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WOOD ANATOMY OF THE NEOTROPICAL MELASTOMATACEAE

BEN J. H. TER WELLE & JIFKE KOEK-NOORMAN

Institute of Systematic Botany, University of Utrecht,
Heidelberglaan 2, Utrecht, The Netherlands.

SUMMARY

The wood anatomy of 47 genera of the neotropical Melastomataceae is described in detail. The wood anatomy of the neotropical part of this pantropical family supports the subdivision into two groups: the subfamily *Memecyloideae* (the genus *Mouriri*) and the subfamily *Melastomatoideae* (all other genera). A relationship of *Mouriri* with other representatives of the family is not supported by the wood anatomical characters, because of differences in fibre type, vessel distribution, and the fibre length/vessel member length ratio, and the presence of included phloem in *Mouriri*. The subfamily *Melastomatoideae* is a fairly homogeneous group. Although some characters are very pronounced in some tribes and scarce or absent in other tribes, most tribes show a wide overlap in their wood anatomical features. An important means to distinguish to a certain extent between tribes is the size and shape of the intervascular pits combined with the size and shape of the vessel—ray and vessel—parenchyma pits. Three groups can be recognized: type 1. all pits round to slightly oval; type 2. intervascular pits round to oval, and the vessel—ray and vessel—parenchyma pits more elongated, oblong to scalariform; type 3. all pits round to oblong and scalariform. Other diagnostic characters are the parenchyma distribution, and the distribution of the fibre pits. The tribe *Blakeeae* can be separated from the other tribes due to the presence of druses and 2–4-seriate rays.

The relationship between wood anatomical characters and habit and habitat, as well as possible phylogenetic trends in the family and classification of the neotropical tribes are discussed.

CONTENTS

INTRODUCTION

Since 1974 the systematic wood anatomy of the Myrtales has been a research project of the Rijksherbarium (Leiden). So far, comprehensive studies have been carried out by Van Vliet and others, dealing with the following groups: Crypteroniaceae sensu lato (Van Vliet, 1975), Rhizophoraceae (1976, Van Vliet; not truly Myrtalean), Lythraceae (Baas & Zweypfenning, 1979), Punicaceae (Bridgwater & Baas, 1978), Combretaceae (Van Vliet, 1979), *Alzatea* (Baas, 1979) and *Leptospermum* (Baas, 1977).

The wood anatomy of the Melastomataceae of the Old World has been studied by Van Vliet and is published in this issue. The neotropical *Melastomataceae* have been subject of study in Utrecht. Preliminary papers deal with the wood anatomy of the tribe *Blakeeae* (Koek-Noorman et al., 1979), fibre-dimorphism in *Miconia* (Ter Welle & Koek-Noorman, 1978) and the occurrence of mega-styloids in *Henriettea* (Ter Welle & Mennega, 1977). The present paper completes our research work on the wood anatomy of the neotropical Melastomataceae.

The Melastomataceae form a large pantropical family of about 3000 species in *c.* 240 genera, approximately two thirds of which are confined to the Neotropics. Among these genera we find herbs (both annuals and perennials), lianas, and epiphytes, but the majority are shrubs or trees. It is a very natural family, usually easy to recognize with the exception of a few genera only. The most recent monograph of the family is that by Krasser (1893). Two years earlier (1891) Cogniaux had published his ideas on the classification of this group. He divided the Melastomataceae into three subfamilies: *Melastomatoideae, Astronioideae* and *Memecyloideae*. After Cogniaux and Krasser no taxonomist, however, published a study dealing with the family as a whole again, and there have been no such studies for the Neotropics or for the Palaeotropics either. The most comprehensive work on the neotropical part of the family is provided by Wurdack (1973) in the Flora of Venezuela. Besides, some genera have been monographed recently, viz. *Memecylon* and *Votomita* by Morley (1976), and *Rhexia* by Kral & Bostick (1969). Since Cogniaux's and Krasser's monographs various new genera were published, viz. *Sandemania, Llewelynia, Alloneuron* and *Tateanthus*, in some cases without indication about the tribe they should be assigned to. In a personal communication Dr. J. J. Wurdack (Washington) has given his opinion on the systematic position of these genera.

Solereder (1899, 1908) gave many anatomical data, mainly based on herbarium material. Metcalfe & Chalk (1950) compiled the data from literature, supplemented by data from their own research. A comprehensive wood anatomical study of the family, however, was not published until now. In this paper we present detailed generic descriptions based on material studied by us. Furthermore, a discussion of some wood anatomical features found in the family and a discussion of existing taxonomic classification are provided.

MATERIAL AND METHODS

For this study, 185 wood specimens, representing 47 genera and 160 species, were examined. Information on collector's numbers and wood collection accession numbers (abbreviations according to Stern, 1978), locality and diameter of the samples is given at

the beginning of each generic description. Sections and macerations were prepared according to standard techniques and embedded in Canada balsam and in glycerin respectively. The terminology proposed by the Committee on nomenclature of the I.A.W.A. (1964) is followed.

As for the quantitative data: vessel diameters were measured in tangential direction and averages are based on 25 measurements. The vessel frequency is based on 10 counts. In the descriptions, average, minimum and maximum values are given for both characters. The percentage of solitary vessels was calculated after examining an area with at least 100 pores. Clusters and multiples were regarded as 2, 3, 4, etc. vessels, depending on the number of vessels per group. The end wall angles were estimated, a horizontal end wall indicated as 'end wall angle 0°'. For the round intervascular pits the minimum and maximum sizes are given, whereas for the oval and oblong pits only the maximum values are given. Vessel member lengths, fibre lengths and parenchyma lengths (including both strands and fusiform cells) are based on 25 measurements per sample. Averages and minimum and maximum sizes are given. Additionally, the averages were used to calculate the ratio of fibre length/vessel element length and parenchyma length/vessel element length, in the descriptions referred to as F/V- and P/V-ratio, respectively. For the fibres, maximum wall thickness and maximum lumen diameter are given. For the parenchyma strands the minimum and maximum number of cells is reported.

In representatives of the Melastomataceae tangential bands of axial parenchyma are scarce. However, in many species parenchyma-like bands do occur. These bands consist of parenchyma strands, fusiform parenchyma cells, and/or fibres which differ from the fibres of the ground tissue in wall thickness, lumen diameter, and sometimes in pit size (Ter Welle & Koek-Noorman, 1978). The relative frequency of these elements may vary considerably, from parenchyma mixed with some sporadic fibres to fibres only. In the descriptions these bands are referred to as pseudoparenchyma. Parenchyma cells, forming part of the bands of pseudoparenchyma, are not mentioned under parenchyma, but only under pseudoparenchyma. Ray height is presented in number of cells and in micrometers. The data concern the highest rays as observed more than once in the sample, i.e. not taking into account rays of exceptional height far exceeding the others.

DESCRIPTIVE PART

EXPLANATORY NOTES

The generic descriptions are arranged alphabetically per tribe, the tribes being arranged in the sequence given by Cogniaux (1891). His classification of the family in subfamilies and tribes is as follows:

'Subordo I', Melastomeae
- Tribus Microlicieae
- Tribus Tibouchineae
- Tribus Osbeckieae (Palaeotropics)
- Tribus Rhexieae
- Tribus Merianieae
- Tribus Oxysporeae (Palaeotropics)
- Tribus Sonerileae (Palaeotropics)
- Tribus Bertolonieae (herbs only, Neotropics)
- Tribus Dissochaeteae (Palaeotropics)

Tribus Miconieae
Tribus Blakeeae
'Subordo 2', Astronieae
Tribus Astronieae (Palaeotropics)
'Subordo 3', Memecyleae
Tribus Memecyleae (Palaeotropics and Neotropics).

The genera studied wood anatomically are:
Microlicieae: 1. Bucquetia, 2. Rhynchanthera, 3. Trembleya;
Tibouchineae: 4. Aciotis, 5. Brachyotum, 6. Macairea, 7. Marcetia, 8. Nepsera, 9. Tibouchina;
Rhexieae: 10. Monochaetum, 11. Pachyloma;
Merianieae: 12. Adelobotrys, 13. Axinaea, 14. Centronia, 15. Graffenrieda, 16. Huberia, 17. Meriania, 18. Opisthocentra;
Miconieae: 19. Bellucia, 20. Calycogonium, 21. Charianthus, 22. Clidemia, 23. Conostegia, 24. Henriettea, 25. Henriettella, 26. Heterotrichum, 27. Leandra, 28. Loreya, 29. Maieta, 30. Mecranium, 31. Miconia, 32. Myriaspora, 33. Ossaea, 34. Pachyanthus, 35. Platycentrum, 36. Tetrazygia, 37. Tococa;
Blakeeae: 38. Blakea, 39. Topobea;
Memecyleae: 40. Mouriri;
Genera described after 1891: 41. Alloneuron, 42. Huilaea, 43. Llewelynia, 44. Neblinanthera, 45. Sandemania, 46. Tateanthus, 47. Tessmannianthus.

If two species of a given genus were studied, quantitative data are given in the generic descriptions. If more than two species in one genus were studied, the quantitative data are presented in additional tables, specified for each species. Information on the number of species, habit, and geographical distribution of a given genus is according to Wurdack (1973) and has been completed by Dr. J. J. Wurdack (pers. communication). When conspicuous or improbable differences between samples of one genus were found, such is mentioned at the end of the generic descriptions under 'notes'.

GENERIC DESCRIPTIONS

Tribe MICROLICEAE

1. **Bucquetia** DC. — Plate 1:1; table 2

Three species of small shrubs from the Andean part of the Neotropics.

M a t e r i a l s e e n : B. glutinosa (L.f.) DC.: Colombia, King et al. 5714 (=Uw 15049), diam. 2 cm.

Growth rings distinct. Vessels diffuse, except on the growth ring boundaries, solitary (12%) and in radial multiples and irregular clusters of 2–8, 61 (58–72) per sq. mm, round to oval, walls 2.5–4 μm, diameter 49 (32–80) μm, vessel member length 400 (275–500) μm. Perforations simple, end wall angles 15°–60°. Intervascular pits alternate, vestured, round and occasionally oval or oblong, 7–10 and up to 25 × 5 μm. Vessel—ray and vessel—parenchyma pits partly vestured, sometimes reticulate or scalariform, round, oval and oblong, from 5 up to 20 × 4 μm. Thin-walled tyloses scarce.

Fibres non-septate, diameter 13 μm, walls 2.5–3 μm, frequently gelatinous. Pits simple, on radial and tangential walls, 2 μm. Length 535 (400–600) μm, F/V ratio 1.34.

Rays heterogeneous, uniseriate and 2–3 (4)-seriate, composed of square and procumbent with only sporadically upright cells. In the multiseriate rays occasionally sheath cells. Height variable, 45 to 104 cells (=1140–2550 μm), 4 (3–7) per mm.

Parenchyma scanty paratracheal, in strands of 2–7 cells or as fusiform cells; 420 (336–480) μm long, P/V ratio 1.05.

Brown deposits occur in variable amounts in rays, parenchyma and fibres.

2. **Rhynchanthera** DC. — Plate 1:2 and 3; table 1 and 2

A genus of about 40 species of shrubs and herbs, occurring from Mexico to Paraguay.

Material seen: R. brachyrhyncha Cham.: Brasil, Paraná, Lindeman & de Haas 257 (=Uw 12531), diam. 1 cm; R. grandiflora (Aubl.)DC.: Panama, Stern et al. 1706 (=Uw 22399=USw 33574), diam. 2 cm; R. paludicola (Donn.Sm.) Gleason: Costa Rica, FHOw 11654 (=Uw 22062), diam. 1.5 cm.

Growth rings absent or present. Vessels diffuse, solitary (30–38%) and in radial multiples and irregular clusters of 2–6, 36 to 67 (31–79) per sq. mm, oval and sporadically angular, walls 2–3.5 μm, diameter 44 to 54 (30–78) μm, vessel member length 300 to 510 (176–656) μm. Perforations simple, end wall angles 5°–50°. Intervascular pits alternate, vestured, round or polygonal, 5–6 μm. Vessel—ray and vessel—parenchyma pits round and more often elongate, sometimes even scalariform, up to 25 × 7 μm. Thin-walled tyloses observed in R. paludicola.

Fibres non-septate, diameter 13 to 20 μm, walls 2.5–3 μm, in part gelatinous. Pits simple, equally frequent on radial and tangential walls, 2–3 μm. Length 505 to 655 (320–720) μm, F/V ratio 1.29–1.70.

Rays heterogeneous, uniseriate and uniseriate with a biseriate part of 2–8 cells high, sheath cells present, all rays composed of square and/or upright and only very few, weakly procumbent cells. The exclusively uniseriate rays up to 19 cells (=1120 μm) in height, those with a biseriate part up to 29 cells (=1080 μm) in height, 8 to 11 (6–13) per mm.

Parenchyma scarce, scanty paratracheal and sometimes diffuse, in strands of 2–4 cells or as fusiform cells; 350 to 530 (240–688) μm, P/V ratio 1.04–1.17.

Bands of pseudo-parenchyma absent or present, composed of few parenchyma cells and many fibres.

Yellow to brown deposits noticed in rays and axial parenchyma.

Notes: R. brachyrhyncha differs in many characters from the foregoing generic description. Vessels: end wall angles 15°–70°, intervascular pits 7–10 μm; and round vessels. Fibres: septate and sporadically non-septate, pits predominantly on the tangential walls. Rays: exclusively uniseriate, procumbent cells are lacking, 13 (9–15) per mm. Bands of pseudo-parenchyma well developed. For differences in lengths of elements, see table 1. R. paludicola has the vessels arranged in tangential zones.

3. **Trembleya** DC. — Plate 1:4; table 2

Restricted to the southern part of Brazil, with c. 15 shrubby species.

Material seen: T. parviflora (D. Don.) Cogn.: Brazil, Paraná, Hatschbach et al. 13939 (=Uw 14354), diam. 2 cm.

Growth rings absent. Vessels diffuse, solitary (21%) and in radial multiples and irregular clusters of 2–6 (11), 75 (61–99) per sq. mm, round to oval, in part angular, walls 2.5–4 μm, diameter 46 (35–100) μm, vessel member length 385 (176–480) μm. Perforations simple, end wall angles 5°–70°. Intervascular pits alternate, vestured, round and sometimes polygonal, 5–9 μm. Vessel—ray and vessel—parenchyma pits round to elongate, sometimes scalariform, from 8 μm up to 28 × 5 μm.

Fibres only sporadically septate, diameter up to 13 μm, walls 2–3 μm, gelatinous fibres scarce. Pits simple, equally frequent on radial and tangential walls, 2–3 μm. Length 480 (368–540) μm, F/V ratio 1.26.

Rays heterogeneous, uniseriate and mostly 2–3 (4) seriate, composed of square and upright with only sporadically procumbent cells. Sometimes vertically compound and sheath cells present. Multiseriate rays up to 40 cells (=1120 μm) high, 8 (6–11) per mm.

Parenchyma scarce, scanty paratracheal, occasionally diffuse, in strands of 2–5 cells or as fusiform cells; 370 (256–528) μm long, P/V ratio 0.96.

Dark brown coloured deposits abundant in the vessels, rays and axial parenchyma.

Tribe TIBOUCHINEAE

4. **Aciotis** D. Don — Table 2

About 30 species of herbs and shrubs from Central America, the Antilles and South America.

Material seen: A. indecora (Bonpl.) Triana var. macrophylla Cogn.: Venezuela, Wurdack & Adderley 42904 (=Uw 22425=USw 17751), diam. 2 cm; A. rostellata (Naud.) Triana: Panama, Ebinger 329 (=Uw 22291=USw 17209), diam. 1 cm.

Growth rings absent. Vessels diffuse, solitary (46 and 35%) and in radial multiples and irregular clusters of 2–6, 74 and 64 (55–85) per sq. mm, round to oval, sporadically angular, walls 3–5 μm, diameter 40 and 31 (23–53) μm, vessel member length 400 and 450 (160–672) μm. Perforations simple, end wall angles 20°–70°. Intervascular pits alternate, vestured, round and/or polygonal, oval and often oblong, sometimes reticulate, respectively 5–8 μm and up to 28 × 4 μm. Vessel—ray and vessel—parenchyma pits similar to the intervascular pits, but often forming a reticulate or even scalariform pattern, up to 28 × 5 μm.

Fibres non-septate and occasionally septate, diameter 18 and 20 μm, walls 1.5–2.5 μm, often gelatinous. Pits simple, on radial and tangential walls, 2–3 μm. Length 525 and 545 (368–704) μm, F/V ratio 1.21–1.30.

Rays heterogeneous, exclusively uniseriate, composed of upright cells only or with a few square cells. Height up to 6 cells (=400 μm), 5 and 6 (3–9) per mm.

Parenchyma scanty paratracheal, and diffuse in A. rostellata, in strands of 2–4 cells or as septate and non-septate fusiform cells; 420 and 505 (320–640) μm long, P/V ratio 1.04–1.12.

Bands of pseudo-parenchyma present but faint in A. indecora.

5. **Brachyotum** Triana. — Table 1 and 2

About 50 species of shrubs and small trees from the uplands and/or Andean parts of Colombia, Ecuador, Peru and Bolivia.

Material seen: B. coronatum (Triana) Wurdack: Peru, Wurdack 676 (=Uw 22279=USw 32519), diam. 3 cm; B. radula Triana: Peru, FHOw 11629 (=Uw 22047), diam. 3 cm; B. strigosum (L.f.) Triana: Colombia, King et al. 5895 (=Uw 22280=USw 37328), diam. 1 cm.

Growth rings faint. Vessels diffuse, solitary (9–42%) and in radial multiples and irregular clusters of 2–8, 35 to 128 (30–143) per sq. mm, round to slightly oval, sometimes angular, walls 2.5–3 μm, diameter 28 to 67 (15–84) μm, vessel member length 310 to 405 (224–544) μm. Perforations simple, end wall angles 0°–70°. Intervascular pits alternate, and sporadically opposite, vestured, round, oval and oblong, respectively up to 10 and up to 38 × 6 μm. Vessel—ray and vessel—parenchyma pits round and more often elongate, occasionally vestured and sporadically unilaterally compound, from 8 up to 20 × 8 μm.

Fibres mostly non-septate, rarely septate, diameter 10–17 μm, walls very variable, from 1.5–4 μm, gelatinous fibres present in variable amounts. Pits simple, more frequent on the radial than on the tangential walls, 2–3 μm. Length 365 to 510 (304–656) μm, F/V ratio 1.18–1.25.

Rays heterogeneous, uniseriate and uniseriate with occasionally a biseriate part of 2–8 cells high, composed of square and/or upright and very few, weakly procumbent cells. Height up to 35–48 cells (=1280 μm), 7 to 10 (6–15) per mm.

Parenchyma scarce, scanty paratracheal, and few diffuse strands present in B. radula. In strands of 2–4 cells or as fusiform cells (sporadically septate), length 330 to 445 (256–560) μm, P/V ratio 1.00–1.09.

Bands of pseudo-parenchyma commonly well developed, with prominent intercellular spaces between the few diffuse parenchyma cells and the fibres.

Light coloured deposits occur in the rays and the axial parenchyma.

Note: Bands of pseudo-parenchyma were not observed in B. radula.

6. **Macairea** DC. — Plate 2:5; table 1 and 2

About 35 species, mostly small shrubs, from the Neotropics.

Material seen: M. axilliflora Wurdack: Venezuela, Maguire et al. 42632 (=Uw 22359=USw 25259), diam. 1 cm; M. maroana Wurdack: Venezuela, Maguire et al. 41772 (=Uw 22360=USw 24980), diam. 2 cm; M. neblinae Wurdack: Venezuela, Maguire et al. 42101 (=Uw 22333=USw 25101), diam. 1 cm; M. pachyphylla Bth.: Suriname, Maguire 24350 (=Uw 2536), diam. 10 cm; M. thyrsiflora DC.: Venezuela, Maguire et al. 41573 (=Uw 22334=USw 24911), diam. 3 cm.

Growth rings absent. Vessels diffuse, solitary (19–36%) and in prominent radial multiples of 2–6 (10) and sporadical irregular clusters, 43 to 143 (35–162) per sq. mm, round to oval, walls 2.5–5 μm, diameter 33 to 76 (25–96) μm, vessel member length 325 to 555(208–816) μm. Perforations simple, end wall angles 10°–60°. Intervascular pits alternate and occasionally opposite, nearly always vestured, round and/or polygonal, oval and sometimes elongate and thus resembling a scalariform pattern, respectively 4 to 8 and up to 35×3 μm. Vessel—ray and vessel—parenchyma pits round and mostly elongate with the long axis vertical but more often horizontal, creating a reticulate or scalariform pattern. The pits are occasionally vestured and from 15×6 up to 33×5 μm.

Fibres both septate and non-septate in the same sample, for the greater part non-septate, diameter 10–15 μm, walls 3–6 μm, gelatinous fibres scarce. Pits minutely bordered, equally frequent on the tangential and the radial walls, their diameter is very variable from sample to sample, respectively from smaller than 2.5 μm up to 4 (5) μm. Length 425 to 760 (320–1152) μm, F/V ratio 1.22–1.50.

Rays heterogeneous, uniseriate, composed of upright or square and upright cells. Height 10 to 22 cells (=390 to 800 μm), 8 to 11 (6–13) per mm.

Parenchyma scarce, scanty paratracheal, and sporadically diffuse, in strands of 2–5 cells or as fusiform cells; length 355 to 610 (224–880) μm, P/V ratio 1.08–1.11.

Bands of pseudo-parenchyma well developed, with variable amounts of parenchyma cells and often with prominent intercellular spaces.

Dark brown deposits observed in vessels, rays, axial parenchyma and fibres.

Notes: M. axilliflora differs strongly in the number and diameter of the vessels. In M. pachyphylla uniseriate and biseriate rays occur, the latter up to 32 cells (=1090 μm). Another sample of this species, taken from herbarium material (Suriname, Kramer & Hekking 2933, diam. 1 cm) showed uniseriate rays only. The intervascular pits of M. pachyphylla are only partly vestured.

7. **Marcetia** DC. — Table 2

A genus of 10 to 15 species of small shrubs, from Brazil to Uruguay.

Material seen: M. taxifolia (St. Hil.) DC. var. glabrescens Cogn.: Brazil, Maas et al. 3143 (Uw 23861), diam. 5 cm.

Growth rings absent. Vessels diffuse, solitary (32%) and in radial multiples and irregular clusters of 2–6, 114 (101–132) per sq. mm, round and oval, angular, walls 2–3 μm, diameter 38 (32–48) μm, vessel member length 390 (176–528) μm. Perforations simple, end wall angles 10°–45°. Intervascular pits alternate, vestured, round, oval and oblong, from 6 up to 15×5 μm. Vessel—ray and vessel—parenchyma pits sporadically round but commonly oblong or elongate, often scalariform, from 7 up to 22 × 7 μm.

Fibres non-septate, diameter up to 12 μm, walls 2.5 μm, often gelatinous. Pits simple, more frequent on the radial than on the tangential walls, 2–3 μm. Length 440 (272–593) μm, F/V ratio 1.11.

Rays heterogeneous, exclusively uniseriate, composed of square and upright cells. Height up to 12 cells (=500 μm), 7 (5–10) per mm.

Parenchyma scarce, scanty paratracheal, in strands of 2–3 (4) cells or as fusiform cells; 325 (240–464) μm long, P/V ratio 0.83.

Bands of pseudo-parenchyma well developed, with many fusiform parenchyma cells.

Light brown coloured deposits in the ray cells and sporadically in fibres and the axial parenchyma.

8. **Nepsera** Naud. — Plate 2:6; table 2

A monotypic genus of herbs and small shrubs, extending from Central America to Brazil.

Material seen: N. aquatica (Aubl.) Naud.: Suriname, Maas 3192 (=Uw 22424), diam. 1 cm.

Growth rings absent. Vessels diffuse, solitary (43%) and in radial multiples and irregular clusters of 2–5, 69 (55–77) per sq. mm, oval, walls 2–2.5 μm, diameter 45 (33–58) μm, vessel member length 245 (160–336) μm. Perforations simple, end wall angles 5°–45°. Intervascular pits alternate, vestured, round and/or oval, mostly elongate, scalariform, 5 to 38 × 5 μm. Vessel—ray and vessel—parenchyma pits mostly elongate with the long axis horizontal, resembling a scalariform pattern, 5 to 38 × 6 μm.

Fibres septate and non-septate, diameter up to 15 μm, walls 2.5–3 μm, often gelatinous. Pits simple, equally frequent on radial and tangential walls, 2 μm. Length 370 (240–448) μm, F/V ratio 1.51.

Rays heterogeneous, uniseriate and 2(3)-seriate, composed of upright and occasionally square and weakly procumbent cells, some sheath cells present.

Height of the uniseriate rays up to 14 cells (=640 μm) and of the multiseriate rays up to 39 cells (=1200 μm), 9 (8–12) per mm.

Parenchyma scarce, scanty paratracheal, in strands of 2–5 cells or as septate and non-septate fusiform cells; length 305 (224–454) μm, P/V ratio 1.25.

Bands of pseudo-parenchyma faint, composed of fibres and diffuse parenchyma cells.

9. **Tibouchina** Aubl. — Plate 2:7 and 8; plate 3:9, 10, 11 and 12; table 1 and 2

About 350 species of herbs, shrubs and small trees. Very well represented in the southeastern part of Brazil, but extending from Mexico and the Antilles to Argentina.

Material seen: T. andreana Cogn.: Colombia, King et al. 5953 (=Uw 15137), diam. 3 cm; T. arborea (Gardn.) Cogn.: Brazil, Rizzini 2169 (=Uw 22403 =USw 31603), diam. over 6 cm; T. aspera Auble.: Suriname, Heyligers 223 (=Uw 6690), diam. 2 cm; T. bipenicillata (Naud.) Cogn.: Panama, Stern et al. 1780 (=Uw 22404 =USw 33624), diam. 2 cm; T. catharinenses Brade: Brazil, Reitz & Klein 27751 (=Uw 14548), diam. 9 cm; T. chironioides (Griseb.) Cogn.: Dominica, Chambers 2569 (=Uw 22405 =USw 33945), diam. 2 cm; T. ciliaris (Vent.) Cogn.: Colombia, King et al. 5776 (=Uw 15067), diam. 5 cm; T. gleasoniana Wurdack: Ecuador, Maas et al. 2962 (=Uw 23577), diam. 5 cm; T. grossa (L.f.) Cogn.: Colombia, King et al. 5904 (=Uw 15116), diam. 3 cm; T. lepidota (Bonpl.) Baill.: Colombia, King et al. 5669 (=Uw 15035), diam. 5 cm; Ecuador, Maas et al. 2975 (=Uw 23585), diam. 3 cm; T. mollis (Bonpl.) Cogn.: Colombia, King. et al. 5927 (=Uw 15123), diam. 2 cm; T. mollis (Bonpl.) Cogn. var. mollis: Ecuador, Maas et al. 2965 (=Uw 23578), diam. 3 cm; T. ochypetala (R. & P.) Baill.: Peru, Schunke 4923 (=Uw 22261), diam. 3 cm; T. pilosa Cogn.: Brazil, Reitz & Klein 27746 (=Uw 14544), diam. 4 cm; T. pulchra Cogn.: Brazil, Reitz 14915 (=Uw 6371), diam. 6 cm; T. sellowiana (Cham.) Cogn.: Brazil, Reitz & Klein 27745 (=Uw 14543), diam. 4 cm; T. stenocarpa (DC.) Cogn. var. boliviensis Cogn.: Bolivia, Krukoff 11051 (=Uw 2696), diam. over 3 cm; T. stenocarpa (DC.) Cogn.: Brazil, Irwin 5243 (=Uw 22410 =USw 35714), diam. 3 cm; T. trichopoda (DC.) Baill.: Brazil, Lindeman & de Haas 2634 (=Uw 13898), diam. 3 cm.

