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How to Use a Dichotomous Key: A Tutorial Featuring 10 Common Shade Trees of the Tampa Bay Area[1]

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Introduction

A dichotomous key is a tool used to help identify an unknown organism. As the prefix di- in its name implies, a dichotomous key leads the user through a sequence of paired, either-or choices (e.g., Does the tree have simple or compound leaves?). Accurately navigating this series of options will lead the user to identify the correct organism if it is included among the list of possible outcomes.

When used properly, a well-designed key can be a very effective identification tool. That said, most dichotomous keys draw on very specific taxonomic terminology to describe identifiable characteristics associated with a tree's leaves, bark, twigs, flowers, and/or fruits. While this makes the key more precise and concise, it can create a barrier for users who lack the experience to comprehend the specific terminology used. For the key included below, all taxonomic terminology is defined in a key-specific glossary. More information and images of these leaf characteristics are offered in the EDIS publication "How to Identify a Tree" by Andreu et al. (2013).

This tutorial features a key of leaf characteristics for ten common broadleaf trees in the Tampa Bay Area. The species selected were included because of their prevalence in both urban and rural landscapes, and because they highlight a wide range of leaf morphological features (e.g., simple vs compound; lobed vs entire). Users of this tutorial should be able to readily find most of these species with minimal effort. Once located, samples can be brought indoors for a hands-on laboratory activity. Even if all ten species are not available, trees not included in the key below can be incorporated into the lab activity to show participants the limitations of this particular key's scope.

Following the key are additional photographs and descriptions of the trees highlighted in this guide. Many field guides use a key to direct the user toward pages with similar descriptive text and figures. While leaf characteristics were the focus of the key used in this tutorial, tree form, bark, flowers, and fruit can all be used in identification. Any or all of these features may be used to confirm whether or not an unknown tree was keyed out correctly.

Tutorial—Using a Key to Identify an Unknown Tree

In the tutorial that follows the key, we start with an unidentified tree and progress step by step through the identification process. At each decision, a photograph will highlight the leaf and twig features of interest on the unidentified specimen.

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Once you have successfully navigated this key to identify our example tree, you can use the same process to distinguish the remaining nine trees from one another. Given the broad scope of this key (broadleaf trees of North and Central Florida) and somewhat limited coverage (ten trees), this key is most effective when used as a tree-identification classroom activity where twig samples of the species have been procured ahead of time. A comprehensive key and tree identification field guide, *Trees: North and Central Florida* (Koeser et al. 2015), produced through the University of Florida, is more suitable for field identification of a broader range of trees found in North and Central Florida's urban and natural areas. Additionally, a list of field guides that incorporate keys into their navigation is included in the References section.

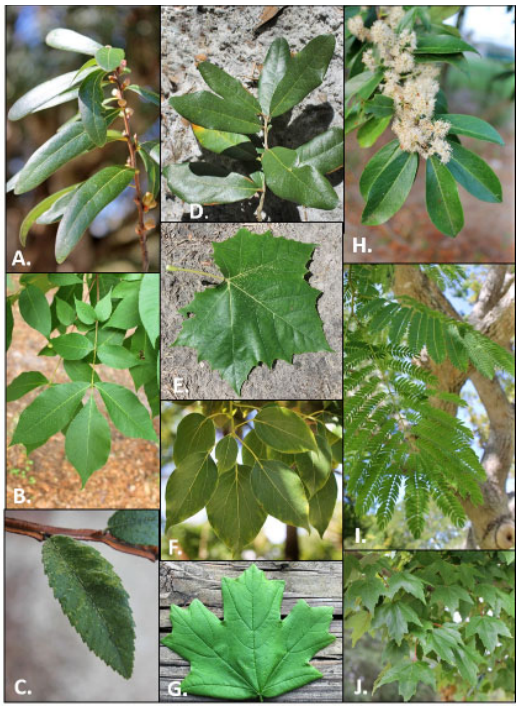


Figure 1. *Trees included in this key: A.)* Laurel Oak (*Quercus laurifolia*); *B.)* Pignut Hickory (*Carya glabra*); *C.)* Winged Elm (*Ulmus alata*); *D.)* Live Oak (*Quercus virginiana*); *E.)* American Sycamore (*Platanus occidentalis*); *F.)* Camphor Tree (*Cinnamomum camphora*); *G.)* Florida Maple (*Acer floridanum*); *H.)* Carolina Laurel Cherry (*Prunus caroliniana*); *I.)* Earpod Tree (*Enterolobium contortisiliquum*); *J.)* Red Maple (*Acer rubrum*)

