

## WHITEFLIES

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Whiteflies have become one of the most "troublesome" insect pests to Agricultural and Horticultural crops nation wide. They have acquired their reputation due to a number of reasons:

- They feed on a broad range of ornamental and agricultural plants.
- They feed on the undersides of leaves, which makes control difficult with contact insecticides.
- They are highly resistant to many conventional insecticides used in greenhouses and nurseries.
- They produce a tremendous amount of offspring from each generation.
- They are capable of transmitting viruses.
- They reduce the aesthetic quality of crops from the black sooty mold fungus that grows on the honeydew they excrete while feeding.

In order to effectively control this pest, it is important to understand the damage, biology, and reasons for whitefly problems.

### DAMAGE

Whiteflies damage plants by sucking out plant fluids and weakening them. Their feeding can cause plant leaves to become yellow (chlorotic). Their sticky liquid excrement, called honeydew, is a medium for black sooty mold fungus which can cover leaves and reduce photosynthesis. Even if a whitefly infestation is brought under control, the remains of dead insects (pupal cases)

and black sooty mold growth are unsightly and may affect crop marketability.

### BIOLOGY

Whiteflies occur on the undersides of leaves. They feed on plant fluids with their piercing-sucking mouthparts. The whitefly life cycle consists of an egg stage, 3 nymphal stages, a pupae stage, and then adult. Adult whiteflies are white, narrow, and less than 1/16 inch long. Eggs are deposited on the underside of mature leaves, often in a crescent-shaped pattern. The spindle-shaped eggs are white when first laid, turning dark gray with time. Eggs hatch in about 10-12 days at temperatures fluctuating between 65 and 75 ° F. The tiny first nymphal stage (crawler) hatches from the egg, crawls a short distance (1/4 inch) and settles down to feed. They do not move from this spot until emerging as adults. They pass through 3 more nymphal stages before adult emergence. About 4 to 5 days before adults emerge, the nymphs enter a "pupal stage". At this time the red eye spots of the developing adult are easily visible through the insect skin (pupal case).

It takes an average of 32 to 39 days to develop from egg to adult (both Greenhouse and Sweet Potato Whitefly) at temperatures between 65 and 75 ° F. About 14 to 16 days of the developmental time are spent in life stages (eggs and pupae) that are tolerant of most insecticides. A female whitefly can lay eggs as quickly as 1 to 3

days after emerging as an adult. A female may lay up to 200 eggs and can live about 1 month, depending on environmental conditions.

Greenhouse Whitefly (GHWF) and Sweet Potato Whitefly (SPWF) identification can be confirmed by the pupal stage. GHWF pupa have parallel sides that are perpendicular to the leaf surface, giving a disk- or cake-shaped appearance. GHWF have a tiny fringe of setae (hairs) around the periphery (or edge) of the pupa. SPWF pupa appear more rounded, or even pointed, with no parallel sides. SPWF pupa have no setae around the edges.

## REASONS FOR WHITEFLY PROBLEMS

### 1. Improper sanitation

The first step in an effective whitefly control program is greenhouse sanitation. Whiteflies in the pupal stage can survive and emerge as adults from leaves that have withered and dried, such as discarded plants and "pet plants" (plants not for sale, but kept in the greenhouse). Remove all debris or unsold plants from previous crops. Place discarded plant material far from greenhouse vents, or bag it, so whiteflies on the plant material do not reenter the greenhouse.

### 2. Poor weed management

Remember that weeds, especially oxalis, chickweed, velvetleaf, and dandelion can serve as alternate hosts for whiteflies. All weeds must be eliminated from inside and around the greenhouse, including areas under benches and in pots. Pay close attention to vegetation outside the greenhouse. Don't allow weeds to grow close to vents, as whiteflies on them may seek shelter inside when cooler temperatures arrive.

### 3. Failure to inspect plants before introducing into greenhouse

It is important to start with clean stock plants or cuttings. Purchase cuttings or liners known to be free of whiteflies. Whitefly-free stock will ensure that the crop is started free of insects from the onset. Inspect all incoming plant material carefully for whitefly or its damage before introducing into the greenhouse. This prevents whitefly populations from migrating to other crops. Then apply insecticides to control any whiteflies that are present.

