Paratachardina pseudolobata

Scientific Name
Paratachardina pseudolobata Kondo & Gullan, 2007

Synonyms:
None

Taxonomic note: The paper by Kondo and Gullan (2007) states that this species has been known mistakenly as *Paratachardina lobata* in previous literature. Taxonomic work by Kondo and Gullan (2007) described it as a new species, *P. pseudolobata*.

This species was found in Florida in 1999. It was originally identified as *Paratachardina lobata lobata* by FDACS-DPI personnel and confirmed by USDA-SEL (Howard et al., 2004).

Figure 1. Adults and nymphs of *Paratachardina pseudolobata* (Jeffrey W. Lotz, Florida Department of Agriculture and Consumer Services, Bugwood.org).

Common Name(s)
Lobate lac scale

Type of Pest
Scale insect

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

Reason for Inclusion
Suggestion from CAPS community; previously a CAPS target until it became established in Florida

Pest Description
Eggs: No description available. This species is ovoviviparous in Florida (Howard et al., 2010).

Nymphs: Also called crawlers. “The first instars of the female are elliptical, maroon colored, and about 0.4 mm long” (Howard and Mannion, 2004).

Adults: “The adult female is about 2 mm [$^{1}/_{16}$ in] long and almost as wide, and of a deep maroon color. It does not have functional legs and is immobile, and is secured to the plant surface by a hard cement” (Howard and Mannion, 2004). “As the scale matures,

individuals tend to merge and may [lose] this distinctive shape. The outer covering is very hard, glossy, and dark reddish-brown…Coloring may appear black because of the coating of sooty mold" (DelValle, 2003).

The formal description of this species along with diagrams can be found in Kondo and Gullan (2007).

Figures 2 & 3. First instar larval nymphs and empty exuviae of *Paratachardina pseudolobata* (F.W. Howard, University of Florida, Bugwood.org).

Biology and Ecology

In Florida, development from the female first instar to adult takes at least 90 days (Howard and Mannion, 2004). Mannion et al. (n.d.) states that the life cycle can be as long as 8 months in Florida. The second instar larva is thought to molt into the adult female (Howard et al., 2004). The first instar can take 8 to 11 weeks to develop, while the second instar can take 7 to 8 weeks. Generations can overlap (Howard et al., 2010). Males have not been observed in Florida or Hawaii (Z. Cheng, personal communication, 2015; Howard et al., 2004). Females are parthenogenetic and ovoviviparous (Howard et al., 2010).

The crawler stage can be dispersed by wind currents or by walking along the host plant material and falling from infested plants to those nearby. The adult females are wingless (Gabel, n.d.).

This species can be found on woody portions of twigs and small branches. They are less frequently found on main stems of usually <2 cm [$^{13}/_{16}$ in] diameter (Howard et al., 2004). When populations are high, the scales form a continuous mass, appearing as a dark, lumpy crust (DelValle, 2003).

The scales suck plant sap from host plants, sapping water and nutrients from the plant. This can cause the infested branches to wilt and die back. Honeydew produced by the scales can lead to sooty mold growth. When the sooty mold is thick on the leaf surface, photosynthesis is inhibited (Gabel, n.d.).

Damage

This species infests branches and main stems that are 2 cm in diameter or less. This species has not been found on foliage in Florida or Hawaii except in rare cases when the insects have been found on leaf petioles (Howard and Mannion, 2004; Z. Cheng, personal communication, 2015). This species can form a crowded, contiguous mass on highly susceptible hosts. These masses appear as a dark, lumpy crust. Up to 42 mature females have been counted per 1 cm on the highly susceptible host, wax-myrtle (*Myrica*

cerifera). Sooty mold can also be observed on the branches, the scales, and as patches on the foliage (Howard et al., 2004).

This species causes several effects on host plants including: 1) dieback of twigs and branches, 2) thinning of foliage due to weakening of the plant, 3) formation of sooty mold, and 4) death of the plant in some species (Howard and Mannion, 2004). The highly susceptible host wax-myrtle is especially prone to dying from heavy infestations (Howard et al., 2004). Hunsberger (2003) states that moderate to severe infestations are associated with plant decline in large trees like *Ficus* spp. that have been infested over several years.

