

Chemical Control of Landscape Pests

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How to use these tables. Choose from the five general types of insect and mite damage to landscape plants. Scan through the column on the left to find the general group of insect/mite identified causing this damage. Then follow the table from left to right to find monitoring, scouting and pesticide management strategies. Biology and management recommendations are provided for specific plant pests are listed in the following section of Hosts and Pests of Landscape Plants. Common pest names often refer to multiple species, and taxonomic groupings, so examples of the species covered under each common name are provided. Occasionally pests sharing a common name may cause several types of damage to

landscape plants, so be sure to make sure that you select the table that best fits the damage type. Note that in some cases, damage to a plant may be of no concern to the homeowner.

Home landscape products are those pesticides that can be purchased at local retail stores and can be used without a pesticide license. These products are listed by active ingredient; products based on the same active ingredient may be comparable and effective. Restricted-use products may be used only by applicators with the appropriate pesticide license. For all products, the applicator must review the pesticide label as some products may negatively impact some species of ornamental plants and some products may only be applied to specific areas within the home landscape. In the case of any discrepancy between these recommendations and the product label, ALWAYS follow the product label. Remember pollinators, such as honeybees, are often susceptible to insecticide products. Unless otherwise specified on the label, DO NOT spray insecticides on plants (including weeds as well as garden crops) that are in bloom.

Table 1. Plant damage due to sucking pests

This damage type is caused by pests that insert piercing-sucking mouthparts into the above ground plant tissues including stems, buds, petioles, needles and leaves. Often this damage results in plant surface stickiness from honeydew production, surface discoloration (sooty mold, tar spots), low plant vigor, canopy yellowing, leaf stippling, premature leaf drop, leaf and shoot distortion and overall plant stunting. A few of these pests can vector plant diseases.

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
Adelgid (Hemiptera: Adelgidae) includes: Balsam woolly adelgid Hemlock woolly adelgid Pine bark adelgid	Monitor the crawler stage with double-sided tape. Best spray timing is early spring or near bud break. Most products are contact insecticides and thorough coverage is essential. Systemic products (circulated within the plant's vascular system) are better suited for tall trees and shrubs.	clothianidin dinotefuran esfenvalerate fluvalinate horticultural oils ^o imidacloprid insecticidal soap ^o pyrethrins ^o pyrethroids ^p spinosad ^o	abamectin acephate acetamiprid azadirachtin carbaryl chlorpyrifos cyantraniliprole spirotetramat thiamethoxam
Aphid – (Hemiptera: Aphididae) includes: Alder aphid Apple aphid Bamboo aphid Beech blight aphid Black cherry aphid Black citrus aphid Common birch aphid Foxglove aphid Geranium aphid Giant conifer aphid Giant willow aphid Hop aphid Leafcurl ash aphid Norway maple aphid Pine aphid Potato aphid Rhododendron aphid Rose aphid Sycamore aphid	Timing critical as many species have complex life cycles that alternate between asexual & sexual reproduction as well as summer and winter plant hosts. Adults, nymphs and winged adults found on succulent plant tissues. Monitor winged adults with yellow sticky traps Scout landscape plants for honeydew and sooty mold. Dormant applications of horticultural oils are effective on managing the non-mobile life stages. Target the rapidly-increasing aphid populations early in the growing season, before leaves curl about and protect aphids from sprays. Most products are contact and thorough coverage is essential. Systemic products (circulated within the plant's vascular system) are better suited for tall trees and shrubs.	acetamiprid azadirachtin ^o <i>Beauveria bassiana</i> ^o carbaryl clothianidin esfenvalerate fluvalinate horticultural oils ^o imidacloprid insecticidal soaps ^o kaolin clay ^o malathion pyrethrins ^o pyrethroids ^p spinosad ^o	abamectin acephate bifentazate chlorantraniliprole chlorpyrifos cyantraniliprole diazinon dimethoate dinotefuran fenpropathrin flupyradifurone <i>Isaria fumosorosea</i> lime sulfur/ calcium methiocarb polysulfide pyridaben pyriproxyfen spirotetramat thiamethoxam tolfenpyrad

