

## Nematodes Associated with Blackberry in Arkansas

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**Abstract:** A survey of the nematodes in blackberry (*Rubus* sp.) rhizospheres was conducted in Arkansas from 1986 to 1989. The state was divided arbitrarily into four quadrants. A total of 134 soil samples was collected, and 150-cm<sup>3</sup> subsamples were assayed for nematodes. Twenty-one species of plant-parasitic nematodes in 11 genera were extracted from the samples. There were differences ( $P = 0.05$ ) among quadrants of the state in percentage occurrence of the nematodes and in population densities in samples. *Xiphinema americanum*, *Helicotylenchus* spp. (*H. paraplatus*, *H. platyurus*, and *H. pseudorobustus*), and *Pratylenchus* spp. (*P. vulnus* and *P. zae*) were found in all quadrants. *Xiphinema americanum* population density was near 1,000 per 150 cm<sup>3</sup> soil in soil samples from two locations. Other nematodes found in one or more quadrants were *Criconebella* spp. (*C. axestis*, *C. curvata*, *C. denoudeni*, *C. ornata*, *C. sphaerocephala*, and *C. xenoplax*), *Paratrichodorus minor*, *Tylenchorhynchus claytoni*, *Hirschmanniella oryzae*, *Hoplolaimus magnistylus*, *Scutellonema bradys*, and undescribed species of *Criconebella*, *Tylenchulus*, *Xiphinema*, and *Meloidogyne*. *Criconebella sphaerocephala* and *Helicotylenchus platyurus* are reported from Arkansas for the first time. *Helicotylenchus paraplatus* is reported from the United States for the first time.

**Key words:** blackberry, *Criconebella sphaerocephala*, *Helicotylenchus paraplatus*, *Helicotylenchus platyurus*, nematode, *Rubus* spp., survey, *Xiphinema americanum*.

Interest is increasing in blackberries (*Rubus* spp.) as an alternative crop for small family farms in Arkansas. Goodey et al. (7) list associations of several nematode genera with *Rubus* spp., including *Aphelenchoides*, *Criconebella*, *Criconebellodes*, *Paratylenchus*, *Pratylenchus*, *Meloidogyne*, and *Xiphinema*.

*Pratylenchus* spp., *Xiphinema* spp., and *Paratylenchus* spp. often occur in raspberry and blackberry plantings in the United States, and *Meloidogyne* spp., *Helicotylenchus* spp., and *Criconebella* spp. are occasionally found; however, pathological information is lacking (15).

The root-knot nematodes *Meloidogyne* spp. have been reported on brambles (*Rubus* spp.) in the United States (8,14), Africa (11), and Australia (2). Infestation of red

raspberries (*Rubus* sp.) by *M. hapla* Chitwood enhances the development of crown gall caused by *Agrobacterium tumefaciens* (8).

Root-lesion nematodes, *Pratylenchus* spp., have been associated with poor performance of *Rubus* spp. in British Columbia (1), North Carolina (4,5), Maryland (6), and New Jersey (9). Application of control measures in areas infested with *Pratylenchus penetrans* (Cobb) Filipjev and Schuurmans Stekhoven and *Xiphinema bakeri* Williams increased growth and yield of red raspberries (12). Red raspberries differed in reaction to *P. penetrans*, possibly indicating a source of resistance (16). *Xiphinema americanum* Cobb transmits tomato ringspot virus of raspberries in British Columbia (13) and probably reduces growth by its feeding activities.

Nematodes cause approximately a 2% loss by direct damage to blackberry production in the United States (3). As blackberry production increases, economic losses to nematodes and associated viruses probably will increase.

In Arkansas information is lacking on nematodes present, the potential damage, and methods of damage management. This survey was conducted to identify nematodes associated with blackberry in Arkansas.

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## MATERIALS AND METHODS

Arkansas was divided arbitrarily into quadrants—northwest (NW), northeast (NE), southeast (SE), and southwest (SW; Fig. 1). Soil samples were collected in the quadrants from “wild” and cultivated blackberry, regardless of type or history of cultivation, soil type, or previous production practices. Soil was sampled with a 2.5-cm-d soil tube 20 cm deep. A sample consisted of 4–10 cores. A total of 134 samples was taken from the SW, SE, and NE quadrants from July to October 1989 and from the NW quadrant at various times from 1986 to 1989. Samples were brought to the laboratory in sealed polyethylene bags, thoroughly mixed, and a 150-cm<sup>3</sup> subsample was processed by the sugar-flotation-centrifugation method to extract nematodes (10).

