

EPPO data sheet on Invasive Plants

Ailanthus altissima

IDENTITY

Preferred scientific name: *Ailanthus altissima* (Mill.) Swingle

Other scientific names: *Ailanthus cacodendron* (Ehrh.) Schinz & Thell., *Ailanthus giraldii* Dode, *Ailanthus glandulosa* Desf., *Ailanthus peregrina* (Buc'hoz) F. A. Barkley, *Ailanthus sutchuensis* Dode, *Ailanthus vilmoriniana* Dode, *Albonia peregrina* Buc'hoz, *Pongelion glandulosum* (Ehrh) Degen, *Rhus cacodendron* Ehrh., *Toxicodendron altissimum* Mill.

Taxonomic position: Simaroubaceae

Common names: Tree of heaven, China sumac, copal tree, stinktree, varnish tree (English), ailante, ailante glanduleux, arbre des dieux, arbre dioïque, arbre du ciel, faux vernis du Japon (French), ailanto, arbol el cielo (Spanish), Chinesischer Götterbaum (German), pajasan žláznatý (Czech), hemelboom (Dutch, Flemish), ailanto (Italian), ailanto (Portuguese).

EPPO computer code: AILAL

Notes on taxonomy and nomenclature

The genus *Ailanthus* comprises about 10 species occurring naturally in Asia and northern Oceania. Three native varieties of *A. altissima* are recognized by Chen (1997), var. *altissima*, var. *tanakai* and var. *sutchuensis*, and several more where the species is introduced.

MORPHOLOGY

A. altissima is a small to medium-sized tree, often 6-10 m tall but up to 30 m, with gracefully curving branches. The bark is smooth, grey with pale stripes. Leaves are compound, 30-120 cm long, commonly 45-60 cm, alternate, pinnate compound, pubescent or nearly glabrous, with 11-25 pairs of leaflets, each 7-12 cm long, lanceolate to ovate-acute, usually with 1-3 pairs of glandular teeth near the base, otherwise entire. Flowers are unisexual, small and yellow, in large panicles at the end of the branches; male flowers having an unpleasant odour. Fruit are one-celled, one-seeded, oblong, thin, spirally-twisted and papery samaras, 30 mm long and 8 mm wide, yellow to light reddish-brown. Seeds have no endosperm, with about 7000 seeds per kg.

SIMILARITIES TO OTHER SPECIES

A. altissima may be confused from a distance with a number of other trees such as species of *Carya*, *Fraxinus*, *Juglans*, *Rhus*, etc., that also bear large pinnately compound leaves, though may be easily distinguished at closer inspection.

PLANT TYPE

A. altissima is a seed or vegetatively propagated, broadleaved tree.

BIOLOGY AND ECOLOGY

A. altissima is dioecious, flowering in May-June with seeds ripening in large, crowned clusters in September-October, with up to 1 million seeds dispersed from October to the following spring. Germination rates are high provided soil has adequate moisture, and seedlings establish a taproot three months after germination. Established trees produce numerous suckers from the roots and sprout vigorously from cut stumps and root fragments, growing up to 3 cm per day. *A. altissima* probably lives for no more than 100 years in North America, but the root system and its sprouts can persist for a longer time. On the basis of morphological, physiological and biochemical characters of *A. altissima* seedlings, significant genetic alteration has occurred since its introduction to the USA 200 years ago though there was no evidence of inbreeding depression (Feret and Bryant, 1974).

Environmental requirements

A. altissima is native to subtropical and warm temperate climates, but is also able to invade climates ranging from cool temperate to tropical (Cronk and Fuller, 1995), but does not thrive in heavy monsoon rainfall areas where it suffers high seedling mortality. Preferred mean annual rainfall is generally 400-1400 mm, and it is relatively drought resistant tolerating a 4-8 month dry season. In submontane zones, it is found in areas with an annual rainfall of 500-700 mm. It grows in full sun and thrives in poor growing conditions. In Central Europe, climate is the major factor affecting its distribution, whereas in mediterranean regions its distribution is affected more by soil fertility than by climatic factors. Preferred mean annual temperature is 7-18°C, and it can also tolerate heavy frosts, surviving absolute minimum temperatures as low as -35°C.

