2. Relation of gene and cytoplasm to pollen sterility.

When genically controlled pollen abortion, due to a homozygous recessive gene ms_1 linked with y endosperm color, is incorporated in the same plant with cytoplasmically controlled abortion, as previously reported, the two conditions are independent of each other in transmission and have no effect upon each other in expression. Further evidence for this independence in transmission has been obtained by crossing gene sterile ms_1 ms_1 plants by normal plants with cytoplasmic pollen restorer genes combined with cytoplasmic pollen abortion. In all crosses of this type the cytoplasmic condition is never transmitted through the pollen, but the pollen restoring gene is transmitted. In F_2 selfed progenies and in backcrosses on to homozygous recessive gene steriles, segregation for gene controlled pollen abortion is clear-cut and uninfluenced by any cytoplasmic condition or the dominant restorer gene. In two lots of backcrossed plants, one grown in the greenhouse, tho other in the field, 98 fertile and 99 sterile plants were observed. In several F_2 progenies grown in the greenhouse and in the field there were 196 fertile and 62 steriles where 194 and 64 were expected. Thus the restorer for cytoplasmic abortion has no effect whatever on the gene controlled condition. The reciprocal cross of normal fertile, having the cytoplasmic sterile condition restored by a dominant gene, crossed by normal plants, without the restorer but with homozygous Ms Ms, gave all fertile plants in F_1 and clear segregation in backcrosses of F_1 by normal fertile and F_1 selfed progenies. Three progenies of each have been grown with the following results: F_2 selfed--106 fertile : 23 sterile (96 and 32 expected), backcross--69 fertile : 49 sterile (59 of each expected). While both ratios deviate significantly from a single factor expectancy clear-cut genic segregation is shown. The dominant gene Ms present in all normal plants has no effect whatever on the expression of cytoplasmic pollen abortion. In this case the pollen sterile plants remain sterile as long as they are pollinated by Ms plants without cytoplasmic gene restorers, and thus differ widely in behavior from the gene sterile plants.

In this way cytoplasmic sterility can simulate genic sterility and has undoubtedly gone undiscovered in many experiments with maize and other plants.

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