K-STATE
Research and Extension

Scale Insect Pests

Scales are insect pests that appear as bumps on a log, resembling outgrowths or galls on host plants. Scales feed on a wide range of plants (trees and shrubs) and can cause serious plant damage if not managed. Scales can be host-specific or feed on many plant species. Scales disperse as first-instar nymphs or crawlers by wind, birds, or insects, and can spread when plant leaves are touching. In general, the abundance and distribution of scale populations within a landscape is associated with the availability of susceptible plants. This fact sheet provides information on biology, scale types, plant damage, and offers strategies for managing specific types of scales.

Table 1. Common name and scientific name of soft or bark scales that feed on trees and shrubs.

Common Name	Scientific Name
Cottony maple scale	*Pulvinaria innumerabilis*
European elm scale	*Gossyparia spuria*
European fruit lecanium scale	*Parthenolecanium corni*
Fletcher scale	*Parthenolecanium fletcheri*
Magnolia scale	*Neolecanium cornuparvum*
Oak kermes scale	*Kermes pubescens*
Pine tortoise scale	*Toumeyella parvicornis*
Tuliptree scale	*Toumeyella liriodendri*

Biology

Most scale females have a high reproductive capacity. Each female, depending on the scale type, is capable of producing more than 1,000 eggs in her lifetime. In some cases, females can reproduce without mating (parthenogenesis). Only two life stages are mobile—the first-instar nymph (crawler) and the adult male. The first-instar nymphs hatch from eggs (Figure 1) and disperse to find suitable feeding sites. Most scale nymphs are less than ⅛ inch long and vary in color from red-orange to brown, depending on the species. Nymphs blend in and are difficult to detect on trees and shrubs with light-colored bark or branches. They are more visible on dark-colored bark or branches.

Later instar nymphs and adult females do not have legs and wings, and are immobile. Males develop legs and wings, but do not have mouthparts for feeding and only live for about two weeks. Scales can be difficult to detect early because of their small size and feeding habits. In addition, scales may feed on different plant parts. Temperature influences the rate of development and the number of generations per year. Scales have one or more generations per year depending on the species.

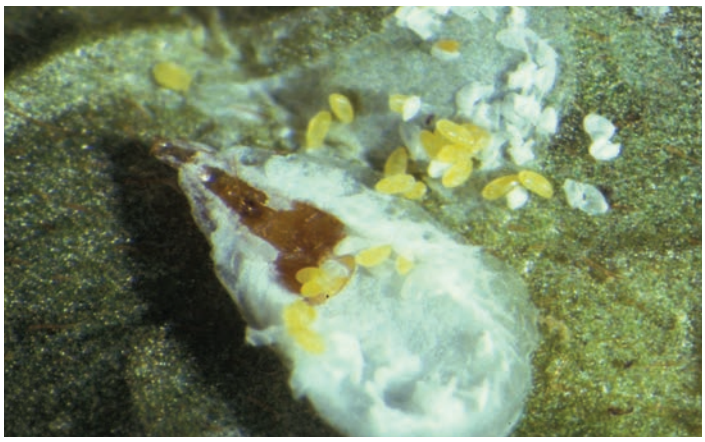

Figure 1. Scale nymphs (crawlers) after hatching from eggs.

Female scales are susceptible to natural enemies (e.g., parasitoids and predators) and temperature fluctuations, due to their immobility and the amount of time spent feeding on host plants (trees and shrubs). While feeding, female scales produce waxy secretions containing lipids and resins that result in the formation of a protective covering. This protective coating serves as a barrier that protects eggs and reduces water loss by reflecting light.

Scale Types

There are two types of scales, soft or bark scales and hard or armored scales (Tables 1 and 2), which can be differentiated by their feeding habits. All scales have piercing-sucking mouthparts, but only soft scales produce honeydew, a clear, sticky liquid that attracts ants. The feeding apparatus enables soft scales to transport large amounts of fluids extracted from food-conducting tissues (phloem). In comparison, hard scales ingest small quantities of plant fluids and tend to explore vast areas of plant tissues to obtain nutrients required for development and reproduction.

Soft scale females do not lose their legs and can move to different feeding sites at various times during development. Hard scales lose their legs and become immobile once they settle and begin feeding. Soft and hard scales overwinter at different life stages (Table 3). The following information describes common characteristics of soft and hard scales with examples of each.

