EPPO Datasheet: *Anoplophora chinensis*

Last updated: 2020-10-28

IDENTITY

Preferred name: *Anoplophora chinensis*
Authority: (Forster)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Coleoptera: Cerambycidae
Other scientific names: *Anoplophora malasiaca* (Thomson), *Cerambyx chinensis* Forster, *Cerambyx farinosus* Houttuyn, *Lamia punctator* Fabricius, *Melanauster chinensis* Thomson
Common names: black and white longhorn, citrus long-horned beetle, citrus longhorn, citrus root cerambycid, white-spotted longicorn beetle
view more common names online...
EPPO Categorization: A2 list
view more categorizations online...
EU Categorization: Emergency measures (formerly), A2 Quarantine pest (Annex II B)
EPPO Code: ANOLCN

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Notes on taxonomy and nomenclature

Anoplophora chinensis is currently a single taxonomic entity. In the past some authors referred to *Anoplophora malasiaca* (Thomson), but in line with the revised taxonomy of the genus *Anoplophora* which occurred in 2002, *A. malasiaca* is synonymized with *A. chinensis* (Lingafelter & Hoebeke, 2002; Wang, 2017). However, despite the revision of the genus *Anoplophora*, the name *A. malasiaca* is still used in Japan (Iwaizumi, 2016; Fujiwara-Tsujii *et al*., 2019; Yasuda *et al*., 2020).

HOSTS

Anoplophora chinensis is polyphagous on woody hosts, having been recorded on many living plants belonging to more than 30 families (Haack *et al*., 2010).

In Asia, *A. chinensis* is a serious pest of citrus orchards (Mitomi *et al*., 1990; Smith *et al*., 1997) and has a wider host range which also includes conifers in the genera *Pinus* and *Cryptomeria* (Wang & Chen, 1984; Lingafelter & Hoebeke, 2002).

In Europe, *Acer* has been indicated as the most commonly infested genus, followed by *Betula* and *Corylus* (Haack *et al*., 2010). In Italy, *A. chinensis* primarily attacks species of *Acer* spp., *Betula* spp., *Carpinus* spp., *Corylus* spp., *Platanus* spp. and *Prunus* spp. (almost exclusively *Prunus laurocerasus*) (Cavagna *et al*., 2013).

Damage has also been found on species of *Aesculus* spp., *Alnus* spp, *Citrus* spp., *Cotoneaster* spp., *Crataegus* spp., *Fagus* spp., *Lagerstroemia* spp., *Malus* spp., *Populus* spp., *Pyrus* spp., *Rosa* spp., *Salix* spp., *Quercus* spp. and *Ulmus* spp. (Maspero *et al*., 2007; EFSA, 2019; Regione Lombardia, 2020a).

Host list: *Acacia decurrens*, *Acacia*, *Acer campestre*, *Acer negundo*, *Acer oblongum*, *Acer palmatum*, *Acer pictum subsp. mono*, *Acer platanoides*, *Acer pseudoplatanus*, *Acer saccharinum*, *Acer*, *Aesculus hippocastanum*, *Aesculus*, *Albizia julibrissin*, *Albizia*, *Allocasuarina verticillata*, *Alnus firma var. multinervis*, *Alnus firma*, *Alnus hirsuta*, *Alnus maximowiczii*, *Alnus sieboldiana*, *Alnus*, *Aralia cordata*, *Aralia*, *Atalantia buxifolia*, *Betula pendula*, *Betula platyphylla var. japonica*, *Betula platyphylla*, *Betula*, *Broussonetia papyrifera*, *Brucea javanica*, *Cajanus cajan*, *Cajanus*, *Camellia oleifera*, *Camellia*, *Carpinus betulus*, *Carpinus laxiflora*, *Carpinus*, *Carya illinoinensis*, *Castanea crenata*, *Castanea*, *Castanopsis sieboldii*, *Castanopsis*, *Casuarina equisetifolia*, *Casuarina*, *Catalpa*, *Cercis*, *Chaenomeles*, *Citrus maxima*, *Citrus reticulata*, *Citrus trifoliata*, *Citrus x aurantiifolia*, *Citrus x aurantium var. sinensis*

