

Research Reveals Possible New Roots for Chocolate

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A new study published in the online PLoS ONE, October 1, completely revolutionizes the long-held beliefs about cacao — the tree on which cocoa is grown. For hundreds of years, scientists, historians, chocolate experts and academics have all believed that chocolate came from one of three types of cacao — Criollo, Forastero or Trinitario.

The study, "Geographic and Genetic Population Differentiation of the Amazonian Chocolate Tree (*Theobroma l. cacao*)," reveals that there are ten distinct genetic groups of cacao, rather than the three types that have been referred to over the decades.

Swedish botanist Carolus Linnaeus (1707 - 1778) named cacao, *Theobroma l. cacao*, Latin for "food of the gods." Although a chocolate beverage was consumed by Mayan royalty, hence the name the food of gods, very little is known about the natural history of this much loved food.

Scientists from Mars, Incorporated, the US Department of Agriculture - Agricultural Research Service (USDA-ARS) and major cocoa institutions CIRAD-France, CEPLAC-Brazil and INIAP-Ecuador have revealed the true geographic origin of cacao, which is the key ingredient in the chocolate we may eat everyday.

"Beyond the major effort to properly categorize and understand cacao's proper genetic history, this new classification of cacao genotypes and the localization of their geographic origins will facilitate the collection of new germplasm with resistance to the devastating cacao diseases," said Dr. Juan Carlos Motamayor, lead scientist, cocoa genetics, Mars, Incorporated. "This is particularly needed information for ongoing research by scientists from cacao-producing countries where the cacao is the livelihood for many small cacao farmers."

Exportation of cacao beans is the primary source of income for several West African countries, such as CÔte d'Ivoire and Ghana, and a significant proportion of the GDP of countries in South America like Ecuador and Indonesia in Asia depend on this crop. Cacao farmers' losses can be up to 80% of their production due to diseases. As a consequence, breeding for disease resistance in an environmentally friendly manner has been identified as the most appropriate approach to avoid such losses.

The lack of knowledge of the genetic diversity of cacao has limited the genetic progress of the breeding programs in the producing countries. Cacao breeders' strategies since the 1930's have been based on hybridizing cacao trees from Criollo, Forastero and Trinitario, long considered to be the official grouping of cacao trees.

These "groups" came from the terms used by Latin American cacao producers to differentiate the cacao grown locally (Criollo) from the introduced (Forastero meaning Foreign). The term Trinitario has been used to refer to the hybrid from Criollo and Forastero, originally cultivated in Trinidad. Botanists also based their nomenclature of *Theobroma l. cacao* subspecies on the differences between Criollo and Forastero and even proposed two geographical origins, one in Central America and another one in South America.

The study reported in PLoS One, includes the genetic analysis of trees collected near Mayan ruins in the Lacandona forest of Mexico, including genotypes from Bahia, Brazil. Analysis of 1241 individual trees with over 100 genetic markers clearly demonstrates that categorizing cacao into three groups — Criollo, Forastero and Trinitario — lacks scientific basis. Instead, 10 genetic groups — Maranon, Curaray, Criollo, Iquitos, Nanay, Contamana, Amelonado, Purus, Nacional and Guiana — were identified, describing more accurately the structure of the genetic diversity in cacao. In the study, the geographic origin of each of the 10 groups is also detailed.

"The new findings, together with our recently announced program to sequence the cacao genome, a partnership program between Mars, USDA-ARS and IBM, should considerably help to speed up the genetic improvement of this species and the selection of new cultivars capable of withstanding the diseases that threaten the existence of our beloved chocolate," said Motamayor.

Source: Mars, Incorporated:

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