WOOD ANATOMY
OF THE
NEOTROPICAL SAPOTACEAE

VII. CHRYSPHYLLUM

RESEARCH PAPER FPL 331

FOREST PRODUCTS LABORATORY
FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE
MADISON, WIS.

1978
The Sapotaceae form an important part of the ecosystem in the neotropics; for example, limited inventories made in the Amazon Basin indicate that this family makes up about 25% of the standing timber volume there. This would represent an astronomical volume of timber but at present only a very small fraction is being utilized. Obviously, better information would help utilization—especially if that information can result in clear identification of species.

The Sapotaceae represent a well-marked and natural family but the homogeneous nature of their floral characters makes generic identification extremely difficult. This in turn is responsible for the extensive synonymy.

Baehni and Bernardi state the situation with respect to Peru but this would hold equally well for all of the neotropics: "For instance, of the 39 species and one variety described hereunder, 13 are known only from the Peruvian type; and 23 taxa here presented have no fruit or seed. It is universally admitted that the taxonomy of this family is almost impossible without—for the same species—leaves, flowers, fruits, and seeds."

Unfortunately, species continue to be named on the basis of flowering or fruiting material alone and this continues to add to the already confused state of affairs.

This paper on Chrysophyllum is the seventh in a series describing the anatomy of the secondary xylem of the neotropical Sapotaceae. The earlier papers, all by the same author and under the same general heading, include:

I. Bumelia—Research Paper FPL 325
II. Mastichodendron—Research Paper FPL 326
III. Dipholis—Research Paper FPL 327
IV. Achrouteria—Research Paper FPL 328
V. Calocarpum—Research Paper FPL 329
VI. Chloroluma—Research Paper FPL 330

Publication in this manner will afford interested anatomists and taxonomists the time to make known their opinions and all such information is hereby solicited. At the termination of this series the data will be assembled into a single comprehensive unit.
WOOD ANATOMY OF NEOTROPICAL SAPOTACEAE:

VII. **CHrysophyllum**

By

B. F. Kukachka, Botanist

Forest Products Laboratory, Forest Service
U.S. Department of Agriculture

---

**Abstract**

In the neotropics, the genus **Chrysophyllum** consists of *C. cainito* and a number of species which have recently been assigned to the genus **Cynodendron**. Many taxonomists have not accepted the new genus **Cynodendron** and this is supported by the present study of the wood anatomy. In this restricted sense, **Chrysophyllum** consists of a group of closely related species that are readily identifiable by their anatomical structure.

**Introduction**

**Chrysophyllum**, in the widest sense, consists of a large number of species of pan-tropical distribution. The accepted type species, **Chrysophyllum cainito** L. was established in 1753 and since that time the genus has grown in numbers with a corresponding increase in complexity. Cronquist (5,6) maintained 40 species native to the Americas after excluding a number of species considered to belong to the genera **Ecclinusa**, **Oxythec** (Neoxythec), and **Pradosia**. However, his treatment has species which are now regarded as belonging to **Chloroluma** and **Prieurella**.

Aubreville (1,2) regarded **Chrysophyllum cainito** L. as monotypic in the Americas and segregated about a dozen genera, some old and some newly described, from the old genus **Chrysophyllum**. The remaining species of "true" **Chrysophyllum** in the Americas were placed in the new genus **Cynodendron** created by Baehni (3), which is based on the type species **Cynodendron oliviforme** (L.) Baegni. Baehni (3) in his "Inventory of

---

1/ Pioneer Research Unit, FPL. The Laboratory is maintained at Madison, Wis. in cooperation with the University of Wisconsin, Madison.
the Genera" maintained *Chrysophyllum cainito* L. as the type of his pan-tropical *Chrysophyllum* and reduced to synonymy practically all the genera which previously had been excluded by Cronquist and Aubreville.

Apparently the taxonomic difference between *Chrysophyllum cainito* and the species assigned to *Cynodendron* lies in the character of the fruit: that of *cainito* being several-seeded while those of *Cynodendron* are one-seeded.

Baehni and Bernardi (4) state "For specimens devoid of fruit, the identification of *Cynodendron* and *Chrysophyllum* will always be hypothetical." This is perhaps the best taxonomic summation of the current problem.

From the anatomical standpoint, the first generic description of the American species was by Record (7); this description is very brief and apparently confused because of the inclusion of several, now-excluded genera.

