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**service in  
ACTION**

**Mountain Pine Beetle**

and related bark beetles

David A. Leatherman and Whitney S. Cranshaw<sup>1</sup>

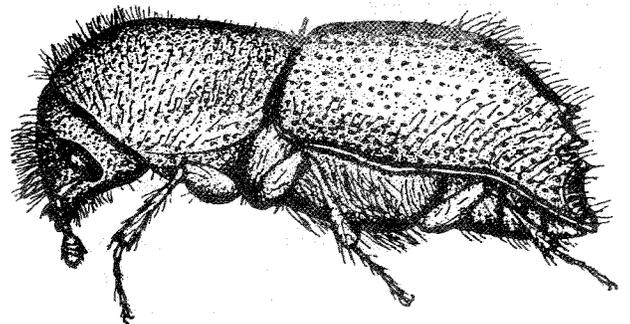
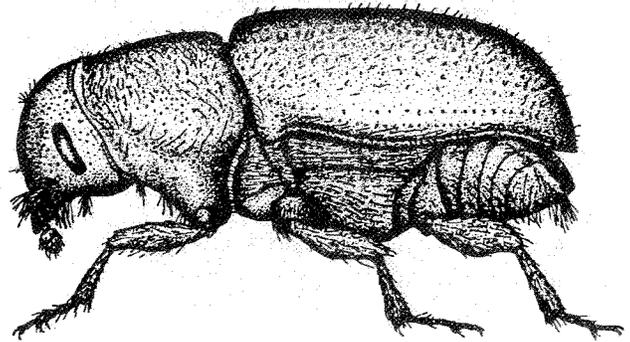
**Quick Facts**

Mountain pine beetle (MPB) is the most important insect pest of Colorado's pine forests. MPB often kill large numbers of trees annually during outbreaks.

Trees that are not growing vigorously due to old age, crowding, poor growing conditions, drought, fire or mechanical damage, root disease and other causes are most likely to be attacked.

For a long-term remedy, thin susceptible stands with emphasis on leaving well-spaced healthy trees.

For short-term controls, spray, burn, and peel attacked trees to kill the beetles. Preventive insecticide sprays can protect green, unattacked trees.



**Figure 1: Adult Dendroctonus (top) versus Ips (bottom). Note gradually curved wing of Dendroctonus. Actual size of Dendroctonus from 3 to 8 mm; Ips 3 to 6.5mm.**

Mountain pine beetle (MPB), *Dendroctonus ponderosae*, is an insect native to the forests of western North America. Previously called the Black Hills beetle or Rocky Mountain pine beetle, periodic outbreaks of the insect can result in losses of millions of trees. Outbreaks develop irrespective of property lines, being equally evident in wilderness areas, mountain subdivisions, and back yards. Even windbreak or landscape pines many miles from the mountains can succumb to beetles imported in infested firewood.

Mountain pine beetles develop in pines, particularly ponderosa, lodgepole, Scots (Scotch), and limber pine. Bristlecone and pinyon pine are less commonly attacked. During early stages of an outbreak, attacks are limited largely to trees under stress from injury, poor site conditions, fire damage, overcrowding, root disease, or old age. However, as

beetle populations increase, MPB attacks may involve most trees in the outbreak area.

A related insect, the Douglas-fir beetle (*Dendroctonus pseudotsugae*), occasionally damages

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Douglas-fir. Most often, outbreaks are associated with previous injury by western spruce budworm (Service in Action sheet 5.543, *Western Spruce Budworm*). Spruce beetle, (*Dendroctonus rufipennis*) is a pest of Engelmann and blue spruce in Colorado. Injured pines also can be attacked by the red turpentine beetle, (*Dendroctonus valens*).

Mountain pine beetle, and other bark beetles in the genus *Dendroctonus*, can be separated from other bark beetles by the shape of the hind wing cover (Figure 1). In side view it is gradually curved. The wing cover of *Ips* or engraver beetles, another common group of bark beetles attacking conifers (Service in Action sheet 5.558, *Ips beetles — characteristics and controls*) is sharply spined; whereas Scolytus beetles, such as the shothole borers and European elm bark beetle, have the area under the wing cover (abdomen) indented.

### Signs and Symptoms of MPB Attack

- Popcorn-shaped masses of resin, called 'pitch-tubes' on the trunk where beetle tunnelling begins. Pitch tubes may be brown or white in color.
- Boring dust in bark crevices and on the ground immediately adjacent to the tree base.
- Evidence of woodpecker feeding on trunk. Patches of bark are removed and bark flakes lie on ground or snow below tree.
- Foliage turning yellowish to reddish throughout the entire tree crown. Usually occurs eight to 10 months after a successful MPB attack.
- Presence of live MPB (eggs, larvae, pupae, and/or adults) as well as galleries under bark. This is the most certain indicator of infestation. A hatchet for removing bark is needed to check trees correctly.
- Bluestained sapwood (Figure 2). Check at more than one point around the tree's circumference.

