NOTES

MORPHOLOGICAL CHARACTERIZATION OF THE EPIDERMIS OF RATTAN PALMS

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Rattans are climbing spiny palms belonging to the subfamily Calamoideae of the family Palmae (Uhl & Dransfield 1987). The center of their natural distribution is in Southeast Asia, which includes 10 genera with a high species frequency in the Malay Archipelago and Borneo. Three genera are endemic to westcentral Africa and one (*Calamus*) is native to both regions.

Detailed studies of the stem anatomy have been undertaken especially with species of the genera, *Calamus Daemonorops* and *Korthalsia* (Tomlinson 1961, Siripatanadilok 1974, Teoh 1978, Parameswaran & Liese 1985, Renuka *et al.* 1987, Cai 1989, Liese & Weiner 1989, Bhat *et al.* 1990). In a comprehensive anatomical investigation of 284 species from all the 13 genera, Weiner (1992) also analysed the epidermis which had hardly been considered so far. Siripatanadilok (1983) and Renuka *et al.* (1987) described differences in the anatomical make-up of the epidermis for 16 *Calamus*, 1 *Daemonorops* and 1 *Korthalsia* species, but the significance of epidermial features for rattan is not yet known.

The culm and leaf epidermis of some species of the genera *Dendrocalamus* have been examined visually (Bisen 1987, Bisen *et al.* 1989).

The epidermis of several rattan species (shown in Table 1) was examined in an investigation. The samples originated from Australia, Benin, China, Congo, Fiji, India, Indonesia, Malaysia, New Guinea, Nigeria, Philippines, Sri Lanka, Sierra Leone, Taiwan, Thailand and Zaire. Most of the specimens were taken from herbaria and the remaining 10% collected in the field with an adequate record of the sample location (Weiner 1992). The preparation of the samples has been described previously (Weiner & Liese 1990). Jeffrey's solution was used for maceration.

The stem anatomy of rattans corresponds to the general structure of the monocotyledons, represented by collateral vascular bundles embedded in ground parenchyma. The stem is covered by an epidermis which can be clearly distinguished from the stem tissue. The epidermis consists in all species of a single, unlignified cell layer with tretraytic stomata, covered by a silica layer (Figure 1).

A few species as exceptions (*e.g. Calamus yunnanenis* and four *Korthalsia* species) have intersperce in the single, unlignified cell layer two smaller cells. Within each species the cells are uniform in size and shape. By studying transverse, radial and tangential sections three basic cell forms can be distinguished:

- recumbent: longest extension in radial direction,
- upright: longest extension in axial direction,
- isodiametric: uniform extension in all directions.

Table 1. Material investigated

Genus investigated	Distribution	Species total*	Species investigated	Number of specimens
Calamus	Asia+Africa	370	160	207
Calospatha	Asia	1	1	3
Ceratolobus	Asia	6	6	10
Daemonorops	Asia	115	65	97
Eremospatha	Africa	12(?)	3	6
Korthalsia	Asia	26	26	39
Laccosperma	Africa	7	2	5
Myrialepis	Asia	1	1	3
Oncocalamus	Africa	3	1	2
Plectocomia	Asia	16	11	16
Plectocomiopsis	Asia	5	5	8
Pogonotium	Asia	3	2	2
Retispatha	Asia	1	1	3

*According to Uhl & Dransfield (1987)

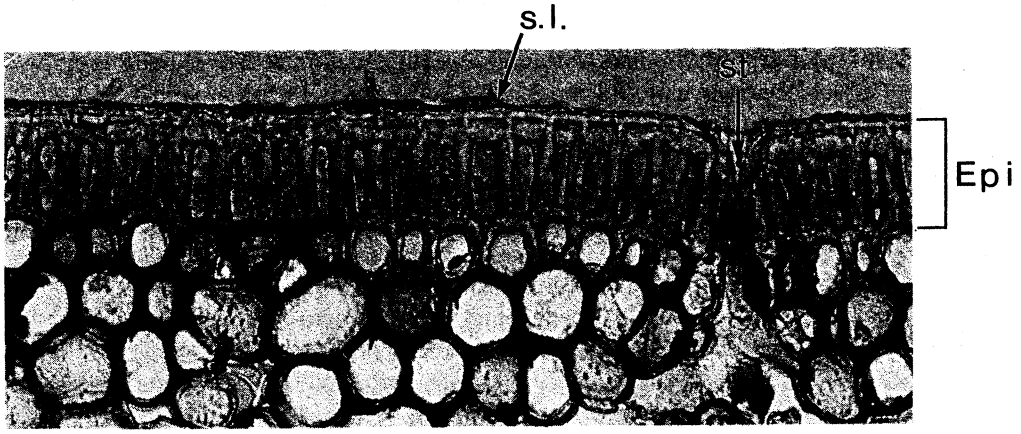

Figure 1. Epidermis with silica layer and stomata
epi = epidermis, s.l. = silica layer, st. = stomata