, *Citrus x aurantium var. unshiu*, *Citrus x aurantium*, *Citrus x junos*, *Citrus x limon*, *Citrus x limonia*, *Citrus x nobilis* , *Citrus*, *Cornus*, *Corylus avellana*, *Cotoneaster*, *Crataegus*, *Cryptomeria japonica*, *Elaeagnus multiflora*, *Elaeagnus umbellata*, *Elaeagnus*, *Eriobotrya japonica*, *Eriobotrya*, *Fagus crenata*, *Fagus sylvatica subsp. orientalis*, *Fagus sylvatica*, *Fagus*, *Ficus carica*, *Ficus*, *Fortunella margarita*, *Fortunella*, *Fraxinus americana*, *Fraxinus*, *Grevillea*, *Hedera rhombea*, *Hedera*, *Hibiscus mutabilis*, *Hibiscus syriacus*, *Hibiscus*, *Ilex chinensis*, *Ilex*, *Juglans mandshurica* , *Juglans*, *Lagerstroemia indica*, *Lagerstroemia*, *Lindera praecox*, *Lindera*, *Liquidambar*, *Litchi chinensis*, *Litchi*, *Maackia amurensis*, *Maackia*, *Machilus thunbergii*, *Mallotus japonicus*, *Mallotus*, *Malus asiatica*, *Malus domestica*, *Malus sylvestris*, *Malus*, *Melia azedarach*, *Melia*, *Momordica charantia*, *Morus alba*, *Morus bombycis*, *Morus*, *Olea europaea*, *Olea*, *Ostrya*, *Persea*, *Platanus occidentalis*, *Platanus orientalis*, *Platanus x hispanica*, *Platanus*, *Populus alba*, *Populus maximowiczii*, *Populus nigra*, *Populus sieboldii*, *Populus tomentosa*, *Populus*, *Prunus armeniaca*, *Prunus laurocerasus*, *Prunus x yedoensis*, *Prunus*, *Psidium guajava*, *Psidium*, *Punica granatum*, *Pyracantha angustifolia*, *Pyracantha*, *Pyrus pyrifolia var. culta*, *Pyrus pyrifolia*, *Pyrus ussuriensis*, *Pyrus*, *Quercus acutissima*, *Quercus glauca*, *Quercus petraea*, *Quercus robur*, *Quercus serrata*, *Quercus texana*, *Quercus virginiana* , *Quercus*, *Rhododendron*, *Rhus*, *Robinia pseudoacacia*, *Robinia*, *Rosa multiflora*, *Rosa rugosa*, *Rosa*, *Rubus microphyllus*, *Rubus palmatus*, *Rubus*, *Sageretia*, *Salix babylonica*, *Salix caprea*, *Salix gracilistyla*, *Salix integra*, *Salix koriyanagi*, *Salix pierotii*, *Salix*, *Sambucus*, *Sapium*, *Sophora*, *Sorbus*, *Stranvaesia*, *Styrax japonicus*, *Toona*, *Toxicodendron vernicifluum*, *Triadica sebifera*, *Ulmus davidiana var. japonica*, *Ulmus*, *Vaccinium corymbosum*, *Vaccinium*, *Vernicia fordii*, *Vernicia*, *Viburnum*, *Zanthoxylum bungeanum*, *Zelkova*, *Ziziphus*

