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Allelism of the cms-S restorers carried by different inbred lines

The gene that restores fertility to S-type male-sterile cytoplasm (cms-S) is designated Rf3 (Duvick, Advan. Genet. 13:1-56, 1965). Its mode of action is gametophytic (Buchert, P.N.A.S. 47:1436-1440, 1961), the phenotype being determined by the genotype of the pollen grain and not of the sporophyte. Our investigations of newly arisen restorers of cms-S (Laughnan and Gabay, In: Genetics and the Biogenesis of Cell Organelles, pp. 330-352, 1975) and attempts to assign them to chromosome have led to a renewed interest in Rf3.

Six of the ten newly arisen restorer genes have been tested for allelism with Rf3, carried by inbred line CE1, and none is allelic. Unpublished studies indicate that the Rf3 gene carried by inbred line CE1 is located in chromosome 2, probably in the long arm. The four newly arisen restorers not tested for allelism with the CE1 restorer have been assigned to chromosomes other than chromosome 2 through use of the waxy translocation series (Gabay and Laughnan, MGCNL 48:44-45, 1974). It is known, therefore, that none of our new restorers is allelic to the standard Rf3 carried by CE1. The question then arises whether the natural restorers found in different maize strains are allelic with the Rf3 of CE1, or do they also represent genes at different loci?

Duvick (MGCNL 31:114, 1957) made all possible crosses between inbred lines CE1, Ky21, BH2, JG3 and JG5, each of which carries the ability to restore fertility to cms-S plants. The resulting F_1 plants were then crossed with cms-S plants of inbred line WF9. Each of the ten F_1 combinations gave testcross progenies that were all fertile, indicating that the restorers carried by the five lines are allelic.

We recently tested the restorer genes carried by the five inbred lines CE1, Ky21, Tr, C103 and CI21E for allelism. The cms-S restorer version of one of the lines to be tested was crossed as female parent with a second line and pollen samples from F_1 offspring were examined for the frequency of aborted pollen grains. If the restorer genes in the tested lines are not allelic, the F_1 pollen sample should contain approximately 25% aborted pollen grains. If, on the other hand, the restorer genes are allelic, all or nearly all of the pollen grains of the F_1 sample should be normal. Eight of the ten possible F_1 combinations were tested in this way, and all five inbred lines were involved in one or more of these combinations. In each case, the F_1 plants produced all, or nearly all normal pollen, indicating that the restorer genes carried in the five lines are allelic. These results are being confirmed by testcrosses. Since two of these lines, CE1 and Ky21, were among those analyzed by Duvick, it may be concluded that the eight lines involved carry the same restorer gene, though it is possible that closely linked restorer loci are involved.

We are currently conducting a search among open pollinated varieties of maize for naturally occurring restorers of cms-S, and having identified numbers of these will determine whether or not the restorers in these strains are allelic to the Rf3 of CE1. In addition, the restorer genes carried by other inbred lines known to restore cms-S are being tested for allelism with Rf3. In this connection, we would appreciate receiving small samples of strains that others have identified as cms-S restorers.

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