

## Vegetative anatomy of *Oncotheca macrocarpa*, a newly described species of *Oncothecaceæ*

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**Summary :** The vegetative anatomy of the newly described species *Oncotheca macrocarpa* McPherson, Morat & Veillon is described. Wood is characterized by solitary pores with scalariform perforation plates, fiber-tracheids, heterocellular rays with prismatic crystals in the ray parenchyma, and diffuse and scanty axial parenchyma. Sieve tube elements possess oblique, compound sieve plates. Nodal anatomy is pentalacunar. Leaves possess distinctive stomata with divided subsidiary cells. Foliar venation is brochidodromous. *Oncotheca macrocarpa* is clearly distinguished from *O. balansæ* by the presence of cuticular striations encircling the stomata, the absence of an adaxial foliar hypodermis, and the occurrence of astrosclereids in the leaf lamina. The presence of foliar astrosclereids further supports suggested affinities between *Oncothecaceæ* and *Theaceæ*.

**Résumé :** L'anatomie de l'appareil végétatif d'*Oncotheca macrocarpa*, espèce récemment décrite, est étudiée. Le bois est caractérisé par des pores solitaires avec des cloisons à perforations scalariformes, des fibres trachéides, des rayons hétérocellulaires avec des cristaux prismatiques dans le parenchyme du rayon et un parenchyme axial diffus et peu abondant. Les éléments des tubes criblés ont des cloisons à cribles composés. L'anatomie nodale est pentalacunaire. Les feuilles ont des stomates distinctifs à cellules subsidiaires divisées. La nervation foliaire est brochidodrome. *Oncotheca macrocarpa* se distingue nettement de *O. balansæ* par la présence de stries cuticulaires encerclant le stomate, l'absence d'un hypoderme foliaire adaxial et la présence de sclérites en étoile dans le limbe foliaire. Les affinités supposées entre *Oncothecaceæ* et *Theaceæ* sont appuyées par la présence de ces sclérites étoilés.

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In a recent issue of this journal, McPHERSON, MORAT & VEILLON (1982) described a newly discovered species belonging to the New Caledonian genus *Oncotheca* Baillon, a dicotyledonous genus previously believed to be monotypic and forming the family *Oncothecaceæ*. In view of the fact that *Oncotheca* has long been regarded as an isolated relict genus, the discovery of a second species, *O. macrocarpa* McPherson, Morat & Veillon, is of particular interest. Recent comprehensive anatomical studies of *O. balansæ* Baillon (BAAS, 1975; CARPENTER & DICKISON, 1976; SHIKLINA, 1977) supported the view that the genus may have its closest affinities with the *Theaceæ*, and provide a basis for comparison with the new plant. Thanks to the collecting efforts and kind considerations of Dr. Gordon McPHERSON I am able to describe the vegetative anatomy of *O. macrocarpa*. I also



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**MATERIAL EXAMINED :** *O. macrocarpa*, New Caledonia : *McPherson 3300, 3475*, Thy valley, ca. 15 air-km NE of Nouméa, forested slopes ca. 500 m alt. (MO, P, NOU), dried and liquid preserved leaves, stems, wood, and young flowers ; *Dickison 237*, Mt. Dzumac, forest (NCU), dried wood, liquid preserved leaves.

## OBSERVATIONS

### LEAF VENATION

Brochidodromous (Pl. 1, 1) ; midvein straight ; secondaries with an acute divergence angle, forming ascending marginal loops, enclosed by tertiary and quaternary arches ; simple intersecondary veins present ; tertiary veins forked, sinuous, or percurrent ; higher orders of venation difficult to resolve due to a reticulum of veins of indistinguishable size ; quaternary veins thick, nearly indistinguishable from tertiary veins ; majority of high-order veins arising at right angles ; marginal venation incomplete, with free vein endings adjacent to the margin of the lamina ; veinlets simple or twice branched ; areolation imperfect, with incompletely closed meshes common ; areoles irregular in shape, large ; veinlets terminate in conventional tracheids or more commonly in dilated tracheids with helical wall thickenings.

