

INSECT CONTROL FOR WOODY PLANTS

Insect control measures for woody plants can be quite involved. Here's a season-by-season strategy for battling the most common yet damaging pests.

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Trees and shrubs are valuable components of residential and commercial landscapes and other parts of our community and urban forests. Although they can add significantly to real estate values, poorly managed trees and shrubs may become a liability.

With proper attention to site selection, careful planting and scheduled maintenance, landscape plants are excellent investments providing many years of diverse benefits such as shading, screening, noise abatement, beautification and air purification.

The following guides discuss some of the most important arthropod (insect and mite) pests of trees and shrubs, and explain how to control them most efficiently. The information is organized by seasons to help you know when to implement pest management procedures.

(In all cases, whenever a pesticide is used, the practitioner should read the label on the container before the insecticide, miticide or other pesticide is used.)

Control tactics

Some insect and mite pests are vulnerable to control tactics after plants have become acclimated to winter temperatures. Landscape managers can capitalize on this window of op-



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portunity by performing pest control functions when other maintenance activities are not competing for their time.

Horticultural spray oils can be used safely on a variety of woody plants to control overwintering stages of spider mites, aphids, adelgids, and armored scales.

Oils can be used throughout the year whenever the temperature is above freezing and plants are not under moisture stress, except when the new growth has just emerged and the leaves are tender. The following cautions should be considered before and when using oils to control pests on

trees and shrubs:

1. Read the label to make sure the product is not phytotoxic to the plants to be sprayed.

2. Do not use oils in the fall after leaves have begun to change color and before the trees have become dormant. (In the South, woody plants may not become dormant until late December).

3. Do not apply oils to tender new growth in the spring.

WINTER

November-March

Adelgids are small, soft-bodied sucking insects that feed on the needles or bark of conifers, including spruces, pines, and Douglas fir. On spruce they cause

pineapple-shaped galls to form on the base (Eastern spruce gall adelgid on Norway and white spruce) or at the terminal end (Cooley spruce gall adelgid on Colorado spruce) of new growth in the spring. On Douglas fir they feed on the underside of needles, causing needle distortion and minor chlorosis.

Most adelgids overwinter as young nymphs on the undersides of branches or needles. Pine bark adelgids overwinter as eggs, nymphs, or adults in bark cracks and crevices on white pine. Copious production of fluffy filaments by nymphs and adults often cause trunks of white pine to be

almost solid white. This population density can debilitate a tree, reduce growth rate and cause tree decline.

Adelgids can be controlled on spruces any time after galls open in late summer until just prior to bud break the following spring.

Every effort should be made to get the toxicant (spray) to the underside of branches where the overwintering stage is located. Horticultural oils may provide good control, but they often remove the bloom from Colorado spruce that gives them their blue cast. Although the bloom will return later in the year, customers are commonly upset when their blue spruce changes color following a pesticide treatment.

Sevin or lindane, applied as a thorough-coverage, hydraulic spray, provide excellent control of adelgids. Recent studies have shown that some of the newer synthetic pyrethroids and Safer's insecticidal soap show promise for controlling adelgids. Be sure to check the pesticide container label to determine that the pest target and its host are cleared for the intended use.

Mite control

Spider mites, including spruce spider mite on coniferous evergreens and southern red mite on hollies, azaleas and other broadleaf evergreens, remove plant juices and deposit silk and waste material on their hosts, causing leaves to become dull and bronze colored.

Most mite feeding damage is done in spring and fall when temperatures are not extreme. They overwinter as eggs, which are usually susceptible to control with horticultural oil used at the dormant season rate.

Be especially watchful for damaging spider mite populations during and following periods of drought. Spider mites were a serious problem during the drought of 1988 and may be abundant again in 1989.

False spider mites are tiny, flat organisms that feed and reproduce slowly throughout the year in the South. Most "winter injury" symptoms on aucuba, azalea, and Japanese hollies are due to feeding by false spider mites.

Horticultural oil and other miticides give adequate control of these pests. Treatment is appropriate at any time of year except in early spring when new, tender growth is emerging.

Aphids are small, soft-bodied sucking insects that insert their mouthparts into the phloem of leaves, stems, and roots to remove sap. They excrete honeydew, a sweet, clear liquid that coats heavily infested plants and drips on cars, walkways, and other surfaces, often causing severe nuisance problems.

