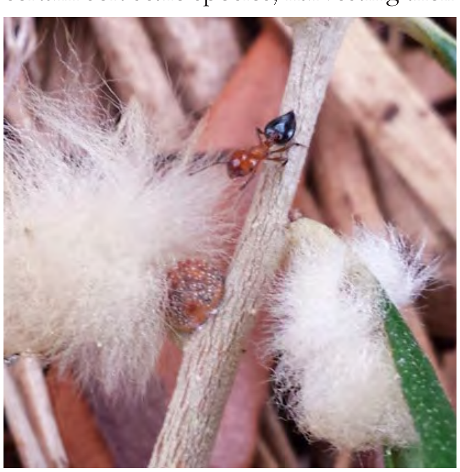
An Introduction to Scale Insects in the Landscape: What They Are, How They Live, and Suggestions for Management

By Patrick Anderson, RCA #475

Scale insects are a common plant-damaging pest found throughout the United States. Their often-cryptic lifecycles, coupled with the unique challenges of the built landscape, can make scale insects a challenging pest for arborists to control.

Introduction to Scale Insects

Scale insects fall within the order *Hemiptera*, the same order that contains such insects as true bugs, whiteflies, aphids, adelgids, and leaf hoppers. One of the distinguishing characteristics of *Hemiptera* is that they have piercing and sucking mouth parts. Approximately 32 families of scale insects fall within the superfamily *Coccoidea* (Gullan and Cook 2007). One distinguishing feature of scale insects is that adult females are highly modified, often lacking wings, antenna, or segmentation. Ecologically speaking, scale insects are important as a food source for other animals, including other insects. Some ant species actually "farm" certain soft scale species, harvesting their sugar-rich honeydew for their colonies.



Ant tending a species of lecanium scale. (Photo credit: RTSA)

Indeed, humans have also been utilizing scale insects for centuries. In one example, the scale species *Dactylopius coccus*, native to tropical and subtropical areas of the Americas, was historically used as a source of red dye for garments, and even today is used in certain cosmetics, foods, and pharmaceutical applications (Borges et al. 2012).

Tulip tree scale example of soft scale insect; notice honeydew on the twig. (Photo credit: RTSA)

Example of sooty mold growing on honeydew produced by cottony camellia scale, a type of soft scale. (Photo credit: RTSA)

Types of Scale Insects

Of the many scale insect families, only a few are considered pests in the American landscape. The majority of these problem scales fall into two families: *Coccidae* (soft scales) and *Diaspididae* (armored scales), but we'll also give honorable mention to *Ericococcoidea* (felt scales).

Soft Scales

Soft scales are physically the largest of the scale families we encounter as pests in the landscape. They can be up to ¼-inch in diameter, with magnolia scale *(Neolecanium cornuparvum)* being as large as ½-inch (Pellitteri 2012). The test (outer covering) can be smooth or cottony, convex, and round to oval in shape. The test is attached to the body of the mature scale, so if you attempt to remove the test from the tree, you would find the body of the scale inside. Some soft scales, known as cottony scales, create distinct egg masses (ovisacs), which are white and cottony in appearance.

Soft scales feed within the phloem, extracting amino acids from the sap. Their excretion is a sugary substance known as honeydew. In severe infestations, honeydew can be a nuisance, causing a sticky mess on anything underneath the tree, including sidewalks, cars, and outdoor furniture. Stinging insects are attracted to honeydew, which may cause a public health risk for allergic citizens. If not removed, sooty mold fungus will begin growing on the honeydew, creating a blackened look to any affected surface and reducing the photosynthetic capacity to any affected foliage.

In general, soft scales have one generation per year (univoltine), and the average female lays hundreds to thousands of eggs, in some cases over 3,000 eggs. The number of eggs produced not only depends on the species of scale, but also the host species and area of feeding. Many of these scales can reproduce sexually or parthenogenetically, and every female may be capable of producing progeny without fertilization (University of Minnesota Extension 2013). Some species, like Florida wax scale *(Ceroplastes floridensis)*, are only known to have females (Futch et al. 2009). Mature males appear as tiny gnat-like insects. In temperate parts of the country, the average soft scale overwinters as a 2nd or 3rd instar (immature stage). In spring, the scale begins feeding and eventually matures into an adult. The adult lays eggs, which hatch under the test into 1st instars, known as crawlers. These crawlers roam until they find a suitable area to feed and settle. In some species (e.g., tulip tree scale, *Toumeyella liriodendri*), the insect will settle on newly elongated twigs and not move again. In other species (e.g., oak lecanium scale, *Parthenolecanium quercifex*), the crawlers will settle on leaves, where they will feed for the growing season. Then, sometime in late summer to early fall, they will move back to the twigs, where they will complete the remainder of their lifecycle.

