Biological Control of Black Cutworms on Golf Courses Using a Baculovirus and Natural Enemies

Andrea Bixby and Daniel A. Potter
University of Kentucky

Objectives:

1. Evaluate AgipMNPV, a naturally occurring baculovirus, as a bio-insecticide for season-long and multi-year preventive control of black cutworms (BCW) on golf courses.
2. Compare infectivity and persistence of AgipMNPV to BCW in sand-based and soil-based putting green and fairway height creeping bentgrass habitats.
3. Investigate compatibility and possible synergism of AgipMNPV with soil insecticides used for grub control on golf courses.
4. Investigate compatibility of endophytic and other insect-resistant turfgrasses with biological control of black cutworms by AgipMNPV.

Start Date: 2007
Project Duration: three years
Total Funding: $60,000

Biological controls, once established, can provide prolonged suppression of insect pests on golf courses. In 2003, a cutworm-specific virus was found decimating populations of black cutworms (BCW) on Kentucky golf courses. Virus-infected BCW rupture and spread millions of infective virus particles onto foliage and thatch.

The virus, identified as *Agrotis ipsilon* multiple nucleopolyhedrovirus (AgipMNPV), was amplified by feeding it to BCW, harvesting their cadavers, and mixing the concentrated virus particles with water. This crude biological insecticide was applied to turf to see if it would infect resident larvae.

Testing showed that it quickly killed young larvae, but that larger ones required higher dosages and fed for several days before being killed. When applied to 12 whole tees of two golf courses, the virus gave 78% and 33-41% control of newly hatched larvae after one week and one month, respectively, but residual control of larger larvae (45-56%) lasted only about a week.

During summer 2009, virus was applied to paired plots on creeping bentgrass greens and mixed-grass surrounds to compare its residual activity in those habitats. Residual efficacy was determined 3 days, and 2 and 5 weeks after application by implanting mid-sized BCW and determining how many were killed by virus infection. Three-day-old virus residues provided 50-60% control in both greens and surrounds, but infection dropped to only 10-20% in both settings after two weeks, and was almost nil by five weeks after application. A virus-based insecticide could provide short-term control of BCW on golf courses, but it would probably need to be re-applied at regular intervals.

Naturalized areas on golf courses could promote beneficial insects by providing pollen, nectar, alternative hosts, or shelter that can attract and sustain natural enemies of pest insects.

Parasitoids are insects that parasitize other insects. When BCW were implanted on golf course tees, 30% of larvae recovered after 10 days in the field had been parasitized. A survey of BCW parasitoids was initiated in 2009 to provide better understanding of how to conserve and recruit these beneficial insects for biological control. For instance, naturalized areas on golf courses could promote beneficial insects by providing pollen, nectar, alternative hosts, or shelter that can attract and sustain natural enemies of pest insects.

Studies were initiated in 2009 to determine the species, natural history, and impact of parasitoids of BCW in golf course habitats. Sentinel eggs and newly hatched larvae were placed in the field monthly in four locations: tees, fairways, and roughs near or far away from naturalized areas on three Kentucky golf courses. We hoped to determine how grass height and proximity to naturalized areas affect parasitism, but the study was inconclusive because ants consumed most of the eggs and larvae.

In another experiment, parasitoids accounted for similar (12-19%) mortality of BCW in field plots of creeping bentgrass and perennial ryegrass. Two parasitoid species that attack BCW eggs and three others that attack the larvae were identified. The most abundant parasitoid, a tachinid fly (*Bonnetia comta*), was reared to study its biology. The female flies, stimulated by BCW frass (feces), to give birth to maggots which are deposited near the entrance to a BCW burrow. The fly maggot crawls onto the victim's back when it comes out to feed. The maggot burrows in, feeds, and kills the BCW in a few days, then emerges from the shriveled victim and forms a pupal case from which a new fly emerges.

Experiments planned for 2009-10 explore chemical cues that attract the parasitic flies to golf turf, as well as compatibility of parasitoids with turf insecticides and endophytic turfgrasses.

Summary Points

- A virus-based biological insecticide has potential for short-term control of black cutworms (BCW) on golf courses.
- Five parasitoid species were found suppressing BCW populations on Kentucky golf courses. A study to determine if naturalized areas, which provide resources for beneficial insects, can increase parasitism of BCW was thwarted by high ant predation.
- Biology of a fly that parasitizes BCW was clarified and studies were initiated to evaluate it for augmentative or conservation bio-control.