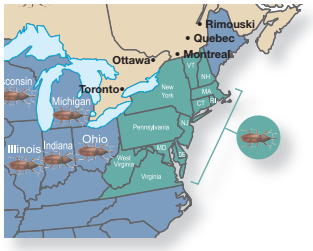
What's up with the annual bluegrass weevil in the North?

The annual bluegrass weevil has established itself in eastern Canada in areas where pesticide use is strictly controlled.



The annual bluegrass weevil (*Listronotus maculicollis* Dietz) (Coleoptera: Curculionidae), formerly "*Hyperodes* weevil," is considered a native pest of close-cut annual bluegrass (*Poa annua* L.) on golf courses in northeastern North America. This insect can also feed on creeping bentgrass (*Agrostis palustris* Huds.), but damage is usually most severe on annual bluegrass. Young larvae feed inside turfgrass stems, whereas later instars feed externally on turfgrass crowns. A single larva can kill as many as a dozen plants during its development and locally trigger turfgrass yellowing. Annual bluegrass weevil adults cause little or no significant damage by partially chewing leaf blades.

ABW in North America

Annual bluegrass weevil turfgrass damage was first reported in 1931 in Connecticut. From 1957 to 1967, damage was observed mainly in the metropolitan New York City area and later throughout much of New York State. Annual bluegrass weevil specimens from several states (Illinois, Indiana, Massachusetts, Michigan, New York,

Annual bluegrass weevil

Left: Annual bluegrass weevil as an adult **(top)**, larva **(bottom left)** and pupa **(bottom right)**. **Photos by Stefano Campagnaro**

Above: Annual bluegrass weevil damage to golf course turf. **Photo by Elisabeth Taschereau**

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Ohio, Wisconsin, Louisiana, Mississippi, California, Oklahoma, Texas, Alaska, Idaho, Nevada, Oregon, Colorado, Minnesota, Nebraska, Wyoming) have been collected and reported officially (5), but the species has been observed from more than 40 states by superintendents and turfgrass managers.

In the U.S., damage caused by this insect so far appears to be limited to golf courses in Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia and West Virginia.

Based on information in the Canadian National Collection of Insects, Arachnids and Nematodes (4), in Canada, the annual bluegrass weevil has been reported officially only in Alberta, British Columbia and Quebec. However, annual bluegrass weevil is known to be a major turfgrass pest in Ontario (7). The distribution of the annual bluegrass weevil in this province is not clearly determined, but it is definitely active in southwestern Ontario (Pam Charbonneau, turfgrass specialist, Ontario Ministry of Agriculture, Food and Rural Affairs, personal communication). Furthermore, populations of annual bluegrass weevil were scouted during 2007 in the Ottawa area, including U.S. border locations such as Cornwall and Prescott.

Recent studies have shown that annual bluegrass weevil is widely distributed throughout Quebec. Most significant populations are located in the Montreal area, and only superintendents from this area currently report annual bluegrass weevil damage. A significant population was found on a golf course north of the 48th parallel and also in the Quebec City area. In general, annual bluegrass weevil populations on golf courses in Quebec were relatively low. Only a few golf courses showed populations near or above the damage threshold of 10-40 larvae/1.1 square feet (0.1 square meter).

In Atlantic provinces, superintendents did not report annual bluegrass weevil damage (Vimy Glass, research coordinator, Atlantic Turfgrass Research Foundation, personal communication). In western Canada, this insect is not an important turfgrass insect pest (2).

ABW seasonal ecology

Two or three generations per year and occasionally a partial fourth generation occur during warm summers on golf courses in the metropolitan New York area, with damage observed in late May and early June and again from early July through August. Typically, damage from the first generation is located mainly along the edges of the greens, tees and fairways, whereas damage from the second generation is found anywhere in these areas, but is often less severe. The development of the first generation (the one that develops as a result of spring oviposition of overwintered adults) is somewhat synchronized so there is a distinct peak in larvae activity in late May or early June. But from that point on, generations overlap a lot, so that, for example, adults from the first generation can be found alongside larvae or pupae

States with weevils

Distribution and damage area (green zone) of the annual bluegrass weevil in North America. Map based on information from earlier research (4,5) and damage reported by superintendents and turfgrass managers. **Illustration by K. Neis**

of the second generation.

