

# EPPO Datasheet: *Celastrus orbiculatus*

Last updated: 2022-08-30

## IDENTITY

**Preferred name:** *Celastrus orbiculatus*

**Authority:** Thunberg

**Taxonomic position:** Plantae: Magnoliophyta: Angiospermae:  
Fabids: Celastrales: Celastraceae

**Other scientific names:** *Celastrus articulatus* Thunb., *Celastrus insularis* Koidz., *Celastrus jeholensis* Nakai ex Nakai & Kitag., *Celastrus lancifolia* Nakai, *Celastrus stephanotiifolius* (Makino) Makino, *Celastrus strigillosus* Nakai, *Celastrus tatarinowii* Rupr., *Celastrus versicolor* Nakai

**Common names:** Asian bittersweet, Asiatic bittersweet, Chinese bittersweet, oriental bittersweet (US), round-leaved bittersweet, staff vine

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**EPPO Categorization:** A2 list

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**EU Categorization:** IAS of Union concern

**EPPO Code:** CELOR



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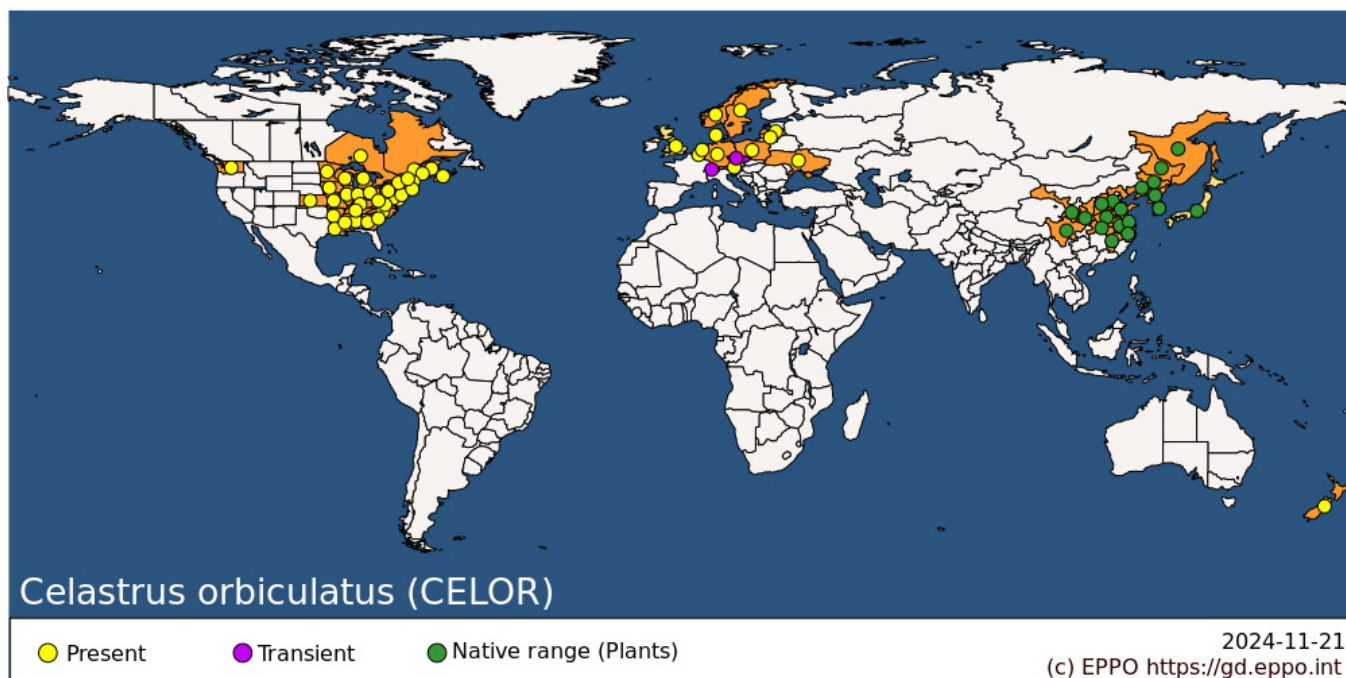
## GEOGRAPHICAL DISTRIBUTION

*Celastrus orbiculatus* is native to China. It is also recorded as native in the Korean Peninsula, Japan and the Russian Far East and Sakhalin Island.

*C. orbiculatus* has been introduced into the EPPO region, and New Zealand and North America. USDA (2020) record *C. orbiculatus* as present in 25 eastern states. However, 31 states document *C. orbiculatus* as present in at least one county according to EDDMapS (<https://www.eddmaps.org/>). The current distribution of the species in the United States extends from Maine south to Georgia and west to Iowa (IPSAWG, 2019). Patterson (1973) stated that *C. orbiculatus* had spread to 33 US states, which included California and Washington. POWO (2020) confirmed that the species is present in Washington State. *C. orbiculatus* is also present in Canada in New Brunswick, Ontario, and Quebec (USDA, 2020) and Nova Scotia (CABI, 2021).