GEOGRAPHICAL DISTRIBUTION

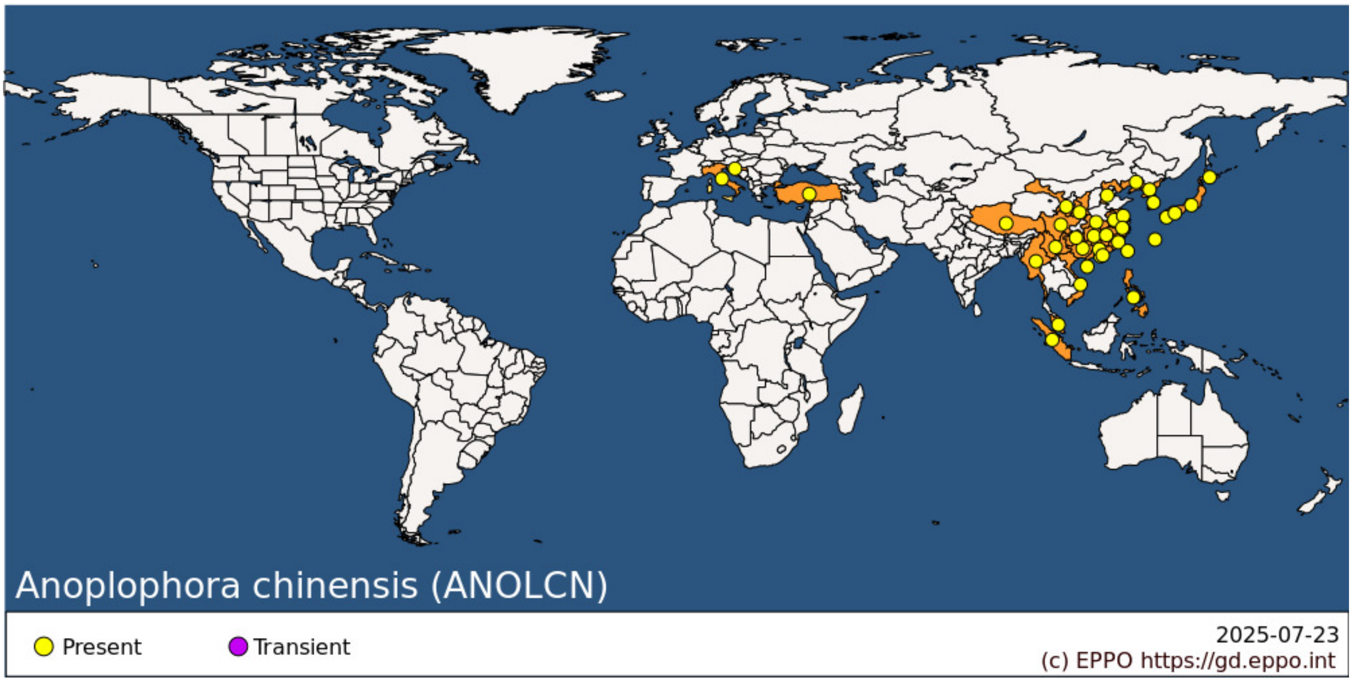
Anoplophora chinensis is native to Asia. This species occurs primarily in China, Japan and the Korean peninsula and it is also reported in Vietnam, Taiwan, the Philippines, Myanmar, Malaysia and Indonesia (Gressitt, 1951; Lingafelter & Hoebeke, 2002).

In 1999 and 2001, *A. chinensis* was found in the USA and was considered eradicated in 2005. Before this, in *A. chinensis* was only reported to occur in the USA in Hawaii (Sorauer, 1954; EPPO, 1999; Gyeltshen & Hodges, 2005).

In the EPPO region, this species was first reported in 1980 in the Netherlands (Haack *et al*., 2010) and several outbreaks occurred from 2000 to the present day. In Italy, *A. chinensis* was detected for the first time in 2000 in Lombardy Region, later it was reported in Lazio Region (2008) and in Tuscany Region (2014 and 2017). In some outbreaks *A. chinensis* has been eradicated, in others containment measures are in place (Colombo & Limonta, 2001; EPPO, 2019).

A. chinensis has been reported and subsequently eradicated in Netherlands (2003, eradicated in 2010), Germany (2008, eradicated in 2017), Denmark (2011, eradicated in 2015) and Switzerland (2014, eradicated in 2019) (EFSA, 2019; EPPO, 2020a).

This beetle has also been reported in France (2003 and 2008), Croatia (2007) and Turkey (2015) where eradication measures are in place (EPPO, 2020a).



