COCONUT: ORIGIN, DOMESTICATION AND CONSERVATION

George V. Thomas, V. Niral and B. Augustine Jerard

Central Plantation Crops Research Institute
(*Indian Council of Agricultural Research*)
Kasaragod 671 124, Kerala, India
Email: cpcri@nic.in; Website: http://cpcri.gov.in

Coconut, *Cocos nucifera* L., is an important crop of the hot and humid tropics. It is a monotypic species under the genus *Cocos* with no known wild or domesticated relatives. It is a diploid species with a chromosome number 2n=32. *Cocos nucifera*, is placed in Arecaceae family (formerly Palmaceae) and the sub family Cocoideae which includes a total of 27 genera and 600 species. Before 1910 many South American palm genera were classified as *Cocos* but now *Cocos nucifera* is considered monospecific, despite the pan tropical distribution of this palm.

The coconut palm is widely cultivated in the tropical region between latitudes 22°N and 22°S. Though it is a sea-side plant, it grows in interior areas also, far away from the sea. Though the coconut palm is grown primarily for its nuts, which is a source of vegetable oil, each and every part of the palm is used by mankind. Hence, it is referred as '*Kalpavriksha*, the Tree of Heaven', "The Tree of Wealth" and "The Tree of Life" as it provides all the necessities of life.

Origin, Domestication and Dispersal

Coconut is considered to be an ancient species with a long history of domestication and cultivation. The origin of the coconut tree is explained in a Hindu Mythological Story. King Trishanku was a saintly man whose one great desire was to ascend bodily into heaven. He had once done a good turn to sage Vishwamitra and the sage decided to help him fulfil his desire. Accordingly, he performed a yagna and Trishanku began to rise heavenwards. When Indra, King of the gods, saw Trishanku at the gates of Heaven, he was furious and catching hold of him, threw him down. Vishwamitra saw Trishanku hurtling downwards and shouted: "Let Trishanku stay where he is now!" Trishanku's fall was arrested. As Indra would not let him ascend into heaven and Vishwamitra would not allow him to come down, Trishanku became suspended between heaven and earth. Folklore has expanded this mythological story to explain the origin of the coconut tree: Vishwamitra knew that Trishanku would eventually fall to earth unless held up by physical means, so he propped him up with a long pole. The pole eventually turned into a coconut tree and Trishanku's head became its fruit. The fibre around the coconut is Trishanku's beard. When you take it off, you see his eyes peering at you.

Attempts to determine the origin and distribution of coconut have not benefited from the pan-tropical distribution of this monospecific genus. Instead, there are

conflicting theories on origins and domestication of coconut.

Martius (1850) considered the West Coast of Central America as the centre of origin of coconut. This was supported by Cook (1901). On the other hand, de Candolle (1885) considered coconut to be of Asiatic origin. Fosberg (1962) considered that the coconut may have been domesticated from a wild species growing somewhere in the present optimum range of the modern coconut but with smaller, less satisfactory fruit. He thought that as it became domesticated it was spread through the agency of man, over an increasingly wide area. Eventually, it replaced its wild ancestor and the original habitat and centre of domestication became obscured. Whilst allowing that dissemination could take place by floating, it was his experience that when coconuts sprout where they have drifted ashore this has always been where there are planted coconuts nearby. Corner (1966) exclaimed, "it has achieved a mechanism for long distance dispersal, yet it is nowhere wild!" These views were not accepted by Sauer (1971). He opined that the tremendous prehistoric range of the species should not be considered as testimony of long-range dispersal by ancient voyagers. Sauer favoured the possibility that spontaneous coconut populations may be truly wild and capable of wide natural dispersal and suggested that *Cocos nucifera* is best regarded as a semi-domesticated species, a complex of local populations with all degrees of dependence upon man, from nil to complete. This was succinctly expressed by Child (1974): "Inland every [coconut] tree owes its existence to man; on the coasts most of them do so."

