‘LOURO PRETO’ – FOUND TO BE THE FIRST SILICA-BEARING CORDIA  
(CORDIA GLABRATA, BORAGINACEAE)  
by  
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Abstract  
The ‘Louro Preto’ of Brazil was identified as the wood of Cordia glabra­ta. Its first description includes the so far unknown occurrence of silica in a species of Boraginaceae. With regard to the specific distribution of inclusions in the genus Cordia a more detailed survey will be undertaken.  

Introduction  
The genus Cordia L. comprising more than 200 woody species of different habits is the largest taxon within the family of Boraginaceae. Most of the Cordia species develop a light brown heartwood, while only a small group is known for a heavier and darker brown heartwood with nearly black stripes as for instance in Cordia dodecandra DC. from Central America (Record & Hess, 1941).  
The dark coloured and striped Cordia species are now of special commercial importance as wood of this type can help to meet the growing demand for walnut and other similarly coloured woods. Among them, one ‘Louro Preto’ has been mentioned repeatedly during the last years; its botanical identity was always given as Cordia trichotoma (Vell.) Arrab. As this species is internationally known for many years as ‘Pere­bei’ from Paraguay (Mainieri, 1965) or as ‘Loro’ from Argentina producing a more evenly coloured heartwood of lower density than ‘Louro Preto’, an investigation was initiated to clarify this confusing identity problem.  

Materials  
Samples investigated: 
Cordia trichotoma (Vell.) Arrab.: RBHw 6083 (Louro, Bra.), RBHw 8442 (Pere­bei, Arg.), RBHw 8643 (Pere­bei, Arg.), RBHw 8645 (Loro negro, Arg.), RBHw 9538 (Inci­en­so, Arg.), RBHw 9915 (Pere­bei, Par.), RBHw 13290 (Pere­bei, Par.), RBHw 16313 (Pere­bei, Par.), RBHw 16314 (Pere­bei, Par.); 
Cordia glabra­ta (Mart.) A. DC.: RBHw 9257 (Piquana negra, Bol.), RBHw 15675 (Louro preto, Bra.), RBHw 16204 (Louro preto, Bra.), RBHw 16257 (Piquana negra, Bol.), RBHw 16311 (Japunaqui, Bol.), RBHw 16389 (Louro preto, Bra.); 
and 4 commercial samples from Brazil, called ‘Louro preto’.  

Results  
The wood anatomical survey of authentic samples of Cordia trichotoma showed practically the same structural features (Almeida, 1947; Chattaway, 1956; Tortorelli, 1956) as for Louro Preto (Figs. 1 & 2) except for different inclusions in the parenchymatic tissue and thicker walled fibres. However, due to the difficulty of judging the taxonomic value of such features under anatomical aspects alone, it was at first impossible to detect any differentiation within Cordia on the specific level.  

Later, during a visit to the main producing area of Louro Preto in the State of Mato Grosso (Brazil), and in the neighbouring part of Bolivia, the author collected from both localities herbarium material and wood samples from flowering trees. The subsequent investigation demonstrated that  
1. all the herbarium material collected as ‘Louro Preto’ from Brazil and as ‘Piquana negra’ from Bolivia belongs to the species Cordia glabra­ta (Mart.) A. DC., and that 
2. other features such as weight (> 0.80 g/cm³, ovendry), colour stripes, wood anatomical structure and inclusions (Figs. 2–6) are identical to those observed in the previously investigated commercial samples of ‘Louro Preto’.

Morphologically Cordia glabra­ta stands next to Cordia insignis, also from Brazil and Bolivia. Both species belong to the section Gerascanthus (Johnston, 1930) which also includes Cordia trichotoma.
Fig. 1. *Cordia trichotoma*. Transverse section with the general pore arrangement representative for the genus and slightly pronounced growth layers; x 48. — Fig. 2-4. *Cordia glabrata*. — 2: Transverse section with denser fibrous tissue and fewer pores; x 48. — 3: Tangential section showing heterogeneous rays of medium width with sheath cells; x 72. — 4: Radial section with nearly regular distribution of silica particles (arrows) in the ray cells; x 170.
### Important structural features

