TECHNICAL SHEETS

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15

EVOLUTION OF THE CLASSIFICATION OF AFRICAN COMMERCIAL SPECIES OF THE AFZELIA GENUS (DOUSSIÉ) AND THE PTEROCARPUS GENUS (PADAUK) IN THE GENERAL NOMENCLATURE OF TROPICAL TIMBER

AFRICAN SPECIES OF THE *AFZELIA* GENUS

Preamble - status of the *Afzelia* genus in Africa

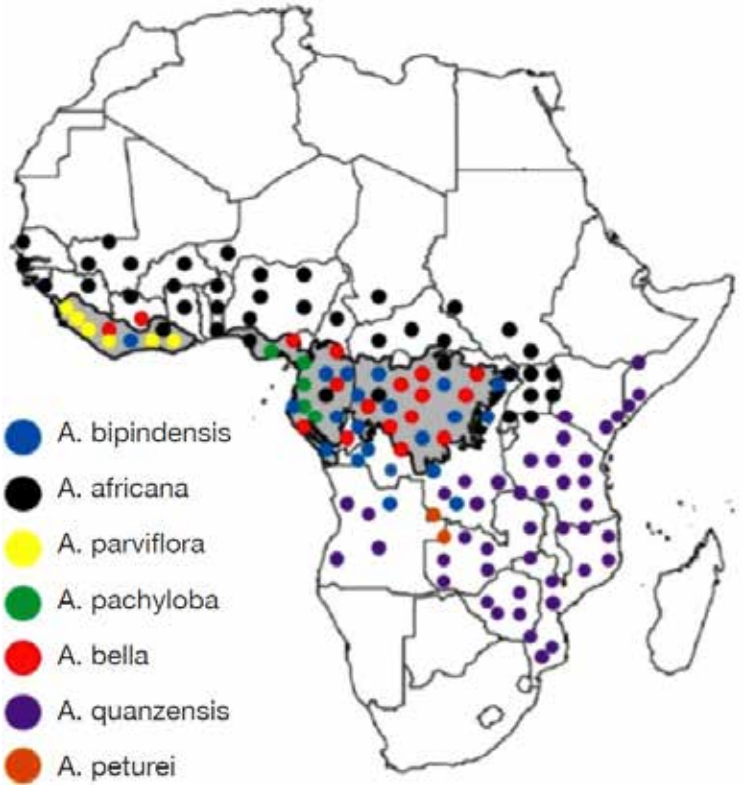
The below information and data are taken from the literature review on the subject by Donkpegan et al. (2014)[1] which mention:

* The genus *Afzelia* Smith (Fabaceae, Caesalpinioideae) consists of seven species in Africa, two of which are found in the open forests of the Zambezi region (A. *quanzensis Welw.* and *A. peturei* De Wild.); four others are endemic to the dense rainforests of the Guinean-Congolese region (*A. bella* Harms, *A. bipindensis* Harms, *A. pachyloba* Harms and *A. parviflora* [Vahl] Hepper) and the last one is mainly found in the Sudanian savannahs (*A. africana* Sm. ex Pers.)

* Four of these species (*A. africana, A. bella, A. bipindensis,* and *A. pachyloba*) are very similar morphologically and are generally sold under the name of "doussié", which is a very sought-after lumber in the forest industry. The morphological distinction of these species is difficult in the field, leading to confusion during forest inventories. This situation seems to be tacitly tolerated in the international tropical timber trade, although different technological properties are regularly reported by professionals (CTFT 1980[2]), especially in terms of the shrinkage observed in the timber.

1. Donkpegan A.S.L., Hardy O., Lejeune P., Oumorou M., Daïnou K., Doucet J-L., 2014. **A complex of Afzelia species from African forests of economic and ecological interest (bibliographic synthesis**.Biotechnol. Agron. Soc. Environ. 2014 18(2). https://orbi.uliege.be/bitstream/2268/168874/1/Donkpegan%20et%20al%202014.pdf

2. Tropical Forestry Technical Center, 1980. **Doussié**. Tropical Timber and Forests, 189: pgs. 37-54.



Based on Donkpegan et al (2014). The geographical distribution on the African continent of the seven African species of the *Afzelia* genus (map adapted from the database of the Geneva Conservatory of Botanical Gardens [CJBG], consulted on 06/11/2012, and White's map, 1986).

