

Extension Note

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British Columbia's Northern Interior Forests

Warren Root Collar Weevil Stand Establishment Decision Aid

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Introduction

Warren root collar weevil (*Hylobius warreni*) is a commonly occurring insect found in most of British Columbia and as far north as the Northwest Territories. This weevil affects many tree species and is found in forest stands of any age, although its impact as a disturbance agent is most important in lodgepole pine stands. Engelmann and white spruce are also common hosts, but incidence levels have not been high enough with these species to cause reforestation issues.

Incidence levels in lodgepole pine stands commonly exceed 30%, although mortality levels are generally far less and occur in younger stands (5–20 years of age). Recent research suggests that a link exists between stands affected by mountain pine beetle (MPB) and root collar weevil. In one study, the incidence of weevil-attacked trees was elevated in young plantations adjacent to mature stands that had sustained high levels of MPB-caused mortality. An understanding of the weevil's biology and the identification of high-hazard stand conditions for both insect species are essential to successfully avoid regeneration issues. Most treatments involve mitigation measures applied during stand establishment.

The Stand Establishment Decision Aid (SEDA) format has been used to extend information on a variety of vegetation and forest health concerns in British Columbia. The two-page SEDA presented in this extension note was developed to summarize information that northern forest managers will need to manage the impacts of the Warren root collar weevil. The following pages describe susceptible stand types, weevil biology, hazard ratings, forest productivity considerations, and appropriate management practices. A resource and reference list that readers can use to find more detailed information is also included. Most reference material that is not available online can be ordered through libraries or the Queen's Printer at: www.qp.gov.bc.ca

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KEYWORDS: *duff reduction strategies, Hylobius warreni, lodgepole pine pests, managing pine plantations, pest hazard ratings, stem girdling, Warren root collar weevil.*

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Warren Root Collar Weevil – Northern Interior Forest Region



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Adult root collar weevil.

Characteristics of susceptible stands

- Host species include lodgepole pine and, to a lesser extent, Engelmann and white spruce, and western white pine.
- Lodgepole pine becomes susceptible at 5 years of age and may be re-attacked periodically through to stand maturity.
- Dominant and co-dominant trees on moister sites with coarse-textured soils and a deep organic duff layer are generally most susceptible.
- The presence of scattered dead, red trees is often the first indication that weevils are present in a stand.
- Leaning green or fading trees and short leaders may also indicate weevil presence.
- Infestation can be confirmed by removing the duff at the root collar and looking for resinosis, often mixed with soil, and the presence of larval tunnels and feeding scars. The pitch formations have the appearance of “kitty litter” mixed with soil.

Biology

- Adult females lay eggs in the summer, depositing them at the root collar in chewed bark niches, and in adjacent duff and soil.
- Adult weevils may live up to 5 years.
- Larvae hatch in about 2 weeks then bore into the bark and cambium, feeding around the circumference of the tree at the root collar.
- Young trees only support one or two larvae while mature trees can support 30 or more. Three or more larvae on a young tree are likely to cause mortality.
- Larvae take 2 years to mature, overwintering twice.

Hazard ratings¹

BEC Zone ^a	Drier subzones	Wetter subzones
ESSF	mk	mc mv
ICH	xw dw mw	mk wk mc wc vc
SBPS	mc	
SBS	dh dw dk mh mw	mm mk mc wk

^a See Meidinger and Pojar (1991) for an explanation of Biogeoclimatic Ecosystem Classification (BEC) zone, subzone, and variant abbreviations.

Hazard Rating Key

Low hazard	Moderate hazard	High hazard

¹ Ratings are based on expert opinion, known insect biology, and current climatic conditions. If a biogeoclimatic unit is not listed, root collar weevil is not considered to be a significant hazard.

- Pupation occurs in the third summer after hatching and adults emerge in the fall or the following spring.
- Feeding activity by the larvae causes pitch exudation, which is mixed with soil and bark to form a sticky mass at the root collar. Larvae build tubelike shelters from the exudate and overwinter in these.
- Following harvest, larvae living on cut stumps may complete their development over a period of up to 3 years.
- Adult weevils feed at night, crawling up the stem to lower branches where they chew into the sapwood of small branches.
- Adult weevils are flightless. Past research suggests that these insects migrate 10–13 m per year when searching for new host trees. Recent experimental evidence suggests that movement rates can be much greater when the habitat contains a large proportion of dead trees.



Matthew Klingenberg

Pupa and characteristic resin exudate on a root.

Management considerations

- In the British Columbia Interior, there is increasing evidence that higher levels of weevil incidence in young pine stands can be expected a few years after MPB attack when the attack occurs in adjacent mature stands. Several treatment considerations exist for situations where high incidence levels are expected.

Harvesting

- In high hazard areas, conduct a general assessment of root collar weevil levels in the mature stand to be harvested and in adjacent mature pine types.
- In biogeoclimatic units that are rated as high or moderate hazard for root collar weevil, consider designing cutblocks that include all of the pine types so that migration out of adjacent mature stands is less pronounced.

