



MUSEU DE  
HISTÓRIA NATURAL  
E JARDIM BOTÂNICO  
DA UFMG

# INTERACTIVE TAXONOMIC KEY FOR IDENTIFICATION OF URBAN TREES IN BELO HORIZONTE, MINAS GERAIS, BRAZIL

Flávia Faria, Ariadne Lopes & João Renato Stehmann



# INTRODUCTION

The Natural History Museum and Botanical Garden of the Federal University of Minas Gerais (MHNJB/UFMG) has a 60 hectare forest reserve, where 30 trees species are used in urban forestry in Belo Horizonte (Minas Gerais, Brazil) can be found.



Trail in the forestry reserv



Lake in the forestry reserv



# INTRODUCTION

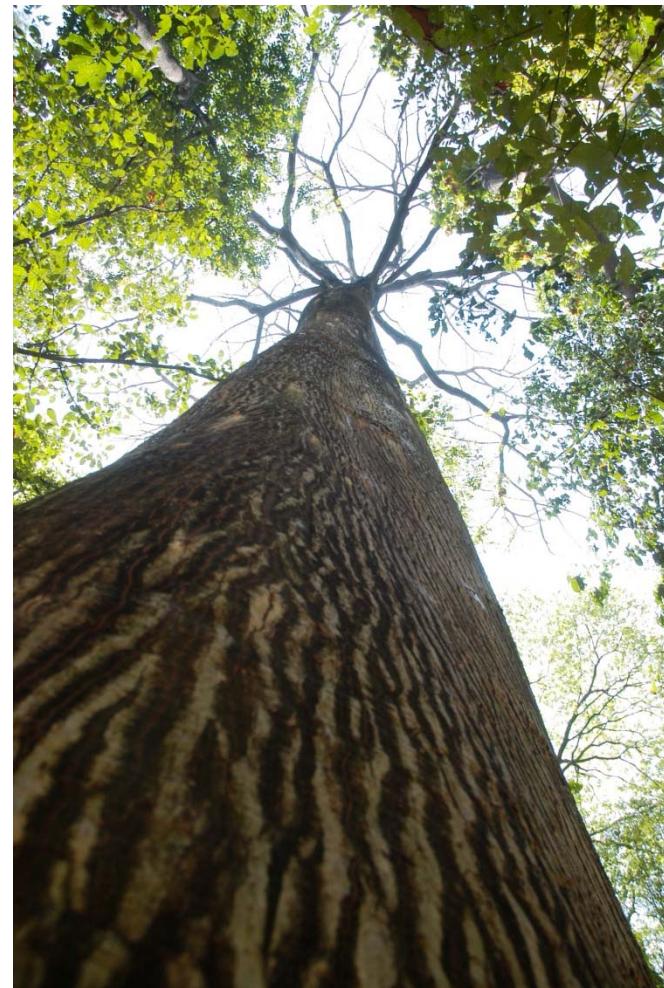
The urban trees have great importance for the urban ecosystem and the quality of human life. For many people in the big cities, the only interaction with plant species occurs through the contact with the urban trees.





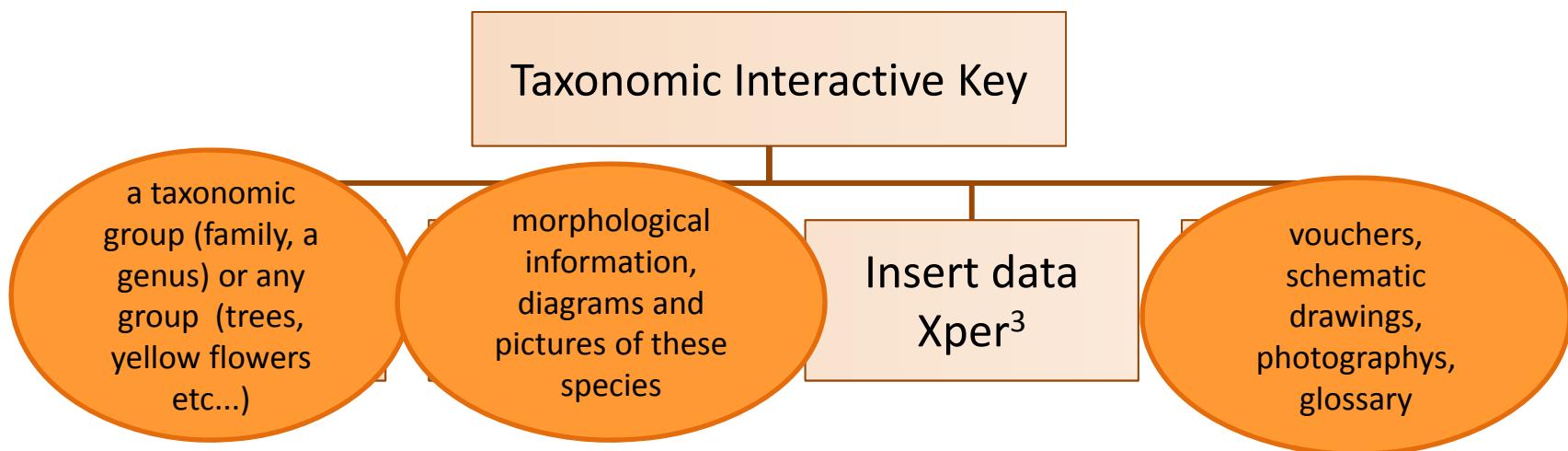
## OBJECTIVE

The aim of this activity is to promote the interest and the enchantment of the general public for plants as well as to encourage teachers to use the teaching material of the project with their students, encouraging them to know and to value our natural heritage.



