2. Peroxidase isoenzyme loci in maize.

Peroxidase isoenzyme polymorphism in maize tissues as observed using starch gel electrophoretic techniques has previously been described (Hamill and Brewbaker, Physiologia Plantarum 22:945-958, 1969). Of some 21 different peroxidase polymorphisms found, 5 of these systems have been subjected to genetic analysis and found to be under the control of 5 different loci. These loci have been designated $\underline{Px}_1$, $\underline{Px}_2$, $\underline{Px}_3$, $\underline{Px}_4$, and $\underline{Px}_5$.

The $\underline{Px}_1$ system moved cathodally on starch gel in the pH 8.1 buffer used, to a position -36 relative to the front on the anodal side. This isoenzyme was found first in seedling root tissues and subsequently, bands moving to the same position were seen in mature roots and some leafy tissues. Genetic analyses for this system were all carried out on seedling root tissue extracts. This locus was previously reported as having 2 alleles (Hamill, Maize News Letter 42:36-37, 1968), each conditioning the production of an isoenzyme with a slightly different electrophoretic mobility. Two additional patterns were found, another isoenzyme variant moving slightly slower than the others, and a null condition in which none of the bands was present. These 4 peroxidase patterns were crossed in all possible combinations and F_2 and backcross progenies were produced to test for allelism. In all cases, F_1's possessed both parental isoenzymes, and the F_2 and backcross progenies segregated with ratios which fit those expected for a single locus with 4 alleles, $\underline{Px}_1^1$, $\underline{Px}_1^2$, $\underline{Px}_1^3$, and $\underline{Px}_1^{null}$.

An attempt was made to localize $\underline{Px}_1$ on its chromosome using B translocation stocks as described by Roman (PNAS 34:36-42, 1948). To date, the long arm of chromosomes 3, 4, and 10, and the short arms of 7 and 9 have been eliminated as the site of $\underline{Px}_1$, but further location of $\underline{Px}_1$ remains to be determined.

The $\underline{Px}_2$ peroxidases stained very densely and very rapidly and were found exclusively in mature pollen following anthesis. There were 2 variants for $\underline{Px}_2$, one moving to position 67 and one to position 62 relative to the front. F_2 and backcross progenies were produced from a cross between the two and ratios were obtained indicating that the 2 isoenzymes

were due to 2 alleles at a single locus. This was designated $\underline{Px}_2$ with alleles $\underline{Px}_2^1$ and $\underline{Px}_2^2$. No null was observed for this locus.

The $\underline{Px}_3$ peroxidase system was observed in mature leaves, internode, husk, and root tissues, but always was seen most clearly in mature leaves. This system consisted of a series of anodal bands in positions 10, 20, 29, and 38. A second variant of this pattern consisted of a series of bands displaced slightly more toward the anode. These isoenzymes showed faintly in seedling and young tissues and reached maximum clarity in mature tissues which had stopped elongation. Data from segregating progenies from both leaf and root extracts indicated that each of these patterns was conditioned by an allele of a single locus, designated $\underline{Px}_3$ with alleles $\underline{Px}_3^1$ and $\underline{Px}_3^2$. Since the $\underline{Px}_3$ peroxidases were most distinct in leaf, internode, or root when the tissue had completed elongation, it might be suggested that these peroxidase isoenzymes are acting as indoleacetic acid oxidases, bringing about the oxidation of auxin and hence cessation of growth. This remains to be proven.

$\underline{Px}_4$, a peroxidase isoenzyme found in leaf tissues, moved cathodally to a position -18 on the starch gel. No variants were observed for this band, except the null condition. Segregating populations from a cross of presence x absence gave data which indicated that the $\underline{Px}_4$ system consisted of a single locus with presence and absence alleles, with the absence allele being dominant. The same ratios would be obtained however, if presence were dominant and under the control of a dominant independently segregating regulatory locus. This possibility has not yet been examined.

The $\underline{Px}_5$ peroxidase was found in leaf tissues and moved cathodally to a position of -24. Like $\underline{Px}_4$, this peroxidase also consisted of presence and absence conditions. Only one inbred (L289) of 64 studied was found to lack this isoenzyme. F_2 and backcross progenies indicated that these were due to a single locus with 2 alleles, with presence dominant.

$\underline{Px}_3$, $\underline{Px}_4$, and $\underline{Px}_5$ were tested for linkage. No evidence of linkage was found for these 3 loci.

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