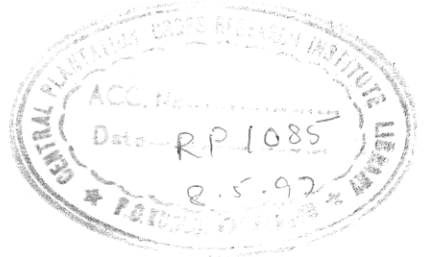


LEAF EPIDERMAL CHARACTERISTICS OF SOME TALL AND DWARF CULTIVARS OF COCONUT, *Cocos nucifera* L. IN THE SUNDARBANS AREA OF WEST BENGAL

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Summary

Results of a comparative study on the leaf epidermis of five tall and three dwarf cultivars of coconut, *Cocos nucifera* are reported. The mature stomata are of tetracytic type. The stomatal frequency and length of guard cells vary significantly ($P \leq 0.05$) among cultivars. The highest frequency of stomata per unit area and the largest guard cells occur in dwarf cultivars (Malayan dwarf yellow and Chowghat dwarf orange respectively). Other characteristics which vary significantly among the cultivars are - number of epidermal cells mm^{-2} and the length of epidermal cells and trichomes. The number of trichomes per unit area however, remains more or less constant among both tall and dwarf cultivars. On the basis of epidermal characteristics, it may be concluded that epidermal characteristics of leaves, particularly stomatal frequency and stomatal index can be regarded as useful characters for identification and selection.

Introduction

The Coconut, *Cocos nucifera* L., is a useful plant of the family Arecaceae (Palmae). Every part of this plant is utilised by humans in one or the other way; hence it has acquired the name 'Kalpabriksha' (heavenly tree). There are two distinct varieties of coconut, tall and dwarf. Each variety has several cultivars. The tall plants start flowering at the age of about 7-8 years and the dwarf ones at about 4 years. They also vary in structure and several morphological characteristics.

The stomata play an important role in dry matter accumulation to the mesophyll cells. Considerable work has been done on the ontogeny, frequency and size of stomata, trichomes and epidermal cells in different palms (Bavappa 1966; Ghose 1979; Ghose and Davis 1973; Ghose, Johri and Davis 1985; Mahabale and Shirke 1967; Tomlinson 1961; and others). However, we are not aware of any comparable studies into coconut palms. The objective of the

present article is to find out the range of variations between different cultivars of both tall and dwarf coconuts in respect to frequency of stomata, epidermal cells and trichomes per unit area, length of guard cells, epidermal cells and trichomes, and width of epidermal cells.

Materials and methods

Small pieces of lamina collected from the mid portion of mature leaves of three plants of each cultivar were studied in five tall cultivars (LM, Lakshadeep micro; WCT, west coast tall; AO, Andaman ordinary; LO, Lakshadeep ordinary; and Local) and three dwarf cultivars (CDO, Chowghat dwarf orange; ISID, Indian Statistical Institute dwarf; and MDY, Malayan dwarf yellow). Most of the seedlings were raised at the district seed farm, Manmathanagar, South 24 Parganas, from seednuts collected from the Central Plantation Crop Research Institute, Kasaragod, Kerala, India. The seednuts of 'Local' and ISID were collected from Manmathanagar and Indian Statistical Institute, Calcutta respectively. The seedlings were transplanted in square method with a spacing of 7.6 m at the corners of each square. The distance between palms in each row and the distance between adjacent rows were the same (7.6 m). Three randomly selected palms from each cultivar were sampled at 3.5 years of age. Epidermal peelings of lamina were prepared according to a method described elsewhere (Ghose & Davis 1973). The peelings were mounted in phenol-glycerine. Ten observations from each leaf sample were taken using a compound Olympus microscope fitted with a lens combination of 7 x 40 which covered an

area of 0.17 mm². Frequency data were converted to stomata per mm². Measurements were also made of the length of guard cells, epidermal cells and trichomes, and width of epidermal cells.

The sampling data were subjected to analysis of variance and Duncan's multiple range test (DMRT) (Gomez & Gomez 1984). The stomatal index was calculated according to the formula given by Salisbury (1927): $I = S/(S+E) \times 100$, where S = number of stomata per unit area, E = number of epidermal cells per unit area and I = stomatal index.

Results and discussion

Stomata

The mature stomata in leaves of *Cocos nucifera* are of tetracytic type (Metcalf 1961) where each stoma is surrounded by four subsidiary cells, two polar and two lateral. The polar subsidiary cells are short and wide, while lateral ones are long and narrow and lie parallel to the long axis of guard cells (Fig. 1). Stomata are totally absent on the adaxial surface (Fig. 2), found only on the abaxial surface, arranged parallel to the long axis of lamina in indistinct files.

Stomatal frequency and stomatal index

The number of stomata per unit area (mm²) varies significantly ($P \leq 0.05$) among cultivars of both tall and dwarf varieties (Table 1). Among the tall cultivars MDY (dwarf) possesses the maximum (185.68), AO (tall) the second maximum (162.54) number and LO (tall) the minimum (125.48) number of



Fig. 1. Abaxial leaf epidermis (CV, LM) showing a trichome and stomata; S = stomata; T = trichome (Mag. x 330).

