EPPO Datasheet: *Triadica sebifera*

Last updated: 2020-04-23

IDENTITY

Preferred name: *Triadica sebifera*
Authority: (Linnaeus) Small
Taxonomic position: Plantae: Magnoliophyta: Angiospermae: Fabids: Malpighiales: Euphorbiaceae: Euphorbioideae
Other scientific names: *Carumbium sebiferum* (Linnaeus) Kurz, *Croton sebiferum* Linnaeus, *Excoecaria sebifera* (Linnaeus) Müller von Aargau, *Sapium sebiferum* (Linnaeus) Roxburgh, *Seborium chinense* Rafinesque, *Stillingia sebifera* (Linnaeus) Michaux, *Stillingia sinensis* Baillon
Common names: Chinese tallow tree, vegetable tallow
view more common names online...
EPPO Categorization: A1 list
view more categorizations online...
EU Categorization: IAS of Union concern
EPPO Code: SAQSE

GEOGRAPHICAL DISTRIBUTION

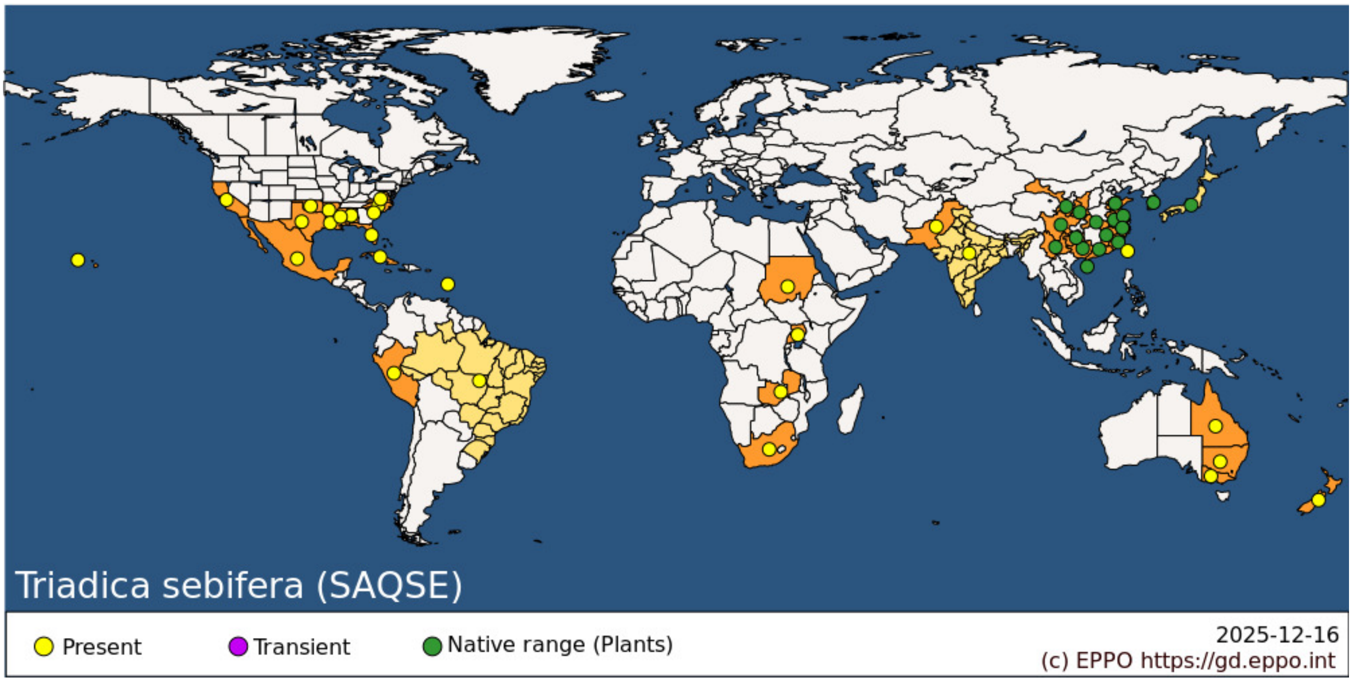
History of introduction and spread

Triadica sebifera is native to China and Japan with a non-native distribution showing invasive behaviour in the USA and Australia. In the southern USA, *T. sebifera* is a major invasive species. Although it was first introduced in the late 18th century, it did not become invasive until the 20th century. This invasion pattern may be due to greater propagule pressure brought about by large-scale commercial planting and hurricanes. Invasions convert grasslands to woody thickets, displace native species and disrupt ecological processes. DeWalt *et al.* (2011) stated that 'Present populations near the sites of the earliest introductions of Chinese tallow tree to the southeastern USA (Charleston, South Carolina and Savannah, Georgia) appear to differ in genetic composition as well as genetic diversity from populations resulting from introductions made approximately 120 years later to the rest of the southeastern USA.'

T. sebifera is becoming an invasive environmental weed of water courses and native vegetation areas in Australia (NSW Government, Australia, 2017). It was originally introduced to as an ornamental tree and has been planted in streets and garden in southeast Queensland and Northern New South Wales (NSW). Naturalised populations occur in various locations throughout south-east Queensland. The largest infestation exists near Casino, NSW. Smaller infestations are evident throughout the North Coast, Central Coast and New England regions of NSW and localized plants exist in Victoria (NSW Government, Australia, 2017). DeWalt *et al*. (2011) details that it is unknown when *T. sebifera* was introduced to Australia, however, its genetic similarity to the rest of the South-eastern USA indicates that it may have been introduced in the early 1900s at the same time it was being extensively planted in areas along the USA coast of the Gulf of Mexico or that it represents a secondary invasion from the South-eastern USA.

