



Bark Beetles

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WHAT YOU SHOULD KNOW

- Bark beetles are a significant cause of tree mortality in the forest and urban environment.
- To protect high-value trees around homesites, use preventative trunk sprays of carbaryl, permethrin, and bifenthrin prior to beetle flight.
- Soil- and trunk-applied systemic insecticides (e.g., imidacloprid and dinotefuran) do not sufficiently protect trees from bark beetle attack.

BIOLOGY

Bark beetles are one of the most destructive forest pests in the world. They are different than the larger longhorned and roundheaded/metallic woodboring beetles commonly infesting the inner wood of trees. The largest bark beetle, the red turpentine beetle (*Dendroctonus valens*), reaches only 8.3 mm in length. Because of their tiny size (Fig. 1), bark beetles are not effective tree killers as individuals. Instead, primary bark beetles work together, sending pioneer beetles to search for stressed or dying trees. When pioneer beetles find a weakened tree, they bore into and feed



Fig. 1. Average size of an adult bark beetle compared to a penny¹.



Fig. 2. Typical top-down dieback pattern on pines infested by Ips beetles².

on the thin phloem layer just under the bark. As they feed, chemicals from their food are converted into attractive chemicals, signaling to other beetles of the same species that a suitable host was found.

Beetles that detect the airborne chemicals will fly to the stressed tree, bore into the phloem, create a mating (nuptial) chamber, mate, and hollow-out a parental gallery laying eggs as they progress. Usually, many beetles attack the same tree in a short period of time allowing them to overcome its defenses (e.g., resin in pines). This is called mass attack. After egg hatch, immature beetles (larvae) (Fig. 12) begin feeding outward from the parental gallery, girdling the tree. This larval girdling is the same as killing a tree by deeply scoring its entire circumference with a knife or

saw. Once the phloem layer is girdled, nutrient transport within the tree stops, and the tree eventually dies. Many bark beetles carry a fungus that inhibits water transport within the tree, aiding in tree death.

In an urban setting, trees are easily stressed by heat and drought, soil compaction, over/under watering, old age, and mechanical damage making them prime targets for bark beetles. Our habit of planting identical tree species in groups or rows makes the problem worse, allowing beetles to easily move between closely growing host trees and cause major aesthetic damage.

HOW DO I KNOW IF MY TREES ARE INFESTED?

Fading tree crowns (Figs. 3-4) are good indicators of bark beetle infestation or other health problems. In some cases, crown fading can be delayed by cold temperatures. Trees attacked in fall may remain mostly green until early summer. Crown fading ranges from very slight off-green, to yellow, brown, and red, depending on how recently the tree was attacked. Trees attacked by *Ips* beetles usually have crown die-back from the top down, which may happen over the course of a season or a few years as successive beetle generations attack progressively lower portions of the tree.

If the crown appears off colored, complete a thorough inspection of the tree trunk and branches. Look for a sawdust like substance (frass) that can be found in the cracks and crevices of tree bark or on the ground around the trunk (Fig. 5). Also look for pitch tubes (Figs. 6-8), which are resin deposits exuded from trees in an attempt to defend itself. Pitch tubes are most common on pine trees, but small amounts of pitch from some hardwoods may also be seen. The presence of pitch tubes and/or frass indicates the need for further investigation. If the tubes and/or frass are visible on more than half of the trunk circumference, use a hatchet to pull back bark from an area under the pitch tubes and examine the exposed wood and back of bark.

Look for signs of current or past beetle infestations such as galleries (Fig. 10), eggs, larvae (Fig. 12), pupae, and adult beetles. If galleries and larvae are present, this indicates a current attack. If the galleries are empty and no larvae, pupae or adult beetles are present, then the infestation is likely old. Note that some beetles, such as the western pine beetle, will



Fig. 3. Recently infested trees may not show obvious signs of fading³.



Figs. 4-5. (Left) Fading crown of bark beetle infested trees². (Right) Frass, or sawdust-like material on the trunk is an indication of bark beetle infestation⁴.



Figs. 6-8. (Left and Right) Pitch tubes are defensive chemical compounds exuded from the tree that may indicate bark beetle attack^{5,6}. (Upper left corner) Bark beetle caught by a tree's defensive resin⁷.



Fig. 9. Exit holes created from emerging adult bark beetles⁸.



