12. Pilosity and hispidulousness of the leaf sheath.

The leaf sheath of corn exhibits hairs of two distinct types, long slender hairs causing pilosity and short hairs resulting in hispidulousness. Both types have been found present on all maize examined although with considerable variation. The gross and microscopic morphology of the pilose and hispidulous hairs have been studied in a large number of varieties and races of maize in order to determine the range of variation.

The pilose hairs are long single cell outgrowths of the epidermis about 4.5 mm. long, at the base of which is a ring or collar of enlarged epidermal cells formed by an elongation, in a direction perpendicular to the epidermal surface, of cells immediately surrounding the hair. The diameter of the collar varies only slightly from plant to plant being about 0.25 mm. with an average height of 0.12 mm. Beneath the collar is an area of cell proliferation produced by the second layer of epidermal cells; embedded in this mass of cells is the swollen end of the hair.

No pattern of arrangement of the pilose hairs has been observed, except that they occur only in the grooves formed by the ridges overlying the vascular bundles of the sheath. There is a complete range in the distribution on the sheath from a few sparsely scattered hairs along the edges at the top of the sheath to a dense covering of the entire sheath.

The hispidulous hairs are microscopic single cell prickles involving only the outer layer of epidermal cells in their formation. They vary in length from about 0.05 mm. to about 0.25 mm., and may be straight or curved. In all the varieties of corn studied these prickles project from the epidermal surface at an angle less than 90 degrees in a basipetal direction. Their distribution is fairly uniform over the entire length of the grooves where the hairs are located. They tend to lie in rows since their presence does not disturb the pattern of the epidermal cells as does the pilose hairs.

A distribution study by countries was made of the variation for these hair types for 508 varieties of Latin American maize. The plants for this study were grown and examined in the field at Weston, Massachusetts. In order to insure uniformity of sampling, the plants were not classified until anthesis, and the second sheath above the uppermost ear was chosen for examination.

Pilosity was divided into five arbitrary classes based on the amaunt of leaf sheath covered. Class 1 had hairs only on the edges of the sheath; class 2 had hairs covering about one quarter of the sheath; class 3 had hairs present for about one half the length of the sheath; class 4 had hairs three quarters of the way down the sheath; class 5 had hairs on the entire sheath.

The results of this classification were grouped according to country of origin. The data shored that the highest percentage for each country fell in class 2, and thai adjoining countries tended to resemble each other. The center of diversity with respect to pilosity is in Guatemala.

The data suggest that the degree of pilosity represented by class 2 may be the normal or "wild" condition and may have been the condition existing in primitive maize. Present variation could be explained on the basis of the introduction into some varieties of a second factor.

Two possible sources for the introduction of a second pilosity factor are Cacahuacintle, a pre-Columbian race of Mexican maize, and Tripsacum pilosum. At present the evidence on this point is not at all conclusive.

A similar distribution study was made for hispidulousness but with less clear-cut results. Hispidulousness was divided into four classes on the basis of the roughness of the leaf sheath as determined by feel with the fingers. Those sheaths which gave no sensation of roughness were called class 1; and those which gave a very strong sensation were classified as class 4.

An analysis of this distribution indicated that adjoining countries tended to be similar. The highest percentage in the Central American countries fell in class 2 and in the South American countries in class 3.

Genetic studies of pilosity and hispidulousness have been in progress for the past three years. Several Latin American varieties were crossed with a multiple-tester strain having marker genes on nine chromosomes (chromosome 5 excepted) and the F_2 and backcross progenies classified. The varieties used were pilose (class 5) from Mexico and Guatemala, hispidulous (class 4) from Nicaraugua, and near-glabrous varieties (class 1 for both pilosity and hispidulousness) from Peru and Colombia. The F_2's and backcrosses with the multiple-tester were classified for the two leaf sheath characteristics and for the nine marker genes. The results of these studies showed strong evidence of linkage between pilosity and the gene A on chromosome 3 and wx on chromosome 9. There was some indication of linkage between hispidulousness and lg on chromosome 2 and wx on chromosome 9.

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