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Double coconut – A unique giant palm from Seychelles

The double coconut is a unique palm endemic to the Seychelles islands. These palm trees can live up to 1,000 years and bear the largest fruits and leaves in the entire plant kingdom. The plant is very slow growing as the palm seed takes 2 years to germinate and double coconut fruit is reported to take 6-7 years to develop. The palm possesses a unique water harvesting system as the large leaves catch water and channel it to their stalks, or petioles, which are scoop-shaped like rain gutters and in this way, soil beneath the palm is kept moist while the distant soils are drier. Various fruit parts are used in traditional systems of medicine besides other use of palm-products. Traditionally, there was a practice of presentation of double coconut as a gift among the members of royal family as a symbol of prosperity. Until recently, the double coconut fruit-seeds were traded illegally due to high demand in the international market. Due to habitat loss and over-collection, the double coconut palm is considered endangered by IUCN Red List of Threatened Species. In India, the 125-year-old female double coconut tree, the lone specimen in India is dying and scientists are trying to save the palm as well as its maturing fruits.

THE Coco-de-Mer palm *Lodoicea maldivica*, commonly known as sea coconut, double coconut or love nut is a unique palm endemic to Seychelles. As the name implies the nuts of double coconut look like two coconut joined together, side by side. The importance of this palm comes from the fact that it bears the largest and the heaviest seed in the plant kingdom. They have an extremely slow life history, and the longest surviving palm is estimated to be more than 350 years old.

The genus *Lodoicea* is one of the four palm genera in the subtribe *Lataniinae* of the tribe *Borasseae*. It is a monotypic genus once widespread to two small islands namely Praslin and Curieuse in Seychelles but now persists in only four main semi-connected populations at Vallée de Mai, Fond Peper, and Fond Ferdinand on Praslin, and also on Curieuse Island due to reintroduction. These palms form the major flora of the palm forest in these islands, surviving through their innate mechanism of water harvesting.

The palm is dioecious, with the male plant growing 25-35 m tall and the females shorter with an approximate height of 20 m. The male inflorescences are massive, catkin-like spikes 1.2-1.8 m long and 8-10 cm wide and are usually unbranched. These spikes are packed with male flowers which are spirally arranged clusters of 60-70 flowers within deep pit-like structures formed by leathery modified bracts. The female spikes are similar in size to those of the male and bear 5-13 flowers of about 5 cm in

Male Inflorescence of *Lodoicea maldivica*

Half husked double coconut with seed

Freshly dehusked seed of *Lodoicea maldivica*

Seed of *Lodoicea maldivica*

diameter. The mature inflorescences of double coconut have the aroma of honey and these flowers are pollinated by endemic lizards like gecko which inhabits the natural habitat of the palms. Probably pollination by wind and rain are also important.

The massive fruit of double coconut is reported to take 6-7 years to develop. The fruit is bilobed, flattened, 40 to 50 cm long, ovoid, and pointed. At maturity, the fruit weighs about 25 kg, the largest fruit in the plant kingdom. Only one seed per fruit usually develops to maturity. The seed is composed mostly of a huge store of hard, white endosperm, though a substantial part of the seed volume is taken up by a central hollow. The size of the seed is around 28 cm by 30 cm, and the fresh weight of seeds varies from 9.5 to 13.4 kg.

The seeds appear to have no mechanism for dispersal, as the heavy nuts sink in water and the flattened shape prevents it from rolling off to a long-distance through the sea. This might be the reason why the palms are found in very limited natural habitats and the name sea coconut. The tough fibrous mesocarp is important in allowing the seed to fall unharmed, even upon a rock. In natural populations, female trees typically bear 2-9 developing nuts across several inflorescences at a time though cultivated trees can bear as many as 60 nuts.

Germinating shoot of *Lodoicea maldivica*

A double coconut seed may take up to two years to germinate. During seed germination, the apex of the cotyledon remains within the seed and develops into a vast haustorium which gradually breaks down and absorbs the endosperm over a period of up to four years. Like other borassoid palms, the species exhibits remote, non-ligular germination, in which the plumule develops at some distance from the seed because of the formation of an extended cotyledonary axis sometimes referred to as the 'rope' with its tip comprising a cavity containing the embryo. The embryo sits in the sinus between the two lobes. At first, the axis exhibits a positive geotropism so that the embryo is buried to depth and then it extends horizontally in the soil, with the result that the seedling becomes established from the seed itself.