Figs. 10-11. (Left) Bark beetle parental and larval galleries; larvae can be seen in newly constructed pupal chambers where they will transform into adults⁹. (Right) Shotgun pattern of exit holes from shothole borers⁶.



Fig. 12. Bark beetle larvae are legless white grubs with a brown head capsule¹⁰.

enter the outer bark layers in later larval stages. If the condition of the phloem layer (soft, white, thin layer between the bark and wood layers) is brown to black, or completely dried-up, then the tree may be dead. Check the rest of the circumference of the tree for live phloem. If no living phloem is found, the tree should be removed and treated to kill the beetles; see the "Sanitation" section for techniques.

Beetle exit holes often have a "shotgun" pattern in tree bark (Figs. 9 & 11), indicating that bark beetles have already exited the tree. If you see any signs of bark beetles--fading crown, pitch tubes, frass, galleries (Fig. 10), larvae (Fig. 12), or adults--be sure to examine the rest of the trees on your property for signs of beetle attack, especially trees of the same or related species. If you live close to your neighbors, they should also be notified to examine their trees. If you are not comfortable evaluating your own tree, contact a qualified arborist for help, or submit samples to the UPPDL.

BEETLE IDENTIFICATION AND COMMON UTAH BARK BEETLES

Bark beetles are small and similar looking. Always have your beetle identified by a professional entomologist. However, homeowners can narrow down the possibilities by answering the following questions:

1) What tree species is affected? Use Table 1 on the following page to narrow down possible bark beetles using host plant/tree information.

2) What do the galleries look like? To view galleries, bark must be removed from the tree. Do not attempt this unless you are sure the whole tree, or the part of the tree you are interested in is dead. Look at the gallery pictures below and match them with the general shape of your galleries.

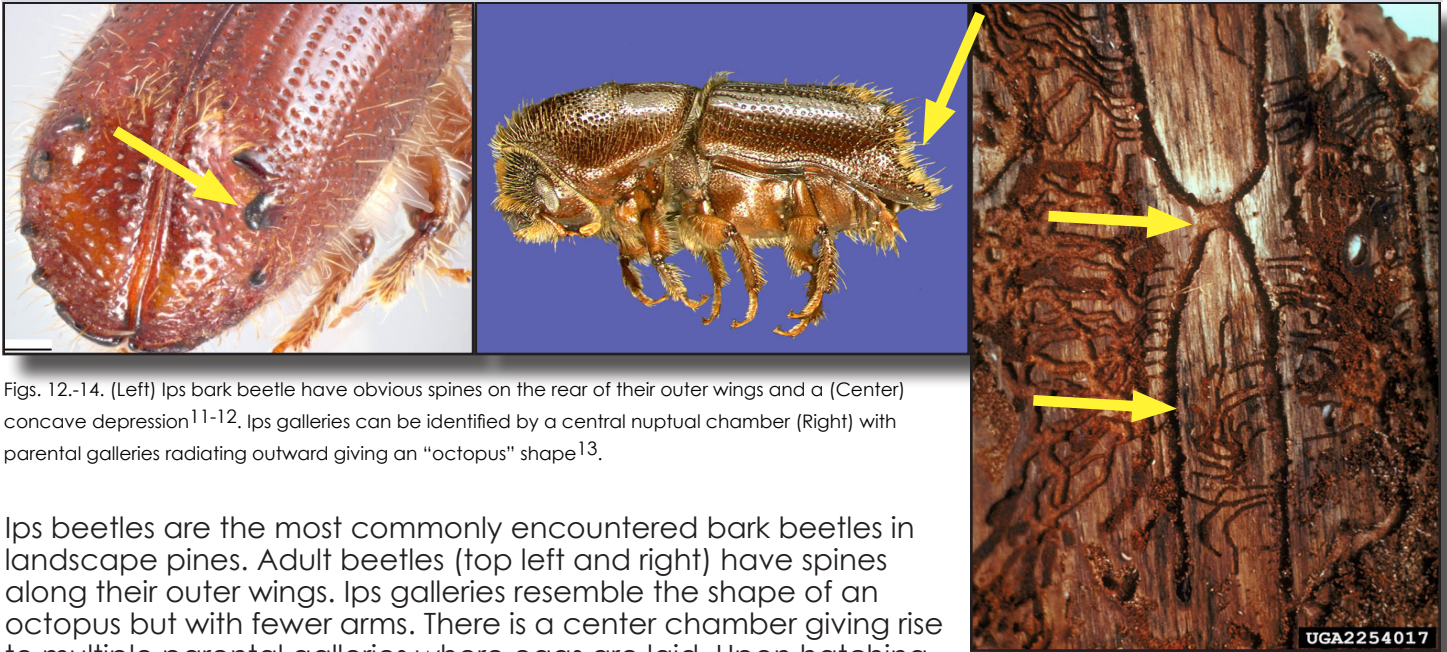
3) What is the general appearance of the beetle? Look at the adult beetle pictures below and match major features. Beetles are extracted from the tree using destructive hatchet sampling methods as well.