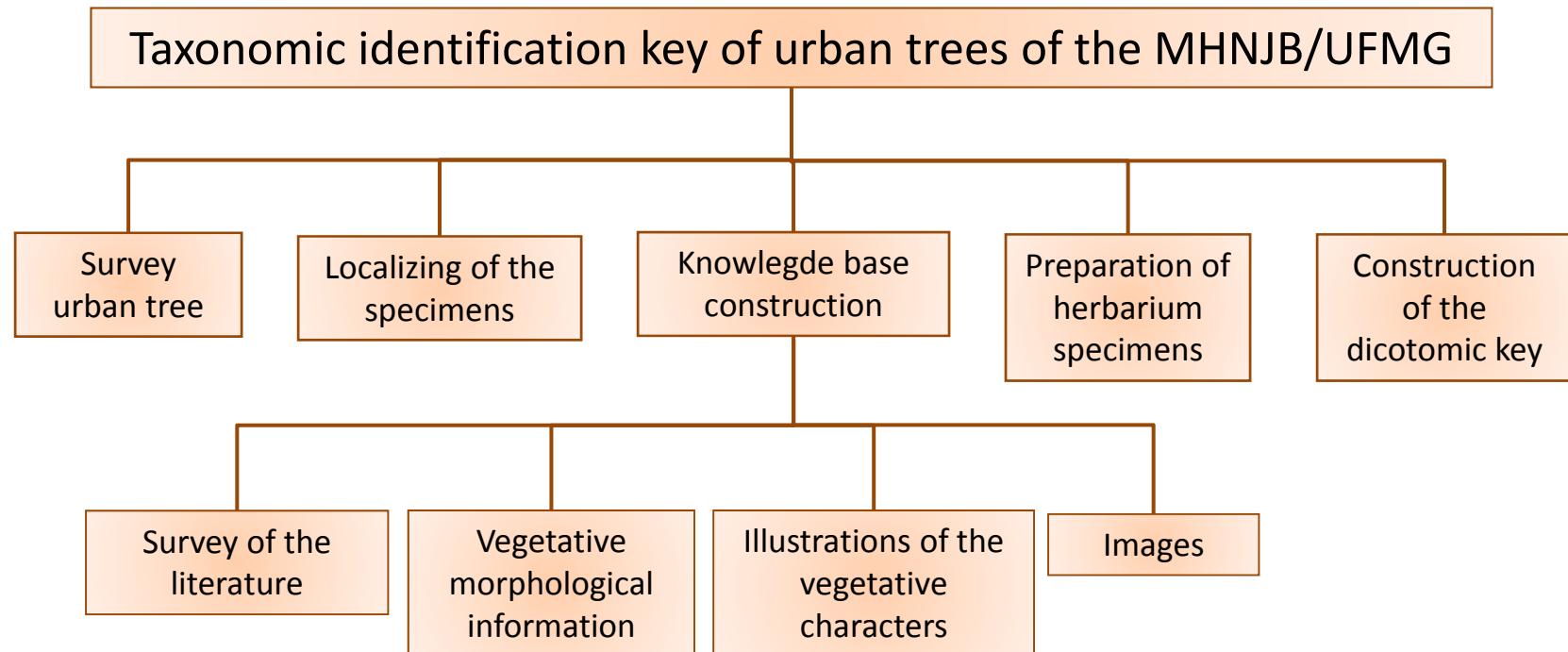


# HOW TO MAKE A TAXONOMY INTERACTIVE KEY





# HOW TO MAKE A TAXONOMIC INTERACTIVE KEY





# RESULTS

- An interactive key for 30 species of Belo Horizonte urban trees;
- Development of teaching material to be used in workshops.

KNOWING THE URBAN TREES OF THE NATURAL HISTORY  
MUSEUM AND BOTANICAL GARDEN OF THE FEDERAL  
UNIVERSITY OF MINAS GERAIS

Ariadne Dias  
Flávia Santos Faria  
João Renato Stehmann

DICHOTOMOUS IDENTIFICATION KEY

1a.Palm .....	<i>Caryota urens</i>
1b.Tree .....	2
2a.Simple leaves <sup>A</sup> .....	3
2b.Compound leaves <sup>B</sup> .....	5
3a.Bi-lobed leaves <sup>C</sup> .....	<i>Bauhinia variegata</i>
3b.Entire leaves <sup>D</sup> .....	4
4a.Leaves with pinnate venation pattern <sup>E</sup> .....	<i>Syzygium cumini</i>
4b.Leaves with palmate-convergent venation pattern <sup>F</sup> .....	<i>Tibouchina granulosa</i>
5a.Leaves with opposite <sup>G</sup> phyllotaxy <sup>H</sup> .....	6
5b.Leaves with alternate <sup>I</sup> phyllotaxy .....	8
6a.Pinnate leaves <sup>J</sup> .....	7
6b.Palmate leaves <sup>K</sup> .....	<i>Handroanthus impetiginosus</i>
7a.Elliptical leaflets <sup>L</sup> .....	<i>Spathodea campanulata</i>
7b.Lanceolate leaflets <sup>M</sup> .....	<i>Tecoma stans</i>
8a.Palmate leaves <sup>N</sup> .....	<i>Ceiba speciosa</i>
8b.Pinnate <sup>O</sup> or bipinnate <sup>P</sup> leaves .....	9
9a.Bipinnate leaves .....	<i>Libidibia ferrea</i>
9b.Pinnate leaves .....	<i>Cassia grandis</i>



# RESULTS

- An interactive key for 30 species of Belo Horizonte urban trees;
- Development of teaching material to be used in workshops.

**ILLUSTRATED GLOSSARY**

**DIVISION OF THE BLADE**



Fig. 1 – Simple      Fig. 2 – Compound

**TYPES OF SIMPLE LEAVES**

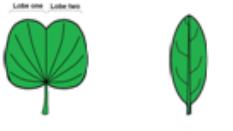


Fig. 3 – Lobed      Fig. 4 – Entire

**VENATION**

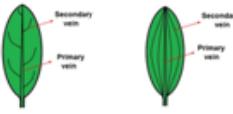


Fig. 5 – Pinnate      Fig. 6 – Palmate-convergent

**PHYLLOTAXY**



Fig. 7 – Opposite      Fig. 8 – Alternate

**A SIMPLE LEAF:** The leaf blade is not divided into leaflets (Fig. 1).

**B COMPOUND LEAF:** The leaf blade is divided into several small parts, known as leaflets (Fig. 2).

**C BI-LOBED LEAF:** The leaf has two lobes equally rounded (Fig. 3).

**D ENTIRE LEAF:** The leaf does not have any division (Fig. 4).

**E PINNATE VENATION PATTERN:** The leaf has only one principal vein (primary vein) that gives off many lateral veins (secondary veins) (Fig. 5).

**F PALMATE-CONVERGENT VENATION PATTERN:** Many secondary veins arising from the tip of the petiole. At the base of the leaf they are closely arranged but diverge from the others in the middle part and converge towards the apex of the leaf (Fig. 6).

