PLANT PATHOLOGY AND NEMATOLOGY

Relative Host Status of Selected Weeds and Crops for *Meloidogyne incognita* and *Rotylenchulus reniformis*

Richard F. Davis* and Theodore M. Webster

ABSTRACT

Plant-parasitic nematodes that damage crops can also reproduce on weeds, thereby reducing the efficacy of nematode-suppressive crop rotations. The amount of reproduction by two important cotton pathogens, *Meloidogyne incognita* and *Rotylenchulus reniformis*, on common weeds in the major crops in the Southeast was not known. This study documented the total reproduction and reproduction relative to cotton by these two nematodes on common southeastern weeds. Final egg counts of *M. incognita* on the plants tested ranged from 0 to 193% of the number on cotton in one trial and from 0 to 407% in a second trial. Final egg counts of *R. reniformis* ranged from 0 to 105% in one trial and from 0 to 454% in a second trial. For *M. incognita*, only prickly sida was consistently a better host than cotton, although ivyleaf morningglory was a better host in one trial. Smallflower morningglory was a moderate host, whereas yellow and purple nutsedge, pigweed, Florida beggarweed, sicklepod, common cocklebur, cutleaf eveningprimrose, and Florida pusley were poor or non-hosts relative to cotton. For *R. reniformis*, only Florida beggarweed was a consistently good host, although purple nutsedge and sicklepod were good hosts in one trial, and smallflower morningglory was a moderate host in both trials. Pigweed, prickly sida, Florida pusley, cutleaf eveningprimrose, yellow nutsedge, and common cocklebur were poor or non-hosts for *R. reniformis*. Most of the weeds tested would not maintain high population levels of *M. incognita* or *R. reniformis* when non-host or nematode-resistant crops were grown.

R. F. Davis and T. M. Webster, USDA-ARS, Crop Protection and Management Research Unit, P.O. Box 748, Tifton, GA 31793
*Corresponding author: rfdavis@tifton.usda.gov

Agricultural fields will inevitably have weeds. Most farmers and agricultural scientists view weeds as a problem, independent of other concerns, because weeds compete for water, nutrients, light, and space, which reduce crop growth and yield. Although competition is the most important effect weeds have on crop production, weeds are part of the ecology of a field and can have other less obvious effects, such as serving as a reservoir for insects (Marshall et al., 2003; Penagos et al., 2003), diseases (Gonzalez et al., 1991; Marley, 1995; Ramappa et al., 1998), and nematodes (Bélair and Benoit, 1996; Davidson and Townshend, 1967; Tedford and Fortnum, 1988; Venkatesh et al., 2000).

Cotton (*Gossypium hirsutum* L.) is often grown in rotation with peanut (*Arachis hypogaea* L.) and corn (*Zea mays* L.), so many of the important weed problems are similar among the crops. In the southeastern USA, annual losses due to weeds (sum of crop yield reductions and costs of control) in cotton, corn, and peanut were estimated to be $20 million, $42 million, and $64 million, respectively (Bridges, 1992). Some of the most troublesome weeds in cotton, corn, and peanut production in Georgia include perennial nutsedges (*Cyperus* spp.), morningglories (*Ipomoea* spp. and *Jacquemontia* spp.), pigweeds (*Amaranthus* spp.), sicklepod [*Senna obutifolia* (L.) Irwin and Barneby], and Florida beggarweed [*Desmodium tortuosum* (Sw.) DC.] (Webster, 2001; Webster, 2004).