Aphid damage

Honeydew serves as a substrate for sooty mold fungi that reduce the aesthetic appeal of host plants and limit their ability to manufacture food



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through the process called photosynthesis. Some species (melon and apple aphids) feed on the most succulent part of the plant. Others (giant willow, giant bark, and Cinara aphids) feed on stems.

High aphid populations can cause leaves to yellow and fall prematurely. Many aphids overwinter as exposed eggs on conifer needles or on stems and buds of other kinds of woody plants. If damaging aphid populations were present the previous summer or fall, an application of horticultural oil before bud break will reduce the spring aphid population, thereby giving the tree a chance to recover before aphids build up again during the following spring and summer.

Soft scales are another kind of sucking insect that drains a tree's energy and reduces its ability to manufacture food by producing honeydew, on which saprophytic sooty mold fungi grow. Heavily infested tulip trees or agnolias may be killed outright by soft scales.

Soft scales that overwinter as nymphs (including cottony maple, cottony maple leaf, magnolia, pine tor-

toise, and Fletcher scales) are at least somewhat vulnerable to horticultural oils during the dormant season. Even a moderate level of control during the dormant season will be beneficial, because soft scales consume copious amounts of plant fluid in the spring and summer before completing their development and before the highly vulnerable crawler stage is present.

SPRING

(April-late June)

Most insects become active in the spring, responding to warmer weather and resumption of plant growth and development. Monitoring trees and shrubs or pests during this time is one of the most important tactics in rational control programs.

Newly-expanding or expanded leaves should be checked for the presence of sucking insects and mites, leafminers, and defoliators. Tree limbs and trunks should be inspected for presence of active borer galleries as evidenced by sawdust or oozing from entrance holes.

Although borer sprays are not effective after the larvae have become established beneath the bark surface, spring is a good time to determine if plants are infested, so appropriate plant health care and direct insect control practices can be implemented when they will be most successful.

Defining defoliators

Insects that consume foliage are commonly called **defoliators**. They are one of the earliest insects to become active in the spring. Eastern tent caterpillar, whitemarked tussock moth, fall cankerworm, and some pine sawflies seem to begin feeding even before we notice new leaf growth.

At times, their populations are high enough to cause significant defoliation.

Commonly, their presence and the webbing that tent caterpillars produce an unsightly appearance. If the infestation is not noticed until much of the plant has already been defoliated, it may be too late to use a direct control measure that season.

Large caterpillars are much more difficult to control with insecticides, and after they have finished feeding there is little justification to apply a control measure. Instead, they should

be controlled during their next generation while caterpillars are still small.

Most lepidopterous defoliators (moths and butterflies) and hymenopterous foliators (sawflies are relatives of bees and wasps) are susceptible to insecticidal control. Sevin, Orthene, diazinon, Dursban, Turcam/Dycarb, malathion, Dylox, and synthetic pyrethroids are all effective against lepidopterous defoliators.

Preparations of the bacterium, *Bacillus thuringiensis*, more commonly known as Bt, are also effective against these pests, especially if used when larvae are small. The hymenopterous sawflies are susceptible to Sevin, Orthene, Dursban, and synthetic pyrethroids.

Elm leaf beetle larvae and adults consume elm foliage throughout the spring and summer. They overwinter as adults, lay eggs on the underside of leaves in the spring, and complete two generations per year throughout much of their range.

Sevin, Orthene, Turcam/Dycarb, and synthetic pyrethroids are effective against both larvae and adults, as is a new strain of Bt known as "San Diego." Furthermore, Sevin or a synthetic pyrethroid sprayed on elm trunks just prior to the descent of the mature larvae of the first generation kills many of the larvae and may reduce defoliation by the second generation. This tactic can be expected to have best results when an entire neighborhood is treated.

Trunk spraying might be especially useful in areas like Manhattan, New York, where canopy spraying is not permitted.

Armored scales are soft-bodied, sucking insects that remove plant fluids from stems, leaves, or roots. They do not produce honeydew, but may become numerous enough to dramatically reduce plant vitality or even cause its death. They are called armored scales because after the first nymphal stage has molted, the succeeding stages are protected by its shed skin and the secreted "test" or armor.

Scale protection

Pesticidal sprays that are effective against active crawlers and settled first nymphs are usually ineffective once the nymph has molted and is protected by the test. Consequently, one window of opportunity to control armored scales should be when they are crawlers or newly settled nymphs.

