

# Liquidambar styraciflua

*Liquidambar styraciflua*, commonly called **American sweetgum**, **sweetgum**, **sweet gum**, **sweet-gum**<sup>[1]</sup> (**sweet gum** in the UK),<sup>[2]</sup> **hazel pine**,<sup>[3]</sup> **American-storax**,<sup>[1]</sup> **bilsted**,<sup>[4]</sup> **red-gum**,<sup>[1]</sup> **satin-walnut**,<sup>[1]</sup> **star-leaved gum**,<sup>[4]</sup> or **alligator-wood**<sup>[1]</sup> is a deciduous tree in the genus *Liquidambar* native to warm temperate areas of eastern North America and tropical montane regions of Mexico and Central America. Sweet gum is one of the main valuable forest trees in the southeastern United States, and is a popular ornamental tree in temperate climates. It is recognizable by the combination of its five-pointed star-shaped leaves and its hard, spiked fruits. It is currently classified in the plant family Altingiaceae, but was formerly considered a member of the Hamamelidaceae.<sup>[5]</sup>

## 1 Names

This plant's genus name *Liquidambar* was first given by Linnaeus in 1753 from [the Latin] *liquidus*, *fluid*, and the Arabic *ambar*, *amber*, in allusion to the fragrant terebinthine juice or gum which exudes from the tree. Its specific epithet *styraciflua* is an old generic name meaning *flowing with styrax* (a plant resin).<sup>[6]</sup> The names “storax” and “styrax” have long been confusingly applied to the aromatic gum or resin of this species, that of *L. orientalis* of Turkey, and to the resin better known as benzoin resin from various tropical trees in the genus *Styrax*.

The common name “sweet gum” refers to the species’ “sweetish gum”,<sup>[7]</sup> contrasting with the black gum (*Nyssa sylvatica*), only distantly related, with which the sweet gum overlaps broadly in range. The species is also known as the “red gum”, for its reddish bark.<sup>[7]</sup>

## 2 History

The earliest known published record of *Liquidambar styraciflua* is in a work by Spanish naturalist Francisco Hernández published posthumously in 1651, in which he describes the species as a large tree producing a fragrant gum resembling liquid amber, whence the genus name *Liquidambar*. In Ray's *Historia Plantarum* (1686) it is called *Styrax liquida*. However, the first mention of any use of the amber is described by Juan de Grijalva, the nephew of the Governor of Cuba, in the year 1517. Juan de Grijalva tells of gift exchanges with the Mayas “who presented them with, among other things, hollow reeds

of about a span long filled with dried herbs and sweet-smelling liquid amber which, when lighted in the way shown by the natives, diffused an agreeable odour.”<sup>[8]</sup> The species was introduced into Europe in 1681 by John Banister, the missionary collector sent out by Bishop Compton, who planted it in the palace gardens at Fulham in London, England.

## 2.1 Fossil record

An ancestor of *Liquidambar styraciflua* is known from Tertiary-aged fossils in Alaska, Greenland, and the mid-continental plateau of North America, much further north than *Liquidambar* now grows. A similar plant is also found in Miocene deposits of the Tertiary of Europe.<sup>[9]</sup>

## 3 Distribution

Sweetgum is one of the most common hardwoods in the southeastern United States, where it occurs naturally at low to moderate altitudes from southwestern Connecticut south to central Florida, and west to Illinois, southern Missouri, and eastern Texas, but not colder areas of Appalachia or the Midwestern states. The species also occurs in Mexico from southern Nuevo León south to Chiapas, as well as in Guatemala, El Salvador, Nicaragua, and Honduras. In Mexico and Central America, it is a characteristic plant of cloud forests, growing at middle elevations in various mountainous areas where the climate is humid and more temperate.<sup>[6]</sup>

The US government distribution maps for this species are incorrect concerning the southern limit of distribution in Florida. This species occurs abundantly at Highlands Hammock State Park, Sebring, Highlands County, FL, and even southwest of Lake Okeechobee. (see the Univ. South Florida Atlas of Florida Plants)<sup>[10]</sup>

