

# COCOA: ORIGIN, DOMESTICATION AND CONSERVATION

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Cocoa represented as 'Food of Gods', the source of chocolate (*Theobroma cacao* L.; family Sterculiaceae/Malvaceae) is indigenous to South America. The Mayas, Toltecs and Aztecs knew the plant more than 3000 years ago. Cocoa thus has one of the oldest histories among crops cultivated by man. Aztecs prepared an energy drink from cocoa beans called 'xocoatl' and the word chocolate is considered to have originated from that. The Spanish learnt the technique of using cocoa beans after roasting and grinding from them, when they conquered Mexico in the 16<sup>th</sup> century and even beans were used as currency. From there on this native species of tropical humid forests of lower equatorial slopes of the Andes (Cheesman, 1944) was further domesticated to many areas where the climate suits the crop. As a perennial tree crop, it is traditionally and still predominantly cultivated beneath a diverse shade covers mainly in small land holdings. Cocoa has the important potential of serving economic, social and environmental ends. The shaded system enhances the soil, protects it from erosion, provides non-cocoa products to the farmer and a refuge to an array of animal groups like birds, insects, small mammals, and reptiles as it provides a fine biodiversity within the system. It was introduced to Southern India

during the present century mainly as an intercrop of coconut and arecanut gardens as it was found that the climate within the gardens is conducive to cocoa growth.

## **Origin and Types of cocoa**

Cocoa belongs to genus *Theobroma* that occurs wild in South and Central America along the Amazon basin and so this is considered to be the centre of origin. There are more than twenty species, but *Theobroma cacao* L. is the only one, which is cultivated. The Criollo variety group having red pods and the Forastero group with green pods evolved in Central America and Guyana region respectively. The Trinitario variety group arose from hybridization between these groups in Venezuela and the West Indies (Barrau, 1979). The Scavina populations originated from Ucayali river basin of Peru (Figuiera, 1997). Criollo populations are subdivided into two geographical groups Central and South American Criollos. The Criollo variety had been cultivated since prehistoric times but was highly susceptible to diseases. Subsequently there was a shift to cultivation of Forastero types. The trees of this variety are hardy and vigorous and spread to commercial cultivation. The common

Forastero populations are Amelonado, Comum, West African Amelonado, Nacional, Matina or Ceylan and Guiana wild Amelonado populations. At Trinidad and New Guinea, the largest population is of Trinitarios. The types originated from Upper Amazon are of good general purpose variety and withstands adverse conditions.

### **Domestication**

Criollo type of cocoa spread to Central America and to Caribbean Islands including Trinidad in 1525 and thereafter to Jamaica. The dissemination to Venezuela and Costa Rica was made by the Spanish (Pittier, 1933). The Venezuelan Criollo type was introduced into Celebes by the Dutch in 1560. They also introduced the crop into Java. Cocoa was introduced into Asia and the Pacific in the 16<sup>th</sup> century (Wood, 1991). The Spanish took Criollo types from Mexico to Philippines in 1614. It was only during seventeenth and eighteenth centuries that the cocoa tree was introduced to many other sub-tropical countries. Introduction to Martinique and Haiti was by the French and to Belem and Bahia in Brazil by Portuguese in 1750. It was introduced to Malaysia in 1778, into Sri Lanka at about 1798. The attempt to begin cocoa cultivation in the main land of Africa was first made by the Dutch missionaries in 1815. During 1822, cocoa seeds were taken from Portuguese colonies of South America to the island, Sao Tome of the West Coast of West Africa. It also spread to the neighbouring island, Principe and these two islands together continued as the leading producers of cocoa in West Africa upto 1910.

Cocoa was then taken to Hawaii in 1831, African island of Fernando Po in 1840 where it flourished. The Bassel missionaries tried another introduction in Ghana in 1857. The most successful introduction into African mainland was however, made by the Ghanaian, Tetteh Quashie in 1879. From

Ghana it spread to other African countries, the most important of which are Ivory Coast, Nigeria and Cameroon. In these countries there was immediate extension in area and they eventually turned out to be the largest producers of cocoa in the world. As it is today, about 68 percent of the total world production of cocoa beans comes from these African countries, where this crop was introduced relatively very late. From Sri Lanka, cocoa was taken to Singapore and Fiji in 1880, Samoa in 1883. Cocoa went to Queensland in 1886 and Bombay and Zanzibar in 1887. Venezuelan cocoa was introduced to Ecuador by 1890. Amazon varieties were taken to Colombian Criollo plantations in the 19<sup>th</sup> century.

