

Reactions of Three Alfalfa Cultivars to Several Species of Plant-Parasitic Nematodes

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ABSTRACT

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Ditylenchus dipsaci reduced growth of all alfalfa cultivars tested, except Washoe. *Pratylenchus penetrans* reduced growth of Washoe and Vernal but not of Thor. *Meloidogyne hapla* reduced the top growth of Thor but not growth of roots and crown. The opposite was true with Washoe. *M. hapla* did not affect Vernal. *P. neglectus*, *Paratylenchus hamatus*, and *Macroposthonia xenoplax* did not affect final plant growth of the cultivars tested.

Additional key words: *Medicago sativa*, pathogenicity

Alfalfa (*Medicago sativa* L.) is parasitized by a number of nematode species, several of which reduce plant growth (1-3, 7-11, 13, 15). Preliminary trials showed that *Ditylenchus dipsaci* (Kuhn) Filipjev, *Pratylenchus penetrans* (Cobb) Filipjev & Schuur. Stekh., and *D. dipsaci* plus *P. penetrans* reduced growth of the cultivar Vernal, but *Pratylenchus hamatus* Thorne & Allen and *Tylenchorhynchus capitatus* Allen did not. All four nematode species reproduced well.

We evaluated the reactions of three alfalfa cultivars to six plant-parasitic nematodes that commonly occur in Washington.

MATERIALS AND METHODS

The nematodes used in the experiments were increased and maintained in a growth room as follows: *P. neglectus* (Rensch) Filipjev & Schuur. Stekh. on corn (*Zea mays* L.); *P. penetrans* on red clover (*Trifolium pratense* L.); *D. dipsaci* on alfalfa sprouts in a monoxenic culture

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(4); *Paratylenchus hamatus* on red clover; *Meloidogyne hapla* Chitwood on tomato (*Lycopersicon esculentum* Mill., 'Tiny Tim'); and *Macroposthonia xenoplax* (Raski) de Grisse & Loof on Concord grape (*Vitis labrusca* L.).

P. neglectus, *P. penetrans*, and *M. hapla* were extracted from roots by misting for 48-72 hr; *Macroposthonia xenoplax* from soil by sieving and decanting; and *D. dipsaci* by placing infected alfalfa tissue on a Baermann funnel for 24 hr. After inoculations were made by pipetting nematodes into 50 ml of water and pouring them around the roots of the plants, the plants were placed in a randomized block design on a greenhouse bench. The temperature in the greenhouse ranged from 18 to 30 C. Plants were watered daily and fertilized with Hoagland's nutrient solution every 2 wk.

Ten pregerminated Thor, Washoe, and Vernal alfalfa seeds were planted into 15-cm diameter clay pots containing methyl bromide-fumigated sandy loam soil. Plants were thinned to five per pot after 8 days and were inoculated 12 days later

with 1,000 *D. dipsaci*, *M. hapla*, *Paratylenchus hamatus*, *P. penetrans*, or *Macroposthonia xenoplax* and 540 *P. neglectus* per pot. Uninoculated plants served as controls. All life stages were used for inoculum, with the exception of *M. hapla*, where second-stage juveniles were added. Each treatment was replicated six times.

Plant tops were harvested and dry weights determined 69, 104, 146, and 209 days after inoculation. This experiment was terminated after the fourth harvest. Nematode counts were made from soil, roots, and crowns. Nematodes were extracted from soil by centrifugal-flotation (6) and from roots and crowns by placing infected plant tissue on screens under mist for 5 days. Dry weights of roots and crowns were obtained after nematode extraction.

RESULTS AND DISCUSSION

D. dipsaci was the only nematode to adversely affect growth of all three alfalfa cultivars (Table 1). Only the root and crown dry weights of Washoe were not reduced by *D. dipsaci*. This was expected, since Washoe was reported to be resistant to *D. dipsaci* (5). Shoot growth, however, was significantly ($P=0.05$) less than that of controls.

P. penetrans reduced growth of Washoe and Vernal but not of Thor (Table 1). *P. penetrans* significantly reduced the dry weights of shoots but not of roots of Vernal. Willis and Thompson also showed that foliage yields of Vernal were reduced by *P. penetrans* (15).

M. hapla significantly ($P=0.05$) reduced the top growth but not the

Table 1. Reactions of alfalfa cultivars Washoe (W), Thor (T), and Vernal (V) to six nematode species

Nematode	Dry weight (g) ^y						Nematodes per pot (in 1,000s) ^y		
	Shoots			Roots and crown			W	T	V
	W	T	V	W	T	V			
Control	24.2 a	28.5 a	23.0 a	5.6 a	4.9 ab	2.8 ab	0	0	0
<i>Ditylenchus dipsaci</i>	17.6 bc	16.2 c	10.4 c	4.1 ab	1.8 c	0.7 c	0.06	0.02	0.23
<i>Paratylenchus hamatus</i>	21.6 abc	23.7 ab	18.9 ab	5.1 ab	3.7 b	3.8 ab	2.4	0.7 ^z	4.2
<i>Meloidogyne hapla</i>	19.1 abc	22.5 b	21.1 ab	3.7 b	4.0 ab	2.9 ab	23.4	23.9	10.5
<i>Pratylenchus penetrans</i>	16.9 c	24.6 ab	15.7 bc	3.8 b	4.9 ab	2.3 b	9.1	8.5	4.4
<i>P. neglectus</i>	22.5 ab	24.9 ab	20.4 ab	5.1 ab	4.9 ab	3.4 ab	0.3	0.1	0.3
<i>Macroposthonia xenoplax</i>	22.4 abc	24.5 ab	21.7 a	4.9 ab	5.5 a	3.8 a	27.2	27.6	34.7

^yMeans of six replicates after 7 mo. Values in each column not followed by the same letter differ significantly ($P=0.05$) according to Duncan's multiple range test.

^zDiffered significantly ($P=0.05$) from Washoe and Vernal.

growth of roots and crown of Thor (Table 1). The opposite was true with Washoe; only the growth of root and crowns was significantly reduced. Vernal was not affected by *M. hapla*. *P. neglectus*, *Paratylenchus hamatus*, and *Macroposthonia xenoplax* did not significantly retard growth of the cultivars (Table 1).

Only small numbers of *D. dipsaci* were recovered; the severe damage to plant growth caused by *D. dipsaci* limited the development of this nematode. *P. neglectus* did not reproduce on any of the cultivars. Townshend and Potter also reported the alfalfa cultivar Saranac to be a poor host for *P. neglectus* (14). *Paratylenchus hamatus* reproduced on all cultivars except Thor (Table 1). *P. penetrans*, *M. hapla*, and *Macroposthonia xenoplax* reproduced well on all cultivars. Differences in nematode reproduction among the cultivars were observed only with *Paratylenchus hamatus*, which reproduced better ($P = 0.05$) on Washoe and Vernal than on Thor. Vernal has been reported to be

slightly resistant to *M. hapla* (12), and in this study the initial population increased by 10.5 times. Vernal was not significantly damaged by *M. hapla*, however, which indicates that this selection was tolerant.

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