CYTOPLASMIC INFLUENCE ON THE INHERITANCE OF THE D8 CMS RESTORER

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Abstract

The cytoplasm of *Gossypium trilobum* (D8) was introgressed into the nuclear background of *G. hirsutum*. During introgression, cytoplasmic male sterile (A) and fertile (R) lines were derived, and the R lines restored fertility in progeny of AxR crosses. Preliminary evidence indicated that the non-restorer allele was not transmitted through the pollen of plants heterozygous for the restorer allele. A series of test crosses were made to validate the preliminary evidence and to determine if cytoplasm played a role in the results. In each cross a series of F_1 paternal families were derived by crossing cms female parents with an individual male parent heterozygous for the restorer allele. One hundred thirteen male parents had the D8 cytoplasm and 62 males had the AD1 cytoplasm. A total of 12,233 F_1 plants were scored for fertility or sterility. Of the 113 families derived from male parents with the D8 cytoplasm, 112 had nearly 100% fertile progeny with only 5 steriles among 7609 fertiles. One family had 21 fertile and 27 fertile. We assume the one exception was due to technical error. Of the 62 families derived from male parents with the AD1 cytoplasm, 58 had combined segregates for male fertile and male sterile of 2189 to 2091. Three families had no fertile plants and one family had no sterile plants. Although other possibilities cannot be eliminated, these four families probably resulted from contaminations in the male parental lines. The weight of the evidence (58 families) showed that the restorer and non-restorer alleles gave expected segregation ratios through the pollen when the male parent cytoplasm was AD1.

These data confirm that the non-restorer allele is not transferred through the pollen of plants with the D8 cytoplasm. This means there are two levels of nuclear/cytoplasmic interaction that result in dysfunction of microsporogenesis. When the non-restorer allele is homozygous, the dysfunction is sporophytic and the sporogenous and tapetal tissues breakdown before meiosis. When the restorer allele is heterozygous, all pollen develops normally by morphological criteria, but genetically only pollen carrying the restorer allele succeeds in fertilization. This means that a dysfunction occurs in the gametophyte carrying the non-restorer allele. The point of dysfunction has not yet been identified.

If the D8 cytoplasm is not deleterious to yield and quality, it has the potential to provide a convenient genetic system for the production of both F_1 hybrids and derived F_2 lines that are fully fertile.

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