Aspects of the Morphology of Jubaeopsis caffra Becc.

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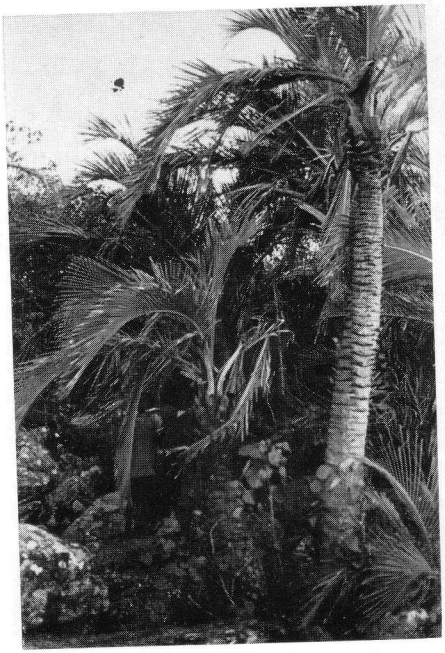
The general morphology of palms is very divergent, with numerous variations in plant size, shape, and structure occurring (Tomlinson, 1961). Just as divergent are the currently morphological descriptions of *Jubaeopsis caffra*. McCurrach (1960) simply describes *Jubaeopsis* as being similar to *Jubaea*. Wicht (1967, 1969) states that it is many-stemmed while Hertrich (1970) describes *Jubaeopsis* as being single-stemmed.

Apart from these contradictory reports, very little else has been published about the morphology of *Jubaeopsis* and consequently a study of the habit, branching, phyllotaxy and leaf morphology was undertaken. Most of the material used in this investigation was obtained from the groves along the Msikaba and Mtentu estuaries in Transkei, but use was also made of a 43-year-old cultivated tree in St. George's Park, Port Elizabeth.

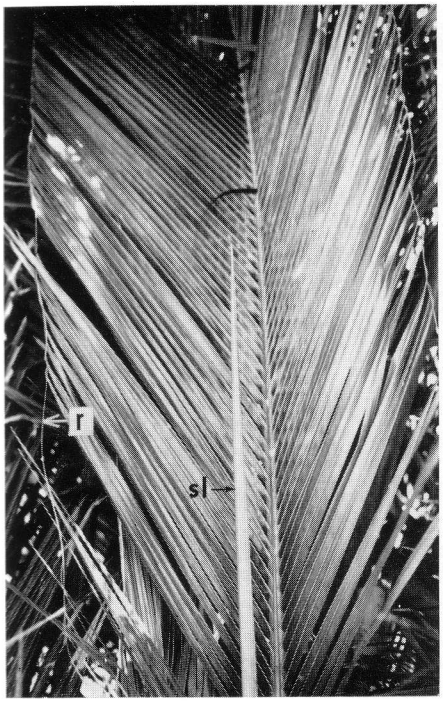
1. A 43-year-old cultivated *Jubaeopsis caffra* growing in St. George's Park, Port Elizabeth, South Africa.

2. Four stems of the cespitose *J. caffra* in St. George's Park, Port Elizabeth.

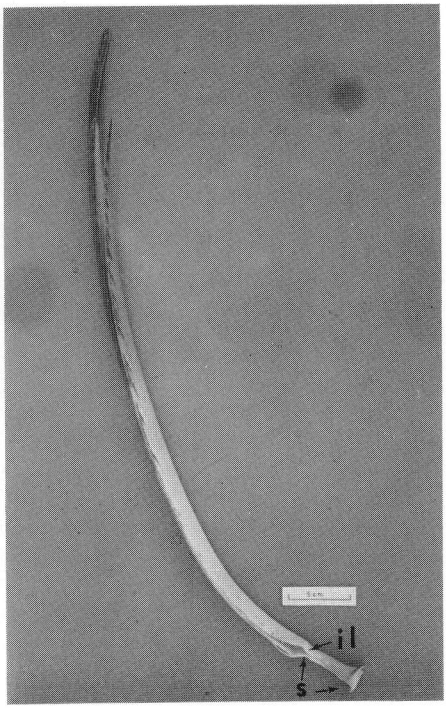


3. An erect, windblown, "left-handed" *Jubaeopsis caffra* growing on the north bank of the Mtentu River in Pondoland.

4. Branching in the distal portion of the stem.



5. A newly expanded leaf of *J. caffra* in which the marginal strips or reins are still attached to the apices of the leaflets (r, reins; sl, spear leaf).



