THE SYSTEMATIC WOOD ANATOMY OF THE MORACEAE (URTICALES) V. GENERA OF THE TRIBE MOREAE WITHOUT URTICACEOUS STAMENS*

by

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Summary

The wood anatomy of the Moreae without urticaceous stamens is described in detail. Generic descriptions of the following genera are provided: *Antiaropsis, Artocarpus, Bagassa, Batocarpus, Clarisia, Parartocarpus, Poulsenia, Prainea, Sorocea, Sparattosyce*, and *Treculia*. Wood anatomical variation below the genus level is very limited, except in the genus *Clarisia*. Intergeneric variation, however, is much more evident. Most genera can be recognised by the presence or absence of septate fibres, and of radial latex tubes, the size of the intervascular pits, the parenchyma distribution, and crystal distribution. The diagnostic and taxonomic value of several characters is discussed.

Key words: Moraceae, Moreae, systematic wood anatomy.

Introduction

This paper is part of a series, in which the wood anatomy of the Moraceae is described and discussed in relation to the taxonomy of the family. The general outline of this study is provided in the first paper (Koek-Noorman et al., 1984). In the fourth paper of the series the wood anatomy of those genera of the tribe Moreae (sensu Berg) which are characterised by urticaceous stamens was described (Ter Welle et al., 1986). In this paper the genera without this type of stamens are dealt with. In addition to the structure of the stamens, the following features can be used to characterise this group of genera in Moreae according to Berg (1983): inflorescences rather simple to complex; macrospermous; diaspores dry or mostly in fleshy structures, mostly zoochorous; mostly in rainforest habitats; taxonomically and geographically segregated, pantropical, but chiefly in the Indo-Malesian region.

The tribe Moreae sensu Berg (1983) comprises all genera of the tribes Artocarpeae and Moreae sensu Corner (1962), and also a few genera assigned to the tribe Olmedieae by Corner (l.c.). The subdivision in two groups based upon these characters, however (Berg, 1983), is not in accordance with the tribes Moreae and Artocarpeae sensu Corner (1962). Both Berg's and Corner's subdivisions deviate from older classifications, as given by, for instance, Bentham and Hooker (1880) and Engler (1888).

The Moreae characterised by the absence of urticaceous stamens comprise the genera *Antiaropsis* (New Guinea), *Artocarpus* (Southeast Asia), *Bagassa* (Neotropics), *Batocarpus* (Neotropics), *Clarisia* (Neotropics), *Hullettia* (Southeast Asia), *Parartocarpus* (Southeast Asia), *Poulsenia* (Neotropics), *Prainea* (Malesia), *Sorocea* (Neotropics), *Sparattosyce* (New Caledonia), and *Treculia* (Tropical Africa).

Methods and Materials

The methods employed are those given in the first paper of this series (Koek-Noorman et al., 1984). All wood samples studied are backed by herbarium vouchers. Taxa of the African and Neotropical genera were identified or cited by the authors of the various monographs. Details on individual wood samples are provided at the beginning of each generic description. The genus *Hullettia* is not represented in this study because wood samples were not at our disposal.

The data on the specific gravity are based on the samples cited and complemented with data on other samples of the Utrecht wood collection not further included in the anatomical study.

Quantitative data generally refer to average values, unless specified otherwise.

Generic descriptions

Antiaropsis Schumann (Figs. 1, 2)

A genus with one or two species (Corner, 1962). The genus is probably restricted to Irian Jaya (Indonesia). Its occurrence in Papua New Guinea is questioned by Corner (1962). The

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shrubs or small trees, up to 11 m high, are found in lowland forests up to 1000 m altitude, usually in the undergrowth.

Material studied: *A. decipiens* Schumann. Indonesia, Irian Jaya: CSIRO H 5198 (Uw 25533).

General features: Growth rings absent; heartwood not available, sapwood light brown. Texture fine, grain straight. Specific gravity c. 750 N per cubic metre.

Microscopic features: Vessels diffuse, solitary (50%) and in short radial multiples of 2–3; 9 per sq.mm, round to slightly oval, diameter 108 μm, vessel member length 525 μm. Perforations simple, end walls almost transverse. Intervascular pits alternate, polygonal, occasionally round, 7–9 μm. Vessel-ray and vessel-parenchyma pits larger, elongated, half-bordered, the borders often reduced. Thin-walled tyloses common, often with vitreous silica. Fibres septate, with several septa per fibre, with small simple pits restricted to the radial walls; walls 3–4 μm, lumina 3–7 μm; length 1600 μm; F/V-ratio 3.0. Rays uniseriate and multiseriate, heterogeneous type II/III, 7 per mm. Uniseriate rays 25%, composed of upright cells only, but variable in height, height up to 12–24 cells (480–800 μm). Multiseriate rays composed of procumbent cells except for the uniseriate margins of 1–5, occasionally up to 20 rows of square and/or upright cells; 3–4 cells wide, up to 960–1400 μm high. Occasionally with some sheath cells. Parenchyma scanty paratracheal, and in concentric bands, 3–6 cells wide and 4–5 per mm. Parenchyma strands of 4 cells. A few latex tubes observed in the rays.

Artocarpus J. R. & G. Forster (Figs. 3–6)

The genus has been monographed by Jarrett (1959c, d, e; 1960a, b). About 50 species are currently recognised. The genus is distributed from India to southern China, Malesia and the Solomon Islands. Two species, *A. altilis* and *A. heterophyllus*, are cultivated all over the tropics for their fruits. Trees to large trees, up to 45 m, in evergreen forests and areas with a mild monsoon climate, usually from sea level up to 1000 m altitude.

Material studied: *A. anisophyllus* Miq. Malaysia, Sabah: Sandakan For. Dept. 50567 (Uw 24213). – *A. blancoi* (Elmer) Merr. Philippines, Quezon: J.P. Rojo 262 (Uw 24214). – *A. communis* J.R. & G. Forster. Indonesia, Irian Jaya: BW 2904 (Uw 24602), BW 4219 (Uw 24603). – *A. dadah* Miq. Indonesia: RTIw IND. Col. T889 (Uw 25521), RTIw IND. Col. 14317 (Uw 25522). – *A. elasticus* Reinw. ex Blume. Malaysia, Sabah: Sandakan Herb. Inst. 18656 (Uw 24215); Indonesia, Java: Koorders 1026c/22031b (Uw 24421). – *A. fretissii* Teijsm. & Binn. ex Hassk. Indonesia, Irian Jaya: BW 9871 (Uw 18112), BW 2133 (Uw 24316), BW 2512 (Uw 24317), BW 2175 (Uw 24318). – *A. horridus* Jarrett. Indonesia, Irian Jaya: BW 11593 (Uw 20479). – *A. integer* (Thunb.) Merr. Indonesia, Irian Jaya: BW 5659 (Uw 24319); Jamaica (cult.): US Nat. Herb. (Uw 8294); South Africa (cult.): Baijnath s.n. (Uw 25507). – *A. kemando* Miq. Malaya: FMS 28853, ex FHOw 4536 (Uw 24608); Indonesia: RTIw IND. Col. 3590 (Uw 24605), Pfeiffer E 755 (Uw 24324). – *A. lakoocha* Roxb. Pakistan: ex MADw 24487 (Uw 18033); Thailand: Royal For. Dept. s.n. (Uw 24656). – *A. lanceifolius* Roxb. Indonesia: RTIw IND. Col. 2200 (Uw 24606); RTIw IND. Col. 4027 (Uw 24606). – *A. nitidus* Trécul. Malaysia, Sabah: Sandakan For. Dept. 25510 (Uw 24217). – *A. sepicanus* Diels. Indonesia, Irian Jaya: Fokkinga 7822 (Uw 24329). – *A. sericicarpus* Jarrett. Malaysia, Sabah: Sandakan For. Dept. 50586 (Uw 24218). – *A. teysmannii* Miq. Indonesia, Irian Jaya: BW 1204 (Uw 24330).

General features: Growth rings absent; heartwood light brown to dark brown, often sharply distinct from the pale yellow to light brown sapwood. Texture coarse, grain (weakly) interlocked. Specific gravity 280–940 N per cubic metre.

Microscopic features: Vessels diffuse, solitary (45–80%) and in short radial multiples and irregular clusters of 2–4; 2–6 per sq. mm, round and oval, diameter 160–310 μm, vessel member length 350–630 μm. Perforations simple, end walls almost transverse. Intervascular pits alternate, round, polygonal and occasionally slightly oval, 9–13 μm. Vessel-ray and vessel-parenchyma pits larger, half-bordered, the borders sometimes reduced. Thin-walled tyloses common, but occasionally absent. Fibres non-septate, with small simple pits restricted to the radial walls; walls 2–4 μm, lumina 7–25 μm, gelatinous fibres present or absent; length 1170–1950 μm; F/V-ratio 2.3–3.9. Rays uniseriate and multiseriate, heterogeneous type II/III, 3–6 per mm. Uniseriate rays 3–30%, composed of upright, square and sometimes few procumbent cells, height up to 4–10 cells (160–480 μm). Multiseriate rays composed of procumbent cells, except for the uniseriate margins of 1–2 (5) rows of square and/or upright cells; 3–5 cells wide, up to 600–1200 μm high. Occasionally few sheath cells present. Parenchyma aliform with short to long wings, occasionally confluent, and sporadically in short wavy bands. Parenchyma strands of 3–4 cells. Vitreous silica common, in the fibres or in the vessels, often enveloping the tyloses. Radial

latex tubes present in most samples, axial latex tubes present or absent (cf. Topper & Koek-Noorman, 1980).

