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Branching Out
from the Canadian Forest Service - Laurentian Forestry Centre

The Hemlock Looper: Wasteful and Unpredictable

The hemlock looper (*Lambdina fiscellaria*), a native insect species that occurs across Canada, is considered a major defoliator. Its name comes from its characteristic walking motion: the larva, which only has legs at either end of its body, moves by thrusting its front legs forward and then drawing its rear legs up to meet them. The Canadian Forest Service (CFS) has been conducting research on this species for a number of years in order to gain insight into its life cycle and its population dynamics and to improve detection and control methods.

A year in the life of a hemlock looper

The hemlock looper overwinters in the egg stage, with young larvae hatching on balsam fir in the spring shortly after bud break. There are two types of loopers: the larvae in northern populations go through four instars whereas those in southern populations go through five. Hemlock looper larvae are present from mid-June to early August: the first two larval instars feed on the needles of the current year's shoots and the third instar feeds on the older foliage. Toward the end of their development, the larvae begin to look for a pupation site. During heavy infestations, trees are covered with silk strands produced by the larvae as they descend the boles in search of food or pupation sites. The adult moths, which are cream coloured, emerge from the pupae between mid-August and mid-October. After mating, the females lay their eggs on the trunks and branches of trees, including dead trees, and sometimes on the ground.


Photo: NRCan


Photo: NRCan

CFS researchers are learning more and more about hemlock looper biology, which appears to be reacting positively to global warming. They are therefore conducting studies to document the effects of changing environmental conditions on egg survival during warm and cold periods, on the timing of egg hatch, on the duration of larval development, and on female fecundity at different temperatures.

Wastefulness that makes you see red

The main hosts of this insect are balsam fir in eastern Canada and hemlock in the western provinces. The hemlock looper is a wasteful feeder, often nibbling only part of a needle before moving to another. Toward the end of July or early August, infested trees take on a reddish colour that is very characteristic of hemlock looper outbreaks. The partially eaten needles dry out and eventually drop off in the fall. Since looper populations build up rapidly, balsam fir mortality may be observed in the first year that damage is detected.

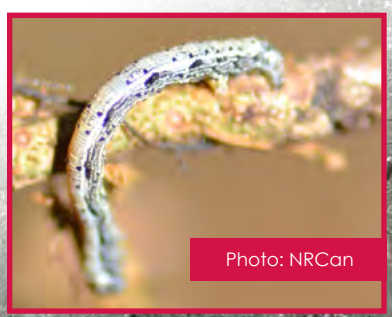
Photo: NRCan


Strip of forest with the reddish colour indicative of recent defoliation.
Photo: NRCan

During severe outbreaks, balsam firs are not the only targets of the hemlock looper; deciduous trees and other coniferous species, including saplings and seedlings, are also attacked.
Photo: NRCan

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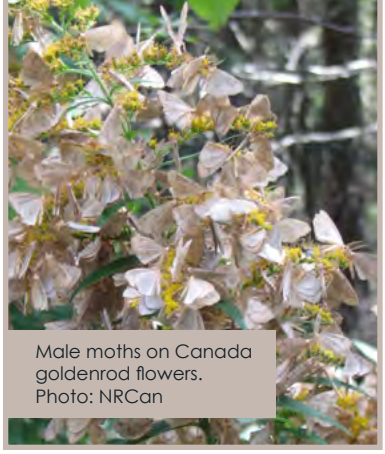

Male moths on Canada goldenrod flowers.
Photo: NRCan

The surviving trees exhibit a marked decrease in radial growth for several years after an outbreak. By analyzing tree-ring data, researchers can reconstruct the history of infestations. Partial defoliation weakens trees, making them vulnerable to diseases and attacks by secondary insect pests.

Although hemlock looper damage can be expressed in terms of wood volume loss, other less readily quantifiable values should also be taken into consideration, including landscape quality, recreation and tourism potential, and environmental quality in outbreak-affected areas that are home to Aboriginal populations.

Population dynamics

Hemlock looper outbreaks develop and subside very suddenly. In the first year of an infestation, small, widely scattered pockets of defoliation can be observed. In the second year, the infestation expands to a larger area. In Quebec, outbreaks rarely last more than two or three years. More severe damage occurs in pure, mature or overmature balsam fir stands.

Light trap.
Photo: NRCan

1. To find out more, see http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/25080.pdf and http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/33423.pdf.

Several natural enemies, including parasitoids, play an important role in looper population dynamics. CFS researchers, working in collaboration with forest sector partners, have identified the key role played by parasitoids of the genus *Telenomus*. These parasitoids attack looper eggs primarily in the spring, and they caused the collapse of an outbreak in the Gaspé Peninsula in the late 1990s and of an outbreak in the Middle North Shore region in 2001. Researchers are currently studying the life cycle and attack behaviour of these parasitoids[1] to assess their potential as biological control agents.

Innovation and collaboration for enhanced detection

Since the 1990s, CFS researchers have developed various tools for detecting the hemlock looper, such as light traps, pheromone traps and oviposition traps. Data collected with these tools and from aerial surveys are used to monitor looper populations in the area sampled. However, this area represents only a small percentage of the vast food supply available to the hemlock looper.

Moths mating.
Photo: NRCan

To ensure broader coverage and long-term monitoring of forests, we must be able to rely on reports from stakeholders working in the field who have been taught to recognize the insect and the signs of its presence.

Useful links

Hemlock looper egg hatching: regular as clockwork:
http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/31713.pdf

Trees, Insects and Diseases of Canada's Forests:
http://tidcf.nrcan.gc.ca/insects/factsheet/8846

Using scents to trap forest insect pests:
http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/28316.pdf

Passive observation or direct action?

In Quebec, hemlock looper monitoring is carried out by the ministère des Ressources naturelles et de la Faune, and the Société de protection des forêts contre les insectes et les maladies takes action when necessary. Aerial spraying with *Bacillus thuringiensis* var. *kurstaki* (*B.t.k.*) is carried out during major outbreaks. In 2000, for example, 40,000 hectares of North Shore forests were sprayed with *B.t.k.* When severely defoliated areas are small, stands can be harvested.

CFS researchers are working towards the development of a model to predict hemlock looper seasonality so that control operations can be better synchronized with the beginning of the targeted larval stage.

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