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Additional Hosts for the Ring Nematode, *Criconemella xenoplax*[1]

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Abstract: Some common legumes and weeds indigenous to peach orchards in South Carolina were tested in greenhouse experiments to determine their host suitability for *Criconemella xenoplax.* Legumes that were hosts for the nematode were dwarf English trefoil (*Lotus corniculatus* var. *arvensis*), big trefoil (*L. uliginosis*), birdsfoot trefoil (*L. corniculatus*), narrowleaf birdsfoot trefoil (*L. tenuis*), ball clover (*Trifolium nigrescens*), rose clover (*T. hirtum*), subterranean clover (*T. subterraneum*), striate lespedeza (*Lespedeza striata*), and partridge pea (*Cassia fasciculata*). Most nonleguminous plants tested did not support population increases, but small increases were observed on orchardgrass (*Dactylis glomerata*), broadleaf signalgrass (*Brachiaria platyphylla*), purslane (*Portulaca oleracea*), and Carolina geranium (*Geranium carolinianum*). Results indicate that leguminous plants probably should not be used as ground cover or rotation crops for plants that are injured by *C. xenopax.*
Key words: alternate host, *Criconemella xenoplax,* feeding association, leguminous host, ring nematode.

Criconemella xenoplax is an important root parasite of peach (*Prunus persica* (L.) Batsch) and is an important factor in young tree mortality (4). In infested orchard sites the nematode population builds up very quickly on young peach trees even when the site has been out of orchard use for many years. Leguminous plants, rotation crops, or native vegetation grown in the years between peach crops might be important factors in the survival and persistence of this nematode. Additionally, host status is an important consideration when choosing a cover crop for the orchard floor.

Zehr et al. (6) reported studies of the host range of *Criconemella xenoplax* (Raski) Luc & Raski and reviewed the literature of the reported hosts and plant associations for this nematode. They found that the legumes vetch (*Vicia sativa* L.), crimson clover (*Trifolium incarnatum* var. *elatius* Gibbelli & Belli), hairy vetch (*V. villosa* Roth), and cowpea (*Vigna unguiculata* subsp. *unguiculata* (L.) Walp.) supported the nematode population, whereas alfalfa (*Medicago sativa* L.) did not, and no reproduction was observed on sicklepod (*Cassia obtusifolia* L.) or showy crotolaria (*Crotolaria spectabilis* Roth).

Our objectives were to 1) determine the host suitability of some other leguminous plants, 2) test the host suitability of certain indigenous plants commonly found in South Carolina peach orchards, and 3) identify nonhosts that might be investigated for suppression of the nematode.

MATERIALS AND METHODS

Lakeland sand (89% sand, 6% silt, 5% clay) was collected from a peach orchard site at the Clemson University Sandhill Research and Education Center at Elgin, South Carolina, and treated with aerated steam at 60 C for 30 minutes. After treating, 1,500 cm^3 soil was dispensed in 2-liter plastic pots and placed on a greenhouse bench for several days before seeds were planted.

Seeds were obtained from commercial suppliers, collected locally from plants in the field, or supplied by Keith Salvo, USDA ARS, Raleigh, North Carolina. Rhizomes rather than seeds were used for purple nutsedge (*Cyperus rotundus*). Seeds were soaked overnight in water and planted directly into the soil. Each plant species was replicated six times; pots were arranged in a randomized complete block design. Seedlings were allowed to establish for ca. 3 weeks before inoculation.

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Criconemella xenoplax was cultured in a greenhouse on 'Nemaguard' peach seedlings growing in Lakeland sand. Nematodes used for inoculation were extracted by centrifugal flotation (2). After the seedlings were well established, a suspension of 500 *C. xenoplax* juveniles and adults in water was pipeted into four holes ca. 5 mm wide and 25 mm deep in the soil.

After inoculation, the plants were watered and fertilized as needed with Peters 20-20-20 nutrient solution (Peters Fertilizer Products, W. R. Grace Corp., Fogelsville, PA 18051). The soil was not permitted to become dry. Nemaguard peach seedlings were included in each experiment as the standard host plant, and a fallow control was used to evaluate survival of the nematodes in the absence of a plant. No supplemental lighting was provided. Greenhouse temperatures ranged from a maximum of 35 C in summer to a minimum of 16 C in winter.

