Trees with Compound Leaves: Identification Guide of Common Georgia Species

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Introduction

Have you ever struggled differentiating a black walnut tree from a pecan tree? Or maybe you have trouble differentiating hickory or ash species?

Leaves are a common tree identification (ID) characteristic. One important process in narrowing down the ID of a tree species is determining what type of leaf a tree has. The two main types of plant leaves are simple leaves and compound leaves. Most native Georgia tree species have simple leaves; however, several have compound leaves. This publication will first describe the morphology of compound leaves and then provide image-based ID characteristics of nineteen common native tree and shrub-like tree species that occur in the state. Tree ID descriptions are organized alphabetically by family name and common name (see Table of Contents).

Several terms are defined in the Glossary at the end of the publication.

Compound Leaf Morphology

Leaves are one of the primary organs of a plant. They conduct critical services for the plant, including photosynthesis (food production for the plant) and transpiration (water movement in the plant). Ecologically, leaves lower ambient air temperatures, slow the impact of rainfall, contribute to soil organic matter, reduce soil erosion, store carbon, are an important food source for wildlife, and more. From a human perspective, leaves cool the air through shading, create beauty, improve health and well-being, and provide many more ecological services, as listed above.

Leaves occur in varying colors, shapes, sizes, surface qualities (e.g., pubescent/“hairy,” smooth, rough, etc.), and margins (e.g., sawtooth/serrated, smooth, lobed, etc.) (Fig. 1). Leaves also have variable leaf vein patterns, petiole lengths, and scents (when crushed). Some species’ leaves even have a specific taste (e.g., sourwood leaves), but avoid tasting any leaf for safety reasons unless you are confident of its ID.

Leaves are arranged along a stem or twig in three primary ways: alternate, opposite, and whorled (Fig. 1). Alternate leaves have one leaf that emerges from each node. Opposite leaves have two leaves that emerge per node and whorled leaf species have more than two leaves per node. Leaf arrangement is an important ID characteristic. Most Georgia tree and tree-like shrub species have alternate leaf arrangement, with a smaller percentage having opposite and whorled leaf arrangement. For example, oak, hickory, elm, and sweetgum trees have alternate leaf arrangement. Ash, dogwood, maple, and elderberry species have opposite leaf arrangement and catalpa has both opposite and whorled leaf arrangement.

Leaves are attached to a twig at a node near a lateral bud (Fig. 1). There are two main types of leaves: simple leaves and compound leaves (Fig. 2). A simple leaf contains one leaf blade that is attached to the twig with a petiole. A compound leaf contains more than one leaf blade (or leaflet), where the leaflets are attached to a rachis (or petiole, in the case of palmately compound leaves) which is attached to a petiole and the twig (Fig. 2). Note that the location of the lateral bud on a twig helps one determine if they are looking at a compound or simple leaf. A compound leaf will not have lateral buds adjacent to the leaflets.
Leaf ID Characteristics

(a) alternate leaf arrangement

Figure 1: (a) Twig segment demonstrates alternate leaf arrangement with one leaf (and one lateral bud) occurring at each node, as well as parts of a leaf (leaf tip, leaf base, leaf veins) and a smooth leaf edge. (b) Twig segment demonstrates opposite leaf arrangement with two leaves (and two buds) occurring at each node, location of the petiole, and a serrated leaf margin.
Figure 2: Diagrams of simple and compound leaves. The top diagram displays the leaf blade, petiole, twig, and location of the lateral bud on a simple leaf. The bottom diagram displays a compound leaf, noting the location of the petiole and rachis, leaflets, lateral bud, and twig. The terminal leaflet is noted since it may be absent on some species. Also, this diagram is an odd-pinnately compound leaf (meaning it has an odd number of leaflets).
There are several types of compound leaves, including pinnately, trifoliate, and palmately compound leaves (Fig. 3 and 4). Pinnately compound leaves are further divided into three sub types: pinnately, bipinnately, and tripinnately compound. Pinnately compound leaves contain a petiole and rachis, with leaflets attached to the rachis (Fig. 2). Bipinnately compound leaves (Fig. 3) are thought of as twice pinnate because they have a second order rachis (rachilla). Tripinnately compound leaves (Fig. 3) have a third order rachis.

