Interim Report

Wood anatomy of *Sterculia quinqueloba* and *Sterculia appendiculata* from Mozambique – a comparative approach for identification purposes

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ABSTRACT

A comparative wood anatomy description of two lesser known wood species from Mozambique (*Sterculia quinqueloba* K. Schum and *Sterculia appendiculata* K. Schum) was carried out in order to reveal typical anatomical features to be used for identification purposes using the Inside Wood datasheet coding system. The study concluded that *Sterculia quinqueloba* has in prismatic crystals and tyloses in the heartwood vessels as the main typical anatomical features that markedly distinguish this species with its closest sister family member of the *Sterculiaceae*, the *Sterculia appendiculata* K. Schum

Key words: *Sterculia appendiculata, Sterculia quinqueloba, Sterculiaceae, wood anatomy, wood identification.*

INTRODUCTION

Like many other tropical countries, the flora of Mozambique is rich in biodiversity. This is easily evidenced by the extensive network of conservation or protected areas largely composed by Forest reserves, Game Reserves and National Parks amounting to about 22 % of the 65 millions hectares of the total forested area across the country. The remaining 51 million hectares of the national forest is mainly aimed at timber production and is hosting about 120 commercial hardwood species [1], [5], [3].

Thus, given the abundance and similarity of many wood species, the identification process can be difficult to ascertain. Correct wood identification ensures that a certain wood species is assigned to the appropriate end-use according to its properties. Some benefits regarding correct wood identification include restoration of ancient and historical wooden buildings, track of trade routes by historians. Additionally, since different wood anatomies represent different climates, correct identification of ancient woods may help to reconstructing ancient ecosystem and report climate change [8].

Amongst the local commercial hardwood species, there are two lesser used similar species from *Sterculiaceae*, namely *Sterculia quinqueloba* (metonha) and *Sterculia appendiculata.* In one hand, *Sterculia quinqueloba* locally known as metonha is a lesser known wood species growing in Mozambique. The wood of metonha is locally marketed and occasionally exported, but its availability in the forest is rapidly declining. On other hand, *Sterculia appendiculata* known as metil is an emerging commercial wood relatively more abundant than its counterpart

Due to this situation, metonha is currently regarded as endangered and therefore red listed by [6] as well as by national authorities. Since endangered species are also part of the natural heritage, full description would be of great importance for many purposes including their identification. Moreover, there is a growing concern that in the near

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future metonha timber can still be traded as metil. Unlike other methods, the use of anatomical features as been regarded as reliable way for wood identification purposes. In this context, this study is intended to provide comparative wood anatomical features following [2] coding system from which both species can easily be separated from each other in the future.

MATERIAL AND METHODS

Sampling site

Samples from both species were taken from logs in sawmill in the province of Cabo Delgado, northen Mozambique. Both species grow alongside in the same forest stand geographically located at: S12º 15´39.5´´ and E 39º11´57.4´´; Altitude is 376 m. This region has typically open dry forest frequently subjected to fire by local people as consequence of either shift cultivation or hunting routines. According to [4], the climate of this region is mostly semi-arid, sub-humid and dry with an annual average precipitation ranging from 800 to 1000 mm and reported temperature varying from 20 ^{o}C to 25^{o}C on average per year.

Light microscopy and analyses

Sections used for light microscopy examination were prepared after boiling small blocks of wood in water with 10% glycerin for 4 h in a 200 ml beaker. Afterwards the samples were rinsed with water and left in water overnight.

Anatomical features were described using terminology described in [2]. Semi-thin sections (20-40 μm) were cut using a Leitz sliding microtome and examined using Leica DMLB light microscope. In order to increase contrast some sections were stained either with 1% lactophenol blue or 1% saffrarin. Quantitative features like vessel density, vessel lumina diameter, number of rays and vessel element length were determined with the help of software Image-Pro® Plus version 1. The IAWA coding system also known as Inside Wood Datasheet was filled out both wood species. The description of *Sterculia appendiculata* has been taken from [7].

RESULTS & DISCUSSION

Wood anatomy of *Sterculia quinqueloba* K. Schum

This wood species has growth rings boundaries indistinct or absent, but marginal bands of parenchyma can be mistaken as growth ring. The vessels are disposed in radial pattern largely as solitary and occasionally radial multiples composed of 2-3 vessels. Single vessel is round shaped with simple perforation plates. Intervessel pits are scalariform, opposite and more than 10 µm in size. Vessel – ray pits have distinct borders and are similar to intervessel pits in size and shape. Helical thickenings were not observed. On average, the tangential diameter of vessel lumina is more than 200 µm. Metonha has very low vessel density ($\leq$ 5 vessels/mm^2). The vessel element length is in the range 300-400 µm. Following is a typical cross section of metonha:

