RESEARCH UPDATE

The early birds got the worms

By Darcy Meeker

A 'friendly' nematode may become the first line of defense against the mole cricket, backed up by a red-eyed fly, a pair of fungi and the bombardier beetle.

When word went out that the University of Florida had a new way to fight mole crickets, 25 golf course managers stepped right up and contributed $8,000 each to test the treatment. Eight grand sounds reasonable to people who are already spending $30,000 to $60,000 a year to spray mole crickets.

"Mole crickets are probably the biggest pest problem we have," said Bob Yount, who directs the Florida Turf Grass Association Research Foundation. The foundation has invested $101,500 in the mole cricket fight so far. That's nearly half of its total research dollars.

The state of Florida has also kicked in funds. Florida's 900-some golf courses aren't the only places where mole crickets' endless munching and burrowing turn valuable green to brown. Counting pastures, lawns and the vegetable industry — and golf courses — exotic mole crickets cost Floridians at least $47 million a year. So estimates Dr. Howard Frank, director of the mole cricket biocontrol project at UF's Institute of Food and Agricultural Sciences (IFAS) in Gainesville.

The pests have spread to Georgia, Alabama, and South Carolina.

Yount is enthusiastic about Frank's latest project to use one of nature's own tools to kill mole crickets.

Enter the "friendly" nematodes. The microscopic worms attack nothing but mole crickets, and they carry bacteria that help do the pests in. The naturally-occurring bacteria are never found anywhere except in mole crickets and the nematodes, so the U. S. Environmental Protection Agency has no problem with using them as a living pesticide.

Chemical pesticides are not faring so well against the ungainly brown insects on golf courses.

Yount says, "Chemicals are not controlling mole crickets as they should. They're growing immune to existing products, and every year we lose one or two of them." The EPA is not registering new mole cricket chemicals.

"Besides," Yount said, "everybody wants to avoid using chemicals anyway."

Mole crickets are exotics. They probably came from South America in the sand ballast of ships, and their natural enemies didn't take hold in their new home. Brazil was the original source of several Florida pests: fire ants, water hyacinth, several weevils, Brazilian pepper , coffeeweed, bristly starbur, cocklebur and milkweed vine. IFAS and the Universidade de Saõ Paulo have a biocontrol research agreement that includes work on mole crickets.

Frank has already tested the nematode in pastures and golf courses in Florida. It's called *Neoaplectana* or *Steinernema* (for classification details see the April 1990 issue of the *Journal of Nematology*). The first releases used worms from Brazil reared in a commercial fermentation vessel. They worked, but now researchers think they have a better bug-battler in a batch of nematodes

from Uruguay.

"It's more virulent against mole crickets," said Frank's co-researcher IFAS nematologist Grover Smart .

Smart is growing the new worms in his lab on dog food and mole crickets.

"We have decided that we would prefer to produce the nematodes ourselves because we feel that the ones we produce are a little better quality. They live longer and are more infective than commercial ones."

Smart explains that the nematodes enter the crickets through their mouths or breathing tubes (spiracles) in their abdomens.

"As the nematode grows, it releases the bacteria. The nematode goes through two complete life cycles, and then the third generation exit as infective juveniles." The mole cricket is dead by then. Smart said nematodes will kill the mole crickets on their own, but it takes longer without the bacteria to give the mole cricket blood poisoning.

How long will the nematodes keep killing mole crickets? Smart says researchers don't have any reason to think they will stop.

"We put nematodes on an experimental plot four years ago. In one year, mole cricket populations fell by 90 percent. We still find a few mole crickets out there, and about 10 percent of them are infected with the nematodes. We don't know how much longer this will take place."

Howard Frank /IFAS

Using solid state electronics, researchers from the University of Florida's Institute of Food and Agricultural Sciences call mole crickets to their fate: to be a tasty meal for nematodes. Calling/collecting stations are placed in the rough.

Smart said the nematodes have now spread 10 miles from the release site.

"We don't know how much effect it's having on mole cricket populations there. We're continuing to monitor those populations, however, and next spring we'll have a better idea what it's doing."

