



**REPORT ON THE TRAINING WORKSHOP TO TRAIN MANAGEMENT AND ENFORCEMENT OFFICERS TO EFFECTIVELY USE THE ROSEWOOD IDENTIFICATION MANUAL AND THE APP**

Prepared by: the Center for Nature Conservation and Development



June 2022

Project title: Strengthening the management and conservation of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in Vietnam.

Programme: CITES Tree Species Programme

Project funding: European Union support to the CITES Secretariat

Implementing partner: Center for Nature Conservation and Development

Cover illustration: Upper photo – Dr. Do Van Ban presenting the identification of *Dalbergia cochinchinensis* and *Dalbergia oliveri* timber based on morphological characteristics. Photo credit: Lo Van Oanh/CCD – 2021.  
Lower photo – A participant studying the manual on the identification of *Dalbergia cochinchinensis* and *Dalbergia oliveri*. Photo credit: La Quang Trung/CCD – 2021.

Citation: Center for Nature Conservation and Development (2022). Report on the training workshop to train management and enforcement officers to effectively use the rosewood identification manual and the App. Center for Nature Conservation and Development, Ha Noi.

Contact: Center for Nature Conservation and Development  
No. 5, Alley 56/119, Tu Lien Street, Tay Ho District, Ha Noi, Vietnam.  
Tel: +84 (0) 246 682 0486  
E-mail: [info@ccd.org.vn](mailto:info@ccd.org.vn)

## CONTENTS

<b>ACKNOWLEDGEMENTS</b> .....	4
<b>ACRONYMS AND ABBREVIATIONS</b> .....	5
<b>1. INTRODUCTION</b> .....	6
<b>2. OBJECTIVES</b> .....	6
<b>3. PARTICIPANTS</b> .....	6
<b>4. METHODS</b> .....	7
<b>5. VENUE, TIME AND PROGRAM</b> .....	7
<b>6. CONTENTS</b> .....	7
6.1. Opening session .....	7
6.2. Training on the identification of <i>D. cochinchinensis</i> and <i>D. oliveri</i> based on morphological characteristics .....	8
6.3. Training on the identification of <i>D. cochinchinensis</i> and <i>D. oliveri</i> based on macroscopic features of wood .....	10
6.3.1. Timber identification methods .....	10
6.3.2. Structural characteristics of woods .....	11
6.3.3. Rosewood timber identification .....	12
6.4. Training on using the rosewood identification App .....	15
<b>7. CONCLUSIONS</b> .....	20
<b>8. APPENDICES</b> .....	21
Appendix 1. List of participants .....	21
Appendix 2. Workshop program .....	22
Appendix 3. Presentation on identifying <i>D. cochinchinensis</i> and <i>D. oliveri</i> based on morphology ...	23
Appendix 4. Presentation on identifying <i>D. cochinchinensis</i> and <i>D. oliveri</i> based on macroscopic features .....	25

## ACKNOWLEDGEMENTS

The report on “the training workshop to train management and enforcement officers to effectively use the rosewood identification manual and the App” was made following the compilation of the identification manual and the development of an identification mobile application for *D. cochinchinensis* and *D. oliveri* in Vietnam. This training workshop was one of the activities under the project “Strengthening the management and conservation of *D. cochinchinensis* and *D. oliveri* in Vietnam”, funded by the European Union for the CITES Tree Species Programme.

Although it was affected by the COVID-19 outbreak, the training was finally delivered. We would like to thank the following organizations of the Ta Dung national park, Nui Chua national park, Kon Ka Kinh national park, Yok Don national park, Phuoc Binh national park, Lo Go Xa Mat national park, Bu Gia Map national park, Cat Tien national park, the Dong Nai Culture and Nature Reserve, the Region III FPD, Binh Thuan provincial FPD, Ba Ria-Vung Tau provincial FPD, and the Dong Nai provincial FPD for sending their staff to this training.

The training workshop would not have been possible without the agreement and support of the Cat Tien national park’s Board of Directorate, therefore, we would like to thank Mr. Pham Hong Luong – Director, Mr. Nguyen Van Thanh – Vice Director, and Mr. Nguyen Van Minh – Vice Director of the Cat Tien national park.

We thank Dr. Do Van Truong – Forest management specialist at VNMN and Dr. Do Van Ban – Timber Management Specialist at VAFS for joining our training and had a presentation on morphological and timber identification of *D. cochinchinensis* and *D. oliveri*.

We are grateful to Mrs. Ha Thi Tuyet Nga – Director, Mr. Vuong Tien Manh – Deputy Director, and Mr. Nguyen Tuan Anh – Expert of CITES Management Authority of Vietnam, Ministry of Agriculture and Rural Development for their support and assistance in this project.

Last, we would like to express our gratitude to Mr. Thang Hooi Chiew – Regional Coordinator for Asia, Dr. Milena Sosa Schmidt – CITES Tree Species Programme (CTSP) Coordinator and Regional Coordinator for Central and South America and the Caribbean, and Dr. Haruko Okusu – Chief, Outreach and Projects Unit, of the CITES Secretariat for their generous support during the implementation of the project.

On behalf of the project team.

Nguyen Manh Ha

Project Team Leader

## ACRONYMS AND ABBREVIATIONS

CCD	Center for Nature Conservation and Development
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
cm	Centimeter
COVID-19	Infectious acute respiratory disease caused by the SARS-CoV-2 coronavirus and its variants starting in 2019
CTSP	CITES Tree Species Programme
<i>D.</i>	<i>Dalbergia</i>
DNA	Deoxyribonucleic acid
EN	Endangered
FPD	Forest Protection Department
IT	Information technology
IUCN	International Union for Conservation of Nature
mm	Millimeter
NDF	Non-detriment findings
VAFS	Vietnamese Academy of Forest Sciences
VNMN	Vietnam National Museum of Nature
VU	Vulnerable

## 1. INTRODUCTION

Vietnam is well-known for its high biodiversity with about 3,000 species of fish, more than 1,000 species of birds, and over 300 species of mammals which have been confirmed and found in Vietnam. Among these, 10% of plant species are endemic to Vietnam (Loc et al., 2018)<sup>1</sup>. However, Vietnam has also been facing serious biodiversity loss due to deforestation and forest degradation as well as illegal hunting, logging, and trade in wild plants and animals, environmental pollution, invasive species, and climate change (Loc et al., 2018). Amongst the illegal logging and trading plant species, two rosewood species, namely, *Dalbergia cochinchinensis* and *Dalbergia oliveri* are the most sought-after species in the harvest and trade for making high-end furniture and decorative products due to their durability, corrosion resistance, and termite resistance.

In Vietnam, many studies on the identification of plant species have been carried out but none of them has been done for *D. cochinchinensis* and *D. oliveri* to support field practitioners to rapidly identify species in the field. Meanwhile, forest protection and law enforcement practices require rapid and accurate identification of timber, timber products, seedlings, and mature trees of these species. For this reason, the Center for Nature Conservation and Development (CCD) had compiled an “Identification manual for *Dalbergia cochinchinensis* Pierre and *Dalbergia oliveri* Gamble ex Prain” to assist local management authorities and law enforcement forces to improve their operational effectiveness in management, protection, and trade control of *D. cochinchinensis* and *D. oliveri*. In addition, CCD had also developed an identification App, known as the *Dalbergia ID*, which can be installed on smart devices, such as mobile phones or tablets to rapidly look up any specimen to see if it is *D. cochinchinensis* or *D. oliveri* or not.

