Research Notes: Iowa State University, Ames, and United States Department of Agriculture

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The A line from a plant typical of the variety is classified in Maturity Group II while the B line is in Group III.

Group III germplasm was also screened at the Isabela substation, College of Agricultural Sciences, University of Puerto Rico, from July 1974 to February 1975. Incandescent lighting was timed to provide continuous lighting and the experiment was terminated at 235 days from planting. Results were similar to the Urbana trial. The sister line, PI 317.334A and one of its parental lines, PI 196.160 (Ooyachi-2), were screened and also found to be day neutral. PI 317.334B also expressed a low degree of photoperiod sensitivity when grown in controlled environment chambers under photoperiods of 12, 14, 16, and 20 hours. The inheritance of the photo-insensitivity of PI 317.334B is being investigated.

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1. The nature of sterility in the \( ms_1 \) male-sterile mutant.*

The male-sterile (female-fertile) mutant \( ms_1 \) is identified by three characteristic features. Kenworthy et al. (1973) reported occurrence of twin seedlings, at a low frequency. We are reporting the two additional characteristics: failure of cytokinesis following telophase II; and production of twice as many pollen mother cells as are found in male-fertile sibs.

In meiosis, normal chromosome pairing and separation occurred in both male-sterile plants and fertile plants. The male-sterile plants, however, showed a failure of cytokinesis after telophase II, resulting in 4-nucleated "pollen grains", which were nonfunctional and eventually degenerated.

*Research supported in part by a grant from the American Soybean Association Research Foundation.
Microscopic examination of cross sections of paraffin-embedded anthers revealed that both male-sterile plants and fertile plants had four locules per anther. Longitudinal serial sections of anthers from male-sterile plants showed twice as many pollen mother cells per locule as were found in fertile plants. The pollen mother cells were approximately the same size in both types. The anthers from male-sterile plants were larger, to accommodate the additional pollen mother cells. Because pollen mother cells from male-sterile plants do not undergo cytokinesis, there are only as many "pollen grains" as pollen mother cells. In the fertile plants, however, four pollen grains come from each pollen mother cell. The ratio of pollen grains per locule in a male-sterile plant as compared to that in a fertile plant was 2:4 rather than the expected 1:4.

References

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Marc C. Albertsen

2. Three independent male-sterile mutations at the ms1 locus.*

In our soybean genetics program, we had observed that pollen from an off-type plant in T258 was large, dark-staining and seemed to have characteristics similar to pollen produced by ms1 plants (Palmer, 1974). This line is called the Ames male-sterile. We received from the U.S. Regional Soybean Laboratory, Urbana, IL 61801, seeds of two lines segregating for sterility. The sterile plants in both lines had large, dark-staining pollen grains. One line, from R. L. Cooper, is called the Urbana male-sterile (Cooper and Boerma, 1975). The other line, from R. L. Bernard, had been found in a commercial field of 'Harosoy' in 1955 and is called the Harosoy male-sterile. The Ames, Urbana, and Harosoy lines are considered to be male-sterile because: (1) they were ineffective as male parents in cross-pollinations (or self-pollinations); and (2) they exhibited some female fertility, although lower than fertile sib plants.

*Research supported in part by a grant from the American Soybean Association Research Foundation.
We made the appropriate allelism tests among the four mutants: \( \text{ms}_1 \), Ames, Urbana, and Harosoy male-steriles (Table 1). The tests were made using known heterozygotes as male parents onto homozygous recessive female parents. The testcrosses were evaluated in both \( F_1 \) and \( F_2 \) generations. All testcross combinations approximated a 1:1 ratio of fertile:sterile plants, with the steriles having large, dark-staining pollen grains. Only a few fertiles have been tested in the \( F_2 \) generation, but all gave good approximations to a 3 fertile:1 sterile ratio. The evidence from the testcrosses and \( F_2 \) segregations strongly supports the hypothesis that the Ames, Urbana, and Harosoy male-steriles are at the same locus as the \( \text{ms}_1 \) mutant. From the data in Table 1, we cannot distinguish whether we have the same allele at the \( \text{ms}_1 \) locus or if we have a multiple allelic series.

We are making additional testcrosses and will evaluate \( F_2 \) progenies for the ratio of fertile:sterile plants. In addition, we will be evaluating the Ames, Urbana, and Harosoy male-steriles for: (1) the occurrence of twin seedlings; (2) the number of pollen mother cells produced; and (3) the failure of cytokinesis following meiosis II. (See Palmer and Albertsen, 1975.)