### **Cocoa in India**

The first cocoa in India is said to be in 1798 after Malaysian and Sri Lankan introductions (Ratnam, 1961), when 8 plants were first shipped from Amazon islands and planted at Courtallam in Tirunelveli district of Madras state. Later in 1873 few plants were planted in Burliar fruit station by Mr. F. B. Thomas the then collector of Coimbatore. No attention was paid to these plants until 1955 and later an attempt on research was started at Kallar and Burliar under the auspices of ICAR. Many introductions were effected in the early 20<sup>th</sup> century, but its cultivation was limited to a few Government farms. Both Criollos and Forasteros were introduced into the country. In South India in Cardomom hills and Shevroys at an altitude of 800 to 1300 m it was introduced (Wood, 1964). The states of Kerala, Madras and Mysore found to be the most suitable areas with rains from both monsoons and with short dry season especially the extreme south and parts along the eastern side of the Western Ghats, e.g. Kanaykumari Dt., near Nagercoil, Courtallam and Tenkasi, Palni Hills and

Anaimalai Hills. The oldest planting (1930-35) of importance was at the Kallar and Burliar Fruit stations, in the Nilgiris, at altitudes of 450 m and 800 m. respectively with Criollo and bulk of the planting material used in India in the early years was from these stations. Another successful planting has been made at Tengumarahada. In Kerala, areas at the foot of the Ghats, in the region where rubber is grown, cocoa was introduced. Cocoa trees were found in compounds in various towns along the Malabar Coast. In Mysore, some parts of the coffee area particularly the Chikmagalur district, showed promises.

In the north east states in Orissa, Assam and Tripura few introductions were made with Ameolonado cocoa imported from Malaysia in 1963. In Assam, Cachar and Lushai Hills were found to be suitable with alluvial soils in valley bottoms. In Andaman Islands also few plantings were done.

In the 1930's it was decided to remove all Forastero plants in the country to maintain the genetic purity of the Criollos which are superior in terms of quality of the produce. The Criollos, which were maintained in the farms, failed to come up well and many plants were damaged by pests and diseases. Though some continued to survive, had low yields. Cocoa cultivation then was resumed in a big way in the 1960's with pods of Forastero type and with the initial introductions from Malaysia followed by African countries (Vikraman Nair, 2002).

### Genetic Resources

Collection, conservation, cataloguing, characterization and distribution are all important in managing germplasm. Scientific expeditions were made to collect wild cocoa over last 50 years. Distribution of cocoa germplasm must be through internationally recognized agencies like

IPGRI (now Bioversity International), which designated, the International Cocoa Gene Bank (ICGB), Trinidad at University of West Indies, at Centro Agronomica Tropical de Investigacion & Ensenanza (CATIE), Turrialba, Costa Rica, Department Especial da Amazonia, CEPLAC, Belem, Brazil, as 'universal collection depositories'. The core of Trinidad collection is Pound's Ecuadorian and Peruvian, Anglo Colombian, representatives of Chalmer's and Allen's material and selections from cultivated cocoa in Trinidad and other Caribbean Islands. The core of Turrialba collection is selections from cultivated cocoa, especially the United Fruit Company clones and their derivatives from Costa Rica, similar material from other American countries and Criollos. Large collections of primary material are also maintained in Colombia, Ecuador, French Guiana, Venezuela and Brazil. Field collections are maintained in Puerto Rico, Cote d'Ivoire, Jamaica, Malaysia, Grenada, Nigeria, Papua New Guinea, Ghana and India. In India, Kerala Agriculture University, Thrissur and CPCRI, Vittal, Karnataka maintains around 700 collections.

The germplasm has been distributed from Trinidad and Costa Rica. Large quantities of seed were distributed from Trinidad to Ghana in 1944 and to Nigeria and Papua New Guinea in the sixties. Long distance distribution is done using intermediate quarantine facilities at the Royal Botanical Gardens, Kew (University of Reading, from 1983) and the United States Department of Agriculture in Miami, Florida. In India NBPGR, New Delhi is facilitating germplasm exchange.

A project was initiated in 1988 to produce a catalogue in the form of a computer database listing information on the origins and location of cocoa germplasm. The database contains information on over 2814

separate accessions of wild cocoa collected since 1938 and the current location of over 3000 clones from these collections. The ICGB, Trinidad and Tobago, conserves nearly 2500 accessions in its field collection. A portion of this germplasm was characterized for phenetic diversity with cocoa descriptor of IPGRI with 60 characteristics representing 24 populations. The computerized International Cocoa Germplasm Database (ICGD) contains information on 8000 wild and selected clones of *Theobroma cacao*, their origins, characteristics and occurrence in germplasm collections (End *et al.*, 1992) which is maintained by Reading University. CIRAD, France provided microsatellite profiles of major clones to this database. The ICGD brings together information on cocoa clones from the literature and from data supplied by research stations and encourages exchange between countries. On the research front, the full cocoa genome was sequenced in 2010 by the collaborative effort of Penn State University, CIRAD and USDA.

