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 is 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 honey bees, 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 by 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 [S] sfenvalerate fluvalinate horticultural oils [O] imidacloprid [S] insecticidal soap [O] pyrethrins[O] pyrethroids [P] spinosad [O] thiamethoxam [S]	abamectin acephate acetamiprid [S] azadirachtin[O] carbaryl chlorpyrifos cyantraniliprole dinotefuran[S] spirotetramat
Aphid (Hemiptera: Aphididae) includes: alder aphid apple aphid bamboo aphid beech blight aphid black cherry aphid	Timing is 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	acephate acetamiprid [S] azadirachtin [O] carbaryl clothianidin [S] esfenvalerate fluvalinate	abamectin *Beauveria bassiana* chlorantraniliprole chlorpyrifos cyantraniliprole diazinon dimethoate

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
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	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.	horticultural oils [O] imidacloprid [S] insecticidal soaps [O] kaolin clay [O] malathion pyrethrins [O] pyrethroids [P] spinosad [O] thiamethoxam [S]	dinotefuran [S] fenpropathrin flupyradifurone *Isaria fumosorosea* lime sulfur/calcium polysulfide [O] methiocarb pyridaben pyriproxyfen spirotetramat tolfenpyrad
Lace Bug (Hemiptera: Tingidae) includes: azalea lace bug rhododendron lace bug	Scout landscape plants for yellow leaf stippling Check the underside of stippled leaves for varnish-like tar spots, and lace bugs. Damage is most pronounced early to mid-July. Most products are contact and thorough coverage on the underside of foliage is essential.	acephate azadirachtin [O] carbaryl esfenvalerate fluvalinate horticultural oils [O] imidacloprid [S] insecticidal soap [O] kaolin clay [O] malathion pyrethrins [O] pyrethroids [P] spinosad [O] thiamethoxam [S]	abamectin *Beauveria bassiana* [O] chlorpyrifos cyantraniliprole dimethoate dinotefuran[S] fenpropathrin flupyradifurone
Leafhopper (Hemiptera: Cicadellidae) includes: rose leafhopper	Scout for leaf stippling, honeydew, and tar spots. Monitor adults with yellow sticky traps. Monitor nymphs with double-sided tape wrapped around branches or twigs. 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.	acephate acetamiprid [S] azadirachtin [O] carbaryl clothianidin [S] esfenvalerate fluvalinate horticultural oils [O] imidacloprid[S] indoxicarb insecticidal soap [O] kaolin clay [O] malathion pyrethrins pyrethroids [P] spinosad [O] thiamethoxam [S]	abamectin *Beauveria bassiana* [O] buprofezin chlorpyrifos dimethoate diazinon dinotefuran[S] fenpropathrin flupyradifurone phosmet pyridaben spirotetramat tolfenpyrad
Mealybug (Hemiptera: Pseudococcidae) includes:	Scout for mealybugs; they may be covered with powdery wax. Examine narrow branch angles, leaf petioles, bud scars for mealybugs. Mealybugs and psyllids produce of honeydew as	acephate acetamiprid [S] azadirachtin [O] carbaryl	*Beauveria bassiana*[O] buprofezin chlorpyrifos diazinon

