*USGA Green Section Record*

TGIF Record Number 167516

# Gifts from Mother Nature

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Sometimes Mother Nature can help in the battle against insect pests. A talented scientist who realizes this is Dr. Dan Potter, an entomologist who continues to guide the University of Kentucky's insect research program that strives to protect golf courses from all sorts of six-legged pests. You see, Dr. Potter's research focuses on what Mother Nature can give golf course superintendents in their efforts to manage insect pest populations.

It's called *biological control***,** and instead of relying primarily on conventional chemical insecticides to control insects that can ravage turf, Dr. Potter's team of researchers identifies the natural enemies of turfgrass pests, and designs management strategies to use them against bugs that threaten the health of golf course turf. Among others, these include other insects and disease-causing organisms like viruses.

*Black cutworms are a worldwide pest on golf course putting greens and tees, and sports fields.*

Although using biological insecticides currently has definite shortcomings, in the long-term it has great potential for environmental advantages. "Biological insecticides currently make up only an estimated one-tenth of one percent of the overall turf insecticide market. Biological pesticides traditionally have been more costly, specific to particular pest species, less reliable and consistent, and slower-acting than chemicals," says Dr. Potter. "On the upside, biological insecticides tend to pose little hazard to people or the environment, and once established can provide long-term control. Given the ever-growing pressure to reduce pesticide inputs, and new technologies for producing microbial insecticides, insect-pathogenic nematodes, viruses, and other organisms doubtless will play a bigger role in the future. And, naturally occurring enemies (pathogens, and parasitic and predatory insects) present on every golf course are the reason why insect outbreaks are the exception rather than rule. If we can learn to conserve and bolster populations of naturally occurring enemies of turf pests, the need for chemical inputs can be reduced."

Golf course superintendents use a combination of strategies, called *integrated pest management* (IPM), to control insect pests. By understanding the biology of both the insect and the turf, superintendents can adjust fertilizers, irrigation, mowing height and soil aeration

techniques to maximize the health of the turf and increase its resistance to insect invasion. However, IPM also includes the use of chemical insecticides when needed.

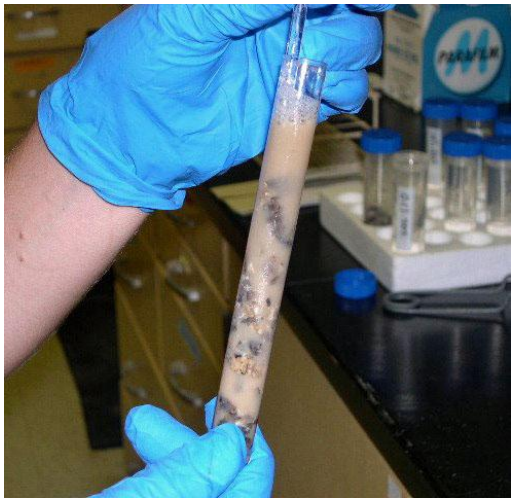
To what extent are biological control strategies compatible with chemical insecticide use? "Most of the new insecticides are relatively selective; that is, they tend to be more active against target pests than against beneficial species. So, a product like halofenozide (MACH 2), which causes lethal premature molting in pest insects, is relatively non-toxic to predatory insects that do not consume the grass," Dr. Potter explains. "Parasitic *Tiphia* wasps that can reduce Japanese beetle grub populations by 40%, or more, are active mainly in April, so postponing preventive grub control until late May or June allows a superintendent to work with, rather than against, them. That is an example of so-called *conservation biological control*. Finally, most modern insecticides have low toxicity to insect pathogens such as nematodes and milky disease bacteria."

*Black cutworm larvae are active at night, chewing the grass surrounding their burrows. The result is brown pock marks that reduce surface smoothness and uniformity.*

Another biological control strategy that University of Kentucky scientists are exploring is the use of a specific group of viruses to control black cutworms, a common perennial pest on golf courses. Black cutworm larvae (caterpillars) are active at night, chewing down the grass surrounding their burrows in thatch and soil and causing brown pock marks that reduce smoothness and uniformity of playing surfaces. This group of viruses, the *baculoviruses*, attacks caterpillars, each strain of baculovirus only infects one or a few closely related host species. Dr. Potter notes that baculoviruses are good candidates for use as biological insecticides because they have no adverse effects on plants, mammals, birds, fish, bees, or other non-target insects.

In 2003, one of Dr. Potter's former graduate students, Callie Prater, discovered a naturally-occurring baculovirus, that killed black cutworms on Kentucky golf courses. Infected caterpillars ruptured at death, releasing fluid filled with millions of virus particles into the turf that infected other cutworms. USGA's Turfgrass and Environmental Research Program soon funded research to evaluate the virus as a potential biological insecticide.

Dr. Potter's research team macerated cutworms infected with the baculovirus and used this suspension of virus particles as a biological insecticide. One week after application, 50-60% of mid-sized introduced cutworms became lethally infected. In trials conducted on whole tees and surrounds at two central Kentucky golf courses, 10-day-old virus residues gave 76% and 82% control of newly-hatched larvae on the two golf courses, but only 41% and 33% cutworm suppression after one month. This suggests that as a biological insecticide, baculovirus is better suited for targeted knock-down of small cutworms than for season-long residual.



*A biological insecticide was prepared by macerating black cutworm larvae infected with a baculovirus to create a suspension containing millions of virus particles capable of infecting other cutworms.*

One unexpected consequence of surveying Kentucky golf courses for cutworms infected with this baculovirus was the discovery of other species that represent potential biological control of black cutworms. These included four wasp species and a fly species that can kill black cutworms. From this work, it is becoming clear that there is a lot to learn about what other naturally occurring predators could help superintendents in their battle against insect pests. This will take additional research, of course, but the research team at the University of Kentucky certainly seems to be up to the task. Dr. Potter recently received the 2010 USGA Green Section Award for his outstanding work.

In the meantime, Dr. Potter offers this advice for superintendents on the front lines who battle turfgrass insect pests, "Practice conservation biological control. Insecticides, like human medicines, are powerful tools, but their over-use can sometimes have adverse side effects. Golf courses are patrolled by billions of beneficial insects that help buffer the turf against pest outbreaks. Use reduced-risk insecticides, and apply them at the proper times. Scout and keep records of past infestations to better focus preventive treatments where they are needed. Diversify out-of-play areas with flowering plants and trees because many of the predatory and parasitic insects that help to suppress pests require the nectar, pollen, or other resources that such plants provide. Keep an open mind because biological control and biological insecticides will play greater roles in the future."

For more information about the University of Kentucky's research program to develop biological control strategies for turfgrass insect pests, readers are encouraged to visit these sites:

http://usgatero.msu.edu/v09/n13.pdf

http://usgatero.msu.edu/v03/n12.pdf

http://usgatero.msu.edu/v08/n08.pdf

http://turf.lib.msu.edu/tero/v01/n08.pdf