



Encarsia formosa

Whitefly Parasite

DESCRIPTION:

Encarsia is a tiny parasitic wasp that parasitizes whiteflies. It was the first biological control agent developed for use in greenhouses. Adults are black with yellow abdomen, less than 1/20-inch (1 mm) long (they do not sting). Larval stages live entirely inside immature whiteflies, which darken and turn black as the parasites develop inside.

TARGET PEST:

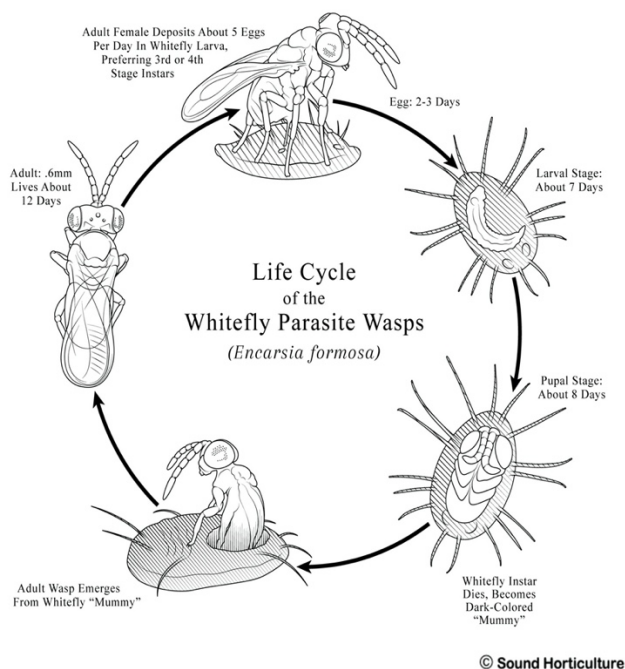
Greenhouse whitefly
(*Trialeurodes vaporariorum*)
Silverleaf whitefly
(*Bemisia argentifolia*)
Sweet potato whitefly
(*Bemisia tabaci*)



Encarsia formosa

LIFE CYCLE:

The complete life cycle takes about 28 days at 70°F (21°C). Temperature greatly affects development rate; for example, larval development takes 15 days at 77°F (25°C) and 45 days at 59°F (15°C). *Encarsia* populations are all female (males sometimes occur but they are not functional). Eggs are laid in 2-week-old whitefly scales (second and third whitefly larval stages), one egg per whitefly. Most *Encarsia* are female and each lays up to 10 eggs per day for an average of 200 eggs. Larvae develop inside the whitefly scale for 10 days at 68°-77°F (20-25°C). They pupate for another 10 days, then adults emerge by chewing a hole in the top of the scale. Adults are most active for about 10 days, although they can live up to 30 days. In addition to parasitizing them, *Encarsia* kill whitefly scales by feeding on the host directly. They also feed on whitefly honeydew.



MONITORING TIPS:

Check the undersides of lower leaves for parasitized whitefly scales. They turn black (for greenhouse whitefly) or transparent brown (for sweet potato whitefly) so are easy to tell from unparasitized scales, which are whitish

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USE IN BIOLOGICAL CONTROL:

Encarsia are effective controls for greenhouse whitefly on greenhouse cucumbers, tomatoes, peppers and poinsettias (for information see Whitefly). They can control silverleaf/sweet potato whitefly, but only under optimum management using high release rates.

Optimum conditions are temperatures over 68°F (20°C), high light levels (7300 lux) and relative humidity 50-70%. When daytime temperatures are less than 64°F (18°C) *Encarsia* activity is sharply reduced, making them less effective.

Do not attempt to use *Encarsia* if high whitefly populations are already established.

The predatory beetle *Delphastus* avoids feeding on the whiteflies that have been parasitized by *Encarsia*. *Delphastus* adults also feed on whitefly eggs and can therefore be used with *Encarsia* (for information see *Delphastus*). The predatory bug, *Dicyphus hesperus* may be used with *Encarsia*. The parasitic wasp *Eretmocerus californicus* may also be used with *Encarsia*.

