

The Big Picture: Grub Control, Neonics & Bees

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White grubs, the larvae of various scarab beetles, are a challenging group of pests for Connecticut gardeners.

For one thing, with subterranean larvae, it can be difficult to know whether you have a damaging population until they have eaten sufficient roots to cause turf or landscape plants to wilt and die.

Secondly, although the adults for some species (Japanese beetles, Asiatic garden beetles and oriental beetles; the only exception is European chafer) feed sufficiently to be considered economically damaging, targeting the adult stage only makes sense in limited cases where the numbers of beetles are overwhelming and serious defoliation is taking place (Japanese beetle on lindens, for example), or where the feeding is on flowers (e.g., Japanese beetles on roses and Asiatic garden beetles on daisies).

The usual strategy is to manage the larval populations with applications of insecticides to turf, resulting in much less injury from the adults.

Targeting the larvae also can significantly reduce the damage to lawns from vertebrate predators (moles, crows, starlings, foxes, etc.) feeding on the nutritious grubs.

People find the combination of damaged turf and the odor associated with skunks visiting to feed on grubs especially troubling.

Reducing the white grub populations in lawns can have other indirect benefits, as reducing the number of moles tunneling in an area removes the super-highways that these tunnels provide to plant-feeding voles.

Moles are principally insectivorous; however, tunneling from moles may be unaffected by eliminating white grubs if earthworms (an important food for moles) are abundant in a lawn.

Is it Time to Change Our White Grub Control Practices?

For the past 20 years, homeowners and professional lawn care companies

have mostly relied upon imidacloprid (Merit, and many other names) for controlling white grubs. This insecticide, and similar, newer neonicotinoids like clothianidin (Arena) and thiamethoxam (Flagship) were a tremendous advance in white grub control because they were much more effective, safer to humans and pets, and applied at considerably lower dosages than the organophosphate (Dursban, Dylox) and carbamate (Carbaryl) insecticides that they replaced.



CLARIFICATION

In our last issue, in a story about Rose Rosette Disease, we said Dr. Richard Cowles and Dr. James LaMondia were at The Connecticut Agricultural Experiment Station's facility in New Haven. Actually, Rich and Jim work out of the Valley Laboratory, the CAES facility in Windsor. Also, many of the rose samples that came in there were analyzed by Rose Hiskes, an Agricultural Research Technician.

The only species of white grub for which imidacloprid has never worked well has been Asiatic garden beetle, for which we would find about 50% grub mortality, vs. 95% grub mortality for the other three important species. However, here are several important reasons to consider changing from applying neonicotinoid insecticides for managing white grubs:

1. Multiple years of using the same insecticide for controlling the same pest is a prescription for insecticide resistance development.

In 2013, a remarkable number of control failures in Connecticut for oriental beetle involved several formulations of imidacloprid. In all cases, there were ample opportunities during that rainy summer for the insecticide to be properly incorporated into the soil and to kill the grubs.

The only species for which control

failure was noted was oriental beetle, causing me to suspect evolution of insecticide resistance in this species.

Unfortunately, if there is resistance to imidacloprid, it is likely that oriental beetle would also be resistant to clothianidin and thiamethoxam, because they have the same mode of action and are structurally so similar.

2. There is concern that the indiscriminate use of neonicotinoids may be injurious to beneficial pollinator insects.

Dr. Dan Potter, from the University of Kentucky, and his students have studied whether Arena sprayed on a lawn containing blooming clover was harmful to bumble bees. Bumble bees are known to be somewhat more sensitive than honey bees to neonicotinoids.

They found that bees foraging from blossoms directly sprayed with Arena died, and that the colonies were unable to produce new queens.

However, spraying open blossoms is prohibited by the label directions. When the clover blossoms were mowed and the bees foraged on blossoms that opened after spraying, bumble bee survival and reproduction was unaffected.

Most homeowners and lawn care operators prefer granular products over liquid sprays, and the granular products are less hazardous to bees.

In this same set of experiments, Dr. Potter's group also tested chlorantraniliprole (Acelepryn, GrubEx) for its impacts on bees. Bumble bees foraging directly on clover blossoms sprayed with this insecticide were unaffected by their exposure.

Therefore, there are several ways

Exercise Caution ...

