Common Whitefly PESTS and Management

Understanding the basics is the key to developing an effective whitefly management program.

By James A. Bethke, Frank J. Byrne and Ronald D. Oetting

As an entomologist, I have been trained to know what a whitefly is, but to my layman friends, a whitefly is a white…fly. Their first thought is of a larger insect like a housefly. When I describe a real whitefly, they recognize it as something they have seen in the garden or landscape, usually after inspecting a plant that contains sooty mold. In the case of high populations, it's easy to see whiteflies fleeing to nearby plants after a plant is tapped.

There are many whitefly pest species, but there are four main species with broad host ranges that you will most likely encounter in ornamental plant production: sweet potato whitefly, greenhouse whitefly, banded winged whitefly and iris whitefly. You may encounter a different species because of host specificity, but they can likely be treated the same as those described here.

Species with a propensity for resistance, such as the sweet potato whitefly, are of greatest concern. Others may carry serious plant pathogens, such as tomato yellow leaf curl virus, that can threaten agriculture; they also must be taken seriously.

Common Characteristics

Whiteflies are generally small, about 1-2 millimeters. They have four life stages: egg, nymph, redeye pupa and adult.

Eggs are partially inserted into the leaf and are initially yellowish, but they darken over time to a purplish brown just before hatching.

There are four nymphal instars; the first is called a crawler because it crawls away from the eggshell and establishes permanently on the plant tissue. The fourth instar eventually becomes the pupa — not a true pupa, actually, but that's for a later discussion.

The pupal stage is the most characteristic stage for whitefly identification; differences among the four species will be described below.

In general, whiteflies can complete a life cycle in about 30 days at 80° F. They can reproduce throughout the year in greenhouses and in warmer climates; they can have several overlapping generations even in nurseries.

Whiteflies prefer to feed and lay eggs on the undersides of leaves. They feed from the vascular system of plants much like related species (aphids, mealybugs and scale) and excrete honeydew, which promotes the production of black sooty mold on plant surfaces.

Many other whitefly species are similar to the four described in this article; even the giant whitefly isn't that big. It's just big for a whitefly.

Greenhouse Whitefly

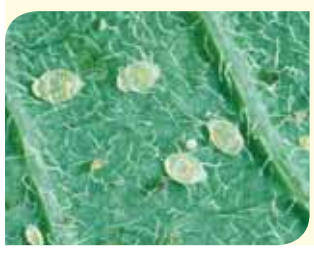
The wings of the greenhouse whitefly (*Trialeurodes vaporariorum* Westwood) are held over its body like a flat rooftop that covers the abdomen when the adult is at rest, above. Females lay eggs in circles on the undersides of leaves of plants with smooth leaves; on plants with pubescent leaves, the eggs may be more scattered.

Greenhouse whitefly pupae are oval and have vertical sides, giving them a cake-like appearance from the side. Along the perimeter of the upper surface, there is a fringe of filaments, below, and much larger wax filaments project above the upper surface of the body.

Sweet Potato (Silverleaf) Whitefly

The adult sweet potato whitefly (*Bemisia tabaci* Gennadius), also known as the silverleaf (*Bemisia argentifolii* Bellows and Perring), holds its wings more angled along the sides of the body, which partially exposes its yellow abdomen when it's at rest, above. Eggs are laid randomly rather than in a circular pattern.

Sweet potato whitefly nymphs are flat and resemble a pancake rather that a birthday cake. The shape of the body of the nymph can vary depending on the texture of the leaf surface. The pupae have red eyespots and white wing pads easily visible from above. The pupa lacks the marginal fringe of filaments seen on the greenhouse whitefly.



Monitoring

Whiteflies can be detected using the common yellow sticky cards that are hung just above the plant canopy in greenhouses. It is recommended, however, that traps be placed at a density of one per 1,000 square feet, a greater density than for most other pests.

The leaf-turning method is also effective: Select leaves at random throughout the crop and turn them slowly to determine whether there are any whiteflies on the underside. The presence of sooty mold suggests the population has gone unnoticed for quite some time, and there may be a lot more

whiteflies out there than you think there are.

