

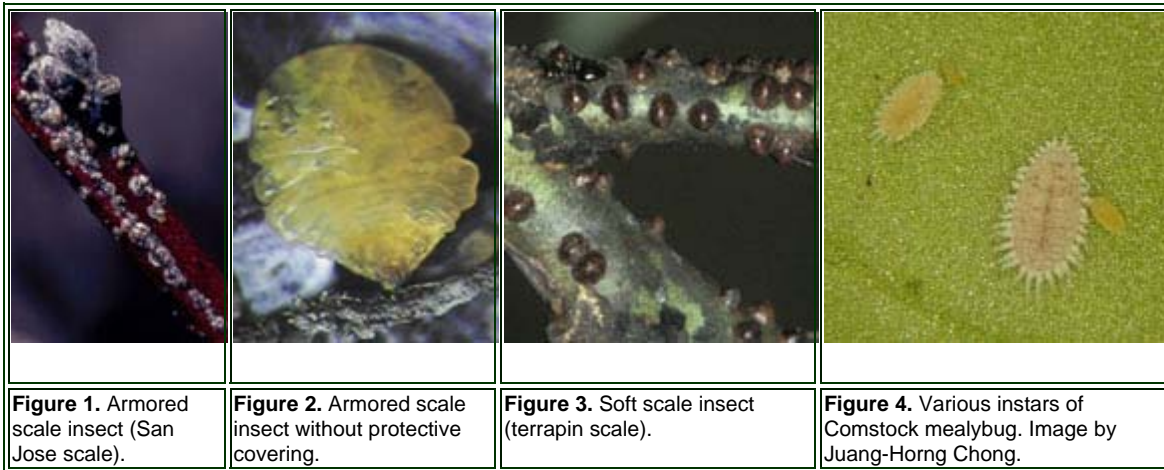
SCALE INSECTS

Greg Hodges

Florida Department of Agriculture and Consumer Services
Division of Plant Industry
Gainesville, FL 32614

Scale insects infest an enormous variety of plant hosts worldwide and are important pests of peaches and virtually all orchard trees.

Scientists typically recognize 18 families of scale and several thousand species. Most common scale pests are from three families: the armored scales (Diaspididae) (Figures 1 and 2), the soft scales (Coccidae) (Figure 3), and the mealybugs (Pseudococcidae) (Figure 4). San Jose and white peach scale, the key scale pests of southeastern peaches, are armored scales. Armored scales are generally flat in appearance and are usually cryptic or well camouflaged. Armored scales tend to be small (2-3 mm long). Except for the adult males and crawlers, armored scale live inside a protective covering made of waxes and previously molted skins. This covering helps protect scale from natural enemies, pesticides, and desiccation. The soft scales are generally convex in shape and are larger (5-10 mm) than armored scales. Soft scales secrete a layer of wax that covers their bodies. As with the armored scale, this wax layer protects them from natural enemies, pesticides, and desiccation. Mealybugs are recognized by the mealy wax and waxy projections emerging from their bodies. Unlike the armored and soft scales, which are generally mobile only in the crawler stage, mealybugs are mobile in all life stages.



Scale damage plants by direct feeding injury or indirect means such as production of honeydew by soft scale and mealybugs. Scale feed by inserting their piercing/sucking mouthparts and withdrawing nutrients. In peaches, feeding damage can cause leaf chlorosis and twig or limb die-back, even death of trees if scale populations reach high levels. Feeding injury to peach fruit, primarily from San Jose scale, produces small, red, measles-like lesions on the skin. Indirect plant damage, such as honeydew production and buildup of sooty mold from soft scales and mealybugs, is rare in southeastern peaches.

Scales have unusual life cycles; females have incomplete metamorphosis (egg-immatures-adult), whereas the males have complete metamorphosis (egg-immatures-pupal state-adult). Not all scales have both male and female sexes. Some species are made up entirely of females. Most scales overwinter as adults or immatures that have almost reached adulthood. In early spring, adults mature and begin laying eggs that generally hatch in two to four weeks. Mobile immature scale are known as crawlers (Figure 5). Crawlers are highly vulnerable to pesticides and oils because they have yet to produce any protective outer covering. Crawlers quickly find a suitable settling site on the host. After settling, crawlers start feeding and producing protective waxes. Within two weeks of settling, crawlers molt to the second instar (equipped with a protective covering). Second instars molt after about two more weeks. In similar fashion, third instars emerge as adults in roughly two weeks. In the Southeast, armored scales may have as many as seven generations. Most soft scales have only one or two generations per year.



