

VARIATION AND VARIETIES OF ZEA MAYS.

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Indian corn is commonly known to be a very variable plant, and any farmer can name off-hand from a dozen to fifty more or less definite varieties. Many attempts have been made to dispose of the plant in a technical way by naming, describing, and classifying these varieties, but the layman, and even the botanist who has not made a special study of the subject, is much in the dark as to what nomenclature is advisable in speaking scientifically of corn. To point out briefly the range of variability of the plant and to discuss critically some of the technical names that have been applied to the varieties of corn is the object of this paper.

In all parts of the maize plant there is a striking variability of size. I have grown healthy plants in a normal environment which were eighteen inches tall at maturity; and plants twenty-four feet tall have been reported. Some plants have stems no larger than a lead pencil, and the stems of others measure six inches in circumference. The leaves and other vegetative parts vary proportionately.

Stalks of most varieties bear only one or two ears, but as many as ten well-developed ears have been seen on a single stalk. An ear may have from four to thirty rows of grains, and there is as great a variation in the number of grains in a row.

The fruit of the plant, being the economic part and the part best known, has been made the basis of most classifications. The pericarp varies from white through shades of pink, red, and yellow to a dark brown, and definite color patterns in the form of stripes are common. The endosperm is usually characterized by the development of a large amount of starch, but in sweet corn the starch is partly replaced by another carbohydrate. In physical character the endosperm is partly soft and partly corneous, and these parts have a more or less definite ratio and arrangement in each variety. The soft portion is always white; the corneous part may be white or yellow. The aleurone is white, red, or blue to black, and mixtures of either of these colors with white occur in definite patterns in some varieties. The largest grain I have ever seen

weighed fifty-six times as much as the smallest. The fruits of most varieties are naked, except for the well-known covering of husks, but there is a variation from this in the podded types, each grain of which has a separate covering composed of the enlarged glumes and palets.

Still further illustrations of ordinary variability might be mentioned, but these will suffice. Besides these, there are some less common variations—sometimes termed mutations and sometimes reversions—which add interest to our investigations but complicate our classifications. A few examples may serve as illustrations. The production of male elements in female inflorescences or female elements in male inflorescences is of common occurrence, and varieties breeding true to these characteristics have, in some instances, been isolated. Emerson has a variety whose leaves have no ligules, and another—a dwarf variety—whose ears bear hermaphrodite flowers. Gernert has isolated a constant strain whose ear is a loose panicle.

The difficulty at the bottom of any attempt to classify the varieties of maize is in the perplexing lack of correlation between these variant characteristics. Some authorities maintain that definite correlations do exist, and others are as confident that they are almost if not quite independent of one another. The merits of either argument is irrelevant to our present consideration. That certain physical correlations do exist is accepted without argument, but all the genetic correlations that have ever been discovered are of little avail in classification. If the various characters had a tendency to remain in groups affording rigid types, a basis for classification would be provided; but, in a practical way, it seems possible to combine in a single plant or to separate at will any two characteristics which are not connected in any physical way, allelomorphs of course being excepted.

Pure botanists, as well as those prompted chiefly by a utilitarian motive, have taken their turn at the problem, and many articles have been published by experiment stations and other institutions. Without going into details, we might analyze the principles employed and see what progress has been made.

I have made no attempt at a thorough investigation of the tribulations through which the maize plant originally passed in getting itself named. Suffice it to say that all that we usually call maize or Indian corn passes technically under the name *Zea Mays* L., the generic root

being the Greek name of some cereal, and the specific a corruption of an Indian name for the plant.

When a distinct variation from the described limits of a species is found, it is customary to make of it a new species or to include it as a variety of the parent species. Both systems have been applied to maize. Sturtevant adopted the plan of a trinominal nomenclature to distinguish seven varieties, as follows: *Zea Mays tunicata*, pod corn; *Zea Mays saccharata*, sweet corn; *Zea Mays indentata*, dent corn; *Zea Mays indurata*, flint corn; *Zea Mays everta*, pop corn; *Zea Mays amylea*, soft corn; and *Zea Mays amylea-saccharata*, a poorly-defined type, part soft and part sweet. Some later authorities have dropped the word *Mays* from these names, giving the types specific rank.

