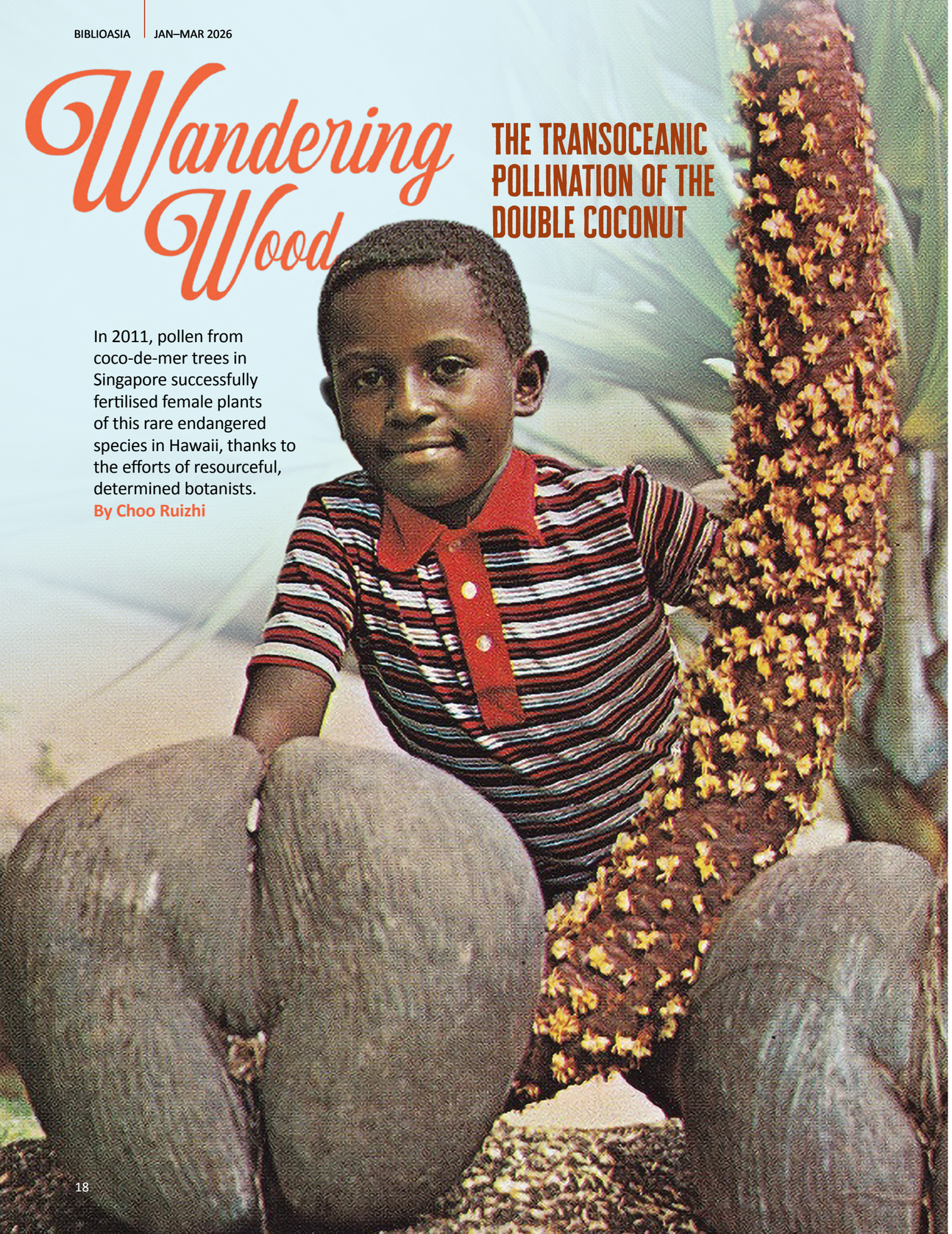
Wandering Wood

THE TRANSOCEANIC POLLINATION OF THE DOUBLE COCONUT

In 2011, pollen from coco-de-mer trees in Singapore successfully fertilised female plants of this rare endangered species in Hawaii, thanks to the efforts of resourceful, determined botanists.

By Choo Ruizhi



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On the afternoon of 31 May 2011, about five days after they had been dispatched from Singapore's Botanic Gardens, pollen from a rare and endangered palm species, the double coconut (*Lodoicea maldivica*), made landfall in Honolulu, Hawaii. Having travelled nearly 11,000 km, the grains were immediately applied to female flowers of the palm at the Foster Botanical Garden, a garden within the network of the Honolulu Botanical Gardens. Although many of the flowers "were already... past optimal time for successful pollination", the fertilisation was successful; weeks later, a single fruit began to develop.