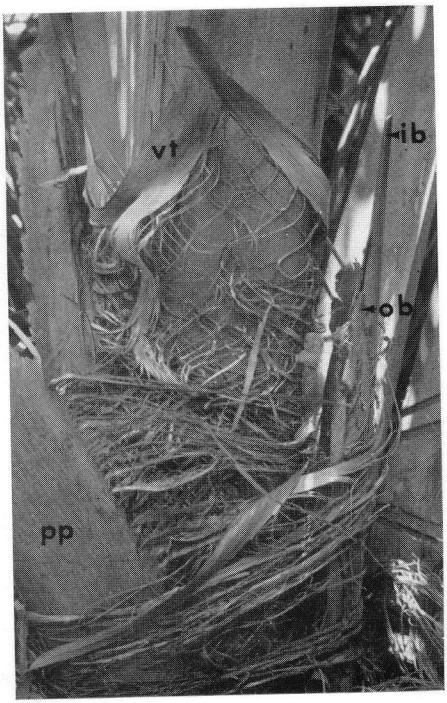
6. The spear leaf of a young sucker. Note the absence of a true petiole (il, insertion point of first leaflets; s, leaf sheath).

Habit and Branching

The tree growing in St. George's Park was 60 cm high at the time of planting and had a single stem (Long, 1950). It is not clear from Long's report whether the leaves were 60 cm long or whether in fact the trunk was this length. During the past 43 years, this single-stemmed tree has developed into a tree consisting of 15 stems, 12 of which are erect trunks, while the other three are still in their juvenile, subterranean state. This tree is characteristic of a typical cespitose growth habit (Fig. 1). The majority of trees in the groves at Msikaba and Mtentu also exhibit this type of habit.

The axillary buds in the basal portion of the trunk, particularly on the conical subterranean section, are very precocious and give rise to numerous suckers (Fig. 2). This is contrary to a report by Barry (1957) who reports that the development of multiple trunks in this species is not by the formation of offshoots from the trunk at ground level, but by divisions high in the crown of the tree. The findings of this study also conflict with McCurrach's (1960) description of *Jubaeopsis* because while this species is cespitose, *Jubaea* is columnar (Tomlinson, 1961). Further, while the trunk of *Jubaea* is often very tall and is probably the thickest of all palms, *Jubaeopsis* is only a medium-sized tree with the trunk attaining a height of seven or eight meters and a diameter of 24 to 30 cm. Both erect and reclining (especially in very old trees) stems occur.

7. The leaf sheath in which the ventral tissues have torn from the pseudopetiole margins to form a ventral flap or tongue (pp, pseudopetiole; t, torn edges of pseudopetiole; vt, ventral tongue).

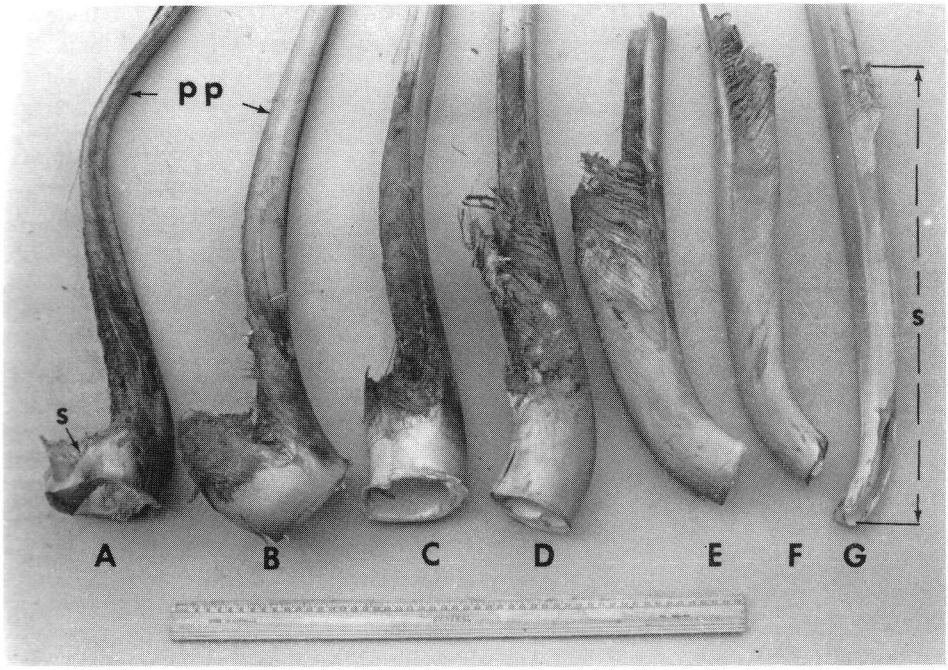


8. Disintegration of the tissues of the ventral tongue. Also evident is an emergent inflorescence which is still enveloped in two bracts. (ib, inner bract around inflorescence; ob, outer bract (prophyll); pp, pseudopetiole; vt, ventral tongue.)

