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1. Gametophyte factors in maize.

There are three alleles at the gametophyte locus on chromosome four in maize: Ga^s, Ga_1, and ga. The presence of other gametophyte factors in seven cross-sterile popcorn inbreds was tested for by examination of the F_2 progeny of crosses of these popcorns with various stocks marking the ten chromosomes of maize. If a gametophyte factor exists in a popcorn inbred and is linked to the locus of a marker gene, the proportion of the F_2 progeny homozygous for the marker gene is less than the expected 25%. This reduced percentage of marker type is caused by the competitive advantage of Ga gametes over ga gametes on heterozygous silk. Cross-sterile inbreds involved were 24-6 and 4501 of South American origin; 1001-52, a Hulless type; the Black Beauty, 4541; a Red popcorn, 4524; a Baby Golden type, 4513; and 401-127 from Minnesota Superb.

In the 1954 News Letter (28:38) the F_2 progeny of a cross between P51 (ga su/ga su) and 401-127 was reported to have resulted in approximately 25% sugary seed set, and it was suggested that there was no cross-sterile factor at the Ga_1 locus. This result was unexpected as all other cross-sterile inbreds so tested resulted in 12-16% sugary seed, and cross-sterility was attributed to the action of the Ga^s allele at the Ga_1 locus. Increased testing by selfing F_1 plants from the same seed which was used in obtaining the results reported in 1954 resulted in two homogenous classes, one with a mean at 22.8% sugary seed and the other with a mean at 19.1% sugary seed. The percent sugary seed in progeny of the cross (P51 X 24-6) X (P51 X 401-127) resulted in two homogeneous groups averaging 23.3 and 16.8% sugary seed. The progeny from the reciprocal cross averaged 24.0 and 17.4% sugary seed. There were on an average about 8-10 ears in each class. The 23.3 and 24.0 percentages were not significantly different from 25% but the 22.8% was. It would appear that the popcorn parent was heterozygous at the Ga_1 locus and the variation in percent sugary seed possibly due to modifying factors or to two allelic gametophyte factors of different competitive ability. All tests involving the F_2 progeny of P51 and a different source of 401-127 resulted in an average of 16.9% sugary seed indicating the presence of a gametophyte factor at the Ga_1 locus.

The F_2 progeny of crosses between bt stocks and 401-127 resulted in an average of 9.4% brittle seed. Analysis indicates that a gametophyte factor is present probably at the Ga_2 locus on chromosome five.

The cross-sterility reaction of 401-127 differs from that of other cross-sterile inbreds. Progeny of the cross ((Hy (ga/ga) X cross-sterile inbred) X cross-sterile inbred) usually result in half of the progeny which will set seed with ga pollen and half which will not. When 401-127 was tested no plants were obtained with a good seed set.

Because of the competitive advantage of Ga gametes over ga gametes all progeny of the cross (Hy X cross-sterile inbred) F_2 should be either Ga /Ga or Ga/ga and induce a full seed set when pollinated onto the cross-sterile parent. When 401-127 was involved not all F_2 plants, when acting as pollen parent, would induce a seed set on 401-127. Results from testing individual plants from the cross (Hy X 401-127) F_2 by pollinating onto 401-127 as the seed parent and by a ga/ga type as the pollen parent led to the formulation of a two factor genetic basis of cross-sterility. This hypothesis must be tested.

Inbreds tested must be divided into two groups on the basis of their behavior in F_2 progeny involving these inbreds crossed with a brittle stock. The first group involving 1001, 4524, and 4501 resulted in percentages of brittle seed not significantly different from 25%. Progeny from the second group segregated as follows:

Inbred	No. F_2 ears	% bt
24-6	1	25.4
	2	11.9
4513	8	21.7
	5	8.2
4541	4	25.2
	5	6.9

It appears that plants involved in these crosses were heterozygous for gametophyte factors at the Ga$_2$ locus. The inbred 4513, when tested, segregated with an average of 21.7% and 8.2% brittle seed and both classes were significantly less than 25%. This inbred might possess modifying factors, or two gametophyte factors at the locus each with a different competitive advantage over ga gametes. These results are of particular interest because these popcorns are long time inbreds.

In 401-127 there are uncertain indications of the presence of gametophyte factors on chromosome three linked to the dwarf locus, and on chromosome nine linked to the shrunken locus. Several other indications of the presence of gametophyte factors were found in 4541 linked with opaque, 4501 linked with shrunken, 4513 linked with waxy, and 24-6 linked with shrunken.

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2. A multifactorial r mottling system.

Further investigations have been made of the r mottling system reported in the 1954 News Letter. Evidence was given at that time which renders it unlikely that a mutable r is involved. Recent work shows the likelihood of a multifactorial system which is responsible for the development of aleurone color in a high percentage of cells of the