The type of the first of these two names came from Dusun Tua, upon the east of Kuala Lumpur in Selangor: and that of the second from Tanjong Malim on the Selangor-Perak border. It extends southwards and has been found at Pulau Sebang in Malacca (Burkill 4960). As a medicinal herb, foliage has been got from Grik in northern Perak; and in Pahang from Budu in the Kuala Lipis district, from Beserah in the Kuantan district, and from Bentong. Mr. Ridley records *C. spinulosa* as occurring in Tonkin also.

The chief use that the Malays make of it is as a poultice for the ripening of boils; but it is also given internally under the idea that it is good for expelling worms, and as one of the innumerable herbs administered speculatively to women during the first three days after childbirth. It is again reported as one of several plants which at Grik are used in a decoction for a bath during fever.

The difference between *C. suffruticosa* and *C. spinulosa* is said to be in the inflorescence: but there is none: in both it is cymose. It was in flower and fruit as Tanjong Malim in February 1904, in bud at Dusun Tua in May 1896 and in flower at Pulau Sabang in August 1919.

I. H. Burkill.

Teratological Notes

A.—Abnormalities in Coconut Palms.

I. Polyembryony. On p. 275 of this *Bulletin*, Vol. III, it was stated that the various references which had been consulted by me on the question of polyembryony in coconuts were not sufficiently clear as to make one to be quite positive about the occurrence of the phenomenon in coconuts. Cases, however, have come to my notice which prove beyond all doubt that polyembryony does occur in coconuts.

The ovary of coconuts, it will be remembered, is three-celled, two of which usually become abortive at an early stage of development, only one attaining maturity. The fruit consists of a thin outer skin or *epicarp*, below which is the thick fibrous *mesocarp* surrounding the hard shell or the stony layer of the nut. This shell is formed mainly of the *endocarp*, but the outer integument of the seed is also represented in it as a lignified inner lining of the shell (fide Juliano)[1]. Inside this stony layer is the solid

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1. Juliano, J. B.—Origin, Development, and Nature of the Stony Layer of the Coconut (Cocos nucifera L.). *Philippine Journ. Sci.*, XXX (1926), p. 187-200, pl. 3.

Winton, A.L.—Anatomy of the Fruit of Cocos nucifera. *Am. Journ. Sci.*, XII (1901), 265-280. Quoted by J. B. Juliano.

endosperm which is the kernel or "meat" in common parlance and which is lined outside by a thin blackish coating. This coating —we may as well call it "testa"—is derived from the inner integument of the ovule (Juliano[1]). Then comes the cavity partially filled with water or "milk" (watery endosperm) in ripe coconuts. Corresponding to the three carpels of the ovary, there are three markings or "eyes" on the endocarp, two of which have become hard after the degeneration of the two cells of the ovary, while the third "eye" of the developed cell is soft. Just beneath this "eye" is the embryo. When the germination sets in, a suctorial organ—*haustorium* or "foot"—develops into the cavity, at the end of the cotyledon of the embryo, which supplies nutriment to the young growing plant by absorbing it from the endosperm.

Bearing these points in mind, it will be easy to study the nature of the phenomena concerned in the cases described below:—

(*a*).—On July 25th, 1925, there was exhibited at the Taiping Agri-Horticultural Show, a germinating coconut from Kampong Jelutong, Bukit Gantang, North Perak, which had put forth three shoots. The coconut was carefully husked by me to find the three shoots as distinct individuals as far as the soft "eye" through which they had extruded from the endocarp. The two other "eyes" were closed and hard as in an ordinary nut where two carpels are abortive. On breaking the nut open, it was observed that each shoot had its origin in a separate embryo, each having a cotyledon and a haustorium of its own. There was only one cavity in the endosperm into which these three haustoria had developed, and there were neither hard, nor leathery dissepiments in it which are said to be present in a polycellular nut.[2] The kernel inside also showed no signs of any special connection with the closed "eyes" as it showed with the soft "eye." This is then a genuine case of polyembryony in coconuts.

