

LEAF ANATOMY OF FREYCINETIA JAVANICA BLUME AND FREYCINETIA SCANDENS GAUDICHAUD (PANDANACEAE, FREYCINETOIDEAE)

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Yessy Santika. 2010. Anatomi daun *Freycinetia javanica* Blume dan *Freycinetia scandens* Gaudichaud (Pandanaceae; Freycinetioideae). *Floribunda* 4(1): 18–20. — Berdasarkan struktur anatomi daunnya, *Freycinetia javanica* dan *F. scandens* dapat dibedakan berdasarkan susunan stomata dan bentuk kutikula keduanya. Karakter anatomi juga mendukung penempatan keduanya berada dalam dua seksi yang berbeda (*F. javanica* dalam seksi *Cyrtopoda*, *F. scandens* termasuk dalam seksi *Oligostigma*).

Kata kunci: Anatomi daun, *Freycinetia*, *F. javanica*, *F. scandens*.

Yessy Santika 2010. Leaf Anatomy of *Freycinetia javanica* Blume and *Freycinetia scandens* Gaudichaud (Pandanaceae; Freycinetioideae). *Floribunda* 4(1): 18–20. — Leaf anatomy of *Freycinetia javanica* and *F. scandens* differs in the arrangement of stomata and the shape of the cuticles. The leaf anatomy also supports the placement of the two species into two separate sections (*Cyrtopoda* for *F. javanica*, *Oligostigma* for *F. scandens*).

Keywords: Leaf anatomy, *Freycinetia*, *F. javanica*, *F. scandens*.

Prior to this present study, the anatomy of *Pandanaceae* has been published by Tomlinson (1965). However, that work was concentrated on the genus *Pandanus*. The genus of *Freycinetia* was only briefly mentioned. North & Willis (1970) studied the leaf anatomy of six species of *Freycinetia* from Solomon Island, *F. hombronii* Martelli, *F. inermis* Ridley, *F. cf. laeta* Merrill & Perry, *F. marantifolia* Hemsley, *F. petiolacea* Merrill & Perry, *F. solomonensis* B.C. Stone. It showed that leaf anatomy cannot be used to identify up to the species level due to the invariable leaf shapes; thus the important distinctive characters can only be seen in the generative organs.

Lim & Stone (1971) studied the epidermal tissue of 14 species of *Freycinetia* in order to find the anatomical supporting evidence for Stone infrageneric classification (Stone 1968). The result of their study indicated that although the structure of stomata structure and other epidermal features proved good for the systematic of the genus, it does not support the infrageneric classification. They argued that this was due to the low variation feature of epidermal leaf structure in the genus. Nevertheless, the study suggests that the leaf anatomy in members of *Freycinetia* is very simple than in *Pandanus*. This is in contrast to Kam (1971), where the result supported the infrageneric classification of *Pandanus*.

F. scandens and *F. javanica* are two species

abundantly found in the lowland up to lower montane forests of Java from 700 up to 1600 m altitudes. *F. javanica* has 12.5–25 cm by 10–30 mm leaf, linear, basally unarmed or with very few short, obtuse teeth, shortly aculeate at the tapering or shortly acuminate triquetrous top. Inflorescences often 2, approximate, the second placed on a short, leafy branch; spathes somewhat fragrant during anthesis; spadices usually 3-nate, sometimes 4–5-nate; 3 borne on c. 1 cm long peduncles, terete, 2.5–3 cm long; female in anthesis 25–48 cm long on peduncle 6–15 mm long; stigmas 4–7; fruiting spadices 5–7 cm long. In *F. scandens* is characterized by leaves not very closely crowded, with not overlapping sheaths, linear-lanceolate, from a more or less strongly narrowed base, unarmed above the caducous sheath-margins or with 1–2 minute spinelets, at and below acuminate, triquetrous top shortly aculeate along the margins and on the back of the midrib, 9–19 cm by 10–30 mm. Flowering spadices 3–4-nate; male ones borne on 1.75–2.5 cm long peduncles, terete; female borne on 1.5–2.5 cm long peduncles, oblong; stigmas 2–3; fruiting spadices 1–4-nate, 3–6 cm long; ripe carpels red. Stem below the leaves often with aculeiform excrescences (Backer & Bakhuizen van den Brink 1968).

