

## Soybean Cyst Nematode in Commercial Snap Beans

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### ABSTRACT

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In July 1981, chlorotic, stunted snap beans in a 30-ha commercial production field were found to be infected by a cyst nematode that was subsequently identified as the soybean cyst nematode, *Heterodera glycines* race 3. This is the first report of the occurrence of this nematode in a commercial production area of *Phaseolus* spp. in the United States.

Host range studies of the soybean cyst nematode *Heterodera glycines* Ichinohe have indicated that *Phaseolus* spp. vary in their suitability as hosts of *H. glycines* (3,8). Most cultivars of *Phaseolus vulgaris* L. are susceptible to *H. glycines* but a few such as Red Kidney, Idaho Refugee, Kentucky Wonder Pole, and Improved Rust Resistant were reported as being resistant (8). However, later research showed that kidney bean was an efficient host for a different *H. glycines* population (1).

On 7 July 1981, we found a cyst nematode on Blue Lake bush type snap beans, *P. vulgaris*, in a 30-ha commercial production field located near Goofy Ridge, Mason County, IL. Pockets of chlorotic, stunted plants were scattered throughout the field, which varied in soil texture from a brown, sandy loam to dune sand. We found white females of a *Heterodera* sp. adhering to the roots. This paper reports our identification of the species of *Heterodera* and subsequently the race of *H. glycines* present in this field.

### MATERIALS AND METHODS

White females and cysts were extracted from soil in the rhizosphere of diseased plants with a gravity-sieving technique (2) using nested screens with 850- and 180- $\mu$ m openings (20 and 80 mesh, respectively). *Heterodera* larvae and males and other species of nematodes were extracted by sugar-flotation, using a

screen with 38- $\mu$ m openings (400 mesh) (7).

Twenty cysts were measured using a camera lucida and examined for shape, presence of bullae, and type of fenestrae. Cysts were then crushed, and stylet length, dorsoesophageal gland orifice location, tail length, hyaline tail terminal, and body length of 34 larvae from five cysts were measured with the camera lucida.

A race determination was conducted in the greenhouse using the soybean lines Essex, Franklin, Peking, PI 90763, and PI 88788 as differentials. Seeds were germinated, and four seedlings were planted in each of thirty-six 10-cm-diameter pots containing 500 cm<sup>3</sup> of field soil. Cysts and larvae in the soil averaged 24 and 860, respectively, per pot. Pots were arranged in a randomized complete block design with six replicates. One

**Table 1.** Measurements of larval characters of *Heterodera glycines* from snap beans

Character	Mean ( $\mu$ m) <sup>a</sup>	Range ( $\mu$ m)
Stylet length	23.1	21.5-24.5
Dorsal esophageal gland orifice	4.4	3.0- 5.0
Tail length	45.5	38.5-50.0
Hyaline tail terminal length	24.9	22.0-29.5
Body length	399	372-420

<sup>a</sup> Mean of 34 larvae from five cysts.

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month after planting, the number of white females that had developed on the differential lines was determined.

## RESULTS AND DISCUSSION

Symptoms observed in the snap bean field were similar to those caused by *H. glycines* infection of soybeans (Fig. 1). The white females observed on the roots were also typical of a cyst nematode infection (Fig. 2). *H. glycines* and *Hoplolaimus galeatus* (Cobb) Thorne were the only plant-parasitic nematodes present in the soil extracts.

Cyst morphology was typical for cyst nematodes belonging to the Schachtii group. Cysts were lemon shaped with bullae and ambifenestrated and averaged  $740 \times 490 \mu\text{m}$ . The size was larger than originally reported by Ichinohe (6) but typical for field populations in Illinois. Measurements of larvae from cysts (Table 1) confirmed our initial identification of *H. glycines*. The stylet length, the most critical measurement for species determination, was the same as the length reported by Hirschmann (5) and that of larvae from other *H. glycines* populations in Illinois. Measurements of the dorsal esophageal gland orifice, hyaline tail terminal, and tail length were those expected for *H. glycines*. Only the total body length differed appreciably from previously published reports (5,6). The shorter body length may be the result of host influences or environmental factors.