**G OPPOSITE PHYLLOTAXY:** There are two leaves per node that stand opposite each other (Fig. 7).

**H PHYLLOTAXY:** It is the arrangement of the leaves on a plant stem.

**I ALTERNATE PHYLLOTAXY:** There is one leaf per node (Fig. 8).

**TYPES OF COMPOUND LEAVES**

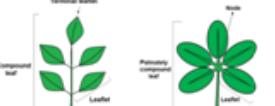


Fig. 9 – Pinnate      Fig. 10 – Palmate

**LEAFLET SHAPE**

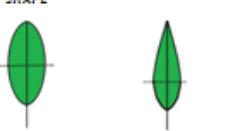


Fig. 11 – Elliptical      Fig. 12 – Lanceolate

**TYPES OF COMPOUND LEAVES**

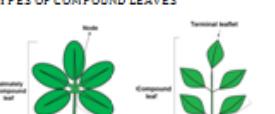


Fig. 13 – Palmate      Fig. 14 – Pinnate

**PALMATE:** more than two leaflets are attached on the upper end of petiole, in the same point (Fig. 13).

**PINNATE LEAF:** More than two leaflets are attached on the upper end of the petiole, coming from the same point (Fig. 14).

**BIPINNATE LEAF:** The leaf is divided into leaflets that are attached along an extension of the stem (Fig. 15).

**J PINNATE LEAF:** The leaf is divided into leaflets that are attached along an extension of the stem (Fig. 9).

**K PALMATE LEAF:** More than two leaflets are attached on the upper end of the petiole, coming from the same point (Fig. 10).

**L ELLIPTICAL SHAPE:** Ellipse-shaped leaflets. The larger length is twice the width (Fig. 11).

**M LANCEOLATE SHAPE:** Lance-head-shaped leaflets. The length is twice or three times the large width (Fig. 12).

**N PALMATE:** more than two leaflets are attached on the upper end of petiole, in the same point (Fig. 13).

**O PINNATE LEAF:** More than two leaflets are attached on the upper end of the petiole, coming from the same point (Fig. 14).

**P BIPINNATE LEAF:** The leaf is divided into leaflets that are attached along an extension of the stem (Fig. 15).



# RESULTS

Interactive Taxonomic Key for Identification of Urban Trees in Belo Horizonte, Minas Gerais, Brazil

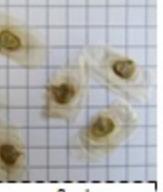
*Bauhinia variegata var. canescens* (Orchid tree) – Fabaceae



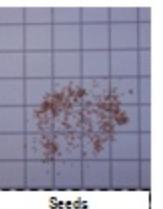
*Celtis speciosa* (Silk floss tree) – Malvaceae



*Spathodea campanulata* (African tulip-tree) – Bignoniaceae

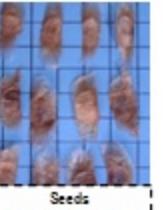


*Tibouchina granulosa* (Glory tree) – Melastomataceae



Interactive Taxonomic Key for Identification of Urban Trees in Belo Horizonte, Minas Gerais, Brazil

*Handroanthus chrysanthus* (Golden trumpet tree) – Bignoniaceae



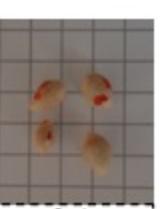
*Patagonia dubium* (Copperpod) – Fabaceae



*Bauhinia variegata* (Orchid tree) – Fabaceae



*Murraya paniculata* (Orange jasmine) – Rutaceae





# RESULTS





# RESULTS





# RESULTS

- 5 workshops were realized (50 participants).





## CONSIDERATIONS

- The interactive key is a good and simple strategy to learn about the plants;
- Xper<sup>2</sup> is a powerful tool for editing and managing taxonomic descriptions. Freely download your Windows™, Mac™ or Linux version in French, English or Spanish.



## CONSIDERATIONS

- This can be an itinerant activity, since internet signal exists;
- People have demonstrated a big interest in the activity. They have related that the workshop has contributed for their knowledge;
- Some participants have complained about the short time of the workshop (2 hours). For this reason we intend to transform it in a basic course of introduction to plant identification.



# TUTORIAL XPER<sup>3</sup>

The biodiversity collaborative  
management platform!





# TUTORIAL XPER<sup>3</sup>

The screenshot shows the homepage of the XPER3 website. At the top, there is a navigation bar with icons for Home, Back, Forward, Stop, Refresh, and a search bar containing the URL "www.xper3.fr". Below the navigation bar is the XPER logo and a language selection "en". To the right is a "Sign In" button. The main content area features a large heading: "The **biodiversity** collaborative management platform !". Below the heading is a descriptive text: "Collaborative descriptive data edition. Online analysis, publication and identification tools." To the right of the text is a white cloud icon containing a magnifying glass, a sun, a paw print, and a leaf. At the bottom left is a green "Sign Up" button with a right-pointing arrow.

Home

www.xper3.fr

xper<sup>3</sup>

en | Sign In

The **biodiversity** collaborative management platform !

Collaborative descriptive data edition. Online analysis, publication and identification tools.

Sign Up



# TUTORIAL XPER<sup>3</sup>



**www.xper3.fr**

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Sign Up





# TUTORIAL XPER<sup>3</sup>

The screenshot shows the XPER3 website homepage. At the top, there is a navigation bar with a 'Home' button, a search icon, and a language dropdown set to 'en'. Below the navigation bar, the XPER logo is displayed, followed by a 'Sign In' button. The main title 'The biodiversity collaborative management platform !' is centered in large, bold, dark font. Below the title, a subtitle reads 'Collaborative descriptive data edition. Online analysis, publication and identification tools.' To the right of the text, there is a decorative graphic of a white cloud containing a magnifying glass, a sun, a paw print, and a leaf. A red arrow points to a green 'Sign Up' button at the bottom left.

Home

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xper<sup>3</sup>

en | Sign In

The **biodiversity** collaborative management platform !