Figure 5. Recently settled white peach scale crawlers; females (translucent cream), males (pink).

In Georgia and South Carolina, two armored scales are key pests of peaches: the San Jose scale (*Quadraspidiotus perniciosus*) and the white peach scale (*Pseudaulacaspis pentagona*). Other scales that occasionally infest peaches in the Southeast include: terrapin scale (*Mesolecanium nigrofasciatum*) (soft scale); European fruit lecanium (*Parthenolecanium corni*) (soft scale); cottony hydrangea scale (*Pulvinaria hydrangeae*) (soft scale); walnut scale (*Quadraspidiotus juglansregiae*) (armored scale); latania scale (*Hemiberlesia lataniae*) (armored scale); Forbes scale (*Quadraspidiotus forbesi*) (armored scale); mining scale (*Howardia biclavis*) (armored scale); camphor scale (*Pseudaonidia duplex*) (armored scale); cottony cushion scale (*Icerya purchasi*) (margarodid scale); Comstock mealybug (*Pseudococcus comstocki*); and taxus mealybug (*Dysmicoccus wistariae*).

SAN JOSE SCALE

San Jose scale, *Q. perniciosus* (Comstock), is a damaging pest that must be managed aggressively to avoid serious losses in productivity and orchard longevity. San Jose scale was introduced into the United States in the San Jose valley of California in 1870. It is a pest of peaches, nectarines, plums, and other deciduous tree fruits including apple and pear. The origin of this scale is China, perhaps on peach. San Jose scale now inhabits most of the United States. The scale is capable of tremendous damage. In 1922, San Jose scale killed 1,000 acres of mature apple trees in southern Illinois. San Jose scale can be found on a number of alternate hosts including persimmon and roses. The Forbes scale (*Q. forbesi* (Johnson)) is similar to San Jose scale in appearance, habits, and distribution.

Description

Adult females of the San Jose scale are yellow, circular, sac-like, legless insects. They secrete and live beneath a protective covering. The covering is round, gray-brown, and made up of concentric rings surrounding a raised nipple near the center (Figure 6). The circular female covering is about 1/16 inch (1.5 mm) in diameter. Adult males are tiny, golden-brown, two-winged insects, about 1/25 inch (1 mm) long with a narrow, dark band across the abdomen (Figure 7). They mature under elongate oval scale coverings, about 1/24 inch (1-2 mm)

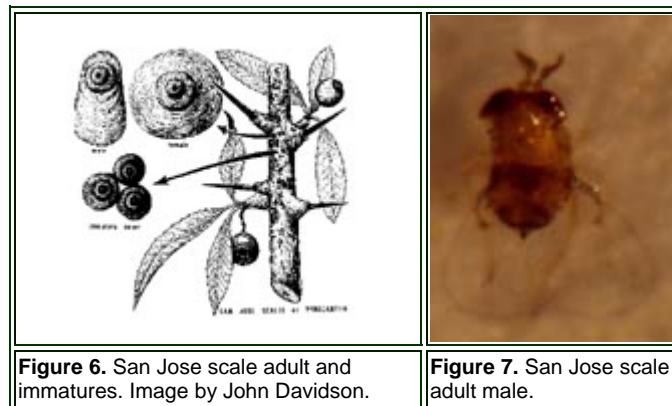


Figure 6. San Jose scale adult and immatures. Image by John Davidson.

Figure 7. San Jose scale adult male.

long with the raised nipple near one end. Nymphs or crawlers have six legs, are yellow, somewhat oval, about 1/100 inch (0.3 mm) long, and resemble tiny larval mites.

Seasonal History and Habits

San Jose scale overwinter primarily in immature life stages that are nearing adulthood beneath their protective coverings. The scale remains inactive until sap flow begins in the spring. Development resumes as temperatures reach 51°F. In warmer Southeast winters, mature females also overwinter. In fact, all San Jose scale stages may be present throughout the year, except during the coldest winter weather. Some overwintering nymphs develop into males and some into females. Females remain stationary beneath their scale covering throughout their lives. In central Georgia, males emerge from beneath their scale covering in April. Males are tiny, winged insects that search out female scales and mate. Four to five weeks after mating (sometime in May), females give birth to living young (crawlers). Females produce crawlers, about 10 per day for two to three weeks, depending upon temperature. Crawlers emerge from under the female scale and move to new sites of infestation on bark, leaves, or fruit. The crawlers can walk considerable distances (2-4 m) or be blown by the wind. It is possible for scale crawlers to be wind blown into orchards from adjacent hedgerows, wooded borders, or orchards. Within one day after emerging, crawlers settle, insert their mouthparts into a host, and begin to feed. Within two to three days of settling, crawlers begin to secrete their protective coating. The coating is enlarged (waxes and molted skins) as the insect grows. There are four or more generations of San Jose scale per year in much of Georgia, with only two generations in Arkansas. San Jose scale has a very high reproductive potential. Serious infestations can develop between harvest and the onset of winter. This is especially true when abundant late-summer rainfall promotes succulent growth favorable for scale development.