Many crops in the southern USA suffer significant yield reductions from nematode parasitism (Koenning et al., 1999). Nematodes can be a limiting factor in cotton and peanut production (Baird et al., 1996; Davis and May, 2003; Dickson, 1998), and nematodes cause greater yield losses in cotton than any other pathogen (Blasingame and Patel, 2003). *Meloidogyne incognita* (Kofoid & White) Chitwood and *Rotylenchulus reniformis* Linford & Oliveira cause more damage to cotton in the USA than any other nematodes (Blasingame and Patel, 2003), and both have wide host ranges that include weeds (Mar-

tin, 1958; Martin, 1961; Tedford and Fortnum, 1988; Robinson et al., 1997). The interaction of weeds and nematodes can affect crop production by reducing the potential benefit of crop rotations (Bélair and Benoit, 1996; McSorley, 1996; O'Bannon et al., 1982) and of nematode resistant crops (Wong and Tylka, 1994) to suppress nematodes.

The abundance of a weed species and the amount of nematode reproduction on that species determine the magnitude of the effect the weed has on nematode population densities. The weeds included in this study occur commonly in Georgia and other areas in the southeastern USA (Webster and MacDonald, 2001). The objective of this study was to determine the relative amount of reproduction of *M. incognita* and *R. reniformis* on selected weeds associated with major crops in the southeastern USA compared to cotton.

MATERIALS AND METHODS

Thirteen plant species were evaluated for relative host status for *M. incognita* race 3 in two greenhouse trials, and fourteen plant species were evaluated for relative host status for *R. reniformis* in two additional greenhouse trials. Plant species evaluated with both *M. incognita* and *R. reniformis* included cotton, peanut, Florida beggarweed (*D. tortuosum*), prickly sida (*Sida spinosa* L.), common cocklebur (*Xanthium strumarium* L.), smallflower morningglory [*Jacquemontia tamnifolia* (L.) Griseb.], pigweed (*Amaranthus* spp.), sicklepod (*S. obutifolia*), cutleaf eveningprimrose (*Oenothera laciniata* Hill.), Florida pusley (*Richardia scabra* L.), purple nutsedge (*Cyperus rotundus* L.), yellow nutsedge (*Cyperus esculentus* L.), and ivyleaf morningglory [*Ipomoea hederaceae* (L.) Jacq.]. Corn also was included in tests with *R. reniformis*. Each trial had seven replications in a randomized complete block design. Cotton (DP5415; Delta Pine and Land Co.; Scott, MS) was used as a susceptible standard for comparison. Seeds were planted into 15-cm-diam. pots on 22 March 2002 for trial 1 and on 24 April 2002 for trial 2 with *M. incognita*, and on 2 July 2002 for trial 1 and on 31 March 2003 for trial 2 with *R. reniformis*. Seedlings were thinned to one per pot prior to inoculation. Each pot held approximately 1.5 L of pasteurized soil (Tifton loamy sand; 83% sand, 9% silt, 7% clay, and ≤1% organic matter). Soil temperatures in the pots varied between 24 and 35°C during the study.

Inoculum was collected from tomato roots (*Lycopersicon esculentum* Mill. cv. Rutgers) by agitating roots in 0.5% sodium hypochlorite solution for 2 min. (Hussey and Barker, 1973) approximately 1 h before inoculation. Inoculum of 8,000 *M. incognita* race 3 eggs/pot (approximately 800 eggs/150cm^3 soil) was added on 8 April for trial 1 and 13 May for trial 2. Eight thousand *R. reniformis* eggs/pot were added on 26 July for trial 1 and 3 June for trial 2. Inoculum was distributed into two holes (approximately 2.5 cm deep) and covered with soil. Pots were watered immediately following inoculation.

Nematode eggs were extracted from all roots in the pot 57 and 56 d after inoculation for the two trials with *M. incognita* and 59 and 55 d after inoculation for the two trials with *R. reniformis*. Roots were washed free of soil, cut into 5-cm pieces, and agitated in a 1% sodium hypochlorite solution in a 1-L flask for 4 min. Eggs were collected and rinsed with tap water on nested 150- over 25-μm-pore sieves. Egg counts were subjected to a square-root transformation to equalize the error variances prior to analysis of variance (SAS Institute Inc.; Cary, NC) and means separated by Fisher's protected least significant difference test (LSD; *P* = 0.05). In a separate analysis, egg counts were standardized as a percentage of the number recovered from cotton. These data were not transformed prior to statistical analysis and means separation (LSD). For discussion in this manuscript, good hosts support nematode reproduction ≥70% of the reproduction on cotton, moderate hosts support reproduction between 36 and 69%, poor hosts support ≤35%, and non-hosts do not support reproduction.