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Sign Up



# TUTORIAL XPER<sup>3</sup>

## My Knowledge Bases

Base name	Owner(s)	Editor(s)	Viewer(s)	
Árvores urbanas do Museu de História Natural e Jardim Botânico da UFMG	Ariadne Lopes	Joao Stehmann	Flávia Faria , Gustavo Jardim	<button>Delete</button>

Or [Create Knowledge Base](#)



# TUTORIAL XPER<sup>3</sup>

xper

Ariadne Caldas (ariadne\_dcl@hotmail.com) Log out | en

Urban Trees in Belo Horizonte, Minas ... | Share | 0 | Saved | Search

Items Descriptive model Description Identification Tools

30 Items

1	Melia azedarach
2	Libidibia ferrea var. leiostachya
3	Ceiba speciosa
4	Spathodea campanulata
5	Bauhinia variegata
6	Sapindus saponaria
7	Tibouchina granulosa
8	Lafoensia glyptocarpa
9	Tecoma stans
10	Syzygium cumini
11	Delonix regia
12	Lagerstroemia speciosa
13	<b>Tabebuia roseoalba</b>
14	Jacaranda mimosifolia
15	Handroanthus impetiginosus
16	Peltorphorum dubium
17	Cordia superba
31	Add a new Item

Definition

Name: Tabebuia roseoalba  
Detail: Tabebuia roseoalba (Ridl.) Mattos || Family: Bignoniaceae || Common names: White trumpet tree, white ipê, Cerrado's ipê. || The Tabebuia roseoalba's tree can reach up to 15 meters tall. This tree has white to light pink flowers arranged in inflorescences. The fruit is a large and woody capsule, which has innumerable winged seeds. || Occurrence: It is native to Brazil, occurring in São Paulo's north, Minas Gerais, Mato Grosso do Sul and Goiás. || Phenology: It starts flowering from August-October when the tree does not have leaves. The fruits mature in October until November's end.

Update

4 pictures 0 videos 0 sounds 0 files

Folha Árvore Flor Fruto



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Alternative name: White trumpet tree

Update

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# TUTORIAL XPER<sup>3</sup>

Screenshot of the XPER application interface showing the identification of a tree species.

The interface includes:

- Header: Ariadne Caldas (ariadne\_dcl@hotmail.com) | Log out | en
- Toolbar: Items, Descriptive model, Description, Identification, Tools
- Left sidebar: List of 30 items, with Tabebuia roseoalba selected (highlighted in green).
- Right panel:
  - Definition** tab:
    - Name: Tabebuia roseoalba
    - Alternative name: White trumpet tree
    - Detail**: Tabebuia roseoalba (Ridl.) Mattos || Family: Bignoniaceae || Common names: White trumpet tree, white ipê, Cerrado's ipê. || The Tabebuia roseoalba's tree can reach up to 15 meters tall. This tree has white to light pink flowers arranged in inflorescences. The fruit is a large and woody capsule, which has innumerable winged seeds. || Occurrence: It is native to Brazil, occurring in São Paulo's north, Minas Gerais, Mato Grosso do Sul and Goiás. || Phenology: It starts flowering from August-October when the tree does not have leaves. The fruits mature in October until November's end.
  - Update** button
- Media** tab:
  - 4 pictures, 0 videos, 0 sounds, 0 files
  - Four image thumbnails: Folha, Árvore, Flor, Fruto.



# TUTORIAL XPER<sup>3</sup>

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Urban Trees in Belo Horizonte, Minas ... | Share | 0 | Saved | Search

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Update

4 pictures 0 videos 0 sounds 0 files

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# TUTORIAL XPER<sup>3</sup>

Screenshot of the XPER application interface showing the "Descriptive model" tab for "Urban Trees in Belo Horizonte, Minas ...".

The interface includes a top navigation bar with user information (Ariadne Caldas, Log out, en), a search bar, and a toolbar with "Items", "Descriptive model" (highlighted with a red arrow), "Description", "Identification", and "Tools".

The main content area displays a list of 11 descriptors on the left and a detailed view of the "Division of the blade" descriptor on the right.

**Descriptive model View:**

- 11 Descriptors:**
  - 1 Division of the blade
  - 2 Types of simple leaf
  - 3 Types of compound leaf
  - 4 Phyllotaxy
  - 5 Shape of the leaf/leaflet
  - 6 Base of the leaf/leaflet
  - 7 Tip of the leaf/leaflet
  - 8 Margin of the leaf/leaflet
  - 9 Venation pattern of the leaf/leaflet
  - 10 Upper leaf zone of the leaf/leaflet
  - 11 Lower leaf zone of the leaf/leaflet

**Descriptor Detail View:**

**Name:** Division of the blade  
**Detail:** Blade (or lamina) is the flattened, green, expanded part of a leaf.

**Descriptors:**  
external morphological characteristics of the leaf

**Media:** 1 pictures, 0 videos, 0 sounds, 0 files

**Image:** A green leaf labeled "Blade".



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Urban Trees in Belo Horizonte, Minas ... | Share | 0 | Saved | Search

Items Descriptive model Description Identification Tools

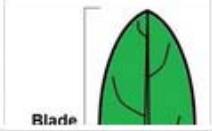
**11 Descriptors**

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Definition Dependencies States

- 1 Simple
- 2 Compound
- 3 Add a new State

1 pictures 0 videos 0 sounds 0 files Descriptor

 Blade

Descriptor  
States  
Simple  
Compound

12 Add a new Descriptor Categorical descriptor

Delete all Choose from Dropbox Add from Url



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Urban Trees in Belo Horizonte, Minas ... | Share | 0 | Saved | Search

