WOOD STRUCTURE OF THE GENUS TALISIA (SAPINDACEAE)

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SUMMARY

A description of the wood structure of 15 species of *Talisia* from the Guianas and adjacent areas is given. Among the neogean genera of the Sapindaceae *Talisia* is readily recognized by the combination of moderately few vessels, uniseriate or bi-seriate homocellular rays, aliform-confluent to banded parenchyma, the cells often containing rhombic crystals, and thick-walled fibres with a narrow lumen. The wood structure of the species is much alike, and it is not possible to identify a wood specimen to species on wood structure alone. It is pointed out that nearly identical wood occurs in the genera *Guarea* and *Trichilia* of the Meliaceae; the resemblance to some genera of tropical South American Leguminosae is more superficial.

1. INTRODUCTION

Talisia is one of the 15 genera of Sapindaceae known from Suriname. Of four of these all species are lianas with abnormal secondary growth; one is herbaceous. The remaining ten genera are woody, and the structure of their stems is rather diversified, which renders it easy to identify a Sapindaceous wood sample to genus. In particular the presence or absence, and the distribution of the parenchyma are important characters for identification.

In connection with KRAMER's taxonomic work on *Talisia* (1972) it seemed of interest to publish an account of the wood structure parallel to his studies. According to KRAMER (in prep.) 16 species occur in Suriname or may be expected there. Wood samples of all but two of these species were available, beside some other South American ones.

2. MATERIAL

In the table the material is listed. Particulars are given about the diameter of the trees. The vernacular names are also listed. The name "pitomba", widely applied to various *Talisia* species in Brazil, does not seem to be used at all in the Guianas.

Generally the wood is hard and in need of treatment with hydrofluoric acid before sectioning.

3. DESCRIPTION OF THE WOOD

As happens so often in wood anatomy, if the structure of a genus is well defined, it is far more difficult or even impossible to tell the species apart. This is also

the case in *Talisia*. Though some differences exist, in particular in the distribution and quantity of the parenchyma, it seems justified to give one general description.

3.1. General characters

The wood of nearly all species is hard and heavy, with a volume weight of 1.00 to 1.10; it is very difficult to cut. The colour varies from yellowish brown (in *T. megaphylla* and *T. microphylla*) to medium greyish brown with a more or less pronounced reddish hue; dark reddish brown heartwood is present in *T. furfuracea*, *T. praealta*, *T. simaboides*, and *T. squarrosa*. There it is well defined and sharply demarcated from the sapwood. Notwithstanding the hardness of the wood it is apparently very prone to fungal attack, most of the blocks being stained by blue-rot fungus.

3.2. Anatomical structure

Vessels: For the greater part solitary, the others in radial rows of two, but also in longer rows and these often dumb-bell shaped with small vessels or tracheids in the middle; the multiples most frequent near the growth ring borders; due to these groups and a slightly irregular distribution the number per square mm is variable, on the average in most species not over 5 per sq. mm, but 12–15 in *T. micrantha* and *T. microphylla*. Diameter usually 60–80 μ in *T. hemidasya*, *T. micrantha*; 80–100 μ in *T. eximia*, *T. guianensis*, *T. longifolia*, *T. megaphylla*, *T. microphylla*, *T. mollis*; 100–160 μ in *T. furfuracea*, *T. simaboides*, *T. praealta*, *T. reticulata;* 125–250 μ in *T. clathrata*, *T. retusa*, *T. squarrosa*, *T. sylvatica*. Intervascular pits crowded, slits enclosed within the border, sometimes slits confluent, diameter 5–7 μ. Length of vessel elements 200–600 μ, on the average 400 μ. Contents generally a yellow or reddish gum; occasionally with hard tyloses in *T. sylvatica*.