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
<p>Lace Bug (Hemiptera: Tingidae) includes: Azalea lace bug Rhododendron lace bug</p>	<p>Scout landscape plants for yellow leaf stippling Check underside of stippled leaves for varnish-like tar spots, and lace bugs.</p> <p>Damage is most pronounced early to mid-July.</p> <p>Most products are contact and thorough coverage on the underside of foliage is essential.</p>	<p>azadirachtin carbaryl clothianidin dinotefuran esfenvalerate fluvalinate horticultural oils^o imidacloprid insecticidal soap^o malathion pyrethrins^o pyrethroids^p spinosad^o</p>	<p>acephate <i>Beauvaria bassiana</i> chlorpyrifos dimethoate fenpropathrin flupyradifurone thiamethoxam</p>
<p>Leafhopper (Hemiptera: Cicadellidae) includes: Rose leafhopper</p>	<p>Scout for leaf stippling, honeydew, and tar spots. Monitor adults with yellow sticky traps.</p> <p>Monitor nymphs with double-sided tape wrapped around branches or twigs.</p> <p>Most products are contact and thorough coverage is essential.</p> <p>Systemic products (circulated within the plant's vascular system) are better suited for tall trees and shrubs.</p>	<p>acetamiprid azadirachtin^o <i>Beauvaria bassiana</i>^o carbaryl clothianidin dinotefuran esfenvalerate fluvalinate horticultural oils^o imidacloprid insecticidal soap^o kaolin clay^o malathion pyrethrins pyrethroids^p spinosad^o</p>	<p>acephate buprofezin chlorpyrifos dimethoate diazinon fenpropathrin flupyradifurone phosmet pyridaben spirotriamat thiamethoxam tolfenpyrad</p>
<p>Mealybug - (Hemiptera: Pseudococcidae) includes: Grape mealybug</p> <p>Psyllid (Hemiptera: Psyllidae) includes: Boxwood psyllid</p> <p>Phylloxera (Hemiptera: Phylloxeridae) includes: Oak phylloxera</p>	<p>Scout for mealybugs; they may be covered with powdery wax.</p> <p>Examine narrow branch angles, leaf petioles, bud scars for mealybugs.</p> <p>Mealybugs and psyllids produce of honeydew as well as crystallized honeydew.</p> <p>Psyllids may cause gall-like structures and leaf distortion on some plant species.</p> <p>Monitor adult psyllids with yellow sticky traps.</p> <p>Most products are contact and thorough coverage is essential.</p> <p>Some products are systemic and are better suited for tall trees and shrubs.</p> <p>Best controlled early in the season, to prevent populations explosions later in the season</p> <p>Scout for phylloxera and the damage they cause (yellow spots on leaves) in the spring and early summer.</p> <p>Dormant applications of horticultural oils are effective on managing the non-motile life stages.</p> <p>Most products are contact and thorough coverage is essential.</p> <p>Some products are systemic and are better suited for tall trees and shrubs.</p>	<p>acetamiprid azadirachtin^o <i>Beauvaria bassiana</i>^o carbaryl esfenvalerate fluvalinate horticultural oils^o imidacloprid insecticidal soap^o kaolin clay^o malathion pyrethrins^o pyrethroids^p spinosad^o</p>	<p>acephate buprofezin chlorpyrifos clothianidin dimethoate dinotefuran flupyradifurone <i>Isaria fumosorosea</i></p>