*C. orbiculatus* was first introduced into New Zealand as a garden ornamental in 1905. Williams and Timmins (2003) state that *C. orbiculatus* has a localized distribution in New Zealand but it is widely distributed in the northern areas of the North Island.

Beringen *et al.*, (2017) report that *C. orbiculatus* is present in eight EU countries (Austria, Belgium, the Czech Republic, Germany, the Netherlands, Poland, Sweden, and the United Kingdom) and Gudžinskas *et al.* (2020) record the species in 13 European countries (adding Latvia, Lithuania, Norway, European Russia, and Ukraine to the previous list) (see EPPO, 2021a).



**EPPO Region:** Austria, Belgium, Czech Republic, Denmark, Germany, Latvia, Lithuania, Netherlands, Norway, Poland, Russia (European Russia, Far East), Sweden, Switzerland, Ukraine, United Kingdom

**Asia:** China (Anhui, Gansu, Hebei, Heilongjiang, Henan, Hubei, Jiangsu, Jiangxi, Jilin, Liaoning, Shaanxi, Shandong, Shanxi, Sichuan, Zhejiang), Japan, Korea Dem. People's Republic, Korea, Republic

**North America:** Canada (New Brunswick, Nova Scotia, Ontario, Québec), United States of America (Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Mainland USA, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, Washington, West Virginia, Wisconsin)

**Oceania:** New Zealand

## MORPHOLOGY

### Plant type

Deciduous woody vine (the form can vary between vine and shrub).

### Description

Both Chinese and North American morphological descriptions have been given as the species could be imported from both regions.

The following information on the morphology of *C. orbiculatus* has been taken from the Flora of China (efloras.org, 2020) and Hou (1955).

'Deciduous twining shrubs, up to 10 or 18 m tall; branchlets glabrous, grey-brown or brown, with sparse and inconspicuous lenticels; axillary buds small, ovate to elliptic, 1–3 mm. Petiole slender, 1–2 cm; leaf blade generally broadly ovate, suborbicular, or rectangular-elliptic, 5–13 × 3–9 cm, glabrous or abaxially sparsely pubescent on veins, base broadly cuneate to obtuse orbicular, margin serrate, apex broadly rounded, muriculate, or shortly acuminate; secondary veins 3–5 pairs. Inflorescences (cymes) axillary, sometimes terminal, 1–3 cm, 1–7- flowered; pedicels jointed below middle or nearly to base. Male flowers: sepals obtuse-triangular; petals obovate-elliptic to rectangular, 3–4 × 2–2.5 mm; disk shallowly cupuliform, lobe shallow, apex rounded-obtuse; stamens 2–3 mm. Female flowers: corolla relatively shorter than that of male flower; disk slightly thick, carnose; staminodes very short; ovary approximately globose; styles ca. 1.5 mm; stigma deeply 3-lobed, lobe apex shallowly 2-lobed. Fruit

(capsule) approximately globose, 8–13 mm wide, yellow, 3-valved. Seeds elliptic, slightly flat, 4–5 × 2.5–3 mm, reddish brown; aril orange-red. *Celastrus orbiculatus* has deep and spreading roots which can grow to 2 cm thick.’

Root surface is deep orange in colour (Bugwood, 2021) (also true of *C. scandens*).

## BIOLOGY AND ECOLOGY

### General

*Celastrus orbiculatus* is a deciduous twining woody vine with leaves emerging in the spring. It flowers from April in the native range, May and June in the North-Eastern United States and the non-native region of the EPPO region. Depending on the habitat, plants can flower after one or two years of growth (Pooler *et al.*, 2002). Flowers are frequently functionally unisexual because of abortion or reduction of male or female parts, thus the plants are usually dioecious, sometimes monoecious, though plants develop both unisexual and perfect flowers: polygamo-dioecious (Brizicky, 1964; Gleason & Cronquist, 1991; Burnham & Santana, 2015).

In the United States, *C. orbiculatus* is, in most cases, functionally dioecious and thus may require cross-pollination. Insect (Brizicky, 1964) and wind pollination (Wyman, 1950) have been documented for this species, suggesting that male and female plants may need to be relatively close for successful cross-pollination. Pollen is shed approximately 24 h after flowers open (Pooler *et al.*, 2002). Fruit and seeds mature around late September in the United States with each fruit containing three to six seeds (Hou, 1955; Greenberg *et al.*, 2001).

Gudžinskas *et al.* (2020) showed that only monoecious individuals were present from 12 sampled individuals at four populations in Lithuania. In other studies, Verloove (2020) showed that the species rarely flowers in Belgium.

Individual plants that do not reproduce sexually, due to age, plant size or lack of light, are dependent on vegetative reproduction for growth. All individuals have the potential to resprout from aerial buds on branches, basal buds on the root collar or stump, and subterranean buds that permit root suckering if above-ground portions are removed (Pavlovic & Leicht-Young, 2011). Small pieces of root left during clearing operations can resprout quickly and may form new plants (Dreyer *et al.*, 1987; Ellsworth *et al.*, 2004).

*Celastrus orbiculatus* can grow rapidly, possibly up to 3 m/year (Patterson, 1973; McNab and Meekers, 1987). In the United States, studies have shown that growth rates differ according to the amount of sunlight the plant receives (Ellsworth *et al.*, 2004).

