EENY-034

Cottony Cushion Scale, *Icerya purchasi* Maskell (Insecta: Hemiptera: Margarodidae)[1]

Avas B. Hamon and Thomas R. Fasulo[2]

Introduction

The cottony cushion scale was described by Maskell (1878) from specimens sent to him by Dr. Purchas from Auckland, New Zealand. The host was kangaroo acacia and the insect was named for Dr. Purchas. At that time only one other species was known in the genus *Icerya* (Maskell 1878). This scale is apparently native to Australia and made its way to California on acacia plants around 1868 or 1869 and in about ten years was causing damage to citrus groves in southern California (Ebeling 1959). New control methods used first in California and later the rest of United States led to the implementation of biological control and legislative quarantine (Ebeling 1959).

Figure 1. Several life stages of the cottony cushion scales, *Icerya purchasi* Maskell, on a twig.
Credits: Paul M. Choate, University of Florida

Distribution

The cottony cushion scale is now widespread throughout the world wherever citrus is grown (Ebeling 1959). In Florida, this scale has been reported from most counties.

The following account of the introduction of this scale insect into Florida is largely taken from Gossard (1901). The vedalia beetle, *Rodolia cardinalis* (Mulsant), was introduced into California in 1888 for the biological control of the cottony cushion scale (DeBach 1973). In 1893, the owners of a nursery in Keene, Florida (Pinellas County), sent an inquiry to someone in California about the possibility of the vedalia beetle (a ladybug) being used to control other scale insects in Florida.

Apparently interpreting this as a request for the ladybug, the California party sent a shipment of these ladybugs and included some cottony cushion scales as food for the ladybugs. The nursery owners, who either did not see the scales or assumed they would be of no consequence, left the packing container near a citrus tree which eventually became infested. The originally infested Florida trees were destroyed, but infested trees appeared again in late 1898. However, this was presumably from a new introduction from nursery stock in about 1895 (Gossard 1901).

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Figure 2. Adult vedalia beetles, *Rodolia cardinalis* (Mulsant), feeding on cottony cushion scale, *Icerya purchasi* Maskell.
Credits: Division of Plant Industry

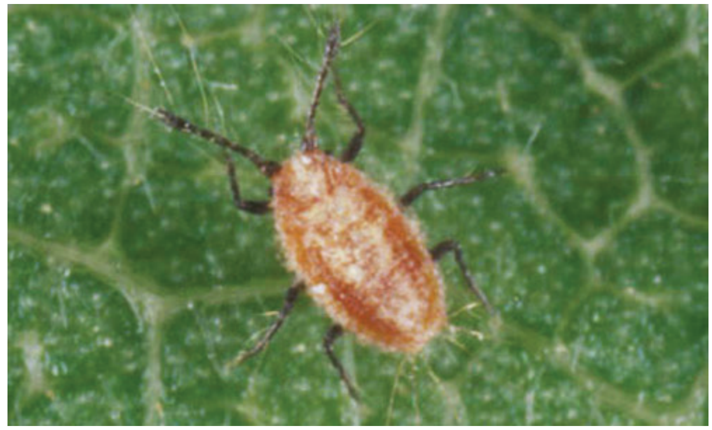

Figure 4. First instar crawler of the cottony cushion scale, *Icerya purchasi* Maskell.
Credits: Lyle J. Buss, University of Florida

Description

The cottony cushion scale can be distinguished easily from other scale insects in Florida. It is the only species of *Icerya* present in Florida. The mature females (actually hermaphrodites) have bright orange-red, yellow, or brown bodies (Ebeling 1959). The body is partially or entirely covered with yellowish or white wax. The most conspicuous feature is the large fluted egg sac, which will frequently be two to 2.5 times longer than the body. The egg sac contains about 1000 red eggs (Gossard 1901).

Figure 3. Adult female cottony cushion scale, *Icerya purchasi* Maskell.
Credits: Division of Plant Industry

Depending on the temperature, eggs hatch in a few days to two months. The newly hatched nymphs are bright red with dark antennae and thin brown legs. The antennae are six-segmented. This is the primary dispersal stage. Nymphs can be wind-blown to new locations, crawl to nearby plants, or possibly hitchhike on other animals. After three molts the adult begins to deposit eggs and secrete the conspicuous egg sac. As the egg sac is formed, the scale's abdomen becomes more and more tilted until the scale appears to be standing on its head.

