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BRANCHED COCONUT PALMS AND THEIR FERTILITY.

Apropos of the note on the *Fertility of Branched Coconut Palms* by Mr. Burkill, published on page 1-2 of Vol. III of this *Bulletin*, the following may not be without interest to readers.

Normally one coconut fruit gives rise to one shoot and this in its turn to one stem. It is not infrequently, however, that one meets with wide deviations from this normal phenomenon. A nut, for instance, may on germination, give rise to more than one shoot, each arising from a separate carpel in the nut. The writer has not come across an instance where a nut had more than two fertile carpels; but it must be remembered that the coconut has a trilocular ovary wherein normally two of the locules become abortive. Cases, therefore, may occur where all three carpels may be stimulated to become fertile as in some species related to *Cocos nucifera*. Forbes reports of "a nut with three cells separated by leathery walls." Sampson ([16]) appears to have seen cases where the septa separating the ovules were hard and not leathery. Forbes, in his article above referred to writes: "I have seen also nuts with cells ranging from four to eight and ten. I send you a rough outline sketch of a tree which has come up from a nut of fourteen cells, all of which germinating, producing a tree with fourteen stems

united at the base." If Forbes' conclusions as to the occurrence of more than three cells in a nut are correct, then the phenomenon concerned might be a case of vegetative multiplication of carpels. If, on the other hand, his conclusions were based merely on the number of shoots that appeared on germination of a nut, then these alternatives are possible (1) that the numerous shoots are due either to the occurrence of polyembryony as in mango, citrus, onion, etc., or (2) to the fasciation of the plumule, or (3) to the monopodial branching with very much abbreviated axis. All these phenomena are loosely described as "branching" although only in the last two cases the true phenomenon of branching occurs. In all other cases, the shoots are distinct individuals, though due to a close adhesion among themselves they may appear to start from single point. The references about the occurrence of polyembryony or more than three carpels in coconuts are not clear, and, therefore, the subject demands further investigations.

The ramification of the main shoot in coconuts is not restricted to the young age only. There are numerous instances where adult coconut palms have branched. The phenomenon concerned in branching palms has been discussed by Mr. Ridley, ([15]) the late Director of the Botanic Gardens, Singapore. He appears to hold the view that true dichotomy never occurs in palms. If this view is correct then the phenomenon of fasciation also never occurs in palms, since fasciation and dichotomy are essentially one and the same phenomenon with the difference that, while in the latter there appears only two shoots, in the former they are always more than two. But the view that true dichotomy never occurs in palms is not absolutely true. Schoute ([17]) has observed the phenomenon of fasciation in stems of some abnormal palms, and that of "true dichotomy of the stem, *as a normal feature*, in *Hyphaene*, an African palm. It (dichotomy) arose as follows: 'The apical meristem ceased to grow, and in place of it, at equal lateral distances therefrom, two new ones appeared.' From this it is obvious that there was no division of the apical meristem into two, and yet true dichotomy is present: because the two lateral branches did not arise owing to injury to the stem-apex: because they are not axillary to any leaves: and because an 'angle-leaf' is present opposite the fork as is the case in dichotomyzing stems of Cryptogams. Moreover, the two branches bore lateral buds in the axils of every leaf. Velenovsky ([17]) has also established by personal observation that true dichotomy occurs in *Chamaedorea Martiana*." Worsdell ([21]) cites a case where the plumule of the palm *Pinanga maculata* in the Kew Gardens, was branched down to the extreme base, the branches being subtended by a common basal sheath. The case was one where it was not easy to decide whether the phenomenon concerned was a true dichotomy or not.

There is another phenomenon which might be confused with the true branching. On the Noakhally Plantation, Akyab, Burma, I was shown plants which were considered as cases of bud-rot and these plants had their central leaves decaying and in some

cases giving disagreable smell. Though a special watch was not kept on the plantation for the disease, yet it was customary to kill and burn all such plants that came to the notice of the manager and spray the neighbouring ones with copper sulphate. It was said that the disease was never seen in the Estate on plants older than ten or twelve years and that the cases were always sporadic, the attacked trees never occurring in groups or bearing any definite relation to the old cases. All this information coupled with my observation of the fact that numerous plants showing similar symptoms, escaped the notice of the man in charge of the plantation and that the disease neither killed these untreated plants nor did it seem to spread from these to the neighbouring trees led me to the conclusion that the trouble in question was other than the suspected bud-rot, genuine cases of which disease I never met on the plantation during my six months stay there. Further observations showed that the pathological condition in most cases could be traced as the consequences of the injury to the palm by the much-prevalent rhinoceros beetles. When the injury to the cabbage reached the apex, the latter was stimulated to change its direction of growth with the result that the young leaves produced previous to this change were starved to death and started to decay. Now the idea that this change of direction of growing apex could be mistaken for true branching would never have occurred to me were it not for the fact, that, through the criticisms by Petch and Gadd, my attention was drawn to such views entertained by Sharples and Lambourne. The former writers have discussed the matter at sufficient length in the *Annals of Botany*, Vol. 37, July 1923, pp. 445-450, and shown that the cases which are considered as genuine cases of lateral branching by the latter (vide *Annals*, Vol. 36, Jan. 1922) are most probably the ones where a change in the direction of growth of the apical bud from vertical to horizontal is involved.

