Past domestication of T. cacao in Central and Latin America revealed by paleogenomics and analysis of methylxanthines

Claire LANAUD[1]

Hélène VIGNES[2], José UTGE[3], Gilles VALETTE[4], Mariella GARCIA CAPUTI[5], Natalia Angarita[6]

[1]CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement)
[2]CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement)
[3]MNHN (Muséum d'histoire naturelle)
[4]Université de Montpellier
[5]MAAC (Museo Antropologico y de Arte Contemporaneo)
[6]Museo Nacional de Bogota

ABSTRACT

Understanding the diversity of a species and its history, in order to better exploit it, is a challenge that breeders often face when creating new varieties adapted to the current environment. Many questions still remain about the first phases of cocoa domestication in Central and Latin America. Using a multidisciplinary approach, associating archaeologists with genomics and biochemistry scientists, we tried to retrace the history of the past domestication of cocoa trees, and their migrations in South America and Central America. Plant paleogenomics is a new field of research, that traces the evolution of cultivated plants in response to human domestication and natural selection since very ancient times. It is based on the analysis of ancient DNA (aDNA) from archaeological remains and can provide direct access to plant varieties consumed several thousand years ago. The oldest traces of cocoa consumption date back 5,500 years and have been identified in the southern Ecuadorian Amazon. New studies, reported in this paper, have been carried out from more than 300 archaeological samples collected mainly all along the Pacific coast of Ecuador and Colombia as well as in Central America and from diverse civilizations, the oldest of which dates back to more than 5000 years before our era. Analyzes have revealed traces of ancient cocoa DNA and methylxanthines (theobromine, theophylline and caffeine) in the ceramic residues of many pre-Columbian cultures. They show a wide use of cocoa throughout the Latin America continent and at very varied times which can go back more than 5000 years. The genetic origin of varieties consumed several thousand years ago could have sometimes been identified by comparison with a large collection of modern genetic resources representing the diversity of the T. cacao species. These results provide new keys to unraveling the past domestication of T. cacao in Latin and Central America.

Keywords: past domestication, paleogenomics, methylxanthine