RESULTS AND DISCUSSION

The host status of a plant to nematodes may be estimated from the total number of nematodes produced in a pot or from the number of nematodes produced per gram of root, and the two measurements can result in very different conclusions (Gast et al., 1984; Jordaan et al., 1988). Because the concern with nematode reproduction on weeds is that nematode population density will increase or be maintained in a field, total reproduction rather than nematodes per gram of root is the more appropriate measure for this type of study. Total reproduction was underestimated in this study because only eggs were extracted and counted, and vermiform stages were not enumerated, but the relative estimates of reproduction should be accurate if the ratio of eggs to vermiform stages was similar among the plants tested. Root growth in pots

may be different than root growth in the field due to the restricted space in a pot, and those differences may affect nematode reproduction. Such differences in root growth would affect nematodes per pot and nematodes per gram of root, so they are not important in deciding which measure to use.

Nematode reproduction was lower than anticipated in all four trials, but final nematode egg counts standardized as a percentage of those produced on a known susceptible host provide an accurate estimate of the relative host status of each plant species. Cotton was used as the susceptible standard in these trials. Peanut was included as a known non-host for the two nematodes. The weeds tested were different in their relative host status to both *M. incognita* and *R. reniformis*. Final *M. incognita* egg counts on the plants tested ranged from 0 to 193% of the number on cotton in one trial and from 0 to 407% in the other trial (Table 1), and final *R. reniformis* egg counts ranged from 0 to 105% in one trial and from 0 to 454% in the other trial (Table 2). Trials could not be combined for analysis due to a statistical interaction ($P \leq 0.05$) between trial and egg counts.

For *M. incognita*, only prickly sida was consistently a better host than cotton, although ivyleaf morningglory was a better host in one trial (Table 1). Smallflower morningglory was a moderate host

of *M. incognita* relative to cotton (53 and 69% of cotton in the two trials), whereas yellow and purple nutsedge, pigweed, Florida beggarweed, sicklepod, common cocklebur, cutleaf eveningprimrose, and Florida pusley were poor or non-hosts (0 to 35% of cotton). For *R. reniformis*, only Florida beggarweed was consistently a good host, purple nutsedge and sicklepod were good hosts in one trial, and smallflower morningglory was a moderate host in both trials (Table 2). Pigweed, prickly sida, Florida pusley, cutleaf eveningprimrose, and yellow nutsedge were consistently poor or non-hosts for *R. reniformis*. Common cocklebur was tested in only one trial, but was a poor host. Weeds that were good hosts for one nematode (i.e. prickly sida for *M. incognita* and Florida beggarweed for *R. reniformis*) were not good hosts for the other nematode. Common cocklebur, cutleaf eveningprimrose, and Florida pusley were poor hosts for both nematodes.

Although *M. incognita* and *R. reniformis* are reported to have wide host ranges (Martin, 1958; Martin, 1961; Robinson et al., 1997), the relative host status of plants listed as hosts often is not known, and the race of *M. incognita* often is not reported. A plant may be classified accurately as a host because nematode reproduction occurs, but the level of reproduction may be much less than that on a susceptible