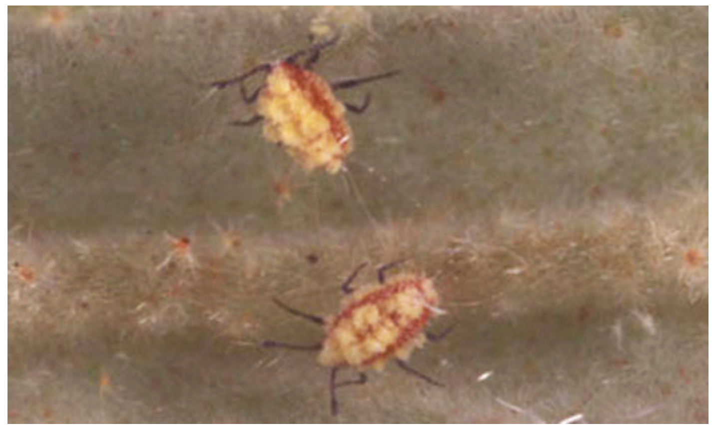

Figure 5. Early nymphal stage of the cottony cushion scale, *Icerya purchasi* Maskell.
Credits: Lyle J. Buss, University of Florida

Figure 6. Various nymphal stages of the cottony cushion scale, *Icerya purchasi* Maskell.
Credits: Lyle J. Buss, University of Florida

Males are rare. They are winged with a dark red body and dark colored antennae. Dark whorls of setae extend from each antennal segment, except the first (Ebeling 1959). It is interesting that the female is always a hermaphrodite with both testes and ovaries. If self-fertilization occurs only hermaphrodites are produced; however, when a hermaphrodite mates with a male, more males and hermaphrodites are produced (Ebeling 1959).

Host Plants

Cottony cushion scale is most frequently collected on *Citrus* and *Pittosporum* in Florida. However, numerous records on other host plants are in the Division of Plant Industry insect files.

Economic Importance

The cottony cushion scale can severely damage trees, resets, and nursery stock. Decreased tree vitality, fruit drop, and defoliation result from the feeding of this scale. Most damage occurs from the feeding of the early immature stages of the scale on the leaves, where they settle in rows along the midrib and veins, and on the smaller twigs. The older nymphs continue to feed, but migrate to the larger twigs, and finally, as adults, they settle on the larger branches and trunk. This scale is seldom found on the fruit. Added damage can result from the accumulation of sooty mold due to the honeydew excreted by the scale.

Management

Insect Management Guide for Scale Insects on Ornamental Plants

Selected References

Baker JR. (2005). Cottony cushion scale. Department of Entomology Insect Note. North Carolina State Extension. (20 April 2020) https://content.ces.ncsu.edu/cottony-cushion-scale

Debach P. 1973. Biological Control of Insect Pests and Weeds, Chapman and Hall, London. 844 p.

Ebeling W. 1959. Subtropical Fruit Pests. University of California Press, Los Angeles. 436 p.

Fasulo TR, Brooks RF. (2001). Scale pests of Florida citrus. Gainesville: University of Florida Institute of Food and Agricultural Sciences. http://ufdc.ufl.edu/IR00008161/00001

Gossard HA. 1901. The cottony cushion scale. Florida Agricultural Experiment Station Bulletin 56:309-356.

Grafton-Cardwell EE. (2003). Cottony Cushion Scale. UC/IPM Online. (no longer online)

Maskell WM. 1878. On some Coccidae in New Zealand. Transactions and Proceedings of the New Zealand Institute 11: 220-223.

Morrison H. 1928. A classification of the higher groups and genera of the coccid family *Margarodidae*. USDA Technical Bulletin 52: 203-211.

Weeden CR, Shelton AM, Li Y, Hoffman MP. (2005). *Rodolia cardinalis* (Coleoptera: Coccinellidae), Vedalia Beetle. Biological Control: A Guide to Natural Enemies in North America. (no longer available online).

