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Reversal of *Arenga pinnata* Spadices into Vegetative Shoots and its Relevance to the Origin of Coconut Bulbils

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Abstract

Two branching *Arenga pinnata* palms standing close to each other in a forest area of Minahasa district of North Sulawesi Province (Indonesia) have aerial shoots (eight in one and six in the other) that have developed from modified inflorescences. There is one more palm growing near Manado that bears over 10 small branches. It is clear that decapitation of the main stem of *A. pinnata* before flowering caused the induction of vegetative shoots. The production of vegetative shoots in the coconut may usually be attributed to other causes. In very exceptional cases, inflorescences are transformed into vegetative shoots as a result of wounding of the stem, a phenomenon similar to that in *Arenga pinnata*.

Arenga pinnata (*A. saccharifera*) grows in the wild in most parts of Indonesia, particularly in Sulawesi Island (formerly Celebes). In many rural areas, the palm is put to considerable use. The massive spadices at a young stage are cut at the tip and the cut surface pared for the collection of *saguir*, which is a refreshing drink. Some people like it more when it becomes fermented, obviously because of the alcoholic content. Fresh sap is boiled down to obtain brown jaggery which is usually made into cakes in coconut shell molds. The young endosperm is also edible, but requires some treatment before it is palatable. The strong black leaf sheath fiber is used for thatching roofs of houses and compound walls, and also brushes and brooms are made out of them. The rest

of the leaf and the stem have no special use.

Arenga pinnata has a single stem that ends in an inflorescence. Flower bunches are produced one after another from leaf axils in a descending order, the youngest and uppermost leaf bearing the bunch just younger than the terminal spadix. The palm continues to produce flower bunches for two to four years until the buds of almost all leaf axils bloom, and then the palm dies. The terminal and a few immediately younger spadices produce only female flowers which develop into fruits. In the next set of about five bunches, the male flowers gradually appear; two such flowers border a female flower. Simultaneously, the size of female flowers in younger bunches decreases. Many of the bunches where both female and male flowers appear also produce fruits. Subsequent bunches produce only paired male flowers and remain barren when the flowers are shed. There is no fixed season for flowering. Usually a palm five to eight years old can commence flowering. Aerial branching or suckering is extremely rare in this species. Two branching palms are briefly reported below.

The branching *Arenga pinnata*

At the entrance of the forest area about 8 km from Girian, Minahasa



1. A branching *Arenga pinnata* having eight ramifications. A boy stands at the apex of the decapitated trunk.



2. View of the crown of *Arenga pinnata* bearing six shoots.

district of North Sulawesi Province (Indonesia), there are numerous *Arenga pinnata* palms growing in the wild. Two of them standing 10 m from each other, bear aerial ramifications, one having eight shoots and the other bearing six branches. The first palm, whose main stem was severed some five years ago at a height of about 4 m from the ground, is shown in Figure 1. Likewise, the stem of the other branching palm was also damaged before it commenced flowering (Fig. 2). The cause for the chopping off of the stems is not known. No serious pest or disease is known to affect the *Arenga* palm either around Girian forest area or elsewhere in Indonesia. The eight offshoots of the first palm differ considerably in size, the uppermost one being the largest, measuring about 2 m from the base to the growing point (Fig. 3). The other shoots are progressively smaller from the tip of the severed trunk. None of the shoots had commenced flowering when I examined them in January 1979. The leaves of the offshoots appear lean and lanky partly due to the crowding of the offshoots and partly because the palm is canopied by forest trees including *Arenga* palms. The offshoots have developed from a length of the stem covering eight nodes and measuring 1.5 m. The foliar spiral of the main stem is right-handed.

The second palm is taller than the first and the stem was severed at a height of about 6 m. The youngest offshoot seen in Figure 4 should be about one year old as it has not yet formed a clear trunk. While the uppermost shoot still continues to grow, the next oldest one has ended in a spadix seen in Figure 4. Although it is the terminal bud so far as the offshoot is concerned, the spadix is devoid of any female flower. More spadices are likely to appear from this offshoot, and at

least three other offshoots are likely to flower very soon.

A large number of palm species are clustering, as they produce many suckers from the underground portion of the stem. Such a branching may be regarded as basal axillary branching. In a few other genera like *Hyphaene*, aerial branching is the normal characteristic. Moreover, in *Hyphaene* and *Nypa*, dichotomy or actual forking of the apex has been reported (Tomlinson 1971). Among exceptional cases of branching, division of the apex and branching of the apex due to wounding is most common. According to Morris (1892), branching is the result of injury to the growing point as it happens with the wild date (*Phoenix sylvestris*) where the stem is injured for the extraction of a sweet sap. Lightning occasionally splits the growing point. A few of the palms that survive the shock emit branches. Diseases affecting the growing point may also induce the production of shoots in palms as reported in *Areca* palm by Sinclair (1889). Another instance reported by Quisumbing (1926) from the Philippines is the following. Two coconut crowns were burnt to eliminate rhinoceros beetle infestation. When new leaves appeared after some time, branches appeared on one of the trees. According to Evans (1966), production of seven branches in a *Phoenix roebelenii* recorded by him was the result of a deliberate act by a skilled plantsman. Davis (1962) induced the production of branches in coconut by artificially splitting the growing point of young shoots. Three such twins are reportedly bearing fruits in India.

There is yet another cause for the production of branches in palms. When the terminal bud of coconut is injured, there seems to be a tendency for the adjacent axillary buds that normally develop into spadices to develop



3. The various offshoots differ in height and size.



4. A spadix (s) arises from the apex of one of the offshoots in palm No. 2.

into vegetative shoots. This amounts to the transformation of lateral inflorescence buds into lateral vegetative branches following wounding of the apex. Quisumbing gives example for the phenomenon occurring in a coconut. The present case of branching in *Arenga pinnata* is another clear example for this. When the original stem was damaged and the axillary buds perhaps deprived of an adequate supply of hormones from the terminal leaves to stimulate the dormant axillary buds into flower bunches, they only developed into vegetative shoots to replace the damaged terminal stem. However, since the offshoots have full sets of leaves, some of their axillary buds are expected to grow into floral shoots capable of producing flowers. The presence of a terminal spadix in one such shoot has confirmed the hypothesis. The remaining shoots are also likely to start flowering.

Reversal of flowers and spadices into vegetative shoots in palms has been reported by many investigators. Such shoots are popularly known as bulbils. Recently we (Sudasrip et al. 1978) were able to layer some such bulbil-shoots from two coconut palms at Manado, and to transplant the rooted bulbils as independent palms. As demonstrated by the *Arenga pinnata* palms here reported, it is hoped that at least some of the bulbils will start producing flowers. Similar reversals have been reported in *Elaeis guineensis* (Davis 1959), *Borassus flabellifer* (Davis and Basu 1968) and in *Chrysalidocarpus lutescens* (Davis 1970).

One more *Arenga pinnata* palm producing many small vegetative shoots instead of flower bunches has been noticed at Mapanget village very close to Manado. Here again the transformation of lateral inflorescence buds to lateral vegetative branches followed wounding of the apex.

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