CLASSIFICATION AND CURRENT NAMES OF THE COMMERCIALISED *AFZELIA*

Four African species[3] of *Afzelia* are (more or less) commonly sold and exported for their timber: *A. africana*, *A. bella, A. bipindensis* and *A. pachyloba.*

These four species are sold under different names: Doussié, Afzelia (the Anglo-Saxon pilot name), as well as Lingué, Apa, Pachyloba, etc.

The *A. quanzensis* species located mainly in East Africa and called Chanfuta in Mozambique, is sometimes available on the international market.

In the General Nomenclature of Tropical Timber[4] the five commercial species of the *Afzelia* genus are all grouped under the name Doussié, as in many other reference documents, whether recent or older (Atlas of Tropical Timber[5], Atlas of Tropical Timber - volume I - Africa[6], Handbook of Hardwood[7], Tropical Timbers of the World[8]...). The correlations between the pilot name, the botanical names and vernacular names are presented as follows in the Nomenclature:

3. Two species of the *Afzelia* genus from Southeast Asia are traded: *A. rhomboidea* S. Vidal (pilot name: Tindalo) and *A. xylocarpa* Craib (pilot name: Makamong). In addition, *Afzelia bijuga* is a synonym of *Intsia bijuga* (pilot name: Merbau).
4. International Tropical Timber Technical Association, 2016. **General Nomenclature of Tropical Timber** - 7th edition French - English. ATIBT, 152 pgs.
5. Gérard J. et al., 2016. **Atlas of tropical Timber**. Practical Guide Collection, Editions QUAE, French version (paper, pdf, epub formats) and English version (pdf and epub formats), 999 pgs.
6. International Tropical Timber Technical Association, 1986. **Atlas of Tropical Timber Volume I - Africa**. ATIBT, 208 pgs.
7. Farmer R.H., (ed.), 1972. **Handbook of Hardwoods**. 2nd Edition. London: Her Majesty's Stationery Office, 243 pgs.
8. Chudnoff M., 1984. **Tropical Timbers of the World**. USDA, Forest Service, 464 pgs.

Pilot name	Botanical names	Vernacular names
Doussié	Afzelia africana Sm. Afzelia bella Harms Afzelia bipindensis Harms Afzelia pachyloba Harms Afzelia quanzensis Welw. (Syn. *Afzelia cuanzensis*) (Syn. *Intsia cuanzensis*)	Aligna (NG); Apa (NG); Azodau (CI); Bolengu (CD); Chanfuta (MZ); Doussié (CM); Edoumeuleu (GA); Kpakpatin (BJ); Kpendei (SL); Lingué (CI, SN); M'Banga (CM); Mbembakofi (TZ); Mkora (TZ); Mussacossa (MZ); N'Kokongo (AO, CG); Pakpajide (BJ); Papao (GH); Pau Conta (GW); Uvala (AO)[9]

The vernacular names and the countries where they are used aren't specifically associated with one or more of the five species, except for the Chanfuta name in Mozambique for *A. quanzensis*.

QUALITY DIFFERENCES BETWEEN THE COMMERCIAL *AFZELIA* SPECIES

The need to commercially differentiate between species of *Afzelia* and to no longer group them together under the single "Doussié" name is linked to the differences in log quality and in the intrinsic quality of the timber observed between the species.

Operators in the timber industry rank the main *Afzelia* species, from *Afzelia bipindensis*, the "true" Doussié, also known as *yellow powder,* the most stable one, up to the Lingué (*Afzelia africana*), the most typically Ivorian one, through the intermediate quality Pachyloba.

Currently, Pachyloba is the subject of much trafficking, particularly in Cameroon, in favour of Asian markets for the manufacture of parquet flooring.

Afzelia bipindensis is therefore considered as the species of the genus whose timber is of the best quality (its timber is considered the most stable) followed by *Afzelia pachyloba* and then *Afzelia africana*.

It appeared necessary to verify these differences in the timber's stability.