Managing Scale Insects on Ornamental Plants[1]

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Introduction

Scale insects are a diverse group of piercing-sucking pests (Hemiptera) commonly found on ornamental plants in landscapes and nurseries. There are over 180 species of scale insects in Florida, but only a small percentage are important pests of ornamental plants (Dekle 1976; Hamon and Williams 1984). Scale insects are small, inconspicuous insects that use hair-like mouthparts to extract plant sap from leaves or branches. These insects can secrete a waxy covering that protects them from the environment and most chemical control measures. There are several families of scale insects; however, they can be generally divided into two main categories: armored and soft. Distinguishing between the two is important because their biology and management differ.

Armored scale insects (Hemiptera: Diaspididae) feed on the contents of cells just under the surface of leaves and bark and excrete their waste in the form of a protective cover (called a test). This cover can be removed to reveal the soft-bodied insect feeding beneath (Figure 1). Once female armored scales begin to feed on a host plant they will remain immobile in that location for the remainder of their life. Even after death, the scale insect cover may remain on the plant for several years. Armored scales are the most diverse group of scale insects in Florida with over 130 species (Dekle 1976).

Figure 1. Gloomy scale, *Melanaspis tenebricosa*, with armored covering removed.
Credits: A.G. Dale

Common Armored Scales

Florida red scale (*Chrysomphalus aonidum*)

Cycad aulacaspis scale (*Aulacaspis yasumatsui*)

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Tea scale (*Fiorinia theae*)

False oleander scale (*Pseudaulacaspis cockerelli*)

White peach scale (*Pseudaulacaspsis pentagona*)

Boisduval scale (*Diaspsis doisduvalii*)

Gloomy scale (*Melanaspis tenebricosa*)

Obscure scale (*Melanaspsis obscura*)

Soft scales (Hemiptera: Coccidae) differ from armored scales in a few important ways. The waxy cover of soft scales is not separate from the insect's body and cannot be removed. Although both are sedentary, unlike armored scales, female soft scales are mobile in every life stage until they begin to produce eggs. In addition, soft scales feed on the phloem vascular tissue of plants and excrete honeydew as waste. There are over 40 reported soft scale insect species in Florida (Hamon and Williams 1984).

Figure 2. False oleander scale, *Pseudaulacaspis cockerelli*, on southern magnolia leaves.
Credits: A.G. Dale

Common Soft Scales

Hemispherical scale (*Saissetia coffeae*)

Tuliptree scale (*Toumeyella liriodendri*)

Florida wax scale (*Ceroplastes floridensis*)

Croton scale, (*Phalacrococcus howertoni*)

Brown soft scale (*Coccus hesperidum* L.)

Philephedra tuberculosa

Banana-shaped scale (*Prococcus acutissimus*)

There are at least 16 other families of scale insect pests, the most important of which include Kerriidae, Monophlebidae, Eriococcidae, and Pseudococcidae. Most of these scale insects are typically grouped with soft scales due to similarities in biology and management. As with soft scales, these insects excrete honeydew as waste and have soft waxy covers as part of their body.

Figure 3. Tuliptree scale, *Toumeyella liriodendra,* nymphs on southern magnolia leaves being tended to by ants.
Credits: A.G. Dale

Other Common Scale Insect Pests

Cottony cushion scale (*Icerya purchasi*) (Monophlebidae)

Lobate lac scale (Paratachardina lobata lobata)(Kerriidae)

Identification and Damage

Armored scales range in size, shape, and color. Adults often have a low profile against the plant surface. As adults, many soft scale insects have a convex, dome-like or cottony appearance, which makes them relatively easy to find. However, nymphs of both are small, often flat, and inconspicuous, which makes detection difficult without close inspection. Due to their size and behavior, scale insects frequently go unnoticed on landscape plants until they reach high numbers.

At low levels of infestation, scale insects are rarely damaging to their host plant. Scale insects damage plants by feeding on vascular fluids and cell contents, which contain sugars and nutrients. This can reduce plant photosynthesis and growth and often presents itself as yellowing leaves, premature leaf drop, branch dieback, or gradual plant death. Soft scale honeydew excretions lead to sooty mold growth, a fungus that can turn plant surfaces black, reducing photosynthesis and making plants unsightly (Figure 4). Scale insect infestations are common on plants stressed due to improper planting, physical damage, or environmental stress. Therefore, cultural management is key to managing scale insect pests.

