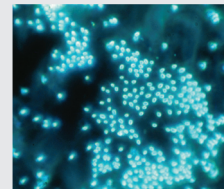




# InBrief

from the Canadian Forest Service – Laurentian Forestry Centre



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## A new host for the white pine weevil

In Quebec, the most severe infestations of white pine weevil occur in Norway spruce and eastern white pine plantations. A number of studies have shown that, although weevil performance (number of eggs laid and adult survival and weight) can be partially explained by the choice of host species, geographic variations may also play a role.

Researchers from the CFS and the Université du Québec à Montréal studied weevil performance in five host species, Norway spruce, white spruce, red spruce, jack pine and white pine, and two ecological regions, the Outaouais (Ottawa Valley) and Appalaches (Appalachian) regions.

Surprisingly, although little variation in weevil performance was found between the two regions, performance differed among host species. Performance was highest on Norway spruce and white pine, and survival rates were greatest on Norway spruce. Researchers also observed that the leaders with the largest diameters had the greatest number of eggs, regardless of the host; however, this explained only a small part of the variation in performance.

Given the weevil's performance on Norway spruce and current infestation levels in Quebec plantations, the researchers predict a rapid buildup in weevil populations. In addition, in regions where the insect's preferred host species are absent, less favoured host species such as white and black spruce may be more intensely affected in coming years. The biological performance of weevils is expected to decrease, however, which will be an advantage in terms of control efforts since outbreaks will progress less rapidly.

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## Do natural parasites of spruce budworm compete with each other?



Photo: M. Cusson

The ichneumonid *Tranosema rostrale*, a small wasp, and the tachnid *Actia interrupta*, a fly, are the most common parasites of spruce budworm populations in the Quebec City region. Annual monitoring of larval attack rates in spruce budworms at two study sites suggested that the two parasites might be competing with each another, with the fly seemingly displacing the wasp.

CFS researchers working in collaboration with colleagues at Dalhousie University and Université Laval demonstrated that multiparasitism involving both species does occur in the field, but at a frequency too low to explain the seasonal pattern of decline in parasitism by the wasp that accompanies the rise in fly attack rates. Based on preliminary data obtained from laboratory experiments, the researchers hypothesized that the fly has a competitive advantage over the wasp and that the success of parasitism by the fly may be enhanced by prior parasitism of spruce budworm by the wasp. The researchers also described a method they developed to detect the presence of wasp eggs, which often escape detection by simple visual examination.

In conclusion, this study suggests that a spruce budworm control strategy involving a massive release of *Actia* flies would not significantly affect

wasp-related budworm mortality, particularly if this type of release were carried out after wasp attack rates had begun to decline.

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## Improving the control of tortricid moths through a better understanding of their reproductive processes

In some insects, particularly lepidopterans, females produce a sex pheromone to attract males for copulation; this is an important element of their reproductive strategy. CFS researchers studied mechanisms controlling the production of this pheromone in two closely related species: spruce budworm and obliquebanded leafroller. In these species, newly emerged females do not produce sex pheromone before the scotophase (dark phase) of their cycle. The researchers wanted to determine, among other things, whether injecting a dose of the neurohormone PBAN, which typically controls sex pheromone biosynthesis, would induce this process in females, and indeed it did.

The researchers also observed that injections of PBAN continued to stimulate sex pheromone production even when the ventral nerve cord (VNC) had been transected or the terminal abdominal ganglion had been removed (both structures are associated with sex pheromone biosynthesis in certain species). The purpose of these manipulations was to identify the pathways, mediated or not, involved in PBAN's control of sex pheromone biosynthesis; they also demonstrated the probable role of the bursa copulatrix (which receives the spermatophore during copulation) in regulating sex pheromone production in the species studied. This work will allow new reproductive control methods to be developed for tortricid moths.

