

Pest Discussion - Whitefly

Few pests are as subtle and insidious as whitefly. While the adults are easily seen and, for some species, easily trapped on yellow sticky cards, the early larval stages are mostly clear and too small to be seen by the naked eye.

When you see one whitefly, you have thousands. In the case of the Greenhouse whitefly, each female can lay about 300 eggs, mostly in the first few weeks of becoming an adult. It doesn't take much imagination to see why whitefly can quickly get out of control.

The chemical insecticides available to combat whitefly are showing alarming rates of resistance and combined with the whitefly's rapid reproduction rate, this pest can be one of the most serious pests that we face for some crops.

There are many species of whitefly, but for most crops the Greenhouse Whitefly is the most common. In some crops, Bemisia (also called the Sweet Potato Whitefly or the Silver Leaf Whitefly) is the most significant species. As the climate changes, Bemisia could surpass the Greenhouse Whitefly as the most significant pest, especially because it is more widely known as a virus vector and its resistance to chemical insecticides is now legendary. Bemisia is further broken down into biotypes B and Q. I will not differentiate the biotypes in this discussion.

Scouting

While Greenhouse Whitefly can be easily monitored by the use of yellow sticky traps hung slightly above the crop, the same cannot be said for Bemisia. The best technique that I have seen for Bemisia was developed by Graeme Murphy of OMAFRA, in Vineland. Graeme suggests randomly picking up 100 plants throughout the crop. I have modified Graeme's idea by kicking as many plants as I can, or, banging benches, or even shaking plants. The point is; Bemisia tend to clump. They don't spread themselves evenly and flutter around like the Greenhouse Whitefly. This clumping is clearly a defensive technique, as their density tends to generate sticky honeydew hotspots quite quickly, which repel the parasitic wasps. In colder areas, or in crops such as Poinsettia, Bemisia also tend to work their way into the warmer areas, in southern corners or near heating pipes or outlets.

The key thing to keep in mind is that one whitefly is one too many. While chemical strategies involve waiting for economic thresholds, biological strategies require prevention. Encarsia must be in place before the first whitefly is seen.

Beware using the trapped adults on the cards as relative indicators of changing whitefly numbers. In the cooler periods, Greenhouse whitefly adults can live for about 3 months. So, even if you have completely eliminated the eggs and larvae of the coming generations, the pest will still be evident.

Eggs of whitefly are surprisingly easy to see and scout. Depending on density and species, many whitefly lay their eggs in tight circles of about 10 eggs. Sometimes, the eggs are laid in a spiral. The eggs tend to be grey and mounted on stalks.

Once the eggs hatch, they become transparent crawlers and are nearly invisible under high intensity growing lights.

For greenhouse whitefly and Bemisia, the next easy stage to see isn't until they get to the third instar, at which time they are anchored down and usually causing noticeable plant stress.

Management

Biological control of any whitefly species relies on prevention. As soon as your plants are placed in your facility, low levels of "fresh" (not refrigerated) parasitoids should be released. Any exposure to cold temperatures below 8 C (46 F) for even just a few hours completely and irreversibly eliminates their searching ability (Biovin). Fresh Encarsia (Encarsia Max) can be released at rates as low as 0.25 wasps per square meter weekly to prevent a whitefly build-up.

With parasitoids there are two factors, aside from how they were harvested and stored, that directly correlate to efficacy. The first factor is host adaption. All parasitoids prefer to parasitize the host that they were reared on. Most are capable of parasitizing many species of whitefly, but, when asked to switch species, the inefficiency can be up to 40 times. The second factor is the actual size of the wasp. Research has consistently shown that the larger the wasp, the more eggs will be laid. Most commercial parasitoids of whitefly are reared on Greenhouse whitefly, not only because of permit issues, but also because the Greenhouse whitefly is a large species, creating larger wasps.

Using our Encarsia Max, the normal strategy is to simply start at 0.25 per meter. Start with more (up to 2 wasps per meter) if whitefly are already present, or if you are in a high pressure area for whitefly, or if you are producing plants that are especially susceptible (attractive) to whitefly.

When a whitefly is observed either in the crop or on a trap, the rate is doubled until the whitefly is no longer detectable. The doubling should only continue until you reach the maximum rate of 8 wasps per square meter. Whitefly levels above this threshold should be treated with either:

- Delphastus catalinae,
- a predatory beetle,
- physical removal by more trapping or vacuuming
- another biological method such as Botanigard or similar fungal pathogens,
- or as a last resort, chemical insecticides. The chemical insecticide is the last resort because there is no going back to biologicals after an application. Great care must be taken to ensure that the chemical selected is still capable of achieving a significant level of control.