Bagassa Aublet (Figs. 7, 8)

In a treatment for the Flora of Suriname, Berg (1975) distinguished two species. Recent studies by the same author revealed that the genus is monotypic, as *B. tiliifolia* is now considered as a juvenile form of *B. guianensis* (Berg, pers. comm.). The genus is distributed in the Guianas and adjacent areas of northern Brazil. The large trees, up to 45 m high, are of rather infrequent occurrence in the lowland rainforests and savannas, up to 650 m altitude.

Material studied: *B. guianensis* Aubl. Guyana: A.C. Smith 3542 (Uw 21698); Surinam: Lanjouw & Lindeman 2433 (Uw 1742); Brazil: INPA X-6288 (Uw 23781), Capucho 356, ex MADw 34591 (Uw 24261). – '*B. tiliifolia* Benoist.'. Guyana: F.D. 5827, ex MADw 3198 (Uw 24263); Surinam: Stahel 194 (Uw 194); French Guiana: BAFOG 1302 (Uw 5790).

General features: Growth rings poorly defined; heartwood dark brown, sharply distinct from the light brown sapwood. Texture medium to coarse, grain interlocked. Specific gravity 880–1000 N per cubic metre.

Microscopic features: Vessels diffuse, solitary (20–60%) and in short radial multiples and irregular clusters of 2–4; 3–4 (7) per sq. mm, round and oval, diameter 145–240 μm, vessel member length 325–445 μm. Perforations simple, end walls almost transverse. Intervascular pits alternate, round, polygonal or slightly oval, 9–13(–15) μm. Vessel-ray and vessel-parenchyma pits larger, elongated, half-bordered, borders sometimes reduced. Thin-walled tyloses common. Fibres nonseptate, with small simple pits restricted to the radial walls; walls 3–5 μm, lumina 5–13 μm, gelatinous fibres in variable amounts; length 945–1150 μm; F/V-ratio 2.7–3.0. Rays uniseriate and multiseriate, heterogeneous type III, sometimes almost homogeneous, 3–7 per mm. Uniseriate rays 0–14%, composed of upright, square and often procumbent cells, height up to 4–9 cells (120–360 μm). Multiseriate rays composed of procumbent cells except for the uniseriate margins of 1–2 rows of square and occasionally upright cells; 2–5 cells wide, up to 600–840 μm high. Sheath cells very scarce. Parenchyma scanty paratracheal to vasicentric, aliform with short wings and some diffuse parenchyma. Parenchyma strands of 3–4 cells. Rhombic crystals common in the margins of the rays, less frequent in the axial parenchyma. Radial latex tubes present in all samples, axial latex tubes occasionally present.

Batocarpus Karsten (Figs. 9 & 10)

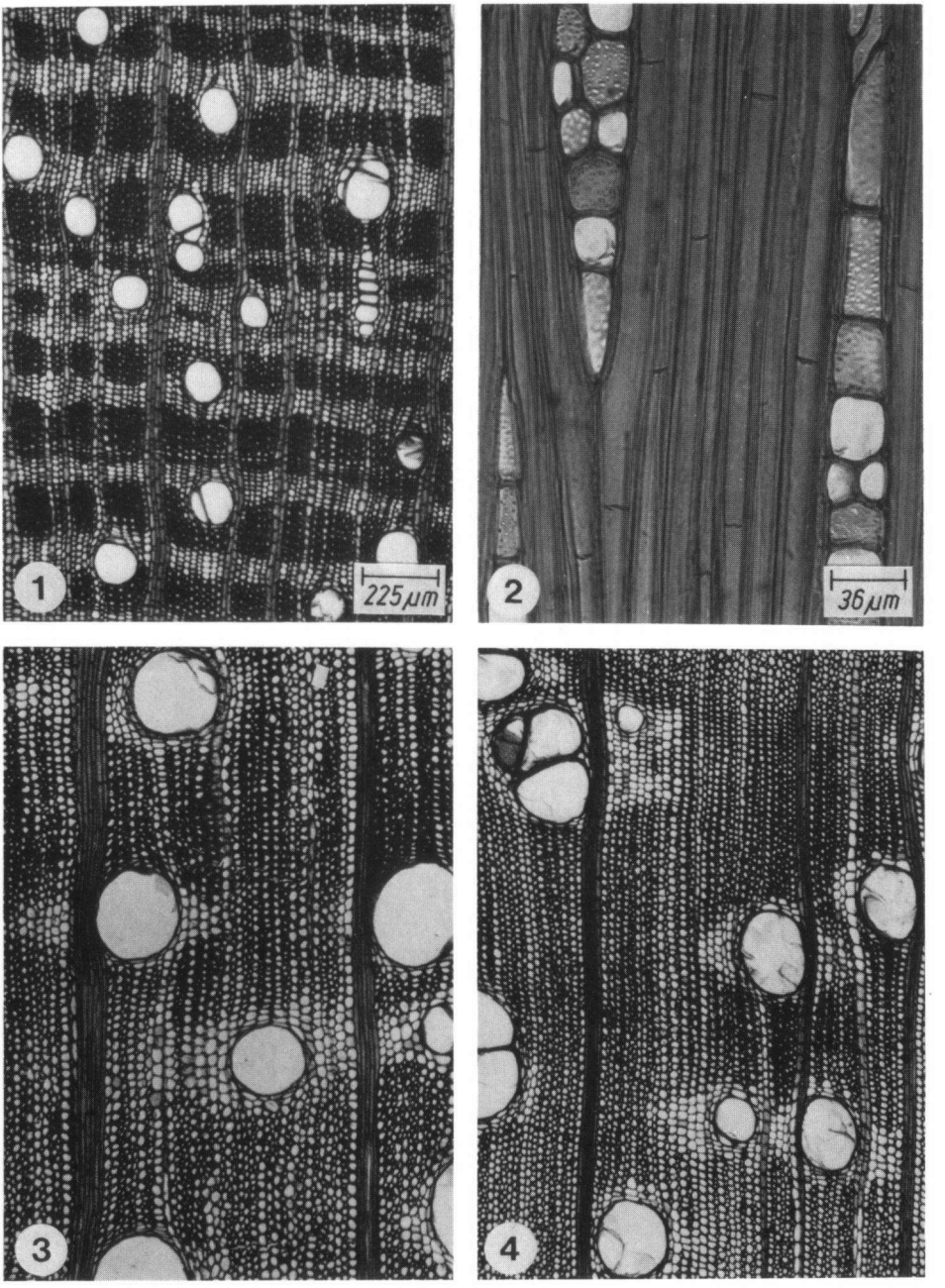
A genus with four species according to the monograph of Mello Filho & Emmerich (1968). The genus is distributed from Costa Rica to Brazil, Peru and Bolivia. Trees up to 20–30 m high, in the tropical lowland rainforests.

Material studied: *B. amazonicus* (Ducke) Fosberg. Brazil, Amazonas: Prance & Maas 15741 (Uw 19158); Krukoff 6422 (Uw 7714); Peru: Williams 5334 (Uw 18416). – *B. orinocensis* Karsten. Ecuador: Berg & Akkermans 1079 (Uw 27049).

General features: Growth rings absent; all samples light greyish or yellowish brown, Williams (1936) described the heartwood of the sample collected by himself (no. 5334) as 'thin, pale or dark brown'. Texture medium to coarse, grain straight to irregular. Specific gravity 540–650 N per cubic metre.

Microscopic features: Vessels diffuse, solitary (40–65%) and in short radial multiples and irregular clusters of 2–4; 2–5 per sq. mm, round to oval, diameter 125–205 μm, vessel member length 405–440 μm (295 μm in *B. amazonicus* from Peru). Perforations simple, end walls almost transverse. Intervascular pits alternate, round or polygonal, 7–10 μm. Vessel-ray and vessel-parenchyma pits larger, elongated and irregular, half-bordered, the borders in part reduced. Thin-walled tyloses occasionally present in some samples, always few. Fibres nonseptate, with small simple pits restricted to the radial walls; walls 2–5 μm, lumina 7–20 μm, partly gelatinous (up to 90% of the fibres gelatinous in *B. orinocensis*); length 1165–1700 μm; F/V-ratio 3.9–4.4 in the samples of *B. amazonicus*, and 2.6 in the sample of *B. orinocensis*. Rays uniseriate and multiseriate, heterogeneous type III, 4–6 per mm. Uniseriate rays 6–18%, composed mainly of upright cells and a few rows of procumbent cells, the upright cells variable in height, height up to 3–6(–8) cells (145–480 μm). Multiseriate rays composed of procumbent cells except for the uniseriate margins of 1–2 rows of square and/or upright cells; 4–6 cells wide, up to 1200–1400 μm high in *B. amazonicus* (Prance & Maas 15741, and Krukoff 6422) and up to 700–800 μm in the other two samples. Occasionally some sheath cells. Parenchyma scanty paratracheal to vasicentric-aliform with short wings, wings sometimes long and confluent. The dominating pattern and the vast majority of the parenchyma is formed by irregular wavy bands, 3–10 cells wide and 2–3 bands per mm. Parenchyma strands of 3–4 cells. Vitreous silica scarcely present in some samples, in vessels and/or fibres.

(text continued on page 184)



Figs. 1–26. Scale-line = 225 µm, unless indicated otherwise.

Fig. 1. *Antiaropsis decipiens*, Uw 25533. — Fig. 2. Ibid., septate fibres. — Fig. 3. *Artocarpus sericicarpus*, Uw 24218. — Fig. 4. *Artocarpus lakoocha*, Uw 18033.