For these three species, the following table presents:

- two physical indicators of the timber's stability, the saturation point of the fibres and the total volume shrinkage during drying (average values extracted from the CIRAD's timber database[10]); **these two characteristics are all the lower the more stable the timber is.**
- two chemical characteristics (Gérard et al. 2019[11]), the average content of alcohol-benzene extracts and the content of water extracts (+ the sum of the two), characteristics that several studies have shown are also indicative of the stability of a timber; Kokutse et al. (2010)[12], Bossu et al. (2016)[13], and Hernandez and Almeida (2006)14 have indeed shown that **the higher the extract content of a timber, the more stable it is.**

9. NG: Nigeria; CI: Ivory Coast; CD: Democratic Republic of Congo; MZ: Mozambique; GA: Gabon; BJ: Benin; SL: Sierra Leone; SN: Senegal; CM: Cameroon; TZ: Tanzania; AO: Angola; CG: Congo; GH: Ghana; GW: Guinea Bissau

10. For *A. bella*, test results are only available for one tree, which is insufficient to compare it with the other three species.

11. Gérard J., Paradis S., Thibaut B., 2019. **CIRAD wood chemical composition database**, https://doi.org/10.18167/DVN1/U1FTIU, CIRAD Dataverse, V2.

12. Kokutse A. D., Brancheriau L., Chaix G., 2010. **Rapid prediction of shrinkage and fibre saturation point on teak** (Tectona grandis) **wood based on near-infrared spectroscopy**. Annals of Forest Science, 67 (4): 403. https://www.afs-journal.org/articles/forest/abs/2010/04/f09144/f09144.html?mb=1

13. Bossu J., Beauchêne J., Estevez Y., Duplais C., Clair B., 2016. **New Insights on Wood Dimensional Stability Influenced by Secondary Metabolites: The Case of a Fast-Growing Tropical Species *Bagassa guianensis* Aubl.**. PLoS ONE, Public Library of Science, 2016, 11. https://hal.inrae.fr/hal-02636844

14. Hernández R.E., Almeida G., 2007. **Effects of extraneous substances, wood density and interlocked grain on fiber saturation point of hardwoods**. Wood Material Science & Engineering 2: pgs. 45-53. https://www.tandfonline.com/doi/full/10.1080/17480270701538425

Espèce	Number of trees tested*	Density	Fibre saturation point (%)	Shrinkage volume (%)	Alcohol-benzene extracts (%)	Extracts with water (%)	Total extracts (%)
Afzelia bipindensis	8/5	0,83	19	7,1	20,1	2,4	11,2
Afzelia pachyloba	3/4	0,75	21	8,4	9	3,6	6,3
Afzelia africana	6/3	0,79	21	7,5	10,4	5,5	7,9

*: for the 3 physical characteristics / for the 3 chemical characteristics, respectively.

These results highlight *A. Bipindensis's* better position compared with the other two species: its fibre saturation point and its volume shrinkage are the lowest and its extract contents are the highest (extract content is the most discriminating characteristic for this species). For the other two species, simply taking these indicators into account doesn't enable us to clearly explain the differences in performance.

For the record, the stability of a timber is also related to other parameters such as variations in the grain's orientation (counter grain, twisted grain, oblique grain) and its sensitivity to humidity variations.

DISTINCTION BETWEEN THE *AFZELIA* SPECIES AND THE NEW PILOT NAMES

It therefore appeared necessary to stop grouping *Afzelia* species under the same "Doussié" pilot name and to assign a specific pilot name to them due to differences in geographical distribution, log quality, technological characteristics and commercial practices between these species.
Consequently, ATIBT's Materials and Standardisation Commission has validated the following names:

Afzelia bipindensis Harms : **Doussié**
Afzelia pachyloba Harms : **Pachyloba**
Afzelia africana Sm. : **Lingué**
Afzelia quanzensis Welw. : **Chanfuta**

The *Afzelia bella* Harms species wasn't taken into consideration due to the highly confidential nature of its trade.

These new correlations between botanical names and pilot names will be included in the next edition of the *General Nomenclature of Tropical Timber*; for the time being, however, they are an addendum.

AFRICAN SPECIES OF THE *PTEROCARPUS* GENUS

Preamble – current classifications and names of Padauk-type *Pterocarpus*

Approximately 20 *Pterocarpus* species are present in African tropical forests[15]. The consideration undertaken regarding the evolution of names of Pterocarpus species whose timber is sold cover these three species: *Pterocarpus osun*, *P. soyauxii* and P. *tinctorius,* which are grouped together under the pilot name **African Padauk** in the General Nomenclature of Tropical Timber.

As with Doussie, this grouping is found in the previously mentioned reference works.

