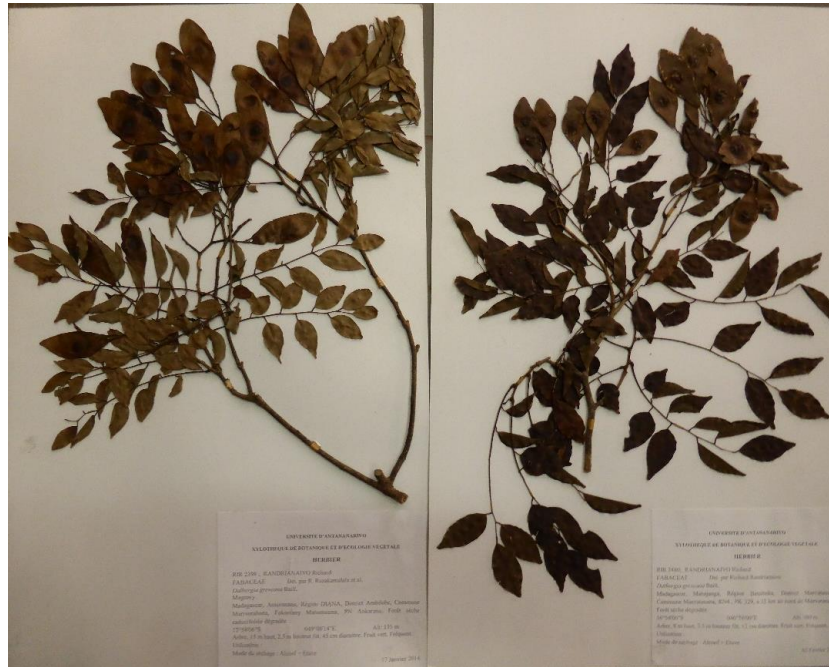


Madagascar's progress in the implementation of the CITES action plan on Wood ID



Forest Legal Alliance meeting
July 6-7, 2016
Washington DC



Aro Vonjy Ramarosandratana
CITES Scientific Authority
University of Antananarivo
Madagascar

CITES COP 16 - The Madagascar Action Plan on Dalbergias and Diospyros (Scientific part)

...

Madagascar should:

- Identify the species that are subjected to trade
- Establish Non Detriment Finding and quotas
- Establish ID tools

Wood ID tools, a pre-requisite to CITES listings of trees

...

- To ensure reliable ID along the value chain
- Tools must be developed and reside in Madagascar



Taxonomy is at the basis of reliable sID tool

...

- A need to establish an authoritative and complete reference library





Establishing a reference library for Malagasy Diospyros and Dalbergia

Dr. Sylvie ANDRIAMBOLOLONERA
Missouri Botanical Garden

Why building a reference library?

...

- To provide the material required by the scientific community to build the set of identification tools
- To serve as a reference for technical experts when they use these identification tools to support management and enforcement

What should be included in?

...



→ TAXONOMY → Herbarium specimen

→ MOLECULAR → DNA barcodes

→ WOOD ANATOMY → Micrography of anatomical characteristics

→ WOOD CHEMISTRY → Chemical profiles

Every botanical material has a unique number

...



Developing Wood technologies in Madagascar



Dr. Tahiana RAMANANANTOADRO
School of Agronomy and Forestry

Progresses in Wood ID technologies



...

- Update of the xylarium of DRFP-FOFIFA and ESSA-Forêts
- Description of the macroscopic wood anatomy of 302 native species belonging to 9 families
- Development of Wood Science Laboratory since 2008
- Use of Near Infrared Spectroscopy (NIRS) to determine geographic provenance of Eucalyptus
- Use of Near Infrared Spectroscopy (NIRS) to identify wood species - ongoing project



Updating of the xylarium of DRFP- FOFIFA and ESSA-Forêts



...



