3. Differential reaction of cytoplasms and genotypes to H. maydis, Race T.

H. maydis (Race T) on green maize plants was first found in 1971 in our nurseries and tests at Athens on July 9 on corn that was planted May 20. Inbreds were rated for reaction on the standard 0; - 5.0 H. maydis scale at 10-day intervals from July 14 to August 24.

The following results indicate a differential reaction not only for cytoplasms but also for genotypes (genes on the chromosomes).

Inbred	Reaction to H. maydis, Race T				
	Athens, Georgia				
	7/14	7/24	8/4	8/14	8/24
GA 152 (N)	1.0	1.0	1.0	1.5	2.5
GA 152 (T cms)	2.0	3.0	4.0	4.5	5.0
Pa 33 (N)	1.0	1.0	1.5	3.0	4.5
Pa 33 (T cms)	2.5	3.5	5.0	5.0	5.0
NY 821 (N)	2.0	2.0	2.5	3.0	4.5
NY 821 (T cms)	3.0	4.0	5.0	5.0	5.0
WF 9 (N)	1.0	1.0	2.5	3.5	4.0
WF 9 (C cms)	2.0	2.0	2.5	3.5	4.0
M 14 (N)	.8	1.0	1.5	2.0	2.5
M 14 (S)	1.0	1.0	1.5	2.5	3.0

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1. The maize peroxidases; designation of seven loci governing peroxidase polymorphisms in maize.

Maize peroxidases have been the subject of our continuing genetic studies, although descriptions have been published for only one of the 7

genetic loci we have encountered (Hamill, MNL 42:36-7, 1968). These loci have been referred to briefly in a summary of 30 maize isozyme genes (Macdonald and Brewbaker, J. Heredity, in press, 1972), and are described in detail below.

There are ten principal peroxidases of maize, as defined by the presence of 10 principal regions of activity on starch and acrylamide gels. These 10 regions are shown in Figure 1, as they occur on acrylamide gels at pH 8.1 (Brewbaker et al., Physiol. Plant 21:930-940, 1968). Approximate Rf values are 74 for $\underline{Px_8}$, 51 for $\underline{Px_6}$ and 24 for $\underline{Px_3}$, allele 1. On starch gels, the peroxidases 7, 9, and 10 are tightly clustered near the origin, while at lower pH levels, cathodal regions migrate very rapidly. Below pH7, little movement occurs of the anodal bands. Eight of the 10 peroxidases have been characterized in our materials by multiple isozymes, largely under allelic control. Each of the peroxidases has tissue specificities or substrate responses that distinguish it and its respective isozymes. Further study will unquestionably reveal new isozymes within these regions.

Peroxidase Px 1 was described briefly by Hamill (MNL 42:36-37) and is an enzyme present in most tissues (exceptions: pollen, seed). Genetic polymorphisms are controlled by the $\underline{Px_1}$ locus, with three common isozymes governed by co-dominant alleles and a null form conditioned by an allele designated $\underline{Px_1^{null}}$. Allele $\underline{Px_1^2}$ is the most frequent (70% of US inbreds).

Peroxidase Px 2 is an enzyme found in glumes and pollen; two co-dominant alleles of the locus $\underline{Px_2}$ govern the two bands observed, with the slow allele $\underline{Px_2^2}$ rare.

Peroxidase Px 3 is our standard reference region and is the most polymorphic, genetically, of the peroxidases. It is most active in leaf, coleoptile and mesocotyl and repressed in pollen, silks and roots. It is derepressed late in the development of all tissues, and becomes very intense in senescing tissues, where multiple bands, diminishing in intensity and equally spaced, are observed (similar peroxidases are found in many grasses). Genetic polymorphisms are under control of the $\underline{Px_3}$ locus with at least 6 alleles, of which one is an apparent duplication. Alleles $\underline{Px_3^1}$ (in 60% of US inbreds) and $\underline{Px_3^2}$ predominate, while $\underline{Px_3^3}$ (a very slow

