

A preliminary timing guide for red scale management

By Jianhua Mo, Andrew Creek, Steven Falivene and Scott Munro

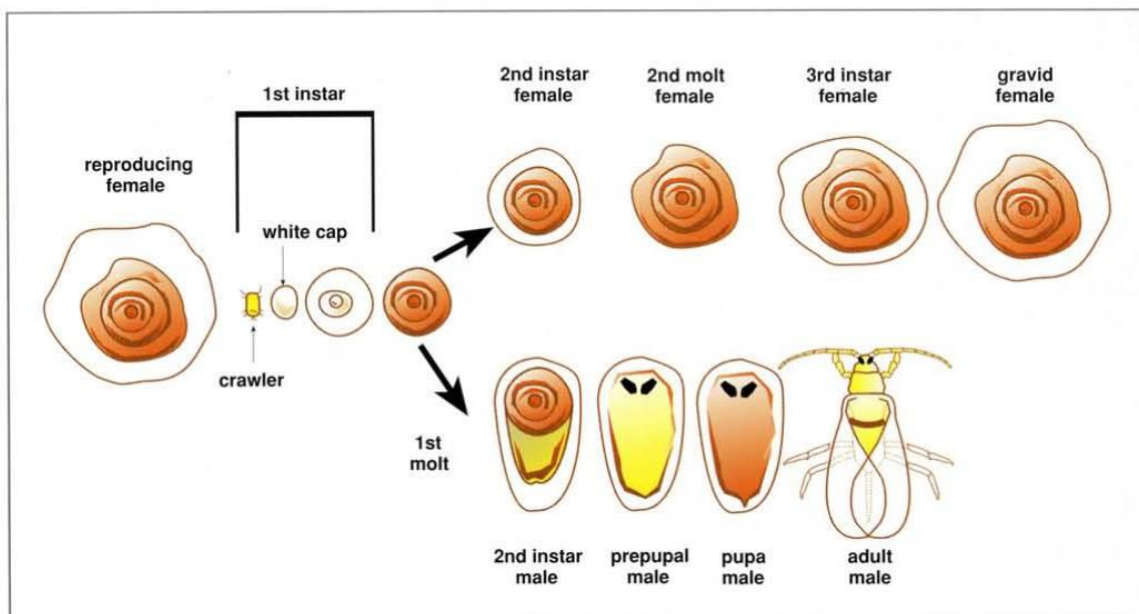
NSW Department of Primary Industries

Key points

- Management techniques for red scale
- Time control with life stage
- Tables to guide control timing

Red scale is a widespread pest of the citrus industry but can be managed if control measures are well-targeted and timed to coincide with specific life stages of the pest.

Red scale's life cycle starts as a crawler that emerges from underneath the cover of a female scale. It soon settles and starts to secrete a wax cover, appearing as a white-cap. From then on, a female scale moults twice to become the second and third instars and mature females. A male scale moults once to become the second instar then pre-pupa, pupa and adult male. Adult male scales have wings and can fly.



Red scale lifecycle. Source: <http://ucanr.edu/sites/KACCitrusEntomology/files/4457.pdf>

A commonly used chemical spray against red scale in the southern citrus regions is oil plus half-rate chlorpyrifos. The spray is only effective against crawlers and newly settled white-caps. Two of the other registered insecticides, pyriproxyfen (Admiral) and buprofezin (Applaud), are most effective when crawlers have completely emerged and become white-caps.

Red scale crawlers are tiny and difficult to see with the naked eye. To assist citrus growers in timing their red scale control, we have developed a preliminary timing guide based on two seasons' monitoring data of pheromone trap catches of adult male scales and seasonal abundance of crawlers in citrus orchards in the Riverina and Sunraysia.

Our pheromone trapping data showed a series of male flight peaks. There was a regular peak of male flights between mid-September and mid-October. From this peak to the following crawler peak, there was an average gap of 428 degree-days (DD) above 11.7°C. Table 1 shows the number of days before the next crawler peak when a male flight peak is detected between 1 October and 15 December. The estimates were obtained using long-term average monthly temperature data from the Bureau of Meteorology.

Table 1. Estimated number of days from a male flight peak to the next crawler peak based on long-term average monthly temperature data from the Bureau of Meteorology.

Male flight peak	Yanco	Griffith	Mildura	Loxton
1 Oct	55	60	61	63
15 Oct	49	53	54	57
1 Nov	40	44	46	49
15 Nov	38	41	42	47
1 Dec	34	36	37	41
15 Dec	32	34	35	39

To predict the timing of the next crawler peak using the above table, we need to know when male flight peaks. This can be found out by weekly monitoring with pheromone traps. We recommend placing four red scale pheromone traps (more than 20m apart) in a red scale infested block by late August and monitor trap catches weekly. A red scale pheromone traps consists of a yellow sticky card (available from www.bugsforbugs.com.au) and a red scale pheromone lure (available from www.entosol.com.au). The lure needs to be changed every four weeks.

For growers who do not use pheromone traps, the following table shows the average catches of adult males and crawlers across all sites and seasons in data analysed so far. Male catch (male flight) in the Riverina and Sunraysia was highest during March and April and lowest during June through to August and in November. Crawler numbers in the Riverina and Sunraysia were highest in November, followed by December, April, and May and lowest during June to September (Table 2).

Table 2. Average catches of adult males and crawlers across all sites and seasons.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Male	514	513	1024	1057	378	24	4	22	519	505	52	548
Crawler	3.35	2.83	4.58	5.19	4.21	1.08	0.17	0.05	0.26	3.27	7.69	5.91

Note: Data collected after Feb 2017 was not included in the estimation. Those data are yet to be analysed.

For growers who plan to release *Aphytis* wasps, timing of peak male flight is also a good indicator of the time when virgin females are abundant. The two stages need to be around the same time for reproduction. Virgin female is the preferred stage for *Aphytis* wasps to parasitise.

This timing guide will be updated when new data become available. An online degree-day calculator will also be published by the end of October to allow growers to use actual temperatures to predict male and crawler peaks.

Acknowledgement

This article is a contribution from the *Development of phenology models and a timing guide for the management of Californian red scale in Australian citrus* (CT15008) project, a strategic levy investment in the Hort Innovation Citrus Fund. The work has been funded by Hort Innovation using the citrus R&D levy, with co-investment from the NSW Department of Primary Industries and contributions from the Australian Government. Thanks to Peter Symens and Grant Napier for helping with data collection.