Fibre tissue: Septate and non-septate fibres mixed without pattern; in most species with very thick fibre walls few septates present, in other species, like *T. princeps*, with relatively wide lumina, nearly all fibres septate. Diameter 9–16 μ, lumen 1–2 (4)μ, diameter wider up to 20 μ and lumen 8–12 μ in *T. clathrata*, *T. princeps*, lumen 6 μ in *T. furfuracea*. Pits small, with a very small border; mainly present on the radial walls. Length on the average 1100 (850–1630) μ. Fibres containing small rhomboid crystals often present at the border of the growth rings (*Plate I, fig. 2*).

Rays: Exclusively uniseriate in most species, sometimes bi-seriate over a short distance without widening; with an about equal number of uni- and bi-seriates in *T. furfuracea* p.p., *T. princeps*, *T. simaboides*, and *T. sylvatica*, and with a preponderance of 2(3)-seriates in *T. retusa*. Homocellular with all cells procumbent and low, 16–20 μ, radially about 100 (80–120) μ long. Width 12–24 μ, in *T. retusa* 28–35 μ. Height variable from 2–40(60) cells, the higher rays usually 500–700 μ high, highest in *T. furfuracea*, *T. longifolia*, and *T. mollis*, where they reach up to about 1 mm. Pits to vessels of the same size as the intervascular pits. Number on the average 9–12 per mm; 7–8 in *T. furfuracea* and

T. simaboides. The cells often filled with brown contents.

Parenchyma: Nearly exclusively paratracheal as narrow, long aliform sheets enveloping the vessels or only present on the abaxial sides, often confluent into long, mostly rather irregular, and undulating bands of variable width and numbers (*Plate I, fig. 1*; *Plate II.*). In *T. eximia*, *T. hemidasya*, *T. guianensis*, *T. microphylla*, *T. praealta*, *T. retusa*, and *T. sylvatica* the first-formed parenchyma of a growth ring is confluent-banded forming a rather straight continuous band, the later formed being aliform or confluent into short bands. However, the distribution pattern for a species may be rather variable, as is the case in the