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
<p>Scale Insect (Hemiptera: Coccidae) includes: Brown soft scale Cottony cushion scale European fruit lecanium Sycamore scale</p> <p>(Hemiptera: Diaspididae) includes: Black pine leaf scale Holly scale Juniper scale Pine needle scale Oystershell scale</p> <p>Eriococcidae includes: Azalea bark scale European elm scale</p>	<p>Scout for non-mobile stages concealed beneath bumps, cotton balls, barnacles, oyster shells.</p> <p>Double-sided tape, adhesive barriers intercept mobile crawler stage.</p> <p>Mobile stages include the newly hatched crawler stage.</p> <p>Pesticide applications timed to target mobile crawler stage.</p> <p>Most products are contact and thorough coverage is essential.</p> <p>Some products are systemic and are better suited for tall trees and shrubs.</p>	<p>acetamiprid azadirachtin^o carbaryl clothianidin dinotefuran fenvalerate fluvalinate horticultural oils^o imidacloprid insecticidal soap^o malathion pyrethrins^o pyrethroids^p spinosad^o</p>	<p>abamectin acephate buprofezin chlorpyrifos <i>Chromobacterium subtsugae</i> cyantraniliprole diazinon dimethoate flupyradifurone lime sulfur/ calcium polysulfidepyriproxyfen spirotetramat thiamethoxam tolfenpyrad</p>
<p>Spider mite (Trombidiformes: Tetranychidae) includes: Bamboo spider mite Brown mite Boxwood spider mite Citrus red mite European red mite Spruce spider mite Two-spotted spider mite False spider mite</p>	<p>Scout for mite feeding damage to the plant foliage; damage includes leaf stippling, leaf bronzing and premature leaf drop.</p> <p>Often a 10- to 20X hand lens is needed to see these mite pests that are often on the underside of the leaf along the midrib.</p> <p>Spider mite webbing may also be detected along the leaf midrib.</p> <p>Many of these products are contact insecticides that target mobile mite stages.</p> <p>Thorough plant coverage with the spray is key to success and often two or more applications may be necessary.</p> <p>Horticultural oils and some insecticides target mite eggs</p>	<p>acephate azadirachtin^o carbaryl fenvalerate fluvalinate horticultural oils^o imidacloprid insecticidal soap^o malathion pyrethrins pyrethroids^p spinosad^o sulfur^o</p>	<p>abamectin acephate acequinocyl <i>Beauvaria bassiana</i>^o bifenazate chlorfenapyr chlorpyrifos clofentezine cyflumetofen diazinon dimethoate emamectin benzoate etoxazole fenbutatin-oxide fenpropathrin fenpyroximate hexythiazox <i>Isaria fumosorosea</i>^o lime sulfur/ calcium polysulfide^o milbemectin propargite pyridaben spiromesifen spirotetramat</p>
<p>Thrips (Thysanoptera: Thripidae) includes: Gladiolus thrips Western flower thrips</p>	<p>Scout the newest tissues of landscape plants for thrips damage, which appears as plant rasping that discolors the surface leaving minute white or ghosting spots.</p> <p>Tap or beat these plant tissues over a dark flat surface to reveal tiny, thin insects that quickly fly or run to escape.</p> <p>The presence of tar spots (frass) may also serve as a sign of thrips activity.</p> <p>Most chemical products are contact insecticides that target thrips larvae or adults and timing of sprays coincides with their presence.</p> <p>Thorough plant coverage with the spray is key to success</p>	<p>acetamiprid azadirachtin^o <i>Beauvaria bassiana</i>^o carbaryl clothianidin esfenvalerate fluvalinate horticultural oils^o imidacloprid insecticidal soap^o kaolin clay^o malathion pyrethrins^o pyrethroids^p spinosad^o</p>	<p>abamectin acephate bifenazate chlorfenapyr chlorpyrifos cyantraniliprole diazinon dimethoate dinotefuran fenpropathrin flupyradifurone <i>Isaria fumosorosea</i>^o novaluran spirotetramat thiamethoxam tolfenpyrad</p>

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
<p>True Bug (Hemiptera: numerous families) include: Honeylocust plant bug Stink bug Western boxelder bug</p>	<p>Scout for the presence of these bugs in landscape plants.</p> <p>Damage to the plant's reproductive structures reduce seed viability.</p> <p>These insects are rarely considered landscape plant pests that require treatment to protect overall health.</p> <p>Often these are nuisance pest congregate in large numbers on homes</p>	<p>acetamiprid carbaryl esfenvalerate imidacloprid pyrethrins^O pyrethroids^P</p>	<p>acephate <i>Beauvaria bassiana</i> chlorpyrifos malathion novaluron thiamethoxam</p>
<p>Whitefly (Hemiptera :Aleyrodidae) includes: Glasshouse whitefly Rhododendron whitefly</p>	<p>Infected leaves may start to turn yellow appear wilted, or prematurely drop from plant.</p> <p>Look for honeydew and sooty molds.</p> <p>Clouds of adults fly away from infested plants when approached.</p> <p>Monitor adults with yellow sticky traps.</p> <p>Most products are contact and thorough coverage is essential.</p> <p>Some products are systemic and are better suited for tall trees and shrubs</p>	<p>acetamiprid azadirachtin^O <i>Beauvaria bassiana</i>^O clothianidin dinotefuran esfenvalerate fluvalinate horticultural oils^O imidacloprid insecticidal soap^O kaolin clay^O malathion pyrethrins^O pyrethroids^P spinosad^O</p>	<p>abamectin acephate bifenazate buprofezin carbaryl chlorpyrifos <i>Chromobacterium</i> <i>subtsugae</i> cyantraniliprole diazinon dimethoate fenazaquin fenpropathrin fenpyroximate flupyradifurone <i>Isaria fumosorosea</i> novaluron pymetrozine pyridaben pyriproxyfen spiromesifen spirotetramat thiamethoxam tolfenpyrad</p>