Despite mentioned by Lim & Stone (1971), the anatomy of the two species from Java has not been studied well. In the infrageneric classificati-

on of the genus, the two species belong to different sections: *F. javanica* belongs to section *Cyrtopoda* (Stone 1972), whereas *F. scandens* belongs to section *Oligostigma* (Warburg 1900; Stone 1968). This placement was based entirely on morphology; thus the aim of this study is to find whether the placement of species in these sections is supported by anatomy, particularly leaf anatomy.

MATERIALS AND METHODS

Five leaf samples were collected from several sites in Java, Sumatra, and Kalimantan (Indonesian Borneo). In this present study the method by Cutler (1978) was implemented. Mature leaves were chosen and most width part of leaf was cut and then killed the tissues by using alcohol 70%. For paradermal slide, material boiled in HNO₃ 10% until epidermal tissue separate from others, washed with distilled water, scraped gently and stained with Safranin; then washed again to removed the stain and get a clean material. Sample

was mounted in glycerine for observation.

For transversal section: two methods are: permanent slide by free hand section and by paraffin embedding (Sass 1951). Slides were observed by light microscope, Nikon 80i. All tissues were observed, epidermis, hypodermis and mesophyll but stressed to epidermal tissue.

RESULT

The two species are quite similar anatomically. Both species have fairly quadrangular epidermal cells, absence of prismatic crystals, and non-papillose. The hypodermis is arranged in few layers, sometimes with fiber bundles. Mesophyll is differentiated into palisade-like and sponge-like cells. The vascular bundles consist of 1 to 2 xylem and phloem surrounded by fibers with bundle sheath cells at the outer part. The bundle sheath extensions are completely absent. However, despite these similarities the two species differ in several anatomical features describe in Table 1.

Table 1. Comparison of leaves anatomy between *Freycinetia javanica* and *F. scandens*

Character	<i>F. javanica</i>	<i>F. scandens</i>
Epidermis		
Shape	Quadrangular (square)	Quadrangular (square and rectangular)
Prismatic crystal	absent	absent
Stomata		
Position	abaxial and adaxial surface	abaxial and adaxial surface
Arrangement	disperse in the surface	cluster in intercostal region
Type	tetracytic	tetracytic
Hypodermis		
Multiple layers	3 layers	2 layers
Fiber	rarely present	present
Mesophyll		
Diferentiation	present	present
Fiber	rarely present	absent
Raphida crystal	present	present
Vascular bundles		
Arrangement	Phloem and fibers disperse surround xylem	Phloem and fibers disperse surround xylem
Bundlesheat	present	present
Bundlesheat extention	absent	absent
Cuticle	Quadrangular to round	Polygonal

DISCUSSION

The result of this present study suggests that leaf anatomy, especially the upper part of epidermal cells can be used to distinguish these two spe-

cies and supports their placements into separate sections. In general the cells are fairly uniform in shapes in *F. javanica*, in which the cells are short square-shaped; whereas in *F. scandens* the cells are more heterogen, in which the cells are both square

and rectangular-shaped.

Other anatomical features that can be used as distinctive characters are the stomatal arrangement at the abaxial part of the leaf and the shape of cuticles. *F. scandens* has stomata at abaxial surface, which clustered between veins. The cuticle is polygonal and pointed at two ends. *F. javanica* possesses dispersal stomatal arrangement on abaxial surface and quadrangular to round cuticle.

Thus, the shape of the epidermal cells and stomatal arrangement are two good distinctive characters to distinguish *F. javanica* from *F. scandens*. Thick cuticle is common within the members of *Pandanaceae* and the result of this present study also shows the importance of this character to distinct the two species. Papilla, on the contrary is not important character to distinguish them due to completely absence in both species. This absence of papilla in these two species is normal as only *F. sumatrana* and *F. insignis*, which possess papilla. Hypodermal, vascular bundles, and mesophyll structures and arrangements are not informative characters for those two species.

CONCLUSION

Anatomical character could be used to distinguish *F. javanica* and *F. scandens* based on stomata arrangement, epidermis shape and cuticle shape. *F. javanica* and *F. scandens* are anatomically proven to be distinct species and their placement into two separate sections is supported.

ACKNOWLEDGMENT

The author would like to gratitude the Keeper of Herbarium Bogoriense (Botany Division), Research Centre for Biology, Indonesian Institute of Sciences for supporting the research. The author would also like to express her appreciation to her colleagues: Dr. Ary P. Keim, Dr. Ruyayah, and Ms. Eka F. Tihurua for fruitful discussions and suggestions to the manuscript.

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