Development of phenology models and a timing guide for the management of red scale in Australian citrus

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Overlapping stages
### Management

**Biological**

- Aphytis wasps, Comperiella wasps, and *Rhyzobius* ladybird are common in the southern citrus regions.
- Aphytis wasps and *Chilocus* ladybird are commercially available.

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**Chemical**

**Mating disruption**

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Chemical control

- OPs (e.g. Lorsban) and carbamates (e.g. methomyl)
  - High impacts on beneficials
  - Only effective against first instar (crawlers, white-caps)

- Systemic insecticides
  - Imidacloprid (Confidor Guard), Spirotetramat (Movento), sulfoxaflor (Transform)
  - Imidacloprid may have negative effect on bees
  - Movento targets young scales. Timing is less critical for Confidor.

Chemical control

- IGRs
  - Pyriproxyfen (Admiral), buprofezin (Applaud)
  - More IPM compatible but adverse effects on some ladybird beetles
  - Only effective against first instar (crawlers, white-caps)

- Oils
  - No residual activity against beneficials
  - Best used during peak crawler abundance
  - Good results but need excellent coverage
Chemical Control

- Red scale distribution is patchy. Usually there is no need to spray the whole orchard.
- Red scale populations are usually kept at below damaging levels by natural enemies.
- Use of broad-spectrum insecticides may decimate natural enemy populations resulting in an increase of red scale populations.

Mating disruption

- Red scale females need to mate before reproducing.
- Overseas studies have shown potential of mating disruption in red scale control.
- Not yet trialed in Australia.
Vulnerable stages

Timing trials
(Oil + half rate chlorpyriphos)

November timing better than other timings
Predict timing of target stages

- Male red scale flights can be monitored with pheromone traps to predict crawler emergence
- Prediction tools have been developed in Spain and California

Male flights and crawler peaks - Riverina

A time-lag of 27-50 days between the 1st male flight peak (mid Sep – early Oct) and the 1st crawler peak (late Oct- mid Nov)
Take Home Message

- Biological control is the key to successful red scale management. Avoid the use of broad-spectrum insecticides where possible.
- Red scale populations are patchy. There is usually no need to spray the whole orchard.
- Oil and growth regulators are best timed to target crawlers, white-caps and first instar.
- Red scale females need to mate to reproduce. Males seek out virgin females by sex pheromone.
- Work is in progress to develop a timing guide for red scale control using pheromone trapping data.

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