Soybean Linkage Studies: Chlorophyll-deficient Mutant

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Introduction

In March 1981 A. Williams of Williams, IN sent seed to me harvested from a number of chlorophyll-deficient plants. His mutant in cultivar Williams [GRIN] (78-2-80) was allelic to *y9* [Soybase] and was linked to *pb* (pubescence tip [Soybase]) (Thorson et al., 1989). His mutant in cultivar Williams (78-3-80) was cytoplasmically inherited and was designated *cyt-Y5* (T315 [GRIN]) (Cianzio and Palmer, 1992). His mutant in cultivar Williams (80-7) was designated *y23* [Soybase] (T288 [GRIN]) and was placed on classical genetic linkage group 8 [Soybase] (Palmer et al. 1990).

Our objective was to determine the inheritance and linkage relationships of chlorophyll-deficient Williams (77-2-80) obtained from A. Williams.

Materials and Methods

Cross-pollinations were made between Williams 77-2-80 and PI 424.078 [GRIN], which is our reference line for nonfluorescent root (*Fr3*) [Soybase] (Delannay and Palmer 1982), at the Bruner Farm near Ames, Iowa. The F1 seed were planted at the University of Puerto Rico – Iowa State University soybean nursery near Isabela, Puerto Rico. F2 seed were sampled for isoenzymes and the F2 seedlings transplanted to the Bruner Farm.

The traits evaluated were: flower color (*W1* locus [Soybase]), *Pb* (pubescence tip locus [Soybase]), *Fr3* (nonfluorescent root locus [Soybase]), isocitrate dehydrogenase (E.C.1.1.1.42 [PDB]), malate dehydrogenase (E.C.1.1.1.37 [PDB]), maleic enzyme (E.C.1.1.1.38 [PDB]), diaphorase (E.C.1.8.1.4 [PDB]), and aconitase (E.C.4.2.1.3 [PDB]). Starch gel electrophoresis procedures of Cardy and Beversdorf (1984a, b) were used to assay for the isoenzymes. The computer program 'Linkage 1' was used to analyze the data and to estimate linkage intensity (Suiter et al., 1983).

Results and Discussion

The Williams 77-2-80 chlorophyll-deficient mutant was not linked to any of the eight mutants tested (Table 1). The 28 additional linkage tests were done between all possible loci pairs (Table 1). Linkage was not detected; the traits tested were independent. The Williams 77-2-80 mutant has not been tested for allelism with known soybean chlorophyll-deficient mutants.

References

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Table 1. F2 linkage of viable yellow plants (Williams 77-2-80) X PI 424.078 (*Fr3 Fr3*). Between 362 to 404 F2 seeds or seedlings were classified for linkage for each comparison. Values are given as percentage recombination with standard errors.

	Fr3 [Soybase]	Viable yellow	*W1*	*Pb*	*Idh2*	MDH	ME	*Dia1*
Viable yellow	48.6 ± 3.4							
W1 [Soybase]	43.7 ± 3.6	49.6 ± 3.4						
Pb [Soybase]	48.1 ± 3.4	49.0 ± 3.4	48.7 ± 3.4					
Idh2 [Soybase]	49.9 ± 2.7	48.2 ± 2.7	46.5 ± 2.7	49.6 ± 2.7				
MDH [Soybase]	47.2 ± 3.4	48.6 ± 3.4	45.3 ± 3.5	48.1 ± 3.4	48.6 ± 2.7			

ME [Soybase]	48.5 $\pm$ 2.7	48.9 $\pm$ 2.7	49.3 $\pm$ 2.7	47.9 $\pm$ 2.7	47.9 $\pm$ 2.2	47.8 $\pm$ 2.7		
Dia1 [Soybase]	47.0 $\pm$ 2.7	49.6 $\pm$ 2.7	48.5 $\pm$ 2.7	44.0 $\pm$ 2.7	50.0 $\pm$ 2.2	47.5 $\pm$ 2.7	50.0 $\pm$ 2.2	
Aco4 [Soybase]	48.8 $\pm$ 2.7	47.8 $\pm$ 2.7	48.6 $\pm$ 2.7	49.6 $\pm$ 2.7	47.6 $\pm$ 2.2	48.7 $\pm$ 2.7	49.6 $\pm$ 2.2	48.7 $\pm$ 2.2