

Encarsia

Whitefly parasite

Biocontrol organism

Encarsia formosa

Encarsia is a wasp parasite which has been widely used to control greenhouse whitefly for over 50 years in Europe, the United Kingdom and North America. The adult wasp is very small (about 0.6 mm long), with a dark head and thorax and a yellow abdomen.

The wasp is able to fly, making short hopping flights, and is attracted to whitefly scales by

the honeydew secretions and the scent the whiteflies give off.

Adult encarsia females lay their eggs inside the second, third and fourth nymphal stages of the whitefly, and also kill young scales by feeding on them directly. When the encarsia egg hatches, the wasp larva feeds inside the scale, which turns black within 2 weeks.

Female encarsia wasps will live 15–39 days and will lay 50–300 eggs, depending on conditions. Male encarsia are very rare, and make up less than 1% of the population.

The development time from egg to a new adult wasp varies from 31 days at 18°C to 10 days at 30°C. The lowest temperature at which the life cycle will proceed is 13°C. The optimum temperature range for development is 27–30°C, at which the egg-laying capacity of encarsia is twice that of the whitefly.

An average daily temperature of 23°C (with 15°C or higher at night) is the minimum for good control of whitefly by encarsia. An average daily temperature of 18°C usually produces an equilibrium between wasp parasite and whitefly host. Lower temperatures will favour the development of whitefly and reduce the effectiveness of encarsia.

Encarsia effectiveness is also reduced at relative humidities above 75%; and heavy deposits of honeydew and plants with very hairy leaf surfaces will decrease its searching ability. The wasps

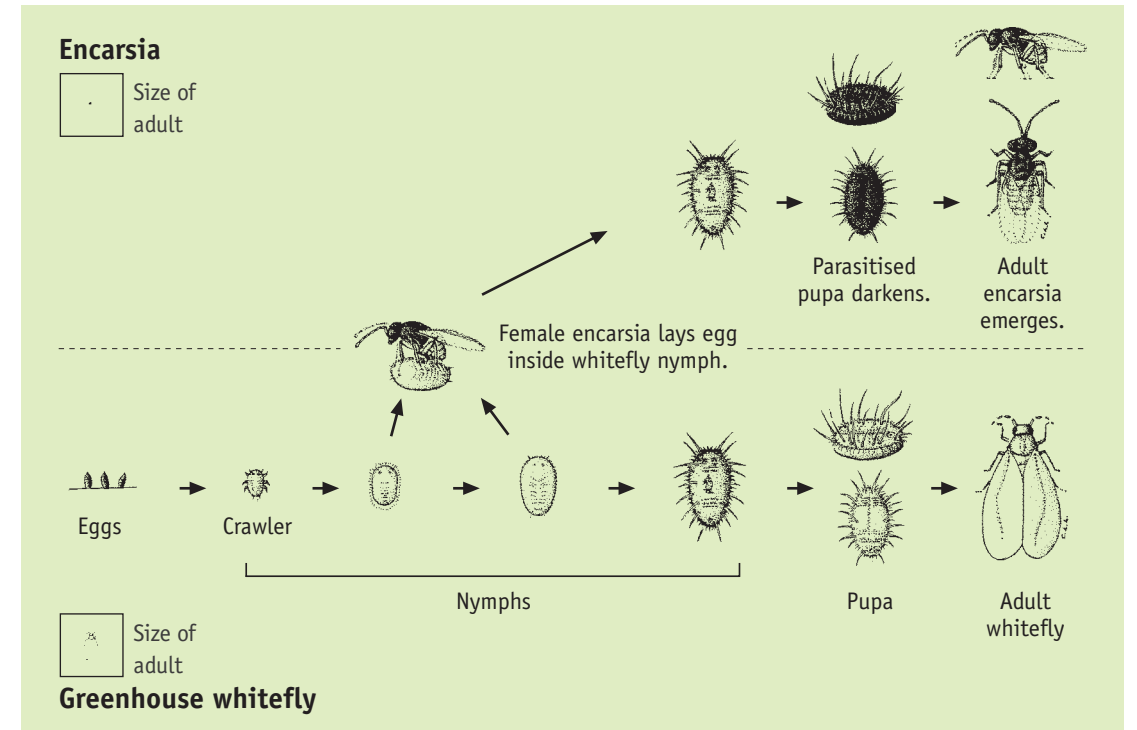


Figure 12: Life cycles of encarsia and of greenhouse whitefly

are also more effective in adequate light. If there are less than 10 hours of daylight, supplementary lighting will be beneficial. In winter, with lower temperatures and shorter day length, artificial heating and lighting are required in greenhouses to achieve the best results.