I have also examined many such specimens having two to three embryos from Singapore, Selangor, Penang and Malacca which go to prove that polyembryony does frequently occur in this country. These shoots may emerge out of the husk in all directions, and often in suchwise as to mislead one to think that these extra shoots are due to the functioning of more than one ovule. Hence I look with great suspicion on all the three cases mentioned from Philippines by Quisumbing[3] as ones where more than one ovule were functional.

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2. Furtado, C. X.—Branched Coconut Palms and their Fertility. Gardens' Bull., Singapore, Vol. III (1924), p. 274.

3. Quisumbing, E.—Branching in Coconut. *Philippines Agriculturist*, XV (1926), p. 3-4.

I have not yet come across in this country a genuine case where more than one ovule had developed giving rise to di—, tri—, or polylocular nut, though such cases have been reported from elsewhere.[3 4 5]

(*b*).—Costerus and Smith (1923)[5] describe a case of polyembryony in thus:—

"Legit H. A. B. Bunnemeyer, Isle of Nangka near Banka, 1917. One celled nut. From one of the black (germinating) spots there emerged four sprouts each showing its own cotyle. No question of branching. Consequently we have here to do with a true case of polyembryony.

"Mr. Smith is thoroughly convinced that the Coconut with three cohering stems, which we described in 1915, is after all a similar case of polyembryony with this difference only that the embryos of 1915 coalesced whereas in the present case they have maintained their full independence."

The coconut referred to as having been described in 1915 is one which had given rise to three sprouts and which on being carefully opened had not shown any dissepiment whatsoever. "Only one germinating plant forcing its way through one of the black spots was to be seen, but the stem of this young plant showed a separation into three. The advanced state of (dry) specimen did not permit of a further examination into the cause of the phenomenon, but of polyembryony there can be no question." No further details or reasons are given why Dr. Smith thinks this to be a genuine case of polyembryony and not of fasciation or branching.

(*c*).—In the Botanic Garden, Penang, there is a "coconut palm" which has three distinct individual stems from the base. Mr. Mohamed Haniff who has been long connected with the garden, informs me that the three stems have orginated from one coconut fruit and that it was planted there in 1901. Only two stems are bearing fruits, while the third one is yet barren and is also very much shorter than the other two. The small growth of this third stem is in all probability due to the fact that twice during its growth it was very badly attacked by borers (there are still marks on the palm of these attacks). The injury caused by the attacks must have retarded the growth very considerably, giving thereby the other two stems a chance to overshadow this one and to make its further development and production of flowers rather difficult. The overshadowing caused by another palm growing close to it may be an additional cause why this stem is weak and infertile. There is another similar palm with two fertile, and

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4. Costerus, J. C. and J. J. Smith.—Studies in Tropical Teratology. *Annales Jard. Bot. Buitenzorg*, XXIX (1915), p. 84-85, and plates.

5. Ibid ibid —ibid XXXII (1923), p. 26 and plates.

one barren, stems in the Botanic Gardens Cooly Lines, Penang, which have originated (*fide* Mr. Haniff) also from one nut. The short and barren stem shows signs of injury in the past. In a private compound at Burma Road, Pulau Tikus, Penang, there is a tree about forty years old which has two stems, distinct from the base, both of which are producing fruits.

II. The Development of the Usually Abortive Ovary in Male Flowers. A coconut spadix was exhibited at the Taiping Show, 1925, which had numerous banana-like fruits and only two nuts of normal shape. The latter were borne in the regions of the spadix where normally female flowers are produced, while the former occupied the positions of male flowers. Apparently this is a case similar to the one quoted on page 263 of this *Bulletin*, III, the banana-like fruits being the result of the development of the usually abortive ovary in male flowers.

III. Albino Coconut Seedlings. In the Taiping Show, 1925, there were exhibited two coconut fruits which had put forth completely albino shoots. The albinism was apparently due to some internal factor, and may be a case of chlorosis due to lack of ferruginous products in the endosperm. It could not be attributed to the lack of light as the plants received ample sunlight at the show (and they must have been exposed during the transit), and because normally coconut seedlings germinated in darkness such as obtained in a closed house, have greenish leaves. Neither nut had put forth any roots out of the husk. From the shape, size and colour, the nuts appeared to have come from the same spadix. Further investigations on these nuts were not possible as they were not for sale.