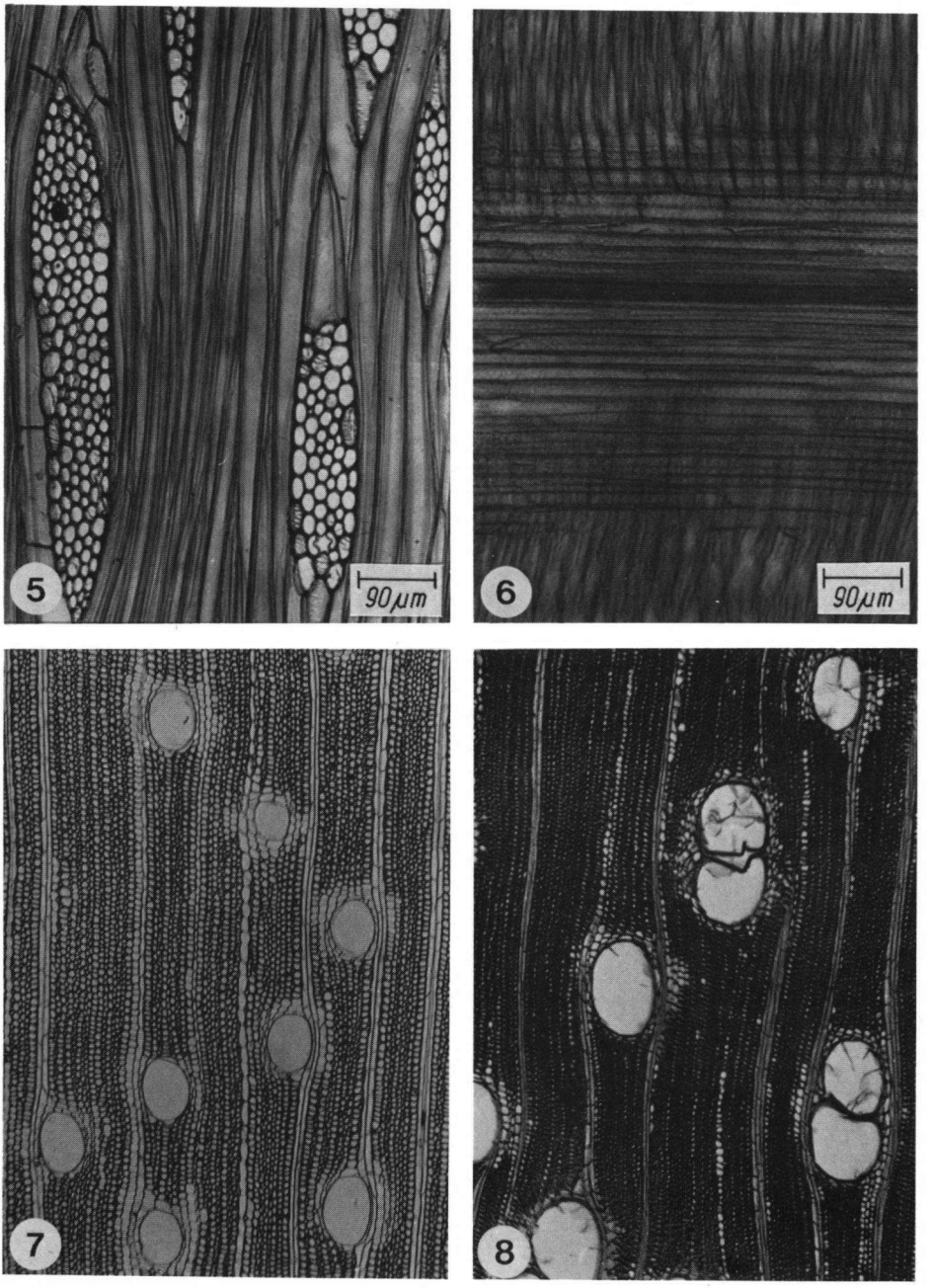


Fig. 5. *Artocarpus sericicarpus*, Uw 24218, radial latex tubes, group 1. — Fig. 6. Ibid., radial latex tube. — Fig. 7. *Bagassa guianensis*, Uw 1742. — Fig. 8. *Bagassa tiliaefolia*, Uw 5790.

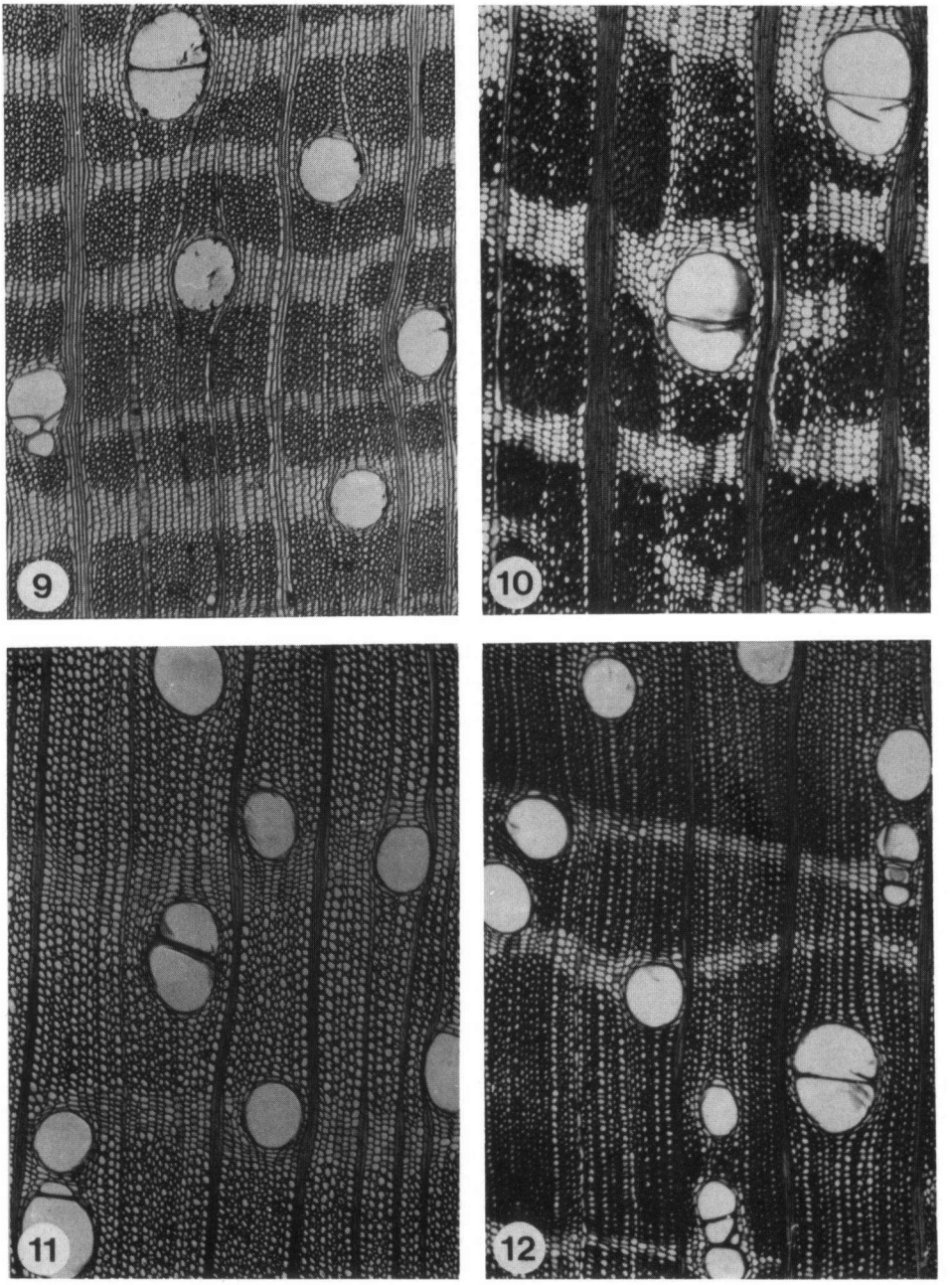


Fig. 9. *Batocarpus amazonicus*, Uw 18416. — Fig. 10. Ibid., Uw 19158. — Fig. 11. *Clarisia biflora*, Uw 25091. — Fig. 12. *Clarisia racemosa*, Uw 14464.