- **DRFP-FOFIFA** : 9 288 specimen, 848 species belonging to 393 genera and 99 families
- **ESSA-Forêts** : 505 specimen, 69 species belonging to 51 genera and 31 families

Description of the macroscopic anatomy of 302 native species belonging to 9 families



- 9 families

Euphorbiaceae, Fabaceae, Lauraceae, Myrtaceae, Proteaceae, Phyllanthaceae, Rhizophoraceae, Rubiaceae, Sapotaceae



- Sanding of RT plane

- Description:

- Observation using hand lens (x10)
- Image acquisition
- 40 criteria: 33 IAWA anatomy, 7 sensory
- Database Microsoft ACCESS

The screenshot shows the 'DescriptMacro' software interface. It features a sidebar with navigation options: 'Rechercher...', 'Tables', 'Descript...', 'Formula...', and 'Descript...'. The main window contains a form with the following fields:

- DescriptMacro** (Title)
- FAMILLE** (Text input)
- NPROV** (Text input)
- Genre** (Text input)
- REF** (Text input)
- Genre_espece** (Text input)

Below these are rows of dropdown menus for various criteria:

- A-Cernes: 2_Cernes invisible; IAWA-77: Absent; IAWA-89: Absent; S-Couleur: Marron ou nua
- B-Porosit: 5_Bois à pores diff; IAWA-78: Absent; UFR-85'_E: Absent; IAWA-201: Absent
- C-Arrang: 8'_Sans arrange; IAWA-79: Absent; UFR-86'_E: Absent; IAWA-203: Absent
- D-Group: 9_Vaisseaux exclus; IAWA-80_: Absent; UFR-85''_E: Absent; UFR-203'_S: Absent
- E-Tailles: 40_Petit; IAWA-81_: Absent; K-Tailles c: 96'_Fines
- IAWA-45: Absent; IAWA-82_: Absent; L-Tailles c: 96''_Rayons moins
- G-Fréque: 46_Très rare; IAWA-83_: Absent; IAWA-103: Absent
- UFR-50'_I: Absent; IAWA-84_: Absent; N-Fréque: 114_Rare
- UFR-56'_I: Absent; IAWA-85_: Absent; IAWA-118: Absent

At the bottom right, there is a 'Sauvegarder enregistrement' button and navigation controls (back, forward, search, and play/pause buttons).

Development of Wood Science Laboratory



...



NIRS-Near Infrared Spectroscopy



Climatic chamber



Core borer



Lab devices



Microscope



Oven

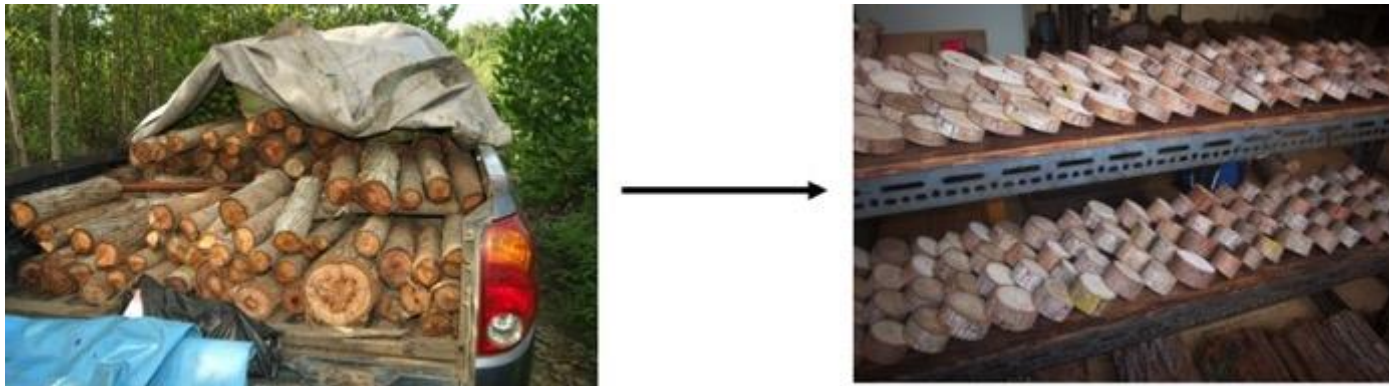


Acoustic BING device

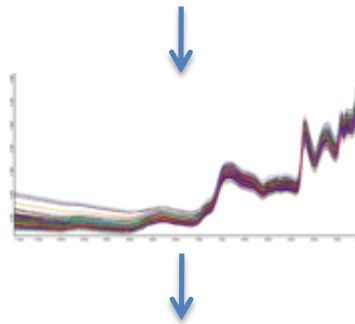
Use of Near Infrared Spectroscopy (NIRS) to determine geographic provenance of Eucalypts



...