Figure 3: Diagrams of bi-pinnately and tri-pinnately compound leaves. The top diagram displays the second order rachis (rachilla) of a bi-pinnately compound leaf and notes the leaflets, petiole, rachis, twig, and location of the lateral bud. The bottom diagram displays a tri-pinnately compound leaf, noting the location of the second and third order rachis (rachilla), petiole, rachis, leaflets, lateral bud, and twig. Note that the top diagram has an odd number of leaflets (odd-pinnate) and the bottom diagram has an even number of leaflets (even-pinnate).
Trifoliate compound leaves have three leaflets (Fig. 4) that may or may not have an elongated rachis attaching the terminal leaflet. Poison-ivy and trifoliate orange are examples of plants with trifoliate compound leaves. Lastly, palmately compound leaflets radiate from one point at the top of the petiole (Fig. 4). Buckeyes are an example of a tree with palmately compound leaves.

For all compound leaves, the leaflets may connect directly to the rachis or have a leaflet stalk (petiolule) (Fig. 3 and 4). Odd-pinnate compound leaves have an odd number of leaflets (e.g., 5-23 leaflets) and even-pinnate indicates an even number of leaflets (e.g., 6-20 leaflets) (Fig. 3). Typically, odd-pinnate compound leaves have a terminal leaflet and even-pinnate compound leaves lack a terminal leaflet.

Figure 4: Diagrams of trifoliate and palmately compound leaves, noting the leaflets, petiole, petiolule (if present), twig, and location of the lateral bud.
**boxelder** (*Acer negundo*)

**FAMILY:** Aceraceae

**Form:** multi-stemmed tree, up to 80 feet (ft.) tall

**Where Found:** moist sites, floodplains, found in mountains and Piedmont

**Leaf:** deciduous, odd pinnately compound, opposite leaf arrangement

- leaf 6-8 inch (in.)
- 3-7 leaflets

- leaf underside paler green, leaflets lobed and serrated. no pubescence

- green twigs with opposite leaf arrangement

- pale grey-brown bark, shallow furrows

- fruit: pairs of winged samaras, in large clusters

- leaves with 3 leaflets resemble poison-ivy
**smooth sumac** (Rhus glabra)

**FAMILY:** Anacardiaceae

**Form:** multi-stemmed tree, often in clonal colonies, up to 20 ft. tall but usually 10-15 ft. tall

**Where Found:** disturbed areas, full sun, roadsides, fields, fence rows, found statewide

**Leaf:** deciduous, odd pinnately compound, alternate leaf arrangement

- leaf 1-2 ft. long
- 2-4 in. leaflets
- leaflet underside: whitish and waxy.
- fruit: bright red drupes, sticky, pubescent, 8-12 in., upright cluster at end of stem, mature late summer
- flowers like winged sumac
- milky sap
- serrated margin
- branch arrangement and red fall color
**staghorn sumac** (*Rhus typhina*)  

**FAMILY**: Anacardiaceae  

**Form**: multi-stemmed tree, often in clonal colonies, up to 25 ft. tall  
**Where Found**: disturbed areas, full sun, roadsides, fields, fence rows, found only in NE GA  
**Leaf**: deciduous, odd pinnately compound, alternate leaf arrangement  
- leaf 1-2 ft. long  
- 2-5 in. leaflets  

- leaflet underside: pale green without pubescence  
- serrated leaflets, milky sap where leaflet connects to rachis  
- twigs and rachis are pubescent  
- fruit: dark red, woolly pubescence, 1 ft. cluster of drupes  
- warty lenticels on bark  

**flowers**: like other sumacs
winged sumac (*Rhus copallinum*)

**FAMILY:** Anacardiaceae

**Form:** multi-stemmed tree, often in clonal colonies, up to 25 ft. tall

**Where Found:** disturbed areas, full sun, roadsides, fields, fence rows, found statewide

**Leaf:** deciduous, odd pinnately compound, alternate leaf arrangement

- Leaf: 8-12 in. long
- 1-2 in. leaflets
- Leaflet underside: pale green or whitish, hairy
- Flower: small whitish flowers, in large clusters (panicles) on end of branch, flowers summer.