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## Ladybird beetle larvae: natural allies in controlling pests in Christmas tree plantations

The balsam twig aphid feeds on the sap of new balsam fir shoots, causing the needles to curl up and shrivel. Damage caused by this pest is particularly severe in Christmas tree plantations, producing less attractive trees which are therefore of less economic value. At present, the only effective way of controlling the insect is using chemical insecticides. However, this aphid has many natural enemies, particularly the eyespotted lady beetle, which occurs naturally in this type of ecosystem.



Photo: T. Arcand

A master's student, co-directed by a CFS researcher and a Université Laval professor, studied the impact of predation by ladybird beetle larvae, mainly the eyespotted lady beetle, on balsam twig aphids. The researchers compared control trees, which naturally contain ladybird beetle larvae, with trees in which the larvae had been eliminated by systematically removing the eggs. The results show that the ladybird beetle larvae reduced not only the number of aphid colonies but also the density of aphids in the remaining colonies. In addition, the presence of the ladybird beetles resulted in a 30% reduction in the density of aphid eggs overwintering on the trees. Although, during severe aphid infestations, predation by ladybird beetle larvae occurs too late to significantly reduce aphid damage, annual shoots were nearly 20% longer on trees protected by the ladybird beetle larvae.

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## A new tool for detecting outbreaks and assessing mortality in hemlock looper

The hemlock looper, a defoliating insect, is a serious pest of coniferous forests. Since outbreaks occur suddenly and tree mortality follows soon after, population buildups must be detected rapidly to allow effective intervention. Although pupae sampling helps in predicting changes in density, no standard tools are available to effectively assess populations. CFS researchers and their colleagues at Quebec's forest pest agency, the Société de protection des forêts contre les insectes et les maladies, and the Quebec Department of Natural Resources and Wildlife compared the effectiveness of a new pupation shelter with an old model.

The new pupation shelter consists of a piece of tubing lined with a strip of burlap. Two vertical lines of three holes each are punched on opposite sides of the tubing. Between the two lines of holes, a vertical incision is made along the entire length of the tube, along with a partial incision, to create a hinge so that the shelter can be easily opened to count the pupae.



Photo: C. Germain

The results show that the new pupation shelter, which is placed on the tree trunk at breast height, is as efficient as the old one in estimating hemlock looper abundance and is more efficient in estimating the impact of associated parasitoids, particularly braconids, which are an important natural enemy of this defoliator. This new shelter is an inexpensive standard tool that can be used easily by nonspecialized personnel, allowing an increased number of sites to be sampled, which is necessary to improve the chances of detecting outbreaks before tree defoliation and mortality occur. The new pupation shelter can also be used to sample other defoliators with the same characteristics, such as the gypsy moth, an exotic species.

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## Springtails, a bioindicator of soil acidity in sugar maple stands

There is a close relationship between soil acidity and the composition of the springtail colonies found in sugar maple stands in Quebec. Springtails' sensitivity to acidity has also been observed in other temperate and boreal forests. Although soil pH is determined directly by soil composition, acidity is also influenced by air pollution and forest management practices such as whole-tree logging and liming.

The primary objective of the study was to determine experimentally whether the composition of springtail colonies would change after the experimental modification of soil pH through liming. Another objective was to analyse the effect of liming on the chemical properties of soil and the biomass of the soil microbes (fungi and bacteria) that make up the springtails' diet. Three different concentrations of calcium hydroxide (lime) were spread on six different plots in sugar maple stands in the Duchesnay experimental forest, located in northwestern Quebec, and springtails were sampled after two years. CFS researchers and their colleagues at the Université du Québec à Montréal and Université Laval observed significant changes in the composition of springtail communities after liming, as well as significant increases in soil microbial biomass, soil pH and concentrations of certain soil minerals. Changes observed in species composition after liming were similar to the differences found at a number of untreated sites (without soil amendments) along an acidity gradient, which were distributed over a large area. The study shows that soil acidity directly affects the composition of springtail communities and confirms the value of these organisms as bioindicators of soil acidity.

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