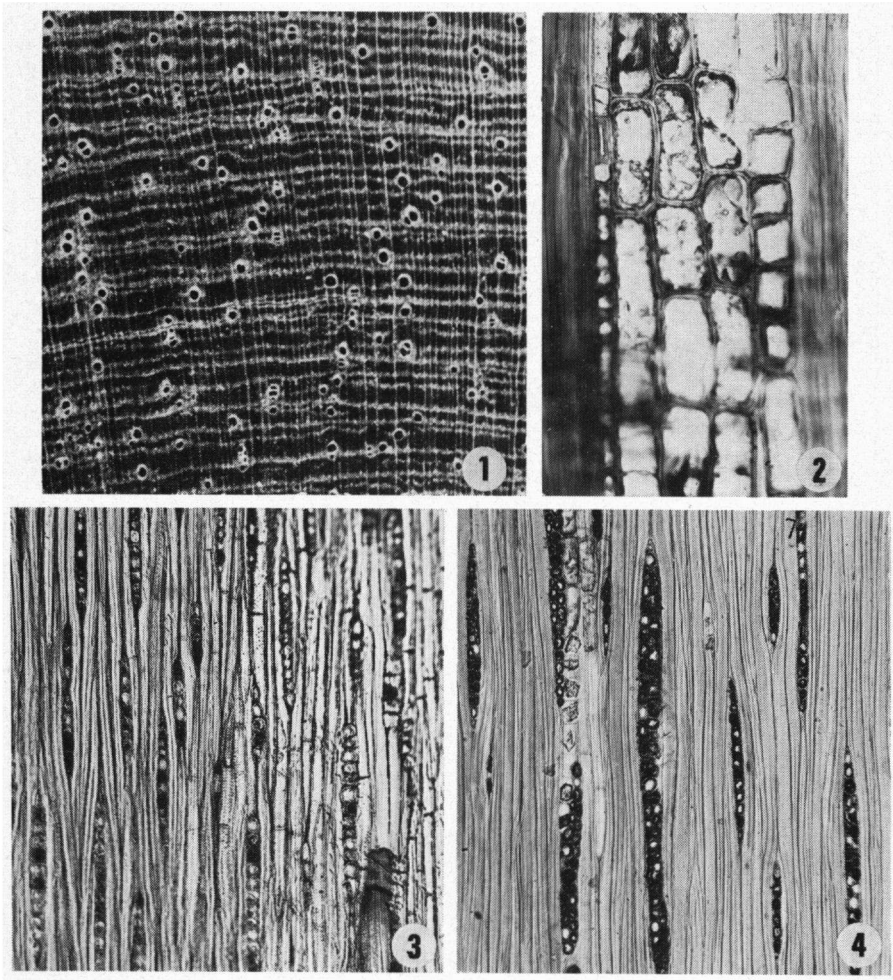

Plate I. Fig. 1. *Talisia megaphylla* (Uw 1198), cross sect. 10×; Fig. 2. *T. sylvatica* (Uw 1803) rad. sect. 200× showing parenchyma cells with large rhombic crystals, and fibres with small crystals on a growth ring border; Fig. 3. *T. microphylla* (Uw 4041) tg. sect. 100×; Fig. 4. *T. simaboides* (Uw 11231) tg. sect. 100×.