O = Some formulations may be OMRI-listed for organic use

P = The synthetic pyrethroids are general insecticides that include products with the active ingredients including bifenthrin, cyhalothrin, cyfluthrin, cypermethrin, deltamethrin and permethrin

Table 2. Plant damage by tissue-feeding pests

Damage is caused by pests with chewing mouthparts that feed on primarily leaf, bud and flower and fruit tissues reducing plant canopy in the form of leaf holes, leaf rolling, skeletonization, and defoliation. While this damage is often considered cosmetic and plants can regenerate these tissues, repeated damage over multiple season can impact overall plant health.

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
<p>Caterpillar (Lepidoptera: Erebiidae) includes: Douglas-fir tussock moth Fall webworm Spruce webworm</p> <p>(Lepidoptera: Gelechiidae) includes: Cotoneaster webworm</p> <p>(Lepidoptera: Lasiocompidae) includes: Forest tent caterpillar Western tent caterpillar</p>	<p>Scout for the webbing and silk tents that can contain numerous caterpillars.</p> <p>Scout the foliage of landscape plants for signs of chewing insect damage, or in extreme cases, plant defoliation.</p> <p>Most chemical products are contact insecticides and target the caterpillars as they feed on foliage outside their webbing or tents.</p> <p><i>Bacillus thuringiensis</i> must be ingested by the caterpillar to be effective.</p> <p>Some products are systemic and are better suited for tall trees and shrubs</p>	<p>azadirachtin^o <i>Bacillus thuringiensis kurstaki</i>^o carbaryl clothianidin emamectin benzoate esfenvalerate fluvinate horticultural oils^o imidacloprid pyrethrins^o pyrethroids^p spinosad^o</p>	<p>acephate <i>Bacillus thuringiensis aizawai</i>^o chlorantraniliprole chlorpyrifos diflubenzuron indoxacarb malathion methoxyfenozide novaluron thiamethoxam</p>
<p>Caterpillar (Lepidoptera: Choreutidae) includes: Apple-and-thorn skeletonizer</p> <p>(Lepidoptera: Erebiidae) includes: Satin moth Silver-spotted tiger moth</p> <p>(Lepidoptera: Geometeridae) includes: Western oak looper</p> <p>(Lepidoptera: Noctuidae) includes: Black cutworm Large yellow underwing Variegated cutworm</p> <p>(Lepidoptera:Notodontidae) includes: Redhumped caterpillar</p> <p>(Lepidoptera: Tortricidae) includes: Spruce budworm</p>	<p>Scout landscape plants for signs of chewing insect damage including leaves, buds, or flower holes, skeletonization, leaf-rolling, or in extreme cases, plant defoliation.</p> <p>Pheromone traps may be available to monitor some adult moth species.</p> <p>Most chemical products are contact insecticides that target the youngest caterpillars and timing of sprays coincides with their presence.</p> <p>Thorough plant coverage with the spray is key to success.</p> <p><i>Bacillus thuringiensis</i> must be ingested by the caterpillars to be effective.</p> <p>Some products are systemic and are better suited for tall trees and shrubs</p>	<p>acephate acetamiprid azadirachtin^o <i>Bacillus thuringiensis kurstaki</i>^o carbaryl clothianidin esfenvalerate fluvalinate horticultural oils^o imidacloprid pyrethrins^o pyrethroids^p spinosad^o</p>	<p>acephate <i>Bacillus thuringiensis aizawai</i>^o chlorantraniliprole chlorfenapyr chlorpyrifos <i>Chromobacterium subsugae</i>^o cryolite cyantraniliprole diflubenzuron indoxacarb malathion methoxyfenozide novaluron thiamethoxam</p>
<p>Earwig - (Dermaptera: Forficulidae) includes: European earwig</p>	<p>Scout for damage caused by earwigs; earwigs tend to chew irregular variable-sized hole in plant tissues.</p> <p>Scout for earwig presence and activity at night with a flashlight.</p> <p>Most chemical products are contact insecticides that target earwig populations early in the spring before they reproduce.</p>	<p>azadirachtin^o carbaryl imidacloprid esfenvalerate fluvalinate malathion pyrethrins^o pyrethroids^p spinosad^o</p>	<p>acephate <i>Beauvaria bassiana</i>^o chlorpyrifos fipronil thiamethoxam</p>