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
grape mealybug **Psyllid** (Hemiptera: Psyllidae) includes: boxwood psyllid hawthorn psylla laurel psylla pear psylla **Phylloxera** (Hemiptera: Phylloxeridae) includes: oak phylloxera	well as crystallized honeydew. Psyllids may cause gall-like structures and leaf distortion on some plant species. Monitor adult psyllids with yellow sticky traps. Best controlled early in the season, to prevent population explosions later in the season. Scout for phylloxera and the damage they cause (yellow spots on leaves) in the spring and early summer. Dormant applications of horticultural oils are effective on managing the non-motile life stages. Most products are contact and thorough coverage is essential. Some products are systemic and are better suited for tall trees and shrubs.	clothianidin [S] esfenvalerate fluvalinate horticultural oils [O] imidacloprid [S] insecticidal soap [O] kaolin clay [O] malathion pyrethrins [O] pyrethroids [P] spinosad [O] thiamethoxam [S]	dimethoate dinotefuran [S] flupyradifurone *Isaria fumosorosea* phosmet pyriproxyfen spirotetramat tolfenpyrad
Scale Insect (Hemiptera: Coccidae) includes: brown soft scale cottony cushion scale European fruit lecanium sycamore scale (Hemiptera: Diaspididae) includes: black pine leaf scale holly scale juniper scale pine needle scale oystershell scale Eriococcidae includes: azalea bark scale European elm scale	Scout for non-mobile stages concealed beneath bumps, cotton balls, barnacles, oyster shells. Double-sided tape, adhesive barriers intercept mobile crawler stage. Mobile stages include the newly hatched crawler stage. Pesticide applications timed to target mobile crawler stage. Most products are contact and thorough coverage is essential. Some products are systemic and are better suited for tall trees and shrubs.	acephate acetamiprid [S] azadirachtin [O] carbaryl clothianidin [S] emamectin benzoate esfenvalerate fluvalinate horticultural oils [O] imidacloprid [S] insecticidal soap [O] malathion pyrethrins [O] pyrethroids [P] spinosad [O] thiamethoxam [S]	abamectin buprofezin chlorpyrifos *Chromobacterium subtsugae* cyantraniliprole diazinon dimethoate dinotefuran [S] flupyradifurone lime sulfur/ calcium polysulfide [O] pyriproxyfen spirotetramat tolfenpyrad
Spider mite (Trombidiformes: Tetranychidae) includes: bamboo spider mite brown mite boxwood spider mite citrus red mite European red mite false spider mite spruce spider mite two-spotted spider mite	Scout for mite feeding damage to the plant foliage; damage includes leaf stippling, leaf bronzing and premature leaf drop. 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. Spider mite webbing may also be detected along the leaf midrib. Many of these products are contact insecticides that target mobile mite stages. Thorough plant coverage with the spray is key to success and often two or more applications may be necessary. Horticultural oils and some insecticides target mite eggs.	acephate azadirachtin [O] esfenvalerate fluvalinate horticultural oils [O] imidacloprid [S] insecticidal soap [O] kaolin clay [O] malathion pyrethrins pyrethroids [P] spinosad [O] sulfur [O] thiamethoxam [S]	abamectin acequinocyl *Beauveria bassiana* [O] bifenazate chlorfenapyr chlorpyrifos clofentezine cyflumetofen diazinon dimethoate etoxazole fenbutatin-oxide fenpropathrin fenpyroximate hexythiazox

