

LEAF ANATOMY OF *TRICHOSANTHES TRICUSPIDATA* AND ITS RELATED SPECIES FROM JAVA

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Rugayah. 2002. Anatomi daun *Trichosanthes tricuspidata* dan kerabat dekatnya di Jawa. *Floribunda* 2(2): 46–49. — Pengamatan anatomi daun melalui sayatan paradermal dan transversal *Trichosanthes tricuspidata* dan jenis kerabatnya (*T. quinquangulata* dan *T. pubera*) di Jawa telah dilakukan. Sayatan paradermal ditemukan dapat dipakai sebagai data pendukung ciri-ciri morfologi daun, bunga, buah dan biji untuk membedakan ketiga jenis tersebut, sedangkan sayatan transversal tidak dapat membedakannya karena ukuran sel masing-masing jenis saling tumpang tindih. Ketiga jenis tersebut mempunyai perbedaan pada bentuk dinding selnya baik pada permukaan atas maupun bawah daunnya. *T. pubera* mempunyai bentuk dinding sel yang sama yaitu berliuk dalam pada kedua permukaan daunnya, *T. quinquangulata* mempunyai dinding sel tetragonal sampai heksagonal pada permukaan atas dan berliuk dalam pada permukaan bawah, sedangkan *T. tricuspidata* ber dinding sel berliuk dangkal pada permukaan atas dan berliuk dalam pada permukaan bawahnya.

Kata kunci: *Trichosanthes*, anatomi daun, Jawa.

Trichosanthes tricuspidata Lour. was described by Loureiro in *Flora Cochinchinensis* (1790). The species is characterized in having glabrous, poly-nerved 3-cuspidate leaves (each leaf with 3 lobes, tapering at apex). For Java, Blume (1826) and Miquel (1856) already recognized this species, but Backer & Bakhuizen van den Brink Jr (1963) mixed up related and resembling taxa and accepted one species-complex under the name *T. bracteata* (Lamk.) Voigt. For Indochina Keraudren (1975) accepted the name *T. tricuspidata* for a part of this complex. Recently Rugayah & de Wilde (1997) treated the material from Java and separated the species-complex into three different species, *T. tricuspidata*, *T. pubera* Blume and *T. quinquangulata* A. Gray, based on morphological characters of leaves, flowers, fruit and seeds.

Anatomical observations on leaves using permanent preparations for transverse sections and semi-permanent preparations for paradermal sections of the three mentioned species are under taken to provide additional supports to these morphological characters.

MATERIALS AND METHOD

Living plants of the three species, collected in Java, were used for this study: *T. tricuspidata* (from Sukabumi, Bogor, Mt. Bunder, Mt. Hali-mun), *T. pubera* (from Leuwiliang) and *T. quinquangulata* (from Bogor, Mt. Bunder, Mt. Halimun).

Leaf anatomy was investigated after fixing the leaves in FAA and embedding in paraffin wax. Transverse sections (20 µm thick) were taken and stained with safranin and fast green and mounted in canada balsam. The paradermal sections were taken from the upper and lower surfaces, then stained with safranin 1% in water and then mounted in glycerin. Descriptions of the stomata types are based on the criteria used by Inamdar & Gangadhara (1976) and Inamdar *et al* (1990).

RESULT AND DISCUSSION

Observations on the leaf-anatomy indicate that the three species have overlapping characters in transverse section, but differ in paradermal section. Transverse sections showed that they are slightly different in epidermal cells and mesophyll layers, but these characters are overlapping. The three species have various sizes of upper and lower epidermis, palisade tissue, spongy tissue and thickness of the blade (Table 1).

The epidermal cells on the upper surface of the blade in the three species are very characteristic. They are conically raised into papillae up to 3.13–8.75µm long. The size of epidermal cells on the upper side of the blade differs from those of the lower one. Most of the cells are smaller in the lower epidermis (1.85–8.75µm long) if compared to the upper ones (10–27.5 µm long).

Table 1. Anatomical characteristics from transverse sections of leaves (measurement in μm).