Nematodes were examined, identified to genus, and counted with the aid of a dissecting microscope with magnifications to 140×. Hand-picked specimens were killed with heat, preserved in 3% formaldehyde solution, and identified to species with the aid of a compound microscope with magnifications to 1,250×. Specimens submitted for identification to species are in the USDA Nematode Collection, Beltsville, MD., USA. Data were analyzed by methods of least squares.

## RESULTS AND DISCUSSION

Twenty-one species of plant-parasitic nematodes were found in the 134 samples of blackberries. Members of three genera were found in all quadrants; four genera were found in three quadrants; and four genera were found in one quadrant (Table 1).

*Helicotylenchus* spp. (*H. paraplaturus*, Siddiqi; *H. platyurus* Perry, Darling & Thorne; *P. pseudorobustus* (Steiner) Golden; and an undescribed species) were found in 85% of the samples with mean population densities of 140/150 cm<sup>3</sup> soil. *Helicotylenchus* spp. were found in all quadrants. Percentage occurrence of *Helicotylenchus* spp. was lower ( $P = 0.05$ ) in the SW quad-

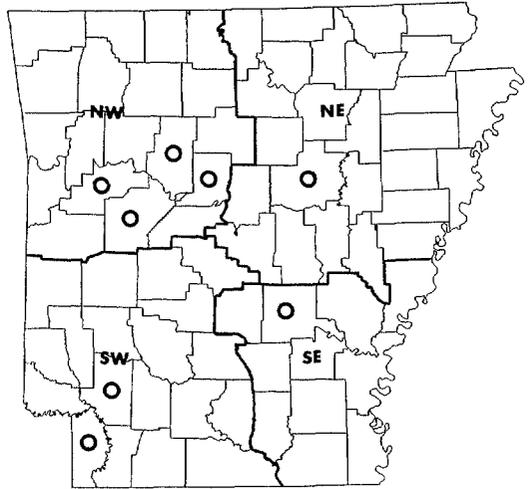


FIG. 1. Location of quadrants and counties (O) in Arkansas from which samples were collected from blackberry soil.

rant, but numbers per sample were lower ( $P = 0.05$ ) in the SE quadrant.

*Xiphinema* spp. (*X. americanum* and an undescribed species) were found in all quadrants. The percentage occurrence of these species was higher ( $P = 0.05$ ) in the NE quadrant, and population densities were higher ( $P = 0.05$ ) in the SW and NE quadrants. In samples containing *Xiphinema* spp., numbers ranged from 62–454/150 cm<sup>3</sup> soil. In noncultivated plantings, *Xiphinema* spp. numbers were 4–467/150 cm<sup>3</sup> soil. In two cultivated plantings, one each in the SW and NE quadrants, *X. americanum* numbers were near 1,000/150 cm<sup>3</sup> soil. In Logan County (NW quadrant), samples from “wild” blackberry plantings contained high numbers of *X. americanum*, whereas samples from outside the “patches” contained low numbers. These results suggest parasitism of blackberry by the nematode.

*Pratylenchus* spp. (*P. vulnus* Allen & Jensen and *P. zeae* Graham) occurred in all quadrants in over 25% of the samples, with mean numbers ranging from 7–46/150 cm<sup>3</sup> soil. The percentage occurrence and numbers per sample were not different ( $P = 0.05$ ) among quadrants.

*Criconebella* spp. (*C. axeste* (Fassuliotis & Williamson) Luc & Raski, *C. curvata* (Raski) Luc & Raski, *C. denoudenii* (DeGrisse) Luc & Raski, *C. ornata* (Raski) Luc & Raski, *C.*

TABLE 1. Nematode genera found in soil around roots of blackberries (*Rubus* spp.) in four quadrants of Arkansas.