Figure 4. Wax scale-infested holly shrub with extensive sooty mold growth.
Credits: A.G. Dale

Biology

Female scale insects go through three general life stages: egg, nymph, and adult. The life stage *most susceptible to control* is the first instar nymph, called a crawler. Adult female armored and soft scale insects are sedentary and wingless and produce offspring. Male scale insects are morphologically different from females. Males go through four life stages and develop wings as adults so they can more easily find females to mate with. Depending on the species, female scale insects may reproduce sexually or parthenogenetically, meaning they can produce offspring without mating.

Scale insects can actively disperse by crawling or by wind to other regions of a host plant or to nearby plants. Evidence suggests that scales may also disperse phoretically by attaching to and riding on other surfaces like bird's feet. One of the most common ways that scales become introduced to the landscape is by using infested plant material. Therefore, close inspection of plant material prior to planting new plants is critical.

Armored Scale Biology

Female armored scale insects are only mobile as crawlers (Figure 5). After selecting a feeding site, females settle on the plant where they lose their antennae and legs and begin to produce their waxy covering. Here, they will feed on the content of plant cells for the remainder of their life. Adult females produce offspring either internally or by depositing eggs underneath their body, typically in the tens to hundreds (Beardsley and Gonzalez 1975). Eggs will hatch and emerge from the covering to find a suitable feeding site and begin the cycle over.

Figure 5. False oleander scale, *Pseudaulacaspis cockerelli,* crawlers and eggs from underneath an adult female.
Credits: Lyle Buss, University of Florida

Soft Scale Biology

Female soft scale insects are mobile during all life stages until they begin to produce eggs. Many species transition from the bark to leaf feeding sites throughout the season. In their final location, adult females will appear more dome-shaped or produce a cottony elongation on their body, which contains the eggs. These structures can contain thousands of eggs at a time (Figure 6) and facilitate rapid increases in scale insect abundance.

Figure 6. Barnacle scale, *Ceroplastes cirripediformis*, adult female ovisac and eggs.
Credits: Lyle Buss, University of Florida

Scouting and Monitoring

Monitoring for scale insects should begin in early spring and continue through mid-summer except in more tropical climates in which crawlers can be found all year. A 5 to 10x hand lens is helpful for spotting and identifying scale insects on plant material. When scouting plants, look for yellow regions on the surface of leaves (Figure 7), which may indicate armored scale feeding on the underside. Also scout for shiny plant surfaces or black sooty mold, which are indicative of soft scale feeding. Monitoring for ant or wasp activity may also help because many ant and wasp species feed on the honeydew secretions of soft scale insects (Figure 3).

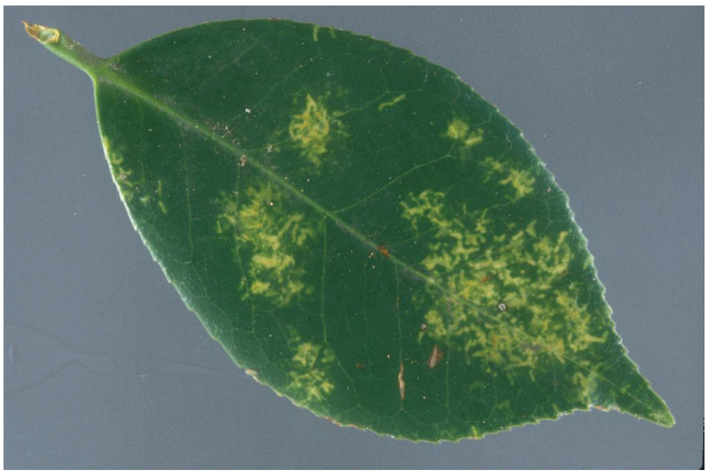

Figure 7. Tea scale, *Fiorinia theae*, feeding damage on the surface of a camellia leaf.
Credits: James Castner, University of Florida

Many predators and parasitoids attack scale insects in the landscape and keep them below damaging levels. When scale insects have been located, look closely for evidence of predation (large openings in scale covers) or parasitism (circular holes in scale covers). Also check to see if scale insects are alive by mashing them with your finger nail or pocket knife to see if a colored liquid comes out. If scales are dead, no liquid will come out when the insect is crushed, and control measures may not be warranted.