A training workshop was organized to guide forest rangers at regional, provincial and district levels, and technical staff of protected areas to use the manual and the App. A total of 33 participants were from protected areas, the Forest Protection Departments at regional, provincial, and district levels, institutions, and specialists from CCD attended the training workshop at the Cat Tien national park to discuss and practise the rosewood identification manual and the App.

## 2. OBJECTIVES

The workshop aimed at building the capacity of management and enforcement officers in the identification of rosewood species with an emphasis on *D. cochinchinensis* and *D. oliveri* to strengthen their forest protection and management efforts.

The specific objectives include:

- To provide updated information on the taxonomy, distribution, conservation status, current harvest, threats, and national and international regulations on rosewood harvest and trade.
- To raise awareness of participants on CITES' requirements for species in Appendix II.
- To instruct participants on how to quickly use the Manual and App for identification of *D. cochinchinensis* and *D. oliveri* in the field.

## 3. PARTICIPANTS

A total of 33 participants who were representatives from law enforcement bodies, forest protection departments, protected areas, and scientific institutions attended the training workshop as in the list of participants in **Appendix 1**. In summary, they are as follows:

- 17 technical officers and forest rangers from nine nature reserves and national parks.
- 4 forest rangers from provincial forest protection departments.
- 3 forest rangers from district forest protection departments.
- 2 law enforcement officials from Region III FPD.
- 5 trainers from research institutions and CCD.
- 2 organizers from CCD.

---

<sup>1</sup> Loc, P. K., Yen, M. D., & Averyanov, L. (2018). Biodiversity in Vietnam. *Global Biodiversity*, 1, 473–502. <https://doi.org/10.1201/9780429487743-14>.

## 4. METHODS

This was a face-to-face training workshop where all trainees and trainers must wear face masks to avoid spreading the SARS-CoV-2 coronavirus and its variants in case anyone was infected. The trainers presented presentations on a large TV screen which showed very high resolution as compared to a projector's screen. The participants could interrupt the trainers at any time if they did not understand or could not follow the presentations. They could discuss with each other during the practical demonstration session.

For the identification of wood features, the trainer showed the participants wood samples of *D. cochinchinensis* and *D. oliveri* to further clarify his presentation.

For the use of the *Dalbergia* ID App, the trainer helped each trainee to install the App on their Android devices, and on how to use the App's features and make queries on the look-up function.

After that, all the participants were given time to practise using the *Dalbergia* ID App, including the use of hand-held magnifiers to observe vessels of *D. cochinchinensis* and *D. oliveri* wood samples in detail.

## 5. VENUE, TIME AND PROGRAM

The training workshop was organized at the headquarters of the Cat Tien national park, Dong Nai province.

The training workshop was conducted on 28 December 2021 and was held back-to-back with the other two training workshops on sharing and implementing the NDF report at the local level on 27 December 2021, and piloting the management and conservation plan for *D. cochinchinensis* and *D. oliveri* in four protected areas in Vietnam from 29-30 December 2021. The workshop program is in **Appendix 2**.

## 6. CONTENTS

### 6.1. Opening session

Dr. Nguyen Manh Ha, the Project Team Leader introduced the objective of the training workshop and presented a summary of the Manual and the process of developing the App, as well as their potential benefits to management and enforcement officers in managing and tracking timber trade on rosewood. His brief is as follows:

The identification manual for *D. cochinchinensis* and *D. oliveri* describes basic morphological characteristics of seedlings and mature trees including stem, leaves, flower, pod, and macroscopic features of wood and timber products of the two species. All macroscopic features are to be observed with unaided eyes or with a hand-held magnifier. The photographs used in the Manual were taken from field surveys and a wood laboratory. They were carefully selected to illustrate the prominent features to enable the two species to be identified in the field.

The App was developed based on the printed manual. A botanist, a timber expert, and the project team had worked together to create a database containing many tables and forms that can be queried when inputting information of one or two or more specimens into the App. The database and the manual were sent to an IT team for designing the App's interfaces using the Adobe XD software. The interfaces of the App were discussed and agreed upon amongst the project team's members, coding was then done by the IT team. The App was then sent to botanists, researchers, and technical officers for field testing. All comments and feedback were collected for further improvement of the App.

The App contains the full description of the two species as described in the printed copy, including species name, distribution maps, biological and ecological characteristics, conservation status, morphological features of mature trees and regenerated trees, and macroscopic features of the timbers. For each species, the scientific name, standard trade name (in Vietnamese and English), and vernacular names were also given following national and CITES standards. The identification system used in the App is based on features of leaves, flowers, pods, and timber, which are visible through direct observation or with a hand-held magnifier. Colored photographs were taken to illustrate prominent features to enable the two species to be identified in the field.

As the App will be used by law enforcement officials such as customs officials, forest rangers, and environment policemen who are not familiar with the botanical terminology, definitions, and explanation of the terms used, a full description of *D. cochinchinensis* or *D. oliveri* is also provided in the App for guidance, as well as in the preparation of specimens for identification.

## 6.2. Training on the identification of *D. cochinchinensis* and *D. oliveri* based on morphological characteristics

Dr. Do Van Truong, a Forest Management Specialist who is also a Botanist from the Vietnam National Museum of Nature, presented the morphological characteristics of *D. cochinchinensis* and *D. oliveri* in Vietnam and guided the participants in using the identification manual. Dr. Truong emphasized the characteristics that were visible in the field with an unaided eye. The presentation is summarized in Table 1 below, however, the detailed presentation is in **Appendix 3**.

*Table 1. Some morphological characteristics of D. cochinchinensis and D. oliveri could be used to rapidly identify the species in fieldwork*

Details	<i>Dalbergia cochinchinensis</i>	<i>Dalbergia oliveri</i>
Scientific name	<i>Dalbergia cochinchinensis</i> Pierre (1898). Synonym: <i>Dalbergia cambodiana</i> Pierre (1898).	<i>Dalbergia oliveri</i> Gamble ex Prain (1897). Synonym: <i>D. bariaensis</i> Pierre (1898); <i>D. dongnaiensis</i> Pierre (1898); <i>D. duperreana</i> Pierre (1898); <i>D. mammosa</i> Pierre (1898).
Common name	- Vietnamese name: Trắc, Cẩm lai nam bộ, Trắc bông, Trắc đen, Trắc trắng, Giầu ca (Gia Rai), Ka Rắc (Ba Na), Ka-nhung (Khor-me). - English name: Siamese rosewood.	- Vietnamese name: Cẩm lai, Cẩm lai Bà Rịa, Cẩm lai đồng nai, Cẩm lai bông, Cẩm lai mật, Cẩm lai vú. - English name: Burmese rosewood, Vietnamese rosewood.
Seedlings	Leaves of seedlings are light green or dark green.	Leaves of seedlings are yellow-red or pinkish-red.
Trunk and bark	The outer bark is brownish-yellow, longitudinally fissured or peeled off into fragments.	The bark is grey or light grey, and flakes in small dark-brown pieces. Lenticels are prominent.
Leaves	Leaves are odd-pinnate from 15 – 20 cm in length, with 7 – 9 leaflets. The leaflet is oval to ovoid. Lateral veins are 7 – 9 pairs and prominent on both sides.	Leaves are pinnately compound, 15 – 25 cm in length, Leaflets are from (9 –) 10 – 15, alternate. The leaflet is oval, oblong to lanceolate. Lateral veins are 9 – 12 pairs and prominent on both sides.
Inflorescence	The inflorescence is corymbose-paniculate at or nearly terminal, 7 – 15(–20) cm long. Bracts are caducous. Flowers are white to milky white, 5.5 – 6 mm long, and aromatic. The calyx tube is 5 mm, glabrous; calyx lobes are oval to obtuse; inner calyx lobes are slightly longer than lateral calyx lobes but as long as the calyx tube. The standard is obovate. Wings are irregularly elliptical. Keel petals are rounded.	The inflorescence is axillary or terminal panicle, 10 – 15 cm long. Bracts and bracteoles are caducous. The flower is bright mauve or purple inside, 12 mm long; the calyx tube is 4 – 5 mm, glabrous or pubescent at the base; upper calyx lobes are obovate, outer calyx lobes are obtuse oval and nearly of the same length, inner calyx lobes are oval, acute and slightly longer than the other calyx lobes or nearly as long as the calyx tube. The Standard is rounded. Wings are spoon-shaped. Keel petals are ear-shaped.
Reproduction parts	Stamens are 9 – 10, and ovary is 2 – 4 ovules and glabrous to villose at the base.	Stamens are 10; filaments are diadelphous. Ovary is 2 – 3 ovules and pubescent.
Pod and seed	Reddish-brown.	The pod is elliptic or lanceolate, 9 – 14 cm long, 2.4 – 4 cm wide, glabrous, sometimes coriaceous, and bright brown, thin, flat, raised over the seed into a pointed cone. Seed is from 1 – 2 (rarely 3), globose or uniform with a size of 12.5 x 9 mm, and red-brown.



