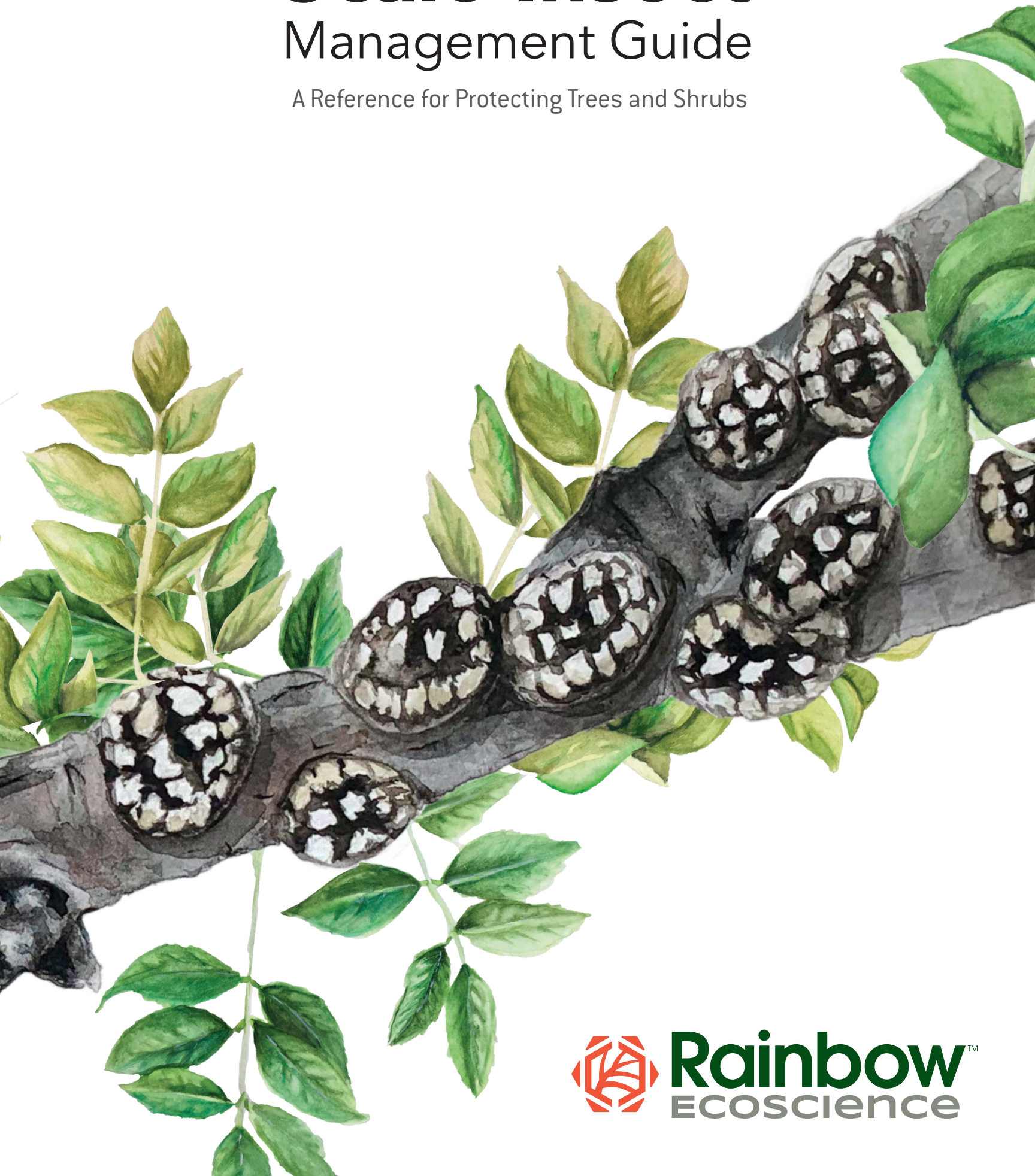


Scale Insect Management Guide

A Reference for Protecting Trees and Shrubs



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ECOSCIENCE



Rainbow has conducted surveys with arborists and landscape managers across the country to identify the most common and challenging plant healthcare issues. We asked what the most common plant healthcare issues were, as well as which issues they were finding most difficult to manage. As expected, the answers varied region to region, but one issue consistently appeared in the top five on every list, regardless of location: scale insects.