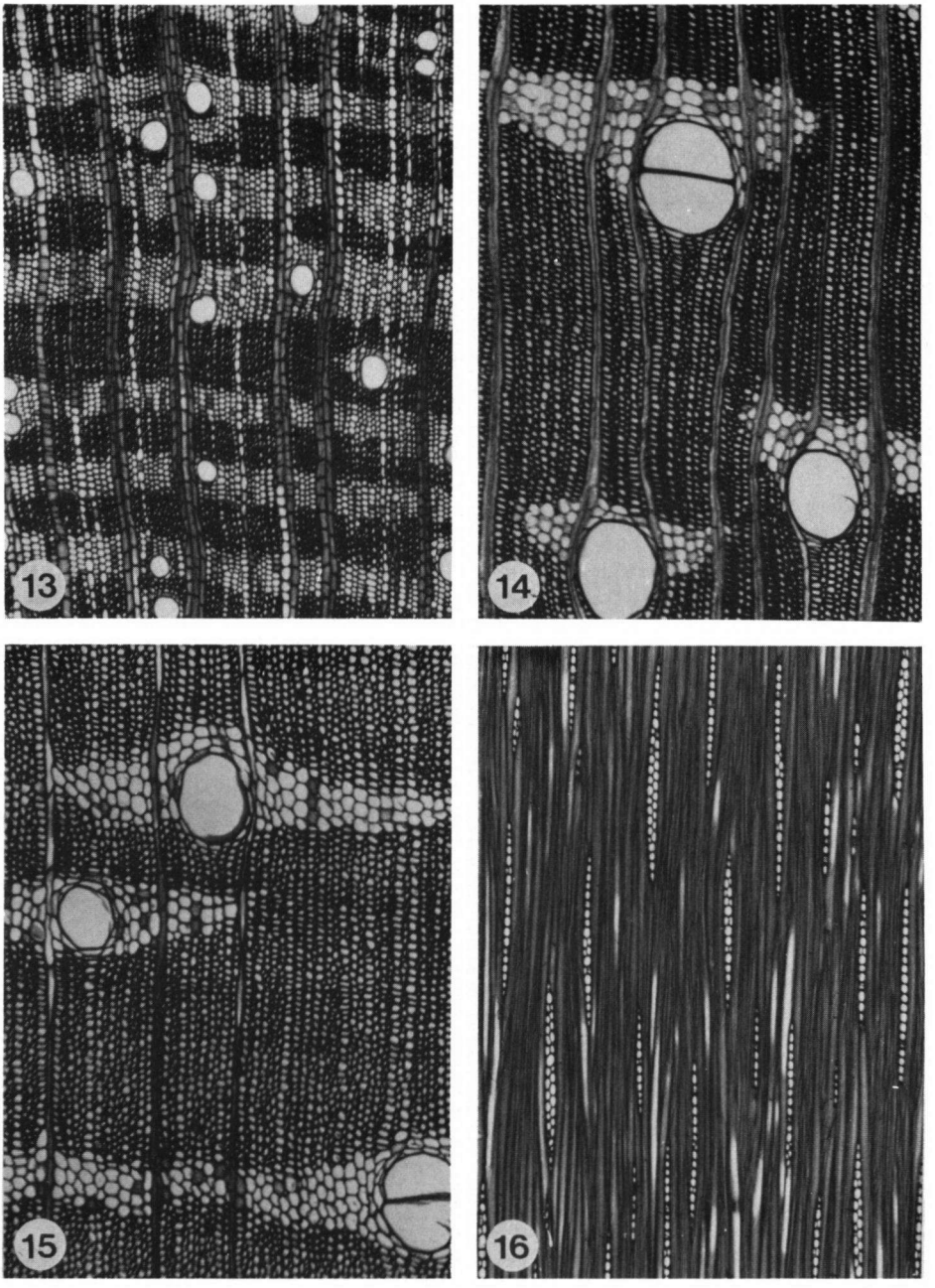


Fig. 13. *Clarisia ilicifolia*, Uw 7982. — Fig. 14. *Parartocarpus bracteatus*, Uw 24435. — Fig. 15. *Parartocarpus venosus* ssp. *forbesii*, Uw 25807. — Fig. 16. Ibid.

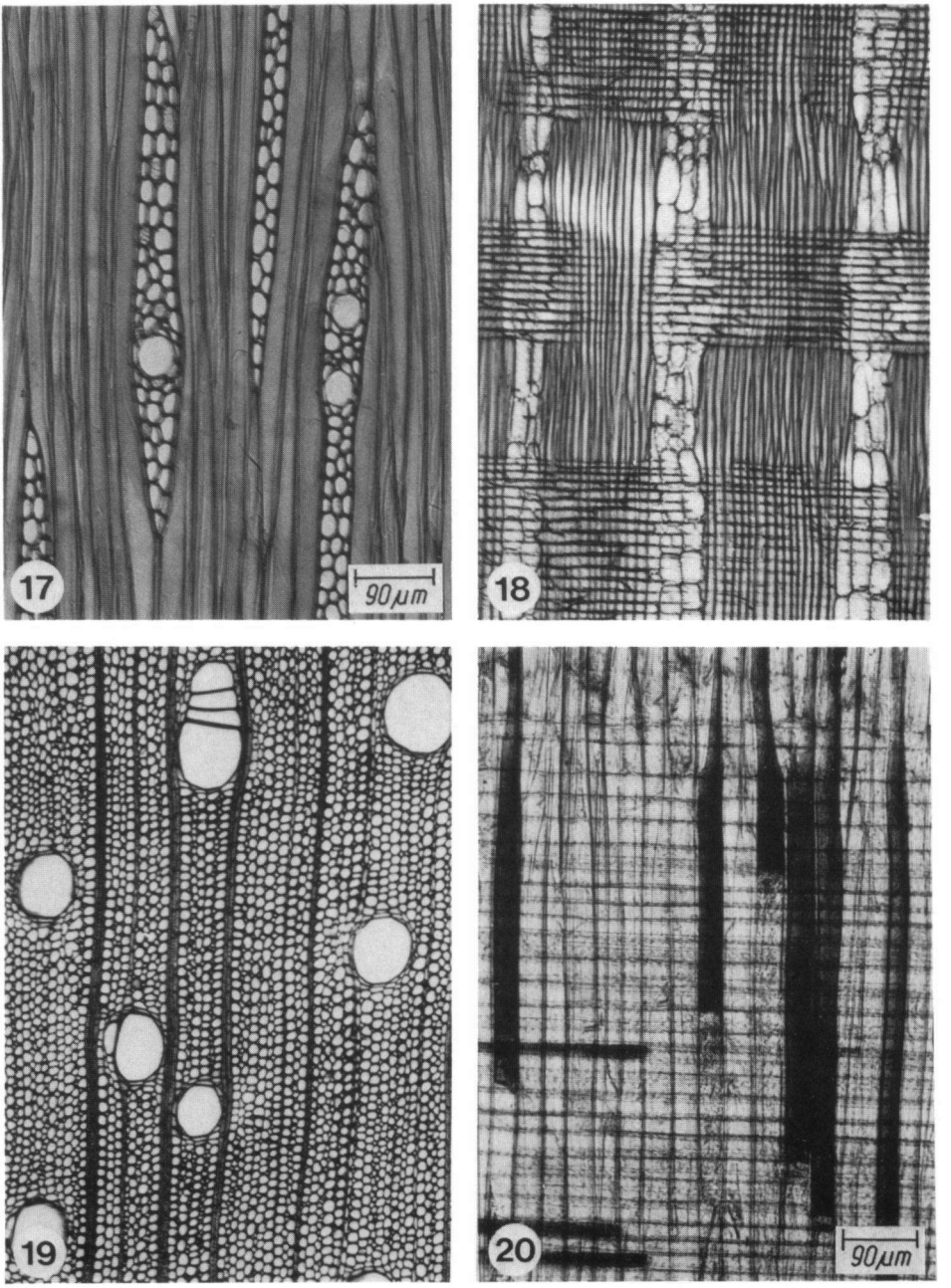


Fig. 17. *Parartocarpus bracteatus*, Uw 24436, radial latex tubes, type 2. — Fig. 18. *Parartocarpus venosus* ssp. *forbesii* Uw 25807, homogeneous rays. — Fig. 19. *Poulsenia armata*, Uw 24638. — Fig. 20. Ibid., Uw 20696, vitreous silica in the fibres.

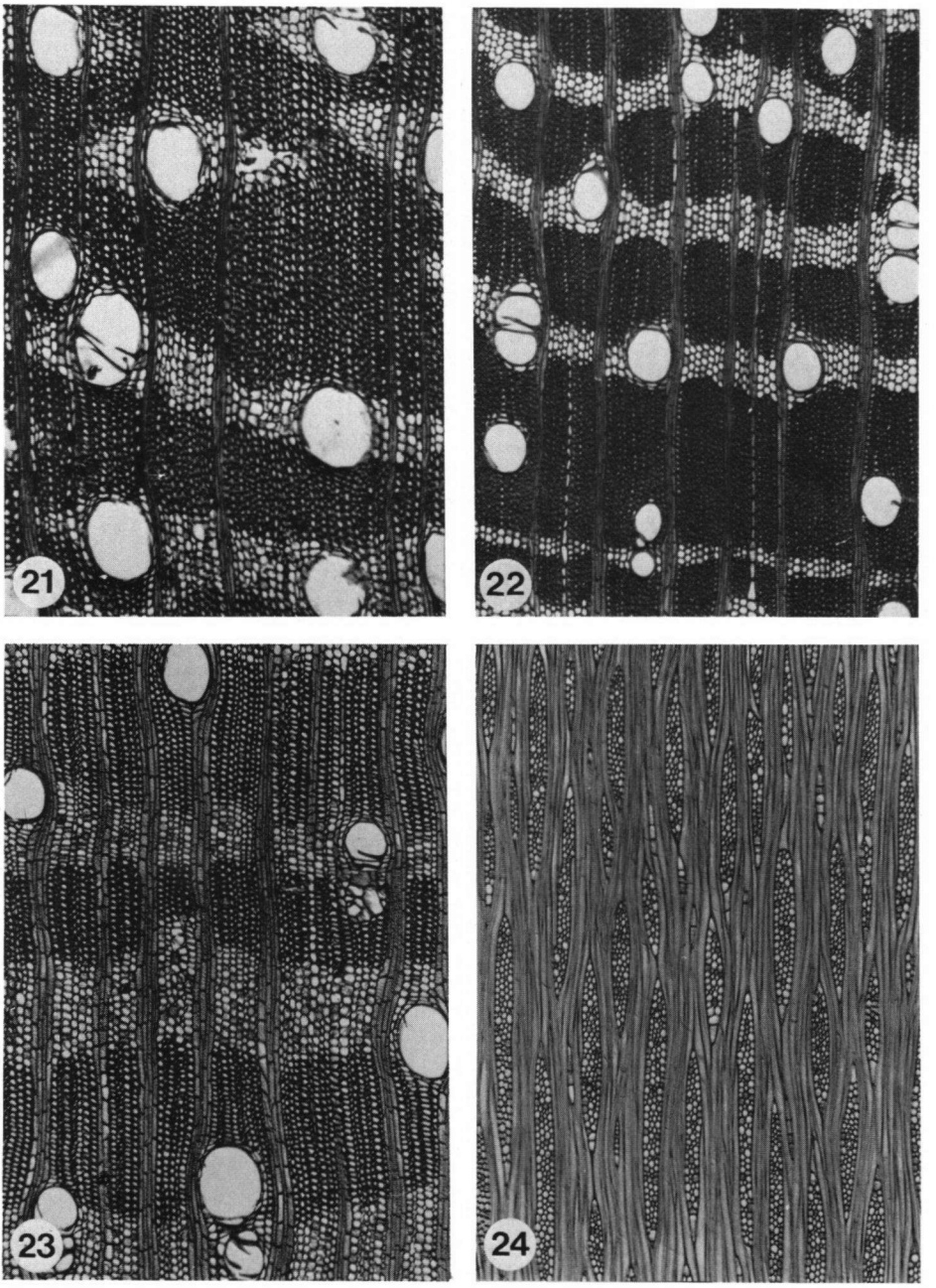
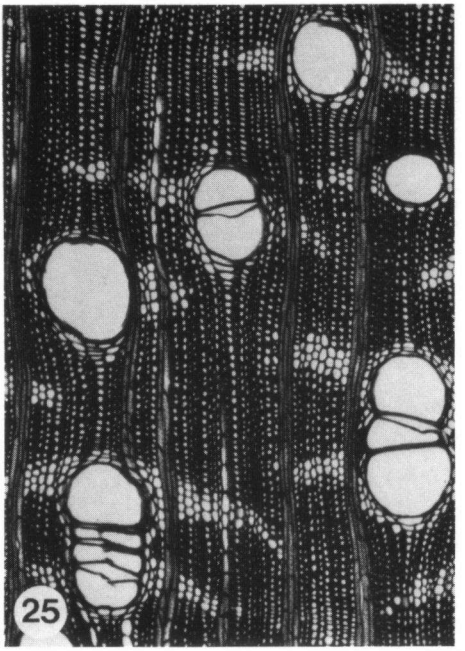