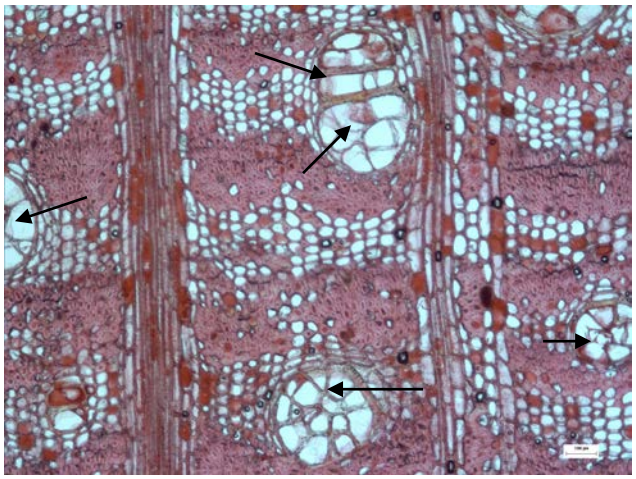

Fig.1- Cross section of *Sterculia quinqueloba*- Tyloses in the heartwood vessels (arrows)

In terms of heartwood extractives, tyloses are very common filling up the vessels. The fibers are thick walled, bordered pits, non septate.

Cross sections show predominantly axial parenchyma as apotracheal, confluent, winged to aliform, in bands mostly more than 3 cells wide. This set of cells is fusiform composed of 3-4 cells per strand and occasionally more than 4 cells were observed. Tangential sections revealed rays having commonly 4-10 seriate cells in width and predominantly more than 1 mm in length. Radial sections exhibit procumbent, square, upright cells mixed along ray. These rays are surrounded by sheath cells and they were observed at most 4 rays/mm.

In terms of mineral inclusions, prismatic crystals were observed either in radial alignment in procumbent ray cells, both in chambered and non chambered axial parenchyma or in tyloses within heartwood vessels. The following figures show prismatic crystals occurring in the aforementioned cell types:

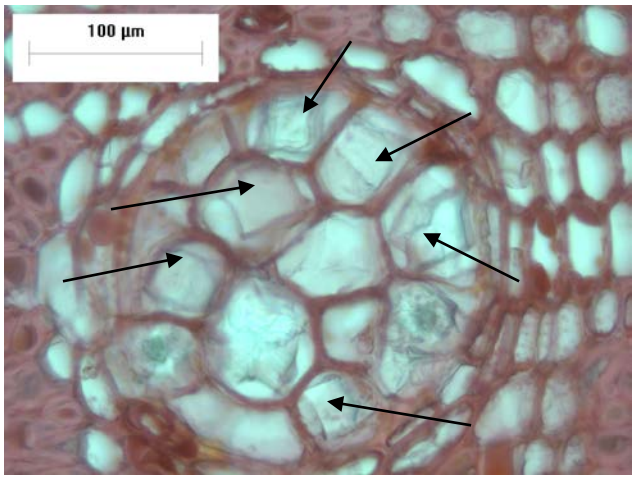

Fig. 2 – Cross section - Crystals observed in tyloses (arrows)

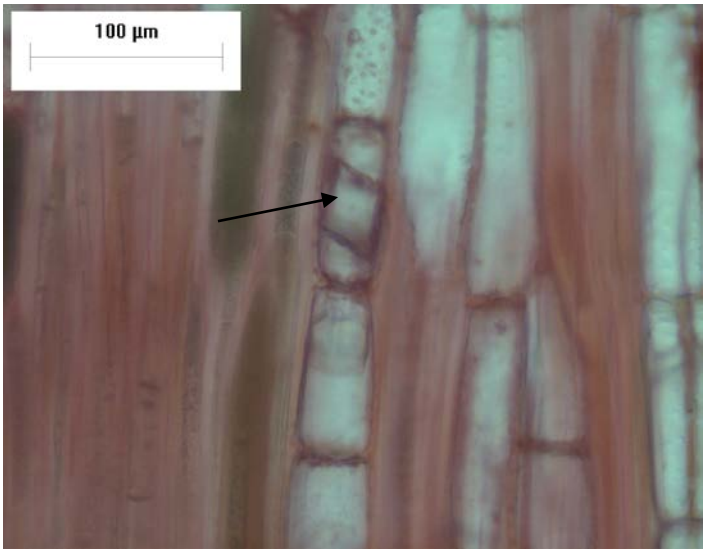

Fig. 3 – Metonha tangential section showing crystals in axial parenchyma cells

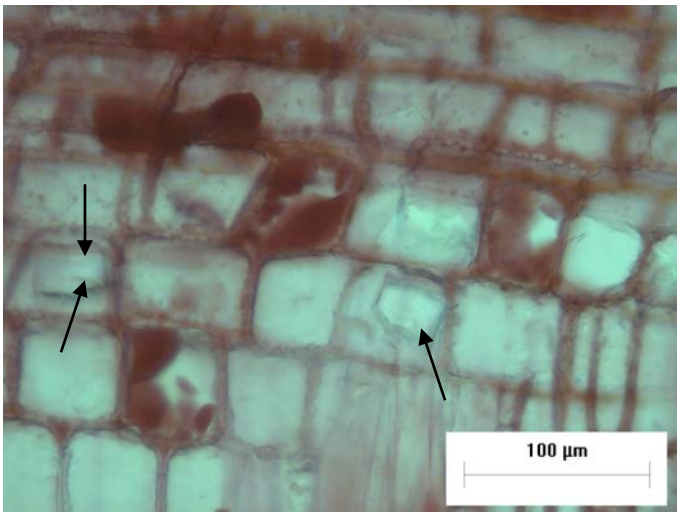

Fig. 4 – Metonha radial view- Crystals (arrows) in radial alignment (within ray cells)

