Michael Stoklos

Judith Brown checks a greenhouse-raised cotton plant for whitefly infestation.

Joe Wehrle

David Byrne inspects vegetables in Yuma for whiteflies.

Whiteflies– The Tiny Bug with the Big Bite

By Rita Connelly

The poinsettia strain of the sweet potato whitefly could be a fictional menace from an old grade-B horror movie. Like those movie monsters, members of the poinsettia strain are causing havoc wherever they're found. And like their movie counterparts, they multiply quickly, travel quickly and seem to be everywhere. Using pesticides or natural enemies to control these tiny pests hasn't worked during critical periods of the growing season. The poinsettia strain resists control, frustrating growers and scientists.

Unfortunately, the poinsettia strain is a true threat to agriculture, not just a figment of some writer's active imagination. In 1991, California's Imperial Valley melon growers suffered a total crop loss caused by this whitefly. Growers have asked for federal disaster aid. Problems in Arizona were less serious on other crops, which may have been due, in part, to the weather. This tiny pest — weighing as little as 26 micrograms and measuring .8 millimeter — has drawn gargantuan attention.

Using predators and parasites has met with only limited success.

At the University of Arizona College of Agriculture, a team of concerned experts is trying to develop a plan of attack. The group includes entomologists David Byrne, Theo Watson, John Palumbo and Leon Moore, plus plant virologist Judith Brown and cotton specialist Jeff Silvertooth. They are backed by graduate students, county extension agents and cotton and vegetable growers throughout western Arizona.

The origins of the poinsettia strain of whitefly are unknown, but sweet potato whiteflies were first noticed in the United States as early as 1894. In Arizona, they were seen in 1926. The poinsettia strain was found in Arizona greenhouses in 1988 by Brown and Costa. However, Byrne is still cautious about the genetic standing of this insect.

"Something is definitely going on with the sweet potato whitefly," Byrne says. "We still can't make a definitive statement about the evolutionary consequences of the behavioral changes we've seen." But changes are occurring.

The whitefly has expanded its host range; hosts serve as food sources, as well as sites for reproduction.

"We know they have different host ranges for feeding and reproduction," Brown says. "The ability for successful reproduction is the key."

While cotton has always been a favorite whitefly host, the poinsettia strain now lives on corn, alfalfa, broccoli, cauliflower, melons, peanuts, citrus, sesame, grapes and various grasses. Host plants also include such common ornamental favorites as roses, lantana and hibiscus. In greenhouses, the poinsettia plant is highly favored by the pest, hence its name.

In cotton, the poinsettia whitefly causes several kinds of problems, Silvertooth says. They attach their mouth parts to the sieve tubes of the phloem (the plant's vascular system) and suck the sugar-rich sap. This heavy feeding harms the host plant's development. Entomologists have shown that, during a growing season, the whiteflies can extract more than 500 pounds of sugar from a single acre of cotton.

The whitefly takes the nutrients it needs and excretes the rest. The thick excrement — known as honeydew — gums up the machinery in the cotton picking and ginning processes.

"The poinsettia strain excretes five times as much honeydew as the old strain of the sweet potato whitefly. It stands to reason they feed five times as hard," Byrne says. Simple mathematics shows how much damage they do just with feeding and excretion alone. But honeydew also acts as a base for a black fungus that can grow on any plant on which the whitefly lives. The fungus interferes with photosynthesis.

Brown has documented another adverse affect. Poinsettia whiteflies are an important vector, or transmitter, of plant diseases. They pick up geminiviruses and closteroviruses on trips through weeds on their way to the crops. Brown is conducting research with a number of newly discovered whitefly-vectored plant viruses in her laboratory.

Unfortunately, whiteflies appear to be resistant to many pesticides. At the same time, many of the whitefly's natural enemies, such as the green lacewing and the big-eyed bug, have been destroyed by wide use of the chemicals. Combinations of pesticides sometimes work, but not reliably.

Byrne has tried trap crop techniques for whitefly control, working with Peter Ellsworth and Jon Chernicky at the UA Maricopa Agricultural Center, near Maricopa, Ariz.

Michael Stokros

Cotton is a favorite host for whiteflies.

"We surround cotton fields with bands of plants that are more attractive to the whitefly — the trap crops — and then hit the bands with pesticides. We don't know how well it will work, but the preliminary evidence is encouraging," Byrne says.

Using predators and parasites has met with only limited success. Byrne and Allen Cohen of the U.S. Department of Agriculture used one type of predator that could eat as many as 50 adults a day. But the predators probably couldn't keep up with the exploding population growth of the whitefly in the early fall. Natural enemies have more influence earlier in the year.

Whitefly migration patterns from one field or one crop to others are changing, also. The entomologists found two whitefly types, or morphs, with wings that are structured differently. One morph stays put, but the other migrates to more distant fields. The entomologists are now looking at behavior.

Byrne and post-doctoral researcher Jackie Blackmer are studying migration with the help of a flying chamber that resembles a huge terrarium tented with black cloth. After whiteflies are placed in the chamber, a light turned on at the top attracts them. Their movement is tracked on film and on a machine much like a seismograph.

Byrne says the sweet potato whitefly flies about 6 centimeters per second. When aided by a 5 mile an hour wind, this speed could mean a flight of up to 12 miles in one morning. In the lab, these whiteflies can sustain flight for more than 2.5 hours in temperatures less than 90 degrees. If the researchers can predict when the insects may migrate, perhaps they will learn how to avert the mass movements.

The poinsettia strain has yet another survival technique — it can reproduce without fertilization. "If the eggs are fertilized, females hatch," Brown says.

Her studies have shown an enzyme difference between A and B whitefly types, which may indicate genetic differences.

Even faced with the complexities of the poinsettia whitefly, the university researchers hope to avoid a repeat of the 1991 disaster in the Imperial Valley. Now, the scientists believe, growers realize the importance of developing and using management techniques, particularly since traditional chemical controls are ineffective.

Some management suggestions are radical, such as plowing under entire crops at the first sign of infestation. However, crop sequencing is one workable suggested approach. In this case, growers would avoid planting favorite whitefly host plants near each other. For example, they would not plant melons next to cotton. Plantings also would have to be timed so crops wouldn't reach certain critical stages that encourage migration at the same time.

Growers will need to regulate crop irrigation. They will have to narrow the time frame during which they terminate cotton irrigation because once cotton dries, whiteflies leave for other crops, such as young lettuce. Perhaps scientists will be able to predict migration better and suggest alternative crops for fall planting.

Byrne also suggests weed hosts must be destroyed to eliminate the rapid increases in the poinsettia strain of whiteflies that live on weeds when other hosts are not available. Destroying weeds also could help control the spread of viral plant diseases.

"Area-wide cooperation by growers and researchers is needed if we're going to successfully control the whitefly," Byrne says. "Growers recognize that one guy can't do it all alone."

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