The present anatomical description is based on wood specimens of *Chrysophyllum cainito* and the species assigned to *Cynodendron* by Aubreville and Baehni. From the standpoint of wood anatomy the species investigated form a very closely related group which is readily identifiable. The small differences encountered are quantitative only and well within the range of variability to be expected within any given genus. No feature or combination of features was found in the anatomy of *Chrysophyllum cainito* that would separate it from the species that have referred to *Cynodendron*. Because of the close anatomical relationship and because *Chrysophyllum cainito* L. is the type species, the generic name *Chrysophyllum* is adopted here; which is in accord with most American taxonomists.

**Description**

Based on specimens of *acreanum, argenteum, auratum, cainito, marginatum, mexicanum, oliviforme, ovale, panamense*, and *revolutum* (table 1).

**General**: Wood gray to light brown; without luster. No distinction in color between heartwood and sapwood. Growth rings distinct in *oliviforme* and *marginatum* but obscure or indistinct in other species (fig. 1). Sometimes apparently demarcated by zones which are relatively free of parenchyma. Wood heavy with a specific gravity range of individual specimens from 0.60 to 1.04 with an overall average of 0.88.
Anatomical:

Pores essentially diffuse (figs. 1, 5, 7) but with a tendency toward radial-echelon arrangement in *marginatum* (fig. 3). Pores commonly in radial multiples of 2-4 and occasionally to 6; rarely longer. Maximum pore diameter of individual specimens ranges from 79 to 197 µm: smallest in *acreanum* (79 µm, fig. 5), largest in *auratum* and *cainito* (197 µm, fig. 7).

Vessel member length averages 700 µm for all species; shortest average in *marginatum* (530 µm) and longest in * Oliviforme* (820 µm).

Tyloses commonly thin-walled but frequently thick-walled or sclerotic in the denser specimens. Very large crystals were observed in the tyloses of most specimens but were not seen in the specimens of *acreanum*, *argenteum* or *marginatum*. Intervessel pit-pair diameter 6-8 µm in *acreanum*, *argenteum*, and *marginatum*; 8-10 µm in other species. Perforations simple.

Axial parenchyma typically reticulate (figs. 2, 4, 6, 8); the cells characteristically without colored contents, crystals, or silica.

Wood rays 1-3(4) seriate; heterocellular. Vertical fusions common. The maximum body height of the 2-4 seriate portion ranges from 79 to 710 µm; very inconsistent even within species and of no diagnostic value. Vessel-ray pitting irregular in shape and size. Silica common in the wood rays and commonly confined to cells with yellow-brown contents. The silica particles are commonly spheroidal or sometimes irregular (clinker), ranging in size from maxima of 8 to 30 µm in different specimens (table 2). The larger particles are frequently of the clinker type. A few crystals were observed in the wood rays of two specimens of *oliviforme*.

Wood fibers thick-walled; the fiber length averages for the different specimens range from 1.22 to 2.10 mm with an overall generic average of 1.64 mm. Vascular tracheids few to rare and not observed in the macerated material of many specimens.

One specimen of *mexicanum* (Skutch 1333) cited by Cronquist (5) apparently does not belong here because of the presence of two-sized crystals and microcrystals which are frequent in the axial parenchyma and wood rays. The characters would suggest *Mastichodendron* but the presence of silica in the wood rays and the large inter-vessel pitting rule out the latter. According to Cronquist, herbarium material is deposited at A, F, NY, and US.

Diagnostic features: Wood gray or light brown; heavy. Essentially diffuse-porous with reticulate parenchyma. Wood rays with silica. Axial parenchyma free of contents.
1. Aubreville, A. 