Growth rings mostly absent, if present faint. Vessels diffuse, solitary (10–76%), and in radial multiples and irregular clusters of 2–9, 7 to 54 (4–73) per sq. mm, round to oval, sporadically angular, walls 1.5–4 μm, diameter 49 to 121 (24–164) μm, 70% of the average values are between 60 and 90 μm, vessel member length 310 to 695 (160–928) μm. Perforations simple, end wall angles 0°–70°. Intervascular pits alternate, vestured, round or polygonal, sometimes oval and sporadically oblong, 5–13 μm and up to 38 × 6 μm respectively. Vessel—ray and vessel—parenchyma pits round to elongate, sometimes scalariform, generally larger than the intervascular pits, the round pits 4–10 μm and the elongate pits up to 38 × 6 μm.

Fibres non-septate or septate or both present in the same species, diameter 10 to 25 μm, walls 2 to 4.5 μm, gelatinous fibres present or absent. Pits simple, more frequent on radial than on tangential

walls, 1.5–4 μm. Length 475 to 815 (256–1324) μm, F/V ratio 1.14–1.74, in 75% over 1.30.

Rays heterogeneous, uniseriate and/or 2–4 seriate, composed of square and upright cells and in some species also of sporadic procumbent cells; sheath cells often present. Height very variable, the uniseriates from 7 to 54 cells (=270 to 1840 μm), the multiseriates from 16 to 90 cells (=480 to 3360 μm), 6 to 11 (4–15) per mm.

Parenchyma variable, always scanty paratracheal, incidentally diffuse, sometimes in tangential bands, those bands in some species consisting of fusiform cells only, in some species consisting of parenchyma strands only, sometimes strands and fusiform parenchyma cells (septate and/or non-septate) both present in the same species. The bands are short to continuous and 2–8 cells wide. Strands of 2–4 cells, sporadically of 2 cells only, or up to 8 cells; length 370 to 635 (256–848) μm, P/V ratio 0.92–1.40.

Bands of pseudo-parenchyma occasionally observed in this genus.

Druses occur in the axial parenchyma of T. bipenicillata. Light yellow to dark brown deposits occur in the rays and the axial parenchyma of many species.

N o t e : As can be seen in the description and in table 1, the genus Tibouchina varies tremendously in a number of features. Besides the number and diameter of the vessels, the type and size of the rays, and the size of the intervascular pits, the distribution of the parenchyma and the composition of the bands of parenchyma and pseudo-parenchyma all vary within wide limits.

Tribe RHEXIEAE

10. **Monochaetum** (DC.) Naud. — Plate 4:13, 14 and 16; table 1 and 2

About 40 species of small shrubs from the western part of tropical America.

M a t e r i a l s e e n : M. compactum Almeda: Panama, Stern et al. 1986 (=Uw 22340 =USw 33760), diam. 1 cm; M. coronatum Gleason: Colombia, King et al. 5665 (=Uw 15033), diam. 1 cm; M. lindenianum Naud.: Colombia, King et al. 5965 (=Uw 22341 =USw 73378), diam. 1 cm; T. meridense (Kl.) Naud.: Colombia, King et al. 5823 (=Uw 15082), diam. 1 cm; M. myrtoideum (Bonpl.) Naud.: Colombia, King et al. 5891 (Uw 15111), diam. 1 cm.

Growth rings absent. Vessels diffuse, solitary (43 to 56%) and in radial multiples and irregular clusters of 2–6, 29 to 63 (16–97) per sq. mm, angular, in part round to oval, walls 2–4 μm, diameter 36 to 58 (23–78) μm, vessel member length 300 to 410 (176–560) μm. Perforations simple, end wall angles 5°–80°. Intervascular pits alternate, sometimes tending to opposite, vestured, polygonal, round and oval and occasionally oblong, sometimes reticulate to almost scalariform, respectively 5 to 9 and 11 × 4 to 28 × 5 μm. Vessel—ray and vessel—parenchyma pits partly vestured, identical to the intervascular pits, but more often reticulate and scalariform, from 9 × 4 to 25 × 8 μm.

Fibres non-septate and sporadically septate, diameter 10 to 23 μm, walls 1.5–3.5 μm, often gelatinous. Pits simple, on radial and tangential walls, 2–3 μm. Length 330 to 560 (224–720) μm, F/V ratio 1.07–1.32.

Rays heterogeneous, uniseriate and uniseriate with a biseriate part of 2–5 cells high, composed of square and upright, sometimes with some weakly procumbent cells. Height 16 to 28 cells (=460 to 880 μm), 7 to 12 (5–16) per mm.

Parenchyma scanty paratracheal and sometimes diffuse in the fibre-tissue, in strands of 2–4 cells or as fusiform cells; length 350 to 435 (272–656) μm, P/V ratio 1.07–1.36.

Bands of pseudo-parenchyma variable, but in general fairly well developed.

Yellowish-brown deposits occasionally present in the rays and axial parenchyma.

N o t e s : Procumbent ray cells were noticed in M. compactum and M. lindenianum. Bands of pseudo-parenchyma were lacking in M. myrtoideum.

11. **Pachyloma** DC. — Plate 4:15; table 2

A genus of 4 species of shrubs in Venezuela, Colombia and Brazil.

Material seen: P. huberioides (Naud.) Triana: Venezuela, Wurdack & Adderley 42800 (=Uw 22396 =USw 17702), diam. 1 cm.

Growth rings absent. Vessels diffuse, solitary (29%), in radial multiples and some irregular clusters of 2–6, 74 (62–82) per sq. mm, angular, walls 3–5 μm, diameter 40 (28–48) μm, vessel member length 390 (256–576) μm. Perforations simple, end wall angles 20°–70°. Intervascular pits alternate, sometimes tending to opposite, vestured, round to oval, respectively 4–6 and up to 8 × 5 μm. Vessel—ray and vessel—parenchyma pits partly vestured, reticulate to scalariform, oblong, up to 25 × 5 μm.

Fibres non-septate and occasionally septate, the latter ones probably restricted to the bands of pseudo-parenchyma, diameter 10–13 μm, walls 2–3 μm, often gelatinous. Pits simple, confined to the radial walls, 2–3 μm. Length 470 (288–592) μm, F/V ratio 1.21.

Rays heterogeneous, uniseriate and very sporadically biseriate, over 1–2 cells high, composed entirely of upright cells which are variable in length. Height up to 30 cells (=1440 μm), 12 (10–13) per mm.

Parenchyma scanty paratracheal and diffuse, scarce, in strands of 2–4 cells or as fusiform cells; length 400 (288–608) μm, P/V ratio 1.03.

Bands of pseudo-parenchyma occasionally present, composed of fibres and few parenchyma cells, with very small intercellular spaces.

Tribe MERIANIEAE

12. **Adelobotrys** DC. — Plate 6:23 and 24; table 2

About 20–25 species of climbers and treelets from Mexico and Jamaica to the Amazon basin in Peru, Bolivia and Brazil.

Material seen: A. macrantha Gleason: Peru, Wurdack 1987 (=Uw 22293 =USw 32560), diam. 3 cm; A. saxosa Wurdack: Venezuela, Maguire et al. 41610 (=Uw 22294 =USw 24933), diam. 1 cm.

At first view there is a strong dissimilarity between the two samples examined, due to the abundant unlignified tissue in the liana A. macrantha. These parts consist of axial and ray parenchyma and to some extent of fibres. Small axial bundles of lignified vessels surrounded by scanty parenchyma and fibres are scattered as isolated groups in the unlignified tissue.

Growth rings absent. Vessels diffuse, solitary (44 and 50%) and in radial multiples and irregular clusters of 2–4, 23 (19–27) and 30 (21–34) per sq. mm, round to angular, walls 5 and 2.5 μm, diameter 112 (56–149) and 69 (44–104) μm, vessel member length 355 (224–560) and 615 (444–816) μm. Perforations simple, end wall angles 0°–25° and 0°–70°. Intervascular pits alternate, vestured, round to polygonal and often oblong, occasionally scalariform, from 7 up to 45 × 4 μm. Vessel—ray and vessel—parenchyma pits partly vestured, often more or less scalariform, commonly oblong, up to 33 × 8 μm.

Fibres non-septate, diameter up to 18 and 11 μm, walls 2.5 and 4.5 μm, partly unlignified in A. macrantha and partly gelatinous in A. saxosa. Pits simple or minutely bordered, on radial and tangential walls, 2–4 μm. Length 480 (320–608) and 880 (640–1008) μm, F/V ratio 1.36 and 1.44.

Rays heterogeneous, uniseriate, composed of upright and square cells, height up to 23 cells (=720 μm) and 27 cells (=1360 μm), 7 (6–10) per mm.

Parenchyma in A. macrantha: some scanty paratracheal, lignified strands and abundant unlignified anastomosing bands, in strands of 2–4 cells or as scarce fusiform cells; length 395 (208–528) μm, P/V ratio 1.12.

Parenchyma in A. saxosa: scanty paratracheal and in short and long tangential bands, 1–3 cells wide, 3–4 bands per mm, in strands of 2–8 cells or as fusiform cells; length 750 (576–976) μm, P/V ratio 1.23.

N o t e s : Thin-walled tyloses and occasionally one or two biseriate parts in the rays, 1–4 cells high observed, in A. macrantha.

13. **Axinaea** Ruiz & Pavon — Table 2

About 20 species of trees and shrubs in tropical America.

M a t e r i a l s e e n : A. macrophylla (Naud.) Triana: Colombia, Cleef 8501 (=Uw 20807), diam. 1 cm; A. nitida Cogn.: Peru, Wurdack 954 (=Uw 22295 =USw 32537), diam. 3 cm.

Growth rings absent. Vessels diffuse, solitary (24 and 34%) and in radial and irregular clusters of 2–8, 67 and 27 (22–77) per sq. mm, round to oval, walls 2–5 μm, diameter 45 and 94 (30–120) μm, vessel member length 390 and 500 (240–688) μm. Perforations simple, end wall angles 15°–80°. Intervascular pits alternate, vestured, round to oval, 5–9 μm. Vessel—ray and vessel—parenchyma pits similar to the intervascular pits, but more variable.

Fibres mostly non-septate mixed with some septate fibres, diameter up to 15 (18) μm, walls 2–4 μm, in part gelatinous. Pits simple, frequent on the radial walls, scarce to absent on the tangential walls, 2–3 μm; length 535 and 635 (432–750) μm, F/V ratio 1.37 and 1.27.

Rays; see notes.

Parenchyma paratracheal, usually almost vasicentric, and scanty diffuse, in strands of 2–6 cells or as fusiform cells; length 435 and 540 (320–650) μm, P/V ratio 1.11 and 1.08.

Bands of pseudo-parenchyma prominent to faint, composed of fibres and some parenchyma cells, occasionally with parenchyma cells in radial rows up to 4 cells and one cell wide, with prominent intercellular spaces.

N o t e s : In A. macrophylla the rays are heterogeneous, uniseriate and with occasionally biseriate portions of 1–3 cells high, composed of square and upright cells, with some rows of weakly procumbent cells. Height up to 36 cells (=1470 μm), 16 (14–20) per mm.

In A. nitida the rays are nearly all homogeneous, uniseriate and 2(3)-seriate, composed of procumbent cells, with occasionally some square cells. Height of the uniseriate rays up to 25 cells (=420 μm), of the multiseriate rays up to 60 cells (=1200 μm), 8 (6–10) per mm.

14. **Centronia** D. Don — Table 2

About 20 species of trees and shrubs from tropical America.

M a t e r i a l s e e n : C. neblinae Wurdack: Venezuela, Maguire et al. 42195 (=Uw 22281 =USw 25141), diam. 3 cm.

Growth rings absent. Vessels diffuse, solitary (24%) and in radial multiples and irregular clusters of 2–5, 17 (13–21) per sq. mm, round to slightly oval, walls 3.5–6 μm, diameter 99 (72–136) μm, vessel member length 610 (384–720) μm. Perforations simple, end wall angles 10°–70°. Intervascular pits alternate and occasionally opposite, vestured, round, polygonal or sporadically oval, 7.5–10 μm. Vessel—ray and vessel—parenchyma pits partly vestured, reticulate to sometimes scalariform, round, oval and often oblong, up to 30 × 6 μm. Thin-walled tyloses abundant.

Fibres non-septate, diameter up to 25 μm, walls 2.5–3.5 μm. Pits minutely bordered, confined to the radial walls, apertures 3–4 μm. Length 820 (608–1056) μm, F/V ratio 1.35.

Rays heterogeneous and exclusively uniseriate, composed of upright and some square cells. Height up to 26 cells (=1120 μm), 11 (9–13) per mm.

Parenchyma scanty paratracheal and abundant in short and long tangential bands, 2–3 cells wide, 3–5 bands per mm, in strands of 2–4 cells or as scarce fusiform cells; length 590 (384–832) μm, P/V ratio 0.97. Intercellular spaces prominent.

Small rhombic crystals in unlignified chambered parenchyma cells.

15. **Graffenrieda** DC. — Plate 5:17 and 19; table 1 and 2

About 40 species of shrubs, small trees and occasionally lianas extending from the Antilles to Bolivia.

Material seen: G. caryophyllea Triana: Venezuela, Maguire et al. 41582 (=Uw 22321 =USw 24914), diam. over 5 cm; G. cucullata (Don.) L. Wms.: Peru, MAD-SJRw 20012 (Uw 22050), diam. over 5 cm; G. fruticosa Wurdack: Venezuela, Maguire et al. 42422 (=Uw 22322 =USw 25185), diam. 2 cm; G. latifolia (Naud.) Triana: Dominica, Stern & Wasshausen 2547 (=Uw 22323 =USw 35574), diam. 4 cm; G. limbata Triana: Brazil, Maguire 56816 (=Uw 16529), diam. over 10 cm; G. polymera Gleason ssp. neblinensis Wurdack: Venezuela, Maguire et al. 42136, Type (=Uw 22324 =USw 25123), diam. 3 cm; G. reticulata Wurdack: Venezuela, Maguire et al. 37253, Type (=Uw 22325 =USw 24889), diam. 3 cm; G. rupestris Ducke: Venezuela, Maguire et al. 27936 (=Uw 22326 =USw 24718), diam. 2 cm; G. weddellii Naud.: Venezuela, Wurdack & Adderley 43375 (=Uw 22327 =USw 17979), diam. 4 cm.

Growth rings absent. Vessels diffuse, solitary (13–41%) and in radial multiples and irregular clusters of 2–8, 5 to 29 (1–34) per sq. mm, angular, round or oval, walls 2–5 μm, diameter 59 to 99 (28–160) μm, vessel member length 425 to 760 (224–1200) μm. Perforations simple, end wall angles 0°–85°. Intervascular pits alternate and sporadically opposite to scalariform, vestured, round and occasionally polygonal, oval or oblong, from 6 to 10 and up to 38 × 6 μm. Vessel—ray and vessel—parenchyma pits partly vestured, sporadically reticulate or scalariform, round, oval or oblong, 5–10 and up to 35 × 5 μm. Thin-walled tyloses sometimes present.

Fibres non-septate, diameter 12 to 30 μm, walls 1.5–5 μm, gelatinous fibres scarce or absent. Pits simple, on the radial walls and absent or scarce on the tangential walls, 2–4 μm. Length 625 to 960 (432–1200) μm, F/V ratio 1.24–1.58.

Rays heterogeneous and exclusively uniseriate or uniseriate with a biseriate part of 2–3 cells high, composed of many upright, some square and sporadically procumbent cells. Height variable, 9 to 18 cells (=480–720 μm) in G. cucullata, G. caryophyllea, G. limbata, G. rupestris and G. weddellii; 24 to 39 cells (=1320–3360) μm in G. fruticosa, G. latifolia, G. polymera and G. reticulata; 8 to 20 (6–23) per mm.

Parenchyma scanty paratracheal and in short or continuous, well developed tangential bands, 2–6 cells wide, 2–6 bands per mm, in strands of 2–6 cells or as scarce fusiform cells; length 555 to 735 (384–1000) μm, P/V ratio 1.00–1.18.

Small rhombic crystals in unlignified chambered parenchyma cells observed in G. caryophylla, G. cucullata, G. limbata, G. reticulata, G. rupestris and G. weddellii.

Light to dark-brown deposits commonly present in the rays and occasionally in the axial parenchyma cells.

Notes: G. fruticosa deviates in the number of vessels per sq. mm, 63 (40–82), and the vessel diameter, 37 (28–58) μm from the other species examined. In G. weddellii the parenchyma strands are 2–9 cells. In the same species the crystal containing cells are swollen. Finally G. weddellii is the only species investigated of which the parenchyma bands should be termed pseudo-parenchyma, because the bands are composed of many fibres and only few parenchyma strands and fusiform cells.

16. **Huberia** DC. — Plate 5:18; table 2

About 10 species of shrubs from Brazil, Peru and Ecuador.

Material seen: H. semiserrata DC.: Brazil, Paraná, Lindeman & de Haas 15608 (=Uw 14364), diam. 5 cm.

Growth rings absent. Vessel diffuse, solitary (31%) and in radial multiples and irregular clusters of 2–7, 35 (29–42) per sq. mm, round to oval, walls 2–3 μm, diameter 83 (52–120) μm, vessel member length 390 (208–544) μm. Perforations simple, end wall angles 0°–45°. Intervascular pits alternate, vestured, round, polygonal and sporadically oval, 10–13 and up to 18 × 8 μm. Vessel—ray and

vessel—parenchyma pits partly vestured, round to oval but mostly oblong, from 11 up to 32 × 10 μm. Thin-walled tyloses scarce.

Fibres mostly septate, but non-septate fibres are also present, diameter up to 18 μm, walls 3–5 μm, gelatinous fibres scarce. Pits simple, confined to the radial walls, 2–2.5 μm. Length 590 (353–768) μm, F/V ratio 1.52.

Rays heterogeneous, uniseriate and very sporadically biseriate, 1–3 cells high, composed of upright and square cells, procumbent cells observed but scarce. Height up to 33 cells (=1570 μm), 14 (11–18) per mm.

Parenchyma scanty, paratracheal and diffuse, in strands of 2–4 cells or as fusiform cells; length 435 (352–560) μm, P/V ratio 1.12.

Bands of pseudo-parenchyma visible with the microscope only, composed of fibres. The intercellular spaces are prominent.

Brown deposits occur in all tissues.

17. **Meriania** Swartz. — Plate 5:20; 6:21 and 22; table 1 and 2

The genus comprises about 50 species of trees and shrubs, from Central America and the Antilles to Bolivia and south-eastern Brazil.

Material seen: M. pallida Gleason: Colombia, Cuatrecasas 15567 (=Uw 22337 =USw 33084), diam. over 5 cm; M. radula (Benth.) Triana: Peru, Wurdack 658 (=Uw 22338 =USw 32517), diam. 3 cm; M. spruceana Cogn.: Peru, USw 10399 (=Uw 22339), diam. over 10 cm; Peru, L. Williams 7010 (=Uw 2695 =MAD-SJRw 19122), diam. over 5 cm; M. tomentosa (Cogn.) Wurdack: Ecuador, SJRw 29515 (=Uw 22051), diam. over 5 cm; M. urceolata Triana: Brazil, Krukoff 7008 (=Uw 8099), diam. over 10 cm; Colombia, For. Dept. s.n. (=Uw 22233), diam. over 15 cm.

Growth rings absent. Vessels diffuse, solitary (22–68%) and in radial multiples and irregular clusters of 2–6, 5 to 38 (4–45) per sq. mm, round or oval and often angular, walls 2–6 μm, diameter 63 to 141 (43–200) μm, vessel member length 405 to 665 (225–992) μm. Perforations simple, end wall angles 0°–60°. Intervascular pits alternate, and/or opposite, vestured, round, polygonal or oval, 5–12 μm. Vessel—ray and vessel—parenchyma pits similar to the intervascular pits, or more often oval.

Fibres exclusively non-septate or both septate and non-septate in the same sample, diameter 10–20 μm, walls 2–5 μm, gelatinous fibres sometimes present. Pits simple or minutely bordered, frequent on the radial walls and frequent to scarce on the tangential walls, apertures very variable from less than 2.5 μm to 4 μm. Length 565 to 1075 (400–1248) μm, F/V ratio 1.28 to 1.64.

Rays heterogeneous to almost homogeneous in some samples. Exclusively uniseriate to uniseriate with a biseriate part of 2–6 cells high, composed of many procumbent and some square cells, upright cells sporadic or absent. Height 19 to 41 cells (=450–1290 μm), 3 to 10(2–13) per mm.

Parenchyma scanty paratracheal and abundant in apotracheal bands, short, island-like and sometimes wavy, in strands of 2–7 cells or as fusiform cells; length 475 to 830 (350–1008) μm, P/V ratio 1.01 to 1.25.

Notes: As can be seen in table 1, the species vary in several quantitative characters, viz. vessel frequency, length of the vessel elements, and the number of rays per mm. In these respects especially M. urceolata is deviating. Besides, in this species long concentric parenchyma bands are frequent. M. tomentosa is the only species with frequent multiseriate rays and relatively large intervascular and vessel—ray pits.

18. **Opisthocentra** Hook. f. — Table 2

A monotypic genus of undershrubs from Venezuela, Brazil and Colombia.

Material seen: O. clidemioides Hook. f.: Venezuela, Wurdack & Adderley 42903 (=Uw 22372 =USw 17750), diam. 1 cm.

Growth rings absent. Vessels diffuse, solitary (46%) and in radial multiples and irregular clusters of 2–5, 64 (51–73) per sq. mm, angular, walls 2–3 μm, diameter 36 (20–53) μm, vessel member length

490 (256–676) μm. Perforations simple, end wall angles 20°–70°. Intervascular pits alternate and occasionally opposite or scalariform, vestured, round, oval and oblong, respectively 4 and up to 35 × 4 μm. Vessel—ray and vessel—parenchyma pits partly vestured, sometimes scalariform, round and oval but mostly oblong, from 6 up to 28 × 6 μm. Thin-walled tyloses common.

Fibres septate, diameter up to 13 μm, walls 2.5–3.5 μm, sometimes gelatinous. Pits simple, frequent on the radial walls and less frequent to scarce on the tangential walls, 2–3 μm. Length 590 (416–764) μm, F/V ratio 1.20.

Rays heterogeneous, exclusively uniseriate, composed of upright cells only. Height up to 36 cells (=2100 μm), 11 (6–15) per mm.

Parenchyma scanty paratracheal and in continuous tangential bands, 1–2 (3) cells wide, 4–5 bands per mm, in strands of 2–7 cells or as some fusiform cells; length 505 (288–656) μm, P/V ratio 1.03, with prominent intercellular spaces.

Small rhombic crystals are abundant in unlignified chambered parenchyma cells.

Tribe MICONIEAE

19. **Bellucia** Neck. — Plate 7:25; table 1 and 2

A genus comprising 12 to 14 described species of trees and shrubs, concentrated in the Amazon lowland, but from Mexico to Peru and Brazil.

Material seen: B. acutata Pilger: Brazil, Krukoff 7093 (=Uw 8174), diam. 5 cm; B. axinanthera Triana: Brazil, Maguire et al. 51755 (=Uw 17158), diam. 11 cm; Panama, Stern et al. 261 (=Uw 11702 =USw 16185), diam. ca. 5 cm; B. grossularioides (L.) Triana: Suriname, Stahel 214 (=Uw 214), diam. over 15 cm; French Guiana, BAFOG 1082 (=Uw 5602), diam. 20 cm; B. imperialis Sald. & Cogn.: Suriname, Lindeman 6462a (=Uw 4440a), diam. 5 cm; Brazil, Krukoff 5580 (=Uw 20045), diam. 5 cm.

Growth rings scarce, faint or absent. Vessels diffuse, solitary (12 to 60%) and in radial multiples and irregular clusters of 2–8, 4 to 17 (1–27) per sq. mm, round to slightly oval, walls 3–7.5 μm, diameter 84 to 148 (60–208) μm, vessel member length 475 to 875 (304–1168) μm. Perforations simple, end wall angles 0°–50°. Intervascular pits alternate, vestured, round and only sporadically polygonal or oval, 4–8 μm. Vessel—ray and vessel—parenchyma pits round, oval and oblong, from 5 to 20 × 5 μm.

Fibres septate, diameter 15 to 25 μm, walls 2 to 5 μm, gelatinous fibres scarce to abundant. Pits simple or minutely bordered, abundant on the radial walls and scarce or absent on the tangential walls, apertures 2–4 (5) μm. Length 715 to 1185 (496–1472) μm, F/V ratio 1.20 to 1.51.

Rays heterogeneous, uniseriate, rarely with a biseriate part of 2–8 cells high situated in the middle of the ray, composed of square, upright and a few weakly procumbent cells. Height 29 to 104 cells (=1000 to 3500 μm), 13 to 20 (10–23) per mm.

Parenchyma scanty paratracheal, in strands of 2–13 cells or as fusiform cells, the latter scarce; length 535 to 790 (384–1120) μm, P/V ratio 0.87 to 1.23.

Bands of pseudo-parenchyma faint to clear, consisting of fibres only.

Brown deposits in the ray and parenchyma occasionally observed.

Note: Thin-walled tyloses noticed in B. acutata and B. grossularioides.

20. **Calycogonium** DC. — Table 2

About 40 species of shrubs, confined to the Antilles, mainly Cuba.

Material seen: C. rhomboideum Urb. & Ekman: Cuba, FHOw 11637 (=Uw 22048), diam. 2 cm; C. squamulosum Cogn.: Puerto Rico, FPRL 22566 (=Uw 22049), diam. over 8 cm.

Growth rings faint or absent. Vessels diffuse, solitary (27 and 50%) and in radial multiples and irregular clusters of 2–8, respectively 80 (68–91) and 13 (10–17) per sq. mm, round to oval, walls 4–5 μm, diameter respectively 36 (20–50) and 91 (56–128) μm, vessel member length 465 and 605 (400–800) μm. Perforations simple, end wall angles 10°–70°. Intervascular pits in C. rhomboideum alternate, vestured, round, 2–3 μm; in C. squamulosum alternate and opposite, vestured, round or polygonal, occasionally elongate, 5 to 8 μm, incidentally coalescent. Vessel—ray and vessel—parenchyma pits in both species similar to the intervascular pits. Tyloses scarce.

Fibres non-septate and septate, diameter up to 15 μm, walls 2.5–4 μm, gelatinous fibres present. Pits simple, confined to the radial walls, only sporadically on the tangential walls, 2–3 μm. Length 630 and 815 (480–1040) μm, F/V ratio 1.36 and 1.35.