About 90% of all species examined possess recumbent epidermis cells. The longest radial dimension of about 80 μ *m* was measured in *Calamus macrosphaerion*. The genus *Plectocomiopsis* has always upright cells. However, the longest axial dimension of about 100 μ *m* occurs in *Plectocomia* species, the shortest of about 10 μ *m* in *Pogonotium*. Isodiametric cells are typical of the genus *Eremospatha* with dimensions between 12 and 18 μ *m*. For all three basic cell forms, the dimensions of tangential direction vary from a minimum of 6 μ *m* for *Retispatha* to a maximum of 30 μ *m* for *Calamus digitatus*, with the majority of the species between 10 and 15 μ *m*.

As seen in transverse section, the outer tangential wall is always thicker than the radial and inner tangential walls. Due to the different wall thickness and three dimensional morphology, the epidermis cells exhibit characteristic shapes of the lumina. Altogether 10 different lumen types have been distinguished for the rattan genera which are presented in Figure 2.

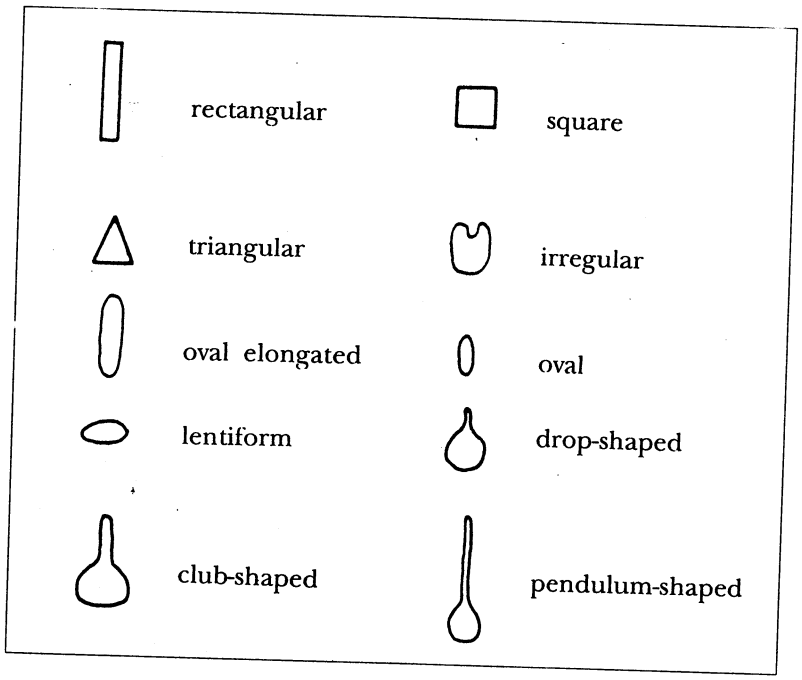

Figure 2. Different lumina shapes of the epidermis cells

All species of the four genera, *Korthalsia, Myrialepis, Plectocomia* and *Plectocomiopsis,* from Asia and the three endemic African genera, *Eremospatha, Laccosperma* and *Oncocalamus,* show only rectangular, oval or square lumina. However, the large genera *Calamus* and *Daemonorops* exhibit a considerable diversity of the lumen types.

A comparative investigation of 66 species represented by multiple specimens proved that the two features, cell dimensions and shapes of lumen, do not differ much within one species. This finding corresponds with observations by Siripatanadilok (1983), who described six lumina types on the basis of one *Daemonorops,* one *Korthalsia* and six *Calamus* species.

The outer tangential cell wall is covered by a thin layer with a smooth and shiny appearance. According to SEM-EDXA investigations, this layer is composed solely of amorphous SiO_2. Its thickness can differ even within one species. After removing the SiO_2 layer with hydrofluoric acid and treating the epidermis with Jeffrey's solution, the cell wall surface of the epidermis becomes exposed in tangential view. Six cell forms have been distinguished which are arranged according to genera in a distinct pattern (Figure 3). The species of one genus exhibit the same form and pattern, but certain differences exist between genera. *Calamus* and *Calospatha* show hexagonal cells in a honeycomb pattern. *Ceratolobus* species have square, *Daemonorops* rombic-rectangular cells. *Pogonotium* has square and rectangular cells in a diagonal pattern. The cells of *Retispatha* are hexagonal and arranged in a diagonal pattern. The genera, *Eremospatha, Korthalsia, Laccosperma, Myrialepis, Plectocomia, Plectocomiopsis* and *Oncocalamus,* exhibit rectangular elongated cells.