**Fruit:** like smooth sumac, but ripen in autumn, are reddish brown, and droop
devil’s walkingstick (Aralia spinosa)

FAMILY: Araliaceae

Form: single-stemmed tree up to 30 ft. tall, often in clonal colonies of root suckers
Where Found: typically, on moist soils nears streams and in bottomland forests, found statewide
Leaf: deciduous, odd bi- or tripinnately compound, alternate leaf arrangement

leaf ≤ 4 ft. long, 2-3 ft. wide
2-4 in. leaflets

leaflet underside: pale green without pubescence.

spines on rachis and leaf underside

serrated leaflet

prickles on stem/trunk

12-18 in. cluster of small white flowers
black locust (Robinia pseudoacacia)

**FAMILY:** Fabaceae

**Form:** single-stemmed tree up to 90 ft. tall, but often only 40-60 ft. tall

**Where Found:** disturbed areas, moist to dry sites. Native to mountains, naturalized in Piedmont

**Leaf:** deciduous, odd pinnately compound, alternate leaf arrangement

- leaf 8-14 in. long
- 7-21 oval leaflets
- leaflets 1 in. long

- leaflets may have notch at tip. Leaf underside paler green and lacks pubescence.

**Flowers:** fragrant clusters, white, late spring

**Bark:** has forked ridges and furrows

**Paired spines at the node**
honeylocust (*Gleditsia triacanthos*)

**FAMILY:** Fabaceae

**Form:** multi-stemmed tree, up to 80 ft. tall, though usually shorter

**Where Found:** floodplains to dry uplands, not native to Georgia but has naturalized in state

**Leaf:** deciduous, even pinnately or bipinnately compound, alternate leaf arrangement

- 5-8 in. long leaf
- 15-30 leaflets

- leaflets are ½ - 1½ long, with paler green underside. No pubescence.

- 2-8 in. long, forked, reddish-purple thorns on trunk

- fruit: 6-8 in. flat, brownish, twisted pod

- thorns on branches
### painted buckeye (*Aesculus sylvatica*)

**FAMILY:** Hippocastanaceae

**Form:** multi-stemmed tree, up to 25 ft. tall  
**Where Found:** well-drained sites, slopes, open forests, found in the Piedmont  
**Leaf:** deciduous, palmately compound, opposite leaf arrangement

| Leaf | leaf 5-8 in.  
|      | 5-7 leaflets  

- leaf underside paler green with some pubescence  
- serrated leaflets

- pair of opposite, pale brown terminal buds, ≤ ½ in.

- bark is brown, thin, with warty lenticels

| Fruit | fruit: capsule, 1-2 in. diameter  
|       | flowers: upright 6-10 in. clusters of small, yellow-green flowers


bitternut hickory (*Carya cordiformis*)

**FAMILY:** Juglandaceae

**Form:** single stemmed tree, up to 100 ft. tall

**Where Found:** floodplains and moist soils, found throughout state except SE corner of state

**Leaf:** deciduous, odd pinnately compound, alternate leaf arrangement

- leaf 7-10 in. long
- 7-11 leaflets
- leaf underside lighter green
- naked terminal bud, gold-yellow with 4 angles
- XY bark pattern with flattened ridges
- leaf underside and rachis pubescent
- serrated margin
- fruit: nut, ≤ 1¼ diameter, round nut with beaked husk, husk splits to base and is winged along suture of husk, yellow hairs on husk
black walnut (*Juglans nigra*)

**FAMILY:** Juglandaceae

**Form:** single stemmed tree, up to 100 ft. tall

**Where Found:** well-drained, moist sites, occasionally on floodplains, mountains and Piedmont

**Leaf:** deciduous, even or odd pinnately compound, alternate leaf arrangement

- leaf 1-2 ft. long
- 9-21 leaflets
- terminal leaflet missing or small
- leaf underside pubescent
- leaf scented when crushed
- stout twigs with chambered pith, (1) petioles and rachis pubescent, (2) tan pubescent lateral buds, (3) “monkey face” leaf scar
- bark is grey to black, deeply furrowed with interconnected ridges

**fruit:** nut, ≤ 2 ½ in. diameter round husk, initially green then turning black, husk does not split open like hickory. Nut’s shell is blackish and ridged
mockernut hickory  \textit{(Carya tomentosa)}