In the EPPO region, the species is absent from the natural environment but there has been historic planting of the species in gardens and botanical gardens.

Distribution



Africa: South Africa, Sudan, Uganda, Zambia
Asia: China (Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Jiangsu, Jiangxi, Shaanxi, Shandong, Sichuan, Yunnan, Zhejiang), India, Japan, Korea, Republic of, Pakistan, Taiwan
North America: Mexico, United States of America (Alabama, Arkansas, California, Florida, Hawaii, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Texas, Virginia)
Central America and Caribbean: Cuba, Martinique
South America: Brazil, Peru
Oceania: Australia (New South Wales, Queensland, Victoria), New Zealand

MORPHOLOGY

Plant type

Deciduous medium-sized tree.

Description

A deciduous tree 20 to 30 m tall. Low-spreading and multiforked to tall and columnar. Stem often crooked and gnarled. Bark is grey, brown and rough. Exudes a milky sap. Twigs slender. Petioles 2–6 cm long, with two sessile disc-shaped glands at the apex. Leaf blades broadly rhombic-ovate, 2–7.5 x 1.5–7 cm, abruptly acutely acuminate, broadly cuneate to rounded, subtruncate at the base, entire, lateral nerves 7–12 pairs, glaucous beneath. Stipules 1-2 mm long, obtuse. *T. sebifera* flowers from April to June, producing both male and female flowers. Fruits are 1 cm three-lobed capsules expected to mature in the autumn. Seeds are 8 mm long and chalky white (covered by a white wax) (Scheld & Cowles, 1981; Bruce *et al.*, 1997).

BIOLOGY AND ECOLOGY

General

Often, more than 95% of seeds are viable, but viability drops to between 10% and 50% after 1 year in natural settings (Renne *et al.*, 2002). A mature tree can produce an average of 100 000 seeds annually, depending on environmental conditions (Jubinsky & Anderson, 1996; Bruce *et al.*, 1997; USDA, 2000). According to Scheld & Cowles (1981), *T. sebifera* can grow up to a height of 2.8 m within 2 years of germination. In addition to intentional plantings by humans, birds and waterways disperse *T. sebifera* seeds (Jubinsky & Anderson, 1996; Bruce *et al.*, 1997).

