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Twin Staminate Inflorescences in Borassus flabellifer L.

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Most pleonanthic palms are characterized by the production of only one inflorescence primordium in the axil of each leaf and its development into an inflorescence. However, an exceptional case of the production of a double spadix in a leaf axil was reported in *Cocos nucifera* by Davis (1957). In recent years, multiple inflorescences are known to occur in six out of fifteen major groups of palms (see Moore 1973, Fisher and Moore 1977). Fisher and Moore (1977) have studied normal multiple inflorescences in eleven genera of palms, namely species of *Aïphanes*, *Arenga*, *Calyptrocalyx*, *Catoblastus*, *Chamaedorea*, *Howea*, *Morenia*, *Paralinospadix*, *Ravenea*, *Wettinia*, and *Wettiniicarpus*. They (Fisher and Moore 1977) predicted that "More examples of multiple inflorescences will become known as collectors pay better attention to the important but often poorly collected inflorescence of palms." Davis (1979) observed about six distinct inflorescences from each node in a staminate *Chamaedorea* species and five or six in *Howea forsterana*.

In the course of ontogenetic studies on the inflorescences of *Borassus flabellifer*, a rare case of the occurrence of two male inflorescences in the axil of each leaf was encountered. As there was no earlier report on this aspect for this taxon, the observations are presented here.

Materials and Methods

The materials for the present study were collected from a healthy staminate (male) plant in the village Aavadaialpuram, Tirunelvely district of Tamil Nadu, India. This plant (Fig. 1) had reached a height of more than fifty feet. Outer foliage leaves of the crown were removed and the inflorescences carefully collected. Peduncular bracts of these inflorescences were excised to facilitate clear observation.

Observations

Borassus is dioecious. Normally, a single inflorescence primordium is initiated in the axil of each leaf. This primordium develops into an inflorescence and the whole event is completed in three consecutive years. During the first year, organization of the inflorescence primordium is followed by the formation of a prophyll and several tubular peduncular bracts on a spiral course and in an acropetal sequence. Production of primary branches with rachillae and initiation of floral primordia occur in the second year. The rest of the development is accomplished in the third year, and the inflorescence emerges from the subtending leaf sheath. The basal part of the inflorescence remains as a compressed solid stump—the hypopodium. The prophyll and proximal peduncular bracts of the inflorescence

are sterile. The distal bracts subtend one primary branch each. Two or more cylindrical rachillae are borne on a primary branch. Bracts of rachillae are spirally arranged and they are connate and adnate with the central axis forming pits. Each pit encloses a cluster of staminate (male) flowers arranged in a cincinnus.

In the abnormal case, two staminate (male) inflorescences are found in each leaf axil. They have a common hypopodium which is very similar to that of a normal inflorescence (Fig. 2). Each of the two inflorescences individually resembles a normal inflorescence in size, shape, and weight. Even the number, size, and shape of prophylls and the other bracts are similar to those of a single inflorescence. The primary branches and rachillae also appear normal. Moreover, flower formation follows the usual course and all the flowers remain fertile. There is no tendency for suppression of any floral or other parts in these inflorescences. On tapping, these inflorescences give out sugary sap as in normal inflorescences. The twin inflorescences reveal the same stage of growth during ontogeny. They grow and mature simultaneously, each having its own prophyll and primary axis. Since several inflorescences are double in the crown, the latter appears very dense (Fig. 1).

It was not possible to trace the early ontogeny of these abnormal inflorescences because of nonavailability of material since the owner of the palm refused to part with it for microtomy. Therefore, the stage at which the ontogenetic deviation sets in has to be decided by a comparison of the primordium of this abnormal inflorescence with that of normal ones. The proximal part of the primordium of abnormal inflorescence is organized into a hypopodium as in a normal inflorescence. Its distal part, which remains meristematic, instead of developing into a single inflorescence, produces two separate inflorescences. The formation of primary axis, prophyll, peduncular bracts, primary branches, rachillae, and flowers commences in a normal way in these two inflorescences.

