Twinning and Haploidy in a Strain of *Gossypium barbadense* L.\(^1\)
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**RESULTS AND DISCUSSION**

Fifty-seven sets of twins were observed from the 6,077 germinated seeds of Z101 and its crosses. In 43 of these 57 twin pairs 1 seedling was much larger than its twin. The larger twin had the dominant color, leaf shape, and/or pilosity of the male parent and had normal-sized stoma. The 43 smaller seedlings had smaller stomata (1 exception) and the recessive plant color, leaf shape, and/or pilosity of the female parent. One twin pair consisted of 2 extremely small plants while the other 15 sets had 2 dominantly marked individuals of approximately equal and normal size. Two extremely small monoeembryonic seedlings were also noted.

All 47 small seedlings were assumed to be haploids because of the presence of the recessive genetic markers. Also, the characteristics of a known haploid coincided with those of the small seedlings while the larger twins had characteristics resembling those of a known amphidiploid (2n=52). Haploidy was verified in 5 plants originating from small seedlings by the presence of 26 univalent chromosomes in pollen mother cells.

Each of the 45 small polyembryonic seedlings in addition to the 2 small monoeembryonic seedlings was, therefore, concluded as being a haploid.

The most likely supposition for the development of these polyembryonic haploids is the formation of an extra embryo from a cell of the embryo sac other than the egg. Such a haploid would probably develop from an unfertilized synergid since the polar nuclei are needed for endosperm development and since the antipodals possibly degenerate prior to maturation of the egg apparatus. Other possibilities, as mentioned in the literature (2), for the occurrence of these haploids are: (1) two embryo sacs within a single ovule and (2) a 16-nucleate embryo sac with only 1 egg cell being fertilized.

The most logical explanation for the monoeembryonic haploids would be development without fertilization of a cell of the egg apparatus.

The rate of twinning of Z101 and its hybrids was 9.4 twin pairs per 1000 germinated seeds. This value is closely related to the haploid frequency with the 47 haploids from Z101 and its hybrids giving an incidence of 7.7 haploids per 1000 germinated seeds.

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**MATERIALS AND METHODS**

In 1960 and 1961, seeds of Z101, 5 marker lines, and 5 crosses—using Z101 as the female parent and each of the marker lines as a male parent—were planted in steam-sterilized sandy loam in wooden flats. Characteristics of Z101 and the marker stocks are shown in Table 1.

Each emerged seedling was scored for: (1) twinning—seedling arising from monoeembryonic or polyembryonic seed; (2) size and apparent vigor; (3) stoma size; (4) plant color—red or green; (5) leaf shape—super okra or normal; and (6) pilosity—pilose or non-pilose.

The above criteria were used in the determination of haploids since: (1) Most observed haploids of *Gossypium* have arisen from twin seedlings. (2) Haploids are generally smaller and less vigorous than 2n plants of the same species. (3) Stomata of haploids usually are smaller than those of comparable diploids and/or polyploids. (4) The parents of the five crosses differed as to plant color, leaf shape, and/or pilosity with the male parent’s trait being dominant to that of the female. A haploid arising from such a cross would possess either the recessive allele from the female or the dominant allele of the male but not both.

Stomata were measured by the sotch tape method described by Sarvella et al. (5).

Stoma size, leaf size, flower size, pollen shedding, and pollen size were recorded for several plants grown to maturity. Chromosomes at meiosis were counted in five plants.

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**Table 1. Characteristics of Z101, a strain of *Gossypium barbadense* L., and 5 genetic marker stocks**

<table>
<thead>
<tr>
<th>Strain</th>
<th>Species</th>
<th>Genetic markers</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z101</td>
<td><em>G. hirsutum</em> L.</td>
<td>green, normal, non-pilose</td>
<td>Doubled haploid of Sea Island, variety 'Puerto Rico'</td>
</tr>
<tr>
<td>505</td>
<td><em>G. hirsutum</em> L.</td>
<td>red, normal, non-pilose</td>
<td>'Al-Buraq' (Russia)</td>
</tr>
<tr>
<td>102</td>
<td><em>G. hirsutum</em> L.</td>
<td>red, normal, non-pilose</td>
<td>Sea Island</td>
</tr>
<tr>
<td>106</td>
<td><em>G. barbadense</em> L.</td>
<td>green, super okra, pilose</td>
<td>From Argentina</td>
</tr>
<tr>
<td>600</td>
<td><em>G. barbadense</em> L.</td>
<td>red, normal, non-pilose</td>
<td></td>
</tr>
</tbody>
</table>