### Production

Around 40 to 50 million people depend upon cocoa worldwide for their livelihood. According to the World Cocoa Foundation at present the area under cocoa is around 7 million ha and about three million tons of cocoa is produced annually, which corresponds to a global market value of \$5.1 billion. Bulk of cocoa is produced in West Africa and South America. The five leading producers are Ghana, Nigeria, Brazil, Ivory Coast and Cameroon. They produce nearly 80 per cent of world cocoa. Other important producers are Columbia, Dominican Republic, Ecuador, Mexico, Trinidad, Indonesia, Malaysia and Papua New Guinea. It was introduced to India during early part of this century, but commercial cultivation started after 1970s as a mixed crop under arecanut, coconut and oil palm

gardens. The area under cocoa is spread over Kerala, Karnataka, Andhra and Tamil Nadu with 46,318 ha and the total production is 12,954 MT. Andhra Pradesh ranks first with an area of 16,969 ha whereas Karnataka ranks first in production with 7,250 MT and the productivity is the highest at Kerala with 592 kg per ha. The average productivity of Indian cocoa is 380 kg per ha. The sale of Indian chocolate industry has increased from \$175M in 2000 to \$450M in 2005 and so the demand of chocolate industry and confectionaries is portrayed as 60,000 MT for the year 2025. National Horticulture Mission identified cocoa as one of the potential crop because of its value in commercial and export markets and of its nutritional and therapeutic values with its polyphenols. With the sole aim of filling the gap between demand and supply and to encourage this remunerative crop, intensive area expansion programmes are being taken up by Directorate Cashew and Cocoa Development (DCCD), Cochin, Kerala and the bean procurement is facilitated by CAMPCO and Cadbury India Pvt. Ltd.

### Species and cultivars

Cocoa, *Theobroma cacao* L. belongs to family Sterculiaceae. The family includes twenty-two species. Other species include *T. bicolor* and *T. grandiflorum*. *T. cacao* is diploid species with a chromosome number of 20. The species has two sub-species viz., *T. cacao* spp *cacao* of Criollo populations and *T.cacao* spp *sphaerocarpum*, which includes all other types. There are three main types of *T.cacao* viz., Criollo, Forastero and Trinitario. The Criollos are characterised by soft red pod husk with 20-30 white, ivory or pale purple beans. The beans ferment faster with weak chocolate flavour. They are less vigorous and susceptible to diseases. Soria (1970) has described several types of Criollo like Mexican Criollo, Pentagona or

Lagarto, Nicaraguan Criollo, and Columbian Criollo. The Forastero belongs to large group of cultivated to semi-wild types. These are hardier than Criollos and most of present cultivated area comprises of Forastero. Forastero has hard green pods and 30 or more, paler to deep purple beans. Majority of area in Brazil and West Africa is predominantly occupied by type known as Amelonado. Amelonados have uniform pod characteristics. The Trinitario type can be considered as Forastero and they have characters intermediate to Criollo and Forastero. They are believed to be cross populations of these two types of cocoa.

*Theobroma cacao* L. includes large number of variable populations such as self compatible, self-incompatible but cross-compatible types. The existence of incompatibility leads to cross pollination and production of hybrids. Establishment of clonal seed gardens with specific types enriched the production and diversity in hybrids. Over the years several varieties of cocoa have been developed in different countries. Some of the important characters that are considered for breeding are high yield, bean quality, vigour and tolerance to biotic and abiotic stresses. The countries

developed their own varieties from germplasm collections maintained by them. Some of the important parent materials are described here. During the period from 1930 to 1934 Pound made a survey of cocoa in Trinidad and Tobago and identified 100 superior types, the Imperial College Selections (ICS) from local Trinitario populations. Some of the best clones are ICS 39,40,48,60 and 95. Expeditions by Pound in Upper Amazon region resulted in some witches broom disease resistant lines like Scavina 6 and 12. Other materials are IMC, NA, PA and SCA. The EET series are from Ecuador. 'Nacional' type is indigenous to Eastern Ecuador (Pound, 1945) which resembles Criollos rather than Forasteros but characterized by distinct 'arriba' flavour and of the world's fine cocoa. In African countries viz., Ghana, Nigeria and Ivory Coast the Amazon parents were used in crossing programmes. In Malaysia after initial set back of Amelonado material, Upper Amazon introductions were tried as planting materials. At present, the entire cocoa population is covered with Forasteros, Amelonados and Amazon selections and hybrids, local Trinitarios and West African hybrids world over.

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