Control

Trees and fruit should be inspected frequently for the presence of scale insects. Scales blend in well with peach bark and are generally hard to see. Controls are suggested when scale lesions were present on fruit the previous year or when scales are found on wood during pruning. Most southeastern peach orchards should receive one dormant oil application every year, primarily for scale control. A second oil application, dormant or delayed-dormant, is advised if orchard history suggests a need. Mark heavily infested trees so you can readily monitor scale development. Pruning out infested branches or suckers can modestly reduce scale abundance. Careful tree training also opens the canopy, which facilitates better spray coverage.

The most common and effective scale control options are two oil applications made during dormancy to kill overwintering scales. Complete coverage with dilute sprays is critical because the oil must coat the scales to kill them. Further in-season scale control is achieved by insecticide sprays targeting the first crawler generation in May. In mid-March, place a San Jose scale pheromone trap in the upper half of each of three scale-infested trees. Monitor traps for male ([Figure 7](#)) capture twice weekly. Once you notice captured males, begin accumulating degree-days (developmental base of 51°F). Crawler emergence occurs 400 to 700 degree-days after initiation of male emergence (early May). Wrap scale-infested branches with double-sided sticky tape (or black electrical tape coated with petroleum jelly) and check tape for scale crawlers twice per week. Spray insecticide promptly when the yellow crawlers appear on the tape and continue sprays every 10 days until no crawlers are captured (usually two sprays are adequate). These sprays should be applied with sufficient volume to wet the wood. In some cases where heavy infestations exist, post-harvest applications may be required and repeated for several years.

WHITE PEACH SCALE

White peach scale, *Pseudaulcaspis pentagona* (Targioni-Tozzetti), is a key pest of southeastern peach. White peach scale is a native of the Orient, but is now found worldwide. The white peach scale was reportedly introduced into the United States in the late 1800s by a nurseryman at Thomasville, Georgia. White peach scale attacks several hundred plant species, but is very common on peach, privet, chinaberry,

mulberry, and persimmon. It is a serious pest of peach. In the early 1900s, thousands of peach trees were lost to white peach scale in Florida and South Georgia.

Description



Figure 8. Female white peach scale cover with eggs.

Adult females of the white peach scale are creamy-white to reddish-orange, oval to circular, sac-like insects, about 1/30 to 1/25 inch (0.8 to 1.0 mm) in diameter. Females live beneath a waxy scale covering (Figure 8) which is oval to circular, grayish to brownish-white, convex, and about 1/12 to 1/10 inch (2.0 to 2.5 mm) in diameter. White peach scale females produce yellowish eggs beneath the scale covering

Adult males are tiny, yellowish, two-winged insects about 11/36 inch (0.7 mm) long, with a wingspread of about 3/50 inch (1.5 mm). They are rarely seen. Male white peach scale coverings are elongate, snowy white, about 3/50 inch (1.5 mm) long, and commonly found in clusters, typically on the lower branches .



Figure 9. White peach scale crawlers (males pink, females translucent).

Nymphs or crawlers are tiny, oval, whitish to orangish insects with six legs (Figure 9).

Seasonal History and Habits

White peach scale overwinter primarily as fertilized females beneath scale coverings. Overwintering females begin laying eggs in February and March. They first lay orange-colored eggs that will become females, then pinkish eggs, which will become males. Eggs are laid underneath the scale covering. Each female lays 100 to 150 eggs, usually over an 8 to 15 day period. Eggs hatch within two to five days.