IV. Suppression of Spikelets in Coconut Spadices. Ordinarily a coconut inflorescence consists of many flower-bearing spikelets produced on a fleshy stalk, which usually does not bear any flowers. At the Agri-Horticultural Shows of Taiping and of Kuala Lumpur, 1925, inflorescences were exhibited which were abnormal in that the axes were unbranched, the flowers being borne directly on them.

The flower-bearing region of one such specimen from Taiping measured three feet and four inches, while the non-flowering portion towards the tip was nearly six inches long, and towards the base over eight inches. The bearing portion of the stalk was occupied by female flowers which were more than a hundred in number. In the basal portion, the flowers were arranged in pairs, each pair being some distance apart from the other, and their arrangement resembled that of the male florets on the spikelets of normal inflorescences. The space between these pairs of flowers gradually decreased towards the end so that in the upper third of the bearing stalk the female flowers were so thickly crowded together that they did not admit any special relation between any two consecutive

flowers. On many of the cushions on which the pairs of female flowers were seated, there were two male florets, one on each side of the pair, while in the upper portion where the flowers were very close to each other one could notice occasionally one male floret between two consecutive female flowers. All the male flowers present at the time of examining the inflorescence had shed their pollen and were quite dry. Many of them dropped down with a slight shake, leaving behind no clear marks or scars to show that they were present there. Like normal flowers, they (male flowers) had six segments in perianth, six stamens and a vestigial ovary.

All the female flowers examined were morphologically normal, except that the papery yellow ring which is usually found around the base of the ovary was occasionally adorned with teeth varying from one to six in number. (For the morphological value of this ring see note on Horned Coconuts). The development of these flowers was acropetal so that the youngest flowers were found at the terminal end. Though many of the flowers towards the basal end had their stigmatic portion out of the perianth envelope, not a single one of them was ripe to receive pollen. This therefore means that any nut developed on such inflorescences would be a result of cross-pollination, unless of course they are fertilised by the pollen from another inflorescence on the same tree or by pollen from the same inflorescence which had retained its vitality till the female flowers had become ready to receive it. That similar inflorescences are not infertile was proved by two other such inflorescences, one at Taiping and the other in Kuala Lumpur. The Taiping specimen had three well-developed nuts and the Kuala Lumpur one had five, in their distal end.

Owing to the advance stages of all such inflorescences examined no further details could be gathered as to the exact relation of the male to female flowers, or as to the nature of the phenomenon concerned in the monstrosity.

I was told in Taiping that the palms which produce these monstrous inflorescences have the habit of producing such monstrosities many times during the course of a year. If so, it would be worth while to keep the palms under observation so as to study how these inflorescences originate, what exactly is the composition and nature of the spathes enveloping them, of young flowers, etc. Such a study may help to throw light as the cause and the nature of the phenomenon involved.

Costerus and Smith[6] who have had a better opportunity of studying such specimens record that all the female flowers in such inflorescences they examined were paired, each female flower being

6. Costerus and Smith.—Ann. Jard. Bot., Buitenzorg, XXXII (1923), p. 24-25 and plates.

flanked by two male florets, but that these male florets soon perished. Similar inflorescences having a side branch have occasionally come to their notice.