Decision Making

Unfortunately, few aesthetic or economic management thresholds exist for managing scale insect pests on ornamental plants. Scales can exist in low abundance without causing plant damage. Consider what is damaging to the plant or aesthetically acceptable for the landscape. Monitor plants in full sun, surrounded by little vegetation, or large amounts of impervious surface (road, parking lot, building) more intensively (Dale et al. 2016). Plants in these locations may be more heavily infested and damaged by scale insects (Meineke et al. 2013).

Intervention

Cultural Control

Prevent scale insect infestations and avoid the expense of long-term management by planting ornamental plants in appropriate locations (Dale et al. 2016). Stress from drought, heat, or sun exposure is associated with scale insect outbreaks. Reducing plant stress by proper planting and irrigation can reduce susceptibility to infestation and damage by certain scale insect pests. Excessive nitrogen fertilizer may increase scale abundance by making the plant more nutritious to scales and reducing the plant’s natural defenses (Herms 2002).

Biological Control

Most native and some exotic scale insect pests are attacked by a number of parasitoid wasps, which often keeps them below damaging levels (Ehler 1995, Dale and Frank 2014; Meineke et al. 2014). Other natural enemies such as lady beetles (Figure 8), lacewings, and predacious midges may also provide supplemental control of scale populations. However, biological control in urban landscapes may struggle due to warmer temperatures, lack of alternative resources, or lack of vegetation refuges for natural enemies (Raupp et al. 2010; Meineke et al. 2014). To maximize potential biological control, provide habitat for natural enemies and reduce temperatures by increasing the amount and diversity of plants in the landscape.

Figure 8. Multicolored Asian lady beetle, *Harmonia axyridis*, predator of scale insects.
Credits: A.G. Dale

Mechanical Control

High-pressure water sprays can remove armored scales and scale covers from bark and reduce populations without the need for chemical control. Consider water sprays when deciduous trees are dormant for the winter, and make sure water pressure is not damaging tree bark or leaves. This is less of an option in regions where trees do not go dormant, but with care and attention it may be done successfully.

Chemical Control

Controlling scale insects with insecticides is often expensive and can take several years to see results. When plants are heavily infested, consider costs and benefits of treatment compared to plant replacement with another plant species.

Foliar insecticide applications should coincide with crawler emergence for best control. This is challenging for many scale insect species because crawlers gradually emerge over several weeks to a few months, or generations overlap. Therefore, broad-spectrum contact insecticides such as pyrethroids may not be effective and could make infestations worse by killing natural enemies (Raupp et al. 1992).

Horticultural oils and dormant oils kill insects by smothering them and breaking down cell membranes. Horticultural oils can also penetrate scale covers. These products can be applied during crawler emergence or when trees are dormant to kill overwintering scales in more temperate regions. Oils may be more practical when treating trees that are smaller in size so that full coverage is achievable. Additional information on horticultural oils, insecticidal soaps, and other natural products can be found at http://edis.ifas.ufl.edu/in197. Most oils should not be used when temperatures are very warm. Be sure to follow label instructions to avoid damaging plant tissue.

Trunk sprays or soil drenches of systemic insecticides such as dinotefuran and acephate may provide effective, season-long control of many scale insects. However, care must be taken to avoid applications to flowering plants or at times when pollinators are foraging. Always follow pollinator protection instructions on insecticide labels. Acetamiprid is a systemic insecticide that can be applied to foliage or bark and is less toxic to beneficial insects than other neonicotinoids. Insect growth regulators such as pyriproxyfen and buprofezin are also foliar applied products that provide effective control and are safer for beneficial insects. With all products, thorough coverage of plant material is critical for insect control. Several products can also be applied as soil drenches, which are picked up systemically and reduce non-target risks and concern over plant coverage. Table 1 lists currently labeled insecticides available for scale insect control on landscape plants. Remember to always follow label directions and local ordinances when using insecticides.

Selected References

Beardsley, J. W., and R. H. Gonzalez. 1975. "The biology and ecology of armored scales." *Annual Review of Entomology* 20:47–73.