Characteristics of Soft or Bark Scales

- Usually one generation per year.
- Produce honeydew, a clear, sticky liquid.
- Typically overwinter as fertilized females.
- Shaped like a helmet.
- Females can lay over 1,000 eggs during their lifetime.
- If present, ants may move soft scales, and protect them from natural enemies (e.g., parasitoids and predators).

Cottony maple scale *(Pulvinaria innumerabilis)*

Cottony maple scale females are ⅛ inch long, flattened, and brown. Females produce white, cottony egg sacs that look like popcorn on branches (Figure 2). Nymphs hatch from eggs during the summer and migrate to the undersides of leaves looking for a place to feed. In the fall, before leaves drop, nymphs return to twigs or branches to overwinter. Cottony maple scale feeds on silver maple, boxelder, birch, elm, and linden trees and produces copious amounts of honeydew. There is one generation per year.

European elm scale *(Gossyparia spuria)*

European elm scale females are ¼ to ⅜ inch long and oval, with a brown shell encircled by a white waxy substance (Figure 3). European elm scales are commonly located on branches or twigs and at junctures that connect branches. Females lay eggs in summer. Eggs hatch into yellow nymphs that actively feed on the undersides of leaves during the summer. European elm scale feeds on American and other native elm species, causing premature yellowing of the leaves. There is one generation per year.

European fruit lecanium scale *(Parthenolecanium corni)*

European fruit lecanium scale is ⅛ to ½ inch long. Females are hemispherical and light to dark brown with mottling on the body (Figure 4). Shape and color vary depending

Figure 2. Cottony maple scale female.

Figure 4. European fruit lecanium scale on branch.

Figure 3. European elm scale females on branch.

Figure 5. Fletcher scale adult females.

on the host plant. From spring through summer, females can produce more than 200 eggs, which remain hidden beneath the female body covering. After laying eggs, the female's body dries up and turns brown. Nymphs hatch and emerge from the female body covering during summer. Second-instar nymphs are ¼ inch long and yellow-brown. Nymphs disperse and begin feeding on leaves. Feeding continues throughout the growing season. In late summer before leaves fall, nymphs return to twigs or branches to overwinter. There is one generation per year.

Fletcher scale *(Parthenolecanium fletcheri)*

Fletcher scale females are ⅕ to ⅛ inch in diameter, round, and light brown (Figure 5). Females lay eggs in spring. Nymphs hatch from eggs during the summer and locate feeding sites near the female. Fletcher scale is a pest of nursery production systems feeding on taxus, yew, and arborvitae. There can be two generations per year.

Magnolia scale *(Neolecanium cornuparvum)*

Magnolia scale is the largest scale in the U.S. Females are ½ to ¾ inch in diameter, pink-orange to brown (Figures 6 and 7), and eventually covered with a white waxy powder (Figure 8). Nymphs hatch from eggs and are active from summer through early fall. First-instar nymphs are dark-gray with a red-brown ridge down the center of the back. Magnolia scale feeds primarily on magnolia plants and produces copious amounts of honeydew. There is one generation per year.

Figure 8. Magnolia scale females covered by white waxy powder.

Oak kermes scale *(Kermes pubescens)*

Oak kermes scale females are ⅛ to ¼ inches long, tan to brown, with light-brown mottling (Figure 9). They feed at the base of petioles (Figure 10), twig crotches, and leaf

Figure 6. Magnolia scale females.

Figure 7. Magnolia scale females.

Figure 9. Oak kermes scale on branch of oak tree.

Figure 10. Oak kermes scale feeding at the base of a leaf petiole.

veins. Old female scales are black and globular with a hard-shelled covering that resembles an oak gall. Females lay eggs in late summer, and then die. Nymphs hatch from eggs in fall and crawl around searching for overwintering sites. There is one generation per year.

Pine tortoise scale *(Toumeyella parvicornis)*

Pine tortoise scale females are ⅛ to ¼ inch in diameter, hemispherical, and red to brown, with dark-brown to black markings (Figure 11). Males are smaller, flattened, and white. Red nymphs are active from early to mid-summer (Figure 12). Pine tortoise scale is a major pest of Christmas trees and produces copious amounts of honeydew. There is one generation per year.

