

INHERITANCE STUDIES ON THE PHYLLOTAXY OF COCONUT PALM

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ABSTRACT

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Inheritance studies on the two distinct types of phyllotaxy in coconut palm indicated that the F_2 segregated for left and right whorls in 1 : 1 ratio irrespective of left \times left, right \times left, left \times right and right \times right combinations. Dominance of either character is ruled out. Asymmetry in coconut palm is decided entirely by probability and does not appear to be controlled by genotypic differences, nor does there seem to be a cytoplasmic effect.

INTRODUCTION

The leaves of coconut palm (*Cocos nucifera*. L) are alternate and arranged in five spirals, running clockwise or counter clockwise. This arrangement continues throughout the growth of the palm. The spathes emerge in a specific direction, left or right from the axil, depending on the clockwise or anticlockwise aestivation of the leaves. The palms with clockwise twist is termed left handed, and the counter clockwise as the right handed (Davis 1963). The inflorescence from a clockwise phyllotaxy falls on the clockwise direction and vice versa and never on either directions. These two specific morphological differences are accompanied by a number of other characters. Davis (1962) studied from different populations and concluded that the leaf direction is not genetically determined. The frequency of lefts ranged from 52.05 to 52.90% (Davis, 1963). But no systematic breeding has been taken up to study the inheritance of the palms with the two specific phyllotaxies. Hence a study was undertaken on this aspect at the Coconut Research Station, Veppankulam and the results are presented in this paper.

MATERIALS AND METHODS

Crosses were effected with the clockwise (left handed) and counter clockwise (right handed) mother palms in all the possible combinations, and the progenies studied at the nursery. Special care was taken to sow only well set and matured nuts in the nursery. Observations on the number of nuts which germinated, the lethal seedlings and the healthy seedlings with their twist were recorded.

Table 1. Number of clockwise and counter-clockwise palms involved in various cross combinations

| Combinations | Number of palms involved | |
|------------------------------------|--------------------------|-------------|
| | Right Spiral | Left Spiral |
| Right spiral \times right spiral | 96 | — |
| Right spiral \times left spiral | 23 | 23 |
| Left spiral \times right spiral | 57 | 57 |
| Left spiral \times left spiral | — | 24 |

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RESULTS AND DISCUSSIONS

The observations recorded are presented in Table 2(a) & (b). The progenies obtained from the different combinations segregated for the 1 : 1 ratio. The ratio did not make much difference even when the lethals added to the right or left twisting progenies. Lethality was highest (4.87%) in the left × right combination while it was minimum (0.47%) in right × right.

Progenies of the various cross combinations failed to reveal dominance of any particular trait and they segregated into clockwise and anticlockwise aestivation for an apparent 1 : 1 ratio. The two types of phyllotaxies obtained from the pooled population were also equal and segregated for a specific 1 : 1 ratio. The ratio did not make much difference even when the lethals are added to the right or left twist, and failed to fit into any of the accepted segregation ratios. The clockwise and anticlockwise aestivations were 48.6 and 51.3% of the total.

Table 2 (a). *F₁ Progenies with clockwise and counterclockwise twist from different cross combinations*

| Combination | No. of palms involved | | No. of nuts sown | No. of nuts failed to germinate | Dead sprouts and lethals | Seedlings observed | |
|-------------------------------|-----------------------|---------------|------------------|---------------------------------|--------------------------|--------------------|---------------|
| | Clockwise twist | Anticlockwise | | | | Clockwise | Anticlockwise |
| Clockwise × Clockwise | 96 | — | 217 | 41 | 1 | 79 | 96 |
| Clockwise × Anticlockwise | 23 | 23 | 266 | 65 | 6 | 103 | 91 |
| Anticlockwise × Clockwise | 57 | 57 | 433 | 90 | 11 | 159 | 173 |
| Anticlockwise × Anticlockwise | — | 28 | 246 | 48 | 12 | 87 | 91 |
| Total | — | — | 1162 | 244 | 30 | 428 | 451 |

Table 2 (b). *Ratio of germination lethality and healthy seedlings observed*

| Characters | Clockwise × Clockwise % | A. clockwise × A. clockwise % | Clockwise × A. clockwise % | A. clockwise × clockwise % |
|---------------------|-------------------------|-------------------------------|----------------------------|----------------------------|
| Ungermination | 17.87 | 22.14 | 24.17 | 19.45 |
| Clockwise-Twist | 44.24 | 34.21 | 40.00 | 30.99 |
| Anticlockwise Twist | 36.40 | 38.72 | 36.72 | 35.37 |
| Lethals | 0.47 | 2.25 | 2.52 | 4.87 |

Davis (1969) has stated that the direction of the foliar spiral in *Cocos nucifera* is not genetical. He obtained 51.16% lefts (clockwise) and 48.84% right (anticlockwise) from population obtained from different centres. The present breeding study reveals that the dominance of either character is ruled out and the segregation is a mean probability. The trait seems not controlled by genotypic differences.

CONCLUSION

Inheritance studies on the clockwise (left handed) and counterclockwise (right handed) aestivation in Coconut palm (*Cocos nucifera*. L) revealed that the F_1 plants segregated in 1 : 1 ratio for the two characters irrespective of the combinations. Dominance of either of the character to be is ruled out. The asymmetry in this palm is decided entirely by probability and does not appear to be controlled by genotypic differences, nor does there seem to be a cytoplasmic effect.

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