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Key Points

- All ages are susceptible.
- Impacts from western blackheaded budworm defoliation start to appear after two years of moderate to severe defoliation.
- Western blackheaded budworm defoliation reduces the vigor of affected trees and may increase their susceptibility to attacks by secondary pest species.

Forest Health Protection and State Forestry Organizations

Management Guide for

Western Blackheaded Budworm

Acleris gloverana (Walsingham)
(Lepidoptera: Tortricidae)

Defoliation of the western blackheaded budworm has often been accompanied or followed by high populations of other defoliators such as the hemlock sawfly and the spruce budworm.

Hosts

- Western hemlock
- Mountain hemlock
- True firs

Minor hosts:

- Spruce
- Douglas-fir

Periodic outbreaks in predictable locations

The western black-headed budworm is an important defoliator of western hemlock. Western hemlock and true firs are the preferred hosts, but spruce and Douglas-fir can also be fed upon. When conditions favor a high population of the western blackheaded budworm the larvae can cause extensive defoliation. Trees of all ages may be killed, top-killed, or severely weakened.

The western blackheaded budworm is a native insect of western North America. The range of the western blackheaded budworm is from northern California and areas of the Rocky Mountains northward into the Yukon and Northwest Territories in Canada and southeastern Alaska. The eastern portion of its range may overlap with that of the eastern black-headed budworm, *Acleris variana* (Fernald), which extends to the Atlantic seaboard.

Damage

Western blackheaded budworm prefers to feed on the upper crowns of dominant and co-dominant trees. Healthy western hemlock appear to be able to withstand one year of severe defoliation without sustaining serious damage, often recovering within a year or two with minimal amounts of top kill or growth loss. Impacts from western blackheaded budworm defoliation start to appear after two years of moderate to severe defoliation. Western blackheaded budworm

defoliation reduces the vigor of affected trees and may increase their susceptibility to attacks by secondary pest species.

The western blackheaded budworm may occur simultaneously with other defoliators. Under conditions of severe attack by multiple species of defoliators, trees may be completely defoliated in a single year and damage may be more severe.

Mortality- although this budworm is not know as a tree killer, mortality losses can occur when trees receive multiple years (>2) of moderate to severe defoliation.

Defoliation Impacts:

- Incremental growth loss- radial and height increment may be reduced by up to 50% for approximately 4 years following the collapse of an outbreak.
- Top-kill- especially in immature stands, results in the loss of previous height increments and can cause deformities in the stem (forks and crooks) as compensating laterals assume dominance. Stagnation of height growth in mature trees is another impact of defoliation.
- Mortality- although this budworm is not know as a tree killer, mortality losses can occur when trees receive multiple years (>2) of moderate to severe defoliation.

Life History

Western blackheaded budworm spends the winter as eggs laid singly on the underside of needles, usually near branch tips in the upper crowns of susceptible host trees.

Eggs hatch in the early spring and the small, pale yellow green larvae with black heads either mine needles or bore into opening buds where they usually remain until after the second molt. Mined buds are destroyed, one larva often boring into two or more buds. Needles of the opening buds are usually only partially eaten and as the larvae grow they clip some needles off at the base and web them together to construct loose shelters. The older larvae leave the buds and move into these shelters, leaving the shelters to feed.

As the larvae grow their bodies become green, and between the

fourth and fifth instars the color of the head changes to brown. Feeding continues on the new foliage until it is depleted and then old foliage is consumed. They are wasteful feeders, leaving partially consumed needles that cause heavily infested trees to have a reddish brown appearance. A mature larva is about ½ inch long.

Pupation takes place within or near their webbed shelters from mid July to mid-August depending upon latitude. Pupae are green to brown and have a square cut abdomen. Pupation lasts from 10 days to two weeks.

Western blackheaded budworm populations usually build up for 2 – 3 years, remain at a high level for 2 or 3 years, and then decrease, often abruptly.

Eggs laid singly on the underside of needles, usually near branch tips in the upper crowns of susceptible host trees.

Identification

The yellow to green body without spots and the dark head capsule distinguish the western blackheaded budworm larva from other budworm species.

Adults are usually mottled gray with brown, gray, or white bands across the wings. Some have a yellow, orange, or white stripe down each wing. The moths have a wing span of $\frac{3}{4}$ of an inch. Moths may live up to a month or more and can lay as many as 150 eggs, but the average is about 80. Moths prefer to lay eggs in the tops of

trees; during an outbreak eggs may be laid through-out the crown.



Western blackheaded budworm larvae feeding on fir needles. Photo by Edward Holsten.

Visible defoliation occurs from late June through July in the intermountain west and from mid July to mid August on the coast.