It was a historic accomplishment, marking the culmination of numerous unsuccessful pollination attempts since 1984. Working together, botanists from Honolulu and Singapore had devised techniques to collect and ship pollen from a palm, native to Seychelles and propagated in Singapore, to fertilise another specimen across the Pacific Ocean.[1]

The double coconut is a remarkable plant. It is named for the two distinct rounded lobes on its fruit that resemble two coconuts joined together, a provocative shape that has aroused comparisons to other parts of the human anatomy. Each fruit can weigh up to 45 kg, the heaviest and largest in the plant kingdom. They often contain one seed, or nut, also the heaviest in the plant kingdom, weighing up to 25 kg.

Geographical Distribution and Characteristics

The double coconut tree is a tall, straight-trunked palm that can grow up to 25 m. It occurs in the wild on only two islands in the Seychelles archipelago: Praslin and Curieuse. The palm is one of the slowest-growing plant species, taking 25 to 40 years to reach sexual maturity and about a century to reach full size. The oldest individuals are estimated to be over 200 years old.[2]

The palm is a dioecious plant, meaning that it bears male and female flowers on separate trees. Male flowers are small and borne on distinctive sausage-like stalks (or "inflorescences") up to 2 m long, while female flowers grow out of thick, bulbed stalks. Once fertilised, the female flower takes six or more years to fully mature into a single fruit.[3]

(Facing page) A Seychellois boy at Vallée de Mai, Praslin, Seychelles, early 1970s. The fruit of the double coconut has two lobes and loosely resembles a woman's pelvis. The male flowers are borne on sausage-like stalks that can grow up to 2 m long. Photo by Dino Sassi - Marcel Fayon, Photo Eden Ltd. *From Wikimedia Commons*.

By the time Western observers first encountered it in 1563, the double coconut was already highly esteemed for its medicinal properties in localities along the coastlines of the Indian Ocean, and as far afield as Indonesia, China and Japan.[4] Yet their means of reproduction remained a mystery. Because they also washed up regularly on the shores of Sri Lanka and the Maldives during the monsoon season, these nuts were widely believed to grow on mythical submerged trees, a persistent legend that resulted in the moniker "coco-de-mer", or coconut of the sea.

When the plant species was first incorporated into Western scientific taxonomies, the botanist Johann Gmelin had assumed the plant originated in the Maldives and accorded it the species name *maldivica*. Although Gmelin's perspectives were later proven false, the rules of scientific nomenclature required that the first valid species label be retained. The double coconut's scientific designation thus reflects earlier Western perceptions of the tree. It was only in 1768 that the nut was finally traced to Praslin in the Seychelles archipelago by a French expedition helmed by the explorer Marc-Joseph Marion du Fresne.[5]

In its native environment, the coco-de-mer is a keystone species and supports many endemic animals like the Seychelles black parrot (*Coracopsis nigra*), Seychelles bulbul (*Hypsipetes crassirostris*) and the endangered Seychelles tiger chameleon (*Archaius tigris*). Due to the year-round flowering of male trees, the coco-de-mer's pollen is also an important food source for many vertebrate and invertebrate species.[6]

One of the female double coconut palms at the Foster Botanical Gardens in Honolulu, 21 September 2024. Fruits on the tree indicate that this individual was successfully pollinated. *Photo by Choo Ruizhi*.

The Allure of the Nuts

To humans, however, it is the coco-de-mer's gigantic nuts which have been most coveted. Partly due to its suggestive shape, which loosely resembles a woman's pelvis, the nut was long believed by many cultures to possess great medicinal value, serving variously as an aphrodisiac, an antiscorbutic (cure for scurvy), a cure for venereal disease and an antidote against poisons. The French naturalist A.M. Rochon recorded that the nuts were "in so much request all over Asia, that it was not uncommon, about the year 1759... to see them sold for upwards of four hundred pounds sterling each".[7]

The coco-de-mer became entangled with the British Empire in the 19th century when Britain became the world's preeminent industrial, commercial and imperial power.[8] Living nuts first arrived at the Royal Botanic Gardens, Kew in 1827, although efforts to germinate them in Britain were consistently unsuccessful even up to 1890.[9]

Germination attempts in other British botanical gardens around the world were more successful where the double coconut had been sent to be studied and cultivated for its potential economic and horticultural value.