Normally the leaf bases are abscised quite cleanly leaving a relatively clean trunk (Figs. 3, 4). However, particularly where trees are exposed to the wind, the rachis breaks at the base of the lamina and consequently the leaf bases (sheath plus pseudopetiole) are not cleanly abscised, but remain attached to the stem, giving the tree an untidy appearance. (The stems shown in Figure 2 are not typical of this species as the tree grows in a park and the dead leaves are sawn off prior to their being naturally abscised.)

Apart from the fact that the basal section of the stem of *J. caffra* gives rise to branches in the form of axillary suckers, the distal or aerial stem section also branches (Fig. 4). This branching is apparently neither a freak occurrence nor the result of injury, but is fairly common in *Jubaeopsis*. From Figure 4, the type of branching appears to be very similar to that found in *Hyphaene*. In this latter genus, and in *Nannorrhops* and *Nypa*, the branching is dichotomous (Tomlinson & Moore, 1966). Whether or not it is true dichotomy in *Jubaeopsis* though, remains to be established. Unfortunately an anatomical investigation of this aspect would involve the destruction of too many trees and has consequently not been undertaken.

The inflorescence develops from an axillary bud and is therefore borne laterally. This confirms the conclusions of Beccari (1913) in this respect. Each



9. Leaf bases dissected from a young *J. caffra* sucker. A, oldest open leaf (brown and dying); F, youngest open leaf; G, spear leaf; B–E, intermediate expanded leaves. (pp, pseudopetiole; s, leaf sheath.)

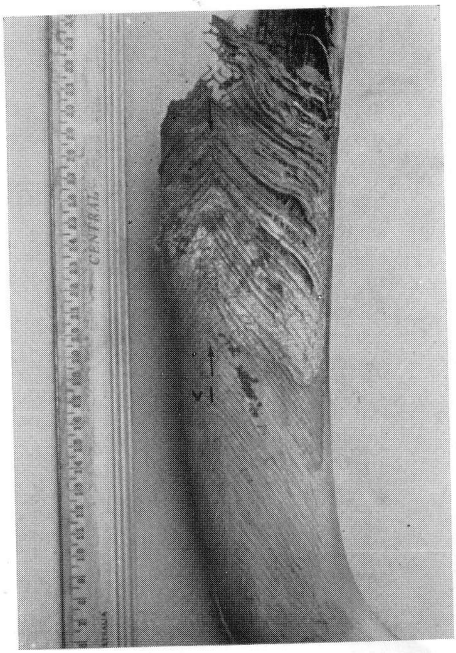
leaf subtends an axillary bud and the inflorescences are borne in the same sequence in which the leaves are formed. Any given adult stem will usually be bearing two or three inflorescences or spadices in various stages of development. Such interfoliar inflorescences together with a cespitose growth habit is considered relatively primitive in palms generally (Moore & Uhl, 1973).

Leaf Morphology

The alternate leaves are arranged in five vertical rows around the stem with a 144° angle of divergence i.e. a phyllotactic fraction of two-fifths. In many palm species the leaf rows are not truly vertical but are sloped or slanted and form a secondary spiral around the trunk (Davis, 1971). In *Jubaeopsis* however, the rows are usually completely vertical with slanted leaf rows only occurring in exceptional cases (Fig. 3).

Generally speaking, the leaves of *J. caffra* are similar to those of other cocosoid palms. They are paripinnate, slightly curved and are approximately six meters long and between 0.6 and 1.0 m wide. Distribution of the reduplicate pinnae is regular (Fig. 5) except at the apex of the lamina. The leaflets, which are all inserted in the same plane on the sides of the rachis, are all equally wide and each has only a single main rib.

As in most other cocosoid palms (Tomlinson, 1962) *J. caffra* has no true petiole. In the spear leaf the sheath extends up to the point at which the lowest pinnae are inserted on the rachis (Fig. 6). As this leaf grows, the thin ventral section of the sheath is distally separated from the thick, woody dorsal portion



10. The fibrous ventral tissues of the leaf sheath. Note the ventral line (vl).

and forms a dry, fibrous "tongue" or ventral flap (Fig. 7). This ventral flap disintegrates as the diameter of the stem increases (Fig. 8) until eventually only the persistent woody dorsal portion of the sheath remains (Fig. 9). This latter structure looks and functions like a true petiole, but is in fact a pseudopetiole.