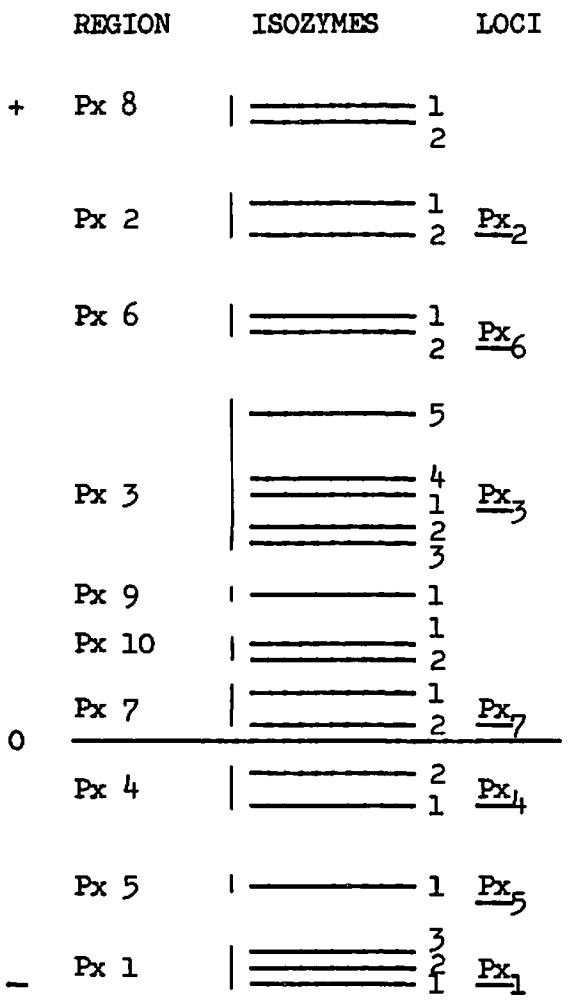

Figure 1. Ten principal peroxidases of maize as they occur on acrylamide gels at pH 8.1.

isozyme) and $\underline{Px}_3^4$ (a fast band) were obtained from the race Clavo. $\underline{Px}_3^5$ (extremely fast band) was obtained from the race Puya segregaciones, where it occurred together with a unique twin-band phenotype. The latter has provisionally been designated by the allele $\underline{Px}_3^6$, acting as an allele that governs synthesis of both isozymes 1 and 2. Alleles for the 1 and 2 bands are present in race Puya, as indeed they have been in almost all of the 80 races studied. The possibility exists that $\underline{Px}_3^6$ is a duplication of the $\underline{Px}_3^1$ and $\underline{Px}_3^2$ alleles. Null variants have never been encountered.

Peroxidase Px 4 is an enzyme that stains intensely in most mature tissues, but is repressed in juvenile leaf, endosperm, coleoptile and ear. A single locus governs the common fast isozyme, $\underline{Px}_4^1$, and a slow variant, $\underline{Px}_4^3$, in Corn Belt materials; an intermediate band, $\underline{Px}_4^2$, has been obtained from the race Clavo, and preliminary data suggest its allelism to this locus. Null variants have not been observed.

Peroxidase Px 5 is repressed in most tissues, and is perhaps observed best in the endosperm, pericarp, and etiolated mesocotyl. A null phenotype (inbred L289) was studied in mature leaves and proved to be under control of a recessive allele at a locus designated $\underline{Px}_5$.

Peroxidase Px 6 is active in most tissues, but repressed in silks and mature leaves. A null phenotype, studied in seedling leaf and coleoptile, characterizes inbred C103, sweet corn inbred P39, and related lines, and is under control of a recessive allele, designated $\underline{Px}_6^{null}$. The Px 6 peroxidase clearly resolves into two closely paired bands on some gels. A slow variant has been observed, but not studied genetically, in teosinte.

Peroxidase Px 7 is a major enzyme of the silk, mature leaf, and pericarp, but is repressed in many other tissues. The common slow band (allele $\underline{Px}_7^2$), with an isoelectric point near pH 7.5, migrates a limited distance from the origin at pH 8.1. A fast variant has been observed in several inbreds (e.g., sweet corn lines T24, T36, and T55) under apparent control of an allele, $\underline{Px}_7^1$. A null or "extremely repressed" phenotype is observed in inbreds B37, CI66, W64A, and others, and preliminary evidence suggests control by a null allele.

Peroxidase Px 8 is observed convincingly only in root tissues, although very low concentrations may occur in leafy tissues, and is often seen as two closely-paired isozymes. It shows high activity on eugenol and appears unrelated to other maize peroxidases. No genetic polymorphisms have been discerned in the limited materials studied.

Peroxidase Px 9, like Px 8, stains intensely in root extracts, although it is observed variably in the cob. It stains intensely on guaiacol, unlike most other peroxidases of maize. Genetic polymorphisms have not been observed.

Peroxidase Px 10 stains intensely in the coleoptile, mesocotyl, and ear, but is absent from leaf, silk, pollen, and other tissues. Two bands and a probable third have been observed in this region but have not yet succumbed to genetic analysis.

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2. Genetic marker stocks in tropical flint background.

Through the years, we have been introducing various genetic markers, especially those affecting the endosperm, into a vigorous tropically-adapted stock to facilitate our breeding and academic studies (Brewbaker, M.N.L. 42:37-8). Despite the vigor and generally wide adaptability of stocks maintained by the Maize Cooperative, they lack resistance to several major tropical pests, and often require rather careful handling in the tropics.

The line chosen for these conversions was CM104, an inbred recognized to have high combining ability from the Coordinated Maize Improvement Scheme of India. CM104 was derived largely by sibbing from the Colombian yellow flint variety, Amarillo Theobromina, pedigree A THEO 21 (B)-6#-15-7#. It has been converted in Hawaii to Mv (resistance to maize mosaic virus I or "corn stripe"), and most marker stocks now carry this resistance. Conversions to Rp_1 (P. sorghi resistance) and Ht_1 (H. turcicum resistance) are nearing completion, and will be used for future backcrosses.

A brief description of CM104 follows: