

A unique coconut palm with aberrant inflorescence traits

A field report

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The coconut (*Cocos nucifera* L.) is among the most valuable and versatile palm to humans, with every part of the palm having been utilized since ancient times. It is a monoecious species, bearing both male and female flowers on the same inflorescence. The coconut inflorescence, known as a spadix, emerges singly in the axil of each leaf. Typically, male flowers are located on the upper portion of the spikelets, while female flowers are found at the base.

Inflorescence development

begins with a vegetative meristem, which subsequently transforms into floral primordia. This transition from vegetative to reproductive phase is regulated by genetic factors in conjunction with environmental cues such as temperature, photoperiod, and the plant's developmental stage. Unlike most flowering plants, which exhibit distinct vegetative and reproductive growth phases, coconut palms maintain both phases throughout their lifespan. The single terminal bud continues

to produce leaves, while axillary buds are routinely converted into inflorescences that give rise to flowers and fruits. In coconut, the inflorescence primordium is reported to initiate in the leaf axils approximately 32 months prior to the opening of the inflorescence. The development of branch primordia occurs around 16 months before spathe opening, while male and female flower primordia form approximately 11 and 12 months prior, respectively. Ovary differentiation begins 6 to 7 months before the inflorescence opens. Various environmental factors, including nutritional status during the 32-month developmental period, significantly influence coconut yield. The spathe typically opens around the 32nd month, with fertilization occurring by the 33rd month following the initiation of floral primordia. Nut development continues for 10 to 12 months after fertilization, depending on seasonal conditions.

Occasionally, coconut inflorescences exhibit developmental abnormalities, which not only attract scientific interest due to their potential implications for plant growth and reproductive biology, but also spark curiosity among farmers and the general



Inflorescence with leaf like structure



Spikelets with stipules at base



Branched spikelet



Spikelet of abnormal palm vs normal spikelet

public. These rare deviations from the typical developmental pattern may present as unusual floral structures or a typical arrangements of reproductive organs, prompting further investigation into their underlying unknown causes. These rare variations may arise from genetic, epigenetic, or physiological factors. One such unusual trait observed in coconut inflorescence development is reported in this article.

A unique coconut palm has been reported from the field of Mr. Yatheendra das, Vadakkuparambil, Karuvatta village, located in Alappuzha District of Kerala. The palm belongs to the West Coast Tall variety and is approximately six to seven years old. An abnormal morphological feature was observed wherein a portion of the inflorescences is modified into a leaf-like structure. The palm displays normal vegetative growth, and the overall appearance is typical of the West Coast Tall variety. Inflorescences are produced in the leaf axils, and their initial development appears normal. The outer spathe emerges

in the usual manner and opens gradually to reveal the enclosed inflorescence. However, at the tip of the inner spathe is modified into a fused, leaf-like structure, measuring on average around 14 cm in length.

Morphological characterization of a typical inflorescence

Two developing inflorescences at the -1 and -2 stages (with the '0' stage being the most mature unopened inflorescence) were collected from the palm for detailed morphological observation. The -1 stage inflorescence measured approximately 75 cm in length, while the -2 stage inflorescence measured 63 cm. In both inflorescences, the leaf-like portion was 14 cm long. Upon detailed examination, both inflorescences exhibited a typical spikes and spikelets, each bearing numerous male flowers. However, female flowers were completely absent in both inflorescences, indicating a deviation from the normal floral structure. A prominent distinguishing feature of the

inflorescences was the presence of conspicuous bracteole, each measuring between 38 and 40 cm in length in -1 stage and -2 stage inflorescence respectively. Additionally, few spikelets at the base were observed to be coiled, and a few exhibited branching—a rare occurrence in typical coconut spikelet architecture.

Another unique morphological feature was the presence of stipule-like structures at the basal portion of the spikelets in the inflorescence. The structures were arranged in an imbricate aestivation pattern, characterized by overlapping one edge turned inward and the other outward, effectively enclosing the base of the spikelets. In the -1 stage inflorescence, seven stipule-like structures were observed, with lengths ranging from 6.5 cm to 20.5 cm. In the -2 stage, eight such structures were present, ranging from 6.5 cm to 25 cm in length. The total number of spikelets was 42 in the -1 stage inflorescence and 49 in the -2 stage inflorescence. Each spikelet bore approximately 65 to 75 male flowers, significantly fewer than those found in normal

coconut inflorescences, which typically bear between 150 and 175 male flowers per spikelet. However, the male flowers appeared morphologically normal, showing no deviations in size or in the number of tepals indicating no apparent abnormalities in their development.

Anatomical studies of the leaf-like structure indicated the absence of stomata, distinguishing it from true leaves. Comparisons with normal fused leaves of similar appearance showed distinct differences, particularly in the arrangement and structure of vascular bundles, further confirming the anomalous nature of the modification. Such floral-to-leaf transformations are typically indicative of phyllody, a condition commonly associated

with infection by phytoplasma. However, the palm does not exhibit any external symptoms of disease and otherwise appears healthy. Nevertheless, further investigation, including molecular analysis, is necessary to confirm the possible presence of phytoplasma or other underlying causes of this floral anomaly.

Another type of unusual coconut palm was reported earlier, commonly referred to as 'bulbil' palms. In such palms, the inflorescences initially appear normal in their external morphology. However, upon opening the spathe, instead of the usual arrangement of spike and spikelets bearing male and female flowers, vegetative shoots or bulbils are observed to emerge. This phenomenon represents

a deviation from the typical reproductive development and is considered a rare morphological abnormality in coconut palms.

In contrast, the currently observed palm at Karuvatta is distinct and unique, exhibiting a different kind of floral modification. While the external development of the inflorescence appears largely normal, a portion of the inner spathe is partially transformed into a leaf-like structure, without the emergence of bulbils or vegetative shoots. To the best of our knowledge, this specific type of modification has not been previously reported in coconut palms, making this a rare type that warrants further scientific investigation. ■

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