2. Aubreville, A. 


7. Record, Samuel J. 
Table 1.--Wood specimens of *Chrysophyllum* examined

<table>
<thead>
<tr>
<th>Species</th>
<th>Collector and number</th>
<th>Origin</th>
<th>Number of wood collection</th>
<th>MADw</th>
<th>SJRw***</th>
</tr>
</thead>
<tbody>
<tr>
<td>acreanum M. A. C. Smith</td>
<td>Krukoff</td>
<td>Brazil</td>
<td>9833</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Krukoff</td>
<td>Brazil</td>
<td>31998</td>
<td></td>
<td></td>
</tr>
<tr>
<td>argenteum Jacq.</td>
<td>Forest Dept.</td>
<td>Trinidad</td>
<td>16800</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leonard</td>
<td>Haiti</td>
<td>4879</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stern-Wasshausen</td>
<td>Dominica</td>
<td>24114</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stoffers</td>
<td>Curacao</td>
<td>32961</td>
<td></td>
<td></td>
</tr>
<tr>
<td>auratum Miq.</td>
<td>Froes</td>
<td>Brazil</td>
<td>27352H</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Froes</td>
<td>Brazil</td>
<td>27373H</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lindeman</td>
<td>Surinam</td>
<td>32933</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lindeman</td>
<td>Surinam</td>
<td>32939</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Little</td>
<td>Ecuador</td>
<td>24370</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maguire et al</td>
<td>Surinam</td>
<td>11938</td>
<td>44074</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Williams</td>
<td>Peru</td>
<td>19908</td>
<td>18338</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Williams-Alston</td>
<td>Venezuela</td>
<td>32919</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forest Dept.</td>
<td>Guyana</td>
<td>3651</td>
<td>43740</td>
<td></td>
</tr>
<tr>
<td>cainito L</td>
<td>Commercial</td>
<td>Panama</td>
<td>3210</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Commercial</td>
<td>Puerto Rico</td>
<td>3597</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Commercial</td>
<td>Costa Rica</td>
<td>11708</td>
<td>47884</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooper-Slater</td>
<td>Panama</td>
<td>10617</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooper-Slater</td>
<td>Panama</td>
<td>10600</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forest Service</td>
<td>Haiti</td>
<td>19577</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forreston</td>
<td>Panama</td>
<td>50964</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fors</td>
<td>Cuba</td>
<td>13786</td>
<td>13777</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gill-Whitford</td>
<td>Cuba</td>
<td>9100</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IICA</td>
<td>Costa Rica</td>
<td>24771</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kluge</td>
<td>Panama</td>
<td>7248</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Schiiffino</td>
<td>Dominican Rep.</td>
<td>35155</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shank</td>
<td>Nicaragua</td>
<td>46831</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shank</td>
<td>Nicaragua</td>
<td>46902</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Skutch</td>
<td>Guatemala</td>
<td>33864H</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>stern et al</td>
<td>Panama</td>
<td>55104</td>
<td></td>
<td></td>
</tr>
<tr>
<td>marginatum (H. &amp; A,) Radlk.</td>
<td>Bosques-Yerb.</td>
<td>Argentina</td>
<td>13706</td>
<td>23540</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Curran</td>
<td>Argentina</td>
<td>1702</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Curran</td>
<td>Argentina</td>
<td>1719</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lindemman-de Haas</td>
<td>Brazil</td>
<td>32977</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>venturi</td>
<td>Argentina</td>
<td>22803H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mexicanum Brand, ex Standl.</td>
<td>Castillo</td>
<td>Belize</td>
<td>21482</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maderas Trop.</td>
<td>Mexico</td>
<td>11244</td>
<td>47915</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Skutch</td>
<td>Guatemala</td>
<td>22983H</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Williams</td>
<td>Mexico</td>
<td>23438</td>
<td>34647</td>
<td></td>
</tr>
<tr>
<td>Species</td>
<td>Collector and number</td>
<td>Origin</td>
<td>Number of wood collection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------------------</td>
<td>------------</td>
<td>---------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nitidum G.F.W. Mey</td>
<td>Forest Dept. 4757**</td>
<td>Guyana</td>
<td>3653 46443</td>
<td></td>
<td></td>
</tr>
<tr>
<td>oliviforme</td>
<td>Bucher</td>
<td>sn Cuba</td>
<td>16139</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Caldwell 8731</td>
<td>sn Florida</td>
<td>1283 49259</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Field Mus. 192</td>
<td>sn Cuba</td>
<td>13855</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gill-Whitford 41</td>
<td>sn Cuba</td>
<td>9052</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gill-Whitford 84</td>
<td>sn Cuba</td>
<td>9095</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gillis 11983</td>
<td>sn Bahamas</td>
<td>28438</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Judd 2594</td>
<td>sn Hawaii</td>
<td>32252</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Harts-Smith 1645</td>
<td>sn Florida</td>
<td>20872</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rhoads 8314</td>
<td>sn Florida</td>
<td>9340 49051</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scarff 11</td>
<td>sn Dominican Rep.</td>
<td>35301</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scott 140</td>
<td>sn Florida</td>
<td>13541</td>
<td></td>
<td></td>
</tr>
<tr>
<td>laevis G. K. Mey</td>
<td>Stern 383</td>
<td>sn Florida</td>
<td>51187</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stern-Brizicky 420</td>
<td>sn Florida</td>
<td>51216</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wilson 15</td>
<td>sn Florida</td>
<td>15959</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10th Census 135</td>
<td>sn Florida</td>
<td>5179</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ovale Rusby</td>
<td>Schunke 4630</td>
<td>sn Peru</td>
<td>33040</td>
<td></td>
<td></td>
</tr>
<tr>
<td>panamense Pittier</td>
<td>Cooper 353</td>
<td>sn Panama</td>
<td>32898 11946</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stork 1669</td>
<td>sn Costa Rica</td>
<td>38464</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wurdack-Adderley 43679</td>
<td>sn Venezuela</td>
<td>54437</td>
<td></td>
<td></td>
</tr>
<tr>
<td>revolutum Mart. and Eichl.</td>
<td>Williams 5522</td>
<td>sn Peru</td>
<td>16345 18766</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Williams 6140</td>
<td>sn Peru</td>
<td>16346 18910</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Williams 6655</td>
<td>sn Peru</td>
<td>16344 19029</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Williams 6900</td>
<td>sn Peru</td>
<td>16343 19097</td>
<td></td>
<td></td>
</tr>
<tr>
<td>unassigned</td>
<td>Acosta-Solis 6394</td>
<td>sn Ecuador</td>
<td>45158</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acosta-Solis 6456</td>
<td>sn Ecuador</td>
<td>45202</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Field Museum 15011</td>
<td>sn Puerto Rico</td>
<td>10911</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kluge 19</td>
<td>sn Belize</td>
<td>7574</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Krukoff 6605</td>
<td>sn Brazil</td>
<td>12562 36762</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maguire et al 54831</td>
<td>sn Surinam</td>
<td>22773</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pittier 309</td>
<td>sn Venezuela</td>
<td>8295</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Woytkowski 5</td>
<td>sn Peru</td>
<td>37792</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Commercial 29</td>
<td>sn Honduras</td>
<td>23098</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Wood doubtfully of this species or genus.
** The MADw and SJRw are different and do not belong in this genus.
*** Wood number with H are from the Harvard Wood Collection.

