

Effects of Several Phytoparasitic Nematodes on the Growth of Basil, *Ocimum basilicum*¹

H. L. RHOADES²

Abstract: Greenhouse experiments were conducted in 15-cm-d pots of steamed Myakka fine sand to determine the host status and tolerance of common basil (*Ocimum basilicum*) to several important phytoparasitic nematodes in Florida. Populations of *Meloidogyne incognita*, *Belonolaimus longicaudatus*, and *Pratylenchus scribneri* increased and caused significant suppression of foliage and root growth during a 10-month period. The population of *Paratrichodorus christiei* increased and caused a significant reduction in foliage yield but did not reduce root growth. *Dolichodorus heterocephalus* also increased in number without affecting foliage yield or root growth. Basil was a poor host for *Hoplolaimus galeatus* and was not damaged by this nematode.

Key words: awl nematode, basil, *Belonolaimus longicaudatus*, *Dolichodorus heterocephalus*, *Hoplolaimus galeatus*, lance nematode, lesion nematode, *Meloidogyne incognita*, *Ocimum basilicum*, *Paratrichodorus christiei*, *Pratylenchus scribneri*, root-knot nematode, sting nematode, stubby-root nematode.

Commercial production of common basil (*Ocimum basilicum* L.) in Florida is presently limited to small plantings of less than 1 ha, but there is potential for future expansion. Also, it is a popular garden herb in many areas of the state. Basil is reported to be a host of *Meloidogyne* sp. (1). *Aphelenchoides ritzemabosi* (Shwartz) Steiner caused injury to basil in greenhouse plantings (4).

In the spring of 1986, soil and root samples from a poorly growing planting of basil were examined for phytoparasitic nematodes and evidence of root injury. The roots were heavily galled and exhibited short stubby roots with lesions along the root axis and at the root tips. Large numbers of *Meloidogyne incognita* (Kofoid & White) Chitwood and *Belonolaimus longicaudatus* Rau and small numbers of *Dolichodorus heterocephalus* Cobb, *Paratrichodorus christiei* (Allen) Siddiqi, and *Hoplolaimus galeatus* (Cobb) Sher were found. In a preliminary greenhouse experiment testing these and other nematodes, *M. incognita*, *B. longicaudatus*, *P. christiei*, and *Pratylenchus scribneri* (Steiner) reproduced on basil (unpubl.). This paper presents the results of a subsequent greenhouse experiment conducted to determine more precisely the pathogenicity of these nematodes to basil.

MATERIALS AND METHODS

Two rooted cuttings (10–12 cm tall) of basil were transplanted into each 15-cm-d pot containing steamed Myakka fine sand (92% sand, 6% silt, 2% clay) in December 1986. During transplanting nematode inoculum suspensions were poured around the roots of the cuttings in each pot as follows: *M. incognita*—5,000 or 15,000 eggs per pot; *B. longicaudatus*, *D. heterocephalus*, and *P. scribneri*—1,000 or 2,000 juveniles and adults, each; *H. galeatus*—7,500 or 15,000 juveniles and adults; and *P. christiei*—150 juveniles and adults. All nematodes had been cultured on suitable hosts in a glasshouse as follows: *M. incognita* on okra (*Hibiscus esculentis* L.); *B. longicaudatus*, *D. heterocephalus*, *H. galeatus*, and *P. christiei* on sorghum-sudangrass hybrid (*Sorghum bicolor* L. × *S. sudanese* (Piper) Staff); and *P. scribneri* on spearmint (*Mentha spicata* L.). *Meloidogyne incognita* eggs were collected by NaOCl extraction (2); *B. longicaudatus*, *D. heterocephalus*, *H. galeatus*, and *P. christiei* by centrifugal flotation (3); and *P. scribneri* by root incubation (5). The experiment was conducted in a greenhouse under 40% shade cloth and maintained at temperatures between 15 and 35 C. The experimental design was a randomized block with five replications. After the cuttings were established, they were thinned to one plant per pot. Each pot was fertilized at monthly intervals with 1 g of 10-4-10 N-P-K mixture. The foliage was clipped

Received for publication 16 December 1987.

¹ Florida Agricultural Experiment Station Journal Series No. 8578.

