

Encarsia-System

The greenhouse whitefly is a very common pest that attacks many greenhouse crops. With the parasitic wasp *Encarsia formosa*, the greenhouse grower disposes of a practical and economical beneficial insect to control whitefly populations.

WHITEFLIES

Adult whiteflies measure about 1 mm and are typically covered with a white waxy powder. Two species commonly occur in greenhouses: the greenhouse whitefly (*Trialeurodes vaporariorum*) and the tobacco whitefly (*Bemisia tabaci*). Tobacco whitefly is also known as silverleaf whitefly (*B. argentifolii*).

Adults of the two whitefly species can be distinguished by their wing position; the greenhouse whitefly holds its wings horizontally over its body (like a flat roof) while the tobacco whitefly brings its wings down along its body sides (tent-like manner). Greenhouse whitefly pupae have an oval form with upright walls and a ring of waxed threads. Tobacco whitefly pupae have a more irregular oval and obliterated form and no ring of waxed threads.

The female whitefly deposits its oval shaped eggs of 0.2 mm generally on the underside of young leaves at the top of the plant. The larva that emerges is mobile during a few hours to search for a suitable place to settle. Later on, and in the subsequent larval stages and the pupal stage, it does not move anymore. The four larval stages look very similar, but differ clearly in size. After the fourth larval stage, a pupa is formed. Finally, an adult whitefly emerges from the pupa through a T-shaped exit hole.

Development time from egg to adult and female fertility are affected by temperature and host plants. For example, development time on tomato takes 20 days at 27°C (80.6°F) or 38 days at 17°C (62.6°F). At 17°C (62.6°F), a female lays 100-150 eggs on tomato, 250-300 eggs on cucumber and 450-600 eggs on eggplant.

Whitefly larvae and adults suck plant juices. Secretion of honeydew fouls leaves and fruit, which become unmarketable. Often, sooty moulds (*Cladosporium* spp.) develop on the honeydew, which affects plant photosynthesis and respiration. Moreover, whiteflies can transmit plant viruses such as TYLC virus by *B. tabaci*.

ENCARSIA FORMOSA

The origin of the parasitic wasp *Encarsia formosa* is not exactly known, it now exists in several parts of the world with mild climate.

A population of *Encarsia* almost exclusively consists of females. Females are about 0.6 mm long, black with a yellow abdomen, while the very rare males are completely black.

The female does not need fertilization; it lays its eggs preferably in the third or early fourth instar greenhouse whitefly larva. Ten days after parasitization (23°C/73.4°F), the larva pupates and turns black. About 11 days later, an adult *Encarsia* leaves the pupa through a round exit hole. Total development time takes 21 days at 23°C (73.4°F), but varies from 15 days at 26°C (78.8°F) to 32 days at 18°C (64.4°F). An *Encarsia* female deposits 10-15 eggs per day and lives for two to three weeks under optimal circumstances. Life span is dramatically reduced at high temperatures. Adult *Encarsia* feed on honeydew and on the body content of first and second instar whitefly larvae (host-feeding). During her life, a female *Encarsia* parasitizes approximately 250 greenhouse whitefly larvae (maximum of 450) and kills another 30 (maximum of 70) by host-feeding. Parasitization of the tobacco whitefly by *Encarsia* is possible; in this case, parasitized larvae do not turn black, but cream to brown. If both species occur, *Encarsia* prefers the greenhouse whitefly.

APPLICATION

For effective biological control of whitefly, it is important to determine which species is present. Against tobacco whitefly, *Eretmocerus eremicus* and *Eretmocerus mundus* are more suitable parasites.

Encarsia formosa is applied on a wide range of greenhouse vegetable and ornamental crops to control greenhouse whiteflies.

The goal of *Encarsia* introductions is to obtain a balance between the pest and *Encarsia* as early as possible. From the first observation of greenhouse whitefly adults on yellow sticky traps (BUG-SCAN®) or in the crop, *Encarsia* is introduced curatively every week until a sufficient parasitization level (at least 80%) is reached. Furthermore, practical experience has shown that it is also useful to introduce *Encarsia* preventatively at low rates.

To obtain a good balance, the following factors should be taken into account:

- At a temperature below 18°C (64.4°F), *Encarsia* almost does not fly anymore and its searching ability is seriously limited. At temperatures above 30°C (86°F), the adult life span is considerably reduced.
- Certain pesticides (e.g. pyrethroids) can have a long negative effect on *Encarsia*.
- If *Encarsia* is introduced too late, large amount of honeydew on leaves can hamper its mobility and consequently reduce whitefly parasitization.
- By picking leaves (following deleafing) too early, parasitized pupae that have not yet emerged will be removed from the greenhouse.
- Regular dusting of pesticides is harmful for *Encarsia*.

In some ornamental crops, in which tolerance of pests is almost zero, high introduction rates are recommended (overkill approach); control will be based almost exclusively on host-feeding.

Before applying a pesticide, always consult the Biobest side-effects list for the effect of the pesticide on *Encarsia*.

ENCARSIA-SYSTEM

Biobest offers *Encarsia* in two formulations.

1. On cards

For a practical and optimal distribution in the greenhouse, Biobest offers *Encarsia* pupae on cards. Cards are to be placed (hung) about 60-90 cm below the top of the plant and at regular intervals in the crop. Shortly after the cards being hung, the first *Encarsia* emerge. Pupae are stuck in a notch in the cards, which protects them against damages during transport or introduction. *Encarsia* on cards are available as units of 5000 or 10000 with 50 or 100 pupae per card; each card contains sufficient pupae to guarantee the emergence of 50 or of 100 *Encarsia*.

2. As loose pupae

Cards are not practical in all crops; therefore Biobest also offers *Encarsia* as loose pupae available in units of 1000, 5000 or 25000. Pupae are introduced in a crop by placing them on a leaf or in a Bio-Box. When using Bio-Boxes, place about 100 pupae per Bio-Box and then distribute (hang) the Bio-Boxes evenly in the crops. Bio-Boxes are to be placed at a height of 30 cm above ground in a young crop, or 120 cm above ground in older and more developed crops.

Encarsia can be stored for a short time between 6 and 10°C (43-50°F), but never at lower temperatures.

ADVANTAGES

- **Applicable in a wide range of crops;**
- **Great searching ability;**
- **Parasitized pupae are easily recognized;**
- **Also kills whitefly by host-feeding;**
- **Practical introduction method;**
- **Reliable result;**
- **Economical.**