Seed production may vary among habitats where open habitats, including canopy gaps, promote abundant fruiting (Webster *et al.*, 2006). In 15 sites in Massachusetts, United States, *C. orbiculatus* seed rain averaged 168 seeds/m<sup>2</sup>, but was highly variable with a range of 13–826 seeds/m<sup>2</sup> (Ellsworth *et al.*, 2004). In the EPPO region, there is variation in fruit production between areas where the species occurs. This may be caused by functionally dioecious plants in the absence of the other gender.

### Habitats

In the native range (in China), *C. orbiculatus* is reported to grow in mixed forests, forest margins and in thickets on grassy slopes (eflora.org, 2020).

In the eastern United States, the following habitats where the species is found, but not limited to, include mixed-hardwood forests (all successional stages), coniferous forests (all successional stages), forest edges, woodlands, shrublands, old-fields, dunelands-field, duneland, coastal beaches, and tidal freshwater and saltmarsh communities (Kearsley, 1999; Wells & Brown, 2000; Merhoff *et al.*, 2003; Von Holle & Motzkin, 2007). Though found in forest systems, a thick litter layer may deter seedling establishment (McNab *et al.*, 2002).

The species clearly benefits from disturbance hence it is commonly found growing along roads and sites disturbed by logging and animal foraging (Ellsworth *et al.*, 2004).

In Europe, *C. orbiculatus* has been found in areas close to urban environments and occupying disturbed habitats, but

also in natural or semi-natural habitats (Alberternst & Nawrath, 2018; Gudžinskas *et al.*, 2020). For example, in Lithuania, Gudžinskas *et al.* (2020) showed that the species invades dry dune woodlands, grasslands, pine, spruce, and alluvial and riparian forests.

*Celastrus orbiculatus* uses trees and other vegetation for support for its climbing habit where it twines around support structures. The utilization of trees and other vegetation enables the species to inhabit the upper canopy. In North America, Putz (1995) estimated that *C. orbiculatus* successfully twines around trees with a 15 cm diameter and can climb larger trees by utilizing the lower branches of the tree (Robertson & Handel, 1993) and other vegetation in the understory. It can also utilize its own stem as structural support to grow up trees with larger diameters (Z. Gudžinskas, personal communication, 2021). Stems can also creep along the ground to increase surface area (Leicht & Silander, 2006).

### **Environmental requirements**

*Celastrus orbiculatus* can tolerate a wide range of soil and other environmental conditions (Leicht-Young *et al.*, 2007). Sinclair *et al.* (1987) highlights that the species does not grow well in waterlogged soils. The species is able to grow slowly in forest understories, foraging for openings in the canopy, and grow rapidly in full sunlight (Greenberg *et al.*, 2004; Leicht & Silander, 2006). *C. orbiculatus* is recorded to grow from 400 to 2200 m a.s.l. (eflora, 2020). Others, e.g. Hou (1955), report an altitudinal range of 100–1400 m in the native range, which is supported by Yang *et al.* (2014).

### **Natural enemies**

Within the EPPO region, there are no host-specific natural enemies of *C. orbiculatus*. Generalist natural enemies will potentially attack the plant, but these are unlikely to inflict enough damage at the population level to influence establishment.

### **Uses and benefits**

In the EPPO region, the species is utilized as an ornamental species in gardens, and it can also be grown as a bonsai plant. In the United States, cut branches of *C. orbiculatus* may be incorporated into decorative wreathes or other floral displays, especially around the festive period (Thanksgiving and Christmas) (Mehrhoff *et al.*, 2003). Cut branches may also be displayed on their own. In almost all cases, fruit and seed will be present as it is the colour of the fruit (orange, red) that makes the species attractive in such displays.

## **PATHWAYS FOR MOVEMENT**

Plants for planting (including bonsais) is the main pathway for the entry of *C. orbiculatus* into the EPPO region. *C. orbiculatus* has been utilized as a garden ornamental species in the EPPO region since 1860 (Gudžinskas *et al.*, 2020). Beringen *et al.* (2017) detail that in the EU the species is available in trade in Belgium, Croatia, the Czech Republic, Denmark, Estonia, Germany, Finland, France, Hungary, Italy, Latvia, Lithuania, the Netherlands, Poland, Romania, Slovenia, Spain, Sweden and the United Kingdom.

Costley (2006) and Fryer (2011) highlight that *C. orbiculatus* was historically utilized as a species for erosion control in the United States, for landscaping purposes and for wildlife food. These planting purposes are not likely to be practiced nowadays. In the EPPO region, *C. orbiculatus* is recommended as a species to plant for noise reduction along roads and railways or as a species for green walls (e.g. Eppel-Hotz, 2012).

It should be noted that *C. orbiculatus* can be mistaken for *C. scandens* (native to North America) in horticultural trade and it is reported that many nurseries in the United States accidentally sell *C. orbiculatus* (Ritterskamp, 2018). Zaya *et al.* (2017) identified 34 plants from 11 vendors in the United States and found that 18 samples (53%) were mislabelled, and 7 out of the 11 vendors sold mislabelled plants.

