



CROP PEST:

Whitefly

Bemisia spp.

DESCRIPTION:

The main pest in greenhouses is the greenhouse whitefly, (*Trialeurodes vaporariorum*) and the sweet potato or silverleaf whitefly (*Bemisia tabaci*).

Adult whiteflies are 1 mm (1/25 inch) long and a powdery white. Larvae are flattened, legless, translucent 'scales', 0.8 mm (1/30 inch) long. Both adults and larvae are found on the undersides of leaves, the adults mostly on upper plant leaves, the larvae lower down on the plant. It is difficult to identify whiteflies trapped on sticky traps, therefore examine adults and immature whiteflies on leaves.

Whiteflies damage crops by sucking plant sap, which weakens plants and causes shoot and leaf distortion. A more serious problem is the large amount of honeydew they secrete onto leaves and fruit. The honeydew is colonized by sooty molds, which reduces the quality of greenhouse vegetables and ornamentals.

TARGET CROP:

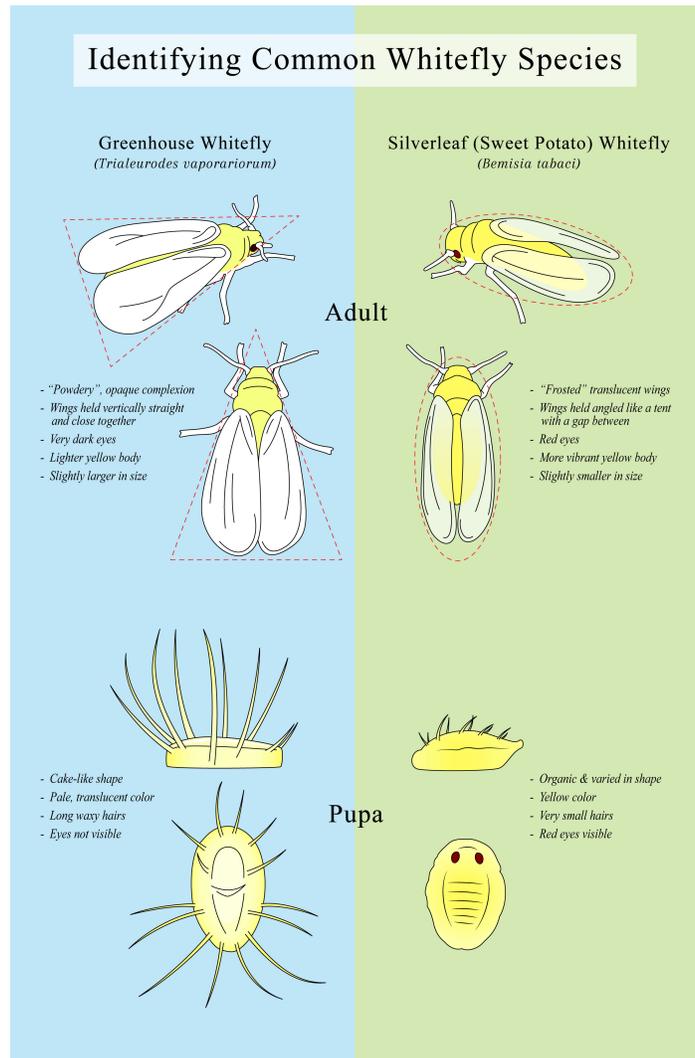
Whiteflies target a variety of ornamental and Tropical crops. Poinsettias are especially vulnerable.

LIFE CYCLE:

A complete greenhouse whitefly life cycle takes 28 days at 20C (68F).

Females lay pinpoint sized, black eggs in circular patterns on the undersides of leaves. Each female lays up to 200 eggs during her one week lifespan. The eggs hatch in 7 days and the mobile larvae ('crawlers') move over the leaves for 5 days, then settles and molts to a sedentary 'scale' stage. After 7 days and another molt, the last stage larva remains where it was feeding and pupates; adults emerge in 8 days.

The life cycle of the sweet potato whitefly is similar, but the development time is shorter, and more eggs are laid.



MONITORING TIPS:

- Begin in the empty greenhouse, before seedlings are planted out.
- Hang up yellow sticky cards (3"x 5") at the rate of 1 trap/50-200 m² (500-2000 ft²). Traps should be placed just above the plant canopy (if sweet potato whitefly is present, lowering the traps within the canopy may give better results.) Whiteflies tend to remain in one area and gradually move out from the initial site.
- Check traps weekly for adult whiteflies; traps should be replaced every 3 weeks.