Table 1. Reproduction of *Meloidogyne incognita* on selected crops and weeds

Plant name	Trial #1		Trial #2	
	Eggs[z]	Cotton (%)	Eggs[z]	Cotton (%)
Prickly sida	138,471 a	193.4 a	177,129 a	407.2 a
Cotton	71,614 b	100.0 b	43,500 c	100.0 c
Smallflower morningglory	37,029 c	52.7 c	30,214 cd	69.5 cd
Ivyleaf morningglory	31,929 c	44.6 c	91,843 b	211.1 b
Yellow nutsedge	11,914 d	16.7 cd	8,100 ef	18.6 d
Pigweed	11,443 d	16.0 cd	2,143 ef	4.9 d
Purple nutsedge	4,714 de	6.6 d	15,000 de	34.5 d
Florida beggarweed	3,514 def	4.9 d	1,329 ef	3.0 d
Sicklepod	3,514 def	4.9 d	343 f	0.8 d
Common cocklebur	600 efg	0.8 d	1,050 f	2.4 d
Cutleaf eveningprimrose	129 fg	0.2 d	986 f	2.3 d
Florida pusley	0 g	0.0 d	343 f	0.8 d
Peanut	0 g	0.0 d	0 f	0.0 d

[z] Pots were inoculated with 8,000 eggs approximately 8 wk prior to data collection. Data presented are means of total numbers of eggs in seven replications, but the statistical analysis was performed on square-root transformed data. Means within a column followed by the same letter are not significantly different according to Fisher's Protected LSD (P = 0.05).

crop plant. Most of the weeds tested in our study are hosts for both *M. incognita* and *R. reniformis*, but most of the weeds should be considered poor hosts for both nematodes relative to cotton. Similarly, most weeds from tobacco fields are moderate to poor hosts for *M. incognita* race 3 (Tedford and Fortnum, 1988). Many weeds from vegetable fields are poor hosts for *R. reniformis*, although those same weeds may be better hosts for *Meloidogyne* spp. (Queneherve et al., 1995). Weeds generally do not serve as reservoirs for phytoparasitic nematodes in sugarcane (*Saccharum* interspecific hybrids) (Showler et al., 1990). In contrast, nematodes in rice (*Oryza sativa* L.) fields reproduce on weeds that grow in fallow fields between rice crops, which perpetuates nematode problems (Babatola, 1980; Rao et al., 1970), and purple nutsedge perpetuates problems with *M. incognita* in chile pepper (*Capsicum annuum* L.) (Schroeder et al., 1993). Weeds growing between spring and fall vegetable crops in Florida are likely to increase population densities of *R. reniformis* (McSorley and Parrado, 1983). For many of the weeds tested, nematode populations would decline if that weed were the only host present.

Most of the weeds tested were reasonably consistent in their relative host status to *M. incognita* and *R. reniformis*, but, as previously noted, a few weeds were inconsistent in their relative host status. Although some variability among trials was expected, very large changes in relative host status, such as that seen for *R. reniformis* on purple nutsedge (13% of cotton in one trial and 454% of cotton in the other), are difficult to explain. Some variability in relative hosts status may be explained by genetic variability in the weed population (Griffin, 1982); however, purple nutsedge has been shown to have limited intraspecific variation (Okoli et al., 1997). When coupled with random variation among trials, genetic variability in the host plant may be sufficient to explain the difference between trials observed for *R. reniformis* on sicklepod or *M. incognita* on ivyleaf morningglory, but it does not seem adequate to explain the far larger difference observed with *R. reniformis* on purple nutsedge.

Florida beggarweed is one of the predominant weeds in peanut production in the southeastern USA (Webster, 2001; Webster and MacDonald, 2001), and it is a very good host for *R. reniformis*.

Table 2. **Reproduction of *Rotylenchulus reniformis* on selected crops and weeds**

Plant name	Trial #1		Trial #2	
	Eggs[1]	Cotton (%)	Eggs[z]	Cotton (%)
Florida beggarweed	7,671 a	104.7 a	18,514 b	73.2 bc
Cotton	7,329 a	100.0 a	25,286 b	100.0 b
Smallflower morningglory	2,871 b	39.2 b	8,229 c	32.6 bc
Ivyleaf morningglory	2,714 bc	37.0 b	971 de	3.8 c
Purple nutsedge	943 de	12.9 b	114,686 a	453.5 a
Sicklepod	900 d	12.3 b	20,486 b	81.0 bc
Pigweed	900 cd	12.3 b	943 de	3.7 c
Prickly sida	857 bcd	11.7 b	2,486 cd	9.8 c
Corn	771 d	10.5 b	343 de	1.4 c
Florida pusley	257 de	3.5 b	257 de	1.0 c
Cutleaf eveningprimrose	250 de	3.4 b	343 de	1.4 c
Yellow nutsedge	0 e	0.0 b	2,743 cd	10.9 c
Peanut	0 e	0.0 b	0 e	0.0 c
Common cocklebur	—[y]	—[y]	514 de	2.0 c

