3. The relation of heterozygosity to environmental variation with reference to some seedling traits in maize.

It is now generally believed that developmental homeostasis with respect to many characters is associated with heterozygosity, particularly in the cross-fertilized species. To state in simple terms, the phenctypic (=environmental) variance of inbreds is greater than that of hybrids. Recent investigations in several organisms indicate that this may not hold good for all characters. With respect to certain traits it has been observed that the variance in hybrids is greater than the variance in inbreds. Attempts have been made to explain this anomaly in terms of the nature of variation, i.e. whether it is developmental or due to adaptive response. As suggested by Falconer (1960), developmental variation, which may be an expression of the degree of buffering or canalization of development, would be expected to be maximum in inbreds and minimum in hybrids. On the contrary, variation due to adaptive response, which may be associated with the greater fitness of hybrids, should be high in hybrids but low in inbreds. If this argument is generally valid, a clue is provided for knowing the nature of the environmental variation in different characters by observing the difference in the degree of variation between inbreds and hybrids.

Starting with this premise, we have undertaken a study of the difference in environmental variation in inbreds and hybrids with respect to seedling as well as adult plant traits. The preliminary data on a few seedling traits lead us to the following tentative inferences: (1) In the case of a few characters like mesocotyl length, coleoptile length and the number of seminal roots, the environmental variance is greater in the inbreds than in the hybrid. According to the view expressed by Falconer (1960) and others, the variation in inbreds with respect to these characters may be of a developmental nature, probably 'arising from accidents of development'. Heterozygosity would lead to developmental homeostasis of these characters. (2) In another group of characters, the variance in the hybrid is strikingly more than that in the inbred parents. The greater variance in the hybrid can presumably be ascribed to the 'adaptive responses' of characters such as radicle length, the average length of seminal roots, and the average number of vascular strands in seminal roots. (3) Perhaps, there is a third category of characters, e.g. the number of vascular strands of the radicle, in which not much difference can be observed between inbreds and the hybrid.

We are further extending this study to (1) other seedling traits, (2) certain aspects of chromosomal behavior like synapsis, chiasma frequency, division synchrony, (3) variation in nucleolus and (4) pollen grain variation.

It is hoped that such a study will yield more information on the nature of variation in these traits and also help us to select additional traits for a thorough characterization of inbred lines. Further, this study has an important bearing on the problem of choice of material (inbreds or hybrids) for experimental studies, especially for evaluating the effect of different factors on growth and development including the meiotic events. This point will be elaborated elsewhere.

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1. Photoresponse of albescent maize.

Wrapping the bases of stems of young, field-grown al/al plants with aluminum foil proved useful in prolonging the period during which green tissue was produced. Plants with the typical albescent top reverted to the production of green foliage after a 15-cm length of aluminum foil was secured to shade the bases of such plants. Following treatment, the greening response was evident within 48 hours in the tissue just emerging from the leaf rolls. Most responsive to the treatment were those albescent plants which had produced the most green tissue in the lower leaves. This technique should be of use whenever al/al pollen is required; treated early, albescent plants would probably produce enough green foliage to sustain a moderate seed set.

Green tissue produced on al/al plants appeared in thin-layer chromatographic separations to have carotenoid and chlorophyll complements similar to those of +/al foliage. Illuminated al/al seedlings also contained a component in the white tissue with an absorption peak near 340 mμ, tentatively identified as phytofluene. Dark-grown al/al and +/al seedlings contained similar amounts of protochlorophyll. Dark or brightly illuminated albescent seedlings failed to develop a content of carotenoids equivalent to that of heterozygotes. On the other hand, in dim light, somewhere below 0.06 m watt/cm^2, total pigment content of al/al seedlings approached that of heterozygotes. Red or blue light under higher intensity illumination appeared to be most effective in preventing pigment accumulation whereas a green cellophane filter allowed moderate pigment formation. In seedlings as in field-grown