In the United States *C. orbiculatus* has spread from sites where it has been planted for ornamental purposes and has subsequently established extensively in natural and managed habitats. An important factor for this spread is the

natural spread of the species by mammals and birds (Greenberg *et al.*, 2001; LaFleur *et al.*, 2009; Merow *et al.*, 2011). Throughout the literature, the European starling (*Sturnus vulgaris*), which is present in North America and native to parts of the EPPO region, is detailed to spread seed of *C. orbiculatus* (La Fleur *et al.*, 2009; Merow *et al.*, 2011). Additionally, in North America other frugivorous birds are reported to eat the fruit of *C. orbiculatus*, including northern flickers (*Colaptes auratus*), yellow-rumped warblers (*Setophaga coronata*), American robins (*Turdus migratorius*) and other thrushes (Turdidae), mockingbirds and catbirds (Mimidae), and mynas (Sturnidae). Greenberg *et al.* (2001) highlight that 75% of seed was apparently removed by vertebrates and presumably dispersed in an oak forest in North Carolina. The fruit are not a preferred fruit of migratory birds, which select, when they are available, several native vines with higher polyphenol and anthocyanin concentrations over *C. orbiculatus* (Bolser *et al.*, 2013). Seeds ingested by birds have a higher germination rate compared to seeds with intact fruits.

In the EPPO region, there is no additional information on bird species which use *C. orbiculatus* berries as a food source, but it is likely a number of frugivorous species do. In Germany, bird dispersal has been recorded at 400 m from the parent plants (Alberternst & Nawrath, 2018). Deer have been reported to feed on *C. orbiculatus* in the United States (Averill *et al.*, 2016; Mundahl & Borsari, 2016), though it is not clear to what extent, if any, they spread propagules.

## IMPACTS

### Effects on plants

*Celastrus orbiculatus* forms dense thickets in open natural and disturbed areas as well as in forest understories and canopies. Such growth reduces light availability and may smother native plant species, suppressing or excluding them (McNab and Meeker, 1987). In the eastern United States, *C. orbiculatus* invades the same habitats as the native *C. scandens*. There has been a decline in *C. scandens* occurrence while *C. orbiculatus* has shown an increase, especially in areas with older *C. orbiculatus* populations (Steward *et al.*, 2003). Hybridization with *C. scandens*, though hybrids appear to be in relatively low numbers, is asymmetrical, with pollen coming primarily from *C. orbiculatus*, potentially accelerating *C. scandens*' decline (Zaya *et al.*, 2015).

In North America, *C. orbiculatus* grows in close proximity to the threatened pitcher thistle (*Cirsium pitcheri* (Leicht-Young & Pavlovic, 2012) and the threatened bird, the piping plover in coastal areas (Dreyer, 1994), potentially threatening their habitats (Leicht-Young & Pavlovic, 2012). If migratory birds are limited to consuming *C. orbiculatus* over other native vine fruits, they may suffer from an inadequate diet, possibly hindering their migration (Bolser *et al.*, 2013).

Locally, *C. orbiculatus* can act as an ecosystem engineer by transforming the structure of habitats, such as forests, in which it may affect all strata (understory, mid-story, and canopy) (Fike & Niering, 1999). *C. orbiculatus* growth in tree canopies may weaken the host trees, making them more vulnerable to abiotic influences, including damage from wind, ice and snow (Siccama *et al.*, 1976). *C. orbiculatus* may facilitate the growth of other destructive vines in forests (Fike & Niering, 1999). *C. orbiculatus* responds positively to fire via root suckering, adding potential fuel to forest systems (Pavlovic *et al.*, 2016). *C. orbiculatus* can have negative impacts on tree regeneration, which may impact the course of succession in a forest system (Ellsworth *et al.*, 2004).

In New Zealand, this species is in the early stage of invasion, putting vulnerable habitat communities at risk, including open scrub, shrublands, early successional forest and the margins of mature forests, particularly those on alluvial or colluvial sites (Williams & Timmins, 2003).

Within the EPPO region, *C. orbiculatus* often invades urban and ruderal environments, where its impact on biodiversity is likely to be low. However, Gudžinskas *et al.* (2020) highlight that *C. orbiculatus* is documented to invade natural and semi-natural environments in Austria, Germany, Poland and Lithuania. Similar impacts on biodiversity may be seen in the rest of the EPPO region, especially as the species can cover the canopy (80–100%), as recorded in Hessen, Germany (Alberternst & Nawrath, 2018). Even under more open forest canopies, as observed in Lithuania, light penetration was reduced to the lower vegetation layers when *C. orbiculatus* was present.

Purcel (2010) details that in Poland in natural forests *C. orbiculatus* is a strong competitor of native vegetation and forms a dense ground cover which can prevent the formation of native vegetation. *C. orbiculatus* can entangle two or

more tree crowns, increasing the risk of trees being toppled by wind. Trees and shrubs, on which it twines, are often deformed, moreover, they are also more susceptible to damage from snow, ice and wind.

