

NYBG

New York City EcoFlora



Ailanthus altissima (Mill.) Swingle
Tree of Heaven

Description: Tree to 20 m tall, clonal from rhizomes; dioecious (perfect flowers occasionally present); twigs, leaves and male flowers malodorous; bark tan or grey, smooth or with shallow furrows; twigs stout, velvety pubescent, with very large, cordate leaf scars. Leaves alternate, odd-pinnately compound, up to 1 m long; rachis thickened at the base (pulvinus); leaflets 11–41, distinctly purplish when emerging, the blades oblong-lanceolate, dark green above, lighter below, the margins generally entire but sometimes crenate, always with at least one thumb-like lobe near the base on the lower (basiscopic) side, the lobes with prominent glands under the tips. Flowers in terminal panicles to 50 cm long, light yellowish green; sepals and petals 5, very small. Fruit samaras, yellow-green or reddish, 3–4 cm long and about 1 cm wide, twisted at both ends with a single seed in the center.

Where Found: Native to China, now nearly cosmopolitan; disturbed areas, particularly in degraded and polluted urban soils; throughout New York City, especially abundant around buildings and industrial sites, but perhaps past its peak as old-school industrial sites and fallow ground become increasingly scarce.

Conservation Status: The tree is banned in Connecticut, Prohibited in Massachusetts and New Hampshire and is a Class B noxious weed in Vermont (USDA PLANTS database). In South Africa, the species is a category 3 Plant Invader and its occurrence is tightly regulated by law.

Natural History: Tree of Heaven grows very quickly; seedlings can grow one to two meters per year (Miller, 1990). They begin fruiting at about four years old and typically do not live more than 100 years (Kasson et al., 2013). Unlike many of our native forest trees that decline in fertility as they age and which may have large fruit crops some years and smaller fruit crops in others, female *Ailanthus* trees consistently produce large numbers of fruits through successive years and show increased fertility as they age (Wickert et al., 2017). Mean seed production from a range of trees studied in south-central Pennsylvania was 32,000 per tree. A typical tree, 40 years old may produce up to 10 million seeds, and exceptionally long-lived individuals can produce over 50 million seeds in their lifetime (Wickert et al., 2017). The oldest tree in Pennsylvania was found by tree-ring analysis to be 119 years old and is probably the oldest tree in the United States (Kasson et al., 2013), establishing an upper limit on the tree's life-span- at least in North America. The authors of that study found a highly significant linear relationship between diameter and age (R^2 79.5, $P=0.0001$) so that a tree can be aged by multiplying the diameter at breast height (D.B.H), in centimeters, by the number 0.8. In its native range, *Ailanthus altissima* is fed on by more than forty arthropod species and twenty pathogens (Kok et al., 2008), but no native phytophagous insects and very few pathogens have been found to predate

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Ailanthus in North America (Kok et al., 2008). The bark, roots and leaves produce powerful allelopathic compounds, including ailanthone, which act as pre- and post-emergent growth inhibitors (Heisey, 1990). Nearly ninety tree species tested were found to be susceptible to these allelopathic chemicals (Kok et al., 2008). Tree of Heaven is the preferred host for the Spotted Lanternfly (*Lycorma delicatula*). The insect was first detected in North America in Pennsylvania in 2014 and has since spread to adjacent states ([NYS DEC, 2018](#)). The Spotted Lanternfly has not been found in New York State (as of 2018).

Cultural History: The tree has been used medicinally in China for millennia. It was first introduced to the United States in Philadelphia, Pennsylvania in 1784 (Kasson et al., 2013). The earliest trees were male clones and it was only sparingly planted as a horticultural curiosity. Widespread adoption as a landscape and street tree increased after seed-bearing trees were introduced in the 1820s, particularly by Prince Nurseries of Flushing, New York (Wickert et al., 2017; Prince, 1823). Researchers are investigating a range of bio-control agents from weevils to *Verticillium* wilts to manage the species.

Name Notes: The genus name is derived from *ailanto*, an Indonesian word meaning tree of the Gods. The epithet, *altissima*, is a superlative of *altus*, meaning high. A common synonym is *Ailanthus glandulosa* Desf.

Species Notes: There are about 5 species in the genus, all from Asia; only Tree of Heaven is naturalized in North America. The species could be mistaken for Staghorn Sumac (*Rhus typhina*), but that species never becomes a large tree, has milky sap (vs clear) and has leaflets evenly toothed (without marginal thumb-like lobes) and conical clusters of red fruits, not samaras.

Links: iNaturalist [observations](#) from New York City. [Specimens](#) from the Mid-Atlantic Herbaria Consortium. Global biotic [interactions](#) from GloBI.

References: Kasson, M.T., M.D. Davis and D.D. Davis. 2013. The invasive *Ailanthus altissima* in Pennsylvania: A case study elucidating species introduction, migration, invasion, and growth patterns in the northeastern US. Northeast. Nat. 20: 1–60. Wickert, K.L. E.S. O’Neal, D.D. Davis and M.T. Kasson. 2017. Seed Production, Viability, and Reproductive Limits of the Invasive *Ailanthus altissima* (Tree-of-Heaven) within Invaded Environments. Forests 2017, 8, 226; doi:10.3390/f8070226. Prince, W. 1823. Catalogue of fruit and ornamental trees and plants, bulbous flower roots, green-house plants, etc. etc., cultivated at the Linnaean Botanic Garden, William Prince, Proprietor, Flushing, Long-Island, near New York. To which is added, a short treatise on their cultivation, etc. T. and J. Swords, New York, New York. 171 pp. Kok, L.T., S.M. Salom, S. Yan, N.J. Herrick and T.J. McAvoy. 2008. Quarantine evaluation of *Eucryptorrhynchus brandti* (Harold) (Coleoptera: Curculionidae), a potential biological control agent of tree of heaven, *Ailanthus altissima*, in Virginia, USA. Proceedings of the XII International Symposium on Biological Control of Weeds. 2008: 292–300. Heisey, R.M. 1990. Allelopathic and herbicidal effects of extracts from tree of heaven (*Ailanthus altissima*). American Journal of Botany 77: 662–670. Miller, J.H. 1990. *Ailanthus altissima* (Mill.) Swingle ailanthus. In: Burns, Russell M.; Honkala, Barbara H., tech. coords. Silvics of North America: Vol. 2. Hardwoods. Agriculture Handbook 654. Washington, DC: U.S. Department of Agriculture, Forest Service: 101–104. NYS DEC. 2018. Stop the invasion. Spotted Lanternfly, *Lycorma delicatula*. Bureau of Invasive Species and Ecosystem Health, New York State Department of Environmental Conservation. https://www.dec.ny.gov/docs/lands_forests_pdf/slffs.pdf