Nematology Circular No. 185
January 1991

Fla. Dept. Agric. & Consumer Serv.
Division of Plant Industry

ROOT-KNOT NEMATODE PARASITISM OF COTTON. III.

J. A. Veech[1]

INTRODUCTION: All nematodes in the genus *Meloidogyne* share the common name "root-knot" nematode which is descriptive of the damage the nematode does to plant roots after infection. There are many species of "root-knot" nematodes: Southern root-knot, Northern root-knot, peanut root-knot, etc. In general appearance root-knot nematodes are similar to one another and this makes it very difficult to distinguish between the species. Indications about the specific identity of root-knot nematodes of North America can be obtained by differential host tests (Table 1). However, species identification obtained with this method is not reliable and should be confirmed by morphological examination of the specimens collected from the infected differential hosts.

Probably the most serious nematode parasite of cotton is the Southern root-knot nematode, *M. incognita*. There are four recognized pathotypes, or races, of *M. incognita* but only race 3 and 4 reproduce aggressively on cotton and are therefore of the most concern to cotton producers. However, if a cotton field becomes weedy with hosts of race 1 or 2, these races may also become a problem. There is some indication that races 1 and 2 can reduce cotton yield if a high number of these nematodes are present on host weeds which will maintain high numbers in a field situation.

Differential host tests are also used to identify the races of *M. incognita* (Table 2). Table 2 indicates the host plants that can be used to separate the races by their differential reproduction on the selective hosts.

LIFE CYCLE: The first stage juvenile of root-knot nematodes, still within the egg, molts its outer body wall and produces a new cuticle. Soon the second stage juvenile hatches from the egg and begins to migrate through the soil. Whether by chance encounter or by some form of attraction not yet understood, the second stage juvenile locates the root of a suitable host or perishes. Second stage juveniles penetrate the root near the root tip. While the nematode is migrating within the root in search of a permanent feeding site, the root continues to grow. Eventually the nematode begins feeding on specific vascular cell primordia. The cell being fed upon becomes significantly modified into a very large, multinucleate cell known as a "giant cell." Extensive cell division and enlargement which results in the typical "root-knot" condition occurs at this location. As the nematode feeds, it enlarges in body size and it can no longer migrate within the root. As this occurs the nematode molts and becomes sexually mature. As quickly as 20 days after initiating parasitism, the female, without the assistance of a male, will begin to deposit fertile eggs in a gelatinous-like sac that she produces to protect the eggs. The sac is produced at the posterior end of the female and usually protrudes from the root surface. A thousand or more eggs may be produced by a single female nematode.

Root-knot nematode infection is easy to observe but should be diagnosed with care as other organisms can cause root swellings as well. The roots are noticeably gnarled or knotted (Fig. 1), somewhat resembling legume roots that are infected by the beneficial nodule producing bacteria. The signs of root-knot nematode presence may or may not be as pronounced on cotton roots, depending on the degree of infection. Therefore, careful observation of the root surface is necessary. Figure 2 shows a noninfested root of the same age as seen in Fig. 1.

CONTROL OF ROOT-KNOT NEMATODES ON COTTON: All nematode management strategies share the same objective: to reduce the number of nematodes in the soil. Root-knot nematode damage is greatest in coarse textured soils and symptoms are most frequently observed in this soil type. There is a fairly direct relationship between the population density of nematodes in the sandier soils and the damage the nematodes impose on the crop.

Because root-knot nematodes generally have a broad host range it is difficult to always find suitable crops to use in rotation with cotton. However, with suitable crops, rotation is effective and is used to manage root-knot nematodes. In the past the most effective nematode management tool available to use to control nematodes on cotton was the application of synthetic chemicals. Recently, however, the application of synthetic chemicals has been all but abandoned for environmental or human health reasons.

---

[1]Research Plant Physiologist (Nematology), Cotton Pathology Research Unit, Southern Crops Research Laboratory, USDA-ARS, College Station, TX 77801.

ROOT-KNOT NEMATODE RESISTANT COTTON: Presently, there are no commercially desirable cultivars of cotton available that are resistant to the root-knot nematode. The best prospects for the development of such cottons, however, seems to be with the Auburn line of cottons (i.e., 'Auburn 634 RNR'). The multiple adversity resistance (MAR) breeding technique, as practiced in Texas, has produced cotton cultivars that provide excellent yields even when challenged by the root-knot nematode. However, when these plants are closely examined it is evident that they support abundant nematode reproduction, thus categorizing the cottons as susceptible but tolerant. Apparently, the MAR breeding program has produced excellent cottons that are tolerant to nematode parasitism.

SELECTED REFERENCES

Heald, C. M., and C. C. Orr. 1984. Nematode diseases of cotton. P. 147-166 in W. R. Nickle, ed. Plant and Insect Nematodes. M. Dekker, New York.

Sasser, J. N. 1972. Nematode diseases of cotton. P. 197-214 in J. M. Webster, ed. Economic Nematology. Academic Press, New York.

Starr, J. L., and L. J. Page. 1990. Nematode parasites of cotton and other tropical fibre crops. P. 539-556 in M. Luc, R. A. Sikora, and J. Bridge, eds. Plant Parasitic Nematodes in Subtropical and Tropical Agriculture. CAB, Wallingford, Oxon, UK.