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
<p>Grasshopper (Orthoptera: Acrididae) includes: Grasshopper (Orthoptera: Gryllidae) includes: True cricket (Orthoptera: Tettigoniidae) includes: Mormon cricket Katydid</p>	<p>Scout for fresh damage caused by grasshopper and cricket adults and nymphs that appears as general chewing damage to plant leaves, stems and fruit. Scout for the presence of grasshoppers or crickets; since some species have wings and jumping legs, they may take flight as you approach plant. In some regions of the state, these insects periodically become pests when their populations explode, and they deplete preferred hosts in rangelands. Most of these products are contact insecticides that intercept invading pests</p>	<p>azadirachtin^o carbaryl imidacloprid esfenvalerate fluvalinate pyrethrins^o pyrethroids^p</p>	<p>acephate chlorpyrifos diflubenzuron dimethoate indoxacarb malathion phosmet</p>
<p>Leaf feeding beetle (Coleoptera: Chrysomelidae) includes: Alder flea beetle Dogwood flea beetle Elm leaf beetle Lily leaf beetle Viburnum leaf Western spotted cucumber beetle Willow flea beetle</p>	<p>Scout landscape plant foliage for chewing damage in the form of scalloped holes, general leaf holes, and leaf skeletonization. When damage is found examine plant for signs of beetle adult or larvae. Adult flea beetles do jump and may escape detection. Most chemical products are contact insecticides. Timing of sprays coincides with target pest activity/presence. Thorough plant coverage with the spray is key to success. <i>Bacillus thuringiensis</i> must be ingested by the beetles to be effective. Some products are systemic and are better suited for tall trees and shrubs.</p>	<p>acetamiprid azadirachtin^o carbaryl esfenvalerate fluvalinate imidacloprid pyrethrins^o pyrethroids^p spinosad^o</p>	<p>acephate <i>Bacillus thuringiensis tenebrionus</i>^o chlorpyrifos clothianidin dinotefuran malathion phosmet thiamethoxam</p>
<p>Sawfly (Hymenoptera: Argidae) includes: Birch sawfly (Hymenoptera: Tenthredinidae) includes: Azalea sawfly Birch leafminer Bristly roseslug Curled rose sawfly Dogwood sawfly Elm leafminer European alder leafminer Green alder sawfly Mountain ash sawfly Pear slug Roseslug Striped alder sawfly</p>	<p>Scout landscape plants for signs of chewing damage caused by larvae. Examine fresh damage for the presence of caterpillar-like or slug-like sawfly larvae. Some species of larvae are gregarious while others are solitary. Most chemical products are contact insecticides that target the youngest larvae and timing of sprays coincides with their presence. Thorough plant coverage with the spray is key to success. Some products are systemic and are better suited for tall trees and shrubs.</p>	<p>acetamiprid azadirachtin^o carbaryl esfenvalerate fluvalinate horticultural oils^o imidacloprid insecticidal soap^o pyrethrins^o pyrethroids^p spinosad^o</p>	<p>acephate chlorpyrifos diazinon diflubenzuron dinotefuran indoxacarb malathion phosmet thiamethoxam</p>