Rays heterogeneous, uniseriate with occasionally a biseriate part over 2–5 cells, usually in the middle of the ray, composed of upright and square cells (C. rhomboideum) or of weakly procumbent, upright and square cells (C. squamulosum). Height up to 18 or 25 cells (=980 μm), 17 (13–21) and 13 (10–17) per mm respectively.

Parenchyma scanty paratracheal, in strands of 2–5 cells or as fusiform cells, septate and non-septate; length 525 to 610 (384–912) μm, P/V ratio 1.00 and 1.13.

Pseudo-parenchyma in tangential, continuous and short and wavy bands, mainly consisting of fibres and fusiform parenchyma cells.

In C. squamulosum large styloids, up to 290 × 22 μm, frequently occur in unlignified parenchyma cells. Crystalline masses occur in all element types.

Brown amorphous contents usually present in the rays and axial parenchyma.

N o t e : Faint helical thickenings were observed in part of the fibres of C. squamulosum.

21. **Charianthus** D. Don — Table 2

Shrubs and small trees, up to 10 m, from the Antilles, especially from mountain areas; about 9 species.

M a t e r i a l s e e n : C. alpinus (Sw.)Howard: Dominica, Wasshausen & Ayensu 363 (=Uw 14757), diam. 2 cm; C. corymbosa (L. C. Rich.) Cogn. var. longifolius (Cogn.) Hodge: Dominica, Chambers 2557 (=Uw 15410), diam. 4 cm.

Growth rings absent. Vessels diffuse, solitary (30 and 41%) and in radial multiples and irregular clusters of 2–7 (11), 31 and 17 (11–43) per sq. mm, round, walls 2–2.5 μm, diameter 51 and 62 (28–84) μm, vessel member length 745 and 460 (192–1088) μm. Perforations simple, end wall angles 10°–60°. Intervascular pits alternate, vestured, round or polygonal, sometimes oval, 4–7 μm. Vessel—ray and vessel—parenchyma pits round, oval and elongate, sometimes scalariform, from 5 to 20 × 4 μm.

Fibres septate, one or two septa per fibre, diameter 18 and 15 μm, walls 2–3 μm, sometimes gelatinous. Pits simple, confined to the radial walls (only sporadically on the tangential walls), 2–3 μm. Length 1100 and 645 (464–1328) μm, F/V ratio 1.48 and 1.41.

Rays heterogeneous, uniseriate, composed of square and upright cells with occasionally few weakly procumbent cells. Height to 27 cells (=460 μm), 11 and 13 (8–15) per mm.

Parenchyma scanty paratracheal, in strands or as fusiform cells (septate and non-septate), in C. alpinus 2–9, usually 6–8, and in C. corymbosa 2–7, usually 2–4 cells per strand; length 700 and 475 (256–1050) μm, P/V ratio 0.94 and 1.04.

Bands of pseudoparenchyma very conspicuous, continuous, composed of fusiform parenchyma cells and fibres.

N o t e : In C. alpinus the length of the fusiform parenchyma cells is 780 μm, the length of the strands is 615 μm. The corresponding P/V ratios are 1.05 and 0.83.

22. **Clidemia** D. Don — Plate 7:26; table 1

About 160 species, shrubs (rarely vines), extending from Mexico to Argentina.

M a t e r i a l s e e n : C. bullosa DC.: Venezuela, Wurdack & Adderley 43046 (=Uw 22306 =USw 17827), diam. 2 cm; Brazil, Harley 10699 (=Uw 22052), diam. 1 cm; C. capitellata (Bonpl.) D.

Don. var. dependens (D. Don.) Macbride: Suriname, Lindeman 6206 (=Uw 4249), diam. 1 cm; C. capitellata (Bonpl.) D. Don.: Panama, Ebinger 634 (=Uw 22289 =USw 17350), diam. 1 cm; C. dentata D. Don.: Suriname, Schulz 9615 (=Uw 10095), diam. 2 cm; C. ciliata D. Don. var. elata (Pitt.) Uribe: Panama, Ebinger 356 (=Uw 22283 =USw 17225), diam. 1 cm; C. minutiflora (Triana) Cogn.: Venezuela, Wurdack & Adderley 43357 (=Uw 22288 =USw 17966), diam. 1 cm; C. novemnervia (DC.) Triana: Venezuela, Wurdack & Adderley 42822 (=Uw 22311 =USw 17717), diam. 1 cm; C. octona (Bonpl.) L. Wms.: Panama, Stern et al. 172 (=Uw 11073 =USw 16134), diam. 1 cm; C. septuplinervia Cogn.: Colombia, King et al. 6060 (=Uw 22308 =USw 37451), diam. 1 cm.

Growth rings faint or absent. Vessels diffuse, solitary (26–48%) and in radial multiples and irregular clusters of 2–7, 41 to 152 (35–172) per sq. mm, round, occasionally angular or oval as well, walls 2–5 μm, diameter 31 to 51 (20–100) μm, vessel member length 405 to 590 (160–784) μm. Perforations simple, end wall angles 0°–70°. Intervascular pits alternate, vestured, round and sporadically slightly oval, 2–5 μm. Vessel—ray and vessel—parenchyma pits round to oval and almost similar to the intervascular pits.

Fibres septate and non-septate in the same sample, occasionally only non-septate, diameter 7 to 15 μm, walls 1.5–4 μm, sometimes gelatinous. Pits simple or minutely bordered, frequent on the radial walls and scarce or absent on the tangential walls, 2–3 μm. Length 480 to 710 (288–875) μm, F/V ratio 1.14 to 1.35.

Rays heterogeneous, exclusively uniseriate, predominantly composed of upright and some square cells with sporadically weakly procumbent cells. Height 20 to 62 cells (=1100 to 3600 μm), 9 to 15 (6–18) per mm.

Parenchyma scanty paratracheal, occasionally diffuse, in strands of 2–4 (6) cells or as fusiform parenchyma cells, occasionally septate; length 380 to 660 (288–880) μm, P/V ratio 0.87 to 1.21.

Bands of pseudoparenchyma faint or conspicuous, mainly composed of fibres.

Occasionally yellow or brown deposits in the rays and parenchyma cells.

N o t e : The intervascular pits in C. capitellata (Uw 22289) and C. septuplinervia are often oblong.

23. **Conostegia** D. Don — Plate 7: 27; table 1 and 2

About 50 species of small trees and shrubs from Central America and West Indies to Peru.

M a t e r i a l s e e n : C. cinnamomea (Beurl.) Wurdack: Panama, Canal Zone, Ebinger 252 (=Uw 22316 =USw 17166), diam. 2 cm; C. montana (Sw.) DC.: Dominica, Chambers 2763 (=Uw 15401), diam. 5 cm; C. rufescens Naud.: Panama, G. P. Cooper 412 (=Uw 22054 =FHOw 3588), diam. 4 cm; C. cf. rufescens Naud.: Colombia, Fuchs 21770 (=Uw 15719), diam. 8 cm; C. xalapensis (Bonpl.) D. Don.: Panama, Stern et al. 1938 (=Uw 14816 =USw 33731), diam. 7 cm.

Growth rings absent. Vessels diffuse, solitary (22–54%) and in radial multiples and irregular clusters of 2–7, 2 to 59 (10–65) per sq. mm, round, sometimes oval or angular, walls 2–3.5 μm, diameter 40 to 83 (24–108) μm, vessel member length 525 to 705 (320–848) μm. Perforations simple, end wall angles 0°–70°. Intervascular pits alternate, vestured, round or polygonal, 4–7.5 (10) μm. Vessel—ray and vessel—parenchyma pits round to oval but mostly elongate, sometimes scalariform, from 3 to 5 up to 25 × 4 μm, occasionally vestured and unilaterally compound.

Fibres both septate (1–3 septa per fibre) and non-septate in the same sample, diameter 13 to 20 μm, walls 1.5–2.5 μm, gelatinous in variable amounts. Pits simple, more frequent on radial than on tangential walls, 2–3 μm. Length 665 to 880 (480–1136) μm, F/V ratio 1.12–1.40.

Rays heterogeneous, exclusively uniseriate, composed of upright and sporadical square cells (C. cinnamomea and C. rufescens) or composed of weakly procumbent, square and upright cells (the other 2 species). Height very variable, from 21 to 57 cells (=608 to 2060 μm), 8 to 13 (5–15) per mm.

Parenchyma abundant, scanty paratracheal and apotracheal in tangential bands, 2 to 6 cells wide, wavy and short, sporadically continuous, in strands of 2–5 (9) cells or as fusiform cells, septate or non-septate, 615 to 760 (474–992) μm long, P/V ratio 1.06 to 1.21.

Bands of pseudoparenchyma, mainly consisting of fusiform parenchyma, are well developed in C. rufescens.

Crystals of various shapes (rhombic to elongate) in unlignified axial parenchyma strands were

observed in C. cinnamomea. In C. xalapensis small rhombic crystals were found in the rays; besides, birefringent crystalline masses were observed in all tissues.

N o t e : C. montana shows growth rings and septate fibres only. In C. cinnamomea the fibre lumen diameter is only 10 μm; the fibre pits are confined to the radial walls.

24. **Henriettea** DC. — Table 1 and 2

Trees and shrubs, about 15 species, from Mexico to Amazonia.

M a t e r i a l s e e n : H. prob. granulata Berg ex Triana: Brazil, Krukoff 7099 (=Uw 8176), diam. 7 cm; H. granulata Berg ex Triana: Guyana, A. C. Smith 3054 (=Uw 21614 =MAD-SJRw 35781), diam. unknown; H. maroniensis Sagot: Suriname, Lindeman 4505 (=Uw 3132), diam. 5 cm; H. multiflora Naud.: Suriname, Lanjouw & Lindeman 689 (=Uw 1300), diam. 16 cm; H. succosa (Aubl.) DC.: Suriname, Lanjouw & Lindeman 744 (=Uw 1315), diam. 4 cm; Suriname, Lindeman 6058 (=Uw 4129), diam. 5 cm.

Growth rings absent. Vessels diffuse, solitary (30–71%) and in radial multiples and irregular clusters of 2–6, 18 to 27 (12–37) per sq. mm, round and/or oval, walls 3–6 μm, diameter 59 to 97 (24–120) μm, vessel member length 625 to 935 (336–1200) μm. Perforations simple, end wall angles 15°–70°. Intervascular pits alternate, vestured, round and sporadically polygonal, 4–5 (7) μm. Vessel—ray and vessel—parenchyma pits round and sporadically oval, respectively 4–5 and 11 × 4 μm.

Fibres commonly septate but non-septate fibres may be present as well, diameter 12 to 18 μm, walls 2.5–6 μm, scarcely gelatinous. Pits simple, frequent on the radial walls, scarce or absent on the tangential walls, 2–3 μm. Length 750 to 1085 (576–1500) μm, F/V ratio 1.16–1.21.

Rays heterogeneous, uniseriate, sporadically biseriate over 1–3 cells in the middle of the ray, composed of upright and only sporadically some square and/or weakly procumbent cells. Height variable from 19 to 27 cells (=1000–1400 μm) in H. granulata and H. multiflora and from 44 to 52 cells (=2160–2300 μm) in H. maroniensis and H. succosa, 13 to 17 (11–24) per mm.

Parenchyma scarce, scanty paratracheal, in strands of 2–7 (10) cells or as fusiform cells (the latter, however, are scarce or even absent); length 570 to 870 (288–1136) μm, P/V ratio very variable from 0.69 to 1.05.

Mega-styloids (cf. ter Welle & Mennega, 1977) occur in H. succosa and H. maroniensis.

In the rays, parenchyma and vessels of all species studied dark to light brown amorphous deposits are present.

N o t e : The vessel frequency in H. granulata (Uw 8176) is very high when compared with the values for the other species.

25. **Henriettella** Naud. — Table 1 and 2

About 40 species of shrubs and trees, well represented at the Antilles, but also extending from Guatamala to Bolivia.

M a t e r i a l s e e n : H. caudata Gleason: Suriname, Maguire 24821 (=Uw 2537), diam. 3 cm; H. cf. flavescens (Aubl.) Triana: Suriname, Lanjouw & Lindeman 2413 (=Uw 1730), diam. 6 cm; H. sylvestris Gleason: Brazil, Krukoff 5272 (=Uw 19865), diam. 8 cm; H. spec.: French Guiana, BAFOG 1237 (=Uw 5726), diam. over 30 cm.

Growth rings present or absent. Vessels diffuse, solitary (23–60%) and in radial multiples and irregular clusters of 2–6 (8), 5 to 48 (2–58) per sq. mm, round to oval, walls 2–6 μm, diameter 50 to 150 (23–200) μm, vessel member length 575 to 1000 (352–1280) μm. Perforations simple, end wall angles 5°–65°. Intervascular pits alternate, vestured, round to oval, occasionally slightly angular, 4–10 μm. Vessel—ray and vessel—parenchyma pits round, oval and often oblong, from 3–6 up to 28 × 6 μm, incidentally unilaterally compound.

Fibres septate, diameter up to 15 (28) μm, walls 2–5 μm, partly gelatinous. Pits simple, frequent on

the radial walls and scarce or absent on the tangential walls, 2–3 μm. Length 770 to 1205 (352–1482) μm, F/V ratio 1.20 to 1.34.

Rays heterogeneous, uniseriate and occasionally biseriate over 2–8 cells in the middle of the ray, composed mainly of procumbent cells in H. sylvestris and H. spec., composed of upright and square cells in the other species studied. Height 20 to 44 cells (=780–2580 μm), 10 to 17 (8–19) per mm. Some rays vertically compound.

Parenchyma scarce, scanty paratracheal, in strands of 2–5 (7) cells or as fusiform cells, length 520 to 575 (352–752) μm, P/V ratio 0.82 to 0.91.

Bands of pseudoparenchyma in H. sylvestris consisting of fibres and parenchyma cells, the latter ones diffuse and in radial rows of 1 cell wide; in the other species consisting of fibres only, but absent in H. flavescens.

Yellow to brown deposits frequently observed in the rays, parenchyma and the fibre tissue.

26. **Heterotrichum** DC. — Table 2

About 10 species from the Antilles, mainly shrubs.

Material seen: H. umbellatum (Mill.) Urb.: Dominica, USw 1962 (=Uw 22347), diam. 3 cm.

Growth rings absent. Vessels diffuse, solitary (22%) and in radial multiples or irregular clusters of 2–5, 51 (46–58) per sq. mm, round, walls 2–2.5 μm, diameter 63 (44–84) μm, vessel member length 460 (192–640) μm. Perforations simple, end wall angles 0°–45°. Intervascular pits alternate, vestured, round to slightly oval, 4–6 μm, partly coalescent. Vessel—ray and vessel—parenchyma pits similar to the intervascular pits, but sporadically elongate and up to 10 × 4 μm.

Fibres non-septate and occasionally septate, diameter up to 10 (12) μm, walls 2.5–3 μm. Pits simple, more frequent on the radial walls than on the tangential ones, 3 μm. Length 570 (458–704) μm, F/V ratio 1.27.

Rays heterogeneous, exclusively uniseriate, composed of upright and some square cells. Height up to 48 cells (=1800 μm), 9 (7–12) per mm.

Parenchyma scanty paratracheal, incidentally almost vasicentric, and diffuse, in strands of 2–5 cells or as fusiform cells, the cells septate in part; length 555 (464–720) μm, P/V ratio 1.18.

Bands of pseudoparenchyma well developed, nearly exclusively consisting of fibres. The bands are apotracheal and paratracheal, sometimes short and wavy.

27. **Leandra** Raddi — Plate 7:28; table 1 and 2

A genus of shrubs and small trees comprising over 200 species, very well represented in the south eastern part of Brazil, but also from Mexico to Paraguay and Argentina.

Material seen: L. barbinervis (Cham ex Tr.) Cogn.: Brazil, Paraná, Reitz & Klein 27747 (=Uw 14545), diam. 4 cm; L. glandulifera (Triana) Cogn.: Venezuela, Wurdack & Adderley 43300 (=Uw 22350 =USw 17951), diam. 1 cm; L. purpurascens (DC.) Cogn.: Brazil, Paraná, Lindeman & de Haas 1889 (=Uw 13388), diam. 1 cm; L. rufescens (DC.) Cogn.: Suriname, Lindeman 5799 (=Uw 3953), diam. 2 cm; L. sanguinea Gleason: Guyana, Maguire et al. 23075 (=Uw 22353 =USw 37858), diam. 1 cm; L. subseriata (Naud.) Cogn.: Colombia, King et al. 5937 (=Uw 15129), diam. 2 cm.

Growth rings rarely present. Vessel diffuse, solitary (19–45%) and in radial multiples and irregular clusters of 2–7, 31 to 94 (24–114) per sq. mm, round and oval and often angular, walls 2–4 μm, diameter 22 to 56 (13–84) μm, vessel member length 380 to 705 (224–848) μm. Perforations simple, end wall angles 5°–80°. Intervascular pits alternate, vestured, round to polygonal and occasionally oval, respectively 3–6 (7.5) and 12 × 5 μm. Vessel—ray and vessel—parenchyma pits round to occasionally oblong, respectively 4–6 and 25 × 4 μm.

Fibres septate, but non-septate in L. barbinervis and L. subseriata, diameter 10–12 μm, walls variable, from 1.5 to 5 μm, partly gelatinous. Pits simple, frequent on the radial walls and scarce or absent on the tangential walls, 2–3 μm. Length 495 to 860 (320–1072) μm, F/V ratio 1.14 to 1.45.

Rays heterogeneous, exclusively uniseriate, composed of upright cells only or with some scarce square cells. Height very variable, 21 to 51 cells (=960 to 3310 μm), 9 to 17(5–19) per mm.

Parenchyma scanty paratracheal, and sometimes diffuse, in strands of 2–6 (8) cells or as fusiform cells; length 435 to 735 (288–992) μm, P/V ratio 0.95 to 1.23.

Bands of pseudoparenchyma more or less tangentially continuous or wavy, consisting mainly of fibres.

Yellow to light-brown deposits scarcely present in the parenchymatous tissues.

N o t e s : L. barbinervis differs from the other species in many anatomical characters. The differences are: vessels solitary (19%), 31 (24–43) per sq. mm; rays uniseriate and biseriate, the biseriate parts are 1–3 cells high, often more than one per ray; the rays are composed of square and few upright and procumbent cells. According to Wurdack (pers. comm.), the species is correctly classified in this genus. L. glandulifera shows many parenchyma cells in the bands of pseudo-parenchyma as compared to the other species of Leandra.

28. **Loreya** DC. — Plate 8: 29 and 30; table 1 and 2

A genus comprising about 14 species varying from small to large trees up to 25 m, occurring in the northern part of South America.

M a t e r i a l s e e n : L. acutifolia Berg ex Triana: Guyana, For. Dept. 3314 (=Uw 930), diam. 10 cm; L. maguirei Wurdack: Venezuela, Maguire et al. 28164 (=Uw 22357 =USw 24762), diam. over 9 cm; L. mespiloides Miq.: Suriname, Lindeman 4587 (=Uw 3182), diam. 10 cm; Venezuela, Breteler 4046 (=Uw 12194), diam. 9 cm; L. mucronata Gleason: Venezuela, Maguire et al. 28168 (=Uw 22358 =USw 24764), diam. 3 cm; L. quadrifolia Gleason: Brazil, Krukoff 1510 (=Uw 19385), diam. 8 cm.

Growth rings absent or present. Vessels diffuse, solitary (11–59%) and in radial multiples and irregular clusters of 2–7 (8), 7 to 22 (4–30) per sq. mm, round to oval, walls 2–5 (7) μm, diameter 58 to 138(32–180) μm, vessel member length 610 to 820(432–1120) μm. Perforations simple, end wall angles 0°–60°. Intervascular pits alternate, vestured, round and/or polygonal, sporadically oval, 5 to 10 μm. Vessel—ray and vessel—parenchyma pits variable, in part similar to the intervascular pits and in part oblong and up to 30 × 6 μm, often coalescent.

Fibres septate and sporadically non-septate as well, diameter 12 to 20 μm, walls 2–4 μm, gelatinous in variable amounts. Pits simple or minutely bordered, frequent on the radial walls, scarce or absent on the tangential walls, 2–5 μm. Length 740 to 1135 (496–1440) μm, F/V ratio 1.11 to 1.48.

Rays heterogeneous, uniseriate, occasionally with a biseriate part of 2–4 cells high in the middle of the rays, composed of square and upright and a varying but always low percentage of weakly procumbent cells. Height 21 to 74 cells (=880–2640 μm), 13 to 16 (10–21) per mm.

Parenchyma scanty paratracheal, in strands of 2–9 cells; fusiform parenchyma sporadical or even lacking; length 570 to 760 (416–976) μm, P/V ratio 0.85 to 1.15.

Bands of pseudo-parenchyma present, sometimes faint, consisting of fibres only. Yellow to dark-brown amorphous deposits occur in the rays.

N o t e s : The F/V ratio of L. acutifolia is 1.48 and is very high when compared to the other figures. Contrary to the general picture in Loreya, the bands of pseudo-parenchyma in L. mucronata consist of fibres and parenchyma strands, the latter ones diffuse and in radial rows of up to 4 cells. The variability of the wood anatomical characters within the group of samples investigated is considerable.

29. **Maieta** Aubl. — Table 2

Three species of shrubs from Venezuela to Brazil and Bolivia.

M a t e r i a l s e e n : M. guianensis Aubl.: Colombia, King et al. 6169 (=Uw 22335 =USw 37503), diam. 0.5 cm.

Growth rings absent. Vessels diffuse, solitary (46%) and irregular clusters of 2–6, 159 (135–175) per sq. mm, round or angular, walls 1.5–2 μm, diameter 27 (17–38) μm, vessel member length 550 (288–880) μm. Perforations simple, end wall angles 20°–60°. Intervascular pits alternate, vestured, round or polygonal, 4–6 μm. Vessel—ray and vessel—parenchyma pits oblong, occasionally scalariform, up to 16 × 5 μm.

Fibres septate and non-septate, diameter up to 13 μm, walls 2–3 μm, partly gelatinous. Pits simple, more frequent on the radial walls than on the tangential walls, 2–3 μm. Length 680 (352–960) μm, F/V ratio 1.24.

Rays heterogeneous, uniseriate, composed exclusively of upright cells, height up to 14 cells (=960 μm), 9 (8–12) per mm.

Parenchyma scanty paratracheal and diffuse, in strands of 2–6 cells or as fusiform cells; length 615 (432–832) μm, P/V ratio 1.11.

Bands of pseudo-parenchyma faint, composed predominantly of fibres, mixed with some parenchyma cells.

N o t e : The sample investigated is small. Therefore the quantitative data may not be representative.

30. **Mecranium** Hook. f. — Table 2

A genus of about 7 species of shrubs and treelets, from the Antilles.

M a t e r i a l s e e n : M. amygdalinum Triana: Cuba, MAD-SJRw 21423 (=Uw 22057), diam. over 5 cm; M. virgatum Triana: Jamaica, Yuncker 18358, twig from herbarium material, diam. 0.6 cm.

Growth rings absent or faint. Vessels solitary (80 and 39%) and in short radial multiples and irregular clusters of 2–4, 7 and 161 (5–175) per sq. mm, round but mostly oval, walls 2–4 μm, diameter 138 and 36 (28–160) μm, vessel member length 535 and 530 (320–768) μm. Perforations simple, end wall angles 5°–60°. Intervascular pits alternate, vestured, round, sometimes slightly polygonal or oval, 5–10 μm. Vessel—ray and vessel—parenchyma pits round, oval and oblong, sometimes almost scalariform, 7–10 to 26 × 6 μm.

Fibres non-septate, diameter 13 and 18 μm, walls 2–3 μm, partly gelatinous. Pits simple, frequent on radial walls, occasionally on tangential walls, 2–3 μm. Length 745 and 595 (512–875) μm, F/V ratio 1.40 and 1.13.

Rays heterogeneous, exclusively uniseriate, composed of procumbent, upright and square cells. Height 24 and 15 cells (=740 and 770 μm), 10 and 12 (9–14) per mm.

Parenchyma scanty paratracheal, in strands of 2–8 cells or as fusiform cells; length 530 and 510 (368–676) μm, P/V ratio 1.00 and 0.97.

Pseudo-parenchyma as well developed short wavy bands and islands, composed of many parenchyma strands and some fibres.

N o t e : The rays of M. virgatum show a relatively high amount of upright cells as compared to the other species.

31. **Miconia** R. & P. — Table 1 and 2

This genus with over 1000 species occurs in all parts of tropical America. Mostly trees and shrubs but occasionally climbers.

M a t e r i a l s e e n : M. chrysophylla (L. C. Rich.) Urb.: Suriname, Lanjouw & Lindeman 1272 (=Uw 1438), diam. 10 cm; M. dodecandra (Desr.) Cogn.: Suriname, Maguire 24457 (=Uw 2538), diam. 15 cm; M. eriocalyx Cogn.: Brazil, Krukoff 6498 (=Uw 7768), diam. 8 cm; M. holosericea (L.) Triana: Suriname, Stahel 339 (=Uw 339), diam. over 20 cm; M. lateriflora Cogn.: Panama, MAD-SJRw 12226 (=Uw 22060), diam. 3 cm; M. lepidota DC.: Suriname, Stahel 223 (=Uw

223), diam. over 20 cm; M. minutiflora (Bonpl.) DC.: Suriname, Lanjouw & Lindeman 2512 (=Uw 1795), diam. over 20 cm; M. poeppigii Triana: Suriname, Stahel 130a (=Uw 130a), diam. over 20 cm; Lanjouw & Lindeman 1287 (=Uw 1442), diam. 20 cm; Brazil, Krukoff 6822 (=Uw 7959), diam. over 10 cm; M. prasina (Sw.) DC.: Brazil, Krukoff 6796 (=Uw 7933), diam. 10 cm; Guyana, A. C. Smith 2814 (=Uw 21579), diam. over 10 cm; A. C. Smith 3298 (=Uw 21674), diam. over 10 cm; M. rubiginosa (Bonpl.) DC.: Suriname, Lanjouw & Lindeman 1706 (=Uw 1526), diam. 6 cm; Lindeman 6687 (=Uw 4521), diam. 4 cm; M. ruficalyx Gleason: Suriname, LBB 11014 (=Uw 11716), diam. 14 cm; M. tomentosa (Rich.) Don.: Suriname, Stahel 331 (=Uw 331), diam. over 20 cm; Brazil, Krukoff 6264 (=Uw 7604), diam. 10 cm.

Growth rings usually absent, but occasionally well developed. Vessels solitary (13–66%) and in radial multiples and irregular clusters of 2–8, 7 to 37 (3–44) per sq. mm, but mostly less than 20 per sq. mm, round and/or oval, walls very variable, 2.5–7 μm, diameter 46 to 130 (25–244) μm, vessel member length 500 to 885 (320–1138) μm. Perforations simple, end wall angles 0°–60°. Intervascular pits alternate and sporadically opposite, vestured, round and sometimes slightly oval, 3–8 μm. Vessel—ray and vessel—parenchyma pits round to slightly oval and sometimes oblong, respectively 3–8 and up to 28 × 5 μm.

Fibres exclusively septate or septate and non-septate in the same sample, diameter 9 to 20 (mostly about 15) μm, walls 2–4 μm, partly gelatinous. Pits simple or minutely bordered, frequent on the radial walls and less frequent to often absent on the tangential walls, 2–3 μm. Length 640 to 1110 (416–1375) μm, F/V ratio 1.20 to 1.46.

