Ceroplastes japonicus

Scientific Name
Ceroplastes japonicus Green

Synonyms:
Ceroplastes floridensis japonicus Green
Cerostegia japonica (Green)
Cerostegia japonicus (Green)
Paracerostegia japonica (Green)

Common Name(s)
Japanese wax scale, tortoise wax scale

Type of Pest
Scale insect

Taxonomic Position
Class: Insecta, **Order:** Hemiptera, **Family:** Coccidae

Reason for inclusion
CAPS Target: AHP Prioritized Pest List for FY2012

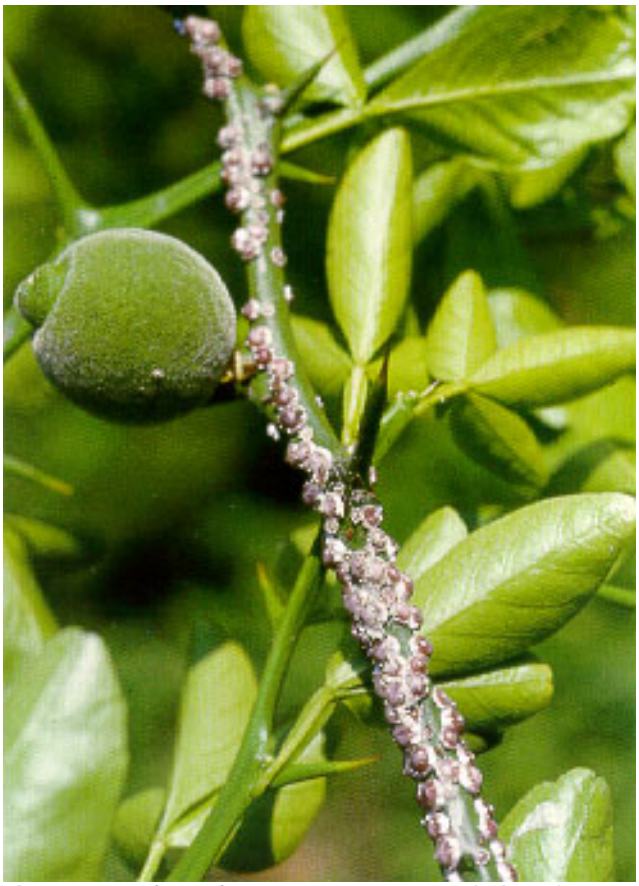

Figure 1. *C. japonicus* on an ornamental plant (Image courtesy of Regione del Veneto).

Pest Description
Eggs: "Eggs of *C. japonicus* are less than 0.5 mm long [0.012 in]" (EPPO, n.d.)

Larvae: "Neonate larvae of *C. japonicus* hatching from eggs have well developed legs and antennae. They move actively searching suitable places for feeding…[larvae fix] themselves on the surface of plants and turn into immovable larvae, which have a form of small stars…The body of a larva is red and is covered by 8 whitish conic wax scales (3 pairs of which are lateral, one is frontal and one is anal) (Shutova, 1970)" (EPPO, n.d.).

Adults: "The adult female of *C. japonicus* is oval, 1.75 – 4.2 mm [0.069 to 0.165 in] long, dorsal side is prominent, ventral side is flat. The upper side of the body is covered by a thick layer of wax, which is usual for all *Ceroplastes* species. The surface is more prominent in the centre and less prominent at the borders. For more young specimens, it is possible to see that the wax cover is composed of 8 separate scales, but they merge while females become older. The wax cover of live females is pink, lighter at the borders. The body under the wax cover is cherry-red. Two snowwhite protuberances are situated on the back side of the wax cover, two – on each lateral side. At the bases

of white protuberances, the colour of the wax cover is more dark because the layer of wax is thinner and the dark red body is seen through it. Legs and 7-segmented antennae are clearly seen on the flat ventral side of the scale. The female lays eggs under its body. During the oviposition, the body is pressed toward the dorsal side. At the end of the oviposition, the female is transformed in a capsule filled by eggs (Shutova, 1970)" (EPPO, n.d.).