Figure 5. Infestation of *Paratachardina pseudolobata* on southern waxmyrtle (*Morella cerifera* (L.) Small) (F.W. Howard, University of Florida, Bugwood.org).

Pest Importance

In Florida, this scale insect has been found on woody dicotyledonous plants; on one coniferous species, the southern red cedar, *Juniperus silicicola*; and the palm *Phoenix roebelenii*. As of October 2002, more than 120 species in 44 families of woody plants have been determined to be hosts of *P. pseudolobata* in Florida (Howard et al., 2004). Many of these are economically important. This list also includes 39 plant species native to Florida (Howard et al., 2004). Some native hosts, such as wax-myrtle (*Myrica cerifera*), are especially susceptible to dense infestations of the scale insect. *Paratachardina pseudolobata* can cause death of the entire plant in these susceptible hosts (Howard and Steinberg, 2005). Most of the exotic host plants are grown as ornamental shrubs or trees or as fruit trees. Some of these are extremely important in the urban landscape as shade trees, specimen trees, or hedges (Howard et al., 2004). Chong et al. (2008) state that the spread of this species throughout the subtropical regions of the United States will likely affect local crop production, the urban landscape, natural areas, and wildlife management.

This species was discovered on the Hawaiian island of O‘ahu in October 2012 (Hawai‘i Department of Agriculture, 2013). “Since then, it has become one of the most severe plant pests in O‘ahu’s urban landscapes, attacking a wide range of plant species, including some that are endemic and endangered” (Cheng and Bhandari, 2015). By 2014, in the study conducted by Cheng and Bhandari (2015), over 80 plant species were found to be infested by *P. pseudolobata.*

Research on chemical and biological controls is currently being conducted on this species to help limit infestations in both Florida and Hawaii (Z. Cheng, personal

communication, 2015; Howard and Steinberg, 2005). Control is considered difficult for many reasons including the insect's thick, resinous coat which makes it impervious to certain insecticides; its broad host range; and lack of natural enemies in Florida (Mannion et al., n.d.).

According to Kondo and Gullan (2007), this species "is one of several polyphagous scale insect species causing canopy dieback on Christmas Island, although this species is not identified in any of the published papers on the subject."

Known Hosts

In Florida, this species has been identified on more than 150 species of trees and shrubs in over 40 plant families. Nearly all are woody dicotyledonous plants (Howard and Mannion, 2004). Many of the exotic host plants found in Florida are grown as ornamental shrubs or trees or as fruit trees (Howard et al., 2004).

Major hosts*

Averrhoa carambola (star-fruit), *Chrysobalanus icaco* (cocoplum), *Conocarpus erectus* (buttonwood), *Ficus aurea* (strangler-fig), *Ficus benjamina* (Benjamin fig), *Ficus microcarpa* (Indian laurel), *Litchi chinensis* (lychee), *Mangifera indica* (mango), *Morella cerifera* (=*Myrica cerifera*) (wax-myrtle), *Myrsine guianensis* (myrsine), *Persea borbonia* (red bay), *Psychotria nervosa* (wild-coffee), and *Terminalia buceras* (=*Bucida buceras*) (black-olive) (Howard et al., 2004).