Rays heterogeneous, exclusively uniseriate and/or uniseriate with a biseriate part, variable in height, composed of square and upright cells, with scanty procumbent cells in some samples. Height 26 to 64 (=1150–3000 μm), 11 to 17 (8–20) per mm.

Parenchyma scarce, scanty paratracheal, in strands of 2–10 cells or, although less frequent, as fusiform cells; length 480 to 1000 (256–1424) μm, P/V ratio 0.93 to 1.18.

Pseudo-parenchyma in islands or in more or less continuous bands, composed of variable amounts of fibres and parenchyma, as described by Ter Welle & Koek-Noorman (1978).

Occasionally light yellow to light brown coloured deposits occur in the ray cells, parenchyma cells and the fibres.

N o t e s : The intervascular pits in M. ruficalyx are 7–10 μm. In M. prasina these pits are very pronounced 'opposite in short rows', part of the apertures being coalescent. In M. lateriflora the vessel diameter is low. M. minutiflora deviates in many respects from the generic description. Besides the features mentioned in table 1, the ray height of up to 85 cells is remarkable. In M. rubiginosa some rays of 2–3 cells wide were observed. The number of rays per mm is very low in M. holosericea. In the fibres and ray cells of M. minutiflora dark birefringent crystalline masses occur.

32. **Myriaspora** DC. — Table 2

A genus of one or two species, shrubs and small trees, from Colombia, Venezuela, Brazil and the Guyana's.

M a t e r i a l s e e n : M. decipiens Naud.: Suriname, Florschütz & Maas 2804 (=Uw 11099), diam. 3 cm; M. egensis DC.: Brazil, Krukoff 6823 (=Uw 7960), diam. 5 cm.

Growth rings faint or absent. Vessels diffuse, solitary (16–30%) and in radial multiples and irregular clusters of 2–7 (9), 40 (30–64) per sq. mm, round to oval, walls 2.5–4.5 μm, diameter 56 to 59 (24–80) μm, vessel member length 515 and 600 (320–880) μm. Perforations simple, end wall angles 5°–60°. Intervascular pits alternate, vestured, round to slightly oval, 3–5 μm. Vessel—ray and vessel—parenchyma pits similar to the intervascular pits.

Fibres septate, more than one septum per fibre, diameter up to 15 μm, walls 1.5–3 μm, scarcely gelatinous. Pits simple, on radial walls, 1–2 μm. Length 665 and 815 (336–976) μm, F/V ratio 1.29 and 1.34.

Rays heterogeneous, exclusively uniseriate, composed of square and upright and sporadically weakly procumbent cells. Height 23 to 37 cells (=820–1470 μm), 14 to 15 (11–19) per mm.

Parenchyma scanty paratracheal, in strands of 2–7 cells or as fusiform cells; length 590 and 575 (352–800) μm, P/V ratio 1.15 and 0.96.

Yellow amorphous deposits occasionally observed in the rays and parenchyma.

33. **Ossaea** DC. — Table 2

About 80 species of shrubs, frequent in the Antilles but also from Mexico to Brazil.

Material seen: O. laxivenula Wurdack: Colombia, King et al. 6205 (=Uw 22376 =USw 37516), diam. 1 cm; O. lima (Desr.) Triana: Dominican Republic, USw 1960 (=Uw 22375), diam. 2 cm.

Growth rings very faint. Vessels diffuse, solitary (14–58%) and in radial multiples and irregular clusters of 2–5, 59 and 66 (49–85) per sq. mm, angular, walls 1.5–2 μm, diameter 36 and 43 (25–55) μm, vessel member length 615 and 480 (240–836) μm. Perforations simple, end wall angles 10°–75°. Intervascular pits alternate and occasionally opposite, vestured, round to polygonal and oblong, respectively 5 and 16 × 4 μm. Vessel—ray and vessel—parenchyma pits similar to the intervascular pits but more frequently oblong, in O. lima tending to scalariform.

Fibres septate and non-septate, diameter up to 12 (15) μm, walls 2–2.5 μm, rarely gelatinous. Pits simple, frequent on the radial walls and less frequent to scarce on the tangential walls, 2–3 μm. Length 725 and 595 (448–848) μm, F/V ratio 1.18 and 1.24.

Rays heterogeneous, exclusively uniseriate, composed of upright cells only. Height 19 to 22 cells (=880–1025 μm), 12 (9–15) per mm.

Parenchyma scanty paratracheal and diffuse, in strands of 2–7 cells or as fusiform cells; length 630 and 565 (416–832) μm, P/V ratio 1.02 and 1.17.

Bands of pseudo-parenchyma, more or less continuous tangential or wavy, consisting of fusiform parenchyma cells, parenchyma strands and fibres.

Light yellow to brown coloured deposits in the rays and less frequently in the axial parenchyma.

34. **Pachyanthus** A. Rich. — Table 2

Shrubs and trees, about 20 species distributed in the Antilles with Cuba as main centre.

Material seen: P. cubensis A. Rich.: Cuba, FHOw 11628 (=Uw 22061), diam. over 10 cm.

Growth rings absent. Vessels diffuse, solitary (62%) and in multiples of 2–5, 25 (19–32) per sq. mm, round, oval or angular, walls 2.5–4 μm, diameter 56 (43–75) μm, vessel member length 315(176–404) μm. Perforations simple, end wall angles 5°–45°. Intervascular pits alternate, vestured, round or polygonal, sporadically oblong, respectively 6–7 μm and 20 × 4 μm. Vessel—ray and vessel—parenchyma pits round to oblong, resp. 4–6 μm and 20 × 4 μm.

Fibres non-septate, only incidentally septate, diameter up to 17 μm, walls 2–2.5 μm. Pits simple, equally frequent on radial and tangential walls, 2–3 μm. Length 455 (352–624) μm, F/V ratio 1.45.

Rays heterogeneous, uniseriate and 2 (3) seriate, composed of many procumbent, some square and sporadically upright cells. Height up to 22 cells (=450 μm), no difference in height between uni- and multiseriate rays; 12 (11–13) per mm.

Parenchyma scanty paratracheal, in strands of 2–5 cells or as fusiform cells; length 375 (240–448) μm, P/V ratio 1.19.

Bands of pseudo-parenchyma well developed, tangential and wavy, more or less continuous, consisting of fibres mixed with parenchyma cells, the latter ones diffuse and in radial rows of up to 5 cells.

Brown to yellow deposits in the rays and parenchyma and scarce in the vessels.

35. **Platycentrum** Naud. — Table 2

A monotypic genus of shrubs from Bolivia and Brazil to Venezuela, Trinidad and French Guiana.

Material seen: P. clidemioides Naud.: Colombia, King et al. 6228 (=Uw 15227), diam. 2 cm.

Growth rings faint. Vessels diffuse, solitary (62%) and in radial multiples and irregular clusters of 2–7, 43 (33–55) per sq. mm, round, walls 1.5–2.5 μm, diameter 46 (32–64) μm, vessel member length 565 (176–848) μm. Perforations simple, end wall angles 0°–45°. Intervascular pits alternate, vestured, round to oval, 4–8 μm. Vessel—ray and vessel—parenchyma pits round and more often elongate, sometimes scalariform, from 6 up to 20 × 5 μm, occasionally vestured and sporadically coalescent.

Fibres septate, 1–2 septa per fibre, and non-septate, diameter up to 18 μm, walls 2.5–3.5 μm, partly gelatinous. Pits simple, on radial walls and incidentally on tangential walls, 2–3 μm. Length 765 (432–992) μm, F/V ratio 1.36.

Rays heterogeneous, exclusively uniseriate, composed of upright and few square cells. Height up to 31 cells (=1220 μm), sporadically vertically composed, 13 (10–17) per mm.

Parenchyma scanty paratracheal, sometimes nearly vasicentric, and diffuse, in strands of 2–9, mostly 6–8 cells or as fusiform parenchyma cells, both septate and non-septate; length 600 (352–880) μm, P/V ratio 1.06.

Bands of pseudo-parenchyma very clear, with about equal quantities of parenchyma and fibres, the parenchyma cells sometimes in radial and/or tangential rows.

36. **Tetrazygia** L. C. Rich. — Table 1 and 2

About 30 species, mainly shrubs and occasionally trees from the Antilles.

Material seen: T. angustifolia (Sw.) DC.: Dominica, Stern & Wasshausen 2445, (=Uw 22401 =USw 35492), diam. over 4 cm; T. bicolor Cogn.: USA, Hilton Scott s.n. (=Uw 22063 =FHOw 12534), diam. over 3 cm; T. discolor (L.) DC.: Dominica, Chambers 2724 (=Uw 15405), diam. 3 cm; T. elaeagnoides (Sw.) DC.: Tortue Island (=Uw 22402 =USw 4349), diam. over 4 cm.

Growth rings absent. Vessels diffuse, solitary (25–41%) and in radial multiples of 2–5 and occasionally irregular clusters, 24 to 88 (18–112) per sq. mm, round to slightly oval, walls 3–5 μm, diameter 34 to 54 (23–75) μm, vessel member length 380 to 465 (208–608) μm. Perforations simple, end wall angles 0°–45°. Intervascular pits alternate, vestured, round or polygonal, 3–5 μm. Vessel—ray and vessel—parenchyma pits similar to the intervascular pits.

Fibres predominantly non-septate, but some septate fibres present in all samples, diameter up to 15 (20) μm, walls 2–4 μm, rarely gelatinous. Pits simple, more frequent on the radial walls than on the tangential walls, 2–3 μm. Length 455 to 660 (288–896) μm, F/V ratio 1.16 to 1.47.

Rays heterogeneous, exclusively uniseriate, composed of procumbent, square and few upright cells. Height 13 to 20 cells (=320–510 μm), 8 to 17 (9–21) per mm.

Parenchyma scanty paratracheal, in strands of 2–4 (5) cells or as fusiform cells; length 375 to 480 (272–560) μm, P/V ratio 0.96 to 1.09.

Bands of pseudo-parenchyma present, partly continuous, partly short and wavy; consisting mainly of fusiform parenchyma cells, mixed with some fibres and parenchyma strands.

Yellow to brown deposits occur in rays and parenchyma cells.

Very small birefringent particles resembling small variously shaped crystals occur in fibres, rays or parenchyma.

Note: In some cases it is very difficult to distinguish between fibres and fusiform parenchyma cells in the bands of pseudo-parenchyma. Consequently the relative frequency of the different elements forming part of the pseudo-parenchyma is difficult to estimate.

37. **Tococa** Aublet — Table 1 and 2

A genus of about 50 species, shrubs and small trees, from Mexico to Brazil and Bolivia.

Material seen: T. egensis Naud.: Peru, MAD-SJRw 17921 (=Uw 22066), diam. over 5 cm; T. guianensis Aubl.: Brazil, Krukoff 5585 (=Uw 20049), diam. 9 cm; T. lasiostyla Cogn.: Venezuela, Maguire et al. 42651 (=Uw 22413 =USw 25273), diam. 3 cm; T. longisepala Cogn.: Brazil, Krukoff 6135 (=Uw 7505), diam. 7 cm; Brazil, Krukoff 6672 (=Uw 7862), diam. 1 cm; T. macrophysca Spr. ex Triana: Venezuela, Wurdack & Adderley 43299 (=Uw 22414 =USw 17950),

diam. over 4 cm; T. subciliata (DC.) Triana: Brazil, Krukoff 6998 (=Uw 8092), diam. 2 cm; T. tepuiensis Wurdack: Venezuela, Maguire et al. 42026 (=Uw 22418 =USw 25076), diam. over 8 cm.

Growth rings faint or absent. Vessels diffuse, solitary (3–68%) and in radial rows or irregular clusters of 2–10, 12 to 83 (8–104) per sq. mm, angular and round, occasionally oval, walls 2–4 μm, diameter 41 to 90 (24–124) μm, vessel member length 605 to 895 (160–1216) μm. Perforations simple, end wall angles 0°–70°. Intervascular pits alternate, vestured, round to polygonal and sometimes slightly oval, diameter very variable, 4–10 (12) μm. Vessel—ray and vessel—parenchyma pits round, oval and oblong, respectively 5–8 and up to 35 × 4 μm, sometimes almost scalariform.

Fibres exclusively septate or both septate and non-septate, diameter 13–20 (25) μm, walls 2–4 (6.5) μm, partly gelatinous. Pits simple or minutely bordered, frequent on the radial walls and absent or scarce on the tangential walls, 2.5–3 μm. Length 765 to 1115 (448–1360) μm, F/V ratio 1.04 to 1.44.

Rays heterogeneous, exclusively uniseriate, composed of upright cells, mixed with few square and sporadically weakly procumbent cells. Height 13 to 33 (47) cells (=880–2320 μm), 8 to 15 (5–17) per mm.

Parenchyma scanty paratracheal and apotracheal varying from diffuse and diffuse in aggregates to continuous tangential bands. These bands which are very common in this genus are 3 to 6 cells wide. In most samples the parenchyma is abundant, in strands of 2–7 (9) cells or, although fewer, as fusiform cells; length 585 to 900 (444–1216) μm, P/V ratio 0.95 to 1.23.

Coloured deposits scarce.

Notes: Druses sporadically occur in idioblasts in T. longisepala (Uw 7862) and in T. subciliata. Faint bands of pseudo-parenchyma occur in T. egensis and in T. subciliata.

Tribe BLAKEEAE

38. **Blakea** P. Browne — Table 1 and 2

A genus comprising about 85 species of trees, shrubs and climbers, mostly from the northern part of tropical America.

Material seen: B. calyptrata Gleason: Colombia, Cuatrecasas 15535 (=Uw 22301 =USw 33077), diam. over 5 cm; B. granatensis Naud.: Idrobo & ter Welle s.n. (=Uw 23623), diam. 2 cm; B. latifolia (R. & P.) Don.: Peru, Wurdack 1981 (=Uw 22302 =USw 32559), diam. 3 cm; B. paludosa Gleason: Peru, Woytkowski 5567 (=Uw 22275 =USw 15979), diam. 3 cm; B. pulverulenta Vahl.: Dominica, Stern & Wasshausen 2488 (=Uw 22276 =USw 35528), diam. over 4 cm.

Growth rings absent to scarce. Vessels diffuse, solitary (24–76%) and in radial multiples and irregular clusters of 2–6 (9), 7 to 19 (3–27) per sq. mm, angular, round to oval, walls 3–5 (12) μm, diameter 72 to 152 (30–200) μm, vessel member length 450 to 725 (224–940) μm. Perforations simple, end wall angles 0°–80°. Intervascular pits alternate, vestured, mostly polygonal but sometimes round to slightly oval, respectively 8–15 and up to 12 × 4 μm. Vessel—ray and vessel—parenchyma pits round, oval and often oblong, occasionally scalariform, 5–15 and up to 30 × 6 μm.

Fibres septate and non-septate, or exclusively septate, diameter 15–26 μm, walls 2–3 μm, partly gelatinous. Pits simple, frequent on radial walls and scarce to frequent on tangential walls, 2–3 μm. Length 670 to 975 (416–1355) μm, F/V ratio 1.15 to 1.49.

Rays heterogeneous, 1–2 seriate and often 3–4 seriate, composed of square and upright cells, sheath cells present. Multiseriate rays often vertically fused. Width up to 26–68 μm, height to 36–59 cells (=1360–2960 μm) for the multiseriate rays, and to 12–17 cells (=720–1150 μm) for the uniseriates, 9 to 12 (7–14) per mm.

Parenchyma scanty paratracheal and in short tangential bands up to 10 cells wide with intercellular spaces between the cells, in strands of 2–4 cells or as fusiform cells; length 540 to 770 (304–1248) μm, P/V ratio 1.06 to 1.23.

Rhombic crystals occur in non-lignified parenchyma strands of B. latifolia. In all species abundant druses in idioblasts were observed.

39. **Topobea** Aublet — Table 1 and 2

A genus of over 50 species, shrubs and trees, from Central America to Brazil.

Material seen: T. alternifolia Gleason: Colombia, Cuatrecasas 16585 (=Uw 22299 =USw 33222), diam. 3 cm; T. longiloba Wurdack; Colombia, Bristol 378 (=Uw 22419 =USw 31736), diam. 2 cm; T. membranacea Wurdack: Panama, Stern & Chambers 175 (=Uw 22420 =USw 15645), diam. 3 cm; T. parasitica Aubl.: Brazil, Maguire et al. 48156 (=Uw 16924), diam. 3 cm; French Guiana, Oldeman B1451 (twig from herbarium material); T. praecox Gleason: Panama & Canal Zone, Ebinger 258 (=Uw 22421 =USw 17170), diam. 3 cm.

Growth rings scarce or absent. Vessels diffuse, solitary (40–64%) and in radial multiples and irregular clusters of 2–6, 6 to 25 (1–30) per sq. mm, round or oval, sometimes angular, walls 4–6 μm, diameter 90 to 136 (44–196) μm, vessel member length 455 to 680 (176–880) μm. Perforations simple, end wall angles 0°–50°. Intervascular pits alternate, vestured, polygonal or round, 8–12 μm. Vessel—ray and vessel—parenchyma pits round, oval and often oblong, respectively 5 to 10 and 36 × 6 μm, sometimes vestured.

Fibres septate, non-septate or both in the same sample, diameter up to 15 (25) μm, walls 2–3 μm, partly gelatinous. Pits simple, frequent on the radial walls and less frequent to scarce on the tangential walls, 2–3 μm. Length 635 to 780 (352–1008) μm, F/V ratio 1.14 to 1.60.

Rays heterogeneous, 1–2-seriate and often 3–4-seriate, composed of square and upright cells, sheath cells sometimes present. Multiseriate rays often vertically fused. Width up to 30–56 μm, height 53 to 95 cells (=2200–4000 μm) for the multiseriate rays and 13 to 22 cells (=640–1480 μm) for the uniseriate rays, 6 to 10 (4–15) per mm.

Parenchyma scanty paratracheal and in short apotracheal tangential bands, up to 7 cells wide, with intercellular spaces, in strands of 2–8 cells or as fusiform cells; length 555 to 690 (240–880) μm, P/V ratio 1.02 to 1.27. In some strands one or two cells are divided parallel to the tangential plane.

Druses abundant in, mostly unlignified, idioblasts.

Notes: T. alternifolia is a liana. Some anatomical characters differ from the generic description, viz. presence of procumbent cells in the rays and the very abundant reticulate and vasicentric occurrence of parenchyma. In T. longiloba tyloses were observed.

Tribe MEMECYLEAE

40. **Mouriri** Aubl. — Plate 8: 31 and 32; table 2

A genus of shrubs and trees, comprising about 75 species, from Central and tropical America.

In comparison with the number of woody species and with the number of available wood samples, the description given below is based on few samples. This is due to the fact that Th. Morley (Minnesota) intends to deal with the systematic wood anatomy of the genus, in addition to his monograph of the neotropical Memecyleae (1976). However, a comprehensive study of the wood anatomy of neotropical Melastomataceae would be incomplete without an at least preliminary description of Mouriri.

Material seen: M. acutiflora Naud.: Guyana, A. C. Smith 2573 (=Uw 21520), diam. over 8 cm; M. chamissoana Cogn.: Brazil, St. Catarina, USw 15035 (=Uw 22386), diam. 5 cm; M. crassifolia Sagot: Brazil, Amapa, Pires 51773 (=Uw 9033), diam. over 15 cm; M. nigra (DC.) Morley: Suriname, Stahel 53 (=Uw 53), diam. over 15 cm; M. vernicosa Naud.: Suriname, Lindeman 6871 (=Uw 4638), diam. 8 cm.

Growth rings absent or faint. Vessels diffuse, solitary and sporadically in clusters of 2–4, 6 to 30 (4–34) per sq. mm, round to oval, walls 5–7.5 μm, diameter 77 to 116 (44–144) μm, vessel member

length 285 to 410 (152–752) μm. Perforations simple, end wall angles 0°–25° (45°). Intervascular pits alternate, vestured, round to slightly oval, 3–5 μm. Vessel—ray and vessel—parenchyma pits similar to the intervascular pits, but often without vestures.

Fibres non-septate, diameter very variable, 2–3 to 8 μm, walls 5–9 μm. Pits bordered, slightly more frequent on the radial than on the tangential walls, diameter of borders 5 μm. Length 715 to 825 (416–1040) μm, F/V ratio 1.76 to 2.52.

Rays heterogeneous, exclusively uniseriate or uniseriate and 2–3 seriate, composed of variable amounts of weakly procumbent, square and upright cells, but homogeneous, composed of procumbent cells in M. crassifolia. Height 3 to 27 cells (=125–640 μm), very low rays are notable in some specimens; 9 to 18 (6–24) per mm.

Parenchyma very scarce to abundant. Although not the whole range is present in each sample, the following types of parenchyma were observed in the samples investigated: diffuse apotracheal, scanty paratracheal, aliform, aliform-confluent, more or less continuous tangential or wavy bands, narrow (1–2 cells) or wider (4–6 cells). Strands of 2–6 cells and occasionally fusiform cells; length 405 to 585 (320–672) μm, P/V ratio 1.32 to 1.42.

Included phloem as isolated strands (foraminate type): on the transverse section diffuse, round, 1–3 per square mm, often with rhombic or styloid crystals.

N o t e : SEM photograps suggest that in Mouriri at least part of the intervascular pits are without vestures.

UNASSIGNED GENERA

41. **Alloneuron** Pilger — Table 2

A genus of 6 species, trees, from Colombia and Peru.

M a t e r i a l s e e n : A. subglabrum Wurdack: Colombia, Cuatrecasas 15764 (=Uw 22430 =USw 33129), diam. over 10 cm.

Growth rings absent. Vessels diffuse, solitary (54%) and in radial multiples and irregular clusters of 2–3, 69 (56–90) per sq. mm, angular to round, walls 2–3 μm, diameter 52 (38–65) μm, vessel member length 700 (496–800) μm. Perforations simple, end wall angles 0°–50°. Intervascular pits alternate and sporadically opposite, vestured, occasionally round but commonly oblong, respectively 5 and 20 × 3 μm, sometimes scalariform, in part coalescent. Vessel—ray and vessel—parenchyma pits similar to the intervascular pits but more often scalariform or oblong, up to 25 × 4 μm. Most vessels filled with thin-walled tyloses.

Fibres septate and non-septate, diameter up to 11 μm, walls 2–4 μm. Pits simple, on the radial walls and scarce on the tangential walls, 2–3 μm. Length 735 (464–912) μm, F/V ratio 1.05.

Rays heterogeneous, uniseriate with a biseriate part (2–8 cells high) in the middle of the ray and sporadically 2 (3) seriate rays, composed of upright and a few square cells, height up to 38 cells (=1460 μm), 13 (11–17) per mm.

Parenchyma scarce, scanty paratracheal, in strands of 2–5 cells or as fusiform cells; length 640 (448–880) μm, P/V ratio 0.91.

Bands of pseudo-parenchyma faint, composed of fibres and scarce diffuse parenchyma.

In the vessels, rays, parenchyma and fibres variable quantities of yellow to brown deposits were noticed.

42. **Huilaea** Wurdack — Table 2

A genus with 3 or 4 species, small trees confined to Colombia.

M a t e r i a l s e e n : H. macrocarpa Uribe ssp. minor Uribe: Colombia, Lozano et al. 2695 (=Uw 23622), diam. 4 cm.

Growth rings absent. Vessels diffuse, solitary (31%) and in radial multiples and irregular clusters of 2–4, 16 (10–23) per sq. mm, round and angular, walls 3–6 μm, diameter 112 (76–156) μm, vessel member length 655 (383–1010) μm. Perforations simple, end wall angles 5°–45°. Intervascular pits alternate, vestured, round to oval, 7 to 10 × 7 μm, many apertures coalescent. Vessel—ray and vessel—parenchyma pits round, oval but mostly oblong, from 7 to 20 × 5 μm, occasionally scalariform.

Fibres septate and non-septate, diameter up to 15 μm, walls 4–5 μm, frequently gelatinous. Pits simple, on the radial walls and very scarce on the tangential walls, 2–3 μm. Length 950 (626–1224) μm, F/V ratio 1.46.

Rays heterogeneous, exclusively uniseriate (few rays with a biseriate part of 2–3 cells), composed of predominantly upright and some square cells. Height up to 19 cells (= 1300 μm), 10 (7–14) per mm.

Parenchyma scanty paratracheal and in short apotracheal bands, in strands of 2–4 cells or as fusiform cells; length 750 (536–928) μm, P/V ratio 1.15.

Bands of pseudo-parenchyma present, the relative frequency of parenchyma and fibres varies within the bands.

Rhombic and elongate crystals but also druses and intermediate forms occur in unlignified parenchyma cells.

43. **Llewelynia** Pittier — Table 2

A monotypic genus from Venezuela. This tree is restricted to altitudes of 900–1300 m.

Material seen: L. williamsii Pittier: Venezuela, L. Williams s.n. (=Uw 22428), diam. over 8 cm.

Growth rings faint. Vessels diffuse, solitary (22%) and in radial multiples and irregular clusters of 2–5, 19 (12–27) per sq. mm, oval, sporadically round or angular, walls 2.5–4 μm, diameter 54 (36–68) μm, vessel member length 410 (176–720) μm. Perforations simple, end wall angles 0°–70°. Intervascular pits alternate, vestured, round to slightly oval, 4–5 μm, in part coalescent. Vessel—ray and vessel—parenchyma pits in part similar to the intervascular pits and in part oblong, up to 20 × 3 μm.

Fibres mostly septate, occasionally non-septate, diameter up to 15 μm, walls 2–2.5 μm, frequently gelatinous. Pits minutely bordered, frequent on the radial walls and less frequent on the tangential walls, 1.5–2 μm. Length 620 (368–912) μm, F/V ratio 1.50.

Rays heterogeneous, exclusively uniseriate, composed of upright and square and sporadically weakly procumbent cells. Height 22 cells (=740 μm), 12 (10–15) per mm.

Parenchyma scanty paratracheal, in strands of 2–4 cells or as fusiform cells (septate and non-septate); length 490 (276–800) μm, P/V ratio 1.18.

Bands of pseudo-parenchyma frequent, partly continuous, partly wavy and short, composed predominantly of parenchyma strands and fusiform cells, mixed with few fibres. On some places radial rows of 4–5 parenchyma cells were observed.

44. **Neblinanthera** Wurdack — Table 2

A monotypic genus from Venezuela and Brazil.

Material seen: N. cumbrensis Wurdack: Venezuela, Maguire et al. 42173, type (=Uw 22371 =USw 25129), diam. 3 cm.

Growth rings absent. Vessels diffuse, solitary (34%) and in many radial multiples, irregular clusters scarce, 73 (65–82) per sq. mm, round, occasionally angular or oval, walls 2–3 μm, diameter 46 (28–64) μm, vessel member length 450 (288–576) μm. Perforations simple, end wall angles 0°–50°. Intervascular pits alternate, vestured, round, 4–6 μm, some apertures coalescent. Vessel—ray and vessel—parenchyma pits partly vestured, round to slightly oval, 4–6 μm. Thin- and thick-walled tyloses observed in some vessels.

Fibres septate, diameter up to 12 μm, walls 3–4.5 μm, occasionally gelatinous. Pits simple, equally frequent on the radial and on the tangential walls, 3 μm. Length 540 (400–704) μm, F/V ratio 1.19.