A young female double coconut palm at the Singapore Botanic Gardens, 9 January 2025. *Photo by Choo Ruizhi.*

One of these localities was the Singapore Botanic Gardens (SBG). Colonial scientists first attempted to raise the double coconut in Singapore in 1875. Although this individual did not survive, several more attempts were made to cultivate the coco-de-mer over the years.[10]

For instance, perusing more than a century of the Gardens' publications, Felix Merklinger, horticulture manager at the SBG between September 2014 and February 2017, notes that a juvenile coco-de-mer was pictured in I.H. Burkhill's *The Botanic Gardens, Singapore: Illustrated Guide* (first published in 1900).[11]

The plant was featured in the SBG's 1955 annual report when it mentioned that two coco-de-mer trees had died: one killed by red stripe weevils (*Rhynchophorus schach*); the second cut down after being severely damaged by the falling branches of an adjacent tree. Fortunately, the SBG was able to obtain four more double coconut seeds directly from Seychelles that same year for cultivation.[12]

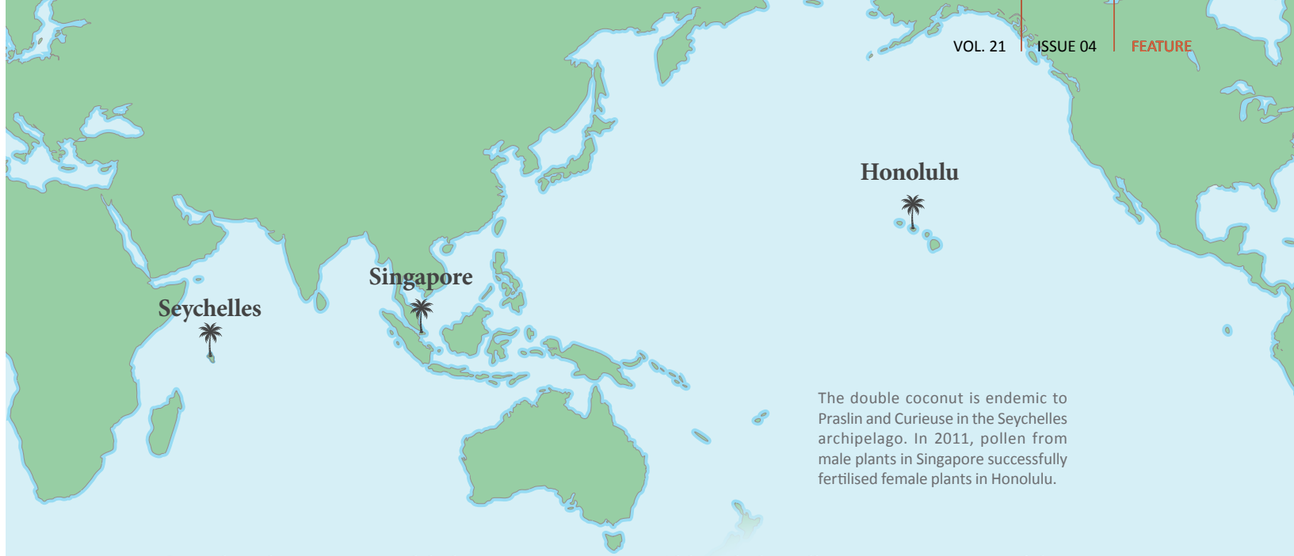
In 2012, *Gardenwise*, the SBG's magazine, reported that the Gardens possessed "three mature double coconuts, one female and two males, plus several younger trees". The mature individuals likely stemmed from the 1955 planting. SBG staff have since successfully pollinated the female tree using pollen from the male plants on several occasions, resulting in a growing number of young palms and developing fruits.[13]

Conserving Unruly Giants

Efforts to propagate the coco-de-mer have become more urgent since 2007 when the palm was categorised as "Endangered" in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species.[14] In the wild, there are only three natural populations totalling about 8,200 mature individuals on the Praslin and Curieuse islands in the Seychelles archipelago, making them highly vulnerable to sudden, catastrophic events like earthquakes and tsunamis.[15]

The palm is primarily threatened by the overharvesting of its nuts for tourist and commodity markets. Depending on size and symmetry, it was reported that in 2010 a single polished specimen could fetch up to US$400 (about US$593 today), while the kernels, extracted from harvested nuts and also exported to Asia, sold for at least US$65 per kg (around US$96 per kg today).[16]

The problem is compounded by the plant's slow reproductive frequency, which prevents populations from regenerating faster than they can be harvested. Moreover, the sheer mass of the nuts limits how far they can spread by themselves since they sink in water and cannot be dispersed by wind or animals.[17]



The double coconut is endemic to Praslin and Curieuse in the Seychelles archipelago. In 2011, pollen from male plants in Singapore successfully fertilised female plants in Honolulu.