Management Programs

There are many pesticides available for control of whiteflies, which creates a good selection for rotation. I won't describe them here.

An effective whitefly management program, which has been published on the Internet, was constructed by a great number of collaborators across the country and is constantly updated with new information. The program lists most of the available pesticides and how to use them effectively. It is available here: mrec.ifas.ufl.edu/LSO/bemisia/bemisia.htm. The program includes an insecticide resistance section, information on where to send whiteflies for identification and suggested treatments for plants in different phases of production. I highly recommend that you familiarize yourself with the program, and watch for more collaboration on other insect pests like this in the future.

This program also highlights neonicotinoids, which are effective against vascular feeders like whiteflies, and ongoing research will help the industry use the products more wisely. Below is a summary of some studies that will be helpful to the industry in time.

Use of Neonicotinoids

Neonicotinoids are heavily favored for the control of whiteflies. These include imidacloprid (Marathon), dinotefuran (Safari), acetamiprid (TriStar) and thiamethoxam (Flagship). They translocate upward in the plant and will then move from the xylem to other plant tissues, including the phloem. Therefore, a neonicotinoid applied to the potting medium will be taken up by the roots and translocated to all parts of the plant. There is a difference, however, in the residual activity of neonicotinoids, including the speed of uptake and dilution or degradation of the active ingredient in the plant.

Neonicotinoid Movement in Soil and Plants

Drench applications of neonicotinoids can be highly effective, but little is known about how the neonicotinoids permeate and persist in plant tissue. It is difficult to know when to apply, reapply or change modes of action when it is not known how long a neonicotinoid to translocate throughout the plant following a drench application for. It's also tough to know how long it will take to reach an effective level or how persistent it will be.

We have been studying the dynamics of neonicotinoid activity in ornamental plant production systems to improve treatment strategies and explain why neonicotinoids work well under some conditions but not others.

Results from studies using imidacloprid in potted poinsettias suggest that imidacloprid persists and remains available for uptake for the entire length of a crop cycle. But that does not necessarily mean it can kill the target pest for that long (Figure 9). Studies of imidacloprid movement in soil columns have shown that the more organic matter present, the longer it takes the imidacloprid to become available for uptake. Variation in the amount of organic matter in the soil media will therefore determine whether sufficient insecticide is released for uptake.

Data from another recent experiment against sweet potato whiteflies on poinsettia have determined the concentrations of imidacloprid and dinotefuran that prevent the establishment of whiteflies. All treatments in this experiment, both imidacloprid and dinotefuran (as well as both foliar and drench applications) proved equally effective for control of a resident adult whitefly population, but not all treatments suppressed the population in the second generation. The higher label rate of dinotefuran was the most effective insecticide treatment at controlling both the second and third generations of sweet potato whiteflies.

Findings

From these studies, we can make some general pest management suggestions using whitefly management on poinsettias as an example.

The current management program for poinsettias calls for the use of softer products early in the crop to control whiteflies, followed by more conventional products such as pyrethroids in the middle of the cropping cycle. Finally, a neonicotinoid application is used to clean up the crop for shipping around Thanksgiving.

If two applications of insecticide can be applied as a split rate — or as a single application when persistence is known to occur — the crop may be well protected for a significant period of time, potentially 90 days. That would alleviate the need for numerous applications early- and mid-crop. We would also suggest that a potting media with less organic matter be used to make more active ingredient available within plant tissues more quickly. Keep in mind that lower organic matter content in the potting media may necessitate adjusted watering schedules to avoid the increased possibility of leaching. Research is ongoing to determine best practices.

Final Thoughts

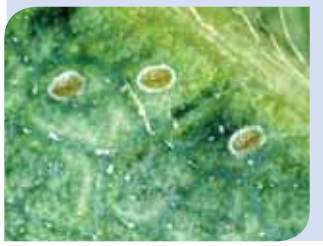
Not every whitefly problem is the same in all areas or in every cropping system. However, the whitefly management program recommended above will help you design an effective management practice for whiteflies at your facility.