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Add a new item

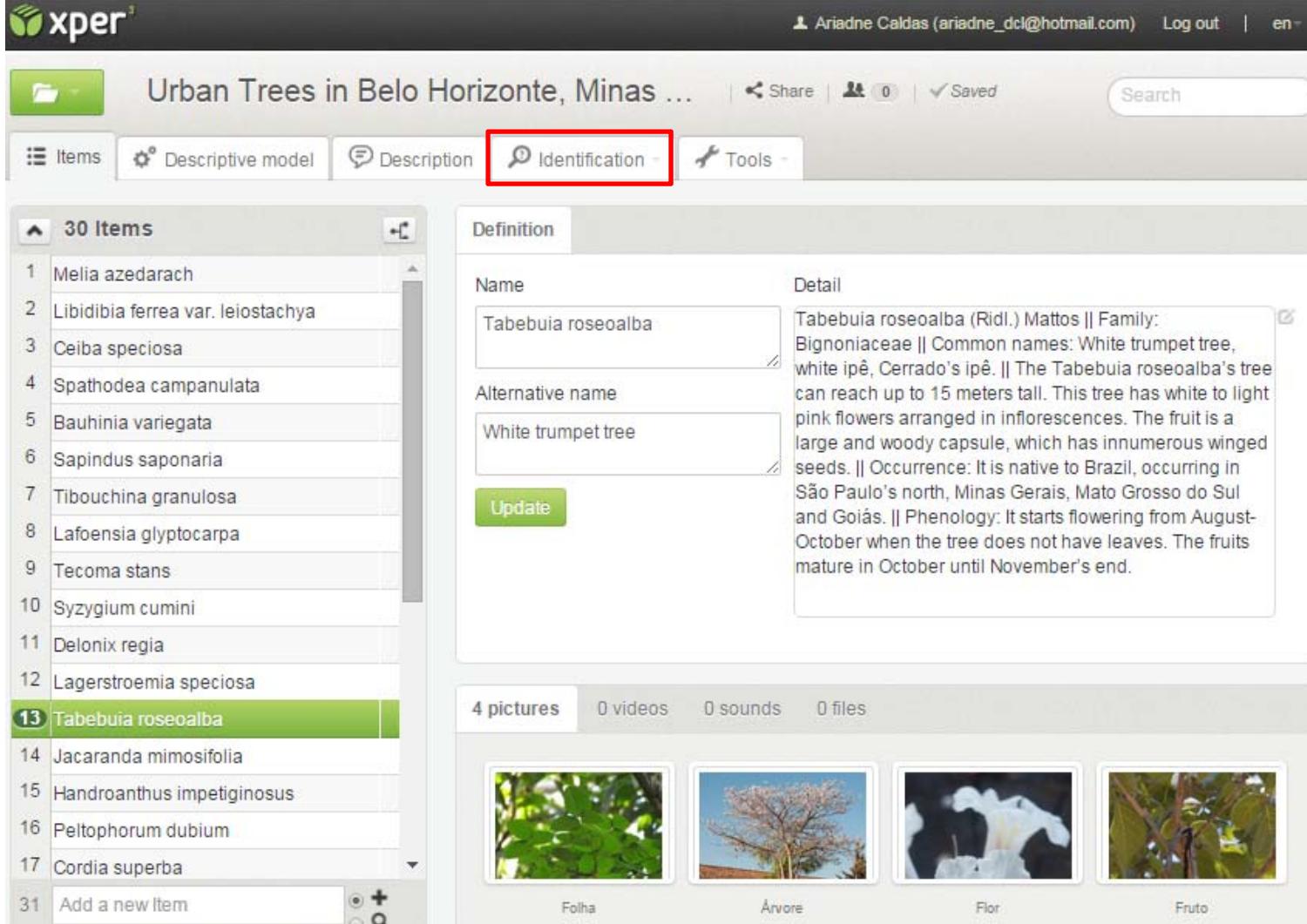
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Update

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# TUTORIAL XPER<sup>3</sup>

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Urban Trees in Belo Horizonte, Minas ... | Share | 0 | Saved | Search

Items | Descriptive model | Description | Identification | Tools

11 Descriptors | History (0)

Types of compound leaf

Compound leaf

Division of the leaflet

Leaflet

Tip

Tip of the leaf/leaflet

The tip or apex is one of the three distinct regions of a leaf blade. It is the part of the lamina farthest removed from the point of attachment of the leaf to the stem.

30 Remaining taxa Among 30

- Melia azedarach
- Libidibia ferrea var. leiostachya
- Ceiba speciosa
- Spathodea campanulata
- Bauhinia variegata
- Sapindus saponaria
- Tibouchina granulosa
- Lafoensis glyptocarpa
- Tecoma stans
- Syzygium cumini
- Delonix regia
- Lagerstroemia speciosa
- Tabebuia roseoalba



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Items Descriptive model Description Identification Tools

11 Descriptors History (0)

Types of compound leaf

Compound leaf Division of the leaflet Leaflet

Tip

Tip of the leaf/leaflet  
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# TUTORIAL XPER<sup>3</sup>

xper<sup>3</sup>

Ariadne Caldas (ariadne\_dcl@hotmail.com) | Log out | en -

Urban Trees in Belo Horizonte, Minas ... | Share | 0 | Saved | Search

Items | Descriptive model | Description | Identification | Tools

11 Descriptors | History (0)

Types of compound leaf

Start the identification with any descriptor

Tip of the leaf/leaflet

The tip or apex is one of the three distinct regions of a leaf blade. It is the part of the lamina farthest removed from the point of attachment of the leaf to the stem.

30 Remaining taxa Among 30

- Melia azedarach
- Libidibia ferrea var. leiostachya
- Ceiba speciosa
- Spathodea campanulata
- Bauhinia variegata
- Sapindus saponaria
- Tibouchina granulosa
- Lafoensia glyptocarpa
- Tecoma stans
- Syzygium cumini
- Delonix regia
- Lagerstroemia speciosa
- Tabebuia roseoalba



# TUTORIAL XPER<sup>3</sup>

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Urban Trees in Belo Horizonte, Minas ... | Share | 0 | Saved | Search

Items Descriptive model Description Identification Tools

11 Descriptors History (0)

Types of compound leaf

30 Remaining taxa Among 30

- Melia azedarach
- Libidibia ferrea var. leiostachya
- Ceiba speciosa
- Spathodea campanulata
- Bauhinia variegata
- Sapindus saponaria
- Tibouchina granulosa
- Lafoensis glyptocarpa
- Tecoma stans
- Syzygium cumini
- Delonix regia
- Lagerstroemia speciosa
- Tabebuia roseoalba

Tip

Tip of the leaf/leaflet

The tip or apex is one of the three distinct regions of a leaf blade. It is the part of the lamina farthest removed from the point of attachment of the leaf to the stem.



# TUTORIAL XPER<sup>3</sup>

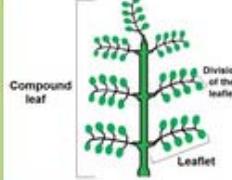
**xper** | Ariadne Caldas (ariadne\_dcl@hotmail.com) | Log out | en ▾

Urban Trees in Belo Horizonte, Minas ... | Share | 0 | Saved

Items Descriptive model Description Identification Tools

11 Descriptors History (0)

Types of compound leaf

Compound leaf 

Odd-pinnate (4)

Even-pinnate (6)

Odd-bipinnate (3)

30 Remaining taxa Among 30

- Melia azedarach
- Libidibia ferrea var. leiostachya
- Ceiba speciosa
- Spathodea campanulata
- Bauhinia variegata
- Sapindus saponaria
- Tibouchina granulosa
- Lafoensia glyptocarpa
- Tecoma stans
- Syzygium cumini
- Delonix regia
- Lagerstroemia speciosa
- Tabebuia roseoalba
- Jacaranda mimosifolia



# TUTORIAL XPER<sup>3</sup>

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Ariadne Caldas (ariadne\_dcl@hotmail.com) Log out | en

Urban Trees in Belo Horizonte, Minas ... | Share | 0 | Saved | Search

Items Descriptive model Description Identification Tools

11 Descriptors History (0) Unselect Submit

Types of compound leaf

Odd-pinnate (4) Even-pinnate (6) Odd-bipinnate (3)

Select one of the states

30 Remaining taxa Among 30

- Melia azedarach
- Libidibia ferrea var. leiostachya
- Ceiba speciosa
- Spathodea campanulata
- Bauhinia variegata
- Sapindus saponaria
- Tibouchina granulosa
- Lafoensia glptocarpa
- Tecoma stans
- Syzygium cumini
- Delonix regia
- Lagerstroemia speciosa
- Tabebuia roseoalba
- Jacaranda mimosifolia



# TUTORIAL XPER<sup>3</sup>

Screenshot of the XPER application interface showing the identification of urban trees in Belo Horizonte, Minas Gerais.

