



Wood Anatomy of *Millettia leucantha* Kurz

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ABSTRACT

Millettia leucantha Kurz belongs to the family Fabaceae. The wood sample of *M. leucantha* was collected from the botanical garden of Scientific Equipment and Research Division, Kasetsart University Research and Development Institute. The sample was made into permanent slides. The preparation of the wood sample was processed with a sliding microtome. The wood anatomical structure was studied under a light microscope and a field emission scanning electron microscope. The results showed that the wood is diffuse porous. Pores are solitary and multiples (2-9). Rays are uniseriate heterocellular and multiseriate heterocellular (Krib's Typell). Vessels are round to oval shapes. Intervessel pits are bordered pits and alternate pitting arrangement. Axial parenchyma cells are banded paratracheal. The transverse section of wood showed that the parenchyma bands are wider than the fiber bands. Starch grains are found in axial parenchyma and rays. Prismatic crystals present in axial parenchyma. The results from this study reveal basic anatomy of *M. leucantha* wood which will be applied to classify species in genus or evaluate of wood properties.

INTRODUCTION

Millettia leucantha Kurz belongs to Fabaceae. There are about 200 species in this genus. It is a native plant to Bangladesh, Cambodia, South-Central China, Laos, Myanmar, Vietnam and Thailand. Thai name is "Sathon". It is a deciduous tree which has a height about 6-7 meters [4, 11]. Many *Millettia* species have a potential of traditional medicine for wound healing, inflammation and skin diseases [12]. Its wood can be used for making cabinet and producing high quality furniture [3]. The anatomical character of wood distinguishes genus in Mimosaceae [9]. Perez-Lara *et al.* (2019) found that characteristics of wood such as size, shape and arrangement of pit, size of vessel, types of crystals support the inclusion to identify fossil woods in Fabaceae family. Several studies have investigated the anatomical wood structure and it can be used for identification among genera or families [1, 10, 13]. This study aims to investigate the wood characteristics which relate to wood properties and to identify *M. leucantha* Kurz.

METHODOLOGY

The wood sample of *M. leucantha* Kurz was collected from the botanical garden of Scientific Equipment and Research Division, Kasetsart University Research and Development Institute, Bangkok, Thailand.

1. Macroscopic study

Wood samples were cut into small cubes 1x1x3 cubic centimeter. They were sectioned by a sliding microtome (Leica, SM2010R) into

80 µm thickness. The sections were observed under a light microscope (Carl Zeiss, AxioStar plus).

2. Microscopic study

2.1 Permanent slide preparation of wood sections

Wood samples were cut into sections in transverse, radial longitudinal and tangential longitudinal sections (three surfaces) using a sliding microtome (Leica, SM2010R) with 20 µm thickness. Three cubics were used and 10 sections of each cubic were performed. The sections were stained with safranin O for 1 hour, washed with distilled water for 3 times and then subjected to ethanol series with 30%, 50%, 70%, 95% and absolute ethanol, respectively. The sections were immersed in xylene for 6 hours and mounted with permount.

2.2 Scanning electron microscope observation

Wood samples were cut in 3 surfaces (transverse, radial longitudinal and tangential longitudinal sections) using a sliding microtome (Leica, SM2010R) with 20 µm thickness. The sections were dehydrated with ethanol series (30%, 50%, 70%, 95%, 100%) and subjected to the critical point dryer (Quorum, K850) and coated with platinum particle using sputter coater (Quorum, 150ES). The samples were observed under field emission scanning electron microscope at 5 kV (Hitachi, SU8020).

2.3 Data collection

Vessel diameter, ray number, ray size as well as width and wall thickness of fiber were measured from 100 replicates.

RESULTS

Macroscopic characters

The wood is yellowish to pale brown, no luster and odorless. Growth rings are indistinct. (Figure 1A). Wood grain is straight.

Microscopic characters

The wood is diffuse porous with solitary pores and multiple (2-9) pores (Figure 1B). Vessels are round to oval shaped with simple perforation, $33.88\text{--}204.17 \pm 39.13 \mu\text{m}$ diameter and $28.50\text{--}293.98 \pm 58.89 \mu\text{m}$ length (Figure 1B). There are 10 pores/ mm^2 . Intervessel pits are bordered with alternate arrangement (Figure 1D, 1E). Rays are uniseriate heterocellular and multiseriate heterocellular (Krib's type II) (Figure 1C). The uniseriate ray is $14.20 \pm 6.86 \mu\text{m}$ width and $97.63 \pm 30.9 \mu\text{m}$ height. The multiseriate ray is $38.23 \pm 17.15 \mu\text{m}$ width (2-5 rows) and $179.84 \pm 38.74 \mu\text{m}$ height. The numbers of rays are 9 ± 1.76 rays/mm. Axial parenchyma cells are banded paratracheal (Figure 1B). Uniseriate and multiseriate rays consist of procumbent and upright cells (Figure 1F). Gum deposit is observed in vessel lumens (Figure 2A). Starch grains are found in axial parenchyma and rays (Figure 2B, 2C). Prismatic crystals present in axial parenchyma (Figure 2B). Fibers are libriform with $7.48 \pm 2.09 \mu\text{m}$ diameter and $3.62 \pm 0.72 \mu\text{m}$ wall thickness. The quantitative data and wood characteristics were presented in table 1.