Scope of Issue

Scale insects are everywhere. They are found on every continent except Antarctica and, if one looks close enough, they can be found in just about every landscape as well. They are on twigs, branches, leaves, and crevices throughout the vegetative world yet most escape our view. Despite their ubiquity in nature, most scale populations are not a serious enough issue to require intervention. In an urban landscape, however, a scale outbreak can be devastating to the plant and impact the enjoyment of the landscape.

A healthy growing plant, tree, or shrub can tolerate low levels of scales without serious impact. Healthy vegetation can have thicker external tissue making it more difficult for scale insect mouthparts to puncture, heavier sap flows to help push the invaders out, and surplus energy to create chemical defense compounds. That said, an unhealthy, stressed plant is more likely to be susceptible to an outbreak as these natural defenses are limited. **Given the link between plant stress and the likelihood of greater scale populations, it is not surprising that urban trees and shrubs seem more vulnerable to heavy infestations than their counterparts in natural-settings.**

Scales can affect myriad plant species, but certain trees and shrubs are more commonly affected in maintained landscapes. If you are already asked to propose work on a property, recommending scale insect treatment will improve tree health, appearance, and allow your clients to better enjoy their landscape.

Recommending scale treatments can also be easy, especially with active infestations, since in most cases you can show clients the signs and/or symptoms of the infestation (see Pages 6-7 for more info).

Lecanium scale is a widespread pest that can affect a wide range of tree hosts including oaks, maples, linden, and birch.
Photos: AdobeStock

Intent of this Guide

Rainbow created this guide to assist professionals in understanding the impacts of scale insects, their biology, identification, and management options as they relate to trees and shrubs in the landscape. This guide provides a generalized overview. **Please contact your Rainbow representative for specific rates, timing, and regional considerations for the pest you are managing.**

Diversity

Scales are a diverse group of insects with a high level of variety. While their closest living relatives include aphids and whiteflies, scales look so different from them and each other it is hard to imagine that they all share a common ancestor.

Scales belong to the Superfamily Coccoidea that currently has roughly 8,000 identified species. Their diversity can be seen in their sizes, shapes, colors, type of protective covering, and host plants. They even have diverse life-cycles (see Page 4) with different pathways for genders. Some species are hermaphrodites, and some have done away with gender altogether and can reproduce asexually.

Scale Insect Quick Facts

- Scale insects first appeared during the Triassic Period and became widespread during the Cretaceous Period, coinciding with the rise of flowering plants.
- Males of most species are not considered plant pests.
- Scales appear covered with different materials including wax, cotton, or a hard shell (right).



Scale insects display a wide variety of morphological differences.

Challenges

It is no accident that scale insects are difficult to manage. Their complicated life-cycles, protective layers, and natural camouflage are all adaptations to avoid predation. This makes them difficult to see, difficult to identify, and difficult to control. Scales are a Top 5 plant healthcare issue across the country, yet most go unseen and unmanaged. Unlike more conspicuous insects, homeowners rarely notice scales and plant healthcare experts are rarely called in to manage them. The damage caused by scales is not unique or particularly showy. A concerned plant owner may notice symptoms like yellowing leaves, sticky honeydew, or a general lack of vigor but they will not often connect those symptoms to insects they cannot see.

Even professionals can overlook the presence of scales and, in some cases, may even be contributing to their proliferation. Particularly in managed landscape settings, non-selective insect spray programs (such as mosquito control sprays) can lead to unexpected scale outbreaks from the reduction of beneficial insects that help keep scale populations in check.

Scales are a Top 5 Plant Healthcare issue across the country, yet most go unseen and unmanaged.



Nuisances like sooty mold on leaves, increases of bees and wasps, and sticky patio furniture may be all the client sees of a scale infestation.