### Life History and Habits

Mountain pine beetle has a one-year life cycle in Colorado. In late summer adults leave the dead, yellow to red needled trees in which they developed. Females seek out living, green trees that they attack by tunneling under the bark. Coordinated mass attacks by many beetles are common. If successful, each beetle pair mates, forms a vertical tunnel (egg gallery) under the bark, and produces about 75 eggs. Following egg hatch, larvae (grubs) tunnel away from the egg gallery producing a characteristic feeding pattern (Figure 3).

MPB larvae spend the winter under the bark. They continue to feed in the spring and transform



**Figure 2: Cross section of ponderosa pine log shows characteristic stain caused by fungus carried on beetle bodies.**

into pupae in June and July. Emergence of new adults can begin in early July and continue through September. However, the great majority of beetles exit trees during late July (lodgepole pine) and mid-August (ponderosa pine).

A key part of this cycle is the ability of MPB (and other bark beetles) to transmit bluestain fungi (*Ceratocystis species*). Spores of these fungi contaminate the bodies of adult beetles and are introduced into the tree during attack. Fungi grow within the tree and, together with beetle feeding, weaken the tree. This mutual network of beetle galleries and bluestain fungi disrupt transport of water in the tree and rapidly kill it. The fungus gives a blue-gray appearance to the sapwood.

### Control

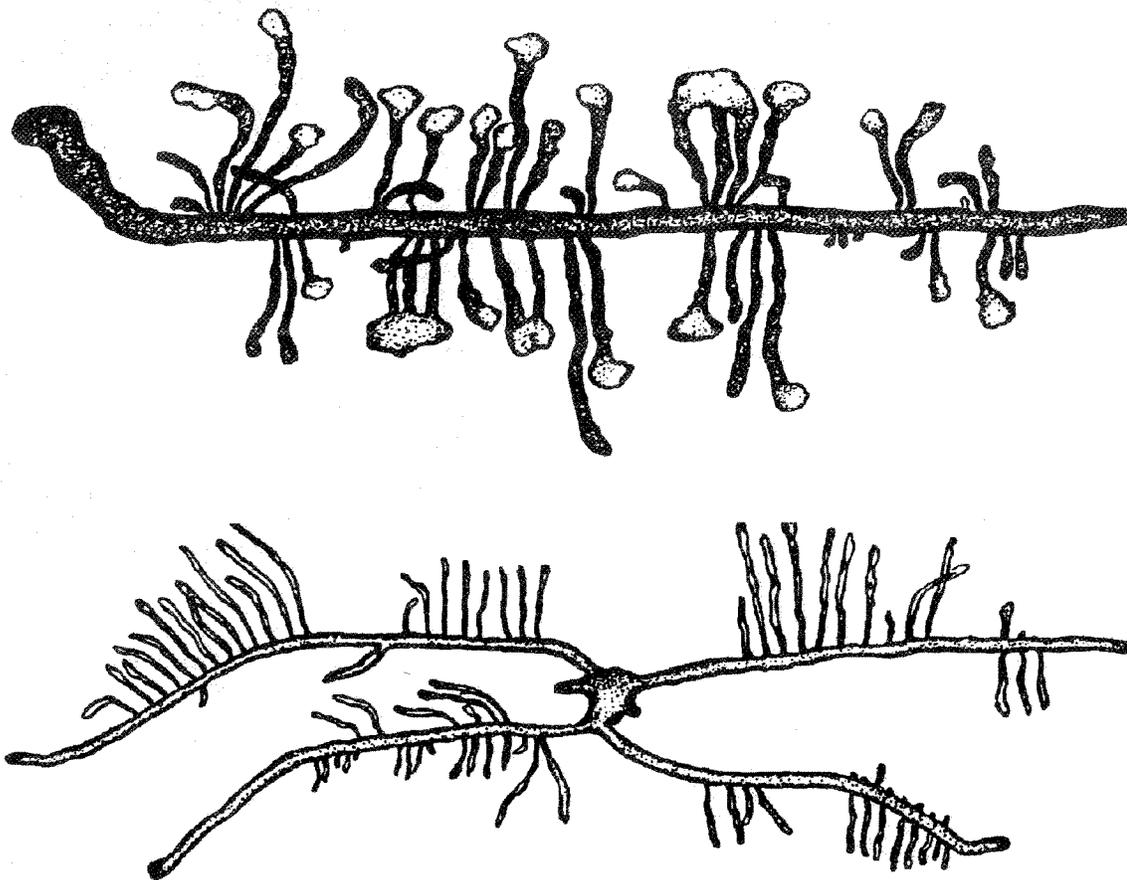
Natural controls of mountain pine beetle include woodpeckers and insects such as clerid beetles that feed on mountain pine beetle adults and larvae under bark. Extreme cold temperatures also can reduce MPB populations. However, during outbreaks these natural controls often fail to prevent additional attacks.

Perhaps the most important natural control is tree vigor. Healthy trees are less attractive to beetles than trees under stress. Vigorously growing trees also have better defenses that allow them to 'pitch out' pine beetles.

Cultural controls that promote tree health and spacing are the primary means to prevent MPB outbreaks. The best long-term means to minimize

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**Figure 3: Typical egg and larval galleries produced by *Dendroctonus* (top) versus *Ips* (bottom).**

MPB losses is to thin trees. Consult a professional forester to select the best cultural practices for your land.