Figure 1. Dr. Do Van Truong presenting the identification of regenerating trees of *D. cochinchinensis* and *D. oliveri*.



Figure 2. A participant from Dong Nai Culture and Nature Reserve studying the Manual.

### 6.3. Training on the identification of *D. cochinchinensis* and *D. oliveri* based on macroscopic features of wood

Dr. Do Van Ban, a Timber Management Specialist from the Vietnamese Academy of Forest Sciences, delivered a presentation on the identification of timber in general and rosewood timber in particular. The presentation detailed the terms used in timber identification and introduced the identification methods used. After the participants understood the basic terminologies, he proceeded to elaborate on the features of rosewood timber, with emphasis on *D. cochinchinensis* and *D. oliveri*.

Some wood specimens were prepared to demonstrate these features during the training for the participant to practise. Details of his presentations are in **Appendix 4**. Below is a summary of his presentation.

#### 6.3.1. Timber identification methods

Timber identification is to identify the scientific name of a wood specimen using structural characteristics which are observed with a hand-held magnifier and comparing existing listing descriptions in previous research and materials.

##### Current identification methods

- *Expert method*: based on experience in harvesting, using, and trading wood or timber products. Expert only identifies the species by unaided eyes, their experience, and familiar sense. This method could be used everywhere, every time, and does not need any expensive types of equipment. However, the number of specimens could be limited due to the experience of the assessor.
- *Anatomical method*:
  - + *Macroscopic features*: based on structural characteristics of the wood specimen which is observed by unaided eyes or hand-held magnifier with the magnification from 8x to 12x. The assessor will compare the observations with existing materials or standard types. The number of specimens required and the accuracy of identification will depend on the database of wood anatomy.
  - + *Microscopic features*: based on structural characteristics of the wood specimen which is observed by microscope with the magnification from 40x to 1,000x. These characteristics will be compared with existing materials or standard types. This method is more accurate than using macroscopic features. The number of specimens required and the accuracy of identification will also depend on the database of wood anatomy.
- *DNA barcoding*: DNA sequencing techniques will be used to identify the wood specimen. The DNA sequence then will be compared with the DNA database. This is the most accurate identification method. It requires a system of expensive machines. The number of specimens required will depend on the DNA database.

##### Specimen sampling

- *Sampling*: The specimen should include sapwood and heartwood. The size of each specimen should be as large as possible in the transverse section and 5 – 10 cm in the longitudinal section. The sampling should be done at multiple sites of the log, on several logs, or on sawn wood if possible. Do not sample the parts that are rotten, broken, or infested with termites.
- *Create sections*: Form a small cubic sample of about 5 x 5 x 5 cm, their surfaces are corresponding to the transverse section, longitudinal section, and radial section. Use a sharp knife to definitively cut to create many observation positions on the transverse section and longitudinal section.
- *Describe the structure of the sample*: Consecutively observe each surface of the cube and identify and describe the structural characteristics of the wood specimen. The assessor should study the wood specimens under natural lights to correctly identify the color of the wood.
- *Look-up scientific name*: Compare the description of the specimen with the existing description or specimen types on databases, materials, websites, etc., to find the exact species name.

### 6.3.2. Structural characteristics of woods

Vessels (pores) are always seen on the transverse section of wood of broad-leaved trees (hardwood), but not in gymnosperm trees (softwood).

There are two main types of cells in most softwood: tracheid cells which provide physical support and conduction of water and sap; and parenchyma cells which provide storage of nutrients during tree growth. The tracheid cells are packed tightly together, aligned in radial and tangential orientations, and form an overall grain direction for the wood. If one were to look at the cross-section of softwood with a hand-held magnifier, one will see that the tracheids are arranged in straight rows perpendicular to the growth rings. The tracheids have hollow centers called lumens, and these become smaller when the tracheid walls thicken as they make the transition from earlywood to latewood. The parenchyma cells are major components in the rays and are oriented radially in a transverse section of the wood. Softwoods also have rays.

Hardwoods also contain components such as softwood: fibers, tracheids, parenchyma cells, and rays. The most important distinction between softwood and hardwood is that almost all hardwoods contain a type of cell called a vessel which is in the form of pipes that run through the tree in the longitudinal direction, connecting the top of the tree with the root system. In the cross-section, the vessels appear as holes (pores). The arrangement of vessels in latewood and earlywood could be a sign to distinguish a group of species.

Structural characteristics of wood are readily seen in three types of sections:

- Transverse section (cross-section): Plane cross-section of the wood specimen perpendicular to the longitudinal axis of the trunk.
- Tangential section: Longitudinal section tangent to the annual rings, growth rings, or perpendicular to rays.
- Radial section: Longitudinal section cross pith of the trunk, perpendicular to the annual rings, growth rings, or parallel to rays.

In the cross-section, heartwood and sapwood are normally distinguished by their colors. Sapwood is the outer layer of wood near the bark having a lighter color. Heartwood is the inner layers of wood near the pith which was established from sapwood and it is generally darker in color than sapwood.

In the longitudinal section of heartwood, longitudinal streaks in dark color form the overall grain.

#### Some main components of wood

- *Vessels (pores)*: are axial series of cells that have coalesced to form an articulated tube-like structure of indeterminate length to distribute water. In the transverse section, vessels are seen as pores. On the tangential section, vessels form tiny streaks along the trunk. Vessels could be solitary or in radial multiples. It arranges in tangential bands (perpendicular to the rays and forming short or long tangential bands), radial patterns (vessel assemblies arranged in radial lines, parallel to the rays), diagonal patterns (vessel assemblies arranged in an intermediate pattern between tangential and radial) or dendritic pattern (vessels arranged in a branching pattern, forming distinct tracts, separated by areas devoid of vessels) or without a specific pattern. The distribution pattern of vessels forms three groups of hardwood:
  - + Wood ring-porous in which the vessels in the earlywood are distinctly larger than those of the latewood of the previous and the same growth ring, and form a well-defined zone or ring.
  - + Wood is semi-ring-porous in which the vessels in the earlywood are distinctly larger than those in the latewood of the previous growth ring, but in which there is a gradual change to smaller vessels in the intermediate and latewood of the same growth ring.
  - + Wood diffuse-porous in which the vessels have more or less the same diameter throughout the growth ring.