V. Horned Coconuts. At the Malacca Agri-Horticultural Show, 1926, three "horned" coconuts (*kelapa tandok*) were shown, each having a horn in appearance similar to the husk. This horn measured five inches in length, and one and one-fourth inches thick in the central portion. It had two small lobes one on each side of the principal one which was large and thick. A copious exudation of gum was found on the inner side of the horn (the side towards the nut), and where there was gummy exudation, the epidermis of the horn seemed to be much affected though the epidermal tissue of the nut appeared to be quite intact. The perianth was then carefully removed from the nut and it was found that this horn was due to the abnormal development of the one side of the papery ring that is usually found between the perianth and the nut, the growth of the other half of the ring having become arrested at an earlier stage, so that it was not visible when the perianth was still attached to the nut. This portion of the ring also had one principal central lobe which measured about one centimeter from the tip of the base, and two small slightly developed ones, and it resembled the perianth in texture. At the tip of the central lobe abundant exudation of gum was noticed. The thalamus had also grown out a little more than usual, especially on the side of the horn, so that the horn could be mistaken for a basal outgrowth of the nut. The horn when cut open was found to be full of fibrous tissue only, like that of the husk, while the nut itself was normal and had all its three "eyes" as usual. The perianth consisted of six normal segments. Hence the view put forward by Masters[7] that these horns are due to the hypertrophy of the perianth segments is untenable.

Petch (1924)[8] describes similar cases of horned coconuts and mentions that the horns may very in number from six downwards and that they sometimes coalesce in pairs, or two or three may unite by their tips. Some of these horns may be fringed by a thin wing, resembling in texture the segments of the perianth. In all such cases examined by him perianth segments were also present and were normal.

Costerus and Smith[9] figure somewhat similar cases in the Buitenzorg *Annales* which they consider to be instances of

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7. Masters, M. T.—*Vegetable Teratology* (1869), pp. 428-429).

8. Petch, T.—Horned Coconut. *Year-Book Dept. of Agric., Ceylon,* (1924), p. 20-21.

9. Costerus, J. C. and J. J. Smith.—Studies in Tropical Teratology. *Annales Jard. Buitenzorg,* XXXIII (1923), p. 95 and fig. 23.

apocarpy, but in the absence of a detailed description, those cases cannot be compared with the above described ones.

Petch seems to favour the view that the horns are due to a duplication of the segments of the gynaecium. But I am inclined to adopt his less favoured view that the horns represent the six stamens. The following will make clear the position of my view:

Examining flowers of coconut, one usually finds in the male, six perianth segments surrounding six stamens inside and a rudimentary pistil in the centre, and in the female, six perianth segments, a fertile pistil in the centre, and a papery ring between the base of the pistil and the inner perianth segments; that is, the papery ring occupies the place of the androecium in the male flower. May not then this papery ring in the female flowers represent the androecium which in the course of evolution has been reduced to this vestigial state? The fact that this papery ring is invariably present in the female flower, and a vestigial ovary is the male flower, and that the ring is a growth quite distinct from the perianth and the ovary, lends support to this view. And from the examination of the horned nuts exhibited at the Malacca Show, it was quite evident that the horns were due to the development of portions of the ring.

Gadd (1924)[10] describes abnormal female flowers of coconut where three carpels were fused only at the base, being free to a greater or less extent at the apex. "Between the perianth and the gynaecium was a ring of six papillae, in a position which stamens would be expected to occupy, if present." These flowers seem to represent a somewhat earlier stage in the evolution of the female flower of coconut.

Recent histological studies made by Juliano[11] regarding the ontogenetical development of the female coconut flower form an additional evidence in favour of the view that the papery ring is a modified androecium. He shows by means of microtome sections that the development of the floral structures is acropetal, that is, the outer two prophylls are first differentiated from the primordium, then the sepals and the petals follow in succession. The ring which he calls "aril" arises just after the formation of the petals but much before the primordium has differentiated into an ovary and carpels. Hence therefore the ring or the horns cannot be an outcome of the multiplication of the carpels.

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10. Gadd, C. H.—An Abnormal Inflorescence from a Nut. *Year-Book, Dept. of Agric., Ceylon*, (1924), p. 21-23.

11. Juliano, J. B.—Origin, Development, and Nature of the Stony Layer of the Coconut. *Philipp. Journ. Sci.*, XXX (1926), p. 187-200 and pl. 1-3.

B.—Ananas sativa.