The main interface includes:

- Header: Ariadne Caldas (ariadne\_dcl@hotmail.com), Log out, en.
- Toolbar: Items, Descriptive model, Description, Identification, Tools.
- Section: 11 Descriptors, History (0).
- Buttons: Unselect, Submit (highlighted with a red box and a green arrow pointing to it from a callout box).
- Image: Types of compound leaf diagram.
- List: Odd-pinnate (4), Even-pinnate (6), Odd-bipinnate (3).
- Callout box: Submit the chosen state.
- Panel: 30 Remaining taxa (Among 30) with a scrollable list of tree species.

Callout box text: Submit the chosen state

Type of Compound Leaf	Count
Odd-pinnate	(4)
Even-pinnate	(6)
Odd-bipinnate	(3)

Panel: 30 Remaining taxa (Among 30)

- Melia azedarach
- Libidibia ferrea var. leiostachya
- Ceiba speciosa
- Spathodea campanulata
- Bauhinia variegata
- Sapindus saponaria
- Tibouchina granulosa
- Lafoensis glyptocarpa
- Tecoma stans
- Syzygium cumini
- Delonix regia
- Lagerstroemia speciosa
- Tabebuia roseoalba
- Jacaranda mimosifolia



# TUTORIAL XPER<sup>3</sup>

xper

Ariadne Caldas (ariadne\_dcl@hotmail.com) Log out | en ▾

Urban Trees in Belo Horizonte, Minas ... | Share | 0 | Saved | Search

Items Descriptive model Description Identification Tools

7 Descriptors History (1)

**Tip**

**Tip of the leaf/leaflet**  
The tip or apex is one of the three distinct regions of a leaf blade. It is the part of the lamina farthest removed from the point of attachment of the leaf to the stem.

**Shape of the leaf/leaflet**  
It refers to what the shape of the leaf looks like.

4 Remaining taxa Among 30

- Spathodea campanulata
- Sapindus saponaria
- Tecoma stans
- Murraya paniculata
- Schizolobium parahyba
- Gaesalpinia pulcherrima
- Garyeta urens
- Reystonea elata
- Samanea inopinata
- Leucaena leucocephala
- Senna multijuga
- Senna maeranthera
- Clitoria fairchildiana
- Eucalyptus tereticornis
- Heleoaly balansae

**Remaining urban tree species**



# TUTORIAL XPER<sup>3</sup>

**Remaining descriptors**

7 Descriptors History (1)

**Tip**

**Tip of the leaf/leaflet**  
The tip or apex is one of the three distinct regions of a leaf blade. It is the part of the lamina farthest removed from the point of attachment of the leaf to the stem.

**Shape of the leaf/leaflet**  
It refers to what the shape of the leaf looks like.

4 Remaining taxa Among 30

- Spathodea campanulata*
- Sapindus saponaria*
- Tecoma stans*
- Murraya paniculata*
- Schizolobium parahyba*
- Gaesalpinia pulcherrima*
- Garyeta urens*
- Reystonea eleraea*
- Samanea inopinata*
- Leucaena leucocephala*
- Senna multiflora*
- Senna maeranthera*
- Clitoria fairchildiana*
- Eucalyptus tereticornis*
- Heleoaly balansae*



# TUTORIAL XPER<sup>3</sup>

Screenshot of the XPER application interface showing a leaf descriptor and remaining taxa list.

The top navigation bar includes:

- User profile: Ariadne Caldas (ariadne\_dcl@hotmail.com)
- Log out
- Language: en

The main content area shows:

- A green folder icon.
- The title: Urban Trees in Belo Horizonte, Minas ...
- Buttons: Items, Descriptive model, Description, Identification, Tools.
- A red arrow points to the "History (1)" button.
- Descriptor details:
  - Tip**: An illustration of a leaf with the word "Tip" pointing to the apex. The text defines it as the part of the lamina farthest from the point of attachment.
  - Shape of the leaf/leaflet**: An illustration of a leaf with a dashed line through the center. The text describes it as the overall shape of the leaf.
- A list of "4 Remaining taxa Among 30":
  - Spathodea campanulata
  - Sapindus saponaria
  - Tecoma stans
  - Murraya paniculata
  - Schizolobium parahyba
  - Gaesalpinia pulcherrima
  - Garyeta urens
  - Reystonea eleracea
  - Samanea inopinata
  - Leucaena leucocephala
  - Senna multijuga
  - Senna maeranthera
  - Clitoria fairchildiana
  - Eucalyptus tereticornis
  - Heleoaly balansae



# TUTORIAL XPER<sup>3</sup>

Screenshot of the XPER application interface showing a tree identification workflow.

The top navigation bar includes:

- User profile: Ariadne Caldas (ariadne\_dcl@hotmail.com)
- Logout link
- Language selection: en

The main search bar shows the query: "Urban Trees in Belo Horizonte, Minas ...".

The toolbar below the search bar includes:

- Items
- Descriptive model
- Description
- Identification
- Tools

The identification process is currently at step 7 Descriptors, with a history of 1 entry: "Types of compound leaf".

The "Odd-pinnate" descriptor is selected, indicated by a red-bordered "X" button in the top right corner of its card.

The "Remaining taxa" list, titled "Among 30", includes the following species:

- Spathodea campanulata*
- Sapindus saponaria*
- Tecoma stans*
- Murraya paniculata*
- Schizoleium parahyba*
- Gaesalpinia pulcherrima*
- Caryota urens*
- Reystonea eleracea*
- Samanea inopinata*
- Leucaena leucocephala*
- Senna multiflora*
- Senna macranthera*
- Gliricidia fairchildiana*
- Eucalyptus tereticornis*
- Helegaly balansae*
- Cassia grandis*



# TUTORIAL XPER<sup>3</sup>

The screenshot shows the XPER software interface for identifying urban trees. The top navigation bar includes the XPER logo, user information (Ariadne Caldas), log out, and language selection (en). The main title is "Urban Trees in Belo Horizonte, Minas ...". The toolbar below the title includes "Items", "Descriptive model", "Description", "Identification", and "Tools".

