EVIDENCE OF A FOURTH GENE FOR RESISTANCE TO THE SOYBEAN CYST NEMATODE[1]

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A HIGH degree of resistance to the soybean cyst nematode, *Heterodera glycines,* is found in the soybean variety 'Peking' (Glycine max). Caldwell, Brim, and Ross[4] have reported that this resistance is conditioned by three independent recessive genes, rhg_1, rhg_2, rhg_3. They suggest either zygotic or gametic elimination or both as possible explanations for a consistent shortage in the resistant class. It is clear that in Peking a dominant allele, Rhg_4, closely linked with the recessive allele, *i*, is also necessary for resistance. The *i* allele is one of 4 known alleles at the *I* locus.[5] These alleles, listed in downward order of dominance, are as follows:

- *I*, which inhibits black, brown, or buff pigment in the seed-coat
- i^i, which restricts dark colored pigments to the hilum
- i^k, which restricts the dark colored pigments to a saddle pattern extending from the hilum
- *i*, which allows complete expression of the dark colored pigments throughout the seed-coat

The portion of the seed-coat from which dark pigment is excluded is yellow. In the 'Scott' variety, the recessive allele, rhg_4, is linked with the dominant allele i^i.

An association between resistance and dark-colored seed-coat was observed in the progenies from a backcross program to transfer resistance from Peking to Scott. All true breeding resistant lines derived from this program had colored seed-coat; resistant yellow-seeded plants always segregated for both seed-coat color and reaction to nematode. To demonstrate that a dominant gene was involved, reciprocal crosses were made between Peking and S62–105, a true breeding yellow-seeded susceptible line derived from a resistant yellow-seeded plant, and therefore assumed to be homozygous for genes rhg_1, rhg_2, rhg_3, rhg_4, and i^i. The parentage of S62–1050 was Scott × (Scott × Peking). Fourteen F_1 plants were tested for resistance and all were found resistant. The F_2 progenies from the cross consisted of 430 resistant to 139 susceptible plants. Expected, based on a 3:1 ratio, was 426.8:142.2. Chi square probability was .7.

On the assumption that the association between colored seed-coat and the dominant gene for resistance was close genetic linkage, a program was set up to find the desirable crossover type of yellow seed-coat linked with the dominant gene for resistance. Starting with one yellow-seeded resistant F_2 plant from Scott × (Scott × Peking), yellow-seeded resistant plants in each succeeding generation, F_3 through F_8, were progeny tested for soybean cyst nematode resistance, to determine whether the desired crossover had occurred. Of 927 resistant yellow-seeded plants tested, progeny of all but 2 segregated for resistance. One homozygous, yellow-seeded, resistant progeny was found in F_7 and one in F_8. The segregating progenies consisted of 4,514 resistant plants and 1,886 susceptible plants. Expected, based on a 3:1 ratio, was 4,800:1,600. Although chi square probability was less than .01, the data did indicate that a dominant gene must be involved. Further proof of the dominant gene for resistance was obtained by crossing the first crossover line with the yellow susceptible line S62–105. Eight F_1 plants were tested and all were resistant. Segregation produced an F_2 of 117 resistant plants and 60 susceptible ones. The expected, based on a 3:1 ratio, was 132.8:44.2 and chi square probability was less than .01. The cause of the consistent shortage of plants in the resistant class in these data is yet to be resolved.

The results suggest that in addition to the three recessive genes already reported, a dominant allele closely linked with the *I* locus for seed-coat color is also necessary for resistance to the soybean cyst nematode. A recombination value of .35% is indicated. In line with the symbols already proposed by Caldwell et at.[4] Rhg_4 rhg_4 are proposed for the resistant and susceptible alleles, respectively, of this fourth locus involved in inheritance of resistance.

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[4] Caldwell, B. E., Brim, C. A., and Ross, J. P. Inheritance of resistance of soybeans to the cyst nematode, *Heterodera glycines.* Agron. J. 52:635–636. 1960.

[5] Owen, F. V. Inheritance studies in Soybeans III. Seed-coat Color and Summary of all other Mendelian Characters thus far reported. Genetics 13:50. 1928.

GROWTH OF WHITE CLOVER WITH AND WITHOUT PRIMARY ROOTS[1]

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THE longevity of the primary taproot of white clover, *Trifolium repens* L., is of short duration. Usually by midsummer of the second production year, the taproot deteriorates, causing the plant to depend entirely upon adventitious roots. Time of death of the primary root frequently coincides with the time stands are lost (2, 4, 5). This association in time suggests that adventitious roots are inferior to primary roots.

Materials and Methods

Controlled-environment chamber experiment. Four controlled-environment chambers were used to grow single plants in No. 3, 46-ounce cans. Six varieties of white clover were grown with and without primary roots in a randomized complete block design at each of 4 temperatures (50, 62, 74, and 86° F. ± 3° F.). The varieties were 'Espanso,' 'Ladino,' 'Louisiana S-1,' 'Merit,' 'Regal,' and XPT, a sparse-flowering, 6-clone experimental variety. A 12-hour photoperiod was used.

Four replicates were grown in each chamber. Since some variation in light intensity existed in the 4- × 4-foot growing areas, the replicates were arranged so that plants within replicates received approximately the same light.

Plants without primary roots were obtained by rooting

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