Dale, A. G., and S. D. Frank. 2014. "Urban warming trumps natural enemy regulation of herbivorous pests." *Ecological Applications* 24:1596–1607.

Dale, A. G., E. Youngsteadt, and S. D. Frank. 2016. "Forecasting the Effects of Heat and Pests on Urban Trees: Impervious Surface Thresholds and the 'Pace-to-Plant' Technique." *Arboriculture & Urban Forestry* 42:181–191.

Dekle, G. W. 1976. *Florida Armored Scale Insects*. Florida Department of Agriculture and Consumer Services.

Ehler, L. E. 1995. "Biological control of obscure scale (Homoptera: Diaspididae) in California: An experimental approach." *Environmental Entomology* 24:779–795.

Hamon, A. B., and M. L. Williams. 1984. *The Soft Scale Insects of Florida (Homoptera: Coccoidea: Coccidae)*. Florida Department of Agriculture and Consumer Services.

Herms, D. A. 2002. "Effects of Fertilization on Insect Resistance of Woody Ornamental Plants: Reassessing an Entrenched Paradigm: Fig. 1."*Environmental Entomology* 31:923–933.

Meineke, E. K., R. R. Dunn, and S. D. Frank. 2014. "Early pest development and loss of biological control are associated with urban warming." *Biol Lett* 10:20140586.

Meineke, E. K., R. R. Dunn, J. O. Sexton, and S. D. Frank. 2013. "Urban warming drives insect pest abundance on street trees." *PLoS One* 8.

Raupp, M. J., C. S. Koehler, and J. A. Davidson. 1992. "Advances in implementing integrated pest management for woody landscape plants." *Annual Review of Entomology* 37:561–585.

Raupp, M. J., P. M. Shrewsbury, and D. A. Herms. 2010. "Ecology of herbivorous arthropods in urban landscapes." *Annu Rev Entomol* 55:19–38.

Table 1. Armored scale insect management.

Active Ingredient	Trade Name	IRAC Class	Activity	Labeled site	Notes
Acephate	Orthene	1B	Contact & translaminar	G, N, L	Target crawlers
Acetamiprid	TriStar	4A	Translaminar systemic	G, N, L	
Buprofezin	Talus	16	Contact	G, N, L	
Dinotefuran	Safari, Zylam	4A	Systemic	G, N, I, L	
Horticultural oil	Several	–	Contact	G, N, I, L	Thorough, frequent applications
Insecticidal soap	Several	–	Contact	G, N, I, L	Thorough, frequent applications
Spirotetramat	Kontos	23	Contact, systemic	G, N, I	
Pyriproxyfen	Distance	7C	Translaminar	G, N, I, L	

*The use of trade names is for example, not comprehensive, and does not imply endorsement or discrimination of other similar products.
*Always read and follow the label-specific instructions. The label is the law.
*G (greenhouse), N (nursery), I (interiorscape), L (landscape)
*Follow local pesticide use ordinances

Table 2. Soft scale insect management.

Active Ingredient	Trade Name	IRAC Class	Activity	Labeled site	Notes
Acephate	Orthene	1B	Contact & translaminar	G, N, L	Crawlers
Acetamiprid	TriStar	4A	Translaminar systemic	G, N, L	
Buprofezin	Talus	16	Contact	G, N, L	
Cyantraniliprole	Mainspring GNL	28	Translaminar systemic	G, N, I, L	
Dinotefuran	Safari	4A	Systemic	G, N, I, L	
Horticultural oil	Several	-	Contact	G, N, I, L	Thorough, frequent applications
Imidacloprid	Merit	4A	Systemic	G, N, I, L	
Imidacloprid	Marathon II, 60 WP		Systemic	G, N, I	
Insecticidal soap	Several	-	Contact	G, N, I, L	Thorough, frequent applications
Pyriproxyfen	Distance	7C	Translaminar	G, N, I, L	
Spinetoram + Sulfoxaflor	Xxpire	4C & 5	Translaminar systemic	G, N,L	Not for residential use
Spirotetramat	Kontos	23	Contact, systemic	G, N, I	
Thiamethoxam	Flagship 25 WG	4A	Translaminar systemic	G, N, I	

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