Tyloses and deposits could be absent or present in the lumen of vessels.

- *Axial parenchyma cells*: are cells that are typically brick-shaped or isodiametric and have simple pits. Parenchyma is concerned with the storage and distribution of food materials. In the transverse section, parenchyma cells are seen as lighter color than other cells and are much more visible if contact with water. Axial parenchyma cells are parenchyma cells derived from

fusiform cambial initials, occurring in the axial direction. On cross-section, axial parenchyma banded or not banded, and is perpendicular to rays. There are two types of axial parenchyma cells, namely, axial parenchyma bands surrounding vessels (pores) and those not surrounding vessels.

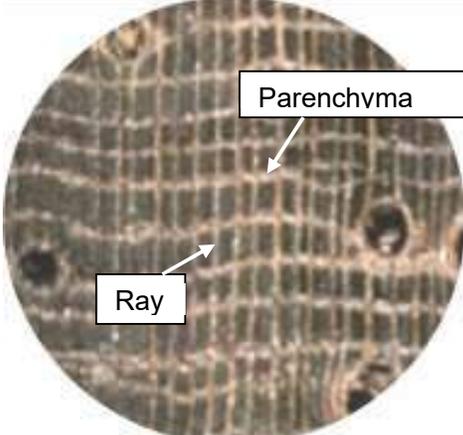
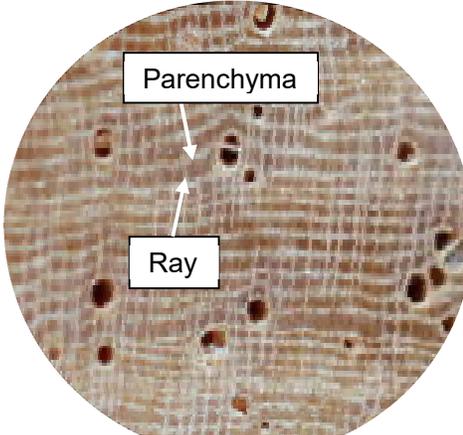
- + Axial parenchyma bands surrounding vessels could be laterally extended with wing-like or lozenge (aliform). Aliform parenchyma coalesced forming irregular tangential or diagonal bands.
  - + Axial parenchyma bands not surrounding vessels form concentric lines or bands, as seen in cross-sections. Axial parenchyma bands in continuous tangential lines of approximately the same width as the rays, forming a reticulate pattern with rays; or in fairly regularly spaced fine lines or bands, arranged horizontally or in arcs, appreciably narrower than the rays, forming a scalariform pattern; or axial parenchyma bands which are much wider than rays.
- **Rays:** a ribbon-like aggregate of cells extending radially in wood. On cross-section, rays form radial lines from the pith to the cambium. Wood rays occur in practically all softwoods and hardwoods of commercial significance. The size and frequency of rays vary considerably and may constitute a very useful diagnostic feature, particularly the very wide and high rays. Ray width is determined in transverse section and can roughly be sub-divided into two macroscopically distinguishable sizes: narrow ray (generally cannot be seen with the unaided eye because of their small size. All softwood characterized by very narrow rays belong to this category), and wide ray (also in combination with narrow rays where this type is visible with the unaided eye, about 0.5 mm (or more) in width). In some cases, rays aggregate in a group of small, narrow rays appearing to the unaided eye or at low magnification as a single large ray.
  - **Resin canal:** an intercellular canal containing resin is also called an intercellular canal.

### 6.3.3. Rosewood timber identification

Wood identification characteristics of *D. cochinchinensis* and *D. oliveri* are presented in Table 2 below:

Table 2. Macroscopic features of *D. cochinchinensis* and *D. oliveri*.

Wood component	<i>D. cochinchinensis</i>	<i>D. oliveri</i>
Sapwood and heartwood	 <p>The sapwood and heartwood are sharply distinguished in color. Sapwood is pale yellowish-grey or light grey. Heartwood is medium reddish-brown, yellow-red, or dark brown. Wood becomes darker in color from reddish-brown, dark brown to black over time.</p>	 <p>Sapwood is clearly demarcated from heartwood as seen on the cross-section. Sapwood is yellowish-grey to light grey. Heartwood color ranges from pink-brown, and orange to reddish-brown. Heartwood color tends to be darker over time.</p>

Wood component	<i>D. cochinchinensis</i>	<i>D. oliveri</i>
Vessels (pores)	 <p data-bbox="459 699 922 863">Wood has diffuse-porous vessels (vessels are distributed over the cross-section). Vessels have different sizes. Vessels are commonly solitary (one vessel) or in short (2 – 3 vessels) radial rows, rarely in radial rows of 4 or more.</p>	 <p data-bbox="938 699 1401 863">Vessels are diffuse-porous. Pores are different in size. Vessels (pores) are in solitary or radial multiples of 2-3, rarely radial multiples of 4 or more.</p>
Deposits	 <p data-bbox="459 1333 922 1411">Heartwood vessels (pores) usually contain dark brown, reddish-brown deposits.</p>	 <p data-bbox="938 1333 1401 1411">Heartwood deposits are present and red or dark brown.</p>
Axial parenchyma bands	 <p data-bbox="459 1860 922 1917">Axial parenchyma is banded or not banded. Parenchyma bands are narrow,</p>	

Wood component	<i>D. cochinchinensis</i>	<i>D. oliveri</i>
	continuous or discontinuous, or sometimes wavy, partially incorporate with rays to form net-shape. Axial parenchyma (light bands on landscape orientation) in continuous tangential lines forming a reticulate pattern with rays (light bands on portrait orientation).	Parenchyma bands are narrow, continuous, discontinuous, or wavy. Parenchyma bands form a reticulate pattern with rays.
Axial parenchyma	Surrounding vessels (pores) form an aliform wing or confluent wing.	Axial parenchyma surrounds vessels (pores) forming an aliform wing or confluent wing.
Rays	Rays are aggregated and arranged evenly appearing to the unaided eyes or at low magnification as a single large ray.	Rays are aggregated and arranged evenly appearing to the unaided eyes or at low magnification as a single large ray on the tangential section.
Others	Wood is hard and heavy.	Wood is hard and heavy but lighter than <i>D. cochinchinensis</i> .



Figure 3. Dr. Do Van Ban presenting the macroscopic features of the wood.



Figure 4. Dr. Do Van Ban presenting the structural characteristics of wood.



Figure 5. Participants practising the identification of rosewood timber specimens.

#### 6.4. Training on using the rosewood identification App

Ms. Dinh Thi Kim Van, a representative for the rosewood identification App developers, trained the participants on using the App. The *Dalbergia* ID App was downloaded and installed on the smartphones of all the participants. The trainer used a software for the laptop named “LDPlayer Android emulator version 4.0” to emulate and open the *Dalbergia* ID on the laptop and then displayed it on a widescreen for the participants to follow. After the presentation, the participants were given time to practise and use the App as well as raise questions to the trainer.

