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# 2025–2026 Florida Citrus Production Guide: Soft-Bodied Insects Attacking Foliage and Fruit[1]

Lauren M. Diepenbrock, Lukasz Stelinski, Xavier Martini, and Jawwad Qureshi[2]

This section is focused on sucking insects that affect foliage, twigs, and fruit of citrus in Florida. Insects covered here include scales, mealybugs, whiteflies, and aphids, which can all impact the health of both young and mature trees and their fruit quality. These insects differ from each other in their biology, generation times, and injury to plants, but approaches to monitoring and management are similar. Individual discussions of some groups are provided, and the tables of management options are organized by active ingredient, with the target pests from this chapter in bold text. Information on the Asian citrus psyllid and citrus leafminer can be found in separate chapters of the *Florida Citrus Production Guide*.

## Scale Insects

There are two major groups of scale insects: soft scales and armored scales. Soft scales generally become larger in size than armored scales and are somewhat mobile as nymphs. Nymphs and adult female armored scales are completely sessile, and adult males of both are tiny gnat-like insects with a single pair of wings. The cover and body of soft scales are attached, whereas the cover can be removed from armored scales, revealing the round body underneath. Another important distinction is that armored scales produce no honeydew, while soft scales produce copious amounts of honeydew that attracts ants and serves as substrate for sooty mold, which often accumulates on foliage below the infestation.

The most important soft-scale species in Florida citrus is the Caribbean black scale (*Saissetia neglecta*), followed by green and brown scales (*Coccus viridis* and *C. hesperidum*, respectively), cottony cushion scale (*Icerya purchasi*), and Florida wax scale (*Ceroplastes floridensis*). Mature females are usually found on scaffold limbs, especially those of young trees. Mobile first instars, or "crawlers," move out toward the outer canopy, and successive nymphal stages gradually migrate inward.

The most important armored scales in Florida are snow scale (*Unaspis citri*), Florida red scale (*Chrysomphalus aonidium*), California red scale (*Aonidiella aurantii*), purple scale (*Lepidosaphes beckii*), Glover's scale (*Lepidosaphes*

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2. Lauren M. Diepenbrock, assistant professor, Integrated Pest Management and Insect Ecology, Department of Entomology and Nematology, UF/IFAS Citrus Research and Education Center; Lukasz L. Stelinski, professor, Department of Entomology and Nematology, UF/IFAS Citrus Research and Education Center; Xavier Martini, associate professor, insect behavior, Department of Entomology and Nematology, UF/IFAS North Florida Research and Education Center; Jawwad Qureshi, associate professor, Department of Entomology and Nematology, UF/IFAS Southwest Florida Research and Education Center; UF/IFAS Extension, Gainesville, FL 32611.

*gloveri*), and chaff scale (*Parlatoria pergandii*). Snow scale tends to infest the trunk and scaffold limbs, especially those of grapefruit. The name refers to the male nymphs, which are white, numerous, and indistinguishable from males of the related species, a lesser snow scale, *Pinnaspis strachani*, and fern scale, *P. aspidistrae*. Female snow scales are relatively large, oyster-shaped, and purple in color with a median ridge. Lesser snow scale generally inhabits smaller limbs, and fern scale makes small, round colonies of males on leaves and fruit, with a single female off to the side. Florida red scale and California red scale typically inhabit fruit, leaves, and small limbs, while purple, Glover's, and chaff scale may be found in any part of the canopy.

Historically, pest management of both armored- and soft-scale insects in Florida citrus has been based on highly successful action of native and introduced natural enemies, including predators, especially ladybeetles, parasitic wasps, and fungal pathogens. These relatively specific natural enemies coexist with their hosts in the citrus grove under most conditions and can respond to and suppress pest numbers when they periodically increase in individual groves. Thus, scale insects should not be considered key pests in development of seasonal programs. However, there are conditions under which natural enemies may not function well. It is in these cases that scale insects achieve importance in an overall Integrated Pest Management program. Factors that are most often responsible for increases in scale populations are (1) weather conditions that disrupt biological control; (2) movement of the pest to groves where natural enemies do not occur; and (3) disruption of natural enemies by other practices, particularly repeated use of broad-spectrum insecticides during a period when natural enemies are active and exposed. When these disruptions occur, scale populations can increase sufficiently to damage leaves, fruit, twigs, branches, or trunks. The sessile nature of scale insects promotes high concentrations of scales in limited areas within the grove, and so building populations can go unnoticed for several generations. Generation times for most scale species require more than one month to progress from egg to adult. Thus, populations do not build quickly like some other pest groups, such as mites or aphids.

