

Tree of Heaven

[*Ailanthus altissima* (P. Mill.) Swingle]

Gary N. Ervin, Ph.D., Associate Professor, Mississippi State University

John D. Madsen, Ph.D., Extension/Research Professor, Mississippi State University

Ryan M. Wersal, Research Associate, Mississippi State University

Rights of Way



Fig. 1. Tree of Heaven in natural habitat.



Fig. 2. Leaves and branches of Tree of Heaven.

Introduction

Problems Created

Tree of Heaven is a rapidly growing tree that quickly can form dense stands. This species is tolerant of shading and saturated soils, so it does well in riparian situations and along forest edges. It spreads both by root sprouts and by abundant wind- and water-dispersed seeds. Tree of Heaven was introduced to Pennsylvania during the 1700s from Europe, despite originating in eastern China. It was introduced separately into California from China during the 1800s. It is planted frequently as an ornamental and is popular in suburban areas because it is quite resistant to browsing by deer.

Regulations

Tree of Heaven is listed as a noxious weed in CT, MA, NH, and VT. In our region, Tree of Heaven is considered a severe invasion threat by the TN Exotic Pest Plant Council. It is not listed as a federal noxious weed.

Description

Vegetative Growth

Tree of Heaven may be confused with hickories (*Carya* spp.) and sumacs (*Rhus* spp.) because of their compound leaf shapes, but it is different by having glands on its lobed leaflet bases and subopposite to alternate leaflet arrangement. It also may exude a strong odor from flowers and other parts, similar to that of peanuts or cashews.

This species can form deciduous trees up to 80' high and 6' across. Twigs are stout, chestnut brown to reddish tan, and glabrous to tomentose with light colored lenticels and heart-shaped leaf scars. Leaf buds are finely hairy and partially hidden by the leaf petiole.

Leaves grow alternately on the stem, are odd- or even-pinnately compound, with 10 to more than 40 leaflets on 1' to 3' rachises with swollen bases that may cover the next year's bud. Leaflets (2" to 7" long and 1" to 2" wide) are lanceolate and asymmetric and may be subopposite to alternately arranged. Leaflet margins are not serrated, and they usually are dark green above and whitish green beneath with roundish glands on lobes at their bases.

Flowering

Tree of Heaven matures in only 2 to 3 years. During April to June, it produces large terminal panicles of small, yellowish-green, unisexual flowers (up to 20" long), with five petals and five sepals. Persistent clusters of single-seeded wing-shaped fruit with twisted tips are visible from July to February. Mature fruit forms dense, showy pink clusters that persist through the winter; each cluster may contain hundreds of seeds.

Dispersal

Seeds are easily dispersed by wind or water, and a high percentage usually is viable.

Spread by

Tree of Heaven was widely sold as an ornamental and small shade tree for landscaping.

Habitat

Tree of Heaven tolerates a wide variety of soil conditions, including dry, rocky soils and urban pavement. It is common in urban areas and disturbed sites, but has shown a limited ability to establish in mature forest. However, it has been known to exploit forest openings. Patches along fencerows, hedges, or forest edge can invade adjacent grasslands, fallow fields, or other openings rapidly, and this species has become a pest of agricultural areas in parts of its range.

Distribution

This tree can be found in 42 states, from Maine to Florida, then into California and even Hawaii. Tree of Heaven is found in several counties in each of the five IPAMS states, but appears to be patchily distributed in each state. This may reflect lack of reporting and insufficient collection by herbaria, as county-level reports from each state are more-or-less evenly spread across the states (with the exception of Mississippi, which likely is simply under-surveyed for this species).

Control Methods

Elimination of this species will be a lengthy process because of its high seed production, germination rate and its vigorous reproduction by root sprouts. Targeting control at mature female plants will reduce seed spread.

Biological Control

None.

Chemical Control

Injection is the best application method for large trees, with triclopyr, picloram, or imazapyr at rates and injection spacing according to label directions. Midsummer timing is most effective, followed in effectiveness by late winter injection. Foliar applications can be made to seedlings and saplings from July to October. Applications should be made with a basal oil carrier and penetrant.

Mature plants can be treated with foliar applications of glyphosate and imazapyr, non-selective systemic herbicides that may kill non-target plants. Triclopyr, a selective systemic herbicide for broad leaf weed control, should be used in areas where desirable grasses are growing. Spray drift and off target injury can be minimized by using a low pressure spray with a large droplet size.

The cut stump method is viable when treating large individual trees or in areas that have desirable vegetation. Stumps should be treated immediately after the tree is cut. Both glyphosate and triclopyr can be applied to cut stumps.

Basal bark applications can be made throughout the year except when the ground is frozen to a height of 15" to 20" from the ground. Triclopyr as a mixture of 25% herbicide and 75% horticultural oil is effective. Imazapyr can also be used as a 10% solution. Increased control can be achieved by combining both triclopyr and imazapyr with a 5% solution of picloram. All basal bark applications should contain an oil carrier and applied to completely wet the bark.

Frill applications can be made by cutting the bark into the cambium layer of the tree in 3" intervals around the trunk.

Cuts should be made at a height of 6" to 18" above the ground. Glyphosate or triclopyr should then be applied immediately to the cuts as a 50% solution.

Mechanical Control

Because this species spreads effectively by root sprouting, cutting is considered an initial control tactic whose success will require either an herbicidal control or repeated cutting of resprouts. Cutting has the greatest effect when trees have begun to flower, by preventing seed production. Cutting may be effected by sawing the tree off at ground level or by girdling within 6" of the ground.

Table 1. Suggested chemical control methods for Tree of Heaven.

Herbicide	Method	Rate per acre
glyphosate	Foliar spray, Broadcast	2% solution
	Cut stump	50% solution
	Frill	50% solution
triclopyr	Foliar spray, Broadcast	20% solution
	Basal bark	25% solution
	Cut stump	50% solution
	Frill	50% solution
	Injection	1.5 milliliters of undiluted concentrate at 3 to 4 inch intervals around the trunk
imazapyr	Foliar spray, Broadcast	1% solution
	Basal bark	10% solution
	Injection	1 milliliter of solution at 3 to 4 inch intervals around the trunk
fosamine ammonium	Foliar spray, Broadcast	30% solution
picloram	Injection	2 milliliters per injection site
triclopyr + picloram	Basal bark	20% + 5% solution
imazapyr + picloram	Basal bark	9% + 5% solution

Gary N. Ervin, Ph.D.
Department of Biological Sciences
Mississippi State University, MS 39762
(662) 325-1203
gervin@biology.msstate.edu

