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TURFGRASS TRENDS

BLUEGRASS WEEVIL CONTROL

Preventive ABW Programs Can Encourage Resistance

Better understanding of biology, natural suppression can mitigate blanket pyrethroid sprays

By Albrecht M. Koppenhöfer, Benjamin A. McGraw

The annual bluegrass weevil (ABW), *Listronotus maculicollis*, is a serious and difficult-to-control pest of close-cut annual bluegrass (*Poa annua*) on greens, tees and fairways in the Northeast (Vittum et al. 1999). Over the last 20 years, the pest's area of impact has expanded from mostly around the New York metropolitan area to throughout the Northeast, west into Ontario, north into Quebec and south into Maryland (Vittum 2005, 2006, McGraw and Koppenhöfer 2007). Management practices, particularly lower mowing heights and reduced fertility, might be creating a better habitat for ABW and reduce the turf's tolerance for ABW feeding.

ABW larvae can cause serious damage to annual bluegrass. ABW clearly prefers annual bluegrass over bentgrass, and the prior also appears to be more susceptible to ABW (Rothwell 2003). Young larvae tunnel the stems, causing the central leaf blades to yellow and die. The older larvae feed externally on the crowns, sometimes severing the stems from the roots. The most severe damage usually is caused by the first generation older larvae around late May/early June in the New York metropolitan area. Damage during this time starts from the fairway edges or the collars, where it also tends to be the most severe. Second-generation larvae in early- to mid-July typically occur in lower densities, but damage can still occur because of the greater environmental stress on the host plants during this time. There often is a third-generation in the metropolitan area, but other stresses on the turf mask the weevil damage on annual bluegrass.

Overwintering takes place in the adult stage in the rough

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PHOTO 1

Adult annual bluegrass weevil.

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PHOTO 2

Annual bluegrass weevil larvae can cause serious damage along the edge of fairways.

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or in the litter under trees (Diaz and Peck 2007). In April the adults migrate into annual bluegrass areas and, after a brief feeding period, the females start laying eggs under the annual bluegrass leaf sheaths. Development of the first generation in spring from eggs to adult takes about six weeks. The first-generation adults become active around mid to late June. Their offspring emerges as the second-generation adults in late July to August. Adults from the third generation migrate back to their overwintering sites from October into November.

Efficacy of synthetics

We have summarized data from insecticide-efficacy tests published between 1993 and 2005 conducted by university researchers in the Northeast (McGraw and Koppenhöfer 2007). The summary shows that pyrethroids were the most effective insecticides with no significant difference among the different compounds. The average control rates were 93 percent for bifenthrin (Talstar), 87 percent for cyfluthrin (Tempo), 84 percent for deltamethrin (DeltaGard) and 97 percent for lambda-cyhalothrin (Scimitar). It is presently recommended to apply pyrethroids against the overwintered adults between full bloom of forsythia and full bloom of flowering dogwood. However, our summary revealed no difference between pyrethroid applications in late April (89 percent) and early May (93 percent).

The organophosphate chlorpyrifos (Dursban) was more effective when applied in early May (83 percent) or late May (83 percent) than in late April (62 percent). While chlorpyrifos applications are now limited to 1 pound of active ingredient per acre (lb ai/acre), the data suggest that this rate was as effective as 2 to 4 lbs ai/acre. The organophosphate trichlorfon (Dylox) was ineffective when applied in late April and early May but provided 79 percent control in late May.

Insecticide resistance

Many golf courses use multiple sprays in spring to achieve adequate suppression of adult ABW to avoid damage from the larvae produced from the eggs they lay. Additional sprays may be applied against later generation adults and larvae. This excessive insecticide use strongly suggests the development of insecticide resistance, particularly to the predominantly used pyrethroids. Recent studies have shown that in several tested golf courses, pyrethroid resistance in

The regular rotation of fungicides from different classes, adherence to label rates and the avoidance or wall-to-wall applications are imperative to avoid developing insecticide resistance.

ABW does exist. To avoid the development of insecticide resistance, it is essential to: 1) regularly rotate insecticide from different insecticide classes, 2) not exceed label rates, and 3) avoid "wall-to-wall" applications.

Unfortunately, most of the newer lesshazardous chemistry appears to lack the efficacy and consistency to replace pyrethroid applications, i.e., the neonicotinoids imidacloprid (52 percent control) and clothianidin (65 percent) and the insect growth regulator halofenozide (48 percent). However, the anthranilic diamide chlorantraniliprole shows great promise with 80 / 93 / 84 percent control when applied in late April / early May/ late May, respectively.

With the increasing pressure to reduce pesticide use on golf courses, there is a dire need to develop effective ABW control options with reduced environmental and health hazards and that are more IPM-compatible and, ideally, more sustainable. Biorationals and biologicals have only received very limited attention. A very limited number of trials with the fungal toxin spinosad (Conserve) suggest that it can be quite effective (80 percent control applied in late April/early May, 90 percent control applied in late May). Entomopathogenic fungi (Beauveria or Metarhizium) and bacteria (Bt = Bacillus thuringiensis) have yet to be tested.

Entomopathogenic nematodes for ABW management

Entomopathogenic nematodes (EPN) have provided good to excellent control of various other weevil pests such as citrus weevils in citrus, black vine weevil in ornamentals and billbugs in turfgrass. In Japan, the EPN species *Steinernema carpocapsae* was the major means of control (average 84 percent) of the hunting billbug before the recent registration of imidacloprid. A limited number of previous tests against ABW indicate that *S. carpocapsae* is more effective when applied as a curative against the larvae in late May than against the adult in late April or early May. Our laboratory observations confirm that adult ABW are not very susceptible to EPN.