Tuliptree scale *(Toumeyella liriodendri)*

Tuliptree scale is one of the largest of all scale species. Females are ¼ to ½ inch in diameter, hemispherical, and gray-green to pink-orange with black mottling (Figure 13). Nymphs hatch from eggs and are active from late summer through early fall. One female can produce up to 3,000 eggs over several weeks. Nymphs feed on twigs or branches. Tuliptree scale feeds on tulip tree, magnolia, and linden and produces copious amounts of honeydew while feeding. There is one generation per year.

Figure 11. Pine tortoise scale females.

Figure 12. Pine tortoise scale nymphs.

Figure 13. Tuliptree scale females. (Photo credit: Blake Layton, Mississippi State University Extension Service)

Characteristics of Hard or Armored Scales

- Usually two or more generations per year.
- Do not produce honeydew.
- Produce a waxy covering called a test that protects the adult female living underneath. The test also shelters eggs and nymphs from changes in environmental conditions and natural enemies (e.g., parasitoids and predators).
- Tend to overwinter as females or as eggs under the bodies of dead females.
- Circular or round in appearance.
- Female lays less than 100 eggs during her lifetime.
- Feed on aboveground plant parts such as leaves, stems, and branches.
- More than one species can occur on a single plant.
- Females and males may exhibit different feeding habits on certain plant parts or locations.

Euonymus scale *(Unaspis euonymi)*

Euonymus scale females are ⅛ to ¼ inch long, dark brown, convex, and resemble an oyster shell, whereas males are white and smaller than females (Figure 14). Nymphs hatch from eggs over a two- to three-week period from late spring through early summer. Nymphs are yellow-orange and move around on leaves and stems. Females are typically found on stems, and males on leaves. Euonymus scale feeds on evergreen euonymus (Figure 15), holly, privet, and pachysandra, causing yellow or white spotting on leaves. There can be up to five generations per year.

Gloomy scale *(Melanaspis tenebricosa)*

The biology and life cycle of gloomy scale is similar to obscure scale described below. The female is less than ⅛ inch in diameter, brown to gray (Figure 16) and lays her eggs during the summer. After hatching, cream-colored nymphs are active throughout the summer, feeding on the bark and branches. Gloomy scale is a nursery and landscape pest that feeds on silver, red, and sugar maple. There is one generation per year.

Juniper scale *(Carulaspis juniperi)*

Juniper scale females are less than ⅛ inch in diameter, round, and white with a yellow center, resembling a small fried egg (Figure 17). In late spring, females lay eggs that hatch into yellow nymphs, which are active from late summer through early fall. Juniper scale feeds on junipers, cypress, and Eastern red cedar. There is one generation per year.

Obscure scale *(Melanaspis obscura)*

Obscure scale females are ⅛ inch in diameter and circular. They are dull gray to black in color (Figure 18) and blend in with the bark of oak trees. Females lay eggs in summer. Nymphs hatch and are active from mid-summer through early fall. Newly emerging (eclosing) nymphs settle close together underneath mature scales, forming overlapping layers. Although obscure scale mainly attacks oaks, they can be found on willow, maple, crabapple, and hickory. There is one generation per year.

Table 2. Common name and scientific name of hard or armored scales that feed on trees and shrubs.

Common Name	Scientific Name
Black pineleaf scale	*Nuculaspis californica*
Euonymus scale	*Unaspis euonymi*
Gloomy Scale	*Melanaspis tenebricosa*
Juniper scale	*Carulaspis juniperi*
Obscure scale	*Melanaspis obscura*
Oystershell scale	*Lepidosaphes ulmi*
Pine needle scale	*Chionaspis pinifoliae*
San Jose scale	*Quadraspidiotus perniciosus*
Scurfy scale	*Chionaspis furfura*
White peach scale	*Pseudaulacaspis pentagona*

Figure 14. Euonymus scale females and males.

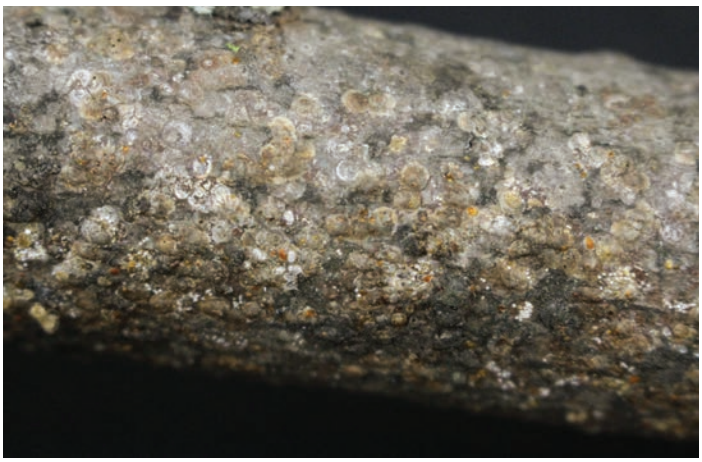

Figure 16. Gloomy scale on branch.