Genus	Occurrence†	Quadrant			
		NW	SW	NE	SE
<i>Helicotylenchus</i>	%	91 a	72 b	100 a	91 a
	No.	177 a	195 a	157 a	13 b
<i>Pratylenchus</i>	%	17 a	28 a	29 a	42 a
	No.	16 a	23 a	28 a	9 a
<i>Xiphinema</i>	%	86 b	66 b	100 a	75 b
	No.	122 b	331 a	230 a	64 b
<i>Paratylenchus</i>	%	49 a	8 b	0	8 b
	No.	91 a	18 a	0	5 a
<i>Tylenchorhynchus</i>	%	19 b	42 a	0	17 b
	No.	39 a	22 a	0	8 a
<i>Criconemella</i>	%	24 b	56 a	0	17 b
	No.	80 a	142 a	0	5 a
<i>Paratrichodorus</i>	%	5 b	66 a	0	83 a
	No.	33 a	61 a	0	17 a
<i>Hirschmanniella</i>	%	2	0	0	0
	No.	1	0	0	0
<i>Tylenchulus</i>	%	2	0	0	0
	No.	1	0	0	0
<i>Hoplolaimus</i>	%	3	0	0	0
	No.	2	0	0	0
<i>Meloidogyne</i>	%	0	28	0	0
	No.	0	59	0	0

Means in the same row followed by common letters do not differ significantly ( $P = 0.05$ ).

† % = proportion of samples containing the nematode genus. No. = average number of nematodes/150 cm<sup>3</sup> soil in samples containing the nematode genus.

*sphaerocephala* (Taylor) Luc & Raski, and *C. xenoplax* (Raski) Luc & Raski) were found in 33% of the total samples, with average numbers of 38/150 cm<sup>3</sup> soil. Percentage infestation was higher ( $P = 0.05$ ) in the SW quadrant than in the NW and SE quadrants. Differences in population densities were not significant.

*Paratrichodorus minor* (Colbran) Siddiqi was found in samples from three quadrants. Percentage occurrence was higher ( $P = 0.05$ ) in the SE and SW quadrants than in the NW quadrant. Population densities were low, and differences among quadrants were not significant ( $P = 0.05$ ).

Juveniles of an undescribed *Meloidogyne* sp. were found in 28% of the samples from the SW quadrant, with populations of 59/150 cm<sup>3</sup> soil. Blackberry may not be a host of this nematode. The percentage occurrence of *Tylenchorhynchus claytoni* Steiner was higher ( $P = 0.05$ ) in the SW than in

other quadrants. Differences in population densities among quadrants were not significant. *Paratylenchus* spp. were found in 49% of the samples in the NW quadrant, with mean numbers of 91/150 cm<sup>3</sup> soil. *Criconema* sp., *Hirschmanniella oryzae* (Von Breda de Hann) Luc & Goodey, *Hoplolaimus magnistylus* Robbins, *Scutellonema bradyi* (Steiner & LeHew) Andrassy, and a *Tylenchulus* sp. were found in the NW quadrant in low numbers and in a few samples.

In addition to the undescribed *Meloidogyne* sp. and *Xiphinema* sp. recorded here, new records are established for *Criconemella sphaerocephala* and *Helicotylenchus platyurus* in Arkansas, and a record is established for *Helicotylenchus paraplatyurus* in the United States.

Fewer genera of nematodes were found in the NE quadrant than in other quadrants. Of the nematodes found in all quad-

rants, *Helicotylenchus* spp., *Pratylenchus* spp., and *Xiphinema* sp. were found in lower ( $P = 0.05$ ) numbers in the SE quadrant than in the other quadrants in which they occurred. *Paratrichodorus minor* occurred in the SW and SE quadrants in moderate numbers, but this nematode was almost absent from the northern quadrants.

*Xiphinema* spp. (principally *X. americanum*), *Helicotylenchus* spp., and *Pratylenchus* spp. were found in both cultivated and "wild" plantings of blackberry in all quadrants. Based on our results and on published information, the nematode most likely to affect production of blackberries in Arkansas is *X. americanum*. Nematode control measures in bramble plantings infested with *X. americanum* exhibited increased growth and yield (13). This nematode is also a vector of a virus disease of brambles (13) and of several viruses of other plants.

*Pratylenchus penetrans*, a pathogen of brambles, was not found in this survey, although it occurs in Arkansas. Parasitism of brambles by the two *Pratylenchus* spp. found in this survey has not been reported.

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