Habitats

In North America, *T. sebifera* has a wide environmental tolerance and can thrive in many different habitats, including forests, wetlands, grasslands, coastal prairie, mesic sites, disturbed sites, low-lying fields, swamp and scrubby flatlands (Bruce *et al.*, 1997; Langeland & Enloe, 2009; Camarillo *et al.*, 2015). *T. sebifera* is capable of invading closed and open forest systems. In the native range in China, *T. sebifera* is found in disturbed habitats at low densities.

Environmental requirements

In the southern forests of the USA, approximately 80% of tallow invasions occur at elevations lower than 50 m or slopes of <2°. At higher elevations, and with steeper slopes, the likelihood of invasion drops dramatically and 'no invasion was reported in the FIA [Forest Inventory Analysis] data for sites where elevation was >165 m or slopes were steeper than 18°' (Gan *et al*., 2009). In Taiwan, *T. sebifera* plantations occur at elevations of 400–700 m (Lin *et al*., 1958). Surveys of *T. sebifera* in the Indian Himalayas recorded trees at an elevational limit of 1600 m (Jaryan *et al*., 2013).

In the southern forests of the USA, *T. sebifera* did not occur at survey sites where the mean minimum temperature in January was below -12°C (10°F) (Gan *et al*., 2009). Grace (1998) suggested that the likeliest northern boundary of *T. sebifera* should be where average minimum winter temperatures dip to -12 to -15°C. In a climate modelling study using CLIMEX, temperatures of 12 and 24°C were determined as the lower temperature threshold for growth and the lower limit of optimal temperature growth, respectively. The upper temperature limit for optimal growth and the upper temperature threshold for growth were determined to be 35 and 40°C, respectively. These values were reached after average annual temperature data from the native range of *T. sebifera* was consulted (Pattison & Mack, 2008).

In Taiwan, *T. sebifera* has been reported on sites with average annual precipitation ranging from 1070 to 3733 mm (Lin *et al.*, 1958; Kirmse & Fisher, 1989; Siemann & Rogers, 2003; Meyer, 2011). In the USA and mainland China, *T. sebifera* sites had an average annual precipitation of 1000–2000 mm (E Siemann, pers. comm. 2017). Kirmse & Fisher (1989) described a New Mexico (USA) plantation where *T. sebifera* grew well with average annual precipitation of 243 mm, although trees were irrigated for the first 2 months after transplanting (90.6% survival).

Evidence from plantations and the native and naturalized range of *T. sebifera* indicates that it is compatible with a wide range of soil types: clays, loams and sands (Radford *et al.*, 1968; Scheld & Cowles, 1981; Bruce *et al*., 1995). In Taiwan, Lin *et al.* (1958) determined the chemical properties of soils on the '18 main habitats of *T. sebifera* tree'. Total nitrogen was 0–0.20% and pH was 2.9–8.5. Gan *et al.* (2009) found that in sites throughout the south-eastern USA the probability of invasion was greater closer to water bodies, probably due in part to soil moisture levels that were favourable for establishment. Bruce (1993) showed that *T. sebifera* exhibited significantly lower seedling survival in treatments with 23% soil moisture compared with treatments with ?31% soil moisture (Bruce, 1993; Meyer, 2011).

Jones & McLeod (1989) found a positive relationship between light availability and biomass production where the greatest production was achieved under 100% light. In greenhouse experiments, seedling shoot and total biomass were significantly lower in ambient light than under an 87% shade cloth. In the field, seedlings perform much better in open than in shaded habitats.

Natural enemies

There are no known natural enemies in the EPPO region.

Uses and benefits

T. sebifera is a highly valued species for both its ornamental qualities and productive capability in agricultural and industrial sectors. Tallow wood is white and close-grained, suitable for carvings, furniture, carts and match making as well as incense (Lin *et al*., 1958; USDA, 2000). The leaves are used to make a black dye and manure (Lin *et al.*, 1958; USDA, 2000).

