GROWERTALKS

Pest Management

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Don’t Get “Weighed-Down” By Scales

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Scales aren’t your typical insect pest because they appear as “bumps on a log” or resemble out-growths or galls on host plants. However, scales feed on a wide range of plants in landscapes, and if not dealt with appropriately, they can severely impact plant health.

Scales may be either host-specific or feed on many plant species. Scales disperse as first instars or crawlers by wind, birds, insects, plants touching and by “wandering.” In general, local and long-distance spread of scale populations is primarily associated with the proximity of susceptible plants in landscapes. This article discusses scales with regards to biology, types, plant damage and management.
Pictured: Magnolia scale.

Biology

Scales, in general, have high reproductive potential with females capable of producing many eggs (>1,000) during their lifetime. However, many scales can reproduce without mating (parthenogenesis). There are two life stages that are mobile: the nymph, or first instar crawler, and adult male. The young nymphs emerge from eggs and move around on the plant surface, searching for suitable feeding sites. Older nymphs and adult females are immobile. Females are usually legless and wingless. Males develop into winged individuals with legs and one pair of wings; however, males don’t feed because they lack functional mouthparts. Scales have piercing-sucking mouthparts that are used to withdraw plant fluids. There may be multiple generations per year, although this is contingent on the scale species.

Small size and feeding location make it difficult to visually detect scale infestations early. It’s interesting to note that scales may exhibit directional responses on plants, which is associated with temperature gradients, by feeding on different plant parts based on exposure to sun or shade. In addition, environmental conditions—including temperature, relative humidity and rainfall—may influence the rate of development and number of generations per year. Moreover, scale infestations may occur more frequently on leaves with dust or

particulate matter, which can interfere with the activity of natural enemies (e.g., parasitoids and predators).

Scale types

There are two types of scales: soft or bark scales, and hard or armored scales. The characteristics of each scale type are listed below.

> Soft or bark scales (examples listed in Table 1):

- There's usually one generation per year
- Soft scales produce honeydew (clear, sticky liquid)
- Typically overwinter as fertilized female
- Appear convex in shape or resemble a helmet
- Females can lay >1,000 eggs during their lifetime
- Ants are present, and will move soft scales around and protect them from natural enemies (e.g., parasitoids and predators)

> Table 1. Examples of soft or bark scales that feed on landscape plants.Cottony maple scale (Pulvinaris innumerabilis)
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> > European elm scale *(Gossyparia spuria)*
> > Fletcher's scale *(Parthenolecanium fletcheri)*
> > Magnolia scale *(Neolecanium cornuparvum)*
> > Pine tortoise scale *(Toumeyella parvicornus)*
> > Tuliptree scale *(Toumeyella liriodendrii)*
> > Kermes scale (many different types)
> > Lecanium scale (many different types)

> Hard or armored scales (examples listed in Table 2):

- There are usually two or more generations per year
- Hard scales don't produce honeydew
- Hard scales produce a waxy covering called a "test." The "test" protects adult females that live under the cover, shelters eggs and crawlers from natural enemies (e.g., parasitoids and predators), and provides protection from fluctuations in environmental conditions.
- Typically overwinter as either females or as eggs underneath the body of dead females
- Appear circular or rounded in shape
- Females generally lay <100 eggs during their lifetime
- Feed on various aboveground portions of plants, including leaves, stems and branches
- More than one species may occur on a single plant
- Females and males may exhibit different feeding habits, such as location on different plant parts

> Table 2. Examples of hard or armored scales that feed on landscape plants.Obscure scale (Melanaspis obscura)
>
> > Oystershell scale *(Lepidosaphes ulmi)*
> > San Jose scale *(Quadraspidiatus perniciousus)*
> > Euonymus scale *(Unaspis euonymii)*
> > Pine needle scale *(Chionaspis pinifoliae)*
> > Scurfy scale *(Chionaspis furfura)*
> > White peach scale *(Pseudaulacaspis pentagona)*
> > Juniper scale *(Carulaspis juniperi)*
> > Black pineleaf scale *(Nuculaspis californica)*

Soft scales and hard scales have different feeding behaviors. Soft scales, like aphids, whiteflies and mealybugs produce honeydew—a clear, sticky liquid that attracts ants. The reason for honeydew production is that the food canal in the mouthparts transports large quantities of plant fluids from the phloem sieve tubes. In contrast, the food canal of hard scales contains various kinds of cells and hard scales only ingest small amounts of plant fluids. Moreover, they use their long stylets to explore vast areas of plant tissue in order to obtain nutrients for development and reproduction.