The first consideration for management should be to determine if the problem is induced by management practices and can be solved by changing those practices. For example, if repeated applications of broad-spectrum pesticides are responsible for scale population increase, then the solution is to stop use of broad-spectrum products and opt for selective materials that can allow natural enemies to recover. If, on the other hand, seasonal fluctuations have brought about population levels of concern, then some intervention with insecticides may be required. The basis for this decision should be population levels of living scales that are deemed sufficient to cause direct damage or produce large quantities of honeydew, which promotes the growth of sooty mold (soft scales only). Scale bodies from previous generations often remain on the plant for several months and may be mistaken for living scales, resulting in the application of pesticides at inappropriate times. For effective suppression, most scale species should be in young nymphal stages (crawlers) at the time of application, because pesticides are not very effective against eggs, large nymphs, or adults. In spring, crawler activity can be monitored using double-sided tape wrapped around a citrus branch and checked weekly. No economic injury levels or thresholds are available for scale insect pests in Florida. Thus, the manager must evaluate each situation, considering the intensity and extent of scale populations and how much damage is likely to result. Generally, the intent of spraying for scale insects is to reduce populations with a single application during the crawler activity period such that no additional sprays are necessary during that season and disruption to biological control is minimized.

Treatment, when warranted, should focus on selection of an appropriate material (see Table 1), but it is equally important that treatment be applied with thorough coverage in mind. Because scale insects are completely or largely immobile, direct contact is essential. Spray volume, ground speed, nozzle choice, and location of the pest populations should all be emphasized to get maximum target coverage. If only a few trees are involved, then spot treatment with a handheld sprayer or other focused application equipment will provide best results. Generally, spray applications designed for contact with pests on the outer canopy are not effective at suppressing scales, especially if the scales are numerous in the interior of the tree. The follow-up to insecticide application for scale insects should involve evaluation of live scale numbers on the appropriate parts of the tree. Dead scales will not be visibly distinguishable from living scales at first. Hatching crawlers will also create the impression that the spray was not effective. Complete elimination of scale insects following an insecticidal spray is neither practical nor necessary and in fact may be counterproductive.

**Soft scales** are generally not pests needing treatment; however, high populations of scales can be damaging to citrus. Following mild winters and when populations build within specific groves, treatment, where needed, should be

based on scouting for crawlers and young nymphs during the generation that develops in April–May. Applications at other times are ineffective.

**Citrus snow scale** likewise is a local problem requiring occasional treatment in specific groves or portions of groves. Evidence for the need to treat includes high populations of crawlers showing on patches of bark that have been brushed clean during the previous week and the association of visible snow scale populations with bark splitting, particularly on young trees that are rapidly increasing in trunk girth. Spot-treat wood of heavily infested trees to runoff with a handheld sprayer.

## Mealybugs

Citrus mealybugs (*Planococcus citri*) are normally under good biological control by a complex of natural enemies in citrus. However, intensive spraying for psyllid control may disrupt their biological control. Mealybugs' waxy covering, sedentary lifestyle, and preference for feeding in concealed locations make them very difficult to kill with insecticides. Only the most toxic materials have appreciable efficacy against mealybugs, but these materials also pose risks to the environment and are likely to disrupt biological control of other pests. Consequently, treatment is warranted only in cases of severe infestations or when the fruit itself is attacked. Systemic materials give superior control while minimizing impacts on beneficials but may not act quickly enough to prevent damage when high populations are established.