PRODUCT INFORMATION:

Encarsia pupae are sold glued onto cards or as loose scales. For pupae on cards, it is important to hang the cards from lower leaves in the shade as *Encarsia* tend to fly upward. Avoid wetting them while watering. If there are hanging baskets in the greenhouses, some cards must be placed on the baskets, as well as on plants on benches. Adults will emerge from the pupae over a period of 1-2 weeks at 68°-77°F (20-25°C). Small emergence holes in the pupae are visible using a 5-10X lens and indicate that the parasite has emerged. If necessary, the *Encarsia* pupae can be held for up to 2 weeks at 40-50°F (5-10°C), however the percentage of emergence will decrease with time.

INTRODUCTION RATES:

0.1-1 *Encarsia* per square foot or 1-5 *Encarsia* /infested plant, every 1-2 weeks for at least 5 introductions, or until 80% of whitefly scales are parasitized.

In commercial greenhouses, *Encarsia* are usually released, either in low numbers before pests are present (called an inoculative release), or in higher numbers after pest populations are established (called an inundative release).

Before Whiteflies are Detected:

- Tomato, cucumber – 0.15 *Encarsia* per square foot weekly
- Sweet pepper/egg plant – 0.05 *Encarsia* per square foot weekly.

After Whiteflies are Established:

Number of whiteflies/week counted on yellow traps*	Tomato, Pepper, Eggplant Release rate/per square foot/week	Cucumber Release rate/per square foot/week
1-4	0.2	0.3
5-8	0.4	0.6
Over 8	0.8	1

Note: Above rates must be at least doubled for control of silverleaf/sweet potato whitefly or if temperatures are 64°F (18°C) or less.

*With small plants, examining the foliage of 1% of the plants will give a more accurate count than yellow traps. At 15 traps per 10,000 ft² (1000m²) a count of 1 whitefly per 15 traps is approximately equivalent to 0.1 individual whitefly per plant or 10/100plants. Starting levels of whitefly above 0.1 per plant can lead to hot spots and control problems.

Encarsia tend to remain in regions where the whitefly are concentrated, therefore it is important to distribute them well throughout the greenhouse:

- For inoculative releases, spread introductions over 40 or more release points per 10,000 ft² (1000m²).
- For inundative releases, use 60 or more release points per 10,000 ft² (1000m²) and place more (1000/plant) where whiteflies are found.

Once the percentage of parasitized scales exceeds 80%, the number of *Encarsia* present should be enough to control greenhouse whitefly.

FOR BEST RESULTS:

The whitefly species in a crop must be correctly identified to make sure it is a species that *Encarsia* can control and to determine the correct release rate. Eliminate whitefly from

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alternate plant sources, such as weeds or previous crops, and from cuttings before *Encarsia* releases begin. High whitefly populations hinder movement of the parasite as does the presence of excessive amount of honeydew. Remove whiteflies and honeydew by spraying with water or 1% Safer's® insecticidal soap.

