Larch Sawfly

Yukon Forest Health — Forest insect and disease

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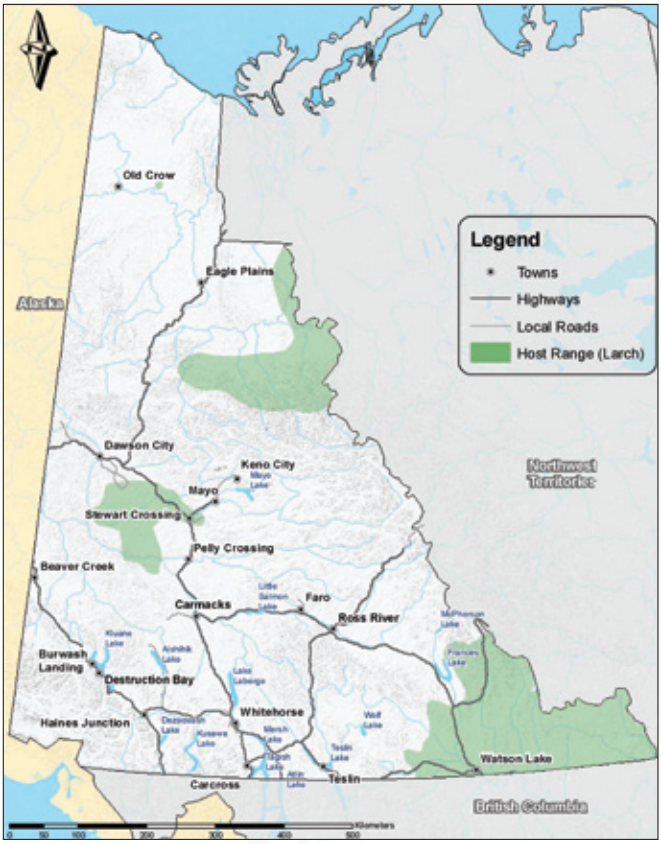
Yukon
Energy, Mines and Resources
Forest Management Branch

Introduction

The larch sawfly (*Pristiphora erichsonii*) is the most damaging pest affecting larch (*Larix laricina*) in North America. Although this species was described in Europe in 1837, it was not reported until 1882 in Canada and 1930 in British Columbia. Since its apparent introduction to North America, possibly from Europe, the larch sawfly has spread across Canada, Alaska and the northern contiguous United States. A 1996 Alaskan outbreak was over 600,000 ha in size. Severe outbreaks do occur in Yukon. In 1996 and 1999, mature eastern larch stands in the moister lowlands of the extreme southeast in Labiche and Beaver River were heavily defoliated with some mortality.

Host Range for Larch Sawfly

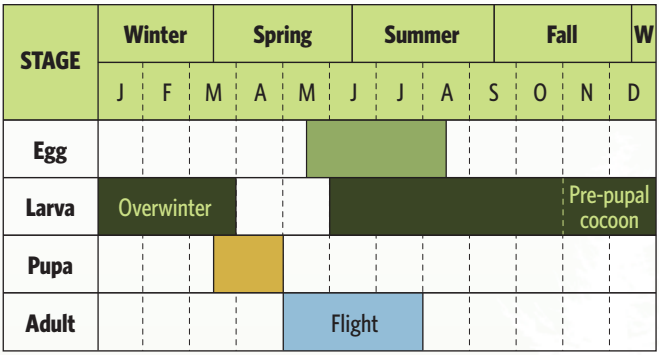


(Source data: Yukon Government Forest Inventory Data [2008] and U.S. Geological Survey [1999] Digital representation of "Atlas of United States Trees" by Elbert L. Little, Jr. (http://esp.cr.usgs.gov/data/little/)
Disclaimer: The data set for historic incidence is likely incomplete and only extends from 1994–2008. Endemic or outbreak populations may have occurred or may currently exist in non-mapped locations within the host range.

Forest Health Program
Forest Management Branch
Energy, Mines and Resources
Government of Yukon
P.O. Box 2703 (K-918)
Whitehorse, YT Y1A 2C6

867-456-3999
Toll free in Yukon: 1-800-661-0408, ext. 3999
www.forestry.emr.gov.yk.ca

Life Cycle



In Yukon the larch sawfly completes its life cycle in one year. Adult sawflies emerge from the duff between May and July. Emergence time is dependent on local climate and seasonal variations in temperature. Males represent less than two percent of the population and reproduction is often asexual. The female lays approximately 75 eggs in rows within a niche on the side of a new shoot. These egg niches cause the shoots to kink and can be an early diagnostic in judging the size of a population.

