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 Book review
 

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**McClintock, B.; Takeo Angel Kato Y.; Blumenschein, A.: Chromosome Constitution of Races of Maize. Its Significance in the Interpretation of Relationships Between Races and Varieties in the Americas.** Chapingo, Mexico: Colegio de Postgraduados 1981. XXXI + 517 pp., 149 figs., 44 tabs., 6 plates. Hard bound \$ 28.00.

The title and sub-title of this book accurately reflect its contents. Most New World maize races have been examined, except for those in Peru, most of those in Colombia, and from certain areas of the Amazon Basin, the United States and Argentina. Over 1,200 races, strains and varieties of maize were analyzed for the presence and/or absence of small, medium or large chromosome knobs, the occurrence of abnormal chromosome 10 and the number of B-chromosomes. The knob forming regions are at specific positions on particular chromosome arms. The state at each knob forming position, e.g., large or knobless, is highly heritable. Thus, pachytene/diplotene analyses reveal the heterozygous or homozygous condition of a knob at any one of the knob forming regions in maize and teosinte.

The book is a superior contribution of encyclopedic proportions. Well over half its pages are devoted to tables and distribution maps of individual chromosome constituents. From this vast amount of complex data, the distribution and frequency of selected individual knobs or groups of the chromosome components are interpreted in terms of where maize developed initially and when, where, and how it was introduced into other parts of the Americas and its fate following introduction. The focus of this study developed as it became evident during the investigations, initiated in the late 1950's, that the degree of likeness and difference in chromosome composition among the accessions could demonstrate differences of racial and/or geographical relationships.

The manner in which the data are used to determine relationships is clearly demonstrated. In this review, I have condensed and freely used the interpretations and conclusions of the authors without repeated reference to them. This was done to call attention to (1) the kinds of information contained in the book, and (2) how the authors combined individual segments of data to develop a coherent theme on the evolution of maize races. The distribution and frequency, for example, of five knobs (the large and medium knobs on the short arm of chromosome 4; and the large, medium and small knobs on the short arm of chromosome 5) link the Mexican races Zapalote Chico to Zapalote Grande and to Palomero Toluqueño, Pepitilla, Chapalote, Reventador and Harinoso de Ocho. This same group of knobs is used to substantiate the relationship of these germplasm components to Nal Tel and the Venezuelan race, Guaribero. Similarly, the distributions of the large, medium or small knobs on the short arm of chromosome 7 are used to trace the migration routes by which maize from one area was carried to another, the probable role of that material in introgression and its influence on subsequent racial germplasms. The large knob links Zapalote Chico and Nal Tel to much of the Venezuelan maize. Maize with that knob is not found in the United States, eastern or central Mexico, or the western Mexican coast unless it is related to those two races. Maize with both the large and medium knob developed in southwestern Mexico. It was taken then to Guatemala and subsequently carried by introgression in the lowlands and was

transported along the Pacific Coast from Oaxaca and Chiapas to Sonora. These components generally did not enter the highlands, the Mayan territory, or Central America south of Guatemala. However, maize having these two knobs may have arrived in Venezuela before other maize did, and, after Tuson and Coastal Tropical Flint developed, had extensive influence in the Caribbean and Guianas. In contrast, the small knob did enter the Mexican Maya area, many races of Guatemala, other Central American countries, or Cuba. In Central and North America, six other groups of special knobs, or combinations of them, were used as additional examples to illustrate how the data reveal the relationship of maize to teosinte, the manner of maize racial formation and contributing germplasm, and geographical areas in which some of the early diverse racial types developed.

The concept of knob complexes is developed from the co-occurrence of specific knobs or knob sizes in certain regions. The origins of knob complexes and their significance in association with migration pathways, introductions and introgression are discussed. One example illustrates how the Andean Complex, in the highland Andean chain from Ecuador through Chile, may represent an early introduction into South America, perhaps from highland Guatemala where small knobs and knobless chromosomes are concentrated. Subsequent long isolation and selection resulted in the many distinctive Andean races prior to the influence on or from later germplasm introductions and introgressions. Examples are also given relative to several complexes in a single area and how these represent different formative germplasms and their sequential infusions.

The highly patterned geographical distribution of chromosome constituents is also convincingly demonstrated in South America and discussed under six broad areas: Northern Territory, Western Highlands, West Coast, Central Region, East Coast and Central Matto Grosso. Here, the types of maize that were transported from one region to another, the times of these transports and the routes taken are discussed with the same logic as that used in North and Central America. These phenomena seem more vividly demonstrated in South America, however, because of the broader geographical scale and greater isolation from original germplasms.

The early interchange of germplasm between maize of the Andean Highlands and Guatemalan Highlands is clearly documented, as is the influence of South Mexican maize on that of northwestern Venezuela. Subsequent migration and introduction to and from these and other areas are also made evident.

The book is an essential reference for students of maize or others having interest in maize races and their origins. Typographical errors are few. Unfortunately, many of the maps are overly reduced, making it difficult to study the relative frequencies and distribution of specific knobs plotted by identifying symbols. Clarity in distinguishing classes of symbols can sometimes be achieved by using a magnifying lens. In some cases, the use of other maps and tabular material in the book is required to reconstruct the distributions and relative frequencies in which one has particular interest. Overall, however, this is an excellent book containing voluminous data, critical analyses and insightful discussions.

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