Soft scales can move from one feeding site to another at various times during development, whereas hard scales cannot move once they've settled and commenced feeding. A distinguishing characteristic of scale females is the long time spent feeding on host plants and immobility (unable to move) that increases vulnerability to natural enemies (e.g., parasitoids and predators) and fluctuations in environmental conditions. Consequently, females will produce waxy secretions to form a covering (body protection) composed of lipids and resins. This covering serves as a barrier to insecticides, protects eggs and reduces desiccation by means of light reflectance.

Plant damage

Scales cause plant damage by directly feeding in the plant vascular fluids and/or by injecting toxins or plant pathogens. Typical symptoms of scale feeding include leaf yellowing, plant wilting, plant stunting and branch dieback. In general, scale feeding doesn't directly kill a plant (tree or shrub). However, this is contingent on the level of a scale infestation. Furthermore, scale feeding may pre-dispose plants to wood-boring insects or secondary plant pathogens, such as fungi.

Scale management

Scale management in landscapes entails implementing an assortment of plant protection strategies, including scouting, cultural control, physical control and use of insecticides.

Scouting for scale infestations on landscape plants involves routinely checking the leaves and branches of susceptible plants and placing double-sided sticky tape on randomly selected branches to detect the presence of crawlers, which will help time insecticide applications (explained below).

Cultural control strategies include: 1) avoid plant stress by maintaining healthy plant growth; 2) implement

proper watering, fertility and mulching practices; 3) if feasible, use plant varieties or cultivars (or even a different plant species) that are less susceptible to scales; and 4) avoid applying excess fertilizer (especially water-soluble, nitrogen-based fertilizers) in order to avoid stimulating scale reproduction or causing females to lay more eggs than normal.

Physical control strategies include:
1) dislodging crawlers from plants using a forceful water spray or using a brush to remove scales from plants; and 2) pruning out heavily-infested branches and removing plant debris from the vicinity.

The benefits of using forceful water sprays are:

- Quickly removes all life stages (eggs, crawlers and adult) from plants
- Cleans plants by removing dust and particulate matter
- Preserves natural enemies (parasitoids and predators)
- Prevents scale populations from building-up, thus avoiding outbreaks of scale populations

Insecticides may be applied to suppress scale populations on landscape plants. Below are guidelines to help maximize the effectiveness of insecticides used against scales:

- Repeat applications are usually required because eggs don't all hatch simultaneously
- Crawlers are most susceptible to insecticides because they haven't formed a protective waxy covering
- Systemic insecticides are generally more effective against soft scales when applied as a granular or drench to the soil than hard scales due to differences in feeding behavior (see above)
- Dormant oils (e.g., petroleum or mineral-based) can be used to kill those scales that overwinter as immatures (e.g., second instar nymphs) or mated adult females, such as obscure scale, euonymus scale and cottony maple scale

There are numerous insecticides that can be used to suppress scale populations; however, always read the label to ensure that the insecticide is labeled for use against scales. The key to using insecticides against scales is timing of application (when crawlers are present) and thorough coverage of all plant parts. Furthermore, the use of plant phenology can help time insecticide applications. Phenology is associated with the relationship of plants and animals in response to weather or environmental factors, such as temperature and rainfall.

In fact, plant development, like flowering time, can be used to predict insect activity and when susceptible life stages are present. For instance, pine needle scale (Chionaspis pinifoliae) eggs hatch when the green hawthorn (Crataegus virdis) is at 50% bloom and euonymus scale (Unaspis euonymi) eggs hatch when this same tree species is at 95% bloom. In both cases, the use of plant phenology can help time insecticide applications when the crawler stage, which is the most susceptible life stage, is present, thus ensuring high mortality.

Since most scales are immobile, they're susceptible to attack by natural enemies, including ladybird beetle larvae and adults, green lacewing larvae, and various parasitoids. However, the use of broad-spectrum insecticides, which are commonly applied in landscapes, can negatively impact populations of natural

enemies, thus stimulating scale outbreaks. There-fore, exercise caution when applying insecticides to suppress scale populations and use “selective” insecticides that are less harmful to natural enemies. **GT**

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