Fig. 21. *Prainea papuana*, Uw 18124. — Fig. 22. *Sorocea guilliminiana*, Uw 20941. — Fig. 23. *Sparattosyce dioica*, Uw 24627. — Fig. 24. Ibid.



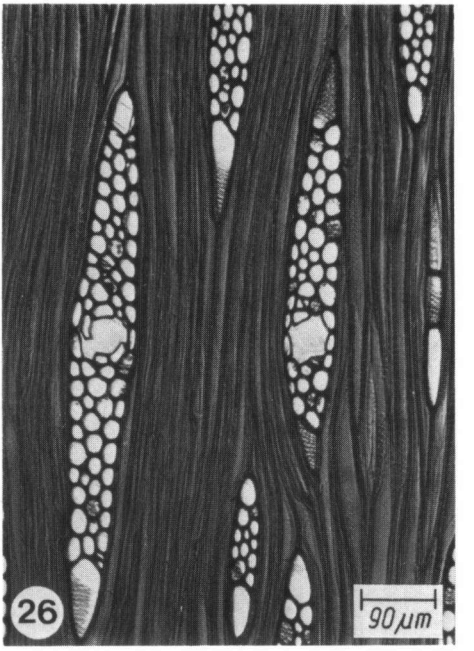


Fig. 25. *Treculia africana*, Uw 24640. — Fig. 26. Ibid., radial latex tubes, type 2.

Note: In Williams 5334 (cited by Mello Filho & Emmerich, 1968, as *B. amazonicus*) rhombic crystals occur in square and upright cells, and less frequently in the procumbent ray cells and the (occasionally chambered) axial parenchyma cells. In all other specimens crystals are lacking.

Clarisia Ruiz & Pavon (Figs. 11–13; Table 1)

The genus comprises three species, according to Berg (1968) who included the genus *Acanthinophyllum* monographed by Burger (1962) by combining *A. ilicifolia* and *A. spruceana* to *Clarisia ilicifolia*. The genus is distributed in Central America and the northern part of South America. Two species (*C. racemosa* and *C. biflora*) are trees up to 40 m high. *Clarisia ilicifolia* is a shrub or tree up to 20 m high. All species occur in tropical lowland forests.

Material studied: *C. biflora* Ruiz & Pavon. Colombia, Chocó: Cuatrecasas 15487 (Uw 25091); Peru: Ellenberg 2511 (Uw 8712). – *C. ilicifolia* (Sprengel) Lanj. & Rossb. Guyana: For. Dept. 4039 (Uw 982); Surinam: Lindeman 6776 (Uw 4587); Daniels & Jonker 1079 (Uw 8593), 1081 (Uw 8595); van Donselaar 1221 (Uw 10835); Brazil: Krukoff 6849 (Uw 7982); Maguire et al. 56675 (Uw 16474). – *C. racemosa* Ruis & Pavon. Venezuela: Breteler 5054 (Uw 12293); Colombia: de Bruijn 1056 (Uw 14464), 1553 (Uw 14496); Ecuador: For. Stat. Connocotto s.n. (Uw 23877); Brazil, Amazonas: Krukoff 6327 (Uw 7645), 6628 (Uw 7829); Loureiro et al., INPA X-5567 (Uw 23714).

General features: Growth rings absent or very faint; heartwood absent or indistinguishable from the light brown sapwood in *C. biflora* and *C. ilicifolia*, heartwood dark brown and sharply defined from the light brown sapwood in *C. racemosa*. Texture medium (*C. ilicifolia*) to coarse (*C. biflora, C. racemosa*), grain straight, but interlocked in *C. racemosa*. Specific gravity 400–500 N per cubic metre in *C. biflora*, and 650–850 N per cubic metre in the other two species.

Microscopic features: Vessels diffuse, solitary (25–51%) and in short radial multiples and irregular clusters of 2–5; 3–13 per sq. mm, round to slightly oval, diameter 75–200 µm, vessel member length 310–485 µm. Perforations simple, end walls almost transverse. Intervascular pits alternate, round and polygonal, 6–11 µm. Vessel-ray and vessel-parenchyma

Table 1. Some wood anatomical characters of species of *Clarisia*.

Species	vessel diameter (in μm)	vessel frequency (per sq. mm)	SiO_2 in vessels	% of uniseriate rays	vessel member length (in μm)	fibre length (in μm)	F/V-ratio	rhombic crystals
C. biflora	180–200	3–4	–	11–16	465–485	1200–1500	2.6–3.1	–
C. ilicifolia	75–105	7–13	+	13–22	310–320	960–1315	3.8–4.2	(u, p, a)
C. racemosa	144–200	4–5	+	1–3	400	1285–1300	3.2–3.3	(p, a)

Legend: F/V-ratio: ratio of fibre and vessel member length. – Crystal distribution: u: in square and upright cells; p: in procubent ray cells; a: in axial parenchyma cells.

pits larger, elongated, and irregularly shaped, half-bordered, the borders sometimes reduced. Thin-walled tyloses common. Fibres nonseptate, with small simple pits restricted to the radial walls; walls 2–4 μm, lumina 6–20 μm, gelatinous fibres often present; length 960–1500 μm; F/V-ratio 2.6–4.2. Rays uniseriate and multiseriate, heterogeneous type II, III and occasionally almost homogeneous, 4–7 per mm. Uniseriate rays 1–22%, composed of variable amounts of procumbent, square and upright cells, height up to 4–12 cells (150–360 μm). Multiseriate rays composed of procumbent cells except for the uniseriate margins of 0–2(–5) cells of square and/or upright cells; 3–6 cells wide, up to 600–1560 μm high. Sheath cells always present, but scarce. Parenchyma vasicentric, aliform with short, and occasionally long wings, but predominantly banded, varying from commonly wavy bands to sometimes concentric bands, 2–6(–8) cells wide and 1–3(–4) per mm. Terminal bands occasionally present. Parenchyma strands of 2–4 cells. Rhombic crystals present or absent in the rays and/or axial parenchyma, usually scarce if present. Vitreous silica common in the vessels, but generally scarce. Radial latex tubes observed in some samples of *C. ilicifolia*.

Note: The wood anatomical difference between the three species of *Clarisia* are considerable. For some characters this is illustrated in Table 1.

Parartocarpus Baillon (Figs. 14–18)

The genus has been monographed by Jarrett (1960c). Two species and four subspecies were recognised by her. A third species was described by Corner (1976). The genus is distributed from Thailand throughout Malesia and the Solomon Islands. The medium to large trees, up to 45 m high, inhabit evergreen lowland rainforests, extending up to 1800 m altitude.

Material studied: *P. bracteatus* (King) Becc. Malaysia: RTIw IND. Col. 24620 (Uw 24435), RTIw IND. Col. 24632 (Uw 24436). – *P. venenosus* (Zoll. & Mor.) Becc. ssp. *borneensis* (Becc.) Jarrett. Indonesia, Borneo: DFP 5008 (Uw 24413). – *P. venenosus* (Zoll. & Mor.) Becc. ssp. *forbesii* (King) Jarrett. Malaysia: F.R.I. Kepong, ex SJRw 38498 (Uw 24639); Indonesia, Sumatra: Krukoff 4124a (Uw 25807). – *P. venenosus* (Zoll. & Mor.) Becc. ssp. *papuanus* (Becc.) Jarrett. Indonesia, Irian Jaya: BW 12294 (Uw 18185), BW 9422 (Uw 20478), BW 4243 (Uw 24352); Philippines, Bataan: BF Manila, ex SJRw 17584 (Uw 24340). – *P. venenosus* (Zoll. & Mor.) Becc. ssp. *venenosus*. Indonesia, Java: Koorders 4273w (Uw 24633).