FAMILY: Juglandaceae

Form: single stemmed tree, up to 90 ft. tall
Where Found: well-drained, upland sites, found statewide
Leaf: deciduous, odd pinnately compound, alternate leaf arrangement

leaf 8-15 in. long
5-9 leaflets

leaves are serrated

back of leaf pubescent

rachis and petiole pubescent

fruit: nut, $\leq 1 \frac{1}{2}$ diameter, round or elliptical, moderately thick husk wall

terminal bud pubescent
Pecan (Carya illinoinsensis)

**FAMILY:** Juglandaceae

**Form:** Single stemmed tree, up to 140 ft. tall

**Where Found:** Not native to GA but has naturalized, prefers moist, rich soils, found statewide

**Leaf:** Deciduous, odd pinnately compound, alternate leaf arrangement

- Leaf 12-18 in. long
- 9-15 leaflets
- Leaflets serrated and curve back towards twig
- Terminal leaflet present
- Heart-shaped leaf scar

**Fruit:** Nut, ≤ 2 diameter, oblong, thin husk and shell, husk splits open

**Greyish brown bark has scaly ridges and narrow furrows on trunk and branches**

**Immature nuts, often in clusters on the tree before falling to the ground**
**pignut hickory** (*Carya glabra*)

**FAMILY:** Juglandaceae

Form: single stemmed tree, up to 100 ft. tall
Where Found: upland, well-drained sites, found statewide
Leaf: deciduous, odd pinnately compound, alternate leaf arrangement

- Leaf 8-12 in. long
- 5-7 leaflets
- leaflets have serrated margins
- bark: interlacing ridges and furrows, grey-brown, may exfoliates
- Fruit: nut, ≤ 1¼ diameter, round or pear-shaped husk with “pig snout” on one end of husk, husk often does not split open
shagbark hickory (Carya ovata)

**FAMILY:** Juglandaceae

**Form:** single stemmed tree, up to 90 ft. tall
**Where Found:** floodplains or valleys. Occurs primarily in Piedmont and mountains
**Leaf:** deciduous, odd pinnately compound, alternate leaf arrangement

- Leaf: 8-14 in. long
- 5 leaflets, typically
- Serrated leaflets have pubescence on leaf margin
- Fruit: nut, ≤ 1 ½ diameter, round with flattened ends, very thick husk splits to base

*shaggy dark grey bark*
green ash \textit{(Fraxinus pennsylvanica)}

**FAMILY**: Oleaceae

**Form**: single stemmed tree, up to 100 ft. tall, dioecious

**Where Found**: well-drained, moist sites, floodplains and waterways, found statewide

**Leaf**: deciduous, odd pinnately compound, opposite leaf arrangement

- Leaf: 6-9 in.  
- 5-9 leaflets  
- no or few serrations

leaf underside paler green with some pubescence on leaf veins

leaves oppositely arranged along twig

fruit: 1-2 in. long  

- samara, 1/8 in. wide, in clusters

half circle leaf scars (not pictured), terminal bud looks like Phillips head screwdriver and has 4 rust-colored, pubescent scales

bark: pale grey or brown, blocky with narrow furrows or interlacing ridges
white ash (*Fraxinus americana*)

**FAMILY:** Oleaceae

**Form:** single stemmed tree, up to 80 ft. tall, dioecious

**Where Found:** well-drained, moist uplands sites, found in mountains, Piedmont, and SW GA

**Leaf:** deciduous, odd pinnately compound, opposite leaf arrangement

- Leaf 8-12 in.
- 5-9 leaflets
- No or few serrations

- Leaf surface dark green and leaf underside pale whitish-green, lacks pubescence

- Fruit: 1-2 in. long samara, ¼ in. wide, in clusters

- (1) c-shaped leaf scars, (2) brownish terminal bud looks like Phillips head screwdriver

- Bark: like green ash
**mountain ash** (*Sorbus americana*)

**FAMILY:** Rosaceae

Form: single stemmed tree, up to 30 ft. tall, or multi-stemmed shrub  
Where Found: rocky upland sites, found at high elevations in the mountains  
Leaf: deciduous, odd pinnately compound, alternate leaf arrangement