The central left panel is titled "11 Descriptors" and "History (0)". It contains the message: "There is no description yet Add a new description in the descriptors panel". A green dashed box highlights this area with the instruction: "Click on Descriptors to continue the identification". A green arrow points from this box towards the "11 Descriptors" tab.

The right panel is titled "30 Remaining taxa Among 30". It lists the following tree species:

- Melia azedarach
- Libidibia ferrea var. leiostachya
- Ceiba speciosa
- Spathodea campanulata
- Bauhinia variegata
- Sapindus saponaria
- Tibouchina granulosa
- Lafoensia glyptocarpa
- Tecoma stans
- Syzygium cumini
- Delonix regia
- Lagerstroemia speciosa
- Tabebuia roseoalba
- Jacaranda mimosifolia
- Handroanthus impetiginosus
- Peltorphorum dubium



# TUTORIAL XPER<sup>3</sup>

Screenshot of the XPER application interface showing a tree identification workflow.

The top navigation bar includes:

- User profile: Ariadne Caldas (ariadne\_dcl@hotmail.com)
- Logout link
- Language selection: en

The main search bar shows: Urban Trees in Belo Horizonte, Minas ...

The toolbar includes:

- Items
- Descriptive model
- Description
- Identification
- Tools

The Identification panel displays:

- 7 Descriptors
- History (1)
- Types of compound leaf
- Odd-pinnate (selected, highlighted in green)

The Tools panel displays:

- 4 Remaining taxa (Among 30)
- Spathodea campanulata*
- Sapindus saponaria*
- Tecoma stans*
- Murraya paniculata*
- Schizoleium parahyba*
- Gaesalpinia pulcherrima*
- Caryota urens*
- Reystonea eleracea*
- Samanea inopinata*
- Leucaena leucocephala*
- Senna multijuga*
- Senna maeranthera*
- Gliricidia fairchildiana*
- Eucalyptus tereticornis*
- Helegaly balansae*
- Cassia grandis*



# TUTORIAL XPER<sup>3</sup>

Screenshot of the XPER application interface showing the identification of compound leaf types.

The main title bar shows "xper" and the user "Ariadne Caldas (ariadne\_dcl@hotmail.com)". The top navigation bar includes "Share", "0", "Saved", and a "Search" bar.

The left panel displays "7 Descriptors" and "History (1)". The right panel shows "4 Remaining taxa" among 30, with a warning message: "Warning : Modifying descriptions can change the result of the next description".

The central area lists "Types of compound leaf" with the following options:

- Odd-pinnate** (selected, indicated by a green checkmark)
- Even-pinnate** (unchecked)
- Odd-bipinnate** (unchecked)
- Even-bipinnate** (unchecked)

A green dashed box highlights the "Odd-pinnate" option, with the text: "Cancel the state that you have selected previously". A green arrow points from this text to the "Odd-pinnate" checkbox.

At the bottom right are "Cancel" and "Change" buttons.



# TUTORIAL XPER<sup>3</sup>

Screenshot of the XPER software interface showing the identification of compound leaves.

The main title bar shows "xper" and the user "Ariadne Caldas (ariadne\_dcl@hotmail.com) Log out | en".

The top navigation bar includes "Items", "Descriptive model", "Description", "Identification", and "Tools".

The current project is "Urban Trees in Belo Horizonte, Minas ...".

The "Identification" tab is active, displaying "7 Descriptors" and "History (1)".

A warning message states: "⚠ Warning : Modifying descriptions can change the result of the next description".

The main content area shows "4 Remaining taxa Among 30".

The "Types of compound leaf" section lists:

- Odd-pinnate** (selected, indicated by a green checkmark)
- Even-pinnate** (unchecked)
- Odd-bipinnate** (checked, indicated by a green checkmark)
- Even-bipinnate** (unchecked)
- Palmate** (unchecked)

A green dashed box highlights the "Odd-bipinnate" option, with a green arrow pointing from it to a text box containing the instruction: "Choose another state".

At the bottom right are "Cancel" and "Change" buttons.



# TUTORIAL XPER<sup>3</sup>

Screenshot of the XPER application interface showing the identification of compound leaves.

The top navigation bar includes:

- User profile: Ariadne Caldas (ariadne\_dcl@hotmail.com)
- Log out
- Language: en

The main search bar shows: Urban Trees in Belo Horizonte, Minas ...

The toolbar below the search bar includes:

- Items
- Descriptive model
- Description
- Identification
- Tools

The current view is under the "Identification" tab, showing "7 Descriptors" and "History (1)".

A warning message is displayed: "⚠ Warning : Modifying descriptions can change the result of the next description".

The main content area displays "4 Remaining taxa Among 30" and lists the following types of compound leaf:

- Odd-pinnate** (selected, indicated by a green checkmark)
- Even-pinnate** (unchecked)
- Odd-bipinnate** (checked)
- Even-bipinnate** (unchecked)
- Palmate** (unchecked)

A callout box with a dashed green border and arrow points to the "Change" button at the bottom right of the list, with the text "Click on Change!".



# TUTORIAL XPER<sup>3</sup>

xper

Ariadne Caldas (ariadne\_dci@hotmail.com) Log out | en

Urban Trees in Belo Horizonte, Minas ... | Share | 0 | Saved | Search

Items Descriptive model Description Identification Tools

6 Descriptors History (1)

Types of compound leaf

Odd-bipinnate

Melia azedarach  
Libidibia ferrea var. leiostachya  
Caryota urens  
Murraya paniculata  
Schizolobium parahyba  
Caesalpinia pulcherrima  
Roystonea oleracea  
Samanea inopinata  
Leucaena leucocephala  
Senna multijuga  
Senna macranthera  
Clitoria fairchildiana  
Eucalyptus tereticornis  
Helegaly balansae  
Cassia grandis  
Cordia superba

Among 30

3 Remaining taxa

Melia azedarach  
Libidibia ferrea var. leiostachya  
Caryota urens  
Murraya paniculata  
Schizolobium parahyba  
Caesalpinia pulcherrima  
Roystonea oleracea  
Samanea inopinata  
Leucaena leucocephala  
Senna multijuga  
Senna macranthera  
Clitoria fairchildiana  
Eucalyptus tereticornis  
Helegaly balansae  
Cassia grandis  
Cordia superba



# TUTORIAL XPER<sup>3</sup>

Screenshot of the XPER application interface showing a tree identification workflow.

