Whitefly Fungus on Its Way to Growers

A natural fungus that kills sweetpotato whiteflies could start providing relief this fall to growers of melons, cucumbers, cole crops, tomatoes, and other vegetables in the Southwest and Florida. Vegetables, citrus, cotton, alfalfa, and other crops have been ravaged by a new whitefly biotype.

With the fungus, vegetable growers may be able to control whiteflies with less reliance on chemical insecticide, says entomologist Raymond I. Carruthers. He is with USDA's Agricultural Research Service in Weslaco, Texas.

In 1992, Carruthers began evaluating 40 fungus strains under a cooperative research and development agreement, or CRADA, with Mycotech Corp. of Butte, Montana. Lab and field tests point to "GHA," a Mycotech strain of *Beauveria bassiana,* as the most promising first candidate for commercialization.

Carruthers and Mycotech entomologist Steven Wraight conducted tests at Weslaco's Subtropical Agricultural Research Laboratory. Carruthers heads the lab's Biological Control of Pests Research Unit. In spring and fall of 1994, the GHA fungus killed up to 90 percent of immature whiteflies in small field plots of cantaloupe, cucumber, and tomato.

Many *B. bassiana* strains have been isolated from soils and insects around the world. For whiteflies, Mycotech plans to market GHA in a wettable powder, as Mycotrol-WP. The company has other GHA formulations for grasshoppers, Mormon crickets, and locusts.

"Originally," says Mycotech vice president Clifford Bradley, "we had tested—and planned to register—the GHA fungus against grasshoppers. We spent $500,000 on toxicology tests on its safety to people and the environment. Luckily, the same strain consistently kills whiteflies."

In March 1995, the U.S. Environmental Protection Agency approved commercial use of Mycotrol. Supplies will be limited until a larger production plant goes on line as planned next year, Bradley adds.

To spray Mycotrol-WP, farmers would mix the powder with water and a wetting agent that helps fungus spores stick to leaves.

When the spores touch a whitefly, they germinate, releasing natural chemicals that poke holes through its skin. Fungi invade and release enzymes that dissolve the insect's fat reserves. Fungal cells feed on this material. The insect soon stops eating, weakens, and dies a few days later. *Beauveria*-infected whiteflies look like brownish bits of rust.

First found in Florida, biotype B of sweetpotato whitefly, also called the silverleaf whitefly, began tormenting American farmers in 1986.

The insect attacks hundreds of plants, including dozens of field crops and ornamentals. It sucks juices from leaves, sapping a plant's vitality. It transmits viruses and resists insecticides. Spending much of its time on leaf bottoms, it is partly shielded from insecticide. Biotype B is prolific and can breed all year where mild climate allows fall- and winter-planted vegetables to bracket the summer season of plants like cotton. Carruthers has seen whitefly densities as high as 500 per square centimeter. "In the air over a heavily infested field, whiteflies look like aerial plankton," he says.

Huge losses—in crop value, sales, employment, and other indirect losses—are blamed on the whitefly. Arizona, California, Florida, and Texas have the worst damage. In California's Imperial Valley, for example, county officials charge whiteflies with annual losses that averaged $320 million and more than 5,000 jobs from 1991 through 1993.

In 1992, scientists at ARS, other agencies, and universities began a coordinated attack plan. [See "Get the Whitefly Swatters—Fast!" *Agricultural Research,* November 1992, pps 4-13.] Carruthers and Wraight began lab bioassays that year with 40 *Beauveria* and *Paecilomyces* strains. Their main questions: Which strains killed whiteflies most consistently and quickly? Which ones were hardiest? Which multiplied fastest?

Meanwhile, Mycotech scientists determined which strains the company could most economically mass-

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At an ARS experimental plot near Weslaco, Texas, technician Joel Garza applies a whitefly-killing fungus, *Beauveria bassiana*, to vegetable crops. (K5848-18)