Meanwhile, he is gearing up to deliver 3 million nematodes to each participating golf course, coinciding with mole cricket flight periods, starting in South Florida.

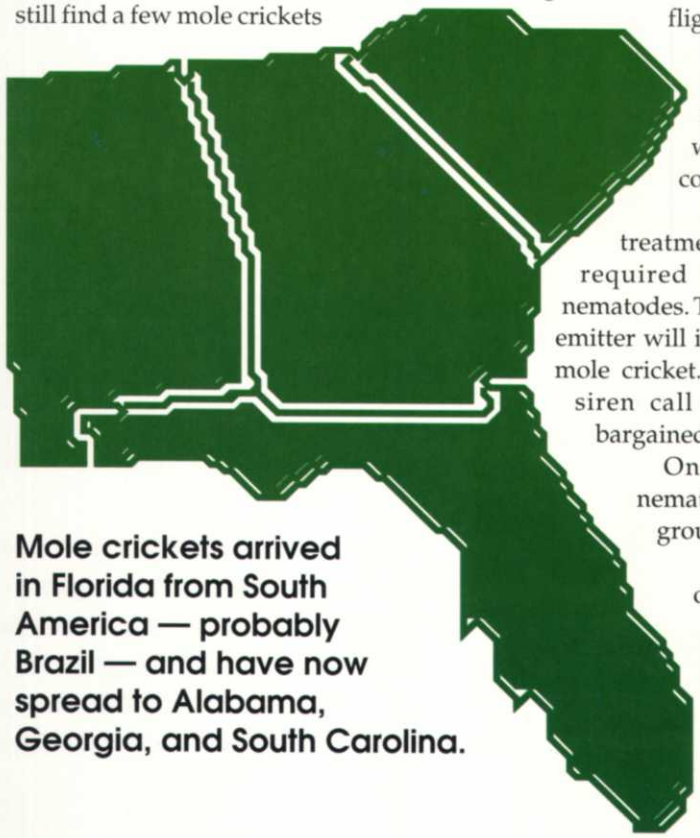
"We wouldn't want the nematodes to starve to death waiting for mole crickets to come along," he said.

Frank said earlier nematode treatments were wall-to-wall and required billions and billions of nematodes. This time, though, a solid state emitter will imitate the mating call of the mole cricket. Those that respond to the siren call will get more than they bargained for.... a dose of nematodes.

On some golf courses, the nematodes will be poured on the ground under the emitters.

"The mole crickets will land on the ground and tunnel in," the IFAS entomologist said. "Some will die there and maintain the inoculum, and some will spread out to other areas. The idea is to start an epidemic among the mole crickets."

In a second test method, a five-gallon bucket is packed with



Mole crickets arrived in Florida from South America — probably Brazil — and have now spread to Alabama, Georgia, and South Carolina.

Susan Winewriter developed the process for raising the Brazilian fly in the laboratory.

foam sponge, soaked with a nematode solution, and stashed under the emitter.

"The point is that the nematodes will be more concentrated than those poured on the ground," Frank explained. Golf course workers will store the bucket in the fridge during the day to keep the tiny worms from cooking in Florida sunshine.

A third method also uses a bucket. This time it's filled with sand impregnated with nematodes.

"After the mole crickets have had time to infect themselves, they can be scooped out of the bucket by golf course personnel and distributed in problem areas." An infected mole cricket will serve as a Typhoid Mary wherever it is placed.

Clients and neighbors shouldn't notice the sounds the emitters make because they'll just blend in with natural mole cricket mating calls, he said.

"Next fall and in the fall of the following year, we'll convert the inoculating stations into sampling traps," he said. "The trapped mole crickets will be shipped to us in Gainesville and we will see what proportion is infected with nematodes."

Frank and friends will supply nematodes and regional training sessions. The golf courses will run the releases themselves and monitor their progress.