Key to 10 Common Shade Trees in the Tampa Bay Area

1. Leaves and buds are opposite. (Go to 2)

1'. Leaves and buds are alternate. (Go to 3)

2. Leaves are simple, lobed, and have entire margins. (Florida Maple, *Acer floridanum*)

2'. Leaves are simple, lobed, and have serrated margins. Leaf petiole and new twig growth are light red in color. (Red Maple, *Acer rubrum*)

3. Leaves are simple. (Go to 4)

3'. Leaves are compound. (Go to 9)

4. Leaves are entire. (Go to 5)

4'. Leaves are serrated or lobed. (Go to 7)

5. Leaf undersides appear silvery or white and are highly aromatic when crushed. (Camphor Tree, *Cinnamomum camphora*)

5'. Leaf undersides are not silvery or white. (Go to 6)

6. Leaves are leathery and revolute. (Live Oak, *Quercus virginiana*)

6'. Leaves are not leathery and are relatively flat. (Laurel Oak, *Quercus laurifolia*)

7. Leaf has 3 to 5 broad triangular lobes. (American Sycamore, *Platanus occidentalis*)

7'. Leaf is serrated, but is lacking lobes. (Go to 8)

8. Leaf base is asymmetric. Corky wings are present on twigs and branches. (Winged Elm, *Ulmus alata*)

8'. Leaf base is symmetric. Leaf margins range from entire to sharply toothed. Leaf petiole is red. Leaf is glossy and aromatic when crushed. (Carolina Laurel Cherry, *Prunus caroliniana*)

9. Leaves are once-compound. (Pignut Hickory, *Carya glabra*)

9'. Leaves are twice-compound. (Earpod Tree, *Enterolobium contortisiliquum*)

Florida Maple (*Acer floridanum*)

Family: Sapindaceae, soapberry family

Florida Hardiness: 8a–9a

Height: 20–60’

Width: 25–40’

Leaf: 1 1/2–3 1/2” long, simple, opposite, star-shaped with 3–5 lobes, and has entire margins. Leaves are green on top, paler green and pubescent underneath, turn orange and yellow in the fall, and are deciduous.

Bark: Light gray and smooth, becoming irregularly ridged and breaking into plates with age

Flower: Small, yellow-green, and emerges in clusters on 1–2” long stalks

Flowering: Early spring, with new leaves

Fruit: 1/2–1 1/2” long, 2-winged samara with a rounded, bulbous seed cavity

Fruiting: Mid summer

Native Range: Southeastern United States

Habitat: Full sun to partial shade, well-drained to occasionally wet soil, high drought tolerance, and no aerosol salt tolerance

Red Maple (*Acer rubrum*)

Family: Sapindaceae, soapberry family

Florida Hardiness: 8a–9b

Height: 60–75’

Width: 25–35’

Leaf: 2–5” long, simple, opposite, ovate, 3–5 lobed, with serrated margins, and a red petiole. Leaves are medium to dark green on top; grayish to silvery underneath; turn yellow, red, and purple in the fall; and are deciduous.

Bark: Light gray and smooth when young, becoming dark gray, rough, ridged, and furrowed with age

Flower: Tiny, red or pink, and emerges in clusters

Flowering: Late winter to early spring, before new leaves emerge

Fruit: 3/4–1” long, pinkish to reddish, 2-winged samara

Fruiting: Spring

Native Range: Eastern United States and neighboring Canadian provinces, in addition to Newfoundland

Habitat: Full sun to partial shade, wet to well-drained soil, moderate drought tolerance, and low aerosol salt tolerance

Pignut Hickory (*Carya glabra*)

Family: Juglandaceae, hickory or walnut family

Florida Hardiness: 8a–9b

Height: 50–65’

Width: 30–40’

Leaf: 8–12” long, odd-pinnately compound, alternate, and made up of 5–7 leaflets. Leaflets are 3–6” long, ovate to lanceolate, have serrated margins, are dark green on top, paler green and pubescent in the vein axils underneath, turn yellow in the fall, and are deciduous.

