CAPS Datasheets provide pest-specific information in support of planning and completing early detection surveys.

Anoplophora chinensis

Scientific Name
Anoplophora chinensis (Forster, 1771)

Synonym(s):
Cerambyx chinensis Forster, 1771
Melanauster chinensis (Forster, 1771)
Cerambyx sinensis Gmelin, 1790
Calloplophora malasiaca Thompson, 1865
Anoplophora malasiaca (Thompson, 1865)

Common Name
Citrus longhorned beetle (CLB), citrus root cerambycid, mulberry white spotted longicorn, white spotted longicorn beetle, rough shouldered longhorned beetle

Type of Pest
Beetle, woodborer

Taxonomic Position
Class: Insecta, **Order:** Coleoptera, **Family:** Cerambycidae

2 cm

Dorsal (top) and lateral view (bottom) of *Anoplophora chinensis* adult. The *A. chinensis* morph from Japan (pictured) has a white hair patch on the scutellum while *A. glabripennis* and *A. chinensis* (morph from China) have a black hair patch (Source: Pest and Diseases Image Library, Bugwood.org)

Pest Recognition
This section describes characteristics of the organism and symptoms that will help surveyors recognize possible infestations in the field, select survey sites, and collect symptomatic material. For morphological descriptions, see the Identification/Diagnostic resources on the AMPS pest page on the CAPS Resource and Collaboration website.

Pest Description

Larvae: *Anoplophora chinensis* larvae are typical round headed woodborers (McDougall, 2001). The larvae are white, opaque, legless grubs, 45 to 60 mm (approx. 1 ¾ to 2 $^{3}/_{8}$ in) long and 10 mm (approx. $^{3}/_{8}$ in) wide when mature with an amber-colored head and black mouthparts (**Figure 1**) (McDougall, 2001).

See Gressitt (1942) and Duffy (1968) for detailed descriptions of the larvae. A key to Oriental cerambycid larvae, including *A. chinensis* can be found in Duffy (1968).

Adults: The adult beetle is large, stout, and approximately 21 to 37 mm (approx. 1 to 1.5 inch) long with shiny black elytra marked with 10 to 12 white round spots (Lingafelter and Hoebeke, 2002). Males are generally smaller than females and have their abdomen tip entirely covered by the elytra in contrast to the partially exposed abdomen of females. Also, the male elytra are narrowed, distally, compared to the rounded female elytra. The male's antennae are about twice as long as the body. The female's antennae are only slightly longer than the body. Each segment of the long, 11-segmented antennae is basally marked with white or light blue bands. The anteriorly and posteriorly narrowed pronotum has a pair of stout spines extending from its sides (**Figures 2 & 3, 4**).

Figure 1. *Anoplophora chinensis* larva (Source: Plant Protection Service Archive (Netherlands), Bugwood.org)

A detailed description of the adult stage can be found in Lingafelter and Hoebeke (2002).

Signs

Adult beetles are large and distinct in appearance and may be observed on hosts (Haack et al., 2010). Other signs of potentially infested trees include: frass near the base of the trunk and near exposed roots, round exit holes that are 6-20 mm (~1/4 – 3/4 in.) in diameter along the bottom 50 cm (~20 in.) of trunk, and exposed roots (Haack et al., 2010).

Figures 2 & 3. *Anoplophora chinensis* (Pest and Diseases Image Library, Bugwood.org)

Figure 4. (Left) Smooth surface at the base of the elytra of *A. glabripennis*; **(Right)** rough, warty surface at the base of the elytra of *A. chinensis* (photos credited to F. Hérard in Haack et al., 2010)

Easily Mistaken Species

Anoplophora chinensis resembles *A. glabripennis*, the Asian longhorned beetle. However, *A. chinensis* has dozens of tubercles (small wart-like projections) at the base of the elytra, which are lacking in the Asian longhorned beetle (**Figure 4**) (Thomas, 2004). This character is clearly visible with a 10x hand lens.

