Chromosomal location of Rf3

Preliminary evidence (Singh, Ph.D. thesis, Univ. of Illinois, 1969) suggested that the cms-S restorer carried by inbred line CE1 is located in either chromosome 2 or 3, probably the former. Unpublished studies (S. W. Noble, personal communication) involving use of translocation testers indicate that the cms-S restorer of inbred line CE1 is located in chromosome 2, probably in the long arm.

Our recent studies confirm the assignment of cms-S restorers carried in a number of inbred strains to the chromosome 2 linkage group. One of these involves an inbred strain carrying Inversion 2a (breakpoints = 2S.75-2L.80), the plant color allele B, and, as it turned out, a natural cms-S restorer not previously identified. cms-S plants heterozygous for the inversion, for B and for the restorer allele, when testcrossed as females gave a total of 335 offspring in 10 families. The data indicate that the restorer factor is closely linked with both B and In2a, recombination values being 5.7 and 3.0, respectively.

The cms-S restorer carried in the In2a stock has been shown independently to be allelic with the restorer carried by inbred line Tr, thus indicating that the latter is also located in chromosome 2. And since Tr is one of the eight restoring lines for which allelism is indicated in an accompanying report in this volume, it appears that all these restorers are assignable to the chromosome 2 linkage group.

Independent evidence for the assignment of the cms-S restorer to chromosome 2 comes from linkage studies involving chromosome 2 translocation heterozygotes. The restorers involved are those carried by inbred lines CE1 and Tr, as well as one carried by the Vg (vestigial glume) strain in which cms-Vg, a member of the S group of sterile cytoplasms, was identified. There is a loose linkage between each of these restorers and the T2-9b interchange point, which is located at 0.2 in the short arm of chromosome 2. These studies also indicate linkage between the restorer carried by the two inbred lines CE1 and Tr, and three translocations with breakpoints well out in the long arm of chromosome 2. Since there is other evidence that the restorer carried by CE1 segregates independently of the ws3, lg and gl2 markers, which lie beyond B in the short arm, the combined information on linkage and recombination from both inversion and translocation heterozygotes suggests that Rf3 is located in 2L, most likely in its proximal region.

J. R. Laughnan and S. J. Gabay

Linkage relations of newly arisen cms-S restorers

Using a new method (Gabay and Laughnan, MGCNL 48:44-45, 1974) involving analysis of pollen samples from waxy translocation heterozygotes, six of the ten new cms-S restorers of spontaneous origin (Laughnan and Gabay, MGCNL 48:38-42, 1974) have been located to chromosome. The pollen data indicate that restorers I and VIII are located in chromosome 8, restorers IV and VII in chromosome 3, and restorers IX and X in chromosome 1. These assignments have been confirmed by test cross data that are now available for all but restorer VII. The data do not rule out the possibility that restorers IX and X may be located at the same site in chromosome 1, but they do suggest that restorers I and VIII, and restorers IV and VII, are at different locations in chromosomes 8 and 3, respectively. Restorers II, III, V and VI have not yet been assigned to chromosomes but tests for allelism indicate that these new restorers are neither allelic with each other nor with the standard restorer Rf3 carried by inbred line CE1. These and other findings support the notion that the spontaneous changes from male-sterile to male-fertile phenotype occurring at the nuclear level involve the integration of a fertility element F, with episomal characteristics, into one or another of the maize chromosomes, rather than mutation at pre-existing restorer or suppressor loci.

S. J. Gabay and J. R. Laughnan