The inadequacy of either system is obvious on close examination. It is based upon a single set of characteristics, and in other respects each variety or species is subject to the full range of variation. In fact even these seven varieties are not distinct with regard to the set of characteristics which forms the basis of division; pod corn necessarily exists in one of the other six forms or in a mixture of them. The name of a species should stand for a description; its value is lessened as exceptions to this description are found, and utterly destroyed as soon as it overlaps other species so far as to render them indistinguishable. If the names stand for nothing but individual characters, then, it would be better to mention the character than the variety possessing it. There is also another disadvantage to the system; it establishes a bad precedent, which, with a little encouragement, would soon lead to a condition bordering on absurdity; in fact, I am not sure that it has not already reached that point. Upon this basis a number of new variety names have already sprung into existence, and more are due to arrive at any time. Blaringhem mutilates a corn plant and gets, or thinks he gets, as a result, a number of new varieties which breed true. To these he gives such names as *Zea Mays praecox*, a very precocious form indeed if we accept his interpretations, and *Zea Mays pseudo-androgyna*, *pseudo* because a *Zea Mays androgyna* already existed. Although his methods and conclusions are a trifle shady, his naming of the new forms illustrates the point in question. Seed companies advertise *Zea gracillima*, *Zea Mays gigantea quadricolor*, *Zea japonica*, and *Zea Curagua*; and the Department of Agriculture is now offering for distribution through the

Office of Seed and Plant Introduction a new discovery, *Zea guatemalensis*, which seems to be ordinary corn from Guatemala. Besides these we have a *Zea Mays chinensis* and a *Zea Mays pensylvanica*, and in this way we might continue until we run out of habitats and combinations of characteristics. Gernert's Branch Corn was hailed as a new seventh species, *Zea ramosa*. Emerson might have named his liguleless variety *Zea Mays aligulata* and his dwarf variety *Zea Mays pygmea-androgyna*, and Stewart or the writer might, on discovering the two-flowered condition of the female spikelets of Country Gentleman sweet corn, have revelled in the invention of some such name as *Zea Mays saccharata geminata*—but none of us did. The difficulty is not in finding new varieties or in naming those found, but in avoiding being led to more ridiculous ends—in stopping the naming process soon enough to permit a name to mean anything; for when anyone has made a complete list of all the varieties that he knows, someone else can always add a few more that he knows, or, if need be, make a few to order by judicious hybridization.

The cause of this confusion is easier to find than is its remedy. It lies in our limited knowledge of the evolutionary history of the plant. No wild form of corn has ever been seen by civilized man. When America was discovered, the plant cultivated by the Indians was almost as complex as it is today. We can, however, imagine the evolutionary process reaching a place where its product was a plant of more or less uniform character agreeing with the generic description of *Zea*. Further evolution, aided by reversion, then proceeded to produce in isolated environments a number of varieties possessing in definite combinations the various characteristics already mentioned. If we knew what these combinations were, we should have a basis for naming varieties. But the plant readily hybridizes with other varieties of its kind, and these different original types, brought together and mixed by the savage or semi-civilized agriculturist, gave us the heterogenous combination that we know corn to be. It is probably safe to say that there exists nowhere in the world today a primary variety of corn that has not been complicated by hybridization with some other variety. Hybridization with teosinte, one of the nearest relatives of maize, has added further difficulties in the tropics, and it is probably due to the limited habitat of teosinte as compared with that of maize, that the dividing line between the two genera has not long ago been obliterated. Few other plants, wild or cul-

tivated, present these difficulties, because few others combine such a range of variability with such ease of hybridization.

I am fully aware that some of these latter remarks are not in accord with the commonly accepted theory of the hybrid origin of maize, but I do not believe that theory to be the correct explanation of the origin of the plant. My full discussion of that point will be presented elsewhere.

A specific name is to be understood as only an abbreviated description, and the only thing about maize that is constant enough to have a fixed description is the whole genus. It is true that in some variations it borders closely upon some other genera and even encroaches upon the territory allotted to another tribe of grasses, but its limits are sufficiently definite to obviate any doubt as to whether or not a plant under observation is corn.

The best taxonomic treatment, then, seems to be to consider *Zea* a monotypic genus and discard all other names than *Zea Mays* L. Reference to the numerous variations can be made to the characteristic directly and not to any arbitrary variety possessing that characteristic in varying combination with other properties.

