

Lodgepole Pine Beetle

Yukon Forest Health —
Forest insect and disease

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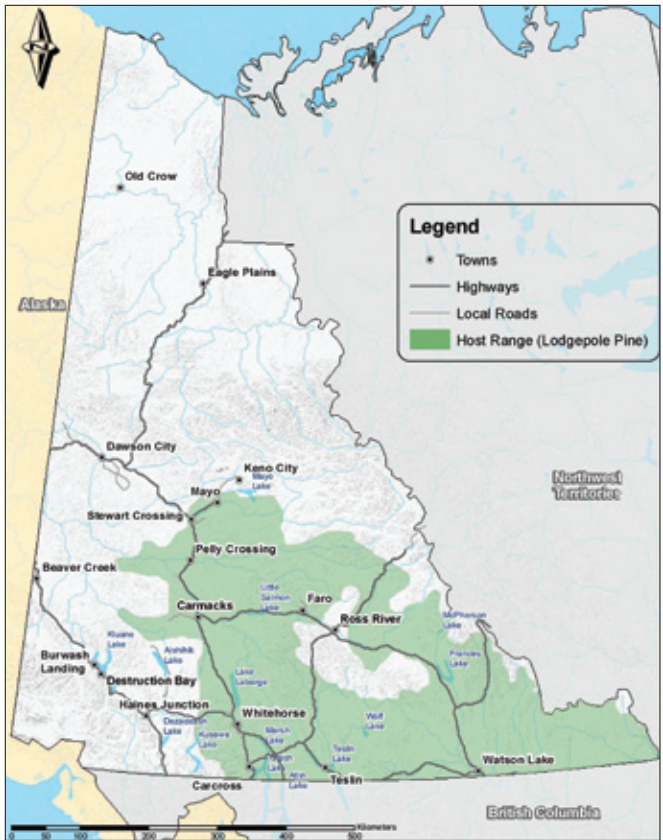
Yukon

Energy, Mines and Resources
Forest Management Branch

Introduction

The lodgepole pine beetle (*Dendroctonus murrayanae*) occurs naturally in lodgepole pine (*Pinus contorta*) stands from Yukon to Ontario and south to the north central United States. Though its occurrence is uncommon, it is the only species of *Dendroctonus* currently attacking pines in Yukon. This species is less likely to attack healthy vigorous trees, preferring weakened trees, fresh stumps, and windfalls. As a result only single and small groups of trees are attacked and outbreaks have never been observed in Yukon. Recent forest health surveys indicate that, despite the recent effect of a moderating climate, lodgepole pine beetle populations have remained at endemic levels.

Host Range for Lodgepole Pine Beetle



(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.

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Life Cycle

STAGE	Winter			Spring			Summer			Fall			W
	J	F	M	A	M	J	J	A	S	O	N	D	
Egg													
Larva	Overwinter												
Pupa													
Adult								Flight Period	Late				

As temperatures increase in early to mid-July, female beetles emerge from the lower bole and root collar of the host tree. Females remain on the host tree or fly to new host material, bore through the bark at the base of a new host and excavate galleries in the phloem (**photo 1**). Unlike other *Dendroctonus* species, lodgepole pine beetles rarely initiate mass attacks. On average, trees host broods of three to five mating pairs.

Females excavate irregularly linear egg galleries, generally upwards, with shallow expansions along the margin. Galleries usually range from 13 to 23 cm in length. A male beetle will join the female in the gallery to mate. The female lays a group of 20 to 50 eggs per gallery, usually along the lower side of the main gallery, in the shallowly excavated margins. If the season permits, the female beetle may re-emerge to find a new host tree and excavate a new gallery.

Eggs hatch after approximately 10 days. Larvae form a collective 'feeding front' at the margins of the brood gallery expanding laterally creating a characteristic "D-shaped" gallery. In preparation for pupating, late instar larvae will create individual mines. Larvae normally overwinter as 4th instar (possibly 3rd in Yukon). They pupate in place the following spring to re-emerge as adults the following July to complete the life cycle in one year.

Definitions:

Bole: the main stem of a tree.

Phloem: the tissue in trees that transports nutrients found just below the bark.

Instar: the stages in the growth of a larva before it pupates.

Frass: a mixture of fecal matter and chewed plant debris.

Host Species Attacked and Damage

Tree species attacked in Yukon: Thick barked, mature lodgepole pine, often but not always with symptoms of physical damage.