Given their characteristics and the long-running fascination with them, there have, unsurprisingly, been significant efforts to cultivate the double coconut. In addition to Singapore, the coco-de-mer was also grown in tropical botanical gardens such as those in Sri Lanka and Zanzibar. Since then, specimens have been successfully raised in gardens in Bogor (Indonesia), Edinburgh (Scotland) and Honolulu (Hawaii), among other localities.[18]

But because pollination – the transfer of pollen grains from the double coconut's male flowers to fertilise cells in its female flower – is necessary for the coco-de-mer to reproduce, the long-term conservation of the endangered species also requires the successful pollination of female trees. Such a condition becomes challenging for gardens possessing trees of only a single sex.

The two sexually mature specimens at the Foster Botanical Garden in Honolulu were both female trees planted in 1937. But without a male palm producing pollen-bearing flowers, there had been no way for the Hawaiian double coconuts to bear fruit and reproduce. Prior efforts to propagate more coco-de-mer in Hawaii hence centred on obtaining pollen from other botanical gardens.

Between 1984 and 2007, at least three pollination attempts were made using pollen from palms in Sri Lanka (1984), Seychelles (1996) and Singapore (2000). All of these attempts, however, had failed due to the long transit: by the time they arrived in Honolulu, the pollen in the flowers had grown mouldy and were no longer viable.[19]

But these failures were meaningful too. The pollination attempt in 2000 had only occurred because Winifred Singeo, director of the Honolulu Botanical Gardens (HBG), had first initiated discussions about pollinating their double coconuts with Chin See Chung, director of the SBG, on the sidelines of the World Botanic Gardens Congress in June 2000.[20]

Although the pollination was unsuccessful, it established the basis for future cooperation between the two botanical gardens. In 2010, the two institutions decided to attempt a fourth pollination. This time, after consulting palm biologists like John Dransfield, head of palm research at the Royal Botanic Gardens, Kew, about more reliable palm pollination methods over long distances, HBG staff chanced upon a 1979 paper by Robert W. Read describing techniques for sending palm pollen through the post.[21]

Read's approach involved the artificial drying of pollen from palm species native to desert regions. Dehydrating the pollen, it was thought, would simply mimic processes such pollen already naturally underwent. The method had since been employed successfully for shipping the palm pollen of species from drier climates across long distances. It was not clear, however, if such techniques would work for palm species from "the ever-wet tropics".[22] Nonetheless, after making adjustments to Read's techniques, HBG and SBG staff then prepared for the next occasion when pollination would become viable: although male double coconuts produce pollen throughout the year, female inflorescences were less common.

They did not have to wait too long. The two female trees in Hawaii have been flowering annually for nearly 30 years. In late May 2011, they bloomed again, setting a whole chain of events into motion. In Singapore on 26 May, a crane truck employed for routine maintenance work was used to collect flowers from the male double coconut tree situated in the Palm Valley of the SBG. Using the pollen from these flowers, staff then hand-pollinated the Gardens' female tree that very same day. It is not known whether this attempt was successful.

Extra male flowers were passed to the SBG's herbarium where their pollen was subsequently extracted and dried over a low heat. The desiccation took two days and by the afternoon of Friday, 27

A woman holding a double coconut and a sausage-like stalk of male flowers at Vallée de Mai, Praslin, Seychelles, early 1970s. Photo by Dino Sassi - Marcel Fayon, Photo Eden Ltd. *From Wikimedia Commons*.

May 2011, three vials of pollen grains were ready to be dispatched.[23] Because some of the materials Read had recommended in 1979 (like gelatin capsules) for shipping the dried pollen were no longer commonly available, SBG staff had to improvise.

The grains were packed in cotton-stoppered vials, placed in a fibre tea bag and stowed in a small resealable plastic sandwich bag. About three teaspoons of silica gel beads were poured into the bag, which was then partly closed to allow air to circulate. The bag was placed into a padded mailing envelope and handed over to an overnight shipping company.[24]

Although the courier service had guaranteed the parcel's delivery to Honolulu within 48 hours, holidays, work schedules and other unforeseen delays jeopardised the pollen's transit. By the time the pollen arrived at the HBG on the afternoon of 31 May 2011 (Honolulu time), 120 hours had elapsed.[25] The pollen was inspected on arrival, and found to be "a light yellow color, dry and powdery, with no sign of mold [sic]".[26]

This was the first parcel of uncontaminated coco-de-mer pollen the HBG had received since it first attempted these transoceanic pollinations in 1984. Two vials were kept in reserve for future pollinations. To maintain their desiccated state, more silica gel, this time in the form of cat litter crystals from a nearby convenience store, was added to the resealable plastic bag sent from the SBG. The package was then immediately refrigerated at 1.1°C and stored for future pollinations.