Rays heterogeneous, uniseriate with scarcely a biseriate part, over 2–4 cells in height in the middle of the ray, composed of upright and some square cells. Height up to 27 cells (=765 μm), 8 (5–11) per mm.

Parenchyma paratracheal in incomplete rings, in strands of 2–4 cells or as fusiform cells; length 430 (288–592) μm, P/V ratio 0.95.

Bands of pseudo-parenchyma, composed of fibres with thinner walls and wider lumina than the fibres of the ground tissue.

Dark brown deposits abundant in the rays and parenchyma and scarce in the fibres.

45. **Sandemania** Gleason — Table 2

One or two species of shrubs from the campinas of Brazil and Peru.

Material seen: S. hoehnei (Cogn.)Wurdack: Brazil, Maas et al. 3101 (=Uw 23637), diam. 1 cm.

Growth rings faint. Vessels diffuse, solitary (14%) and for the greater part in radial multiples of 2–12, irregular clusters scarce, 74 (61–97) per sq. mm, angular to round, walls 3–4 μm, diameter 48 (28–63) μm, vessel member length 375 (272–544) μm. Perforations simple, end wall angles 15°–70°. Intervascular pits alternate, vestured, round to polygonal, 4–6 μm. Vessel—ray and vessel—parenchyma pits round, oval or oblong, from 5 to 16 × 5 μm.

Fibres septate, diameter up to 8–13 μm, walls 5 μm, frequently gelatinous. Pits simple, on radial and tangential walls, 2–3 μm. Length 475 (336–698) μm, F/V ratio 1.26.

Rays heterogeneous, uniseriate and 2–3-seriate, composed of upright, some square and sporadically weakly procumbent cells. Height up to 94 cells (=2700 μm), 3 (2–5) per mm.

Parenchyma scarce, scanty paratracheal, in strands of 2–7 cells; length 425 (320–640) μm, P/V ratio 1.13.

Dark brown amorphous deposits present in all tissues.

46. **Tateanthus** Gleason — Table 2

A monotypic genus of shrubs from Venezuela and Brazil.

Material seen: T. duidae Gleason: Venezuela, Maguire 42227 (=Uw 22400 =USw 25151), diam. 2 cm.

Growth rings present. Vessels diffuse, solitary (23%) and especially in radial multiples of 2–7 and some irregular clusters, 72 (56–97) per sq. mm, angular and round to oval, walls 3–4 μm, diameter 43 (25–63) μm, vessel member length 380 (272–496) μm. Perforations simple, end wall angles 5°–60°. Intervascular pits alternate, vestured, round, oval and oblong, from 6–7 up to 18 × 3 μm. Vessel—ray and vessel—parenchyma pits oblong, sometimes almost scalariform, up to 23 × 5 μm. Thin-walled tyloses frequent.

Fibres septate, diameter up to 13 μm, walls 3–4 μm. Pits simple, equally frequent on the radial and tangential walls, 2–3 μm. Length 490 (320–460) μm, F/V ratio 1.28.

Rays heterogeneous, uniseriate and 2–3-seriate, composed of upright and some square cells, occasionally with sheath cells. Height of the uniseriate rays up to 20 cells (=740 μm), the multiseriates up to 25 cells (=980 μm), sporadically vertically composed rays observed, 5 (3–8) per mm.

Parenchyma scarce, scanty paratracheal, in strands of 2–4 cells or as fusiform cells; length 385 (256–480) μm, F/V ratio 1.01.

Brown amorphous deposits present in rays, parenchyma and vessels.

47. **Tessmannianthus** Markgraf — Table 2

A genus of 3 species of trees, from Colombia and Peru.

Material seen: T. calcaratus (Gleason) Wurdack: Colombia, H. P. Fuchs 21762 (=Uw 15714), diam. over 10 cm; H. P. Fuchs 22054 (=Uw 15748), diam. over 10 cm.

Growth rings absent. Vessels diffuse, solitary (35–60%) and in radial multiples and irregular clusters of 2–4, 7 to 9 (4–15) per sq. mm, round to oval, walls 3–5 μm, diameter 108 to 115 (64–160) μm, vessel member length 740 to 810 (576–960) μm. Perforations simple, end wall angles 0°–45°. Intervascular pits alternate, vestured, polygonal and round, scanty, oval to oblong, from 10–14 and up to 38 × 8 μm. Vessel—ray and vessel—parenchyma pits partly vestured, round to oval, from 5 to 12 × 5 μm. Thin-walled tyloses sometimes present.

Fibres non-septate, diameter 15–18 μm, walls 1.5–3 μm, frequently gelatinous. Pits simple, frequent on the radial walls and less frequent to scarce on the tangential walls, 2 μm. Length 935 to 975 (496–1184) μm, F/V ratio 1.20 and 1.26.

Rays nearly homogeneous, uniseriate and 2-(3)-seriate, composed of procumbent cells, with scanty marginal rows of square cells. Height of the uniseriate rays 23 to 46 cells (=370–900 μm), of the multiseriate rays 41 to 44 cells (=500–800 μm), 12 (10–14) per mm.

Parenchyma abundant, scanty paratracheal and in short to continuous tangential bands, 5–20 cells wide, commonly apotracheal, in strands of 2–5 cells or as fusiform cells; length 685 to 870 (512–996) μm, P/V ratio 0.92 and 1.08.

Bands of pseudo-parenchyma: although sporadically a few fibres are intermingled, we are inclined to classify the bands as 'parenchyma' instead of pseudo-parenchyma, firstly because of the scarcety of the fibres, secondly because the bands are very conspicuous, similar to normal parenchyma bands.

Scanty styloids in unlignified, enlarged parenchyma cells, 120 × 25 to 180 × 40 μm.

Yellowish deposits occur in some ray cells.

DISCUSSION OF INDIVIDUAL WOOD ANATOMICAL CHARACTERS WITH COMMENTS ON DIAGNOSTIC VALUE

Growth rings

Growth rings were found in several genera. Their presence, however, is variable below the genus level, and mostly they are faint, only indicated by a slight difference in fibre wall thickness and radial lumen diameter. *Bucquetia glutinosa* is the only species in which the frequency and diameter of the pores slightly vary and thus contribute to the distinction of the growth rings. For diagnostic purposes the growth rings are useless.

Vessels

The distribution of the vessels in the Melastomataceae is diffuse. The percentage of solitary vessels varies considerably (3–80%) within tribes and genera. The remaining pores are arranged in short radial multiples and irregular clusters of 2–6 (9) cells. *Mouriri* is the only genus with almost 100% of the vessels solitary in all samples studied. Pronounced radial chains are found in *Sandemania* and *Macairea axilliflora*. A clear tangential arrangement could be seen in *Rhynchanthera paludicola*. As a result, vessel distribution is of limited value in distinguishing between genera.

The vessels are commonly round to oval, sometimes also angular. Angular shapes are predominant in *Monochaetum*, *Pachyloma*, *Opisthocentra* and *Blakea*. Of these genera, *Blakea* is the only one of which relatively large samples were available. The other three genera were represented by 1 cm thick stems.

In the following characters the individual genera widely overlap: in range of vessel frequency (e.g. in *Tibouchina* 7–44, in *Miconia* 7–37 per sq. mm), in range of vessel diameter (e.g. in *Tibouchina* 18–121 μm, in *Miconia* 46–130 μm) and vessel member length (*Tibouchina* 310–695 μm, *Bellucia* 475–875 μm, *Rhynchanthera* 300–510 μm). This variation extremely limits the diagnostic value of these quantitative characters.

The intervascular pits are vestured (with the partial exceptions in some pits of *Macai-*

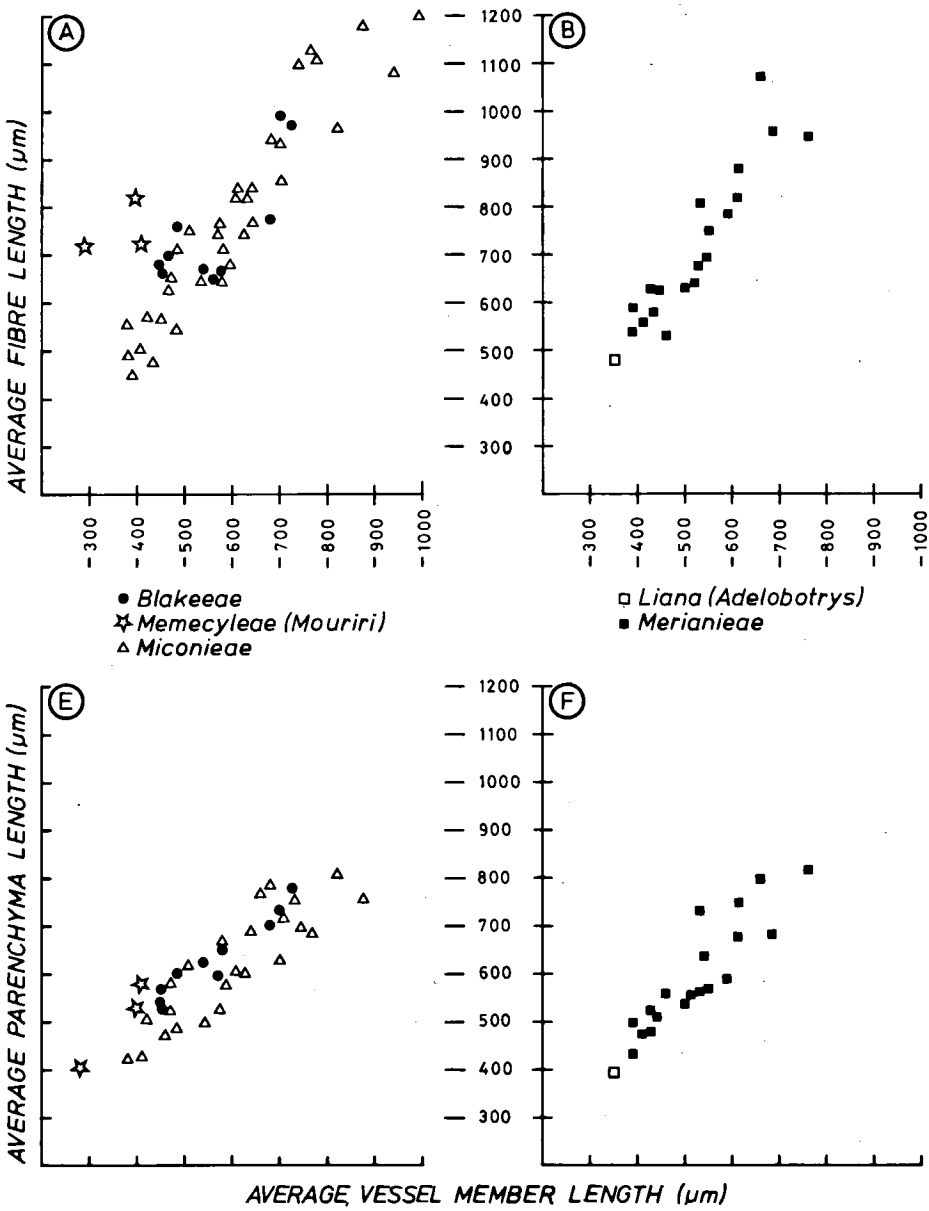
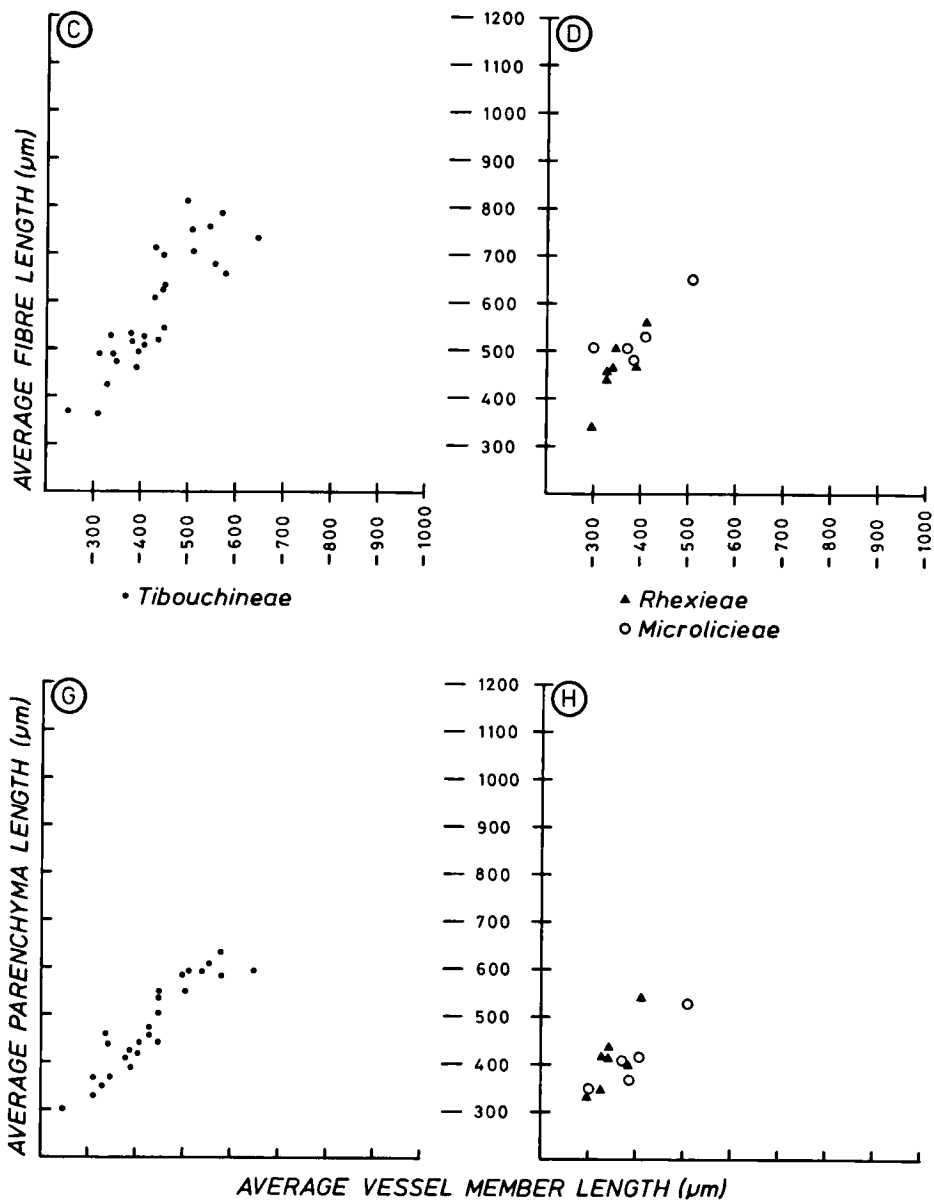


Fig. 1. Vessel member length, fibre length and parenchyma strand length in the tribes of Neotropical Melastomataceae.


C
D
G
H
AVERAGE FIBRE LENGTH (µm)
AVERAGE PARENCHYMA LENGTH (µm)
AVERAGE VESSEL MEMBER LENGTH (µm)
300
400
500
600
700
800
900
1000
1100
1200
• Tibouchineae
▲ Rhexieae
o Microlicieae

rea and *Mouriri*). This is not unexpected, as the occurrence of vestures has also been reported in other Myrtalean families (Metcalfe & Chalk, 1950; van Vliet, 1978; Baas & Zweypfenning, 1979). Of the types of vestures recognized by van Vliet (1978) type A and B1 are present in the *Melastomataceae*, but intermediate forms also occur (Koek-Noorman et al. 1979). As these types are very similar it does not seem justified to attach taxonomic value to the limited variation in this family.

The intervascular pits are polygonal, round and/or oval to oblong. Sometimes they tend to be reticulate or scalariform or are (partly) unilaterally compound. The vessel—ray and vessel—parenchyma pits may be similar to the intervascular pits, but often they are more oblong, reticulate or scalariform. It is possible to distinguish between three groups of genera:

1. Genera with polygonal or round to slightly oval intervascular pits, (2) 3–10 μm, and similar vessel—ray and vessel—parenchyma pits, viz. *Axinaea, Calycogonium, Clidemia, Henriettea, Heterotrichum, Meriania, Mouriri, Myriaspora* and *Neblinanthera.*
2. Genera with polygonal or round to oval intervascular pits, 3–10 (13) μm; vessel—ray and vessel—parenchyma pits more elongate, oblong to scalariform, reticulate, the size varying considerably, not seldom up to 35 × 5 μm. This combination of pits was found in *Bellucia, Blakea, Centronia, Charianthus, Conostegia, Henriettella, Huberia, Huilea, Leandra, Llewelynia, Loreya, Maieta, Mecranium, Miconia, Pachyloma, Platycentrum, Rhynchanthera, Sandemania, Tetrazygia, Tibouchina p.p., Tococa, Topobea,* and *Trembleya.*
3. Genera with intervascular, vessel—ray and vessel—parenchyma pits (round to) oblong. Although the vessel—ray and vessel—parenchyma pits are often more elongate and sometimes reticulate, one can say that in this group of genera the intervascular pits and the vessel—ray and vessel—parenchyma pits are more or less similar. It applies to *Aciotis, Adelobotrys, Alloneuron, Brachyotum, Bucquetia, Graffenrieda, Macairea, Marcetia, Monochaetum, Nepsera, Opisthocentra, Ossaea, Pachyanthus, Tateanthus, Tessmannianthus,* and *Tibouchina p.p.*

As the shape of the pits and the size of the polygonal and round to oval pits are rather constant within the genera studied, we consider the intervascular, vessel—ray and vessel—parenchyma pits as characters with diagnostic value on the generic, and sometimes on the species level (see table 2).

Tracheids

Sporadically one or two tracheids were found in a maceration. We have no indication that their presence is of any diagnostic or taxonomic value. Therefore their occurrence is not reported in the generic descriptions.

Fibres

In nearly all samples studied all fibres can be classified as libriform fibres: the pits are simple or show strongly reduced borders, they occur either on radial walls only, or on radial and (usually less frequent) on tangential walls. The fibres are usually septate and

non-septate in the same sample. However, sometimes the fibres are exclusively septate or non-septate. The fibres of *Mouriri* are deviating and should be classified as fibre tracheids because of their distinctly bordered pits (5 μm), occurrence of the bordered pits on tangential walls and radial walls, the absence of septa and the relatively thick cell walls.

The average fibre length varies between 340 and 1205 μm. The average values for species of the same genus may vary considerably and sometimes show a complete overlap with species of other genera. There is a slight correlation between fibre length and plant habit: we found relatively long fibres in genera with large trees (*Bellucia, Henriettea, Henriettella*). The fibre length/vessel member length ratio varies from 1.04 to 1.74 with the exception of *Mouriri*, where the F/V ratio varies from 1.76 to 2.52. These values will be discussed under 'Taxonomic value of the wood anatomical characters' (see also fig. 1).

The diagnostic value of the fibre characters (with exception of the presence of fibre-tracheids in *Mouriri*) is restricted. Genera with only non-septate fibres are: *Adelobotrys, Bucquetia, Centronia, Graffenrieda, Marcetia, Mecranium, Mouriri, Rhynchanthera,* and *Tessmannianthus*. Exclusively septate fibres were found in species of *Bellucia, Henriettella,* and *Loreya*. In the other genera both septate and non-septate fibres were found, in varying quantities per sample. Occasionally the fibre tissue consists of two types of fibres, deviating in wall thickness, lumen diameter and sometimes in length (viz. *Bellucia, Clidemia, Heterotrichum, Huberia, Leandra, Loreya,* and *Maieta*). This fibre dimorphism is correlated with the phenomenon of pseudoparenchyma. Therefore it will be discussed below under '*Parenchyma and pseudoparenchyma*'.

Rays

Most Melastomataceae show rays which are uniseriate (with at most occasionally a small biseriate part), composed of upright and square cells, in some genera mixed with some rows of weakly procumbent cells. Multiseriate rays were observed in *Bucquetia* and *Pachyanthus* (both with predominantly procumbent cells), *Nepsera, Sandemania, Tibouchina,* and *Trembleya* (predominantly upright and square cells, mixed with some weakly procumbent cells), *Blakea, Tateanthus,* and *Topobea* (procumbent cells lacking). Uniseriate rays, composed of procumbent cells only, were found in some species of *Meriania,* viz. *pallida* and *spruceana* (homogeneous rays, type I of Kribs classification, 1968). *Tessmannianthus* is the only genus with uni- and multiseriate rays composed of (nearly exclusively) procumbent cells. Although we thus found a certain range of variation (table 2), the diagnostic value of ray width is not very clear. Multiseriate rays are present in all species studied of *Blakea, Tessmannianthus,* and *Topobea*. Three of the 19 species of *Tibouchina* showed uniseriate rays only. As for the composition of the rays, the presence of exclusively procumbent cells is a means to identify taxa (viz. *Meriania, Tessmannianthus*). The composition of the rays of neotropical and palaeotropical *Melastomataceae* in relation to taxonomy and phylogeny is discussed in an other paper in this issue (Van Vliet et al. 1981; see also the last chapter of this paper).

Ray height variation is from 6 to 104 cells (255–4000 μm). The whole range can be found in the genus *Tibouchina*. Although in other genera the variation is less great, the overlap is such that the ray height has no diagnostic significance, except perhaps in some cases as

additional evidence. *Mouriri vernicosa* is notable because of the very low uniseriate rays combined with multiseriates about three times as high (3 resp. 24 cells, 125 resp. 365 μm).

Parenchyma and pseudoparenchyma

Parenchyma occurs as fusiform cells and strands of 2–4 (9) cells. Both types of cells may be septate or non-septate.

Scanty paratracheal strands occur in all samples studied (table 2). In some specimens it tends to be vasicentric. Diffuse parenchyma cells between the fibre tissue occur in about half of the genera, but are always scanty. Much more frequently parenchyma is found in a banded pattern, the bands consisting either of parenchyma cells only, or of a mixture of varying amounts of parenchyma cells and fibres. In other species, comparable bands are formed by fibres only, these fibres deviate from the fibres of the ground tissue in wall thickness, lumen diameter and cell length. In an earlier paper (Ter Welle and Koek-Noorman, 1978) we described such bands exclusively or partly consisting of fibres in more detail, and also the morphology of the participating elements. Since then, comparable phenomena have been reported in the *Lythraceae* (Baas & Zweypfenning, 1979). In this paper, we refer to bands consisting either of fibres, or of fibres and parenchyma cells, as pseudoparenchyma. As in some samples the fibres are very similar to the (septate or non-septate) fusiform cells, it is not always easy to decide what types of elements exactly compose the bands of pseudoparenchyma. Nevertheless we are sure that in none of the specimens examined, with the exception of *Huilaea*, both true parenchyma bands and bands of pseudoparenchyma occur together. No bands at all were found in *Bucquetia*, *Henriettea*, *Sandemania*, *Tateanthus*, and *Trembleya*. Bands of parenchyma cells only (2–10 cells wide, continuous or short and wavy) were found in *Adelobotrys*, *Blakea*, *Centronia*, *Conostegia*, *Graffenrieda*, *Huilaea*, *Meriania*, *Mouriri p.p.*, *Opisthocentra*, *Tessmannianthus*, *Tibouchina p.p.*, *Tococa*, and *Topobea*. In all genera not mentioned, bands of pseudoparenchyma occur. *Tibouchina* and *Conostegia* are the only two genera in which species with parenchyma bands and species with bands of pseudoparenchyma were found.

In the generic descriptions the average, minimum, and maximum values of parenchyma length is based on both fusiform cells and strands. These averages are used in the calculations of parenchyma length/vessel member length ratio. For the family it varies from 0.69–1.42, but the vast majority lies between 1.00 and 1.15. These values will be discussed further on under 'Taxonomic values of the wood anatomical characters' (see also fig. 1). In macerations of 98 samples enough strands and fusiform cells were observed to justify a comparison between the respective length of both types of parenchyma separately. In 31 samples we found the average values of fusiform cells and strands to be nearly equal (the difference less than 10 μm), in 16 samples the strands were notably longer (20–100 μm), and in the remaining 51 samples the fusiform cells were longer than the parenchyma strands.

It is remarkable that in genera with true parenchyma bands, fusiform cells are lacking, or, if present, are as long or shorter than the parenchyma strands (*Adelobotrys*, *Blakea*, *Centronia*, *Conostegia*, *Graffenrieda*, *Meriania*, *Opisthocentra*, *Tococa*, and *Topobea*). *Tibouchina* and *Tessmannianthus* do not follow this tendency. The longer fusiform cells

are mainly found in genera of the *Microlicieae, Tibouchineae,* and less frequently in the *Miconieae.*

Although sometimes bands of pseudoparenchyma can be distinguished from true parenchyma bands only with difficulty as the participating types of elements are so much alike, we are convinced that the diagnostic significance of pseudoparenchyma vs. parenchyma is considerable on the genus and species level (f.i. in the *Merianieae*). The phylogenetic and taxonomic implications will be discussed below.

Crystals and crystalline masses

Crystals are of restricted occurrence in the Melastomataceae. Druses were observed in the axial parenchyma strands in *Adelobotrys p.p., Tibouchina p.p., Tococa p.p., Blakea, Huilaea,* and *Topobea;* in the last three genera always present in unlignified cells or idioblasts (Koek-Noorman et al., 1979). Megastyloids as described for *Henriettea* by Ter Welle and Mennega (1977) were also found in *Calycogonium* and *Tessmannianthus.* Small rhombic crystals in unlignified, often chambered parenchyma cells are present in *Centronia, Conostegia cinnamomea, Graffenrieda* and *Opisthocentra.* In *Conostegia xalapensis* comparable but smaller rhombic crystals were found in the ray cells. In *Blakea latifolia* and in *Huilaea,* beside the druses mentioned before, rhombic crystals and intermediates between the two crystal types occur.

Birefringent crystalline masses were observed in axial parenchyma cells and/or ray cells of species of *Calycogonium, Conostegia, Miconia* and *Tetrazygia.* The diagnostic value of crystals in general is often considered to be restricted, as the frequency within species or even specimens may vary tremendously. However, notwithstanding their rather scarce occurrence, the variation of crystal types is notable, and especially the occurrence of druses, megastyloids and crystalline masses is useful for diagnostic purposes. The druses can be used in identification on the genus level (*Blakea, Topobea*) or on the species level (*Tibouchina, Tococa,* prob. *Huilaea*). Megastyloids, rhombic crystals, and crystalline masses seem to be useful on the species level.

WOOD ANATOMY IN RELATION TO HABIT AND HABITAT

Within the Melastomataceae lianas are scarce. In our material they were represented by *Adelobotrys macrantha* and *Topobea alternifolia* only. It is tempting to assume that the abundant unlignified parenchyma in *A. macrantha* and the reticulate parenchyma pattern in *T. alternifolia* are related to the climbing habit. Other deviating phenomena were not found, except for the large part of the transverse section occupied by vessels.

The other material available consists of samples from twigs and/or stems of small shrubs, and samples from trunks of large trees. Although the tendency is not overwhelming, the highest values of vessel member length, fibre length, and parenchyma strand length are generally found in samples of large trees.