Minor hosts

Acacia auriculiformis (earleaf acacia), *Acalypha wilkesiana* (copperleaf), *Acer rubrum* (red maple), *Annona cherimola* x *squamosa* (atemoya), *Annona glabra* (pond-apple), *Annona muricata* (soursop), *Annona reticulata* (custard-apple), *Annona squamosa* (sugar-apple), *Antidesma bunius* (Bignay), *Ardisia escallonioides* (marlberry), *Baccharis halimifolia* (saltbush), *Bauhinia* sp., *Blighia sapida* (akee), *Brosimum alicastrum* (Mayan breadnut), *Brunfelsia* sp., *Brunfelsia nitida* (lady-of-the-night), *Brya ebenus* (Jamaican raintree), *Bursera simaruba* (gumbo-limbo), *Cajanus cajan* (pigeon pea), *Calliandra haematocephala* (powderpuff), *Calliandra surinamensis* (pink powderpuff), *Callistemon viminalis* (weeping bottlebrush), *Calophyllum brasiliense* (Brazilian beauty-leaf), *Calophyllum antillanum* (=*C. calaba*) (ocuje), *Calyptranthes pallens* (spicewood), *Calyptranthes zuzygium* (myrtle-of-the-river), *Cananga odorata* (ylang-ylang), *Capparis cynophallophora* (Jamaica caper tree), *Casearia hirsuta* (raspalengua), *Casuarina equisetifolia* (Australian-pine), *Celtis laevigata* (sugarberry), *Cestrum nocturnum* (night-blooming jessamine), *Chrysophyllum cainito* (star-apple), *Chrysophyllum oliviforme* (satinleaf), *Cinnamomum verum* (=*C. zeylanicum*) (cinnamon), *Citrus paradisi* (grapefruit), *Clausena lansium* (wampi), *Clusia rosea* (pitch-apple), *Coffea arabica* (coffee), *Cupaniopsis anacardioides* (carrotwood), *Dichrostachys cinerea* (marabu), *Diospyros digyna* (black sapote), *Dovyalis hebecarpa* (Ceylon gooseberry), *Ebenopsis ebano* (=*Pithecellobium flexicaule*) (Texas ebony), *Elaeocarpus* sp., *Eugenia axillaris* (white-stopper Eugenia), *Eugenia brasiliensis* (grumichama), *Eugenia uniflora* (Surinam-cherry), *Eugenia confusa* (redberry stopper), *Exothea paniculata* (inkwood), *Ficus nota* (tibig), *Ficus rubiginosa* (rusty leaf fig), *Ficus cordata* subsp. *salicifolia* (willow-leaf fig),

Filicium decipiens (Japanese fern-tree), *Fortunella japonica* (round kumquat), *Garcinia* spp. (=*Rheedia* sp.), *Garcinia aristata* (=*Rheedia aristata*) (manajú), *Garcinia intermedia* (lemon drop mangosteen), *Garcinia prainiana* (button mangosteen), *Gardenia jasminoides* (gardenia), *Grewia occidentalis* (starflower), *Guaiacum officinale* (guayacán), *Guarea guidonia* (yamagua), *Guazuma ulmifolia* (guasima), *Hamelia cuprea* (Bahamas flame bush), *Hamelia patens* (firebush), *Hibiscus rosa-sinensis* (hibiscus), *Ilex vomitoria* (yaupon holly), *Inga vera* subsp. *affinis* (ingá doce), *Juniperus virginiana* subsp. *silicicola* (southern red-cedar), *Krugiodendron ferreum* (black ironwood), *Lagerstroemia indica* (crape-myrtle), *Lagerstroemia speciosa* (queen's crape-myrtle), *Laguncularia racemosa* (white mangrove), *Lansium domesticum* (duku), *Laurus nobilis* (sweetbay), *Leonotis leonurus* (lion's-ear), *Licaria triandra* (pepperleaf sweetwood), *Lysiloma latisiliquum* (wild-tamarind), *Lysiloma sabicu* (horseflesh-mahogany), *Macadamia integrifolia* (macadamia nut), *Macadamia tetraphylla* (macadamia nut), *Manilkara jaimiqui* (wild-dilly), *Manilkara zapota* (sapodilla), *Melaleuca quinquenervia* (cajeput), *Melaleuca decora* (honeymyrtle), *Melicocca bijuga* (Spanish-lime), *Michelia champaca* (champaka), *Millettia pinnata* (=*Pongamia pinnata*) (Pongam), *Mimusops elengi* (Spanish-cherry), *Mussaenda erythrophylla*, *Nectandra coriacea* (lancewood), *Ocimum* sp. (Thai basil), *Pachystachys lutea* (golden shrimp plant), *Parthenocissus quinquefolia* (Virginia-creeper), *Peltophorum pterocarpum* (copperpod), *Persea americana* (avocado), *Petrea volubilis* (queen's wreath), *Phoenix roebelenii* (miniature date palm), *Pimenta dioica* (allspice), *Pimenta racemosa* (bay rum), *Plinia cauliflora* (=*Myrciaria cauliflora*) (jaboticaba), *Polygala cowellii* (violet-tree), *Psidium guajava* (guava), *Psidium cattleyanun* var. *littorale* (strawberry guava), *Psychotria ligustrifolia* (wild-coffee), *Quercus geminata* (sand live oak), *Quercus laurifolia* (laurel oak), *Quercus virginiana* (live oak), *Rhizophora mangle* (red mangrove), *Rosa* sp. (rose), *Ruellia* sp., *Rondeletia leucophylla*, *Salix caroliniana* (coastal plains willow), *Schinus terebinthifolius* (Brazilian-pepper), *Sideroxylon celastrinum* (=*Bumelia celastrina*) (saffron-plum), *Sideroxylon foetidissimum* (=*Mastichodendron foetidissimum*) (false-mastic), *Sideroxylon salicifolium* (=*Dipholis salicifolia*) (willow bustic), *Synsepalum dulcificum* (miracle fruit), *Syzygium cumini* (jambolan), *Syxygium jambos* (rose apple), *Syzygium paniculatum*, *Terminalia muelleri*, *Terminalia catappa* (tropical-almond), and *Trema micrantha* (Florida trema) (Howard et al., 2004; Novoa et al., 2006; Segarra-Carmona and Cabrera-Asencio, 2010).

