ENTOMOLOGY

Is Devastating Whitefly Invader Really a New Species?

In 1986 a new variety of whitefly, a common crop pest in Florida and the Southwest, came winging its way out of Florida's poinsettia greenhouses; by 1991 it was tearing through California and Arizona, leaving millions of dollars of crop destruction in its wake. Because this latest invader looked identical to a species known as the sweet potato whitefly, entomologists classified it as a new strain ("strain B") of that species. But strain B was hardier, more prolific and more voracious than the usual strain A—and it infested crops the A strain never touched. Farmers called it "Superbug."

PHOTOS BY T.M. PERRING

Potent pests. The tiny silverleaf whitefly *(left)* causes several disfiguring plant conditions, including irregular ripening tomatoes *(right)* and squash silverleaf *(not shown)*, for which it is named.

Although the two whitefly varieties are physically indistinguishable, Superbug's devastating qualities led entomologists to suspect that the novel strain could be an entirely new species. In this issue of *Science*, Thomas Perring and his colleagues at the University of California (UC), Riverside, offer evidence that seems to confirm that hunch (see page 74). It's a finding that could have some important implications for controlling the pest. "If it is a different species, that is very significant," says Michael Parrella, chairman of entomology at UC Davis. The knowledge could influence the search for natural enemies of the strain—a promising means of control, since the pest isn't controlled well by insecticides. But because the stakes are high, researchers are urging careful scrutiny of the data before the new-species notion is accepted.

Perring and his colleagues addressed the species question with four tests—two biological and two genetic. "Species may be defined as populations that are reproductively isolated and genetically distinct," says Perring. To test for reproductive isolation, the group paired males of strain A with females of strain B—and vice versa—and checked for hybrid offspring. Finding none, they observed the behavior of mixed pairs, and found that although the males courted the females, the pairs didn't mate.

Like the behavioral tests, genetic analysis showed significant differences between strains. A battery of enzymes that are the same within each strain were found to differ between strains. Furthermore, a test designed to look at variations in segments of DNA found more than 80% similarity within each type, but less than 10% similarity between types. This led the team to conclude that strain B is indeed a separate species, which they dubbed "silverleaf whitefly," after a condition it causes in squash.

But some researchers worry about the Riverside team's results, because their A strain insects came not from the field but from cultures that had been maintained in the laboratory for years—a practice that can lead to genetic divergence or behavioral quirks that could render them unable to breed with other whiteflies. "It would be a stronger case if they had an A strain from someplace in the field," says David Byrne, a whitefly researcher at the University of Arizona. But that's a tall order, because the B strain seems to have overrun the A strain in the wild, making A type whiteflies nearly impossible to find.

Perring's team addressed that concern by using two lab strains of A flies and showing that they were genetically similar to each other and could interbreed, despite the fact that they had been cultured independently for years. And unpublished results from another team add additional support. Geneticists Nick Gawel and Alan Bartlett, of the U.S. Department of Agriculture's (USDA) Western Cotton Research Laboratory in Phoenix, got around the A strain problem by using A strain whiteflies that were collected and preserved in 1982 and 1988, before the B strain took over. The dead insects obviously can't be tested for mating, but they were fine for DNA analysis. The results resemble the Riverside findings: 95% similarity within strains, but only 6% between strains. "The similarities between A and B were no greater than those between A and [other whitefly species]," Gawel says.

That might seem to settle the case, but other researchers say they have data refuting the two-species conclusion. Bruce Campbell, at the USDA agricultural research laboratory in Albany, California, compared ribosomal RNA genes, which are widely used for determining taxonomic relationships, and found that there is no difference between the A and B strains, while he saw significant differences between the A strain and other whitefly species. And James Duffus, of the USDA lab in Salinas, California, claims he has produced hybrids between A and B strains by mixing males and females of both types, but his claim is somewhat controversial, because his typing method depends on an enzyme that many researchers consider to be an unreliable marker.

Obviously the debate isn't over yet. But if Perring's group is correct, that means "there may be several different, morphologically very similar species" of sweet potato whiteflies from around the world, improperly grouped together as one species, says Tom Bellows, a member of the Riverside team. That has significant implications, he adds, because different species may vary not only in their preferred target for infestation but also in the predators and parasites they attract.

The last point is crucial, because finding and importing natural enemies is, at the moment, one of the most attractive strategies for whitefly control. The best candidates are tiny "parasitoid" wasps that lay their eggs in whitefly larvae. Such wasps were used against the ash whitefly, another species of whitefly that invaded California just 2 years ago, and now, after the introduction of the right parasitoid, can hardly be found. But some of these wasps are quite host-specific, says Allen Cohen, a research entomologist with USDA in Phoenix, and so knowing the precise target species is key. Moreover, the most productive place to search for the right parasitoids would be the native home of the silverleaf whitefly—and no one knows where that is.

If sweet potato whiteflies from around the world wind up being separated into several species, that would likely help pinpoint the original home of the silverleaf variety. And that in turn could lead to discovery of the much-needed natural enemy. But while researchers keep turning up potato leaves looking for answers to those questions, one lesson is clear: If you have your choice of whitefly pests, take the A strain.

–Marcia Barinaga