T. sebifera tree seeds are a source of vegetable tallow, a quick-drying oil and protein food. The outer covering of the seeds contains solid fat known as Chinese vegetable tallow and the kernels produce a drying oil called stillingia oil. Candles, soap, cloth dressing and fuel are made from the tallow. The oil is used in machine oils, as a crude lamp oil and in making varnishes and paints (because of its quick-drying properties). The presscake remaining after extraction of tallow and oil can be processed to make a valuable animal feed and human food, rich in protein. Different parts of the plants are used in traditional Chinese medicine (USDA 2000, Gao *et al.*, 2016).

In the early 20th century, the Foreign Plant Introduction Division of the US Department of Agriculture promoted the planting of tallow trees in the Gulf Coast and Southern US States to establish a local soap industry (USDA, 2000; DeWalt *et al*., 2011). When cultivated under conventional agricultural methods, *T. sebifera* can be grown over extensive areas of land and can provide woody biomass for direct burning or conversion to charcoal, ethanol and methanol (Scheld & Cowles, 1981; USDA, 2000). Wen *et al.*, (2010) demonstrated that *T. sebifera* seed oil can be converted to biodiesel. Due to its ability to resprout, its rapid growth rate and its tolerance to flooding, drought and salt, *T. sebifera* has been considered as a biomass crop for the Gulf Coast region of the USA (Scheld & Cowles, 1981; USDA, 2000).

Birds, both wild and domestic, will feed on the seeds and it is sometime recommended as a bird food (USDA, 2000, Renne *et al*., 2002). The flowers of *T. sebifera* are visited by honeybees, contributing to a commercially desirable, light-coloured honey (USDA, 2000; Renne *et al*., 2002). *T. sebifera* is recognized as an important species for commercial honey production in Louisiana (Lieux, 1975).

With regard to repeated introductions, *T. sebifera* has an extensive history of cultivation and sale and as an ornamental, especially in the USA (Bruce *et al.*, 1997; Siemann & Rogers, 2003; Camarillo *et al*., 2015). By 1983, 200 000 - 300 000 trees were being grown for the ornamental trade in Houston, Texas alone (USDA, 2000).

Within the EPPO region, apart from the species in trade, there are no current socio-economic benefits for the species. Currently, there is little information available on the value of the species in horticulture. The species is listed as available from two suppliers in the UK (https://www.rhs.org.uk/ Plants/Nurseries-Search-Result?query=239677).

PATHWAYS FOR MOVEMENT

T. sebifera has a long history of deliberate planting within the EPPO region. Seeds can be bought on the internet and shipped nearly anywhere in the EPPO region. *T. sebifera* is available via nurseries within the EPPO region. The species can also be purchased via online suppliers outside the EPPO region. However, given that the seeds can be dispersed by birds and waterways, any tree producing berries within the EPPO region could be the origin of a new establishment, especially trees that are planted near moving bodies of water. *T. sebifera* can survive in urban, rural, natural and disturbed habitat.

IMPACTS

Effects on plants

In the USA, *T. sebifera* displaces native plant species and establishes dominant stands, and can transform areas of prairie and grassland to woody thickets within 10 years (Cameron & Spencer, 1989; Bruce *et al.*, 1995, 1997; Siemann & Rogers, 2003). *T. sebifera* has been shown to invade south-east coastal prairie that is the sole habitat of the federally endangered Attwater’s prairie chicken (*Tympanuchus cupido attwateri*), the exclusive wintering ground of the federally endangered whooping crane (*Grus americana*) and important habitat for several other critically imperilled grassland birds. In addition, one federally endangered and 12 critically imperilled (category 11) plant species occur in the remaining fragments of this once vast ecosystem.

Environmental and social impact

T. sebifera can decrease water quality. The species can also displace native species, reducing genetic resources. When leaf material becomes incorporated into the water body, this has been shown to be toxic to amphibians (Cotton *et al.*, 2012). Leonard (2008) showed that the leaf litter can have negative impacts on the native habitat: (1) leaf litter has a direct effect on water quality; (2) *T. sebifera* can cause differential survival and performance of tadpoles; (3) differences in water quality due to leaf litter can cause changes in tadpole behaviour; and (4) *T. sebifera* leaf litter breaks down much faster than litter from native trees and this influences the composition of the aquatic community.