## 4 Description

### 4.1 Size

*Liquidambar styraciflua* is a medium-sized to large tree, growing anywhere from 50–70 feet (15–21 m) in cultivation and up to 150 feet (46 m) in the wild,<sup>[11]</sup> with a trunk up 2–3 feet (0.61–0.91 m) in diameter, on average.<sup>[12]</sup> Trees may live to 400 years.<sup>[13]</sup> The tree is a symmetrical

shape and crowns into an egg shape when the branches get too heavy after its first two years of cultivation.<sup>[6]</sup>

## 4.2 Bark and branches

Another distinctive feature of the tree is the peculiar appearance of its small branches and twigs. The bark attaches itself to these in plates edgewise instead of laterally, and a piece of the leafless branch with the aid of a little imagination readily takes on a reptilian form; indeed, the tree is sometimes called *Alligator-wood*.<sup>[9]</sup> The bark is a light brown tinged with red and sometimes gray with dark streaks and weighs 37 lbs. per cubic foot.<sup>[12]</sup> It is deeply fissured with scaly ridges.<sup>[9]</sup> The branches carry layers of cork.<sup>[14]</sup> The branchlets are pithy, many-angled, winged, and at first covered with rusty hairs, finally becoming red brown, gray or dark brown.<sup>[9]</sup> As an ornamental tree, the species has a drawback—the branches may have ridges or “wings” that cause more surface area, increasing weight of snow and ice accumulation on the tree. However, the wood is heavy and hard with an interlocking grain,<sup>[6]</sup> but is difficult to season.<sup>[15]</sup>

- Small branches with edgewise plates of bark
- Deeply ridged bark

## 4.3 Leaves

The leaves usually have five (but sometimes three or seven) sharply pointed palmate lobes.<sup>[11]</sup> They are 3-5 inches wide on average and have three distinct bundle scars.<sup>[16]</sup>

They are long and broad, with a 6–10 centimetres (2.4–3.9 in) petiole. The rich dark green, smooth, shiny, star-shaped leaves generally turn brilliant orange, red, and purple colors in the autumn.<sup>[6]</sup> This autumnal coloring has been characterized as not simply a flame, but a conflagration. Its reds and yellows compare to that of the maples (*Acer*), and in addition it has the dark purples and smoky browns of the ash (*Fraxinus*).<sup>[9]</sup> However, in the northern part of its range, and where planted in yet colder areas, the leaves are often killed by frost while still green. On the other hand, in the extreme southern or tropical parts of its range, some trees are evergreen or semi-evergreen, with negligible fall color. The leaves are three to seven inches broad with glandular serrate teeth. The base is truncate or slightly heart-shaped. They come out of the bud plicate, downy, pale green, when full grown are bright green, smooth, shining above, paler beneath.<sup>[9]</sup> They contain tannin and when bruised give a resinous fragrance.<sup>[15]</sup>

While the starry five-pointed leaves of *Liquidambar* resemble those of some maples (*Acer*), *Liquidambar* is easily distinguished from *Acer* by its glossy, leathery leaves

that are positioned singly (alternate), not in pairs (opposite) on the stems. *Luna* and *Promethea* moth caterpillars feed on the leaves.<sup>[17]</sup>

- Summer foliage
- Autumn foliage

## 4.4 Flowers



*Flower of sweetgum*

The flowers typically appear in March to May and persist into Autumn, sometimes persisting into the Winter. They are typically about 1–1.5 inches (25–38 mm) in diameter and are covered with rusty hairs.<sup>[12]</sup> The flowers are unisexual<sup>[17]</sup> and greenish in color. Staminate flowers in terminal racemes two to three inches long, the pistillate in a solitary head on a slender peduncle borne in the axil of an upper leaf. Staminate flowers destitute of calyx and corolla, but are surrounded by hairy bracts. Stamens indefinite; filaments short; anthers introrse. Pistillate flowers with a two-celled, two-beaked ovary, the carpels produced into a long, recurved, persistent style. The ovaries all more or less cohere and harden in fruit. There are many ovules but few mature.<sup>[9]</sup>

## 4.5 Fruit

The distinctive compound fruit is hard, dry, and globose, 1–1.5 inches (25–38 mm) in diameter, composed of numerous (40-60) capsules.<sup>[12]</sup> Each capsule, containing one to two small seeds, has a pair of terminal spikes (for a total of 80-120 spikes). When the fruit opens and the seeds are released, each capsule is associated with a small hole (40-60 of these) in the compound fruit.