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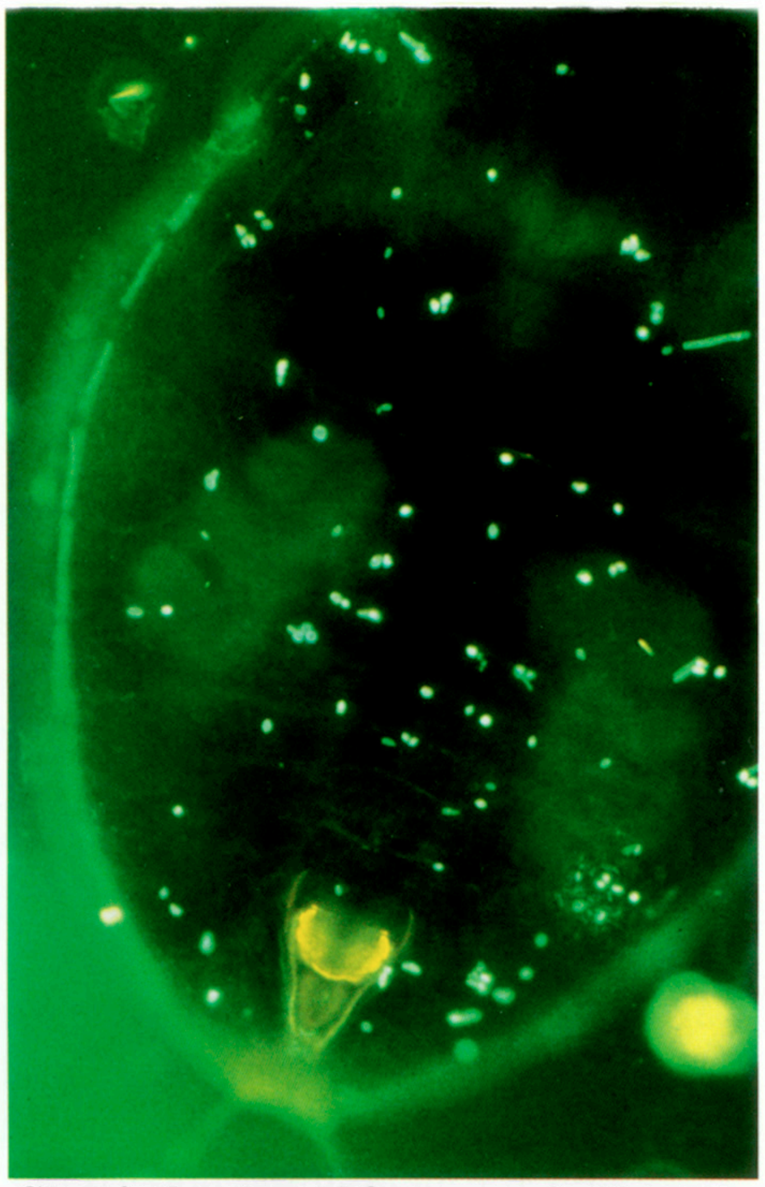

Chemicals released from germinating spores of *Beauveria bassiana* on the back of this whitefly nymph will make holes in its skin, or cuticle. Enzymes from the invading fungus will dissolve the insect's fat reserves, providing food for fungal cells to grow. Soon the nymph will weaken and die.

produce at high quality.

With the best candidates from their lab bioassays, Carruthers and Wraight then ran outdoor tests in plots about 8 rows wide and 30 feet long. "We sprayed live fungus spores mixed with water and a wetting agent," Carruthers says.

The fungus performed as well as or better than insecticide. It consistently reduced numbers of nymphs—immature whiteflies—by to 90 percent or more.

"We think most growers may need to use insecticide to knock down the first whitefly populations infesting spring-planted melons and other vegetables," Carruthers says. "Then they would spray just the fungus about every week or so, depending on how severe the infestation is."

The fungus is undergoing larger field tests this year in Arizona, California, and Texas. The primary aim is to refine integrated pest management strategies for using it on vegetable crops. IPM doesn't always eliminate chemical pesticide, but it can dramatically reduce the number of applications.

To help adjust IPM strategies, Weslaco scientists are using computers to simulate life cycles of the pest and its natural enemies. Will spraying fungus instead of insecticide leave fields with larger natural populations of whitefly enemies such as parasitic wasps? "So far, small field studies at Weslaco show the fungus has little effect on field populations of biocontrol insects," Carruthers says. "We'll examine this more closely."

Scientists are also combining fungus sprays and a biocontrol-release tactic called augmentation in which quantities of a natural enemy of a crop pest are introduced into an area. In one test, begun this spring in Parker, Arizona, they will release 100,000 to 200,000 *Serangium parcesetosum* beetles in commercial cantaloupe and honeydew melon fields. They're also spraying fungus. Insecticide will be a last resort.

USDA's Animal and Plant Health Inspection Service is conducting the Parker test in cooperation with the Arizona Cotton Research and Protection Council, ARS, and Mycotech. "Besides finding out if this can control whiteflies in melon fields, we want to see if it can reduce the number of whiteflies switching to nearby cotton soon after the melon harvest," says Robert Staten.

In Phoenix, Arizona, Staten directs APHIS' Methods Development Center, which is lab-rearing the beetles. Their ancestors—from India—were collected by Lawrence Lacey and Alan Kirk at ARS' European Biocontrol Research Laboratory in Montpellier, France, and colleagues.

At Weslaco, scientists will investigate why the fungus so far has killed more whiteflies on some varieties of cotton than on others. Tests using about a half-dozen cotton varieties will be run by scientists at the Weslaco lab, Mycotech, and ARS' Area-wide Pest Management Research Unit in College Station, Texas.

"We think this fungus has wide-ranging potential," Carruthers notes, "and some other fungi may be as good or better."

One is a strain of *Paecilomyces fumosoroseus*. Carruthers and Wraight included it in bioassays after it caused a natural epidemic in whiteflies in Texas broccoli fields. And ARS researchers in West Virginia and New York are cooperating with Mycotech and university scientists to see if the Mycotrol fungus can control Russian wheat aphid and pear psylla.—By **Jim De Quattro,** ARS.

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In an ARS lab test at Weslaco, Texas, insect pathologist Stephen Wraight of Myotech Corporation sprays fungal pathogens on immature whiteflies. (K5847-7)