General features: Growth rings absent; heartwood light yellow-brown, indistinguishable from the sapwood. Texture coarse, grain interlocked. Specific gravity (290–)400–600 N per cubic metre.

Microscopic features: Vessels diffuse, solitary (21–60%) and in short radial multiples

or regular clusters of 2–4 (5); 1–3 per sq.mm, round to oval, diameter 170–275 μm, vessel member length 465–740 μm. Perforations simple, end walls almost transverse. Intervascular pits alternate, polygonal and occasionally round, 14–15 μm. Vessel-ray and vessel-parenchyma pits larger, elongated and more irregularly shaped, half-bordered, the borders usually reduced. Thin-walled tyloses very scarce. Fibres nonseptate, with small simple pits restricted to the radial walls; walls 2–4 μm, lumina 15–25 μm; length 1370–1810 μm; F/V-ratio 2.2–3.8. Rays uniseriate and multiseriate, homogeneous, 4–6 per mm. Uniseriate rays usually 1–8%, in some samples up to 30%, composed of procumbent cells only, height up to 4–14 cells (140–420 μm). Multiseriate rays composed of procumbent cells only; 2–3 (4) cells wide, up to 600–1200 μm high. Parenchyma rather abundant, vasicentric-aliform with short and/or long wings to confluent, occasionally in short wavy bands. In all samples a tendency towards unilateral abaxial parenchyma is evident. Parenchyma strands of 3–4 cells. Radial latex tubes common and with a large diameter as compared to the surrounding ray cells; as a result, the latex tubes are very conspicuous. Rhombic crystals common, but sometimes scarce, in the axial parenchyma.

Poulsenia Eggers (Figs. 19, 20)

A monotypic genus distributed from Mexico to Ecuador and Bolivia. Trees up to 40 m high in tropical rainforests within the area.

Material studied: *P. armata* (Miq.) Standley. Mexico: Williams 8426, ex SJRw 34588 (Uw 24624); Trigos 309 (Uw 25689); Costa Rica: IICA CCO 29 (Uw 20696); Panama: Cooper & Slater 132, ex SJRw 10312 (Uw 24628), Cooper & Slater 88, ex SJRw 10269 (Uw 24629); Colombia: Cuatrecasas 14342 (Uw 24638).

General features: Growth rings faint or absent; heartwood yellow to creamish and indistinguishable from the sapwood. Texture medium to coarse, grain interlocked. Specific gravity 250–450 N per cubic metre.

Microscopic features: Vessels diffuse, solitary (35–90%) and in short radial multiples or irregular clusters of 2–4; 4–10 per sq.mm, round to slightly oval, diameter 105–210 μm, vessel member length 670–695 μm. Perforations simple, end walls almost transverse. Intervascular pits alternate, round and/or polygonal, 6–9 μm. Vessel-ray and vessel-parenchyma pits larger, elongated, more irregular-shaped, half-bordered, the borders reduced. Thin-walled tyloses sometimes present, but always scarce. Fibres nonseptate, with small simple pits restricted to the radial walls; walls 2–3 μm, lumina 15–35 μm; length 1410–1415 μm; F/V-ratio 2.0–2.1. Rays uniseriate and multiseriate, heterogeneous type III, 3–5 per mm. Uniseriate rays 3–27%, composed of upright and square cells and a few procumbent cells, height up to 4–7 cells (180–310 μm). Multiseriate rays composed of procumbent cells except for the uniseriate margins of 1–2 rows of square and/or upright cells; 4–6 cells wide, up to 960–1400 μm high. Occasionally with some sheath cells. Parenchyma vasicentric-aliform with short wings, occasionally confluent. Parenchyma strands of 2–8 cells. The parenchyma distribution is not very clear in the transverse sections, because the lumen diameter/wall thickness ratio of the fibres is almost equal to that of the parenchyma cells. Vitreous silica abundant in the fibres, and occasionally also in the axial parenchyma and the vessels. Radial latex tubes common, the diameter of the tubes in part equal to the diameter of the ray cells, partly larger (as seen in the tangential section).

Notes: Going from Mexico, Costa Rica, Panama, to Colombia, the diameter of the intervascular pits increases from 6–7 to 9 μm. At the same time, the specific gravity decreases from 450 to 250 N per cubic metre.

In about 50% of the samples a tendency towards an oblique vessel distribution was noticed. The genus shows a high accumulation of vitreous silica, which may exceed 7% (of dry weight) according to Van Slooten (1968).

Prainea King ex Hook. f. (Fig. 21)

The genus comprises four species according to the most recent monograph (Jarrett, 1959b). The species are confined to Malesia: 3 species in Sumatra, Malaya and Borneo, and 1 in the Moluccas and Irian Jaya / Papua New Guinea. The trees up to 35 m high are found in evergreen rainforests up to 1200 m altitude.

Material studied: *P. frutescens* Becc., Malaysia, Sarawak: CSIRO 32639 (Uw 24363). – *P. limpato* (Miq.) Beumée ex Heyne. Malesia (?): RTIw IND. Col. 20013 (Uw 24437), RTIw IND. Col. 14316 (Uw 24438). – *P. papuana* Becc. Indonesia, Irian Jaya: BW 11785 (Uw 18124), BW 1559 Fokkinga (Uw 24356), BW 1664 Fokkinga (Uw 24357).

General features: Growth rings absent; heartwood dark-brown, sharply defined from the light-brown sapwood. Texture medium to coarse, grain slightly interlocked. Specific gravity 600–700 N per cubic metre (in *P. limpato* 780–980 N per cubic metre).

Microscopic features: Vessels diffuse, solitary (50–84%) and in short radial multiples and irregular clusters of 2–4; 2–4 per sq.mm,

round to slightly oval, diameter 190–220 μm (130 μm in *P. limpato*, Uw 24438), vessel member length 350–450 μm. Perforations simple, end walls almost transverse. Intervascular pits alternate, round and polygonal, 9–12 μm. Vessel-ray and vessel-parenchyma pits larger, elongated, more irregular-shaped, half-bordered, the borders often reduced. Thin-walled tyloses common, varying from abundant to scarce. Fibres all or in part septate, several septa per fibre, with small simple pits restricted to the radial walls; walls 2–5 μm, lumina 7–14 μm, partly gelatinous in *P. frutescens*; length 1230–1420 μm; F/V-ratio 3.1–3.5. Rays uniseriate and multiseriate, heterogeneous type III, 4–7 per mm. Uniseriate rays 13–20%, composed of upright and square cells, only occasionally some procumbent cells, height up to 4–7 cells (240–420 μm). Multiseriate rays composed of procumbent cells except for the uniseriate margins of 1–3 rows of square and/or upright cells; 3–5 cells wide, up to 720–1200 μm (in *P. frutescens* up to 480 μm) high. Occasionally with some sheath cells. Parenchyma vasicentric-aliform with short to long wings, occasionally confluent or in short (wavy) bands. Parenchyma strands of 4 cells. Vitreous silica common in the vessels, enveloping the tyloses; occasionally also in the fibres and sporadically in the axial parenchyma.

Sorocea St. Hil. (Fig. 22)

The genus has recently been monographed by Berg and Akkermans (1985), who recognised 16 species. The genus *Paraclarisia* was already included in *Sorocea* by Burger et al. (1962). *Sorocea* is distributed in the Neotropics, from Guatemala to Paraguay and Argentina, and in Curacao. The shrubs or trees are up to 6–20 m high, and are generally components of the understory in moist, non-flooded forests, from sea level up to 2000 m altitude.

Material studied: *S. bonplandii* (Baillon) W. Burger, Lanjouw & W. Boer. Brazil, Santa Catharina: Reitz 15026 (Uw 6409), Paraná: Lindeman & H. de Haas 1988 (Uw 13437), 2842 (Uw 13928). – *S. duckei* W. Burger. Brazil, Amazonas: F. Mello, INPA X-3745 (Uw 23664). – *S. faustiniana* Cuatrec. Colombia, Chocó: Cuatrecasas 15204 (Uw 24928). – *S. guilliminiana* Gaudich. Brazil, Amazonas: Prance et al. 18248 (Uw 20902), 19825 (Uw 20941), Matto Grosso: Krukoff 1349 (Uw 19305), 7039 (Uw 8126), 6143, type (Uw 7513), 6223 (Uw 7568). – *S. hirtella* Mildbread. Brazil, Acre: Krukoff 5084 (Uw 19745), 5785 (Uw 20188); Peru: Schunke V. 4827 (Uw 21086). – *S. muriculata* Miq. Brazil, Amazonas: Krukoff 6988 (Uw 8082), 8520 (Uw 16200); Prance & Berg 18468 (Uw 20913); Surinam: Oldenburger et al. 1402 (Uw 17968). – *S. trophoides* Burger ssp. *rhodorachis* Cuatrec. Colombia, Chocó: Cuatrecasas 14891 (Uw 25362), 15572, type (Uw 25436).

General features: Growth rings absent or faint; yellowish to light brown, no difference between heartwood and sapwood. Texture fine, grain straight, sometimes slightly interlocked. Specific gravity 500–1000 N per cubic metre.