Hybridization is unlikely to be a negative impact in the EPPO region as there are no native congeners and *C. scandens* has a limited occurrence in the EPPO region. It is possible that both *C. scandens* and *C. orbiculatus* are imported and hybridization may occur where both species are established. Additionally, material imported from North America may include the hybrid. The hybrid is more vigorous than *C. scandens* though hybrid seed are smaller than seed of either species (Pooler *et al.*, 2002; Zaya *et al.*, 2015).

## **Environmental and social impact**

*C. orbiculatus* has negative impacts in managed forests. Reductions in tree regeneration and timber production are the most-documented negative impacts on ecosystem services due to *C. orbiculatus*. The twining habit of *C. orbiculatus* on trees restricts tree growth, overtops canopies and increases the probability of wind and ice damage (Horton & Francis, 2014). Increased weight in the tree crowns can lead to major limb breakage or trunk failure (Delisle & Parshall, 2018). Marks and Canham (2015) demonstrated that tree mortality in Connecticut (United States) caused by vines is primarily due to *C. orbiculatus* and that this vine causes 9.8% of tree mortality where *C. orbiculatus* is present. Additionally, Delisle and Parshall (2018) showed that *Populus grandidentata* and *Quercus rubra* trees that had *C. orbiculatus* growing over them for many years had reduced growth.

The impact of *C. orbiculatus* on soils is less clear. Leicht-Young *et al.* (2009) showed that sites invaded by *C. orbiculatus* were associated with soils having significantly higher soil pH, potassium, calcium and magnesium levels. In a subsequent study, adding *C. orbiculatus* litter to previously uninvaded soil increased nutrients significantly after 3 years. However, positive soil feedback could not be documented. Growing *C. orbiculatus* in soil (*C. orbiculatus*-primed soil) showed an increase in potassium but lower nitrogen mineralization with no other nutrient changes. Native vines appeared to have more of an impact on soil nutrient use than *C. orbiculatus* (Leicht-Young *et al.*, 2015). These results suggest that *C. orbiculatus* may indeed act like a nutrient pump, as suggested by Beringen *et al.* (2017), but impacts may be tempered by the presence of other vines.

Ellsworth *et al.* (2004) suggest that failure to control *C. orbiculatus* can result in severe forest degradation and considerably higher future costs associated with forest restoration. If detected early, especially prior to any timber harvest, removal costs can be minimal. Unfortunately, in forested areas of the United States this shade-tolerant species is often small and without flowers and fruit, making it difficult to distinguish from the native congener.

There are general management costs for controlling this species along with other invasive plants in natural areas as well as managed forests. There also may be management costs associated with control of *C. orbiculatus* along transportation networks in the United States, however, the EWG has not been able to find any additional information to support this.

Horse DVM (2020) detail that all parts of *C. orbiculatus* are considered toxic to horses though the toxin is an unknown gastrointestinal irritant. There is evidence that *C. scandens* is toxic to dogs, cats and horses due to chemical compounds such as cardenolides and alkaloids, which cause vomiting (not horses), diarrhoea, seizures (rare) and weakness. White-tail deer consume *C. orbiculatus* foliage (Lynch, 2009; McNab & Meeker, 1987). The fruit may be toxic to humans.

## **CONTROL**

### **Mechanical control**

Small liana plants can be hand-pulled but the entire plant should be removed, including the entire root system. For climbing vines, cutting the vines should be done near the ground at a comfortable height to kill upper portions and relieve the tree canopy. Attempts should be made to minimize damage to the bark of the host tree. Rooted portions can remain alive and should be pulled, repeatedly cut to the ground or treated with herbicide. Cutting without herbicide treatment will require vigilance and repeated cutting because plants will resprout from the base.

## Chemical control

Herbicides with systemic active ingredients such as triclopyr and glyphosate are effective as they are absorbed into plant tissues and carried to the roots, killing the entire plant within about a week. Basal bark application can be highly effective (Lynch, 2009). Chemical control is effective if the stems are first cut by hand or mowed and herbicide is applied immediately to cut stem tissue.

## Biological control

There are no known biological control agents against *C. orbiculatus*.

## Integrated control

Integrated control or integrated pest management, i.e. a program based on a combination of preventive, cultural, mechanical and chemical practices, should be always considered, particularly in the case of large infestations.

## REGULATORY STATUS

In the EPPO region, *C. orbiculatus* is included on the EPPO A2 list of pests recommended for regulation as a quarantine pest. At the time of writing (September 2021), it is being considered for inclusion on the EU List of invasive alien species of union concern (Regulation 1143/20141).

In New Zealand *C. orbiculatus* has been regulated as a quarantine pest since 2001. It is included in the Official New Zealand Pest Register (Pest Register for Importing Commodities to New Zealand, <https://pierpestoregister.mpi.govt.nz/PestsRegister/ImportCommodity/>).

In the United States *C. orbiculatus* is not regulated at the federal level, although it is regulated in some states (USDA, 2020), specifically Connecticut (invasive, banned noxious weed), Maine (prohibited invasive species), Massachusetts (prohibited noxious weed), New Hampshire (prohibited invasive species), New York (prohibited invasive species), North Carolina (Class C noxious weed), Rhode Island (listed as widespread and invasive, no legal authority), Vermont (Class B noxious weed) and Virginia (Tier 3 noxious weed).