*Howard et al. (2004) states that differences in susceptibility have not been determined experimentally, but some appear to be more highly susceptible than others.

Additional hosts in Hawaii

Cheng and Bhandari (2015) evaluated hosts found on the University of Hawaii at Manoa campus and nearby urban landscapes. In this study, the authors did not differentiate between major and minor hosts. Plant species were considered hosts if at least one mature female was present on the plant (Cheng and Bhandari, 2015). The following list represents additional hosts found on the UH-Manoa Campus, in addition to the major and minor hosts listed above (Cheng and Bhandari, 2015). The authors also denoted hosts native to Hawaii and of endangered status (see footnotes below the list).

Acacia confuse (formosa koa), *Acacia koa* (Koa tree),* *Brownia coccinea* (scarlet flame bean), *Caesalpinia pulcherrima* (dwarf poinciana), *Cinnamomum burmanni* (Korintji cassia), *Cordia dichotoma* (fragrant manjack), *Cordia lutea* (yellow geiger), *Diospryros sandwicensis* (lama),* *Elaeodendron orientale* (false olive), *Euphorbia celastroides*, formerly known as *Chamaesyce celastroides* (ʻAkoko),* *Ficus binnendykii* (narrow leaf ficus), *Ficus calophylloides* (Kamani-leaved fig), *Ficus celebensis* (willow fig), *Ficus elastic* (Indian rubber tree), *Ficus petiolaris* (Mary's tree), *Ficus religiosa* (Bo tree, sacred fig), *Ficus rumphii* (Rumpf's fig tree), *Gardenia brighamii* (Hawaiian gardenia),*,** *Gardenia sootepensis* (golden gardenia), *Gardenia taitensis* (tiare, Tahitian gardenia), *Graptophyllum pictum* (caricature plant), *Hibiscus arnottianus* (Hawaiian white hibiscus),* *Hibiscus clayi* (Koki'o 'ula),*,** *Hibiscus kokio* spp. *kokio* (Hawaiian red hibiscus),* *Hibiscus kokio* spp. *saintjohnianus* (Koki'o),* *Hibiscus* spp. (hibiscus), *Hibiscus waimeae* (Koki'o ke'oke'o),* *Jasminum multiflorum* (Pïkake hökü, star jasmine), *Koelreuteria formosana* (golden-rain tree), *Lebronnecia kokioides*,* *Lecythis minor* (Monkeypot nuts), *Leea guineensis* (leea), *Lophostemon confertus* (vinegar tree), *Malvaviscus grandiflora* (Turk's cap), *Metrosideros polymorpha* (ʻÖhi'a lehua),* *Millettia pinnata* (pongamia, Indian beech), *Morinda citrifolia* (noni, Indian mulberry), *Ocimum basilicum* (basil), *Pipturus albidus* (Waimea nettle), *Pisonia umbellifera* (Pāpala kēpau),* *Plumbago auriculata* (plumbago), *Podranea ricasoliana* (Port John's creeper), *Pseuderanthemum carruthersii* (False eranthemum), *Psydrax odorata* (alahe'e),* *Sanchezia speciose* (sanchezia), *Santalum ellipticum* (Coast sandalwood),* *Sesbania tomentosa* (ʻOhai),*,** *Solanum melongena* (eggplant), *Spathodea campanulata* (African tulip tree), *Tabebuia impetiginosa* (amapa), *Terminalia melanocarpa* (moo-jee, brown damson), *Terminalia* spp. (black terminalia), *Thespesia grandiflora* (maga), *Tipuana tipu* (rosewood).