The use of whitefly-trapping plants can be very effective. Eggplant is an extremely popular plant for whitefly. In many crops, just one or two eggplants per acre can prevent a buildup of whitefly in the crop. For crops such as pepper, eggplants can completely “pull” all of the whitefly off the crop and onto the eggplant. Trapping plants should become “banking” plants by focussing the biological controls onto the eggplant. I have seen over 500 *Delphastus* on a single eggplant, which was covered in Greenhouse whitefly, in a clean pepper house. *Bemisia* is also attracted to eggplant, but because they don’t disperse as much as Greenhouse whitefly, trapping plants are significantly less effective. If the *Bemisia* are regularly agitated by moving benches, “tickling” boom applications, or simply plant movement, the eggplant will become more effective as a trap, even with *Bemisia*.

If you are dealing only with *Bemisia*, the weapon of choice is *Delphastus catalinae*. This beetle was given to us by Lance Osborne of the University of Florida and it is a native predator of *Bemisia* in Florida. Despite our having reared this beetle for about 25 years on Greenhouse whitefly, when they are released, they will always fly to the *Bemisia* areas first. They clearly track down *Bemisia* by smell. But this beetle can be frustrating to work with and scout. *Delphastus catalinae* prefer *Bemisia* eggs so they tend to leave the areas where the customer releases them, which are the areas where the larger scale is making a sticky mess. In addition, because birds are the natural predators of these beetles, when you approach them, they tend to drop off the plant, which is their defensive maneuver. When you can easily find *Delphastus* in the sticky hot spots that is an indication that they are completing their role. Having already eaten all of the eggs and the smaller scale, they work their way up the whitefly timeline until all they have left to eat is adult whitefly.

There are many other predators of whitefly: true bugs like *Dicyphus* and *Orius*; and, many generalist predatory mites like whitefly eggs and crawlers. But most of these, and certainly the mites, are quickly deterred by the honeydew stickiness that the whitefly creates as a defensive technique. We consider generalist mites such as: *fallacis*; *swirski*; *cucumeris*; *californicus*; *limonicus*; and, *degenerans* to be just bonuses in whitefly prevention, but not the important whitefly management tools such as *Encarsia*, *Delphastus* and *Eretmocerus*.

Dynamics of Whitefly

Whitefly pressure always seems to increase in the fall. This has usually been blamed on whitefly moving in from outdoors into a warmer, protected environment. This may be true in some situations but much of the population increase also has to do with the changing lifespan of the whitefly. In high temperatures (over 30 C or 90 F), Greenhouse whitefly adults will only live for a few weeks, or even days, in extreme heat. Once the venting and cooling stops and the greenhouse begins heating, the drop in temperature reduces the attrition of whitefly adults. In the fall, spring, and winter, Greenhouse whitefly adults can live for up to 3 months. So, in the fall, the buildup is most often due to the whitefly adults living for up to 10 times as long. Even though they live longer, they still tend to lay all of their eggs in the first few weeks. The moral of this is: **try not to panic in the fall**. You can waste a lot of money on unnecessary product, or

even worse, go to a chemical intervention that is completely unnecessary and will lead to significant control problems later in the year.

All whitefly are sucking insects and all sucking insects are attracted to soft new growth -- it is easier for them to push their feeding tubes into the plant. The growing tips of the plant tend to have the highest nutrient levels. For many years we have been able to demonstrate the effect of ammonium nitrate as the nitrogen source and its positive relationship to enhanced whitefly and all sucking insect growth. Whitefly love ammonium nitrate and thrive with it. If you have the option, especially during low light times, of switching your fertilizer to a calcium nitrite source of nitrogen, you will find that the whitefly pressure will be greatly reduced.

The tendency of whitefly to gather on the growing tips, especially in the winter, also makes it possible for relatively easy mechanical removal. If you have spray booms, try attaching tickling ribbons or string that will gently disturb the plants as the boom passes overhead. This will force the whitefly to disperse and fly about for a bit. If you can add a vacuum to the trailing edge of the boom, you can remove a significant level of whitefly adults. When this technique is repeated, you will remove the adults that continually move up on to the softest plant material. Repeated passes, over a few days, can significantly reduce the level of whitefly adults present and by removing the adults, prevent a sticky buildup of the honeydew, allowing the parasitoids easier access.