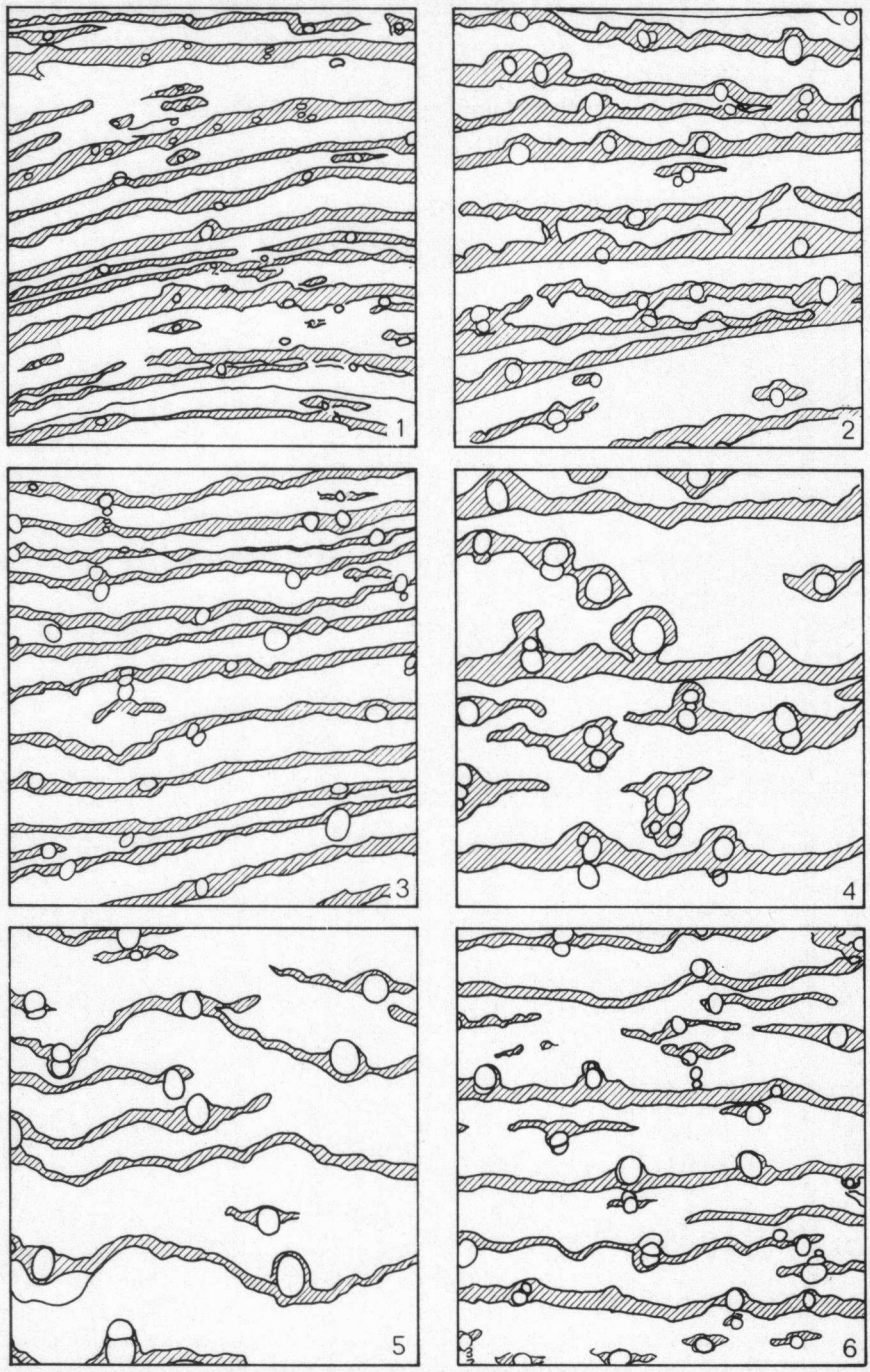

Plate II. Camera lucida drawings of parenchyma and vessel distribution as seen on cross sections. In all drawings the wood is oriented with the bark side above; rays are omitted. Magnification 20×. 1. *Talisia micrantha* (Uw 3124); 2. *T. mollis* (Uw 2349); 3. *T. praealta* (Uw 4742); 4. *T. retusa* (Uw 15357); 5. *T. simaboides* (Uw 11231); 6. *T. sylvatica* (Uw 1803).

two samples of *T. furfuracea*, and even in the same wood sample a different type of distribution can be found in various growth rings. In *T. micrantha* and *T. princeps* the bands are 4–6 or 8 cells wide and completely surround the vessels; in *T. clathrata* the parenchyma is restricted to a narrow vasicentric ring and only occasionally short-aliform; in the other species the bands are of variable width, 2–8 cells wide. Number of bands 3–4 per mm in *T. micrantha*, *T. microphylla*, *T. mollis*, *T. simaboides*, and *T. squarrosa*; 2–4 in *T. furfuracea* and *T. hemidasya*, and 5–7 in *T. megaphylla*. Strands usually consisting of 4–8 cells, but strands of 2 cells also found. In all species, except *T. princeps*, in some of the cells two to four rhombic crystals of about 20 μ present.

Growth rings: In a number of species distinct, in particular with a handlens, and characterized by a straighter band of parenchyma at the margin of a growth period. These bands in nearly all species bordered by one row of fibres containing small rhombic crystals.

3.3. Characteristic of the wood structure

Vessels moderately few, rather narrow to medium-sized, pits 5–7 μ; fibres thick-walled with a narrow or extremely narrow lumen; rays homocellular, uniseriate or partly 2–3-seriate; parenchyma aliform, aliform-confluent, and confluent-banded, forming long and narrow, more or less straight bands; crystals often present in the parenchyma cells.

4. DISCUSSION

By the combination of characters listed above, and in particular by the arrangement of the parenchyma, *Talisia* is easily recognized and distinct from other genera of the Sapindaceae in the New World.

As might be expected from an investigation of an extensive collection of wood samples some amendments are necessary of the notes on the structure of *Talisia* as published by RECORD & HESS (1943) and by METCALFE & CHALK (1950) in their respective general treatments of the Sapindaceae. For instance, the septation of the fibres, considered as one of the characteristic features of the family, is often very difficult to observe and may even be absent in the majority of species with thick-walled fibres with a narrow lumen. It may be remarked that JANSSONIUS (1908) also failed to find septate fibres in some of the Javanese species studied by him. The broad bands of parenchyma particularly stressed by Record and Hess are not a constant feature of all species either, as there is much more variation in parenchyma distribution and in width and regularity of the bands.