<table>
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<th><strong>Cordia glabrata</strong></th>
<th><strong>Cordia trichotoma</strong></th>
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<tr>
<td></td>
<td>(average values from 7 different trees)</td>
<td>(average values from 9 different trees)</td>
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<tr>
<td><strong>Vessels</strong></td>
<td></td>
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<tr>
<td>diameter</td>
<td>110–140 µm</td>
<td>120–160 µm</td>
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<tr>
<td>pit diameter</td>
<td>5–6 µm</td>
<td>5–6 µm</td>
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<tr>
<td>perforations</td>
<td>simple</td>
<td>simple</td>
</tr>
<tr>
<td>tyloses</td>
<td>abundant</td>
<td>abundant</td>
</tr>
<tr>
<td><strong>Rays</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>height</td>
<td>1000 µm</td>
<td>1000 µm</td>
</tr>
<tr>
<td>width</td>
<td>4–5 cells</td>
<td>4–5 cells</td>
</tr>
<tr>
<td>sheath cells</td>
<td>abundant</td>
<td>abundant</td>
</tr>
<tr>
<td>type</td>
<td>heterogeneous</td>
<td>heterogeneous</td>
</tr>
<tr>
<td><strong>Fibres</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pit diameter</td>
<td>3 µm (finely bordered)</td>
<td>3 µm (finely bordered)</td>
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<tr>
<td><strong>Inclusions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ca-oxalate crystals</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Silica grains</td>
<td>yes</td>
<td>no</td>
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The silica grains are present in all ray cells as well as in the vertical parenchyma (Fig. 4); they have an irregular to slightly rounded shape occupying always the lesser part of the cell luma. Occasionally a silica particle can be found together with a bigger oxalate crystal in the same cell (Figs. 4 & 5). The oxalate crystals are of the normal rhomboid type (Chattaway, 1956); crystal-sand, as often developed in other *Cordia* species (Scurfield et al., 1937), does not occur.

This means that *Cordia glabrata* is the first boraginaceous species found to show a constant presence of optically visible silica, and therefore this feature is of significant taxonomic value. The identity of silicium has been confirmed by x-ray microanalysis (Kevex energy dispersive system in combination with Auto-scan SEM). Amos (1952) did not mention *C. glabrata* in his comprehensive report on silica and included the Boraginaceae among the non-siliceous families.

Besides the species mentioned above another 48 species of *Cordia* from all regions of their natural distribution were investigated. Likewise, they are characterized by a special combination of different oxalate inclusions in the parenchyma which is constant for a given species. A preliminary study of the related genera *Ehretia*, *Bourreria* and *Patagonula* revealed that, accordingly, similar groupings are possible between these taxa. Therefore an extended investigation will be undertaken for a better understanding of the possible diagnostic value of inclusions, the taxonomy of Boraginaceae and the relation between wood anatomical features and the presently recognized subgrouping of the genus *Cordia*.

### Acknowledgements

I wish to thank Prof. Dr. N. Parameswaran for providing the microanalysis and the SEM micrograph.

### References


WOOD ANATOMY NEWS

Request for Olacaceae wood samples

It is intended to embark on a comprehensive wood anatomical study of the family Olacaceae (pantropical) at the Rijksherbarium in the near future. Unfortunately this family is rather poorly represented in most wood collections and it will be necessary to obtain additional collections from the field. Any assistance in acquiring off-cuts for sectioning of wood samples from existing wood collections or from freshly collected material, preferably with full collecting data and/or herbarium vouchers will be highly appreciated and ultimately reciprocated with duplicate slides. Materials can be sent to P. Baas, Rijksherbarium, P.O. Box 9514, 2300 RA Leiden, The Netherlands.

Proposals on Wood Terminology

It is surprising to find no mention of the terms ‘protophloem’ and ‘metaphloem’ in the ‘Multilingual glossary of terms used in wood anatomy’. Therefore it is proposed to add the two following definitions, based on the publications of Esau (1953, 1960, 1977), in the next edition of the Glossary. English and French versions are given:

**Protophloem** — First-formed primary phloem with elements that mature before the plant organ completes elongation.

**Protophloème** — Phloème formé antérieurement au métaphloème, et dont les éléments conducteurs atteignent leur maturité avant que l’organe ait complété son elongation.

**Metaphloem** — Later-formed primary phloem with elements that mature after the plant organ completes elongation, although it may be differentiating during the elongation.

**Metaphloème** — Phloème formé postérieurement au protophloème, et dont les éléments conducteurs atteignent leur maturité après que l’organe ait complété son elongation, quoiqu’il puisse se différencier durant l’elongation.

References


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Fig. 5–6. Cordia glabrata. — 5: Radial section showing silica particles together with oxalate crystals (arrows) in the same cell (see also Fig. 4); x 420. — 6: Tangential section with a ray cell and a silica particle, fixed to the cell wall; SEM x 2400.