1. Results of Further Inheritance Studies of the Kys Type of Cytoplasmic Male Sterility in Corn

As reported by Schwartz (Genetics 36:676-696. 1951) male sterile plants of the Kys sterile have (1) sterile cytoplasm □, (2) dominant Ms_{21} genes and (3) recessive suppressor gene s^{ga}. The alternative condition of any one of these factors gives normal fertile plants. It was also reported by Shwartz that the suppressor gene S^{ga} exhibits male gametophyte competition with recessive s^{ga}, so that in a $S^{ga}s^{ga}$ plant the dominant S^{ga} functions to the exclusion of recessive s^{ga} through the pollen. A large number of sparse pollinations, where sga pollen might be deposited on a silk where no S^{ga} pollen grains are present, failed to transmit s^{ga} through the pollen. Screening (74 micron) pollen composed of a mixture of S^{ga} and s^{ga} pollen grains was successful in transmitting s^{ga} through the pollen, but at an extremely low rate.

Further observations revealed that heterozygous plants (□ Msms $S^{ga}S^{ga}$) produce 50% pollen grains which are partially filled with starch, the remaining 50% are normal. In a segregating population, plants were classified as to whether they produced partial pollen grains as shown below.

Genotype	Pollen	Test Cross Result
□ MsMs $S^{ga}S^{ga}$	Normal	All fertile
□ Msms $S^{ga}S^{ga}$	Normal	All fertile
□ MsMs $S^{ga}s^{ga}$	50% Partial	1:1 for sterility
□ Msms $S^{ga}s^{ga}$	50% Partial	3:1 for sterility

Individual plants in the segregating population above were outcrossed to the recessive tester □ msms $s^{ga}s^{ga}$. If partial pollen indicates segregation of $S^{ga}s^{ga}$ all such plants when crossed with the tester should segregate either 1:1 or 3:1 for sterility. All plants with normal pollen would give all fertile progeny when crossed onto the tester. Such results were obtained, so the presence of 50% of the pollen grains partially filled with starch indicates the plan light is refracted by the pollen grains facilitates the detection of the partial pollen.

Microscopic examination revealed that it is not a case of simple gametophyte competition (pollen tube growth; etc.) when S^{ga} functions to the exclusion of s^{ga}, but rather, the s^{ga} (partial) pollen grains abort, as none were observed to germinate on silks. Recessive s^{ga} pollen is abnormal only when developing in competition with S^{ga} pollen in the same plant since pollen from □ msms $s^{ga}s^{ga}$ plants is normal. Further, when pollen from □ Msms $S^{ga}S^{ga}$ and □ msms $s^{ga}s^{ga}$ plants was composited, so we have a mixture of S^{ga} and s^{ga} pollen, no competition existed as both kinds of pollen functioned.

This information makes it possible to introduce this type of sterility into standard inbreds without having to transmit s^{ga} through the pollen. Certain genotypes can be identified in testcross and backcross populations by examination of the pollen without resorting to test crosses for identification.

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