Utah's Common Bark Beetles

Bark Beetle Name	Scientific Name	Utah Hosts	Generations Per Year*
Spruce Ips	<i>Ips hunteri</i>	blue & Engelmann spruce	2 - 3
Spruce Ips	<i>Ips pillifrons</i>	Engelmann spruce	2 - 3
Pine Engraver	<i>Ips pini</i>	ponderosa, lodgepole, and occasionally other pines	2 - 3
Pinyon Ips	<i>Ips confusus</i>	pinyon and singleleaf pinyon	up to 5
Six-Spined Ips	<i>Ips calligraphus</i>	ponderosa pine	2 - 4
Pine "Ips"	<i>Orthotomicus latidens</i>	pinyon, lodgepole, limber, ponderosa and other pines	1 - 2
Banded Elm Bark Beetle	<i>Scolytus schevyrewi</i>	elms	2 - 3
European Elm Bark Beetle	<i>Scolytus multistriatus</i>	elms	2 - 3
Fir Engraver	<i>Scolytus ventralis</i>	firs	1/2 - 1
Shot-hole Borer	<i>Scolytus rugulosus</i>	apples, pears, cherries, and hawthorns	2
Mountain Pine Beetle	<i>Dendroctonus ponderosae</i>	lodgepole, ponderosa, limber, and other pines	1
Douglas-Fir Beetle	<i>Dendroctonus pseudotsugae</i>	Douglas-fir	1
Roundheaded Pine Beetle	<i>Dendroctonus adjunctus</i>	ponderosa pine	1
Spruce Beetle	<i>Dendroctonus rufipennis</i>	Engelmann and blue spruce	1/2 - 1
European Shot-hole Borer	<i>Xyleborus dispar</i>	Norway & sugar maple, water & paper birch, hazels, walnuts, apples, pears, cherries, oak, willow, and grapes	1
Walnut Twig Beetle	<i>Pityophthorus juglandis</i>	walnuts	2
Arizona Cypress Beetle	<i>Phloeosinus cristatus</i>	Arizona cypress, junipers, cedars, sequoia, redwood	1 - 2
Western balsam Engraver	<i>Dryocetes confusus</i>	sub-alpine fir, white fir, and Engelmann spruce (not common)	1/2

Table 1. Common bark beetles and host trees in Utah. *Generations per year are given, but may vary depending on your location in Utah: use lower estimates for northern Utah and high elevations and the higher end for southern and lower elevation sites.