Our study is restricted to the Melastomataceae from a tropical region. This geographical delimitation does not allow a meaningful discussion of wood anatomical characters in relation to latitude. The ecological variation, on the contrary, is notable: representatives are found in the lowlands as well as in high Andean regions, in dry and in wet habitats. In

the last few years several authors elaborated on ecological factors in relation to wood anatomy (e.g. Baas, 1973; Carlquist, 1975) and described intriguing trends. Looking through the samples for which ecological data were available, we have not observed any significant differences between typical lowland and mountain species for characters as presence of growth rings, vessel diameter and frequency, vessel member length, fibre and parenchyma length and distribution, and F/V and P/V ratio. The following may serve as an example:

Nepsera aquatica, a species from wet thickets (Morichales of the Llanos) and *Sandemania hoehnei*, restricted to the white sand savannas near Manaus (Campina forest) with long very dry periods, show both vessel and fibre lengths ranked among the very shortest values; there is no real difference in vessel diameter and frequency between both species.

TAXONOMIC VALUE OF THE WOOD ANATOMICAL CHARACTERS

The diagnostic value of a number of wood anatomical characters has been discussed in a previous chapter. However, characters of which the diagnostic value is limited because of the occurrence of intermediate character states, may still be of taxonomic value, because they may witness mutual affinity (Van Vliet, 1979). The characters which seem to be most strongly correlated with the existing classification of Melastomataceae are: fibre tissue consisting of fibre-tracheids, presence of included phloem, and vessels exclusively solitary. In each of these characters *Mouriri* (subfamily *Memecyloideae*) is distinct from the other genera studied, all belonging to the subfamily *Melastomatoideae*.

Vessel features with taxonomic value within the *Melastomatoideae* are the shape and size of the intervascular pits and of the vessel—ray and vessel—parenchyma pits. Polygonal or round (oval) intervascular pits are mostly found in *Blakeeae*, *Miconieae*, *Microlicieae*, and *Merianieae p.p.* They are (round to) oblong in most *Tibouchineae*, *Rhexieae*, and *Merianieae p.p.* Round to oval vessel—ray and vessel—parenchyma pits are often found in *Merianieae p.p.* and in *Miconieae p.p.*, whereas (round to) oblong to scalariform vessel—ray and vessel—parenchyma pits are predominant in all other tribes.

The characteristics of the libriform fibres have only a slight correlation with taxonomic groups. *Blakeeae p.p.*, *Microlicieae*, *Rhexieae p.p.*, and *Tibouchineae* show fibre pits on both radial and tangential walls, whereas in *Merianieae* and *Miconieae* the pits are restricted to or predominant on radial walls. In a similar way the tribes can be divided into 2 groups using septation of the fibres. Predominantly non-septate fibres (sometimes mixed with septate fibres) are found in *Microlicieae*, *Rhexieae*, and *Tibouchineae* and in *Merianieae p.p.* Septate fibres outnumber the non-septate fibres in *Blakeeae* and *Miconieae p.p.* Besides these differences in pit distribution and septation, we see a slight shift in average values of fibre length. This is pictured in figs. 1A–1D, where the mean fibre lengths are plotted against mean vessel member lengths. It will be clear that the variation in lengths is greatest in *Merianieae* and *Miconieae*, and is smaller in *Microlicieae* and *Rhexieae*. As there is a strong correlation between vessel member length and fibre length, the F/V ratios are rather similar in all tribes and vary within narrow limits (0.97–1.74). In *Mouriri* the F/V ratios are usually over 2.0.

The diagnostic and taxonomic value of ray cell types seems to be restricted to the genus

or species level. The same can be said for the width of the rays with the exception of the *Blakeeae*, where multiseriate rays (heterogeneous, type I) are characteristic.

Parenchyma distribution seems to have more taxonomic significance. The diagnostic value has already been mentioned before. On the tribal level most *Microlicieae* are characterized by the presence of scanty paratracheal parenchyma only, while the *Blakeeae* and the *Merianieae p.p.* are characterized by true parenchyma bands. Nearly all *Miconieae*, *Rhexieae*, and *Tibouchineae* show bands of pseudoparenchyma.

In figs. 1E–1H the mean vessel member lengths are plotted against the mean parenchyma lengths. We see a pattern, comparable with that of the fibre length/vessel member length graphs. The maximal variation of vessel member length, parenchyma length and P/V ratio is found within the *Miconieae*. As the maximum vessel member length in *Merianieae* is lower, whereas the variation in parenchyma length is similar to that in *Miconieae*, the P/V ratios on the whole are higher and above 1.00. Vessel member lengths and parenchyma lengths in *Microlicieae* and *Rhexieae* are comparable and are among the shortest found in the family. To a lesser extent the same can be said for *Tibouchineae*. The three species of *Mouriri* also show short vessel members, but due to relatively longer parenchyma cells the P/V ratios are the highest ones for the Melastomataceae.

As crystalline masses and megastyloids occur in some representatives of the *Miconieae* and in *Tessmannianthus*, they seem to have some taxonomic value. Druses are rare in one species of *Tibouchina* and one of *Tococa*, but prominent in *Blakea*, *Topobea*, and *Huilaea*. They have some taxonomic value on the tribal and species level.

RELATIONSHIPS WITHIN THE MELASTOMATACEAE

Since early times the family has been subdivided into three subfamilies. The subfamily *Memecyloideae* accomodates the *Memecyleae*, the *Astronioideae* include only palaeotropical genera. The third and largest one is the subfamily *Melastomatoideae*. Except for *Mouriri* belonging to the *Memecyleae*, all genera studied here are classified in the third subfamily. We will discuss the classification given by Cogniaux (1891) and include a discussion of the position of the genera subsequently described.

Subfamily MEMECYLOIDEAE

The subdivision of the family is emphasized by the deviating characters in *Mouriri*. The differences between *Mouriri* and all neotropical *Melastomatoideae* are numerous and essential. In fact we dare say, that the wood anatomical characters contradict a position of *Mouriri* near the *Melastomatoideae*, especially because of the great homogeneity of the *Melastomatoideae*. According to Morley (1976) there is no reason to separate *Mouriri* from the other Melastomataceae.

Subfamily MELASTOMATOIDEAE

Although there is a real variability within this subfamily (see table 2), the *Melastomatoideae* constitute a wood anatomically homogeneous group, characterized by the

1—(2—4)-seriate, mostly heterogeneous rays (i.e. mostly composed of erect to weakly procumbent cells), and the vague to clear bands of pseudoparenchyma, sometimes nearly exclusively composed of fibres, sometimes predominantly composed of parenchyma cells; in some taxa (see table 2) instead of bands of pseudoparenchyma, true parenchyma bands occur. The fibre tissue consists of libriform fibres. The vessels are mostly narrow (less than 100 μm in diameter) and numerous, partly arranged in short radial multiples.

The tribe *Microlicieae* has no characters differentiating it clearly from all the other tribes of this subfamily. On the other hand, a number of characters links it with *Tibouchineae* and *Rhexieae:* the high frequency of fibre pits on both radial and tangential walls, the predominance of non-septate fibres, and the short vessel member and parenchyma strand length. Differences with these two tribes are found in the parenchyma distribution (in *Microlicieae* bands are usually lacking, in *Tibouchineae* and *Rhexieae* pseudoparenchyma or parenchyma bands are present). *Bucquetia* was classified in the *Tibouchineae* by Krasser (1893). This is supported by the shape of the intervascular pits, but contradicted by the absence of parenchyma bands. Whiffin & Tomb (1972) suggest affinity with the *Merianieae* because of similarities in seed morphology. In the parenchyma distribution and the distribution of fibre pits we find no reason to support their ideas. Wherever *Bucquetia* is placed, it remains anomalous because of the mainly procumbent ray cells. The position of *Tateanthus* will be discussed under *Merianieae*.

The *Tibouchineae* are fairly homogeneous, the only 'disturbing' variation being found in the true parenchyma bands in most species of *Tibouchina* versus bands of pseudoparenchyma in the other *Tibouchineae*. *Marcetia* fits in this group and there is no reason to follow Krasser (1893), who accomodated *Marcetia* in the *Microlicieae*. According to Wurdack (pers. comm.) and Whiffin & Tomb (1972), *Sandemania* should be placed in the *Tibouchineae*. The only objection against this position is found in the absence of bands of (pseudo)parenchyma, which suggest affinities with *Microlicieae*. *Monochaetum* and *Pachyloma* were classified in the *Rhexieae* by Cogniaux (1891), and also by Krasser (1893). The pattern of medullary bundles of *Monochaetum* (Metcalfe & Chalk, 1950), however, suggests affinity with the *Tibouchineae*. Wurdack (pers. comm.) and Whiffin & Tomb (1972) tend to accommodate *Monochaetum* in the *Tibouchineae*. Wood anatomical support for a position of *Monochaetum* in the *Tibouchineae* is weak but present. *Monochaetum* differs from *Pachyloma* in the shape of the intervascular pits and vessel—ray and vessel—parenchyma pits, the presence of square ray cells, and the frequent fibre pits on the tangential walls. In these characters *Monochaetum* matches most *Tibouchineae*.

The tribe *Merianieae* is rather heterogeneous in features, here considered to be of (some) taxonomic value viz. intervascular pits, vessel-ray and vessel-parenchyma pits, presence or absence of septate fibres, position of fibre pits. A comparatively constant character is the parenchyma arrangement in tangential bands (exceptions being found in *Axinaea* and *Huberia*, where bands of pseudoparenchyma composed of fibres were found). In the light of this heterogeneity, there is no wood anatomical evidence to remove *Opisthocentra*. Contrary to Cogniaux (1891) and Krasser (1893) who listed *Opisthocentra* in this tribe, Whiffin & Tomb (1972) accommodated it in the *Bertolonieae*, like they did with *Tateanthus*. As we had no other representative of *Bertolonieae* at our disposal, we could only compare *Opisthocentra* and *Tateanthus*. They appear to be dissimilar in ray width, position of fibre pits, and parenchyma distribution. Gleason (1931), in his descrip-

tion of the new genus *Tateanthus*, suggested a close affinity with the palaeotropical *Sonerileae*. Van Vliet (this issue) proposes a new delimitation of *Sonerileae* (including *Oxysporeae*). Wood anatomically there are affinities between *Tateanthus* and some genera of the new subtribe *Oxysporinae*. Wurdack places *Tateanthus* somewhere near *Merianieae*, *Microlicieae*, and *Sonerileae*. Whereas *Tateanthus* differs from *Microlicieae* in the shape of the intervascular pits, there is a good agreement in parenchyma distribution (scanty paratracheal), ray width, and, in addition, the position of the fibre pits. Consequently, we would suggest a position in the immediate neighbourhood of *Microlicieae*. *Neblinanthera* and *Tessmannianthus* are two other genera, mentioned by Wurdack (1964, and pers. comm.) in relation to *Merianieae* (fig. 2). Due to the wide variability found in *Merianieae*, most of the characters of *Neblinanthera* and *Tessmannianthus* fit within the tribe as a whole, the only strongly deviating feature being the multiseriate homogeneous rays of *Tessmannianthus*. However, this character is not found anywhere else in the family. The presence of megastyloids in *Tessmannianthus* suggests affinity with *Miconieae*. However, the size and shape of the intervascular pits, the parenchyma bands, and the absence of septate fibres approach the situation in the *Merianieae*.

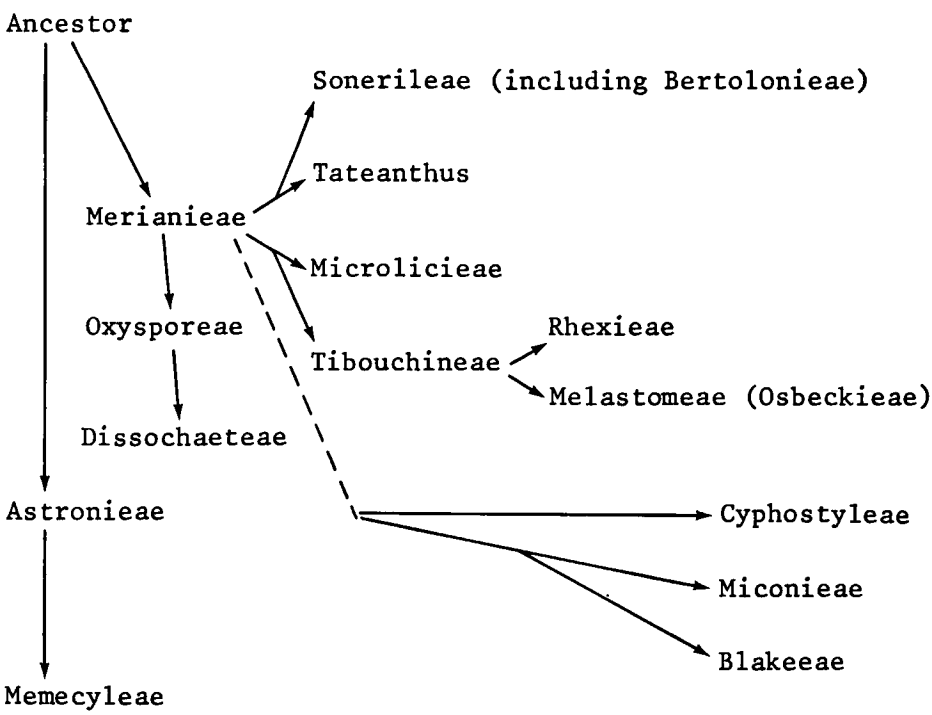


Fig. 2. Possible tribal phylogeny in the Melastomataceae as suggested by J. J. Wurdack.

The *Miconieae* are by far the largest tribe of the family. Considering the large number of available representatives, the tribe is rather homogeneous. We may mention the (polygonal to) round intervascular pits (except in *Ossaea* and *Pachyanthus*), the bands of pseudoparenchyma (except in *Henriettea* where parenchyma is scanty paratracheal, and in *Conostegia* and *Tococa* where true parenchyma bands occur). In the *Miconieae*, the shortest and the longest vessel elements, fibres, and parenchyma strands of the neotropical representatives of the family are found. *Pachyanthus* is the only genus listed in the *Miconieae* by Cogniaux (1891) for which the wood anatomy is suggestive of another position. The combination of oblong intervascular and vessel—ray pits, the predominantly non-septate fibres with pits on radial and tangential walls and the 2–3-seriate rays tempt us to compare *Pachyanthus* with *Microlicieae* and some *Tibouchineae*. *Alloneuron* is one of the genera not listed by Cogniaux (1891). It should be accommodated in the *Cyphostyleae* (Wurdack, pers. comm.). Wood anatomically there is a good agreement with the *Miconieae*, an allied tribe. *Llwelynia*, another genus not listed by Cogniaux, shows a close resemblance with some *Miconieae*, among other *Henriettella*.

The *Blakeeae*, together with *Huilaea*, have been described and discussed before (Koek-Noorman et al., 1979). Suffice it to say that the combination of multiseriate rays and frequent occurrence of druses distinguishes the tribe from other *Melastomataceae*, with the only exception of some species of *Tibouchina*. Consequently, the wood anatomy does not support Wurdack's suggestion to include the *Blakeeae* in the *Miconieae*.

PHYLOGENETIC SPECULATIONS

In a study like the present one, it is tempting to try to arrange the material studied in a phylogenetic sequence. Phylogenetic trends in wood anatomy were first established by Bailey & Tupper (1918) and Bailey (1920, 1957). A survey of the trends found by him and later authors was given by Tippo (1946) and afterwards by Carlquist (1961, 1975) and Baas (1973). Carlquist in his discussion incorporated the possibility that (some) trends, formerly considered to be irreversible, can be modified by ecological factors. In this study we had to come to a decision, either to apply these trends, established in studies of large and diverse plant groups, or to define which features in Melastomataceae are 'primitive' (plesiomorphic) and 'derived' (apomorphic) using other criteria. Hennig (1966) has described an attractive method, which has already proved its usefulness in systematic botany (Bremer & Wanntorp, 1978) and in some wood anatomical discussions on taxonomic relations (Baas & Zweypfenning, 1979; Koek-Noorman, 1980). Because of the possibility that some wood anatomical trends are reversible, we are inclined to prefer the second choice and to look for relevant features in our data set. However, we realize that there are some strong objections. If we want to arrange our material in a scheme following a cladistic analysis, the smallest taxonomic units in the cladogram, i.o. the genera of the Melastomataceae studied, must be homogeneous with regard to the wood anatomical characters used to define the bifurcations of the cladogram. Although the number of genera is overwhelming, the number of different character states is small. An additional difficulty is, that only part of the genera is woody. In spite of these difficulties it appeared possible to accommodate a significant part of our material in a cladogram (fig. 3).

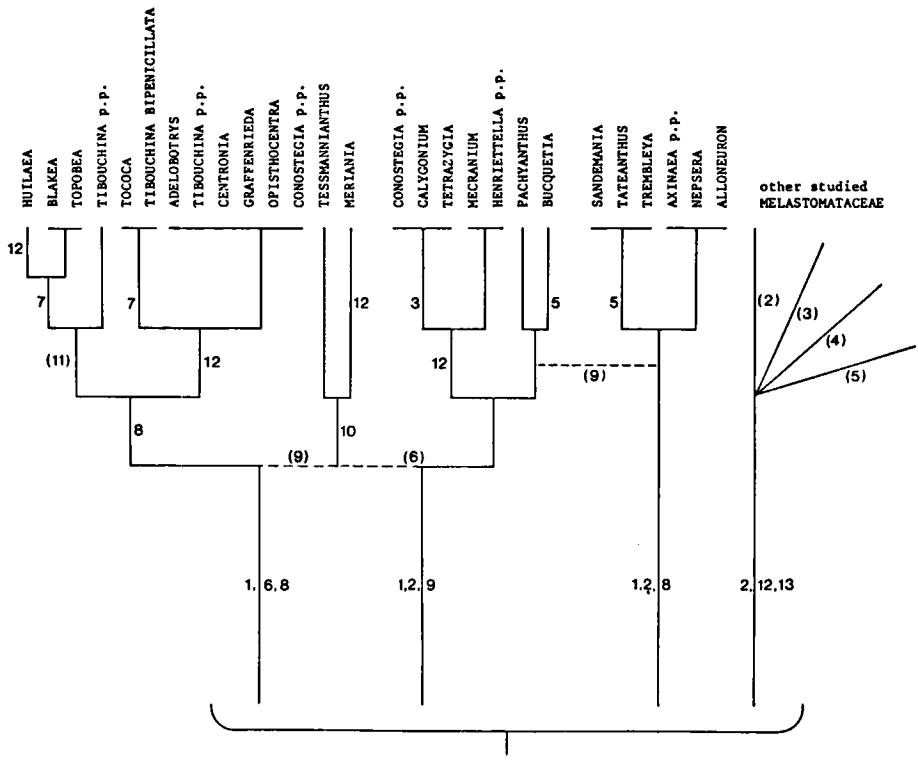


Fig. 3. Cladogram representing possible phylogenetic relationships in **Melastomataceae** as deduced from some ray- and parenchyma features.

Legenda.

1. Uni- and multiseriate rays present.
2. Bands of pseudoparenchyma composed of fibres and parenchyma strands.
3. Bands of pseudoparenchyma composed of fibres and fusiform parenchyma cells.
4. Bands of pseudoparenchyma composed of fibres.
5. Parenchyma only scanty paratracheal.
6. Bands of parenchyma.
7. Druses present.
8. Rays heterogeneous, composed of square, upright and weakly procumbent cells.
9. Rays heterogeneous, partly composed of clearly procumbent cells.
10. Rays homogeneous, composed exclusively of procumbent cells.
11. Rays tending to become wider and higher.
12. Rays uniseriate.
13. Rays heterogeneous, composed (nearly) exclusively of square and upright cells.

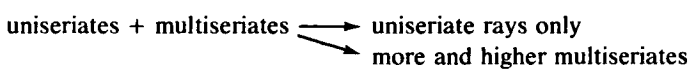
Numbers between brackets indicate possible relationships which are not worked out in cladistic bifurcations.
In the bipartitions, the numbers indicate the apomorphic (i.e. derived) character state. For explanation see text.

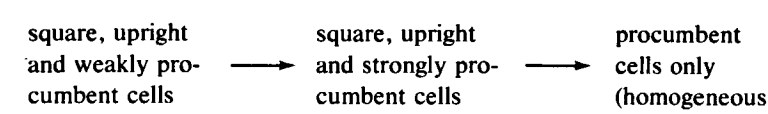
For the procedure of arranging the taxa in a cladogram, only few characters seem to be useful: the presence of parenchyma in bands or as part of the bands of pseudoparenchyma, and two ray characters, viz. heterogeneous versus homogeneous and multiseriate versus uniseriate. We are inclined to accept the hypothesis (Baas & Zweypfenning, 1979), that the presence of true parenchyma bands is an apomorphic character state as compared to the bands of parenchyma mixed with fibres: the pseudoparenchyma. The most convincing cladograms are those in which *Blakeeae, Tibouchina,* several *Merianieae, Conostegia, Tococa,* and *Tessmannianthus* form a monophyletic group. This group is characterized by the presence of parenchyma bands. In this group nearly all specimens with crystalline inclusions are clustered. Rays consisting (predominantly) of procumbent cells should be considered to be apomorphic. For this group, the plesiomorphic character states are: uniseriate and multiseriate rays present, both consisting of square and upright cells; crystals absent. The character: rays at least partly composed of procumbent cells combines *Conostegia* to *Bucquetia*. It is possible to link this group with *Tessmannianthus* and *Meriania* along the line pseudoparenchyma developing into parenchyma bands. A small group of genera (*Sandemania – Alloneuron,* see fig. 2) shows multiseriate rays (consisting of square and procumbent cells), which makes it possible to link them with the group of genera with multiseriate rays, composed at least partly of procumbent cells. However, we prefer an arrangement in which the sister group is to be found among the other Melastomataceae.

Most other samples not arranged in this cladogram show rays composed of predominantly square and upright cells, and bands of pseudoparenchyma consisting of a mixture of fibres and parenchyma strands, or of fibres only (in some cases no bands occur at all). It is impossible to indicate, how these remaining *Melastomataceae* should be incorporated in this cladogram.

As compared with the other genera studied, *Mouriri* shows a number of strikingly different character states. Therefore, this group is not included in the cladogram.

As indicated in the cladogram, we have no clear-cut idea, as how to combine the four groups. Nevertheless, a conclusion might be, that within the family plesiomorphic ray character states are: multiseriate rays composed of predominantly square and upright cells, sometimes mixed with weakly procumbent cells. The development may have been along the lines:





Because it is impossible to arrange our data in a monophyletic sequence, we assume that parallel lines of ray development have occurred in Melastomataceae. This phenomenon has been considered before to be very common within the Dicotyledons. As stated

before, banded parenchyma can be assumed to be apomorphic in this family. The plesiomorphic character state for the neotropical Melastomataceae, as suggested by our cladistic bifurcations is: parenchyma located in bands of pseudoparenchyma. Because of the impossibility, to suggest a cladistic combination for all four groups of neotropical Melastomataceae, it is not possible to indicate the plesiomorphic character state of parenchyma distribution for these groups together. Furthermore, it is not possible, to construct a cladogram in such a way that the grouping of taxa represents existing taxonomic classifications. The self-evident conclusion is that the result of application of cladistic methods on the wood anatomical data of neotropical Melastomataceae is incomplete.

The other possibility is, as said before, to compare the wood anatomical data with the phylogenetic trends, established in studies of large groups of plants. For this we definitely prefer to extend our scope and to consider the family on a worldwide basis. In another paper (Van Vliet et al., this issue) we return to this subject.

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Table 1. Some wood anatomical characters of individual species of neotropical Melastomataceae.

