

Nematicidal effect of fungal filtrates against root-knot nematodes

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ABSTRACT: *In vitro* experiment was conducted to study the effect of different fungal filtrates against *Meloidogyne incognita* (Kofoed and White) Chitwood, and *M. javanica* (Treub) Chitwood. Significant nematode mortality was observed in all the culture filtrates and as the exposure time increased there was an increase in mortality of nematodes recorded. The culture filtrates of *Trichoderma harzianum* Rifai (PDBCTH 2) and *T. koningii* Oudem recorded 100 per cent mortality within 24 h of exposure in both the nematode species. Culture filtrates of different fungi under study, except *T. harzianum* (PDBCTH 7 and PDBCTH 8) against *M. incognita* and PDBCTH 8 against *M. javanica*, recorded 100 per cent nematode mortality at 96 h of exposure.

KEY WORDS: Culture filtrate, *Gliocladium* spp., *Meloidogyne incognita*, *M. javanica*, *Trichoderma* spp.

Root-knot nematodes are important plant pathogens affecting crop production throughout the world. Recent problems in the use of chemical pesticides have enhanced the development of biocontrol methods for integrated management of plant parasitic nematodes with various types of antagonistic organisms. Toxic and inhibitory effects of several fungal filtrates on different stages of different nematodes

have been confirmed by several workers (Alam *et al.*, 1973; Khan and Hussain, 1989; Chattopadhyay and De, 1995; Pathak and Kumar, 1995). An attempt has been made to study the effect of culture filtrates of some antagonistic fungi on the mortality of the juveniles of *Meloidogyne incognita* (Kofoed and White) Chitwood and *M. javanica* (Treub) Chitwood under laboratory conditions.

MATERIALS AND METHODS

A laboratory experiment was conducted at Pathology Section, Project Directorate of Biological Control, Bangalore during February 1997, to find out the nematicidal effect of some culture filtrates against root knot nematodes. Three isolates each of *Trichoderma harzianum* and *T. viride* Pers. and one each of *T. koningii*, *T. pseudokoningii* Rifai, *Gliocladium virens* Miller, Giddens and Foster. and *G. deliquescens* were cultured on potato dextrose broth in 250 ml Erlenmeyer's flasks and incubated at 27°C. Maximum fungal growth was noticed after fifteen days and this culture was used to obtain filtrates. The flasks were vigorously shaken before filtration through Whatman No.1 filter paper. This filtrate was examined under stereoscope binocular microscope to ascertain that there was no fungal spore. These filtrates were kept in vials @ 5ml each. In each such vials of, hand picked 50 second stage juveniles of *M. incognita* and *M. javanica* were introduced separately. Three replications were maintained in each treatment. Juveniles were pricked with a pick to ascertain that they are dead. Observations on mortality of juveniles were recorded after 4, 24, 48, 72 and 96 h and the data analysed statistically.

RESULTS AND DISCUSSION

Toxic effect on *M. incognita*

The results on effect of fungal filtrates on *M. incognita* are presented in Table 1. All filtrates exhibited the mortality of

nematode and it enhanced with the exposure time. After 24 h the mortality varied from 0 to 34.6 per cent. The maximum mortality of 34.6 per cent was recorded in *T. viride* (PDBCTV 4) isolate followed by *T. koningii* (34.0%), *G. deliquescens* (22.6%), *T. harzianum* (PDBCTH 2) (22.0%), *G. virens* (16.0%), *T. pseudokoningii* (15.3%) and *T. harzianum* (ITCC 2395) (12.0%) after 4 h of exposure. After 24 h exposure 100 per cent mortality was recorded with *T. koningii* (ITCC 2170) and *T. harzianum* (PDBCTH 2) isolates. There was an increase in mortality (10.6 to 100%) after 48h exposure and significantly differed from control. After 96 h exposure, except for *T. harzianum* (PDBCTH 7) and *T. harzianum* (PDBCTH 8) all other fungal filtrates recorded cent per cent mortality.

Toxic effect on *M. javanica*

Significant mortality was recorded with all culture filtrates and the percentage of mortality varied with exposure time (Table 2). Mortality of *M. javanica* juveniles 4 h after exposure ranged from 0 to 44.0 per cent and the maximum mortality (44.0 %) was recorded in *G. deliquescens*. In *Trichoderma harzianum* (PDBCTH 2) and *T. koningii* treatments 100 per cent mortality was recorded after 24 h exposure and it ranged from 3.3 to 98.6 per cent in other treatments. *Trichoderma harzianum* (ITCC 2395), *G. virens* and *G. deliquescens* treatments recorded 100 per cent mortality after 48 h exposure comparing *T. viride* (PDBCTV 4), *T. viride* (ITCC 1433) and *T. pseudokoningii* after 72 h exposure and *T. harzianum* (PDBCTH

Table 1. Effect of different fungal filtrates on mortality of *M. incognita* juveniles