[z] Pots were inoculated with 8,000 eggs approximately 8 wk prior to data collection. Data presented are means of total numbers of eggs in seven replications, but the statistical analysis was performed on square-root transformed data. Means within a column followed by the same letter are not significantly different according to Fisher's Protected LSD (*P* = 0.05).

[y] Not tested.

In fields where *R. reniformis* is present, suppression of the nematode by rotating peanut with cotton would be greatly reduced by a heavy infestation of Florida beggarweed. Other weed species that could possibly confound nematode-suppressive rotations for cotton include sicklepod, ivyleaf morningglory, smallflower morningglory, purple nutsedge, and prickly sida. All of these weeds rank among the six most common weeds encountered in corn and/or peanut in the Southeast (Webster, 2001; Webster, 2004). Most of the weeds tested were poor or nonhosts for *M. incognita* and *R. reniformis* and would not perpetuate nematode problems when non-host or nematode-resistant crops were grown. This does not contradict the idea that weeds in a rotation crop may reduce beneficial effects (Bélair and Benoit, 1996; McSorley, 1996; Vanstone and Russ, 2001), but it does demonstrate that many of the common weeds encountered in the major crops rotated with cotton in the southeastern USA are unlikely to do so.

The finding that most weeds are relatively poor hosts for *M. incognita* and *R. reniformis* suggests the possibility that nematodes could affect the plant competition between cotton and weeds. Nematode parasitism reduces cotton growth (Starr, 1998), but the growth of weeds that are poor hosts is likely to be unaffected unless the weed is very intolerant of the nematode. In a field where cotton is being damaged by nematodes, but the weeds are unencumbered, the weeds may provide more competition to the cotton than would be the case in the absence of the nematodes. Therefore, minimizing nematode damage to cotton through the use of nematicides, host plant resistance, or other means may ultimately preserve the ability of cotton to be as competitive as possible with weeds. Nematode parasitism of a crop has been shown to increase the effects of competition from weeds when soybean [*Glycines max* (L.) Merrill] growth was reduced by soybean cyst nematode (*Heterodera glycines* Ichinohe) damage (Alston et al., 1991). Similarly, tomatoes infected with *Meloidogyne incognita* were shown to be less competitive with black nightshade (*Solanum nigrum* L.) than non-infected tomato (Gonzalez Ponce et al., 1995).

CONCLUSIONS

Most weeds support some reproduction of *M. incognita* and *R. reniformis* and are hosts for these nematodes, but most of the weeds tested in this study were poor or very poor hosts. Florida beggarweed has the possibility of maintaining high population densities of *R. reniformis* when a non-host crop, such as peanut, is grown in rotation with cotton. Similarly, prickly sida has the potential to reduce the effectiveness of growing a genotype of cotton with *M. incognita* resistance. It appears that many weeds have little potential to maintain high enough nematode population levels to perpetuate nematode problems. Because cotton suffers significant damage from these nematodes, and weeds that are very poor hosts probably do not suffer significant damage, nematode parasitism of cotton may increase the level of competition from weeds. If so, then minimizing nematode-induced damage to cotton through effective nematode management also would minimize yield suppression from weeds by preserving the ability of the crop to be competitive with weeds.

REFERENCES

Alston, D. G., J. R. Bradley, H. D. Coble, and D. P. Schmitt. 1991. Impact of population density of *Heterodera glycines* on soybean canopy growth and weed competition. Plant Dis. 75:1016-1018.