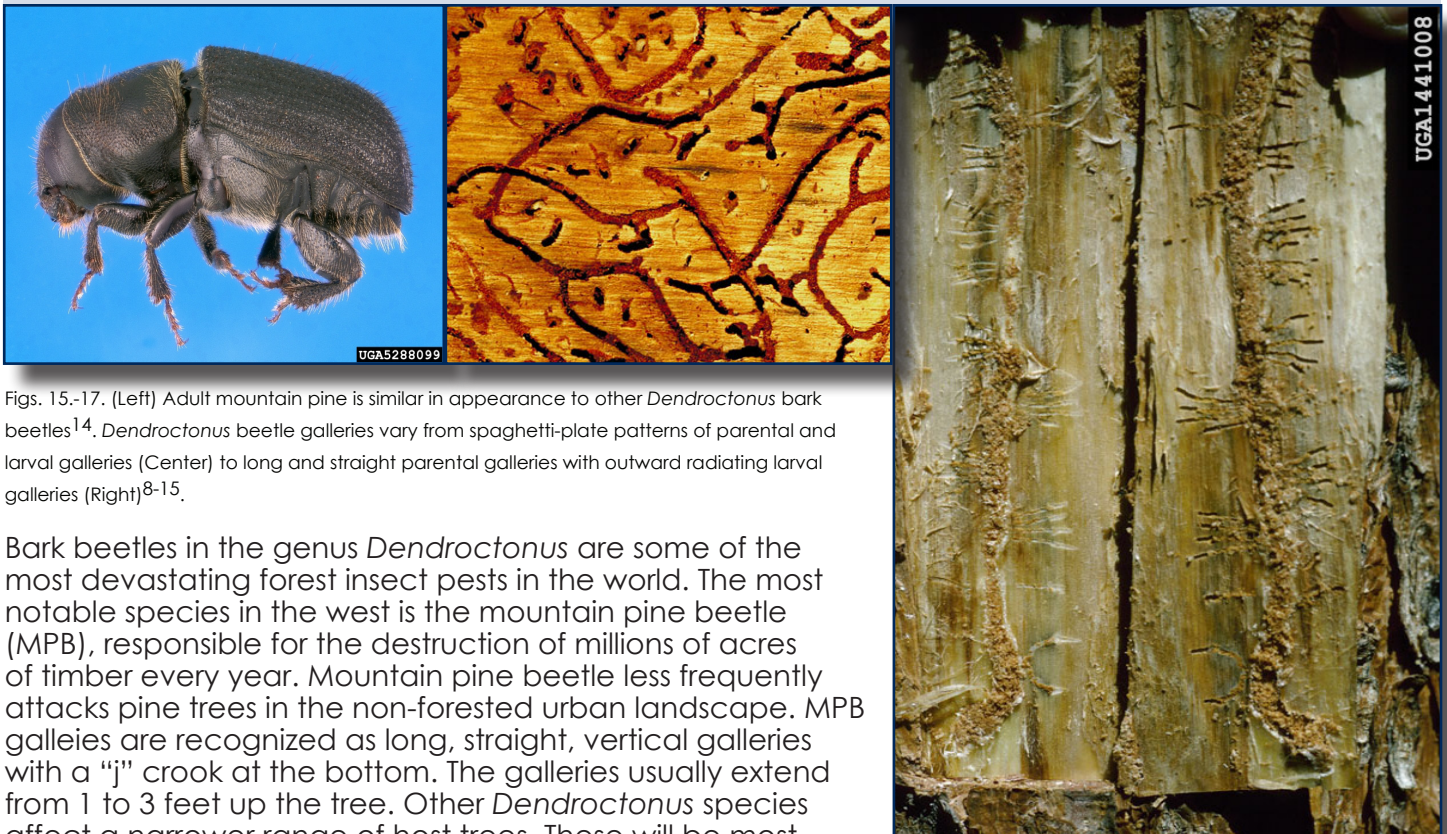
IPS BEETLES



Figs. 12-14. (Left) Ips bark beetle have obvious spines on the rear of their outer wings and a (Center) concave depression¹¹⁻¹². Ips galleries can be identified by a central nuptial chamber (Right) with parental galleries radiating outward giving an "octopus" shape¹³.

Ips beetles are the most commonly encountered bark beetles in landscape pines. Adult beetles (top left and right) have spines along their outer wings. Ips galleries resemble the shape of an octopus but with fewer arms. There is a center chamber giving rise to multiple parental galleries where eggs are laid. Upon hatching, larvae radiate outward from the parental gallery. Larval galleries become progressively wider as the larvae grow, terminating in a circular to oval pupal chamber. Ideally, adults and immature beetles will be present in your sample, indicating they are still in the tree. If empty galleries and pupal chambers are present then it is likely the beetles have emerged to attack another host.

DENDROCTONUS BEETLES



Figs. 15-17. (Left) Adult mountain pine is similar in appearance to other *Dendroctonus* bark beetles¹⁴. *Dendroctonus* beetle galleries vary from spaghetti-plate patterns of parental and larval galleries (Center) to long and straight parental galleries with outward radiating larval galleries (Right)⁸⁻¹⁵.

Bark beetles in the genus *Dendroctonus* are some of the most devastating forest insect pests in the world. The most notable species in the west is the mountain pine beetle (MPB), responsible for the destruction of millions of acres of timber every year. Mountain pine beetle less frequently attacks pine trees in the non-forested urban landscape. MPB galleries are recognized as long, straight, vertical galleries with a "j" crook at the bottom. The galleries usually extend from 1 to 3 feet up the tree. Other *Dendroctonus* species affect a narrower range of host trees. These will be most commonly seen in high elevation lodgepole and spruce forests in Utah.

