Natural Turf Management, Part 5

Biological Insecticides

By Alan Goforth

Environmental, worker safety and efficacy concerns are causing sports turf professionals to rethink insect control strategies. The past decade has seen a dramatic shift away from traditional "harsh" chemicals and toward a strategic approach that integrates the use of chemicals, beneficial insects and biological insecticides.

"The turf industry in general has often been looked upon as heavy pesticide users," says Dr. Steven Alm, associate professor of entomology at the University of Rhode Island. "The industry is definitely now heading toward a more integrated approach."

Bacillus What?

This changing landscape has opened the door for increased use of the biological insecticide *Bacillus thuringiensis,* commonly known as Bt. Although Bt, a soil-living bacterium, can be found almost anywhere, its exact function in nature is not completely understood. It appears to be readily consumed as food by other microorganisms and does not persist long after being sprayed.

Bt can be readily fermented in large quantities, making it the most commonly used bacterial pest control agent. In this process, the Bt produces a relatively large crystal, which occupies much of the inside of the cell. The particular strain or variety of Bt determines the shape and composition of the crystal, which is responsible for most of the toxic effect on pests.

The key to understanding Bt performance on turf insects is to realize it is *not* a chemical insecticide. The mode of action is completely different, which also means results are evaluated differently.

Bts work only if ingested by the insect, so they must be applied when pests are actively feeding. A specific pH and specific enzymes are required for the crystal to solubilize in the insect gut. After ingestion, the Bt binds to a specific site in the gut wall. As the wall deteriorates, the contents leak into the body cavity, while spores also can infect the insect body.

Insects generally die within two to seven days. However, there is no plant damage during this time, because body paralysis causes insects to stop feeding.

Bt insecticides offer many benefits. They are extremely specific and not toxic to most non-target plants, insects and mammals, so beneficial insects survive to provide continued control. In addition, Bts degrade rapidly, have little or no environmental impact and can be highly efficacious.

Promising Development

So why haven't Bts been used more widely? Dr. Harry Niemczyk, emeritus professor of entomology at Ohio State University, offers this assessment after working with Bts since 1971. "Bts are an excellent fit in many situations. However, the problem is that they have not been stable in the soil and have not given us effective insect control."

A new product, on track for registration both nationally and in California, promises to move Bts into the forefront. Mycogen Corporation will market Bt *Buibui* under the name M-Press™ for control of white grubs. The organism (or bacterium), discovered in Japan in 1991, is distinguished by a spherical or ball-shaped crystal with a dark outer layer. It is highly specific and controls only certain scarab beetle grubs.

"Japanese beetle grub control will be the best fit," says Paul Bystrak, manager of field development for Mycogen. "It's a problem on the vast majority of U.S. golf courses, except California and Florida.

"In California, it will be effective on the green Junebug. They are large pests and leave clutter on the turf when controlled with insecticides above ground. M-Press controls them below ground, however, which will eliminate this problem."

The product also will be effective against masked chafers in California and Texas, he adds.

Success in the Field

It takes a lot to impress Niemczyk, but he's clearly excited about the potential for M-Press on Japanese beetles.

"I can't think of a product we haven't evaluated over the years," he says. "I was absolutely surprised to have a biological agent like this actually move from the site of application (on the surface) through thatch and organic matter to the zone where grubs feed. I was pleasantly surprised by the control. We had never worked with a Bt with this degree of control."

Niemczyk tested the product at four different rates in 1994. "We had what entomologists like to call an excellent infestation that year," he recalls. "In untreated plots, there were 49 grubs per square foot. We applied M-Press in the latter part of August, at the second or third stage of development. We evaluated the results in late September, and the control was fantastic. At the highest rates, Bt *Buibui* gave us 96 percent control."

Alm noted similar results in his research, although he targeted the Oriental beetle.

"The Oriental beetle is not found throughout the United States, but it can be as destructive as Japanese beetle larvae on turf," he says. "I have tried M-Press for a couple of years on Oriental beetles, and it's been very effective. I've gotten a 96 to 99 percent mortality rate, depending upon the rate."

Bystrak's challenge is achieving acceptable control at an acceptable rate, preferably in the two- to three-gallon-per-acre range. Complete control is not necessary, Niemczyk points out.

"You don't need 100 percent control," he says. "You just need to get populations below damage thresholds."

Learning to integrate biologicals into insect control programs will be an ongoing process. Researchers apparently have only scratched the surface of potential Bt uses.

"One company has identified more than 10,000 strains of Bt, so there is great potential," Niemczyk says. "I'm happy the industry is putting money behind biologicals." ❑