T. sebifera supports a lower diversity of arthropods than co-occurring native trees in Texas (Hartley *et al*., 2010) and the native prairies it displaces (Cameron & Spencer, 1989; Hartley *et al*., 2004). *T. sebifera* seedlings can establish at such high densities that fine fuels are lacking even in a stand of smaller trees. These changes in fuel characteristics result in patchier and/or less severe fires, with a negative impact on native species (Meyer, 2011).

T. sebifera exhibits rapid leaf decay, which may alter soil nutrients (primarily higher levels of nitrogen) in ecosystems with fewer deciduous trees. *T. sebifera* can alter nutrient cycling and the species composition of decomposers. *T. sebifera* stands in Texas demonstrated higher net productivity than the original grassland ecosystem, and at 15 years old, *T. sebifera* stands in Texas demonstrated significantly higher net primary productivity than adjacent native prairie (Harcombe *et al.*, 1993). Cameron & Spencer (1989) found that in *T. sebifera* woodland the concentrations of the nutrients P, K, NO_3–N, Zn, Mn and Fe were significantly higher than in native prairie, while Mg and Na were significantly lower. *T. sebifera* exhibits rapid leaf decay, which may increase nutrient alteration in ecosystems with fewer deciduous trees (Cameron & Spencer, 1989).

In invasive contexts, *T. sebifera* can alter nutrient cycling and species composition among decomposers (Cameron & Spencer, 1989; Zou *et al.*, 2006). Siemann & Rogers (2003) demonstrated that the competitive advantage displayed by *T. sebifera* in the Southern USA may be due to the species being released from specialist herbivores. After comparing populations from the invasive range in Texas with populations from the native range in China, Rogers & Siemann (2005) concluded that 'invasive *Sapium* ecotypes have a greater capacity to compensate for herbivory damage than native *Sapium* ecotypes'.

CONTROL

Most sources describe *T. sebifera* infestations as nearly impossible to eliminate. Mechanical control of *T. sebifera* in Florida has either failed or exacerbated the infestation. Previous attempts at control have been through application of prescribed burns and mechanical removal of trees and seedlings, but there has been limited success due to the density of growth and the likelihood of disturbing non-target vegetation and soil. If the roots are not completely removed, the tree will regenerate. However, most sources agree that control should take place over a 3–5 year period. Proven, reliable, biological control agents are not currently available. In North America, applications of basal bark herbicide are commonly used for control.

REGULATORY STATUS

In 2016, *T. sebifera* was identified as a priority for risk assessment within the requirements of Regulation 1143/2014 (Branquart *et al*., 2016; Tanner *et al.*, 2017). A subsequent pest risk analysis concluded that *T. sebifera* posed a high phytosanitary risk to the endangered area (EPPO, 2018) and was added to the EPPO A1 List of pests recommended for regulation. In 2019, *T. sebifera* was included on the (EU) list of Union concern (EU Regulation 1143/2014).

In the USA, *T. sebifera* is listed as a noxious weed in the following States: Florida, Mississippi, Texas and Louisiana (https://plants.usda.gov/core/profile?symbol=TRSE6). In Australia, *T. sebifera* is regarded as an environmental weed in New South Wales and a potential environmental weed in Queensland.

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The datasheet was produced following an Expert Working Group (EWG) that risk analysed *T. sebifera* for the EPPO region in October 2017. The composition of the EWG was as follows: G. Brundu (University of Sassari, Department of Agriculture, IT), D. Chapman (Centre for Ecology and Hydrology, GB), L. Flory (University of Florida, US), J. Le Roux (Stellenbosch University, ZA), O. Pescott (Centre for Ecology and Hydrology, GB), E. Siemann (Rice University, US), U. Starfinger (Institute for National and International Plant Health, DE) and R. Tanner (EPPO).

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Datasheet history

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