Two African species that are traded are not included: *Pterocarpus angolensis* (pilot name: Muninga) and *Pterocarpus erinaceus*[16] (pilot name: Vene)[17].

In the Nomenclature, the vernacular names of the African Padauk and the countries where these names are used are not specifically associated with each of the three species, with the exception of the name Osun in Nigeria for *P. osun*:

Pilot name	Botanical names	Vernacular names
African padauk	Pterocarpus osun Craib Pterocarpus soyauxii Taub. Pterocarpus tinctorius Welw.	Kisésé (CG) ; M'Bèl (CM, GA) ; Mongola (CD) ; Mukula (CD) ; N'Gula (CD) ; Osun (NG) ; Padouk (CF) ; Palo rojo (GQ) ; Tacula (AO)[18]

DISTRIBUTION AND GENERAL CHARACTERISTICS OF *PTEROCARPUS SOYAUXII, PTEROCARPUS OSUN,* AND *PTEROCARPUS TINCTORIUS*

The distribution and general characteristics of the three Padauk species are taken from the book Prota - Lumber 1[19]:

15. Five species of the *Pterocarpus genus* from Southeast Asia are traded: *Pterocarpus macrocarpus* and *Pterocarpus marsupium* (pilot name: Padauk Burma); *Pterocarpus dalbergioides* and *Pterocarpus indicus* (pilot name: Padauk Amboina); *Pterocarpus santalinus* (trade name: false red sandalwood), a species listed in Annex II of the CITES (14 February 2021). The *Pterocarpus officinalis* species (pilot name: Drago) is harvested in South America.

16. Listed in Annex II of the CITES (version: 14 February 2021).

17. Two African Pterocarpus species that are not traded are cited in the reference literature*:
Pterocarpus tessmannii (Equatorial Guinea, Gabon, DRC), whose red timber could be found in commercial batches of African Padauk.
Pterocarpus mildbraedii (Liberia, Cameroon, Equatorial Guinea, Gabon) whose heartwood is white, hence the name "White Padauk" that is sometimes used in publications; this name is not used by operators in the sector.
*Sources: Flore du Gabon, Leguminosae - Papilionoideae (van der Maesen L., Sosef M., 2016); Useful trees of Gabon (Meunier Q., Moumbogou C., Doucet J.L., 2015); Trees of Central Africa's dense forests (Vivien J., Faure J.J., 2011); PROTA Lumber 1 (Louppe D. (ed.), Oteng-Amoako A.A. (ed.), Brink M. (ed.), 2008).

18. CG: Congo; CM: Cameroon; GA: Gabon; CD: Democratic Republic of Congo; NG: Nigeria; CF: Central African Republic; GQ: Equatorial Guinea; AO: Angola

19. Louppe D., Oteng-Amoako A.A., Brink M. (Publishers), 2008. **Plant Resources of Tropical Africa 7(1)**, Timbers 1. 2008. PROTA Foundation, Wageningen, Netherlands/Backhuys Publishers, Leiden, Netherlands/ CTA, Wageningen, Netherlands. 785 pgs.