Eggs develop under the bark for about one week before the larvae hatch. Initially, the larvae are colonial **(photo 1b)** and will work their way over entire branches before dispersing throughout the crown of the tree. After about three weeks of heavy feeding that leaves entire branches needleless, the mature larvae **(photo 4)** will fall from the tree and spin themselves cocoons in the forest litter where they overwinter. The larvae pupate in early spring before emerging as adults.

Host Species Attacked and Damage

Tree species attacked in Yukon: The larch sawfly feeds on all age classes of eastern larch or tamarack. Outside Yukon, western larch (*L. occidentalis*) and, to a lesser extent, subalpine larch (*L. lylallii*) and ornamental Siberian larch (*L. sibirica*) are also hosts.

Although some damage is caused by female sawflies laying eggs in young shoots, most damage is related to defoliation caused by groups of feeding larvae. Characteristic curling and discoloration of young shoots is an early indication of sawfly presence. This is caused by egg laying and can result in a reduction in buds and eventual crown deformation. Larval sawfly will feed first on young shoots, and then move to needles on older branches resulting in areas of near complete defoliation.

Unlike most coniferous tree species, larch is deciduous and can refoliate within several weeks following an attack. In cases of severe defoliation, damage can substantially reduce tree growth and even kill the tree. Although tip dieback, reduced growth and branch mortality are common, complete tree mortality is rare except during severe outbreaks.

Key features for identification:

- Capsule shaped eggs are translucent and about 1.5 mm in diameter.
- New larvae have brown heads and cream coloured bodies.
- Larvae reach about 20 mm and are grey green on top and whitish green on the underside. Head and front legs are glossy black **(photo 1a, b)**.
- Pupa is adult shaped and about 10 mm long. It begins white-yellow and becomes black with maturity.
- Capsule shaped cocoon is papery and brown **(photo 2)**.
- The adult is 7–10 mm long. The body is black with an orange band around the mid-abdomen. Males have bi-coloured yellowish antennae; female antennae are black.
- New shoots exhibit slits in the bark and characteristic curling after egg laying.
- Patchy defoliation starts near the shoot tip, and moves throughout the crown **(photo 3)**.

Photo number:

1. **a) Larvae group feeding.** Citation: Scott Tunnock, USDA Forest Service, Bugwood.org, **b) Larvae group feeding.** Citation: Steven Katovich, USDA Forest Service, Bugwood.org
2. **Pupal cases/cocoon.** Citation: Arnold T. Drooz, USDA Forest Service, Bugwood.org
3. **Stand damage.** Citation: Arnold T. Drooz, USDA Forest Service, Bugwood.org
4. **Larval close-up.** Citation: James B. Hanson, USDA Forest Service, Bugwood.org

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Similar damage

The larch sawfly is one of several defoliators of larch in Yukon. The three lined larch sawfly can also be found in Yukon. Other pests that can cause defoliation of larch are larch bud moth (*Zieraphera spp.*), larch needle cast (*Meria laricis*), and larch needle blight (*Hypodermella laricis*), though none have been observed in Yukon. Defoliation can also occur as a result of physical damage or drought stress to trees. Examination of the damage, larvae or adult will enable determination of the cause.

Risk Assessment

The following tables summarize the likelihood of occurrence and magnitude of impact of an outbreak at the stand level. These tables are a coarse guide for estimating the risk of an outbreak when populations are at endemic levels.

Likelihood of Occurrence

Defoliator outbreaks tend to be cyclical and, beyond the presence of the host species, are not necessarily linked to specific environmental, climatic or stand conditions that enable an approximation of the likelihood of occurrence. However, physiological stress in host trees influences susceptibility and defoliator populations can be negatively or positively impacted by environmental, climatic or stand conditions. For example, late spring frosts may kill large numbers of larvae and below average snow accumulation may kill larvae overwintering in the duff.

