GROWERTALKS

Pest Management

7/27/2015

Know Your Enemy: Armored Scale Biology & IPM

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Armored scale insects may be the most difficult pests to manage on landscape trees and shrubs. Most trees and shrubs are hosts for multiple armored scale species that are tiny, cryptic and impervious to many insecticides. There are hundreds of armored scale species in the U.S. Some of the most common scale species on woody landscape plants are obscure scale, euonymus scale, tea scale, Japanese maple scale, false oleander scale, pine needle scale and juniper scale.

Pictured: Adult female (gray) and male (white) euonymus scales on Japanese euonymus. Notice yellow chlorotic leaf spots that often indicate scales

However, species composition and severity will vary based on your region. For example, gloomy scales are severe pests of red maples in the Southeast, but are uncommon in other regions. In this article, we'll discuss the key components of armored scale biology and Integrated Pest Management (IPM). This should give you a leg up on whatever the most prevalent scale pests are in your area.

Biology and damage.

Armored scales live beneath a waxy cover, called a test, for most of their life cycle. The test helps protect them from predators, parasitoids, environmental conditions and many insecticides. Most species spend the winter as adults or nymphs beneath their test, then lay eggs in spring. Tiny nymphs, called crawlers, hatch from eggs and are the only mobile stage of armored scales and the only stage without a test. The crawlers' jobs are to find a new spot to feed before settling down to build a test and feed. As you might expect, they can crawl, but they're also spread around by wind. Some armored scale species like gloomy scale have one generation per year. Others like, euonymus scale and Japanese maple scale, have multiple generations that can vary by region or year due to temperature.

Armored scales feed by inserting thread-like hollow mouthparts into leaves or stems and sucking out plant fluids. This removes nutrients and energy that plants need to grow. Thus, scale infestations can reduce plant

growth and lead to leaf drop, dead branches and eventually death. Some species, like euonymus scale, feed on leaves, which often causes yellow chlorotic spots on the tops of leaves where scales are feeding below.

Scouting and monitoring.
There are too many scale species to learn every one by sight. In addition to armored scales (family *Diaspididae*), there are also hundreds of soft scale species (family *Coccidae*) and species in over a dozen other families. It's important to identify the scale species you're trying to manage (get a guide book or help from your extension service) so you know the life cycle to target the crawler stage.

Even if you can't identify the scales to species, it's essential to distinguish armored scales from scales in other families, such as soft scales. This is because armored scales are less vulnerable to contact insecticides than soft scales. More importantly, the systemic insecticide imidacloprid does not kill armored scales, but does kill soft scales. Fortunately, there are two easy ways to determine if the scales frustrating you are armored or not.

Use the tip of your pocketknife to flip the test off of the scale. Armored scales will remain on the branch after you've removed their tests. Soft scales cannot be separated from their test so the whole insect will flip over with the cover. Not trained in insect surgery? Another difference is that armored scales don't produce honeydew, but soft scales and other scales do. Thus, if the leaves below your scale infestation are covered in sticky honeydew or sooty mold, you have soft scales. Or you have soft and armored scales.

Decision-making.
Deciding if intervention is necessary begins with determining if the scales are alive. Scale tests can remain on plants for years after the insect dies. Folks in my lab have counted scale tests on 100-year-old red maple twigs in museums. So before you apply insecticides, do a quick test. Flip a couple tests, then look for live insects below. Or you can squash some of the scales with your thumbnail. If the scales are alive, colored juice will come out and stain your finger. This crude monitoring technique allows you to check a lot of scales quickly.

There are no established thresholds to help landscapers decide if insecticide treatment is necessary. Consider conditions at the plant site and the tolerance of your client. Scales may spread faster on plants that are surrounded by impervious surfaces, such as roads and sidewalks, which cause drought stress and warm the environment. Impervious surfaces and even expanses of grass can reduce the abundance and diversity of predators and parasitoids that attack scales. Without this baseline natural control, scales will spread faster. Thus, plants surrounded by turf or hardscape may require treatment sooner and more often than plants in more complex landscapes.

Intervention.
Plants that need frequent scale management could be replaced with a species that is less susceptible. Reducing plant stress and increasing habitat complexity could bolster natural enemy communities. When insecticides are necessary, remember that armored scales live under waxy covers and are relatively waterproof. Therefore, contact insecticides—such as pyrethroids—don't provide adequate control unless applied to the crawler stage. Even then, since crawlers can emerge over several months or continuously, you're unlikely to get them all. In addition, pyrethroids, organophosphates and other insecticides that leave a

toxic residue on plant surfaces kill natural enemies and can make scale infestations worse. This was shown decades ago when mosquito and nuisance fly control programs caused scale outbreaks that resolved once the sprays were stopped.

So what's the best approach? There are insecticides from several classes available for armored scale management. Insect growth regulators disrupt insect development, preventing eggs and nymphs from developing into reproductive adults. Neonicotinoids are another insecticide class that includes some compounds for armored scale management. Neonicotinoids move systemically through plants, making them toxic for pests to consume. Thus, even though applications during crawler emergence are optimal, any feeding stage of the scales could ingest the insecticide. Imidacloprid is the most commonly used neonicotinoid, but it's not effective against armored scales. This is why it's essential to differentiate armored scales from other families while scouting. There are many insecticides available and new ones coming out all the time, so check with your extension service for a complete list labeled in your area.

Horticultural oils can also be effective for armored scale management. Horticultural oils kill insects by blocking their spiracles (breathing pores) and by disrupting fatty acids and cell membranes. Horticultural oils work on contact with insects, so they're best applied when crawlers are active. They don't leave a toxic residue, so multiple applications over the course of crawler emergence may be required. However, horticultural oils are inexpensive and kill many other common pests, such as mites and aphids, without much disruption of natural enemies.

You cannot manage scales you don't know you have. Thus, the key to reducing scale abundance and damage in your nursery is scouting to find them before they get out of control and identifying them so you know when the tender, vulnerable crawlers are active. Know your enemy and scale management will get just a little easier. **GT**

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