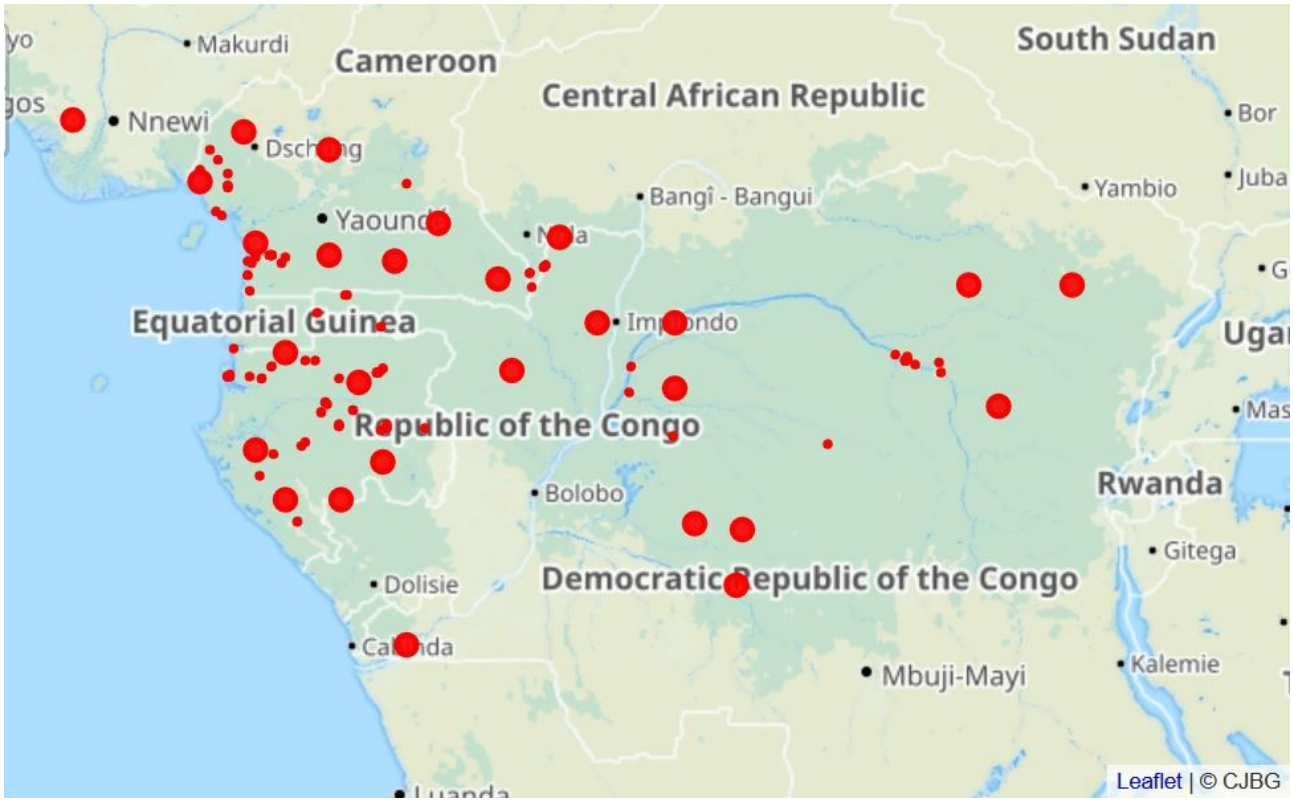
* *Pterocarpus soyauxii* is found from south-eastern Nigeria to eastern Democratic Republic of Congo, and southward to northern Angola. The tree can reach 55 m in height; its bole is straight and cylindrical, without branches up to 20 m, and reaches 1.4 m in diameter. This species is the most common of the three Padauk species and accounts for most of the volumes that are sold.

* *Pterocarpus osun* is endemic to southern Nigeria, Cameroon and Equatorial Guinea. The tree is small to medium in size, sometimes reaching 30 m in height but most often of a much smaller stature; its bole is often short and tortuous. The timber of the noblest boles is sold in small quantities, often in mixture with *Pterocarpus soyauxii*.

* *Pterocarpus tinctorius* is present in central, eastern and southern Africa, from the Congo and the Democratic Republic of Congo to Tanzania and southwards to Angola, Zambia, Malawi and Mozambique. This species is the most eastern of the three species of Padauk. The tree is small to medium in size medium size, reaching up to 25 m high; its bole, free of branches sometimes up to 15 m, is often straight and cylindrical, reaching 0.75 m in diameter. This timber is sold in small quantities on the international market.