Meanwhile, one entire vial of pollen was applied to the female flowers at the Foster Botanical Garden. Although they were "already dry at the tips and appeared to be past optimal time for successful pollination", HBG staff proceeded with the pollination. Using a small, pointed paintbrush moistened with tap water, the HBG's plant propagator, Romel Silva, applied the pollen from Singapore to the tips of each of the 10 female Honolulu flowers. The effort proved successful. Several weeks later, one of the pollinated flowers began to swell, developing slowly into a fruit.

In late July 2011, two months after the initial pollination, giant day geckos (*Phelsuma madagascariensis grandis*) in the Foster Botanical Garden began congregating around a second inflorescence. One of the female coco-de-mer trees had put out another 10 flowers. Exuding a strong scent and a sticky mucus, which had enticed the lizards in the first place, the flowers were ready for pollination. Noting these developments, HBG staff prepared for a second pollination attempt. Using the two remaining vials of pollen from Singapore, Silva hand-pollinated all 10 flowers three times over the next few days. This second pollination effort was far more successful: eight of the ten flowers began swelling and developing into young fruits weeks later.[27]

After 27 years, the HBG had finally succeeded in pollinating its female trees on the fourth attempt. The Honolulu double coconuts were nearly 75 years old at the time of pollination; still young, nonetheless, by the timescale of their species.

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The successful pollination of the Honolulu coco-de-mer arguably appears less exceptional when situated in the longer historical context of plantation agriculture in Singapore. As the historical efforts to cultivate coffee, rubber and oil palm locally demonstrate, colonial scientists have been experimenting with transplanting foreign, potentially profitable plant species to Singaporean soil since the 1800s.[28] Moreover, the desiccation techniques utilised by scientists at the SBG and HBG, the logistical systems that conveyed the pollen to Honolulu and even the communication technologies which allowed plant specialists to coordinate the pollination have all existed for decades.

What perhaps sets this story apart are the reasons for which these significant resources were mobilised and the actors involved. Unlike earlier efforts at economic botany in the 19th and 20th centuries where cash crops had been cultivated in the ceaseless search for profit often by European empires or corporations, the 2011 pollination of the Honolulu coco-de-mer had been conducted in the name of saving a charismatic and endangered palm species.

The success of this relatively simple pollen transfer technique opened up new possibilities for the conservation of the coco-de-mer. Botanical gardens with isolated male or female plants could now exchange pollen with other gardens across long distances, significantly expanding the gene pool and improving the prospects of the double coconut's survival in the 21st century.

Additionally, the collaboration had been researched, coordinated and conducted entirely by non-state actors, i.e., between two institutions of botanical research. Personal relationships between the staff of the SBG and HBG played a crucial role in these conservation efforts, following long-established traditions of cooperation between botanical gardens. For instance, the HBG credited the enthusiastic support of Alan Tan Chye Soon, deputy director of the SBG – who had obtained his Bachelor of Science in Tropical Horticulture at the University of Hawai'i at Mānoa – for facilitating the collaboration.[29]

Over the past two centuries, the intense fascination for the coco-de-mer's unique qualities ironically contributed to its decline. Yet such qualities had also allowed these curious trees to be spread outside their native range, initially for economic and then for conservation purposes.

The double coconut's unique qualities had so captivated humans that they devised new ways to disperse and propagate these plants across vast expanses. Human desire, curiosity and ingenuity transformed the coco-de-mer into wandering wood, allowing the tree to thrive unexpectedly in islands and gardens far beyond its natural habitat.

In Seychelles, there is a legend about how the palm reproduces: on stormy nights, male trees are believed to uproot themselves, wandering the forest to mate with female trees. In the rainswept darkness, the distinct sound produced by the leaves of the palm rubbing against one another is said to be the sound of trees mating. Witnessing such an event, however, was believed to result in blindness, or even death for unfortunate observers.[30]

In many respects, these transoceanic pollinations of the coco-de-mer are even more extraordinary than the old Seychellois legends of walking trees, for woven into them, too, is a story of charismatic plants – and the resourceful, determined botanists who worked across international boundaries to save them from extinction. ♦

NOTES

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14 F. Fleischer-Dogley, M.J. Huber and S. Ismail, "Double Coconut Palm: *Lodoicea maldivica*," The IUCN Red List of Threatened Species, 1 February 2007, https://www.iucnredlist.org/species/38602/10136618.

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25 Honolulu (GMT-10) is 18 hours behind Singapore (GMT+8). The package was only successfully delivered on the morning of 1 June, Singapore time.

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