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Inheritance of Giant Mutant Plant in Upland Cotton[1]

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ABNORMALLY large, off-type plants have been found in upland cotton fields in California. Although they vary considerably, such plants are characterized by heavy, stiff, tall stalks, larger than normal leaves, small bolls, delayed flowering, and poor production of fruit. Normal plants start to fruit in May and June, while off-types have no fruit until August and even then few bolls are set. These giant plants are most noticeable toward the end of the season because of their abnormally large size (Figure 1).

Stag in Acala 4–42 was investigated by Endrizzi et al.,[3] who found it to be due to the trisomic condition of chromosome 1 of the A genome of *G. hirsutum*.

This paper presents data of a study of the inheritance and genetic nature of a giant mutant found in the Deltapine 15 variety of cotton in the Imperial Valley.

PROCEDURE AND RESULTS

A single plant of the giant mutant was observed in 1957 in Deltapine 15 cotton in a variety test at the University of California Imperial Valley Field Station. In 1958, open-pollinated seeds from this plant were grown in a progeny row. Of 26 plants, 14 were giant and 12 were normal. Both types were self-pollinated for further progeny testing in 1959 and 1960.

In 1959 bulked selfed seed from giant plants grown in 1958 produced 54 giant and 32 normal plants. Progenies of normal plants continued to be normal. A progeny of selfed seeds from the original giant plant produced 34 giant and 36 normal plants.

In 1960 selfed progenies of 17 giant plants gave a total of 458 giants and 189 normal plants. No giant plant ever produced a true breeding giant progeny. Progenies of the 1959 normal plants again were all normal. F_1 plants from crosses made using giant as female and normal as male parents segregated 86 giants to 102 normal plants. The reciprocal cross produced 38 giants and 57 normals. The reciprocal crosses were made using several giant plants as parents. Intercrosses among nongiant plants always produced normal progenies.

The segregation of the different progenies and their chi-square values are shown in Table 1. Chi-square analysis indicated that each of the 17 progenies segregated 2 giants to 1 normal; furthermore the total and pooled chi-square values agreed with a 2:1 ratio and the heterogeneity chi-square was not significant.

Cytological examination[4] of giant plants failed to show any chromosomal aberrations.

Figure 1. Giant mutant cotton plant (left) and normal Deltapine 15 plant (right).

Table 1. Segregation of giant mutant cotton in 1958, 1959, and 1960.

Progeny identification	Year grown	Number of plants			X^2	P
		Giant	normal			
Original giant plant	1958	14	12	2:1	1.919	.10-.20
				1:1	.154	.50-.70
	1959	34	36	2:1	10.320	01
				1:1	.057	.80-.90
Bulk selfs, 1958 giant	1959	54	32	2:1	.580	.30-.50
				1:1	5.628	.01-.02
Plant progenies, 1	1960	14	4	2:1	.995	.30-.50
1959 giant 2		14	4		.995	.30-.50
3		16	5		.851	.30-.50
4		21	8		.426	.50-.70
5		18	6		.744	.30-.50
6		23	5		3.006	.05-.10
7		46	11		5.031	.02-.05
8		32	11		1.153	.20-.30
9		53	16		3.176	.05-.10
10		31	12		.563	.30-.50
11		24	11		.055	.80-.90
12		25	14		.118	.70-.80
13		58	24		.600	.30-.50
14		32	16		.000	.99
15		14	10		.750	.30-.50
16		17	16		3.426	.05-.10
17		20	16		2.000	.10-.20
Total					23.889	.05-.10
Pooled		458	189		4.946	.02-.05
Heterogeneity					18.943	.20-.30
F_1, giant×normal		86	102	1:1	1.362	.20-.30
F_1, normal×giant		38	57	1:1	3.800	.05-.10

DISCUSSION

The fact that no giant plant ever produced a true breeding giant progeny indicates that giant is expressed only in the heterozygous condition and that the homozygote must be lethal. This was shown by progenies of the orig-

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[3] Endrizzi, J. E., McMichael, S. C., and Brown, Meta. Chromosomal constitution of "Stag" plants of *Gossypium hirsutum*, "Acala 4-42." Crop Science 3, 1:1–3, 1963.

[4] Grateful acknowledgement is made to Dr. Meta S. Brown, Texas A & M College for cytological examination.

inal giant mutant plant grown both in 1958 and 1959 and by the fact that 17 randomly chosen, giant plants, when progeny tested, did not produce any progenies true breeding for the giant characteristic. If giant is governed by a single dominant factor the progenies of the heterozygous original plant should fit a 3:1 ratio. However, if the homozygous dominant is lethal a 2:1 is expected. This appears to be borne out by the chi-square probabilities.

Reciprocal crosses between giant and normal segregated 1 giant to 1 normal as would be expected if giant is controlled by a single dominant factor expressed in the heterozygous condition.

The gene symbol Gi is proposed for this character.

The delayed flowering and poor fruit set of this type make it economically undesirable in commercial cotton fields. The plants have heavy, thick stalks, large limbs, and leaves, and they compete severely for space with neighboring plants. Delay of harvest until late in the season would tend to increase the frequency of the giant mutant in subsequent years unless these plants are rogued from planting seed increase fields. The large size makes these plants easy to recognize and to rogue.

SUMMARY

Data are presented for a genetic explanation of the tall, large-leafed, semi-fruitless plant type which is relatively common in cotton fields in the Imperial Valley of California.

A single factor with dominance for giant and lethality of the homozygous dominant is indicated.

No cytological chromosome aberrations were found.

The gene symbol Gi is proposed for this character.