Below is a summary of the presentation on how to use the App.

**Open the App and review the App features**

On the homepage, there are four features that users can choose respectively:

1. Read the information and description of *D. cochinchinensis* and *D. oliveri*: in this feature, the user can read all information about the species as in the printed Manual including the nomenclature, distribution, biology, and ecology, as well as a description of the morphological characteristics of trees and seedlings, including features of log and sawn wood and the macroscopic features of the wood.
2. Go to the look-up page: this feature helps the user to identify a specimen as to whether it belongs to *D. cochinchinensis* or *D. oliveri* or not.
3. Explanation of glossary: this page helps to explain the terminology used in the App as well as in the Manual.
4. Introduction of the App: this page contains a short introduction of the App, its objectives and benefits as well as acknowledgements to the Project and sponsors.

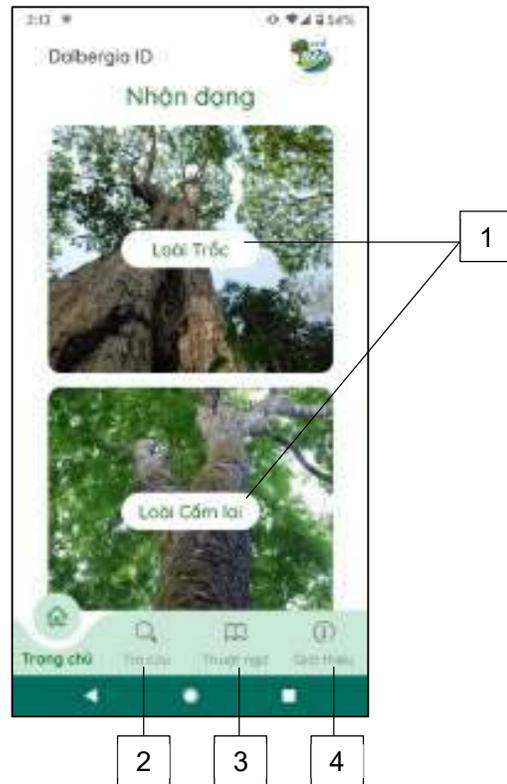


Figure 6. Homepage of the Dalbergia ID App.

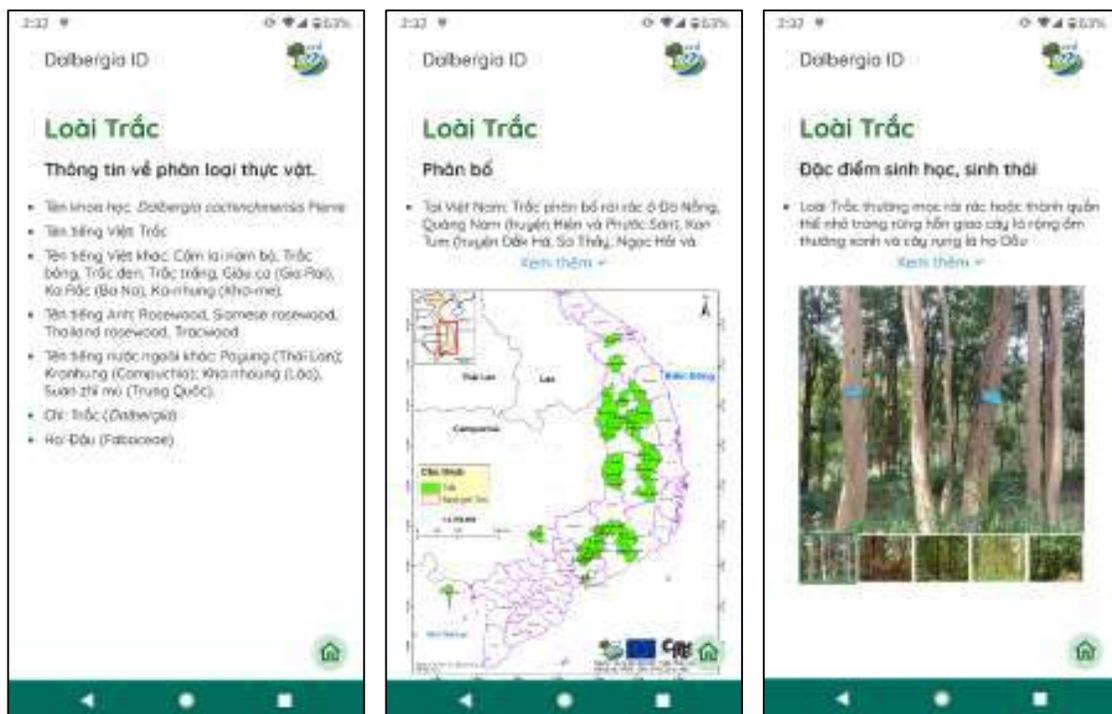


Figure 7. Information page of *D. cochinchinensis*.

### Use the look-up feature

**Step 1:** On the look-up page, the user can choose one or more of the following types of specimens that they have: leaves, flowers, pods, or wood. For example, leaves and flowers.

**Step 2:** Click the button “Answer” (green button) to answer all queries about the leaves and flowers. On the answer page, users can only move forward if they have answered all the questions about the specimen that they have. Or they can click the button “home” to go back to the homepage, or the button “backward” to go back to the previous page.

**Step 3:** After answering all the questions, the App will move to the result page. Choose “view result” (green button) to see the name of the specimen, or choose “delete data” (red button) to delete all the answers.

The accuracy of the results will depend on the number of specimens used. Twelve possible answers could be shown in quotation marks “...”, as follows:

- **“The look-up specimen has characteristics of *D. cochinchinensis*”** if the user has only one type of specimen (flowers or leaves or pods) and it has all the characteristics of *D. cochinchinensis*.
- **“The look-up specimen has characteristics of *D. oliveri*”** if the user has only one type of specimen (flowers or leaves or pods) and it has all the characteristics of *D. oliveri*.
- **“The look-up specimen could be *D. cochinchinensis*”** if the look-up specimen is wood or the user uses two types of specimens (flowers and leaves or flowers and pods or leaves and pods) and they have all the characteristics of *D. cochinchinensis*.
- **“The look-up specimen could be *D. oliveri*”** if the look-up specimen is wood or the user uses two types of specimens (flowers and leaves or flowers and pods or leaves and pods) and they have all the characteristics of *D. oliveri*.
- **“The look-up specimen has one characteristic of *D. cochinchinensis*”** if the user uses three types of the specimens and only one of them has the characteristics of *D. cochinchinensis*.
- **“The look-up specimen has one characteristic of *D. oliveri*”** if the user uses three types of the specimens and only one of them has the characteristics of *D. oliveri*.
- **“The look-up specimens have two characteristics of *D. cochinchinensis*”** if the user uses three types of specimens and two of them have the characteristics of *D. cochinchinensis*.
- **“The look-up specimens have two characteristics of *D. oliveri*”** if the user uses three types of specimens and two of them have the characteristics of *D. oliveri*.
- **“The look-up specimens have characteristics of both species”** if the user uses two (one of each species) or three (two of one species and one of the other species) types of specimens.
- **“The look-up specimen is *D. cochinchinensis*”** if the user uses three specimens of leaves, flowers, and pods and all of them have the characteristics of *D. cochinchinensis*.
- **“The look-up specimen is *D. oliveri*”** if the user uses three specimens of leaves, flowers, and pods and all of them have the characteristics of *D. oliveri*.
- **“The look-up specimens do not have characteristics of *D. cochinchinensis* and *D. oliveri*”** if the look-up specimen does not have the characteristics of *D. cochinchinensis* or *D. oliveri*.

