

Furiously Aggressive Invasive TREE-OF-HEAVEN OR PARADISE TREE

Poisons the Soil, Wrecks Fields & Forests, Hosts Spotted Lanternfly



Tree-of-heaven grows here in a fencerow. Note the reddish orange, showy seed clusters on this female tree.

The Culprit

Some folks who are victims of tree-of-heaven's crimes against their land jokingly call it the "tree-from-hell." Paradise tree is the common name used most often in rural Virginia. These names reflect the tree's upturned branches, which point to heaven, though some say the tree earned this name because the flowers and leaves "stink to high heaven." It is also called stinking sumac and ailanthus, after its botanical name *Ailanthus altissima*.

A serious agricultural pest, tree-of-heaven is fast-growing and weak-wooded, and often forms dense thickets. It destroys the value of pastures, hayfields, woodlands, and timber because the tree outcompetes desirable plants by poisoning the soil with toxins exuded from its roots and fallen leaves. Where it grows near buildings, its roots can penetrate sewer lines and foundations. And, as if these traits aren't bad enough, tree-of-heaven seems to be a preferred host for a new pest, the spotted lanternfly, which threatens to become a serious agricultural problem by ruining fruit crops; it also attacks forest and landscape trees.

Imported from China and planted in a Philadelphia garden in 1784, the tree was commonly available in nurseries by the mid-1800's. It soon escaped cultivation and today tree-of-heaven infests 30 states in North America.

Known Hangouts

Tree-of-heaven can invade almost anywhere its seeds land, especially disturbed soil. It grows in fields, fence- and hedge-rows, roadsides, powerline cuts, forest edges and openings, and young forests. The tree aggressively marches into sunny, disturbed areas such as clear-cut woodlots, spaces in forests where large trees are cut, fall or die. In urban areas, the tree sprouts in sidewalks, walls, alleys, and parking lots.

Modus Operandi

Tree-of-heaven does not wait for an invitation to invade natural areas. It enters where it is not welcome by two aggressive methods: producing huge amounts of seeds and sprouting from its vigorous root system. Once it has crashed the party, it poisons the soil with toxins secreted from its roots and fallen leaves. These toxins kill desirable plants and can also cause a skin rash.

A mature female tree is estimated to produce 300,000 to 350,000 wind-dispersed seeds. Hundreds of seedlings can pop up in recently planted fields and hayfields, if mature trees grow nearby. If a tree is cut to the ground, it refuses to die. It fights on by sending up rapidly growing suckers from its wide-spreading roots. Such suckers can form a dense stand of trees in no time.



Positive

Left: male flowers. **Right:** samaras (seedpods) on female tree.

Identification

Tree-of-heaven can reach 80 feet and has an irregular, open branching pattern. Trunk bark is patterned and pale tan when young and gray when mature; it is smoother than the bark of most native trees. The bold-textured, feather-shaped leaves are 1 to 4 feet long and are composed of 11 to 41 leaflets with a terminal leaflet. The leaves alternate along stout branches and the leaflets are also arranged in an alternate pattern along the midrib. The edges of the leaflets are smooth, except for one or more small notches near their bases. Small bumps or glands are visible on these notches, which is helpful in making an accurate identification.

Male and female flowers occur on separate trees and form large, showy, yellowish-green clusters at the branch tips. Seed clusters on female trees are eye-catching; they begin creamy-yellow and ripen to yellow-green or red-brown. Individual fruits in the clusters are single seeds enclosed in a twisted papery covering. Seed clusters lose their color in winter and remain on the leafless tree for many months.

Mistaken Identity

Several native trees and shrubs, such as walnut, ash, and sumac, resemble tree-of-heaven. All these plants have large, feather-shaped leaves made up of many leaflets. You can tell these trees apart by studying the arrangement of their branches and leaves, whether or not they have teeth along the edges of their leaves, and the texture of their bark.

Unlike tree-of-heaven, walnut and sumac leaves have small teeth along the entire length of the leaflets' edges. Ash leaves are not toothed; neither are ailanthus leaves except for one or two teeth at the base of each leaflet. You can tell ash leaves from ailanthus leaves because ash leaves are arranged directly opposite each other on the branches, and ash leaflets are also directly opposite each other on the midrib. Tree-of-heaven leaves and leaflets are alternate or subalternate, not opposite. The bark on tree-of-heaven is relatively smooth; walnut and ash have rough, dark bark with ridges and furrows. Sumac bark is smooth.

Sumac most closely resembles tree-of-heaven; you can identify it by its shrubby form and upright clusters of yellow or red flowers that bloom in early summer and by spires of colorful red fruits that ripen in summer and fall. Sumac bears flowers and fruits later in summer than tree-of-heaven.

Seedlings and young plants of all these trees are the most difficult to tell apart. One way to identify tree-of-heaven is to break and crush a leaf or twig and take a sniff. Tree-of-heaven smells like rancid peanut butter.



Left: Leaflets of tree-of-heaven have small notches at their bases and the leaflets are alternate. **Right:** Leaflets of sumac have teeth along all the edges and the leaflets are opposite each other.

Search & Destroy Strategy

Battling tree-of-heaven is difficult, because of the abundant seedlings it produces and because the entire root system must be killed to prevent a thicket of vigorous resprouts from occurring. Look for large and small trees in forests and along fences and roadsides. Search for seedlings and saplings near female trees and search for root sprouts near fallen or seemingly-dead trees. Control methods vary depending upon tree size. It's best to target large female trees first to halt further seed dispersal.

Manual & Mechanical: Hand-pull young seedlings when soil is moist; be sure to remove the entire root system. If you cannot remove the roots because the seedling is too large, then use a foliar herbicide on it and similar-sized plants. Root suckers resemble seedlings, but cannot be effectively pulled because they are attached to large roots and the stem breaks



Tree-of-heaven has sprouted from roots after larger trees were cut by a road work crew, which only made the problem worse.

Foliar Spray: In the war against tree-of-heaven, chemical warfare in the form of herbicides is the most effective treatment and can successfully kill seedlings and small trees. Be careful not to spray desirable plants.

Basal Bark: For trees with trunks 4 to 6 inches in diameter, instead of a foliar spray, use a basal bark treatment from February 15 to April 15. Spray a complete circle of a concentrated recommended herbicide diluted in vegetable or mineral oil on lowest 12 inches of the trunks.

Hack & Squirt: Kill larger trees by making cuts with a hatchet into sapwood at about waist height, leaving 2 inches between cuts. Spray a concentrated water-soluble herbicide into the cuts immediately after you make them. (If you make continuous cuts the roots are likely to send up suckers.) This is best done from June 1 to October 1; at that time the herbicide moves readily into the roots.

Cut Stump: Cutting down live ailanthus promotes prolific resprouting. If trees must be felled, apply concentrated, recommended, water-soluble herbicide to the perimeter and sides of the cut stump.

Follow up all treatments by applying a foliar or basal spray to any suckers, new seedlings, and saplings.

For currently approved herbicide recommendations, check the Virginia Department of Forestry chart *Non-Native Invasive Plant Species Control Treatments*, which you can download from the Blue Ridge PRISM website.

TREE-OF-HEAVEN LOOK-ALIKES

How to tell tree-of-heaven from its look-alikes.

Tree Species	Leaf Margin	Pattern	Bark
Tree-of-Heaven	smooth	alternate	smooth
Ash	smooth	opposite	rough
Staghorn Sumac	toothed	opposite	smooth
Walnut	toothed	alternate	rough