Lodgepole pine beetle rarely initiate a mass attack. Successive attacks over two or more years are normally required to kill green standing trees. They are normally attracted to windfall, fresh stumps, and old, injured or otherwise weakened trees. *D. murrayanae* can co-occur with other bark beetles such as pine engraver beetle (*Ips pini*). When lodgepole pine beetle attack a larger, more vigorous tree, large pitch tubes in combination with resinous boring dust are usually a sign of attack. A distinguishing feature of this beetle attack is that the attacks occur on the lower bole and root collar of the tree. If the attack continues long enough to girdle phloem, trees will exhibit the typical symptomatic red foliage of bark beetle attack (**photo 2**).

Key features for identification:

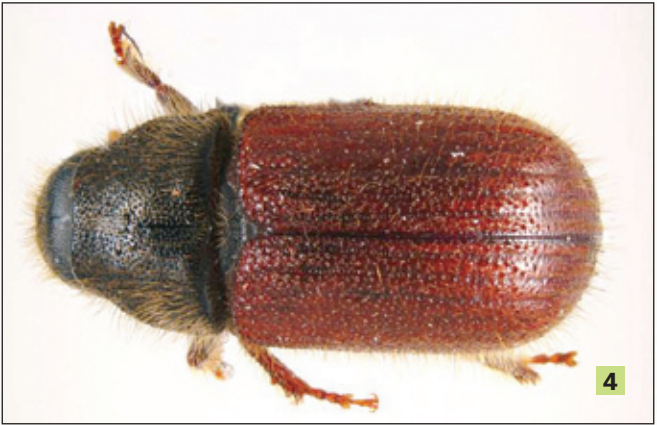
- The oblong egg is satiny white (1.2 mm long).
- Larvae (6 mm) are grub-like, creamy white, with no legs, and have two distinct anal shields.
- The pupa is creamy white and resembles an adult without fully developed wings.
- The dark brown to black adult beetle has reddish-brown wing covers and is 5.5–6.6 mm long (**photo 3 and photo 4**).
- Adult males have distinct genitalia.
- Main egg galleries are free from frass and boring dust.
- Larvae feed en masse, forming a common large “D-shaped” gallery.

Photo number:

- 1. Main gallery prior to larval feeding.**
Citation: Carroll, A. L., Canadian Forest Service.
- 2. Mature lodgepole pine mortality due to *D. murrayanae* infestation.** Citation:
Rod Garbutt, Canadian Forest Service.
- 3. Adult, side view.** Citation: Walker, K. (2009) Lodgepole Pine Beetle (*Dendroctonus murrayanae*) Pest and Diseases Image Library.
- 4. Adult viewed from above.** Citation: Walker, K. (2009) Lodgepole Pine Beetle (*Dendroctonus murrayanae*) Pest and Diseases Image Library.







Similar damage

Damage caused by pine engraver beetle and mountain pine beetle (*Dendroctonus ponderosae*) (not currently found in Yukon) can be confused with that of the lodgepole pine beetle. The galleries of the lodgepole and mountain pine beetle do not extend as far into the sapwood as those of the pine engraver beetle and are differently shaped. In addition, pitch tubes are usually present along the entire length of the bole with mountain pine beetle attack, whereas the lodgepole pine beetle pitch tubes are isolated to the lower bole and root collar. In Yukon, *Ips pini* is usually responsible for group tree mortality adjacent to fire wood piles and clearings.

Risk Assessment

The lodgepole pine beetle is not likely to cause significant tree mortality. Outbreaks have never been observed in Yukon and it is not a commercially significant damage agent elsewhere in North America. Given that an outbreak has never occurred, the risk is negligible at present.

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. Bark beetle species may benefit from warmer temperatures because of:

- higher rates of overwinter survival
- fewer frost events especially in early winter before larvae harden off (produce anti-freeze)
- longer summer season for growth and reproduction (shorter life-cycles)
- moisture stressed trees with less resistance to attack

A short life cycle, mobility, reproductive potential and physiological sensitivity to temperature (i.e., insects are cold blooded) will mean that the abundance and diversity of bark beetles at higher latitudes could change in a relatively short period of time as they take advantage of new climatically suitable habitats. However, the lodgepole pine beetle has not previously shown a propensity for mass attack behaviour so, while the beetle's distribution may change, it is not likely that it will become more aggressive. If host trees are stressed under a warmer/drier scenario, lodgepole pine beetle attack incidence may increase.

Management Options

Monitoring

Given that mortality is rare, lodgepole pine beetle activity is best determined from ground surveys. The best time of year for monitoring is mid-July to late summer when beetle flight and brood establishment are occurring and pitch tubes are still prominent at the base of the tree. Galleries may be visible beneath the bark. Red trees can be a sign of previous year's attack. For aerial survey standards, refer to 'BC Aerial Survey Standards' (MoF, 2000).

Direct Control

Given the non-aggressive nature of the lodgepole pine beetle, direct control measures have not been necessary. If outbreaks do occur in the future, then direct control measures used for other bark beetles would be relevant.

References

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