DISCUSSION

M. leucantha has indistinct growth ring boundaries which are very common in tropical tree such as Anacardiaceae, Mimosaceae [6]. Wood grain is straight orientation, parallel to the longitudinal axis. This kind of grain orientation significantly affect wood strength. [8]. Forest research and development office (2005) reported that *M. leucantha* is hardwood because it has the static bending property modulus of rupture (MOR) more than 1000 kg/cm^2 which durable in nature more than 6 years. *M. leucantha* wood characteristics possible relates to the size of vessel and the thickness of fiber cell wall. The wood has small vessels and thick wall fiber which cause high hardness. As a result, the wood has potential for furniture making and construction. Chiwapreecha *et al.* (2016) reported that the gum deposit is also observed in *M. brandisiana* Kurz. Wood deposits such as resins, gum, crystals, silica, tannins and oils are usually occur in the woods of Fabaceae member. Some wood deposits can protect wood against termites, beetles and fungi [7, 14]. The characteristics of wood such as sizes, shapes and arrangement of pit, sizes of vessel, types of crystals support the inclusion to identify woods in Fabaceae, Anacardiaceae, Fagaceae families [2,10 13].

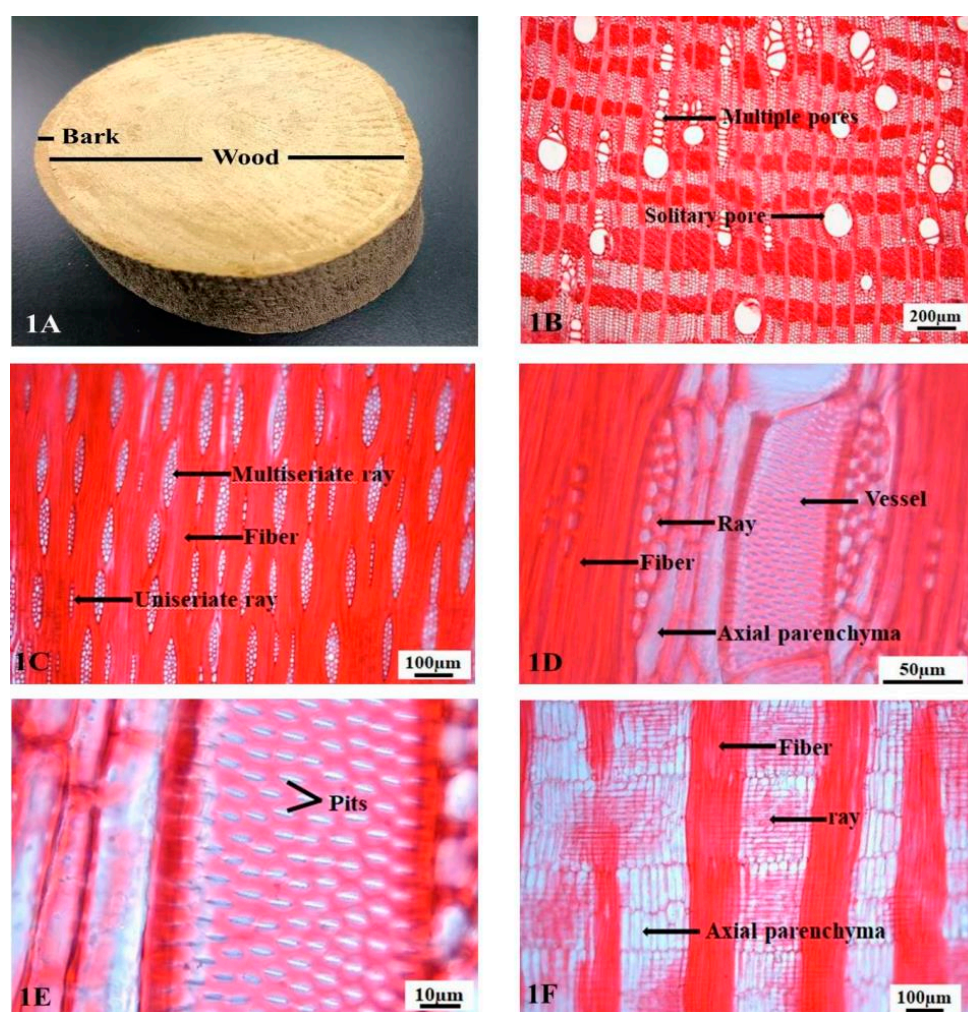


Figure 1. Light micrographs of wood characteristics of *M. leucantha* Kurz 1A Transverse surface of wood, 1B Pores in transverse surface, 1C Uniseriate and multiseriate rays in tangential surface, 1D Vessel and axial parenchyma in tangential surface, 1E Intervessel pits, 1F Multiseriate rays and axial parenchyma in radial surface.