Menon and Pandalai (1960) reviewed extensively the different theories pertaining to the origin of coconut and based on the weight of evidence favoured the original home of the coconut being located somewhere in South East Asia. They concluded that it was not possible to precisely locate the original home of coconut within this geographical area. Harries (1974) reassessed the various elements and by rearranging the disputed points into a logical sequence, attempted to resolve the differences and establish a basis for coconut classification based on evolutionary angle. Harries (1974) concluded "The fossils *Cocos zeylandica, C. sahnii, Palmoxylon sundaram* and *P. parthasarathyi,* which have been found as far apart as New Zealand and India (Sauer, 1967) and the suggestion that *Cocos* originated in South America (Purseglove, 1972) implicate such a wide area that, without extra evidence, further speculation on origin would be futile".

Presently, an origin for the whole Cocoeae tribe in western Gondwanaland seems most compatible with the present day distribution (Uhl and Dransfield 1987). It is postulated that the tribe probably differentiated shortly before the break up of that super-continent. Members radiated and became very diverse in the Americas; some rafted on the African and Madagascar Plates, where they survive to the present day (Dransfield 1989); others rafted on the Indian plate, where they are now extinct. With its ability to float the coconut became independent of plate tectonics for its dispersal. The wild type evolved by floating between the volcanic islands and atolls where these fringed the continental plates and not on the lands masses at all. The coasts and islands of the Tethys Sea could have been the ancestral home of the coconut, from where it dispersed by floating to other islands in the Indian Ocean and from there

into Pacific (but not into the Atlantic) Ocean (Harries 1990).

Regardless of its origin, the coconut has spread across much of the tropics, probably aided in many cases by sea-faring peoples. Further, the fruit is light and buoyant and can float long distances aided by sea currents. It has been reported that coconut fruits collected from the sea as far north as Norway were found to be viable (subsequently germinated when placed under the favourable conditions).

Having originated at some place in South East Asia, the coconut appears to have moved towards the Pacific and further into America. Towards the West it moved to India and Madagascar over the calm tropical waters. However, dissemination through water could not have been the sole agency for coconut dispersal. Humans have played a major role in the introduction and spread of coconut. The Spaniards introduced it into the West Indies and the southern shores of the Caribbean Sea while the Portuguese introduced it into Bahia and other parts of Brazil. The early Polynesian voyagers, from their homelands in the South Pacific, spread coconuts to the different islands of the Pacific while the Arabs disseminated it on the African Coast. From India, the maritime Tamils along with mariners from Bengal distributed it into the lands of the Indian Ocean.

Further, it is presumed that the early humans while domesticating habitats in coastal areas started domesticating the coconut palms, resulting in the absence of wild forms in the present day coconut population.

Coconut Production

The coconut palm thrives on sandy soils and is highly tolerant of salinity. It prefers areas with abundant sunlight, regular rainfall (minimum of 1,500 mm annually) and high humidity (70-80% RH) for optimum growth. They are very hard to establish in dry climates and requires frequent irrigation. Further, under cold conditions, where there is not sufficient warmth, the coconut palms may grow but not fruit properly.

Coconut palms, globally, occupy an area of 11.74 million hectares with a production of 55.57 billion nuts. The main coconut growing areas are located in Asia, Oceania, West Indies, Central and South America and West and East Africa.

Percentage share in area & production: Major countries (Source: APCC)

Country	Area (%)	Production (%)
India	15.85	26.85
Indonesia	31.54	25.76
Philippines	27.41	20.90
Other Asia Pacific Coconut growing Countries	12.12	12.06
Others	13.08	14.43

India with about 1.89 million hectares under coconut and an annual production of 15,730 million nuts is one of the major coconut producing countries in the world. The coconut palm is cultivated in the coastal tracts of Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Orissa, West Bengal, Pondicherry, Gujarat, Goa and Maharashtra, Assam, Tripura, Chhattisgarh and in the islands of Lakshadweep and Andaman and Nicobar. The states of Kerala, Tamil Nadu and Karnataka account for about 89.77 per cent of the area and 90.64 per cent of the production in the country (2007-08). Coconut

makes a contribution of approximately Rs. 8000 crores to the GDP and Rs. 650 crores to the export earnings of the country and provides direct and indirect employment to more than 10 million people.