1. Crown of *Borassus flabellifer* showing double staminate (male) spadices.

Discussion and Conclusions

The structure and organization of multiple inflorescences in palms are not the same in all the taxa studied so far. In *Cocos nucifera* (Davis 1957), there is a common outer spathe (bract) enclosing the entire double inflorescence. Further, a great number of unusually large female flowers are borne on such an inflorescence. On the other hand, the twin inflorescences in *Borassus flabellifer* neither arise in the

2. One double staminate (male) spadix detached from the tree.

axil of a common bract nor do the flowers exhibit an unusual large size.

Fisher and Moore (1977), who examined the ontogeny of normal multiple inflorescences in eleven genera of palms, pointed out that in all the instances, the primary bud apex always organizes a central inflorescence. The lateral bud apices, initiated centrifugally on either side on the flanks of the hypopodium, develop into additional inflorescences. Moreover, the central inflorescence flowers first at any flowering node while the flowers on the laterals open later (Fisher and Moore 1977). In *Borassus flabellifer*, on the contrary, the individual inflorescence of the twin does not reveal any deviation either during development or in the time of flowering. On the basis of its organization and behaviour, it is inescapable to conclude that the primary bud cleaves once producing two meristematic loci. And the subsequent destiny of the two apices, apparently, is exactly similar as is evidenced by the size, structure, and mode of flowering at any given time.

The causes for the origin of multiple inflorescences are so far not elucidated. In some taxa, it is a regular feature (Fisher and Moore 1977). In others, it appears to be rare and abnormal—a freak (Davis 1957, and present study). At least in *Borassus* of the present study, it is not due to the attack of insects, fungal infection, or physical damage. Extensive and intensive histochemical studies of the growing apices alone could indicate the probable biochemical gradients involved in directing the production of such inflorescences—both as a regular feature and as a freak.

The term hypopodium is used for the basal part of the inflorescence between the region of its attachment and the insertion of the prophyll (Fisher and Moore 1977). The basal portion of the multiple inflorescence is also called by the same term which seems quite appropriate.

Production of multiple inflorescences in *Borassus flabellifer* is decidedly advantageous to the plant, mainly because there is an increase in production of pollen and a greater chance of pollinating more pistillate (female) flowers to effect more fruit set. We agree with Fisher and Moore (1977) on this point also.

Summary

Double staminate (male) inflorescences have been noted in one individual of *Borassus flabellifer*. These two spadices have a common hypopodium. Both the spadices of a unit are exactly similar to each other and each one simulates a normal inflorescence structurally and functionally. Suppression of floral or other parts is not en-

countered. The observations made have been evaluated in the light of the previous work.

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Literature Cited

Davis, T. A. 1957. Twin and fasciated spikes. Bull. Indian Centr. Coconut Cttee. 10: 231–233. (Cited In Menon, K.V. and Pandalai, K.M. 1958. The coconut palm—A monograph. Indian central coconut committee. Ernakulam, S. India. 384 pp.)

———. 1979. Some unusual formations in palms. Principes 23: 80–83.

Fisher, J. B. and H. E. Moore, Jr. 1977. Multiple inflorescences in palms (Arecaceae): their development and significance. Bot. Jahrb. Syst. 98: 573–611.

Moore, H. E., Jr. 1973. The major groups of palms and their distribution. Gentes Herb. 11: 27–141.

HAROLD E. MOORE, JR.
1917–1980

Harold E. Moore, Jr., Liberty Hyde Bailey Professor of Botany at Cornell University, and Editor of PRINCIPES since 1957, died suddenly on October 17 after a brief illness. For Hal, the editorship of PRINCIPES was a labor of love. Those who knew and loved him should know that while ill at home and in the hospital he prepared this issue and did all but the final checking of the page proof. He has also edited manuscripts for January and April. We will publish a tribute to Hal later. Friends may send remembrances to the Harold E. Moore, Jr. Memorial Fund, Cornell University.

JOHN DRANSFIELD
NATALIE W. UHL
Associated Editors

Errata

Page 17, column 1, line 34, for *lauterbachiana* read *lauterbachii.*
Page 27, column 1, line 9, for *lauterbachiana* read *lauterbachianum.*