Chlorantraniliprole is a broad-spectrum insecticide that's toxic to certain marine/estuarine invertebrates (oysters and shrimp) and may leach in some soils. It's not approved for use on Long Island for this reason. We include it for the sake of completeness and because it's less toxic than its predecessors. However, it should only be used when safer IPM methods fail. Please consider an alternative if you live near water.

to mitigate the risk of neonicotinoids to bees: (a) eliminate blooming weeds from turf, (b) mow before applying a liquid neonicotinoid product, (c) apply a granular neonicotinoid product, or (d) apply Acelepryn or an alternative, bee-safe white grub insecticide.

New alternatives are non-toxic to bees and people. The exciting news is that there are alternatives to imidacloprid for white grub control that are both safe to bees and to people.

In my field tests of chlorantraniliprole, there were no surviving white grubs in my plots in Windsor, even when the product was applied at 0.8 ounce of active ingredient per acre, which is one-half the labeled dosage for white grub control.

Thus, chlorantraniliprole continues the trend since the 1950s toward white grub insecticides with improved mammalian safety and greater efficacy (less active ingredient for control).

Because this product has exceptionally long-lived soil residues (a half-life of about two years), I estimate that a full label dose application of this insecticide to turf, if properly incorporated, should provide 2-3 years of white grub control.

Tests required for registration demonstrated that chlorantraniliprole has essentially unmeasurable toxicity to vertebrates, and the U.S. EPA has allowed this insecticide to be marketed without any signal word (Caution, Warning or Danger) as is required for other pesticides (though currently marketed products do have the "Caution" statement).

One caveat is that this insecticide, like imidacloprid, is quickly broken down by sunlight and binds very tightly to organic matter. Like imidacloprid, it should

be used as a preventive, so that newly hatched larvae can encounter the insecticide. Therefore, for it to be effective, it must be incorporated with significant rainfall or irrigation after application.

Failures of control in 2014 with this product for managing white grubs were associated with excessive thatch in lawns, which can tie up the active ingredient and prevent proper incorporation into soil.

In spite of its low water solubility (1/200 that of imidacloprid!), chlorantraniliprole is systemic, and so it translocates into foliage, where it then also prevents injury from sod webworms, cutworms, and armyworms in turf.

Do not allow pesticides to contaminate impervious surfaces like driveways as this can lead to contamination of aquatic resources.

Another new insecticide available for managing white grubs is Phyllom Bio-products' grubGONE!, a product based on *Bacillus thuringiensis* var. *galleriae* (*Btg*).

Bt insecticides are proteins formed by bacteria that, when partially digested by susceptible insects, disrupt midgut cells, leading to starvation and death. *Btg* has activity against both larval and adult beetles, and so a new option for managing adult scarabs is the companion product beetleGONE! containing the same active ingredient.

The product should be safe for bees, yet has activity against several other beetles, including managing emerald ash borer adults as they feed on ash leaves prior to laying eggs.

Like chlorantraniliprole or imidacloprid, the *Btg* product will need to be incorporated with rainfall to be ingested

Biocontrol for Japanese and Oriental Beetles

For information on using peonies to attract *Tiphia* parasitic wasps, natural enemies of Japanese beetle and oriental beetle grubs, see <http://ipm.uconn.edu> or email ana.legrand@uconn.edu

by newly hatched white grub larvae.

However, unlike synthetic insecticides which persist in the environment and are best applied with a preventive springtime application, the *Bt* product will quickly degrade in the soil; so its optimum application timing will coincide with the end of egg hatch (generally the first week of August), to target the largest number of susceptible grubs.

Of the Two Newer White Grub Insecticides, Which is Better?

From an ecological and long-term perspective, the 75% white grub control with grubGONE! reported by my turf entomologist colleagues may be preferable to the 100% control obtained with chlorantraniliprole (each when applied under perfect conditions).

My reasoning is that there are important parasites, predators, and diseases of white grubs, which if denied the presence of their hosts for multiple years at a site, will simply disappear.

Then, if insecticide resistance to chlorantraniliprole should develop, this biological safety net will no longer be present and the pest can resurge to be worse than ever.