EPPO Region: Croatia, Italy (mainland), Türkiye
Asia: China (Anhui, Aomen (Macau), Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Shaanxi, Sichuan, Xianggang (Hong Kong), Xizhang, Yunnan, Zhejiang), Indonesia (Sumatra), Japan (Hokkaido, Honshu, Kyushu, Ryukyu Archipelago, Shikoku), Korea, Democratic People's Republic of, Korea, Republic of, Malaysia (West), Myanmar, Philippines, Taiwan, Vietnam

BIOLOGY

Anoplophora chinensis generally completes its life cycle in one year, however occasionally the lifecycle can take two years to complete (Haack *et al*., 2010). Adults can be observed from May to October with a peak emergence usually from May to July. However, if the environmental conditions are optimal, adults can be observed until December. Newly emerged adults undertake maturation feeding for 10-15 days on leaves, twigs, petioles and bark before mate-finding and copulation occurs (Maspero *et al*., 2007; Haack *et al*., 2010; EPPO, 2013; Wang, 2017).

After copulation the females lays eggs, one by one, under the bark of the lower trunk, on exposed roots and along root collar region. At the time of oviposition, they make 'T-shaped' incisions with their mandibles on the bark of the host plant, in order to be able to introduce the ovipositor and lay the eggs. Females lay an average of 70 eggs in their lifetimes (Haack *et al*., 2010; Wang, 2017).

Larvae dig long feeding tunnels in both trunks and exposed roots, initially in the cambial region and later enter the woody tissues of the lowest portions of the trunk and roots, in the heartwood and sapwood (Haack *et al*., 2010).

Most individuals of *A. chinensis* overwinter as larvae at various stage of their development, depending on the egg laying period. The mature overwintering larvae pupate usually during spring (Maspero *et al*., 2007; Haack *et al*., 2010).

DETECTION AND IDENTIFICATION

Symptoms

Several symptoms may indicate that a host is infested with *A. chinensis*. The presence of larvae inside the wood is revealed by frass and woodpulp expelled from the trunk (visible near the collar) and emerging roots (Haack *et al*., 2010; Vukadin & Hrašovec, 2010; Ciampitti & Cavagna, 2013; EFSA, 2019).

Circular exit holes (usually 10-15 mm) made by emerging adults can be observed at the base of the trunk and on the emerging roots of host plants; another symptom of adults infestation are the ‘T-shaped’ oviposition incisions (Haack *et al*., 2010; Ciampitti & Cavagna, 2013), however they are very difficult to find without a thorough visual inspection.

Typical symptoms of the presence of adults are the signs of feeding on twigs and suckers, as well as wilting foliage, stem discoloration and branch desiccation (Haack *et al*., 2010; Ciampitti & Cavagna, 2013; EFSA, 2019).

Morphology

Eggs

About 5 mm long, elongate, subcylindrical and tapering towards both ends. Creamy-white but towards hatching gradually turning yellowish-brown (Lieu, 1945).

Larvae

The larva is an elongate, cylindrical, legless grub. It is creamy-white, with some yellow, chitinized patterns on the prothorax. It ranges from about 5 mm long for the newly hatched larvae up to about 50 mm long for the mature larvae. The head is brown, prognathous and usually retracted into the prothorax. The prothorax is always larger than the abdomen, meso- and metathorax and about twice the width of the head. A distinct pigmented band is present anterior to the pronotal shield. The antennae are very short, three-segmented. The ocelli, one on each side, are ventro-lateral to the antennae (Lieu, 1945; Nakamura, 1981; Gyeltshen & Hodges, 2005; Pennacchio *et al*., 2012).

Pupae

The pupae are exarate and 27 to 38 mm long; they have elytra that only partially cover the membranous hind wings and curve around to the ventral surface of the body (Gyeltshen & Hodges, 2005).

Adult

Typically cerambycid in shape; the body length usually ranges between 19 and 37 mm. Antennae 1.7-2 times length of body in male; 1.2 times length of body in female. The beetle is black with several white hair spots on the elytra. Adults of both sexes have the characteristic of possessing 20–40 small projections (tubercles) on the basal one fifth of each elytron. This character can allow *A. chinensis* to be distinguished from *A. glabripennis* (Lingafelter & Hoebeke, 2002; Thomas, 2004; Haack *et al*., 2010; EPPO, 2016a; EFSA, 2019).