In Quebec, annual bluegrass weevil generally completes two generations per year on golf courses (Figure 1). Overwintered adults are present on golf greens from the end of April to the first week of May. The first generation of adults is generally observed on greens from the end of June to the first week of July, and they are usually less abundant than the overwintered adults. The second generation of adults is found from mid-August to the end of the season, until their movement to overwintering sites such as leaf litter under trees or other sheltered sites along borders of golf courses.

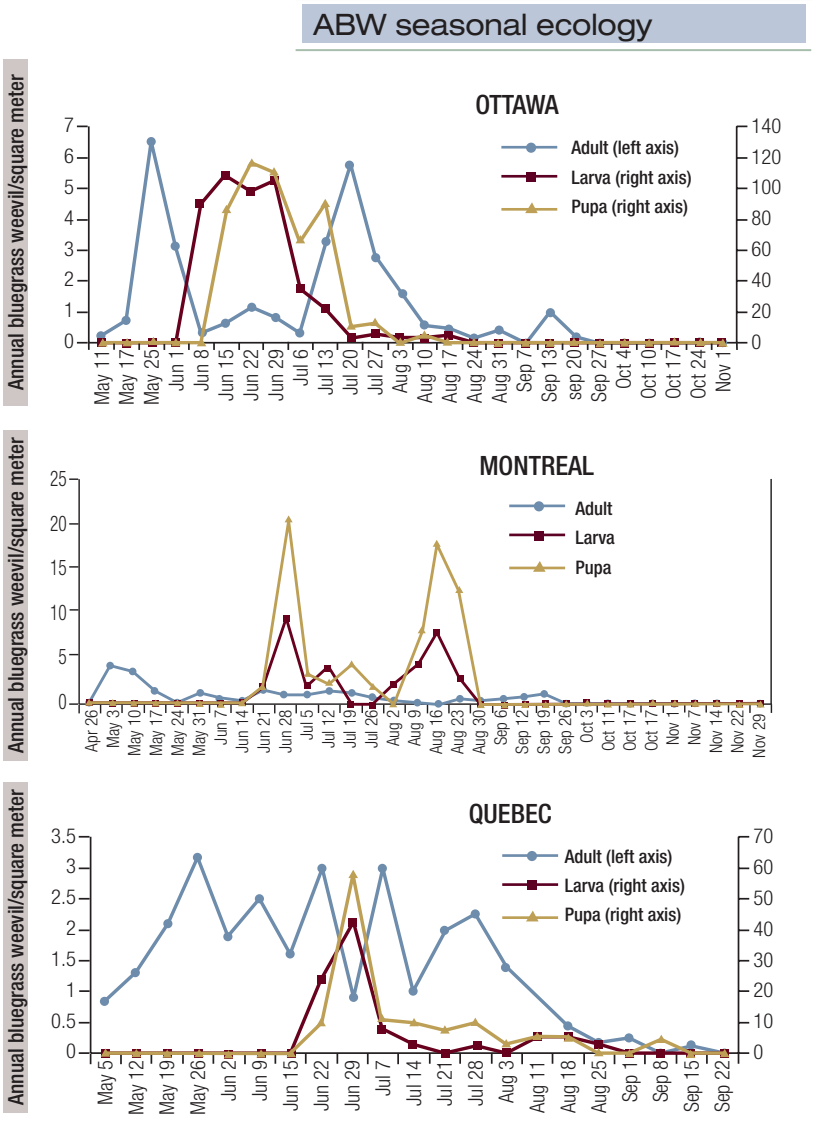

Figure 1. Seasonal ecology of the annual bluegrass weevil in three cities in eastern Canada. The insect completes two generations per year on golf courses. Overwintered adults are present on greens from the end of April to the first week of May, and the first generation of adults is present from the end of June to the first week of July. The second generation is present from mid-August to the end of the season.