If the returns are “The look-up specimen could be *D. cochinchinensis*/*D. oliveri*” or “The look-up specimen is *D. cochinchinensis*/*D. oliveri*”, the user can find details of the species by clicking on the button “see more” (green one). In other cases, click on the button “finished look-up” (grey button) to finish the process and to go back to the look-up page.



Figure 8. Choose the type of specimen then click "answer/Trả lời".



Figure 9. Answer all questions about leaves.



Figure 10. Answer all questions about flowers.



Figure 11. The returns could vary depending on the answers given.



Figure 12. If the answer is *D. cochinchinensis*/*D. oliveri*, click "see more/Xem thêm" to move to the information page or "finish/Hoàn tất" to end the process.





Figure 13. Ms. Dinh Thi Kim Van introducing the Dalbergia ID App.



Figure 14. Ms. Dinh Thi Kim Van demonstrating the App's functions.



Figure 15. A participant from Binh Thuan FPD asking about the use of the App.

## 7. CONCLUSIONS

The training workshop consisted of presentations on introduction and guidance on using the rosewood identification Manual and App, which were developed to assist enforcement officers, including forest rangers, customs officers, and law enforcement officers to rapidly identify *D. cochinchinensis*, *D. oliveri*, and their products in the field. The objectives of the training were to (i) introduce and deliver the Manual and the App to relevant stakeholders who are working in the forestry sector and those in the management of timber trade; (ii) provide information and raise awareness on the conservation status of rosewood, including national and international regulations; (iii) share information on the distribution, biology and ecology of *D. cochinchinensis* and *D. oliveri*; (iv) explain the terminology used in the Manual and the App; and (v) provide tips and guidance on how to use the Manual and the App effectively.

The Participants were taught how to identify *D. cochinchinensis* and *D. oliveri* in the field using morphological features, such as barks, leaves, seed and pods, and seedlings, as well as macroscopic features of wood, such as vessels, parenchyma cells, rays and resin canals.

After the training, all the participants were able to use and apply the Manual and the App to their work and would continue to disseminate what they had learnt to the other relevant stakeholders in Vietnam.

## 8. APPENDICES

### Appendix 1. List of participants

No.	Name	Gender	Agency/Organization	Role
1	Hoang Van Hung	Male	Ta Dung national park	Trainee
2	Nguyen Van Hung	Male	Nui Chua national park	Trainee
3	Nguyen Quoc Luan	Male	Kon Ka Kinh national park	Trainee
4	Vo Quang Trung	Male	Dong Nai Culture and Nature Reserve	Trainee
5	Dinh Xuan Dan	Male	Dong Nai Culture and Nature Reserve	Trainee
6	Cao Duong Cuong	Male	Yok Don national park	Trainee
7	Luu Thanh	Male	Yok Don national park	Trainee
8	Luu Van Luong	Male	Phuoc Binh national park	Trainee
9	Nguyen Thanh Xuan	Male	Lo Go Xa Mat national park	Trainee
10	Nguyen Duc Cuong	Male	Dinh Quan district FPD of Dong Nai province	Trainee
11	Pham Duc Thien	Male	Tan Phu district FPD of Dong Nai province	Trainee
12	Vo Ngoc Thuan	Male	Binh Thuan provincial FPD	Trainee
13	Dang Thi Minh Huong	Female	Binh Thuan provincial FPD	Trainee
14	Nguyen Van Cuong	Male	Cat Tien national park	Trainee
15	Tran Dinh Hung	Male	Cat Tien national park	Trainee
16	Nguyen Van Huu Canh	Male	Cat Tien national park	Trainee
17	Nguyen Van Khanh	Male	Cat Tien national park	Trainee
18	Ho Huy Thanh	Male	Cat Tien national park	Trainee
19	Vo Huy Sang	Male	Bu Gia Map national park	Trainee
20	Le Duy Thang	Male	Bu Gia Map national park	Trainee
21	Pham Van Bien	Male	Bu Gia Map national park	Trainee
22	Bui Quoc Vuong	Male	Xuyen Moc district FPD of Ba Ria-Vung Tau province	Trainee
23	Bui Manh Hoa	Male	Ba Ria-Vung Tau provincial FPD	Trainee
24	Tran Giang Nam	Male	Ba Ria-Vung Tau provincial FPD	Trainee
25	Vu Dung Hieu	Male	Region III FPD	Trainee
26	Nguyen Manh Hung	Male	Region III FPD	Trainee
27	Dinh Thi Kim Van	Female	CCD	Trainer
28	Do Van Ban	Male	VASF	Trainer
29	Do Van Truong	Male	VNMN	Trainer
30	Nguyen Manh Ha	Male	CCD	Trainer
31	La Quang Trung	Male	CCD	Trainer
32	Lo Van Oanh	Male	CCD	Organizer
33	Nguyen Hong Ha	Female	CCD	Organizer

## Appendix 2. Workshop program



### TRUNG TÂM BẢO TỒN THIÊN NHIÊN VÀ PHÁT TRIỂN (CCD)

Địa chỉ: Số 5, Ngách 58/119, Phố Từ Liêm, Quận Tây Hồ, Hà Nội, Việt Nam

Điện thoại: +84 (0) 246 682 0486

E-mail: [info@ccd.org.vn](mailto:info@ccd.org.vn)

Website: <https://ccd.org.vn/>

Facebook: [/ccd.org.vn](https://www.facebook.com/ccd.org.vn/)

## CHƯƠNG TRÌNH TẬP HUẤN

### Hướng dẫn sử dụng Cẩm nang và Ứng dụng nhận diện loài Trắc và Cẩm lai ở Việt Nam

Thời gian: ngày 28/12/2021

Địa điểm: Hội trường, Vườn quốc gia Cát Tiên, tỉnh Đồng Nai.

Chương trình dự kiến:

Thời gian	Nội dung	Chịu trách nhiệm
08:00 – 08:15	Giới thiệu mục đích, thành phần và nội dung khoá tập huấn	Ông Lê Quang Trung
08:15 – 09:30	Hướng dẫn sử dụng Cẩm nang nhận dạng loài Trắc và Cẩm lai – Phần sinh thái	Ông Đỗ Văn Trường
09:30 – 10:15	Thực hành hướng dẫn sử dụng Cẩm nang nhận dạng loài Trắc và Cẩm lai – Phần sinh thái	Ông Đỗ Văn Trường
10:15 – 10:30	Nghỉ giải lao	Tất cả đại biểu
10:20 – 11:30	Hướng dẫn sử dụng Cẩm nang nhận dạng loài Trắc và Cẩm lai – Phần gỗ	Ông Đỗ Văn Bản
11:30 – 11:45	Tóm tắt nội dung buổi sáng	Ông Lê Quang Trung
11:45 – 13:30	Ăn trưa	Tất cả đại biểu
13:30 – 15:00	Thực hành hướng dẫn sử dụng Cẩm nang nhận dạng loài Trắc và Cẩm lai – Phần gỗ	Tất cả đại biểu. Ông Đỗ Văn Bản chủ trì
15:00 – 15:15	Nghỉ giải lao	Tất cả đại biểu
15:15 – 16:00	Hướng dẫn sử dụng Ứng dụng nhận diện Trắc và Cẩm lai	Bà Đinh Thị Kim Vân
16:00 – 17:00	Thực hành sử dụng ứng dụng nhận diện Trắc và Cẩm lai	Tất cả đại biểu. Bà Đinh Thị Kim Vân chủ trì
17:00 – 17:20	Tổng kết	Ông Lê Quang Trung và tất cả đại biểu
17:20 – 19:00	Ăn tối	Tất cả đại biểu



