Ancient Mexican maize varieties

June 26 2008

Maize was first domesticated in the highlands of Mexico about 10,000 years ago and is now one of the most important crop plants in the world. It is a member of the grass family, which also hosts the world's other major crops including rice, wheat, barley, sorghum, and sugar cane. As early agriculturalists selected plants with desirable traits, they were also selecting genes important for transforming a wild grass into a food plant. Since that time, Mexican farmers have created thousands of varieties suitable for cultivation in the numerous environments in the Mexican landscape—from dry, temperate highlands to moist, tropical lowlands. Because of its importance as food, the need to improve yield, and the challenges presented by changing climate, the maize genome of the B73 cultivar is being sequenced. However, because maize has a complex genome and many varieties, the genome sequence from just one variety will not be adequate to represent the diversity of maize worldwide. Mexican scientists are also sequencing and analyzing the genomes of the ancient landraces to recapture the full genetic diversity of this complex and adaptable crop.

Dr. Vielle-Calzada and his colleagues, Octavio Martinez de la Vega, Julio Vega-Arrenguin, Gustavo Hernandez-Guzman, Enrique Ibarra-Laclette, Beatriz Jimenez-Moraila, Guilermo Corona-Armenta, Cesar Alvarez-Mejia, Araceli Fernandez-Cortes, Gustavo de la Riva, Alfredo Herrera-Estrella, and Luis Herrera-Estrella, are in the process of sequencing one of the ancient popcorn races, Palomero, and analyzing its molecular and functional diversity relative to other maize races. Dr. Vielle-Calzada, of the National Laboratory of Genomics for Biodiversity, Cinvestav, Mexico, will be presenting this work at a

symposium on Maize Biology at the annual meeting of the American Society of Plant Biologists in Mérida, Mexico (June 28, 11:30 AM).

Like other varieties of maize, the popcorn landraces are used throughout the world. Archeological evidence traces the earliest popcorn in the USA to New Mexico, suggesting an overland dispersal from the highlands of central Mexico into the northern plains of Mexico and then into the southwestern USA. Recent studies also support the hypothesis that popcorns are some of the oldest races of maize and group closely with teosinte in phylogenetic analyses.

Palomero is an ancient popcorn landrace of the Central and Northern Highlands Group. Vielle-Calzada and his colleagues estimated that its genome is about 22% smaller than that of B73. Their structural and functional analysis of this genome reveals a large number of unreported sequences, suggesting that the ancient landraces contain a large pool of unexplored genetic diversity that could be useful in new crop generation as well as the study of the evolution and domestication of maize and other cereals. Other studies in Mexico and elsewhere have shown that Mexican maize varieties are extraordinarily diverse.

Maize is a good model plant for studying the development of cereal crops because of its complex genome, numerous developmental mutants, and thousands of varieties. It is thought that as many as 1200 genes were selected in the process of transforming maize into a versatile food plant, and the process continues today. In regions throughout Mexico, farmers still cultivate local or criollo maize varieties in traditional ways as well as generating new varieties. They are thus contributing to conservation of the genetic diversity of maize and preserving traits that could be useful in yet unforeseen circumstances.

Many of the ancient varieties like Palomero were adaptations to different environmental conditions such as different soils, temperature,

altitude, and drought. Preservation of these varieties and knowledge of their genetic and adaptive histories are of paramount importance as farmers around the world cope with changes in temperature and water availability and struggle to maintain a food supply for growing populations. These sequencing efforts are providing the data for genomic and mutant analyses that are needed for the genetic engineering of crops to improve yield as well as resistance to pests and tolerance for difficult growing conditions. The knowledge gained from these efforts can also be applied in crop and yield improvement efforts for other cereals.

Source: American Society of Plant Biologists