A remarkable feature of young plants is the enormous size of their leaves and the great length of their petioles, these being especially elongated when growing beneath the canopy. A new leaf is produced proximately every 260 days. The large leaves catch water and channel it to their stalks, or petioles, which are scoop-shaped like rain gutters. The water runs down each gutter to the base of the petiole, which is split where it attaches to the trunk. This is a unique water harvesting system for the palm, which keeps the soil beneath the palm moist while the distant soils are drier. The palm leaves form a huge funnel that intercepts any nutrient-rich detritus on the leaves (pollen, dead flowers, bird faeces and more) which is flushed to the base of the trunk when it rains. In this way, *Laodicea* improves its nutrient supply and that of its dispersal limited offspring. Despite growing in nutrient-poor soils of Seychelles, the palm maintains a high level of reproductive function and producing vegetative tissues with very low nutrient concentrations. Investing so little into the foliage means the palm has more to invest in its fruit. Another remarkable thing about the palm is that, it seems to be

Leaf petiole of an adult palm

Seedling of *Lodoicea maldivica*

Adult palm with fruits

unique in the plant kingdom in caring for the seedlings after they germinate. Seedlings benefit from growing in the shadow of the parent, because they have access to the more nutritious soil there. In increasingly humid conditions on Seychelles, strong selection for plants with the tallest seedlings happens and such seedlings establish successfully under the low light conditions. As a result, juvenile plants can reach a height of 15 m and hold their foliage in the forest canopy. This capacity to produce such an enormous juvenile plant is related in part to the large food reserves in the seed.

Economically, Coco-de-Mer nuts are the most valuable in the world. There were incidents of double coconut given as a wedding gift by the government of Seychelles to the UK heir to the throne and his wife, the Duke, and Duchess of Cambridge. It is long considered an antidote to various poisons. The fruits are made use of in Ayurvedic medicine like *kashaya mridha sanjivini gulika, sidha* medicines for diabetes, vomiting, and also in traditional Chinese medicine. In historical herbal texts like '*Ambonese Herbal'* of the 17th century, there is mention of *Lodoicea* as a remedy for treating stomach ache as well as acidity or bilious casting up of the stomach. The male inflorescence as well as the nuts themselves have spawned a wide range of commercial products such as beverages and perfumes. Various parts of double coconut were traditionally used by the inhabitants of Praslin Island, its leaves being made into thatch (sewn also with thread made from the veins of the leaves), baskets, hats and mats, trunk into furniture, crates and walking sticks, husk into rope, and nuts into utensils and vessels for water storage or liquor manufacture. The indumentum of the young leaves was used for wound dressing and stuffing pillows while the jelly found inside immature nuts was considered a delicacy. The ripe fruits contain a tough endocarp, used to make the spots on dominoes. There has also been a tradition of making *kamandals* (drinking vessels) from the double coconut by bisecting the shell and it was believed that those who consume water from these *kamandals* will be protected from poisoning. Subsequently, sadhus started using *kamandals* and it got its place in religious rituals.

Lodoicea maldivica is categorized in the IUCN Red List of Threatened Species as endangered status to which it was recently upgraded. The major threat to the species is long-term over-exploitation of the nuts, which has a significant detrimental effect upon natural recruitment and regeneration. The trees, which may live for up to 1000 years, are estimated to take a century to reach full size and further 25 years to reach reproductive age. The nuts are harvested and sold as souvenirs, fetching prices of up to $400 for a polished specimen or $65 per kg for the kernels alone. The species has been protected and the nut trade legally controlled since 1995, but poaching continues to represent a severe constraint upon regeneration in the wild. Fire is another major threat that has repeatedly impacted the Praslin Island population. These threats are compounded by the highly restricted distribution of the species, due largely to the fact that the nuts are too heavy to roll uphill and also that they sink in water, rendering successful dispersal limited.

The nuts of Coco-de-Mer, retrieved from the sea, were in demand long before it was known that they came from Seychelles. Potentates particularly interested in their presumed aphrodisiac properties paid huge sums for the nuts. On the Maldive Islands, the king had exclusive rights to all double coconuts washed ashore. In the East Indies, a hand was often severed from those who did not surrender a newly discovered nut to the local ruler. The European nobles in the sixteenth century often had shells of these nuts polished and decorated with valuable jewels as collectibles for their private galleries.

In India, only one specimen tree of *Lodoicea maldivica* exists and is maintained at Acharya Jagadish Chandra Bose Indian Botanic Garden (AJCBIBG), Botanical Survey of India (BSI), Kolkata, West Bengal. The seeds obtained from Seychelles in 1894 were used to raise the palm. The plant grew into a female palm and successful artificial pollination was carried out in August 2013 with the pollen obtained from Nong Nooch Tropical Garden, Thailand. At present, the 125-year-old female double coconut tree, the lone specimen in India is dying and scientists are trying to save the palm as well as its maturing fruits to extract the seeds.

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