Wood anatomy of *Sterculia appendiculata* K. Schum (Metil), Fig. 5

According to [7], this wood species has straight grain and the growth ring boundaries are indistinct. Heartwood and sapwood were not distinguishable at the macroscopic level. Vessels diffuse, 3 (1--4)/sq. mm, lumen diameter 371(195--527) µm, solitary or in radial pairs, rounded and oval in TS, perforations simple, intervessel pits alternate, (8--10 µm in size, Fig. 5A, F). Vessel-ray pits with reduced borders to simple and similar to the intervessel pits in size and shape. Vessel element length 489 (298--583) µm. Tyloses, gums or other deposits absent from the heartwood vessels. Fibres 2220 (1500--2750) µm long, thick-walled 6 (4--9) µm, in bands that are narrower than the very broad axial parenchyma bands (Fig. 5 A, B). Ground tissue fibres with simple to minutely bordered pits. Axial parenchyma in 3--20 cells wide bands, in strands of 3--4 cells, storied (Fig. 5B). Prismatic crystals in both chambered and non-chambered axial parenchyma cells (Fig. 5D-arrows).

Rays, 1--4/mm, (--3), 3--17 seriate, 1429 (500--3000) µm tall, composed of procumbent central cells, with 1--4 rows of square to upright marginal cells, and surrounded by sheath cells (Fig. 5B, E).

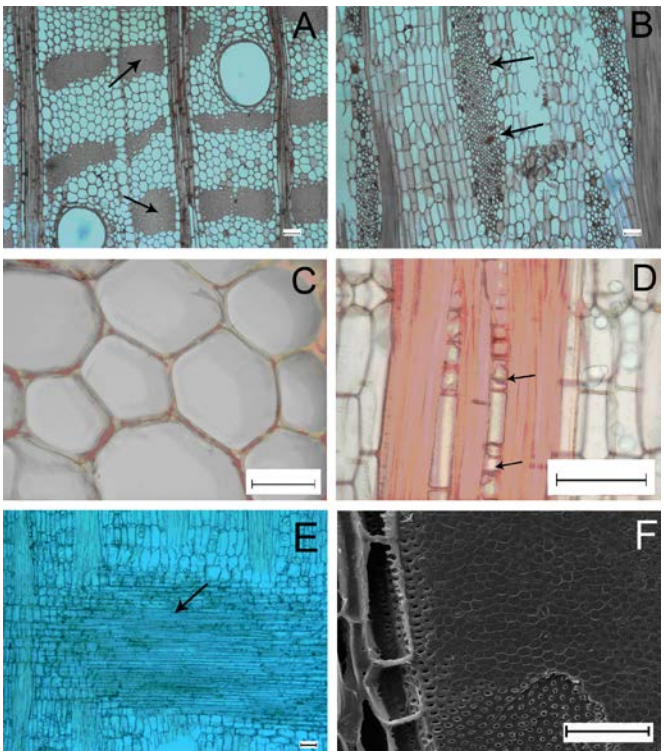

Fig.5 Micrographs of *Sterculia appendiculata* from [7]

Comparative wood anatomy for both *Sterculiaceae*

The anatomical features of metonha (*S. quinqueloba*) can easily be mistaken from those of its family member (*Sterculia appendiculata*). However, typical anatomical features distinguishing both species are the pattern occurrence of prismatic crystals and presence of tyloses in the heartwood vessels (see Fig 1 & Fig 5 A). Metil has prismatic crystals only observed in axial parenchyma cells (Fig. 5D) while metonha (*S. quinqueloba*) also exhibit this trait in axial parenchyma cells, but also in tyloses and procumbent ray cells (radial alignment) (Figs. 1, 2, 3 & 4). The remaining anatomical features of both species are similar.

CONCLUSIONS

The objective of this study was to provide typical wood anatomical traits to be used for distinguishing the two similar wood species using [2] coding system also used in Inside Wood database. In this respect, *S. quinqueloba* (metonha) can be identified under the following codes: 2-5-7-13-20-21-27?-30-43-46-53-56-66-69-84-85-90-92-98-104-109-110-114-139-141-142-179-189-192-199. With regard to *S. appendiculata* (metil), the following codes apply:

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