Anoplophora chinensis may also be confused with *Monochamus scutellatus*, the whitespotted sawyer, and other *Monochamus* species that are present in much of the United States (**Figure 5**).

Biology and Ecology

Anoplophora chinensis typically produces one generation per year, although a two-year life cycle or longer is possible (Haack et al., 2010; Van der Gaag et al., 2010). Depending on local climate, adults may be active from April to December, but peak adult activity is from May to July (Haack et al., 2010; Lingafelter and Hoebeke, 2002). Adults feed on twigs and leaves (**Figure 6**); however, larvae cause the most significant damage when they tunnel into the wood (Haack et al., 2010).

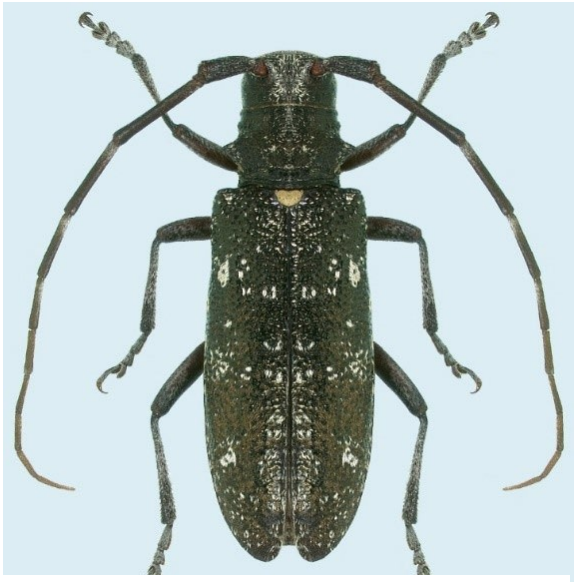

Figure 5. *Monochamus scutellatus*, the whitespotted sawyer (Natasha Wright, FDACS, Bugwood.org)

A single female can lay up to 200 eggs (Lingafelter and Hoebeke, 2002). Eggs are laid along the lower trunk, root collar, and on exposed roots in slits that have been chewed by the adult female in the bark. During egg-laying, the bark often

splits, resulting in a T-shaped scar (**Figure 7**) (Haack et al., 2010). Larvae hatch after one to three weeks (Gyeltshen and Hodges, 2005). The larvae first tunnel in the cambial region between the bark and the wood and later in the sapwood and heartwood (Haack et al., 2010). As the larvae feed, large amounts of frass are ejected through holes in the bark and can be found at the base of infested trees (Haack et al., 2010; McDougall, 2001).

Figure 6. Feeding damage on bonsai maple (Art Wagner, USDA APHIS PPQ, Bugwood.org)

Pupation occurs in a chamber at the end of the larval tunnel (Haack et al., 2010). Pupation takes place in late spring and early summer (Haack et al., 2010). This stage lasts from four to six weeks. The new adult stage is inactive and takes about one to two weeks to mature before emerging (Gyeltshen and Hodges, 2005). After pupation, adults emerge through circular exit holes that are normally 10-15mm (~2/5 – 3/5 in.), but can range from 6-20 mm (~1/4 – 3/4 in.) in diameter (**Figure 8**) (Haack et al., 2010).

Known Hosts

This species attacks a wide range of trees in more than 25 different families and over 40 different genera (Gyeltshen and Hodges, 2005), including commercially important genera such as: *Citrus* spp., *Populus* spp. (poplar species), *Prunus* spp. (stone fruit species), and *Salix* spp. (willow species) (McDougall, 2001; Sjöman et al., 2014).

The host list below includes cultivated and wild plants that, 1) are infested by the pest under natural conditions, 2) are frequently described as major, primary, or preferred hosts, and 3) have primary evidence for feeding and damage, documented in the literature. Plants are highlighted in bold if they are commercially produced and the pest causes economically significant damage.

