

Scale in citrus

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- Scales are unusual insects, appearing to lack legs and eyes. Eleven species have been found on citrus in WA.

Damage

- Scales produce honeydew (a sugary substance) as they feed.
- Sooty mould (a fungus) grows on top of the honeydew, coating leaves, twigs and fruit in a black powder (Figures 2, 3). Sooty mould can delay colour break and interfere with photosynthesis.
- At high populations, scales can defoliate trees and kill twigs, but this type of damage is rare.

Life cycle

Adult stages

- Female scales do not need to mate in order to lay eggs. Some species of scale lay eggs, others give birth to live young.
- Eggs or crawlers are laid into the body cavity or into the waxy cover.
- The female dies after laying eggs and eggs and crawlers may remain under her body for a few days.
- To check if eggs or crawlers are present, lift up the scale cover. If you find 'powder' under the scale, these are likely to be eggs.
- **Males** are insect-like with legs and wings and are highly mobile. They are short lived (1 day or less) and do not feed. Males are rare in many scale species.

Immature stages

- Crawlers are minute: usually less than 1 mm in size. They can be dispersed by wind, pickers and by birds.
- After a few hours or days, crawlers settle in small depressions on twigs, fruits, or leaves.
- Once they have found a suitable feeding site, the crawler inserts its piercing mouthparts into the plant and begins to produce a waxy covering. The crawler molts (sheds its skin) to become a first instar.
- Depending on the species, there can be up to three moults or instars between the crawler and adult stage.



Figure 1. Red scale (*Aonidiella aurantii*) on lemon. Outbreak occurred after application of non-selective insecticides.



Figure 2. Sooty mould on leaves and fruit caused by a heavy soft brown scale infestation.



Figure 3. Hard wax scale (*Ceroplastes sinensis*). Outbreak occurred after application of non-selective insecticides.

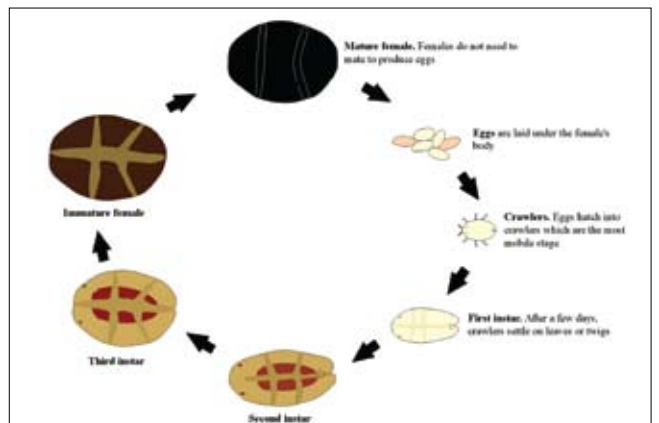












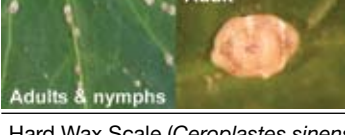





Figure 4. Scale life cycle (black scale shown).

Important Disclaimer

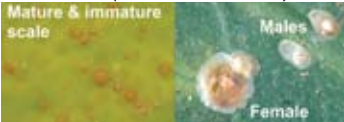
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Table 1. Scale species found in WA citrus*

Common name (Scientific name)	Description	Distribution	Action level	Biological control
Soft scales				
Soft Brown Scale (<i>Coccus hesperidum</i>)				
	<p>Size: 3-4 mm</p> <p>Nymph: yellow-green, yellow-brown, flat & oval.</p> <p>Adult: brown, sometimes mottled, oval.</p>	All citrus growing areas. Not common in northern WA.	15% or more of green twigs infested.	
Black Scale (<i>Saissetia oleae</i>)				
	<p>Size: 3-5 mm</p> <p>Nymph: yellow-green, flat, oval; later instars have 'H-pattern' on back</p> <p>Adult: black, dome-shaped, 'H-pattern' not present in older scale.</p>	Most WA citrus growing areas. Also a major pest of olives.	10% or more of green twigs infested with 1 or more scales; mandarins: 5% or more of green twigs infested.	
Citricola Scale (<i>Coccus pseudomagnoliarum</i>)				
	<p>Size: 3-4 mm</p> <p>Nymph: translucent, yellow-green, flat, oval. No H-pattern on back</p> <p>Adult: grey-brown, mottled, oval</p>	Not common in WA citrus.	15% or more of green twigs infested with 1 or more scales.	
Cottony Cushion Scale (<i>Icerya purchasi</i>)				
	<p>Size: 5 mm</p> <p>Nymph: orange-red body</p> <p>Adult: red-brown, females may be covered by a mealy secretion; distinctive egg sac (photo left)</p>	Common in citrus, rarely causes damage.	5% or more of green twigs infested with 1 or more scales	
Green coffee scale (<i>Coccus viridis</i>)				
	<p>Size: 3-4 mm</p> <p>Nymph: translucent, yellow-green, flat, oval</p> <p>Adult: yellow-green, oval, u-shaped gut visible</p>	Rare.	5% or more of green twigs infested with 1 or more scales	
White Wax Scale (<i>Ceroplastes destructor</i>)				
	<p>Size: 6 mm</p> <p>Nymph: white</p> <p>Adult: white, soft & moist. When squashed, body underneath is red-dark brown</p>	Limited distribution: Harvey, Capel, Nannup.	5% or more of green twigs infested with 1 or more scales.	
Pink Wax Scale (<i>Ceroplastes rubens</i>)				
	<p>Size: 3-4 mm</p> <p>Nymph: pale pink</p> <p>Adult: when squashed, body underneath is pink-red, lobes either side of body</p>	Rare.	5% or more of green twigs infested with 1 or more scales.	
Hard Wax Scale (<i>Ceroplastes sinensis</i>)				
	<p>Size: 7 mm</p> <p>Nymph: pink-red body, white waxy filaments giving a 'star' shape</p> <p>Adult: hard pink-white dry wax, body underneath is red</p>	Burekup, Harvey, Capel.	5% or more of green twigs infested with 1 or more scales	