Bark: Gray-brown and smooth when young, developing scaly ridges that are interwoven in a diamond-like pattern with age

Flower: Male: 2–3” long, yellow-green catkin, often in pairs of 3. Female: small, green spike that emerges in clusters at branch tips.

Flowering: Spring

Fruit: 1–2 1/2” long, ellipsoid or obovoid, dry, hard nut that is enclosed in a 4-valved husk that turns from green to brown and splits halfway down to the base with maturity.

Fruiting: Matures in early fall

Native Range: Eastern half of the United States and extreme southern Ontario

Habitat: Full sun to partial shade, well-drained to occasionally wet soil, high drought tolerance, and moderate aerosol salt tolerance

Camphor Tree (*Cinnamomum camphora*)

Family: Lauraceae, laurel family

Florida Hardiness: 8b–11

Height: 40–50’

Width: 50–70’

Leaf: 2–4” long, simple, alternate, ovate to obovate, with entire and wavy margins. Leaves are dark green and shiny on top, glaucous or silvery underneath, fragrant when crushed, and are evergreen.

Bark: Brown to gray, becoming increasingly furrowed and ridged with age

Flower: Small, greenish-white, and emerges in clusters on 2–3” long panicles

Flowering: Spring

Fruit: 1/3”, round, shiny drupe that turns from green to black when ripe

Native Range: Eastern Asia. *Invasive*—not recommended in the north and central regions of the state by UF/IFAS faculty, except for specified and limited use that has been approved by the UF/IFAS Invasive Plants Working Group. *Caution*—may be recommended in the southern region of the state by UF/IFAS faculty, but should be managed to prevent its escape (UF/IFAS IPWG 2015).

Habitat: Full sun to partial shade, well-drained soil, high drought tolerance, and low aerosol salt tolerance

Earpod Tree (*Enterolobium contortisiliquum*)

Family: Fabaceae or Leguminosae, legume family

Florida Hardiness: 10–11

Height: 60–90’

Width: Up to 80’

Leaf: Bipinnately compound and alternate, with primary and secondary leaflets having opposite arrangement. Primary leaflets are in pairs of 3–14 and are made up of 10–15 pairs of oblong, secondary leaflets that are up to 3/4” long. Secondary leaflets are dark green on top, lighter green underneath, asymmetrical along the midvein, have entire margins, and are deciduous.

Bark: Light gray, becoming textured with vertical striations with age

Flower: Small, greenish-white, and emerges in clusters on axillary umbels

Flowering: Spring

Fruit: 2 1/2–3” long, kidney-shaped seed pod that turns from green to oxblood or almost black when mature

Fruiting: Summer

Native Range: Argentina, Bolivia, Brazil, Paraguay, and Uruguay

Habitat: Full sun to partial shade and well-drained soils

American Sycamore (*Platanus occidentalis*)

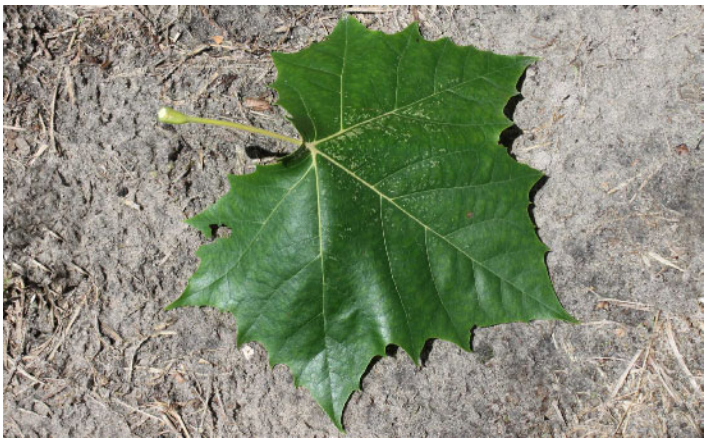
Family: Platanaceae, planetree family

Florida Hardiness: 8a–9a

Height: 75–90’

Width: 50–70’

Leaf: 4–9” long, simple, alternate, ovate, with 3–5 broad-



triangular lobes, and coarsely toothed margins. Leaves are bright green and smooth on top, paler green and pubescent underneath with pubescence remaining only on veins with maturity, turn yellow in the fall, and are deciduous.