Figure 15. Euonymus scale feeding on evergreen euonymus plant.

Figure 17. Juniper scale.

Figure 18. Obscure scale on branch.

Oystershell scale *(Lepidosaphes ulmi)*

Oystershell scale is 1/10 inch in length, brown, and looks like oyster shells (Figure 19). Nymphs hatch from eggs and are active from spring through summer. Entire branches can be encrusted with oystershell scale when populations are extensive. Oystershell scale feeds on ash, dogwood, lilac, maple, and willow. There is one generation per year.

Figure 19. Oystershell scale on branch.

Figure 20. Pine needle scale.

Pine needle scale *(Chionaspis pinifoliae)*

Pine needle scale females are 1/16 to 1/8 inch, elongated, and white with a yellow portion that tapers on one end (Figure 20). First- and second-instar nymphs are narrow, flat, and yellow. Males have a small, rectangular, white covering. The eggs located underneath the dead female are red. Pine needle scale feeds on pine trees and shrubs, including mugo pine (Figure 21). There are two generations per year.

San Jose scale *(Quadraspidiotus perniciosus)*

San Jose scale females are circular, flat, and gray to brown (Figure 22). Yellow-orange nymphs hatch from eggs and feed on bark, leaves, and fruit from spring through summer. Extensive populations may result in the formation of a gray crust on branches, which often leads to twig or branch dieback. San Jose scale feeds on a wide range of fruit and ornamental trees and shrubs. There can be multiple generations per year.

Figure 21. Mugo pine infested with pine needle scale.

Figure 22. San Jose scale.

Plant Damage

Scales damage plants when feeding on the vascular fluids. In some cases, they inject toxins or plant pathogens. Symptoms associated with scale feeding include leaf yellowing, plant wilting, plant stunting, and branch dieback. Scale feeding may not kill a plant directly, but this depends on the level of infestation. Scale feeding predisposes plants to wood-boring insects, and the feeding wounds provide entry sites for secondary plant pathogens such as fungi.

Management

Management strategies include scouting, cultural and physical control, and insecticides.

Scouting: Routinely inspect leaves and branches of susceptible plants. Randomly select branches and wrap with double-sided sticky tape. Check tape for nymphs at least twice a week, and time insecticide applications based on results. An alternative method is to shake branches over a black piece of paper and look for nymphs moving around.

Cultural controls:

- Avoid plant stress by maintaining plant health, which reduces susceptibility to scales.
- Implement proper watering, fertilization, and mulching practices.
- Use plant types (species), varieties, or cultivars that are less susceptible to scales.
- Avoid overfertilizing plants with water-soluble, nitrogen-based fertilizers to prevent stimulating female reproduction.

Physical controls: Remove heavily infested branches and dispose of immediately. Spray plants with water, applying enough force to dislodge scales. Make sure to thoroughly cover all plant parts (e.g., stems, branches, and leaves). This method offers several advantages, such as: 1) quickly removes all life stages (eggs, nymphs, and adults) from plants; 2) cleans plants by removing dust and particulate matter; 3) preserves natural enemies including parasitoids and predators; and 4) prevents scale populations from establishing, which avoids outbreaks.

Insecticides: Contact insecticides can be applied to suppress scale populations on plants. For best results, the following practices are recommended: 1) time applications when nymphs are present. Nymphs are the most susceptible life stage because they have not formed a protective covering; 2) ensure thorough coverage of all plant parts; and 3) make multiple applications, recognizing that eggs do not all hatch at the same time, and nymphs must come into direct contact with insecticides. Fall insecticide applications may be effective in killing some scales (e.g., oak kermes scale) when nymphs migrate to overwintering sites. Once scales form a waxy covering, they are less susceptible to contact insecticides. Nymphs that settle under old scale coverings are also protected from insecticide applications.

