

EFFECT OF *BELONOLAIMUS LONGICAUDATUS*, *DOLICHODORUS HETEROCEPHALUS*, AND *PRATYLENCHUS SCRIBNERI* ON GROWTH OF SPEARMINT, *MENTHA SPICATA*, IN FLORIDA.<sup>1</sup>

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ABSTRACT

Rhoades, H. L. 1983. Effect of *Belonolaimus longicaudatus*, *Dolichodorus heterocephalus*, and *Pratylenchus scribneri* on growth of spearmint, *Mentha spicata*, in Florida. *Nematropica* 13:145-151.

Severely stunted beds of spearmint, *Mentha spicata* L., in central Florida were found to be heavily infested with *Belonolaimus longicaudatus* Rau, *Dolichodorus heterocephalus* Cobb, and *Pratylenchus scribneri* Steiner in Sherbakoff and Stanley. When transferred to the greenhouse, all three species reproduced readily on *M. spicata*. Separate inoculations of 500 and 2500 of each of the three nematode species in 15-cm pots resulted in stunting, chlorosis, and significantly reduced clipping weights of *M. spicata* within 4-5 months for all three nematode species. Root systems were also severely injured and significantly reduced in weight by all three nematode species.

*Additional key words:* mint, sting nematode, awl nematode, lesion nematode, herbs, nematode pathogenicity.

RESUMEN

Rhoades, H.L. 1983. Efecto de *Belonolaimus longicaudatus*, *Dolichodorus heterocephalus*, y *Pratylenchus scribneri* sobre el crecimiento de la menta, *Mentha spicata*, en la Florida. *Nematropica* 13:145-151.

Se determinó que las plantas de menta, *Mentha spicata* L. en canchales, en la región central de la Florida, severamente reducidas en su crecimiento, estaban altamente infestadas con *Belonolaimus longicaudatus* Rau, *Dolichodorus heterocephalus* Cobb, y *Pratylenchus scribneri* Steiner in Sherbakoff and Stanley. En el invernadero las tres especies se reprodujeron fácilmente en *M. spicata*. Las inoculaciones por separado, en macetas de 15 cm con 500 y 2500 nematodos de cada una de las tres especies resultaron en crecimiento reducido, clorosis y disminución significativa del peso del follaje de corte de *M. spicata* en un período de 4-5 meses para las tres especies de nematodos. El sistema radicular fue también severamente dañado y reducido en peso por las tres especies de nematodos.

*Palabras claves adicionales:* menta, nematodo de aguijón, nematodo de punzón, nematodo lesionador, patogenicidad del nematodo.

## INTRODUCTION

Commercial growth of spearmint, *Mentha spicata* L., is presently quite limited in Florida, but there is potential for considerable expansion for winter and early spring production. Also, it is a popular garden herb in many areas of the state. Several nematodes have been reported associated with or injuring *Mentha* spp. Horner and Jensen (3) found the following nematodes in Oregon associated with damage to peppermint, *M. piperita* L.: root-knot, *Meloidogyne hapla* Chitwood; pin, *Paratylenchus macrophallus* Goodey; needle, *Longidorus sylphus* Thorne; and leaf and bud, *Aphelenchoides* sp. Later, Jensen and Horner (5) reported that the needle nematode, *L. sylphus*, was the most important ectoparasitic nematode causing injury to peppermint in Oregon. Bergeson (1) demonstrated in greenhouse tests in Indiana that symptoms of *Verticillium* wilt of peppermint appeared 2 weeks earlier when inoculated with both *V. dahliae* and the lesion nematode, *Pratylenchus penetrans* (Cobb, 1917) Filipjev & Schuurmans Stekhoven, than with the fungus alone. Also, he reported that growth of peppermint was significantly reduced by the nematode alone as well as in combination with the wilt fungus. Later, Bergeson and Green (2) reported the following nematodes associated with root damage and growth reduction of peppermint and spearmint in Indiana: lesion, *P. penetrans*; needle, *Longidorus* sp.; dagger, *Xiphinema americanum* Cobb; pin, *Paratylenchus* sp.; stubby root, *Trichodorus* sp.; and stylet, *Tylenchorhynchus* sp. Only *P. penetrans* was found in all plant and soil samples; subsequent greenhouse experiments demonstrated that the three cultivars of peppermint grown in Indiana were equally susceptible to root damage and growth reduction caused by *P. penetrans*.