Babatola, J. O. 1980. Studies on the weed hosts of the rice root nematode, *Hirschmanniella spinicaudata* Sch. Stek. 1944. Weed Res. 20:59-61.

Baird, R. E., R. F. Davis, P. J. Alt, B. G. Mullinix, and G. B. Padgett. 1996. Frequency and geographical distribution of plant-parasitic nematodes on cotton in Georgia. J. Nematol. (Supplement) 28:661-667.

Bélair, G., and D. L. Benoit. 1996. Host suitability of 32 common weeds to *Meloidogyne hapla* in organic soils of southwestern Quebec. J. Nematol. (Supplement) 28:643-647.

Blasingame, D., and M. V. Patel. 2003. Cotton disease loss estimate committee report. p. 252-253. *In* Proc. Beltwide Cotton Conf., Nashville, TN. 6-10 Jan. 2003. Natl. Cotton Counc. Am., Memphis, TN.

Bridges, D. C. 1992. Crop losses due to weeds in the United States. Weed Sci. Soc. Am., Champaign, IL.

Davidson, T. R., and J. L. Townshend. 1967. Some weed hosts of the southern root-knot nematode, *Meloidogyne incognita*. Nematologica 13:452-458.

Davis, R. F., and O. L. May. 2003. Relationships between tolerance and resistance to *Meloidogyne incognita* in cotton. J. Nematol. 35:411-416.

Dickson, D. W. 1998. Peanut. p. 523-566. *In* K. R. Barker, G. A. Pederson, and G. L. Windham (ed.) Plant nematode interactions. ASA, Madison, WI.

Gast, R. E., R. G. Wilson, and E. D. Kerr. 1984. Lesion nematode (*Pratylenchus* spp.) infection of weeds species and fieldbeans (*Phaseolus vulgaris*). Weed Sci. 32:616-620.

Gonzalez, C. F., G. W. Xu, H. L. Li, and J. W. Cosper. 1991. *Leersia hexandra*, an alternative host for *Xanthomonas campestris* pv. *oryzae* in Texas. Plant Dis. 75:159-162.

Gonzalez Ponce, R., C. Zancada, M. Verduga, and L. Salas. 1995. The influence of the nematode *Meloidogyne incognita* on competition between *Solanum nigrum* and tomato. Weed Res. 35:437-443.

Griffin, G. D. 1982. Differences in the response of certain weed host populations to *Heterodera schachtii*. J. Nematol.14:174-182.

Hussey, R. S., and K. R. Barker. 1973. A comparison of methods of collecting inocula of *Meloidogyne* spp., including a new technique. Plant Dis. Rep. 57:1025-1028.

Jordaan, E. M., and D. De Waele. 1988. Host status of five weed species and their effects on *Pratylenchus zaea* infestation of maize. J. Nematol. 21:620-624.

Koenning, S. R., C. Overstreet, J. W. Noling, P. A. Donald, J. O. Becker, and B. A. Fortnum. 1999. Survey of crop losses in response to phytoparasitic nematodes in the United States for 1994. J. Nematol. (Supplement) 31:587-618.

McSorley, R. 1996. Impact of crop management practices on soil nematode populations. Proc. Soil Crop Sci. Soc. Fla. 55:63-66.

McSorley, R., and J. L. Parrado. 1983. Influence of summer management strategies on nematode populations in a subtropical agroecosystem. Nematropica 13:1-8.

Marley, P. S. 1995. *Cynodon dactylon* - and alternative host for *Sporisorium sorghi*, the causal organism of sorghum covered smut. Crop Prot. 14:491-493.

Marshall, E. J. P., V. K. Brown, N. D. Boatman, P. J. W. Lutman, G. R. Squire, and L. K. Ward. 2003. The role of weeds in supporting biological diversity within crop fields. Weed Res. 43:77-89.