**Hướng dẫn sử dụng Cẩm nang nhận dạng loài Trắc (*Dalbergia cochinchinensis* Pierre) và Cẩm lai (*D. oliveri* Gamble ex Prain) ở Việt Nam**

**Đinh Thị Kim Vân & Đỗ Văn Trường**

Mục đích: nhằm hỗ trợ bảo cứu nhanh loài Trắc và Cẩm lai trong quá trình tác nghiệp của cán bộ, nhân viên hoạt động trong lĩnh vực lâm nghiệp và thực thi pháp luật ngoài hiện trường, dựa trên đặc điểm hình thái



**MỤC LỤC**

- 1. Mục đích..... 1
- 2. Phạm vi..... 2
- 3. Nội dung..... 3
- 4. Các hình ảnh minh họa..... 3
- 5. Hình ảnh đã ghi nhận trước đây..... 3
- 6. Trắc..... 3
- 7. Cẩm lai..... 3
- 8. Hình ảnh minh họa các loài..... 3
- 9. Cẩm lai..... 3
- 10. Cẩm lai..... 3
- 11. Cẩm lai..... 3
- 12. Cẩm lai..... 3
- 13. Cẩm lai..... 3
- 14. Cẩm lai..... 3
- 15. Cẩm lai..... 3
- 16. Cẩm lai..... 3
- 17. Cẩm lai..... 3
- 18. Cẩm lai..... 3
- 19. Cẩm lai..... 3
- 20. Cẩm lai..... 3
- 21. Cẩm lai..... 3
- 22. Cẩm lai..... 3
- 23. Cẩm lai..... 3
- 24. Cẩm lai..... 3
- 25. Cẩm lai..... 3
- 26. Cẩm lai..... 3
- 27. Cẩm lai..... 3
- 28. Cẩm lai..... 3
- 29. Cẩm lai..... 3
- 30. Cẩm lai..... 3

### 1. TÊN KHOA HỌC

<b>Tên khoa học và tên đồng nghĩa</b>	<i>Dalbergia cochinchinensis</i> Pierre (1896).	<i>Dalbergia oliveri</i> Gamble ex Prain (1897).
	Mẫu chuẩn (Typus): Pierre 1710b (Dec. 1866) Việt Nam, Sông Bé, Bắc Cày. Syn: <i>Dalbergia cambodiana</i> Pierre (1866).	Mẫu chuẩn (Typus): Oliver s.n (1892), Tamalan, U. Suma. Syn: <i>D. baccata</i> Pierre (1866); <i>D. dongnaiensis</i> Pierre (1898); <i>D. dipetiana</i> Pierre (1896); <i>D. macrobotrya</i> Pierre (1898).

### 2. TÊN PHỔ THÔNG

<b>Tên phổ thông</b>	<b>Tiếng Việt:</b> Trắc, Cẩm lai nam bộ, Trắc bồng, Trắc đen, Trắc tông, Gấu ca (Gia Rai), Ka Trắc (Ba Nà), Ka-nhung (Khơ-me).	<b>Tiếng Việt:</b> Cẩm lai, Cẩm lai Bà Rịa, Cẩm lai đồng nai, Cẩm lai bông, Cẩm lai mít, Cẩm lai và, Mít, Pa đông đeng, Cẩm lai lá.
	<b>Tiếng nước ngoài:</b> Phayung (Thái Lan), Kramtung (Campuchia), Kha nhuong (Lào), Suan zhi mu (Trung Quốc).	<b>Tiếng nước ngoài:</b> Heang ruon (Campuchia), Mai Chang Chan (Thái Lan), Kampae, Mai Kur phae, Pa dong deang (Lào), Tametan (Myanmar).

### 3. CÂY TÁI SINH

<b>TRẮC</b>	<b>CẨM LAI</b>
	
Lá non xanh nhạt đến xanh thẫm	Lá non màu đỏ-hồng nhạt

### 4. THÂN & VỎ

<b>TRẮC</b>	<b>CẨM LAI</b>
	
Vỏ vàng nhạt, nứt dọc thân, và bong mỏng.	Vỏ màu xám, có bì không rời rõ.

### 5. LÁ

<b>TRẮC</b>	<b>CẨM LAI</b>
	
<ul style="list-style-type: none"> <li>• Lá kép lông chim lẻ dài 15-30 cm, với 7-9 lá chét</li> <li>• Lá chét hình trái xoan tới hình trứng</li> <li>• Gân bên 7-9 đôi, nổi rõ cả hai mặt</li> </ul>	<ul style="list-style-type: none"> <li>• Lá kép lông chim lẻ dài 15-25 cm, với (9-) 10-15 lá chét</li> <li>• Lá chét hình bầu dục thuôn</li> <li>• Gân bên 9-12 đôi, nổi rõ cả hai mặt</li> </ul>

### 6. CỤM HOA & HOA

<b>TRẮC</b>	<b>CẨM LAI</b>
	
<ul style="list-style-type: none"> <li>• Cụm hoa hình chùy-tụ tán tản cùng hoặc gần tán cùng, dài 7-15 (-20) cm; ít bắc sừng rụng.</li> </ul>	<ul style="list-style-type: none"> <li>• Cụm hoa hình chùy tán cùng hoặc gần tán cùng, dài 10-15 cm, ít bắc sừng rụng.</li> </ul>

## 6. CỤM HOA & HOA



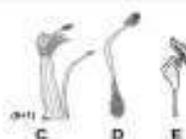
• Hoa màu hồng, từ tổng hợp: dài 5,5-8 mm, thơm; ống dài dài 5 mm, nối với các thùy dài nhỏ hình bầu dục thuộc hai từ, sắc trắng đỏ vàng trong khi đôi khi màu trắng đỏ bên, không màu khi đã bằng ống dài; dài không lớn.

• Quả có hình trứng ngược, 2 hạt, bên trong màu đen, hình thu hình hạt.

• Hoa màu hoa có sáng hoặc màu tím bên trong, dài 12 mm, ống dài dài 4-5 mm, hoặc hoặc có ống thưa ở gốc, các thùy dài hình bầu dục, các thùy dài bên hình bầu dục từ và dài gần như nhau, thùy dài trong hình bầu dục, nhọn, hai đôi khi màu trắng hoặc hoặc đỏ gần bằng ống dài.

• Quả có hình trứng, cạnh bên hình bầu dục, cạnh trên hình hạt.

## 7. NHỊ VÀ BỘ NHUY



### TRẮC

- Nhị 9-10, chỉ nhị dính với nhau thành 2 bó (9 + 1);
- Bầu 2-4 lá noãn, nhẵn hoặc đôi khi có lông ở gốc.

### CẨM LAI

- Nhị 10; chỉ nhị dính với nhau thành 2 bó (9 + 1);
- Bầu 2-3 lá noãn, có lông.