In the early spring of 1981, soil samples brought to the author's laboratory from a commercial planting of *M. spicata* on Myakka fine sand near Oviedo, Florida, were found to harbor high populations of the following nematodes: sting, *Belonolaimus longicaudatus* Rau; awl, *Dolichodorus heterocephalus* Cobb; and lesion, *Pratylenchus scribneri* Steiner in Sherbakoff and Stanley. Also present, but in much lower numbers, was the stubby-root nematode, *Paratrichodorus christiei* (Allen) Siddiqi. On-site examination of the spearmint beds revealed very uneven, stunted growth, and a combination of chlorotic and red-colored plants with extremely limited root systems.

Greenhouse plantings from cuttings of spearmint infested with low numbers of hand-picked specimens of these nematodes during the summer and fall of 1981 revealed rapid reproduction of *B. longicaudatus*, *D. heterocephalus*, and *P. scribneri*. However, there was no increase in population of *P. christiei*.

With this information at hand, greenhouse trials were conducted

during late 1981 and in 1982 to determine the pathogenicity of *B. longicaudatus*, *D. heterocephalus*, and *P. scribneri* to *M. spicata*.

### MATERIALS AND METHODS

On December 16, 1981, five replicates each of 500 and 2500 *B. longicaudatus* were placed around single rooted cuttings of *M. spicata* in 15-cm pots of steam sterilized Myakka fine sand. The nematodes had been cultured on *M. spicata* in the greenhouse and were added around the roots of the cuttings as they were transplanted. Five pots, with only supernatant liquid from above settled nematodes added, served as checks. Experiments having the same numbers of nematodes, replicates, etc. were set up for *D. heterocephalus* and *P. scribneri* on December 22, 1981, and January 4, 1982, respectively. The pots were arranged in a randomized block design in a greenhouse for each nematode species. The experiments were conducted for 8 months for the sting and awl nematodes, during which the pots were fertilized 4 times with a 10-4-10 NPK mixture and plants were clipped and weighed 8 times. The lesion nematode experiment lasted 7 months during which it was fertilized 3 times and plants were clipped and weighed 6 times. After the last clipping, soil samples were taken from each pot with a soil probe and processed by a centrifugal-flotation technique (4) for determining soil populations of the nematodes. The roots then were washed, blotted dry, and weighed. The final population of the lesion nematode was determined by counting nematodes that emerged from roots incubated for one week by the Young technique (6). The roots then were oven-dried for determining populations per gram of dried roots.

### RESULTS AND DISCUSSION

The first clipping from the sting nematode experiment indicated that the highest infestation level caused a reduction in plant growth (Table 1). However, as stolons grew out from the center of the pot where the nematodes had been concentrated, plant growth and yield recovered and clipping weights were not significantly different among treatments until the fourth clipping or approximately 4 months after the experiment was initiated. At this point, and until the experiment was terminated, chlorosis was evident in infested pots and clipping weights were significantly lower than from check pots in three of the last five clippings for the low initial infestation level and four of the last five clippings for the high infestation level. The reduction in the final clipping was highly significant for both infestation levels.

The results from the awl nematode experiment were very similar to those obtained for the sting nematode. The first clipping for the highest

Table 1. Effect of nematodes on top growth of *Mentha spicata*.

		Harvest dates and yield <sup>2</sup>							
<i>Belonolaimus longicaudatus</i>		Feb. 2	Mar. 4	Apr. 5	May 21	Jun. 9	Jul. 1	Jul. 27	Aug. 23
Beginning infestation level									
None		30.5	36.6	28.6	36.7	34.2	39.5	39.2	50.3
500		25.2	38.6	31.4	22.9*	37.6	27.0**	35.8	32.6**
2500		19.2	41.7	40.7	25.9*	33.1	29.9**	21.0*	32.2**
<i>Dolichodorus heterocephalus</i>		Harvest dates and yield <sup>2</sup>							
Beginning infestation level		Feb. 2	Mar. 4	Apr. 5	May 21	Jun. 9	Jul. 1	Jul. 27	Aug. 23
None		19.5	47.9	29.9	24.7	41.8	36.3	38.5	48.9
500		21.4	50.6	25.5	30.1	33.4**	19.3**	21.2**	19.9**
2500		2.3**	46.7	45.5	30.7	26.6**	19.5**	22.2**	19.3**
<i>Pratylenchus scribneri</i>		Harvest dates and yield <sup>2</sup>							
Beginning infestation level		Feb. 19	May 18	May 21	Jun. 11	Jul. 1	Jul. 27		
None		39.3	42.8	38.1	34.7	25.8	22.6		
500		41.4	51.4	26.4**	16.9**	8.9**	0.9**		
2500		34.5	49.5	27.6**	14.8**	7.4**	0.6**		

<sup>2</sup>Average fresh weight per pot in grams.