- leaf 6-10 in.  
- 9-17 leaflets

- serrated leaflets

- leaflet underside lighter green and may or may not have pubescence

- fruit: cluster of round ¼ in. reddish-orange fruits, ripen in summer, persist through winter.  
- Flowers: dense, white clusters

- petiole long, red, and grooved
**Hercules' club** (*Zanthoxylum clava-herculis*)

**FAMILY:** Rutaceae

**Form:** single stemmed tree, up to 30 ft. tall, or multi-stemmed shrub

**Where Found:** sandy sites and maritime forests, primarily Coastal Plains (some Piedmont sites)

**Leaf:** evergreen/tardily-deciduous, odd pinnately compound, alternate leaf arrangement

- leaf 5-8 in.
- 7-9 leaflets
- leaflets and rachis can have prickles
- waxy leaf surface, leaflets slightly serrated
- leaves lack pubescence, fragrant when crushed
- flowers: terminal flowers cluster, small, green
- fruit: ¼ in., reddish
- bark grey, dome-like projections with a sharp prickles

**FAMILY:** Rutaceae
American elder (*Sambucus canadensis*)

**FAMILY:** Viburnaceae

**Form:** multi-stemmed shrubby tree, up to 12 ft. tall

**Where Found:** near water or moist areas, found statewide

**Leaf:** deciduous, odd pinnately compound, opposite leaf arrangement

- Leaf 6-11 in. long
- 5-11 leaflets

- Leaflet underside pale green or whitish. No pubescence.

- Rachis grooved like celery

- Serrated leaflets

**Flowers:** ≤ 8 in. clusters of small, white flowers.

**Fruits:** ≤ 8 in. clusters of small, purple drupes.

**Opposite leaves**
Glossary

Blade- the broad portion of the leaf that is separate from the petiole.

Blocky- a type of bark with square-like raised bark protrusions.

Capsule- a type of (typically) dry fruits that split or burst open to release seeds.

Chambered Pith- the pith is the soft inner core of a twig. A chambered pith is when the interior portion of a twig has numerous chambers that run perpendicular to the length of the twig. Chambered piths are common in black walnut.

Dioecious- having male and female reproductive organs in separate individuals (e.g., male flowers and female flowers on separate trees).

Drupe- a fleshy fruit that surrounds a hardened pit, that contains a single seed.

Entire Leaf Margin- leaf margin lacking serrations or other protrusions.

Furrow- a channeled depression in bark, usually found between bark ridges. These can be thought of as valleys between bark ridges and vary in their width, length, and depth.

Lateral Bud- a bud that develops in the axil between a leaf petiole and a twig. Also called an axillary bud, these buds occur along the side of a twig.

Lenticel- a tissue on the bark of a woody plant that may resemble a raised circular or horizontal area. Lenticels allow the plant to exchange gases with the atmosphere.

Margin- edge of leaf blade or leaflet.

Node- the place where leaves, buds or branching twigs originate.

Petiole- the stalk that attaches the leaf blade to the stem.

Petiolule- the stalk of a leaflet.

Prickle- a coarse, spine-like growth from the plant stem’s epidermis.

Pubescence- soft “down” or fine short “hairs” on the leaves and stems of plants Pubescence is a type of trichome. Trichomes are structures on the surface of a plant that serve a variety of functions and vary considerably in their shape.

Rachilla- a small or secondary rachis.

Rachis- an extension of the petiole of a compound leaf that bears the leaflets.

Ridge- a raised ridge-like projection on bark that often occurs between furrows. Ridges vary in length, width, color, and more.

Root Sprout- a stem that emerges from a root some distance from the tree. These sprouts are clones of the parent tree.

Samara- a type of fruit with flattened, fibrous wings.

Scaly- characteristic of bark that indicates flakiness.

Serration- saw-like appearance or a row of sharp or tooth-like projections on the edge of the leaf.

Spine- a modified leaf that is firm, slender, and sharp-pointed.

Stem- trunk of a tree (in the context of this publication).

Terminal Flowers, Fruits, and Buds- placement of these structures at the end of a twig or branch.

Thorn- modified shoots that are often sharp tipped and may be branched or unbranched.
References


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