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
			Isaria fumosorosea [O] lime sulfur/ calcium polysulfide [O] methiocarb propargite pyridaben spiromesifen spirotetramat
Thrips (Thysanoptera: Thripidae) includes: gladiolus thrips western flower thrips	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. Tap or beat these plant tissues over a dark flat surface to reveal tiny, thin insects that quickly fly or run to escape. The presence of tar spots (frass) may also serve as a sign of thrips activity. Most chemical products are contact insecticides that target thrips larvae and adults, thus timing of sprays coincides with their presence. Thorough plant coverage with the spray is key to success.	acephate acetamiprid [S] azadirachtin [O] carbaryl clothianidin [S] esfenvalerate fluvalinate horticultural oils [O] imidacloprid [S] insecticidal soap [O] kaolin clay [O] malathion pyrethrins [O] pyrethroids [P] spinosad [O] thiamethoxam [S]	abamectin *Beauveria bassiana* [O] chlorfenapyr chlorpyrifos cyantraniliprole diazinon dimethoate dinotefuron [S] fenpropathrin flupyradifurone *Isaria fumosorosea* [O] methiocarb novaluron spirotetramat tolfenpyrad
True Bug (Hemiptera: numerous families) includes: honeylocust plant bug stink bug western boxelder bug	Scout for the presence of these bugs in landscape plants. Damage to the plant's reproductive structures reduce seed viability. These insects are rarely considered landscape plant pests that require treatment to protect overall health. Often these are nuisance pest congregate in large numbers on homes.	acetamiprid [S] carbaryl esfenvalerate imidacloprid [S] fluvalinate malathion pyrethrins [O] pyrethroids [P]	acephate *Beauveria bassiana* [O] chlorpyrifos dinotefuran [S] fipronil novaluron thiamethoxam [S]
Whitefly (Hemiptera: Aleyrodidae) includes: glasshouse whitefly rhododendron whitefly	Infected leaves may start to turn yellow, appear wilted, or prematurely drop from plant. Look for honeydew and sooty molds. Clouds of adults fly away from infested plants when approached. Monitor adults with yellow sticky traps. Most products are contact and thorough coverage is essential. Some products are systemic and are better suited for tall trees and shrubs.	acephate acetamiprid [S] azadirachtin [O] clothianidin [S] esfenvalerate fluvalinate horticultural oils [O] imidacloprid [S] insecticidal soap [O] kaolin clay [O] malathion pyrethrins [O] pyrethroids [P]	abamectin *Beauveria bassiana* [O] buprofezin carbaryl chlorpyrifos *Chromobacterium subtsugae* cyantraniliprole diazinon dimethoate dinotefuran [S] etoxazole fenazaquin

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
		spinosad [O] thiamethoxam [S]	fenpropathrin fenpyroximate flupyradifurone *Isaria fumosorosea* novaluron pymetrozine pyridaben pyriproxyfen spiromesifen spirotetramat tolfenpyrad

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

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

S = Systemic products that circulate within the plant's vascular system.

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 seasons can impact overall plant health.

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
Tent Caterpillar (Lepidoptera: Erebidae) includes: Douglas-fir tussock moth fall webworm spruce webworm (Lepidoptera: Gelechiidae) includes: cotoneaster webworm (Lepidoptera: Lasiocompidae) includes: forest tent caterpillar western tent caterpillar	Scout for the webbing and silk tents that can contain numerous caterpillars. Scout the foliage of landscape plants for signs of chewing insect damage, or in extreme cases, plant defoliation. Most chemical products are contact insecticides and target the caterpillars as they feed on foliage outside their webbing or tents. *Bacillus thuringiensis* must be ingested by the caterpillar to be effective. Some products are systemic and are better suited for tall trees and shrubs.	acephate azadirachtin [O] *Bacillus thuringiensis kurstaki* [O] carbaryl clothianidin [S] emamectin benzoate esfenvalerate horticultural oils [O] imidacloprid [S] malathion pyrethrins [O] pyrethroids [P] spinosad [O] thiamethoxam [S]	abamectin *Bacillus thuringiensis aizawai* [O] chlorpyrifos diazinon diflubenzuron indoxacarb methoxyfenozide phosmet spinetoram tebufenozide
Caterpillar (Lepidoptera: Choreutidae) includes: apple-and-thorn	Scout landscape plants for signs of chewing insect damage including leaves, buds, or flower holes, skeletonization, leaf-rolling, or in extreme cases, plant defoliation. Pheromone traps may be available to monitor	acephate acetamiprid [S] azadirachtin [O] *Bacillus thuringiensis*	abamectin *Bacillus thuringiensis aizawai/kurstaki* [O] chlorantraniliprole

