

OCCURRENCE OF CHLOROPHYLL DEFICIENCY IN ARECANUT

(*Areca Catechu* Linn).

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INTRODUCTION

Arecanut palm is a green foliaged plant, occurrence of cases of chlorophyll deficiencies being hitherto not recorded. Chlorophyll deficiency in the seedlings is a common feature in several cereals and has been reported in rice, maize, wheat, barley etc. That such deficiency is brought about by genetic factors has been well established by work done on rice and maize. Though most of these characters which are recessives

to the normal green are inherited in a Mendelian fashion, non-mendelian inheritance involving the plasm has also been recognized in several cases. Plants heterozygous for the factors may appear green and cannot be distinguished from the homozygous green except by breeding tests. It has also been found that some of these factors in their homozygous state are completely lethal in their effect on the seedlings necessitating the continuation of species only through heterozygous individuals. The study of the effects

of two lethal recessive seed factors on the height of maize has revealed that normal green plants are the tallest, those heterozygous for one character being slightly shorter and those heterozygous for both the characters being the shortest.

REVIEW

Ramiah K. (1929) while studying the inheritance of characters in rice has reported the occurrence of pure white Mendelian recessive lethal in the definite proportion of 3:1 and 15:1 of green to white with other more complicated ratios. Besides he has also reported an intermediate form, pale yellow in colour and slow in growth which attained maturity like the normal greens. *Morinaga T* (1932) as quoted by Ramiah et al, has recorded the simple inheritance of yellow seedlings, *Xantha* which perishes within two or three weeks after germination. Mitra and Ganguli (1934) have reported the inheritance of white striped and albino plants. They found that the white striped plants segregate into a 3:1 ratio of green to striped plants. The white striped character has also been reported to be persisting. Ramiah and Ramanujam (1935) have noted the occurrence of green and yellow striped seedlings and yellow and white striped seedlings in rice which subsequently changed to green. Zebra marked seedlings with the first few leaves showing horizontal band of white and green have also been reported. Babcock and Clausen (1927) while discussing the chlorophyll deficiency in plants have stated that in maize the seedlings devoid of chlorophyll die as soon as they have exhausted the food material in the endosperm. Albinism has also been recorded in coconut (Patel 1938). Occurrence of chlorophyll

deficiency in arecanut has not been reported so far.

OBSERVATIONS

Twentyfive thousand to fifty thousand seednuts gathered from the premarked mother palms were sown at the Central Arecanut Research Station, Vittal, from 1955-56 onwards for raising quality arecanut seedlings. The nuts gathered from individual palms were sown separately and the following general observations regarding the occurrence of chlorophyll deficiencies were made while recording their germination.

(a) *Albinos* :—(Plate 1-2). Out of the 25,000 seedlings raised from 164 mother palms during the year 1955-56, nuts of a few bunches collected from individual mother palms were found to give rise to white seedlings. The range of occurrence varied from 2.4% to 13% in individual bunches. But the percentage of these seedlings to the total population raised was rather low being only 0.028. Nuts gathered from mother palms which exhibited albinism were found to be consistently segregating year after year for this character. The seedlings were pure white in colour and without any pigment on leaves and stem. The albinos were transplanted along with the normal greens under identical conditions after noting the morphological features of the seedlings. The seedlings got established and continued to put forth two to three fresh leaves. Thereafter there was no growth and the seedlings died in about 300 days after sowing the nuts. The seedlings were poor in growth with few functioning leaves and roots (Table).