² Professor (Nematologist), University of Florida, IFAS, Central Florida Research and Education Center, Sanford, FL 32771.

TABLE 1. Nematode reproduction and effect on foliage and root weights of *Ocimum basilicum*.

Treatment	Nematodes		Yield (g)§	
	Inoculum level†	Final population‡	Foliage	Roots
Check (no nematodes)			241	29.8
<i>Meloidogyne incognita</i>	5,000	16,800	127	16.5
	15,000	24,350	156	17.5
<i>Belonolaimus longicaudatus</i>	1,000	10,150	137	11.4
	2,000	10,275	109	12.8
<i>Dolichodorus heterocephalus</i>	1,000	2,525	236	25.4
	2,000	5,525	243	25.5
<i>Hoplolaimus galeatus</i>	7,500	1,775	240	24.4
	15,000	1,800	253	26.3
<i>Pratylenchus scribneri</i>	1,000	11,301	189	14.0
	2,000	22,117	175	14.3
<i>Paratrichodorus christiei</i>	150	2,550	183	24.6
LSD ($P = 0.05$)			44	6.4
($P = 0.01$)			59	8.6

† Number added per 15-cm-d pot. *M. incognita* consisted of eggs; others consisted of a mixture of life stages.

‡ Average number per 15-cm-d pot. *M. incognita* consisted of second-stage juveniles (roots were heavily galled); *P. scribneri* consisted of a combination of nematodes from soil plus the number extracted from roots during 1 week.

§ Total fresh weight of foliage from six harvests and fresh weight of roots at end of experiment.

and weighed each time regrowth reached the bloom stage, a total of six harvests during the experiment. After 10 months, the experiment was terminated and soil samples were collected from each pot with a 2.5-cm-d probe and processed by centrifugal flotation (3) for nematodes. The roots were washed, examined directly for nematode injury, blotted dry, and weighed. Roots were incubated for 1 week for extraction of *P. scribneri* (5). Yield data were analyzed following standard procedures for analysis of variance (ANOVA), and differences between means were tested using Fisher's least significant difference.

RESULTS AND DISCUSSION

Early growth of the basil was relatively uniform in all pots regardless of treatment up to 5 months after transplanting. During the last 5 months of the experiment, however, plants in pots inoculated with *M. incognita*, *B. longicaudatus*, or *P. scribneri* became chlorotic and the growth rate slowed resulting in lower yields (Table 1). Injury symptoms were less noticeable on *P. christiei*-inoculated plants, but plant growth was reduced toward the end of the experiment and total yield was less than the uninoculated controls ($P = 0.05$). If a higher in-

oculum level of *P. christiei* had been used, greater reductions in yield may have occurred.

Root injury symptoms typical of the different nematode species were present on plants infected with the nematodes that caused growth reductions. *Meloidogyne incognita* produced heavy galling and severe necrosis; *B. longicaudatus* caused the root system to be greatly abbreviated with stubby roots, swollen tips, and darkened lesions; roots infected with *P. scribneri* were dead or exhibited brown lesions and decay; and *P. christiei* induced some shortening of secondary roots.

These experiments demonstrated that *M. incognita*, *B. longicaudatus*, and *P. scribneri* are pathogenic to basil. Results were inconclusive concerning *P. christiei*, but evidence indicated that it, too, is pathogenic to basil. If production of basil is to continue or expand in Florida, adequate nematode control practices will need to be developed.

LITERATURE CITED

1. Goodey, J. B., and M. T. Franklin. 1958. The nematode parasites of plants catalogued under their hosts. Commonwealth Agricultural Bureaux, Farnham Royal, Bucks., England.
2. Hussey, R. S., and K. R. Barker. 1973. A comparison of methods of collecting inocula of *Meloido-*

gyna spp., including a new technique. *Plant Disease Reporter* 57:1025-1028.

3. Jenkins, W. F. 1964. A rapid centrifugal-floatation technique for separating nematodes from soil. *Plant Disease Reporter* 48:692.

4. Lamberti, F., and A. Garibaldi. 1977. Leaf

nematodes on basil. *Nematologia Mediterranea* 5:335-338.

5. Young, T. W. 1954. An incubation method for collecting migratory endo-parasitic nematodes. *Plant Disease Reporter* 38:794-795.