

Detection of *Heterodera glycines* on Soybean in Brazil

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ABSTRACT

Mendes, M. L., and Dickson, D. W. 1993. Detection of *Heterodera glycines* on soybean in Brazil. *Plant Dis.* 77:499-500.

The soybean cyst nematode (*Heterodera glycines*) was detected and identified on soybean (*Glycine max*) during a survey made in 65 soybean fields on 52 farms in six states in central Brazil during March–June 1992. The infested sites were located near the municipalities of Iraí de Minas and Nova Ponte, Minas Gerais; Chapadão do Céu and Aporé, Goiás; Chapadão do Sul, Mato Grosso do Sul; and Campo Verde, Mato Grosso. The large geographic region represented by these infested sites likely means that *H. glycines* is widely established in Brazil. On the basis of the severity of plant stunting and the number of cysts extracted from soil collected at each site, it is estimated that *H. glycines* has been present on soybean in Brazil for an extended period.

Soybean (*Glycine max* (L.) Merr.) is an important crop in Brazil, the second leading producer in the world. Soybean was first grown in the southern region of Brazil. During the 1970s, soybean plantings expanded rapidly, and now the crop is grown predominantly in the savanna regions of central Brazil.

Several nematode genera and species have been reported as parasites of soybean in Brazil: *Meloidogyne incognita* (Kofoid & White) Chitwood; *M. javanica* (Treub) Chitwood; *M. arenaria* (Neal) Chitwood; *Pratylenchus brachyurus* (Godfrey) Filipjev & Schuurmans-Steckhoven; *Helicotylenchus dihystra* (Cobb) Sher; *Criconebella* spp.; and *Hoplolaimus* spp. (2,5,6,8).

Heterodera glycines Ichinohe, the soybean cyst nematode (SCN), is the most important pathogen of soybean in the United States and in eastern Asia (1,15). It was first detected in Colombia in 1983 (3,12) but had not been observed in Brazil until it was suspected in samples from Nova Ponte, Minas Gerais (7) and Campo Verde, Mato Grosso (9) and reported as *Heterodera* sp. in 1992. Our objectives were first to determine the occurrence of *H. glycines* on soybean in Brazil and then to survey the major soybean-producing regions of Brazil to determine the extent of the nematode's spread and the severity of any infestations.

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Florida Agricultural Experiment Station Journal Series No. R02902.

Accepted for publication 13 January 1993.

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MATERIALS AND METHODS

A survey was conducted in 65 soybean fields on 52 farms in the major soybean-growing regions of Brazil with the cooperation of growers, extension personnel from state governments, cooperatives, and grower associations. The farms were selected on the basis of reported yield suppressions and/or aboveground plant symptoms of stunting, irregular patterns of plant growth, and chlorosis. Some sites were selected because of their proximity to the sites where the SCN was detected, i.e., soil samples were collected from soybean fields that were nearby to fields showing disease symptoms. The survey was conducted in the states of São Paulo, Minas Gerais, Bahia, Goiás, Mato Grosso, and Mato Grosso do Sul (Fig. 1). These states include the majority of the soybean produced in Brazil.

Soil and root samples were randomly collected across soybean fields 20–30 cm deep with a shovel. Samples were taken in the root zone of diseased as well as healthy plants. Six to 12 samples each with 200–300 g of soil were taken per hectare, and the soil was thoroughly mixed to give a final sample of 500–1,000 g.

Soybean roots in each soil sample were processed by washing and rubbing them by hand to free any females and cysts, then sieving the soil suspension through nested 850- μ m-pore and 250- μ m-pore sieves (13). A portion of each sample was dried at 25 C and processed for cysts by suspending the soil in water, then passing it through nested 850- μ m-pore and 250- μ m-pore sieves (16). Vermiform nematodes were extracted from the soil samples (100 cm³) by the centrifuge-flotation technique (4).

RESULTS AND DISCUSSION

The identification of *H. glycines* was based on morphometries of the second-

stage juveniles, females, males, and cysts (11). SCNs were isolated from soil and root samples collected from farms near Iraí de Minas and Nova Ponte, Minas Gerais; Chapadão do Céu and Aporé, Goiás; Chapadão do Sul, Mato Grosso do Sul; and Campo Verde, Mato Grosso (Fig. 1). Thirteen farms were infested with the SCN and 5,220 ha were estimated to be infested (Table 1).