## 8. QUẢ & HẠT

### TRẮC



• Quả hình bầu dục thuôn, dài 4,5-7,5 (-8 cm), rộng 0,5-1,2 cm, mỏng, dai, nhẵn, mang 1-2 hạt.

• Hạt hình thận, kích thước 4 x 6 mm, màu nâu đỏ.

### CẨM LAI



• Quả hình mác, dài 9-14 cm, rộng 2,4-4 cm, mỏng, phẳng, phẳng lên ở hạt dạng hình chóp, nhẵn, mang 1-2 (ít khi 3).

• Hạt hình cầu hoặc thận, kích thước 12,5 x 8 mm, màu nâu đỏ.

## 9. SINH HỌC VÀ SINH THÁI HỌC

### TRẮC

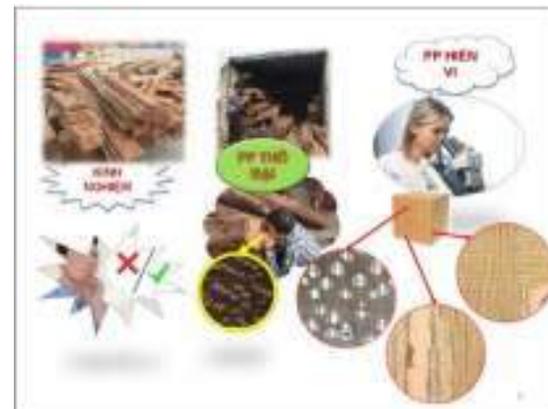
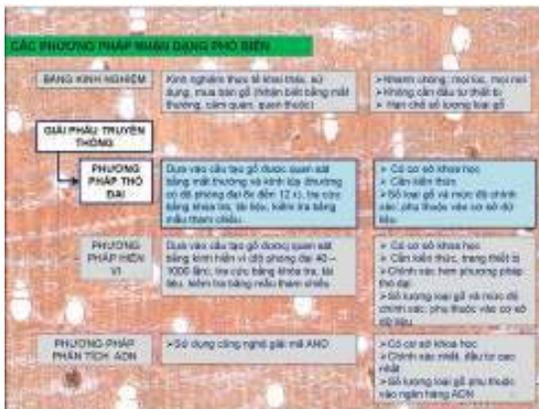
- Ra hoa tháng 6-7. Quả tháng 9-11.
- Mọc trong kiểu rừng hỗn giao cây lá rộng ẩm thường xanh và rừng lá họ Dầu trên đất thấp hoặc rừng cây lá rộng ẩm thường xanh, mùa mưa hoặc đôi trên đất thấp.
- Mọc ở nơi có độ dày tầng đất mặt trung bình, thành phần đất sét pha cát và đất có chứa đá vôi.

### CẨM LAI

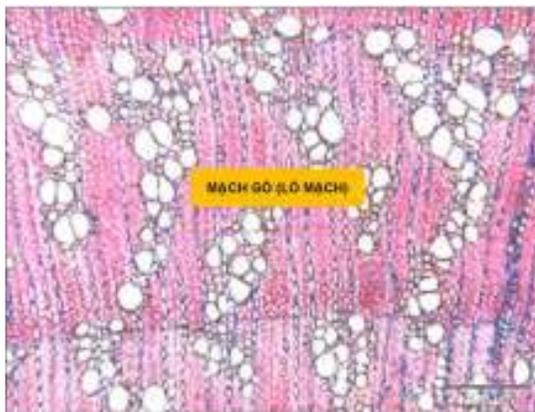
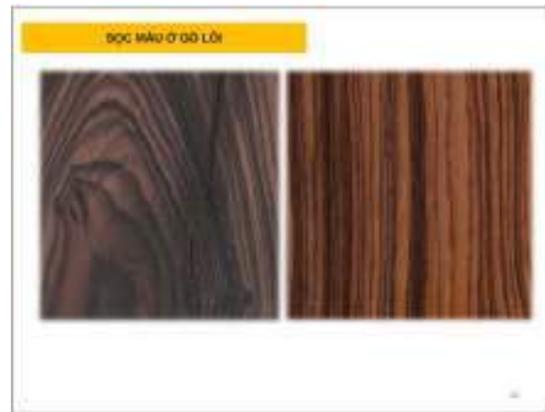
- Ra hoa tháng 4-5. Quả tháng 9-12
- Mọc trong kiểu rừng hỗn giao cây lá rộng thường xanh và rừng lá họ Dầu mùa mưa hoặc đôi trên đất thấp hoặc rừng cây lá rộng, thường xanh, mùa mưa hoặc đôi trên đất thấp.
- Mọc ở đất Bazan vàng đỏ hoặc đất bồi tụ tầng dày, nền đất lượng đôi bằng phẳng, độ dốc nhỏ, thường gặp ở những nơi ẩm và sen sông, suối.

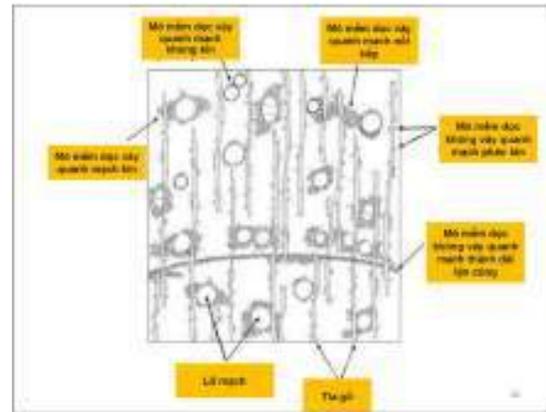
Thanks for your attention

Appendix 4. Presentation on identifying *D. cochinchinensis* and *D. oliveri* based on macroscopic features









### TRÁC (TRÁC NƯỚC)

Tên khoa học: *Dalbergia cochinchinensis* Pierre ex Lanoue.  
Tên thường gọi: **Burma rosewood**



- Dày và dễ phân biệt: Lõi màu nâu (trắng) đến tím hoặc nâu đen, có vân mây nâu đen.
- Mạch đen, dày ngắn 2-3, 4 khi lớn 4, phân tán
- Trong mạch thường có chất chứa màu nâu đen.
- Mũi nhọn vẩy quanh mạch rỗng, hình cánh và cánh nhỏ hẹp.
- Mũi nhọn hình đôi lá hẹp, thường đứt đoạn, đôi khi đâm vọt ra ngoài thành răng cưa.
- Tụ nhỏ lỏng
- Gỗ rất nặng, chắc chắn.

10

### CẨM LÂM

Tên khoa học: *Dalbergia oliveri* Brink.  
Tên thường gọi: **Burmese rosewood, Burma blackwood**



- Dày và dễ phân biệt: Bề mặt màu hồng, nâu tím, nâu vàng, có vân màu nâu đen.
- Mạch đen, dày ngắn 2-3, 4 khi lớn 4, phân tán
- Trong mạch thường có chất chứa màu nâu đen.
- Mũi nhọn vẩy quanh mạch rỗng, hình cánh và cánh nhỏ hẹp.
- Mũi nhọn hình đôi lá hẹp, thường đứt đoạn, đôi khi đâm vọt ra ngoài thành răng cưa.
- Tụ nhỏ lỏng
- Gỗ rất nặng, nhưng nhẹ hơn Trác.

11

CHÂN THÀNH CẢM ƠN CÁC QUÝ VỊ ĐẠI BIỂU  
BÀ LẠNG NGHE.

12