

CORNELL UNIVERSITY
Ithaca, New York
Department of Plant Breeding

1. An analytic study on the chloroplast lesion of w_3 mutant seedlings.

The recessive allele of the W_3 gene was incorporated into five Mexican maize races by appropriate breeding methods. From segregation progenies, albino and normal seedlings were selected for studies. Investigation of genic and cytoplasmic effects of the five maize races on the physiological function of homozygous mutant $w_3 w_3$ and normal W_3- were conducted on the following relationships:

- (1) Photochemical conversion of protochlorophyll to chlorophyll-a in etiolated seedlings.
- (2) Aerobic and anaerobic (nitrogen atmosphere) photosensitivities of chlorophyll-a in etiolated seedlings.

Selected seed stocks were germinated in the dark. The etiolated normal and mutant seedlings were allowed to complete photoconversion of protochlorophyll to chlorophyll-a under either aerobic or anaerobic conditions. It was found that chlorophyll-a formation was similar for both normal and mutant seedlings under anaerobic illuminated environment. The quantities of chlorophyll-a increased within minutes after the etiolated seedlings were anaerobically exposed to light. It soon reached a plateau; no more chlorophyll increment was observed thereafter. However, if the photoconversion process of protochlorophyll to chlorophyll-a was conducted in air, normal and mutant behaved quite differently after the conversion of chlorophyll. After a brief lag period, the chlorophyll-a content of normal seedlings increased linearly with time of exposure in light. The mutant seedlings, however, lost pigment and became fully bleached after approximately 10 minutes of illumination. These same phenomena have been observed by Koski (1), Koski and Smith (2), and by Anderson and Robertson (3). Phenotypically the w_3 mutant seedling can be characterized by its inability to retain chlorophyll-a once formed. Tests were carried out on the w_3 mutant in varied background genotypes. In all, w_3 mutant and normal seedlings of five maize races were tested. Slight influence of varied genetic backgrounds was found for w_3/w_3 genic action in the seedlings. It appears that a fundamental change in chloroplasts, such as that triggered by the homozygous recessive w_3 gene, is rather autonomous from other cellular activities.

References:

1. Koski, V. M., Arch. Biochem. 29:339, 1950.
2. _____, and Smith, J. H. C., Arch. Biochem. Biophys. 34:189, 1951.
3. Anderson, I.A., and Robertson, D. S., Plant Physiol. 35:531, 1959.

H. Z. Liu
H. L. Everett