Determining when this occurs requires close inspection of infested plants with the aid of magnification device such as 10x hand lens. (To use a hand lens, hold the lens near your

Preventive maintenance still the best defense

Plants growing on undisturbed, native sites are often vigorous and suffer little from attack by insects, mites, or pathogens. However, many landscapes are on disturbed or non-adaptive sites like city streets, parking lots, malls and parks. In these places human activities or harsh environmental factors decrease the vitality of trees and shrubs and they are commonly attacked by damaging organisms that further decrease their aesthetic appeal and longevity.

Many insects and mites are opportunistic in that they cannot successfully attack a healthy tree or shrub. Therefore, the first line of defense against these opportunistic pests is to keep trees and shrubs healthy and vital. This can be done by preventive maintenance in the form of plant health care.

Preventive maintenance includes mulching trees to keep mowers from wounding the bark; irrigating during summer and fall droughts; aerification of the soil to provide oxygen to roots; and proper fertilization (following the directions of a soil test report). Still, some pests such as the Japanese beetle can attack perfectly healthy host plants. The landscape manager will have to directly intervene to prevent damage that may threaten plant beauty or survival. □

—the authors

eye, and stabilize it by pressing the side of your thumb against your cheek. Then, bring infested foliage into focus by moving it toward the lens.)

Plants infested with armored scales should be sprayed after all crawlers have hatched. The only way to determine when this has occurred is to check for crawler hatch and to overturn female coverings to make sure eggs are no longer present. This procedure works well for those armored scales that overwinter as eggs, including pine needle scale and oystershell scale.

Pine needle scale can be controlled

with a single application of an effective insecticide applied sometime in late April or early May, depending upon your geographical area. Oystershell scale crawler hatch occurs at different times on different hosts within any one geographical area. Also, hatch on a single host plant occurs over a period of at least two weeks in some parts of the country. Therefore, two applications spaced about 10 days apart, beginning several days after first crawler hatch in late May or early June, are required to achieve successful control of this pest.

Euonymus scale, which attacks both euonymus and pachysandra overwinters as inseminated females, and crawler hatch is protracted in the spring. Before spraying, prune out the most heavily infested branches if feasible. Two or three applications of Cygon or another effective insecticide, spaced at 10 day intervals, beginning several days after first crawler hatch, are required to control this pest. In all cases, high pressure, high volume sprays should be used to control all armored and most soft scale infestations.

All armored scales that have more than one generation per year (pine needle, euonymus, and white peach scales) should always be controlled during the spring crawler hatch, because the hatching period is shorter at that time and fewer pesticide applications are required to provide control. Orthene, diazinon, Dursban, and Sevin have been used to control armored and soft scales for a number of years.

During the past three years Safer's insecticidal soap has been the best product against pine needle scale crawlers in tests in Ohio. It should be equally effective against other scales if applied as a thorough-coverage spray during the crawler and first nymphal stages.

Horticultural oil

Horticultural oil may also be effective against armored scale crawlers and settled first nymphs. Be sure to check the container label to determine that the product is labeled for the specific target pest on the host that will be sprayed.

Aphid populations can explode since a new generation can be produced every 10 to 15 days in the North and even faster in the South. In the North, they are often at damaging population density during summer drought or just after a drought. Check the underside of leaves periodically, especially during hot, dry weather to determine if aphids are present and whether their population is increas-



Clearwing moth borers are common in ash, dogwood, flowering fruit trees, lilac, oak and rhododendron. Borer larvae feeds beneath bark.

ing. If the plant is under water stress and aphid numbers are building up, an insecticidal spray should be used to prevent premature leaf drop on valuable specimen trees.

Be sure to thoroughly irrigate plants under moisture stress before applying a pesticide to avoid pesticide injury to the plant. In the North, aphid impact is most common on maples and oaks. In the South, aphid populations are often high in late winter and early spring before lady beetles and

other predators become active and abundant enough to provide control.

On the other hand, crape myrtle aphid populations often become damaging later in the summer. Mist-blower applications are excellent against free-living aphids. Insecticidal soaps are registered for use against aphids on shade trees and shrubs, but they have not been effective by themselves against the common birch aphid.

Soaps may be more effective when

combined with horticultural oil or a conventional insecticide. There are many other aphicides labeled for use in nursery and landscape management.