Martin, G. C. 1958. Root-knot nematodes (*Meloidogyne* spp.) in the Federation of Rhodesia and Nyasaland. Nematologica 3:332-349.

Martin, G. C. 1961. Plant species attacked by root-knot nematodes (*Meloidogyne* spp.) in the Federation of Rhodesia and Nyasaland. Nematologica 6:130-134.

O'Bannon, J. H., G. S. Santo, and A. P. Nyczepir. 1982. Host range of the Columbia root-knot nematode. Plant Dis. 66:1045-1048.

Okoli, C. A. N., D. G. Shilling, R. L. Smith, and T. A. Bewick. 1997. Genetic diversity in purple nutsedge (*Cyperus rotundus* L.) and yellow nutsedge (*Cyperus esculentus* L.). Biol. Control 8:111-118.

Penagos, D. I., R. Magallanes, J. Valle, J. Cisneros, A. M. Martinez, D. Goulson, J. W. Chapman, P. Caballero, R. D. Cave, and T. Williams. 2003. Effect of weeds on insect pests of maize and their natural enemies in southern Mexico. Int. J. Pest Manage. 49:155-161.

Queneherve, P., F. Drob, and P. Topart. 1995. Host status of some weeds to *Meloidogyne* spp., *Pratylenchus* spp., *Helicotylenchus* spp, and *Rotylenchulus reniformis* associated with vegetables cultivated in polytunnels in Martinique. Nematropica 25:149-157.

Ramappa, H. K., V. Muniyappa, and J. Colvin. 1998. The contribution of tomato and alternative host plants to tomato leaf curl virus inoculum pressure in different areas of south India. Ann. Appl. Biol. 133:187-198.

Rao, Y. S., P. Israel, and H. Biswas. 1970. Weed and rotation crop plants as hosts for the rice root-knot nematode, *Meloidogyne graminicola* (Golden and Birchfield). Oryza 7:137-142.

Robinson, A. F., R. N. Inserra, E. P. Caswell-Chen, N. Vovlas, and A. Troccoli. 1997. *Rotylenchulus* species: identification, distribution, host ranges, and crop plant resistance. Nematropica 27:127-180.

Schroeder, J., S. H. Thomas, and L. Murray. 1993. Yellow and purple nutsedge and chile peppers host southern root-knot nematode. Weed Sci. 41:150-156.

Showler, A. T., T. E. Reagan, and K. P. Shao. 1990. Nematode interactions with weeds and sugarcane mosaic virus in Louisiana sugarcane. J. Nematol. 22:31-38.

Starr, J. L. 1998. Cotton. p. 359-379. *In* K. R. Barker, A. Pederson, and G. L. Windham (ed.) Plant nematode interactions. ASA, Madison, WI.

Tedford, E. C., and B. A. Fortnum. 1988. Weed hosts of *Meloidogyne arenaria* and *M. incognita* common in tobacco fields in South Carolina. Ann. Appl. Nematol. (J. Nematol. Supplement 20) 2:102-105.

Vanstone, V. A., and M. H. Russ. 2001. Ability of weeds to host the root lesion nematodes *Pratylenchus neglectus* and *P. thornei*. I. Grass weeds. Aust. Plant Pathol. 30:245-250.

Venkatesh, R., S. K. Harrison, and R. M. Riedel. 2000. Weed hosts of soybean cyst nematode (*Heterodera glycines*) in Ohio. Weed Tech. 14:156-160.

Webster, T. M. 2001. Southern states weed survey: broadleaf crops subsection. Proc. Southern Weed Sci. Soc. 54:244-259.

Webster, T. M. 2004. Southern states weed survey: grass crops subsection. Proc. Southern Weed Sci. Soc. 57:404-426.

Webster, T. M., and G. E. MacDonald. 2001. A survey of weeds in various crops in Georgia. Weed Tech. 15:771-790.

Wong, A. T. S., and G. L. Tylka. 1994. Eight nonhost weed species of *Heterodera glycines* in Iowa. Plant Dis. 78:365-367.