

natural tetraploids there is a low frequency of quadrivalent synapsis indicative of an auto-allopolyploid origin. Experimental verification of the hypothesis that the tetraploids did in fact originate as doubled hybrids of T. maizar and T. zopilotense or similar diploid species (Randolph and Hernandez, Genetics 35:686, 1950) has been undertaken by making the appropriate crosses to be followed by induced chromosome doubling of the diploid hybrids.

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3. Cytotaxonomic studies of Tripsacum in Mexico and Guatemala.

In 1963 field studies of *Tripsacum* populations were undertaken in Mexico and Guatemala and continued in 1965 to learn more about the interrelationships of the diploid and tetraploid species and to evaluate their taxonomic status. Included in these studies were populations from the state of Durango in northern Mexico and southward through Sinaloa, Nayarit, Jalisco and Guerrero on the west coast, eastward to Vera Cruz and southward into the states of Oaxaca and Chiapas. In Guatemala populations were studied from the rain forests of the Coban area, the San Antonio Huixta area of southwestern Guatemala, and the neighborhood of Jalapa in southeastern Guatemala. The type localities of the six species of *Tripsacum* described from these countries were visited. Utilizing appropriate techniques of cytogenetics and numerical taxonomy, measurements and other data were obtained for statistical analysis from 5 to 15 or more individuals selected as representative of more than 40 reproductively isolated populations. The size of the populations studied varied from a small number of clones in recently disturbed habitats to many hectares in undisturbed habitats of various kinds. The measurements included morphological characteristics of the culm, leaves, inflorescences, spikelets and the amount, kind and distribution of pubescence; also the percentage of good pollen, chromosome number and other features of taxonomic significance that were recorded totaled more than 20 items for each plant. Voucher herbarium specimens were preserved and live-plant collections were made for garden culture of individuals from which the measurements and other data had been recorded.

Preliminary evaluation of these data and the accompanying field observations indicated it is only at the diploid level that there are in the region studied good species as ordinarily defined. Among the tetraploid populations there is a unique array of phenotypes varying widely in combinations of morphological traits from extremes much like the assumed parental species, T. zopilotense and T. maizar, to intermediates including a wide range in combinations of the various contrasting traits of those two species or others

like them. Although habitat preferences were apparent with populations having plants with narrow leaves being restricted ordinarily to the more arid regions, those with broad leaves to humid areas and intermediates to localities with intermediate amounts of rainfall, morphological discontinuities between populations limited to these or other habitat preferences were not observed.

Among the populations studied there were noted various individual characteristics not present in either T. maizar or T. zopilotense as, for example, the soft lanulose-tomentose pubescence of T. australe noted in three geographically isolated tetraploid populations, essentially glabrous tetraploid types with narrow leaves and a general growth habit like that of T. dactyloides, and a diploid population from Chiapas having a growth habit in certain respects remarkably similar to that of Manisuris rugosa. Such characteristics might have originated as gene mutants in these particular populations or they could be segregants from hybrid combinations of species other than T. maizar and T. zopilotense. The distribution of T. australe and T. dactyloides, now apparently limited to South America and the United States, respectively, in earlier times might have included intermediate regions where they might have been sympatrically associated with T. maizar, T. zopilotense or similar species and participated with them in the origin of present day tetraploid populations. These possibilities need further study and it is essential to explore the possibility that relatively true-breeding, morphologically similar populations are in process of becoming established in contiguous areas with a geographical distribution adequate for their consideration as species or subspecies. Very much needed, also, are thorough karyotype analyses of the pachytene chromosomes in all existing diploid Tripsacum species and tetraploid populations from very different geographical areas. There is some indication that knob frequencies are variable in some of the diploid species, and this as well as other features of Tripsacum chromosome morphology need further study to clarify their usefulness in the study of natural relationships.

There is also need for ecological studies of Tripsacum, especially in Latin America where different types display an amazingly wide range of adaptation to differences in altitude, latitude, climatic and edaphic conditions. More needs to be known concerning modes of dispersal of the corneous Tripsacum "seeds" by migratory birds over long distances and over shorter distances by birds and other animals not actively migrating, and to a more limited extent by seeds floating in mountain streams, arroyas and drainage canals. The aggressive spread in recent decades of tetraploid populations into disturbed habitats bordering improved highways of Latin America is especially noteworthy. Various methods of sexual and asexual reproduction, the role of apomixis, polyembryony (c.f. Farquharson,

Indiana Acad. Sci Proc. 63: 80-82, 1954) and parthenogenesis in relation to the rare occurrence in tetraploid populations of atypical diploids and extremes of aneuploidy, and of their low percentages of viable seed produced, should be investigated more thoroughly. Various alleles affecting plant colors of *Tripsacum* apparently in much the same manner as in maize with respect to the well known A B Pl C R Pr series, are widely distributed at both the diploid and the tetraploid level from the equatorial region of South America northward in many localities of Central America, Mexico and the United States, suggesting that parallel mutation rather than "introgression" is a simpler and more plausible explanation of the presence of tripsacoid traits in various unimproved races of maize.

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