Authoritative identification involves detailed microscopic examination of newly matured adult females. Morphological descriptions and illustrations of the adult female are given by Pellizzari and Camporese (1994) as well as a key to the immature female stages. A key to the *Ceroplastes* species that occur in the Mediterranean is given by Pellizzari and Camporese (1994).

Biology and Ecology:
C. japonicus has one generation per year in both China and Italy (Davis et al., 2005; Pellizzari and Camporese, 1994). Oviposition occurs in late May to mid-July in Korea with eggs hatching and crawlers occurring form early June to early August (Davis et al., 2005). Adults are found in mid-October (Davis et al., 2005). In Russia, maturity occurs in September (EPPO, n.d.). Males can fly but not very well. Mating can occur until the end of October. Males die after mating and only live for 3-4 days (EPPO, n.d.).

In Italy, eggs are laid from May to June with hatching occurring in June (Pellizzari and Camporese, 1994). The first molt occurs in July while the second molt occurs in August (Pellizzari and Camporese, 1994). Larvae are mobile for the first few days after hatching but will then fix themselves to the leaves or annual shoots of the host plants and form a wax covering (EPPO, n.d.). Female larvae are able to change feeding locations preferring sunny locations, whereas males cannot move (EPPO, n.d.). Molts occur in July (second instar) and August (third instar) (Davis et al., 2005).

Adult females appear in September where they prepare to overwinter (Pellizzari and Camporese, 1994). Female size and fecundity are dependent on the host plant (Pellizzari and Camporese, 1994) and the feeding site (EPPO, n.d.). If *C. japonicus* is on a deciduous plant, the larvae will move from leaves to branches in autumn before leaf fall (EPPO, n.d.) Mated mature females are the overwintering stage (EPPO, n.d.).

Optimal developmental conditions are 24-27°C (75.2-80.6°F) and 75 to 80% air humidity (EPPO, n.d.).

Symptoms

Infestations of *C. japonicus* occur on foliage, stems, and branches. This results in reduced vigor and the debilitation of the host plant. Heavy infestations may result in chlorotic spotting, the premature shedding of leaves, wilting, and the dieback of stems. Honeydew, a sweet substance excreted by the scale insects, deposited on the leaves and fruit serve as a medium for the growth of black sooty molds (CABI, 2004). Sooty mold can reduce photosynthesis, plant vigor, fruit quality, yield, and marketability of the commodity (Ben-Dov and Hodgson, 1997; Jančar et al., 1999).

Pest Importance

Ceroplastes japonicus is a pest of ornamentals in towns and nurseries in northern and central Italy, but it is not yet recorded as a pest in southern Italy (Pellizzari and Camporese, 1994). It is also a pest of ornamental plants in urban environments in Japan; a major local pest of jujube trees in Zhejiang, China (Luo et al., 1994); a pest of citrus, mulberry, persimmon, and fruit trees in western part of the Republic of Georgia (Borchsenius, 1957); and a pest of citrus and subtropical crops in southern Russia (Prokopenko and Mokrousova, 1981).

In addition to the direct feeding damage, the honeydew secreted forms a substrate for the growth of black sooty molds, which screen light from the leaves and impair gas exchange and photosynthesis. Sooty mold also reduces the market value of plants and produce (CABI, 2004).

Known Hosts

Primary hosts

Camellia sinensis (tea), *Citrus* spp., *Citrus deliciosa* (mediterranean mandarin), *Citrus reticulata* (mandarin), *Diospyros kaki* (oriental persimmon), *Hedera helix* (ivy), *Ilex aquifolium* (Christmas holly), *Jasminum* spp. (jasmine), *Laurus nobilis* (bay laurel), *Poncirus trifoliata* (Trifoliate orange), *Prunus* spp. (stone fruit), and *Ziziphus jujuba* (common jujube) (CABI, 2004).