After 3–4 months, depending upon when test plants reached senescence, the shoots were removed and the soil and roots were emptied into a polyethylene bag where they were shaken to dislodge the soil and nematodes from the roots. After thorough mixing, the nematodes were extracted from the soil by centrifugal flotation (2). Total nematodes and numbers of gravid females were counted and compared with the initial population. Reproduction (Table 1) was computed by dividing the final population (Pf) by the initial population (Pi).

Results and Discussion

Criconemella xenoplax populations increased considerably on Nemaguard peach in each of the four experiments (Table 1), but Pf/Pi values differed among the four experiments. The very high Pf/Pi value for peach in experiment 4 may have resulted from the longer duration of the experiment (4 months), the cooler temperatures that prevailed during the period, or other factors that affected efficacy of inoculum. The number of gravid females observed in association with peach also was large in experiment 4 (Table 1).

Legumes comparable to peach in the rate of population increase and the number of gravid females were dwarf English trefoil, subterranean clover, and big trefoil (experiment 1), striate lespedeza (experiment 2), and rose clover (experiment 3). Other legumes that supported population increases included partridge pea, ball clover, birdsfoot trefoil, and narrowleaf birdsfoot trefoil. Little or no reproduction was observed on sicklepod, as previously reported (6), or on crown vetch.

Nonleguminous plants that maintained populations of *C. xenoplax* or permitted modest increases included orchardgrass, broadleaf signalgrass, purslane, and Carolina geranium. Orchardgrass has been reported as a nonhost (3) and did not sustain the nematode population in a previous study (6), but in the present study the population was maintained.

Extraction efficiency should be considered when interpreting the data in Table 1, but we were unable to determine efficiency with confidence. When a known number of nematodes was added to Lakeland sand and then extracted by centrifugal-flotation (2), extraction efficiency was ca. 27%. However, more than twice as many nematodes were extracted from naturally infested soil when using centrifugal flotation than when flotation-centrifugation (1) was used; therefore, we believe that the extraction efficiency with centrifugal-flotation for the test plants probably was greater than 27%.

The presence of gravid females indicates that some plants having a low Pf/Pi ratio in fact supported nematode reproduction (e.g., annual fescue in experiment 1), and the finding of occasional gravid females in association with plants having very low Pf/Pi ratios may indicate that even some of these can support limited reproduction.

These data show that many legumes are suitable hosts for *C. xenoplax*; therefore they may not be good rotation crops or ground cover in orchard sites where this nematode is a problem. Important exceptions are alfalfa (3,5,6) and peanut (5), which have been reported to be nonhosts or limited hosts

TABLE 1. Reproduction of *Criconemella xenoplax* on certain plants either indigenous in South Carolina peach orchards or that may be considered for ground cover in orchards.