Detection and inspection methods

Visual detection at the beginning of infestation is difficult due to the small amount of frass ejected externally by larvae. However, the frass becomes easier to see as the larvae mature as there is an accumulation of frass outside of the trunk on the ground (near collar region) and on emerging roots. This sign can be confused with frass ejected by larvae of xylophagous *Lepidoptera* (e.g. *Cossus cossus*) and others xylophagous Coleoptera. A molecular test (nested PCR) allowing the detection of *A. chinensis* DNA in frass has been developed (Strangi *et al*., 2013). However limited validation data are available for this test. Exit holes may be visual on the trunk of host plants after the first generation has emerged.

The use of traps could be coupled with others detection and inspection methods. In 2015 a study was published where a male-produced attractant pheromone was identified in *A. chinensis* (Hansen *et al*., 2015; Yasui & Fujiwara-Tsujii, 2016). However, according to the literature, there is no commercial trapping system available for *A. chinensis* specifically (EFSA, 2019). In Italy (Lombardy Region) some results were obtained using Cross Vane Panel Traps and Multi Funnel Traps loaded with various mixtures of the plant volatiles in combination with *Anoplophora glabripennis* attractants; the traps were positioned in areas of recent outbreaks and in those where eradication is close to being achieved. In addition, the traps are used for early detection in sites considered to be at risk (e.g. areas for green composting) (Regione Lombardia, 2020a).

Public awareness is a very effective tool for surveillance and plays a fundamental role. In Italy (Lombardy Region) the active role of citizens was considered fundamental to detect new *A. chinensis* infestation and to prevent its spread (Ciampitti & Cavagna, 2014). Citizens can also support the surveillance of *A. chinensis* through citizen science apps such as FitoDetective (Regione Lombardia, 2020b).

To confirm that a plant is infested by *A. chinensis* and not by another xylophagus species, it is essential to identify the larva(e) or the adult specimen(s) found by morphological or molecular analyses. Pennacchio *et al*. (2012) and Lingafelter & Hoebecke, 2002 published useful taxonomical keys for the morphological identification of late instar larvae and of the adults respectively. An EPPO diagnostic protocol is in preparation for this pest. Molecular identification of specimens can be performed using DNA barcoding (see EPPO Standard PM 7/129 (EPPO, 2016b)).

PATHWAYS FOR MOVEMENT

The most important pathway for the introduction of *A. chinensis* is the import of host plants from areas where this species is present (EPPO, 2013).

In international trade, *A. chinensis* is most likely to be moved as eggs, larvae or pupae in live woody plants such as bonsai and nursery stock. (Haack *et al*., 2010; EPPO, 2001, 2002; CABI, 2020).

The adults fly readily, as is the case for other Cerambycidae. EFSA (2019) estimated that the maximum distance of natural spread in one year is about 194 m (with a 95% uncertainty range of 42–904 m). The specific scenario considers a population with a 2-year cycle based on average conditions in the European Union. In Italy, a geographic study shows that new infestations of *A. chinensis* could be found within 500 m of the previously infested trees in urban areas and within 663 m in agricultural areas (Cavagna *et al*., 2013).

PEST SIGNIFICANCE

Economic impact

The most important damage is caused by larvae. These bore into the wood of living trees reducing the quality and value of the wood and causing the death of trees (Eschen *et al*., 2015).

As previously reported, in Asia *A. chinensis* is considered a serious pest of citrus orchards where it causes important economic losses (Gressitt, 1942; Lieu, 1945; Mitomi *et al*., 1990; Smith *et al*., 1997). Because of this, citrus plantations near import locations are risk areas that should be considered for surveillance and monitoring, particularly in regions where citrus cultivation is of economic relevance (EFSA, 2019).

In Asia, *A. chinensis* is also an important pest of many stone and pome fruit, and mulberry trees (Li *et al*. 1997). Due to its wide host range, *A. chinensis* could have extremely high economic impacts in countries where it is introduced.