Species	Thickness of blade	Epidermis thickness		Size of cells of palisade tissue		Number of layers of spongy tissue
		Upper-side	Lower-side	First layer	Second layer	
<i>T. pubera</i>	60–82.50	10–22.50	1.88–7.50	11.25–23.75 x 3.75–7.50	7.50–15 x 2.50–4	3–4
<i>T. tricuspidata</i>	115–146.25	6.25–27.50	3.75–8.75	25–33.75 x 3.13–6.25	7.50–16.25 x 3.75–8.75	4–6
<i>T. quinquangulata</i>	75–113.75	7.50–16.25	2.50–6.25	21.25–30 x 6.25–7.50	13.75–18.75 x 3.75–7.5	3–5

The mesophyll of the three species is monofacial, while the palisade is only found under the upper-side epidermis. The mesophyll consists of two layers of palisade tissue and 2–6 layers of spongy tissue. The palisade has uniform cells of a more or less cylindrical shape, which contain numerous chloroplasts. They have two layers of palisade, with cells of the second layer shorter than the first layer one. *T. pubera* has the smallest size of palisade cells, followed by *T. quinquangulata* and *T. tricuspidata*. The spongy tissue is formed by big, thin-walled, strongly vacuolized cells. *T. pubera* has 3–4 layers, whereas *T. quinquangulata*, and *T. tricuspidata* have 3–5 and 4–6 layers respectively. In descending order the blade of *T.*

tricuspidata is thickest, 115–146.25 μm , followed by *T. quinquangulata*, 75–113.75 μm , and by *T. pubera*, 60–82.50 μm .

The paradermal sections shows that, the stomata type of these species is mostly anomocytic rarely anisocytic (Table 2). The mature stomata are surrounded by 3–7 ordinary epidermal cells. The shape of the epidermal cell walls at the adaxial and the abaxial surfaces differs remarkably in each species. *T. quinquangulata* and *T. tricuspidata* have more entire epidermal cell walls at the adaxial compared to the abaxial ones. On the other hand *T. pubera* has sinuous epidermal cell walls on both sides.

Table 2. Occurrence and types of stomata

No.	Species		Type of stoma	Ordinary epidermal cells	Epidermal cell walls
1	<i>T. pubera</i>	upper	Anomocytic	3–5	Deeply sinuous
		lower	Anomocytic	3–5	Deeply sinuous
2	<i>T. tricuspidata</i>	upper	Anisocytic,anomocytic	3–5	Slightly sinuous
		lower	Anisocytic,anomocytic	4–6	Deeply sinuous
3	<i>T. quinquangulata</i>	upper	Anisocytic,anomocytic	4–6	Hexagonal/entire
		lower	Anisocytic,anomocytic	3–4	Deeply sinuous

The present study supports earlier contention that anatomical evidence can be used to indicate the relationships of the higher taxa in *Cucurbitaceae* (Inamdar et al 1990). From the present observation is shown that *T. tricuspidata*, *T. pubera* and *T. quinquangulata* are specifically different in epidermal cells of the leaves. *T. pubera* has deeply sinuous walls of the epidermis

cells on both surfaces, whereas *T. quinquangulata* has entire (tetra-hexagonal) epidermal cell walls, on the upper surface and very sinuous ones on the lower surface. *T. tricuspidata* has slightly sinuous epidermal cell walls on the upper surface and very sinuous ones on the lower surface. The three species can be identified by their leaf anatomy with the following key:

