

# Scale insects

## Hard and soft scales

### Background

Scale insects refer to a large group of sucking insects from the order Hemiptera, which includes such groups as aphids, psyllids, stink bugs, shield bugs, whiteflies, pirate bugs and other groups. There are more than 20 families of scale insects world-wide including hard or armoured scales (family Diaspididae), soft scale (family Coccidae), ground pearls or margarodid scales (family Margarodidae), mealybugs (family Pseudococcidae), felt scales (Eriococcidae) and other smaller groups, e.g. cochineal insects (family Dactylopiidae). While all scale insects are basically a sap-sucking sack, there is a surprising amount of diversity in the biology of these insect groups.

This factsheet discusses the generalised lifecycle of scale insects and the difference between 'soft' and 'hard' scales. Refer to the [scale insect pest management plan](#) for more detail on the biology of commonly encountered scale groups including common species encountered in a production nurseries in Australia. Also refer to the pest management plan for detailed strategies for managing scale insect pests. Refer to the [mealybug factsheet at the NGIA website](#) for the biology and management of this group specifically.

### Generalised biology of all scale insects

All scale insects have a similar basic biology, though exceptions occur. Scale insects are sack-like and often do not have functional legs. The 'scale' refers to a substance secreted over the back of the insect. In most cases, adult females are sedentary and do not move. Most species lay eggs underneath their body, though some lay live young. Some species are parthenogenetic, meaning that they can



Fig. 1. Coccid (soft) scale insects attended by ants.

reproduce without mating, others are hermaphroditic, e.g. some species from the genus *Icerya* have both male and female reproductive organs. Females are relatively long-lived, perhaps surviving a number of weeks to months under good conditions. Their main role is

to reproduce and they do this very well, often being able to lay hundreds of eggs over their lifetime.

Males, when they occur, are very different in appearance to females (Fig. 3). They are generally smaller than females and appear superficially similar to whiteflies or gnats. Similar to flies, they only have one pair of functional wings; their hindwings are much reduced. They always have functional legs, but some species do not have any wings. Males do not feed, are short lived and only serve to mate with females.

First instar nymphs (that either hatch from eggs or are live born) are called crawlers. Crawlers are the main means that scale insects are naturally dispersed. They are generally very small, being about a millimetre long or less, have functional legs and antennae. They are very light-weight and can disperse with the wind easily. Some species have been reported to be phoretic, meaning the crawler attaches to an insect and 'hitch-hike'. Some species also attach to male scales, e.g. some species from the genus *Cystococcus*.

After moulting to second instar, most scale insects become immobile for the rest of their life; their legs are reduced or absent. They grow in size, but are similar in appearance to females. Nymphal females have two or three nymphal instars before becoming an adult. Males always have four nymphal instars; the last of which is metamorphic and called a pupa.

All scale insects excrete honeydew, which is basically plant sap, high in sugar. Ants may attend scale insects, collecting honeydew. Honeydew is also dropped or shot away from the body. Black sooty mould often grows on leaves that have received honeydew.

### Typical damage caused by scale insects

Feeding on young, growing tips can cause distorted foliage. Feeding on leaves may cause them to yellow and plants may appear water stressed. Heavy infestations can cause stems and branches to dieback; unhealthy plants may die. Scales present on fruit may cause them to be blemished or distorted, particularly if present when fruit are developing. A small number of species induce ornate galls in their host plants.

As mentioned above, honeydew often causes the growth of black sooty mould, which can be extremely unattractive and may cause plants to be unsaleable. Black sooty mould is superficial and can sometimes be removed with some fungicide applications, but is only recommended after scale insects have been eradicated.



**Fig. 2.** Pink wax scale on *Schoenoplectus*, lake club rush (top). Soft wax scale, *Ceoplastes* sp. (middle - John. A. Weidhass, Virginia Polytechnic Institute and State University, Bugwood.org); cottony camellia scale (bottom - United States National Collection of Scale Insects Photographs, Bugwood.org).

## Soft scale vs hard scales

The terms soft and hard scales do not refer to the firmness of their body; some soft scale are more firm and tougher than some hard scale. Hard scales produce a waxy 'scale' above their body that is not connected to the soft body present underneath the armour (Figs. 3-4). In other words, the scale insect lives underneath a protective cover. In contrast, soft scales and most other scale insects are directly connected to their protective covering. This has implications for chemical control. Any contact produce contacting the outer surface of the hard scale does not come in contact with the body of the insect. Therefore, products that are translaminar, systemic or have a fumigant action must be applied if managing scale insects with pesticides.

While the outer layer of soft scales is part of the body of the insect (Figs 1-2), many species secrete a thick waxy cuticle or ornate waxy exudates that causes pesticides to be sloughed off. Therefore, some soft scales also require similar pesticides to be effective.