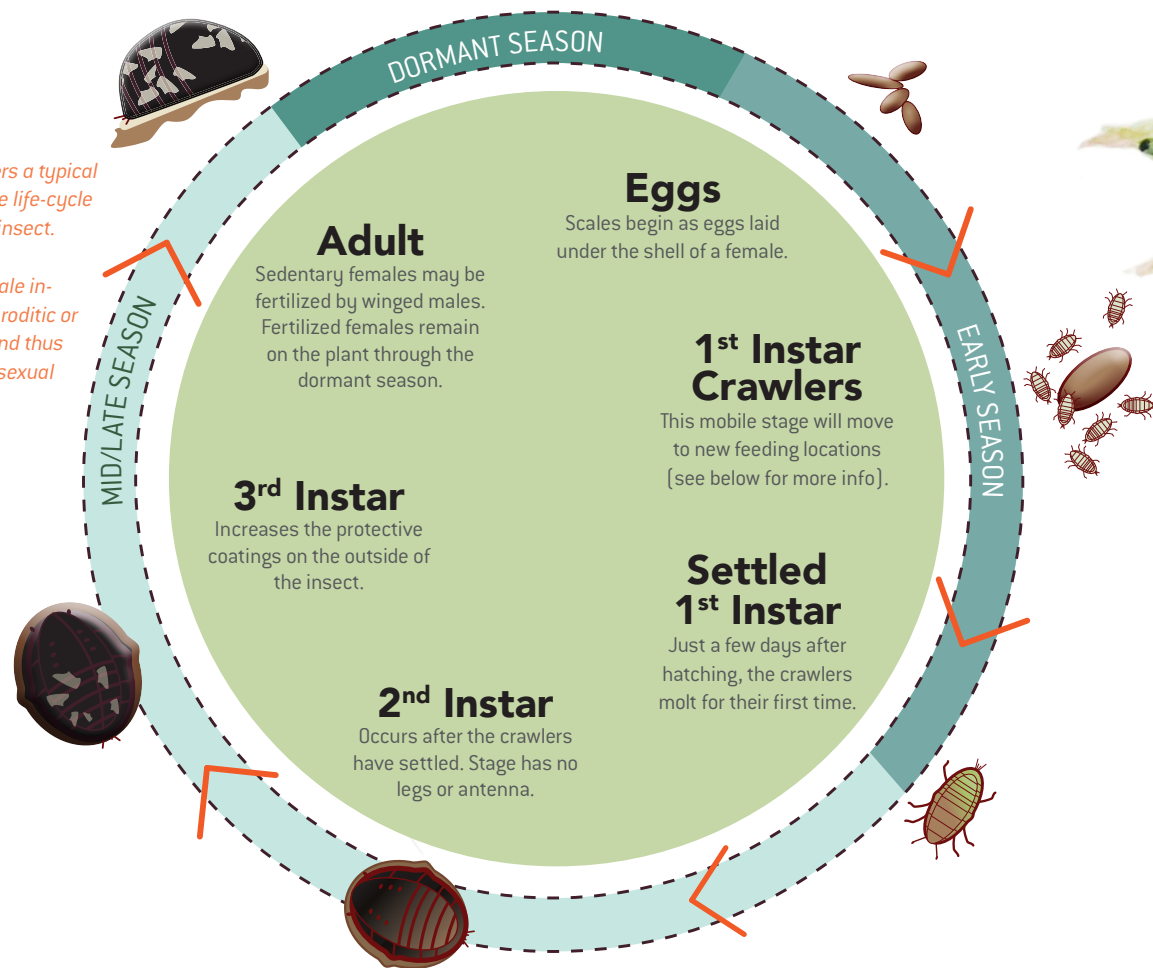
Biology

Scale insects reproduce quickly utilizing many different strategies. A single fertilized female can lay hundreds to thousands of eggs in her lifetime, allowing populations to build rapidly if conditions are favorable. In most species, only the nymphs and sedentary adult females are considered plants pests. For species that produce males, they are winged and only live a short time after completing their part of the mating process. Adult males do not feed. Adding to the complexity, there are many documented cases of hermaphroditism and even parthenogenetic (asexual) reproduction within certain scale species. **While there is tremendous diversity within scale insect biology, the following generalizations provide a suitable understanding for the purposes of management:**

Generalized Scale Life-Cycle

This overview covers a typical sexual reproductive life-cycle for a female scale insect.

Note that many scale insects are hermaphroditic or parthenogenetic and thus do not go through sexual reproduction.



Crawlers Explained:

Early in the season, most species have legs that allow them to move around. This mobile nymph stage is commonly referred to as 'crawlers'. Crawlers possess legs and antennae, but lack the protective covering seen in later life stages (Fig 1).