Lebbeck mealybug/hibiscus mealybug (*Nipaecoccus viridis*), present in Florida since 2009, was recently reported in citrus, with the first population documented in the late spring of 2019. Like other mealybugs, it prefers to feed in cryptic locations, making it difficult to find until populations are high enough that large amounts of sooty mold develop and damage to fruit, leaves, and branches is visible. Severe infestations can result in twig dieback and even death of young trees. Several predatory insects have been found to consume this species, and with careful spray planning, they can be integral to gaining control of this pest. Early-season control is key to reducing yield loss from Lebbeck mealybug. Systemic materials that can be applied during bloom should be used to prevent population buildup and protect developing fruit. Contact materials can provide near-term population reduction by killing crawlers and young nymphs, but these materials have little efficacy on the reproductive adult. If using contact insecticides, target them toward times when crawlers are abundant, which can be determined by scouting. **These findings for Lebbeck mealybug are preliminary.**

## Whiteflies

The most important whiteflies in Florida are citrus whitefly (*Dialeurodes citri*), the cloudy-winged whitefly (*Singhiella*[=*Dialeurodes*]*citrifolii*), the wooly whitefly (*Aleurothrixus floccosus*), and citrus blackfly (*A. woglumi*). These insects are generally present in most groves in very low numbers and are normally under good biological control by various specialist parasitoids and generalist predators, including the entomopathenogenic fungus *Aschersonia alyrodis*, which can provide excellent control of whitefly nymphs. Whiteflies are dependent on new growth for their development and reproduction; consequently, they are active in citrus only during periods of flush. Populations are rarely high enough to warrant treatment unless biological control has been disrupted. Large populations of these insects can deposit considerable volumes of honeydew, leading to sooty mold accumulation. Serious infestations of whiteflies are an indication that management practices should be reviewed.

## Aphids

The most common aphids in Florida citrus are the green citrus aphid or Spirea aphid (*Aphis spiraecola*) and the cotton or melon aphid (*A. gossypii*). The green citrus aphid is responsible for curling of young flush due to feeding injury. This aphid and the melon aphid attack many different plant species and migrate into citrus mostly in spring. The brown citrus aphid (*Toxoptera citricida*) is the most important vector of citrus tristeza virus (CTV), which is responsible for quick decline of trees on sour orange rootstock that often die suddenly with fruit still attached. Brown citrus aphid has a narrow host range restricted largely to Rutaceae, particularly citrus, and has now become rare in Florida, possibly due to intense spraying for psyllids. However, melon aphid is also a vector of CTV and is also dark in color, but mottled, distinguishing it morphologically from brown citrus aphid. Aphids are dependent on the availability of newly expanding leaves for their development and reproduction, so these insects may become problematic during periods of new citrus growth, primarily on young trees in spring and fall. Aphids are largely controlled by many generalist natural enemies, such as ladybeetles, hoverflies, and lacewings, that normally maintain their populations and those of other insects found in flush below levels that warrant treatment in producing groves. Excessive honeydew accumulation on leaves will result in the growth of sooty mold fungus that blocks light and reduces

photosynthetic activity. However, mature groves sustain little damage and should not need treatment. Treatment is warranted only in young groves (<3 years old) if a large portion (i.e., >50%) of expanding terminals is infested. Surveys for aphids should be conducted early in flushing cycles when most terminals are still in the feather stage. Systemic materials, such as Admire–applied to the soil for young trees or by foliar application for mature trees–will give good control with minimal impact on beneficial species, but the time required for uptake of these materials by the tree restricts their usefulness to preventive, rather than responsive, treatments.

## Recommended Chemical Controls

READ THE LABEL. Some product labels specify rates per acre, while others specify rates per volume delivered (e.g., per 100 gal). Refer to label for details on how product should be mixed for desired targets.

See Table 1.

Rates for pesticides are given as the maximum amount required to treat mature citrus trees unless otherwise noted. To treat smaller trees with commercial application equipment including handguns, mix the per-acre rate for mature trees in 250 gal of water. Calibrate and arrange nozzles to deliver thorough distribution, and treat as many acres as this volume of spray allows.

