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NEMATICIDAL EFFECTS OF SOME *FUSARIUM* TOXINS[1]

by
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Interaction among *Fusarium* diseases and plant parasitic nematodes on cultivated crops have mainly been studied with particular attention to their interrelationships in the rhizosphere of the host plants, to the enhancement of *Fusarium* wilt in the presence of nematodes or to the break-down of resistance produced by the nematode attack (Powell, 1971; Orion and Hoestra, 1974; Palmer and MacDonald, 1974; Pitcher, 1974; Nordmeyer and Sikora, 1983; Mai and Abawi, 1987).

Factors affecting the behaviour of these pathogens in nature often give rise to a complex of results that cannot be completely evaluated without considering the occurrence of all the variables involved. Some nematological experiments consider the ability of *Fusarium* spp. to produce toxic compounds and their effect on the different life stages of many species of plant parasitic and saprophytic nematodes (Krizkova *et al.*, 1979; Mani and Sethi, 1984). All these findings mainly indicate that some unidentified toxins, sugars or aminoacids, probably present in the filtrates used, were responsible for the death of the nematodes.

The ability shown by several species and strains of *Fusarium* spp. to produce mycotoxins (Marasas *et al.*, 1984), could play an important role in affecting nematode behaviour or interfering with the life stages. The present investigation was undertaken to determine the effect of some *Fusarium* toxins on the hatching of eggs of the root-knot nematode *Meloidogyne incognita* (Kofoid *et* White) Chitw.

Materials and Methods

Egg masses of *M. incognita* dissected from inoculated tomato plants cv. Roma grown in a greenhouse, were washed twice in sterile distilled water and placed in test tubes containing methanolic solutions (2% methanol) of different concentrations of the following *Fusarium* toxins: fusarenone, moniliformin, neosolaniol, nivalenol, T2 toxin, T2 tetraol, T2 triol, zearalenol, zearalenone.

The egg hatch was determined after three weeks exposure at room temperature. Percent hatching was obtained from the following expression: $H = \frac{J}{J+E} \times 100$, where J = number of juveniles in the solution and E = number of unhatched eggs.

Methanolic solution (2%) was used as control. Five replicates were used for each test.

Results and Discussion

T2 toxin, moniliformin, fusarenone and neosolaniol produced the highest toxic effect on eggs, reducing significantly ($P = 0.01$) the average percent of hatching (Table I).

A lower activity was observed for the highest concentrations of zearalenol (5000 ppm; $P = 0.05$), whereas all the other toxins tested did not show any significant toxicity. During counting some malformed cells of first stage juveniles were observed inside the egg-shell of unhatched eggs of the T2 toxin test. However, further investigations are needed to assess the mode of action, the kind of damage produced and the embryogenic stages most susceptible to the toxins.

Many *Fusarium* spp. are reported to be toxin producers (Marasas *et al.*, 1984), and nematicidal effects are also reported for mycelial extracts of *Alternaria* spp., *Penicillium* spp., *Aspergillus* spp. and other soil fungi (Krizkova *et al.*, 1979; Singh *et al.*, 1983; Mankau, 1967). Filtrates of some nematophagous fungi also showed nematicidal activity (Krizkova *et al.*, 1976), whereas three species belonging to the genus *Nematoctonus* are able to produce a thermostable toxin lethal to parasitized nematodes during the germination of infective conidia (Giuma *et al.*, 1973).

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The present investigation indicates that interaction between *Fusarium* spp. and root-knot nematodes in the soil could be influenced by the ability of isolates of some *Fusarium* spp. to produce toxins. These compounds were able to interfere in the embryogenic development of the eggs or to reduce the viability of the first stage juveniles, and could thus affect the nematode population dynamics in the field, where crops are rotated in soils previously infected with *Fusarium*.

Finally, studies concerning interactions among these two pathogens must also consider the possibility that the *Fusarium* isolates could be able to produce, in soil, concentrations of toxins lethal also to nematodes.

TABLE I - *Effect of some* Fusarium *toxins on the egg hatch of* Meloidogyne incognita [a]

Toxin	concentration mg/l	average egg hatch (%)
Control		79.4
Fusarenone	1000	14.2**
Moniliformin	50	21.4**
	500	6.8**
	1000	5.2**
Neosolaniol	1000	46.1**
Nivalenol	1000	73.0
T2 toxin	50	31.2**
	500	5.4**
	1000	3.5**
T2 tetraol	1000	70.4
T2 triol	1000	75.1
Zearalenol	1000	77.0
	5000	54.2*
Zearalenone	1000	81.7
	5000	70.5

[a] Assays were carried out on 5 replications. All tested solutions, including the control, contained 2% methanol.
* Significantly different from the control at P=0.05
** Significantly different from the control at P=0.01.

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