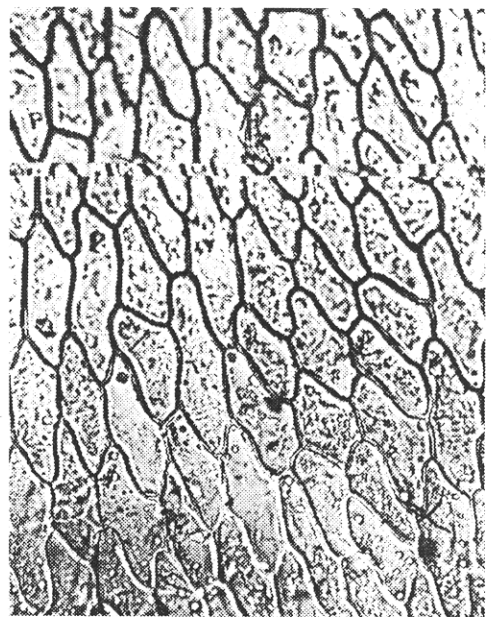


Fig. 2. Adaxial leaf epidermis (CV, LM) devoid of any stomata or trichome (Mag. x 330).

stomata per mm². From DMRT of different cultivars of coconut it is observed that MDY and LO cultivars distinctly differ from all other cultivars in respect of number of stomata per unit area. WCT, Local, CDO and ISID are at par having intermediate numbers of stomata. This trend is also noticed in their stomatal indices. MDY shows the highest (13.02) and LO the lowest (10.55) stomatal index value.

Length of guard cells

The length of guard cells also varies significantly ($P \leq 0.05$) among cultivars (Table 1). The longest guard cells (38.81 μm) occur in CDO and intermediate in MDY and LO (35.20 μm and 35.10 μm respectively). The rest of the cultivars

do not differ significantly among themselves in their length of guard cells.

Number and size of epidermal cells

The number of epidermal cells per mm² ranges from 1063.47 (LO) to 1239.53 (MDY) among different cultivars. ISID (1213.65), Local (1175.42) and AO (1180.32) show intermediate position in respect of number of epidermal cells per mm². The longest epidermal cell (60.55 μm) occurs in LO and shortest (46.98 μm) in MDY. These findings indicate that length of epidermal cells may have negative correlation (significant at 1% level, $r = -0.891$) with the number of epidermal cells per unit area. The maximum width (16.27 μm) of epidermal cells occurs in MDY and minimum

(13.53 μm) in Local. CDO (15.56 μm) possesses the intermediate width. The frequency of epidermal cells per unit area, their lengths and widths vary significantly ($P \leq 0.05$) among the cultivars (Table 1). However, width of cells varied less than cell number and cell length (ca. 14 μm) particularly in tall cultivars.

Number and length of trichomes

The number of trichomes per unit area is meagre (ca. 2-3) and does not vary significantly among cultivars. However, their lengths vary significantly ($P \leq 0.05$) among the cultivars. Trichomes of LO exhibited a

maximum length of 103.41 μm and MDY, a minimum of 84.14 μm (Table 1).

On the basis of above observations it may be concluded that epidermal characteristics of leaves, particularly stomatal frequency and stomatal index can be regarded as useful characters for identification and selection. Bavappa (1966) identified the various varieties of *Areca catechu* on the basis of the number of stomata per unit area. Whether stomatal frequency of leaves has any effect on the yield of a palm, could be tested in future when yield data of the plantation will be available in future from this project.

Table 1. Variation in number (mm^{-2}) and size (μm) of epidermal structures of leaves in different tall and dwarf cultivars of coconut (mean values for 30 observations from three palms of each cultivar).

Culti- vars*	No. of stomata	Length of guard cell	No. of epi** .cell	Length of epi** .cell	Width of epi** .cell	No. of trichome	Length of trichome	Stomatal index
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
LM	148.42 b	33.51 a	1122.09 b	54.10 bc	14.65 ab	2.16 a	94.97 b	11.68
WCT	159.01 bc	33.11 a	1154.83 bc	54.81 bc	14.55 ab	2.16 a	91.09 ab	12.10
AO	162.54 c	34.22 ab	1180.32 cd	53.50 bc	14.28 ab	1.96 a	88.97 ab	12.10
LO	125.48 a	35.10 b	1063.47 a	60.55 d	14.14 ab	1.96 a	103.41 c	10.55
Local	157.83 bc	33.55 a	1175.42 cd	52.35 b	13.53 a	1.68 a	92.34 ab	11.83
CDO	158.03 bc	38.81 c	1166.60 c	57.24 cd	15.56 bc	2.02 a	93.39 ab	11.93
ISID	155.28 bc	33.11 a	1213.65 de	50.90 ab	14.38 ab	1.43 a	87.79 ab	11.34
MDY	185.68 d	35.20 b	1239.53 e	46.98 a	16.27 c	1.82 a	84.14 a	13.02

Means followed by a common letter are not significantly different at the 5% level by DMRT. *Refer to Materials and methods; **epi. = epidermal

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