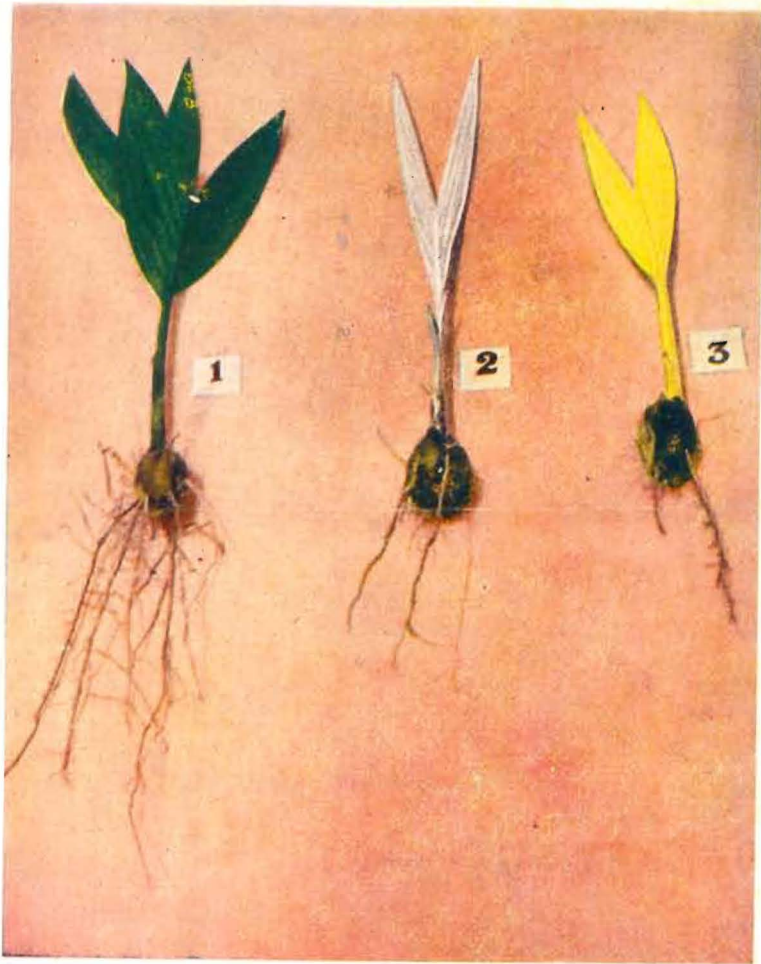


Plate I

1 Normal Green. 2 Albino. 3 Yellow (Xantha).

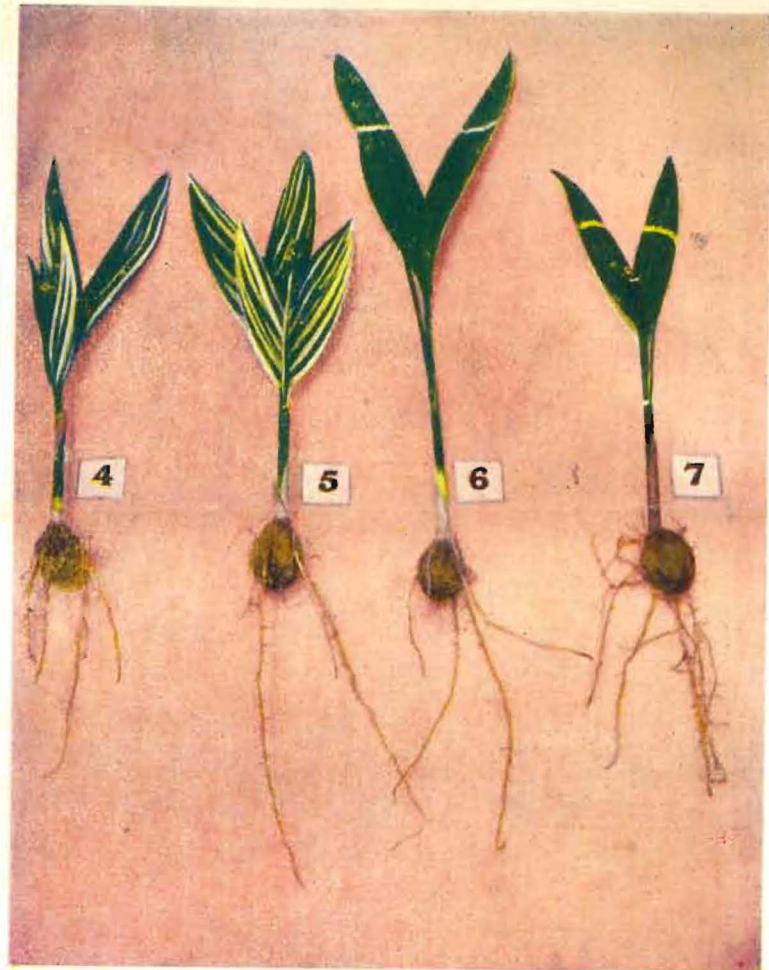


Plate II

4 Green & White Striped. 5 Green, Yellow & White Striped.
6 Zebra-White. 7 Zebra-Yellow.



Plate III
Green, Yellow and White Stripes on
Tender Green Stem and Leaf Sheath.

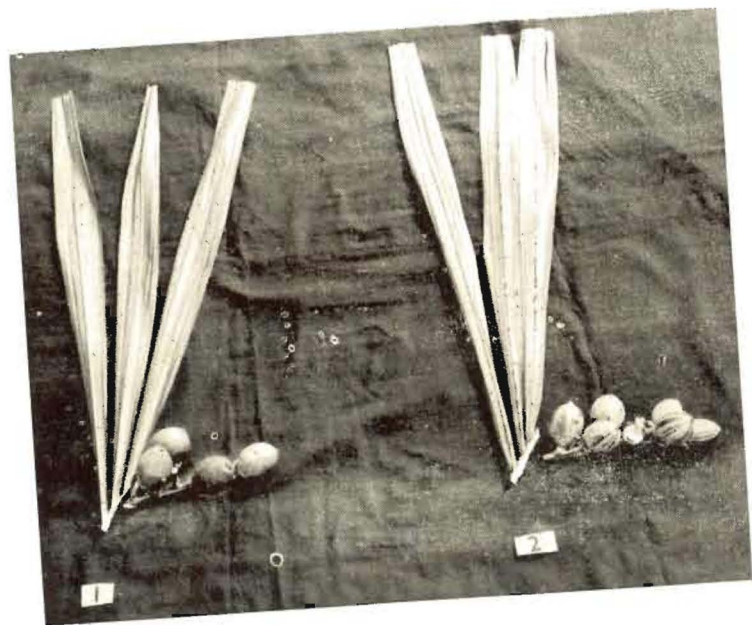


Plate IV
1 Leaf & Fruit of Normal Green Palm.
2 Leaf & Fruit of Green, Yellow and White Striped Palm.