Versatile uses of coconut

Nearly all parts of the coconut palm are useful, true to its name *kalpa vriksha* in Sanskrit - the tree which provides all the necessities of life. Culinary uses of coconut include oil for cooking, and coconut meat which is edible and used fresh or dried in cooking curries, sweets and other delicacies. The tender coconut water, which is sterile until opened, mixes easily with blood and it was reportedly used during World War II in emergency transfusions. It contains sugar, fiber, proteins, antioxidants, vitamins and minerals, and provides an isotonic electrolyte balance, making it a nutritious food source. It is being increasingly used as a refreshing drink throughout the humid tropics, and is also used in isotonic sports drinks. In modern times, coconut water is used as a growth supplement in plant tissue culture/micropropagation.

The coconut milk is made by processing grated coconut with hot water or milk, which extracts the oil and aromatic compounds. When refrigerated and left to set, coconut cream will rise to the top and separate from the milk. The milk is used to produce virgin coconut oil by controlled heating and removing the oil fraction. Virgin coconut oil is found superior to the oil extracted from copra for cosmetic purposes. The leftover fibre from coconut milk production is used as livestock feed.

The sap derived from incising the inflorescence is drunk fresh as "neera", or fermented to produce palm wine, also known as "toddy". The sap can also be processed by boiling to create a sweet syrup.

The coconut husk has numerous uses like potting medium for raising saplings, growing orchids. The major utility is for the production of coir fibre and coir compost. The coir is subsequently used in the production of rope, as well as household products like beds, brushes and door mats. It is also useful as geotextiles for soil and water conservation. The coconut husk and shells are also used for making handicrafts, as fuel and a source of charcoal and activated carbon.

Coconut sprout called as "Millionaire's Salad" are the cabbage of adult palms which are edible. They are considered a rare delicacy, as harvesting the buds kills the palms. Newly germinated coconuts contain an edible fluff of marshmallow-like consistency called coconut haustorium.

Coconut leaves are used for making brooms in India. The leaves provide materials for baskets and roofing thatch. In Kerala and Tamil Nadu, the woven coconut leaves are used as 'pandals' (temporary sheds) for the functions and for roofing material. The roots are used as a dye, a mouthwash, and a medicine for dysentery. A frayed-out piece of root can also be used as a toothbrush. In Kerala, coconut timber is used for house construction. It is increasingly being used as an ecologically sound substitute for other hardwoods, especially in making furniture and for specialized construction.

Coconut is an essential element of rituals in the Hindu tradition, and often is decorated with bright metal foils and other symbols of auspiciousness. It is offered during worship to a Hindu God or Goddess. Irrespective of their religious affiliation, fishermen of India

West Coast Tall

Andaman Ordinary Tall

Laccadive Ordinary Tall

Gangabondam Green Dwarf

Chowghat Orange Dwarf

often offer it to the rivers and seas in the hopes of making bountiful catches. In Hindu wedding ceremonies, traditionally a coconut is placed over the opening of a pot, representing the womb symbolizing fertility. In Kerala, coconut flowers are a prerequisite for a marriage ceremony. The flowers are inserted into a barrel filled with paddy (nirapara) and along with the traditional lamp (nilavilakku) placed on the centre stage during the wedding ceremony. Hindus often initiate the beginning of any new activity by breaking a coconut to ensure the blessings of the gods and its successful completion. The Hindu goddess of well-being and wealth, goddess Lakshmi, is often depicted as holding a coconut in her hand. In South India, the Hindus keep the coconut and banana along with other 'Pooja' materials, and break open the coconut and after that only the pooja/prayers will be started.

Coconut Varietal Classification

The coconut palm, *Cocos nucifera*, belongs to the monotypic genus *Cocos* with no known wild or domesticated relatives. However, the present day population of this palm presents a wide range of variability and a number of workers have attempted a systemic classification of the various forms of coconut. According to systematic classification by Narayan and John (1949), coconut varieties can be broadly grouped into two groups - Talls and Dwarfs, on the basis of a few important characters like stature, growth characteristics of the palm, precocious nature in flowering and nut and copra characters. This is the widely accepted classification used for distinguishing coconut cultivars. The tall cultivars are the most commonly cultivated for commercial production in all coconut growing regions of the world while the dwarf varieties are usually grown for ornamental and breeding purpose.