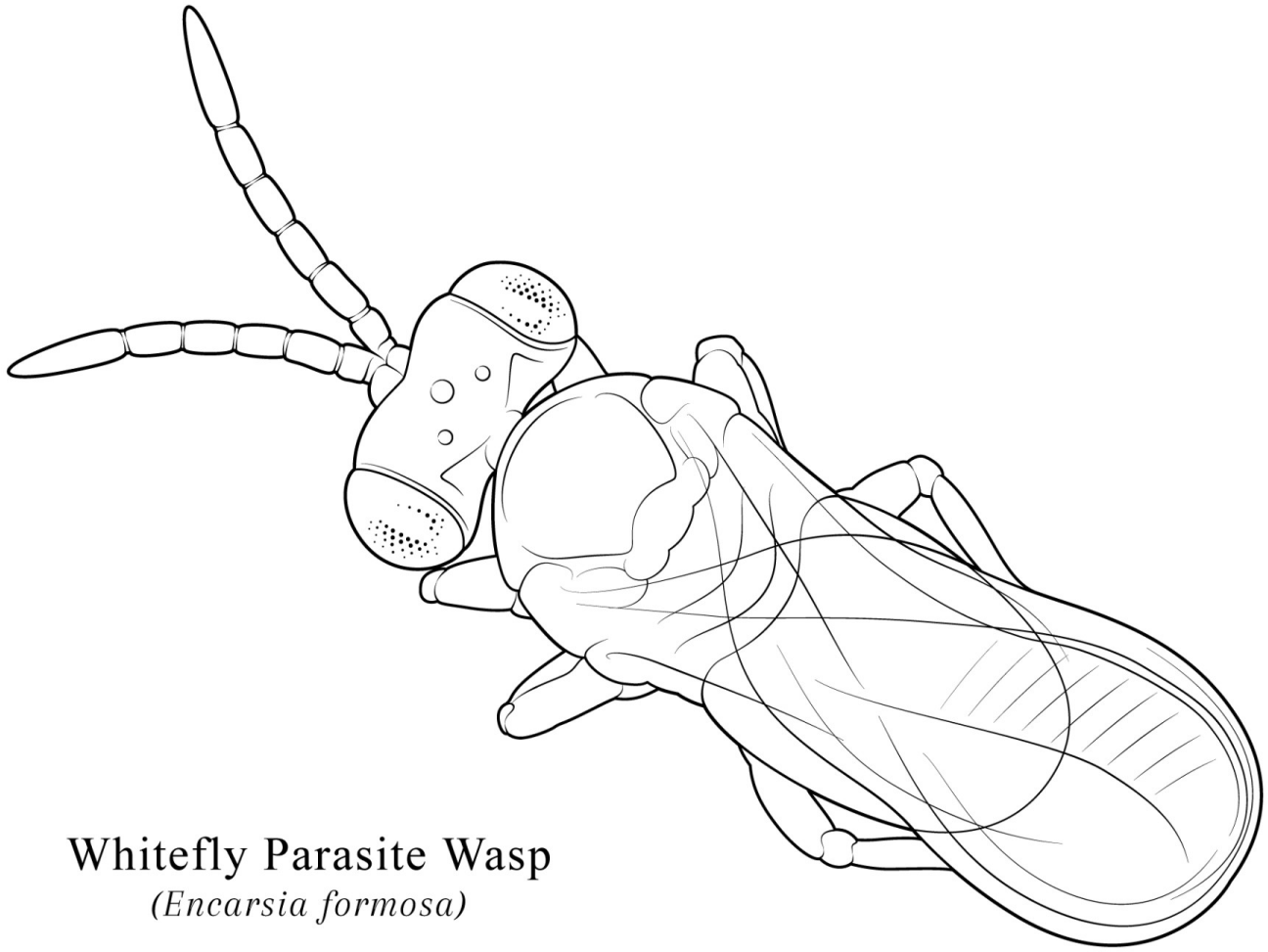
When de-leafing tomato plants, do not remove leaves that have significant numbers of black (parasitized) whitefly scales unless these have emerged. If leaves must be pruned from plants, retain them in the greenhouse, under the plants, until the wasps have emerged (1 to 2 weeks). Loss of control will occur if leaves are discarded with unemerged black scale and this cannot usually be compensated for by adding more *Encarsia* due to the high numbers needed (i.e. up to 1 adult *Encarsia*/0.5-inch² in hot spots).

USING CHEMICALS:

Encarsia are extremely sensitive to insecticide residues (for effects of pesticides on *Encarsia*, contact Sound Horticulture for information). Plastic covering or flooring used in greenhouses may harbor residues at levels that are harmful to this parasite for over 6 months. If, after a month of introducing *Encarsia*, whitefly parasitism is not occurring, contact supplier for assistance. Commercial spreader stickers in spray applications are harmful to *Encarsia*.

If whitefly hot spots develop, spot spray with Safer's soap (1% solution), weekly, directing the spray onto new leaves to kill adult whiteflies and early stages of scale. Kinoprene may also be used on ornamental crops.

**Content Courtesy of
Applied Bio-nomics Ltd**



Whitefly Parasite Wasp
(*Encarsia formosa*)

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