(b) **Yellow (Xantha) Plate 1 - 3:**—The occurrence of these seedlings which are deficient in their chlorophyll content and which are deep yellow in colour were rather low, the extent of occurrence being 2.1 to 5.9% in the individual bunches. The percentage of these seedlings to the total population worked out to 0.032. The morphological features of the seedlings were recorded and the seedlings transplanted. Even though the seedlings got established, they did not survive beyond 300 days after sowing the nuts. The seedlings were poor and almost similar to albinos with quite a few roots and functioning leaves (Table).

Seedlings with variation in the depth of chlorophyll pigment with all gradations of green to yellowish-green colour of the leaves as well as the stem were also noted.

(c) **Green and white (Plate II-4):**—In the case of these seedlings, the white stripes are found to develop over the green. The occurrence in the different bunches varied from 1.6% to 12.2% and the percentage to the total population was 0.100. The seedlings were transplanted after recording the morphological characters and they got established like the normal green. The seedlings in general were poorer than the normal green with reference to number of roots, their length and girth (Table).

(d) **Green yellow and white striped seedlings (Plate II-5):**—This type which showed development of yellow and white stripes over the green was found to occur to a large extent in the population. The range of occurrence in the different bunches varied from 2.0 to 15.3% and the percentage to the

total population was 0.216. The seedlings were transplanted after recording the morphological features. They were found to be fairly normal when compared with normal green even though the number of roots and girth were slightly less. They established well and were found to grow like the normal greens retaining the stripes throughout.

During the course of survey of gardens, a young palm with green yellow and white stripes on the tender green stem as well as on the leaves and leaf sheath was spotted out (Plate III). Another bearing palm with similar characters was also observed and on examination, it was seen that even nuts and floral parts showed the striped character (Plate IV). Ripe nuts from this palm also retained the striped character.

(e) **Zebra - white and yellow (Plate II - 6 and 7):**—Seedlings with white or pale yellow stripes across the leaf length were found to occur in large percentage in certain lots. The occurrence of such zebra marking was found to be limited for the first three or four leaves, leaves produced thereafter being quite normal. Leaves were found to dry first along these zebra markings forcing the portion above these markings to break off, giving finally a cut appearance to the leaves. The percentage of occurrence of such plants varied from 5.0 to 42% and the percentage to the total population was 0.138. The morphological data of the seedlings recorded showed that they were almost similar to the normal greens (Table).

A comparative statement of morphological features (mean data) is given in Table below.

MORPHOLOGICAL FEATURES (MEAN DATA).

Type of seedlings.	Primary roots		Secondary roots.	No. of leaves		Height (c.m.)	Girth (c.m.)
	No.	Length (c.m.)		Total	functioning		
(a) Albino.	4.3	10.5	Sparse	3.3	1.6	26.3	3.3
(b) Yellow (Xantha).	2.3	11.6	Sparse	2.6	1.6	23.6	3.0
(c) Green and white.	6.0	16.0	Large	3.5	2.5	27.0	4.5
(d) Green white and yellow.	7.0	15.7	Large	4.0	4.0	29.0	4.5
(e) Zebra.	6.5	17.8	Large	4.0	4.0	25.5	5.2
(f) Green.	10.0	23.3	Large	4.0	4.0	30.0	6.0

DISCUSSION.

The chlorophyll deficient characters noted in arecanut shows a good deal of similarity with the chlorophyll deficient types noted in maize and rice. It may be mentioned here that arecanut is also essentially a cross fertilized crop like maize.

As regards the extent of occurrence of these types in arecanut, it has been found that unlike rice and maize wherein white seedlings had the most frequent occurrence, it was the striped seedlings that were noted to the maximum extent. The white and the yellow seedlings could not survive beyond 300 days. These types as well as the others were poorer than the normal green in their vegetative growth as seen from the table.

The presence of chlorophyll defective characters is unfavourable from the economic point of view, as apart from the lethal or semi-lethal effect of the character in the homozygous condition, it has been shown that plants heterozygous for such characters

may be less vigorous than the homozygous green plant. (Mangelsdorf as quoted by Ramiah et al 1935). In naturally cross fertilized plant like Areca, these recessives are preserved in the heterozygous condition and are accumulated but readily brought to light when the stock is selfed. The segregation of these chlorophyll characters thus indicates the possibilities of selfing taking place to a certain extent or the presence of plants with similar genetic constitution in the near vicinity. In view of the fact that such characters are not economically advantageous, it will be worthwhile to avoid plants of such genetic constitution in the hybridization programme. Further studies which are underway will throw more light on this aspect.

SUMMARY.

Five chlorophyll deficient forms recorded in arecanut for the first time have been described. The extent of their occurrence have been worked out. Of all the types,

striped seedlings were found to occur to the maximum extent, the least being albinos. The economic advantages or otherwise of such deficiencies have been indicated.

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