## Monitoring

Monitoring is essential for all pests, diseases and general plant health. Monitoring provides essential information for making management decisions. At any given time, it will detect the presence and numbers of scale insects, their natural enemies (predators and parasitoids) and other pests and diseases. Regular monitoring can be used to determine the change in numbers, i.e. whether populations are increasing or decreasing. This information is extremely valuable and informs how effective each management action has been.

Monitoring for scale insects should include visual observations including turning over leaves, looking for black sooty mould and the presence of ants on plants. Plants that have scale insect damage, or are otherwise unhealthy, should be examined more carefully. Use a x10 or x20 hand lens, where necessary, and examine stems, petioles, leaves, under leaf sheaths and roots.

Once scale insects have been observed, check for the presence of egg masses and crawlers; this may involve removing female scale insects as eggs are often laid under their body. This is important as it indicates that populations will increase quickly if management actions are not taken. The proportion of different life stages present, most notably crawlers, may also change the exact actions taken; crawlers are susceptible to pesticides, but other stages are more tolerant.

It is recommended to have scale insects that are regularly encountered identified to access more

specific information on their biology. Management actions can then be tailored specifically.

## Management of scale insects

Even small numbers of scales on a plant that is sold may cause significant issues for ultimate customers. Therefore, plants should be sold without any scale insects present. Management of scale insects should focus on preventing infestations and managing populations before they cause economic loss. Scale insects are notoriously difficult to control once established as they are often tolerant to pesticides or protect their offspring from contact. Fortunately scale insects can be managed effectively if nursery managers are proactive. These management actions include cultural, chemical and biological control options.

Many cultural management practices minimise infestations by scale insects and these are discussed in more detail in the scale insect pest management plan. It is recommended to inspect new stock carefully and to self quarantine stock for a period of time prior to inclusion with the rest of the nursery. Squash small numbers of scales present but carefully monitor as it can be difficult to eradicate all individuals by squashing. Only propagate from plants without any pests or diseases.

Remove plants with heavy infestations, taking care to reduce spread of scale insects while doing so. If infestations are limited to a particular branch and it can be pruned, remove this plant material and monitor closely to ensure the rest of the plant is clean. Also remove crop debris regularly and disinfest the growing area to reduce reinfestation of pests into the crop.



**Fig. 3.** Hard scale with cover removed showing body beneath. Photo by J.A. Davidson, Univ. Md, College Pk, Bugwood.org)

Control ants as they spread crawlers and protect scale insects from natural enemies.

There are a number of commercially available predators and many naturally occurring parasites and predators that may occur in the nurseries if use of pesticides is minimised. Refer to the pest management plan and biological control agent producers for details on commercially available predators suitable against scale insects.

### Chemical control

Scale insects are difficult to manage using pesticides alone. Contact products tend to be sloughed off their waxy body and they may be tolerant to systemic products. If pesticides are to be used to manage scale insects it is recommended to apply contact products only when there is a high proportion of crawlers present. Crawlers are very susceptible to many pesticides, including oil-based products. If high populations are present it is recommended to remove highly infested plant material and then apply with a systemic product, perhaps combined with an oil or detergent based product if this will not cause a phytotoxic reaction to the plant. Also, consider modifying the way that pests are managed, such that monitoring is conducted more frequently; increase the use of cultural management options.

Consecutive weekly pesticide applications will almost always be required if using pesticides to manage scale insects. Even then, total control may not be achieved. It is always recommended to rotate between active ingredients from at least three different mode of action groups. This will reduce the likelihood of inducing pesticide resistance substantially.

Pesticides will almost always significantly reduce predator populations. Some products can be active against predators for months after application, but have limited or negligible impact on pest populations after the initial application. Therefore, carefully consider whether it is necessary to apply pesticides, particularly when they have a long residual impact on beneficial populations. Refer to the pest management plan for detailed recommendations on pesticide applications.

**Version 2.** This document was updated by Andrew Manners (Agri-science Queensland, Department of Agriculture and Fisheries, Ecosciences Precinct, GPO Box 267, Brisbane QLD 4001) as part of NY15002 Building the resilience and on-farm biosecurity capacity of the Australian production nursery industry in 2016. Thanks go to John Duff and Lindy Coates for helpful comments on previous versions of this factsheet. Photographs in this factsheet have been taken by DAF staff unless otherwise acknowledged.



**Fig. 4.** Hard scales. Latania scale *Hemiberlesia lataniae* (above); *Chionaspis* sp. scale with crawlers under armour. Photos by J.A. Davidson, Univ. Md, College Pk, Bugwood.org);