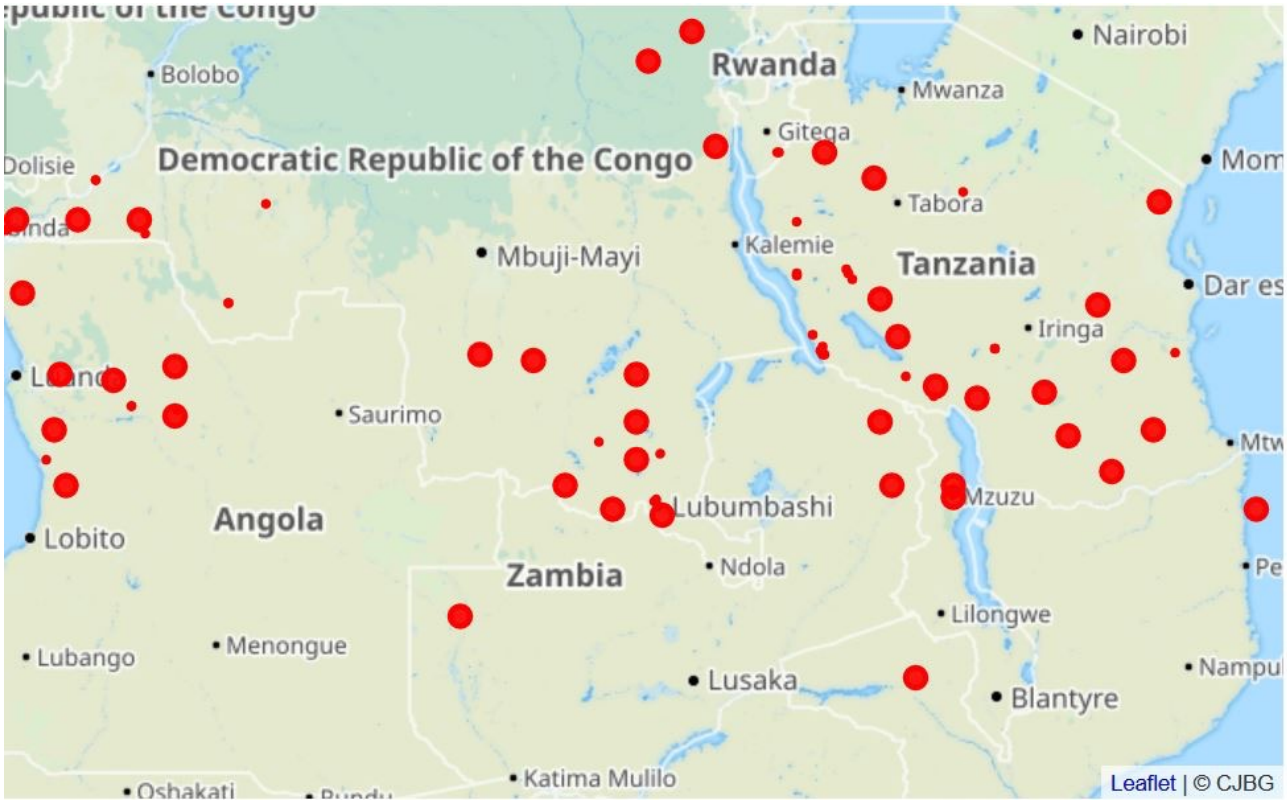
The following three maps show the geographical distribution of the three species in Africa (based on observations made in the framework of the **African Plant Database** project