The peculiar habit of *T. megaphylla*, a species with an unbranched small stem and a tuft of leaves at the end, did not show up by a different wood structure. Neither did other species, like *T. hemidasya*, *T. longifolia*, *T. micrantha*, and *T. mollis*, which according to collectors' notes are also "Schopfbäume". The wood structure of *T. princeps* is rather different from the other species by the great amount of parenchyma, and the thin-walled, septate fibres with a wide

lumen. The section studied by me at the Jodrell Laboratory at Kew came, according to the label, from a specimen cultivated in the Royal Botanic Gardens, the country of origin being Venezuela. Mr. Richardson of the Jodrell Laboratory kindly informed me that no records exist about this specimen and the species is no longer under cultivation. According to RADLKOFER (1932) *T. princeps* is only known from cultivated specimens, except for Jacquin's original specimen collected near Caracas. The deviating circumstances of cultivation perhaps account for the thin-walled fibres and the abundance of the parenchyma tissue.

HESS (1948) in his key to woods with concentric bands of parenchyma, keys out *Talisia* together with *Dipterodendron* of the Sapindaceae, differentiating between the two genera by using the size and alignment of the parenchyma bands in a growth ring, these bands being more regular in *Dipterodendron*. *Melicoccus*, taxonomically the nearest relative, has also broader and more regular bands, and its rays are 2–3 cells wide.

Far more striking is the resemblance between the wood of *Talisia* and species of the Meliaceous genera *Guarea* and *Trichilia*. Both *Guarea* and *Trichilia* species may have uniseriate rays and the same type of parenchyma distribution; also macroscopically the often reddish and heavy wood resembles *Talisia*. The most important difference between *Talisia* and the other two genera is to be found in the size of the intervascular pits, which generally is about 4 μ in *Guarea* and *Trichilia*. Moreover, the rays are in the latter genera slightly heterocellular, and the septae of the fibres are much more distinct and always present.

As RECORD & HESS (1943) also remarked, some members of the Leguminosae likewise resemble *Talisia*, e.g. *Swartzia* and *Platymiscium*, but can easily be differentiated by their storied structure and vestured intervascular pitting.

The similarity in wood structure of Sapindaceae and Meliaceae (and several more families with pinnate leaves), based on a large number of genera, was discussed by HEIMSCH (1942). Recently ROCK (1972) reached the same conclusion for the members of the "Pinnatae" of the Florida Keys. JANSSONIUS (1950) hinted at a possible relationship between families from the ultimate position of their genera in his dichotomous key to Javanese woods (1940). If woods belonging to different families are keyed out together under the same cipher in the last part of the key, it means that these woods resemble each other in at least quite a number of important wood characters. Going over his key with this principle in mind, he points out, i.a., how genera of Meliaceae and Sapindaceae are found close together. He also mentions that in several places genera of Sapindaceae and Leguminosae are headed under the same group. I do not think that many modern taxonomists consider these two families as closely related; only HALLIER (1912) incorporated in his Aesculinae both Sapindaceae and Leguminosae. Furthermore it is rather hazardous to derive far-reaching conclusions from the relative position of genera in a key. This was what Janssonius did, but he wanted to draw the attention of taxonomists to remarkable similarities in the structure of the secondary wood in genera belonging to families usually not considered as being in any way closely related.