Target pests

- Greenhouse whitefly *Trialeurodes vaporariorum*
- Poinsettia whitefly, cotton whitefly or tobacco whitefly *Bemisia tabaci*

Greenhouse whitefly is the major species of whitefly occurring in greenhouse crops and ornamentals in Australia and worldwide. Poinsettia whitefly is present in Australia, and becoming more of a problem. A chemical-resistant strain has been identified.

Whiteflies are sap-sucking insects, with both adult and juvenile forms causing plant damage. Plants that are heavily infested may turn yellow and wilt, and their growth may be stunted.

Whiteflies also excrete sticky honeydew which covers leaf surfaces, allowing the growth of sooty mould. Heavy deposits of honeydew



Plate 49: Encarsia female laying an egg inside a whitefly nymph. The black scale is already parasitised and a new wasp will soon emerge.



Plate 50: Parasitised whitefly nymph, showing developing encarsia larva inside

interrupt photosynthesis and transpiration of the plant. Whiteflies can also transmit plant viruses.

Adult whiteflies prefer the undersurfaces of upper leaves or actively growing shoots, where they lay their eggs.

Immature whiteflies, called scales or nymphs, are found on young, fully expanded leaves. Older leaves showing damage generally bear the empty skins left behind when the adults emerge from the scales.



Plate 51: A new adult encarsia wasp has emerged from the parasitised scale on the right by chewing an exit hole. Another is emerging from the scale on the left.



Plate 52: Adult whiteflies congregating on the undersides of new foliage to lay eggs

Whiteflies are difficult to control because the undersurfaces of leaves are difficult to spray. Whiteflies also develop resistance to many pesticides if these are used frequently. Resistant strains can be transported across the country on plants and planting material.

Suitable crops/environments

Encarsia can be introduced into all crops attacked by greenhouse whitefly. These include tomatoes, cucumbers and a wide range of nursery, ornamental and broadacre crops.

Before release

Do not use residual pesticides for 4 weeks before introducing encarsia.

Introduce parasites before the whitefly population is high. Monitor whitefly levels using yellow sticky traps at 1 trap per 100 m². Start releasing encarsia when the first whiteflies are noted. Alternatively, start releasing encarsia at the start of each new crop, assuming whiteflies are already present.



Plate 53: Adult greenhouse whitefly and fresh yellow eggs

If necessary adjust temperature (23–27°C), humidity (50–70%) and lighting (minimum 10 hours' daylight) to favour encarsia development.

If the number of adult whiteflies exceeds 10 per leaf, spot-spray new growth of infested plants with non-residual pesticides or insecticidal soap.

If whitefly populations reach high densities, large amounts of honeydew will be produced and sooty mould may develop. In such situations, an application of pesticide is required. Parasite releases should start 4–6 weeks after the population of whitefly has been reduced.

Overhead irrigation may also help to reduce heavy deposits of honeydew.

At release

The parasite is packaged on cards containing about 100 black parasitised scales. Place the cards well below the top of a plant, in the shade and close to developing whitefly nymphs. Distribute cards evenly through the greenhouse and concentrate a few more around known infestations. The parasites will emerge over a few days. Cards should not be removed for at least 10 days from placement.

Be sure to open packages within the release area, in case some parasites have emerged during shipment. Immediate release is recommended.

Recommended release rates

The following rates should be used as a guide.

Tomatoes: 1 parasite per 4 plants or 2 parasites per m². Introduce weekly for 6–8 weeks, or until 80% of whitefly scales have turned black.

Cucumbers: 1 parasite per 2 plants or 4 parasites per m². Introduce weekly for 8–10 weeks or until 80% of whitefly scales have turned black.

Other vegetables and ornamentals: Use the same release rates as for tomatoes unless leaf



Plate 54: Mature greenhouse whitefly eggs turn black before hatching.



Plate 55: Immature whitefly nymphs, unparasitised



Plate 56: Encarsia release card

surfaces are very hairy, in which case use the cucumber release rates.

If whitefly levels are high, or control is difficult during winter, rates should be doubled.

If poinsettia whitefly is a problem, then again rates should be doubled.

After release

Monitor plants at least once a week, checking new, fully expanded growth. Black parasitised scales should be present within 4 weeks of the first release, and good control should be achieved within 2–3 months. Releases can be discontinued when approximately 80% of scales have turned black.

If leaves on the plants need to be pruned, check for the presence of black scales. If they are present, leave them there for 2 weeks to allow the emergence of new parasites.

Cultural practices to aid encarsia establishment

If possible, adjust temperature (to 23–27°C), humidity (to 50–70%) and lighting (to at least 10 hours' light) to favour encarsia development.

Chemical use

Most fungicides, miticides and nutritional sprays are fairly safe, but nearly all insecticides are toxic to encarsia. Refer to the chemical toxicity table, or consult your supplier for more information.

Additional information

The supplier is always interested in feedback from those using encarsia. Please report your success rate and make contact whenever you have any queries.

Other natural enemies of whitefly

Lacewings, e.g. *Mallada signata*