Larvae are observed on golf courses in mid-June (first generation) and in early August (second generation). Even though the average monthly temperature is usually lower in Quebec City than in Montreal and Ottawa, two larval peaks were recorded in 2006 and also 2007 (Table 1).

Interestingly, at the only golf course where annual bluegrass weevil was found east of Quebec City (north of the 48th parallel), data suggest only one generation per year. The seasonal ecology of annual bluegrass weevil in Quebec was therefore similar to what has been suggested in Ontario (7). No information for other Canadian provinces is available because of the low population or absence of the annual bluegrass weevil.

Options for controlling ABW

Insecticidal control

In the U.S., several insecticides are available to manage the annual bluegrass weevil. The traditional approach has been to apply a product that stays bound in the thatch to target adult activity in the spring. The application should be made between *Forsythia* full bloom and dogwood full bloom, using Dursban (chlorpyrifos; Dow AgroSciences) or a pyrethroid. The application should be watered-in lightly, with only one or two passes of the irrigation head. Recent field trials have shown at least three products can be used to target larvae in the first generation. These applications should be made as soon as damage becomes apparent or larvae are noticed during routine scouting efforts.

The products that have been reasonably consistent include Dylox (trichlorfon; Bayer Crop Science), Conserve (spinosad; Dow AgroSciences) or Provaunt (indoxacarb; DuPont). Each of these products has a different mode of action and has been tested in several locations against the first generation of larvae. Less information is available on how well they might work in July or August applications to control the second generation of larvae.

In Canada, fewer chemical products are available to target the annual bluegrass weevil on golf courses. The only active ingredient currently registered in Canada for the annual bluegrass weevil is chlorpyrifos (6). Even though the annual bluegrass weevil is widespread in Quebec and Ontario, this insect causes only sporadic damage on golf courses. This situation combined with a Canadian registration process that imposes additional cost and time may explain why pesticide companies have registered few products to control the annual bluegrass weevil in Canada.

Integrated pest management

The implementation of an IPM strategy for golf

courses is certainly beneficial for optimizing control of the annual bluegrass weevil. Basic knowledge of the insect's biology gives superintendents key management tools for controlling annual bluegrass weevil. Thus, CGR, the Coalition for Responsible Golf in Quebec (regrouping six associations of the golf industry in Quebec: Canadian Society of Club Managers-district Quebec, Golf Quebec, Quebec Golf Superintendents Association, Quebec Turfgrass Research Foundation, National Golf Course Owners Association Canada-district Quebec, and Royal Canadian Golf Association), and the Canadian Turfgrass Research Foundation in collaboration with researchers from Agriculture and Agri-Food Canada started a research project in 2005 on turfgrass insect pests, including the annual bluegrass weevil.

One objective of this research is to provide superintendents with daily information from April to November on the seasonal development and abundance of major turfgrass insect pests for different areas in Quebec and Ontario. Research technicians are collecting these scouting data on golf courses involved in the research project. The data collected are transferred on a Real-Time Alarm System (RTAS) available on a Web site (www.golfresponsible.org). Two-year data are now available on the RTAS and represent a powerful tool for superintendents and researchers to improve their knowledge and management of turfgrass insect pests. For instance, the RTAS is helpful for superintendents trying to determine precisely the best timing of control for the annual bluegrass weevil in a specific area and evaluate whether an application is needed considering the abundance year after year. For the annual bluegrass weevil, five-year data are already part of the RTAS with a predictive model applicable to eastern Canada.

In Canada, particularly in Quebec where legislation and regulations are more restrictive, superintendents are required to reduce chemical pesticide inputs and every three years must present a pesticide reduction plan to the Quebec Ministry of Environment (Ministère du Développement durable, de l'Environnement et des Parcs du Québec). This situation heavily influences the management strategies employed by superintendents against turfgrass insect pests. For instance, targeting annual bluegrass weevil adults in spring is not recommended unless superintendents can prove the golf course has a history of serious annual bluegrass weevil damage.