The top navigation bar includes:

- User profile: Ariadne Caldas (ariadne\_dci@hotmail.com)
- Log out
- Language: en

The main workspace shows a project titled "Urban Trees in Belo Horizonte, Minas ...".

Toolbars at the top include:

- Items
- Descriptive model
- Description
- Identification
- Tools

A red arrow points to the "Identification" tab, which is currently selected.

The left panel displays "6 Descriptors" and "History (1)".

The central panel shows "Types of compound leaf" and "Odd-bipinnate" selected, indicated by a green checkmark.

The right panel lists "3 Remaining taxa Among 30":

- Melia azedarach
- Libidibia ferrea var. leiostachya
- Caryota urens
- Murraya paniculata
- Schizolobium parahyba
- Caesalpinia pulcherrima
- Roystonea oleracea
- Samanea inopinata
- Leucaena leucocephala
- Senna multijuga
- Senna macranthera
- Clitoria fairchildiana
- Eucalyptus tereticornis
- Helegaly balansae
- Cassia grandis
- Cordia superba



# TUTORIAL XPER<sup>3</sup>

The screenshot shows the XPER web application interface. At the top, there is a navigation bar with the XPER logo, user information (Ariadne Caldas), and language selection (en). Below the navigation bar, the main title is "Urban Trees in Belo Horizonte, Minas ...". The interface includes several tabs: "Items", "Descriptive model", "Description", "Identification" (selected), and "Tools". A red arrow points from the left side of the interface towards the "Identification" panel.

The "Identification" panel displays the following information:

- 0 Descriptors
- History (2)
- A message: "There are no descriptors left. Check your results in the remaining taxa panel."
- A link: [Reset and restart](#)
- A progress bar at the bottom.
- A list titled "1 Remaining taxa Among 30" containing the following species names:
  - Caryota urens
  - Libidibia ferrea var. leiostachya
  - Melia azedarach
  - Murraya paniculata
  - Schizolobium parahyba
  - Gaesalpinia pulcherrima
  - Roystonea eleracea
  - Samanea inopinata
  - Leucaena leucocephala
  - Senna multijuga
  - Senna maeranthera
  - Gloria fairchildiana
  - Eucalyptus tereticornis
  - Holocalyx balansae
  - Gassia grandis
  - Gordia superba



# TUTORIAL XPER<sup>3</sup>

**Caryota urens** - Remaining



PREV NEXT

Caryota urens Jacq. || Family: Arecaceae || Common names: Solitary fishtail palm, toddy palm, wine palm. It is a palm tree that can reach up to 30 m tall. The ultimate leaflets have a characteristic shape, somewhat like the tail of a fish, leading to the popular English name of fishtail palm. This species has a globose fruit, red to black in color, with one seed. || Occurrence: It is a native palm tree to the tropical area from Southeast Asia (India, Burma, Sri Lanka e Malaysia). || Phenology: Flowering starts for the first time around 13 years of age and produces several inflorescences every year.



# TUTORIAL XPER<sup>3</sup>

Caryota urens - Remaining



◀ PREV NEXT ▶

...

Caryota urens Jacq. || Family: Arecaceae || Common names: Solitary fishtail palm, toddy palm, wine palm. It is a palm tree that can reach up to 30 m tall. The ultimate leaflets have a characteristic shape, somewhat like the tail of a fish, leading to the popular English name of fishtail palm. This species has a globose fruit, red to black in color, with one seed. || Occurrence: It is a native palm tree to the tropical area from Southeast Asia (India, Burma, Sri Lanka e Malaysia). || Phenology: Flowering starts for the first time around 13 years of age and produces several inflorescences every year.



# TUTORIAL XPER<sup>3</sup>





# TUTORIAL XPER<sup>3</sup>

The screenshot shows the XPER software interface for identifying urban trees in Belo Horizonte, Minas Gerais. The top navigation bar includes the XPER logo, user information (Ariadne Caldas, ariadne\_dcl@hotmail.com), and language selection (en). The main workspace displays a message: "There are no descriptors left. Check your results in the remaining taxa panel". A green dashed box highlights the text "Click on Reset and Restart" with a green arrow pointing to the "Reset and restart" link. The right panel lists "1 Remaining taxa Among 30" with a scrollable list of tree species names.

0 Descriptors History (2)

There are no descriptors left  
Check your results in the remaining taxa panel

Reset and restart

Click on  
Reset and  
Restart

1 Remaining taxa Among 30

- Caryota urens
- Libidibia ferrea var. leiostachya
- Melia azedarach
- Murraya paniculata
- Schizolobium parahyba
- Gaesalpinia pulcherrima
- Reystonea eлерacea
- Samanca inopinata
- Leucaena leucocephala
- Senna multijuga
- Senna macranthera
- Gliricidia fairchildiana
- Eucalyptus tereticornis
- Heleoaly balansae
- Gossia grandis
- Cordia superba



# TUTORIAL XPER<sup>3</sup>

xper<sup>3</sup> Ariadne Caldas (ariadne\_dcl@hotmail.com) Log out | en -

Urban Trees in Belo Horizonte, Minas ... | Share | 0 | Saved | Search

Items Descriptive model Description Identification Tools

11 Descriptors History (0)

Types of compound leaf

Compound leaf Division of the leaflet Leaflet

Tip

Tip of the leaf/leaflet

The tip or apex is one of the three distinct regions of a leaf blade. It is the part of the lamina farthest removed from the point of attachment of the leaf to the stem.

30 Remaining taxa Among 30

- Melia azedarach
- Libidibia ferrea var. leiostachya
- Ceiba speciosa
- Spathodea campanulata
- Bauhinia variegata
- Sapindus saponaria
- Tibouchina granulosa
- Lafoensis glyptocarpa
- Tecoma stans
- Syzygium cumini
- Delonix regia
- Lagerstroemia speciosa
- Tabebuia roseoalba



## ACKNOWLEDGEMENTS

- BGCI and MBG supporting Flávia Faria;
- BGCI Congress organization;
- MBG Herbarium and Dr. Solomon;
- PROGRAD/UFMG for supporting Ariadne Lopes;
- PROEX/UFMG for Ariadne Lopes's scholarship;
- Alex Markus Eckert and Russell Paget for helping on the text's review;
- And you for participating on workshop.



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