Hard (or armoured) scale

Red Scale (*Aonidiella aurantii*)

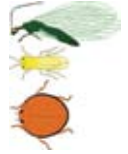


Size: 2 mm

Nymph: red, thin, circular
Adult: female – red-brown circular, male – elongated, paler than female

Most common scale pest. Found in all citrus growing areas.

1 – 3+ scales on 10% or more fruit. Later varieties/early-mid season, 1 or more scales on 15-20% or more of fruit.



Circular black scale (*Chrysomphalus aonidum*)



Size: 2 mm

Nymph: brown to black, circular
Adult: female – reddish-brown to black, round; male – elongated

Rare. Also pest of bananas.

10% or of more fruit infested with 1 or more scales.

Mussel scale (*Lepidosaphes beckii*)



Size: 3-4 mm long

Nymph: similar to adult
Adult: female – brown, shaped like a mussel shell; male – brown, narrower

Rare.

20% or more of more fruit infested with 1 or more scales.

Key:



* Scales most commonly found in citrus in WA are shown in this publication.

Identifying scale

- There are two types of scale: 'soft' and 'hard' (or armoured). Soft scales do not have a separate protective covering whereas armoured scales do. Examples of soft scale include soft brown and white wax scale. The most common armoured scale is red scale.
- Shape and colour are the two main features to take into account when identifying scale. You may need a hand lens to see scale.
- Scales are active from spring to autumn, less active in winter.

Monitoring

- At a minimum, check for the presence or absence of scale on five randomly selected green twigs (5-10 leaves per twig) per tree.
- For red scale, check five randomly selected fruit per tree.
- The total number of trees you need to sample depends on block size. As a rough guide, try to sample at least 10 trees per block.

Managing scales

- Scale are **not normally a serious** problem in citrus, unless the predator and parasite complex (beneficials) has been destroyed.
- This can occur through: (1) application of non-selective insecticides, e.g. use of cover sprays to control Mediterranean fruit fly; (2) scale infesting areas where natural enemies do not occur; or (3) disruption of biological control by weather.

Ant control

- Because ants often defend scale insects from predators and parasites, their control is important. Separate Farmnotes are available on ant control.

Biological control

- Beneficials can be bought and released to control scale. Note that beneficials will die if released onto leaves that have been treated with insecticide.
- Scales are best controlled when crawlers and newly settled young scales are present.

Parasites

Aphytis species

- Target: red scale
- The only commercially available parasites are for control of red scale. These are *Aphytis lignanensis*, which is suited to tropical conditions, and *Aphytis melinus*, which is more suited to temperate conditions.
- For *A. lignanensis*, releases are recommended from March-April. For *A. melinus*, release from November-March. *Aphytis* are supplied as adults. More than one release may be required.



(a) *Cryptolaemus montrouzieri*



(b) Red *Chilocorus*



(c) green lacewing larva



(d) green lacewing adult

Predators

Mealybug ladybird (*Cryptolaemus montrouzieri*)

- Target: cottony cushion scale, soft brown scale, black scale, citricola scale, citrus mealybug
- *Cryptolaemus* are sold as adults, but may also occur naturally in the orchard.

Red Chilocorus (*Chilocorus circumdatus*)

- Target: red scales
- Red *Chilocorus* are sold as adults.

Green lacewing (*Mallada signata*)

- Target: Soft scales, aphids, white flies
- Lacewings are supplied as eggs; the larvae hatch shortly after their arrival.

Chemical control

- Soil applied insecticides such as Confidor are effective at reducing scale populations on young trees that are not fruit bearing. However, they do disrupt IPM programs since all prey on the trees are killed.
- Horticultural oil sprays work well with IPM programs and give very good control of most scale insects when timed and applied well.
- Oils do kill some beneficial wasps and suppress beneficial mite populations. However, residues do not persist and *Aphytis* wasps can be released soon after treatment.
- Oil sprays can damage trees, particularly when applied in hot weather when trees are water stressed.
- Always check the label before spraying as not all oils are registered for use in citrus.

Acknowledgements

Photograph of citricola scale nymph and male and female red scale by Jack Kelly Clark (University of California); photographs of circular black scale nymphs and adults, green coffee scale on leaf by Chris Freebairn (©State of Queensland, Department of Primary Industries & Forestry). All other scale photos by Sonya Broughton.

Further reading:

Citrus pests and their natural enemies: integrated pest management in Australia edited by D. Smith, G.A. Beattie & R.H Broadley, published by Queensland Department of Primary Industries, 1997.