## PHYTOSANITARY MEASURES

EPPO (2021) recommends phytosanitary measures for plants for planting (including seed and bonsais). The measure identified includes the prohibition of import into the EPPO region.

Early detection is important to identify new occurrences of the species. *C. orbiculatus* should be monitored and where it occurs control measures should be implemented with the aim of eradication or containment. In addition, public awareness campaigns to prevent spread from existing populations in countries at high risk are necessary. *C. orbiculatus* should be banned from sale in countries within the EPPO region and action to remove it from the natural environment encouraged.

## REFERENCES

Alberternst B & Nawrath S (2018) Untersuchungen 2017 zum Rundblättrigen Baumwürger (*Celastrus orbiculatus*) in Hessen. Gutachten im Auftrag des Hessischen Landesamts für Naturschutz, Umwelt und Geologie.

Averill KM, Mortensen DA, Smithwick EAH & Post E (2016) Deer feeding selectivity for invasive plants. *Biological Invasions* **18**, 1247–1263.

Beringen R, van Duinen GA, de Hoop L, de Hullu PC, Matthews J, Odé B, van Valkenburg JLCH, van der Velde G & Leuven RSEW (2017) Risk assessment of the alien staff-vine (*Celastrus orbiculatus*). Netherlands Centre of



## Expertise for Exotic Species (NEC-E)

Bolser JA, Alan RR, Smith AD, Li L, Seeram NP & McWilliams SR (2013) Birds select fruits with more anthocyanins and phenolic compounds during autumn migration. *The Wilson Journal of Ornithology* **125**, 97–108.

Brizicky G (1964) The genera of Celastrales in the Southeastern United States. *Journal of the Arnold Arboretum* **45**, 206–218. Burnham RJ & Santana CV (2015) Distribution, diversity, and traits of native, exotic, and invasive climbing plants in Michigan. *Brittonia* **67**, 350–370.

Bugwood (2021) *Celastrus orbiculatus*. Available at: [https://wiki.bugwood.org/Celastrus\\_orbiculatus](https://wiki.bugwood.org/Celastrus_orbiculatus) (accessed 25 January 2021)

CABI (2021) *Celastrus orbiculatus*. Invasive Species Compendium. <https://www.cabi.org/isc/datasheet/12009>

Costley JL (2006) Introduced species summary project. Oriental bittersweet (*Celastrus orbiculatus*). Available at: <http://www.columbia.edu/itc/cerc/danof-f-burg/invasionbio/invspsumm/Celastrusorbiculatus.htm> (accessed 25 January 2021)

Delisle ZJ & Parshall T (2018) The effects of Oriental bittersweet on native trees in a New England forest. *Northeastern Naturalist* **25**, 188–196.

Dreyer G (1994). Element stewardship abstract: *Celastrus orbiculatus*, [Online]. In: Invasive on the web: The Nature Conservancy wildland invasive species program. The Nature Conservancy (Producer). Available: <http://tncweeds.ucdavis.edu/esadocs/documents/celaorb.html> [accessed 25 January 2021].

Dreyer GD, Baird LM & Fickler C (1987) *Celastrus scandens* and *Celastrus orbiculatus*: comparisons of reproductive potential between a native and an introduced woody vine. *Bulletin of the Torrey Botanical Club* **114**, 260–264.

Eflora (2020) efloras.org.

Ellsworth JW, Harrington RA & Fownes JH (2004) Seedling emergence, growth, and allocation of oriental bittersweet: effects of seed input, seed bank, and forest litter. *Forest Ecology and Management* **190**, 225–264.

Eppel-Hotz A (2012) Grüner Schmuck im Straßenraum – Bewährte Pflanzen für Lärmschutzsysteme. Hrsg. Bayerische Landesanstalt für Weinbau und Gartenbau, Abteilung Landespflanze.

[https://www.lwg.bayern.de/mam/cms06/landespflanze/dateien/gruener\\_schmuck.pdf](https://www.lwg.bayern.de/mam/cms06/landespflanze/dateien/gruener_schmuck.pdf)

EPPO (2021a) EPPO Global Database. Available at: <https://gd.eppo.int/>

EPPO (2021) EPPO Technical Document No. 1084. Pest risk analysis for *Celastrus orbiculatus*. EPPO, Paris. Available at <https://gd.eppo.int/taxon/CELOR/documents>

Fike J & Niering WA (1999) Four decades of old field vegetation development and the role of *Celastrus orbiculatus* in the northeastern United States. *Journal of Vegetation Science* **10**, 483–492.

Fryer JL (2011) *Celastrus orbiculatus*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <https://www.fs.fed.us/database/feis/plants/vine/celorb/all.html> [accessed 17 November 2020].

Gleason HA & Cronquist A (1991) Manual of Vascular Plants of Northeastern United States and Adjacent Canada. Second edition. The New York Botanical Garden, New York.