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
<p>Weevil (Coleoptera: Curculionidae)</p> <p>Leaf-feeders include: Black vine weevil Clay-colored weevil Douglas-fir twig weevil Lilac root weevil, Obscure root weevil Strawberry root weevil Poplar-and-willow borer Woods weevil</p> <p>Bud (seed)-feeders include: Hollyhock weevil Rose curculio</p>	<p>Scout for damaged foliage with notched leaf margins.</p> <p>Foliar damage is often cosmetic only and rarely impacts overall health of landscape plant.</p> <p>For any unthrifty shrub, tree or plant, search the soil in the plant's root zone for c-shaped weevil grubs.</p> <p>The poplar-and-willow borer larvae feed along plant stems and trunks.</p> <p>Most chemical products are contact insecticides and target the adult weevils before they lay eggs.</p> <p>Timing of sprays coincides with adult weevil activity/presence.</p> <p>Adult activity can be done at night by jarring and capturing adults.</p> <p>Adults of most species are active in late May and June.</p> <p>Scout for the adult beetles as they feed on and oviposit in buds.</p> <p>Rose curculio emerge in early spring.</p> <p>Hollyhock weevil is active in July and August.</p> <p>Damage is limited to flower buds and reproduction and does not affect the overall health of the infested plants.</p>	<p>acetamiprid azadirachtin^O <i>Beauveria bassiana</i>^O carbaryl clothianidin esfenvalerate fluvalinate imidacloprid kaolin clay^O malathion pyrethrins^O pyrethroids^P spinosad^O</p>	<p>acephate <i>Bacillus thuringiensis galleriae</i>^O chlorantraniliprole chlorpyrifos cryolite cyantraniliprole diazinon diflubenzuron dimethoate dinotefuron indoxacarb phosmet thiamethoxam trichlorfon</p>

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Table 3. Landscape plant deformation

Plant deformation is caused by pests that often live within plant tissues and their feeding damage brings about tissue deformations such as leaf galls, leaf mines, and leaf blistering. This damage can cause plant stunting and undesirable plant growth habits.

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
<p>Blister & rust mite (Trombidiformes: Eriophyidae) includes: Cyclamen mite Fuchsia gall mite Lime nail gall mite Linden gall mite Maple bladder gall mite Pearleaf blister mite Peach silver mite Pine mite</p>	<p>Scout home landscape plants for unusual growth habits such as galls, leaf blisters, big buds, twisting needles, or curling leaves.</p> <p>Also scout for leaf or needle discoloration, (silvering, chlorosis).</p> <p>These mites can also cause fruit russeting.</p> <p>Often a 10- to 20X hand lens is needed to see these mite pests.</p> <p>In general, the damage caused by these pests is cosmetic and not detrimental to the overall health of the plant.</p> <p>When annual damage threatens plant health or growth form, this product targets the mites when they are active and before they are established in plant tissues; timing is key.</p>	<p>ccarbaryl horticultural oils^o insecticidal soap^o kaolin clay^o pyrethrins^o pyrethroids^p sulfur^o</p>	<p>abamectin carbaryl chlorfenapyr diazinon diflubenzuron fenbutatin-oxide pyridaben spiromesifen spirotetramat</p>
<p>Gall Aphid (Hemiptera: Aphididae) includes: Lettuce root aphid Manzanita leaf gall aphid Poplar petiole gall aphid</p> <p>(Hemiptera: Adelgidae) includes: Cooley spruce gall adelgid</p>	<p>Scout landscape plants for the formation of galls on the leaves, needles or stems</p> <p>Most products are contact and thorough coverage is essential</p> <p>Pest species identification is important as these products must be applied before the pest gets into plant tissues</p>	<p>carbaryl pyrethrins^o pyrethroids^p</p>	<p>chlorpyrifos</p>
<p>Gall wasp (Hymenoptera: Cynipidae) includes: Bassetia gall wasp California jumping gall wasp Mossy rose gall wasp Oregon oak gall wasp Spiny rose gall wasp</p>	<p>Scout landscape plants for the presence of galls.</p> <p>Make sure these abnormal plant growths have active wasp larvae in them.</p> <p>Most products are contact and thorough coverage is essential</p> <p>These products typically target the adult wasp before eggs are laid in leaf tissues.</p> <p>Some products are systemic and are better suited for tall trees and shrubs.</p> <p>Damage is primarily cosmetic.</p> <p>Damage can lead to premature defoliation, but healthy plants can recover unless this becomes an annual infestation</p>	<p>carbaryl clothianidin emamectin benzoate fluvalinate imidacloprid insecticidal soap^o pyrethrins^o pyrethroids^p</p>	<p>No additional products</p>