Without this protective layer, crawlers are more susceptible to control treatments, making the crawler stage an ideal time for management. Tracking growing degree days can be very useful for timing treatments. Contact Rainbow for more info.

Fig.1

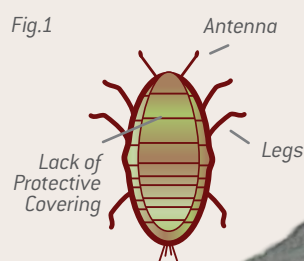


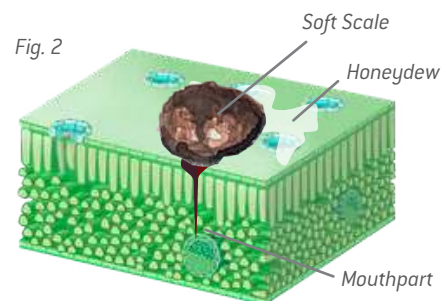
Photo: Rainbow Scientific

Scale Differences

Broadly speaking, scale insects fall into two distinct classes: soft scales and armored (hard) scales. While these are not strict biological classifications, this distinction makes it easier for understanding why different types of scale insects require different management strategies. **All scale insects have piercing-sucking mouthparts but where they use those mouthparts inside the plant tissue can have impacts on what signs and symptoms may be present and the treatments used to control them.**

Soft Scales

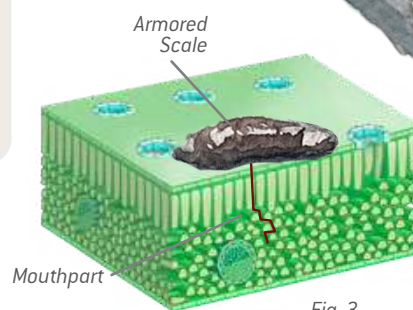
Soft scale insects use their mouthparts to pierce directly into the plant's vascular tissue (Fig. 2). Higher pressure inside the xylem and phloem force the sugary solution to the insect. Some of the solution is consumed but the insect excretes much in the form of honeydew, a sticky material that can cover leaves, twigs, and objects below. The presence of honeydew one way to diagnose soft scales.



Soft scales feed directly in the vascular tissue, resulting in honeydew that can often lead to a black fungus known as 'sooty mold.'

Armored Scales

Armored scales (also referred to as 'hard' scales) can be difficult to see on twigs and are often overlooked as part of the twig or bark. Hard scales do not feed directly in the vascular tissue but rather in the intercellular and mesophyll tissue (Fig. 3). As a result, hard scale insects do not produce honeydew. Instead, this type of feeding can result in chlorotic leaf spots that can coalesce and lead to leaf drop.



Hard scales feed in cell tissue and do not produce honeydew.

Diagnosis

Scales are both small and naturally camouflaged making identification difficult, especially from a distance. When diagnosing scale insects it is important to look for a combination of signs (the pests themselves) and the symptoms (affects on the tree) to confirm the type of scale infestation prior to selecting a management option. Thoroughly inspect under-sides of leaves, twigs, and bark crevices as scale insects are not always easily identified at first glance.

Signs	Symptoms
The insects themselves come in many different shapes and sizes:	The trees respond to a scale infestation in many different ways:
 Oystershell appearance (armored scale) Photo: D. Taylor, Sunrise Tree Service	
 Plate-like appearance (armored scale) Photo: Rainbow Scientific	
 Convex appearance (soft scale) Photo: Rainbow Scientific	
 Cottony appearance (soft scale) Photo: AdobeStock	



Thinning Canopy

An overall loss of vigor commonly accompanies a scale infestation. Affected trees will often have less dense foliage than nearby unaffected plants.



Mild Chlorosis

Pale, yellowing foliage can be commonly seen on scale-infested trees and shrubs. Mild chlorosis is commonly associated with armored scale outbreaks.



Secondary Pests

As the tree or shrub loses vigor they are often susceptible to other maladies. Accompanying issues like borers or aphids may require a management intervention as well.