Greenberg CH, Smith LM & Levey DJ (2001) Fruit fate, seed germination and growth of an invasive vine - an experimental test of 'sit and wait' strategy. *Biological Invasions* **3**, 363–372.

Greenberg CH, Konopik E, Smith LM & Levey DJ (2004) Fruit fate, seed germination and growth of an invasive vine: an experimental test of 'sit and wait' strategy. In: Gottschalk KW (ed) Proceedings of the 15th USDA



Interagency Research Forum on gypsy moth and other invasive species (2004-01-13/16, Annapolis, MD). GTR NE-332. Newtown Square, PA. USDA, Forest Service, Northeastern Research Station, 34–36.

Gudžinskas Z, Petrulaitis L & Žalneravičius E (2020) Emerging invasion threat of the liana *Celastrus orbiculatus* (Celastraceae) in Europe. *NeoBiota* **56**, 1–25.

Hou D (1955) A revision of the genus *Celastrus*. *Annals of the Missouri Botanical Garden* **42**, 215–302.

Horse DVM (2020) Oriental bittersweet. Available at: <http://www.horsedvm.com/poisonous/bittersweet/>

Horton JL & Francis JS (2014) Using dendroecology to examine the effect of Oriental bittersweet (*Celastrus orbiculatus*) invasion on tulip poplar (*Liriodendron tulipifera*) growth. *The American Midland Naturalist* **172**, 25–36.

IPSAWG (2019) Oriental bittersweet *Celastrus orbiculatus*. Invasive plant species fact sheet. Available at: <https://www.in.gov/dnr/files/OrientalBittersweet.pdf> (accessed 24 February 2020).

Kearsley J (1999) Inventory and vegetation classification of floodplain forest communities in Massachusetts. *Rhodora* **101**, 105–135.

LaFleur N, Rubega M & Parent J (2009) Does frugivory by European starlings (*Sturnus vulgaris*) facilitate germination in invasive plants? *The Journal of the Torrey Botanical Society* **136**, 332–341.

Leicht SA & Silander JA (2006) Differential responses of invasive *Celastrus orbiculatus* (Celastraceae) and native *C. scandens* to changes in light quality. *American Journal of Botany* **93**, 972–977.

Leicht-Young SA, Bois ST & Silander JA (2015) Impacts of *Celastrus* primed soil on common native and invasive woodland species. *Plant Ecology* **216**, 503–516.

Leicht-Young SA, O'Donnell H, Latimer AM & Silander JA (2009) Effects of an invasive plant species, *Celastrus orbiculatus*, on soil composition and processes. *The American Midland Naturalist* **161**, 219–231.

Leicht-Young SA & Pavlovic NB (2012) Encroachment of Oriental Bittersweet into Pitcher's Thistle habitat. *Natural Areas Association* **32**, 171–176.

Leicht-Young SA, Pavlovic NB, Grundel R & Frohnapple KJ (2007) Distinguishing native (*Celastrus scandens* L.) and invasive *C. orbiculatus* Thunb.) bittersweet species using morphological characteristics. *The Journal of the Torrey Botanical Society* **134**, 441–450.

Lynch A (2009) Investigating distribution and treatments for effective mechanical and herbicide application for controlling oriental bittersweet (*Celastrus orbiculatus* Thunb.) vines in an Appalachian hardwood forest. MS Thesis, Davis College of Agriculture, Natural Resources and Design, USA.

McNab W, Loftis H & David L (2002) Probability of occurrence and habitat features for oriental bittersweet in an oak forest in the southern Appalachian Mountains, USA. *Forest Ecology and Management* **155**, 45–54.

McNab H & Meeker M (1987) Oriental bittersweet: a growing threat to hardwood silviculture in the Appalachians. *Northern Journal of Applied Forestry* **4** 174–177.

Marks CO & Canham CD (2015) A quantitative framework for demographic trends in size-structured populations: analysis of threats to floodplain forests. *Ecosphere* **6**, 232.

Mehrhoff LJ, Silander JA Jr, Leicht SA, Mosher ES & Tabak NM (2003) IPANE: Invasive Plant Atlas of New England, [Online].

Storrs, CT: University of Connecticut, Department of Ecology and Evolutionary Biology (Producer). Available: <http://nbii-nin.ciesin.columbia.edu/ipane/>

Merow C, LaFleur N, Silander JA, Wilson AM & Rubega M (2011) Developing dynamic mechanistic species