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
<p>Leafminer (Diptera numerous families) include: Boxwood leafminer California gallfly Douglas-fir needle midge Honeylocust pod gall midge Poplar twiggall fly Rose midge Rose stem miner Willow beaked-gall midge</p>	<p>Scout landscape plants for the presence of galls, leaf mines, and rolled leaves.</p> <p>Make sure these abnormal plant growths have active maggots in them.</p> <p>Most products are contact and thorough coverage is essential.</p> <p>These products typically target the adult fly before eggs are laid in leaf tissues.</p> <p>Some products are systemic and are better suited for tall trees and shrubs.</p> <p>Damage is primarily cosmetic.</p> <p>Damage can lead to premature defoliation, but healthy plants can recover unless this becomes an annual infestation.</p>	<p>acetamiprid azadirachtin carbaryl clothianidin dinotefuran esfenvalerate fluvalinate horticultural oils^o imidacloprid insecticidal soap^o kaolin clay^o malathion pyrethrins^o pyrethroids^p spinosad^o</p>	<p>abamectin acephate chlorpyrifos cyantraniliprole diazinon diflubenzuron dimethoate emamectin benzoate fenpropathrin flupyradifurone methoxyfenozide phosmet novaluron thiamethoxam</p>
<p>Leafminer (Lepidoptera: numerous families) include: Aspen blotchminer Azalea leafminer Ceanothus leafminer Cypress tip moth Holly leafminer Lilac leafminer Madrona shield bearer Spotted tentiform leafminer Spruce needleminer</p>	<p>Scout for leaf- or needle-mining activity early in the season as leaves unfurl.</p> <p>Pheromone traps are available for some moth species.</p> <p>Most products are contact and thorough coverage is essential.</p> <p>These products typically target the adult pest before eggs are laid in leaf tissues.</p> <p>Some products are systemic and are better suited for tall trees and shrubs.</p> <p>Damage is primarily cosmetic.</p> <p>Damage can lead to premature defoliation, but healthy plants can recover unless this becomes an annual infestation.</p>	<p>acetamiprid azadirachtin carbaryl clothianidin dinotefuran imidacloprid insecticidal soap^o malathion pyrethrins^o pyrethroids^p spinosad^o</p>	<p>abamectin acephate chlorantraniliprole chlorpyrifos cyantraniliprole diazinon diflubenzuron dimethoate emamectin benzoate fenpropathrin flupyradifurone methoxyfenozide novaluron pyriproxyfen thiamethoxam</p>
<p>Leafroller (Lepidoptera: Tortricidae) includes: Carnation tortrix European leafroller Fruittree leafroller Holly bud moth Oblique-banded leafroller Orange tortrix Pine shoot moth Three-lined leafroller</p>	<p>Scout for and examine rolled leaves near branch tips for caterpillars</p> <p>Pheromone traps are available for many of these moth species</p> <p>Most products are contact and thorough coverage is essential.</p>	<p>acetamiprid azadirachtin <i>Bacillus thuringiensis kurstaki</i> carbaryl clothianidin esfenvalerate horticultural oils^o kaolin clay malathion pyrethrins^o pyrethroids^p spinosad^o</p>	<p>acephate <i>Bacillus thuringiensis aizawai</i> <i>Beauveria bassiana</i> chlorpyrifos cryolite cyantraniliprole diazinon diflubenzuron emamectin benzoate methoxyfenozide novaluron phosmet</p>

O = Some formulations may be OMRI-listed for organic use.

P = The synthetic pyrethroids are general insecticides that include products with the active ingredients including bifenthrin, cyhalothrin, cyfluthrin, cypermethrin, deltamethrin and permethrin

Table 4. Landscape plant damage by stem and trunk borers

This damage is caused by pests that bore into and feed on the plant stem, trunk, scaffold branches of perennial plants. Damage can girdle plant causing death to tissue above the damage and/or weaken the structural integrity of the plant leading to lodging, breaking and limb drop.