\*Significantly lower than the uninfested (5% level).

\*\*Significantly lower than the uninfested (1% level).

infestation level was significantly less than the check but there was no further reduction until the fifth clipping at 5 months. From this point on, chlorosis was very evident in infested plants and all remaining clippings were highly significantly less than the check.

In the lesion nematode experiment, no reduction in clipping weight occurred until the third clipping or 4 months after inoculation. However, from this point on, there was a very rapid decline in plant growth and all remaining clipping weights were significantly reduced in infested pots. When the experiment was terminated after 7 months, all plants in infested pots were dead or moribund, demonstrating the extreme pathogenicity of this nematode to spearmint.

Soil samples taken at the end of the experiments showed that the original populations of 500 and 2500 nematodes had increased as follows: sting, 18,275 and 17,675 per pot, respectively; awl, 14,540 and 15,675, respectively; and lesion, 29,325 and 22,825, respectively. In addition, an average of 7200 lesion nematodes per gram of dried roots were extracted during a 1 week extraction period.

Roots weights were greatly reduced by all three nematode species (Table 2). Damage was very similar for sting and awl nematodes with characteristic symptoms of short stubby roots exhibiting dark, shrunken lesions along the root axis and at the tip. Most of the roots were dead in lesion-nematode-infested pots (Fig. 1) but the remaining live roots exhibited the typical brown lesions and decay caused by this nematode.

The results of these experiments show that *B. longicaudatus*, *D. heterocephalus*, and *P. scribneri* are all highly pathogenic to *M. spicata*. *P. scribneri* was the most injurious in these tests. If production of *M. spicata* is to continue or expand in Florida, adequate nematode control will need to be developed.

Table 2. Effect of nematodes on root growth of *Mentha spicata*.

Beginning infestation level	Root weight for inoculation test with: <sup>2</sup>		
	<i>Belonolaimus longicaudatus</i>	<i>Dolichodorus heterocephalus</i>	<i>Pratylenchus scribneri</i>
None	137	129	97
500	89**	100**	53**
2500	80**	87**	51**

<sup>2</sup>Moist weight of roots in grams after final harvest of top growth.

\*\*Significantly less than the uninfested (1% level).



Fig. 1. Root injury caused by *Pratylenchus scribneri* on *Mentha spicata*. Left, uninfested; right, infested.

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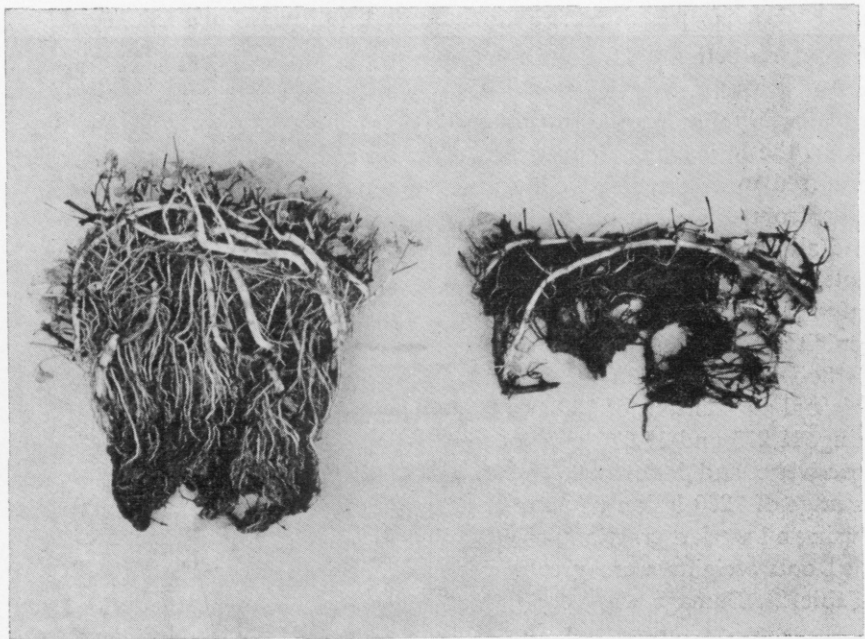


Fig. 1. Root injury caused by *Pratylenchus scribneri* on *Mentha spicata*.  
Left, uninfested; right, infested.

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