Logs infested with MPB can be treated in various ways to kill developing beetles before they emerge as adults in summer. Logs may be burned to kill the larvae under bark. Intense solar radiation that dries out the cambium and raises temperatures to lethal levels (110F+) can kill MPB larvae. Beetles also die if the bark is removed by peeling or milling. Burying is another option to kill MPB in infested logs. In some cases, hauling infested logs to "safe sites" a mile or more from susceptible tree hosts also is practiced. Following beetle emergence, wood can be used without threat to other trees.

Chemical control options for MPB have been greatly limited in recent years. Former treatments that involve ethylene dibromide fumigation have been banned. Cacodylic acid (Silvisar products) and most formulations of lindane are unavailable or Restricted-Use. These treatments were primarily used to kill larvae in trees or adults as they emerge. (A few formulations of lindane, usually marketed as some brand of 'borer spray', remain available to treat infested logs.)

Certain formulations of carbaryl (Sevin, Sevimol, etc.) are registered for use to prevent attacks on individual trees. These sprays are applied to living green trees in early summer to kill attacking beetles. This preventive spray is quite effective through one MPB flight (one year) in ponderosa pine areas. In lodgepole pine areas, recent evidence indicates one spraying may provide satisfactory protection through two flights (two years).

**Always carefully read and follow all label precautions** before applying carbaryl for MPB prevention.

Research is ongoing with lures involving special attractants (pheromones) for beetle management. Primarily this has involved pheromones with attract beetles to 'trap' logs or trees where they can be more easily removed or treated. This approach has been effective in Colorado settings where there are trees available for sacrifice. Done correctly, combined with tree treatments, pheromones can be useful in reducing outbreaks in a small area.

Repellent pheromones to disperse beetles from high-value trees also are being developed. However, these have not yet provided consistently reliable protection in Colorado testing.

- Once MPB infest a tree, nothing practical can be done to save that particular tree.
- Under epidemic or outbreak conditions, enough beetles can emerge from an infested tree to kill about two same-sized trees the following year.
- Ips and related beetles that emerge early in summer often are mistaken for mountain pine beetle, leading to early reports that "MPB is flying". Be sure to properly identify the beetles you find associated with your trees.
- Trees from which MPB have already emerged (look for numerous, round, pitch-free exit holes in bark) do not need to be treated.
- The direction and spread rate of a beetle infestation is impossible to predict. However, attacked trees usually are adjacent or near previously killed trees.

### Douglas-fir Beetle

A different species of bark beetle damages Douglas-fir in Colorado. The Douglas-fir beetle (*D. pseudotsugae*) also causes the rapid reddish-brown needle discoloration associated with MPB and other bark beetles. Douglas-fir beetle does not produce MPB-like pitch tubes, although clear sap may ooze from boring wounds.

Douglas-fir beetles have one generation per year. However, they overwinter as both large larvae and adults under the bark. Adults typically begin emerging in late April and May (earlier than MPB), but over 75 percent of the population emerges the last three weeks of June. Thus, the emergence period can extend from April through July.

Controls for Douglas-fir beetle generally are similar to MPB. However, since adults can emerge earlier, developing beetles must be destroyed and preventive sprays applied by late April.

### Spruce Beetle

Engelmann and blue spruce can be attacked by the spruce beetle, *Dendroctonus rufipennis*. This beetle is considered to be less aggressive than MPB and usually limits attacks to wind-thrown trees, slash, and tree stumps. However, apparently healthy spruce trees can be attacked when beetle populations become epidemic. The largest single mass-killing of trees recorded in North America is attributed to spruce beetle, in the White River National Forest during the 1940's.

Spruce beetles generally take two years to complete a generation and attacks may take longer to kill a tree than occurs with other bark beetles. Pitch tubes usually are not formed and presence of brown sawdust from borings is often the best evidence of attack. Adult beetles emerge in late June and July.

### Red Turpentine Beetle

Pines and, rarely, other conifer species sometimes are attacked by the red turpentine beetle, *Dendroctonus valens*. Trees scorched near the base by fire or injured during construction are particularly susceptible. Turpentine beetle attacks are characterized by large, pinkish-purple pitch tubes confined to the lower eight feet of the trunk. Beetles may be active throughout the warmer months, peaking in mid-summer.

Tunnels produced by red turpentine beetle do not have a regular egg gallery. Beetles make short, irregular tunnels and developing larvae feed as a group excavating a shallow cavity under the bark. Trees can survive attack, but weakening can make them more susceptible to other bark beetles.

Cultural practices that promote tree vigor can help avoid attacks by red turpentine beetle. Preventive insecticide sprays (carbaryl) applied before adult attacks, also are effective. Individual trees can be protected by screening the lower trunk.

### Related Service in Action Sheets

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|-------|---|
| 5.506 | Dutch elm disease                         |
| 5.543 | Western spruce budworms                   |
| 5.558 | Ips beetles — characteristics and control |
| 5.567 | Ponderosa pine budworms                   |

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