A. altissima grows best on loose and porous soils, but can grow on a variety of soil types from heavy clays, sandy or clayey loams to calcareous dry and shallow soils. *A. altissima* has the ability to grow in poor soils and under environmentally stressful conditions such as low nutrient and oxygen content, and can tolerate barren rocky hills if annual rainfall is above 750 mm (Zheng, 1988). *A. altissima* is found at a range of altitudes up to 2400 m.

Climatic and vegetational categorization

A. altissima is associated with areas with a warm to hot wet summer and a cool (to cold) wet winter, but in fact occurs throughout the USA, showing that it can at least survive under drier conditions. It is hardy to zone 7 (-18 to -12°C). It is associated with the vegetation zones: temperate deciduous forests and mixed conifer forests (extending to temperate steppes).

HABITAT

Habitats occupied by *A. altissima* include managed grasslands, natural grasslands, managed forestry, natural forest, riverbanks/canalsides, rail/roadsides, wastelands and urban areas. *A. altissima* establishes itself readily on artificially disturbed sites such as roadsides and ditches, particularly in the Mediterranean region, such as in France (Kowarik, 1983; Lepart et al., 1991), and in naturally forested areas it can become established in areas disturbed by storms or infestations. It is the most widespread woody invasive species invading forested areas in the USA, occurring wherever moisture allows (Luken and Thieret 1997). In South Africa it invades forest margins, roadsides and riverbanks in cool, moist regions (Henderson, 2001).

CROPS / OTHER PLANTS AFFECTED

A. altissima rarely invades agricultural land unless fallowed, but it is a weed of grasslands and forests, both managed and natural.

PATHWAYS FOR MOVEMENT AND DISPERSAL

Seeds may be dispersed long distances by wind, especially in dry weather, but detailed information on other dissemination pathways is limited. Intentional introduction has been the common means of long distance dispersal, being introduced to North America, Europe and Oceania as an ornamental, production and protection species, and it is likely to be further introduced internationally.

USES AND BENEFITS

A. altissima continues to be cultivated in many countries, being valued mainly for shade, shelter and erosion control, particularly in cities where soils are poor and the atmosphere is smoky, also for land reclamation. The wood is valued, being light and soft with yellow-white sapwood and yellow-brown heartwood, easy to dry and process and the somewhat decay-resistant, suitable for construction, packaging, furniture, paper pulp, matches, fuel and charcoal. Leaves are a fodder for silkworms, plant extracts are used to treat epilepsy, asthma and many other ailments, seeds as a source of a fatty oil and protein, and roots and leaves contain allelopathic and herbicidal compounds (Zheng, 1978; Heisey, 1990, 1997; IWS, 1982; Lin et al., 1995).

GEOGRAPHICAL DISTRIBUTION

EPPO region: Albania, Austria, Belgium, Czechia, France, Germany, Greece, Hungary, Italy, Moldova, Netherlands, Portugal (mainland, Azores), Romania, Serbia and Montenegro, Spain, Switzerland, Ukraine, United Kingdom.

Asia: China (widespread), India, Indonesia, Iran, Japan, Korea Republic, Malaysia, Pakistan.

Africa: South Africa.

North America: Canada (British Columbia, Ontario), Mexico, USA (all states).

South America: Argentina, Chile.

Oceania: Australia, New Zealand.

HISTORY OF INTRODUCTION / SPREAD

A. altissima is native to northern and central China, ranging from Liaoning and Hebei in the north to Guangxi and Fujian in the south, and from Zhejiang and Shandong in the east to Gansu in the west (Li, 1963; Zheng, 1978; Liu, 1988). It has become naturalized in many temperate regions where introduced. *A. altissima* seed was brought to the UK in 1751, and was introduced into North America in 1784, now extensively naturalized and in some areas so well established that it appears to be a part of the native flora (Schopmeyer, 1974; Luken and Thieret, 1997). It was brought to California by the Chinese who came during the goldrush in the 1890s and frequently occurs in abandoned mining sites (Hoshovsky, 1988), and was also reported to be already widespread and naturalized in Tennessee in the late 1800s (SE-EPPC, 2002). It was introduced from China and Japan to northern India where it is cultivated, growing abundantly along roadsides in Himachal Pradesh, used for afforestation in Jammu and Kashmir and as an avenue tree elsewhere (Singh et al., 1992). In Iran, it is planted in green belts around cities in semi-arid areas (Luna, 1996).

IMPACT

Economic impact

Although *A. altissima* is recorded as a weed of agricultural land, grasslands and forests, there is no information on economic impacts, loss in production or control costs. The roots are capable of damaging sewers and foundations.

