

Floral abnormalities in coconuts

1. Abnormal male flowers in a dwarf (natural cross) palm.

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ALTHOUGH a number of abnormalities have been reported from time to time in many plant species, coconut (*Cocos nucifera* L.) is of special interest in that it exhibits quite an array of abnormal development with regard to vegetative organs, floral parts as well as fruits and seeds. The various abnormalities so far encountered have been described by Menon and Pandalai (1958) in their monograph on the palm. That we have not so far fully acquainted with all the abnormalities occurring in the palm is brought to light by recent reports on other abnormal features which have hitherto been unknown. In the present article is described an unreported case of abnormal development of male flowers in a palm.

The tree producing the abnormal flowers grows in the Kith Block of the Central Coconut Research Station, Kasaragod and is a progeny of Chowghat dwarf red originally planted as a pure dwarf; but it

appears to be a natural cross of dwarf with tall male. In external appearance the tree is quite normal and a moderately good bearer. As will be seen from Figs. 1b and 2 the abnormal male flowers are borne on fairly long stalk-like portions at the tips of spikes. Every spike in an inflorescence and every inflorescence in this tree show this abnormality.

In order to make clear the nature of the abnormality observed, a detailed description of a typical male flower in coconuts is necessary. A typical male flower has 6 perianth lobes arranged in two trimerous whorls. The outer row consists of three small, free sepals and the inner of three large free valvate petals. Inner to the perianth segments are six large free stamens and in the centre of the flower three small tooth-like structures, constituting the pistillode.

Unlike the normal male flower above described, the abnormal

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flowers met with in this tree show from Table 1 below, in which varying numbers of perianth parts, detailed analysis of 67 different stamens and pistillodes as seen types of flowers is given.

TABLE 1
Showing details of floral parts in the abnormal flowers

	Sl. No.	Perianth parts	Stamens	Tooth-like structures representing the pistillode
	1	2	3	4
Normal flower	1.	6	6	3
Abnormal flowers	2.	1 normal + 1 trifold at the tip	6	4
	3.	6	8	3
	4.	6	8 normal stamens + 1 sterile filament	7 + 1 bifid at the tip
	5.	7	7	3
	6.	7	5 + 2 sterile filaments	2+2 bifid at the tip
	7.	7	7	2+1 bifid at the tip
	8.	7	8+2 sterile filaments	4
	9.	6+1 bifid at the tip	8	4
	10.	8	5	4
	11.	8	6	3
	12.	8	7	3
	13.	8	7+1 sterile filament	4
	14.	9	8	4
	15.	9	8+1 with half anther	4
	16.	10	8+1 sterile filament	5
	17.	10	8+2 with half anthers	5
	18.	10	9+1 sterile filament	7
	19.	10+1 with inner petaloid growth	6	4
	20.	11	9	5
	21.	11	12	6