	Vessel frequency	Av. tang. diam. (µm)	Av. vessel member length (µm)	Av. fibre length (µm)	Av. length of par. cells and strands (µm)	Shape of the inter-vascular pits	Size of the inter-vascular pits (µm)	Shape of the vessel-ray pits	Size of the vessel-ray pits (µm)	Fibres	Width of the rays	Composition of the rays	Number of rays	Type of parenchyma distribution
TRIBE MICROLICIEAE														
Rhynchanthera														
R. brachyrhyncha	67	44	510	655	530	p	7-10	ob	18x4	o	a	a.(b)	13	(di)
R. grandiflora	36	54	375	510	410	r	5-6	r,o,ob	25x7	–	a	a,b,(c)	8	–
R. paludicola	54	51	300	505	350	p	5-6	r,o,ob	5/25x5	–	a,b	a,b	11	(di),(bap)
TRIBE TIBOUCHINEAE														
Brachyotum														
B. coronatum	35	67	390	465	390	p,r,ob	10/38x6	r,o,ob	6/20x8	–	a,(b)	a,b	10	bap
B. radula	58	49	405	510	445	r,o,ob	10/30x8	r,o	8/15x6	–	a,(b)	b	10	bap
B. strigosum	128	28	310	365	330	r,o,ob	30x4	(r),o,ob	17x5	–	a	a,b	7	bap
Macairea														
M. axilliflora	143	33	325	425	355	r,o,ob,(s)	5-6/35x3	o,ob	17x6	o	a	a,b	11	di,bap
M. maroana	46	64	555	680	610	r	6-8	o,ob	28x5	o	a	a,b	9	bap
M. neblinae	55	59	385	515	425	p,r,(ob)	6-7/23x4	o,ob,(s)	33x5	o	a	a,b	8	bap
M. pachyphylla	43	76	545	760	595	r	5-7	r,o,ob	8/25x5	X	a	(a),b	10	bap
M. thyrsiflora	45	68	505	755	555	p,(ob)	4-6/20x4	(r),o,ob	25x5	o	a	a,b	8	di,bap
Tibouchina														
T. andreana	44	56	345	475	370	r,o	8-12	r,ob,s	6/24x4	–	a,b	(a),b	12	bap
T. arborea	11	121	580	660	585	p,(r)	10-13	r,ob	10/20x6	o	a,b,c	a,b,c,d	6	bap
T. aspera	42	53	310	490	370	(p),r,o	5/8x5	ob,s	18x23	–	a,b,c	a,b,c,d	10	di,bap
T. dipenicellata	7	89	430	610	475	p,r,(o)	6-7/10x15	(r),ob,(s)	10/37x8	o	a	a,(b)	11	ba
T. catharinensis	54	61	380	535	410	p,r,o,(ob)	7/28x6	r,ob	5/25x5	o	a,b,c	a,b,c	9	di
T. chironioides	34	49	395	495	420	p,r,o,ob	7/28x5	r,ob	7/28x5	–	a,b,c	a,b,d	9	–

T. ciliaris	22	85	570	785	635	r	5-7	r	4-6	o	a,c	a,(b)	11	bap
T. gleasoniana	8	18	450	635	445	p,r,(o)	7-10/15x7	r,ob	30x5	–	a,b	a,b,d	10	–
T. grossa	39	66	445	630	540	r,oh	8-10/18x8	ob	32x8	–	a,b	a,b,(d)	9	bap
T. lepid. Uw 15035	12	65	435	705	465	r,o,ob	8/25x9	r,ob	24x6	o	a,b	a,b,(d)	11	–
T. lepid. Uw 23585	9	102	645	735	595	p,r,o,ob	10/30x8	ob	38x6	–	a,b	a,(b)	6	bap
T. mollis Uw 15123	27	66	430	520	460	p,r,(o),(ob)	7-8/30x7	ob	22x5	–	a,b	a,b	8	–
T. mollis Uw 23578	21	60	335	530	455	p,r,ob	7/20x5	ob,(s)	25x6	–	a,b	a,b	9	ba
T. ochypetala	17	86	335	545	375	r,(o),(ob)	7-8/38x6	r,ob	25x5	o	a,b,c	a,b,(c)	10	ba
T. pilosa	25	68	340	490	410	r,o,ob	8-13/18x8	r,ob	8/20x5	–	a,b	a,b,c	7	–
T. pulchra	22	86	495	815	585	(p),r,o	10/15x10	ob	28x6	X	a,b,c	a,b,d	7	(al)
T. sellowiana	31	69	450	700	560	p,r,(o)	8-13	(r),ob	10/25x8	–	a,b,c	a,(b),(d)	10	–
T. stenoc. Uw 22410	12	96	400	695	560	p,r	8-10	r,ob,(s)	10/28x6	o	a,b	a,b,(c)	9	ba
T. stenoc. Uw 2696	29	63	–	–	–	r,o	8-13	ob	23x5	o	a	a,b	11	–
T. trichopoda	29	82	510	705	595	p,r,o	8/13x6	r,ob	8/30x8	o	a,b	a,b,c,d	7	–
TRIBE RHEXIEAE														
Monochaetum														
M. compactum	36	49	325	440	350	r,o,(ob)	6-9/15x5	r,o,(ob)	6-9/15x5	o	a,(b)	a,(b)	8	bap
M. coronatum	31	56	410	560	540	r,o	7-8/15x6	r,o,(ob)	8-7/13x4	–	a	a,b	12	bap
M. lindenianum	29	58	345	505	435	r	8-9	r,o	8-9/20x5	–	a,(b)	a	7	ba
M. meridense	56	47	330	455	415	p,r,(o)	6-8/11x4	r,o,(ob)	5-6/15x4	–	a	a,(b)	9	bap
M. multiflorum	34	36	300	340	330	r,o,ob	5/18x4	r,o,(ob)	4-5/15x4	–	a	a,b	12	bap
M. myrtoideum	63	39	340	465	410	(o),ob,s	28x5	r,o,ob	6/25x8	–	a,b	a,b	11	–
TRIBE MERIANIEAE														
Graffenrieda														
G. caryophyllea	5	99	–	–	–	r,o	10/13x9	r,o,ob	10/50x8	–	a	a,b	12	ba
G. cucullata	20	66	425	625	–	p,(r),(o)	6/10x5	r,o,ob	5/32x4	–	a	a,b	10	ba
G. fruticosa	64	37	550	750	570	p,r,o,ob,(s)	4-5/38x4	r,o,ob	5/20x5	–	a	a	16	di,bap
G. latifolia	13	65	685	960	685	r,o,ob	6/27x4	r,o,ob	5/23x5	–	a	a,b	13	ba
G. limbata	10	96	760	945	–	p,r	7-12	r,o,ob	8/35x6	–	a	a	10	ba
G. polymera	14	59	485	765	555	r,o,ob	6/18x4	r,o,ob	4/25x6	–	a	a	20	ba
G. reticulata	29	69	540	695	635	r,o,ob	6-8/38x6	r,o,ob	5-6/30x5	–	a	a	14	ba
G. rupestris	11	80	550	675	595	p,r,o	5-6/13x5	r,o,ob	5/35x5	–	a	a,(b)	8	ba
G. weddellii	12	93	530	810	735	r	6-8	r,o	8-10/15x8	–	a	(a),b,(c)	10	ba

Meriania														
M. pallida	27	98	590	785	595	p,(o)	10x4	r,o	5/10x5	o	a	(b),c	8	ba
M. radula	38	63	405	565	475	p,r,o	7-9	r,o	5/12x4	–	a,(b)	(b),c	8	ba
M. spruc. Uw 2695	18	75	–	–	–	r,o	5-7	r,o	5/10x5	o	a,(b)	c	3	ba
M. spruc. Uw 22339	17	77	435	635	510	p,r	5-7	r	4	–	a,(b)	c	4	ba
M. tomentosa	12	105	530	680	565	r,o,ob	–	r,ob,(s)	24x12	–	a,b,c	b	6	ba
M. urceol. Uw 8099	6	109	660	1075	800	p	7-10	r,o	5-13	–	a,(b)	b,(c)	10	ba
M. urceol. Uw 22333	5	141	665	1000	830	p,r	10-12	r,o	8-10	–	a,(b)	(b),c	10	ba
TRIBE MICONIEAE														
Bellucia														
B. acutata	17	84	640	770	690	r,(o)	5-7	o,ob	5/20x4	o	a,(b)	(a),b	15	–
B. axinan. Uw 11072	7	148	680	945	790	r	5-6	r,(o)	5-7	X	a,(b)	a,b	15	bap
B. axinan. Uw 17158	7	98	475	715	580	r	5-8	r,o,ob	5/20x5	X	a	a,b	14	–
B. grossul. Uw 214	8	127	625	820	605	r,(o)	5-6	r,(o)	5-8	X	a,(b)	b	20	bap
B. grossul. Uw 5602	4	133	570	745	535	r,o	5-8	r,o,(ob)	5/15x4	X	a,(b)	b	17	bap
B. imper. Uw 4440a	10	112	700	940	630	r	5-7	r,o	5/10x5	X	a	a,b	14	–
B. imper. Uw 20045	11	118	875	1185	755	p,r	4-5	r,o,ob	5/20x5	X	a	a,b	13	–
Clidemia														
C. bullosa Uw 22052	76	51	405	510	430	r,(o)	4-6	r,o	3-12	o	a	a	12	(bap)
C. bullosa Uw 22306	73	46	405	510	455	r	4-5	r,(o)	4-5	–	a	a,(b)	11	bap
C. capit. Uw 4249	75	50	590	685	575	r	3-4	r,(o)	4-7	X	a	a	15	di,bap
C. capit. Uw 22289	152	32	580	710	660	o,ob	23x4	r,(ob,s),re	5-8/20x4	o	a	a	14	di,bap
C. ciliata	85	40	540	620	500	r,(o)	3-5	r,(o,re)	3-5	o	a	a	10	bap
C. dentata	87	34	420	570	510	r	4-5	r,o	4-5/15x4	o	a	a,(b)	12	bap
C. minutiflora	41	51	545	635	530	r	3-4	r	3-4	o	a	a	10	bap
C. novemnervia	140	33	435	480	380	r	2-3	r	2-3	–	a	a,(b)	9	di,bap
C. septuplinervia	136	31	520	605	510	p,ob	4-5/18x3	r,o,ob	4-5/18x3	o	a	a	10	bap
Conostegia														
C. cinnamomea	56	40	525	665	655	p,r	4-6	r,(ob)	4-6/16x4	o	a	a	10	ba
C. montana	18	63	550	770	615	p,r	5-8	r,o,ob	5-7/25x4	o	a	a,b	9	ba
C. rufesc. Uw 15719	21	59	630	880	760	r	5-7	r	5	o	a	(a),(b),c	13	bap
C. rufesc. Uw 22054	59	45	635	720	670	p,r	5-7	r,o	3-5/15x3	o	a	a	13	bap

C. xalapensis	12	83	705	875	750	p,r	8-10	r,o,ob	5/24x4	o	a	b,c	8	ba
Henriettea														
H. granul. Uw 8176	41	59	625	750	570	p,r	4-5	r,o	5/11x4	–	a	a,(b)	17	–
H. granul. Uw 21614	27	64	–	–	–	r	4-5	r,o	5/10x4	X	a	a	17	–
H. maroniensis	22	82	935	1085	650	r	5	r	4-5	X	a	a	14	–
H. multiflora	18	97	820	945	810	r	5-7	r	4-7	X	a	a	15	–
H. succosa Uw 1315	18	78	825	1000	840	r	5-6	r,(o)	5-6	X	a	a	13	–
H. succosa Uw 4129	19	79	825	1000	870	r	5	r	5	X	a	a,(b)	14	–
Henriettella														
H. caudata	48	55	635	840	575	p	4-5	r,(o)	4-6	X	a	a	17	bap
H. flavescens	28	50	575	770	520	r	3-4	r,(ob)	3-4/15x3	X	a	a,(b)	12	–
H. sylvestris	15	120	640	835	520	p,r	8-10	r,(ob)	5-6/15x3	X	a,(b)	b,c	11	bap
H. spec.	5	150	1000	1205	–	r,(o)	7-10	r,o,ob,(s)	28x6	X	a	b,c	10	bap
Leandra														
L. barbinervis	31	56	530	645	505	r	5-8	r,o	5/10x4	–	a,(b)	b	12	bap
L. glandulifera	89	35	570	655	540	r	5	r,(o)	5	X	a	a	12	di,bap
L. purpurascens	94	49	505	755	620	p,r,(o)	5	(r),o,ob	5/20x3	X	a	a	9	bap
L. rufescens	71	22	705	860	735	r,(o)	3-5	r,(o)	5-6	X	a	a	13	bap
L. sanguinea	86	40	480	545	490	p	4-5	r,(o)	4-5	X	a	a	10	bap
L. subseriata	89	49	380	495	435	r	5-6	r,o,ob	4-5/25x3	–	a	a	17	bap
Loreya														
L. acutifolia	11	111	765	1135	–	p,r	8-10	(r),ob	5-8/30x6	X	a	a,b	14	(bap)
L. maguirei	7	138	820	965	–	p,r	8-10	ob	25x5	X	a,(b)	(a),b,c	16	(bap)
L. mespil. Uw 3182	20	101	610	840	700	r	5-7	r	5-7	X	a	a,(b)	14	(bap)
L. mespil. Uw 12194	14	97	670	740	570	p	5-6	r	4-6	X	a	a,(b)	16	bap
L. mucronata	22	58	725	820	675	p,r	5-7	r	5-7	X	a	(a),b	13	bap
L. quadrifolia	16	69	735	910	760	p,r	5-9	r,ob	5/15x4	X	a	a,(b)	14	bap
Miconia														
M. chrysophylla	37	80	515	650	510	r	4-6	r,o,ob	5/17x4	X	a	a,b	16	bap
M. dodecandra	9	130	810	1105	915	r	7	r,o,ob	7/28x5	X	a	a,b	11	bap
M. eriocalyx	30	67	560	710	525	r,o	4-5/10x3	r,o	4-5/13x3	o	a	a,(b)	12	(bap)
M. holosericea	17	83	885	1060	1000	r	5-8	r	5-8	o	a	a,b	6	bap

M. lateriflora	10	46	735	1005	690	r,o	4-5	r,o	5-7	X	a	a	11	bap
M. lepidota	12	95	565	745	575	r	3-5	r	3-5	o	a	a,b	16	(di)
M. minutiflora	8	119	565	710	585	r	5-6	r	5-6	o	a,b	(a),b,c	15	bap
M. poepp. Uw 130a	7	126	720	1005	775	r	3-4	r	3-5	X	a	b,c	12	bap
M. poepp. Uw 1442	8	119	770	965	690	r	3-4	r	3-6	X	a	b,c	11	bap
M. poepp. Uw 7959	7	128	660	885	600	r	5-8	r	4-6	X	a,b	(b),c	16	bap
M. prasina Uw 7933	17	95	660	895	780	r	5-7	r	5	o	a	a		
M. prasina Uw 21579	24	73	–	–	–	r	5	r	5	–	a	a,(b)	17	bap
M. prasina Uw 21674	17	86	–	–	–	r	5	r	4	o	a,(b)	(a),b	15	bap
M. rubig. Uw 1562	16	87	500	640	480	r	6	r	5	o	a,b	(a),b,c	13	(bap)
M. rubig. Uw 4521	22	80	565	825	–	r	5	r,o	4-7	X	a,(b)	(a),b	13	(bap)
M. ruficalyx	15	119	665	905	770	r	7-10	r,o,ob	5/12x4	X	a	b,c	11	bap
M. toment. Uw 331	20	90	715	880	785	r	6	r,o,ob	5/28x5	o	a	a,(b)	13	(bap)
M. toment. Uw 7604	31	87	715	870	735	r	4-7	r,o,ob	5/25x5	X	a	a,(b)	13	(di)
Tetrazygia														
T. angustifolia	88	34	390	455	375	r	3-5	r	3-4	–	a	b,c	17	bap
T. bicolor	37	54	465	660	480	r	3-4	r	4-5	–	a	b,(c)	8	bap
T. discolor	27	52	410	515	435	r	4-5	r,o	5-7	–	a	a,b,c	12	bap
T. elaeagnoides	24	45	380	565	415	r	3-5	r	3-5	o	a	b,(c)	12	bap
Tococa														
T. egensis	18	90	615	765	640	p	5-7	ob	5/33x5	o	a	a,b,(c)	11	bap
T. guianensis	40	54	620	775	585	p,r,o	5-8	r,ob	8/25x6	X	a	a,b	13	ba
T. lasiostyla	45	75	760	870	720	r	5-7	r,ob	5/28x4	–	a	a	10	ba
T. longis. Uw 7505	69	49	605	775	745	p,r	4-6	r,ob,(s)	20x5	X	a	a,(b)	15	ba
T. longis. Uw 7862	83	41	685	830	755	r,(o)	5-7	r,ob,(s)	28x5	X	a	a,(b)	11	ba
T. macrophysca	33	60	655	870	790	r,o	8/12x6	r,(ob)	6/18x6	–	a	a,(b)	15	ba
T. subciliata	60	55	775	1115	900	p,r	4-6	r,ob	5/25x5	X	a	a	11	bap
T. tepuiensis	12	74	895	930	875	r	8-10	r,ob,s	5/35x4	o	a	a,b	8	ba
TRIBE BLAKEEAE														
Blakea														
B. calyptrata	7	111	480	705	590	p	12-15	r,ob	5-8/28x7	X	a,b,c	a,(b),d	9	ba
B. granatensis	19	96	580	670	660	p	10	r,ob	8/20x6	X	a,b,c	a,b,d	12	ba

B. latifolia	17	72	725	975	770	p	8-11	r,ob	8/30x6	o	a,b	a,(d)	9	ba
B. paludosa	9	152	705	995	750	p,(r),(o)	10-16	r,ob	10-15/30x6	o	a,b,c	a,d	9	ba
B. pulverulenta	8	84	450	670	540	r,o	8/12x4	r,ob	8/23x5	o	a,b,(c)	a,b,d	10	ba
Topobea														
T. alternifolia	25	150	565	650	585	p	5-8	r,o,ob	5-8/20x5	X	a,b,(c),	a,b,c,d	6	ba
T. longiloba	14	123	545	675	620	p	8-10	r,o,ob	5/25x5	o	a,b	a,b,d	10	ba
T. membranacea	13	102	465	750	555	(p),r	8-11	r,o,ob	7/25x5	–	a,b,c	a,b,d	9	ba
T. paras. Uw 16924	6	106	455	670	575	p	6-10	o,ob	36x6	o	(a,b),c	a,b	8	ba
T. parasitica	19	64	495	635	575	r,ob	8/25x7	r,o,ob	10/20x6	–	a,(b)	a,(b)	10	ba
T. praecox	11	106	680	780	690	p	7-9	r,o,ob	8/30x8	o	a,b,(c)	a,b	8	ba

Legenda

Shape of the intervascular, vessel-ray, and vessel-parenchyma pits: o = oval; ob = oblong; p = polygonal; r = round; re = reticulate; s = scalariform.

Fibres: X = septate; o = septate and non-septate; – = non-septate.

Width of the rays: a = uniseriate; b = biseriate; c = multiseriate.

Composition of the rays: a = upright cells; b = square cells; c = procumbent cells; d = sheath cells.

Type of parenchyma: al = aliform; ba = banded; bap = bands of pseudoparenchyma; di = diffuse.

( ) = character weakly developed.

Table 2. Variation of some wood anatomical characters in studied neotropical genera of Melastomataceae.

Genus	Av. vessel member length (um)	Type of pitting	Av. fibre length (µm)	Septate fibres	Non-septate fibres	Fibre pits on tang. walls	Ray width (cells)	Procumbent ray cells	Square ray cells	Upright ray cells	Parenchyma distribution
TRIBE MICROLICIEAE											
Buquetia	400	3	535	–	X	X	1,2-3	X	X	(X)	sc
Rhynchanthera	300-510	2	510-655	–	X	X	1,(2)	(–)	X	X	sc,bap
Trembleya	385	2	480	o	X	X	1,2-3	(X)	X	X	sc
TRIBE TIBOUCHINEAE											
Aciotis	400-450	3	525-545	X	X	X	1	–	(X)	X	sc,(bap)
Brachyotum	310-405	3	365-510	o	X	X	1	(–)	X	X	sc,bap
Macairea	325-555	2/3	425-760	X	X	X	1	–	X	X	sc,bap
Marcetia	390	3	440	–	X	X	1	–	X	X	sc,bap
Nepsera	245	3	370	X	X	X	1,2-3	(–)	(X)	X	sc,(bap)
Tibouchina	310-695	2/3	475-815	X	X	X	1,2-4	(X)	X	X	sc,di,ba,bap
TRIBE RHEXIEAE											
Monochaetum	300-410	3	330-560	o	X	X	1	(–)	X	X	sc,bap
Pachyloma	390	2	470	o	X	–	1	–	–	X	sc,di,bap
TRIBE MERIANIEAE											
Adelobotrys	535-615	3	480-880	–	X	X	1	–	X	X	sc,ba
Axinaea	390-500	1	535-635	o	X	–	1,2-3	(X)	X	X	sc,bap
Centronia	610	2	820	–	X	–	1	–	(X)	x	sc,ba
Graffenrieda	425-760	3	625-960	–	X	–	1	(X)	X	X	sc,ba
Huberia	390	2	590	X	o	–	1	(X)	X	X	sc,bap
Merianía	405-665	1	565-1075	X	X	o	1	X	(X)	–	sc,ba
Opisthocentra	490	3	590	X	–	o	1	–	–	X	sc,ba
TRIBE MICONIEAE											
Bellucia	475-875	2	715-1185	X	–	–	1	(–)	X	X	sc,bap
Calycogonium	465-605	1	630-815	X	X	–	1	(–)	X	X	sc,bap
Charianthus	460-745	2	645-1100	X	–	–	1	(–)	X	X	sc,bap
Clidemia	405-590	1	480-710	X	X	–	1	(–)	X	X	sc,bap
Conostegia	525-705	2	665-880	X	X	X	1	(–)	X	X	sc,bap
Henriettea	625-935	1/2	750-1085	X	X	–	1	–	(X)	X	sc
Henriettella	575-1000	2	770-1205	X	–	–	1	X/–	X	X	sc,(bap)
Heterotrichum	450	1/2	570	X	X	X	1	–	X	X	sc,di,bap
Leandra	380-705	2/3	495-860	X	X	–	1	–	(X)	X	sc,bap
Loreya	610-820	2	740-1135	X	X	–	1	(–)	X	X	sc,bap
Maieta	550	1/2	680	X	X	X	1	–	–	X	sc,di,bap
Mecranium	520-535	2	595-745	–	X	o	1	X	X	X	sc,bap
Miconia	500-885	2	640-1100	X	X	X	1	(–)	X	X	sc,bap
Myriaspora	515-600	1	665-815	X	–	–	1	(–)	X	X	sc
Ossaea	480-615	3	595-725	X	X	X	1	–	–	X	sc,di,bap
Pachyanthus	315	2/3	455	–	X	X	1,2-3	X	(X)	(X)	sc,bap
Platycentrum	565	2	765	X	X	o	1	–	(X)	X	sc,di,bap
Tetrazygia	380-465	1	455-660	–	X	X	1	X	X	(X)	sc,bap
Tococa	605-895	2	765-1115	X	X	–	1	–	(X)	X	sc,di,ba,(bap)
TRIBE BLAKEEAE											
Blakea	450-725	1/2	670-775	X	X	X	1,2-4	–	X	X	sc,ba
Topobea	455-680	2	635-780	X	X	X	1,2-4	–	X	X	sc,ba
TRIBE MEMECYLEAE											
Mouriri	285-410	1	715-825	–	X	X	1,2-3	X	X	X	sc,di,al,ba
Unassigned genera											
Alloneuron	700	3	735	X	X	o	1,2-3	–	(X)	X	sc,(bap)
Huilaea	655	2	950	X	X	–	1	–	(X)	X	sc,bap
Llewelynia	410	2	620	X	o	X	1	(–)	X	X	sc,bap
Neblinanthera	450	1	540	X	–	X	1	–	(X)	X	sc,bap
Sandemania	375	2	475	X	–	X	1,2-3	(–)	(X)	X	sc
Tateanthus	380	3	490	X	–	X	1,2-3	–	(X)	X	sc
Tessmannianthus	740-810	3	935-975	–	X	o	1,2-3	X	(X)	–	sc,ba

Legenda
Type of pitting: 1. intervascular, vessel-ray and vessel-parenchyma pits in general round.
2. Intervascular pits round; vessel-ray and vessel-parenchyma pits in general oblong.
3. Intervascular, vessel-ray and vessel-parenchyma pits oblong.
Septate, non-septate fibres, and presence of fibre pits on tang. walls: X = present; o = scanty; – = absent.
Ray-cells: X = present; (X) = sometimes present; (–) = scanty; – = absent.
Parenchyma: al = aliform; ba = banded; bap = bands of pseudoparenchyma; di = diffuse; sc = scanty paratracheal.
( ) = the type of parenchyma distribution is sometimes present.

EXPLANATION OF THE PLATES

The magnification of all transverse section is × 41 and of all tangential sections × 91.

Plate 1 MICROLICIEAE
1. Bucquetia glutinosa (*King et al. 5714*)
2–3. Rhynchanthera paludicola (*FHOw 11654*)
4. Trembleya parviflora (*Hatschbach et al. 13939*)

Plate 2 TIBOUCHINEAE
5. Macairea maroana (*Maguire et al. 41772*)
6. Nepsera aquatica (*Maas 3192*)
7. Tibouchina catharinensis (*Reitz& Klein 27751*)
8. Tibouchina lepidota (*King et al. 5669*)

Plate 3 TIBOUCHINEAE
9. Tibouchina catharinensis (*Reitz & Klein 27751*)
10. Tibouchina chironioides (*Chambers 2569*)
11. Tibouchina lepidota (*King et al. 5669*)
12. Tibouchina mollis var. mollis (*Maas et al. 2965*)

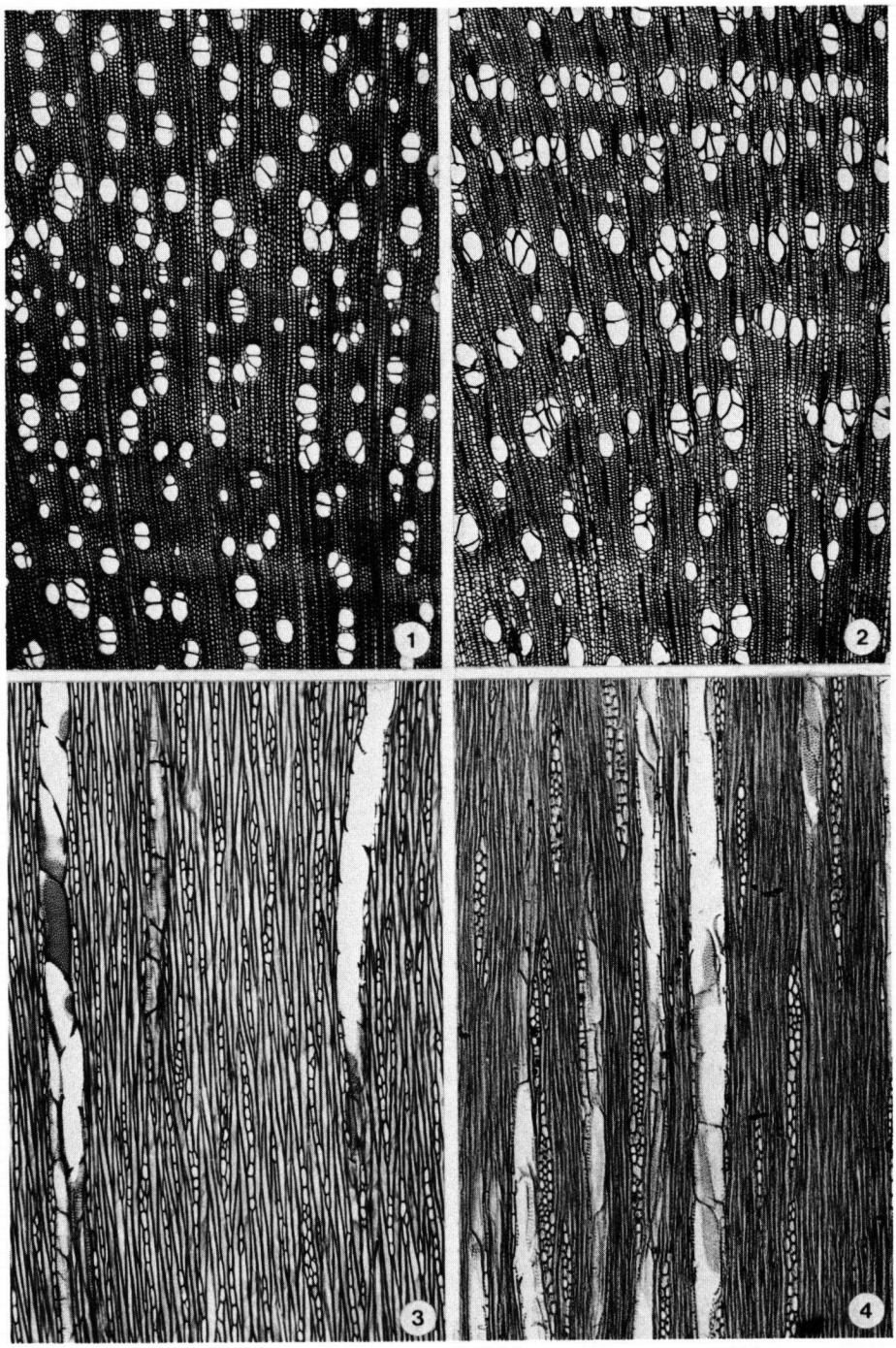
Plate 4 RHEXIEAE
13, 16. Monochaetum compactum (*Stern et al. 1986*)
14. Monochaetum myrtoideum (*King et al. 5891*)
15. Pachyloma huberioides (*Wurdack & Adderley 42800*)

Plate 5 MERIANIEAE
17. Graffenrieda cucullata (*MAD-SJRw 20012*)
18. Huberia semiserrata (*Hatschbach et al. 15608*)
19. Graffenrieda latifolia (*Stern & Wasshausen 2547*)
20. Meriania pallida (*Cuatrecasas 15567*)

Plate 6 MERIANIEAE
21. Meriania pallida (*Cuatrecasas 15567*)
22. Meriania tomentosa (*MAD-SJRw 29515*)
23. Adelobotrys saxosa (*Maguire et al. 41610*)
24. Adelobotrys macrantha (*Wurdack 1987*)

Plate 7 MICONIEAE
25. Bellucia axinanthera (*Maguire et al. 51755*)
26. Clidemia dentata (*Schulz 9615*)
27. Conostegia xalapensis (*Stern et al. 1938*)
28. Leandra barbinervis (*Reitz & Klein 27747*)

