3. Studies on the expression and transmission of s^{ga} in Kys male sterility.

In 1952 a study was begun to transfer the cytoplasmic-genic type of male sterility found in the strain Kys to several inbred lines. Crosses were made between Kys ♀ mm s^{ga} s^{ga} and M_{14}, N_6, 38-11, 187-2, Hy_2 and WF9, all of which should have the genotype 0 $MMS^{ga}S^{ga}$. In 1953 the F_1 plants wore backcrossed as females to the respective lines and the progenies were grown in the field in 1954. They would all be expected to carry the cytoplasmic factor for sterility but would segregate 1 $MMS^{ga}S^{ga}$: 1 $MMS^{ga}s^{ga}$: 1 $MmS^{ga}S^{ga}$: 1 Mm $S^{ga}s^{ga}$, and the $S^{ga}s^{ga}$ plants should have 50% partially filled pollen (see Bauman, Maize Newsletter 28:51, 1954). Each of the six progenies segregated for plants having 50% partially filled pollen, but in varying ratios as shown in Table 1. The expression of s^{ga} as partially filled pollen in $S^{ga}s^{ga}$ genotypes seems to vary with the line background, although the numbers are rather small in each progeny.

Table 1. Segregation of plants having filled pollen ($S^{ga}S^{ga}$) and 50% partially filled pollen ($S^{ga}s^{ga}$) in the first backcross progenies from crosses between Kys male sterile and each of six inbred lines.

	Number of plants having		
Line involved	Filled pollen	50% partially filled pollen	50% small pollen
WF9	20	2	4
38-11	7	13	4
Hy 2	12	13	0
N6	13	13	3
187-2	13	8	0
M14	19	6	1

Where possible, plants having 50% partially filled pollen were selected for the second backcross to the line. The silks of the ear shoots on these plants were divided, and roughly half the silks were pollinated with a Kys ♀ mmssACRPr stock to test the condition of the M gene. The other half of the silks were pollinated a day or two later with the appropriate line. At maturity the purple seeds from the cross with the Kys tester stock were separated from the colorless aleurone seeds resulting from the cross with the line, although some difficulty was encountered with the expression of purple aleurone. The progenies of these crosses are being grown in the greenhouse to test and use the appropriate genotypes in the third backcross to two of the lines, WF9 and 38-11.

In order to test the functioning of s^{ga} pollen in competition with S^{ga} pollen, F_1 plants from crosses involving the lines WF9 and M14, and having the genotype ♀ MmS^{ga} s^{ga} were self-pollinated in the greenhouse, using pollen sparsely in an attempt to get one pollen grain per silk. The functioning of s^{ga} pollen would be indicated by the occurrence of male sterile plants in the F_2 progenies with a frequency of 1 in 5 or less. In 1954 23 F_2 progenies were grown in the field and, of 891 F_2 plants, 856 were classifiable for pollen. The remaining 35 plants had broken tassels (corn borer damage) or dried tassels (drought damage).

None of the 856 classifiable plants had sterile tassels. One plant had mainly empty pollen grains, but a few grains were partially filled. Thirty-one per cent of the plants had 50% partially filled pollen. These are likely $S^{ga}s^{ga}$ genotypes although, even if the s^{ga} gametes functioned only through the eggs, there is a significant deviation from the expected 50%. Some of these genotypes may have been missed if they were not always expressed by partially filled pollen as indicated in table 1, or there may be a competitive effect of the S^{ga} and s^{ga} alleles on the female side. Nine plants had 50% empty pollen and a few plants segregated for small pollen. In view of these results it would appear difficult, if not impossible, to transfer the s^{ga} allele of an $S^{ga}s^{ga}$ plant to its progeny by sparse pollination.

In order to determine whether an $S^{ga}s^{ga}$ plant lacking the cytoplasmic factor for male sterility would segregate for 50% partially filled pollen, crosses were made between the inbred lines WF9 and M14 as female and the Kys stock. The F_1 plants were grown in 1954 and the pollen classified. Out of 30 plants from the two crosses none showed any segregation for partially filled pollen. It would seem that the cytoplasmic factor for sterility is needed for the incomplete development of s^{ga} pollen grains, although tests involving other lines are needed, since WF9 and M14 may give poor expression, as shown in table 1.

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