Upon hatching, crawlers immediately leave the protection of the parent scale and move to new sites to settle. Crawlers frequently do not move far from their parent, some even anchor under the parent scale. Male white peach scale crawlers locate in clusters on older, lower portions of the tree. Female crawlers are generally more active than male crawlers and may disperse throughout the tree, although they are seldom seen on terminal, green wood, or fruit. Crawlers soon anchor at a new site, insert their slender mouthparts and begin to feed. About seven to nine days after hatching from the eggs, anchored crawlers molt and begin forming their own scale covering. The scale covering is cemented firmly to the bark and is relatively impermeable.

A third molt gives rise to the adults. Adult females remain under their scale throughout their life. Winged adult males emerge from beneath their scales, seek out females, and mate. Males do not feed and die shortly after mating. Mated females soon begin to lay eggs. Females usually die following oviposition. A complete white peach scale generation, from egg to egg, takes 50 days at 75°F. Developmental time is temperature dependent and varies considerably in the field.

Control

Several parasites and predators attack white peach scale, but in commercially managed peaches, natural enemies seldom provide acceptable control. Insecticide applications specifically for scale control are

usually required. Armored scales are difficult to kill with insecticides. The mainstay of control is application of two dormant oil treatments ideally at two-week intervals. These treatments provide a reasonable degree of control. Well-timed insecticide applications aimed at the unprotected crawlers provide good control. Both methods should be used where white peach scale infestations are chronic or heavy.

Crawlers are unarmored and susceptible to insecticides for only seven to nine days, so identifying the periods of egg hatch and crawler activity is critical to the proper timing of crawler sprays. These periods vary with season and location. To pinpoint crawler activity, identify infested trees and check scale development twice a week. To monitor crawler emergence of either white peach scale or San Jose scale, find a limb heavily infested with scale. Be sure you have a vigorous infestation with mostly live scale. Check by carefully picking the scale covers off of adults with a pocketknife. Use a hand lens to examine the scale you uncover. Live scale are moist, creamy white to reddish-orange in color, whereas dead scale are shriveled and either black or gray. Once you locate a vigorous infestation, wrap the limb with double-sided sticky tape or black electrical tape coated with petroleum jelly. When crawler emergence begins, the tiny crawlers will be caught crossing the tape. Monitor tapes twice weekly. With a hand lens, crawlers are easily seen against the tape. Spray as soon as feasible after you find scale crawlers. If emergence continues, spray again a week later. Thorough coverage is essential. Dilute airblast application with at least 150 gals/acre will work, but handgun application does a better job, especially against white peach scale. Approximate peaks of white peach scale crawler generations are based on observation and the references cited.

Middle Georgia (Yonce and Jacklin 1974): April 21, July 1, August 5, October 5

South Georgia (Kuitert 1967, Van Duyn and Murphy 1971): March 21, May 5, July 15, September 21

Two or more crawler generations may develop each year after harvest. Make special efforts to detect and control these late season crawlers. Crawlers of the third generation are known to be very important in the spread of white peach scale. In middle Georgia, the August borer spray normally provides an important component of overall white peach scale control. In south Georgia, borers should be treated immediately after harvest. A special scale treatment applied between mid-September and late October is very valuable for scale and helps with borer control. Always monitor for crawlers and time sprays accordingly. If post-harvest crawler generations are not controlled, a heavy scale infestation may be carried into the winter, making control even more difficult the following year.

Spray coverage is also critical for good control. To be effective, both dormant oils and crawler sprays must be applied with sufficient volume and pressure to thoroughly cover the woody portions of the tree.

REFERENCES

- Ball, J. C. and J. E. Brodgon. 1978.** White peach scale in Florida. FL Coop. Ext. Serv., IFAS. Pub., Entomol. 38. 4p.
- Bobb, M. L., J. A. Wiedhaas, Jr. and L. E. Ponton. 1973.** White peach scale: life history and control studies. J. Econ. Entomol. 66: 1290-1292.
- Johnson, D. T. 1984.** The codling moth and San Jose scale monitoring program in Arkansas. Proc. AR State Hort. Soc. 105: 137-140.
- Kuitert, L. C. 1967.** Observations on the biology, bionomics, and control of the white peach scale, *Pseudaulacaspis pentagona* (Targ.). Proc. FL State Hort. Soc. 80: 376-380.
- Van Duyn, J. and M. Murphy. 1971.** Life history and control of white peach scale, *Pseudaulacaspis pentagona* (Homoptera: Coccoidea). FL Entomol. 54: 90-95.
- Yonce, C. E. and S. W. Jacklin. 1974.** Life history of the white peach scale in central Georgia. J. GA Entomol. Soc. 9: 213-216.