Talisia-species	U-wood number	Collection	Origin	Diameter of the tree	Vernacular name
T. clathrata Radlk.	U 18805	Y. Mexia 4118	Braz., Minas Gerais	unknown	
T. eximia Kramer	U 11975	J. v. Donselaar 3047	Suriname	5 cm	gran tatoe (Auk.)
T. furfuracea Sandw.	U 1111	For. Dept. 2987	Guiana	about 30 m high	black moroballi
T. furfuracea Sandw.	U 5756	B.A.F.O.G. 1268	Fr. Guiana	24 cm	paicoussa, bois flambeau
T. guianensis Aubl.	U 4323	J. Lindeman 6314	Suriname	3 cm	
T. guianensis Aubl.	U 4412	J. Lindeman 6432	Suriname	3.5 cm	kraskras tiki
T. guianensis Aubl.	U 4530	J. Lindeman 6699	Suriname	2 cm	
T. hemidasya Radlk.	U 2487	B. Maguire et al. 24690	Suriname	5 cm	
T. longifolia (Benth.) Radlk.	U 8545	G. Daniëls & F. P. Jonker 861	Suriname	4.5 cm	tatoe (Auk.); kassi kassi tiki
T. longifolia (Benth.) Radlk.	U 17558	B. Maguire et al. 55885	Suriname	6 cm	
T. megaphylla Sagot	U 330	G. Stahel wood coll. 330	Suriname	about 6 cm	karaballi takoro iwi (Ar.)
T. megaphylla Sagot	U 1198	J. Lanjouw & J. Lindeman 388	Suriname	9 cm	toerisie (Car.)
T. megaphylla Sagot	U 2781	id. 3798	Suriname	8 cm	mankrappa
T. megaphylla Sagot	U 3472	J. Lindeman 5138	Suriname	6 cm	kraskras tiki
T. megaphylla Sagot	U 4204	J. Lindeman 6152	Suriname	2 cm	
T. megaphylla Sagot	U 10961	J. G. Wessels Boer 1363	Suriname	2 cm	tatoe
T. megaphylla Sagot	U 11988	J. v. Donselaar 3071	Suriname	3.5 cm	
T. megaphylla Sagot	U 15348	F. Oldenburger & R. Norde 507	Suriname	5 cm	
T. megaphylla Sagot	U 17425	B. Maguire et al. 55046*[1]	Suriname	7 cm	
T. megaphylla Sagot	U 19642	B. A. Krukoff 4840	Brazil, Amaz.	6 cm	
T. micrantha Radlk.	U 3124	J. Lindeman 4465	Suriname	2 cm	
T. micrantha Radlk.	U 3173	J. Lindeman 4577	Suriname	2 cm	
T. micrantha Radlk.	U 4144	J. Lindeman 6073	Suriname	1 cm	
T. micrantha Radlk.	U 4563	J. Lindeman 6746	Suriname	2 cm	
T. microphylla Uitt.	U 4041	J. Lindeman 5897	Suriname	5 cm	
T. microphylla Uitt.	U 4055	J. Lindeman 5913	Suriname	1.5 cm	
T. microphylla Uitt.	U 4191	J. Lindeman 6138	Suriname	1.5 cm	
T. mollis Kunth	U 2030	J. & P. A. Florschütz 1385	Suriname	2 cm	
T. mollis Kunth	U 2349	J. Lindeman 3582	Suriname	4.5 cm	kraskras tiki
T. praealta Radlk.	U 1659	J. Lanjouw & J. Lindeman 2218	Suriname	24 cm	