In our neonicotinoids research, we have found that they can be effectively used against whiteflies as both foliar and drench applications. Because of greater persistence, drench applications can provide long-term control of important pests if effective concentrations are reached within the treated plants. We have also determined that the composition of the potting media can impact the efficacy of drench applications of neonicotinoids. Organic matter

Iris Whitefly

Adult iris whiteflies (*Aleyrodes spiroeoides* Quaintance) are slightly larger than the other three described here. They hold their wings flat over their backs like the greenhouse whitefly, but the wings are noticeably rounded at the tip, and each wing has a darkened spot on the lower half, above.

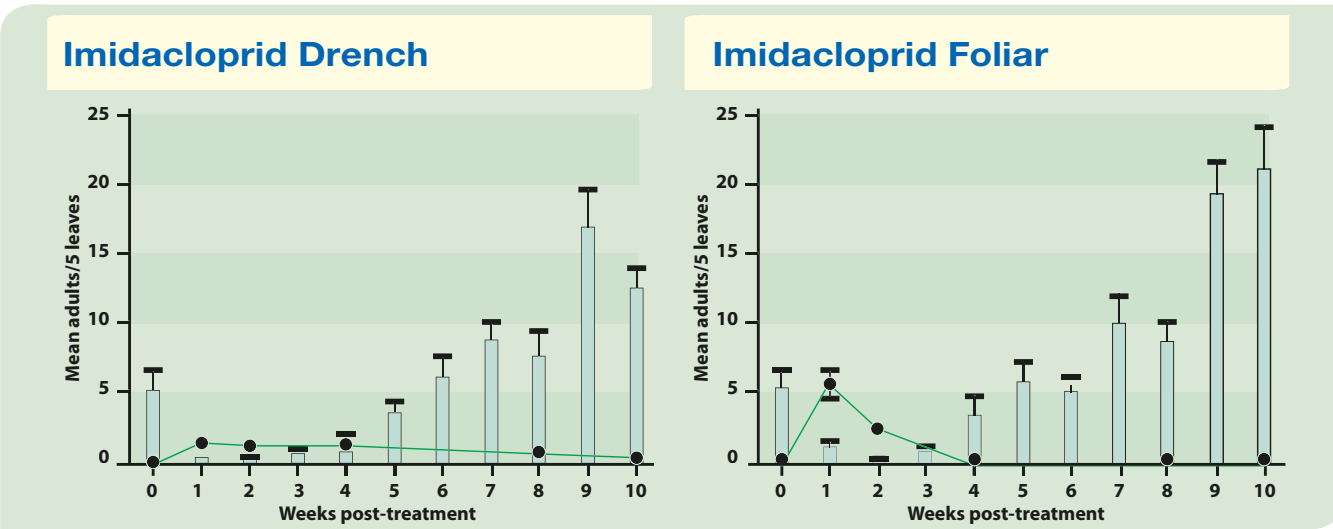
Eggs are laid in distinctive circles, and large amounts of wax can be found around both the eggs and the nymphs. The last-stage nymphs secrete white wax plumes, ribbons or filaments, forming fringes around their bodies that protect them from parasitoids and predators, left.



Banded Winged Whitefly

Adult banded winged whiteflies (*Trialeurodes abutilonea* Haldeman) hold their wing much like greenhouse whiteflies, like a flat rooftop that covers the abdomen when the adult is at rest, but the wings feature distinctive grayish bands in a zigzag pattern, above.

Nymphs are similar to greenhouse whitefly nymphs, oval with a filamentous fringe, below. Pupae are also similar to that of the greenhouse whitefly, with a birthday cake-like appearance. The banded winged whitefly pupa, however, is distinguished by having a darkened band down the length of the back of the pupal case.



Whitefly population and imidacloprid (Marathon) concentration in an experiment to determine the persistence of imidacloprid in poinsettia leaves over time and compare it to the population of sweet potato whitefly. The lines on the graphs represent the amount of imidacloprid in the leaves and the bars represent the whitefly population levels.

content is especially important, and we will have more information on this important aspect in the future. GPN

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