### 4. Failure to establish a monitoring program

An efficient monitoring and record-keeping program is essential for early detection of whitefly populations and evaluation of management techniques. Monitoring increases the effectiveness of insecticides by pinpointing the most vulnerable stage of the life cycle. Plants must be inspected weekly. A 10X hand lens will be needed to observe eggs and small larval stages.

Yellow sticky traps, placed throughout the crop, will help detect adults. Space yellow sticky traps about every 50 feet throughout the crop on stakes just above the crop canopy. Check sticky traps once or twice weekly to monitor adult populations.

Efficient record-keeping techniques provide a means to evaluate effectiveness of control procedures and time insecticide applications or biological control releases. Maintain detailed records on: locations where whiteflies are found, life stages present, temperature, time of year, level of infestation, plants species attacked, whitefly species, and number of whiteflies caught per sticky trap. Check with your pesticide supplier for sample

cards.

#### 5. Absence of screening material

Screens and/or insect barriers should be used to exclude whiteflies from the greenhouse. In areas where whitefly populations exist outside the greenhouse, screen to keep any external populations from entering the greenhouse. Screens will help reduce the number of whiteflies moving into a greenhouse from cultivated and wild plants outside. Growers can compensate for the reduced air flow from screening by installing additional exhaust fans and/or increasing the square footage of screened surfaces.

#### 6. Failure to eliminate the color "yellow" from greenhouse

Whiteflies can land on yellow clothing or equipment and hitch a ride from an infested area to a clean one. Prohibit yellow clothing and equipment from being used within the greenhouse facilities, except for monitoring with yellow sticky traps. Minimize use of yellow tractors or carts, or yellow apparel such as hard hats or spray suits. Instruct employees to wear red, brown, and other dark colored clothing.

#### 7. Poor coverage with insecticides

Since whiteflies feed and reproduce on the lower leaf surfaces, it is extremely important to get thorough coverage of any insecticide. For contact insecticides, direct the spray toward the underside of leaves. Use the smallest spray particles possible. Plant spacing may need adjusting to allow better spray coverage. If the undersides of leaves are not covered, no control of immature whiteflies will be obtained. Close spacing of plants to obtain

maximum production may not be the best strategy for insect control (or for disease control and production of good quality plants). Good leaf coverage and good insect control are difficult when plants are spaced close together. It is important to get good insecticide coverage of lower leaf surfaces as well as penetration of the foliage canopy.

#### 8. Failure to rotate insecticides

Select insecticides from different chemical classes to avoid buildup of resistance. The best way to manage resistance is to rotate chemicals based on their mode of action, or how the insecticide kills the insect. Insecticides should be rotated between, not within, a generation (32 and 39 days at 65 and 75 °F). A weekly rotation is too short to be effective.

#### 9. Lack of knowledge of pests biology

Knowledge of whitefly biology and life cycle is important for efficient and economical control. Proper identification of whitefly life stages is important for several reasons. Growers may fail to notice whether immature stages are present on leaf undersides and bring plants infested with significant numbers of whiteflies into the greenhouse or may fail to notice a serious infestation until clouds of adults begin to emerge. Also, because the early life stages are the most susceptible to the majority of insecticides, growers who can properly identify various life stages will be able to achieve better control with fewer sprays by timing insecticide applications primarily toward susceptible stages. Finally, it is important to know which whitefly species (Greenhouse or Sweet Potato) is present for optimal control.

**10. Failure to implement a total Integrated Pest Management approach**

The basic components of IPM are: Sanitation, Monitoring, Record-keeping, Exclusion, Inspection, Quarantine, Biological Control, and Chemical Control. IPM is simply a combination of these management techniques and common sense. Failure to incorporate all aspects of IPM will most surely result in failure to control whitefly. By

combining all these control strategies into an IPM program tailored to the growers operation, whitefly populations can be held in check.

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