Magnitude of Consequence

The magnitude of consequence is a subjective assessment of the potential consequences of an outbreak. This list is not exhaustive and is intended to stimulate thought on potential impacts to consider over time.

Value	**Impact**							
	-							**+**
Traditional Use[1]								
Comment:	No impact anticipated							
Visual Quality[2]				■				
Comment:	Dead foliage period (-)							
Timber Productivity[3]								
Comment:	Not applicable							
Wildfire Hazard[4]								
Comment:	No impact anticipated							
Public Safety[5]								
Comment:	No impact anticipated							
Hydrology[6]								
Comment:	No impact anticipated							
Time Scale (years)	20+	15	10	0-5	0-5	10	15	20+
Comment:	Impact refers to a predicted, substantial positive (+) or negative (-) impact on a value for an estimated time period							

Notes:

1. In this context, traditional use values considered are hunting, trapping and understory shrub/plant use. Given that sawfly outbreaks rarely cause mortality, no impact is anticipated.
2. Visual quality is negatively impacted for a brief period during the current year's attack but larch can refoliate within several weeks so visual impact is likely to be fleeting unless mortality occurs.
3. There is no commercial harvesting of larch in Yukon and, given that most larch occurs in swampy areas and is small diameter, timber productivity is not considered applicable.
4. Given that larch can refoliate within several weeks and that mortality is rare, no impact on wildfire hazard is anticipated.
5. Given that sawfly outbreaks rarely cause mortality, no impact is anticipated.
6. Given that sawfly outbreaks rarely cause mortality, no impact is anticipated.

Implications of Climate Change

General Circulation Model (GCM) results in the 2007 Intergovernmental Panel on Climate Change (IPCC) report indicate that warming in northern Canada is likely to be greatest in winter (up to 10°C) and warmer by 3–5°C in summer. Mean annual precipitation is also predicted to increase (particularly in fall and winter). More rainfall is expected on windward slopes of the mountains in the west, therefore the rain shadow effect of the St. Elias Mountains may mean that southern Yukon will not experience increased rainfall. Higher temperatures will increase levels of evaporation and transpiration, and ultimately lower soil moisture levels. Therefore, even if summer rainfall is maintained at current average levels, higher temperatures would result in limited soil water availability and cause moisture stress in trees. Temperature and precipitation are likely to be the dominant drivers of change in insect populations, pathogen abundance and tree responses as it influences insect/pathogen development, dispersal, survival, distribution and abundance. Defoliator species may benefit from warmer temperatures because of:

- higher rates of overwinter survival
- fewer late spring frost events
- longer summer season for growth and reproduction

Alternatively, if the timing of critical stages in the host (e.g., spring budburst) changes so that it is no longer in sync with key life stages of the defoliator (e.g., spring larval emergence), the defoliator population may be negatively impacted. Elevated carbon dioxide levels would likely reduce the nitrogen content in host needles/leaves, which may have either a positive or negative impact on defoliators depending on their nutritional requirements.

A short life cycle, mobility, reproductive potential and physiological sensitivity to temperature (i.e., insects are cold blooded) will mean that the distribution and diversity of defoliators at higher latitudes could change in a relatively short period of time as they take advantage of new climatically suitable habitats. Under a warming scenario, defoliator outbreaks could become more frequent and more severe, which could increase tree mortality, particularly if trees are drought stressed.

Management Options

Monitoring

Larch sawfly activity can be viewed from both aerial and ground surveys; however, it is hard to distinguish larch beetle (*Dendroctonus simplex*) mortality from repeated sawfly defoliation, especially during aerial surveys. The best time of year for ground or aerial monitoring is late July and August when larvae are actively feeding. For efficiency, survey work should be focused in larch leading stands. For aerial survey standards, refer to 'BC Aerial Survey Standards' (MoF, 2000). For strategic planning information, refer to the Forest Management Branch risk-based monitoring strategy (Ott, 2009).

Direct Control

Direct control is difficult for naturally growing single larch, or stands of larch affected by the larch sawfly. Although highly damaging to the environment, commercial pesticides can be an effective control for small outbreaks of sawfly. Direct control is more effective for small quantities of young trees or ornamental trees in urban settings. Methods include removal of needles and litter containing overwintering larvae, frequent spraying of affected branches with high pressure water, shaking infested branches and removing larvae by hand.

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