colour became dark brown and was followed by collapse and decay of the tissues and the seedlings shrivelled and died. Highest mortality was recorded in this treatment followed by simultaneous inoculation of fungus and nematode and then

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fungus preceding nematodes (Table D). *R. solani* was reported to cause root rotting of tobacco seedling when *M. incognita* infection was well established (Powell and Batten, 1967). Severe root rotting of the cardamom seedlings occurred when the root-knot nematode was present with the fungus and eventually the seedlings collapsed.

Differences among the treatments were found significant for all the morphological parameters studied except rhizome girth, however, highest reduction in leaf area, shoot length, shoot weight, root length and weight and rhizome girth were recorded in the treatment where nemato-

de were followed by fungus (Table I). The growth of the seedlings was adversely affected when inoculated with the nematode alone, but without killing any of the plants. A high degree of synergism between the two pathogens was evident from the high mortality; root-knot infestation index was as high in the treatment where nematode inoculation followed by fungus as with nematode alone. This study indicated that *R. solani* invasion was most severe to cardamom seedlings when *M. incognita* infection was well established; hence *M. incognita* predisposes cardamom to *R. solani* in damping off and rhizome rot disease.

TABLE I - Effect of *Meloidogyne incognita* and *Rhizoctonia solani* on growth of cardamom seedlings

Treatment	No. of tillers	Leaf		Shoot		Root		Rhizom		Mortality	Root rot index 0-5	Root-knot infestation index
		length cm	breadth cm	length cm	weight g	length cm	weight g	girth cm	weigh g			
Control	2.1	18.1	4.2	46.2	12.8	50.4	11.7	3.5	2.7	0.0	0.0	-
Nematode alone	1.0	8.3	2.7	15.2	2.1	8.3	1.7	1.7	2.5	0.0	0.6	+++
Fungus alone	1.0	8.0	3.6	20.0	2.1	10.5	1.5	2.0	1.0	13.7	2.0	
Nematode + Fungus (simultaneously)	1.0	10.8	2.4	21.4	3.0	12.3	0.7	1.9	0.8	33.2	3.0	++
Nematode followed by fungus	1.0	2.3	1.2	9.7	1.2	5.7	0.6	1.4	0.7	53.0	2.9	+++
Fungus followed by nematode	1.0	7.0	1.9	15.3	2.2	7.9	1.6	1.7	0.8	20.0	2.0	+
C. D. (P = 0.05)	0.1	0.9	0.1	3.2	1.0	1.8	1.0	0.1	-	11.2	0.5	

- = No infection; + = Light infection; ++ = Moderate infection; +++ = Severe infection.

#### Literature cited

- ALI S. S., 1983. Root-knot nematode of cardamom and its control. Extension pamphlet no. 17, Central Plantation Crops Research Institute, Kasaragod, Kerala 1-6.
- POWELL N. T. and BATTEN C. K., 1967. The influence of *Meloidogyne incognita* on *Rhizoctonia* root-rot in tobacco. *Phytopathology*, 57: 826 (Abstr.).

- SASI P. S. and WILSON K. I., 1979. Rawa meal sand a cheap medium for culturing *Rhizoctonia solani*. *Indian J. Microbiol.*, 19: 252.
- SUBBARAO M. K., 1938. Report of the Mycologist 1938. Adm. Rep. Tea Sci. Dep. Unit Plants Assn. S. Indian., 28-42.
- WILSON K. I., SASI P. S. and RAJGOPALAN B., 1979. Damping off cardamom caused by *Rhizoctonia solani* Kühn. *Current Sci.*, 48: 364.