In field trials in 2006 and 2007 and in parallel laboratory trials on field-infested turf plugs, several nematode products significantly reduced ABW larvae when applied in late May (Figure 1, p. 84). Reductions were observed as follows: *S. carpocapsae* (Millenium) (62 percent to 69 percent in field; 68 percent to 95 percent in lab); *S. feltiae* (Nemasys) (24 percent to 92 percent; 86 percent to 92 percent); *H. megidis* (Nemasys H) (45 percent to 77 percent, 62 percent to 76 percent); *H. bacteriophora* (Nemasys G) (71 percent, 37 percent); *S. kraussei* (Nemasys L) (0 to 77 percent, 67 percent to 76 percent). The 2007 field trial also suggested that species combinations and split application (applied one week apart) can further improve EPN efficacy against ABW larvae. Further trials in 2008 should help solidify our observations and identify the best nematode species and application strategies.

Observations suggest that natural nematode populations cannot reliably suppress ABW populations below damage thresholds.

We are also studying seasonal dynamics of ABW and EPN on golf course fairways that are not treated with insecticides other than imidacloprid for white grub control. Naturally occurring *S. carpocapsae* and *H. bacteriophora* infect mostly fourth and fifth instar larvae, but some third instars and pupae also can have significant impact in all three ABW generations (up to 54 percent generation mortality). But our observations also suggest that natural nematode population cannot reliably suppress ABW populations below damage thresholds.

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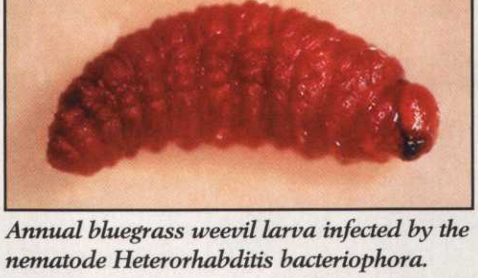
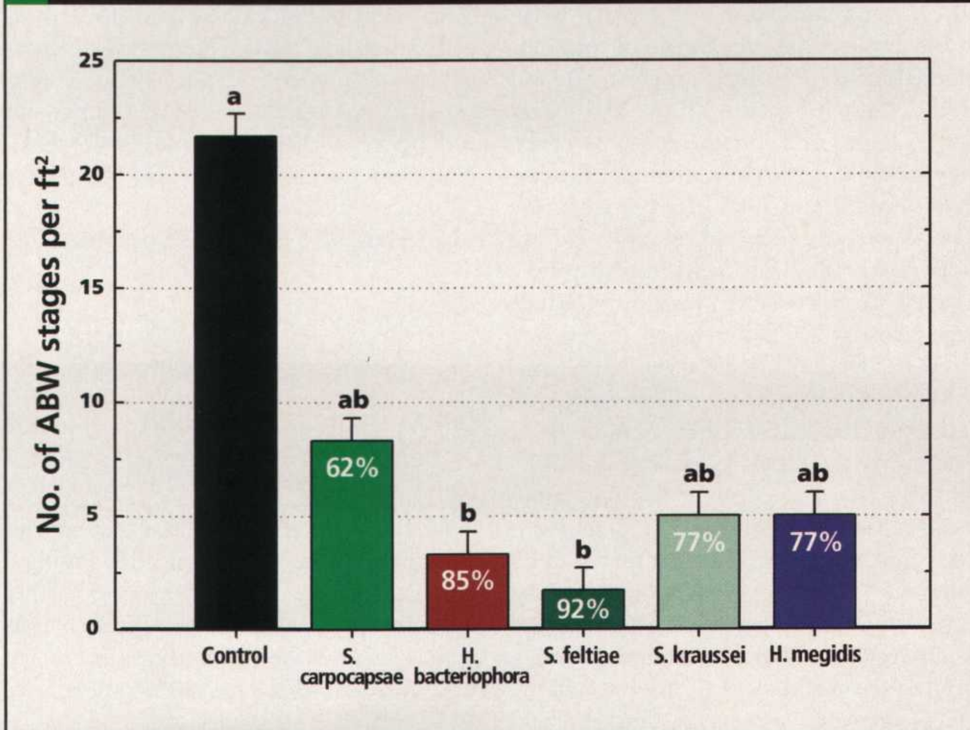
PHOTO 3



Annual bluegrass weevil larva infected by the nematode Heterorhabditis bacteriophora.

The chart to the right represents results from annual bluegrass weevil field trials in 2006 and 2007. The percentages represent the amount of control for a particular species. Letters above the bars indicate statistical correlations.

FIGURE 1



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Outlook

Turfgrass entomologists throughout the Northeast are now collaborating to develop a better understanding of ABW biology, better ways of predicting and monitoring ABW populations and finding safer ABW management tools. Ultimately, this will allow superintendents to replace preventive blanket pyrethroid sprays with spot treatments on an as-needed basis using less toxic alternatives. This in turn would allow existing natural enemies of ABW and other turfgrass pests to contribute more effectively to the suppression of pest populations.

Acknowledgments: This research was supported in part by grants from the United States Golf Association and the Golf Course Superintendents Association of America — Chapter Cooperative Research Program, along with the GCSA of New Jersey, Long Island GCSA and the Keystone AGS.

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