Photos: Rainbow Scientific and AdobeStock

*This swamp white oak (Fig. 4) is in an urban tree stress situation - compacted soils, hot/dry environment, broken branch from a vehicle strike, etc. Closer inspection reveals lecanium scale is present as well (Fig. 5).
Photos: Rainbow Scientific*



Dieback

Twigs and branches can begin to decline and dieback as a scale infestation progresses. This can most commonly be seen in the upper portions of the canopy.



Stunted Growth

A scale infestation can cause diminished growth, particularly if the presence goes untreated for several years.



Honeydew & Sooty Mold

Honeydew and the resulting black mold is common with soft scale infestations. Be sure to eliminate other honeydew sources from other piercing and sucking insects like aphids.



Fig. 4 Swamp white oak in a stressful situation



Fig. 5 Inspection reveals scales present



Diagnose Source of Stress

As scale outbreaks are often associated with plant stress, a proper management protocol should include an identification and remediation proposal to address the source.

Common Sources of Plant Stress:

- Soil compaction
- Drought
- Defoliation
- Nutrient deficiencies
- Chemical injury
- Mechanical damage
- Transplant shock
- Improper planting depth
- Lack of root space
- Competing vegetation

Management

There is no silver bullet. Scales require a toolbox approach.

No matter the time of year or the preferred application method, we have a management tool that is right for you. Whether you need fast results, long-lasting control, or a green-alternative to conventional tools, the predictable results you need can still be achieved with Rainbow's toolbox of solutions.

Scale management starts with a proper identification of the pest because there are different tools to use for different types of scales. As many scale insect structures may persist on the plant for some time after treatment, it is important to communicate this to the client. **Along with the Keys to Success (right), setting the proper expectations of results with the client is a critical part of a complete scale management plan.**

Keys to Success:

- 1. PROPER DIAGNOSIS**
Management is often species-specific
- 2. TREATMENT SELECTION**
Consider combining treatment strategies for heavier outbreaks
- 3. APPLICATION**
Field training and execution are critical
- 4. MONITORING**
Follow-ups are important to assess efficacy

Soft Scale Management

The time of year and the preferred application method are two key considerations to take into account.

Contact Rainbow for specific rates and pest treatment protocols.

	JAN-MAR	APR-JUN	JUL-SEP	OCT-DEC
Proxite™ INSECT GROWTH REGULATOR				
Transtect™ 70WSP				
Transtect™ Infusible				
Xytect™				
RTSA Horticultural Oil				

This chart shows the time of year when each product can be applied. The color bars represent the application timing for each product. See Application Method Key on page 9.

Notes:

- Proxite should be applied at the time of crawler emergence.
- Transtect can be applied 14 -21 days prior to crawler emergence. Transtect Infusible can be applied within a few days of crawler emergence.
- Xytect must be applied 30-120 days prior to crawler emergence and can be applied in the fall for control the following season.
- Adding a low rate of RES Hort Oil to Proxite as an adjuvant improves efficacy.

What are Insect Growth Regulators?

Proxite™ is an insect growth regulator (IGR) that affects all life stages of the insect. It reduces the adult's ability to produce eggs, it has ovicidal activity, and it inhibits the metamorphosis of nymphs. Proxite prevents scales from completing their life-cycle, causing them to stop feeding, which leads to their eventual death (Fig. 7). This novel treatment is applied through foliar spray, and has translaminar movement giving Proxite full and complete coverage on both sides of the leaves.

Proxite is a non-neonicotinoid solution for scales and is an ideal tool for integrated pest management (IPM) or insect resistance management (IRM) programs. **Its targeted mode of action allows Proxite to be used on flowering trees and shrubs that also attract beneficial insects and pollinators.**

The product remains active for 14-28 days and should be applied no more than twice every six months. Proxite is a non-restricted General Use product that has a CAUTION signal word and is considered a reduced risk for beneficial insects and pollinators.