On the basis of stem anatomical features - especially vascular bundles, ground parenchyma and fibre arrangement - a dichotomous key for the identification of the rattan genera has been developed (Weiner 1992, Weiner & Liese 1993). The results of this investigation indicate that epidermal morphology can serve as an additional feature to differentiate rattans at the generic, in certain instances even at the specific level. This confirms similar observations for bamboo culms by Chauhan *et al.* (1992) for five species of two genera.

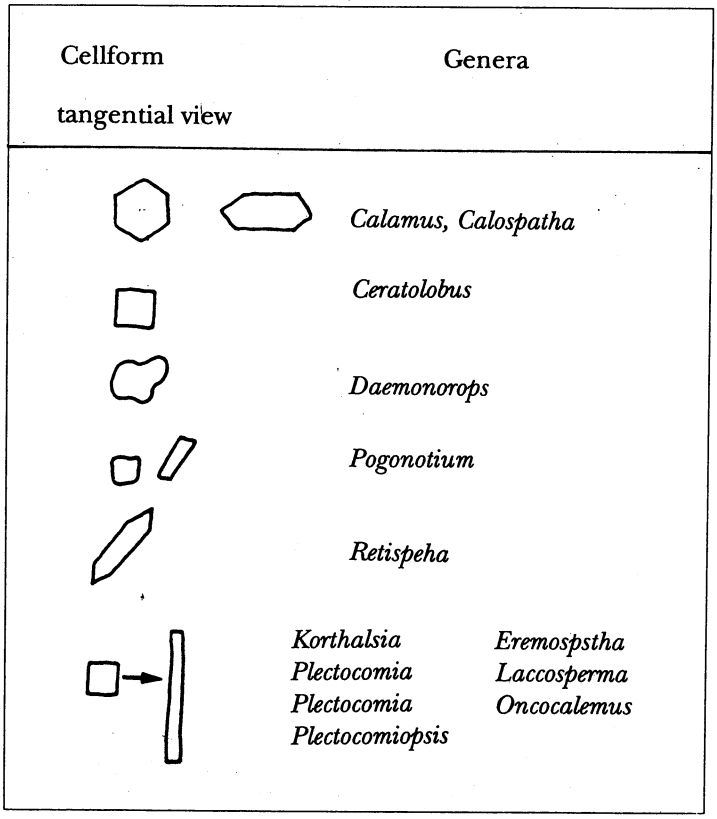

Figure 3. Surface view of epidermal cells

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EFFECT OF MAHOGANY SHOOT BORER ON GROWTH OF WEST INDIES MAHOGANIES IN FLORIDA

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The mahogany shoot borer [*Hypsipyla grandella* (Zeller)], (Lepidoptera: Pyralidae) is a pest of tropical American meliaceous timber trees, including mahoganies (*Swietenia* spp.) and tropical-cedars (*Cedrela* spp.) Larvae of mahogany shoot borers hollow out shoots, causing them to collapse and die back. Death of the terminal shoot (leader) has been reported to result in loss of height growth, which is said to be more severe in cases in which secondary leaders are also attacked, and if trees form multiple leaders the results are poorly formed timber trees (reviewed by Lamb 1966, Grijpma 1974). *Hypsipyla robusta* Moore plays a similar role on meliaceous timber trees in tropical Africa, Asia and Australia (Beeson 1919). Of the two species, *H. grandella* is better known scientifically. Information on its impact on culture of mahoganies is available from several countries. For example, the mahogany shoot borer was considered a major pest in Puerto Rico, where plantations involving hundreds of thousands of mahoganies and tropical-cedars failed due to mahogany shoot borer attacks (Martorell 1943). However, Bauer (1987) observed relatively little damage by this insect to young Honduras mahoganies (*S. macrophylla*) and *S. mahagoni* X *S. macrophylla* hybrid mahoganies in a study conducted in Puerto Rico. In studies of mahogany shoot borer attack in different parcels of Honduras mahoganies and tropical-cedars in Peru, Yamazaki *et al.* (1990, 1992) found that 0 to 95% of the tropical - cedars and 5 to 49% of the Honduras mahoganies were attacked during one season of observations. The incidence and severity of mahogany shoot borer attack apparently varies with host plant species and other conditions.

The West Indies mahogany (*S. mahagoni*) is native to the Greater Antilles, Bahamas and southern Florida. We made observations to evaluate the effect of mahogany shoot borer damage to growth of this species in Florida.