Secondary hosts

Acer spp. (maple), *Acer japonicum* (full moon maple), *Acer negundo* (boxelder), *Acer palmatum* (Japanese maple), *Acer pseudoplatanus* (sycamore), *Acer saccharinum* (silver maple), *Actinidia chinensis* (kiwi), *Aegle sepiaria* (bitter orange), *Annona* spp., *Aucuba japonica*, *Berberis* spp. (barberry), *Buxus* spp. (boxwood), *Buxus sempervirens* (boxwood), *Camellia* spp. (boxwood), *Camellia japonica* (camellia), *Camellia oleifera* (tea oil plant), *Cerasus avium* (bird cherry), *Cerasus vulgaris* (morello cherry), *Chaenomeles japonica*, *Cleyera japonica*, *Cornus mas* (cornelian cherry), *Crataegus* spp. (hawthorn), *Cycas revoluta*, *Cydonia oblonga* (quince), *Deutzia crenata* (crenate pride of Rochester), *Diospyros* spp. (persimmon), *Ehretia acuminata*, *Elaeagnus pungens*, *Elaeocarpus decipiens*, *Epimedium colchicum* (small eleven flower), *Eriobotrya japonica* (loquat), *Euonymus* spp. (spindle tree), *Euonymus japonicus*, *Eurya japonica*, *Fatsia japonica* (Japanese aralia), *Feijoa sellowiana* (Feijoa fruit), *Ficus carica* (fig), *Hedera* spp. (ivy), *Hedera colchica* (colchis ivy), *Hydrangea hortensia*, *Ilex* spp. (holly), *Ilex colchica* (black sea holly), *Ilex cornuta* (Chinese holly), *Ilex integra*, *Ilex latifolia*, *Laurus* spp. (laurel), *Liquidambar styraciflua* (sweetgum), *Machilus thunbergii*, *Magnolia* spp., *Magnolia grandiflora* (Southern magnolia), *Mahonia aquifolium* (holly barberry), *Malus* spp. (ornamental species apple), *Mangifera indica* (mango), *Morus* spp. (mulberrytree), *Myrsine africana* (African boxwood), *Myrtus communis* (myrtle), *Nerium oleander* (oleander), *Persea thunbergii*, *Persica vulgaris* (peach), *Pittosporum* (cheesewood), *Pittosporum tobira* (Japanese pittosporum), *Platanus hybrida* (London planetree), *Platanus orientalis* (plane), *Podocarpus nagi* (Asian bayberry), *Prunus avium* (sweet cherry), *Prunus laurocerasus* (cherry laurel), *Prunus mume* (Japanese apricot

tree), *Prunus persica* (peach), *Prunus yedoensis*, *Psidium guajava* (guava), *Punica granatum* (pomegranate), *Pyracantha coccinea* (Scarlet firethorn), *Pyrus* spp. (pear), *Pyrus communis* (European pear), *Pyrus pyrifolia* (Japanese pear), *Pyrus sinensis* (harbin pear), *Salix* spp. (willow), *Thea sinensis* (China tea), *Trachelospermum asiaticum*, *Ulmus campestris* (English elm), *Ulmus minor* (European field elm), *Vitis vinifera* (grapevine), and *Ziziphus* spp. (jujube) (CABI, 2004; Davis et al., 2005; Ben-Dov, 2010; EPPO, n.d.).

Pathogens Vectored

This pest is not currently known to vector any pathogens or other associated organisms. However, honeydew supports the growth of black sooty mold.

Known Distribution

According to Borchsenius (1949), *C. japonicus* originated in eastern Asia and was accidentally introduced into the Republic of Georgia, southern Russia, Italy, and France. It was first detected in Italy in 1983 and has since spread throughout the country, as it continues to increase its range (Camporese and Pellizzari, 1994; Pellizzari and Camporese, 1994). It also appears to be spreading in the Republic of Georgia (Dekanoidze, 1971). Green (1921), Boratynski and Williams (1964) and Ben-Dov (1993) record *C. japonicus* in the United Kingdom, but it is currently not established in the UK (CABI, 2010).

Currently this pest is found in the following areas: Armenia, Azerbaijan, China, Croatia, France, Georgia, Italy, Japan, Korea, Nepal, Russia, Slovakia, Slovenia, and Turkey (Bisby et al., 2007; Masten-Milek et al., 2007; Ben-Dov, 2010; CABI, 2010).