It is not uncommon to see various forms of monstrosities in the fruits (soroses) of pine-apples (*Ananas sativa*). Hitherto I have been the following abnormal forms in this Peninsula:—

I. Fasciation. One of such monstrous pine-apple fruits had cylindrical base about two inches long and was much stouter than the average fruits of the same variety. The fruit then showed a tendency to taper in one axis and expand in the other. The expansion had occurred to such an enormous extent that it had given rise to several twistings and bendings. Measurements with a tape would indicate that the topmost part of the fruit had become more than two feet in breadth, while its thickness had been reduced to about an inch or a little more. The foliose shoot that usually crowns a pine-apple fruit had also fasciated apace with the fruit. Its vertical axis had become abbreviated to a very considerable extent and the leaves were reduced to mere scales, about an inch and half in length and half an inch in breadth, so that the expanded apex of the fruit appeared as if fringed with these scaly leaves. This forms appears to be very rare in pine-apples.

Another form of fasciation that is more commonly met with in pine-apples is one which differs from the former in that the fruit in the latter flattens to a less extent and produces many cylindrical heads, each with a normal or reduced crown of its own. I have seen pine-apples with three, five and seven heads.

The third kind of fasciation affects the crown of the fruits only. In one such specimen the leafy crown had trifurcated, the fruit itself remaining normal. That these three shoots were due to fasciation of the main axis and not to the proliferation of the two axillary shoots was easy to be seen as the leaves were reduced to small scales and the lower portion of the stalk had become very much thicker.

Fasciation showing various grades of these three cases have been also observed.

II. Proliferation. On the stalk bearing the three-headed fasciated fruit described above, there were many, much proliferated, vegetative shoots arising from the axils of the bracts. They had grown as long as the fruit itself, and were present only in the upper portion of the stalk, close to the base of the fruit, lower portion of the stalk bearing no such shoots.

In another specimen there was a similar proliferation of shoots in the axils of bracts close to the fruit, but these shoots were reproductive so that they produced many banana-like, elongated fruits at the base of the main fruit.

Sometimes axillary shoots on the base of the leafy crown of the pine-apple fruit grow very vigorously, even much faster than the main shoot itself.

Proliferation of vegetative shoots on the stalk or on the crown of the fruit is very common, almost a "normal" phenomenon in pine-apples. Production of fruits at the base of the principal fruit has been noticed by me only twice in this country.

C. X. Furtado.

Dioscorea tamarisciflora, *Pr. and Burk.*

In September, 1890, Mr. Charles Curtis collected in the Langkawi islands a Dioscorea with male flowers, which was described in 1914 under the above name in the Journal of the Asiatic Society of Bengal, N. S., 10, p. 22, and until recently it has remained known only by his specimens. But in the early part of 1924, two collectors, Mohamed Nur and Kiah, were sent from the Botanic Gardens, Singapore, to the mountain of Gunong Pulai in the south-western part of the State of Johore, whence they brought back living tubers of the same plant; and these gave upon cultivation in the Gardens, both male and female plants. It is possible therefore to add to what is already known about it.

The tubers are black, densely covered with short roots, sparingly branched, the branches more or less cylindrical. They form at the surface of the soil and descend for 20 to 30 cm. It would seem by their appearance and surface growth as if they may be altogether unappetising to the hungriest of wild pigs, the chief destroyers of edible forest tubers. The plate given here well illustrates them.

The stems towards the base and also above carry sparingly small prickles. They attain the thickness of a crow-quill, and climb over any convenient support to 2 or 3 metres.

The upper leaves have been described. The lower are similarly ternate and scarcely differ. All leaflets are relatively small, the middle attaining little more than 5 cm. by 1.75 cm.

The male flowers have also been described. They were produced in Singapore in the greatest abundance.

The female flowers were more sparingly developed. They offered nothing that is not seen in the closely allied species of Dioscorea, section *Lasiophyton*.

The capsules resemble those of *D. pentaphylla*: but are slightly more acute, as the accompanying line block shews.

From the Langkawi islands to Gunong Pulai in a straight line it is about 450 miles, i.e. almost the whole length of British Malaya; and the species may occur sporadically throughout the Peninsula. It has been already found in one other place, namely