*Native to Hawaii.

**Endangered in Hawaii.

See Cheng and Bhandari (2015) for a full list of the hosts found on the UH-Manoa Campus in Hawaii.

Pathogens or Associated Organisms Vectored

This species is not known to vector any pathogens or other associated organisms. However, the presence of this species can lead to the formation of sooty mold on the branches, scales, and as patches on the foliage (Howard et al., 2004).

Figure 6. Sooty-mold associated with *Paratachardina pseudolobata* on *Inga edulis* (ice cream bean) (F.W. Howard, University of Florida, Bugwood.org).

Known Distribution

The native range of this species is unknown (Segarra-Carmona and Cabrera-Asencio, 2010). This species was discovered on the Hawaiian island of O‘ahu in October 2012. As of January 2015, it has not been observed on any of the other Hawaiian Islands (Cheng and Bhandari, 2015).

Caribbean: Bahamas, Cuba, and Puerto Rico; **North America:** Florida, Hawaii (limited to the island of O‘ahu; **Oceania:** Christmas Island (Australia) (Novoa et al., 2006; Kondo and Gullan, 2007; Segarra-Carmona and Cabrera-Asencio, 2010; Kondo and Gullan, 2011).

Pathway

The mature females of this scale are wingless and immobile. Scales rely mostly on passive dispersal of the crawler stage via air currents (Howard et al., 2004).

This species could be moved in international trade on infested host material. Since its introduction into Puerto Rico, it has been intercepted three times on plant material meant for consumption being shipped to New York and New Jersey (AQAS, 2015, queried May 27, 2015).

Potential Distribution within the United States

Due to the polyphagous nature of this species, it is not likely to be limited by host material. However, research on the ability of this species to survive freezing temperatures by Chong et al. (2008) suggests that the expansion of this species in the United States will be limited by winter temperature. In the contiguous United States, this species has a “higher potential to invade areas where the average winter temperature do[es] not drop below freezing for an extended duration (3 or more consecutive days), such as southern Florida, Rio Grande Valley in Texas, and Colorado river Delta between California and Arizona” (Chong et al., 2008). This species also poses a risk to tropical states and territories based on its current distribution and host plants.

Survey

Approved Method for Pest Surveillance*:

The approved method for this species is visual inspection.

In Hawaii, surveys have been focused on urban landscapes, where *Paratachardina pseudolobata* infestations have been most severe (Z. Cheng, personal communication, 2015). At a survey location, all ornamental plants and shade trees should be inspected.

When *Paratachardina pseudolobata* infestations are heavy, the plants may have a black color (because of the sooty mold associated with the pest) (Z. Cheng, personal communication, 2015). This may able to be observed from a distance. Closer inspection is then required to confirm presence of the pest. Visual inspection should be focused on twigs less 2 cm ($^{13}/_{16}$ in) in diameter.