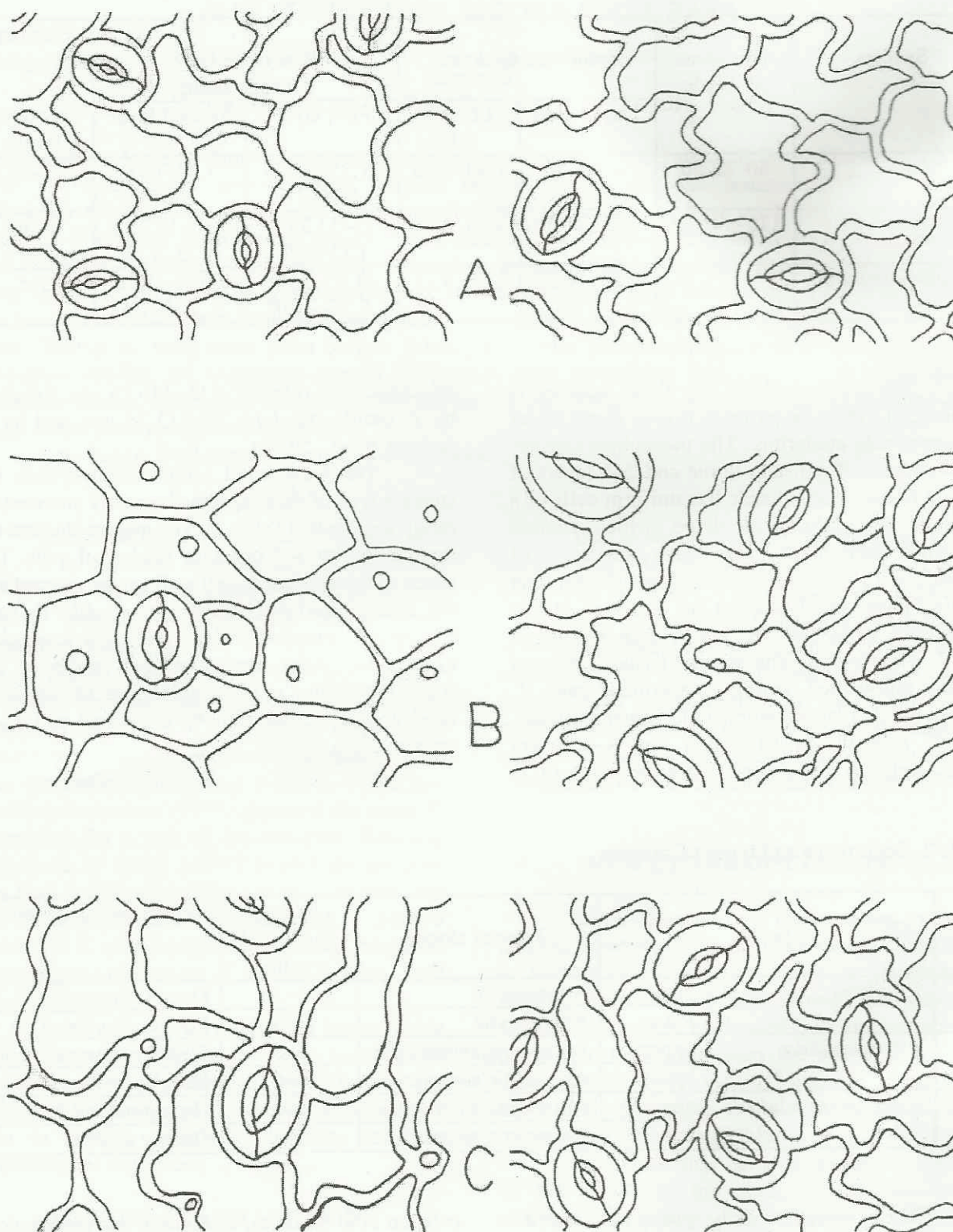


Fig. 1. Paradermal section: upper surface (left); lower surface (right). A. *T. pubera* Blume, B. *T. quinquangulata* A. Gray, C. *T. tricuspidata* Lour.

Key to the species based on leaf anatomy

1. a. Walls of the epidermis cells deeply sinuous on upper surfaces; anisocytic stomata absent; thickness of blade 60–82.5 μm *T. pubera*
- b. Walls of the epidermal cells various on upper surfaces; anisocytic stomata present 2
2. a. Walls of the epidermis cells slightly sinuous on the upper surface; thickness of blade 115–46.25 μm *T. tricuspidata*
- b. Walls of the epidermis cells entire (cells hexagonal) on the upper surface; thickness of blade 75–113.75 μm *T. quinquangulata*

Trichosanthes pubera Blume — Fig. 1. A

The paradermal section shows similar anomocytic stomata with 3–5 ordinary epidermal cells, but differs in epidermal cell types on both surfaces. The adaxial has less sinuous cell walls than the abaxial. In transverse section the blade is 60–82.5 μm thick; the upper epidermis is 10–22.5 μm thick, the lower epidermis is 1.88–7.5 μm thick. Cells of the first palisade layer measure 11.25–23.75 x 3.13–5 μm and those of the second layer 7.5–15 x 2.5–3.75 μm . The spongy tissue consists of 3–4 layers.

Trichosanthes quinquangulata A. Gray—Fig. 1.B

The paradermal section reveals an anomocytic, anisocytic type of stomata with 4–6 ordinary epidermal cells on both surfaces. The epidermal cells differ on both sides. The adaxial lacks sinuous cell walls; the cell walls are mostly hexagonal or rectangular, but the abaxial has very sinuous cells. In transverse section the blade is 75–113.75 μm thick; the upper epidermis is 7.5–16.25 μm thick, the lower one is 2.5–6.25 μm thick. The cells of the first palisade layer of the mesophyll tissue measure (21.25–)25–30 x 6.25–7.5 μm , those of the second layer 13.75–18.75 x 3.75–7.5 μm . The spongy tissue consists of 3–5 layers.

Trichosanthes tricuspidata Lour. — Fig. 1. C

The paradermal section shows similar type of stomata anisocytic and anomocytic on both surfaces but differ in epidermal cell walls. The adaxial has slightly sinuous epidermal cell walls,

whereas the abaxial has very sinuous cell walls. In transverse section the blade is 115–146.25 μm thick; the upper epidermis is 6.25–27.5 μm thick, the lower one is 3.75–8.75 μm thick. Cells of the first palisade layer measure 25–33.75 x 3.125–6.25 μm and those of the second layer 7.5–16.25 x 3.75–8.75 μm . The spongy layer consists of 4–6 layers.

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