https://africanplantdatabase.ch/



Geographical distribution of Pterocarpus soyauxii

Geographical distribution of Pterocarpus osun



Geographical distribution of Pterocarpus tinctorius

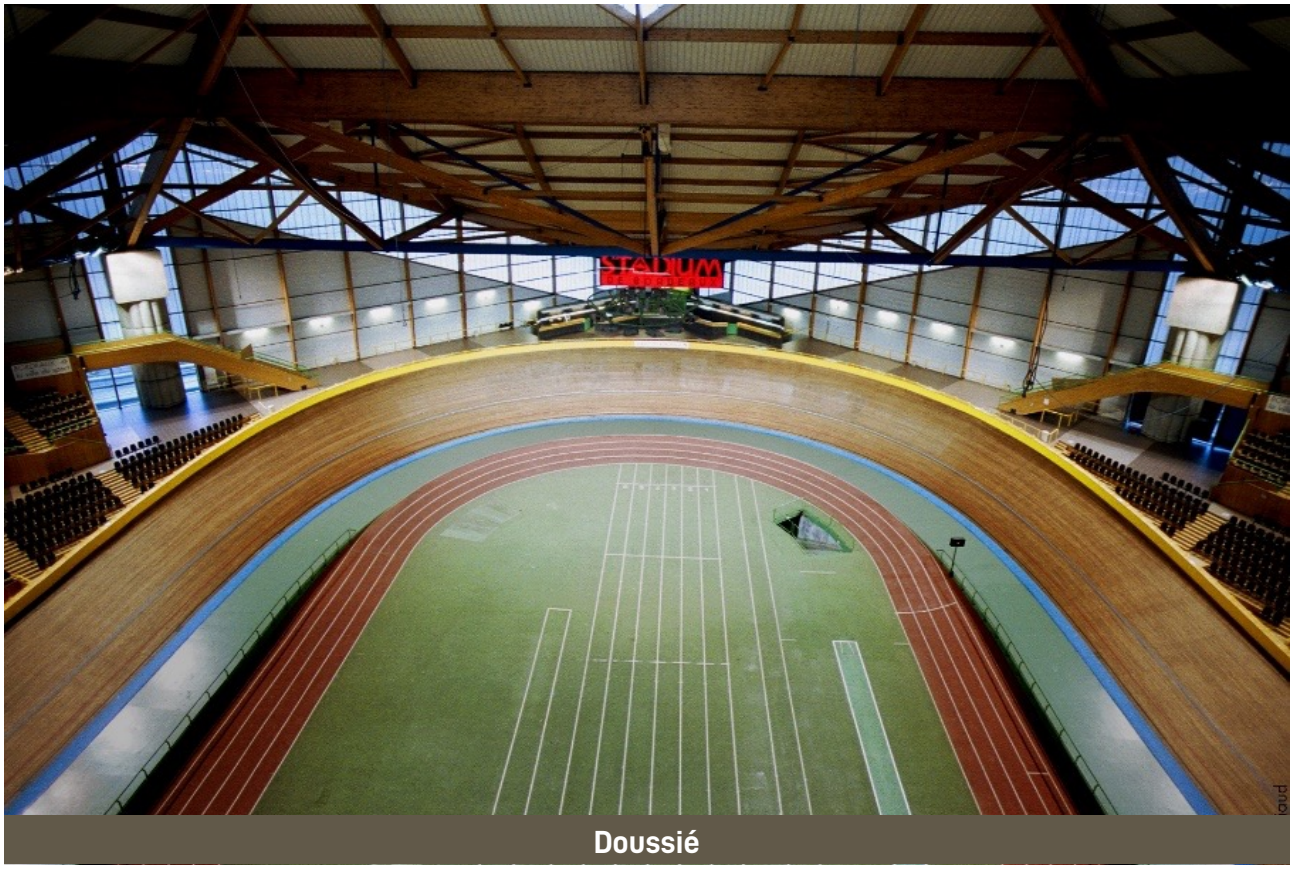
DISTINCTION BETWEEN THE *PTEROCARPUS* SPECIES AND NEW PILOT NAMES

Differences in geographical distribution, log quality, and availability between the three species of *Pterocarpus* lead to questions regarding the coherence of their grouping under the same pilot name.
The listing of the *Pterocarpus tinctorius* species in Annex II of the CITES (14 February 2021) was a triggering factor that made it necessary to distinguish it from the other two species of the genus.

As a result, ATIBT's *Materials and Standardisation Commission* has validated the following names:

Pterocarpus soyauxii Taub. et *Pterocarpus osun* Craib : **Padouk d'Afrique**
Pterocarpus tinctorius Welw. : **Tinctorius**[20]

These new correlations between botanical names and pilot names will be included in the next edition of the *General Nomenclature of Tropical Timber*. For the time being, they are an addendum.



Bordeaux's Velodrome Stadium bicycle track - France (© APC Viaud - AXEL VEGA)

20. = Tinctorial in French

Doussié

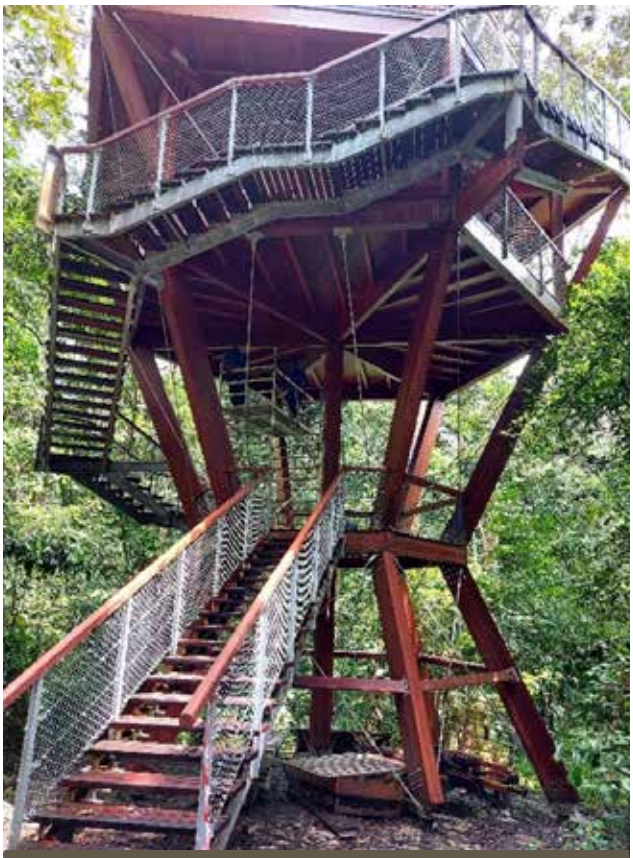
Storefront facade cladding - Andorra
(© Michel Vernay, CIRAD)
Excerpt from Tropix V7