Target pests examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
<p>Bark Beetle (Coleoptera: Scolytidae) includes: Elm bark beetle European elm bark beetle European shothole borer Mountain pine beetle Shothole borer</p>	<p>Scout any weakened trees/shrubs. Examine branches, twigs and trunks in late spring for small holes made by adult beetles. Examine inner bark of unhealthy trees or shrubs for larval galleries. Pesticides are generally not recommended because trees and shrubs are already in decline. These products intercept bark beetles before they bore into the host. Insect pheromones are available to monitor some bark beetle species. Some beetle species transmit plant diseases.</p>	<p>azadirachtin^O clothianidin imidacloprid pyrethrins^O pyrethroids^P</p>	<p>carbaryl chlorpyrifos thiamethoxam</p>
<p>Wood or Trunk Borer (Coleoptera: Buprestidae) includes: Flatheaded cedar borer Locust borer (Coleoptera: Cerambycidae) includes: Bronze birch borer Mountain pine beetle</p>	<p>Scout any weakened trees/shrubs. Examine any dead branches, twigs and trunks for beetle larvae galleries and adult exit holes. Pesticides are generally not recommended because trees and shrubs are already in decline. However, some products are labeled for specific borers. These products intercept adult beetles as they exit the host to visit another</p>	<p>acetamiprid pyrethrins^O pyrethroids^P</p>	<p>chlorpyrifos fipronil thiamethoxam</p>
<p>Stem & Twig Borer (Diptera: Cecidomyiidae) includes: Raspberry cane maggot Rose midge (Lepidoptera: Sesiidae) includes: Ash borer Douglas-fir pitch moth Peachtree borer Sequoia pitch moth Other Lepidoptera includes: Carpenterworm Cherry bark tortrix Coneworm Cypress tip moth Maple tip moth Peach twig borer Snapdragon plume moth</p>	<p>Immature stages bore into or feed within plant stems, trunks or twigs. Most of these products target adults or intercept the pest before they enter plant. Proper application timing is key to product efficacy. Insect pheromones are available to monitor some borer species. When feasible cut off infested twigs, branches and terminals. When feasible, physically remove or kill borers with a pointed instrument or remove infested soil, debris, and pitch</p>	<p>pyrethroids^P pyrethrins^O</p>	<p>acephate chlorpyrifos chlorantraniliprole cyantraniliprole emamectin benzoate</p>

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Table 5. Landscape plant damage by root feeders and root borers

Subterranean pests that feed on or bore into the roots and crowns of plants can damage, deform or weaken plants reducing the plants ability to stand upright or to absorb the necessary water and soil nutrients to feed the aboveground portion of the plant.

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
<p>Beetle (Coleoptera:Cuculionidae) includes: Black vine weevil Clay-colored weevil Woods weevil</p> <p>(Coleoptera: Elateridae) includes: Wireworms, various</p> <p>(Coleoptera: Scarabaeidae) includes: White grubs, various</p>	<p>Beetle larvae with chewing mouthparts. Tend to be plant generalists and may impact only the newly planted ornamentals.</p> <p>Roots may appear damaged, missing tissues, bored or hollowed out.</p> <p>Some beetles can gradually build up high populations in perennial crops where crop or soil rotations are not a management option.</p> <p>Effective products either intercept adult beetles as they oviposit eggs or specially formulated for soil application</p>	<p><i>Beauvaria bassiana</i>^O carbaryl clothianidin dinotefuran imidacloprid pyrethroids^P pyrethrins^O</p>	<p>acephate <i>Bacillus thuringiensis galleriae</i> beneficial nematodes^O chlorantraniliprole chlorpyrifos cyantraniliprole dinotefuran ethoprop phosmet thiamethoxam</p>
<p>Root aphid (Hemiptera:Aphididae) includes: Beech blight aphid Leafcurl ash aphid Woolly alder aphid Woolly elm aphid</p>	<p>Root feeders with piercing sucking mouthparts.</p> <p>Root deformation and plant stunting.</p> <p>Often just a nuisance or cosmetic pest problem when life stages migrate to the above ground portion of the plant.</p> <p>These products target only the above-ground population of these aphids.</p> <p>Most products are contact and thorough coverage is essential.</p>	<p>azadirachtin^O pyrethrins^O pyrethroids^P</p>	<p>chlorpyrifos</p>

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