Preferred hosts

Acer spp. (maple)*, *Acer palmatum* (Japanese maple)*, *Acer saccharinum* (silver maple)*, *Aesculus* spp. (buckeye)*, *Aesculus hippocastanum* (horse chestnut)*, *Alnus* spp. (alder)*, *Betula* spp. (birch)*, *Carpinus* spp. (hornbeam)*, ***Citrus* spp. (citrus)**, ***Citrus* x *aurantiifolia* (key lime)***, ***Citrus* x *aurantium* (sour orange)***, ***Citrus* x *limon* (lemon)***, ***Citrus maxima* (pummelo)**, ***Citrus nobilis* (tangor)**, ***Citrus reticulata* (mandarin)***, ***Citrus sinensis* (navel orange)**, *Cornus* spp. (dogwood)*, *Corylus avellana* (common filbert)*, *Cotoneaster* spp. (cotoneaster)*, *Crataegus* spp. (hawthorn)*, *Fagus* spp. (beech)*, *Lagerstroemia* spp. (lagerstroemia)*, *Liquidambar* spp. (sweetgum)*, *Malus* spp. (apple)*, *Morus* spp. (mulberry)*, *Platanus* spp. (sycamore)*, *Populus* spp. (cottonwood)*, *Prunus laurocerasus* (cherry laurel)*, *Pyrus* spp. (pear)*, *Quercus* spp. (oak)*, *Rhododendron* spp. (rhododendren)*, *Rosa* spp.

* Host with known U.S. distribution.

(rose)*, *Salix* spp. (willow)*, *Sorbus* spp. (mountain ash)*, and *Ulmus* spp. (elm) (Cavagna et al., 2013; Lieu, 1945; McDougall, 2001; Peverieri et al., 2012; Sjöman et al., 2014).

For a more complete list of hosts, see Sjöman et al. (2014).

Pest Importance

Anoplophora chinensis is considered one of the most destructive cerambycid pests of fruit trees. In lowland areas of China, there have been substantial economic losses in citrus (Gressitt, 1942; Wang et al., 1996). Historically, a large number of trees have been killed annually, with 90 percent of citrus trees affected and 100 percent of young trees killed despite control measures (Gressitt, 1942). In a survey in Japan, 50 to 94 percent of inspected citrus trees had an *A. chinensis* exit hole (Mitomi et al., 1990). Damage due to larvae can make plants susceptible to disease and wind damage (CABI, 2021).

Figure 7. 'T' shaped oviposition scars (photo by F. Hérard in Haack et al., 2010)

Damage caused by adults feeding on leaves and twig bark is not usually considered severe (Gyeltshen and Hodges, 2005). However, adult damage to fruiting shoots of fruit trees can cause economic losses (CABI, 2021).

Citrus is an important crop in the United States. In 2020, citrus was grown on 681,300 acres at an estimated value of $3.4 billion (NASS, 2020).

Anoplophora chinensis is listed as a harmful organism in Albania, Antarctica, Chile, El Salvador, Eurasian Customs Union, European Union, Guatemala, Holy See, India, Mexico, Republic of Moldova, Monaco, Morocco, Norway, San Marino, Serbia, and Turkey (APHIS, 2021). In addition, the genus *Anoplophora* is listed as a harmful organism for Antigua and Barbuda, Brazil, Canada, Chile, Jordan, Paraguay, Peru, and Uruguay (APHIS, 2021). There may be trade implications with these countries if this pest becomes established in the United States.

Pathogens or Associated Organisms Vectored

Anoplophora chinensis is not a known vector and does not have any associated organisms. However, damage caused by the larval stage can increase host susceptibility to various secondary plant pathogens (Gyeltshen and Hodges, 2005).

Known Distribution

Anoplophora chinensis is native to **Asia:** China, Japan, Indonesia, Malaysia, North Korea, Philippines, South Korea, and Taiwan (Lingafelter and Hoebeke, 2002).

This species has been introduced to **Europe:** Croatia, Italy, and Turkey (Hérard and Maspero, 2019), and has been eradicated from France and the Netherlands (Hérard and Maspero, 2019).

Pathway

Anoplophora chinensis can move through international trade. This insect is moved mainly as eggs, larvae, or pupae in wood products like crates, pallets, and dunnage, or in imported woody plant material like bonsai or penjing trees (Hérard and Maspero, 2019; McDougall, 2001). Most interceptions of *A. chinensis* occur on live plants (Haack et al., 2010).