Bark: White and sloughing off in thin, irregular plates to reveal green, tan, cream, and brown inner bark

Flower: Small and borne in compact, dense clusters on a spherical head

Flowering: Spring

Fruit: 1/2–1”, brown, globulose cluster of achenes

Fruiting: Ripens in late fall to early winter

Native Range: Eastern half of the United States and southern Ontario

Habitat: Full sun, wet to well-drained soil, high drought tolerance, and moderate aerosol salt tolerance

Carolina Laurel Cherry (*Prunus caroliniana*)

Family: Rosaceae, rose family

Florida Hardiness: 8a–10a

Height: 25–40' and thicket-forming

Width: 15–25'

Leaf: 2–4" long, simple, alternate, elliptic, with entire to sharply toothed margins. Leaves are dark green and shiny on top, dull green underneath, fragrant when crushed, attached to a red petiole, and are evergreen.

Bark: Reddish-brown, smooth, and flecked with lenticels when young, then darkens to gray or almost black, and splits and fissures with age

Flower: Small, white, fragrant, and emerges on 2–3" long racemes

Flowering: Winter

Fruit: 1/3–1/2", black, oval, shiny drupe

Fruiting: Spring and summer

Native Range: Southeastern United States and eastern Texas

Habitat: Full sun to full shade, well-drained soil, high drought tolerance, and moderate aerosol salt tolerance

Laurel Oak (*Quercus laurifolia*)

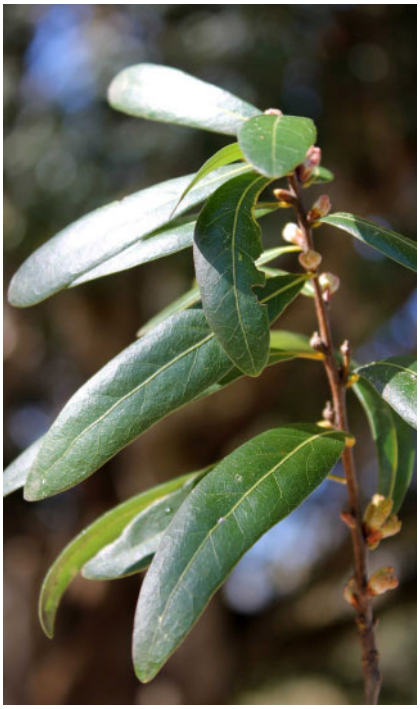
Family: Fagaceae, beech or oak family

Florida Hardiness: 8a–10a

Height: 60–70'

Width: 35–45'

Leaf: 3–5" long, simple, alternate, ovate to oblanceolate or appearing diamond-shaped, with entire margins. Leaves are green and glossy on top, somewhat lighter green and smooth underneath, turn yellow in the fall, and are deciduous in the north and semi-evergreen in the south.



Bark: Dark gray and smooth when young, developing shallow fissures with flat ridges, and sometimes has a fluted or buttressed base with age

Flower: Male: 1 1/2–3" long, yellow-green catkin. Female: tiny, green to reddish spike that emerges from leaf axils.

Flowering: Early spring

Fruit: 1/2" long, nearly round, brown acorn. The cap has tight, reddish-brown scales and covers the top 1/4 of the shiny nut.

Fruiting: Fall

Native Range: Southeastern United States and east Texas

Habitat: Full sun to partial shade, well-drained to occasionally wet soil, moderate drought tolerance, and low aerosol salt tolerance

Live Oak (*Quercus virginiana*)

Family: Fagaceae, beech or oak family

Florida Hardiness: 8a–10b

Height: 60–80'

Width: 60–120'

Leaf: 2–5" long, simple, alternate, oblong or elliptic, and with revolute margins but new growth may be toothed or shallowly lobed. Leaves are dark green and glossy on top, paler green and may or may not have pubescence underneath, stiff, leathery, and are evergreen to semi-evergreen.

