

Biology of the Mountain Pine Beetle

This small beetle (about 5 mm long) attacks and kills mature trees by boring through the bark and mining the phloem — the soft layer between the bark and wood of the tree. Its eggs hatch into larvae that consume the phloem, killing the tree. Mountain pine beetles prefer to attack larger, mature trees that are more than 80 years old.

The mountain pine beetle's life events — including overwintering stage and main adult flight — occur at specific times of year.



Life cycle

The life-span of a mountain pine beetle (*Dendroctonus ponderosae*) is about one year.

The life cycles of most bark beetle species include the following events:

- Adult females emerge when ambient air temperature exceeds approximately 16°C, find new suitable host material, and emit aggregating pheromones to initiate mass attack.
- Males join the females and each pair constructs an egg gallery under the bark, parallel to the grain.
- The sapwood is inoculated with spores of a blue-stain fungus as the egg gallery is built. This fungus prevents the tree from repelling and killing the attacking beetles with tree pitch.
- Eggs are laid and hatch into larvae, which feed on the phloem in feeding channels constructed at right angles to the egg gallery.
- Mountain pine beetle larvae spend the winter under bark. They continue to feed in the spring and transform into pupae in June and July.
- After four instars, larvae pupate and develop into adults under the bark.
- Young adults pick up blue-stain fungal spores while in the pupal chamber.
- Adult mountain pine beetles emerge from an infested tree during summer or early fall.

Table: Life cycle events

Factor	Mountain pine beetle
Main adult flight	July through August
Host preference	Living trees
Normal life-cycle duration	One year
Overwintering stage	Larvae

The action of the larval feeding in the phloem and fungal colonization of the sapwood completely blocks all translocation tissues and kills the infested tree.

Three Stages of Attack

1. *Green Attack* – Adult beetles have tunneled underneath the bark to lay their eggs. The needles stay green for several months
2. *Red Attack* – As the beetles mine the layers between the bark and the wood, they cut off the tree's supply of nutrients, causing the needles of the now-dead tree to turn red
3. *Grey Attack* – The needles have fallen off the tree, leaving only the bare branches. The decaying tree is more susceptible to falling or being blown down

In some cases only one side of a tree will be successfully attacked (strip attack); this tree will survive unless living portions are re-attacked in subsequent years.

Beetles and Weather

Cold weather can kill the mountain pine beetle. The beetle's eggs and larvae are the most susceptible to freezing temperatures.

Populations will die off if

- midwinter temperatures are -35°C to -40°C or colder over several days
- early fall or late spring temperatures are -25°C or colder over several days

A cold snap is most effective

- in the fall, before the beetles can build up their natural anti-freeze (glycerol) levels
- before it snows, because a deep layer of snow can help insulate mountain pine beetles in the base of a tree

Windchill affects mountain pine beetles, but usually is not sustained enough to increase winter mortality significantly.

Hot and dry summers leave pine trees drought-stressed and more susceptible to attack by the mountain pine beetle.