Fungal isolates	Exposure time (h)				
	4	24	48	72	96
<i>Trichoderma harzianum</i> (ITCC 2395)	12.0 (20.5)	75.3 (60.6)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)
<i>T. harzianum</i> (PDBCTH 2)	22.6 (28.6)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)
<i>T. harzianum</i> (PDBCTH 7)	0.0 (4.0)	2.6 (9.3)	10.6 (19.5)	26.6 (31.2)	34.0 (35.9)
<i>T. harzianum</i> (PDBCTH 8)	0.0 (4.0)	0.0 (4.0)	27.3 (31.7)	36.0 (37.1)	44.0 (41.8)
<i>T. viride</i> (PDBCTV 4)	34.6 (36.3)	88.6 (71.4)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)
<i>T. viride</i> (ITCC 1433)	0.0 (4.0)	20.0 (26.5)	70.0 (57.3)	100.0 (90.0)	100.0 (90.0)
<i>T. koningii</i> (ITCC 2170)	34.0 (35.9)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)
<i>T. pseudokoningii</i> (ITCC 3694)	15.3 (23.2)	70.6 (57.5)	92.0 (76.8)	100.0 (90.0)	100.0 (90.0)
<i>Gliocladium virens</i> (ITCC 4177)	16.0 (23.8)	64.0 (53.7)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)
<i>G. deliquescens</i> (ITCC 3450)	22.6 (28.6)	67.3 (55.5)	89.3 (72.0)	100.0 (90.0)	100.0 (90.0)
Control (broth alone)	0.0 (4.0)	0.0 (4.0)	0.0 (4.0)	2.6 (10.1)	22.6 (28.6)
Control (water alone)	0.0 (4.0)	0.0 (4.0)	0.0 (4.0)	1.3 (7.4)	8.6 (17.4)
CD (P=0.05)	5.1	8.4	7.2	3.2	3.2

Figures in parantheses are arcsine transformed values

7) after 96 h. Among the culture filtrates *T. harzianum* (PDBCTH 8) recorded 51.3 per cent mortality of juveniles and it was found to be less effective. In uninoculated potato dextrose broth treatment 48 per cent mortality was recorded 96 h after exposure and it was significantly different from water alone treatment.

In earlier study also *T. viride* recorded highest mortality of *M. incognita* and other fungi viz., *Aspergillus niger* v. Tieghem, *Curvularia lunata* (Wakker) Boedijn, and *Sclerotium rolfsii* Sacc exhibited inhibitory effect on hatching and mortality of nematodes (Singh, 1983). Tabreiz *et al.*

Table 2. Effect of different fungal filtrates on mortality of *M. javanica* juveniles

Fungal isolates	Exposure time (h)				
	4	24	48	72	96
<i>Trichoderma harzianum</i> (ITCC 2395)	28.0 (32.2)	98.6 (86.4)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)
<i>T. harzianum</i> (PDBCTH 2)	37.3 (37.8)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)
<i>T. harzianum</i> (PDBCTH 7)	0.0 (4.0)	6.0 (13.3)	14.3 (22.3)	86.6 (69.9)	100.0 (90.0)
<i>T. harzianum</i> (PDBCTH 8)	0.0 (4.0)	3.3 (10.3)	22.6 (27.6)	44.0 (41.8)	51.3 (46.0)
<i>T. viride</i> (PDBCTV 4)	34.0 (35.9)	96.6 (90.0)	96.6 (84.0)	100.0 (90.0)	100.0 (90.0)
<i>T. viride</i> (ITCC 1433)	0.0 (4.0)	48.0 (44.1)	86.0 (73.2)	100.0 (90.0)	100.0 (90.0)
<i>T. koningii</i> (ITCC 2170)	16.0 (23.7)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)
<i>T. pseudokoningii</i> (ITCC 3694)	22.6 (28.6)	90.6 (73.2)	96.6 (84.0)	100.0 (90.0)	100.0 (90.0)
<i>Gliocladium virens</i> (ITCC 4177)	23.3 (29.0)	95.3 (80.1)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)
<i>G. deliquescens</i> (ITCC 3450)	44.0 (41.8)	96.0 (81.1)	100.0 (90.0)	100.0 (90.0)	100.0 (90.0)
Control (broth alone)	0.0 (4.0)	0.0 (4.0)	4.6 (11.9)	26.0 (33.0)	48.0 (44.1)
Control (water alone)	0.0 (4.0)	0.0 (4.0)	0.0 (4.0)	8.0 (16.8)	18.0 (25.4)
CD(P=0.05)	5.3	7.3	10.7	5.6	2.8

Figures in parentheses are arcsine transformed values

(1984) found that per cent mortality was directly proportional to concentration of *Aspergillus* filtrates and duration of exposure in *M. incognita* juveniles. Maximum mortality of *M. graminicola* Golden and Birchfield was recorded in 100 and 50 per cent concentration of

T. harzianum culture filtrate at different time intervals (Pathak and Kumar, 1995). Present study corroborates with their earlier finding on increase in mortality rate of *M. incognita*, *M. javanica* juveniles with increased exposure time.

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