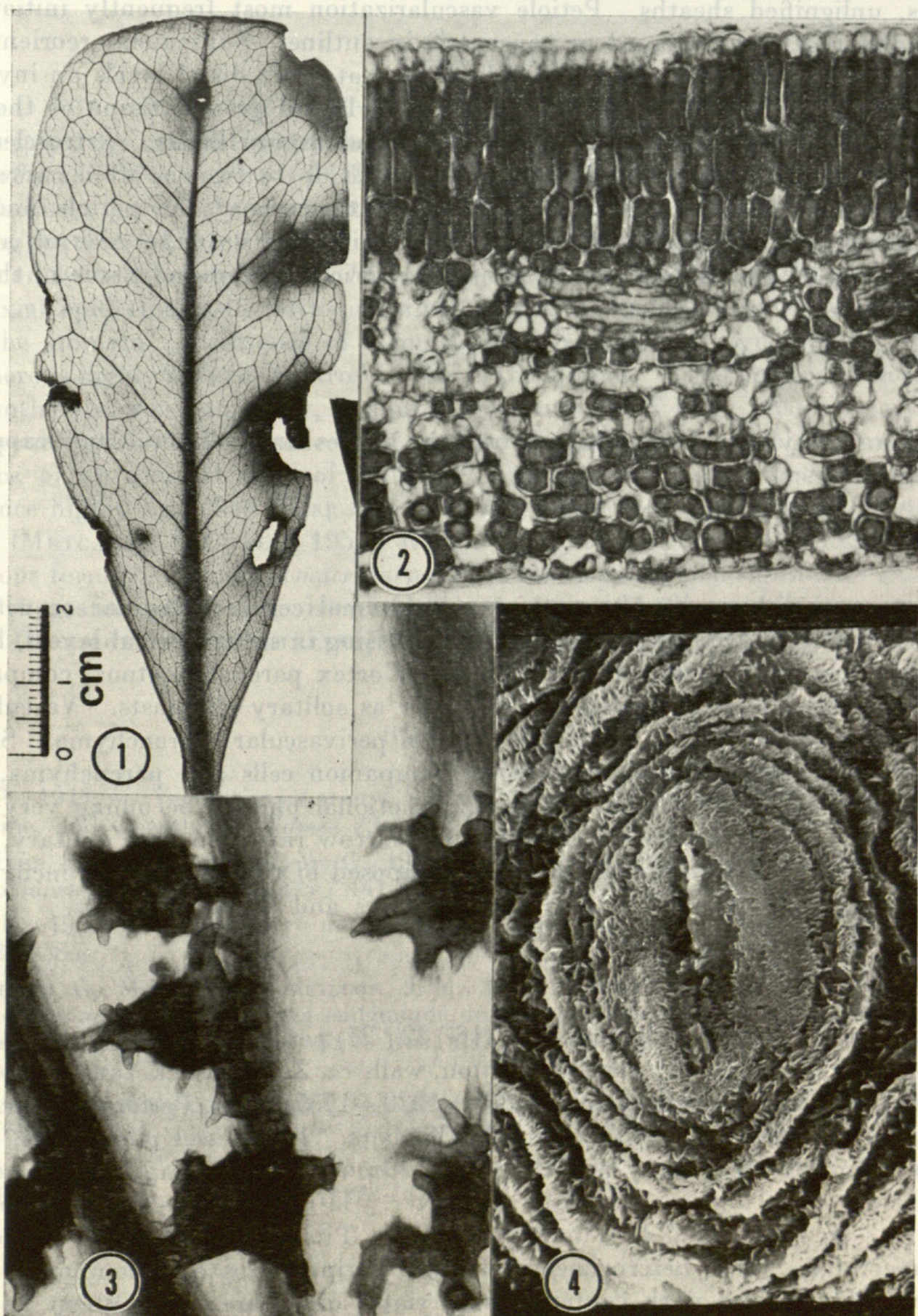
### LEAF : IN SURFACE VIEW

Glabrous. Adaxial cuticle smooth ; abaxial cuticle with prominent striations oriented in concentric rings of striae surrounding the stomata (Pl. 1, 4). Epicuticular wax particles in the form of rods and filaments present in association with the striae and covering the guard cells. Epidermal cells of both adaxial and abaxial surface with straight to only slightly curved anticlinal walls ; cells overlying veins not greatly modified. Stomata confined to abaxial surface, randomly orientated, conforming to the unusual type with subdivided subsidiary cells described and illustrated by BAAS (1975) and CARPENTER & DICKISON (1976) for *O. balansæ* ; guard cell pairs average 37  $\mu$ m in length.

### LEAF : IN TRANSVERSE SECTION

Lamina bifacial. Adaxial cuticle 3-5  $\mu$ m thick ; abaxial cuticle 3-4  $\mu$ m thick, with striations. Epidermal cells square or rectangular, those of the adaxial surface slightly larger than those of the abaxial surface. Mesophyll densely tanniniferous, composed of 2-3-layered palisade region and compact spongy region of unligified cells (Pl. 1, 2). Midrib with a prominently raised abaxial surface and slightly raised adaxial surface. Ground tissue of midrib parenchymatous with compact peripheral layers. Midrib vasculature forming an arc with invaginated ends. Ends may or may not be separated from the central arc. Perivascular sclerenchyma absent. Veins of the lamina embedded in paren-