Plant species	Common name	Cultivar	Pf/Pi†	Gravid females (no./100 cm³ soil)
	Experiment 1, 7 February–14 May 1986			
Bromus mollis L.	Soft chess	Blando	0.53 ± 0.17	2.9
Festuca megalura Nutt.	Annual fescue	Zorro	0.51 ± 0.19	3.2
Festuca ovina L.	Sheep fescue	Covar	0.77 ± 0.19	1.2
Geranium carolinianum L.	Carolina geranium		1.41 ± 0.76	1.3
Linaria canadensis (L.) Dumont	Blue toadflax		0.18 ± 0.05	0.2
Lotus corniculatus var. *arvenis* Pers.	Dwarf English trefoil	Kalo	44.79 ± 6.59	119.8
Lotus uliginosus Schkuhr	Big trefoil	Marshfield	49.11 ± 10.53	84.5
Trifolium subteranneum L.	Subterranean clover	Mt. Barker	9.20 ± 4.28	36.7
Prunus persica (L.) Batsch	Peach	Nemaguard	11.23 ± 2.49	102.0
Fallow soil			0.07 ± 0.04	0.0
	Experiment 2, 9 July–10 October 1986			
Brachiaria platyphylla (Grisebach) Nash.	Broadleaf signalgrass		1.38 ± 0.31	1.1
Cassia obtusifolia L.	Sicklepod		0.21 ± 0.04	0.3
Cyperus rotundus L.	Purple nutsedge		0.32 ± 0.08	0.0
Dichondra repens Forste	Dichondra		0.45 ± 0.13	0.6
Euphorbia supina Raf.	Prostrate spurge		0.39 ± 0.09	0.0
Lespedeza striata (Thunb.) H. & A.	Striate lespedeza	Kobe	43.86 ± 9.43	60.4
Portulaca oleracea L.	Purslane		1.67 ± 0.23	5.0
Richardia scabra L.	Florida pusly		0.02 ± 0.02	0.0
Prunus persica (L.) Batsch	Peach	Nemaguard	65.59 ± 13.12	151.3
Fallow soil			0.14 ± 0.02	0.0
	Experiment 3, 22 October 1986–11 February 1987			
Coronilla varia L.	Crown vetch		0.28 ± 0.11	0.4
Euphorbia supina Raf.	Prostrate spurge		0.21 ± 0.03	0.0
Indigofera hirsuta L.	Hairy indigo		0.40 ± 0.08	0.4
Mollugo verticillata L.	Carpetweed		0.14 ± 0.03	0.0
Plantago aristata Michaux.	Bracted plantain		0.19 ± 0.02	0.0
Portulaca pilosa L.	Purslane		0.38 ± 0.11	0.0
Taraxacum officinale Wiggers	Dandelion		0.16 ± 0.06	0.0
Trifolium hirtum All.	Rose clover		37.66 ± 10.50	111.7
Prunus persica (L.) Batsch	Peach	Nemaguard	30.93 ± 8.47	87.5
Fallow soil			0.31 ± 0.06	0.0
	Experiment 4, 13 November 1986–13 March 1987			
Cassia fasciculata Michaux	Partridge pea	Comanche	9.23 ± 1.86	61.7
Dactylis glomerata L.	Orchardgrass	Pomar	1.88 ± 0.40	2.5
Festuca ovina v. *duriuscula* (L.) Koch	Hard fescue	Durar	0.16 ± 0.05	0.0
Lotus corniculatus L.	Birdsfoot trefoil	Cascade	20.60 ± 1.48	49.0
Lotus corniculatus L.	Birdsfoot trefoil	Mackinaw	14.04 ± 3.29	51.7
Lotus tenuis Waldst. & Kit.	Narrowleaf birdsfoot trefoil		6.78 ± 3.09	16.7
Paspalum notatum Flugge	Bahiagrass		0.31 ± 0.09	0.0
Trifolium nigrescens Viv.	Ball clover		52.40 ± 8.92	190.0
Prunus persica (L.) Batsch	Peach	Nemaguard	101.65 ± 25.11	496.7
Fallow soil			0.50 ± 0.06	0.0

† Pf/Pi = final population divided by initial population with standard error shown.

for this nematode. Sicklepod and showy crotalaria (6) are nonhosts, but these are noxious weeds that are not likely to be useful in peach orchards. Soybean (*Glycine max* (L.) Merr.) sometimes is interplanted with peach in young orchards or used as a rotation crop. We have not investigated soybean as a host for *C. xenoplax*, but *C. xenoplax* usually is not associated with soybean in South Carolina plantings (S. A. Lewis, pers. comm.). Very recently, however, soybean was found to support population increases in experimental comparisons (A. P. Nyczepir, pers. comm.).

Among the nonleguminous plants found or reported (6) to support reproduction of *C. xenoplax*, several are common weeds in South Carolina. These plants apparently sustain a low population level of *C. xenoplax* in orchard sites where other crops are used in rotation or where native vegetation is permitted to grow in the absence of peach orchards. Because *C. xenoplax* can increase rapidly on peach roots, these low population levels probably increase to large numbers very quickly, as is commonly observed when orchard sites are replanted.

In the mild climate of the southeastern United States, *C. xenoplax* is active throughout the year. Ground cover plants that support population increases of *C. xenoplax* might add further stress on peach roots during winter months when peach root growth has slowed or stopped. Unless further studies show that such cover crops are not harmful to peach tree survival, we suggest that legumes not be used in peach orchards infested with *C. xenoplax*. Suitability of nonhosts or those that do not sustain populations, such as nimblewill (6), soft chess, annual fescue, hard fescue, or bahiagrass (6) should be studied for use as orchard ground cover.

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