Pathway

There have been 32 interceptions of *C. japonicus* at United States ports of entry while interceptions only identified to *Ceroplastes* species has occurred 290 times (AQAS, 2011; queried 4-11-2011). The majority of interceptions occurred on host material for consumption in baggage; other interceptions have occurred on general and permit cargo (AQAS, 2011; queried 4-11-2011).

Spread can occur with movement of host plants for planting, possibly fruit, and naturally through movement of first instar larvae (EPPO, n.d.).

Survey

CAPS-Approved Method*:

Visual inspection. Look on leaves, fruit, and stems for 1) thick layer of grayish to pinkish-white, oily wax that contrasts in color with the host plant, 2) signs of sooty mold, and 3) sticky honeydew.

Literature-Based Methods:

Visual inspection. Adult female *Ceroplastes japonicus* are conspicuous as they are covered by a thick layer of greyish to pinkish-white, oily wax that contrasts in color with the host plant. Heavy infestations are conspicuous and the foliage, fruit, and stems of the plant become covered in sticky honeydew, serving as a medium for the growth of black sooty molds. *C. japonicus* is polyphagous, attacking more than 100 plant species belonging to 40 genera placed in 24 families, including many crop and ornamental plants (Ben-Dov, 1993; Pellizzari and Camporese, 1994). The most common host plants are citrus, persimmon, holly, and ivy. In the Republic of Georgia, it is also common on mulberry and fruit trees, and in Italy, on bay laurel and maple (Pellizzari and Camporese, 1994). Visual inspection of potentially infested plants is the best way of finding colonies of C. *japonicus* on a plant. Inspect host plants with a 10X magnification lens. Look on the leaves and stems of the host plants (Masten-Milek et al., 2007).

Survey site and selection

Areas where host material is found should be targeted for surveys; these can include orchards, nurseries, residential areas and other areas where host plants are used as ornamentals.

Time of year to survey

In Italy, eggs hatch in June with adult females appearing in September (Pellizzari and Camporese, 1994) while adults appear in mid-October in Korea (Davis et al., 2005).

Identification

CAPS-Approved Method*:

Morphological. Adult females can be distinguished based on morphological characters in slide mounted specimens.

Authoritative identification involves detailed microscopic examination of newly matured adult females. Morphological descriptions and illustrations of the adult female are given by Pellizzari and Camporese (1994) as well as a key to the immature female stages. A key to the *Ceroplastes* species that occur in the Mediterranean, including *C. japonicus*, *C. floridensis*, *C. sinensis*, *C. cirripediformis*, *C. rusci*, and *C. actiniformis*, is given in Pellizzari and Camporese (1994).

A description of the adult male, second-instar male, prepupa, and pupa can be found in Rainato and Pellizzari (2008).

Ceroplastes japonicus should be distinguished from the closely related *C. floridensis*, which occurs worldwide in tropical and subtropical regions. The main characters used to distinguish the two species are the number and different arrangements of stigmatic setae along the body margin. In *C. japonicus,* the stigmatic setae form an uninterrupted row between the anterior and posterior stigmatic clefts, whereas, in *C. floridensis*, they are interrupted with 7 to 12 bristle-shaped marginal setae. *Ceroplastes japonicus* has an average of 111 stigmatic setae on each side of the body compared with an average of 60 stigmatic setae in *C. floridensis* (Pellizzari and Camporese, 1994).

The Scale Insects – Identification Tools for Species of Quarantine Significance provides keys and fact sheets that can help identify scale insects, including *Ceroplastes japonicus* (http://www.sel.barc.usda.gov/ScaleKeys/index.html).

*For the most up-to-date methods for survey and identification, see Appendix M in the most recent CAPS Survey Guidelines.

Easily Confused Pests

All stages are similar to other *Ceroplastes* species. *Ceroplastes japonicus* is most commonly confused with *C. floridensis*. Adult females can be distinguished based on morphological characters in slide mounted specimens.

C. japonicus may be confused with other *Ceroplastes* species present in the United States including: *Ceroplastes brachyurus*, *C. ceriferus*, *C. cirripediformis*, *C. dugesii*, *C. feltyi*, *C. floridensis*, *C. irregularis*, *C. nakaharai*, *C. rubens*, *C. rusci*, *C. sinensis*, and *C. utilis*.

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