This species has been intercepted at North American ports of entry in Georgia, Wisconsin, and Washington. Specimens were recovered from bonsai and nursery stock imported from Japan and Korea (McDougall, 2001).

Use the PPQ Commodity Import and Export manuals listed below to determine 1) if host plants or material are allowed to enter the United States from countries where the organism is present and 2) what phytosanitary measures (e.g., inspections, phytosanitary certificates, post entry quarantines, mandatory treatments) are in use. These manuals are updated regularly.

Figure 8. Exit hole by *Anoplophora chinensis* adult (Plant Protection Service Archive (Netherlands), Plant Protection Service, Bugwood.org)

Fruits and Vegetables Import Requirements (FAVIR) Online Database: The FAVIR database lists all import requirements for fruits and vegetables. To search by commodity, select 'Approved Name' at the top left of the page. Select the commodity from the drop-down menu and then click 'Search'. Click on the 'Commodity Summary' tab for details.
https://epermits.aphis.usda.gov/manual/index.cfm?action=pubHome

Plants for Planting Manual: This manual is a resource for regulating imported plants or plant parts for propagation including buds, bulbs, corms, cuttings, layers, pollen, scions, seeds, tissue, tubers, and like structures.
https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/plants_for_planting.pdf

Cut Flowers and Greenery Import Manual: This manual is a resource for regulating imported fresh, cut plants used for decoration and for protecting plants from extinction due to trade.

https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/cut_flower_imports.pdf

Miscellaneous and Processed Products Import Manual: This manual is a resource for regulating imported, processed plants and non-plants that may introduce exotic pests.
https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/miscellaneous.pdf

Treatment Manual: This manual provides information about treatments applied to imported and domestic commodities to limit the movement of agricultural pests into or within the United States.
https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment.pdf

Potential Distribution within the United States

Based on the current global distribution of *A. chinensis*, we predict that *A. chinensis* could establish in Plant Hardiness Zones 4-13 (Takeuchi et al., 2018). These Plant Hardiness Zones correspond to all of the contiguous United States, Hawaii, southern Alaska, and most of Puerto Rico. There is some uncertainty around the potential for *A. chinensis* to establish in the extremes of these Plant Hardiness Zones since most of the reported distribution of *A. chinensis* is based on large provincial areas (Lingafelter and Hoebeke, 2002). Host plants of *A. chinensis* are located throughout the potential distribution area (USDA-NRCS, 2021). States with major citrus production include California, Florida, and Texas (NASS, 2020).

Survey and Key Diagnostics

Approved Methods for Pest Surveillance*:

For the current approved methods and guidance for survey and identification, see Approved Methods for Pest Surveillance (AMPS) pest page on the CAPS Resource and Collaboration website, at https://caps.ceris.purdue.edu/approved-methods.

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Versions

April 2010: Version 1

September 2014 (version 2)

1) Added new images (figures 1, 2, 3, and 8)
2) Updated datasheet format.
3) Updated **Pest Description** section.
4) Updated **Biology and Ecology** section.
5) Updated **Damage** section.
6) Added **Pest Importance** section.
7) Updated **Known Hosts** section.
8) Updated **Pathogens or Associated Organisms Vectored** section.
9) Updated **Known Distribution** section.
10) Updated **Pathway** section.
11) Updated **Potential Distribution within the United States** section; added most recent NAPPFAST map.
12) Added **Commonly Encountered Non-targets** section.

April 2021 (version 3)

1) Added new images (figures 6, 7, and 9).
2) Updated datasheet format.
3) Updated **Scientific Name** section to have only important synonyms.
4) Updated **Known Host** section.
5) Updated **Known Distribution** section.
6) Updated **Pathway** section.
7) Updated **Potential Distribution within the United States** section. Removed old map and used Plant Hardiness Zones to determine potential distribution.
8) Updated **Survey** section.

Reviewer(s)

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