In North America and Europe, *A. chinensis* has been found mostly in urban areas. Often the destruction of infested plants is required to prevent its spread. In the case of private gardens this may involve not only economic costs, but also have a social impact on local inhabitants.

Control

The main control measures against the spread of *A. chinensis* consist of the destruction and the removal of infested trees including roots. Using root grinding equipment can help ensure effectiveness. In addition, for effective control of *A. chinensis* in urban areas, the collaboration of citizens is essential, for this reason it is very important to replace the destroyed infested plants with non-host plants.

Because oviposition occurs mainly on the lower trunk it is possible to apply techniques to exclude ovipositing adults (Adachi, 1989). In Italy wire nets are applied for this purpose on particularly valuable plants or in situations where it is not technically possible to destroy the stumps.

A wide variety of insecticides have been tested for *Anoplophora* spp., mainly on *A. glabripennis*. In Asia, for example, the fumigant aluminum phosphide is placed directly in larval galleries, organophosphates are used as systemic treatments, and pyrethroids are commonly used as trunk and foliar sprays (Hu *et al*., 2009). Another promising pyrethroid is lambda-cyhalothrin, which can be applied as an encapsulated contact insecticide (Smith *et al.*, 2009).

Chemical control of larvae is usually not very effective for *A. chinensis*, however, chemical studies conducted in Italy in 2013 achieved some promising results when the basal trunks were initially treated with pyrethroid solutions and after 20 days treated with a mixture of pyrethroids and neonicotinoids (Cavalieri, 2013; Wang, 2017).

Some biological control agents have been studied and tested. In Italy (Lombardy Region), in 2002 in Parabiago area (Milano Province) a Eulophid *Aprostocetus anoplophorae* n. sp. has been reported on *A. chinensis* eggs. Several field trials with *A. anoplophorae* have been held in Lombardy Region (Delvare *et al*., 2004; Hérard *et al*., 2005; Brabbs *et al*., 2015; Maspero, 2015). In the literature several potential control agents are reported such as the nematode *Steinernema feltiae*, the entomopathogenic fungus *Beauveria brongniartii* and some insect parasitoids (e.g. *Spathius erythrocephalus*) (Kashio, 1982, 1986; Kashio & Ujiye, 1988; Brabbs *et al*., 2015).

Phytosanitary risk

A. chinensis is highly polyphagous. The availability of host plants is not a limiting factor for its establishment and spread in the EPPO countries as well as climatic conditions, except in the most northern areas. The findings and outbreaks that have occurred in Europe from 2000 to date demonstrate the beetle’s adaptation to different climates and environments; due to this, the risk of establishment, spread and damage is considered very high (Van Der Gaag *et al*., 2008).

This species is able to attack and cause damage to fruit trees, ornamental and forest plants.

Detection of *A. chinensis* infestations is very problematic because often the infested plants are without signs and infestations may remain undetected for many years and allow the growth of a large population. In this case, eradication and control activities become long and costly. For this reason, it is very important to set up an accurate surveillance of the territory and implement strategies of early detection.

PHYTOSANITARY MEASURES

Since movement of live plants are the main pathway of movement of *A. chinensis*, it is important that the host plants are only imported from pest-free areas. Alternatively, the plants should be grown under carefully supervised conditions in registered nurseries. Suitable precautions would be to grow the plants for at least two years before dispatch in an insect-proof enclosure, inspecting them several times a year for the presence of *A. chinensis.*

As a general approach, it has also been recommended that when importing plants for planting (except seeds) and wood commodities of *Castanea, Quercus, Betula, Populus, Salix, Fagus, Ulmus and Juglans* from countries where *A. chinensis* occurs, precautions should have been taken to avoid any infestations while the consignments are transported through possibly infested areas (EPPO, 2017a,b,c,d,2018, 2020a,b).

In Europe, *A. chinensis* is subjected to emergency measures under Commission Implementing Decision 2012/138/EU of 1 March 2012 as regards emergency measures to prevent the introduction into and the spread within the Union.

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