- 267 eucalypts wood samples from seed orchard in Mahela
- 439 eucalypts wood samples from rural plantations located in 4 regions of Madagascar (Fianarantsoa, Andasibe-Moramanga, Anjozorobe, Manjakandriana)



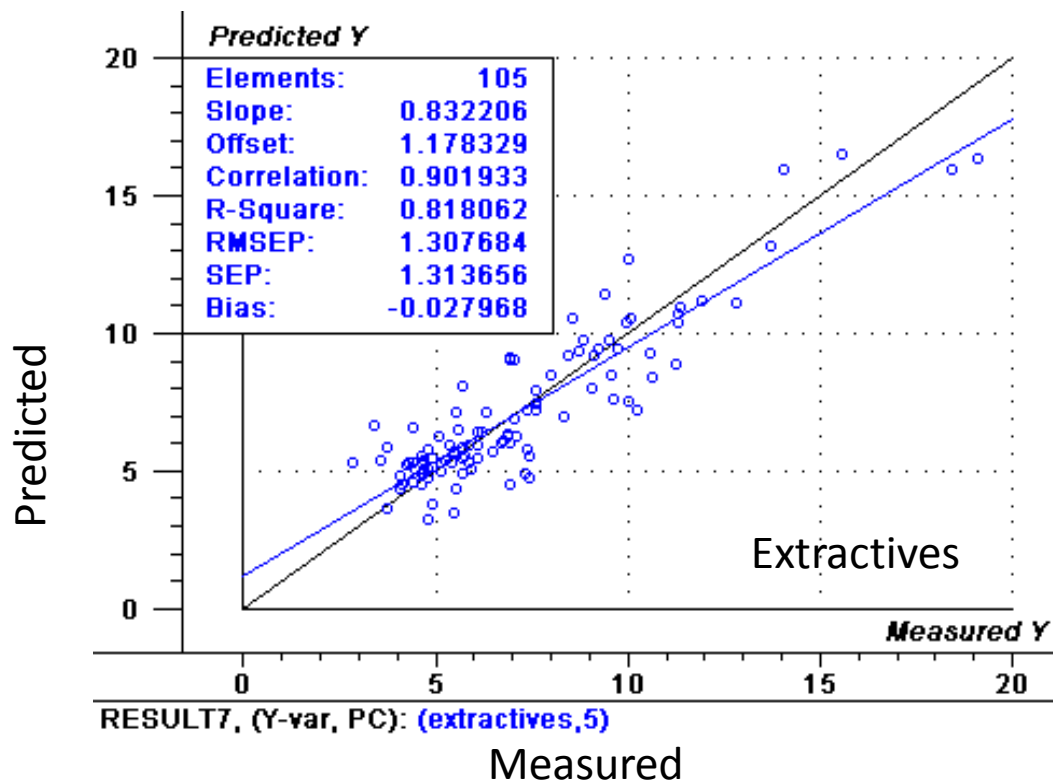
85% of the geographical provenances of the eucalypts wood samples were correctly identified using NIRS

Use of Near Infrared Spectroscopy (NIRS) to identify wood species - Ongoing project



...

- Prediction of chemical properties: to differentiate Rosewood from Palissander (both belonging to DALBERGIA family)



Extractives, lignin, cellulose, hemicellulose contents correctly predicted by NIRS

Stem anatomy of *Dalbergia* and *Diospyros* species from Madagascar



Dr. Harisoa RAVAOMANALINA
Dept. Plant Biology and Ecology

• The first anatomical atlas about Malagasy precious wood (Harisoa Ravaomanalina, Alan Crivellaroly, Fritz Schweingruber)

Dalbergia louvelii R. Vig.