If permission can be obtained from the property owner, a tree pruner may be used to collect twigs for inspection. This is especially helpful for large/tall shade trees (like banyans, which are the primary hosts for *P. pseudolobata* in Hawaii) (Z. Cheng, personal communication, 2015).

NOTE: Pest Surveillance (Pest Detection, Farm Bill, etc.) funding cannot be used to survey for this pest on the island of O'ahu or in Florida, where the pest is known to be established. Funding may be used to support surveys in other states/ territories not known to have the pest and on the other Hawaiian Islands.

*For the most up-to-date methods for survey and identification, see Approved Methods on the CAPS Resource and Collaboration Site, at https://caps.ceris.purdue.edu/approved-methods.

Survey Site Selection:
In Florida, this species is found in both coastal and inland areas (Gabel, n.d.). It has been found on ornamental plants, forest and shade trees, food and crop plants, and native and naturalized plants in a variety of environmental settings including universities, individual residences, botanical gardens, preserves, and nurseries (Weaver, 2003). It is not likely to cause problems in greenhouses, interiorscapes, or inside homes (Mannion et al., n.d.).

Though the pest has a wide host range, surveys should include highly susceptible hosts. In Florida, wax-myrtle, *Myrica cerifera,* has been observed with large populations of *P. pseudolobata* (Howard and Steinberg, 2005).

In Hawaii, the plant families Fabaceae, Malvaceae, Moraceae, and Myrtaceae were found to be most susceptible (Cheng and Bhandari, 2015). Cheng and Bhandari (2015) observed that ficus trees and hibiscus plants are highly prone to severe infestation in Hawaii. Weeping banyans (*Ficus benjamina*) have been reported as one of the most severely infested plant species in Hawaii (Cheng and Bhandari, 2015).

Time of year to survey:
This species can be found throughout the year in Florida and Hawaii (Z. Cheng, personal communication, 2015). Howard et al. (2010) found that "the numbers of crawlers counted per month on host plants were notably uniform throughout the year, but there was evidence of a slight increase in crawler production during the warmer months (Howard et al., 2010). This has been the case in Hawaii as well (Z. Cheng, personal communication, 2015).

Key Diagnostics/Identification

Approved Method for Pest Surveillance*:
Morphological. Magnification is needed to identify to species level. "The genus is very characteristic for its shape and color and is easily recognized in the field. This is the only species in the genus known to occur in the New World" (G. Evans, personal communication, 2015).

An in-depth description of this species (adult female, second-instar female and first-instar female) as well as a key to adult females in this genus can be found in Kondo and Gullan (2007).

There is also a Scale Insects ID tool available: http://idtools.org/id/scales/factsheet.php?name=6942. This includes a key (under other scales) and factsheet with description. A key to adult females in the family Kerriidae known to occur in the New World (including *P. pseudolobata*) can be found in Kondo and Gullan (2011).

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Easily Confused Species

The genus is very characteristic for its shape and color and is easily recognized in the field. This is also the only species in the genus known to occur in the New World (G. Evans, personal communication, 2015). First instars could be confused with other scales, however, the second instar to adult have a distinctive fat bowtie shape, making it easily discernible from other species. In Hawaii, *P. pseudolobata* has not been mistaken for any other species, especially at the adult stage (Z. Cheng, personal communication, 2015).

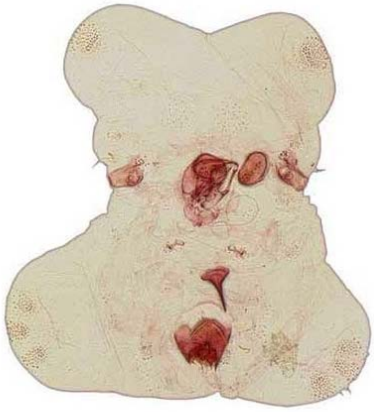

Figure 1. Ventral view of adult *Paratachardina pseudolobata* (Alessandra Rung, California Department of Food & Agriculture, Bugwood.org).

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