Bark: Reddish-brown and furrowed when young, turning gray to almost black, and becoming rough, deeply furrowed, and blocky with age

Flower: Male: 2–3" long, yellow-green catkin. Female: Tiny, reddish spike that emerges from leaf axils.

Flowering: Early spring

Fruit: 3/4" long, oblong, dark brown acorn. The cap is bowl-shaped, warty, and covers the top 1/3 of the shiny nut.

Fruiting: Matures in fall

Native Range: Atlantic and Gulf Coastal states of the southeastern United States, in addition to south central Texas, and northeastern Mexico

Habitat: Full sun to partial shade, well-drained to occasionally wet soil, and high drought and aerosol salt tolerance

Winged Elm (*Ulmus alata*)

Family: Ulmaceae, elm family

Florida Hardiness: 8a–9b

Height: 45–70’

Width: 30–40’

Leaf: 2–4” long, simple, alternate, narrowly ovate, with stiff, doubly serrated margins. Leaves have uneven bases, are dark green on top, paler green underneath with pubescence in the leaf axils, turn yellow in the fall, and are deciduous.

Bark: Red-brown to ashy-gray, shallowly fissured, with flat-topped ridges, and corky, wing-like appendages on opposite sides of twigs and branches, although the latter may be lacking in older specimens

Flower: Small, reddish, bell-shaped, and emerges in clusters at leaf axils

Flowering: Early spring

Fruit: 3/8–1/2” across, brown, flat, elliptic samara, with pubescence around the margin

Fruiting: Shortly after flowering

Native Range: Southern two-thirds of the eastern half of the United States

Habitat: Full sun to partial shade, wet to well-drained soil, high drought tolerance, and moderate aerosol salt tolerance

Using the Key to Identify an Unknown Species

In the tutorial that follows, we will start with an unidentified tree and progress step by step through the identification process. At each decision, a photograph will highlight the leaf and twig features of interest on the unidentified specimen.

1. Leaves and buds are opposite. (Go to 2)

1’. Leaves and buds are alternate. (Go to 3)

As seen in Figure 2, the leaves and buds are not directly opposite from one another. Instead, as you move from the base of the twig to its tip (top to bottom as shown in Figure 2), you will note that the leaves **alternate** from one side of the twig to the other. Because of this we follow the instructions included with the second option and move on to the third set of choices.

Figure 2. Twig from an unidentified shade tree featured in this key.

3. Leaves are simple. (Go to 4)

3'. Leaves are compound. (Go to 9)

Looking at our specimen we can see that a single leaf (blade) is directly attached to the twig (Figure 3; note the presence of a bud at the point of attachment). When this occurs a leaf is considered simple (see glossary), so we choose the first option and go to the fourth set of choices.

Figure 3. Twig and bud from an unidentified shade tree featured in this key.

4. Leaves are entire. (Go to 5)

4'. Leaves are serrated or lobed. (Go to 7)

Looking closer at the leaf margins (Figure 4) we can see they are devoid of any serrations, teeth, or lobes. Following the instructions for the first option, we move on to the fifth set of choices.

5. Leaf undersides appear silvery or white and are highly aromatic when crushed. (Camphor Tree, *Cinnamomum camphora*)

5'. Leaf undersides are not silvery or white. (Go to 6)

Flipping the leaf over (Figure 5) we observe that, while it is a lighter green than the top of the leaf, the underside of the leaf is neither silvery nor white. Noting this, we continue on to the sixth and final set of choices.

