

Table 1. Risk and monitoring period for red scale activity.

Flowering			Fruit drop		Golf ball			Colour break		Maturation		
Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	

Description

Crawler and white cap: females give birth to mobile, live young called crawlers, which are pale yellow and tiny (<0.5 mm). They soon settle and start to secrete a wax cover, becoming 'white caps' (Figure 1 and Figure 2).

Immature: an immature female scale moults twice to become the third instar, which develops into a mature female. A male scale moults once to become a second instar, which develops into a pre-pupa, pupa and then an adult male. The scale cover becomes red after the first moult.

Adults: mature females remain under the round, reddish-brown scale cover. Mature males emerge from the elongated scale cover, are yellow, winged and about 1 mm long.

Similar pests

Yellow scale appear similar and are commonly found in the southern growing regions. Circular black scale occurs in coastal and northern regions. The scale cover is distinctly darker than red scale.

Life cycle

Red scale usually has 3 to 4 generations in southern areas, but can have 5 to 6 in northern regions, depending on temperature. Only crawlers and adult males are free moving.

Damage

Red scale infests leaves (Figure 3), fruits, twigs and limbs of all citrus varieties. Heavy infestations cause leaf drop and twig dieback. Scale downgrades fruit and is a quarantine pest of concern for some export markets.

Thresholds are complicated and vary depending on the time of year, the intended market and the level of biological control present.

Risk period is from November to April (Table 1).

Monitoring

Use a 10x hand lens to check fruit for scales at least monthly from November to April. It is important to monitor and detect early stages before fruit are heavily infested (Figure 4). Also monitor for scale parasitism;



Figure 1. Stages of red scale. Inset photo: JK Clark, UC Regents.

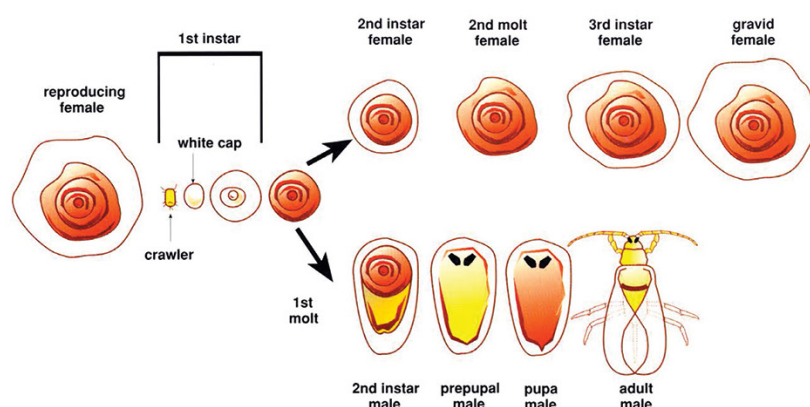


Figure 2. Red scale life cycle. Source: Forster et al. (1995).



Figure 3. Red scale can infect leaves as well as fruit.

IPDM for the citrus industry



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this can be difficult and is best done by a professional pest scout. A high level of parasitism might negate or delay the need for a spray. A horticultural mineral oil application is the least disruptive red scale control option for parasitic wasps.

Traps: pheromone traps can be used to determine male flights and help time applications to target young growth stages. Once a peak in males has been determined, the [NSW DPI red scale prediction tool](#) can be used to predict when young scales are present.

Management and control

Cultural: minimise dust; use high pressure washing at the packing house.

Biological: good parasitism levels reduce the need for chemical sprays. *Aphytis melanus*, *A. lingnanensis* (Figure 5) are the most important natural parasites for red scale. They parasitise the scales by laying their eggs under the scale covers onto the scale body (ectoparasite).

Comperiella bifasciata wasps are naturally occurring and parasitise red scales by laying their eggs inside the scale body (endoparasite; Figure 6).

Rhyzobius lophanthae is a scale-eating lady beetle. Both the larvae and adult beetle feed on red scale (Figure 7).

Chemical: chemical control of red scale is difficult due to its sedentary habit and wax covering. Control is best when targeting young scale growth stages and good coverage of the entire tree is essential.

Horticultural mineral oils have minimal effect on beneficials and are best used during peak crawler abundance. Good spray coverage is essential. Resistance risk is minimal.

Insect growth regulators are less toxic to some natural predators but are very disruptive to lady beetles. They are most effective against first instar scales.

Systemics move into the plant. If applied to foliage, spray coverage is still important for good results. Soil-applied systemics must also be applied carefully to ensure uptake to all parts of the tree. Soil application reduces direct effects on natural predators. Development of resistance is a concern.

Organophosphates have a high effect on beneficials. They are most effective against young scales but can control all ages. Residues are no longer allowed in some markets.

Reference

Forster L, Luck RF and Grafton-Cardwell E. 1995. *Life stages of California red scale and its parasitoids*. Publication Number 21529E. University of California Division of Agriculture and Natural Resources, <https://anrcatalog.ucanr.edu/pdf/21529E.pdf>.

More information

[Red scale prediction tool](#)



[Biological Services](#)



[Bugs for Bugs](#)



[NSW DPI website](#)

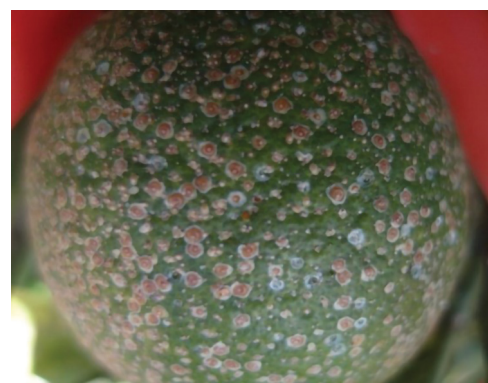


Figure 4. Fruit infested with red scale.



Figure 5. *Aphytis* wasps are important parasites of red scale.



Figure 7. *Rhyzobius lophanthae* (larvae left and adult right).



Figure 6. *Comperiella bifasciata*.



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