Talls: Tall palms are referred to as var. typica and are the most commonly cultivated for commercial production in all coconut growing regions of the world. Tall palms grow to a height of 20-30m, first flowering in 6-10 years after planting. Talls are sturdy and may attain an age of 80-100 years. These palms are normally cross-pollinated and hence highly heterozygous. The fruits are generally medium to large in size and produce good quantity and quality of copra with fairly high oil content. Some popular exotic tall cultivars are Fiji Tall, Philippines Ordinary Tall, Sri Lankan Tall, West African Tall, Panama Tall, Malayan Tall, Jamaican Tall and San Ramon Tall. Among the indigenous tall cultivars, West Coast Tall, East Coast Tall, Benaulim Tall, Tiptur Tall, Andaman Ordinary Tall and Laccadive Ordinary Tall are popular.

***Dwarfs*:** Dwarf palms referred to as var. nana, are not grown on a commercial scale. They are of shorter stature, 8-10m high when 20 years old and start bearing about 3-4 years after planting and have a short productive life of about 40-50 years. The dwarf palms are more homozygous than talls, due to a high degree of self pollination. They produce fruits, which are generally small to medium in size. The dwarfs are presumed to have originated from talls either through mutation or by inbreeding. Among the exotic dwarf cultivars, Malayan Yellow Dwarf, Malayan Orange Dwarf and Malayan Green Dwarf have become popular in all coconut growing countries of the World. The popular indigenous dwarf cultivars grown are Chowghat Green Dwarf, Chowghat

Orange Dwarf, Kenthali Orange Dwarf and Gangabondam Green Dwarf.

Harries (1974) grouped the present coconut population based on the fruit component traits and the time taken for germination into two groups, *viz. Niu Kafa* (wild type - with greater proportion of husk and late germination) and *Niu Vai* (domesticated type - lesser husk and more endosperm and early germination).

In addition, certain variants have also been observed. One is the seedless coconut or male coconut tree, which produces only male flowers and another is spikeless coconut palm or spicata having unbranched inflorescence with the male (few male flowers) and female flowers borne directly on the primary spike. Other variant forms of coconut palms observed in nature include the plicata (with fused leaflets). Further, while the endosperm of normal coconuts are solid and firm, when mature, certain palms bear fruits with buttery (jelly-like) endosperm and are referred to as Thairu Thengai (India) or Makapuno (Philippines).

Conservation of Coconut Genetic Resources

The Central Plantation Crops Research Institute, Kasaragod is actively involved in the collection and conservation of coconut biodiversity for utilization in the coconut improvement programme. CPCRI has collected a total of 398 coconut accessions, with 266 indigenous coconut accessions, from almost all coconut growing regions within the country. In addition to the indigenous coconut germplasm, about 132 exotic collections representing major coconut populations of South Asia, South East Asia, Central and South America, Africa, Pacific Ocean Islands and Indian Ocean Islands are also conserved in the field gene bank at CPCRI.

India also hosts the International Coconut Genebank - South Asia (ICG-SA), which has been established at CPCRI Research Centre, Kidu, Karnataka, about 100 km east of Kasaragod. The ICG-SA is one of the five multi-site gene banks of coconut as identified by the COGENT Steering Committee with the rest being located in Indonesia (for Southeast and East Asia), Papua New Guinea (for the South Pacific), Cote d' Ivorie (for Africa and the Indian Ocean) and Brazil (for Latin America Caribbean), The ICGs has been established to enable the efficient conservation, evaluation and safe movement of coconut germplasm and is a part of the International Network of *ex situ* collections, provided for in Article 7 of the International Undertaking on Plant Genetic Resources with the Food and Agriculture Organisation (FAO) of the United Nations acting as the trustee. Presently 91 accessions, representing indigenous coconut germplasm as well as coconut ecotypes of Philippines, Malaysia, Sri Lanka, Bangladesh, Indian Ocean Islands of Mauritius, Madagascar and Seychelles, Comoros and Reunion, Maldives, Pacific Ocean Islands, Africa and the Caribbean Region are planted in the ICG-SA.

Conclusion

Regardless of its origin, the coconut has spread across much of the tropics, probably aided by sea currents and in many cases by sea-faring people. Coconut continues to play an important role in the lives of people in the traditional coconut growing regions around the world and also contributes to the economy of these nations.

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