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
skeletonizer (Lepidoptera: Erebidae) includes: satin moth silver-spotted tiger moth (Lepidoptera: Geometeridae) includes: western oak looper (Lepidoptera: Noctuidae) includes: black cutworm large yellow underwing variegated cutworm (Lepidoptera: Notodontidae) includes: western redhumped caterpillar (Lepidoptera: Tortricidae) includes: spruce budworm	some adult moth species. Most chemical products are contact insecticides that target the youngest caterpillars and the timing of sprays coincides with their presence. Thorough plant coverage with the spray is key to success. *Bacillus thuringiensis* must be ingested by the caterpillars to be effective. Some products are systemic and are better suited for tall trees and shrubs.	*kurstaki* [O] carbaryl clothianidin [S] esfenvalerate fluvalinate horticultural oils [O] imidacloprid [S] kaolin clay malathion pyrethrins [O] pyrethroids [P] spinosad [O] thiamethoxam [S]	chlorfenapyr chlorpyrifos *Chromobacterium subtsugae* [O] cyantraniliprole diflubenzuron indoxacarb methoxyfenozide novaluron
Earwig - (Dermaptera: Forficulidae) includes: European earwig	Scout for damage caused by earwigs; earwigs tend to chew irregular variable-sized hole in plant tissues. Scout for earwig presence and activity at night with a flashlight. Most chemical products are contact insecticides that target earwig populations early in the spring before they reproduce.	azadirachtin [O] carbaryl clothianidin [S] esfenvalerate fluvalinate imidacloprid [S] malathion pyrethrins [O] pyrethroids [P] spinosad [O] thiamethoxam [S]	acephate acetamiprid [S] *Beauveria bassiana* [O] chlorpyrifos fipronil
Grasshopper (Orthoptera: Acrididae) includes: grasshopper (Orthoptera: Gryllidae) includes: true cricket (Orthoptera: Tettigoniidae) includes: Mormon cricket katydid	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 the 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.	acephate azadirachtin [O] carbaryl imidacloprid [S] esfenvalerate fluvalinate malathion pyrethrins [O] pyrethroids [P] thiamethoxam [S]	chlorpyrifos clothianidin [S] diflubenzuron dimethoate indoxacarb phosmet

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
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	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. *Bacillus thuringiensis* must be ingested by the beetles to be effective. Some products are systemic and are better suited for tall trees and shrubs.	acetamiprid [S] azadirachtin [O] carbaryl esfenvalerate fluvalinate imidacloprid [S] malathion pyrethrins [O] pyrethroids [P] spinosad [O] thiamethoxam [S]	acephate chlorpyrifos diazinon phosmet
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	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.	acephate acetamiprid [S] azadirachtin [O] carbaryl clothianidin [S] esfenvalerate fluvalinate horticultural oils [O] imidacloprid [S] insecticidal soap [O] pyrethrins [O] pyrethroids [P] spinosad [O] thiamethoxam [S]	abamectin chlorpyrifos diazinon dimethoate diflubenzuron dinotefluran[S] indoxacarb malathion phosmet
Weevil (Coleoptera: Curculionidae) Leaf-feeders include: black vine weevil clay-colored weevil Douglas-fir twig weevil lilac root weevil, obscure root weevil poplar-and-willow borer wtrawberry root weevil woods weevil Bud (seed)-feeders include: hollyhock weevil	Scout for damaged foliage with notched leaf margins. Foliar damage is often cosmetic only and rarely impacts the overall health of landscape plant. For any unthrifty shrub, tree or plant, search the soil in the plant's root zone for c-shaped weevil grubs. The poplar-and-willow borer larvae feed along plant stems and trunks. Most chemical products are contact insecticides and target the adult weevils before they lay eggs. Timing of sprays coincides with adult weevil activity/presence.	acephate acetamiprid [S] azadirachtin [O] *Bacillus thuringiensis galleriae* [O] carbaryl clothianidin [S] esfenvalerate fluvalinate imidacloprid [S] kaolin clay [O] malathion pyrethrins [O]	*Beauveria bassiana* [O] chlorantraniliprole chlorpyrifos cryolite cyantraniliprole diazinon diflubenzuron dimethoate dinotefuran [S] indoxacarb novaluron phosmet trichlorfon

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
rose curculio	Adult activity can be done at night by jarring and capturing adults. Adults of most species are active in late May and June. Scout for the adult beetles as they feed on and oviposit in buds. Rose curculio emerge in early spring. Hollyhock weevil is active in July and August. Damage is limited to flower buds and reproduction and does not affect the overall health of the infested plants.	pyrethroids [P] spinosad [O] thiamethoxam [S]	

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

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

S = Systemic products that circulate within the plant's vascular system.

