Use of a Baculovirus for Season-long Control of Black Cutworms on Golf Courses and Compatability with Soil Insecticides and Insect-resistant Turfgrasses

Daniel A. Potter and Andrea Bixby
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, have the potential to provide prolonged suppression of insect pests on golf courses. In 2003, a former graduate student discovered a caterpillar-specific virus decimating populations of black cutworms (BCW) on Kentucky golf courses. The virus, identified as *Agrotis ipsilon* multiple nucleopolyhedrovirus (AgipMNPV), was amplified by feeding it to healthy 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. Initial testing showed this AgipMNPV suspension to quickly kill young larvae, but that larger ones require higher dosages and continue to feed for several days before being killed. Virus-infected BCW rupture in death and spread millions of infective virus particles onto foliage and thatch. Virus sprays gave good control of BCW in small-plot field trials in fairway- and collar-height creeping bentgrass.

Thousands of laboratory-reared BCW were infected with AgipNMPV during the winter, harvested, and stockpiled to prepare enough virus suspension for a realistic field trial. Six whole tees at each of two central Kentucky golf courses, plus 2 meters into the surrounds, were sprayed with virus suspension in spring 2008, with six untreated tees on each course used for comparison. Efficacy was determined at monthly intervals by sampling natural densities of BCW and by implanting sentinel larvae and eggs, using irritant (soap) drenches to recover short-term survivors, and rearing them to determine how many ultimately died from virus.

Once infected by the virus, black cutworm larvae can be used to prepare virus suspensions and applied to the field to further infect resident larvae.

The virus provided 78% control of young larvae hatched from eggs and 45-56% control of third instars placed in the turf one week after application. We are currently examining hundreds of BCW blood smears on microscope slides to determine how many weeks of suppression the virus application provided.

Studies were initiated in 2008 to investigate the virus' compatibility with host-plant resistance. BCW that develop on endophytic grasses or Kentucky bluegrass show delayed growth and development. Such stress may increase their susceptibility to virus residues encountered in the turf.

BCW were allowed to feed in the greenhouse for 3 days on 'Rosalin' perennial ryegrass with (E+) or without (E-) endophyte. Four rates of virus were then applied to the grass blades. Larvae were left to feed on grass for 10 days and then survival, growth, and incidence of virus were assessed. Main effects of endophyte and virus were highly significant. Larvae feeding on E+ grass were stunted, yet the virus caused similarly high (85-97%) mortality of BCW irrespective of grass type. This shows that AgipMNPV is not deactivated by alkaloids in the E+ grasses.

Inactivation of microbes by solar radiation can be a major hurdle to biological insecticides under field conditions. Optical brighteners have been used as adjuvants for insect pathogens in other systems because they absorb UV light and can protect original virus activity for weeks after application.

In summer 2008 we evaluated two optical brighteners for enhancing efficacy and persistence of AgipNMPV against BCW in fairway-height creeping bentgrass field plots. The virus provided and average of 89, 44, and 18% mortality after 1, 3 and 5 weeks, respectively, but the brighteners did not significantly synergize or prolong infectivity.

Summary Points

- AgipMNPV gave good short-term control of BCW on golf course tees under actual play conditions. Extent to which it gave season-long control is still being evaluated.
- AgipMNPV is compatible with insect-resistant endophytic turfgrasses.
- AgipMNPV also gave good control in fairway-cut creeping bentgrass, but addition of optical brighteners to the virus from UV degradation did not detectably prolong infectivity or synergize its efficacy at lower rates.