(Page 2 of 2)
Table 2.—Silica content of some *Chrysophyllum* species

<table>
<thead>
<tr>
<th>Species</th>
<th>Collector</th>
<th>Country</th>
<th>Silica* Pct</th>
</tr>
</thead>
<tbody>
<tr>
<td>cainito</td>
<td>Shank</td>
<td>116 Nicaragua</td>
<td>0.25</td>
</tr>
<tr>
<td>marginatum</td>
<td>Lindeman-deHaas</td>
<td>1347 Brazil (Parana)</td>
<td>0.54</td>
</tr>
<tr>
<td>oliviforme</td>
<td>Caldwell</td>
<td>8731 Florida</td>
<td>0.25</td>
</tr>
<tr>
<td>panamense</td>
<td>Stork</td>
<td>1669 Costa Rica</td>
<td>0.96</td>
</tr>
<tr>
<td>revolutum</td>
<td>Williams</td>
<td>6140 Peru</td>
<td>1.13</td>
</tr>
</tbody>
</table>

* Based on ovendry weight of the wood.
Figure 1.--C. oliviforme, showing distinct growth rings and typical pore and parenchyma arrangement (Stern 140) X 30.

Figure 2.--C. oliviforme, but showing parenchyma detail. X 110.

Figure 3.--C. marginatum showing radial-echelon arrangement of pores. (Venturi 18) X 30.

Figure 4.--C. marginatum but showing parenchyma detail. X 110.
Figure 5.-- C. acreanum showing general arrangement of pores and parenchyma and the very small pores of this species (Krukoff 5593) X 30.

Figure 6.-- C. acreanum but showing parenchyma detail. X 110.

Figure 7.-- C. cainito showing general arrangement of pores and parenchyma and the large pores of this species (Forgeson 19) X 30.

Figure 8.-- C. cainito but showing parenchyma detail. X 110.