Impact on biodiversity

In the USA, from Massachusetts to Texas, *A. altissima* forms dense thickets that displace native vegetation, and is especially invasive along stream banks in the west (Westbrooks, 1998). Young trees grow rapidly, outcompeting other plant species for light and space. Toxins produced in the bark and leaves accumulate in the soil and inhibit the growth of other plants (Anon., 2002).

RISK AND IMPACT FACTORS

A. altissima has negative impacts principally on biodiversity and the environment, also forestry production, native flora and fauna.

SUMMARY OF INVASIVENESS

A. altissima has become a weed in cultivated, pasture, forestry, wasteland and urban areas. Seedlings and root suckers grow rapidly and spread prolifically and thus quickly outcompetes many native species for light and space, and prolific fruiting, ready germination, adaptability to infertile sites and rapid growth rate make *A. altissima* a noxious weed in many countries where it has been introduced. It also produces a toxin in its bark and leaves which accumulates in the soil inhibiting the growth of other plants.

CHARACTERISTIC		(Y)es, (N)o
Invasiveness		
1	Is the species invasive in its native range?	N
2	Has it proved invasive outside its native range? (i.e. is it an invasive alien species)?	Y
3	Is it highly adaptable to different environments?	Y
4	Does it have high reproductive potential? (e.g. for weeds; prolific seed production, high germination rate, reproduction by rhizomes, tubers, stolons or root/stem fragments).	Y
5	Is it highly mobile locally? (i.e. for weeds, propagules capable of moving long distances by wind, water, attachment to machinery, animals or humans).	Y
6	Can its propagules remain viable for more than one year?	Y
7	Does it tolerate, or benefit from, cultivation, browsing pressure, mutilation, fire etc?	Y
Impacts		
8	Is it competitive to agricultural and plantation crops or pasture plants?	Y
9	Does it cause impacts on ecosystem processes? (e.g. hydrology, sedimentation, fire risk, nutrient cycling etc.).	Y
10	Does it adversely affect natural communities? (biodiversity, native populations, endangered or threatened species) by competition or hybridization (underline one or both).	Y
11	Does it adversely affect community structure? (e.g. effects on the food chain, elimination or creation of a canopy).	Y
12	Does it adversely affect human health? (e.g. allergies, effects on water or air quality).	Y
13	Does it have sociological impacts on recreational patterns, aesthetics, property values?	N
14	Is it harmful to animals? (e.g. poisonous plant parts or vector of animal diseases).	Y
15	Does it produce spines, thorns or burrs (or other discomfort)?	N
16	Is it a host or vector to recognised pests and pathogens of agriculture or forestry etc?	N
Likelihood of entry/control		
17	Is it highly likely to be transported internationally (a) accidentally? (e.g. as a contaminant).	N
18	Is it highly likely to be transported internationally (b) deliberately? (e.g. as an ornamental)	Y
19	Is it difficult to identify / detect as a commodity contaminant? (e.g. due to small seed size)	N
20	Is it difficult to identify / detect in the field? (e.g. similarities to other species, inconspicuousness)	N
21	Is it difficult / costly to control? (e.g. resistance to pesticides)	Y

CONTROL

Mechanical control

A. altissima is very difficult to remove once the tap-root is established and seedlings should be removed by hand as early as possible. With larger plants, two cuts per year will be required over several years (Anon., 2002).

Chemical control

Control is effective with glyphosate, triclopyr or 2,4,5-T, as a foliar spray, basal bark application or onto freshly cut stumps (e.g. Hoshovsky, 1988; SE-EPPC, 2002).

Biological control

Luken and Thieret (1997) cite reports of preliminary investigations into natural enemies though none have been released.

REGULATORY STATUS

A. altissima is a category 3 weed in South Africa (Conservation of Agricultural Resources Act 1983), with landowners responsible for its containment and prohibited within the vicinity of watercourses. It is a noxious weed in Australia, a regionally controlled weed in Victoria (Catchment and Land Protection Act 1994), a category W2/W3 weed in New South Wales (Noxious Weeds Act 1993), prohibited until assessed in Western Australia, and is a declared weed in other states and territories (Anon., 1998). In the USA, it is a Class B noxious weed in Vermont and is a prohibited invasive weed in New Hampshire (USDA-NRCS, 2005).

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