Armored Scales

Armored scales are distinct from soft scales in several ways. Adult armored scales are generally smaller than soft scales, with most being less than 1/8 inch, and they are elongate to round. The tests of many species have an oyster shell shape, while others appear like scrambled eggs. Armored scales produce a test that is made of waxy secretions and cast skin, which is not connected to the body of the insect. Therefore, if you removed the test, the insect would remain on the tree.

Armored scale feeding habits are also different from soft scales. Armored scales get nutrition from feeding within cells, not from sap in the phloem (Sadof and Neal 1993). Consequently, honeydew is

Cottony maple leaf scale 1st instar crawlers emerging from ovisacs. (Photo credit: RTSA)

Euonymus scale—example of an armored scale. (Photo credit: RTSA)

not associated with armored scale feeding. Damage from armored scale feeding on leaves appears as a stippled chlorosis, which can eventually coalesce. Severe infestations can also cause premature leaf drop, wilting, and reduced overall vigor of the tree.

With some exceptions (e.g., gloomy scale, *Melanaspis tenebricosa*), armored scales can have several generations per year in temperate areas of the country, with females often laying less than 100 eggs per generation. Most armored scales produce sexually, so both male and female scales will be present. In many species, all life stages (e.g., adults, eggs, and nymphs) can be found on the host plant at the same time. Just like in soft scales, 1st instar crawlers hatch underneath the female test. In most armored scale species, once 1st instar female crawlers settle, they remain immobile for the rest of their lifecycle. Just like in soft scales, adult male armored scales appear as tiny gnat-like insects.

Honorable Mention—Felt Scales

The felt scales have similar feeding habits and appearance to soft scales. They secrete a felt-like covering over their round bodies and are phloem feeders that can excrete a copious amount of honeydew. Most species have multiple generations per year, with the crape myrtle bark scale *(Acanthococcus lagerstroemiae)*, newly introduced to the United States, having two to four per year and producing 100–300 eggs per generation (Layton 2016).

Damage and Control of Scale Insects

Small populations of scale insects rarely cause noticeable plant damage, but at high populations, these pests can cause chlorosis and early leaf drop. Severe population outbreaks can cause wilting of stems and noticeable reduction of plant vigor. Often, natural predators like lady bird beetles and parasitoid wasps control scales naturally. The scale destroyer beetle *(Lindorus lophanthae)* is an example of biological control that can be released in landscapes to help suppress scale populations.

It is crucial to accurately identify the species of scale and know its lifecycle when developing an integrated pest management (IPM) plan that will employ products applied to the plant. Scale insects are most vulnerable to foliar-applied control methods when they are crawlers. Using growing degree days and phenology can help with timing applications according to pest lifecycle.

There are many active ingredients that work well to manage scale insect crawlers. Some are broad-spectrum while others are very specific to piercing and sucking insects. Insect growth regulators (IGRs) are also available. IGRs work by blocking the insect's ability to molt into its next instar stage. IGRs can be very effective and are considered not as harmful to beneficial and benign insects when compared to other foliar spray options. Since many of these insects overwinter as nymphs,

sprays of horticultural oil in late fall or early spring can work well to manage populations. Interestingly, recent work by Drs. Quesada and Sadof found that horticultural oil killed a greater percentage of armored scales than soft scales, whereas insecticidal soap gave greater control against soft scales (Quesada and Sadoff 2017).

When using soil- and bark-applied or trunk-injected systemic applications, product choice, length of residual, and the time in which it will take for the active ingredient to accumulate to toxic levels for the insect are paramount. In addition, due to the subtle differences between soft and armored scales (e.g., feeding habits), specific products are more effective on certain species than

Crape myrtle bark scale, an example of a felt scale. (Photo credit: RTSA)

Gloomy scale 1st instar crawlers under female test. (Photo credit: RTSA)

Chlorosis caused by tea scale feeding. (Photo credit: RTSA)

others. Again, targeting the early instars will yield better control compared to targeting later instars or adults.

For example, soil-applied imidacloprid works well to control the majority of soft scales, but it can take from 30 to 180 days to accumulate in leaves at levels that will cause mortality. Therefore, if application is timed incorrectly, control will not be achieved. Furthermore, Sadof and Sclar (2000) concluded that imidacloprid is not readily translocated beyond vascular plant tissue (Rebek and Sadof 2003). Thus, armored scales, feeding within cell contents, do not readily come into contact with imidacloprid and are not well controlled by products containing this active ingredient. In contrast, systemically applied treatments of dinotefuran have displayed good control of certain armored scale insects (Cowles 2010).

Scale insects have always been one of my favorite insects to attempt to manage in the landscape. Due to their unique lifecycles and habits, controlling these insects can be challenging but also rewarding once you've settled on a successful IPM strategy. Before settling on a strategy, one must consider the scale species, lifecycle, site, health and vigor of the affected plant, and level of natural control present.

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