Identification of Additional Soybean Germ Plasm with Resistance to Race 3 of the Soybean Cyst Nematode

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ABSTRACT

A total of 9,153 soybean (Glycine max) germ plasm lines through PI 458024A were evaluated for their resistance to race 3 of soybean cyst nematode (Heteroder a glycines) by growing them in infested soil and counting the number of white females infesting the roots 30 days after planting. Nineteen additional highly resistant and 15 moderately resistant lines were identified. Most of these lines are in maturity group II, III, or IV and have a black seed coat.

Soybean cyst nematode (Heteroder a glycines Ichinohe) is a major disease pathogen of soybeans (Glycine max (L.) Merr.) in the United States. Extensive screening has been performed to identify sources of resistance. Ross and Brim (5) found PI 90763, PI 84751, Ilsoy, and Peking to be resistant to the field populations of soybean cyst nematode (SCN) in North Carolina. Golden et al (3) described the determination of races of SCN. Epps and Hartwig (2) tested more than 3,000 soybean cultivars and lines against race 4 of SCN and reported PI 88788, PI 89772, PI 87631-1, Cloud, Columbia, Peking, PI 84751, and PI 90763 to have a high level of resistance. Anand (1) screened more than 2,000 additional soybean PIs and observed PI 416762 to be resistant to races 3 and 4. Several thousand new lines have been added to the U.S. soybean collection that have never been evaluated for cyst nematode resistance. The object of this study was to screen the entire U.S. collection against race 3 of SCN.

MATERIALS AND METHODS
The soybean germ plasm collection in maturity groups 000 through IV was obtained from R. L. Bernard, Department of Agronomy, University of Illinois, Urbana, and the collection in groups V through X from E. E. Hartwig, Delta Branch Experiment Station, P.O. Box 196, Stoneville, MS. It included a total of 9,153 lines ending at PI 458024A. The initial race 3 culture was collected from the Ames Plantation near Grand Junction, TN, and was tested against check soybean lines Peking, Forrest, PI 88788, and PI 90763 and the susceptible cultivar Essex to confirm its race status. Fresh inoculum of SCN was prepared each month by increasing it on Essex. Ten plants of each PI line were screened. Two seeds were sown in an 8-cm pot containing about 20 cysts per 100 g of soil.
Ten pots of the check lines were also planted each time a new soil lot was prepared in order to verify inoculum purity and viability. The plants were grown in the greenhouse at 26.5 ± 2°C.

Thirty days after planting, the roots were exposed by gently shaking them free of soil. The white cysts on the roots of each plant were counted to rate the lines for resistance. Lines with zero to five white cysts were classified as highly resistant, whereas those with as many as 10 white cysts were considered moderately resistant. Susceptible lines had 30 or more white cysts per plant. The screening process was repeated for all lines classified as resistant.

RESULTS AND DISCUSSION

Descriptions of the resistant lines are presented in Table 1. The 30 lines found highly resistant include I1 that were previously reported resistant to one or more races of SCN (1,2,5). Nineteen additional highly resistant lines and 15 moderately resistant lines were isolated. Two of the lines, PI 438496 and PI 438497, received from Russia in 1980, were designated as Peking in their record. PI 438496 is highly variable because three distinct sublines were isolated. PI 438496B was resistant, whereas PI 438496A and PI 438496C were susceptible. Both PI 438496B and PI 438497 are in maturity group III, whereas Peking from the U.S. collection is in group IV. The seed coat of PI 438496B is black with brown mottling, whereas Peking is completely black. These lines might be traced to natural crosses with Peking.

The U.S. soybean collection includes lines received from different countries on various occasions; however, it is difficult in some cases to locate the primary seed source of several of the SCN-resistant lines. Most of the resistant lines are in maturity group II, III, or IV (Table 2). This may be attributed to the place of their origin, because the maximum infestation of SCN has been reported from the northeastern provinces of China, where maturity groups II, III, and IV are adapted.

The numbers of black, yellow, brown, and green-seeded resistant lines were 32, 7, 3, and 3, respectively. More than 50% of the U.S. collection lines are yellow seeded, whereas 71% of the cyst-resistant lines are black seeded. The remainder are yellow (15%), brown (7%), and green (7%) seeded. This may indicate a common background for the resistant lines. Close linkage has been reported between genes for seed coat color and reaction to cyst nematodes (4).

All of our soybean varieties grown at present acquired resistance from Peking for race 3 and from PI 88788 for race 4. Use of new sources of resistance may provide additional genes to broaden the genetic base contributing to resistance.

LITERATURE CITED