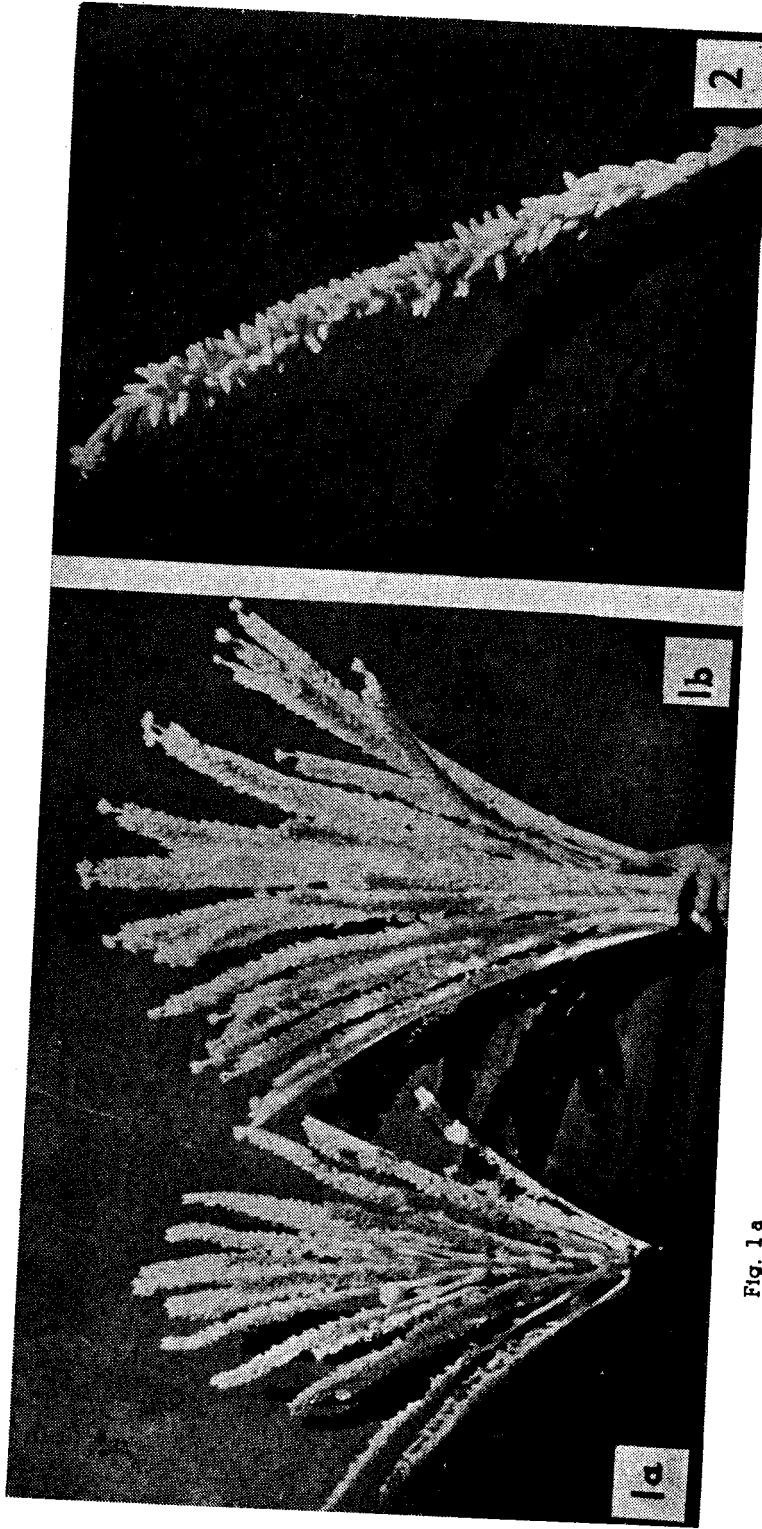


Fig. 1 a
A normal inflorescence of
the dwarf variety

Fig. 1 b
An inflorescence with abnormal
flowers at the tips of spikes

Fig. 2
A spike with the abnormal
flower at the tip

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1	2	3	4
22.	11	14+1 sterile filament	31
23.	12	16+1 with single anther+ 1 with swollen connective and filament	16
24.	12	14+1 fused to perianth	15
25.	12	16	20
26.	13	6+1 with half anther +1 sterile filament	5
27.	13	9+1 with 2 anther lobes fused with perianth	7
28.	13	11	3
29.	10+1 trifid at the tip	11	7+1 bifid at the tip
30.	13	10	13
31.	13	13	11
32.	13	14	11
33.	14	7	6
34.	14	15	23
35.	15	12+1 sterile filament	8
36.	16	22	29
37.	17	11	12
38.	17	17	17
39.	19	19	19
40.	19	21	14
41.	18+1 bifid at the tip	22	59
42.	19	26+3 sterile filaments	24
43.	20	30+1 sterile filament	25
44.	20	16	21+2 bifid at the tip
45.	21	22	15
46.	21	19	21
47.	20	27+1 with petalloid filament+1 half anther attached to perianth	27+2 bifid at the tip

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	1	2	3	4
48.		21	31	23
49.		22	24	24
50.		21+1 with inner outgrowth	21+2 attached to perianth	32
51.		23	20	10
52.		23	26	12
53.		23	24+1 with half anther fertile and other half sterile + 1 sterile filament	25
54.		23	27	13
55.		23	26+2 stamens fused by their filaments + 4 sterile filaments	16+1 bifid at the tip
56.		25	30	33
57.		26	35+1 with single anther lobe+1 with 3 anther lobes+2 sterile filaments	24
58.		28	30+2 with half anthers	23
59.		29	33+2 sterile filaments	32
60.		29	32	23
61.		30	36	18
62.		31	34	35
63.		32	31	21
64.		31	32+2 fused by lower side of anther lobes + 2 fused to perianth + 7 sterile filaments	21
65.		35	42	33
66.		36	47	7
67.		36	37+2 united + 4 sterile filaments	26
68.		30	43+1 with 3 anther lobes+3 sterile filaments	39

FLORAL ABNORMALITIES IN COCONUTS

In most of the flowers examined there are incredibly large numbers of floral parts ranging from 6-39 perianth lobes, 5-47 stamens and 3-39 pistillodes. An abnormal flower and its parts (19 perianth lobes, 19 stamens and 19 pistillodes) are illustrated in Fig. 3. The stalk-like

FIG. 3



An abnormal male flower (A), with 19 perianth parts (B), 19 stamens (C) and 19 pistillodes (D)

portion bearing the abnormal flower is 1-2" long and is covered by spirally arranged bracts.

