

Biological-based Management of White Grubs, Cutworms, and Mound-building Ants on Golf Courses

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Objectives:

1. Survey, identify, and assess the impact of microbial pathogens and parasitic insects attacking white grubs and cutworms on Kentucky golf courses, the first such study in the transition zone.
2. Study late-summer, reproductive activity of mound-building ants, including timing and duration of swarming, number of new queens produced, distance they will disperse, and feasibility of targeting young queens to prevent initiation of new nests on golf courses.
3. Investigate co-dependence of mound-building ants with grass root-feeding aphids, and whether managing the aphids will discourage ant encroachment onto putting greens and tees.

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Project Duration: three years

Total Funding: \$76,719

Callie Prater, a graduate student, discovered a cutworm-specific baculovirus (AgipMNPV) causing 80 to 95% mortality of black cutworms (BCW) on central Kentucky golf courses. This is the first report of a region-wide viral epidemic nearly annihilating a turf pest. A bio-insecticide containing this virus could make long-term biological control of BCW a reality. We amplified the pathogen by feeding it to healthy BCW, allowed them to die, and harvested virus from their carcasses. The virus provided 80 to 99% mortality in field trials regardless of whether or not it was applied with irrigation or with spray adjuvants intended to increase persistence. The virus may be better suited as a preventive for season-long suppression than as a curative treatment in response to damage.

Four species of parasitic wasps were found attacking BCW on golf courses and life history studies were initiated. *Meteorus spp.*, a braconid wasp, lays eggs in mid- to large-sized cutworms. Its larvae feed internally on the BCW, emerging from the flaccid victim and spinning cocoons in about 10 days. An average of 36 parasitoid larvae emerges from each host. Individual wasps live up to two months.

Another parasitoid, a tiny encyrtid wasp, parasitizes BCW eggs. It displays an unusual reproductive adaptation called polyembryony wherein a single egg subdivides repeatedly, giving rise to more than 1000 parasitic wasps that emerge from each host. Collectively these wasps help suppress BCW populations on golf courses, so understanding their biology

will help superintendents fine-tune treatment regimes to conserve their benefits.

Graduate student Reid Maier studied mound-building ants, *Lasius neoniger*, on and around putting greens. Mounds are concentrated around the edges of sand-based greens. Excavations confirmed that main nest chambers are located outside greens in adjacent native soil of roughs. Experiments showed that the ant colonies rapidly expand auxiliary nest



Once infected with the baculovirus, the insect liquefies internally and dies. The integument soon ruptures releasing the liquefied contents containing millions of virus particles into the environment.

chambers into closely-mowed areas with sandy soil with increased mound-building. Also, insect and earthworm fragments on putting greens may provide the ants a ready supply of protein food. *Lasius* ants tend root aphids as one of many food sources, and aphids were more abundant in ant nests than away from nests. Targeting the aphids with soil-applied imidacloprid, however, did not alleviate mounding.

Sand-filled pitfall traps were used to monitor emergence of ant queens on golf courses. Several pulses of queens emerged over about four weeks beginning in late August, generally after rains.

Preventively applying a pyrethroid insecticide gave only short-term residual control of young queens crawling over the turf. Targeting such queens may prevent some new nests, but many colonies are perennial, overwintering with large numbers of workers. These findings indicate that ant control should focus on the perimeter of greens and include a two-meter wide band of nearby rough.

Summary Points

- A caterpillar-specific baculovirus found decimating black cutworms (BCW) on golf courses has the potential to provide long-term biological control. A virus suspension gave 80 to 99% control of BCW in field trials. Epidemiology from infection of BCW to cessation of feeding and death was investigated. This is the first research to explore use of a virus as a bio-insecticide for turf.

- Biological studies of parasitic wasps found attacking BCW on golf courses may help superintendents to adjust treatment timing to conserve beneficial natural enemies.

- Excavations revealed the main nests of mound-building *Lasius neoniger* ants are outside of sand-based greens in adjacent roughs. Experiments showed ants quickly encroach into low-cut turf and sandy soil by excavating auxiliary tunnels and pushing up mounds. Ant control efforts should focus on the green perimeter.

- Ant queens emerged over a 4-week period beginning in late August. Pyrethroid sprays gave short-term residual control of young queens. That tactic may prevent some new nests, but probably will not eliminate infestations because established colonies often persist for more than one year.