Generalized Life Cycle of Scale Insects and the Effects of Proxite IGR

Fig. 6 UNTREATED

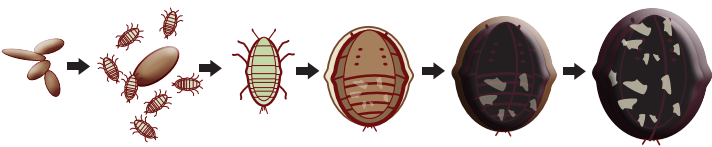
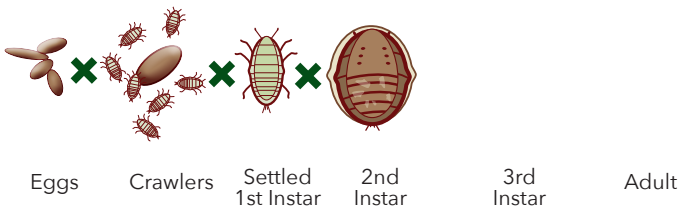


Fig. 7 TREATED with PROXITE™



X Stages disrupted by Proxite IGR

Proxite IGR specifically disrupts different life stages of scale insects, reducing its impact on non-target and beneficial species.

Armored Scale Management

Although armored (hard) scales do not have as many management tools in the toolbox as soft scales, they can still be predictable to manage. *Contact Rainbow for specific rates and pest treatment protocols.*

	JAN-MAR	APR-JUN	JUL-SEP	OCT-DEC
Proxite™ INSECT GROWTH REGULATOR				
Transtect™ 70WSP				
Transtect™ Infusible				
RTSA Horticultural Oil				

This chart shows the time of year when each product can be applied.

The color bars represent the application timing for each product. See Application Method Key below.

Notes:

- Consider combining treatment strategies for heavier outbreaks.
- Heavy infestations may require a multi-year approach.
- Combine spray and soil applications in the first year, soil treatments alone in the second year.
- Pruning and removing infested branches may help reduce severe infestations.

Why is Transtect effective on soft AND armored scales?

Compared to other treatments in the same class, Transtect and Transtect Infusible are considerably more soluble in solution (Fig. 8). This allows the treatment to move into places within the plant tissue that other products miss.

Similar treatments, like Xytect, can be found in the vascular tissue, but armored scale insects do not feed directly in these places (see Page 5). Armored scales feed in the areas within cells and only Transtect's active ingredient is soluble enough to get into these areas. **This allows Transtect to be the most effective systemic treatment available for soft AND armored scale control.**

Transtect treatments are fast-acting and can be applied by different application methods depending on the site conditions or client preference.



Photos: Dr. D. Held, Mississippi State

Magnolia treated with one application of Transtect (right) and untreated control (left) with significant damage from false oleander scale (armored scale).

Relative Solubility of Neonicotinoids

Data Source: Valent USA

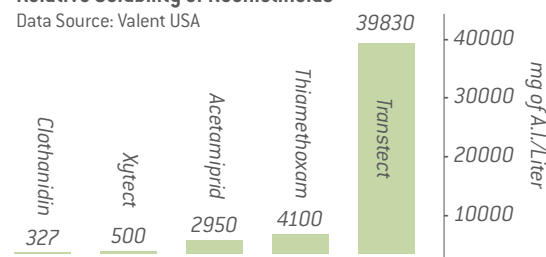


Fig 8. Transtect is significantly more soluble than other treatments in the same class.

Efficacy of Transtect on Pine Needle Scale

Data Source: Dr. D. Herms, OSU

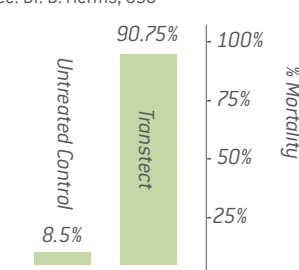


Fig 9. Transtect is very effective on armored scales, such as pine needle scale. Data 3 weeks after treatment.

Application Method Key:



Foliar Spray



Bark Spray



Tree Injection



Soil Application

Photos: Rainbow Scientific

Success Stories

While there are no doubt challenges with managing scale insect pests, there are certainly many success stories worth sharing. Below are a few examples. Please contact Rainbow for information on a specific scale management protocol.

Pest: Lecanium Scale Host: Willow Oak	
Treatments Used	Notes
Transtect (bark spray)	<i>"Rainbow's Transtect bark spray application is a huge advantage for living our team's motto: Use Less Pesticide, Get Better Results. We use it as a tool to combat scales on large trees without the need to spray high into the air."</i>
Time of Year	
Midseason	
Pro: Justin N., Arborscapes, VA	

A close-up photograph of a Willow Oak branch. The bark is light gray and textured. Several dark, oval-shaped scale insects are visible on the bark. A green leaf is partially visible in the background.