Plate 8 MICONIEAE/MEMECYLEAE
29–30. Loreya quadrifolia (*Krukoff 1510*)
31–32. Mouriri collocarpa (*Breteler 4800*)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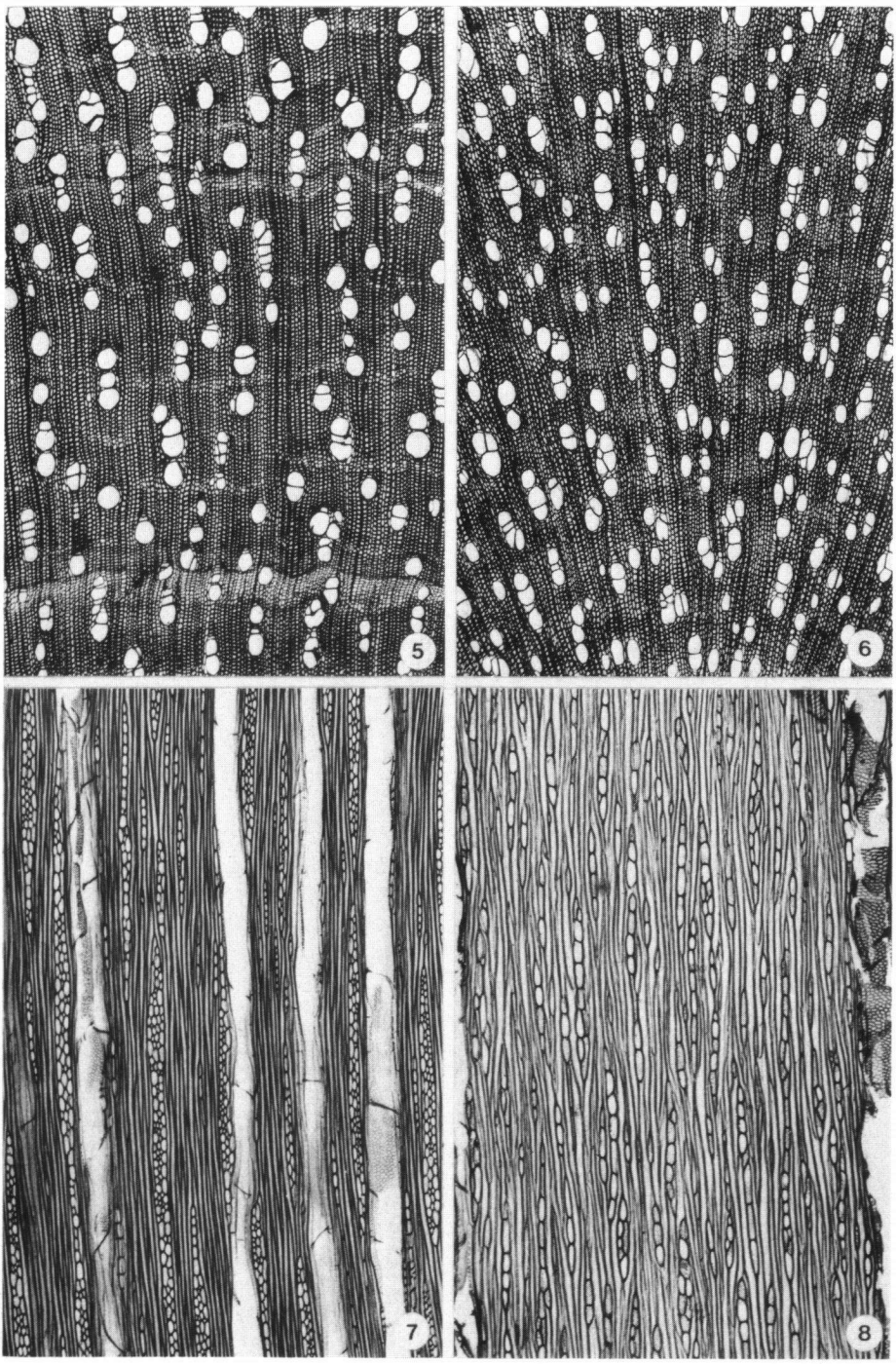
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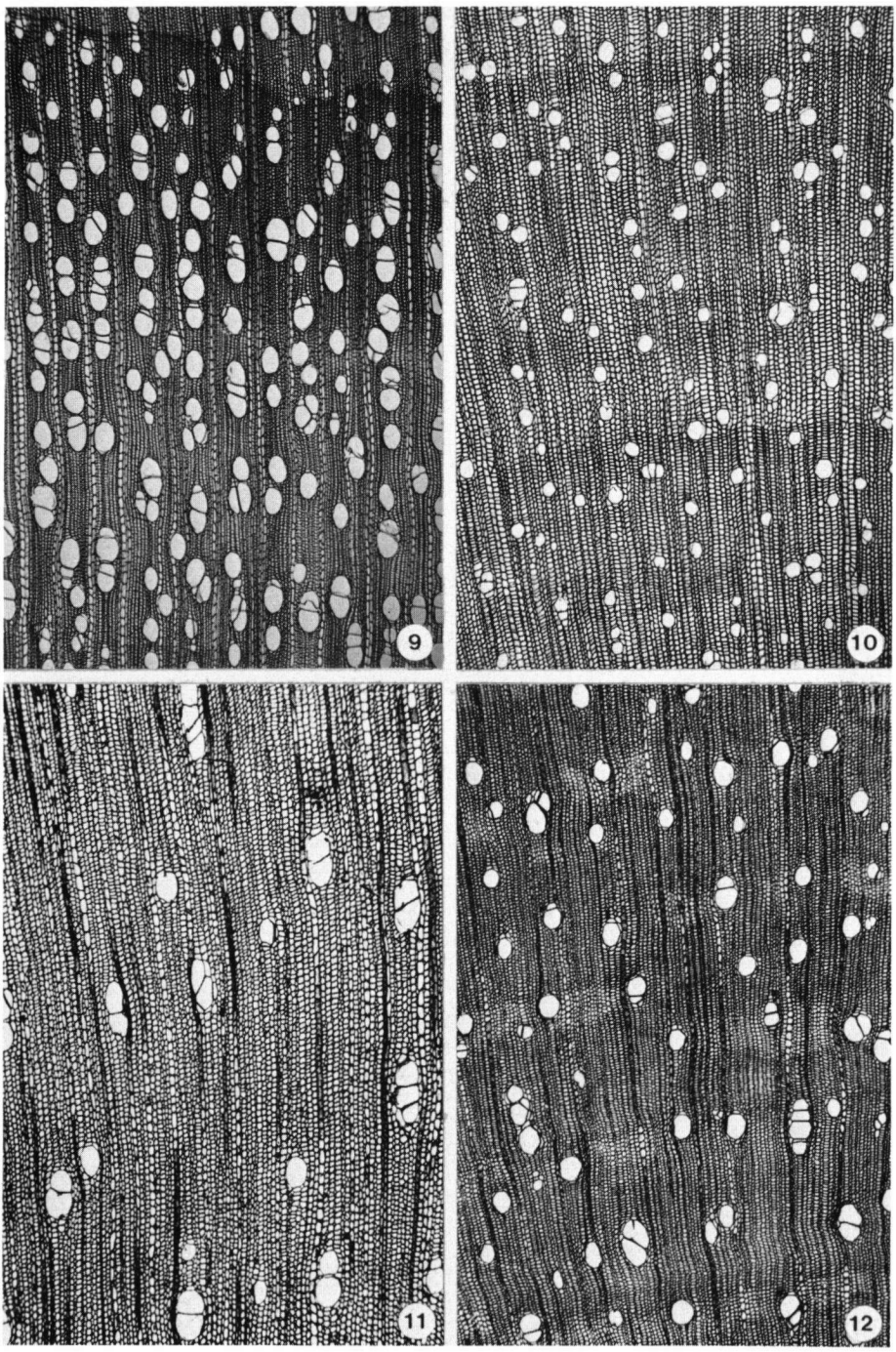
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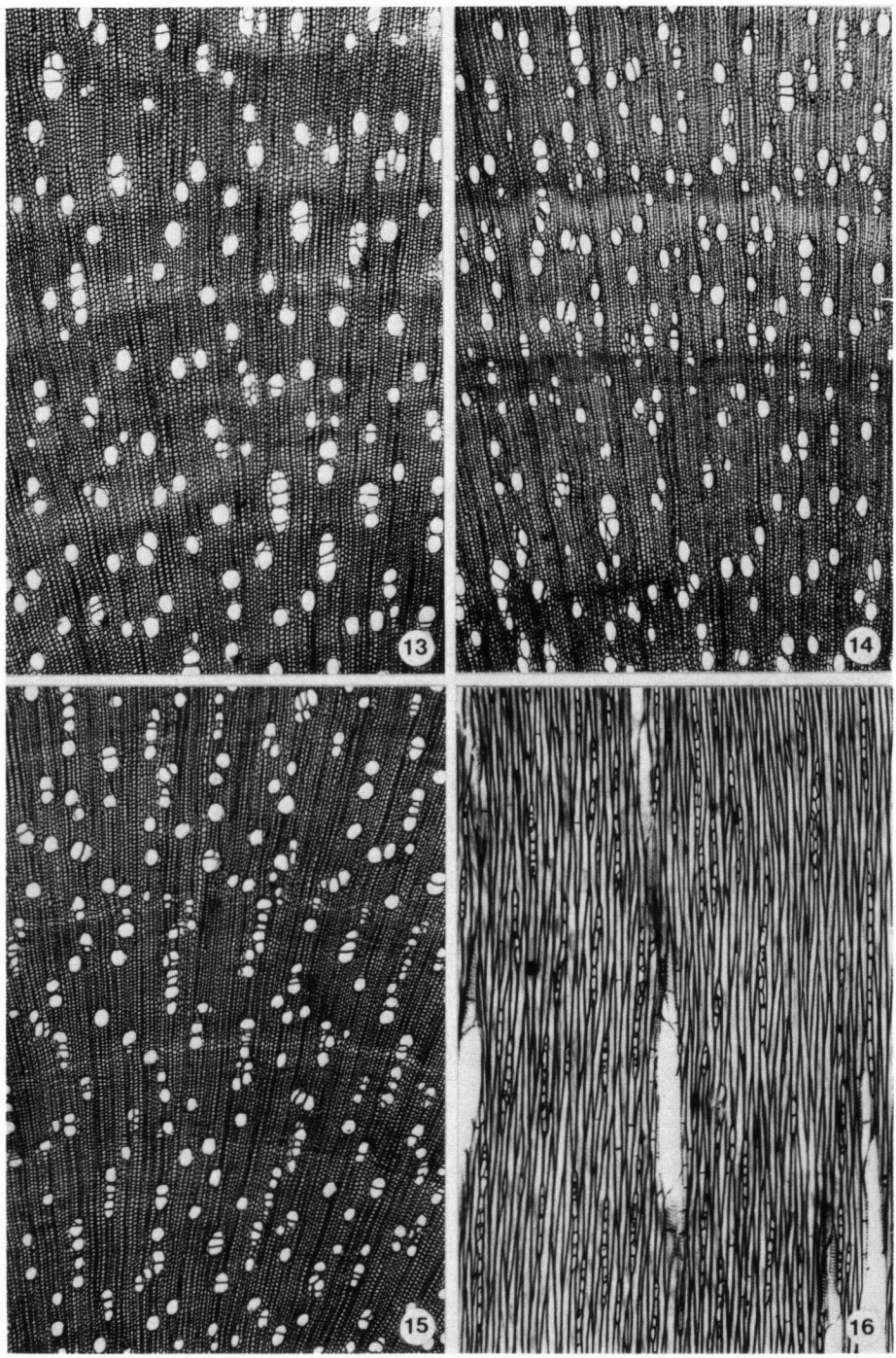
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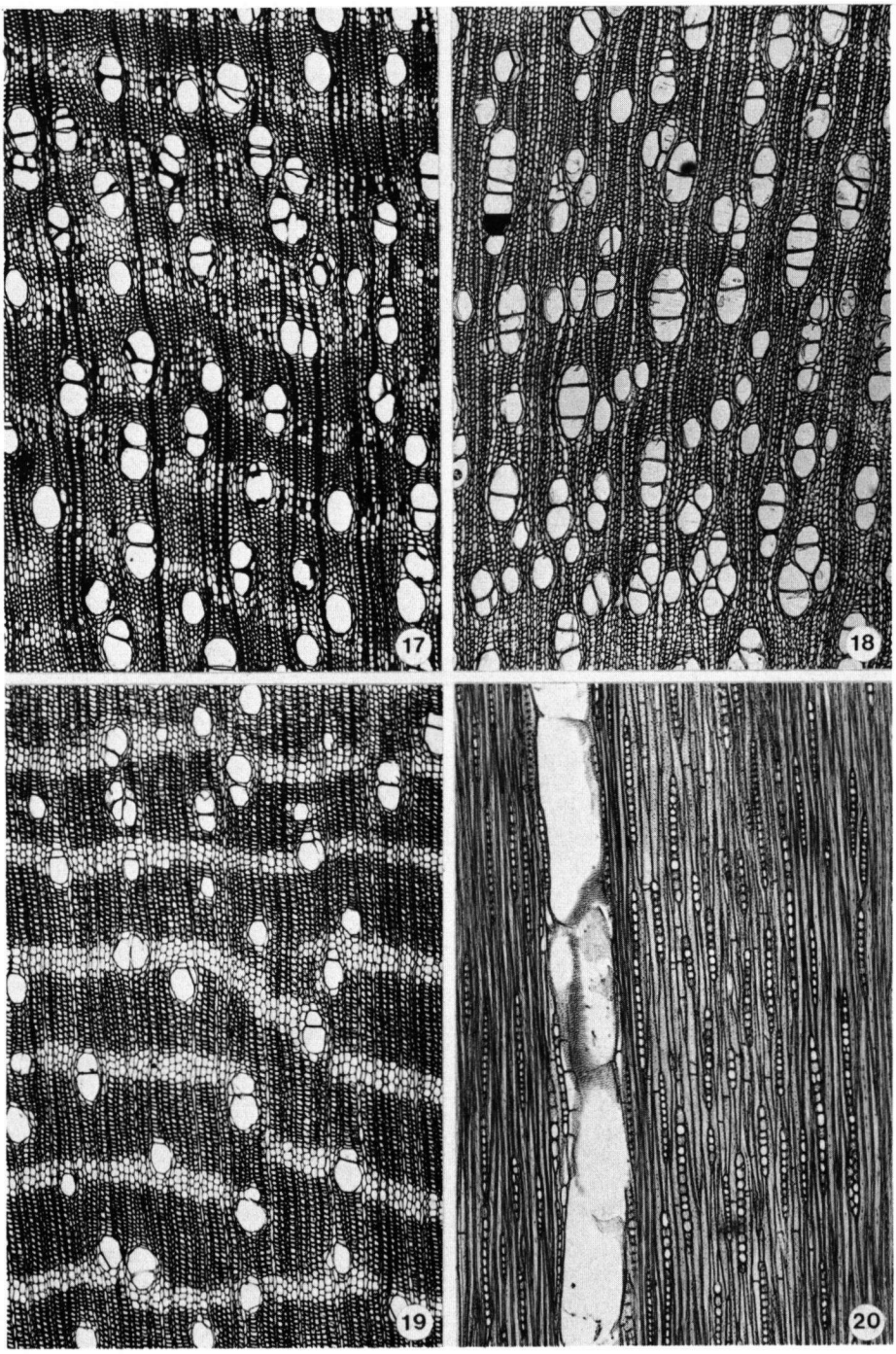
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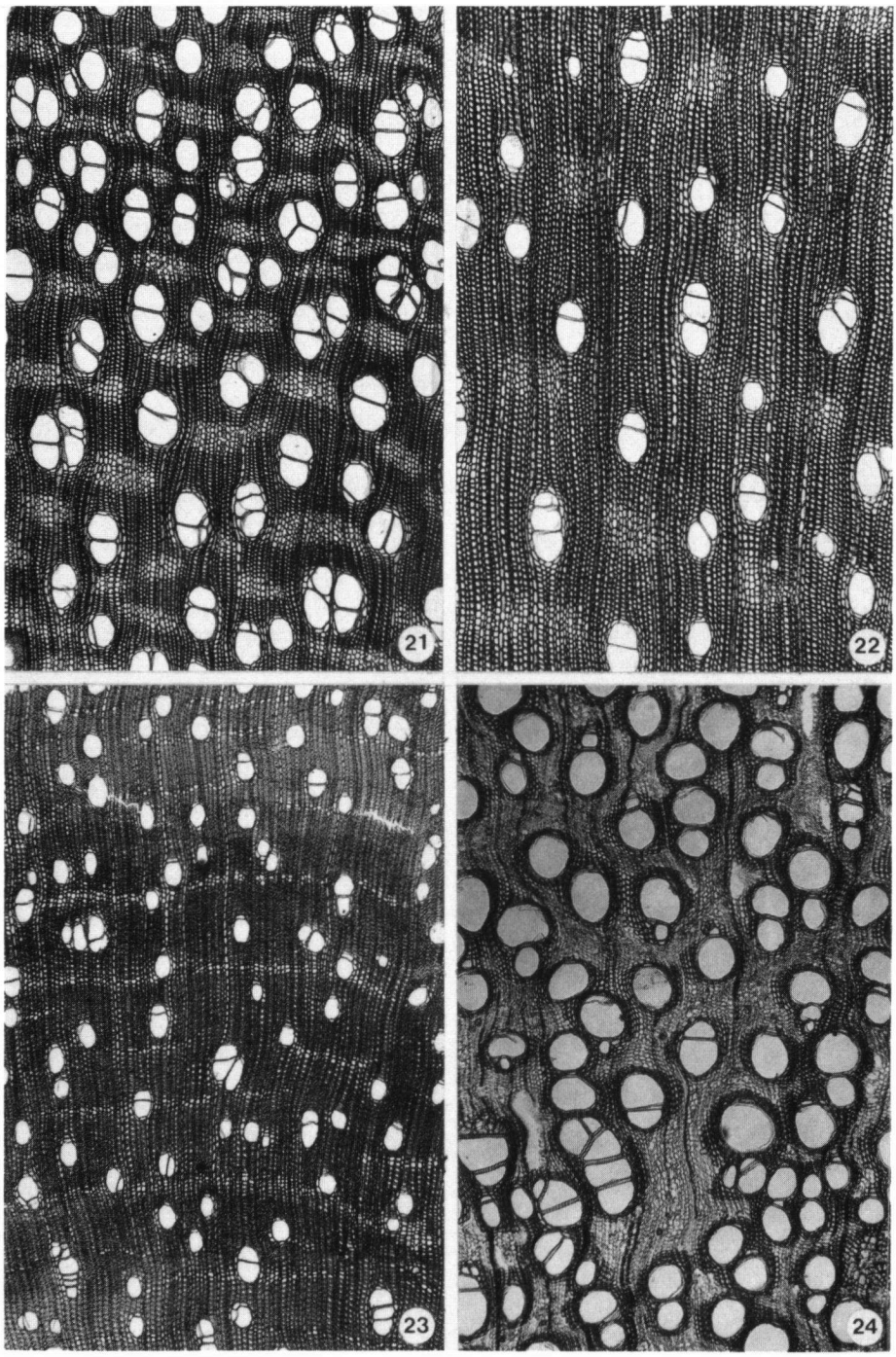
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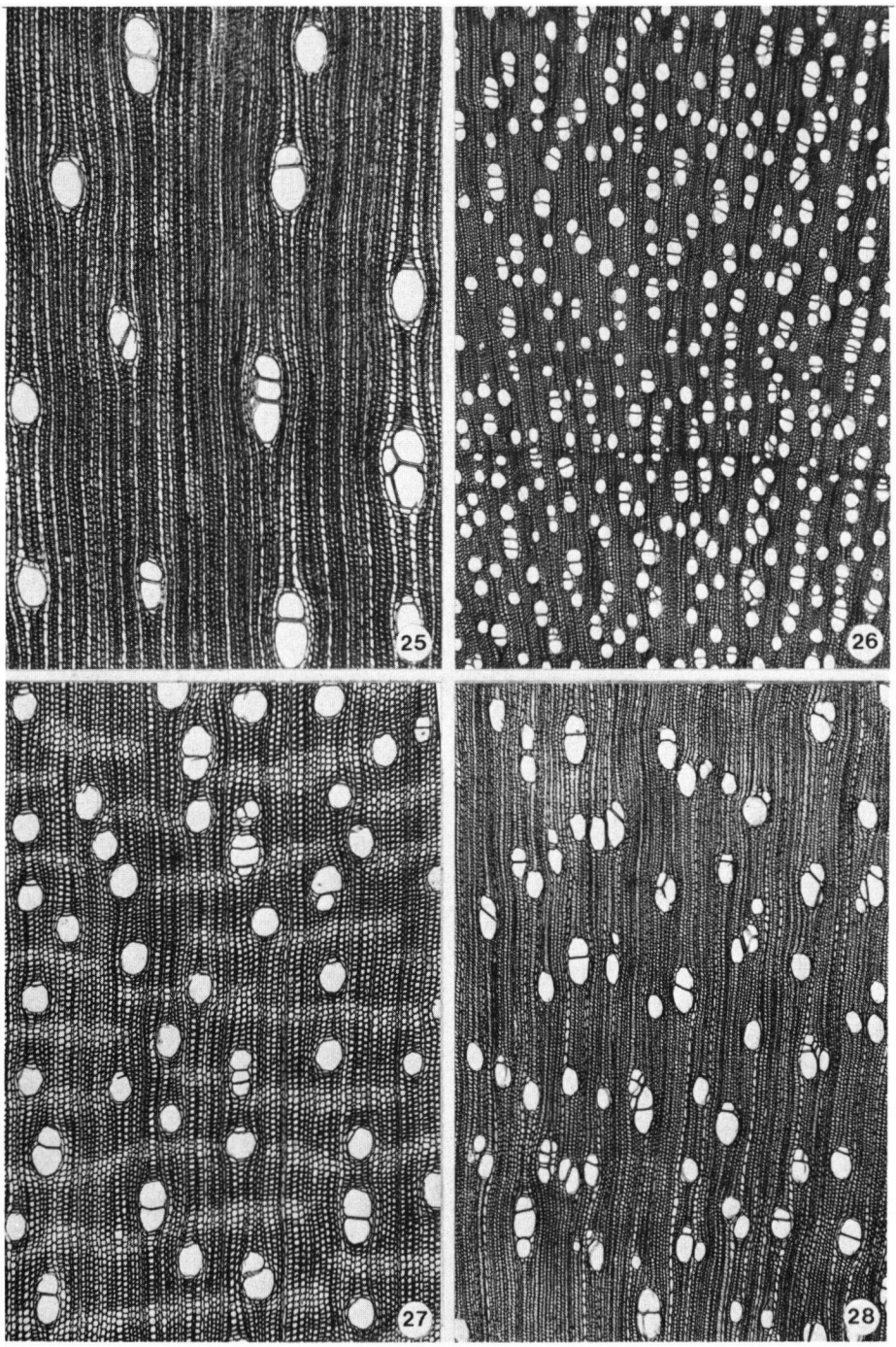
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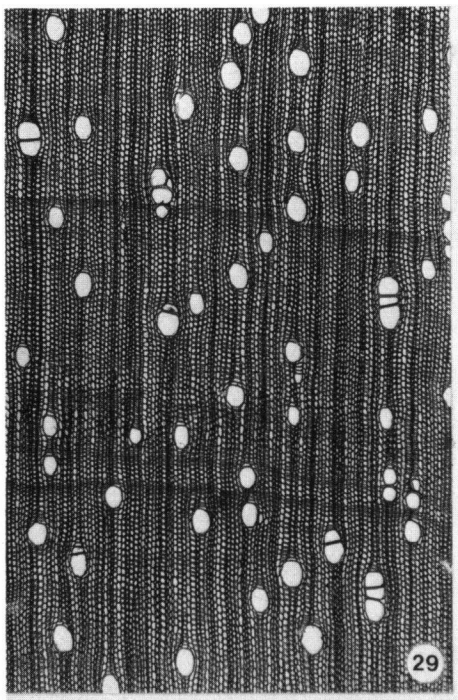
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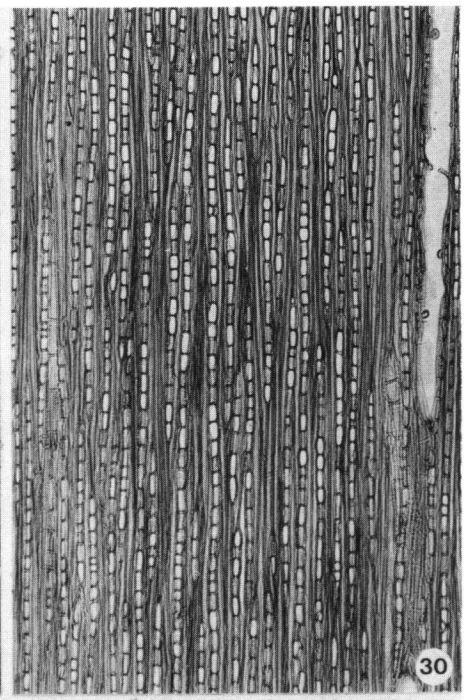
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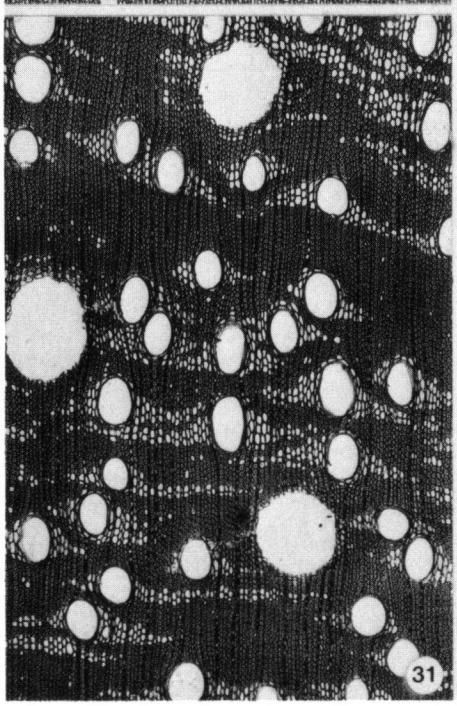
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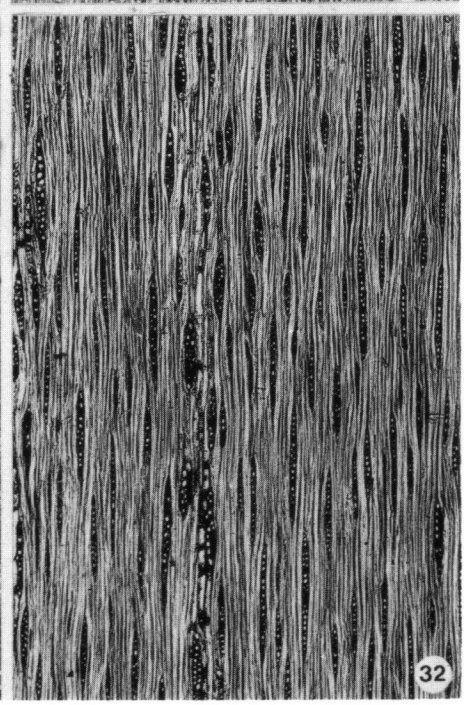
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