



# IMPORTANT EXAMPLES

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## Forest Insects and Disease

- Mountain Pine Beetle
- Dwarf Mistletoe
- Western Spruce Budworm
- Western Gall Rust
- Root Disease



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# MOUNTAIN PINE BEETLE

*Dendroctonus ponderosae* Hopkins

## Vulnerable Trees

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All native and introduced species of pines.

## Where it Occurs

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Wherever vulnerable species are found in Montana.

## Damage to Trees

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Both adult beetles and their young (larvae) feed in phloem layer of the tree, just under the inner bark. Feeding girdles the tree. The insect inoculates the tree with blue stain fungi. The fungi grow in the water conducting tissue of the tree, clogging it, and cutting off water to the branches and foliage. Usually trees are killed, but some may have only portions of the crown killed. Trees less than 5 inches dbh (diameter at breast height) are seldom attacked.

## How to Identify

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This is one of the few bark beetles that usually make very obvious pitch tubes on the bark surface at the point of attack (figure 1, page 3). Pitch tubes are masses of sap (resin) mixed with bark and wood borings. Boring dust is also evident in bark crevices and around the base of infested trees.

To be sure of mountain pine beetle identification, peel off a portion of bark underneath the pitch tubes. Look for straight, vertical feeding galleries with a crook or “J” at bottom (figure 2, page 3). Feeding galleries can extend upward 30 inches or more along the tree stem. Galleries are packed tightly with frass (insect droppings). Larvae (grubs) are present in the galleries during fall and winter. Most pupate or change into adult beetles in late spring. The adults emerge from the bark in midsummer and attack new trees. Mature adults are black and about three-sixteenths inch long. Infested trees fade within a year from yellow-green to red-brown. Woodpeckers use trees while they are fading, taking advantage of all the insects under the bark.

## Similar Damage

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Boring dust is also present when pines are attacked by Ips (another kind of beetle called “engraver beetle”) or other secondary bark beetles (insects that attack trees once they have died). Gallery shape and pattern distinguishes mountain pine beetle from Ips and secondary bark beetles.

# DWARF MISTLETOE

*Arceuthobium spp.*

## Vulnerable Trees

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Five species of dwarf mistletoe infect 11 native conifers in Montana. Major hosts are Douglas-fir, western larch, lodgepole pine, and ponderosa pine.

## Where it Occurs

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Wherever vulnerable species are found in Montana except Douglas-fir and ponderosa pine. Douglas-fir dwarf mistletoe occurs only west of the Continental Divide. Ponderosa pine dwarf mistletoe is found near Coeur d'Alene, Idaho.

## Damage to Trees

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Thick, dense foliage growth, called "witches brooms" often form on infected branches (fig. 4, page 3). Stem cankers or swellings sometimes result from infections by dwarf mistletoe. Tree height and diameter growth can be severely reduced. Tree form or shape is also affected. Bark beetles can attack trees weakened by dwarf mistletoe infections.

## How to Identify

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Dwarf mistletoe plants grow on branches or stems of vulnerable trees (figs. 3, 5, and 6, page 3). Their shoots are from 1 to 4 inches in length. They are scattered along young twigs, or in groups on branches or tree stems. Their color varies from yellow to purple to brown or olive green. When the shoots fall off, small basal cups often remain embedded in the bark. Witches brooms, cankers, and swellings on tree stems and branches are also indicators of dwarf mistletoe infections.

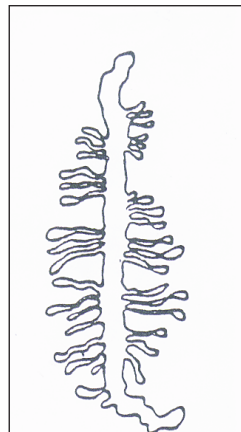
## Similar Damage

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Witches brooms, cankers and swellings can be caused by a number of other agents. "Stimulation brooms" often are produced after stands have been thinned. Occasionally, witches brooms and swellings are caused by frost damage to growing cells in both the cambium (tissue under the bark) and buds. Cankers are caused by a number of common canker-causing fungi. Sunscald and mechanical injuries also cause damages which can be confused with cankers. Look for dwarf mistletoe plants, to be sure of dwarf mistletoe infection.