Pest: Crape Myrtle Bark Scale Host: Crape Myrtle		
	Treatments Used	Notes
	<i>Transtect OR Xytect with Proxite + Hort Oil</i>	<i>"Using whichever systemic made sense for the time of year/speed of uptake combined with IGRs [Proxite] and oils, we quickly had a comprehensive way of treating an unsightly pest at almost any time of season."</i>
	Time of Year	
	<i>All season</i>	
Pro: <i>Chris D., Heartwood Tree Service, LLC</i>		

We have found Rainbow's products and expertise particularly helpful in managing scale in our area.

*- Chris D.
Heartwood Tree Service, LLC*

Get the Protocols You Need

There are many factors to consider when employing a scale management treatment and we are here to help. Rainbow has created management protocols for the most significant scale pests that affect trees, shrubs, and landscape plants. Our protocols cover the biology, diagnosis, management strategies, and expectations that give you the predictable results you need to communicate with your clients. **Contact Rainbow today for the top protocols in your region.**

[A] = Armored Scale [S] = Soft Scale

50+

Available Scale
Management Protocols

NORTHWEST

- Cottony Maple Scale [S]
- Cottony Camellia Scale [S]
- Pine Needle Scale [A]
- Oystershell Scale [A]

WEST COAST

- Lecanium Scale [S]
- Calico Scale [S]
- Tulip Tree Scale [S]
- Irregular Pine Scale [S]
- Obscure Scale [A]

ROCKY MOUNTAINS

- European Elm Scale [S]
- Kermes Scale [S]
- Pine Needle Scale [A]
- Oystershell Scale [A]

MIDWEST

- Euonymus Scale [A]
- Calico Scale [S]
- Oystershell Scale [A]
- Magnolia Scale [S]
- Pine Needle Scale [A]

NORTHEAST

- White Peach/Prunicola Scale [A]
- Lecanium Scale [S]
- Elongate Hemlock Scale [A]
- Magnolia Scale [S]
- Fletcher Scale [S]

MIDATLANTIC

- Tea Scale [A]
- Cottony Camellia Scale [S]
- Crape Myrtle Bark Scale [S]
- Japanese Maple Scale [A]
- Tuliptree Scale [S]

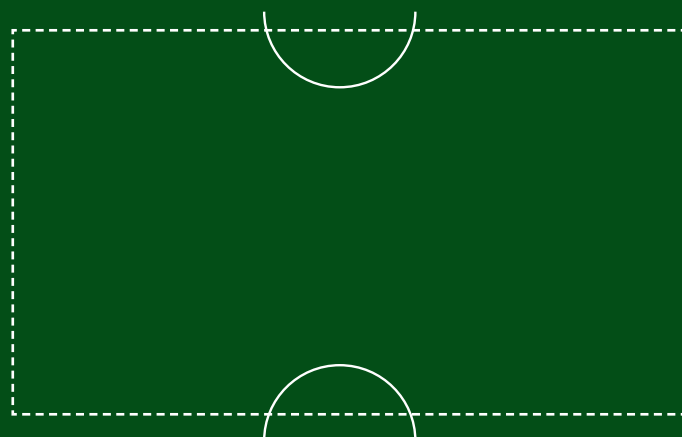
FLORIDA

- Hemispherical Scale
- FL Red Scale
- Phantasma Scale
- Cycad Scale
- Cottony Cushion Scale
- Magnolia Scale

SOUTHEAST

- Gloomy Scale [A]
- Tea Scale [A]
- Obscure Scale [A]
- Lecanium Scale [S]
- Crape Myrtle Bark Scale [S]

No matter where in the country you live or what pest you are looking to manage, Rainbow has the protocol you need.



Rainbow
ECOSCIENCE

Ordering & Tech Support: **877-272-6747**
www.RainbowEcoscience.com



Since 1976, Rainbow has been a leader in the Green Industry, advancing the science and understanding of plant healthcare through research and the development of predictable management protocols.

As one of the nation's largest independent tree service companies, Rainbow brings unmatched knowledge in both the science and the daily operations of plant healthcare. We are passionate about serving you.

TECHNICAL SUPPORT:
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