Microscopic features: Vessels diffuse, solitary (20–63%) and in short radial multiples and irregular clusters of 2–4 (5); 8–21 per mm, round to slightly oval, diameter 68–130 μm, vessel member length 325–475 μm. Perforation simple, end walls almost transverse. Intervascular pits alternate, round and sometimes polygonal, 6–12 μm. Vessel-ray and vessel-parenchyma pits larger, elongated, half-bordered, the borders often reduced. Thin-walled tyloses common. Fibres nonseptate, with small simple pits restricted to the radial cell walls; walls 2–4 μm, lumina 4–12 μm, gelatinous fibres common; length 1080–1460 μm; F/V-ratio 2.5–3.9. Rays uniseriate and multiseriate, heterogeneous type II/III, 6–9 per mm. Uniseriate rays 7–40%, composed of upright and square and occasionally few procumbent cells, height up to 6–19 cells (180–600 μm). Multiseriate rays composed of procumbent cells except for the uniseriate margins of 1–3 (10) rows of square and/or upright cells; 2–5 cells wide, up to 660–1200 μm high. Parenchyma scanty paratracheal, but predominantly as concentric, sometimes more or less wavy bands enclosing the vessel in part, sometimes also terminal bands present, 2–9 cells wide and 2.7–5 bands per mm. Parenchyma strands of 3–4 cells. Rhombic crystals in the square and upright cells from few to abundant, and less frequent to occasionally absent in the axial parenchyma cells. Radial latex tubes observed in one sample.

Notes. The wood anatomy of the genus is very homogeneous. One species, *S. muriculata*, can be identified using the average vessel diameter, being 68–70 μm in this species, and 90–130 μm in the other species.

Sparattosyce Bureau (Figs. 23, 24)

A genus comprising two species, restricted to New Caledonia and occurring in moderately high forest as trees of up to 8 m high.

Material studied: *S. dioica* Bureau. New Caledonia: Sarlin G 153, ex C.T.F.T. 6201 (Uw 24627), s.n., ex SJRw 14688 (Uw 18425), s.n., ex SJRw 14301 (Uw 18424).

General features: Growth rings absent; light yellow brown, unknown whether dealing

with heartwood or sapwood. Texture medium to coarse, grain straight. Specific gravity 500–540 N per cubic metre.

Microscopic features: Vessels diffuse, solitary (25–50%) and in short radial multiples and occasionally irregular clusters of 2–5; 4–9 per sq. mm, round to slightly oval, diameter 130–160 μm, vessel member length 425–530 μm. Perforations simple, end walls almost transverse. Intervascular pits alternate, round and/or polygonal, 9–11 μm. Vessel-ray and vessel-parenchyma pits larger, elongated, half-bordered, the borders often reduced. Very few thin-walled tyloses occasionally present. Fibres septate, several septa per fibre, but also nonseptate in the same sample, with small simple pits restricted to the radial walls; walls 3–4 μm, lumina 7–20 μm, occasionally gelatinous; length 1080–1255 μm; F/V-ratio 2.1–2.6. Rays uniseriate and multiseriate, heterogeneous type II/III, 6–7 per mm. Uniseriate rays 8–23%, composed of square, upright and some procumbent cells, height up to 6–13 cells (180–600 μm). Multiseriate rays composed of procumbent cells except for the uniseriate margins of 1–2 (in Uw 18425 of 1–6) rows of square and/or upright cells; 3–5 cells wide, up to 720–1450 μm high. Occasionally with a few sheath cells. Parenchyma in concentric bands, partly enclosing the vessels, 4–14 cells wide and 1.4–2 per mm, and some scanty paratracheal strands. Parenchyma strands of 2–4 cells. Rhombic crystals abundant in the axial parenchyma cells, and few in the ray cells. Vitreous silica in the fibres and the axial parenchyma of one sample (Uw 18425).

Treculia Decaisne (Figs. 25, 26)

A recent monograph of the genus by Berg (1977b) comprises three species. The genus is distributed as trees or shrubs from Senegal to Sudan, Angola, Moçambique, and Madagascar. Species available for this study are trees up to 30(–50) m high, from humid to dry primary forests, swamp forest or secondary vegetation, from sea level to 1300 m altitude.

Material studied: *T. africana* Decaisne. Ivory Coast: Détienne 117 (Uw 24640); Cameroon: Foury 131 (Uw 25687); Sao Tomé: Museu Ultramar no. 30 (Uw 26978); Zaire: Louis 2507 (Uw 24242), Inst. Nat. Agron. 3144, ex MADw 17257 (Uw 26977).

General features: Growth rings absent; light brown, no differences observed between sapwood and heartwood. Texture medium to coarse, grain straight. Specific gravity 480–670 N per cubic metre.

Microscopic features: Vessels diffuse, solitary (32–50%) and in short radial multiples and irregular clusters of 2–5; 3–5 (10) per mm, round to slightly oval, diameter 145–205 μm, vessel member length 400–520 μm. Perforations simple, end walls almost transverse. Intervascular pits alternate, round and/or polygonal, 7–9 μm. Vessel-ray and vessel-parenchyma pits larger, elongated, half-bordered, the borders in part reduced. Thin-walled tyloses common, but scarce. Fibres nonseptate, with many small simple pits in the radial walls, occasionally also in the tangential walls; walls 3–5 μm, lumina 9–20 μm, gelatinous fibres occasionally present; length 1245–1575 μm; F/V-ratio 2.7–3.7. Rays uniseriate and multiseriate, heterogeneous type II/III, 4–6 per mm. Uniseriate rays 5–20 %, composed of upright and square cells, height up to 3–5 cells (180–360 μm). Multiseriate rays composed of procumbent cells except for the uniseriate margins of 1–4 rows of upright and/or square cells, 3–5 cells wide, up to 600–660 μm high. Occasionally with some sheath cells. Parenchyma aliform with long narrow wings, confluent and sometimes in short wavy bands. Parenchyma strands of 2 cells. Rhombic crystals common in the square and upright marginal ray cells, few, and very few in the two samples from Zaire. Radial latex tubes common, the diameter of the tubes large compared with the diameter of the ray cells (tangential sections).

Discussion

Wood anatomical variation within genera

Most studied genera are very homogeneous in their wood anatomical characters. This holds in particular for *Artocarpus, Bagassa, Pararto-carpus, Poulsenia, Sparattosyce* and *Treculia.* Within *Batocarpus*, slightly more variation is found in the amount and distribution of the parenchyma (Figs. 9, 10).

In *Prainea*, the sample of *P. limpato* deviates by its narrow vessels and high specific gravity. The sample of *P. frutescens* shows relatively low multiseriate rays. These few exceptions do not disturb the impression of *Prainea* as a natural, well defined genus.

The wood anatomy of *Sorocea* is also homogeneous. The fact, that the vessel diameter of *S. muriculata* is lower than those of the other species (see genus description), is not due to a dry habitat. Only one of the samples studied by us was collected on a dry slope in the Sipaliwini Savanna in southern Surinam showing that the species can endure water stress in this area with its long dry season and low annual rainfall. However, according to Burger et al. (1962), this species occurs in 'moist forests and the

mata de terra firma and the Várzeas.' In other aspects, *S. muriculata* also completely fits in with the samples of other species, at least two of which are known from an area with an annual rainfall of more than 7000 mm (i.e., Chocó, near Bajo Calima, Colombia): *S. faustiniana* and *S. trophoides* ssp. *rhodorachis*.

The genus *Clarisia* is much less homogeneous. Three species were recognised by Berg (1968). The wood anatomical characters can be used to identify the individual species quite easily (see Table 1 on page 185). In 1936 the genera *Clarisia* and *Acanthinophyllum* were revised by Lanjouw. He concluded that they are congeneric. A monograph including these two genera was published in 1962 by Burger. He separated the species with capitate pistillate inflorescences as a distinct genus, *Acanthinophyllum*, from *Clarisia*, leaving only *C. biflora* and *C. racemosa* in *Clarisia*. In *Acanthinophyllum* two species, viz. *A. ilicifolium* and *A. spruceanum*, were recognised. The most recent taxonomic discussion on this problem is by Berg (1968). In his opinion, *A. spruceanum*, only known from the type collection, cannot be distinguished from the very variable *A. ilicifolium*. As a result Berg included *A. spruceanum* in *A. ilicifolium*. Berg also re-evaluated the characters used by Burger (1962) to separate *A. ilicifolium* from *Clarisia*. His conclusion is that *Acanthinophyllum* does not merit generic rank. Consequently, *A. ilicifolium* was transferred again to *Clarisia*. The wood anatomical differences as observed between the three species thus accommodated in *Clarisia* are substantial (Table 1). Based on these differences one could defend a genus rank for *C. ilicifolia* as suggested by Burger (1962). Taking into account the variation range within other, larger genera, however, we decided to follow the genus concept of Berg (1968).

Crystals

Rhombic crystals are rather common in the genera studied. The crystals occur in the ray cells, and less frequently in the axial parenchyma cells. The number of crystals is generally known to be variable from sample to sample. Also in the material used for this study, the amount of crystals varies considerably. However, presence and distribution of crystals, regardless of quantity, distinguishes (groups of) genera (Table 2).

Bagassa and *Sorocea* are similar in their crystal distribution (predominantly in square and upright ray cells but also few in procumbent ray cells and axial parenchyma). *Parartocarpus* and *Sparattosyce* show crystals in axial parenchyma (*Sparattosyce* also occasionally in ray cells). *Treculia* shows crystals in square and upright ray cells only. Crystals are lacking in *Antiaropsis, Artocarpus, Batocarpus* (mostly), *Poulsenia* and *Prainea*. In *Clarisia*, crystals vary not only quantitatively, but also in distribution. Rhombic crystals are absent in *C. biflora*. Few to very few rhombic crystals occur in *C. racemosa:* they are absent in three samples; in one sample very few rhombic crystals were observed in the ray cells; in three samples from Venezuela and Colombia few to very few crystals occur in the axial parenchyma cells. The occurrence of the crystals in *C. ilicifolia* follows a comparable pattern: three samples lack crystals; in one sample very few crystals occur in the ray cells; in the three other samples many to few crystals occur in the ray cells and in the axial parenchyma cells.

Vitreous silica

The quantity of vitreous silica is always (very) variable. It may surround the tyloses, but in some samples it completely fills up the smaller vessels. Fibres and axial parenchyma and occasionally also some of the ray cells may be completely or partly filled.