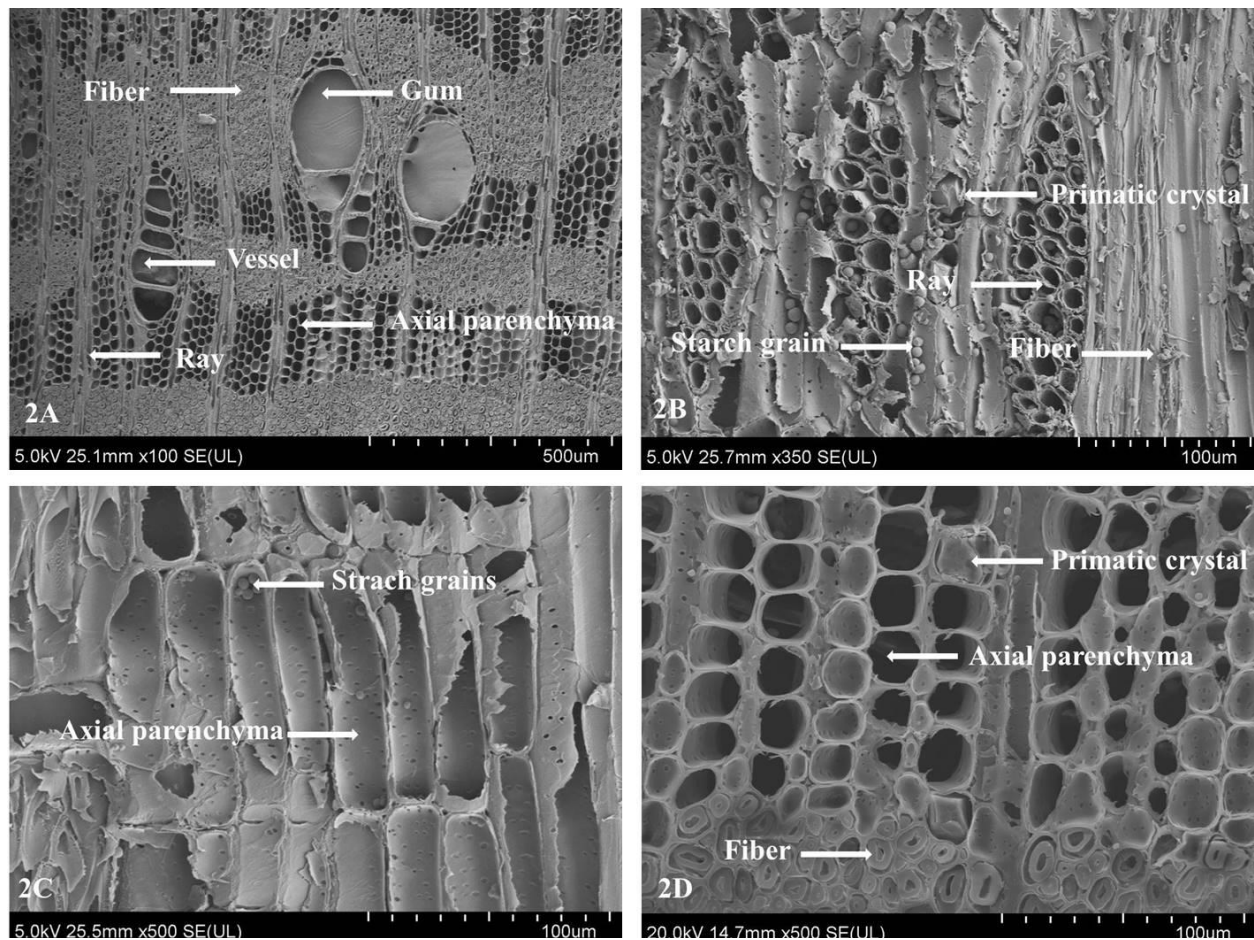


Figure 2. Scanning electron micrographs of *M. leucantha* Kurz wood 2A Transverse surface, 2B Starch grains and prismatic crystals in tangential surface, 2C Axial parenchyma in radial surface, 2D Transverse surface of fibers and axial parenchyma.

Table 1. Quantitative data and anatomical characteristics of *M. leucantha* Kurz wood.

Vessel Diameter (μm)	Vessel Length (μm)	Uniseriate ray		Multiseriate ray		Ray number (Rays/mm)	Fiber	
		Width (μm)	Length (μm)	Width (μm)	Length (μm)		Wall thickness (μm)	Diameter (μm)
102.08±39.13 (33.88-204.17)	120.19±58.89 (28.50-293.98)	14.20±6.86 (5.63-24.79)	97.63±30.9 (53.15-144.11)	38.23±17.15 (12.45-92.42)	179.84±38.74 (94.67-364.06)	9±1.76 (6-13)	3.62±0.72 (2.27-4.55)	7.48±2.09 (3.64-10.91)

CONCLUSION

M. leucantha wood is diffuse porous and growth ring indistinct. There are two types of rays, uniseriate heterocellular and multiseriate heterocellular rays. Axial parenchyma are banded paratracheal. The wood showed a potential for construction and furniture making. The anatomical characteristics of wood are important data for species identification and evaluate wood property.

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