Pl. 1. — Leaf anatomy of *Oncotheca macrophylla* McPherson, Morat & Veillon. All taken from *McPherson 3475*: 1, cleared leaf showing brochidodromous venation; 2, transverse section  $\times 125$ ; 3, highly branched astrosclereids from the lamina  $\times 215$ ; 4, scanning electron photomicrograph of stomatal complex showing encircling cuticular striations and the presence of epicuticular wax particles on both striations and guard cells  $\times 1800$ .



chymatous, unligified sheaths. Petiole vascularization most frequently initiated as 5 major bundles that are U-shaped or concentric in outline. Subsequent reorientation of the vasculature produces an uninvcinated arc and at more distal levels an invcinated arc. Druse crystals present in the central mesophyll and ground tissue of the midrib. Sclereids present in the form of brachysclereids and astrosclereids. Astrosclereids are varied in form with complex branching patterns with up to twelve, often curved, arms, thickwalled, pitted, occurring as diffuse idioblasts throughout the petiole and lamina (Pl. 1, 3), being concentrated at the base of the lamina and on either side of, and along the entire length of, the midrib; brachysclereids restricted to ground tissue of the petiole and midrib.

#### NODE

Nodal anatomy is pentalacunar, five-trace; traces are collateral and capped with perivascular fibers.

#### AXIS

Glabrous. Cuticle up to  $13\text{ }\mu\text{m}$  thick. Epidermal cells rectangular or with dome-shaped outer walls in younger stems. Periderm arising in subepidermal layers, becoming very thick-walled and sclerotic in older stems. Cortex parenchymatous, compact, with numerous brachysclereids occurring in clusters or as solitary idioblasts. Vascular tissue in a complete cylinder, with an interrupted ring of perivascular sclerenchyma. Secondary phloem abundant, composed of sieve tubes, companion cells and parenchyma, without mechanical cells in the functional tissue, nonfunctional phloem becoming very sclerotic in older stems. Secondary xylem traversed by narrow rays and with solitary, angular, to circular vessels, fibers thick-walled. Pith composed of thick-walled parenchyma, with numerous large brachysclereids occurring in clusters and as solitary cells.

#### WOOD

Growth rings absent. Vessels diffuse, (16-) 22 (-27) per  $\text{mm}^2$ , solitary or rarely in pairs, mostly rounded in outline in transverse section, walls *ca.*  $2.5\text{ }\mu\text{m}$  thick, tangential diameter (47-) 73 (-90)  $\mu\text{m}$ , vessel element length (868-) 1229 (-1757)  $\mu\text{m}$ . Perforations scalariform in almost vertical end walls, with (12-) 22 (-36) bars. Intervessel pits sparse, opposite, 3-5  $\mu\text{m}$  in diameter. Vessel-ray pits the same. Ground tissue composed of thick-walled fiber-tracheids, 10-30  $\mu\text{m}$  in tangential diameter, (1100-) 1597 (-2080)  $\mu\text{m}$  long, with bordered pits on both radial and tangential walls. Pits average 5  $\mu\text{m}$  in diameter with slit-like apertures. Rays heterogeneous of two distinct sizes and composed of thick-walled parenchyma with dark contents; uniseriates of square, procumbent and mostly erect cells, (70-) 347 (-858)  $\mu\text{m}$  in height; multiseriates bi- and triseriate with generally long uniseriate marginal extensions of upright cells and central portion of square and procumbent cells, (303-) 858 (-2323)  $\mu\text{m}$  in height. Axial parenchyma mostly diffuse and paratracheal scanty, occasionally diffuse-in-aggregates with 2 (3) cells. Large prismatic crystals abundant in the ray parenchyma.



## DISCUSSION

Despite the overall morphological and anatomical resemblances of the two species of *Oncotheca*, *O. macrocarpa* is anatomically distinct and thus possesses a number of structural features previously unreported in the family. In addition to the primary distinguishing features of the fruit and flower outlined by McPHERSON & *al.* (1982), *O. macrocarpa* can be separated from *O. balansæ* by the following foliar anatomical characters : 1) abaxial epidermal cells with prominent cuticular striations in concentric rings encircling the stomata ; 2) absence of a multiple layered adaxial hypodermis ; 3) occurrence of numerous highly branched astrosclereids in the lamina. The two species closely resemble one another in wood anatomy, including the presence of large prismatic crystals in the ray parenchyma, in the presence of a pentalacunar, five-trace nodal anatomy, and in the presence of an unusual type of stomatal structure with subdivided subsidiary cells.

Since highly branched foliar sclereids are a characteristic feature of many theaceous genera (METCALFE & CHALK, 1950 ; KENG, 1962), the occurrence of foliar astrosclereids of various forms in *Oncotheca macrocarpa* provides an additional significant clue in support of the suggested relationship between *Oncothecaceæ* and *Theaceæ* (BAAS, 1975 ; CARPENTER & DICKISON, 1975 ; SHIKLINA, 1977).

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