An ultrastructural investigation of monosomic maize

Satyanarayana (unpublished) observed that the r-X1 deficiency produced a large number of monosomic and trisomic plants. The r-X1 deficiency includes the R locus on chromosome 10 of maize and was originally induced with X-ray irradiation by L. J. Stadler. Using this system, Weber (1973, Genetics 74:S292) has been able to produce plants monosomic for nine, and possibly all ten, of the maize chromosomes. This is the first time that a series of this type has been produced in any diploid organism.

A comparison of a monosomic with its diploid siblings is a comparison between one and two copies of all genes on the monosomic chromosome. If a gene expressing dosage effects is located on the monosomic chromosome, then a difference will be found between the monosomic and its diploid siblings in the phenotypic expression of that gene. In this way, one can simultaneously screen all the genes on the monosomic chromosome without using mutations. It has been shown that monosomic-diploid comparisons can be used to locate genes expressing dosage effects (Plewa and Weber, 1973, Can. J. Genet. Cytol. 15:313; 1975, Genetics 81:277).

The purpose of this study was to compare the ultrastructure of monosomic and diploid sibling plants to determine if genes located on specific chromosomes, expressing a dosage effect, have an influence on the ultrastructure of selected maize cells.

In this study, monosomics for chromosome 2, 6, 7, 8 and 10 were used. Leaves from different monosomic plants and normal diploid plants were sampled for electron microscopic investigation at three different stages: seedling stage (two weeks after germination), sporocyte stage (6 weeks after germination), and during anthesis (10 weeks after germination). All leaf samples were taken from the middle part of the first leaf of plants at each different stage. Root tips from the apical meristematic region from different monosomic plants and normal diploid plants were also sampled for electron microscopy. However, in all cases root tips were taken only from seedling stage growing in clay pots in the greenhouse.

Although no obvious morphological differences between monosomic plants and their diploid siblings were detected in leaf mesophyll cells or root-tip meristematic cells, there appear to be certain differences at the ultrastructural level, such as the number of thylakoids per granum in chloroplasts. These differences will be the basis of a future discussion. (Supported in part by ERDA Contract No. E(11-1)-2121).

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Linkage of y3 and al

I have assumed that y3 and al were different pleiotropic manifestations of a single allele. Apparent crossovers were rare and could be accounted for by either misclassification of endosperm color or through hetero-fertilization, known to be high in these stocks. In the winter season of 1974-75 sizable F_2 progenies from the cross Y3 Al/y3 al were classified and grown in the sand bench. A random sample of the apparent crossovers, y3 Al, were transplanted and grown to maturity. Without adjustment the apparent percentage of crossing over between y3 and al was 3.5. Selfed progeny of the presumed crossovers indicated that approximately half were not crossovers and the assigned y3 Al phenotype was due either to misclassification or heterofertilization. If the total number of presumed crossovers is adjusted on the basis of the tested sub-sample, the percentage crossing over is reduced to 2.0. Stocks of y3 Al are now available, the genotypic constitution having been verified by appropriate testcrosses in 1975.

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