Suppression of plant growth in soybean fields where the SCN was found ranged from slight (no visible symptoms) to severe. In most cases, the infested sites were fairly extensive, indicating the nematode had been present for an extended period. The fields where the SCN was found have only been in soybean production for the past 7–10 yr, but most have been monocultured with soybean. The average number of cysts extracted from soil collected from infested fields ranged from 128 to 626/100 cm³ of soil (Table 2). The average number of second-stage juveniles extracted was relatively low, ranging from 0 to 156/100 cm³ of soil (Table 2); soil samples with zero nematodes were too dry for extraction of juveniles.

On the basis of our field observations, we believe that SCN is well established in the central region of Brazil. Because most of the producers move equipment around from farm to farm, it is probable that SCN already has been distributed widely in the region surveyed.

All sites where SCN occurred were located in the savanna region and have similar cropping histories and climatic conditions. Soybean, with a few exceptions, is monocultured in this region, and most fields have been in cultivation 7–10 yr. The infested sites are located 700–900 m above sea level, and the temperature

Table 1. Sites in Brazil found to be infested with *Heterodera glycines* during 1991–1992

State Site	Farms (no.)	Area (ha)
Minas Gerais		
Iraí de Minas	1	100
Nova Ponte	1	200
Goiás		
Chapadão do Céu	6	3,200
Aporé	1	10
Mato Grosso do Sul		
Chapadão do Sul	1	10
Mato Grosso		
Campo Verde	3	1,700
Total	13	5,220

Table 2. Average number of cysts and second-stage juveniles of *Heterodera glycines* in soil samples collected from six sites in Brazil during 1991–1992

State Site	No. of samples infested	Average no./100 cm ³ of soil	
		Cysts	Juveniles
Minas Gerais			
Iraí de Minas	1	347	0 ^a
Nova Ponte	3	626	80
Goiás			
Chapadão do Céu	6	418	156
Aporê	1	280	0 ^a
Mato Grosso do Sul			
Chapadão do Sul	1	128	0 ^a
Mato Grosso			
Campo Verde	5	156	40

^a Soil too dry for extraction of juveniles.



Fig. 1. Sites of soybean cyst nematode infestations in Brazil found during 1991–1992: 1 = Iraí de Minas, Minas Gerais; 2 = Nova Ponte, Minas Gerais; 3 = Chapadão do Céu, Goiás; 4 = Aporê, Goiás; 5 = Chapadão do Sul, Mato Grosso do Sul; and 6 = Campo Verde, Mato Grosso. Shading indicates the states surveyed.

ranges from 19 to 28 C in the summer.

This serious pathogen of soybean now occurs in at least four states in Brazil's major soybean-producing region. Management of SCN with resistant cultivars is difficult because this nematode shows a high degree of genetic variability for parasitism (13). Nevertheless, a cropping system with nonhost species and resistant cultivars is reported as the best way to

manage SCN (10,14). Information on the reaction of soybean cultivars grown in Brazil to SCN is very limited. We observed severe infection on the following cultivars or genotypes: Cristalina, Savana, Seriema, Eureka, Canarana, Iracema, Estrela, Doko, UVF-10 (Uberaba), EMGOPA 305, IAC-8, FT-72991, FT-77209, FT-73743, FT-74546, FT-73895, and FT-66761. Cultivars from the

United States that are resistant to the SCN are not currently grown in Brazil.

Although soybean is the most important crop affected by SCN, the nematode has a host range that includes the genus *Phaseolus* and other legumes (1). Further investigations are needed to determine the race(s) of SCN present in Brazil, and the germ plasm most commonly used in breeding should be evaluated for resistance.

ACKNOWLEDGMENTS

We thank the personnel who contributed to this research, especially I. R. de Almeida, A. J. Bottan, J. L. Bottan, A. Carnielli, D. Estevão, V. Henkemaier, H. Kage, J. Marques, J. M. de Moraes, N. Pasin, S. C. Resende, O. F. Resende, N. C. Ribeiro, O. M. Silva, C. Yamanaka, and N. L. Zuffo.

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