

Aphytis

Armoured scale parasites

Biocontrol organisms

☞ *Aphytis lingnanensis*

☞ *Aphytis melinus*

Parasitic wasps of the genus *Aphytis* have long been recognised as highly efficient natural enemies of armoured scale insects. *Aphytis lingnanensis* does well in Queensland and northern New South Wales, whereas *A. melinus* is better suited to the drier citrus-producing areas such as the Murrumbidgee Irrigation Area, Riverland and Sunraysia districts of southern Australia.

Aphytis are tiny yellow wasps capable of short flights within a tree, or from one tree to the next. They are very slow to spread over longer distances. Two or three adult wasps can fit onto a pinhead and their distinguishing features are difficult to observe without a microscope.

The adult female wasp lays her eggs under the scale cover onto the body of second-instar and unmated mature female scales. After hatching, the developing aphytis larvae feed on the scale insects, ultimately killing them. The next generation of aphytis emerges about 3 weeks later to mate and continue the cycle. Adult wasps also use scales as a food source, killing them by direct feeding.

Each wasp will live for about 2 weeks under field conditions and each female is capable of laying over 100 eggs. Aphytis passes through



Plate 45: Aphytis wasp laying eggs in red scale

approximately three generations for every generation of red scale; that is, they cycle three times as fast.

Target pests

Armoured scale insects, including:

- ☞ Red scale *Aonidiella aurantii*
- ☞ Oriental scale *Aonidiella orientalis*
- ☞ Oleander scale *Aspidiotus nerii*

Armoured scales are insects that live on plants underneath the protection of hard scale covers. Adult females produce 150 or more eggs, which

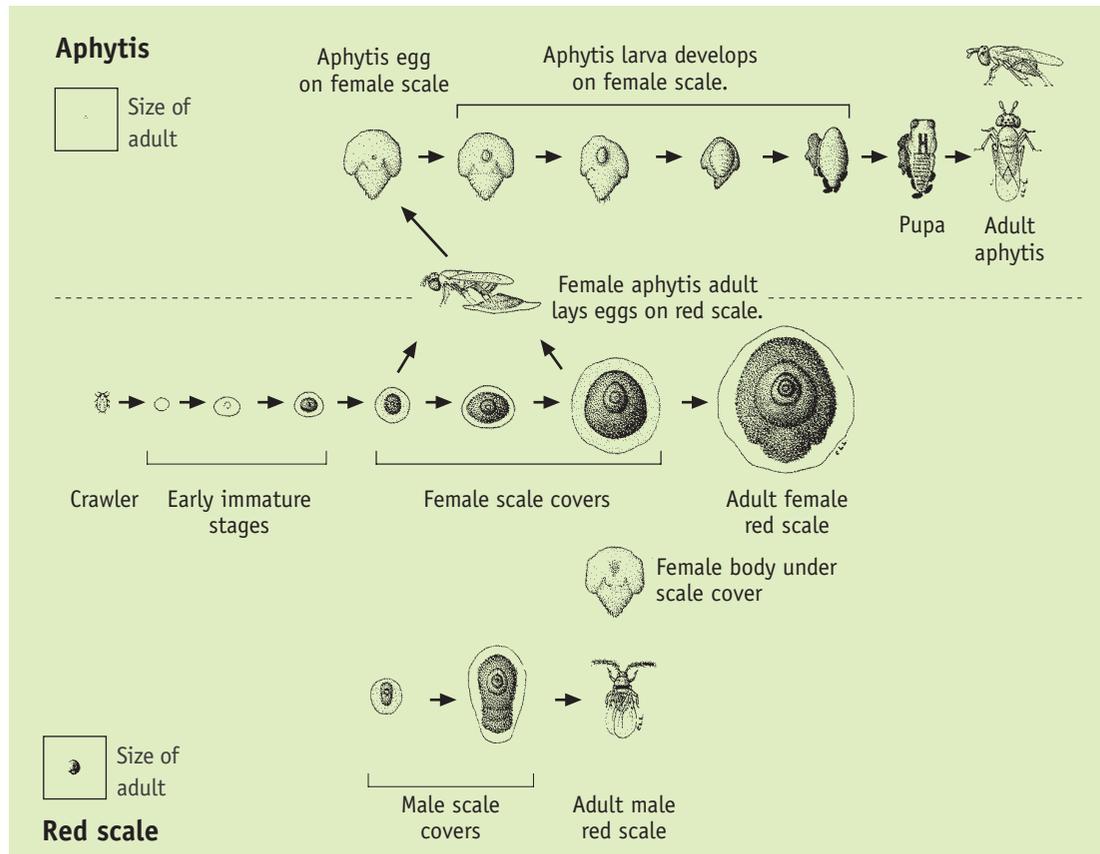


Figure 11: Life cycles of the aphytis wasp and of red scale

hatch into crawlers with six legs. Crawlers move to find a suitable place to settle, but can also be spread by wind, birds and fruit pickers. When the crawlers settle, they start feeding and produce circular covers by secreting waxy filaments.