Veech, J. A. 1984. Cotton protection practices in the USA and world. Section C: Nematodes. P. 309-330 in R. J. Kohel, and C. F. Lewis, eds. Cotton. Agronomy Monograph no. 24. ASA-SSSA, Madison, WI.

_____. 1990. Nematode parasitism of cotton. Fla. Dept. Agric. & Consumer Serv., Div. Plant Ind., Nema. Circ. No. 183.

Watkins, G. M. (ed.). 1981. Compendium of cotton diseases, Nematodes. P. 50-56. The American Phytopathological Society, St. Paul, Minnesota.

Table 1. Host differentials and their "suitability" for reproduction of the major American species of nematodes in the genus *Meloidogyne*.

	Species of *Meloidogyne*			
Host Differential	*arenaria*	*incognita*	*javanica*	*hapla*
Tomato, 'Rutgers'	+	+	+	+
Pepper, 'Cal. Wonder'	±	+	-	-
Peanut, 'Florrunner'	±	-	-	+
Melon, 'Charleston Gray'	+	+	+	-
Cotton, 'Deltapine 16'	-	±	-	-
Tobacco	+	±	+	+

\+ supports aggressive reproduction
± variable reproduction*
\- slight or no reproduction

*probably related to pathotypes (races) of the nematode.

Table 2. Host differentials for identifying the four races of *Meloidogyne incognita*.

Host Differential	1	2	3	4
Tobacco ('NC 95')	+	-	+	-
Cotton ('Deltapine 16')	-	-	+	+

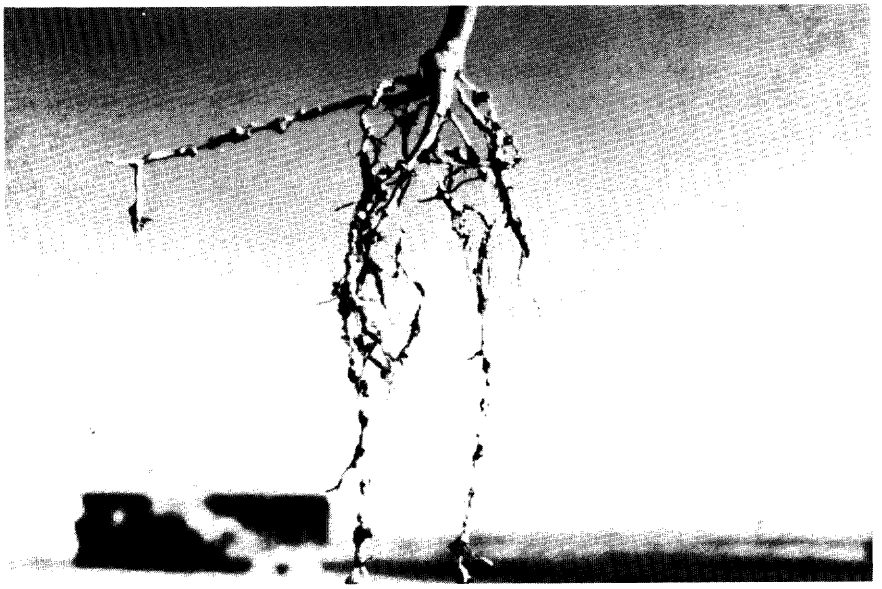

Fig. 1. Cotton roots infected by the root-knot nematode, *Meloidogyne incognita*. Note the numerous small galls (knots) on the roots.

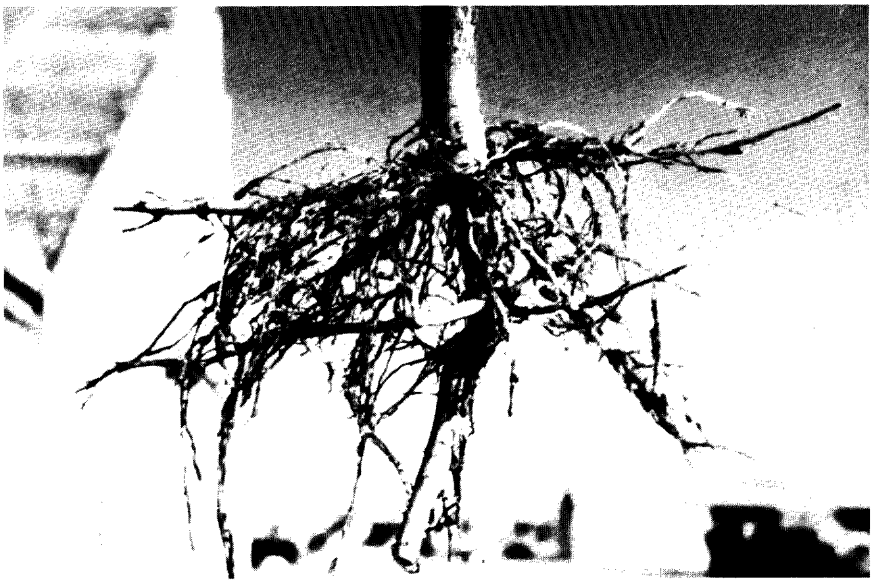

Fig. 2. Noninfected cotton roots from plant of the same age as plant in Fig. 1.

Contribution No. 413, Bureau of Nematology [Nema. Circ. #185]