Furthermore, although applying insecticides with 2-3 year predicted residual control of pests has appeal, such long-residual properties are worrisome from an environmental toxicology perspective. The longer pesticides persist in the environment, the more unpredictable the long-term unintended consequences of their use may be.

For those homeowners that embrace having plants blooming in their lawns, mixed blooming vegetation such as dandelions, ground ivy, and clover provide aesthetic relief from monochromatic grass.

Since a "weed" is defined as a plant growing where it is not wanted, accept-

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About *Bacillus thuringiensis* var. *galleriae*

Phyllom's new bioproducts, grubGONE! and beetleGONE!, based on *Bacillus thuringiensis* var. *galleriae* (*Btg*), control beetle grubs and adults respectively. These include Japanese, oriental, Asiatic garden beetles and European, Northern and Southern masked chafers as well as Green June beetle and May/June beetles.

Btg is also active on the adult stage of the Emerald Ash Borer and Phyllom is waiting for approval from the USDA for that use.

Bacillus thuringiensis microbes are all naturally occurring and found in soils and on foliage. They are not the product of genetic engineering. Most creatures on earth evolve and live in the presence of naturally occurring *Bt*.

Phyllom's *Btg* products are produced via fermentation like beer, wine or tofu. All ingredients used are food grade and the primary ingredients are plant sources of carbohydrates and protein.

The product has a shelf life of 2 years if stored in dry, closed containers and not exposed to extreme heat.

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ance of these blooming plants is the easiest approach to instant weed control.

Providing greater abundance of blooming plants is an important direct action for improving the health of pollinators such as bees and butterflies.

Adoption of either of the new white grub insecticides (*Bacillus thuringiensis* var. *galleriae* and chlorantraniliprole), over the previous choices, is completely compatible with using the lawn as valued forage for pollinators, and elimi-

nates one of the justifications (protecting bees from pesticides) for eliminating blooming plants from lawns.

What About School Grounds?

Connecticut schools (K-8 grades) cannot apply any EPA registered insecticides to their athletic fields, playgrounds, or aesthetic turf to control white grubs.

Under the existing law, the only products permitted for managing white grubs are so-called Section 25b exempt insecticides and insect pathogenic nematodes.

Section 25b exempt products contain active ingredients that the EPA has decided may be used as pesticides without going through their review process.

Like the virtually unregulated dietary supplement business, there are no standards for the safety or efficacy of these products.

For example, even though cedar oil

products claim to be effective against white grubs, my lab tests determined that CedarCure was ineffective against oriental beetle larvae, and in field tests its use led to greater survival of oriental beetle grubs (probably through disruption of ant predators).

Furthermore, the active ingredients in cedar oil are suspected rodent carcinogens.

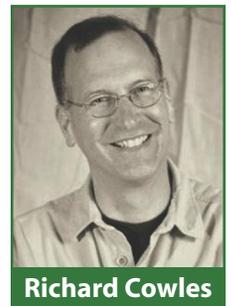
Overall, then, use of such 25b exempt products is unwise, unless they are subjected to the same set of tests for efficacy and safety as U.S. EPA registered products.

Insect pathogenic nematodes have been extensively tested, and some schools are using them for suppressing white grubs. The species available for this purpose, *Heterorhabditis bacteriophora*, on average under ideal conditions, kills about 60% of Japanese beetle, 40% of oriental beetle, and substantially less of other species.

If a school athletic field becomes infested with European chafer, insect pathogenic nematodes are unlikely to be effective, and there are no effective and legal treatment options available to protect that turf, some towns may be forced to consider synthetic turf fields. Unfortunately, there are possible health concerns associated with synthetic turf fields that need to be considered. Fortunately, *Btg* is presently being reviewed for use on K-8 fields in Connecticut. 🌸

Disclaimer: Mention of specific products does not constitute an endorsement. Always read and follow label directions: pesticides are toxic and directions need to be followed to protect your health and the health of the environment. The label is the law!

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Richard Cowles

Where to Get *Bt galleriae*

Phyllom BioProducts (www.phyllombioproducts.com) makes grubGONE! and beetleGONE! These products can be purchased from Green Earth Ag & Turf in Branford (www.greeneearthagandturf.com).

You can also purchase beetleJUS! and grubHALT!, equivalent consumer brands, from Gardens Alive at www.gardensalive.com



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