# MOUNTAIN PINE BEETLE

**Figure 1** ▶  
Pitch tubes on the bark are evidence of MOUNTAIN PINE BEETLE attack.



◀ **Figure 2**  
Under the bark, the MOUNTAIN PINE BEETLE gallery has a “crook” at the lower end.

# DWARF MISTLETOE



▲ **Figure 3**  
LOGEPOLE PINE DWARF MISTLETOE female shoots on an infected branch.



▲ **Figure 4**  
DOUGLAS-FIR DWARF MISTLETOE causes witches brooms to form on infected branches.



▲ **Figure 5**  
LOGEPOLE PINE DWARF MISTLETOE male shoots.



◀ **Figure 6**  
DOUGLAS-FIR DWARF MISTLETOE shoots are about the same length as the tree's needles.

# WESTERN SPRUCE BUDWORM

*Choristoneura occidentalis* Freeman

## Vulnerable Trees

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Douglas-fir, all true firs, spruce, and larch. May be found on pines.

## Where it Occurs

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Wherever vulnerable species are found in Montana; however, the most significant damage occurs on dry sites.

## Damage to Trees

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Budworm larvae (there are several instars or growth stages) feed inside new buds and old needles in the spring. Then they move to new foliage as it begins growing (fig. 7, page 6). After several years of heavy feeding by this insect, branch dieback, top kill, and tree mortality can occur. Cones and seeds of all vulnerable species are also destroyed. In the case of larch trees, the new top and side branchlets are severed.

## How to Identify

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Look for larvae in silky nests of webbed, chewed needles (fig. 9, page 6) from June until August. Small larvae are noticeable in the spring and early summer. They are light green to light brown with darker heads. Mature larvae have brown heads and bodies, with prominent ivory-colored spots (fig. 8, page 6). They can be one inch long when fully grown. Pupae (young crawlers) are three-fourths of an inch long and brown and are found in the nests from mid-July into August. Adult moths are mottled rust-brown and have a wingspan of about one inch. Female moths lay eggs on needles in a shingle pattern in August. Larvae hatch and immediately seek shelter for the winter.

## Similar Damage

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Larvae of western blackheaded budworm cause similar damage, but are identified by pale yellow body with black heads and are somewhat smaller. Other foliage feeding larvae may be present but none have the distinctive coloration and spots of budworm larvae. On pines, they may be confused with sugar pine tortrix which are generally smaller. Cone damage is similar to that caused by several species of cone worms.

# WESTERN GALL RUST

*Endocronartium harknessii* (Moore) Hirat.

## **Vulnerable Trees**

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Lodgepole and ponderosa pines.

## **Where it Occurs**

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Wherever vulnerable species are found in Montana.

## **Damage to Trees**

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Round swellings, called galls, grow on infected branches or stems (fig. 10, page 6). Branches and small stems are killed when insects and other fungi attack the galled tissue. Cankers (decaying wood) are produced from stem galls. Stem galls, (those that grow on the trunk of the tree) are often the places where trees break during windstorms.

## **How to Identify**

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Galls form on branches or stems. The galls crack open during the spring, exposing yellow or orange spores and releasing them into the air. This is called sporulation. Pustules of yellow or orange spores form in bark cracks on galls in spring. In saplings and larger trees, stem infections eventually form cankers referred to as "hip cankers" (fig. 11, page 6). Sporulation (yellow-orange coloring) can sometimes be seen at the edges of hip cankers in spring.

## **Similar Damage**

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Comandra blister rust stem cankers are sometimes mistaken for gall rust hip cankers (fig. 12, page 6). Comandra cankers are usually somewhat longer than they are wide.

## WESTERN SPRUCE BUDWORM



▲ **Figure 7**  
Young WESTERN SPRUCE BUDWORM feed on developing shoots.



▲ **Figure 8**  
Mature WESTERN SPRUCE BUDWORM. Note prominent ivory-colored spots.



▲ **Figure 9**  
WESTERN SPRUCE BUDWORM web needles together, making silken nests in which they feed.

## WESTERN GALL RUST



▲ **Figure 10**  
Sporulating WESTERN GALL RUST branch gall.



▲ **Figure 11**  
WESTERN GALL RUST infections on stems of young trees often result in hip cankers as the trees grow.