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
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	Scout home landscape plants for unusual growth habits such as galls, leaf blisters, big buds, twisting needles, or curling leaves. Also scout for leaf or needle discoloration, (silvering, chlorosis). These mites can also cause fruit russeting. Often a 10x to 20x hand lens is needed to see these mite pests. In general, the damage caused by these pests is cosmetic and not detrimental to the overall health of the plant. 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.	carbaryl horticultural oils [O] insecticidal soap [O] kaolin clay [O] pyrethroids [P] sulfur [O] spinosad [O]	abamectin chlorfenapyr diazinon diflubenzuron fenbutatin-oxide fypyroximate lime sulfur/ calcium polysulfide [O] pyridaben spiromesifen spirotetramat
Gall Aphid (Hemiptera: Aphididae) includes: lettuce root aphid manzanita leaf gall aphid poplar petiole gall aphid	Scout landscape plants for the formation of galls on the leaves, needles or stems. Most products are contact and thorough coverage is essential. Pest species identification is important as these products must be applied before the pest gets into plant tissues.	none	carbaryl chlorpyrifos

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
(Hemiptera: Adelgidae) includes: Cooley spruce gall adelgid			
Gall Wasp (Hymenoptera: Cynipidae) includes: Bassettia gall wasp California jumping gall wasp mossy rose gall wasp Oregon oak gall wasp spiny rose gall wasp	Scout landscape plants for the presence of galls. Make sure these abnormal plant growths have active wasp larvae in them. Most products are contact and thorough coverage is essential. These products typically target the adult wasp before eggs are laid in leaf tissues. Some products are systemic and are better suited for tall trees and shrubs. Damage is primarily cosmetic. Damage can lead to premature defoliation, but healthy plants can recover unless this becomes an annual infestation.	carbaryl emamectin benzoate pyrethroids [P]	No additional products
Leafminer (Diptera numerous families) includes: boxwood leafminer California gallfly Douglas-fir needle midge honeylocust pod gall midge poplar twiggall fly rose midge rose stem miner willow beaked-gall midge	Species identification is key as leafminers represent different orders of insect with different pesticide susceptibilities. Labels may vary based on species. Scout landscape plants for the presence of galls, leaf mines, and rolled leaves. Make sure these abnormal plant growths have active maggots in them. Most products are contact and thorough coverage is essential. These products typically target the adult fly before eggs are laid in leaf tissues. Some products are systemic and are better suited for tall trees and shrubs. Damage is primarily cosmetic. Damage can lead to premature defoliation, but healthy plants can recover unless this becomes an annual infestation.	carbaryl clothianidin [S] imidacloprid [S] pyrethroids [P] malathion	abamectin cyantraniliprole
Leafminer (Lepidoptera: numerous families) includes: Aspen blotchminer azalea leafminer Ceanothus leafminer cypress tip moth holly leafminer lilac leafminer madrona shield bearer spotted tentiform leafminer	Species identification is key as leafminers represent different orders of insect with different pesticide susceptibilities. Labels may vary based on species. Scout for leaf- or needle-mining activity early in the season as leaves unfurl. Pheromone traps are available for some moth species. Most products are contact and thorough coverage is essential. These products typically target the adult pest before eggs are laid in leaf tissues. Some products are systemic and are better suited	acephate acetamiprid [S] azadirectin [O] carbaryl clothianidin [S] dinotefuran [S] emamectin benzoate fluvinate imidacloprid [S] insecticidal soap [O] malathion	abamectin chlorantraniliprole chlorpyrifos cyantraniliprole diazinon diflubenzuron dimethoate fenpropathrin flupyradifurone methoxyfenozide novaluron