SCOLYTUS BEETLES



Of the four common *Scolytus* beetles in Utah, the elm-feeding European elm bark beetle and the banded elm bark beetle are the most abundant in the urban landscape. They are also major vectors of the Dutch Elm Disease (DED) fungus, which can kill elm trees or cause chronic illness and stress. For more in-depth information, please see our fact sheet "[Elm Bark Beetles and Dutch Elm Disease](#)."

The shothole borer can infest stressed or injured portions of apple, cherry, pear, and hawthorn trees in Utah. Normally, this beetle kills larger tree branches rather than whole trees. In Utah the fir engraver beetle commonly kills stressed fir trees in high-elevation forests, but can infest fir trees commonly planted in the landscape.

Figs. 18-20. (Left) Fir engraver galleries¹. (Middle) Banded elm bark beetle feeding on branch crotches¹⁶. (Right) Shothole borer adult¹.

DRYOCETES, PHLOEOSINUS, PITYOPHTHORUS, AND XYLEBORUS BEETLES



Figs. 21-23. (Left) Adult western balsam bark beetle¹⁵. (Middle) Adult *Phloeosinus* beetle¹⁸. (Right) Adult walnut twig beetle¹⁹.

The beetles in Figures 24 - 27 are mostly minor pests in Utah. The western balsam bark beetle mostly attack diseased or stressed fir trees at high elevations, but could affect white and other ornamental firs in the landscape. All records of *Phloeosinus* beetles in Utah are from ornamental Arizona cypress trees in Washington County.

Most *Pityophthorus* beetles affect smaller limbs and branches on dying or stressed trees or limbs. They usually do not cause tree death and are not a pest of concern. One notable exception is the Walnut Twig Beetle, which together with its tree-killing fungus, Thousand Cankers Disease (*Geosmithia* sp.), has killed many black and other walnuts throughout the west and areas of the midwest and southeast. Together, the beetle and fungus are the major pest of walnuts in the U.S. For more information on this beetle read the [fact sheet from Colorado State University](#).

Xyleborus beetles are called ambrosia beetles because of the ambrosia fungus they carry. Ambrosia beetles are different from other bark beetles in that they do not feed in the phloem layer, but bore into the sapwood of the tree. Once in the sapwood, they feed on the growing ambrosia fungus inside of their galleries from which they gain their nutrition.

CONTROL

Mechanical/Physical:

Keep trees healthy and stress free with proper deep watering and fertilization, especially for old, stressed trees. In some situations, tree roots must compete with turf roots or will have deeper root systems than turf and must be watered less frequently for longer durations. Soil should contain adequate moisture to a depth of about 20 inches. Soil moisture can be tested by pushing a long screw driver or slim metal rod into the soil. The metal will easily penetrate moist soil, and will stop when dry soil is reached. Deep watering to trees should be done once a week during hot summer months (July, August) and less frequently in the cooler months. The amount of water it takes to deep irrigate to 20 inches will depend on your soil type (less water for sandy soils, more for clay soils), so experiment with watering times until your screwdriver test shows moisture to a depth of about 20 inches. Irrigation at normal turf volumes is not adequate for tree irrigation. Supplemental or additional sprinkler irrigation is necessary. For more information on proper watering [click here](#).

Bark beetle control must be preventative and should begin with monitoring and scouting. Closely observe your trees to catch health issues before they become major problems. For more detail on what to look for, see the section "How do I Know if My Tree is Infested?" above. Consult your local USU Extension office or the UPPDL for current information on beetle flights and spray timing.

Monitoring/Traps:

Lindgren funnel traps used in combination with attractive lures (e.g., ips trilure, alpha-pinene, ethanol, etc.) can attract various bark beetles. When beetles specific to your host tree (e.g., spruce ips and blue spruce) begin showing up in traps, preventative sprays should be applied immediately. While traps can give accurate adult flight information, they also attract beetles to your property, which could lead to tree attack. Use traps and lures carefully. Never locate traps near host trees as spillover can occur. It is more effective to visually monitor your neighborhood and surrounding areas to see if trees have been killed by bark beetles. This could indicate that beetles are in the area, and that protection of high-value trees may be needed.