Signs of Attack

- Defoliation is often the first indication of western blackheaded budworm outbreaks. They are wasteful feeders not usually consuming entire needles. The dead, partially consumed needles turn red. Defoliation appears as a reddish haze in the summer; faint initially (first year) but becoming very bright during the summer (end of July) at the peak of the outbreak. Discoloration is usually heaviest in the upper crown.
- Look for black-headed, green-yellow bodied larvae feeding on new foliage; careful observation may reveal webbing on twigs. Adults may be seen in flight from late August to October, and eggs are present in the fall and winter.
- Old infestations may be identified by scattered dead topped trees, or in the case of severe repeated attacks, by groups of dead standing trees.
- Western blackheaded budworm populations often increase so rapidly that forests which are green and healthy one year may appear red the next. Defoliation becomes noticeable from late June to late July, depending upon latitude.

Hemlock sawfly, hemlock looper, and western spruce budworm populations may increase simultaneously with western blackheaded budworm populations. Walkthroughs of the affected area should be done to confirm the causal agent.

Monitoring

Population Monitoring and Predictive Sampling—Larval and egg sampling can detect building populations years prior to an outbreak. From egg sampling results during the early fall, defoliation predictions can be made for the following summer.

- **Larval Sampling:** To dislodge western blackheaded budworm larvae from sample trees, beat branches with a 8 foot pole held over a 6 x 9 foot ground sheet. Each plot sample consists of 3 trees. Annual sampling in this manner will detect increases in budworm populations prior to the occurrence of outbreaks.
- **Egg Sampling:** Sample a 45 cm branch tip per tree from each of the north and south aspects, from the mid-crown of 10 trees per sample location. The average number of healthy eggs per branch provides an estimate of next years defoliation levels as listed in Table 1. Visual assessments or the hot water method (as outlined for the western hemlock looper egg sampling) should be used to count the number of eggs per sample.

Table 1. Predicted defoliation levels for the western black-headed budworm based on the numbers of eggs per branch

Numbers of eggs per branch	Predicted Defoliation
1-5	Trace (evidence of feeding barely detectable close up)
6-25	Light (some branch and/or upper crown defoliation; barley visible from the air; and 25% average needle loss)
26-59	Moderate (pronounced discoloration and noticeably thin foliage; severe top defoliation; and 26-60% average needle loss)
60+	Severe (top and many branches completely defoliated; most trees more than 50% defoliated; and 61% average needle loss)

-Warning-

**Remember,
when using
pesticides,
always read
and follow the
label!**

**Please contact
Forest Health
Specialists
before
organizing a
spray project for
this insect.**

Management Considerations:

Prevention-- Stand tending treatments such as spacing and fertilization will help maintain a healthy stand that is more resilient to budworm defoliation. Well spaced, even-aged mature stands should be less susceptible and suffer fewer impacts from western blackheaded budworm defoliations,

In certain areas where the probability of periodic outbreaks is high and where the pre-harvest stand composition is mostly preferred host species, reforestation prescriptions might include higher percentages of non-host species and irregular distribution of stand age classes.

Indirect Control—Western blackheaded budworm populations are normally held to low levels by several natural factors:

- Parasites- a recent study has confirmed the importance of egg and larval parasitism.
- Predators including insects and birds- small forest song birds are known to be effective natural enemies.
- Diseases- caused by fungi and viruses have been found in collapsing populations.
- Abnormal weather conditions- especially cold, wet summer periods.
- Starvation, caused by too many larvae and insufficient food, often is the most significant factor in terminating an outbreak.

Abundant preferred food supply and reduced occurrence of the natural control factors, alone or in combination, are suspected major reasons for the periodic population surges or outbreaks of the western black-headed budworm.

Pheromones—Two attractant pheromones for the western blackheaded budworm have been identified: (E)-11, 13-Tetradecadienal and (Z)-11, 13-Tetradecadienal. To date no pheromone management or monitoring systems have been devised for this moth.

Pesticides—Only experimental aerial spray applications or operational trials have been made from 1956-1990 for control of damage by this occasional pest. Most recently trials using commercial formulations of the bacterial insecticide *Bacillus thuringiensis kurstaki* (Btk) suggest the possibility of strategic applications of this material, particularly within parts of sensitive coastal watersheds.

Other Reading

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Schmiege, D.C. and Crosby, D. 1970. Black-headed budworm in Western United States. US Department of Agriculture Forest Service Forest Pest Leaflet 45, 4 p.

Web References:

Defoliator Management Guidebook-British Columbia
www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/defoliat/defoltoc.htm

Conifer Defoliating Insects of British Columbia
www.pfc.forestry.ca/entomology/defoliators/budworms/west_blackheaded_e.html

new
<http://imfc.cfl.scf.rncan.gc.ca/insecte-insect-eng.asp?geID=1000039>

Photo images
www.forestryimages.org/browse/subimages.cfm?SUB=87

Forest Health Protection and State Forestry Organizations

Assistance on State And Private Lands

Montana: (406) 542-4300

Idaho: (208) 769-1525

Utah: (801) 538-5211

Nevada: (775) 684-2513

Wyoming: (307) 777-5659

N.Dakota: (701) 228-5422

Assistance on Federal Lands

US Forest Service
Region One
Missoula: (406) 329-3605
Coeur d'Alene: (208) 765-7342

US Forest Service
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