EN: Rosewood FR: Bois de rose ML: Andramena, Bolabola

Stem xylem: 2 9 8 1 11 13 22 23 1 23 30 - 42 47 52 56 58 61 66 - 70 - 77 82 83 85 90 91 - 96 1 102 2 106 115 118 120 121 122 136 142 154 180 189 192 196
 Branch xylem: 2 9 8 1 - 13 22 23 1 23 30 41 - 47 52 56 58 61 66 69 70 76 77 82 - 85 90 91 96 96 1 102 2 106 115 118 120 121 122 136 142 154 180 189 -
 Bark: 82 84 86 1 89 812 813 814 815 817 820 831 833 834
 Pith: P1 P3.3 P4 P9.1 P10.1 P15

Fabaceae

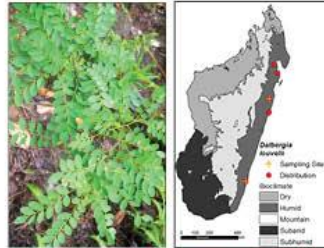
PLANT DESCRIPTION

Tree 8-10 m high and 18 cm dbh. Endemic to Madagascar. Exploited species.

DISTRIBUTION

Elevation: 0-999m. Vegetation formation: Forest. Bioclimate: Humid. PA: Betampona and Mananara-Nord. NPA: Mahabo-Mananivo.

Slides made from material from Betampona.

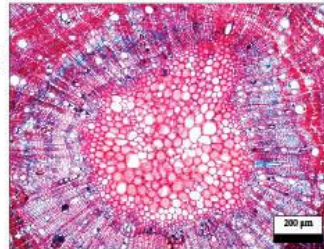


PITH AND PRIMARY XYLEM ANATOMY

Pith
Pith shape round to star-like. Thick-walled parenchyma cells present. Cells dimorphic. Simple pits in transverse cell walls. Vascular bundles clearly separated. Pith visible in polarized light.

Primary xylem

Vessels solitary and in short radial multiples. Fibers thin-walled in radial rows.



BRANCH XYLEM ANATOMY

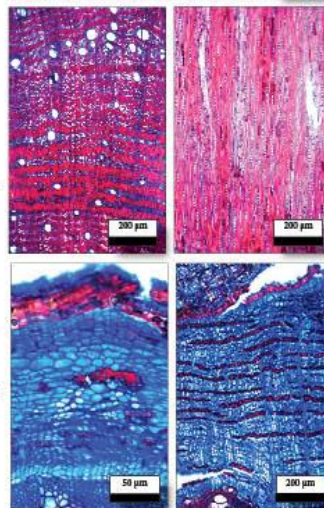
Description: Growth rings boundaries indistinct. Tangential diameter of vessel 50-120 µm, 9-22 vessels per mm². Vessel elements length 70-130 µm. Intervessel pits small 4-7 µm. Fibers thin- to thick-walled and thick-walled. Axial parenchyma diffuse, diffuse-in-aggregates, winged-aliform and in narrow lines of 1 to 3 cells. Ray high 40-180 µm, 8 to 16 per mm. Rays exclusively uniseriate.

Differences to stem: Vessel diameter is smaller than the stem (50-120 µm / 110-260 µm). Axial parenchyma bands are wider and fibres are very thick-walled in the stem. Rays are exclusively uniseriate in the branch while they are uni- and biseriate in the stem.

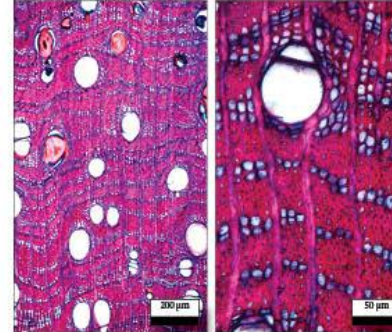
BARK ANATOMY

Bark juvenile: Non collapsed and collapsed sieve tubes with two or three fibre cells per group present. The cortex consists on irregular blue staining parenchyma cells and groups of fibres tangentially scattered or irregularly dispersed.

Bark adult: The phloem consist on alternating fibre bands and collapsed and non collapsed sieve tubes. Phellem homogeneous consists on regularly arranged of rectangular cells. Lignified cells in phellem distinct in polarized light.