There is yet another phenomenon commonly called "branching", though strictly speaking it is a case which ought to go under the title of chloranthy or proliferation. It consists in the metamorphosis of an inflorescence shoot and usually the trees start producing these abnormal structures when it is of the age to produce normal inflorescences and it continues to produce them till its death. Ridley, ([15]) Petch ([13]) Iyengar ([10]) and Burkill ([2]) have discussed this abnormality in some detail. From the perusal of the literature consulted and from my own observations I am led to conclude that these "bulbils", for so they are termed by Ridley, are never persistent, though Forbes, from his observations made in the Cocos Keeling Islands, was inclined to believe them so. No doubt these outgrowths have usually a much longer life than normal inflorescences, or the leaves of the trees. In one case I observed these abnormal inflorescences grew for more than five years. But even if their life was prolonged for more years I do not think they would give rise to the permanently branched palm, at least the phenomenon concerned would be very different from that of the ordinary ramification in palms, (cf. Burkill's paper).

The peduncle that bears these abnormal structures is essentially of the type of the normal inflorescences: clean, and fibrous for a foot or less from the base, while the structure of the branches from the point of fork is of the type of the stem. The peduncle does not increase in size much more than the peduncle of normal inflorescences, and, like the peduncle of normal inflorescences, has a tendency to form abscise layer and separate form the main axis. Some of these bulbils bear minute inflorescences consisting of tiny male florets and no female. In the cases observed by me these flowers were borne by secondary shoots produced on the bulbils. The bulbils do not show any tendency to form roots in artificial media ([5]) & ([10]).

Dr. Pulney Andy ([1]) has described a monstrosity which consisted in the phyllody of the greater portion of the female flowers in the spadix, and not of the whole inflorescence itself. Here too "the flower-bud cannot, by such metamorphosis, give rise to ramification in a palm without a true axillary leaf-bud."

Fertility.

In the above discussion it becomes clear that the term "branching" is loosely applied to various phenomena, including some that cannot be classed as branching. And it is possible that the conception that the true branched palms are permanently infertile has orginated from the confusion which exists as to the meaning of the term "branched" coconut palms, that is, by transference to others of the conception derived from some special case or phenomena. Otherwise the prevalence of the idea that the branched palms are permanently unproductive is really unfounded.

I have seen a coconut "branching" at the base bearing fruits; and there are numerous references which show that branched coconuts are not infertile. Morris, ([11]) for instance, reports a fruit in the Kew Museum from a branched coconut tree of the Fiji Islands. According to Scott, ([18]) there was a tree in the vicinity of Calcutta with five fruit-bearing branches. Henry ([8]) makes mention of a coconut tree in the Marquezas Islands, which at the age of eighteen branched into two, both heads starting to bear fruits after two years from the occurrence of the forking. Among these cases there are at least two references which are of interest to Malaya. The frontispiece of the treatise on coconut by Munro and Brown ([12]) is of a coconut tree branching out near the top into five distinct stems, each of which is carrying fruit. The second is of a coconut tree in Penang which had six branches, each of which were "loaded with nuts." ([3]) Apart from these, the *Consols of the East* by Smith and Pape ([20]) and Hunger's *Cocos nucifera* ([9]) have photographs of branched coconut palms bearing fruits. In fact considering the presence of the photographs in the above quoted standard treatises on coconut, one cannot understand the reputed prevalence in Malaya of the view that branched coconut palms are sterile.

By this I do not wish to be understood to say that all truly branched coconut palms are productive. Cases may occur where branched coconuts may not start yielding for a very long period; but in such cases, before one can draw conclusions, it has to be ascertained whether the unproductiveness is due to want of proper care, to the fact that the tree has not yet finished branching, or to some other cause.

A very interesting point in connection with these abnormal palms is to know how their progeny behave and it is very astonishing that nobody has yet tried to solve this question. It is not yet known, for instance, whether seeds of these palms will keep true to the abnormal character or return to the character of the parents to these abnormal ones; whether all of the seeds will do so or only a part of them, and how large a part. In carrying investigations in these lines care has to be taken to prevent cross-fertilisation with the pollen from other plants. This will probably be an easy matter with the dwarf coconuts in Malaya where normally the male and female flowers ripen in a manner as to ensure self-pollination if protected by a bag from foreign pollen. If, however, the inflorescences of these abnormal palms are protandrous, then the female flowers will have to be artificially fertilised with the pollen from the male flowers in the same tree. The branches of palms subject to heavy winds and, therefore, liable to be broken, may be induced to form aerial roots on stems by marcottage and then detached and planted in a place convenient to carry on with the observations. The crown of a palm thus detached has been observed by me to grow when planted out and this practice, it appears, is sometimes resorted to by the gardeners in Malabar, India. ([6])

In cases where the inflorescences foliate I have not come across a single reference stating that such trees or their bulbils have borne fruits. In the case described by Dr. Pulney Andy the tree does not produce a perfect fruit. And probably these are the only two phenomena of the ones described above which are infertile. These cases however should not be confused with the ones where coconut fruits, instead of falling when mature and dry, remain on the stalk and under certain conditions germinate on the tree. Guppy ([7]) saw a case where a seedling thus germinated was about eighteen inches high.

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