In addition to the variation in number of floral parts, several

teratological features of perianth parts, stamens and pistillodes have also been noted. Some of these are illustrated in Fig. 4 and they include;

FIG. 4.



Some teratological features of floral parts in the abnormal flower.

- A & B. *Trifid and bifid perianth lobes.*
- C. *Petal with inner petalloid growth.*
- D. *Petal with inner fleshy outgrowth.*
- E. *Petal with half anther attached.*
- F & G. *Petal with anthers attached.*
- H & I. *Petalloid filaments.*
- J. *A typical stamen.*
- K. *Stamen with swollen filament.*
- L. *Stamen with upper portion of filament and connective swollen.*
- M. *Stamen with three anther lobes.*
- N. *Two anthers on a common filament forked at the tip.*
- O. *Stamen with one anther lobe fertile and the other sterile.*
- P & Q. *Half anthers with two types of attachment.*
- R. *Sterile filament.*
- S & T. *Tooth-like portions of pistillodes showing forked tips.*

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1. bifid and trifold perianth lobes.
2. perianth with inner petaloid or fleshy out-growths, stamens, anthers or half anthers attached in different ways.
3. stamens with swollen filaments, filament and connective both swollen.
4. stamens with three fertile anther lobes.
5. stamens with half anthers.
6. stamens with one anther lobe fertile and the other sterile.
7. stamens reduced as sterile filaments.
8. stamens with two separate anthers at the tips of forked filaments.
9. stamens with petaloid filaments.
10. bifid pistillodes.

COMMENTS

Though stray instances of abnormal flowers with increased numbers of perianth parts, stamens and pistillodes have been reported before, the maximum number of parts noted so far are 13 perianth lobes in a female flower and 9 perianth parts, 12 stamens and 6 pistillodes in a male flower. In the present case most of the flowers show very large numbers of floral parts, up to more than 6 times the number of perianth, about 8 times the number of stamens

and 13 times the number of pistillodes present in a normal male flower. It is significant to note that this increase in number of floral parts in most cases is not in conformity with the trimerous organization of the typical flower. Equally interesting is the fact that in the abnormal flowers examined the number of floral parts is never less than that present in the normal flower save for two instances in which a flower showed 5 stamens and another, 2 perianth lobes of which one was trifold, indicating fusion of 3 lobes. These are cases of reduction in the number of floral parts. Another point of interest that deserves mention is the teratological features exhibited by the perianth parts and stamens. The various floral parts ranging from typical sepals to typical stamens indicate that these teratological developments, though fortuitous, may give significant hints about the trend of progressive evolution of the floral whorls.

Recent investigations on staminal teratology in *Nicotiana* (Krishnamurthy and Bhat, 1959) have shown that they may be heritable or non-heritable. They have also shown that some of the heritable malformations are controlled by recessive genes. There can be no doubt that some of the many abnormalities in coconuts especially those concerning the floral organs, which constitute a majority of freaks on record, may also be heritable though the

inherent difficulty connected with genetic experiments in this species, stands in the way of their detection. The presence of abnormal flowers in all the inflorescences in this tree suggests that it should be due to some genetic peculiarities of the tree.

Cytological studies on this palm did not reveal any detectable difference in chromosome behaviour. Meiosis was quite normal with regular pairing leading to the formation of 16 bivalents.

There is however, possibility that cryptic structural differentiation of chromosomes or gene mutations may be involved. Recent investigations on the cytology of the *spicata* palms with unbranched inflorescences (Ninan & Josy, unpublished) have revealed the presence of

heterozygous inversions, translocations and repeats at pachytene in pollen mother cells. Though the bearing of these chromosome alterations on the *spicata* character in coconuts is yet to be established from evidences on breeding behaviour, it is likely that similar chromosome alterations of a detectable or cryptic nature or gene mutations might be responsible for some of the floral abnormalities in coconuts.

The present finding of abnormal flowers in the progeny of a dwarf palm is also of special interest in that almost all the abnormalities on record in coconuts have been encountered in the tall variety.

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