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
spruce needleminer	for tall trees and shrubs. Damage is primarily cosmetic. Damage can lead to premature defoliation, but healthy plants can recover unless this becomes an annual infestation.	pyrethrins [O] pyrethroids [P] spinosad [O] thiamethoxam [S]	pyriproxyfen
Leafroller (Lepidoptera: Tortricidae) includes: carnation tortrix European leafroller fruittree leafroller holly bud moth oblique-banded leafroller orange tortrix pine shoot moth three-lined leafroller	Scout for and examine rolled leaves near branch tips for caterpillars. Pheromone traps are available for many of these moth species. Most products are contact and thorough coverage is essential.	acephate azadirectin [O] *Bacillus thuringiensis kurstaki* [O] carbaryl clothianidin [S] emamectin benzoate esfenvalerate horticultural oils [O] kaolin clay [O] malathion pyrethrins [O] pyrethroids [P] spinosad [O]	abamectin acetamiprid [S] *Bacillus thuringiensis aizawai* *Beauveria bassiana* [O] chlorpyrifos cyantraniliprole diazinon imidacloprid [S] methoxyfenozide novaluron phosmet spinetoram thiamethoxam[S]

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

S = Systemic products that circulate within the plant's vascular system.

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 pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
Bark Beetle (Coleoptera: Scolytidae) includes: elm bark beetle European elm bark beetle European shothole borer mountain pine beetle shothole borer	Scout any weakened trees/shrubs for signs of infestation. Examine branches, twigs and trunks in late spring for small holes made by adult beetles. Examine the 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	azadirachtin [O] clothianidin [S] imidacloprid [S] pyrethroids [P] thiamethoxam [S]	carbaryl chlorpyrifos fipronil pyrethrins [O]

Target pest examples	Monitoring & scouting strategies	Home landscape chemical products	Restricted-use chemical products
	bark beetle species. Some beetle species transmit plant diseases.		
Wood or Trunk Borer (Coleoptera: Buprestidae) includes: flatheaded cedar borer locust borer (Coleoptera: Cerambycidae) includes: bronze birch borer mountain pine beetle	Scout any weakened trees/shrubs for signs of infestation. 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 host plant.	acephate clothianidin [S] imidacloprid [S] pyrethroids [P]	chlorpyrifos
Stem & Twig Borer (Diptera: Cecidomyiidae) includes: raspberry cane maggot rose midge (Lepidoptera: Sessidae) 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	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.	esfenvalerate horticultural oils [O] imidacloprid [S] pyrethroids [P] pyrethrins [O]	acephate chlorpyrifos diazinon malathion phosmet

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

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

S = Systemic products that circulate within the plant's vascular system.

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
Beetle (Coleoptera: Cuculionidae) includes: black vine weevil clay-colored weevil woods weevil (Coleoptera: Elateridae) includes: wireworms, various (Coleoptera: Scarabaeidae) includes: white grubs, various	Beetle larvae with chewing mouthparts. Tend to be plant generalists and may impact only the newly planted ornamentals. Roots may appear damaged, missing tissues, bored through or hollowed out. Some beetles can gradually build up high populations in perennial crops where crop or soil rotations are not a management option. Effective products either intercept adult beetles as they oviposit eggs or specially formulated for soil application.	carbaryl clothianidin [S] imidacloprid [S] pyrethroids [P] spinosad [O]	acephate *Bacillus thuringiensis galleriae* *Beauveria bassiana* [O] beneficial nematodes [O] chlorantraniliprole chlorpyrifos cyantraniliprole dinotefuran [S] ethoprop phosmet thiamethoxam[S]
Root aphid (Hemiptera: Aphididae) includes: beech blight aphid leafcurl ash aphid Woolly elm aphid	Root feeders with piercing sucking mouthparts. Root deformation and plant stunting. A nuisance or cosmetic pest problem often when life stages migrate to the above ground portion of the plant. These products target only the above-ground population of these aphids. Most products are contact and thorough coverage is essential.	azadirachtin [O] pyrethrins [O] pyrethroids [P]	chlorpyrifos

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

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S = Systemic products that circulate within the plant's vascular system.