Stand establishment

- If brush hazard is not high, consider delaying planting by 2–3 years in harvested areas that previously had a moderate to high hazard rating for root collar weevil. Newly planted trees will not be attacked until they have a root collar diameter of about 2 cm.
- If incidence levels in the harvested stand were high, establish a less susceptible species along cutblock edges adjacent to mature pine stands or within the cutblock.
- Broadcast burning or scarification to reduce duff levels on preferred weevil habitat (moist sites with a substantial duff layer) may reduce adult population levels and delay infestation from adjacent stands. Light burning is unlikely to affect larvae because they occur deeper within the duff and under the bark.
- Disc-trenching and planting seedlings on mounds may decrease mortality levels because this treatment reduces duff and moisture levels around the root collar.
- Exposing mineral soil around the root collar during planting is also an option to discourage weevil attack. Weigh the merits of this treatment against the possibility that removal of humus horizons will adversely affect seedling survival and growth.
- Consider increasing planting density to greater than 1600 stems per hectare in anticipation of higher than usual mortality. Higher stand density may also result in earlier crown closure and increased shade, which retards larvae development by lowering temperatures at the root collar.

Plantation maintenance

- In moderate to high weevil hazard subzones, delay spacing until the stand is at least 20 years old.
- If the stand is marginally stocked, fill-plant with alternate species and delay declaring free growing until re-survey is complete.

Warren Root Collar Weevil – Northern Interior Forest Region

Damage and impact on productivity

- Little damage is caused directly by adult weevils.
- Most damage is caused by larvae that girdle the tree by feeding (or chewing) on the phloem and outer sapwood at the root collar. Stem radial growth does not seem to be significantly affected until girdling exceeds 70%. Leader growth, however, is more sensitive to girdling injury and declines by 10–30% in the years immediately following damage. The leader length appears to decrease in proportion to the amount of stem girdling.
- Feeding damage on roots can kill or weaken them, predisposing the tree to snow press or windthrow.
- In older trees, the area of feeding tends to shift to the larger lateral roots. Large trees are seldom girdled.
- In young stands (5–20 years old), weevils seem to prefer dominant and co-dominant trees.
- Mortality usually occurs as single trees or small groups randomly scattered throughout a stand.
- A recent study of nine sites in the central Interior showed that mortality in young stands caused by weevils was generally highest when directly adjacent to mature, unsalvaged stands heavily affected by MPB. The mortality in young stands tends to decrease with increasing distance from the stand edges. Mortality increases with increasing pine composition in mature stands, with increasing percentage of mature pine mortality, and with increasing time since MPB attack. This implies that adult weevils migrate to seek new hosts when food supply is reduced by MPB. Populations rarely reach levels that require intervention within 7 years of planting, but longer-term studies on these increasing mortality trends are not yet complete.
- Until recently, damage caused by root collar weevil has not had a serious effect on stocking, except in localized pockets. Mortality levels exceeding 10% are rare. One study of 30 cutblocks in the Kispiox Forest District in the Interior Cedar–Hemlock zone showed that, on average, 39% of planted pine were attacked by root collar weevil, but accumulated tree mortality in individual cutblocks varied from 0 to 8.8%.
- Height growth reductions on partially girdled stems in British Columbia and Alberta were reported to range from 10 to 30% in the years immediately following damage.
- There is some evidence that an association may exist between root collar weevil and tomentosus root rot.

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Test Your Knowledge . . .

British Columbia's Northern Interior Forests: Warren Root Collar Weevil Stand Establishment Decision Aid

How well can you recall some of the main messages in the preceding Extension Note?

Test your knowledge by answering the following questions. Answers are at the bottom of the page.

Significant plantation damage resulting from root collar weevil has not been common historically, but recent indirect evidence suggests that this might change in the face of new climate patterns. Here are a few questions to test whether your current level of knowledge leaves you prepared to recognize and deal with potential problems that might arise as a result of this insect.

1. Lodgepole pine trees of any age can host root collar weevils.
 - A) True
 - B) False

2. Which symptoms are not characteristic of root collar weevil?
 - A) Pitch-soaked frass and soil at the root collar
 - B) Scattered red trees in a stand
 - C) Resin on the lower stem
 - D) Shortened leader growth
 - E) None of the above

3. Root collar weevils prefer the smaller, weaker trees in a stand.
 - A) True
 - B) False

4. In high hazard root collar weevil areas adjacent to a mature stand with high levels of dead trees resulting from MPB attack, it is best to:
 - A) Plant large stock at wide spacing immediately to get a head start before weevils get into the plantation
 - B) Plant more than 1600 stems per hectare
 - C) Intermix a less susceptible species with pine even if it isn't as well suited to the site ecologically
 - D) Leave an unplanted buffer strip
 - E) Disc-trench and plant seedlings on mounds

ANSWERS

1. A 2. C 3. B 4. B and E