Guatemala that are more similar to T. lanceolatum than to other species thus far described from these countries, and all have been tetraploid. However, a recent collection by Garrison Wilkes from Chihuahua in north-central Mexico, now growing at the Fairchild Garden under accession number FG65-1253, is listed as a diploid, and appears to have the differentiating characters of Hitchcock's T. dactyloides ssp. hispidum.

If the natural affinities of T. latifolium and laxum; australe and the dactyloides of Inagua, and of the eastern United States; the dactyloides of the central United States and dactyloides ssp. hispidum and lanceolatum of northern Mexico; suggested by similarities in traits of taxonomic significance and numerical chromosome relationships, are substantiated by tests of crossability, pachytene karyotype analyses, and other cytogenetic evidence, there will remain for evaluation the many dissimilar populations of Mexico, Guatemala and elsewhere in Latin America that appear to be diverse genetic recombinants at the tetraploid level of natural alloploid derivatives of the very dissimilar T. maizar and zopilotense.

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1. Perennial maize.

The perennial habit in maize appears to be conditioned by the recessive condition at three loci, pe, gt, and id.

A cross was made in 1964 between homzygous pe/pe gt/gt maize and normal segregates in selfed progenies segregating for id. The cross was selfed in the winter of 1964-1965, and the progeny grown out in the summer of 1965 in a pilot experiment to determine if any segregate had a perennial phenotype. From a progeny of 940 in the Salinas Valley nursery, 15 possibly perennial plants were selected, propagated, and observed critically in the Florida winter nursery for perennialism. Only 3 proved to be perennial, and continued to make totipotent growth through the end of the winter season. One of these was grown as a houseplant during the same winter season, and was reset into the 1966 summer nursery at Greenfield, where it continuously made totipotent growth all summer, and still survives as of January 1967, at the age of 21 months. The clone has produced seed twice, and flowered many successive times without loss of vegetative vigor.

According to the mechanics of the cross made, the expected frequency of perennial segregates is 1/2 x 2/3 x 1/64, or 5 triply recessive (perennial) plants from the progeny of 940. Only 3 were realized. However, cultural conditions may be held suspect since any plant that died a cultural death would have been classified as nonperennial. In fact, it has been found that perennial maize is difficult to clone unless one waits until the propagules have formed adventitious roots before they are removed from the

vegetative parent. In the present background, at least, perennial maize is also susceptible to infections admitted through wounds occasioned by removing propagules prematurely.

A more comprehensive experiment was conducted in the 1966 summer nursery from remnant seed of families previously determined to be segregating for id. From a total progeny of 2091, 527 were identified as id/id. Of the latter, 36 were classified as good perennials at the end of the growing season in late December 1966. Criteria for classification were (1) ability to regrow after being cut down near the ground, (2) the continued production of totipotent growth through at least three successive vegetative generations with no loss of vigor, (3) ability to undergo cloning, (4) production of numerous axillary plantlets from culms which have been induced into a prostrate attitude (see Figures 7 and 22, Genetics 50:395, 400).

The extremely long growing season at Greenfield, in the opinion of the author, gives sufficient time to critically assess perennialism before the end of the growth period. However, a further check is being made by taking several of the 36 clones into the greenhouse.

The expectation for frequency of perennial segregates in the 1966 experiment is 1/64 x 2091, or 33. The realization of 36 is in good agreement with expectation, and appears to confirm the hypothesis that perennialism is simply conditioned, by the pe/pe gt/gt id/id genotype. However, the author believes that this interpretation must be tempered with caution. The background-environment dependency of pe has been well established in many previous experiments. It is not hard to imagine that the apparently good segregations may relate to more complex background effects which could quantitatively mimic unitary genetic segregation. It may be, and indeed one needs to assume that gt/gt id/id is the background which is critical for the identification of pe. Most experienced maize geneticists will not find it difficult to concur with the writer that the simple interpretation of data in this case ought to be held suspect for a while.

Because of the difficulty in trying to obtain good genetic data involving an incompletely penetrant gene like pe, other experiments were performed to provide additional, inferential information as to the nature of perennialism. The two-gene synthesis, gt/gt id/id was made and observed in the summer of 1966. Although the gt-id phenotype could easily be identified, it was not perennial. It resembled somewhat the pe-gt phenotype described previously by the author in its ability to produce more than one successive generation of tillers. However, these "ran out" more quickly than in pe-gt maize, through rapidly progressing preinduction and the attendant vegetative suppression.

In another experiment, an attempt was made to derive perennials from the progeny of a cross between id/id maize and a stock which has ability to produce fully indeterminant tillers (McClintock's c tester). The id/id segregates in this freely tillering background succeeded in producing only one generation of tillers, and thus had fewer perennial attributes than either gt-id or pe-gt phenotypes.

Observations and data strongly support the three gene hypothesis. At worst, the basis of perennialism cannot be very complex.

D. L. Shaver

2. Modification of the id/id phenotype.

The id phenotype is commonly thought of as being photoperiod-dependent for floral initiation, and as being almost invariably earless. In a previous report the author has shown that in his stocks, id/id segregates have not been photoperiod-controlled in outdoor experiments since floral induction can occur during the summer solstice and, in winter nurseries, may fail to occur during the winter solstice. In no case has any factor other than simple age of the culm (as a function of the inherent earliness of the specific stock involved) appeared to affect time of flowering in outdoor culture. However, when the author cultured one of his perennial plants as a houseplant during the winter of 1965-1966, by spring it had become highly induced, to the extent that new basal branches were prematurely flowering at a very small size, producing mixed, seed-bearing terminal inflorescences. To all appearances, the plant was "running out" in the manner previously described for the pe/pe gt/gt phenotype. Upon the return of summer weather, however, the plant was reset out-of-doors April 1966 whereupon it immediately resumed producing indeterminant and totipotent growth and continues to do so at the present time, January 1967. It is to be remembered that another propagule of this same clone was grown in the winter nursery concurrently, and showed no signs whatever of premature induction at any time. Since most of the reported work with id deals with greenhouse culture, it is possible that light quality, perhaps UV content, is critical in the expression of id.

Earlessness of id/id maize is obviously of great concern, since all perennial maize is homozygous id. Accordingly perennial maize has never produced ears. The several instances of seed production have been cases of tassel seed formation. However, a homozygous id synthetic has been established by the simple procedure of recombination among rare segregates which were successful in producing ears. The main segment of this population is only in its S_2 generation, but was successful in producing ears on 243 plants in a population of 313, a proportion of nearly 78%. Moreover, the ear fertility of this population was nearly doubled between the S_2 and the S_3 generation. Ear conformation is normal and ear size occasionally exceeds what one might expect from normal plants of this background. It is certain that earlessness of the id/id phenotype is another example of effects that are completely under the control of modifying genes. By inference, the perennial phenotype would produce ears normally if it were transferred to this background.

D. L. Shaver

3. Decussate phyllotaxy in maize.

Among the id/id segregates of a progeny grown in 1965, several plants had irregular patterns of leaf placement. In one case, a plant had a completely regular decussate phyllotaxis, beginning with the 5th node.