Note: Using higher densities of traps helps pinpoint infestation sites more accurately. If monitoring time is limited, however, it is more important to check and record counts on fewer traps (the lower rate) and do it weekly, than to check larger numbers of traps but at longer intervals. With small plants, examining the foliage of 1% of the plants will give a more accurate count.

*With small plants, examining the foliage of 1% of the plants will give a more accurate count than yellow traps. At 15 traps per 1000 sq.m. 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.

BENEFICIAL INSECT CONTROL:

Encarsia formosa — a tiny, 1 mm (1/20 inch) long wasp that parasitizes immature stages of whitefly. It is sold as parasitized scales glued to cards, from which the adult wasps emerge. As the wasp develops inside, greenhouse whitefly scales gradually turn black; parasitized sweet potato whitefly scales turn a tan color.

If there is a history of whitefly problems, best results are achieved when *Encarsia* are introduced preventively, at low rates, before whiteflies are found on monitoring traps. They are usually released weekly, until 80% of whitefly pupae appear parasitized.

In warm regions or areas where a large number of greenhouses have whitefly infestations, the whiteflies may move onto outdoor plants. This makes them more difficult to control as whiteflies continually re-infest the crop plants. *Encarsia* are less effective during cool weather and overcast periods, therefore whitefly populations must be monitored closely.

Introduction Rates and Release Information

Generally, 1 to 2 *Encarsia* per 10 square foot canopy will provide full coverage. For pupae on cards, make sure they are placed in the lower foliage away from direct light. *Encarsia* fly upward. Reapply every week until infestation reduces, then you can scale back. Typically this takes at least 3 weeks.

Eretmocerus californicus— *Eretmocerus californicus* is another tiny parasitic wasp that is used along with *Encarsia*, especially at higher temperatures. *Eretmocerus* must be released at higher rates than *Encarsia* because, unlike *Encarsia*, which are all females, *Eretmocerus* has both sexes and females must be mated to lay eggs.

Introduction Rates and Release Information

On average, release 1 to 20 *Eretmocerus* per 10 square feet. For pupae on cards, make sure they are placed in the lower foliage away from direct light. Reapply every week for at least 5 weeks for full control.

Delphastus catalinae—a small, black, 1.4 mm (1/15 inch) long beetle in the lady beetle family. Both adults and larvae feed on whitefly eggs and immature stages. *Delphastus* is sold as adults and should be applied as soon as whiteflies are detected. *Delphastus* works especially well with *Encarsia* in whitefly 'hot spots' because it avoids feeding on parasitized whitefly scale.

Introduction Rates and Release Information

Apply .5 to 1 *Delphastus* per square foot of canopy. Simply walk through the operation gently tapping the container to release adults. Only release when whiteflies are present. They do not survive without a food source.

INSECTICIDE OPTIONS:

- Any plant material brought in should be thoroughly inspected and treated with compatible chemicals (see below), if necessary to reduce whitefly numbers before using biological controls.
- Insecticidal soap (Safer's(R)) is moderately toxic to developing *Encarsia* pupae and will kill the adults, but has no residual effect. It can be used as a spot spray in whitefly 'hot spots' or to knock down whitefly numbers at the beginning of a new crop. Use a 1% solution, weekly, directing the spray onto new leaves to kill adult whiteflies and crawler stages of scale.
- Kinoprene (Enstar(R)) is a slow-acting insect growth regulator that does not affect *Encarsia*. It is only registered for use on ornamental crops.
- Nicotine fumigant is moderately effective on whitefly, but can be used before introducing *Encarsia* because it has a low residual effect (it kills adults *Encarsia* but doesn't kill *Encarsia* pupae).

CULTURAL CONTROL TIPS:

- It is essential to start with a clean crop at the beginning of the season, therefore destroy all crop residues and dispose of them at a site remote from the greenhouse
- If the previous crop was infested with whiteflies, leave the greenhouse entirely empty of plants for 5 days, with heat, to starve whiteflies or kill them with cold by allowing the greenhouse to freeze to at least -15oC (0oF) for a week.
- If a plant-free period is not possible between crops, use a short-residual fumigant such as naled (Dibrom). Apply at the end of the crop, before removing plant debris, and again to the empty greenhouse.
- Keep the greenhouse weed-free, and maintain a 3-m (10 ft) wide, weed-free border around the greenhouse.
- Do not keep ornamental plants in vegetable greenhouses as these are also whitefly hosts and may vector virus as well.
- If greenhouse whitefly numbers are high, hang yellow sticky tapes (up to 1 tape per plant) at the top of the plant canopy to trap adult whiteflies. If sweet potato whitefly is present, hang traps about 1 meter below the top of the plants.
- If whiteflies are present on outdoor plants, screen all entry points with anti-virus screen or whitefly proof screen.

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