Lindane kills adelgids

Overwintering adelgids can be controlled by using hydraulic application of lindane or Sevin, stressing coverage to the underside of branches and leaves before budbreak. Cooley spruce gall adelgid on Douglas-fir is most vulnerable to contact action when the insecticide is sprayed just when the bud scales are being pushed away from expanding needles.

Once buds have broken, adelgids on spruce are protected within galls. They do not become vulnerable again until the gall matures, splits open and new adelgids emerge to mate and lay eggs the following August or September.

Birch, boxwood, and holly leaf-miners are highly specialized insects whose larval stages injure trees and shrubs by destroying leaf tissue. The results of their activity is analogous to that caused by defoliators.

Birch leafminer is a sawfly (related to honey bees) that overwinters in cocoons in the soil. Adults emerge in

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May; there are three or more generations per year in much of its range.

Foliage can be protected by spraying when the adult sawflies are actively mating and feeding on birch leaves. Sevin, malathion, lindane and synthetic pyrethroids are effective when used before eggs are deposited within leaf tissue. After egg laying has begun or mines have formed, a systemic insecticide like Orthene or Cygon should be used.

Holly leafminer is a true fly that overwinters in the larval stage within mined leaves and emerges in May. Spring application of Orthene, diazinon, Dursban, Sevin, or a synthetic pyrethroid is effective before eggs are laid. After oviposition has begun, Orthene should be used to kill newly established larvae.

Boxwood leafminer is a gall midge that also has just one generation per year. A mid- to late-spring application of Cygon will provide adequate control of this pest.

What to use

Spider mites, such as two-spotted spider mite and tumid mite, are common and damaging on plants under water stress and during long, hot summers. They complete many generations

throughout the spring and summer.

Kelthane, Mavrik, Talstar, Soap and Pentac are usually effective against spider mites. Whenever a product is used that does not kill mite eggs, you must make two applications

The first line of defense against these opportunistic pests is to keep trees and shrubs healthy and vital.

at a five day (South) or ten day (North) interval to achieve an acceptable level of control. A hydraulic sprayer must be used to insure thorough coverage, especially for plants with dense foliage like foundation plantings, conifers, and other evergreens.

Root weevils (black vine, strawberry root) can be destructive in both adult and larval stages. Adults chew notches in leaf margins. Larvae consume small roots and debark larger roots, sometimes causing death of

foundation plants like rhododendron, azalea, and yew (taxus).

The best approach for controlling root weevils is to spray foliage after adults emerge above ground in spring and summer but before they begin to produce eggs. Hydraulic sprays of Turcam/Dycarb, Mavrik, Talstar or Tempo 2 should begin in mid-June, followed by repeat applications at three to four week intervals until August.

Every effort must be made to achieve thorough coverage, spraying all adult hosts, including conifers, taxus, rhododendrons and azaleas, euonymus, hosta, Japanese holly, etc.

Level of control is directly related to degree of coverage and following through with repeat applications at three to four week intervals. Drenching soil beneath host plants during the August adulticide application may help reduce larval populations.

Clearwing moth **borers** are common in ash, dogwood, flowering fruit trees, lilac, oak, and rhododendron. Flatheaded borers (adults are called metallic wood borers) are common in oaks, white barked birches, and other stressed hardwoods. Borer larvae cause damage by feeding beneath bark, disrupting movement of water and sugars, destroying the cambium (the cells that give rise to lateral growth), and reducing structural integrity.

Using borer traps

Clearwing borer presence and flight periods can be monitored with pheromone traps. These cost-effective clearwing borer monitoring traps are available from: Trécé, Incorporated, P.O. Box 5267, Salinas, CA 93915; Great Lakes IPM, 10220 Church Road N. E., Vestaburg, MI 48891; Scentry Monitoring Products, P.O. Box 426, Buckeye, AZ 85326-0090.

A four trap kit costs about \$35 and will be efficient to monitor clearwing moths throughout your service area for an entire year.

A single, thorough-coverage bark spray of Dursban or lindane, 10 to 14 days after first male moth capture, will provide season long control of most clearwing moth borers.

Three applications of bark/foliage sprays with Turcam/Dycarb, Dursban, or lindane are required to control flatheaded borers.

The first application should be made just prior to first adult emergence (some time in May). Bark and foliage should be sprayed because adults feed on leaves for several days before they begin egg production.

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