Chemical Control:

Once the beetles are under the bark and have girdled the tree, there are no chemicals that will save the tree. Preventive insecticides should be applied before beetles emerge in spring or early summer. Spring insecticide applications should occur once temperatures are consistently over 50°F. At this temperature, many bark beetles continue development under the bark or emerge to find new host trees. Properly timed and applied insecticides will kill bark beetles as they chew through the insecticide-soaked bark, preventing successful attack. Some products are labeled for trunk applications to infested trees to kill beetles as they emerge or under the bark to prevent infestation of additional trees. To date, no systemic insecticides have been proven effective at preventing bark beetles from killing trees.

To protect ornamental (non-fruit bearing) trees from bark beetle attack apply a preventative insecticide prior to beetle flight. Since bark treatments are applied at a higher rate than for other sites, select products labeled for use as a bark treatment on ornamental or forest trees, depending on your situation. The most effective active ingredients include carbaryl, bifenthrin, and permethrin. Below are a few examples of each. Links to product labels are included, but may be outdated. Please make sure you read the label on the product you purchase before use. Information on bark beetle prevention/control can be found near the bottom of the product labels.

Carbaryl: Group 1A, Carbamates

+ Carbaryl 4L ([label](#))

- **Type:** General use.
- **Site:** Direct trunk treatment: Roses, flowers, other herbaceous plants, woody plants, evergreens, and shrubs.
- **Labeled Pests:** Elm bark beetle, Ips engraver beetles, mountain pine beetle, roundheaded pine beetle, spruce beetle, western pine beetle.
- **Application:** Apply to bark and main branches down to 5 inches diameter in spring prior to flight. Only one application per year needed.
- **Notes:** Licensed professional with high-powered spray equipment recommended. Quantities sold intended for agricultural or commercial use.

+ Sevin XLR Plus (label)

- **Type:** General use.
- **Site:** Direct trunk treatment: Forested areas and rangeland trees; forests, tree plantations planted Christmas trees, parks, rural shelter belts, rangeland trees.
- **Labeled Pests:** Elm bark beetle, Ips engraver beetles, mountain pine beetle, roundheaded pine beetle, spruce beetle, western pine beetle.
- **Application:** Apply to bark and main branches down to 5 inches diameter in spring prior to flight. Only one application per year needed.
- **Notes:** Licensed professional with high-powered spray equipment recommended. Quantities sold intended for agricultural or commercial use.

Bifenthrin: Group 3A, Pyrethroids

+ Bifen XTS Insecticide/Termiticide (label)

- **Type:** General use.
- **Site:** Trunk spray to ornamental trees.
- **Labeled Pests:** To control *Dendroctonus* bark beetles such as black turpentine beetle, mountain pine beetle, western pine tip beetle, southern pine tip beetle, and engraver beetles (*Ips* spp.) Also for use on other bark beetles such as ambrosia beetles, elm bark beetles, and emerald ash borer.
- **Application:** Apply to bark and main branches down to 5 inches diameter in spring prior to flight. Only one application per year needed. Can also be used to control emerging brood from attacked or dead trees.
- **Notes:** Licensed professional with high-powered spray equipment recommended. Recommended for licensed commercial applicators for termite control, but includes application to ornamental trees for the control of bark beetles.

+ Onyx Insecticide (label)

- **Type:** General use.
- **Site:** Trunk spray to ornamental trees.
- **Labeled Pests:** To control *Dendroctonus* bark beetles such as mountain pine beetle, southern pine beetle, western pine beetle, black turpentine beetle, and engraver beetles (*Ips* spp.) Also for use on other bark beetles such as ambrosia beetles, elm bark beetles, and emerald ash borer.
- **Application:** Apply to bark and main branches down to 5 inches diameter in spring prior to flight. Only one application per year needed. Can also be used to control emerging brood from attacked or dead trees.
- **Notes:** Licensed professional with high-powered spray equipment recommended. Intended for use by licensed commercial applicators for control of turf and ornamental pests.

Permethrin: Group 3A, Pyrethroids

+ Astro (label)

- **Type:** General use.
- **Site:** Ornamental trees.
- **Labeled Pests:** To control bark beetles: *Dendroctonus* spp., *Ips* spp., elm bark beetles, mountain pine beetle, pine engravers, turpentine beetles, and western pine beetle.
- **Application:** Apply to bark and main branches down to 5 inches diameter in spring prior to flight. Can also be used to control emerging brood from attacked or dead trees.
- **Notes:** Licensed professional with high-powered spray equipment recommended. Intended for use by licensed commercial applicators for control of insect pests on lawns, ornamental trees and shrubs and around buildings for perimeter insect control including landscaped areas around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields.