Fallen, opened fruits are often abundant beneath the trees; these have been popularly nicknamed “burr (or bir) balls”,<sup>[13]</sup> “gum balls”,<sup>[18]</sup> “space bugs”, “monkey balls”, “bommyknockers”, “sticker balls”,<sup>[19]</sup> or “goblin bombs”.

The fruit is a multicapsular spherical head and hangs on the branches during the winter. The woody capsules are

mostly filled with abortive seeds resembling sawdust.<sup>[9]</sup> The seeds are about one-quarter of an inch thick, winged, and wind-dispersed. Goldfinches, purple finches, squirrels, and chipmunks eat the seeds of the tree.<sup>[17]</sup> The seeds stratify within 30–90 days at 33°–41 °F or soaked in water for 15–20 days.<sup>[16]</sup> The long-stemmed fruit balls of *Liquidambar* resemble those of the **American sycamore** or **buttonwood** (*Platanus occidentalis*), but are spiny and remain intact after their seeds are dispersed; the softer fruits of *Platanus* disintegrate upon seed dispersal. The long-persisting fallen spiked fruits can be unpleasant to walk on; sweet gum is banned in some places for this reason.<sup>[13]</sup> In abundance, they can leave a lawn lumpy. The winter buds are yellow brown, one-fourth of an inch long, acute. The inner scales enlarge with the growing shoot, becoming half an inch long, green tipped with red.<sup>[9]</sup>

- Immature fruit
- Mature fruits and seeds of sweetgum

## 5 Uses

### 5.1 Wood



Lumber

Sweetgum (*Liquidambar styraciflua*) is one of the most important commercial hardwoods in the Southeastern United States. Its wood is bright reddish brown (with the sapwood nearly white) and may have black grain in the heartwood; it is heavy, straight, satiny, and close-grained, but not strong. It takes a beautiful polish, but warps badly in drying. The wood has a **specific gravity** of 0.5910. It is too liable to decay for outdoor use.<sup>[9]</sup>

In the carpentry industry, the timber is referred to as satin walnut<sup>[11]</sup> and is one of the most important materials for plywood manufacturers. It is used for furniture, interior trim, railroad ties, cigar boxes, crates, flooring, barrels, woodenware, and wood pulp.<sup>[20]</sup> It is also used for veneer for plywood. The wood is very compact and fine-grained, the heartwood being reddish, and, when cut into planks, marked transversely with blackish belts. Sweetgum is used principally for lumber, veneer, plywood, slack cooperage, fuel, and pulpwood. The lumber is made into boxes and crates, furniture, cabinets for

radios, televisions, and phonographs, interior trim, and millwork. The veneer and plywood, (typically backed with some other kind of wood which shrinks and warps less) are used for boxes, pallets, crates, baskets, and interior woodwork. It was formerly used in the interior finish of **railroad sleeping cars**. Being readily dyed black, it is sometimes substituted for **ebony** for such uses as inexpensive picture frames.<sup>[9][21]</sup>

### 5.2 Resin

The tree's gum resin, for which the tree is named, exudes from the bark of the tree when wounded.<sup>[17]</sup> It has many names, including **liquid amber** or **copalm balsam**. It is a kind of native balsam, or resin, resembling turpentine. It may be clear, reddish, or yellow, with a pleasant smell like ambergris. As the resin ages, it solidifies, the form in which it was historically exported in barrels. The resin is produced by stripping, boiling, and pressing the tree's bark.<sup>[13]</sup>

### 5.3 Shikimic acid

*L. styraciflua* seeds may be a renewable source of shikimic acid.<sup>[22]</sup>