Biological control

Because only one chemical product is currently registered for annual bluegrass weevil on golf courses in Canada, there is certainly a need for additional products and perhaps a great opportunity for alternative control methods such as biological agents. Recent studies on the potential of entomopathogenic nematodes to control annual bluegrass weevil have shown that these biological agents can provide significant control of annual bluegrass weevil larvae under field conditions and cause significant mortality (3).

Several turf entomologists in the northeastern United States are collaborating to refine our understanding of how to use entomopathogenic nematodes most effectively. In a field trial conducted in Massachusetts in 2007, *Steinernema carpocapsae* reduced larval populations significantly when applied at the time that annual bluegrass weevil larvae were mostly third and fourth instars (mid to late May in Hartford, Conn.). However, the same nematode applied 10 days earlier did not reduce populations sufficiently, nor did the other two nematode species included in the trial. Clearly, we need more field data, investigating several different application dates, locations and techniques, before we will be able to recommend entomopathogenic nematodes to control the annual bluegrass weevil consistently.

Average temperatures for eastern Canada

		Average monthly temperature*			
		Minimum		Maximum	
Spatial coordinates	Location	F	C	F	C
45°49' N, 75°67' W	Ottawa	5.4	-14.8	79.5	26.4
45°45' N, 74°18' W	Montreal	3.2	-16.0	80.1	26.7
46°54' N, 71°90' W	Quebec	2.3	-16.5	77.2	25.1
48°37' N, 68°70' W	Rimouski	3.7	-15.7	73.8	23.2

* Average daily temperature are from Canadian Climate Normals 1971-2000. Data source: Environment Canada www.climate.weatheroffice.ec.gc.ca; average monthly temperature for January (coldest) and July (warmest) based on a 30-year period. F, Fahrenheit; C, Celsius.

Table 1. Average minimum and maximum temperature for cities in eastern Canada.

ABW population fluctuations

U.S. populations

In the U.S., annual bluegrass weevil populations vary from one year to another. Earlier in this decade, populations appeared to be quite low in parts of the northeastern U.S., but populations in many locations in 2007 were the highest we have seen in 35 years. We suspect an unusually warm period in January 2007 somehow resulted in higher winter survival than "normal," but we

The research says

- The annual bluegrass weevil has been officially reported in 20 states in the U.S. Although it has been officially reported only in Alberta, British Columbia and Quebec in Canada, it is known to be a problem in Ontario.
- U.S. golf courses have three or four generations of ABW annually, but courses in Canada have only two generations.
- Several pesticides are options for ABW control in the U.S., but tighter restrictions in Canada leave only one traditional pesticide for ABW control. In Canada, the Coalition for Responsible Golf, the Canadian Turfgrass Research Foundation and others are working to establish viable IPM programs for insect control.
- Entomologists in the U.S. are trying to develop ways to use entomopathogenic nematodes to control ABW.

really don't know why the numbers were so high last year. The potential exists for high populations in 2008, in part because there were more weevils entering this winter than "normal," and in part because we've already had a warm period similar to the one experienced in January 2007.

On most golf courses the larval populations are highest in June, and then the population seems to decline slowly but steadily through the summer. Damage often is most noticeable in late May or June, because the population is more synchronized, and is mostly in the larval (damaging) stage. In July and August the population is spread out, with adults, small larvae, medium larvae, large larvae and pupae occurring side-by-side, so there is a dilution of the number of insects actually feeding. However, every so often we see golf courses where the damage gets progressively worse through the summer, in part because the annual bluegrass weevil population is increasing and in part because turf stress is increasing.

Canada populations

In Canada, it is actually difficult to prove whether annual bluegrass weevil populations increase over the years. Data collected in Quebec since 2001 do not indicate a significant increase of this insect on golf courses over the years. However, some observations showed that annual bluegrass weevil is becoming a more prevalent pest on some golf courses. Data from the pesticide reduction plan submitted to Quebec Ministry of Environment (Ministère du Développement durable, de l'Environnement et des Parcs du Québec) in 2006 indicated that annual bluegrass weevil is the third most important insect pest on golf courses in Quebec (1). We now have a clear picture of the annual bluegrass weevil situation in eastern Canada, and keeping track of this pest will allow us to know more about its distribution and pest status.

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