While the ventral tissues in the leaf sheath of *J. caffra* are conspicuously fibrous (Figs. 8, 10) they are not totally persistent and undergo continual degeneration and decomposition so that in the mature leaf, only a narrow proximal band of ventral tissue remains (Fig. 9A, B). It thus seems as if the type of sheath that occurs here is intermediate between the *Phoenix* type and *Cocos* type (Tomlinson, 1962). However, the actual construction of the ventral tissue is very similar to that of *Cocos* (Tomlinson, 1964) in that it is comprised of three basic fibrous and vascular bundle systems, viz. warp, weft, and filling.

The warp and weft constitute the two main systems of parallel bundles with the abaxial bundles being the warp while the weft is formed by the adaxial ones. Contrary to the condition in *Cocos* though (Tomlinson, 1964), the warp and weft in *Jubaeopsis* are equally thick. The filling, as in *Cocos*, is composed of strands that are very much thinner than those of the other two systems.

Along the ventral line of the sheath there is an interchange of warp and weft strands (Fig. 10). At this point the abaxial strands of the warp of one-half of the leaf base pass under those of the other half and continue to the opposite margin of the pseudopetiole as weft strands. The functional efficiency of this type of foliar structure is very high (Tomlinson, 1964).

Acknowledgements

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PALM BRIEFS

Date Breeding in Thailand

Some seedlings of *Phoenix dactylifera*, the date palm, produce completely sweet fruit in various localities in Thailand. This is considered to be a clear indication of success in growing dates in Thailand. Such fruit can be eaten fresh, preserved in syrup, or variously processed. There is no competition from imported dates because imported dates are taxed more than one dollar U.S. per kilogram.

Phoenix species have 18 gametic chromosomes and cross with each other. Species from the humid hot climates such as *P. reclinata*, *P. pusilla*, *P. zeylanica*, *P. paludosa*, *P. hanceana*, *P. acaulis*, *P. loureirii*, and *P. sylvestris* will be crossed with *P. dactylifera* in a breeding program sponsored by the Ministry of Agriculture and Cooperative of Thailand through a *Phoenix* development group, which includes two members of The Palm Society, Mr. Pittha Bunnag and myself. The Institut Français de Recherches Fruitières Outre-Mer (I.F.A.C.) is also interested. It will send viable seeds of *Phoenix reclinata* and *P. dactylifera* and will provide technical and genetic information.

Phoenix reclinata, which grows wild in humid hot regions of Africa, should have the greatest potential for variability and adaptability and should be the most important species for crossing with *P. dactylifera*. It produces soft, sweet, and agreeable-tasting fruit 20 mm in length, and it ranges through the largest number of bioclimatic conditions in the wild state. The resulting hybrid seedlings should produce maximum variation in fruit characters in the F_2 and later generations. Selections of better adapted hybrids that produce good quality fruit can be made for further breeding.

Other date cultivars that should be valuable for date breeding in Thailand are some from Kolokani, Mali, where the annual rainfall is 1,074 mm and excellent fruit ripens in April, the dry month there. A similar potential may be found in dates from Salala on the Oman coast of the Arabian Sea, where the monsoon dumps heavy rains so that coconut palms are now cultivated in great numbers and nearly supplant the date palms. Dry dates such as 'Karut' from Iran, 'Barakawi' from Sudan, and 'Thoory' from Algeria should be useful. 'Tadala' from Algeria is thought by P. Munier to be a false date, a hybrid between *P. dactylifera* and certain other species. It is more rain resistant than 'Halawy,' 'Medjool,' 'Thoory,' and 'Khadrawy.'

It is hoped that there will occur a parallel in the quality of dates in humid regions comparable to the high quality from arid desert regions, though in a new form of fruit character. Any further interesting progress will be reported in PRINCIPES. Viable seed or offshoots of interesting *Phoenix* hybrids developed in the program will be available to members of The Palm Society and to those who contribute seeds or any assistance.

Members who are interested may forward seeds to Dr. Siribongse Boon-Long, Inspector General, Ministry of Agriculture and Cooperative, Rajadamnern Avenue, Bangkok, Thailand. Viable seeds of *Phoenix reclinata* are now urgently needed and will be greatly