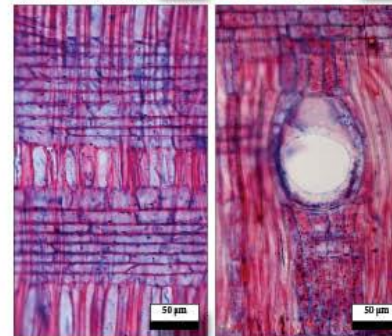


STEM XYLEM ANATOMY



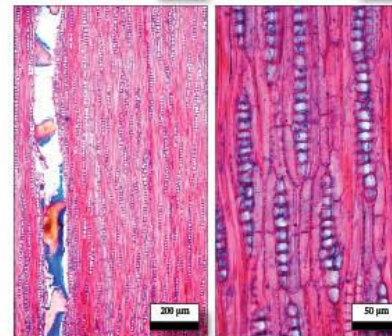
Transverse section

Growth rings boundaries absent. Vessels circular, solitary and in radial multiples of 2-7. Vessel in clusters of 2-4 present. Tangential diameter of vessel 110-260 µm, 5-20 vessels per mm². Gums common. Fibers very thick-walled. Axial parenchyma diffuse-in-aggregates, winged-aliform and in bands of 2-9 cells. Rays 9 to 15 per mm.



Radial section

Simple perforation plates. Intervessel pits oval to circular and alternate, 4-7 µm in diameter. Vessel-ray and intervessel pits similar, with distinct borders. Vessel element length 90-330 µm. Fibres with simple to minutely bordered pits (libriform fibers). Heterocellular rays, body ray cells procumbent with 1 row of upright and/or square marginal cells.



Tangential section

Rays uni- and biseriate, rays predominantly uniseriate. Ray high 50-410 µm with 4-17 cells in height. Fusiform parenchyma cells composed by 1-2 cells per strand. Rays and axial parenchyma irregularly storied. More than 3 prismatic crystals (7-13) of about the same size per chamber in axial parenchyma cells.

Dalbergia louvelii R. Vig.

Fabaceae

Dalbergia louvelii R. Vig.

Achievements (2013-2014)

- 19 *Dalbergia* and 31 *Diospyros* species were compared on their stem wood anatomy
 - Separation between *Dalbergia* species is possible by using ring porosity, ray type and ray width
 - Ray width and vessels grouping are used for *Diospyros* species
- Wood anatomical features can be used to differentiate at species level

Limits

- Each species were only represented with one wood specimen

Achievements (2015)

- Establishment of the first wood anatomy lab at the University of Antananarivo



Slicing



Staining

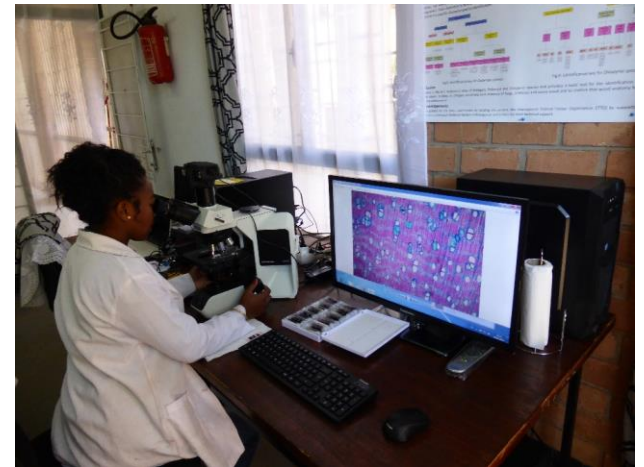


Image acquisition

Ongoing works (2016)

- A project with ETH Zurich funded by ITTO-CITES
“Establishment of a fully documented reference sample collection and identification system for all CITES-listed *Dalbergia* species and a feasibility study for *Diospyros* and look-alike species”

1- To start the anatomical description of 11 look-alike species

The wood anatomy of some other species looks macroscopically or anatomically similar to the protected rosewood and palisander (*Dalbergia*), as well as ebony wood (*Diospyros*).

2- To establish a reference samples collection

Based on herbarium and wood specimens for some Malagasy *Dalbergia* and *Diospyros* and look-alike species that are fully documented by taxonomists

To Do List:

- ⇒ To complete lab equipment in order to increase performances in routine analyses and maintaining of samples
- ⇒ To validate wood anatomy discrimination keys by including more samples per species
- ⇒ To develop user friendly wood ID tools to be used by enforcement officials
- ⇒ To develop capacities in collection and curation of reference collections for *Dalbergia*, *Diospyros* and look-a-like species



They opened the window at the right time and
help facing the rosewood crisis

...

- Three women, three pillars of Wood ID in Madagascar
- 250 species to process, it is our natural heritage
- Progress done with some collateral damages but acclaimed and backed by local scientists