- distribution models: Predicting bird-mediated spread of invasive plants across Northeastern North America. *The American Naturalist* **178**, 30–43.
- Mundahi N & Borsari B (2016) Browsing by White-Tailed Deer on Invasive Oriental Bittersweet Spreading into Restored Grasslands. 24th North American Prairie Conference.
- Patterson DT (1973) The ecology of Oriental bittersweet, *Celastrus orbiculatus*, a weedy introduced ornamental vine. Durham, NC: Duke University. 252 p. Dissertation.
- Pavlovic NB, Leicht-Young SA & Grundel R (2016) Oriental bittersweet (*Celastrus orbiculatus*): Spreading by fire. *Forest Ecology and Management* **364**, 183–194.
- Pavlovic NB & Leicht-Young SA (2011) Are temperate mature forests buffered from invasive lianas? *The Journal of the Torrey Botanical Society* **138**, 85–92.
- Pooler MR, Dix RL & Feely J (2002) Interspecific hybridizations between the native bittersweet, *Celastrus scandens*, and the introduced invasive species, *C. orbiculatus*. *Southeastern Naturalist*, 69–76.
- POWO (2020) Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; <http://www.plantsoftheworldonline.org/> [Accessed: 25 10 2020].
- Purcel A (2010) The expansion of Oriental Bittersweet *Celastrus orbiculatus* in the central segment of Mi?dzyszcz Fortified Zone. *Przeł?d Przyrodniczy* **3**, 3–14.
- Putz FE (1995) Relay ascension of big trees by vines in Rock Creek Park, District of Columbia. *Castanea* **60**, 167–169.
- Robinson GR & Handel SN (1993) Forest restoration on a closed landfill: rapid addition of new species by bird dispersal. *Conservation Biology* **7**, 271–278.
- Ritterskamp M (2018) Invasive species of the month Oriental bittersweet (*Celastrus orbiculatus*). <https://daviesscoswcd.org/images/pdf/December-2018-Oriental-Bittersweet.pdf>
- Siccama TG, Weir G & Wallace K (1976) Ice damage in a mixed hardwood forest in Connecticut in relation to *Vitis* infestation. *Bulletin of the Torrey Botanical Club* **103**, 180–183.
- Sinclair W, Lyon H & Johnson W (1987) Diseases of trees and shrubs. Second edition. Cornell University Press, Ithaca, New York.
- Steward AM, Clemants SE & Moore G (2003) The concurrent decline of the native *Celastrus scandens* and spread of the non-native *Celastrus orbiculatus* in the New York City metropolitan area. *The Journal of the Torrey Botanical Society* **130**, 283–291.
- USDA (2020) *Celastrus orbiculatus* Thunb. Oriental bittersweet. Available at: <https://plants.sc.egov.usda.gov/core/profile?symbol=CEOR7>
- Verloove F (2020) *Celastrus orbiculatus*. Manual of the Alien Plants of Belgium. Botanic Garden of Meise, Belgium. <https://www.alienplantsbelgium.be>
- Von Holle B & Motzkin G (2007) Historical land use and environmental determinants of nonnative plant distribution in coastal southern New England. *Biological Conservation* **136**, 33–43.
- Webster CR, Jenkins MA & Jose S (2006) Woody invaders and the challenges they pose to forest ecosystems in the Eastern United States. *Forest Ecology* **104**, 366–374.
- Wells EF & Brown RL (2000) An annotated checklist of the vascular plants in the forest at historic Mount Vernon, Virginia: a legacy from the past. *Castanea* **65**, 242–257.

Williams PA & Timmins SM (2003) Climbing spindle berry (*Celastrus orbiculatus* Thunb.) biology, ecology, and impacts in New Zealand. *Science for Conservation* **234**, 28 p.

Wyman D (1950) Fruiting habits of certain ornamental plants. *Arnoldia* **10**, 81–85.

Yang JC, Hwang HS, Lee HJ, Jung SY, Ji S-J, Oh S-H & Lee Y-M (2014) Distribution of vascular plants along the altitudinal gradient of Gyeongjisan (Mt.) in Korea. *Journal of Asia-Pacific Biodiversity* **7**, e40–e71.

Zaya DN, Leicht-Young SA, Pavlovic NB, Hetrea CS & Ashley MV (2017) Mislabelling of an invasive vine (*Celastrus orbiculatus*) as a native congener (*C. scandens*) in horticulture. *Invasive Plant Science and Management* **10**, 313–321.

Zaya DN, Leicht-Young SA, Pavlovic NB, Feldheim KA & Ashley MV (2015) Genetic characterization of hybridization between native and invasive bittersweet vines (*Celastrus* spp.). *Biological Invasions* **17**, 2975–2988.

## ACKNOWLEDGEMENTS

This datasheet was produced following an expert working group that risk-analysed *C. orbiculatus* for the EPPO region in January and February 2021. The composition of the expert working group was G. Brundu (University of Sassari, Department of Agriculture, IT), D. Chapman (Stirling University, UK), S. Follak (AGES, AT), G. Fried (ANSES, FR), Z. Gudzinskas (Nature Research Centre, Institute of Botany, LT), C. Huebner (USDA, US), A. MacLeod (Defra, GB), U. Starfinger (Julius Kühn Institut, DE) and J. Van Valkenburg (National Plant Protection Organization, NL).

## How to cite this datasheet?

EPPO (2024) *Celastrus orbiculatus*. EPPO datasheets on pests recommended for regulation. Available online. <https://gd.eppo.int>

## Datasheet history

This datasheet was first published in the EPPO Bulletin in 2022. It is now maintained in an electronic format in the EPPO Global Database. The sections on 'Identity' and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.

EPPO (2022) Datasheets on pests recommended for regulation. *Celastrus orbiculatus*. *EPPO Bulletin* **52**(2), 379-386. <https://doi.org/10.1111/epp.12833>