RESEARCH NOTES

Suppression of Pratylenchus penetrans and Tylenchorhynchus dubius by Trichoderma viride

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Trichoderma spp. are common soil fungi which influence the development of plant-pathogenic fungi in the soil (1, 8). Yang et al. (9) found that *T. harzianum* influenced the severity of Fusarium wilt of cotton in the presence of *Meloidogyne incognita*. We report herein that the survival of two other plant-parasitic nematodes also was influenced by addition of comminuted cultures of *Trichoderma viride* to soil.

Trichoderma viride isolated from roots of apple (*Malus sylvestris* Mill.) was grown in 8% casamino acid liquid medium (2) [25 ml/125-ml Erlenmeyer flask on a rotary shaker (10 rpm/min) at room temperature (ca 22C)]. After 7 days, the contents of the flasks were comminuted in a blender for 3 min and then 125 ml of this mixture were diluted with an equal volume of water. Sixty ml of this mixture were mixed with 250 gm of a fine sandy loam naturally infested with 83 *Pratylenchus penetrans* and 21 *Tylenchorhynchus dubius*/100 gm of soil. The 250 gm of soil were placed in a 340-ml styrofoam cup and mixed by shaking. A sterile medium or deionized water was added to infested soil in a similar manner to provide controls. For comparison, the nematicide oxamyl and the fungicide benomyl were used in soil with and without mycelial suspensions at the rate of 10 μg (a.i.)/gm of soil. The cups of soil were randomized in 4 blocks on a laboratory bench, watered as needed, and incubated for 3 weeks at 22C. After 3 weeks, 2 samples (100 gm each) were taken from each replicate. Nematodes were extracted by the paper-filter method (4). Thus only live, motile nematodes were counted.

In the first experiment with infested soil, counts of *P. penetrans* and *T. dubius*/100 gm of soil after 3 weeks (Table 1) showed that, although oxamyl was most effective, *T. viride*, oxamyl, and benomyl reduced survival of *P. penetrans* and *T. dubius*. The sterile medium had no effect on survival.

In another experiment, 7-day-old liquid cultures of *T. viride* were washed onto a No. 1 Watman filter paper and allowed to drain for 15 min. The mycelium was rinsed twice with deionized water, resuspended in 125 ml of deionized water, and blended for 3 min at high speed in the blender. Five ml of a water suspension containing 65-75 *P. penetrans* were mixed separately with 25 ml of each of the following: chopped mycelial suspension; filtered medium from the 7-day-old liquid cultures of *T. viride;* sterile, nonused medium; and deionized water. Each treatment was replicated 4 times and placed in a completely randomized arrangement in rows on the laboratory bench. After 3 days at room temperature

TABLE 1. Survival of *Pratylenchus penetrans* and *Tylenchorhynchus dubius* as influenced by *Trichoderma* spp.

Medium & soil additive	No. nematodes/100 gm soil[x]	
	P. penetrans	*T. dubius*
Oxamyl-treated soil	2 b[y]	1 b
Benomyl-treated soil	14 b	2 b
Infested soil + *Trichoderma*	7 b	2 b
Oxamyl-treated soil + *Trichoderma*	0 b	0 b
Infested soil + sterile medium	63 a	21 a
Infested soil + water	74 a	15 a

[x]Determined by tissue method 3 weeks after inoculation. Initial numbers of nematodes/100 gm soil were: *P. penetrans* — 83; *T. dubius* — 21.

[y]Figures followed by same letter not significantly different from each other ($P = 0.05$) by Duncan multiple range system.

Received for publication 26 February 1976.

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(ca 22 C), the mixtures were washed onto a tissue filter (4) and the active nematodes that passed through the filter were counted. The test was repeated. None of these treatments affected *P. penetrans* in these short-term tests.

These results indcate that chopped mycelium of *T. viride* mixed with soil is antagonistic to two common parasitic nematodes found in Connecticut. This finding is not surprising since *Trichoderma* spp. have been isolated from decomposing paper, and decaying paper and sawdust were toxic to *P. penetrans* (6). Although Rich and Miller (7) and Edmunds and Mai (3) did not find *T. viride* antagonistic to *P. penetrans,* it is known to be antagonistic to *Rhizoctonia solani* and other fungi. These antagonistic activities against fungi may have been due to antifungal substances produced by *Trichoderma* spp. (1).

Our results suggest that *Trichoderma* spp. in soil are in part responsible for the poor survival of *P. penetrans* and *T. dubius.* Miller (5) found that fungicides which increased hatching of eggs of the tobacco cyst nematode *Heterodera tabacum* also prevented breakdown of the paper cup containers from which *Trichoderma* spp. were isolated (unpublished data). Results presented herein suggest that *Trichoderma* spp. may have played a role in suppressing hatching of eggs of *H. tabacum.* If *Trichoderma* spp. suppress hatching or influence egg development of *H. tabacum,* they may also influence survival of *P. penetrans.*

LITERATURE CITED

1. DENNIS, C., and J. M. WEBSTER. 1971. Antagonistic properties of species-groups of Trichoderma. I. Production of non-volatile antibiotics. Trans. Brit. Mycol. Soc. 57:25-39.
2. DIMOND, A. E., D. DAVIS, R. A. CHAPMAN, and E. M. STODDARD. 1952. Plant chemotherapy as evaluated by the Fusarium wilt assay on tomatoes. Conn. Agric. Exp. Stn. Bull. 557. 82 p.
3. EDMUNDS, J. E., and W. F. MAI. 1966. Population increase of Pratylenchus penetrans in alfalfa and celery roots infected with Trichoderma viride. Phytopathology 56:1320-1321.
4. MILLER, P. M. 1957. Cheap, disposable filters for nematode surveys. Plant Dis. Rep. 41:192-193.
5. MILLER, P. M. 1967. Stimulating emergence of Heterodera tabacum with fungicides. Plant Dis. Rep. 51:202-206.
6. MILLER, P. M., and L. V. EDGINGTON. 1962. Effects of paper and sawdust soil amendments on meadow nematodes and subsequent Verticillium wilt of tomatoes. Plant Dis. Rep. 46:745-747.
7. RICH, S., and P. M. MILLER. 1964. Verticillium wilt of strawberries made worse by soil fungicides that stimulate meadow nematode populations. Plant Dis. Rep. 48:246-248.
8. WEINDLING, R. 1932. Trichoderma lignorum as a parasite of other fungi. Phytopathology 22:837-845.
9. YANG, HENRY, N. T. POWELL, and K. R. BARKER. 1976. The influence of *Trichoderma harzianum* on the root-knot Fusarium wilt complex in cotton. J. Nematol. 8:81-87.