Scale insects feed by sucking sap. They attack all plant parts, but are most prominent on the fruit. Heavy infestations may cause discolouration, leaf drop and shoot distortion, which can lead to bark splitting, twig dieback and even tree death.

Chemical control of scale pests is difficult because of the hard waxy covers protecting the insects. The developing resistance of scale insects to pesticides is also an increasing problem.



Plate 46: Aphytis pupa exposed by removing scale cover. The pupa forms after the larva has consumed the scale insect. An adult aphytis wasp will emerge from each such pupa.

Suitable crops/environments

Citrus is the main crop attacked by red scale, but other hosts include passionfruit, olives, walnuts, roses and ivy. Papaws and a wide range of ornamentals, such as palms and ferns, are hosts for oriental and oleander scales.

Aphytis wasps prefer healthy, well-foliaged trees, which provide shelter from extremes of heat and low humidity. Dust is harmful to most beneficial insects and mites, so effective pest management is unlikely in dusty areas such as along roadways. Irrigation can help to minimise dust.

Citrus trees up to 5 years old are usually poor candidates for biological control because they offer little natural shelter for beneficial organisms.

Before release

Aphytis should be released annually; multiple releases will help the parasites to establish. Aphytis may build up naturally without being released, but it will take much longer for numbers to reach those of an orchard where releases have been made. This can lead to higher scale populations at harvest, together with reduced quality and yield.

In winter, lower temperatures and a change in the availability of suitable scale stages for parasitism lead to a decline in aphytis numbers. It is best to release aphytis in spring and early summer before the scale insects have built up to damaging levels. Booster releases should be made in summer and autumn if pesticides have been used, if summer temperatures have been very high, or if scale levels are still high late in the season. Multiple releases may be required in blocks with a history of scale problems. Avoid toxic chemicals 4 weeks before and 4 weeks after any aphytis release.



Plate 47: Red scale on citrus fruit, showing crawlers, white caps and more advanced stages

At release

Aphytis is supplied either in plastic capsules or in paper cups. A capsule holds 1000 wasps and should be attached to a twig on the shaded side of the tree, with the capsule lid removed. A cup holds 10 000 wasps, which are distributed over nine folded strips of paper inside the cup. These paper strips should be placed in individual trees in a regular pattern to achieve the release rates suggested below. The cup itself is placed at the tenth release point. Standard citrus plantings (250 trees/ha) need one release point at every ninth tree to ensure uniform distribution over the block. For high-density plantings, make one release at every twelfth tree.

Recommended release rates

Citrus: Minimum 25 000 wasps per hectare (25 capsules or 2.5 cups per hectare)

Passionfruit: Minimum 50 000 wasps per hectare (50 capsules or 5 cups per hectare)

Where red scale populations are high, additional releases should be made. Consult with your aphytis supplier for optimum timing of releases.

After release

It is difficult to detect the adult wasps after release because they spend most of their life cycle developing within and feeding on the scale insect.

Regular monitoring by an experienced scout is recommended to check that the wasps are established. With some experience, the level of parasitism can be assessed with the aid of a microscope. Continue releases until at least 50% of available stages (second and unmated third instar female scales) have been parasitised.

Cultural practices to aid aphytis establishment

Farm practices that reduce wind, increase humidity and minimise dust in the orchard will help the aphytis to establish. Windbreaks and

overhead irrigation are effective means of achieving these conditions. Under-tree irrigation is less effective in increasing humidity but still valuable. Weeds and cover crops between rows also increase humidity within the orchard. Some weeds can be useful as a supply of nectar for adult aphytis to feed on.

Large populations of ants interfere with parasites and reduce their performance. In these situations ants should be controlled by selective spraying or should be excluded from the crop.

Chemical use

Aphytis wasps are very effective parasites of scale insects but they are delicate organisms and are easily harmed by pesticides. Copper fungicides, nutritional sprays and some miticides are safe for use with aphytis, however. Synthetic pyrethroids should never be used. Organophosphate and carbamate insecticides are also toxic and must be avoided; if they have to be used, however, allow at least 4 weeks to elapse before releasing parasites. If clean-up spraying is

warranted for scale control, an application of narrow-range petroleum spray oil is recommended. Drift of pesticides from neighbouring blocks should also be prevented.

Additional information

Aphytis is usually dispatched by overnight courier, where available, and should be received within 1–2 days. Honey is smeared under the lids of the capsules or cups to provide food for the wasps.

On arrival, the wasps should be released as soon as possible. In the event of adverse weather

such as extreme heat or high rainfall, they may be stored for 1–2 days in a cool, dark room at about 17°C before release. They should not be refrigerated. Extra honey should be placed under the lid as food for the wasps if the original supply has already been consumed.

Other natural enemies of red scale

The small parasitic wasp *Comperiella bifasciata*

The scale-eating ladybird *Rhyzobius lophanthae*



Plate 48: Red scale on citrus fruit and leaves