As can be seen in Table 2, silica is always present in *Artocarpus, Poulsenia* and *Prainea*; it was never found in *Antiaropsis, Bagassa, Parartocarpus, Sorocea* and *Treculia*.

Axial and radial latex tubes

A study of the occurrence of axial and radial latex tubes in *Artocarpus* was carried out by Topper and Koek-Noorman (1980). They concluded that the value of axial latex tubes in taxonomy seems to be restricted. Although radial latex tubes were recorded for all species of *Artocarpus* studied, in three species both specimens with and specimens without radial latex tubes were encountered.

The radial latex tubes can be classified into two types, differing in relative size:

1. radial latex tubes with a diameter more or less equal to the surrounding ray cells as seen in tangential sections;
2. radial latex tubes with a diameter (much) larger than the surrounding ray cells.

Tubes of type 2 are easy to detect, even without a special staining. However, tubes of type 1 can only be observed if the contents of the tubes have a colour distinct from that of the ray cells and are retained in the sections, or when special staining with Sudan III is applied. The results presented here are partly based on observations of unstained sections. Therefore, further studies, using specific staining techniques, may eventually reveal the occurrence of radial latex tubes of type 1 in more taxa.

Table 2. Wood anatomical characters of the genera of the Moreae without urticaceous stamens.

	Vessels					Fibres			Rays
Genus	diameter (in μm)	member length (in μm)	solitary vessels (%)	frequency (per sq. mm)	pit size (in μm)	septate	length (in μm)	F/V-ratio	ray type
Antiaropsis	108	525	50	9	7–9	+	1600	3.0	II/III
Artocarpus	160–310	350–630	45–80	2–6	9–13	–	1170–1950	2.3–3.9	II/III
Bagassa	145–240	325–445	20–60	3–4 (7)	9–13	–	945–1150	2.7–3.0	III
Batocarpus	125–205	295–440	40–65	2–5	7–10	–	1165–1700	3.9–4.4	III
Clarisia	75–200	310–485	25–51	3–13	6–11	–	960–1500	2.6–4.2	(II)/III/(ho)
Parartocarpus	170–275	465–740	21–60	1–3	14–15	–	1370–1810	2.2–3.8	ho
Poulsenia	105–210	670–695	35–90	4–10	6–9	–	1410–1415	2.0–2.1	III
Prainea	130–220	350–450	50–84	2–4	9–12	+	1230–1420	3.1–3.5	III
Sorocea	68–130	325–475	20–63	8–21	6–12	–	1080–1460	2.5–3.9	II/III
Sparattosyce	130–160	425–530	25–50	4–9	9–11	+	1080–1255	2.1–2.6	II/III
Treculia	145–205	400–520	32–50	3–5 (10)	7–9	–	1245–1575	2.7–3.7	II/III

Table 2 (continued)

	Rays			Parenchyma												
				distribution												
Genus	multiseriate ray height (in μm)	multiseriate ray width (in cells)	frequency (per mm)	d	sp	v	as	al	c	wb	cb	width band (in cells)	number bands (per mm)	radial latex tubes	rhombic crystals	vitreous silica
Antiaropsis	960–1400	3–4	7	–	(+)	–	–	–	–	–	+	3–6	4–5	+ (2)	–	–
Artocarpus	600–1200	3–5	3–6	–	–	–	+	+	(+)	–	–	–	–	+ (1)	–	f, vt, (p)
Bagassa	600–840	2–5	3–7	(+)	(+)	+	(+)	–	–	–	–	–	–	+ (1)	u, p, a	–
Batocarpus	700–1400	4–6	4–6	–	–	(+)	(+)	(+)	(+)	+	–	3–10	2–3	–	–/u, p, a	(f, v)
Clarisia	600–1560	3–6	4–7	–	–	(+)	(+)	(+)	(+)	(+)	(+)	2–6	1–3	–/+ (2)	(u, p, a)	(v, vt)
Parartocarpus	600–1200	2–3	4–6	–	–	–	+	+	(+)	(+)	–	–	–	+ (2)	a	–
Poulsenia	960–1400	4–6	3–5	–	–	+	+	–	(+)	–	–	–	–	+ (2)	–	f, (v, p)
Prainea	480–1200	3–5	4–7	–	–	+	+	(+)	(+)	–	–	–	–	–	–	vt, (f, p)
Sorocea	660–1200	2–5	6–9	–	(+)	–	–	–	–	(+)	+	2–9	2.7–5	–	u, p, a	–
Sparattosyce	720–1450	3–5	6–7	–	(+)	–	–	–	–	–	+	4–14	1.4–2	–	a (p)	(f, p)
Treculia	600–660	3–5	4–6	–	–	–	–	+	(+)	–	–	–	–	+ (2)	u	–

Legend: +: present; –: absent; between brackets: occasionally present. – Rays: II, III: heterogeneous types II, III, according to Kribs (1968); ho: homogeneous, i.e., composed of procumbent cells only. – Parenchyma distribution: d: diffuse; sp: scanty paratracheal; v: vasicentric; as: aliform; al: aliform with long wings; c: confluent; wb: wavy bands; cb: concentric bands. – Radial latex tubes: 1: diameter of the tubes more or less equal to the diameter of the ray cells (in tangential view); 2: diameter of the tubes (much) larger than the diameter of the ray cells (tangential view). – Crystal distribution: u: in square and upright cells; p: in procumbent ray cells; a: in axial parenchyma cells. – Vitreous silica: f: in fibres; p: in parenchyma; v: in vessels; vt: in tyloses in the vessels.

As far as we know, radial latex tubes are present in all samples of:

Antiaropsis : type 2, radial, diameter approx. 28 μm, few;
Artocarpus : type 1, radial and axial (in part), 10–20 μm, relatively abundant;
Bagassa : type 1, radial and occasionally axial, 12–20 μm, few;
Parartocarpus : type 2, radial, diameter 20–48 μm, usually abundant;
Poulsenia : type 2, radial, diameter (10) 16–24 μm, few;
Treculia : type 2, radial, diameter 24–48 μm, few to abundant.

The genus *Clarisia* is problematic with respect to the presence of radial latex tubes. They are absent in *C. racemosa* and *C. biflora*. In *C. ilicifolia* three of the four specimens from Surinam show some radial latex tubes of type 1 (diameter approx. 12 μm).

One latex tube of size type 2 was observed in *Sorocea hirtella* (Uw 19745). As none of the other *Sorocea* samples studied showed any latex tubes, the genus *Sorocea* is regarded essentially as a taxon without latex tubes. Finally, no latex tubes were found in the genera *Batocarpus, Prainea*, and *Sparattosyce*.

Based on these data, the occurrence of radial latex tubes may be regarded as a useful character for generic diagnosis, even if we keep in mind the possibility that narrow latex tubes (type 1) may have been overlooked in some taxa until now.

Identification of the individual genera

All individual genera studied are (highly) homogeneous, except *Clarisia*, where several wood anatomical characters vary from species to species, or even within the species.

In contrast, the wood anatomy on the intergeneric level is heterogeneous. Most individual genera may be identified using the following features: the occurrence of septate fibres (*Antiaropsis, Prainea, Sparattosyce*); of rhombic crystals (*Bagassa, Clarisia, Parartocarpus, Sorocea, Sparattosyce, Treculia*), homogeneous rays (*Clarisia, Parartocarpus*), and the parenchyma pattern: bands in contrast to a vasicentric or aliform-confluent distribution (see Table 2). The only problem is found in *Clarisia*, as the three species appear to be variable in all these features with the exception of absence of septate fibres.

Taxonomic affinities

The 11 genera studied, now united in the group of Moreae without urticaceous stamens (Berg, 1983), have been assigned to several tribes and subtribes in the past (see Introduction).

Next to the presence or absence of crystals, vitreous silica, and latex tubes, parenchyma distribution and the occurrence of septate fibres are characters sometimes useful in classification.

Three genera are considered to be closely allied by all taxonomists: *Artocarpus, Parartocarpus* and *Treculia*. Jarrett (1959a) mentions *Prainea* as a close ally of *Artocarpus* with *Parartocarpus* and *Treculia* in a less closely allied series. We found no particular wood anatomical features to support a close relationship between these four genera, despite their possession of vasicentric-aliform (to confluent) parenchyma. This pattern is also found, however, in *Bagassa* and *Poulsenia*, which were never placed in the same tribe with *Artocarpus* and allies before.

The genera with concentric parenchyma bands were formerly placed in two different groups: *Clarisia* and *Sorocea* in subtribe Euartocarpeae (Engler, 1888) and Moreae (Corner, 1962); *Antiaropsis* and *Sparattosyce* (the latter in Ficeae according to Engler, 1888) in Olmedieae (Corner, 1962). The Olmedieae (= Castilleae sensu Berg, 1977a) are characterised by the presence of septate fibres (Mennega & Lanzing-Vinkenborg, 1977). Septate fibres also occur in *Antiaropsis* and *Sparattosyce* (this paper) and *Olmedia* (Ter Welle et al., 1986). Within the Castilleae sensu Berg the parenchyma pattern varies from aliform-confluent to banded (Koek-Noorman et al., 1984), and we found no wood anatomical arguments to exclude *Antiaropsis, Sparattosyce* and *Olmedia* from the Olmedieae. *Prainea* is the only genus with septate fibres, which has never assigned to the Olmedieae.

It will be evident from the foregoing (see also Ter Welle et al., 1986), that wood anatomical characters within the Moreae can be used to identify (groups of) genera, but that comments on the delimitation of this tribe can only be made when the family as a whole is taken into consideration. This will be the subject of a subsequent paper.

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