2. Geographical and genetic variation in pollen size.

When a study of the fossil maize pollen from Mexico, reported above, was begun it soon became apparent that very few comparable data on size and other characteristics of maize pollen are available. A study was therefore undertaken of pollen from the maize varieties of this hemisphere. The pollen was obtained from ripe anthers of herbarium specimens of tassels all grown in the vicinity of Cambridge. The pollen was mounted in lactic acid which causes it to swell to approximately its original size. Twenty-five grains from each tassel were measured for maximum diameter under the microscope with an eyepiece micrometer. Altogether 17,350 grains from 694 plants from the maize of fifteen different countries were measured. The results in terms of modal frequencies are set forth in Table 1.

Subsequent studies have revealed that there are sources of error in these data. For example, free pollen which has been shed from dehiscing anthers is usually larger than pollen teased from a ripe anther. Also there is some variation in pollen size from season to season in the same stocks. However, the data in Table 1 represent rather large samples and are so consistent in certain characteristics that they are believed to be significant.

Table 1. Geographical Variation in Pollen Size

			Diameter in microns Modes		
Country of Origin	No. Plants	No. Pollen Grains	1	2	3
U. S. (Inbred strains)	50	1250	90		
Mexico	47	1175	90		
Guatemala	115	2875	92	100	
Salvador	5	125	92	96	100
Honduras	43	1075	92	96	100
Costa Rica	35	875	90	96	100
Nicaragua	13	325	90	100	
Panama	7	175	100		
Colombia	65	1625	90		
Venezuela	16	400	90		
Ecuador	52	1300	90		
Peru		63	1575	90	100
Bolivia	130	3250	90	96	100
Paraguay	39	975	92	96	100
Brazil	14	250	92	102	
Totals	694	17,350			

The most interesting feature of the frequency distributions with respect to pollen size is that the curves are often bimodal or trimodal and there seem to be significant geographical regularities in size frequencies. In Central America for example, Honduras, Salvador and Costa Rica, adjoining countries, have frequency curves with modes at 90-92, 96, and 100 microns. Guatemala and Nicaragua, which lie to the north and south respectively of

these three countries, have curves with modes at 90-92 and 100 microns. Mexico, which is still farther north, and Panama, which is farther south, each have curves with only one mode, which in Mexico is at 90 and in Panama at 100 microns. In Central America the center of diversity with respect to pollen size occurs in Honduras and diversity decreases in both directions from the center.

A similar situation exists in South America. There the center of diversity in pollen size is in Bolivia and Paraguay, whose curves for pollen size have modes at 90-92, 96 and 100 microns. The curves for Brazil and Peru are bimodal with peaks at 90-92 and 100-102 microns. Ecuador, Colombia and Venezuela, adjoining countries, all have unimodal curves with modes at 90 microns.

Pollen size is in some cases a plant character affecting all pollen grains in the tassel. But in some instances size is directly determined by the genes within the pollen grain and there is segregation for size within a single anther. A hybrid of P39 with a Bolivian variety, for example, produced pollen grains of two sizes in approximately equal numbers, the smaller with a mode at 90, the larger with a mode at 102 microns. There are apparently at least two distinct genotypes in maize with respect to genes for pollen size acting in the haploid state. There may be several more. It will be important to determine how many different genes and chromosomes are involved in pollen size and whether selective fertilization which might act as an isolating factor occurs when there is segregation for pollen size.

An attempt has been made to correlate pollen size with other characteristics of the corn plant. When all of the data available are considered it is difficult to show any strong correlation. There are, however, correlations within certain smaller samples of the population. In Mexican races of maize, for example, pollen size tends to be correlated with ear length (style length?). In pop corn varieties there is a significant correlation between pollen size and kernel size. This is shown in Table 2, where pop corn varieties, arbitrarily placed in three groups with respect to kernel size, are compared in pollen size.

Table 2. Relation between size of kernels and diameter of pollen grains in microns in pop corn varieties.

		Pollen Grains	
Size Kernels	No. Strains	No.	Mean
Small	9	1800	91.6
Medium	15	3000	96.1
Large	7	1400	100.3

Since domesticated grasses usually not only have larger pollen grains than their wild counterparts but are also larger in other organs, including the caryopsis, it is possible that variation in pollen size in maize is the product of genes affecting the size of plant parts in general. Genes of this kind may have played a very important role in the evolution of the species under domestication.

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