Among the golf courses involved are the Royal Poinciana Golf Course in Naples, Sun City Center in Sun City, Bay Hill Club in Orlando, Fiddlesticks Country Club in Ft. Myers, Waterford GC in Venice, Riviera GC in Ormond Beach, Cypress Creek CC in Orlando, Quail Ridge GC in Spring Hill, Interlachen CC in Winter Park, Cypress Run in Tarpon Springs, Countryside CC in Clearwater and Woodfield CC in Boca Raton.

The Gainesville G&CC is participating in wall-to-wall nematode experiments. Two other golf clubs and three pastures will also receive the treatment and be monitored for mole cricket populations and grass cover.

A question to be answered by

And the bent goes on...

KIEFFER/JANLARK

Dan Jones, CGCS, photographs some newly germinated bentgrass on his test plots at Banyan GC in West Palm Beach.

Jones is one of 12 superintendents taking part in the national trials of some strains developed by Dr. Milton Ingleke at the Texas A&M research center in Dallas.

"We're not supposed to do anything special with it," says Jones, mindful of the effort required to keep the current strains of the cool-season grass alive in Florida's long, hot, humid summers.

"If it requires special treatment, it won't be suited for Florida. That's the point of the trial."

Looking on is Jones's assistant, Tim Echols. A full description of the test will be reported in the Spring issue.

further research: How can golf courses control for nematodes that hurt grass without upsetting the usefulness of the nematodes that attack mole crickets?

During the course of the two-year test of the nematodes, participating golf courses will receive a bonus: another biological control agent for the mole cricket. This one is a red-eyed fly from Brazil that answers the mole cricket's mating call. Its young, laid on or near mole crickets, burrow into the cricket.

Ten days later the mole cricket is dead, the grubs then pupate and emerge as adult flies to chase after more mole crickets.

About the size of a house fly, *Euphasiopterx depleta* is also targeted to mole crickets and will harm nothing else in Florida.

Releases usually use fly pupae in damp sand, in a system developed by Susan Winewriter, an IFAS technician. She is the first person in the world to lab rear the Brazilian fly, or any of its cousins that parasitize crickets and katydids.

The fly is established near Gainesville and has spread over a mile on its own accord, Frank said.

"We plan another release site for the fly funded by FTGA at the Doral Golf and Country Club in Miami. Doral will run a monitoring station for us and send a portion of trapped flies to us, releasing the rest," he said.

Two fungi that kill mole crickets are research targets in Dr. Drion Boucias' IFAS lab at UF.

Frank says, "Preliminary attempts to infect mole crickets by pouring buckets of the fungi in water onto the soil did not work. But we do know that mole crickets will take the bait Rod Kepner developed. We'll try that same bait to incorporate the fungal pathogens and do trials to find out whether that works. If it does, that will give us another non-chemical method to control mole crickets."

Frank said the research is three to four years away from proving itself.

Meanwhile other pathogens — protozoa and viruses — are being investigated for IFAS by Dr. Sergio Alves in Piricicaba near Saõ Paulo in Brazil.

Then there's the wasp that another member of the mole cricket research team, Dr. Jim Castner, researched for his Ph.D. at Florida. It was only a partial success.

"The population still exists at Ft. Lauderdale on the IFAS research center there and on land nearby," Frank explained. "Castner's dissertation showed that it was taking only the short-winged mole cricket, not the tawny and Southern mole crickets. In the lab, it had attacked all three. It surprised us."

Frank said researchers are looking at related wasps that parasitize mole crickets in Bolivia at slightly higher altitudes. The hope is they'll tolerate cooler temperatures and be able to survive winters farther north.

One of Frank's favorites in nature's arsenal against armies of mole crickets is the bombardier beetle. So called because it sprays a brown "defensive secretion" when disturbed, it eats a smorgasbord of small insects as an adult. However, its larvae are specialist predators of mole cricket eggs. Without mole crickets, it can't survive because it has nothing to eat.

There are a lot of questions left to ask in mole cricket research: What happens when you introduce more than one natural enemy? What conditions favor which biological control agent? What's the best way to raise and deliver the biocontrols? Research continues. We'll keep you posted.