T. praealta Radlk.	U 2712	J. Lindeman 3722	Suriname	5 cm	
T. praealta Radlk.	U 2811	J. Lindeman 3832	Suriname	4.5 cm	
T. praealta Radlk.	U 4603	J. Lindeman 6797	Suriname	6 cm	
T. praealta Radlk.	U 3537	J. Lindeman 4645	Suriname	4 cm	
T. praealta Radlk.	U 4737	J. Lindeman 7023	Suriname	5 cm	
T. praealta Radlk.	U 4742	J. Lindeman 7030	Suriname	7 cm	
T. praealta Radlk.	U 10959	J. v. Donselaar 1955	Suriname	7 cm	
T. praealta Radlk.	U 12164	J. v. Donselaar 3786	Suriname	5.4 cm	
T. retusa Cowan	U 15357	F. Oldenburger & R. Norde 538	Suriname	18 cm	
T. simaboides Kramer	U 11231	Maas-L. B. B. 10818	Suriname	16 cm	mankrappa
T. squarrosa Radlk.	U 1112	For. Dept. 1176	Guiana	unknown	
T. squarrosa Radlk.	U 5301	B.A.F.O.G. 226 M	Fr. Guiana	50 cm	singabassou
T. squarrosa Radlk.	U 5302	B.A.F.O.G. 227 M	Fr. Guiana	50 cm	singabassou
T. squarrosa Radlk.	U 5305	B.A.F.O.G. 230 M	Fr. Guiana	50 cm	singabassou
T. squarrosa Radlk.	U 5320	B.A.F.O.G. 244 M	Fr. Guiana	over 40 cm	singabassou
T. squarrosa Radlk.	U 5340	B.A.F.O.G. 265 M	Fr. Guiana	25 cm	tatoe
T. sylvatica (Aubl.) Radlk.*[2]	U 246	G. Stahel, wood collection 246	Suriname	10 cm	
T. sylvatica (Aubl.) Radlk.	U 1787	J. Lanjouw & J. Lindeman 2497	Suriname	7 cm	
T. sylvatica (Aubl.) Radlk.	U 1803	J. Lanjouw & J. Lindeman 2523	Suriname	15.5 cm	
T. sylvatica (Aubl.) Radlk.	U 2771	J. Lindeman 3785	Suriname	8 cm	
T. sylvatica (Aubl.) Radlk.	U 2808	J. Lindeman 3828	Suriname	11 cm	
T. sylvatica (Aubl.) Radlk.	U 2862	J. Lindeman 3887	Suriname	8 cm	
T. sylvatica (Aubl.) Radlk.	U 3217	J. Lindeman 4675	Suriname	2 cm	
T. sylvatica (Aubl.) Radlk.	U 3269	J. Lindeman 4579	Suriname	4.5 cm	
T. sylvatica (Aubl.) Radlk.	U 3330	J. Lindeman 4886	Suriname	4 cm	
T. sylvatica (Aubl.) Radlk.	U 3360	J. Lindeman 4930	Suriname	4.5 cm	
T. sylvatica (Aubl.) Radlk.	U 3398	J. Lindeman 4990	Suriname	6 cm	
T. sylvatica (Aubl.) Radlk.	U 4003	J. Lindeman 5852	Suriname	1.5 cm	bos knippa
T. sylvatica (Aubl.) Radlk.	U 4195	J. Lindeman 6142	Suriname	2 cm	bos knippa
T. sylvatica (Aubl.) Radlk.	U 5072	J. Lindeman 7676	Suriname	8 cm	
T. sylvatica (Aubl.) Radlk.	U 12154	J. v. Donselaar 3762	Suriname	2.5 cm	

*[1] unbranched small tree with a tuft of leaves; up to 10 m high
*[2] including T. pedicellaris (Sagot) Radlk.

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REFERENCES

HALLIER, H. (1912): L'origine et le système phylétique des Angiospermes exposés à l'aide de leur arbre généalogique. *Arch. Neerl. Sc. Nat.* sér. 3b, **I**: 146–234.

HEIMSCH, CH. (1942): Comparative anatomy of the secondary xylem in the "Gruinales" and "Terebinthales" of Wettstein. *Lilloa* **8**: 83–197.

HESS, R. W. (1948): Keys to American woods. XXI. Parenchyma in numerous continuous bands. *Trop. Woods* No. **94**, p. 29–53.

JANSSONIUS, H. H. (1908): *Mikrographie des Holzes der auf Java vorkommenden Baumarten.* Bd. 2, Sapindaceae, 316–407. Brill, Leiden.

— (1940): *Anatomische Bestimmungstabelle für die Javanischen Hölzer.* Brill, Leiden.

— (1950): Wood anatomy and relationship. *Blumea* **6**: 408–462.

KRAMER, K. U. (1972): Studies in the New World Sapindaceae I. Notes on the genus Talisia Aublet. *Acta Bot. Neerl.* **21**: 671–678.

— (in prep.): Sapindaceae, in: *Flora of Suriname* II, 1 (Additions and Corrections).

METCALFE, C. R. & L. CHALK (1950): *Anatomy of the Dicotyledons.* Vol. I: 419–431. Clarendon Press, Oxford.

RADLKOFER, L. (1932): Sapindaceae. *Pflanzenreich* **98d**: 854.

RECORD, S. J. & R. W. HESS (1943): *Timbers of the New World.* New Haven.

ROCK, B. NELSON (1972): The woods and flora of the Florida Keys: "Pinnatae". *Smiths. Contr. to Botany* No. **5**: 1–35.