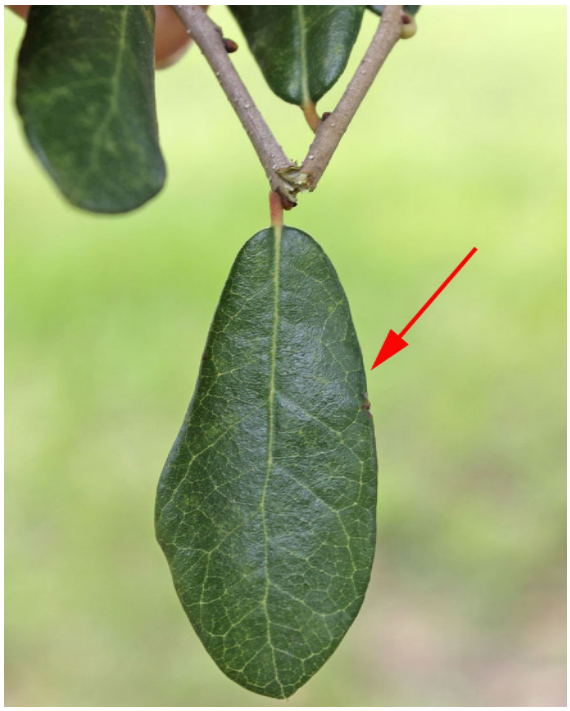


Figure 4. A close-up of a single leaf.

6. Leaves are leathery and revolute. (Live Oak, *Quercus virginiana*)

6'. Leaves are not leathery and are relatively flat. (Laurel Oak, *Quercus laurifolia*)

We have now come to the point where we may be able to make an identification. Neither of the two options listed above directs the user to go further into the key. Both terminate on one of two species of oak: live oak (*Quercus virginiana*) or laurel oak (*Quercus laurifolia*).

Figure 5. Underside of leaf.

If the tree we are identifying is a live oak (first option), the leaves should be leathery and revolute. Leathery is best assessed by touch; however, Figure 6 does show some distinct curling of the leaf margins, which means that the leaves are revolute (see glossary). As such, we have good evidence to make a final determination. The tree keyed out for this tutorial is a live oak (*Quercus virginiana*).

Figure 6. Curling of leaf margins.

As one nears the end of a key, the characteristics compared become more and more similar. Had we not been completely convinced by the live oak description at this stage (e.g., not been able to assess if it was truly leathery), we could have compared the sample to the description for the alternative, laurel oak. If, based on the descriptions, the tree clearly was not a laurel oak, we could assume the tree in question was either a live oak or not included as a possibility in the key, depending on how strongly the leaves in question deviated from the stated characteristics in the key. When faced with this situation, it may be helpful to re-key the tree in question from a different side of the tree (using a different twig and leaf sample), as there can be morphological differences in another location of the tree.

Conclusion

Once you have successfully navigated this key to identify our example tree, you can use the same process to distinguish the remaining nine trees from one another. Given the broad scope of the key (broadleaf shade trees in the Tampa Bay Area) and its limited coverage (ten trees), this key is most effective when used as a tree-identification classroom activity where twig samples of the species have been procured ahead of time. The ten tree species included in this article were selected to introduce the user to the various leaf attributes that can be used for identification (leaf attachment, simple vs. compound, leaf margins, and other defining features). A comprehensive key and tree identification field guide, *Trees: North and Central Florida* (Koeser et al. 2015), produced through the University of Florida, is more suitable for field identification of trees found in North and Central Florida's urban and natural areas. Additionally, a list of field guides that incorporate keys into their navigation is included in the references section.

Additional References and Field Guides with Keys

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Glossary

Alternate—pertaining to bud or leaf arrangement, one leaf or bud at each node, situated at alternating positions along the stem. In this arrangement, the leaves are not directly across from each other.

Compound—leaf with two or more leaflets.

Entire—term describing a leaf margin without teeth.

Leaf base—bottom part of the leaf

Lobed—having leaf segments that project outward, creating voids between the segments.

Margin—the outer edge of a leaf

Once-compound leaves—a compound leaf that has leaflets attached directly to an extended petiole (rachis).

Opposite—pertaining to leaf or branch arrangement, leaves or branches situated two at each node, across from each other on the stem.

Petiole—stalk connecting the leaf blade to that of the main stem.

Revolute—rolled backward or underneath

Serrated—sawtooth margin of a leaf, with the teeth pointed forward.

Simple—single-bladed leaf, not composed of leaflets.

Twice-compound leaves—a compound leaf that has leaflets arranged on side branches off the main extended petiole (rachis).