+ Hi Yield 38 Plus Turf, Termite & Ornamental Insect Control (label)

- **Type:** General use. Intended for homeowner use.
- **Site:** Ornamentals.
- **Labeled Pests:** To control bark beetles and boring insects (including, but not limited to: ash borer, bronze birch borer, rhododendron borer, elm bark beetles and turpentine beetles.)
- **Application:** Stem-infesting beetles: treat lower branches and trunk prior to adult emergence. Complete, uniform coverage is needed for best control. A repeat application may be necessary on a 3 to 4 week interval to prevent severe tree stem damage.
- **Notes:** For outdoor homeowner (residential) use only. Best product for use by non-licensed chemical applicators. High powered spray equipment needed for complete coverage on larger trees.

For homeowners, Hi-Yield 38 Plus Turf, Termite & Ornamental Insect Control Containing 38% Permethrin is readily available, sold in various quantities, reasonably priced, and can be used for other residential turf and landscape pests. Other general use products above can be purchased for homeowner use, but usually come in larger quantities and are intended for use by licensed, commercial applicators.

Application of chemicals takes special equipment. If larger trees need treatment, hire a company with high-pressure spray equipment to reach far up in the tree for complete coverage and optimum protection. Select a product that is labeled for the intended site and situation of application.

Avoid use of these chemicals on flowering trees during bloom to prevent bee death. For full protection, apply the product of choice throughout the growing season at the interval listed on the label. Some of the products above only require one application per year in the spring prior to beetle flight. Contact your local Extension office or the UPPDL for guidance on spray timing and product selection.

Sanitation:

If an active infestation is discovered in a tree and the tree will die, the tree should be removed immediately and treated to prevent further development and flight of beetles. A common **mistake** is to cut down an infested tree and then stack infested logs under a

nearby host tree. Removing a tree does not kill the beetles and they can still develop under the bark and emerge to attack more trees! After cutting an infested tree there are multiple techniques for killing beetles under the bark:

- *Debark*: Remove all bark from the tree.
- *Insecticide Spray*: Use a labeled insecticide to treat the tree prior to removal or to logs after removal.
- *Solarization*: Cut logs intended for firewood use should be stacked in an area of full sun and covered tightly with black plastic.
- *Suffocation*: Logs can be buried under soil or submerged in water.
- *Chip*: If no firewood is desired, cut logs can be chipped and used as mulch.

ADDITIONAL RESOURCES

[Ips Beetles: Colorado State University Fact Sheet](#)
[Mountain Pine Beetle: Colorado State University Fact Sheet](#)
[USDA Forest Service, Rocky Mt. Research Station Website](#)
[Utah Division of Forestry, Fire and State Lands Fact Sheet](#)
[University of California Integrated Pest Management Program Fact Sheet](#)
[Bark and Woodboring Beetles of the World Website](#)

PHOTOS

- 1 USDA Forest Service, Ogden Archives, Bugwood.org.
- 2 William M. Ciesla, Forest Health International, Bugwood.org
- 3 Bill Ciesla, Colorado State University.
- 4 Brytten Steed, USDA Forest Service, Bugwood.org.
- 5 Chris Schnepf, University of Idaho, Bugwood.org.
- 6 Jack Kelly Clark, University of California Statewide IPM Project.
- 7 Darren Blackford, USDA Forest Service, Bugwood.org.
- 8 Ronald F Billings, Texas Forest Service, Bugwood.org.
- 9 Ladd Livingston, Idaho Department of lands, Bugwood.org.
- 10 Gerald J. Lenhard, Louisiana State University, Bugwood.org.
- 11 Pest and Disease Image Library, Australia, Bugwood.org.
- 12 David T. Almquist, University of Florida, Bugwood.org.
- 13 Jerald Dewey, USDA Forest Service, Bugwood.org.
- 14 Erich G. Vallery, USDA Forest Service, Bugwood.org.
- 15 USDA Forest Service, Region 2, Bugwood.org.
- 16 Whitney Cranshaw, Colorado State University, Bugwood.org.
- 17 Budapest Horvath Museum, Victoria, Melbourne, Australia, Bugwood.org.
- 18 Natasha Wright, Florida Department of Ag. and Consumer Services, Bugwood.org.
- 19 Jim Labonte, Oregon Department of Agriculture.

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