



Pest Notes

Balsam Fir Sawfly

no. 4

The balsam fir sawfly (*Neodiprion abietis*) is a native defoliating insect found throughout Canada. Adult males and females differ in appearance. Males tend to be black with feathery antennae whereas females are larger and mostly brown with thin antennae. Immature balsam fir sawflies are hairless larvae (caterpillars) and resemble the larvae of moths and butterflies (Figure 1).

Figure 1. Balsam fir sawfly: adult female (left), adult male (centre) and larvae (right)



Photos: Dr. Gaetan Leclair, Natural Resources Canada

With climate change predicted to negatively affect balsam fir in the Atlantic provinces, balsam fir sawfly populations may increase in response to tree stress by taking advantage of increasingly weakened, susceptible trees.

Figure 2. A) Yellowish spots on balsam fir needles indicating the presence of balsam fir sawfly eggs (left).



Photo: Dr. Gaetan Leclair, Natural Resources Canada

LIFE CYCLE

The balsam fir sawfly completes its life cycle in a single year. The females lay their eggs individually in slits along the edge of needles on current-year shoots in late August and September (Figure 2A). The eggs overwinter on the needles, and larvae emerge in early summer of the following year and begin feeding in groups (Figure 2B).

Male and female balsam fir sawfly develop differently. The males have four larval stages (instars) while females require five instars to complete their development. In late summer, the larvae spin a cocoon and pupate for two to three weeks. Males emerge slightly earlier than females and wait for females to emerge for mating. Mating is not a prerequisite for the female to lay eggs. They lay both male and female eggs if mating has occurred, but otherwise lay only male eggs.

Figure 2. B) Young balsam fir sawfly larvae feeding on balsam fir (right).



Photo: Dr. Gaetan Leclair, Natural Resources Canada

DAMAGE

The damage to balsam fir is caused by the larvae. In eastern Canada, the balsam fir sawfly's preferred food is balsam fir needles. However, it will also feed on the needles of white spruce, black spruce and eastern larch (tamarack). While the better-known spruce budworm prefers feeding on current-year foliage, the balsam fir sawfly prefers one-year-old needles. The larvae are messy feeders and often skeletonize needles, causing them to die and fall off the twig or branch. This feeding behaviour results in a characteristic lion's tail appearance of branches, with only current-year needles remaining (Figure 3).

Figure 3. Balsam fir sawflies prefer older needles, which creates this typical lion's tail appearance of balsam fir foliage.



Photo: Dr. Gaetan Leclair, Natural Resources Canada

All tree stands, regardless of maturity class, will suffer growth loss because of reduced foliage, but few trees die during outbreaks. The balsam fir sawfly appears to prefer younger stands and, especially, thinned balsam fir stands. Although these stands suffer growth loss, trees seldom die. Mature trees are less desirable to the sawfly but the effect of defoliation persists, causing some mature trees to die after the outbreak.

Balsam fir grown for Christmas trees are particularly vulnerable because they closely resemble young, thinned balsam fir stands. Although a single year of defoliation is of little consequence to balsam fir grown for timber production, it may reduce the value of balsam fir grown for Christmas trees to the point that they are unsellable.

MANAGEMENT

In nature, balsam fir sawfly populations are kept at low levels by natural enemies such as predators and parasites and especially by pathogens such as viruses. The tendency of young larvae to feed in groups helps spread a virus through the population. Although effective, these natural enemies are not always sufficient. Outbreaks can occur, causing significant defoliation and even death after several years, especially in older balsam fir stands.

Researchers at the Atlantic Forestry Centre of Natural Resources Canada have developed a sprayable formulation of a naturally occurring balsam fir sawfly virus, called Abietiv™. The virus is produced in the laboratory and applied to foliage in infested areas. The larvae ingest the virus while feeding. The virus then replicates within the larvae and is eventually expelled. The result is that the original larvae dies and more of the virus is available to infect more sawfly larvae. Abietiv™ is registered for use in forests and woodlots by Health Canada's Pest Management Regulatory Agency. This product affects only sawflies and causes no harm to the environment.

References

- Iqbal, J., Maclean, D.A., and Kershaw, J.A. 2011. "Balsam fir sawfly defoliation effects on survival and growth quantified from permanent plots and dendrochronology." *Forestry*, 84(4): 349–362.
- Johns, R.C., Fidgen, J., and Ostaff, D.P. 2013. "Host-tree oviposition preference of balsam fir sawfly, *Neodiprion abietis* (Hymenoptera: Diprionidae), in New Brunswick, Canada." *The Canadian Entomologist*, 145: 430–434.
- Lucarotti, C.J., Morin, B., Graham, R.I., and Lapointe, R. 2007. "Production, application, and field performance of Abietiv™, the balsam fir sawfly Nucleopolyhedrovirus." *Virologica Sinica*, 22(2): 163–172.
- Ostaff, D.P., Piene, H., Quiring, D.T., Moreau, G., Farrell, J.C.G., and Scarr, T. 2006. "Influence of pre-commercial thinning of balsam fir on defoliation by the balsam fir sawfly." *Forest Ecology and Management*, 223: 342–348.
- Parsons, K., Quiring, D., Piene, H., and Moreau, G. 2005. "Relationship between balsam fir sawfly density and defoliation in balsam fir." *Forest Ecology and Management*, 205: 325–331.

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