<table>
<thead>
<tr>
<th>Female parent*</th>
<th>Male parent*</th>
<th>Number of ( F_1 ) plants</th>
<th>Fertile</th>
<th>Sterile</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{ms}_1 \text{ms}_1 )</td>
<td>AMS</td>
<td>2**</td>
<td>3**</td>
<td></td>
</tr>
<tr>
<td>AMS</td>
<td>( \text{Ms}_1 \text{ms}_1 )</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>UMS</td>
<td>AMS</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>UMS</td>
<td>( \text{Ms}_1 \text{ms}_1 )</td>
<td>6</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>HMS</td>
<td>( \text{Ms}_1 \text{ms}_1 )</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>HMS</td>
<td>AMS</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

*In this note for the Soybean Genetics Newsletter we have called the mutants: AMS (Ames male-sterile); HMS (Harosoy male-sterile); and UMS (Urbana male-sterile). Female parents were male-sterile plants; male parents were known heterozygotes.

**Includes twin seedling (one member fertile; other member sterile).
References

3. Inheritance and derivation of T225H, Y\textsubscript{18}Y\textsubscript{18}.

In a cross of the cultivar 'Lincoln' (female parent) by a yellow plant of T225, Y\textsubscript{18}, (male parent), the F\textsubscript{1} was green. In the F\textsubscript{2}, we had segregation of 3 green plants:1 yellow plant (Table 1), satisfying the hypothesis that Y\textsubscript{18} is a single recessive gene.

Crosses of T225 (yellow branch on a variegated plant) by 'Clark 63' (male parent) were obtained. T225 has white flowers; Clark 63 has purple flowers. The two F\textsubscript{1}'s were green with purple flowers, and in the F\textsubscript{2} we had good fits to the expected 9:3:3:1 segregation for plant color and flower color (Table 1). There was no indication of linkage of plant color with flower color. Further indication of independent assortment of two genes was evidenced by segregation of F\textsubscript{2} families in a 1:2:2:4:1:2 ratio.

The data in Table 1 show that Y\textsubscript{18} is a single genetic trait and is inherited as a single Mendelian recessive.

While it is possible to obtain Y\textsubscript{18}Y\textsubscript{18} plants among the progeny of Y\textsubscript{m}Y\textsubscript{m}\textsubscript{18}Y\textsubscript{18}, we have circumvented the use of variegated plants by using a yellow plant in a cross with a green sib. As a result of cross 1, we have Y\textsubscript{18} present in the heterozygous state, Y\textsubscript{18}Y\textsubscript{18}, in its original background, the cultivar Lincoln. We can now produce many yellow plants and green plants without the presence of the variegated plants. The yellow plants may prove useful in biochemical and developmental studies.

We believe this genetic combination, Y\textsubscript{18}Y\textsubscript{18}, should be maintained, either from the above-mentioned cross or by selection from a mutated T225. This new type is designated T225H* while the original line, T225, is maintained.

*For T-strains with an H suffix (e.g., T225H), the gene is carried as the heterozygote because the homozygous mutant is lethal, sterile, or very weak.
as the mutable form $y_{18}^m$. Since T225H is lethal under field conditions, it needs to be maintained as the heterozygote. Seed of T225H has been deposited with R. L. Bernard, U.S. Regional Soybean Laboratory, Urbana, IL 61801.

Table 1
Genetic crosses made to determine the inheritance of $y_{18}$

<table>
<thead>
<tr>
<th>Cross number</th>
<th>Female parent</th>
<th>Male parent</th>
<th>Genotype of $F_1$</th>
<th>$F_2$ segregation ratio</th>
<th>$\chi^2$</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Expected</td>
<td>Observed</td>
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<tr>
<td>1</td>
<td>Lincoln</td>
<td>T225$^a$</td>
<td>Yw</td>
<td>3Yw</td>
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<td></td>
<td></td>
<td></td>
<td>1yw</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>T225$^b$</td>
<td>Clark 63</td>
<td>YW</td>
<td>9YW</td>
<td>69</td>
</tr>
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<td></td>
<td></td>
<td>3Yw</td>
<td>23</td>
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<td></td>
<td>3yw</td>
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<td></td>
<td>1yw</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>T225$^b$</td>
<td>Clark 63</td>
<td>YW</td>
<td>9YW</td>
<td>66</td>
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<td>3Yw</td>
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<td>3yw</td>
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<td></td>
<td></td>
<td></td>
<td>1yw</td>
<td>4</td>
</tr>
</tbody>
</table>

$^a$yellow plant

$^b$yellow branch on a variegated plant

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1. Protein, oil and fatty acid composition of certain soybean mutants and mutation-derived lines.

Some mutants and mutation-derived lines of 'S.J.2' and 'Sansai' soybean varieties were obtained after seed irradiation with gamma rays (Smutkupt, 1973; Smutkupt and Gypmantasiri, 1974). Among them, three of S.J.2 lines, three of Sansai lines, including each control and one 'S.J.1' line (see Table 1)