The race test (Table 2) and  $45\text{-}\mu\text{m}$  tail length (4) indicated that the *H. glycines* population on snap bean was race 3. This is the race most frequently encountered in Illinois.

The infested snap bean field was planted to corn in 1980 and soybeans in 1979. In prior years, the producer followed a strict corn-soybean rotation and had never observed soybean cyst nematode damage in this field. The nematode undoubtedly has been in this field for several years but was below the detection level because severe symptoms were not observed.

The presence of the soybean cyst nematode in the snap bean production area of Illinois poses an immediate and serious threat to this crop. It is probable that many producers already have the nematode in their fields and are unaware of its presence. A gradual decline in productivity over several years or even chlorotic areas in fields may be attributed to other causes such as relative fertility, other soilborne pathogens, and high or low areas in the fields.

Other snap bean production areas in the United States may have the soybean cyst nematode, but producers may not be aware of its presence. This possibility exists particularly in states such as Florida, Arkansas, and Tennessee, which have infestations of the soybean cyst nematode, and Wisconsin, which is

partially surrounded by states with infestations of *H. glycines*.

Because snap beans in Mason County are double cropped, we have initiated

nematicide trials and are sampling farms in this production area to determine the extent of the infestation.

**Added in galley:** In 1981, *H. glycines*

**Table 2.** Development of *Heterodera glycines* races and the snap bean population on soybean differentials

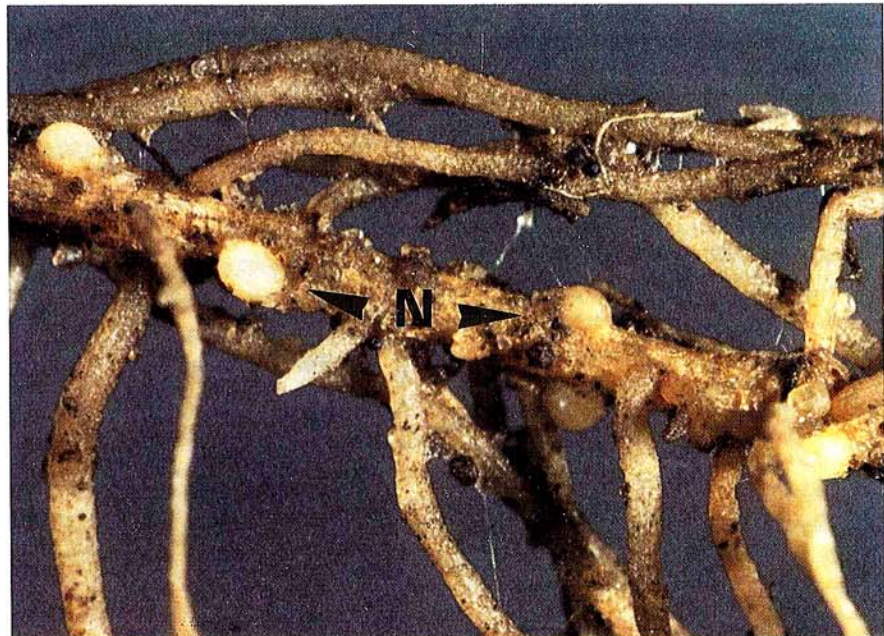
Race or population	Differentials				
	Franklin	Peking	PI 88788	PI 90763	Essex
1	- <sup>a</sup>	-	+	-	+
2	+	+	+	-	+
3	-	-	-	-	+
4	+	+	+	+	+
Snap bean	-(<1%) <sup>b</sup>	-(0%)	-(7%)	-(7%)	+(100%)

<sup>a</sup> - = Number of white females < 10% of the number on Essex; + = number of white females  $\geq$  10% of the number on Essex (after Golden et al [4]).

<sup>b</sup> Percentage of development of white females compared with development on Essex.



**Fig. 1.** Field symptoms of *Heterodera glycines* infection of snap bean.



**Fig. 2.** White females (N) of *Heterodera glycines* on snap bean root.

was also found on snap beans in North Carolina (D. P. Schmitt, *personal communication*).

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