## 6 Cultivation



A group of young sweetgum in autumn

*Liquidambar styraciflua* is a popular ornamental and forestal tree, cultivated for its distinctive foliage and intense autumn colors. It is commonly grown throughout its native North American range as well as many other temperate parts of the world. The species grows best in moist, acidic loam or clay soil, and tolerates poor drainage. It typically grows with other coastal plain species such as willow oak and sweetbay magnolia.<sup>[17]</sup> Its salt tolerance is moderate. Chlorosis can develop on alkaline soil, especially where organic matter is low. Also,

the American sweetgum tree doesn't grow well in shady areas.<sup>[12]</sup>

Among the many cultivars of *Liquidambar styraciflua* are (those marked agm have gained the Royal Horticultural Society's Award of Garden Merit):

- Burgundy – dark red to purple fall colors may persist through winter
- Clydesform – columnar or narrowly pyramidal; slow growth to 9 meters; yellow-orange fall colors; also sold as 'Emerald Sentinel'
- Festival – columnar; pale green summer leaves; bright fall hues of yellow, pink and red; less hardy than most
- Goduzam – variegated; pink to red-purple in autumn; also called 'Gold Dust'
- Grazam – pyramidal, with glossy leaves. Orange, red and purple fall colors
- Gumball – dwarf shrubby cultivar seldom more than 6 feet (2 meters) tall, with purple-red fall color
- Lane Roberts (agm)<sup>[23]</sup>
- Moraine – upright, rounded form, fast growth, red fall color, hardy to  $-30^{\circ}\text{C}$
- Palo Alto – various shades of red in fall; best in California
- Parasol – develops rounded crown; mature height 10 meters; deep red fall color
- Rotundiloba – sterile cultivar with rounded lobes on leaves, originally discovered in North Carolina in the 1930s
- Slender Silhouette – very narrow columnar form
- Worplesdon (agm)<sup>[24]</sup> – cutleaf cultivar with orange, red and purple fall colors

The organizers of the September 11th Memorial in New York donated a grove of sweet gum trees to the Flight 93 Memorial in Shanksville, Pennsylvania.<sup>[25]</sup>

### 6.1 Infection on *Liquidambar styraciflua*

The imperfect fungus *Tubakia dryina* Sutton is a leaf parasite reported to occur on a wide range of host plants, including species of Sweet Gum (*Liquidambar styraciflua* L.). Limber and Cash reported that leaf spots produced by this pathogen on several different genera of forest trees were 2–5 mm diameter with regular margins. During the summer of 1994 in the Nacogdoches County area of Texas, a prominent leaf spot on Sweet Gum was



*Sweetgum (red) in a natural park*

widespread. Infected leaves had numerous necrotic lesions, each surrounded by a reddish halo. The lesions tended to merge resulting in large areas of dead tissue. Infection and fungal development of *D. dryina* were investigated on leaves of sweet gum using a combination of microscopic techniques. *D. dryina* infection on Sweet Gum has been associated with the disease red leaf spot. Results of this investigation indicate that *D. dryina* can penetrate leaf tissue directly, thus having the ability to initiate infection on both upper and lower leaf surfaces. In other regions of the U.S., Sweet Gum populations may not be as susceptible to local populations of this fungus. Environmental stress factors may also be involved, as reports have indicated that herbicide application and chlorosis caused by iron deficiency may increase susceptibility of *Dicarpella dryina*. Tannins (a type of biomolecule found in trees to protect it from fire, insects, and bacteria) have been reported to occur in healthy tissue of a variety of plants including sweet gum. They may prevent pathogen invasion by inhibiting fungal enzyme activity. Although cells of healthy sweet gum tissue appear rich in tannins, these materials apparently were not effective in preventing fungal colonization by *D. dryina*.<sup>[26]</sup>

## 7 References

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## 8 External links

- USDA Plants Profile: *Liquidambar styraciflua*
- Flora of North America: *Liquidambar styraciflua*
- Interactive Distribution Map for *Liquidambar styraciflua*
- University of Michigan - Dearborn: Native American Ethnobotany of *Liquidambar styraciflua*
- USFS Silvics Manual: *Liquidambar styraciflua*
- USGS Species Distribution Maps: *Liquidambar styraciflua* (pdf file).
- Bioimages.vanderbilt.edu: *Liquidambar styraciflua* images
- Landscaping.about.com: American Sweetgum Trees
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