Types of Insecticides

A number of insecticides are available that can be used to suppress scale populations. Read the label to make sure the product is labeled for use on scales. The following types of insecticides can be used against scales:

Horticultural oils (e.g., petroleum or mineral-based) are contact insecticides applied primarily from spring through fall. Oils prevent normal gas exchange through the cuticle (skin) by blocking the breathing pores (spiracles) or by directly penetrating through the cuticle, which disrupts respiration. Horticultural oils are less effective against scales that crowd together or where layers of scale coverings have accumulated. Horticultural oils kill all life stages (eggs, nymphs, and adults) but do not persist long so repeat applications are required during the growing season. Do not apply horticultural oils when temperatures are 80˚F or higher to avoid plant injury. Horticultural oils should be applied when temperatures are between 50 and 75˚F.

Dormant oils (e.g., petroleum or mineral-based) are contact insecticides applied in the winter and are effective in killing scales that overwinter as first- or second-instar nymphs or mated adult females, including: obscure scale, euonymus scale, and cottony maple scale. However, dormant oils are not as effective in killing hard scales that overwinter as eggs (e.g., oystershell and pine needle scale) because eggs killed as a result of the first application form a protective layer against subsequent dormant oil applications. Read the label carefully checking for plants that may be sensitive to dormant oils.

Insecticidal soaps (e.g., potassium salts of fatty acids) are contact insecticides that disrupt the cuticle, causing insects to dry up. They are effective on active nymphs and those that have settled to feed. Like horticultural oils, insecticidal soaps do not persist long so repeat applications are required during the growing season.

Systemic insecticides are applied as a drench or granule to the soil where the active ingredient is taken up by the roots and translocated/distributed throughout the plant. Systemic insecticides are generally more effective against soft scales than hard scales because of differences in their feeding behaviors (see Scale Types on page 1). Systemic insecticides must be applied before scales are present.

Table 3. Common name, scientific name, scale type (hard or soft), and overwintering life stages of scales.

Common Name	Scientific Name	Scale Type	Overwintering Life Stage
Euonymus scale	*Unaspis euonymi*	Hard	Fertilized female
Gloomy scale	*Melanaspis tenebricosa*	Hard	Fertilized female
Juniper scale	*Carulaspis juniperi*	Hard	Fertilized female
Obscure scale	*Melanaspis obscura*	Hard	Second instar nymph on bark
Oystershell scale	*Lepidosaphes ulmi*	Hard	Eggs underneath covering of dead female
Pine needle scale	*Chionaspis pinifoliae*	Hard	Eggs underneath covering of dead female
San Jose scale	*Quadraspidiotus perniciosus*	Hard	Second instar nymph
Cottony maple scale	*Pulvinaria innumerabilis*	Soft	Second instar female nymph on twigs or branches
European elm scale	*Gossyparia spuria*	Soft	Second instar nymph in bark crevices
European fruit lecanium scale	*Parthenolecanium corni*	Soft	Second instar nymph
Fletcher scale	*Parthenolecanium fletcheri*	Soft	Second instar nymph on leaves and shoots
Magnolia scale	*Neolecanium cornuparvum*	Soft	Nymph on twigs or branches
Oak kermes scale	*Kermes pubescens*	Soft	First instar nymph on branches
Pine tortoise scale	*Toumeyella parvicornis*	Soft	Fertilized female on twigs
Tuliptree scale	*Toumeyella liriodendri*	Soft	Second instar nymph on twigs and branches

Plant Phenology

Plant phenology describes the relationship between plants and insects in response to weather or environmental factors such as temperature. This information is useful in the timing of insecticide applications. For example, plant development, such as flowering time, can be used to predict scale activity and the presence of susceptible life stages. Pine needle scale eggs can be expected to hatch when the green hawthorn (*Crataegus viridis*) is at 50% bloom and euonymus scale eggs at 95% bloom. Oystershell and pine needle scale nymphs are active when Vanhoutte spirea (*Spiraea* x *vanhouttei*) is in full bloom (Figure 23). Plant phenology ensures high mortality by enabling timing of insecticide applications to coincide with the presence of nymphs, the most susceptible life stage.

Figure 23. Vanhoutte spirea in full bloom.

Natural Enemies

Due to their immobility as they mature to adults, scales are susceptible to attack by natural enemies, including ladybird beetle larvae and adults, green lacewing larvae, and various parasitoids. The use of broad-spectrum contact insecticides, which are commonly applied by homeowners and professionals, can negatively impact populations of natural enemies, thus stimulating scale outbreaks. Exercise caution when applying any insecticide to suppress scale populations, and try to select those that are less harmful to natural enemies.

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