▲ **Figure 12**  
COMANDRA BLISTER RUST cankers on young lodgepole or ponderosa pines roughen the bark and cause some appearance of swelling. This one is sporulating.

# ROOT DISEASE

## Vulnerable Trees

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Trees of all sizes, ages and species are killed by root disease. Five major root diseases are found in Montana:

- armillaria: primarily Douglas-fir
- laminated: Douglas-fir and grand fir
- annosus: Douglas-fir, grand fir, ponderosa pine and subalpine fir
- black stain: Douglas-fir, lodgepole pine, ponderosa pine, and eastern white pine
- schweinitzii: Douglas-fir

## Where it Occurs

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Root disease spreads underground from roots of diseased trees to those of healthy ones. The result is usually several to hundreds of trees dying or dead in groups, called root disease pockets.

## How to Identify

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There are both forest stand and individual tree symptoms which can be used to detect most root diseases. Root disease occurs in two patterns in forest stands. The first is in root disease pockets, and the second is scattered individual trees and small groups of dead trees. Both types may occur in the same stand creating a mosaic effect.

## Forest Stand Symptoms

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Root disease pockets range in size from part of an acre to hundreds of acres. They usually have many young trees or dense brush growing in the center. This is ringed with dead and dying trees intermixed with apparently unaffected trees along the margin of the pocket (fig. 13, page 8). Root disease pockets have various shapes. They range from round to long, narrow strips, to irregular patches. They are often restricted to particular aspects, and drainages. Tree species less affected by root rot sometimes mask the presence of a root disease pocket because only the most susceptible species are killed. Such stands simply appear to be understocked or irregularly stocked.

Scattered root disease often goes undetected because it is subtle. Only a few trees per acre die and these are scattered among the apparently unaffected trees (fig. 14, page 8). The eventual toll of scattered root disease can be greater than root disease pockets, because it is usually more extensive throughout a stand or drainage.

## Individual Tree Symptoms

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Symptoms vary depending on how rapid death occurs, the interaction with bark beetles, and season of death (fig. 15, page 8). Generally, trees with root disease lose their needles beginning with the oldest and progressing to the youngest. Trees appear to be thinning from the lowest part of the crown up, and the innermost part of the crown (nearest the stem) out, toward the branch tips (figs. 16 and 17, page 8).

If bark beetles attack dying trees they speed up the process and trees may not have time to shed many needles before they die. In this case, the crown may turn uniformly yellow or red (fig. 17, page 8). Small trees which are killed rapidly by root disease may turn uniformly red. Shortened top growth and short leaves are often symptoms in seedlings and saplings a year or two before death (fig. 18, page 8).



# ROOT DISEASE



◀ **Figure 13**  
ROOT DISEASE  
POCKET with  
sapling regeneration  
in the center and  
dead and dying trees  
ringing the outer  
margin.



◀ **Figure 14**  
Scattered ROOT  
DISEASE mortality  
Notice occasional  
dead trees.



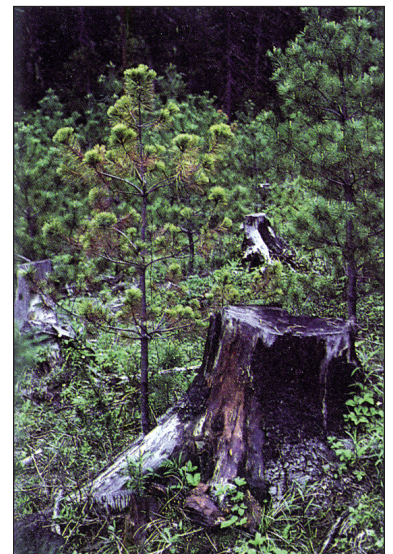
▲ **Figure 15**  
ROOT DISEASE POCKET  
with brush invading. Note  
the snags and thin-crowned  
trees.



▲ **Figure 16**  
Crown symptoms of ROOT  
DISEASE. Crown thins from  
lower branches first to upper  
branches last, and from  
innermost leaves first to  
outermost buds last.



▲ **Figure 17**  
ROOT DISEASE crown  
symptoms with bark beetles  
attacking diseased trees.



▲ **Figure 18**  
Sapling with ROOT  
DISEASE. Shortened shoot  
and needle growth marks  
the imminent death of this  
pine.