Table 1. Recommended chemical controls for scales, mealybugs, whiteflies, and aphids.

| IRAC MOA[1] | Pesticide Trade Name | Rate/Acre[2] | Comments | Pests Controlled |
|---|---|---|---|---|
| 1B | **Dimethoate** | | | |
| | various products | see label | | **Aphids, scales**, psyllids |
| 4A | **Clothianidin (soil drench)** | | | |
| | Belay 50 WDG | 3.2–6.4 oz | For use on nonbearing trees only; do not apply within 1 year of fruit harvest. Do not exceed 12.8 oz/acre (0.4 lb a.i./acre) per year. Do not apply this product to blooming, pollen-shedding or nectar-producing parts of plants if bees may forage on the plants during this time period. | **Aphids**, psyllids, citrus leafminer |
| | Belay Insecticide | 3–12 fl oz | Refer to the section 24c SLN label issued by the Florida Department of Agriculture and Consumer Services for application directions of this product to bearing citrus trees (expires December 31, 2025). For bearing trees, do not apply more than 12 fl oz/acre per application, and do not apply more than 24 fl oz/acre in a 12-month period. | |
| 4A | **Imidacloprid** | | | |
| | Various products, 2F, 4F and 4.6F | see label | Limit of 0.5 lb a.i./acre per growing season regardless of application type (soil and/or foliar) and trade name of imidacloprid product used. | **Aphids, mealybugs, scales, whiteflies**, psyllids, citrus leafminer (soil only) |
| | Foliar application | Half to full rate | Do not apply during bloom or within 10 days of bloom or when bees are actively foraging. | |
| | Soil application | Half to full rate | 8 fl oz of Admire Pro 4.6F per acre per 12 months when applied to soil. Do not exceed 0.5 lb a.i./acre per application. See SLN for additional information. | |
| 4A | **Thiamethoxam** | | | |
| | Actara (foliar application) | 4.0–5.5 oz | Do not exceed a total of 11.0 oz/acre (0.172 lb a.i./acre) per growing season. Do not apply during prebloom or during bloom when bees are actively foraging. | **Aphids, mealybugs, scales, whiteflies**, psyllids |
| | Platinum 75 SG (soil drench) | 1.83–3.67 oz | Do not exceed a total of 3.67 oz/acre (0.172 lb a.i./acre) per growing season. Do not apply during prebloom or during bloom when bees are actively foraging. | **Aphids, mealybugs, scales, whiteflies**, psyllids, citrus leafminer |
| 16 | **Buprofesin** | | | |
| | Applaud | 1–2 fl oz | Apply for scale insects when crawler emergence is heavy. | **Mealybugs, scales, whiteflies** |
| 23 | **Spirotetramat** | | Only controls psyllid nymphs, not adults. Limit of 0.32 lb a.i./acre. per 12 months. Minimum interval of 21 days between applications. | |
| | Movento 240 | 10 fl oz + 3% v/v | Do not make more than one application during primary citrus bloom period. Recommended to be applied in 2% horticultural mineral oil. | **Aphids, mealybugs, scales, whiteflies**, citrus rust mites, psyllids |
| | Movento MPC | 16 fl oz + 3% v/v | Do not apply within 10 days prior to bloom, during bloom, or until petal fall is complete. Recommended to be applied in 2% horticultural mineral oil. | |
| 29 | **Floconamid** | | | |
| | Beleaf 50SG | 2.8 oz | Apply when populations begin to build. | **Aphids** |
| UN[3] | **Horticultural Mineral Oil** | | | |
| | 97+% (FC 435-66, FC 455-88, or 470 oil) | 5 gal | Do not apply when temperatures exceed 94°F. 470 weight oil has not been evaluated for effects on fruit coloring or ripening. These oils are more likely to be phytotoxic than lighter oils. | **Aphid, scales**, leafminer, citrus rust mite, aphids, scales |

[1] Mode of action class for citrus pesticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 11.4 (2025).
[2] Lower rates may be used on smaller trees. Do not use less than the minimum label rate.
[3] Mode of action unknown.