Pachyloba

Pachyloba pepper mill -
Brûlerie Moderne, Douala, Cameroon
(© Emmanuel Groutel, WALE)

Padauk

Facade of the Ministry of Water and Forests, Libreville - Gabon
(© Jean Gérard, CIRAD) Excerpt from the *Tropical Timber Atlas*

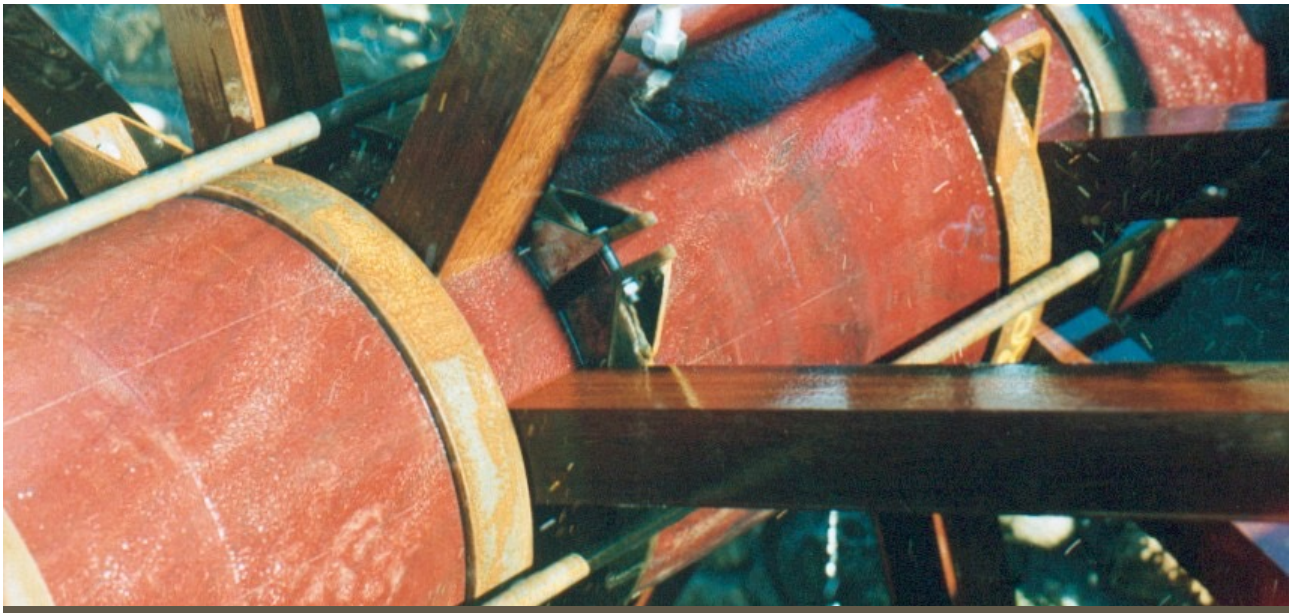


Padauk

Educational tower at the Raponda Walker Arboretum, Cap Esterias - Gabon. Ecowood manufacturing (© Emmanuel Groutel, WALE)
https://www.gabonreview.com/arc-demeraude-une-salle-de-classe-perchee-dans-les-arbres-a-larboretum-raponda-walker/

Padauk

Details of a post, railing, crossbeam and connectors of the Raponda Walker Arboretum's educational tower, Cap Esterias - Gabon Ecowood fabrication (© Emmanuel Groutel, WALE)



Padauk

Hub with Ipê spokes on a paddle wheel (or mill) feeding the hydraulic irrigation network for market gardening in Cazilhac, Hérault - France (© Michel Vernay, CIRAD)
Excerpt from Bois et Forêts des Tropiques num. 269 (3), pgs. 102-104

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